United States Government Accountability Office

GAO

Report to Congressional Requesters

September 2006

ENDANGERED SPECIES

Many Factors Affect the Length of Time to Recover Select Species

GAO-06-730

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Highlights

Highlights of GAO-06-730, a report to congressional requesters

Why GAO Did This Study

The U.S. Fish and Wildlife Service and the National Marine Fisheries Service (the services) are responsible for administration and implementation of the Endangered Species Act of 1973. The act generally requires the services to develop recovery plans for endangered and threatened species—species facing extinction or likely to face extinction, respectively. Recovery plans identify threats to the species' survival and the actions needed to mitigate those threats.

Proposed amendments to the act are under consideration and GAO was asked to provide information to facilitate this effort. In April 2006, GAO issued a report providing high-level information on the extent to which recovery plans contain estimates of when species are expected to be recovered, among other things. This follow-on report provides more detailed information on the factors that affect species recovery and the importance of recovery plans in recovery efforts. For 31 species—selected because they were nearing recovery, or had significant attention devoted to them and thus would be expected to be making progress towards recovery—GAO (1) identifies factors affecting the length of time to recover the species and (2) describes the role recovery plans have played in recovering these species. The Department of the Interior agreed with the facts presented in this report. The Department of Commerce declined to comment.

www.gao.gov/cgi-bin/getrpt?GAO-06-730.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Robin Nazzaro at (202) 512-3841 or nazzaror@gao.gov.

What GAO Found

Many factors affect the length of time it takes to recover the 31 species GAO reviewed. Specifically, 19 of these species have been recently delisted (removed from the list of endangered and threatened species) or are likely to be delisted within the next 25 years either because (1) they faced a primary threat that has been or is being mitigated; (2) they were found to be more prevalent than biologists thought at the time they were listed and/or habitats have been secured for the species; or (3) they are expected to respond relatively quickly to recovery efforts because, for example, they reproduce quickly in the presence of good habitat. The remaining 12 species are much farther away from being delisted, and for some, recovery is uncertain. Some of these species are not expected to recover for many decades because they respond relatively slowly to recovery efforts, for example, because they reproduce slowly. Recovery for the remaining species is uncertain either because their habitat is difficult to protect, or because not enough is known about the threats facing the species or how to mitigate those threats.

Recovery plans have played an important role in the recovery efforts of nearly all of the species GAO reviewed by identifying many of the actions the services' biologists deemed most important to the species' recovery. The services' biologists report that these actions have contributed, at least in part, to the progress made in recovering these species. For example, recovery of the red-cockaded woodpecker is dependent on having sufficient habitat—the species nests in cavities that they peck out of old pine trees, but logging largely eliminated these trees from the woodpecker's range. The recovery plan identifies measures to protect the habitat, including land acquisition and conservation agreements with landowners, as well as steps to provide artificial nest boxes until pines mature enough to provide natural habitat for the birds. The services' biologists told us that these actions have significantly improved this species' prospects for recovery. However, for about one-half of the species GAO reviewed, actions beyond those in the recovery plans also played an important role in progress toward the species' recovery. For example, the banning of the insecticide dichloro-diphenyl-trichloroethane (DDT) by the Environmental Protection Agency in 1972—a year before the Endangered Species Act was enacted—has been critical to recovery of the bald eagle.

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Abbreviations

BLM	Bureau of Land Management
BOR	Bureau of Reclamation
DDT	dichloro-diphenyl-trichloroethane
DPS	distinct population segments
FWS	U.S. Fish and Wildlife Service
NMFS	National Marine Fisheries Service

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Accountability * Integrity * Reliability

United States Government Accountability Office
Washington, D.C. 20548

September 6, 2006

Congressional Requesters

The Endangered Species Act of 1973 protects species facing extinction (endangered species) or likely to face extinction in the foreseeable future (threatened species), and the ecosystems upon which they depend. The act has long been a lightning rod for political debate about the extent to which the nation's natural resources should be protected, and how best to protect them. Proponents of the act, and what it seeks to accomplish, believe that it is important to preserve the unique genetic characteristics of each species as a practical response to the impact that humans are having on the earth, and may also believe there is a moral obligation to do so. Some critics of the act deemphasize the importance of preserving every individual species and argue that doing so, in many cases, is too costly—especially when implementation of the act results in restricting uses of public and private land and resources. Others are critical of the veracity of the data used to make decisions under the act.

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS), collectively referred to as "the services," are the federal agencies responsible for administration and implementation of the Endangered Species Act. FWS has primary responsibility for fresh water and land species, while NMFS has primary responsibility for anadromous fish and most marine species. The Endangered Species Act outlines criteria that the services must apply to determine whether a species warrants the protection of the act, and the process to follow to place the species on the list of threatened and endangered species. The act also generally requires the services to develop recovery plans for the conservation and survival of listed species.[1]

While the act has many provisions that could be evaluated, one of the most important measures of its success is the number of species that have "recovered," or improved to the point that they no longer need the act's protection. Since the act's inception in 1973, about 1,300 domestic species have been placed on the list of threatened and endangered species, but only

[1]A recovery plan is not required if the Secretaries of Commerce or the Interior find that such a plan will not promote the conservation of the species.

a few have been removed (delisted).[2] Supporters of the act claim it is an indication of success that only nine species protected by the act have become extinct. Critics, on the other hand, claim it is an indication of failure that only 17 species protected by the act have recovered.

Proposed amendments to the Endangered Species Act are under consideration, and you asked us to provide information on recovery plans and progress made on their implementation to facilitate this effort. In an April 2006 report, we provided high-level information on 107 randomly selected recovery plans covering about 200 species.[3] We reported on the extent to which these plans contained estimates of when a species is expected to have recovered, among other things. In this report, for a nonprobability sample of 31 species, we provide a more in-depth review of the efforts undertaken to recover species. We selected these species because they are nearing recovery or had significant attention devoted to them and, thus, would be expected to be making progress towards recovery. For these 31 species, we (1) identify factors affecting the length of time to recover the species and (2) describe the role that recovery plans have played in recovering these species.

FWS is responsible for 28 of the 31 species we reviewed. NMFS is responsible for the remaining three species—the northern right whale and two distinct population segments (DPS) of the Steller sea lion.[4] Our assessment of the recovery efforts and description of the role of recovery plans in those efforts is based primarily on species' recovery plans, *Federal Register* notices associated with the species, and information provided by biologists at the services that are responsible for recovering the species we reviewed. We obtained, from FWS and NMFS biologists, estimated time frames for delisting many of the species we reviewed. It is important to note that these estimates were based on the assumption that needed actions would take place, even though funding may not be available to conduct these actions, or the actions may be out of the services' control. Consequently, the estimates provided should be considered best-case

[2]Both domestic and foreign species are listed under the Endangered Species Act; foreign species are those with current and historic ranges that occur entirely under the jurisdiction of other countries.

[3]GAO, *Endangered Species: Time and Costs Required to Recover Species Are Largely Unknown*, GAO-06-463R (Washington, D.C.: April 6, 2006).

[4]A DPS is a subdivision of a vertebrate species that is treated as a species for purposes of listing under the Endangered Species Act. *See* 61 *Fed. Reg*. 4722 (Feb. 7, 1996).

scenarios. Salmon, steelhead, and the desert tortoise were excluded from our analyses because we have issued comprehensive reports on these species.[5] A more detailed description of our scope and methodology is presented in appendix I. Information on each of the species we reviewed is presented in appendix II. We performed our work between September 2005 and August 2006, in accordance with generally accepted government auditing standards.

Results in Brief

Many factors affect the length of time it will take to recover the 31 species we reviewed, and some may not be recovered at all. These factors range from the successful removal of the primary threat faced by a species, to difficulty protecting a species' habitat or difficulty understanding what threats a species is facing. The length of time it has taken, or is expected to take, to recover these species, ranges from less than a decade to possibly more than a century; specifically:

- Nineteen of the thirty-one species have been recently delisted, or are likely to be delisted, within the next 25 years. Each will likely spend less than 50 years on the endangered species list. Eight of these species faced a primary threat that has been or is being mitigated. Six species are more prevalent than biologists thought at the time they were listed, and/or FWS has been effective in protecting their habitats. The other five species are the beneficiaries of recovery efforts involving a wide range of stakeholders and significant resources, and are expected to respond relatively quickly to these efforts.

- The remaining 12 of the 31 species we reviewed are much farther away from being delisted and could spend more than 50 years on the endangered species list; for some, recovery is uncertain. The services' biologists believe that 4 of these 12 species will eventually recover, but not for many decades, because the species are slow to respond to recovery efforts—for example, because they reproduce slowly or depend on habitat that takes a long time to develop. FWS is having difficulty recovering the remaining eight species: five because they cannot secure needed habitat, and three because they do not know

[5]See GAO, E*ndangered Species: Research Strategy and Long-Term Monitoring Needed for the Mojave Desert Tortoise Recovery Program*, GAO-03-23 (Washington, D.C.: Dec. 9, 2002) and GAO, *Columbia River Basin Salmon and Steelhead: Federal Agencies' Recovery Responsibilities, Expenditures and Actions*, GAO-02-612 (Washington, D.C.: July 26, 2002).

enough about the threats facing the species or how to mitigate these threats. FWS cannot predict whether or when a successful recovery of these eight species will be possible.

For all but one of the species we reviewed, recovery plans played an important role in recovery efforts by identifying many of the actions that the services' biologists deem most important to the recovery of the species. Although not all of these species are nearing recovery, the services' biologists report that the success that these species have had can be attributed, at least in part, to actions in the species' recovery plans. For example, recovery of the red-cockaded woodpecker depends on having sufficient habitat—the species nests in cavities that are pecked out of old pine trees, which logging largely eliminated from the woodpecker's range. The recovery plan identifies measures to protect woodpecker habitat, including conservation agreements with private landowners, as well as steps to provide artificial nest boxes until pines mature enough to provide natural habitat for the birds. The services' biologists told us that these actions have significantly improved this species' prospects for recovery. However, for about one-half of the species we reviewed, the services' biologists also identified actions important to the recovery of the species that were beyond those included in the species' recovery plans. For example, the banning of the insecticide dichloro-diphenyl-trichloroethane (DDT) by the Environmental Protection Agency in 1972 has been critical to recovery of the bald eagle, but was not included in its recovery plan. One of the species we reviewed, the dwarf-flowered heartleaf—a small flowering plant found in North Carolina and South Carolina—does not have a recovery plan because, with new populations of the species repeatedly being found, information about the species is changing rapidly. The species may be delisted without a recovery plan.

We provided the Department of the Interior (Interior) and the Department of Commerce (Commerce) with a draft of this report for review and comment. The Department of the Interior generally agreed with the information presented in the report (see app. III). Commerce declined to provide an overall assessment of the draft because the report does not contain recommendations.

Background

The purpose of the Endangered Species Act of 1973 is to conserve threatened and endangered species, and the ecosystems upon which they depend. The act defines conservation as the recovery of threatened and endangered species so that they no longer need the protective measures

afforded by the act. An endangered species is a species facing extinction throughout all, or a significant portion of, its range; threatened species are those likely to become endangered in the foreseeable future. The act requires the Secretary of the Interior to publish, in the *Federal Register*, a list of species determined to be threatened or endangered. Included in the definition of species are subspecies of animals and plants, and DPSs of vertebrate species.

The act generally requires the services to develop recovery plans for the conservation and survival of threatened and endangered species, unless the services determine that a plan will not promote their conservation. The act directs the services, to the maximum extent practicable, to incorporate in each recovery plan (1) a description of site-specific management actions necessary to achieve the plan's goal for the conservation and survival of the species; (2) objective, measurable criteria that will result in a determination that the species can be removed from the list of threatened and endangered species (i.e., delisted); and (3) estimates of the time and cost required to carry out those measures needed to achieve the plan's goal.

The services develop and implement recovery plans, among other actions, to reverse the decline of each listed species and ensure its long-term survival. To do this, recovery plans aim to identify threats to the species' survival and the actions needed to mitigate those threats. A recovery plan may include a variety of methods and procedures to recover listed species, such as habitat acquisition and restoration to prevent extinction or further decline, and other on-the-ground activities for managing and monitoring endangered and threatened species. The services' officials also told us that recovery plans are important for communicating needed actions to other federal agencies, state and local agencies, researchers, industry, private landowners, and others, because the services often depend on other entities to implement recovery actions. For example, in many cases, FWS does not have jurisdiction to implement recovery actions on lands occupied by endangered species, which is important because loss of habitat is often the principal cause of species' declines. Recovery plans can take years or decades to fully implement, depending on the needs of the species covered by the plan. As of May 2006, the services had approved 580 recovery plans covering about 1,080 species (or about 83 percent) of the 1,300 domestic species protected by the act.

Once a species recovers, it can be delisted.[6] To determine that a species is recovered and ready to be delisted, the services follow a process similar to that used to list a species—they propose delisting a species in the *Federal Register* and seek public comment on the action before they finalize the delisting. The act requires the services to use the same criteria to delist species that are used to list species. Specifically, to delist a species, the services must determine that the species is no longer threatened or endangered based on an assessment of five factors: (1) whether there is a present or threatened destruction, modification, or curtailment of the species' habitat or range; (2) whether the species is subject to overutilization for commercial, recreational, scientific, or educational purposes; (3) whether disease or predation is a factor; (4) whether existing regulatory mechanisms are inadequate; and (5) whether other natural and manmade factors are affecting the species' continued existence.

Besides delisting species because they have recovered, species can also be delisted if they are found to be extinct, or if the original data used to list the species is found to be in error. For example, if additional analysis finds the species is not unique but rather a member of a more prevalent species, its listing becomes unwarranted. As of May 2006, FWS reports that a total of 41 species have been removed from the list of threatened and endangered species—9 species because they have been declared extinct, 15 species because original data used to list the species was in error, and 17 species as a result of recovery efforts.[7]

In addition, the act requires that the services report biennially to certain congressional committees on efforts to develop and implement recovery plans. The services implement this requirement through separate biennial reports to Congress. FWS's reports satisfy the act's reporting requirement by including a statistic called "recovery achieved." The recovery achieved statistic is meant to estimate the extent to which the recovery objectives for each species have been achieved and reflects the species' overall progress towards recovery; it is not the proportion of discrete actions in the recovery plan that has been completed. It is expressed as a percentage range—0 to 25 percent, 26 to 50 percent, 51 to 75 percent, or 76 to 100

[6]A species may also be downlisted from endangered to threatened as a result of recovery efforts. The services must announce downlisting proposals in the *Federal Register* to solicit public comments on the action.

[7]FWS reports that 2 of the 17 species delisted due to recovery were delisted because of a combination of recovery efforts and data error.

percent. The FWS report includes this statistic for species under FWS's jurisdiction, as well as for those managed jointly with NMFS. NMFS's biennial reports to Congress do not include a recovery achieved statistic, but rather a narrative description of efforts to implement recovery plans. Additionally, the act requires FWS to submit an annual report to Congress on federal expenditures for the conservation of all endangered or threatened species, as well as expenditures by states receiving federal financial assistance for such conservation activities.

Many Factors Affect the Length of Time to Recover Certain Threatened and Endangered Species

Many factors are responsible for the varying length of time it will take to recover the 31 species we reviewed. The services' biologists report that 19 of these species are likely to be delisted within the next 25 years because (1) the primary threats faced by the species have been or are being mitigated; (2) the species are more prevalent than thought at the time they were listed and/or habitat has been secured for the species; or (3) they are the beneficiaries of extensive recovery efforts and are expected to respond relatively quickly to those efforts. In contrast, the remaining 12 species are far from recovery because (1) they respond slowly to recovery actions; (2) the services have not been successful in protecting essential habitat; or (3) there are gaps in knowledge about the threats challenging their survival, or how to mitigate these threats.

Factors Affecting the Species We Reviewed That Are Delisted or Likely to Be Delisted within the Next 25 Years

Nineteen of the thirty-one species we reviewed have already been delisted, or are likely to be recovered and delisted within the next 25 years. The services' biologists expect that many will be delisted within the next 10 years, and all of these species will likely spend less than 50 years on the endangered species list. Eight of these species are recovered, or are nearing recovery, and will likely be delisted in 10 years because they faced primary threats that have been or are being mitigated. Six of the species are recovered, or are nearing recovery, and most will likely be delisted within the next 10 years because they are more prevalent than thought at the time they were listed, and/or key habitat is being protected. The remaining 5 of the 19 species are expected to recover and be delisted within 25 years, because they are expected to respond relatively quickly to recovery efforts involving significant resources and a wide range of stakeholders.

Primary Threats Have Been, or Are Being, Mitigated for Some Species

Eight of the species we reviewed are recovered, or are nearing recovery, because the primary threats facing the species have been, or are being, mitigated. These species are likely to be delisted within the next 10 years.

The bald eagle is one example. The primary threat to the eagle's survival was the widespread use of DDT, an insecticide that caused thin egg shells and reproductive failure. Thus, although there were other steps that needed to be taken (primarily addressing loss of important habitat), the banning of DDT in 1972 was critical to achieving the bald eagle's recovery. FWS reports that the eagle is recovered and has recently proposed delisting the species. Another example is the Magazine Mountain shagreen—a land snail found only on the north side of Magazine Mountain in Arkansas. The primary threat to this species was human use of its habitat or areas close to its habitat. Specifically, the Department of Defense considered using Magazine Mountain for military exercises, and the state of Arkansas proposed building a visitor's center and related facilities on the summit of the mountain—the highest peak in the state. After the snail was listed, however, the Department of Defense withdrew its plans for military exercises in the area, and the visitor's center and associated facilities were designed and built so that potential impacts from construction and operation have been mitigated. FWS biologists told us that the snail's population is stable, but that a proposed 3-year study to gather additional biological information about the species needs to be completed before the species can be proposed for delisting. Table 1 summarizes some key details about the eight species.

Table 1: Species Facing a Primary Threat That Has Been, or Is Being, Mitigated

Species name	Year species was listed and target delisting time frame[a, b]	Primary threat that has been, or is being, mitigated
Bald eagle	Listed: 1967/1978[c] Proposed for delisting: 1999 and 2006 Anticipated to be delisted: by 2010	The insecticide DDT causes reproductive failure in bald eagles. This threat was mitigated when the Environmental Protection Agency banned DDT in 1972. Habitat protections and guidance to avoid disturbing nesting sites have also helped. FWS proposed delisting the eagle in 1999; however, action was delayed because of legal concerns. FWS reinitiated the process to delist the bald eagle in February 2006.
Borax Lake chub (fish)	Listed: 1980 Anticipated to be delisted: by 2015	The primary threats were geothermal development, and shoreline alteration due to grazing. Legislation prevented geothermal development and land acquisition is protecting shoreline.
Columbian white-tailed deer—Douglas County DPS[d]	Listed: 1967 Delisted: 2003	Habitat protection via land acquisition and hunting restrictions were critical to the deer's recovery and subsequent delisting in July 2003.
Gray wolf—western Great Lakes recovery population	Listed: 1967 Proposed for delisting: 2006 Anticipated to be delisted: by 2010	Human predation was the primary threat facing the gray wolf; for instance, wolves were frequently killed by farmers to protect their livestock from predation. Programs that removed livestock-killing wolves, and compensated farmers who lost livestock to wolves, helped reduce this practice. Delisting has been delayed due to legal questions about how to delist this population, since all gray wolves are currently listed as a single entity rather than as distinct population segments.
Papery whitlow-wort—central Florida subspecies (plant)	Listed: 1987 Anticipated to be delisted: by 2010	Habitat has been protected and restored through land acquisition and management activities.
Steller sea lion—eastern DPS[d]	Listed: 1990 Anticipated to be delisted: by 2010	The killing of Steller sea lions by humans (for example, to protect fishing gear or to reduce population numbers) was a major threat that has been prohibited.
Magazine Mountain shagreen (land snail)	Listed: 1989 Anticipated to be delisted: by 2010	Two planned actions that could have affected the species' habitat were withdrawn or mitigated.
Virginia round-leaf birch (tree)	Listed: 1978 Anticipated to be delisted: by 2015	Helping propagation of seedlings in the wild and protecting them until they could withstand herbivory helped ensure the species' survival. Additionally, distributing seedlings to the public helped reduce illegal collecting.

Sources: FWS and NMFS.

[a]Target time frames for delisting assume that remaining recovery actions are taken. However, many factors, including availability of funding, cooperation with partners, acquisition of land, and responsiveness of the species, may render these time frames unattainable or obsolete. We present estimates in 5-year increments.

[b]Species with a listing date before 1973, the year the Endangered Species Act was enacted, were originally listed under provisions of the Endangered Species Preservation Act of 1966 or the Endangered Species Conservation Act of 1969, and "grandfathered" onto the list of threatened and endangered species under the 1973 act.

[c]The bald eagle was first listed in 1967, but the listing only applied to bald eagles in southern states. FWS later determined that there was no morphological or geographical basis to distinguish northern and southern eagles and extended protection to all bald eagles in the 48 conterminous states in 1978.

[d]A DPS is a subdivision of a vertebrate species that, for purposes of listing, is treated as a species under the Endangered Species Act.

Almost all of the eight species nearing recovery due to mitigation of a primary threat were included in the sample of species we reviewed because, among other reasons, in FWS's fiscal year 2001–2002 recovery report to Congres, these species were reported to have achieved 76 to 100 percent of their recovery. The one exception is the Steller sea lion, which we selected because there was a relatively high level of federal and state expenditures on the species as reported for fiscal year 2003. (NMFS does not report a recovery achieved statistic for species for which it is responsible.)

Some Species Are More Prevalent Than Initially Thought and/or the Species' Habitat Is Being Protected

Six of the species we reviewed have recovered, or are nearing recovery, because they are more prevalent than thought when listed, and/or FWS has been successful in protecting important habitat. The services' biologists expect that all but one of these species will be delisted within the next 10 years. After a species is listed, it typically receives more attention; sometimes this attention comes in the form of additional funding to survey for the species, which can lead to finding additional individuals or populations. The Uncompahgre fritillary butterfly is an example of a species where the discovery of additional populations, coupled with management actions to protect those populations, could result in the species being delisted within the next 6 years. When the butterfly was listed in 1991, there were only two known colonies and a few individual butterflies that had been located at two other sites. However, since that time, monitoring has uncovered nine additional colonies. Habitat protections, such as prohibitions on collecting all types of butterflies in key habitat areas, have also helped this species. FWS biologists believe that the species is nearing recovery but, as some of the colonies were only discovered between 4 and 5 years ago, additional monitoring is needed. The recovery plan calls for population levels to have remained stable for 10 years before the species is considered recovered.

Besides finding additional populations, sometimes a species is determined to be more abundant than originally thought because of changes to how the species is taxonomically classified. For example, the Truckee barberry, a small evergreen shrub found in California, was delisted after it was reclassified and included as part of a more common species that is not threatened or endangered. Table 2 summarizes some key details for these six species.

Table 2: Species More Prevalent Than Initially Thought and/or Having Habitat Protections

Species name	Year species was listed and target delisting time frame[a]	Prevalence and habitat protection factors
Dwarf-flowered heartleaf (plant)	Listed: 1989 Anticipated to be delisted: by 2015	Additional populations were discovered, but some habitat still needs protection.
Eggert's sunflower (plant)	Listed: 1997 Delisted: 2005	Additional populations were discovered, and FWS secured conservation agreements from public and private landowners to protect and restore habitat. Protective actions include burning, mowing, or thinning plants that compete with the species.
Johnston's frankenia (plant)	Listed: 1984 Proposed for delisting: 2003 Anticipated to be delisted: 2006	Landowners initially resisted requests to survey for the species but eventually reconsidered; additional populations were subsequently discovered. Conservation agreements with private landowners now protect the species' habitat.
Truckee barberry (plant)	Listed: 1979 Delisted: 2003	At the time of listing, it was not clear how the Truckee barberry was related to other species. Taxonomic analyses later determined that this species is the same as another much more prevalent species.
Uinta Basin hookless cactus	Listed: 1979 Anticipated to be delisted: by 2025	The species is more prevalent than originally thought, but still needs habitat protections.
Uncompahgre fritillary butterfly	Listed: 1991 Anticipated to be delisted: by 2015	Additional populations were discovered, and populations on federal land have been protected by eliminating species collection and reducing access to species habitat.

Source: FWS.

[a]Target time frames for delisting assume that remaining recovery actions are taken. However, many factors, including availability of funding, cooperation with partners, acquisition of land, and responsiveness of the species, may render these time frames unattainable or obsolete. We present estimates in 5-year increments.

As with the species in table 1, all of the six species that are nearing recovery because they are more prevalent (and/or because their habitat has been protected) were included in our sample because they were reported to have 76 to 100 percent of their recovery achieved in FWS's fiscal year 2001-2002 recovery report to Congress.

Some Species Are Likely to Respond Quickly to Recovery Efforts

Five of the species we reviewed are likely to be recovered within the next 25 years, because they are expected to respond relatively quickly to focused recovery efforts with many stakeholders and significant resources. For example, the Rio Grande silvery minnow, a fish that rarely exceeds 4 inches, was historically found in the Rio Grande and Pecos Rivers. However, habitat degradation restricted the fish to 5 percent of its historic range, all in the Rio Grande. To recover the minnow and other endangered species in the area (including the southwestern willow flycatcher, which is

also reviewed in this report), the river is being restored to a more natural state. The restoration will transform the deeply channeled river with high banks that isolate the river from the surrounding floodplain to a more gently flowing river with broader, lower banks that will provide eddies and slack water for juvenile minnows. To achieve this, a myriad of property owners and water-rights interests must be coordinated. Specifically, the Middle Rio Grande Endangered Species Act Collaborative Program—a broad coalition of federal, tribal, and local governments; property owners; and others—is leading efforts to restore the river. Efforts are underway to physically manipulate the river banks, and the Bureau of Reclamation and the U.S. Army Corps of Engineers are manipulating the river's flow to create floods that reconnect the river with the surrounding floodplain. FWS is introducing captively-bred minnows to increase the population size. FWS biologists report that manipulating the river's flow regime is an effective way to create habitat, and that minnow populations increase rapidly when provided with good habitat. Table 3 summarizes some key details about the minnow and four other species that are responding quickly, or expected to respond quickly, to recovery actions.

Table 3: Species Expected to Respond Relatively Quickly to Extensive Recovery Efforts

Species name	Year species was listed and target delisting time frame[a,b]	Stakeholder involvement and resource investment
Colorado pikeminnow (fish)	Listed: 1967 Anticipated to be delisted: by 2015	This extensive recovery program involves significant resources (about $200 million since 1989 on the pikeminnow and other species) and a large number of partners—including federal and state agencies, tribes, and private sector entities. Key actions include providing water to ensure adequate flows, and controlling introductions of nonnative recreational fish species that compete with and prey on the pikeminnow. The effort to recover the pikeminnow is part of a larger effort that includes three other fish species including the razorback sucker, which is also profiled in this report. Because the species breeds annually, biologists believe that successful implementation of recovery actions would result in the species recovering relatively quickly.

(Continued From Previous Page)

Species name	Year species was listed and target delisting time frame[a,b]	Stakeholder involvement and resource investment
Razorback sucker (fish)	Listed: 1991 Anticipated to be delisted: by 2025	This extensive recovery program involves significant resources (about $200 million since 1989 on the razorback sucker and other species) and a large number of partners—including federal and state agencies, tribes, and private entities. Key actions include land acquisition of floodplain habitat and controlling introductions of nonnative recreational fish species that compete with and prey on the sucker. The effort to recover the sucker is part of a larger effort focused on it and three other fish, including the Colorado pikeminnow, which is also profiled in this report. Because the species breeds annually, biologists believe that successful implementation of recovery actions would result in the species recovering relatively quickly.
Rio Grande silvery minnow	Listed: 1994 Anticipated to be delisted: by 2030	This extensive recovery program involves significant resources (about $45 million since 2001) and a large number of partners—including state and local agencies, and private landowners. Key actions include creating needed habitat and introducing captively-bred minnows. Habitat can be created relatively quickly and populations can increase rapidly in the presence of good habitat.
Southwestern willow flycatcher (bird)	Listed: 1995 Anticipated to be delisted: by 2025	A large number of stakeholders were involved in developing the recovery plan for the species, and this has resulted in wide support for the species. The species' biology also helps with recovery, as it uses a variety of habitats that are easy to establish and become available to the species quickly. The species also reproduces annually. About $40 million has been spent since 1995 developing the recovery plan and implementing recovery actions.
Steller sea lion—western DPS[c]	Listed: 1990 Anticipated to be delisted: by 2030	This is an extensive recovery program involving significant resource investment (over $167 million since 1992, including efforts to recover the eastern DPS). Actions taken include extensive research, closures of fishery areas, and reductions in disturbances at breeding sites. Although uncertainty exists about the cause of both the decline and increase in sea lion populations, the annual growth rate of the western DPS reached target levels of 3 percent in 2000 and NMFS biologists believe this trend will continue.

Sources: FWS and NMFS.

[a]Target time frames for delisting assume that remaining recovery actions are taken. However, many factors, including availability of funding, cooperation with partners, acquisition of land, and responsiveness of the species, may render these time frames unattainable or obsolete. We present estimates in 5-year increments.

[b]Species with a listing date before 1973, the year the Endangered Species Act was enacted, were originally listed under provisions of the Endangered Species Preservation Act of 1966 or the Endangered Species Conservation Act of 1969, and "grandfathered" onto the list of threatened and endangered species under the 1973 act.

[c]A DPS is a subdivision of a vertebrate species that, for the purposes of listing under the Endangered Species Act, is treated as a species.

In contrast to the species in tables 1 and 2, these species were included in our sample primarily because there was a relatively high level of federal and state expenditures on the species as reported for fiscal year 2003. None of the four for which FWS is responsible were reported to have 76 to 100 percent of their recovery achieved in FWS's fiscal year 2001–2002 recovery report to Congress.

Factors Affecting the Species We Reviewed That Are Likely Far from Recovery

The recovery efforts for 12 of the 31 species we reviewed are far from complete, and the outcome for some is uncertain. These species are likely to spend at least 50 years on the endangered species list, some significantly longer than that. The services' biologists believe that four of these species will likely recover, but not for many decades—they respond slowly to recovery efforts. An additional five species are far from recovery because FWS is unable to protect habitat necessary for the species' recovery. For the three remaining species, not enough is known about the threats they face, or how to mitigate those threats, to predict whether or when a successful recovery is possible.

Some Species Respond Slowly to Recovery Efforts

For four species we reviewed, recovery efforts are far from complete because the species respond slowly to these efforts. For example, the species may have a relatively low reproductive rate; alternatively, it may depend on habitat that takes a long time to develop to the point that it is useful to the species. Although the services' biologists are optimistic that these four species will eventually recover, they do not believe this will occur in the foreseeable future. For example, NMFS biologists expect the northern right whale to recover eventually, but not for many decades. This whale population was brought to extremely low levels by commercial whaling. Although an international agreement has protected the northern right whale from commercial whaling worldwide since 1935, populations remain extremely depleted—the current population estimate is about 300 individuals. The main threat the whale still faces is human-caused mortality by fishing gear entanglement and collisions with ships. NMFS biologists believe the right whale has a high potential for recovery because the threats to the species are known and can be addressed—actions are being implemented that have reduced mortality associated with fishing gear and ships. However, NMFS biologists also believe it will take a long time for the whale to recover because of its very low population and slow reproduction. Table 4 summarizes some key details for these four species.

Table 4: Species Expected to Recover but That Respond Relatively Slowly to Recovery Efforts

Species name	Year species was listed[a]	Reason for relatively slow recovery
Northern right whale (north Atlantic population)	Listed: 1970	This species lives up to 70 years and reproduces infrequently—once every 3 to 5 years. Commercial whaling severely depleted the population (the current population is only about 300 individuals). Extensive efforts are being taken to reduce whale injuries and mortalities caused by fishing gear entanglement and ship strikes, but the species' low reproductive rate and small population will require a long recovery period.
Red-cockaded woodpecker	Listed: 1970	The species depends on habitat that was nearly eliminated and takes a long time to develop. It also has very selective nesting behavior. It pecks out cavities in old pine trees, and creating a suitable nest cavity can take a decade. However, much of the pine forests in the woodpeckers' habitat have been logged and adversely affected by fire suppression and other activities. As a result, it will be decades before these forests develop to the point that they can be used by the species, and it could take more than 70 years for the species to be delisted.
West Indian manatee (Florida population)	Listed: 1967	Significant efforts to reduce human-caused mortality (such as from collisions with boats) are having a positive effect, but manatees remain extremely vulnerable to mortality due to a lack of warm-water wintering sites. Manatees historically relied on warm water from natural springs, but these are becoming scarce. As a result, many manatees rely on industrial discharges such as cooling water discharges from power plants. However, the reliability of these sources is unpredictable and loss of even one site (such as for maintenance or an emergency) can cause hundreds of manatee deaths. The Florida manatee population is increasing slightly, but uncertainty over the availability of warm-water wintering sites, coupled with the manatee's tendency to return to the same winter sites year after year, means the species' recovery is still many decades away.
Whooping crane	Listed: 1967	Extensive efforts to breed the crane in captivity and reintroduce it into the wild have been relatively successful, but the species will take a long time to recover because the population size fell to a very small number; the species reproduces slowly; and it continues to face threats on its migration routes.

Sources: FWS and NMFS.

[a]Species with a listing date before 1973, the year the Endangered Species Act was enacted, were originally listed under provisions of the Endangered Species Preservation Act of 1966 or the Endangered Species Conservation Act of 1969, and "grandfathered" onto the list of threatened and endangered species under the 1973 act.

These four species were included in our sample primarily because of the relatively high level of federal and state expenditures on the species as reported for fiscal year 2003. The two species for which FWS is responsible were reported as having between 0 and 50 percent of their recovery achieved in the 2001–2002 recovery report to Congress.

Some Species' Habitats Are Difficult to Protect

Recovery efforts for five of the species we reviewed are far from complete because FWS is unable to protect the habitat necessary to recover these

species. For example, the recovery plan for the Florida panther calls for three viable, self-sustaining populations—which must each include at least 240 panthers to maintain genetic diversity. However, as of 2005, there is currently only one population estimated at 76 panthers; its genetic diversity is being augmented by a closely related subspecies found in Texas. The habitat this small population currently relies on is at its carrying capacity and is declining by about one percent per year because of housing and citrus development. FWS biologists report that, although it is biologically feasible to recover the panther, they do not believe it is likely this will occur because of the lack of public support for expanding the current population and establishing additional populations—actions that rely on additional suitable habitat being available to the panther. The lack of public support stems largely from fears of the animal and predation on livestock and pets.

The Socorro isopod, a one-fourth-inch long member of the crustacean family, is another example of FWS being unable to protect the habitat necessary to recover a species, but for a different reason than that of the Florida panther. The only wild population of isopods is found in New Mexico, and lives in the pipes of an abandoned bathhouse that was built to take advantage of the natural hot spring the species historically relied on. The bathhouse and the water rights to the spring that feeds the bathhouse are privately owned. The recovery plan for the isopod calls for an agreement with the property owner to protect the species—either an easement, lease, or outright purchase of the property. However, FWS biologists told us that the property owner has not consented to such an agreement, although he has taken some actions to protect the species, such as repairing a fence surrounding the bathhouse that helps protect it from vandals. However, without the property owner's cooperation, FWS cannot secure the habitat essential to ensure the survival of the species and thus delist it. Table 5 summarizes some key details for these five species.

Table 5: Species for Which Essential Habitat Is Not Protected

Species name	Year species was listed[a]	Habitat protection needed
Ash Meadows sunray (plant)	Listed: 1985	The primary threat at the time of listing was development of its unique habitat—a desert wetland in Nevada. This threat was partially mitigated through land acquisition, but the area remains vulnerable to mineral extraction.
Black-footed ferret	Listed: 1967	Ferrets rely on prairie dog colonies for habitat and on prairie dogs for food. However, strong public opposition to prairie dogs prevents the establishment of sufficient prairie dog populations to support recovery of the ferret. In addition, disease threatens the prairie dogs and the ferret.
Florida panther	Listed: 1967	Development continues to reduce the size of already insufficient habitat for the panther, and there is public opposition to establishing additional populations in other locations.
Papery whitlow-wort—Florida panhandle subspecies (plant)	Listed: 1987	The primary threat to the species is habitat loss through residential, industrial, and commercial development. Land management activities and habitat protections, including land acquisition, are needed. However, funds have not yet been available to fully implement recovery actions.
Socorro isopod (crustacean)	Listed: 1978	Water rights to the spring supporting the only wild population are privately owned.

Source: FWS.

[a]Species with a listing date before 1973, the year the Endangered Species Act was enacted, were originally listed under provisions of the Endangered Species Preservation Act of 1966 or the Endangered Species Conservation Act of 1969, and "grandfathered" onto the list of threatened and endangered species under the 1973 act.

The Florida panther and the black-footed ferret were included in our sample because there was a relatively high level of federal and state expenditures on the species as reported for fiscal year 2003, and each species had at least one full-time staff member dedicated to its recovery. The other three species—the Ash Meadows sunray, the papery whitlow-wort, and the Socorro isopod—were included in our sample because FWS reported them as having between 76 and 100 percent of their recovery achieved in the fiscal year 2001–2002 recovery report to Congress; however, as discussed above, it is unclear when these species will be delisted.

Key Information Is Lacking about the Threats Some Species Face

FWS cannot predict whether or when a successful recovery is possible for the remaining three species we reviewed because it does not know enough about the threats facing the species, or how to mitigate those threats. These three species could spend more than 50 years on the endangered species list. The Indiana bat is one example. This species has been found throughout much of the eastern United States. The bats winter in caves or mines, called hibernacula, that satisfy their highly specific need for cold

(but not freezing) temperatures during hibernation. The fact that they hibernate in a relatively small number of caves suggests that very few caves meet their habitat requirements. FWS biologists originally thought that the only major threat to the bat was anthropomorphic changes to its hibernacula. For example, gates installed to control human access to caves have been documented as major causes of Indiana bat declines because they prevent bat access or do not allow proper air flow; human disturbances in caves with hibernating bats have also been found to adversely affect the species. Yet despite actions to protect the hibernacula and remove these threats, population levels have not rebounded, suggesting that the species faces additional threats when not hibernating. The additional threats are not well known because the species is difficult to study—it is nocturnal, widely dispersed during the summer, and roosts in trees with exfoliating bark. This latter point is problematic because climbing these trees (for example, to conduct studies on the species) could destroy the habitat. Table 6 summarizes some key details for these three species.

Table 6: Species for Which Key Information Is Lacking

Species name	Year species was listed[a]	Key information gap
Ash Meadows gumplant (plant)	Listed: 1985	An invasive species may threaten the gumplant and FWS biologists do not know how to remove it from the gumplant's habitat.
Indiana bat	Listed: 1967	Unknown threats to the bat are suspected during summer months. A revised recovery plan is being drafted that will include recovery actions to address this information gap.
Spring-loving centaury (plant)	Listed: 1985	An invasive species may threaten the centaury and FWS biologists do not know how to remove it from the centaury's habitat.

Source: FWS.

[a]Species with a listing date before 1973, the year the Endangered Species Act was enacted, were originally listed under provisions of the Endangered Species Preservation Act of 1966 or the Endangered Species Conservation Act of 1969, and "grandfathered" onto the list of threatened and endangered species under the 1973 act.

We included the Ash Meadows gumplant and the Spring-loving centaury in our sample because they were reported to have 76 to 100 percent of their recovery achieved in the fiscal year 2001–2002 recovery report to Congress. However, FWS biologists believe that a recently identified threat to these two species may result in the recovery-achieved statistic for these species being lowered in the next recovery report to Congress. The third species—the Indiana bat—was included in our sample because of the relatively high

level of federal and state expenditures on the species as reported for fiscal year 2003.

Recovery Plans Play an Important Role in Recovering Certain Threatened and Endangered Species

We found that recovery plans have played an important role in the recovery efforts of all but one of the 31 species we reviewed. More specifically, for 13 of the species, biologists report that the recovery plan contains key actions needed to achieve progress in recovering the species. Although not all of these species are nearing recovery, the services' biologists report that the success that these species have had can be attributed, in large part, to implementation of actions in the species' recovery plans. For an additional 17 species, biologists report that, although recovery plans have played an important role in the species' progress toward recovery, events unrelated to the plan have also had a critical impact on recovery progress. In some cases, historic and legal events outside the purview of the recovery plan—such as the banning of DDT, which set the stage for the bald eagle's recovery—have been critical to the species recovery. For some species, the discovery of new populations has played an important role in their recovery, although monitoring for additional populations is often a recovery-plan activity. Finally, one species—the dwarf-flowered heartleaf—does not have a recovery plan, and may not need one. FWS biologists report that information about this species is changing rapidly as new and larger populations are being identified. FWS has considered delisting this species, but some stakeholders raised concerns about development threats in the species' habitat. The species' status is currently undergoing a review, and it may be possible to delist it without having a recovery plan.[8]

Implementation of Recovery Plan Actions Has Been the Primary Driver in Recovering 13 Species

Thirteen of the species we reviewed are recovering, in large part due to the implementation of actions in the species' recovery plans. Although not all of these species are nearing recovery, the success that these species have had is attributed primarily to the recovery actions identified in the species' recovery plans. For example, the red-cockaded woodpecker, which is found in 11 states from Florida to Texas to Virginia, is expected to recover largely as a result of implementation of actions in its recovery plan. The species nests in old pine trees and, by creating and maintaining wounds in

[8]The act requires that the services conduct reviews of all the species protected by the act every 5 years to determine whether the species should be delisted, or whether the species' status should change from endangered to threatened, or vice versa.

the tree that exude resin, exploits the ability of these pines to produce large amounts of resin. The resin creates an effective barrier against climbing snakes and prevents nest predation. The woodpecker requires large pine trees because it excavates a cavity within the heartwood (center) of the tree. The diameter of the heartwood must be large enough to contain the entire cavity—otherwise the woodpecker could be entrapped by the resin. The woodpecker requires pines at least 60 to 80 years old because the higher incidence of heartwood decay greatly facilitates cavity excavation. Excavation can take many years, and averages from 6 to 13 years depending on the type of tree being excavated. The species declined significantly because logging eliminated much of the woodpecker's habitat of old-growth pine. FWS biologists report that, although the woodpecker was listed in 1970, not enough was known about the species' biology to develop the recovery actions necessary to bring about the bird's recovery until the mid 1990s. Three of the most significant efforts that have helped the woodpecker were in the plan—prescribed burns have helped develop suitable habitat, artificial nesting cavities have provided a stop-gap measure until existing pine trees mature, and translocation of birds to new locations with suitable habitat has expanded the population. The plan also identified measures to protect existing woodpecker habitat on private land, for example, through conservation agreements. Since the development and implementation of the recovery plan, woodpecker populations have been steadily increasing. Table 7 summarizes some key details for these 13 species.

Table 7: Species Whose Recovery Plans Have Played a Primary Role in the Species' Progress toward Recovery

Species name	Role of plan in species recovery
Black-footed ferret	A captive breeding program outlined in the recovery plan was essential to creating self-sustaining populations in the wild.
Colorado pikeminnow	Key actions in the recovery plan include restoring water flows and controlling the introduction of nonnative fish.
Columbian white-tailed deer—Douglas County DPS[a]	Key actions in the recovery plan include habitat protection (through land acquisition, easements, and other means) by federal, state, and local agencies; and monitoring conducted by the state to determine the status of the species.
Florida panther	Key actions in the recovery plan include introducing Texas mountain lions (a closely related subspecies) to keep the species from becoming dangerously inbred; collaring and monitoring to determine population health and status; and installing highway underpasses to reduce mortality.
Indiana bat	The recovery plan included various steps to protect hibernacula and reduce disturbances to hibernating bats.
Papery whitlow-wort—central Florida subspecies (plant)	Land acquisition and restoration activities included in the recovery plan are helping recover this species.
Papery whitlow-wort—Florida panhandle subspecies (plant)	Land acquisition and restoration activities included in the recovery plan, although still incomplete, have helped this species.
Razorback sucker	Key actions in the recovery plan include land acquisition to provide floodplain habitat and controlling the introduction of nonnative fish species.
Red-cockaded woodpecker	The most beneficial actions in the recovery plan have been prescribed burns to ensure suitable foraging habitat and prevent hardwood tree encroachment; relocation of some woodpeckers to areas with suitable habitat; and providing artificial nesting cavities until trees are mature enough to be used by the species.
Rio Grande silvery minnow	Key actions in the recovery plan include augmenting wild populations of minnows, restoring habitat, and purchasing water rights to help ensure adequate water flows.
Southwestern willow flycatcher (bird)	A large number of stakeholders collaborated on the recovery plan. This public support has been the most effective plan-related action to date. The plan is only 2 years old, and public support will be essential to implement the widespread habitat restoration and protection that is needed to recover the species.
Truckee barberry (plant)	Taxonomic research called for in the recovery plan determined that the Truckee barberry should be reclassified as part of a more prevalent species.
West Indian manatee (Florida population)	Key actions in the recovery plan include reducing mortality from boat collisions, fishing gear entanglement, and entrapment in navigation locks.

Source: FWS.

[a]A DPS is a subdivision of a vertebrate species that, for purposes of listing, is treated as a species under the Endangered Species Act.

Recovery for 17 Species is Driven by Both the Recovery Plan and Other Factors

For 17 of the species we reviewed, biologists report that, while recovery plans played important roles, events outside of the plans have also been critical to the species' recovery efforts. In some cases, historic and legal events have been critical to a species' recovery. For example, the whooping crane benefited from protections that occurred before endangered species legislation was in existence. In the early 1900s, it was recognized that the crane's population was decreasing. The major cause of this decline was thought to be hunting and, as wetlands were drained and turned into farmland, habitat loss. The Migratory Bird Treaty Act of 1916 prohibited hunting of the crane (and most other migratory birds in the United States). The crane also benefited from the creation of two protected areas—one specifically to protect the crane, the other to protect another species that shared the crane's habitat. In 1922, Canada created a national park to protect a small herd of bison and the crane was later found to summer there. In 1937, the Aransas National Wildlife Refuge in Texas was created to protect cranes that were currently wintering there. While these actions were critical to protecting the crane and its habitat, the population remained low and did not exceed 100 until the winter of 1983–84. Accordingly, the 1980 recovery plan set forth many additional recovery actions that have greatly helped the species, such as introducing captively-bred cranes into the wild. Perhaps the best-known of these recovery actions is the use of ultralight aircraft to teach cranes migration routes between summer and winter habitats.

Similarly, the Borax Lake chub also benefited from several events not included in its recovery plan. The chub is a fish, typically less than 2 inches long, found in Borax Lake and adjacent wetlands in arid southeastern Oregon. The lake is fed by several thermal springs that were vulnerable to geothermal development. The immediate threat was removed when the energy exploration company speculating in the area abandoned its plans to pursue development of a hydrogeothermal facility in the Borax Lake area. These actions were not part of the recovery plan but were critical to protecting the Borax Lake chub. They were supplemented by implementation of a key action called for in the recovery plan—purchasing the privately owned land surrounding the lake.

For other species, the discovery of new populations has played an important role in their recovery. For example, Johnston's frankenia, a small perennial shrub found in south Texas and an adjacent area in northeastern Mexico, was listed under the Endangered Species Act in 1984. At the time of listing, there were only five known populations in Texas—all on privately-owned lands. However, many private lands had not been surveyed

for the species because of resistance from the landowners. A key action in the recovery plan was working with landowners to gain access to their lands to conduct monitoring. Once this was accomplished, the plant was found to be more prevalent than thought at the time of listing, and FWS proposed delisting the species in 2003. While the discovery of previously unknown populations is a fortunate event that cannot be prescribed by a recovery plan, monitoring and surveying to determine species' abundance and distribution can be included in a recovery plan. Table 8 summarizes some key details for these 17 species.

Table 8: Species Whose Recovery Has Been Aided by Both Recovery Plans and Other Factors

Species name	Important recovery actions found in recovery plans	Events outside of recovery plans that have aided species' recovery
Ash Meadows gumplant (plant)	Securing land and water rights to protect habitat.	Creation of a national wildlife refuge to protect essential habitat.
Ash Meadows sunray (plant)	Securing land and water rights to protect habitat.	Creation of a national wildlife refuge to protect essential habitat.
Bald eagle	Habitat protection and enhancement of nesting areas, and management guidelines to limit disturbances around nests.	Banning of DDT in 1972.
Borax Lake chub (fish)	Land acquisition around Borax Lake, and the Bureau of Land Management placing special management status on the area around the lake.	Withdrawal of an energy exploration company's plans to pursue development of a hydrogeothermal facility in the Borax Lake area.
Eggert's sunflower (plant)	Prescribed fires to improve habitat; research on genetics; and, for habitat, management plans and conservation agreements.	Species was more prevalent than thought at the time of listing.
Gray wolf (western Great Lakes recovery population)	Strong enforcement of hunting prohibition, depredation control and compensation programs, and public education.	Protections, due to listing the species, sharply curtailed hunting; state programs that protected the wolf also were important.
Johnston's frankenia (plant)	Getting private landowners' cooperation to survey habitat.	Species was more prevalent than thought at the time of listing.
Magazine Mountain shagreen (land snail)	U.S. Forest Service designating habitat areas as "special interest" areas and conducting additional monitoring.	The Department of Defense withdrew plans to use the area for exercises, and FWS provided input to protect the species during development of an environmental impact statement for construction of a facility near the species' habitat.
Northern right whale (north Atlantic population)	Reducing collisions with ships and entanglement with fishing gear.	World-wide ban on hunting in 1935 saved the species from extinction.
Socorro isopod (crustacean)	Another population of isopods was created in 1990 that relies on the same spring as the original population, bringing the total number of isopod populations to three.	Establishment of a captive population in 1977 was relied on to repopulate the habitat when the only wild population became extinct in 1988.

(Continued From Previous Page)

Species name	Important recovery actions found in recovery plans	Events outside of recovery plans that have aided species' recovery
Spring-loving centaury (plant)	Securing land and water rights to protect habitat.	Creation of a national wildlife refuge to protect essential habitat.
Steller sea lion (eastern DPS)[a]	Prohibition on shooting, and protection of habitat and offshore foraging areas.	Also protected by the Marine Mammal Protection Act.
Steller sea lion (western DPS)[a]	Reduction of competition for prey with commercial fishing operations.	Also protected by the Marine Mammal Protection Act.
Uinta Basin hookless cactus	Research to determine species morphology.	Species was more prevalent than thought at the time of listing.
Uncompahgre fritillary butterfly	Closures of key areas to prevent illegal collection, monitoring to identify additional colonies, and management of sheep grazing.	The U.S. Forest Service established a "no ground disturbing" provision for the Rio Grande National Forest that prevents animals such as sheep from trampling potential butterfly habitat.
Virginia round-leaf birch (tree)	Habitat alteration to provide more sunlight to seedlings in the wild and distribution of greenhouse-grown seedlings to the public to stop collection from wild populations.	U.S. Forest Service fenced the two mature trees that occurred on National Forest land and conducted soil disturbance activities to encourage seed germination.
Whooping crane	Captive breeding and reintroduction programs.	Protection of key habitat areas through the creation, in 1922, of a national park in Canada and the creation, in 1937, of a national wildlife refuge in Texas.

Sources: FWS and NMFS.

[a]A DPS is a subdivision of a vertebrate species that, for purposes of listing, is treated as a species under the Endangered Species Act.

Agency Comments

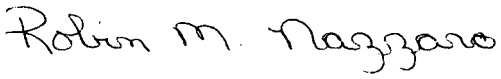
We provided Interior and Commerce with a draft of this report for review and comment. Interior generally agreed with the information presented in this report; its letter is presented in appendix III. Additionally, Interior provided technical comments that we have incorporated into the report, as appropriate. Commerce declined to provide a general assessment of the draft because the report does not contain recommendations. Commerce did, however, provide technical comments that we have incorporated into the report, as appropriate.

We performed our work from September 2005 through August 2006 in accordance with generally accepted government auditing standards. A description of our scope and methodology can be found in appendix I.

As discussed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the Secretary

of the Interior, the Secretary of Commerce, and interested congressional committees. We will also make copies available to others upon request. In addition, this report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you have any questions about this report or need additional information, please contact me at (202) 512-3841 or nazzaror@gao.gov. Contact points for our Office of Congressional Relations and Public Affairs can be found on the last page of this report. Key contributors to this report were Charles T. Egan, Trish McClure, Alison O'Neill, Rebecca Shea, Maria Vargas, and Mary Welch.



Robin M. Nazzaro
Director, Natural Resources
and Environment

List of congressional requesters

The Honorable James M. Inhofe
Chairman
The Honorable James M. Jeffords
Ranking Minority Member
Committee on Environment and Public Works
United States Senate

The Honorable Lincoln Chafee
Chairman
Subcommittee on Fisheries, Wildlife, and Water
Committee on Environment and Public Works
United States Senate

The Honorable Richard W. Pombo
Chairman
The Honorable Nick J. Rahall II
Ranking Minority Member
Committee on Resources
House of Representatives

The Honorable Michael D. Crapo
United States Senate

The Honorable Frank R. Lautenberg
United States Senate

The Honorable Lisa Murkowski
United States Senate

The Honorable Harry Reid
United States Senate

The Honorable Craig Thomas
United States Senate

Scope and Methodology

In response to a request from 10 members of Congress, we (1) identified factors affecting the length of time to recover 31 selected species listed as threatened or endangered under the Endangered Species Act, and (2) described the role that recovery plans have played in recovering these species. As agreed with our requesters, we selected a nonprobability sample of species to review. Results from nonprobability samples cannot be used to make inferences about a population because some elements in the studied population have no chance or an unknown chance of being selected. However, our in-depth review of these selected species provides valuable, case-level insights into their progress toward recovery and the role that recovery plans have played in that progress.

We used a multi-step process to select the nonprobability sample of species for review. First, we used three criteria to identify species that were nearing recovery or had significant attention devoted to them, and thus would be expected to be making progress towards recovery. These three criteria were: (1) species that are nearing recovery as reported by the U.S. Fish and Wildlife Service (FWS), (2) species with relatively high federal and state expenditures, and (3) species with at least one full-time staff member dedicated to recovery. To identify species nearing recovery, we used FWS's fiscal year 2001–2002 biennial report to Congress on the status of species recovery.[1] This was the most recent report available at the time we selected our sample. In this report, FWS provides the percent of recovery objectives achieved for each species—both for those which it has primary responsibility, and for those which it shares responsibility with the National Marine Fisheries Service (NMFS). We considered species to be nearing recovery if they were reported to have achieved 76 to 100 percent of their recovery objectives. NMFS does not report this measure. To identify species with relatively high federal and state expenditures, we used the fiscal year 2003 annual report to Congress of federal and state expenditures.[2] This was the most recent report available at the time we selected our species. It provides expenditure data on all listed species, regardless of which service has primary responsibility. We excluded salmon, steelhead, and the desert tortoise from this sample, even though they had relatively high expenditures, because we have issued

[1]See FWS, *Recovery Report to Congress, Fiscal Years 2001-2002.*

[2]See FWS, *Federal and State Endangered and Threatened Species Expenditures, Fiscal Year 2003.*

comprehensive reports on these species.[3] We relied on FWS officials to identify species that had at least one full-time staff member devoted to recovery efforts. NMFS officials told us that their staff work in recovery teams, and that having a full-time staff member dedicated to recovery efforts would not be a good measure of the resources the agency was devoting to recovery of the species. We identified 40 species that met these three criteria.

Next, because of time and resource constraints, we took several steps to reduce the 40 species to a more manageable number. We prioritized species for review by generally selecting all of the species that satisfied at least two of the three criteria, and species that were nearing recovery and had relatively low federal and state expenditures (in order to understand how species can achieve recovery with relatively low expenditures). This process yielded 20 species for review. As agreed with your offices, we reviewed all 20 of these species and as many of the remaining 20 species as time and resources permitted. To prioritize this second group of 20 species, we excluded certain species from review based on a variety of factors. For example, we chose to exclude species that were similar, or had similar habitats, to other species that were already included for review. For instance, we excluded some populations of the gray wolf from our sample because we had included the western Great Lakes population of the gray wolf in our first group of 20 species for review. We also excluded the Louisiana black bear because of the additional demands that Hurricane Katrina placed on local FWS staff. This process reduced the second group of species for review down to nine.

While our selection process yielded 29 species for review, we ultimately reported on 31 species because 2 of the species we selected—the Papery whitlow-wort and the Steller sea lion—consist of subspecies or distinct population segments (DPS), and we included these in our review.[4] FWS has primary responsibility for all the species we reviewed except for three—the northern right whale and the eastern and western DPSs of the Steller sea lion—for which NMFS has primary responsibility.

[3]See GAO, *Endangered Species: Research Strategy and Long-Term Monitoring Needed for the Mojave Desert Tortoise Recovery Program*, GAO-03-23 (Washington, D.C.: Dec. 9, 2002) and GAO, *Columbia River Basin Salmon and Steelhead: Federal Agencies' Recovery Responsibilities, Expenditures and Actions*, GAO-02-612 (Washington, D.C.: July 26, 2002).

[4]A DPS is a subdivision of a vertebrate species that is treated as a species for purposes of listing under the Endangered Species Act. *See* 61 *Fed. Reg*. 4722 (Feb. 7, 1996).

To identify factors affecting the length of time to recover the 31 selected species and describe the role that recovery plans have played in recovering these species, we reviewed each species' recovery plan and *Federal Register* documents associated with each species' listing and delisting actions, as appropriate. We also interviewed the services' officials at headquarters, and the services' biologists designated as the primary contact for each species' recovery effort, and obtained additional documentation, as necessary.

We performed our work between September 2005 and August 2006 in accordance with generally accepted government auditing standards.

Table 9 lists the species included in our nonprobability sample and the criteria used to select them.

Table 9: Selection Criteria for Species Included in Our Nonprobability Sample

Species name	Federal and state expenditures, FY 2003	Percentage Of recovery objectives achieved, FY 2001–2002	At least one full-time staff member dedicated to recovery efforts
Mammals			
Black-footed ferret	$1,791,796	0-25 percent	Yes
Columbian white-tailed deer (Douglas County population)	Not Available[a]	76-100 percent	No
Florida panther	6,301,276	0-25 percent	Yes
Gray wolf (western Great Lakes population)	403,108	76-100 percent	Yes
Indiana bat	5,218,103	26-50 percent	No
Northern right whale (north Atlantic population)	11,802,149	Not Applicable[b]	Not Applicable[c]
Steller sea lion (eastern DPS)	5,296,600	Not Applicable[b]	Not Applicable[c]
Steller sea lion (western DPS)	49,514,210	Not Applicable[b]	Not Applicable[c]
West Indian manatee (Florida population)	9,798,514	26-50 percent	No
Birds			
Bald eagle (northern states recovery area)	7,831,531	76-100 percent	No
Red-cockaded woodpecker	11,069,069	0-25 percent	Yes
Southwestern willow flycatcher	9,909,284	0-25 percent	Yes
Whooping crane	3,299,156	26-50 percent	Yes

(Continued From Previous Page)

Species name	Federal and state expenditures, FY 2003	Percentage Of recovery objectives achieved, FY 2001–2002	At least one full-time staff member dedicated to recovery efforts
Fishes			
Borax Lake chub	19,600	76-100 percent	No
Colorado pikeminnow	6,872,158	51-75 percent	No
Razorback sucker	7,127,470	0-25 percent	No
Rio Grande silvery minnow	11,300,700	0-25 percent	Yes
Snails			
Magazine Mountain shagreen	0	76-100 percent	No
Insects			
Uncompahgre fritillary butterfly	40,343	76-100 percent	No
Crustaceans			
Socorro isopod	5,500	76-100 percent	No
Plants			
Ash Meadows gumplant	0	76-100 percent	No
Ash Meadows sunray	300	76-100 percent	No
(Ash Meadows) Spring-loving centaury	0	76-100 percent	No
Dwarf-flowered heartleaf	4,520	76-100 percent	No
Eggert's sunflower	178,520	76-100 percent	No
Johnston's frankenia	51,200	76-100 percent	No
Papery whitlow-wort (central Florida subspecies)	200	76-100 percent	No
Papery whitlow-wort (Florida panhandle subspecies)	Expenditures included under Papery whitlow-wort (central Florida subspecies)	76-100 percent	No
Truckee barberry	30,225	76-100 percent	No
Uinta Basin hookless cactus	30,747	76-100 percent	No
Virginia round-leaf birch	1,300	76-100 percent	No

Sources: FWS and NMFS.

[a]The Douglas County population of the Columbian white-tailed deer was not included in the federal and state endangered and threatened species expenditures report for fiscal year 2003. The species was delisted in July 2003.

[b]NMFS does not report percent of recovery objectives achieved.

[c]NMFS officials told us that staff work in recovery teams and that having a full-time staff member dedicated to recovery efforts would not be a good measure of the resources the agency was devoting to the species recovery.

Information on 31 Select Species

This appendix provides information on each of the 31 species we reviewed for this report, including species characteristics, threats to the species' survival, and costs and partnerships for implementing recovery actions. The species' profiles are organized by taxonomic group as follows: mammals, birds, fishes, snails, insects, crustaceans, and plants.

The information provided is based primarily on species' recovery plans, *Federal Register* notices associated with the species, and information provided by the biologists at the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) who are responsible for recovering the species we reviewed. We have attempted to provide estimates of the costs to date to recover each species, however, there are inherent limitations to expenditure data, and species-specific information is not always available because recovery actions may benefit more than one species (e.g., through habitat restoration). Additionally, in some cases, federal and state agencies track expenditures by activity rather than by species. Complete expenditure data on a species' recovery can also be difficult to obtain, because many entities, in addition to FWS and NMFS, may implement recovery actions, but are not required to report their expenditures. These entities include timber companies and commercial fishing operations, nongovernmental organizations such as The Nature Conservancy, and universities and independent researchers.

Several of the profiles discuss Section 6 funds and Section 7 consultations—these refer to sections in the Endangered Species Act. Section 6 authorizes grants to states that maintain programs to conserve listed species. Section 7 requires that federal agencies, in consultation with FWS or NMFS, insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. Following the consultation, FWS or NMFS must issue a biological opinion stating how the action will affect the species or its critical habitat. If jeopardy or adverse modification is found, the opinion identifies the steps (called "reasonable and prudent alternatives") needed to avoid such harm. These consultations may result in an agency modifying its activities.

Species with a listing date before 1973, the year the Endangered Species Act was enacted, were originally listed under provisions of the Endangered Species Preservation Act of 1966 or the Endangered Species Conservation Act of 1969, and "grandfathered" onto the list of threatened and endangered species under the 1973 act.

Mammals

Black-Footed Ferret

The black-footed ferret *(Mustela nigripes)* was listed as endangered in 1967, when only a small population remained in South Dakota. By the early 1970s, the species was thought to be extinct in the wild. However, a small population of black-footed ferrets was discovered in Wyoming in 1981. Black-footed ferrets have been reintroduced into Arizona, Colorado, Montana, South Dakota, Utah, Wyoming, and Chihuahua, Mexico. Black-footed ferrets are mostly nocturnal, solitary carnivores that feed on prairie dogs and live in prairie dog burrows. As such, black-footed ferret populations closely correspond to prairie dog populations.

Threats

The decline of the black-footed ferret was an unintended consequence of concerted public and private efforts to eliminate prairie dogs. Prairie dog populations were dramatically reduced or locally eliminated by large-scale conversion of native grasslands into crop lands, and decades of widespread poisoning designed to reduce prairie dog competition with cattle grazing. In more recent years, sylvatic plague, a disease spread primarily by fleas that is devastating to both prairie dog and ferret populations, has become a serious threat to ferret recovery.

Role of Recovery Plan

FWS approved a recovery plan for the black-footed ferret in June 1978, revised it in August 1988, and is now revising it again. The plan seeks to ensure the species' survival by maintaining a captive population and increasing free-ranging populations to the widest possible distribution across the ferrets' historical range. FWS officials reported that the captive breeding program is the most important and expensive recovery activity for the ferret. FWS started with 18 captured black-footed ferrets in 1987. Since then, the ferrets have produced more than 5,000 offspring—over 2,000 of which have been released into the wild.

FWS reports that, although the number of black-footed ferrets has increased substantially, recovery of the species remains a challenge. While the captive breeding program has worked well, reintroduction efforts have had mixed success. Two populations in South Dakota and one in Wyoming are thought to be self-sustaining, and substantial progress is being made at two other sites. However, drought and plague have affected population stability at other recovery areas. Specifically, a drought in South Dakota last year caused prairie dog populations in a section of the Buffalo Gap

National Grasslands, where the black-footed ferret had been successfully reintroduced, to disperse onto adjacent private lands. Thousands of acres of public and private lands were subsequently baited with poison by private landowners to eliminate the prairie dogs. Additionally, FWS and several partners are currently pursuing a plague vaccine for the ferret that appears promising.

According to FWS officials, the technology and expertise to fully recover the ferret exists; they estimate that they could delist the species by 2025. However, the officials note that sufficient commitment from federal agencies, states, and private landowners to restore and protect sufficient habitat for wild populations does not exist and, as a result, the ferret faces an uncertain future.

Costs and Partnerships

FWS officials were not able to provide expenditure data for black-footed ferret recovery efforts, but estimated that the many partners involved in the species' recovery spend more than $2 million annually. More than 50 percent of recovery expenditures is for captive breeding; 35 to 45 percent is for reintroduction, monitoring, trapping for relocation, and habitat assessment. A very small fraction of expenditures is for habitat conservation. Some 27 state and federal agencies, tribes, and conservation organizations are official participants on FWS's black-footed ferret recovery implementation team.

Columbian White-Tailed Deer (Douglas County Population)

The Columbian white-tailed deer *(Odocoileus virginianus leucurus)* was listed as endangered in 1967. At that time, only a small population was known to survive along the lower Columbia River and on some islands off the coast of Washington; however, an additional population was discovered in 1978 in Douglas County, Oregon. The lower Columbia River and the Douglas County populations were treated separately for recovery purposes because of differences in location, habitat, threats, and land use. The Douglas County population was classified as a distinct population segment (DPS) and delisted in 2003.[1]

[1]A DPS is a subdivision of a vertebrate species that, for purposes of listing, is treated as a species under the Endangered Species Act. *See* 61 *Fed. Reg.* 4722 (Feb. 7, 1996).

Threats	An FWS official reports that the primary threats to the Columbian white-tailed deer were habitat loss and hunting (both legal and illegal).
Role of Recovery Plan	FWS approved a recovery plan for the Columbian white-tailed deer in 1976 and revised it in 1983 after the 1978 discovery of the Douglas County population. An FWS official reports that the most effective recovery actions for the species were in the plan and were: (1) land acquisitions by state and local governments, FWS, and the Bureau of Land Management (BLM) to secure habitat; (2) a Douglas County ordinance that protects, in perpetuity, riparian areas from development; and (3) a partnership with the Oregon Department of Fish and Wildlife. The Oregon Department of Fish and Wildlife has researched, monitored, and maintained location and health data for the species for many years, and modified its monitoring methods at FWS's request to obtain the data needed to delist the Douglas County population.
Costs and Partnerships	An FWS official reports that the agency does not have comprehensive recovery expenditure data for the Columbian white-tailed deer, but notes that recovery was done on a "shoestring budget" because, once FWS secured suitable habitat, the population rebounded without extensive agency intervention. FWS estimates it took about 20 percent of one staff member's annual salary to conduct recovery activities and delist the Douglas County population. Between 1995 and 1998, FWS also provided $177,000 in funding through a cooperative agreement with the Oregon Department of Fish and Wildlife for monitoring and habitat research. Douglas County also incurred expenses to protect habitat and some private landowners contributed funds to recovery efforts. The FWS official attributes the Columbian white-tailed deer's recovery to "strong partnerships and a cooperative spirit" with other governmental entities.

Florida Panther

The Florida panther (*Puma concolor coryi)*, a subspecies of mountain lion, was listed as endangered in 1967. The Florida panther is six to seven feet long with short, dark rust-colored fur. It originally ranged from eastern Texas to South Carolina—through Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, and parts of Tennessee—but is now restricted to less than 5 percent of its historic range.

Threats	The Florida panther faces several threats, including habitat loss, low genetic viability, and disease. The habitat that supports the only wild population is already at its carrying capacity and is shrinking by about 1

percent annually. Habitat loss is due to intensified urbanization, residential development, conversion to agriculture, water management, and mining and mineral exploitation. Because there are so few wild panthers in Florida, the species has suffered a loss of genetic variability—which often causes diminished health, such as heart and reproductive defects. The panther is also susceptible to diseases such as panleukopenia (decreased white blood cells), feline calicivirus, and pseudorabies. Any or all of these may increase kitten mortality and seriously reduce adult panther vitality. In 2003 and 2004, 5 of the 87 known wild Florida panthers were lost to feline leukemia. FWS officials report that a lack of public support, based on fear of the animal and its predation on livestock and pets, is an obstacle to reintroducing the Florida panther into other sites in its historic range and, ultimately, recovering the species.

Role of Recovery Plan

FWS approved a recovery plan for the Florida panther in 1981 and revised it in 1987, 1995, and 2006. According to FWS officials, the most important recovery actions for the species are found in the recovery plan. These include habitat protection, radio collaring and monitoring to determine the health and status of the population, constructing highway underpasses to reduce vehicle strikes, and introducing female panthers from Texas (which belong to a related subspecies) to the Florida population to restore genetic health. FWS officials said that one new female Texas panther needs to be introduced into the Florida population each generation to maintain sufficient genetic diversity. FWS officials report that the recovery plan for the Florida panther has been critical in keeping it from becoming extinct, but note that the plan focuses on avoiding extinction rather than promoting recovery.

FWS officials report that it is unlikely that the panther will ever be recovered and delisted. Officials say that the Florida panther will never have a genetically sustainable population in south Florida because available habitat is not large enough to support a self-sustaining population, which would require at least 240 panthers, particularly given the rapid development that this area experiences. FWS has identified areas in Arkansas, Alabama, and northern Florida/southern Georgia where enough habitat exists to sustain populations of that size. However, reintroduction of panthers into these areas is unlikely to occur because of a lack of public support.

Costs and Partnerships

Most recovery tasks for the panther are implemented by the Florida Panther Interagency Committee, which was organized in 1986. This committee consists of several agencies including FWS, the National Park

Service, the Florida Fish and Wildlife Conservation Commission, and the Florida Department of Environmental Protection. FWS officials were unable to provide recovery expenditure data on panther recovery, but estimate that Florida state agencies bear about 90 percent of the costs, while the National Park Service and FWS account for about 7 percent and 3 percent, respectively. The Florida Fish and Wildlife Conservation Commission, with help from the National Park Service, has played a major role in genetics, radio collaring, and monitoring activities.

Gray Wolf (Western Great Lakes Recovery Population)

The gray wolf was listed as endangered in 1967. Gray wolves weigh about 50 to 100 pounds and are usually a mixed gray color. The gray wolf has had a complex relationship with the law. When the act first took effect in 1973, two populations of gray wolves were "grandfathered" onto the list of threatened and endangered species—one in Minnesota and Michigan, and one in the northern Rocky Mountains. In 1976, two more populations of gray wolves that ranged in the southwestern United States were added to the list. To update the taxonomy of the species based on new information and address other issues, FWS issued a new listing in 1978 that classified the gray wolf as a single species that was endangered throughout the lower 48 states, except for a population in Minnesota that was listed as threatened. Even though the gray wolf was listed as a single species, FWS still recognized separate populations for managing recovery efforts. (FWS officials later determined that wolves that historically occurred in 16 southeastern states were actually a separate species—the red wolf.) For this report, we evaluated recovery actions for the western Great Lakes population; other populations are the western (which includes the Rocky Mountains) and the southwestern populations.

The historic range of the western Great Lakes population *(Canis lupus lycaon)* once included most of the eastern United States and southeastern Canada, but its present U.S. range only includes parts of Michigan, Minnesota, and Wisconsin. FWS officials believe that this population is ready to be delisted. However, its delisting is constrained because it is not listed as a separate entity—it is part of the larger gray wolf listing. To clarify the current status of the various populations of gray wolves and to delist the western Great Lakes population, FWS proposed a rule in 2000 to (1) reclassify the gray wolf as "not listed" in 16 southeastern states that are historic red wolf ranges; (2) establish a DPS for the western Great Lakes population to be listed as threatened; (3) establish a DPS for the western population to be listed as threatened; and (4) establish a DPS for the southwestern population to be listed as endangered. While the rule was

finalized in 2003, FWS was sued for this action. In early 2005, courts ruled that FWS's action was arbitrary and capricious with regard to how they grouped states into these four separate classifications. Therefore, the wolf listing reverted to the prior listing action from 1978; this listing identifies the gray wolf as endangered in 47 of the lower 48 states, and threatened in Minnesota. To address the court's concern with the prior delisting proposal, FWS is addressing redesignation of the gray wolf on a population-by-population basis. In February 2006, FWS issued an advance notice of proposed rulemaking to establish a Northern Rocky Mountain DPS and delist it at the same time. Similarly, in March 2006, FWS officials proposed a rule to create a western Great Lakes DPS and delist it at the same time.

Threats

FWS officials report that ranchers who kill the wolf to protect livestock are the primary threat to the western Great Lakes population. In addition, the public's fear of wolves results in opposition, which is a complicating factor for recovery of the species.

Role of Recovery Plan

FWS approved a recovery plan for the western Great Lakes population of the gray wolf in 1978 and revised it in 1992. Officials reported that the comprehensiveness of this plan and the numerous partners' efforts made recovery of the western Great Lakes population possible. Actions in the recovery plan that were most important for recovering this population were the creation of programs to compensate ranchers for livestock lost to wolves, and the removal of wolves from areas where they prey on livestock. The plan also included public education on wolf biology, behavior, and ecology that has been important for improving the public's understanding of the species.

Costs and Partnerships

FWS officials report that the large number of entities involved in recovery efforts for the gray wolf makes it impossible to estimate total expenditures. FWS expenditures in fiscal year 2004 included almost $645,000–$140,000 for law enforcement; $60,000 for Section 7 consultations, mostly with the U.S. Department of Agriculture; $55,000 for monitoring and research on FWS refuges; and about $390,000 for the delisting process. The agriculture and natural resources departments in Michigan, Minnesota, and Wisconsin dedicate resources to help FWS enforce laws that protect the gray wolf. Additionally, these states, along with the U.S. Department of Agriculture's Wildlife Service and the nongovernmental organization Defenders of Wildlife, fund and manage the livestock compensation programs. Public education is conducted by a variety of additional nongovernmental

organizations, such as the International Wolf Center and the Timber Wolf Alliance. Indian tribes also protect the gray wolf on their land.

Indiana Bat

The Indiana bat *(Myotis sodalis)* was listed as endangered in March 1967. The Indiana bat is a migratory species that hibernates in the winter and disperses throughout much of the eastern United States in the summer. Based on censuses taken every other year in caves where the bats hibernate during the winter (called hibernacula), researchers estimate that the Indiana bat population has declined by about 60 percent since the 1960s—falling to about 353,000 in the mid 1990s.

Threats

FWS officials report that they initially believed that winter habitat loss was the primary threat to the Indiana bat. The bats require certain temperatures in caves during their winter hibernation—they will freeze if the temperature is too low and burn up their fat reserves before spring if the temperature is too high. Large numbers of Indiana bats hibernate in a very small number of large, complex caves because such caves provide a more stable temperature than smaller caves. However, these caves are often easily accessible to humans and have features that make them attractive for recreational and commercial purposes. As a result, doors and walls were often added to cave openings, changing the temperature of the caves to the point that they no longer provide suitable habitat. In addition, researchers now believe that bat populations are affected by a number of threats when they are not hibernating, the most significant of which are not yet known.

Role of Recovery Plan

FWS officials approved a recovery plan for the Indiana bat in 1983, and drafted a revision in March 1999. The 1999 revision, however, was not approved because of differences of opinion among recovery team members, and because FWS needed to address the significant public comments received. A new draft revision is expected in 2006. FWS officials report that an important recovery action that was identified in the 1983 recovery plan was to protect hibernacula. Actions have been implemented to do this, including removing doors and walls in order to restore cave temperatures to normal, gating hibernacula to control human access, and allowing cave tours only during the summer when bats are not present. However, FWS officials report that these efforts have not always resulted in the expected increases in hibernating populations, suggesting that additional, unknown threats affect the Indiana bat. Therefore, the draft revision of the recovery plan is focusing heavily on research. FWS officials

report that they cannot estimate the Indiana bat's potential for delisting because they lack sufficient information about key aspects of the species' life cycle and the threats it faces. It appears that the population is increasing; however, it remains far below historic levels.

Costs and Partnerships

FWS officials could not provide an estimate of recovery expenditures for the Indiana bat because they are not centrally collected. Partners include states, which have used Section 6 funds for land acquisition, and the U.S. Forest Service (Forest Service) and Department of Defense, which monitor summer bat colonies on their lands.

Northern Right Whale

The northern right whale *(Eubalaena glacialis)* was listed as endangered in 1970. Adult right whales are generally between 45 and 55 feet in length and can weigh up to 70 tons. Historically, there were two populations of this whale. An eastern North Atlantic population was historically found along the northwestern coast of Africa and in Northern European waters, but is generally considered to be extinct. A western North Atlantic population is found along the eastern United States coast and includes about 300 whales.

Threats

The primary threats to the survival of the northern right whale are its low population numbers, fishing gear entanglement, and collisions with ships. In the past, the greatest threat was commercial whaling, which was banned internationally in 1935.

Role of Recovery Plan

NMFS approved a recovery plan for the northern right whale in 1991, and revised it in 2005. Several important recovery actions included in the recovery plan have been implemented for the species. In particular, extensive effort is expended implementing surveillance and alert systems. Specifically, aircraft surveys identify locations of right whales; these locations are then shared with ship captains. On a number of occasions, aircraft observers were able to contact and divert ships on direct courses for right whales. In addition, NMFS and the U. S. Coast Guard jointly developed a mandatory ship reporting system that became operational in 1999 for use in right whale habitat to help avoid ship strikes. Ships entering right whale habitat are required to report their location, speed, and direction; an automatic message replies with relevant whale location information. U. S.Navy vessels also report information on ship strikes and provide advisories to ship captains.

Other important actions that have been implemented from the recovery plan include closing fishing areas during certain times, and buy-back programs for commercial fishing operations in which old fishing gear is purchased so it can be replaced with specially designed new gear that is less hazardous to whales. NMFS is also proposing prohibiting float rope—used by fisherman between traps and fishing gear—which creates large loops of line that can cause serious injury and mortality to right whales. Although significant steps have been taken to reduce fishing gear entanglements and ship strikes, NMFS officials acknowledge that additional efforts are needed. NMFS officials report that the northern right whale has a high potential for recovery because the threats to the species are known and manageable. However, they report that it will take more than 50 years to meet recovery goals because right whales reproduce infrequently.

Costs and Partnerships

NMFS officials report that it would be difficult to provide comprehensive cost estimates because significant funding for right whale recovery is provided by other entities. Key partners in right whale recovery include the U.S. Coast Guard, the U.S. Navy, other government agencies, nongovernmental organizations, and the commercial fishing industry.

Steller Sea Lion (Eastern and Western DPSs)

The Steller sea lion (*Eumetopias jubatus*) was listed as threatened in 1990. In the 1950s, an estimated 240,000 to 300,000 Steller sea lions ranged across the Pacific rim from southern California, Canada, and Alaska, into Russia and northern Japan. By 1990, the species had declined by about 80 percent. In 1997, NMFS reclassified the Steller sea lion as two DPSs based on new genetic information—the eastern DPS extends east from Cape Suckling, Alaska, to British Columbia, and south to California; the western DPS extends from Japan around the Pacific Rim to Cape Suckling. The eastern DPS was listed as threatened, while the western DPS was listed as endangered.

Threats

NMFS reports that the primary threat to the Steller sea lion, at the time it was listed, was the killing of sea lions to protect fishing gear and reduce their population size. Additional threats for the western DPS include predation by killer whales, environmental change, subsistence harvests, and disease. These threats also affect the eastern DPS, but do not appear to be limiting its recovery.

Role of Recovery Plan

NMFS approved a recovery plan for the Steller sea lion in 1992, and a draft revision is currently being considered. Important actions in the 1992 recovery plan were to collect background information on the biology of Steller sea lions, develop and implement new research methods to better understand the causes of decline, and assess the efficacy of fishery conservation measures. In accordance with the recovery plan, NMFS and its partners have monitored Steller sea lion population trends, gained valuable information on general sea lion ecology, evaluated threats to recovery, and determined which populations are at risk. Key conservation measures in the recovery plan that have been implemented include reducing direct and incidental harm and killing by commercial fishing operations, eliminating disturbances at breeding sites, and reducing competition with commercial fisheries for sea lion prey.

NMFS officials report that the eastern DPS has been doing well for quite some time and hope to delist it by 2010. The western DPS has been increasing by about 3 percent annually since 2000, but NMFS reports that this increase may not represent a statistically significant trend. The increases correlate with recovery actions taken in the late 1990s and 2000s to reduce direct harm and killing of sea lions by commercial fisheries and competition between fisheries and Steller sea lions; however, NMFS cannot definitively determine a causal link. If the western DPS continues to increase, NMFS officials said that they may consider downlisting it within the next decade and delisting it around 2030.

Costs and Partnerships

Between 1992 and 2005, NMFS received over $167 million in appropriations for Steller sea lion recovery efforts, with most of that provided in recent years. Funding from 1992 through 2000 totaled just $18.5 million, compared to about $149 million between 2001 and 2005—a substantial increase that resulted from concerns about the potential impact of commercial fisheries on the Steller sea lion's decline. The most significant expenditures for the sea lion are on research. Approximately $40 million per year in 2001 and 2002 was dedicated to research; current funding for research is about $20 million per year.

Between 1992 and 2005, NMFS's internal funding accounted for about one-third of the overall expenditures on sea lion recovery (about $52 million); the remainder of the $167 million was distributed in the form of grants to state government, fishery management councils, and the public. NMFS activities include conducting Section 7 consultations, supporting the recovery team, and implementing conservation actions and the Marine Mammal Protection Act. NMFS officials report that partners have been

critical to sea lion recovery efforts and include state governments, fishery management councils, and the public.

West Indian Manatee (Florida Population)

The Florida subspecies *(Trichechus manatus latirostris)* of the West Indian manatee was listed in 1967.[2] The manatee is a large gray or brown aquatic mammal. Adults average about 10 feet long and weigh about 1,000 pounds. Florida manatees can be found throughout the southeastern United States, with Florida and Georgia at the core of its range. The Florida population consists of four subpopulations, divided regionally throughout coastal and riverine waters: the Atlantic, St. Johns River, northwest, and southwest. The Florida Fish and Wildlife Conservation Commission's 2001 survey of the Florida population reported a minimum of 1,400 to 1,500 manatees in the Atlantic subpopulation; 1,400 in the southwest subpopulation; 175 in the upper St. Johns River subpopulation; and 400 in the northwest subpopulation.

Threats

FWS officials report that the primary threats to the manatee are collisions with watercraft, entrapment in navigation locks, entanglement in fishing gear, and a lack of warm-water wintering sites.

Role of Recovery Plan

FWS approved a recovery plan for the manatee in 1980 and updated it in 1989, 1996, and 2001. FWS officials report that decreasing the number of manatee deaths from watercraft collisions, entrapment in navigation locks, and entanglement in fishing gear are the most important efforts implemented as part of the recovery plan. Watercraft collisions, and related manatee deaths and injuries, have been the focus of FWS's and its partner's recovery activities for many years. At least 25 percent of manatee mortalities are caused by collisions with watercraft, and many manatees bear scars from these encounters. Federal and state managers have sought to reduce the number of such deaths and injuries through law enforcement, outreach, education, and the designation of manatee protection areas and no-wake zones. This process is ongoing, and efforts continue to reduce the number of such events.

[2]This listing was amended in 1970 to include the Antillean subspecies *(T. m. manatus)*. Within the jurisdiction of the United States, Antillean manatees are found in Puerto Rico, the Virgin Islands, and occasionally in Texas. There are two separate recovery plans for the West Indian manatee, one for the Florida subspecies and another for the Antillean subspecies in Puerto Rico.

To reduce entrapment in navigation locks, the U.S. Army Corps of Engineers (the Corps) and state water management agencies have retrofitted water control structures and navigation locks with pressure sensors or acoustic arrays—devices that use acoustic signals to detect the presence of manatees—to allow trapped manatees to escape. In addition, Florida has banned fishing nets and is considering seasonal closures of fishing areas, which may help to reduce manatee mortality from entanglement in fishing gear.

FWS officials report that they do not anticipate delisting the manatee in the near future, although they are reviewing the species to determine if it should be downlisted from endangered to threatened. The availability of warm-water wintering sites remains a major challenge to manatee recovery. Historically, the manatee relied on warm water from natural springs; these springs are diminishing, however. Many warm-water sites currently used by manatees are created artificially through discharges from power plants and other industries. Approximately 585 manatees have been counted at a single warm-water discharge site. If one of these plants closes and the water cools, even temporarily, manatee mortalities could number in the hundreds. Because manatees return to the same warm-water wintering sites year after year, preserving these sites is critical to successful recovery efforts—as is trying to attract manatees to more secure sites. However, given their fidelity to a single wintering site, it will take a long time to attract sufficient numbers of manatees to more secure wintering sites.

Costs and Partnerships

FWS officials report that estimating the cost of recovery for the manatee is challenging because of the large number of public and private organizations involved, but note that the costs are very high. For example, FWS officials state that, from fiscal years 1994 through 2005, the Corps spent over $7 million retrofitting gates on water control structures with pressure sensors and equipping navigation locks with acoustic arrays. It costs approximately $100,000 to retrofit each gate with the pressure sensors, and $1,000,000 to install acoustic arrays on navigation locks. State agencies have also contributed funds for these activities, but FWS officials did not have that cost information. Additional partners in manatee recovery include several zoos and aquaria—located in California, Florida, Ohio, and Puerto Rico—that conduct manatee rescue rehabilitation and release programs. In these programs, a manatee is brought into captivity when injured or sick and, upon rehabilitation, released back into the wild. FWS officials report that these programs also cost millions of dollars.

Birds

Bald Eagle (Northern States Recovery Area)

The bald eagle is a large bird of prey found only in North America. Eagles rely primarily on fish for their diet, and their habitat is almost exclusively near lakes, rivers, and sea coasts. Most bald eagles live for about 30 years, making it a relatively long-lived species. A bald eagle subspecies found in the southern United States was listed as endangered in 1967. However, in 1978, due to a lack of distinguishing physical characteristics, FWS reclassified all bald eagles in the United States as one species *(Haliaeetus leucocephalus)*. FWS listed the species as endangered throughout the lower 48 states, except in Michigan, Minnesota, Oregon, Washington, and Wisconsin, where it was classified as threatened. To manage the recovery program for the bald eagle, FWS established five areas with individual recovery plans. We reviewed the northern states recovery area, which is the largest of these recovery areas; it covers 24 states.

According to FWS officials, a 1963 survey of bald eagles in the lower 48 states found only 417 nesting pairs. That number had grown to 3,399 pairs in 1991; of these, 1,188 pairs were found in the FWS region that leads the efforts for the northern states recovery area. In 1995, the bald eagle was downlisted from endangered to threatened throughout the lower 48 states. FWS proposed delisting the bald eagle in 1999 due to recovery, but met resistance because of concerns over the changes in protections afforded the species—even though it is also protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. FWS reinitiated the process to delist the bald eagle in February 2006. To address concerns with the prior delisting proposal, FWS also issued draft management guidelines for bald eagles and a proposed rule for a regulatory definition for "disturb" under the Bald and Golden Eagle Protection Act.

Threats

Originally, the primary threats to the bald eagle were hunting, trapping, and pesticides—especially dichloro-diphenyl-trichloroethane (DDT), which was widely used in the late 1940s to control insects that damaged agriculture and carried diseases such as malaria. FWS officials report that current threats to the bald eagle include habitat loss due to development and other human activities, especially along the coast and near inland rivers and waterways.

Role of Recovery Plan

Historic threats to the bald eagle have long been mitigated. The Bald Eagle Protection Act of 1940 (amended as the Bald and Golden Eagle Protection Act in 1962) made hunting and trapping the bald eagle unlawful; the eagle was afforded additional protection under the Endangered Species Act. In addition, the Environmental Protection Agency banned DDT in the United States in 1972 because of the harm it caused to wildlife. These actions occurred long before there was a recovery plan for the species.

FWS approved a recovery plan for the northern states population of bald eagles in 1983. The plan covers 24 states where bald eagles were listed as either threatened or endangered. Key activities in the plan that have been implemented include protecting habitat, managing nesting areas, and educating the public to avoid disturbing habitats. FWS officials report that education and law enforcement programs called for by the recovery plan have resulted in habitat restoration and the reduction of illegal hunting and trapping. Additionally, they report that the extensive knowledge they obtained through years of research have contributed to the recovery process. Further, the bald eagles' prominence as a national symbol, coupled with education and public support, has also been critical in the recovery of this species. Even though habitat loss continues to escalate as the U.S. population increases, bald eagle populations continue to grow.

Costs and Partnerships

While FWS has led efforts to implement the recovery plan for the bald eagle, there are a wide variety of government partners in the northern recovery area, including state forestry departments, the Forest Service, the National Park Service, the Department of Defense, the Bureau of Reclamation (BOR), and BLM. Nongovernmental partners include the National Wildlife Federation, the Audubon Society, the American Eagle Foundation, forest product companies, and various bird watching societies. Additionally, FWS officials report that grassroots volunteer efforts and financial contributions from private parties played an important role in the bald eagle's recovery. According to FWS officials, annual expenditures for the recovery and protection of the bald eagle, by public and private agencies nationwide, have exceeded $1 million each year for the past decade.

Red-Cockaded Woodpecker

The red-cockaded woodpecker *(Picoides borealis)* was listed as endangered in 1970. It is a black and white bird about 8 inches long. On occasion, the male displays red feathers on its head. The woodpecker builds nest cavities in old-growth pine trees (70–120 years old) with wood that is both soft enough for the woodpecker to make a nest cavity and large

enough for the cavity to be free of pine resin. The bird's range includes Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, and Virginia.

Threats

An FWS official reports that the primary threats to the red-cockaded woodpecker are habitat fragmentation resulting from development, and the limited availability of old growth pine trees due to past timber harvests. Fire suppression activities also severely harm the species' habitat because they result in hardwood tree encroachment in pine forests, which in turn causes woodpeckers to abandon their nesting cavities in these areas.

Role of Recovery Plan

FWS approved a recovery plan for the red-cockaded woodpecker in 1979, and revised it in 1985 and 2003. FWS reports that the most effective recovery actions are in the species' recovery plan, and include (1) the scheduling of prescribed burns every 2 to 3 years to ensure suitable foraging habitat and prevent hardwood tree encroachment, (2) the building of artificial cavities in suitable trees, and (3) the relocation of red-cockaded woodpeckers into artificial cavities to establish new breeding populations. Building artificial cavities is necessary because most existing trees are not suitable for the red-cockaded woodpecker to carve cavities.

In addition, during the 1990s, FWS worked with timber companies and other industries to determine the conditions under which these entities would assist in recovery efforts for the species, given that some habitat and potential habitat were privately owned. FWS officials report that agreements with these entities have played an important role in the red-cockaded woodpecker's recovery, and also provide private landowners with economic and legal predictability regarding the uses of their land.

An FWS official reports that red-cockaded woodpecker populations have steadily increased, from 4,600 groups in 1995 to 5,900 groups in 2005 (groups include a mating pair and other individuals who help build nesting cavities.) While these increases are promising, the FWS official estimates that, because of the time it takes for the woodpecker's habitat to mature, it will take at least 25 years to downlist the species and over 50 years to meet the population and habitat requirements for delisting.

Costs and Partnerships

An FWS official reports that more than 150 public and private entities have been involved with recovery efforts; therefore, the complete cost of the red-cockaded woodpecker's recovery cannot be estimated. Some federal agencies do have cost information—for example, the Department of

Defense reported spending about $62 million on the species from 1991 through 2003 (an average of about $5 million per year). The Forest Service spent slightly more than $1 million each year for fiscal years 2004 and 2005. In addition to federal agencies, FWS has agreements with many state agencies and private entities in Florida, North Carolina, and South Carolina to implement recovery actions. Private entities involved include International Paper, The Nature Conservancy, Plum Creek Timber Company, Turner Endangered Species Fund, and private landowners.

Southwestern Willow Flycatcher

The southwestern subspecies of the willow flycatcher (*Empidonax traillii extimus*) was listed as endangered in 1995. The southwestern willow flycatcher is a bird less than 6 inches long with a grayish-green back and wings, light grey to olive breast, whitish throat, and pale yellowish belly. It nests in dense growths of trees and shrubs in moist riparian ecosystems in the arid southwestern United States and northern Mexico, and migrates to Central America and northern South America for the fall and winter.

Threats

FWS reports that habitat loss and predation are the primary threats to this subspecies. There are three locations where a large proportion of the subspecies breeds, all of which may be damaged by efforts to divert water or tap into surrounding aquifers. Nest predation by avian, reptilian, and mammalian predators also threatens the southwestern willow flycatcher, but FWS officials say that it will not make recovery impossible.

Role of Recovery Plan

FWS approved a recovery plan for the southwestern willow flycatcher in 2002. FWS officials report that it took over 5 years to develop the recovery plan due to the amount of biological information needed and the amount of stakeholder involvement in the plan's development. The recovery plan reflects the contributions of over 240 stakeholders in seven states, including state and federal agencies, private landowners, water management organizations, and about 15 Native American tribes. The plan identifies the actions that biologists believe are important for recovering the species, with habitat restoration being the most critical action needed. FWS officials report that, fortunately, flycatcher habitat can be developed and occupied quickly, and officials expect this to aid in a relatively quick recovery of the species. Although they are still early in the implementation of the recovery plan and much work is needed, FWS is optimistic about recovery of the species by 2020.

The flycatcher also benefits from being included in the Lower Colorado River Multi-species Conservation Plan, which is a comprehensive plan for more than 26 listed and unlisted species that occur in certain areas in the lower Colorado River basin. Activities that are being implemented or are planned under this conservation plan (fiscal year 2006 is the first full year of implementation of this plan) include fish augmentation, research, monitoring, and habitat restoration.

Cost and Partnerships

FWS officials report that such a wide array of stakeholders makes it impossible to provide a cost estimate for the recovery efforts taken for the southwestern willow flycatcher. FWS officials estimate that the federal government pays about 60 percent of the total costs, state agencies about 20 to 25 percent, and other entities about 15 percent. They report that the top five types of expenditures are for annual surveying and monitoring, land acquisition, habitat restoration, research, and complying with legal requirements. FWS estimates that, collectively, state agencies in Arizona, California, Colorado, New Mexico, Nevada, and Utah have spent about $60 million on the southwestern willow flycatcher since the subspecies was listed in 1995. This includes annual expenses of slightly less than $1 million for habitat improvement and about $1 million for surveying and monitoring 414 sites. FWS, other federal agencies, state agencies, and entities seeking permits have spent about $44 million complying with legal requirements, primarily associated with evaluating the effects of projects on the species and its habitat, and, in some cases, reducing and minimizing adverse effects the projects might have. BOR and the U.S. Geological Survey have spent about $1 million on research. FWS estimates that the flycatcher portion of the Lower Colorado River Multi-species Conservation Plan will cost about $2.2 million per year.

Whooping Crane

The whooping crane (*Grus americana*) was listed as endangered in 1967. Whooping cranes weigh about 15 pounds and reach about 5 feet in height. They require a wetlands habitat with water about 18 inches deep, such as coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows, rivers, and agricultural fields. Whooping cranes live 20 to 30 years in the wild and up to 30 to 40 years in captivity, making them a relatively long-lived species. Breeding pairs fledge chicks relatively late in their lives—at about 5 to 7 years of age—and may only successfully fledge 5 to 10 chicks during their lifetime. Breeding pairs return to the same summer and winter nesting territories each year.

The whooping crane's potential extinction was recognized as early as the beginning of the twentieth century and, by 1941, there were only 15 or 16 known whooping cranes in the wild, all wintering in Texas.

Threats

The crane's population decline was largely due to the hunting and draining of wetlands to convert land for agriculture. FWS officials report several continuing threats to the whooping crane, including habitat loss along its migratory routes and in its Texas gulf coast wintering area; development of power lines and wind turbines along its migratory routes; declining populations of the crane's primary food source, the blue crab; rising water levels in coastal Texas attributed to global warming; and threats to water quality in the refuge wetlands in Texas due to urban development and potential chemical spills.

Role of Recovery Plan

Progress recovering the whooping crane is attributed to implementation of recovery plan actions, as well as actions taken before the species was even listed for protection under the Endangered Species Act. Specifically, several actions in the first half of the century helped prevent the extinction of the whooping crane. Passage of the 1916 Migratory Bird Treaty Act ended legal hunting of the whooping crane; and the creation of a national park in Canada in 1922 and a national wildlife refuge in Texas in 1937 preserved essential habitat. However, these actions were not sufficient to protect the crane from extinction and it was eventually listed under the Endangered Species Act.

FWS approved a recovery plan for the whooping crane in 1980, revised it in 1986 and 1994, and produced a new draft revision in 2005. Important recovery plan actions include the breeding of cranes in captivity with the intent to re-introduce the crane into the wild. Re-introducing the crane in this way will establish multiple self-sustaining wild populations. FWS officials report that implementing the recovery plan is challenging because they do not have control over major threats such as development, river flows, power line locations, and climate change. However, FWS officials report that the status of the whooping crane is improving, and attribute this improvement to the implementation of some of the recovery plan's actions, including increasing the population and providing additional protection at the species' summer and winter habitats. FWS and the Canadian Wildlife Service are maintaining what is believed to be an historic growth rate for the whooping crane—about 4.5 percent per year. FWS officials said that doing more to address impacts from power lines along the crane's migratory routes is an important action remaining to help with recovery, but that doing so is resource-intensive.

Currently, there are three whooping crane populations in the wild and seven populations in captivity. One wild population nests in Canada and winters in Texas, another migrates between Wisconsin and Florida, and the third is a non-migratory population that lives in Florida. As of December 2005, the total population was estimated to be about 476 cranes: 341 in the wild and 135 in captivity. FWS is hopeful about recovery of the species and expects to downlist the whooping crane from endangered to threatened around 2035.

Costs and Partnerships

The whooping crane recovery program is a joint effort between FWS and the Canadian Wildlife Service. FWS officials estimate that about $82 million has been spent recovering the whooping crane between fiscal years 1950 and 2005. However, this is likely an incomplete estimate because of the numerous domestic and international government agencies and private partners involved, including the Canadian government, the International Crane Foundation, Operation Migration, the Platte River Whooping Crane Maintenance Trust, the San Antonio Water System, the San Antonio Zoo, the Calgary Zoo, the U.S. Geological Survey, the universities of Alberta and Florida, and Texas A&M University. Officials stated that, in fiscal year 2005, the U.S. and Canadian governments spent about $2.5 million, private entities spent about $1.2 million, and universities spent about $38,000 on recovery actions for the crane. FWS officials stated that it costs about $1 million annually to produce 25 whooping cranes in captivity, and that this expense has been shared between government and nongovernmental entities.

Fishes

Borax Lake Chub

The Borax Lake chub (*Gila boraxobius*) was listed as endangered in 1980 by an emergency regulation and was listed on a non-emergency basis in 1982. The chub is a small minnow endemic to Borax Lake, a natural 10-acre lake fed by thermal springs that are situated atop large sodium-borate deposits in Oregon.

Threats

FWS reports that the initial primary threat to the Borax Lake chub was habitat loss due to potential impact from geothermal energy development and alteration of the lake's shoreline. However, an FWS review of the chub in 2003 identified other threats to its water source. Specifically, the aquifer

that feeds Borax Lake may be at risk due to groundwater pumping on private lands, and increased recreational use at the lake poses a threat to the lake's water quality. Recreational use such as off-highway vehicles, wading, camping, and boating, also increases the potential for introducing invasive plants and animals that may harm the chub. The chub is inherently vulnerable to catastrophic loss due to its highly limited distribution and dependence on a single water source.

Recovery Plan Role

A recovery plan was approved for the Borax Lake chub in 1987. Key actions called for by the recovery plan focus on protecting the lake ecosystem, and include the acquisition of key private lands, protection of subsurface waters, implementation of controls on human access, removal of livestock grazing, and monitoring of the population. FWS reports that, of these actions, the most significant that have been implemented are BLM's designation of the land surrounding Borax Lake as an Area of Critical Environmental Concern in 1983, The Nature Conservancy's purchase of Borax Lake and the surrounding private lands in 1993, The Nature Conservancy and BLM's elimination of grazing within the critical habitat surrounding Borax Lake, and the completion of numerous studies of the chub and other species that led to a better understanding of the Borax Lake ecosystem. Additionally, a crucial action for the species recovery that was external to the recovery plan was the passage of the Steens Mountain Cooperative Management and Protection Act of 2000, which withdrew public lands from mineral and geothermal development within most of the area surrounding Borax Lake.

FWS reports that it has met many of the chub's recovery objectives over the last two decades and that the species may be nearing recovery. Actions needed to downlist the chub from endangered to threatened include the development of a conservation agreement (or a memorandum of understanding) between FWS, BLM, The Nature Conservancy, and the Oregon Department of Fish and Wildlife, to clarify roles and responsibilities associated with the management of the chub and the Borax Lake ecosystem. Other actions likely needed before delisting include (1) assessing visitor use of Borax Lake; (2) eliminating inappropriate vehicle and boat access to reduce the threat of invasive species; (3) investigating the use of interpretive signs, boardwalks, and designated observation sites to explain the unique and fragile features of the ecosystem; (4) conducting additional research to determine the risks of developing groundwater resources on private lands, public lands with private subsurface rights, and (pending the results of additional research) acquiring groundwater and/or surface rights as needed; and (5) developing a contingency plan that would

identify procedures, needed equipment, and responsibilities for collecting fish in case of an emergency.

Cost and Partnerships

An FWS official reported that information on the implementation costs of recovery actions, by agency or organization, is limited; however, the official estimated that less than $50,000 has been spent on the chub in the last decade. Over the last 5 years, FWS has spent approximately $20,000 on recovery implementation, of which $5,000 was used to assemble a scientific panel for a study of the status of the Borax Lake chub and $15,000 was allocated for monitoring (and the development of a long-term monitoring plan). Key partners in the chub's recovery effort have been The Nature Conservancy, BLM, and the Oregon Department of Fish and Wildlife.

Colorado Pikeminnow

The Colorado pikeminnow *(Ptychocheilus lucius)*, originally called the Colorado squawfish, was listed as endangered in 1967. The Colorado pikeminnow is the largest North American minnow; weights over 79 pounds and lengths of almost 6 feet have been recorded. However, more recently, specimens weighing more than 15 pounds have been rare. Natural populations live in rivers in Colorado, New Mexico, and Utah, while hatchery-reared Colorado pikeminnow have been stocked in the Salt and Verde Rivers in Arizona. The largest population of Colorado pikeminnow is found in the Green River in Colorado and Utah, although FWS officials report that this population declined from 3,100 in 2001 to 2,300 in 2003. The population in the Colorado River has been increasing since estimates began in 1991.

Threats

FWS officials report that the primary threats to the Colorado pikeminnow are reduced water flow in rivers due to consumptive use, stream flow regulation, and drought; hydromodification due to dams; and competition with, and predation by, nonnative fish in their habitat. Dams have fragmented rivers and blocked fish passages, while the reservoirs formed by these dams were stocked for recreational fishing with nonnative fishes that prey upon the Colorado pikeminnow and compete with it for food.

Role of Recovery Plan

FWS approved a recovery plan for the Colorado pikeminnow in 1978 and revised it in 1991; the plan was revised again in 2002 to include more specific recovery goals. The Colorado pikeminnow is one of four fish covered by both the Upper Colorado River Endangered Fish Recovery

Program and the San Juan River Basin Recovery Implementation Program.[3] FWS officials report that management actions in the recovery plan that address threats have been implemented, successfully moving the pikeminnow towards recovery. Objectives for downlisting the Colorado pikeminnow include maintaining a specified number of naturally self-sustaining populations in two to three areas. To meet these objectives, actions have been taken on all the major rivers in the Upper Colorado River Basin (including the San Juan River Basin); these actions include ensuring appropriate water flow and quality, and controlling problematic nonnative fishes. FWS officials report that the pikeminnow responds quickly to habitat improvements and reproduces quickly; they hope to delist the species around 2015.

Costs and Partnerships

The Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program track expenditures for the Colorado pikeminnow, the razorback sucker, the bonytail, and the humpback chub together, so costs specific to Colorado pikeminnow recovery are not available.[4] Both programs are funded primarily by power revenues from the Colorado River Storage Project and long-term cost sharing between the four participating states—Colorado, New Mexico, Utah, and Wyoming.[5] FWS is one of many program partners, including other federal agencies; Native American tribes; and private entities like the Colorado River Energy Distributors Association, the Colorado Water Congress, the Utah Water Users Association, The Nature Conservancy, and Western Resource Advocates. From fiscal years 1989 through 2006, the Upper Colorado River Endangered Fish Recovery Program spent more than $161 million on endangered fish recovery, of which FWS provided more than $20 million. From fiscal years 1992 through 2006, the San Juan River Basin Recovery Implementation Program spent more than $34.6

[3]These programs also address the razorback sucker, which is another species we reviewed for this report.

[4]*Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program: Program Highlights 2005-2006* provides a summary of the programs, including a complete list of partners, total costs for implementing various elements of the programs, and detailed status information on the four species.

[5]The Colorado River Storage Project is a multipurpose plan, undertaken by BOR in 1956, to control the flow of the upper Colorado and its tributaries, and to aid in the development of the upper Colorado River basin. Since the flow of the Colorado is erratic, this project was needed to maintain an even flow of water to the lower basin during dry years. A series of dams regulates stream flow, provides storage reservoirs, creates hydroelectric power, and irrigates both new and previously developed acreage.

million on endangered fish recovery, of which FWS provided more than $1.6 million.

Razorback Sucker

The razorback sucker (*Xyrauchen texanus)* was listed as endangered in 1991. It grows to about 2.5 feet in length and weighs less than 7 pounds. In the mid 1970s, less than 100 adult razorback suckers were estimated to live in the middle Green River in Colorado and Utah. Currently, it is found in small numbers in rivers in Arizona, Colorado, New Mexico, Nevada, and Utah, with the largest concentration in Lake Mojave.

Threats

FWS officials report that the biggest threats to the razorback sucker are stream flow regulation in rivers, habitat modifications, competition and predation by nonnative fish stocked for recreational fishing, pesticides, and pollution.

Role of Recovery Plan

FWS approved a recovery plan for the razorback sucker in 1998 and amended it in 2002 to include more specific goals. The razorback sucker is one of four fish the Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program are working to recover.[6] FWS officials report that management actions in the recovery plan are being implemented and have been important to recovery progress made for the species. These actions include efforts to expand existing populations and establish new ones, ensure appropriate water flow and quality, control problematic nonnative fishes, acquire and protect floodplain habitat, minimize the risk of hazardous-materials spills in critical habitat areas, and minimize the threat of hybridization with the white sucker. Reintroducing hatchery-produced razorback suckers has been the foundation for successfully reestablishing self-sustaining populations of the species in several Colorado and Utah rivers. For example, population surveys have found the number of fish increased from about 100 in the mid-1970s to about 2,700 in the early 2000s. FWS officials report that they anticipate delisting the species around 2025.

Costs and Partnerships

The Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program track expenditures for the razorback sucker, Colorado pikeminnow, bonytail, and humpback chub

[6]These programs also address the Colorado pikeminnow, which is another species we reviewed for this report.

together, so costs specific to the razorback sucker recovery are not available.[7] Both programs are funded primarily by revenues from the Colorado River Storage Project, and long-term cost sharing between the four participating states—Colorado, New Mexico, Utah, and Wyoming.[8] FWS is one of many program partners, including other federal agencies; Native American tribes; and private sector entities like the Colorado River Energy Distributors Association, the Colorado Water Congress, the Utah Water Users Association, The Nature Conservancy, and Western Resource Advocates. From fiscal year 1989 through 2006, the Upper Colorado River Endangered Fish Recovery Program spent more than $161 million on endangered fish recovery, of which FWS provided more than $20 million. For fiscal years 1992 through 2006, the San Juan River Basin Recovery Implementation Program spent more than $34.6 million on endangered fish recovery, of which FWS provided more than $1.6 million.

Rio Grande Silvery Minnow

The Rio Grande silvery minnow (*Hybognathus amarus*) was listed as endangered in 1994. The minnow is a 4-inch long silver and white fish that historically lived throughout the Rio Grande River basin in New Mexico and Texas. When listed, it occupied only 5 percent of its historic range—a 187-mile area of the Rio Grande River in New Mexico—and had been completely extirpated from the Pecos River and downstream portions of the Rio Grande River.

Threats

FWS officials cite habitat modification as the primary threat to the species, which they attribute to several causes, such as stream modification and channelization; regulation of river flow to provide water for agricultural and industrial uses; diminished water quality caused by municipal, industrial, and agricultural discharges; and competition with or predation by introduced nonnative fish species. FWS traces the decline of the silvery minnow all the way back to 1916, when Elephant Butte Dam, one of five dams constructed within the minnow's habitat, closed its gates. Nonnative fish species that were stocked into the reservoirs created by the dams often completely eliminated native fish species. Droughts have also posed problems for the species, as in 1996, when 30 miles of river went dry.

[7]See footnote 4 for details.

[8]See footnote 5 for details.

Role of Recovery Plan

FWS approved a recovery plan for the Rio Grande silvery minnow in 1999 and is currently revising it. It is scheduled to be complete in 2006 and will continue many of the actions in the current plan. FWS officials report that the most successful recovery actions for the minnow, which are all included in the current recovery plan, are cooperative water management, habitat restoration, and captive propagation and release of minnows—over 600,000 silvery minnows have been released into the wild since 2002. Another critical action in the recovery plan includes efforts to establish habitat and re-establish minnow populations outside its current range in the Rio Grande River. FWS has initiated processes to establish an experimental population in Big Bend National Park in Texas. FWS hopes to finalize these processes by the fall of 2007 and begin stocking fish in Big Bend in the spring of 2008. FWS officials estimate the minnow will be delisted around 2030, but this is contingent on continued successful reintroduction of the species.

Costs and Partnerships

FWS officials report that they cannot provide comprehensive recovery cost estimates for the silvery minnow because of the large number of partners involved. However, FWS officials report that the Middle Rio Grande Endangered Species Collaborative Program and BOR have spent the most on recovery actions since 2001—about $28 million and $11 million, respectively. Other expenditures for recovery actions for the minnow include about $500,000 by FWS and $5 million by the Interstate Stream Commission in New Mexico. The collaborative program is a partnership of 20 organizations, including the New Mexico Department of Game and Fish, the Corps, the Interstate Stream Commission, and the Bureau of Indian Affairs. The program is focused on protecting and improving the status of endangered species along the Middle Rio Grande River including the Southwestern willow flycatcher (another listed species we reviewed for this report). These two species benefit from actions to restore water flows and habitat.

Snails

Magazine Mountain Shagreen

The Magazine Mountain shagreen (*Mesodon magazinensis*) was listed as threatened in 1989. The shagreen is a brown or buff-colored snail about one-half inch wide and less than one-half inch high. It is known to live only in rock debris along the base of cliffs on the north and west slopes of Mount Magazine in the Ozark National Forest in western Arkansas.

Threats

FWS officials cite the potential for habitat loss as the greatest threat to the shagreen because it relies on a single, highly unique habitat. Threats to the species when it was listed included a proposal by the Department of Defense, which would have brought heavy military equipment into the shagreen's habitat, and the development of a state park on Mount Magazine. Today, the species remains vulnerable to catastrophic events, such as wildfire, which could completely destroy its habitat.

Role of Recovery Plan

The two primary threats to the snail when it was listed were mitigated by actions that were outside of the recovery plan for the species. Specifically, the Forest Service designated Mount Magazine as a "special interest area," which affords protection to the species by prohibiting certain activities such as timber harvesting and the use of herbicides and pesticides. The Department of Defense withdrew its proposal for military operations in the area because it conflicted with the Forest Service's land management plan for the area. In addition, FWS participated in the preparation of an environmental impact statement for the development of the proposed state park, which led to a memorandum of understanding between FWS, the Forest Service, and the Arkansas State Parks agency. The memorandum of understanding ensures protection of the species during the development of the park.

FWS approved a recovery plan for the shagreen in 1994 and, with its partners, has implemented most of the actions. Two of the important recovery tasks in the plan were (1) the Forest Service's monitoring of the shagreen population for 10 years—which is almost complete—and (2) FWS, the Forest Service, and the State of Arkansas entering into a memorandum of agreement to share in recovery efforts and protection of the species. Additional recovery actions that have been important for the species include better planning in regards to prescribed fires, timber harvests, and use of chemical fire retardants within the shagreen habitat.

These actions were not included in FWS's recovery plan, but were part of the Forest Service's Ozark National Forest Management Plan and the special interest area designation of Mount Magazine. Additionally, FWS and the Forest Service have held numerous informal consultations on fire management, and are developing a new method of monitoring overall forest health that would include monitoring other snails that inhabit the forest floor as surrogates for the shagreen. Although Forest Service surveys show that the population appears to be stable, it remains listed because funding for the research needed to delist it had not been available until this year. FWS reports that it may be able to delist the species by 2010.

Costs and Partnerships

According to an FWS official, the Forest Service estimates that the cost to monitor the Magazine Mountain shagreen has been about $1,000 per year for the last 9 years. This constitutes at least 75 percent of the total amount of funds the Forest Service has spent to recover the shagreen. The other 25 percent of Forest Service costs were for supporting actions, such as revising the land management plan for the area and developing land management standards to protect the shagreen. The proposed biological research needed to support delisting the species will cost about $90,000. FWS, the Forest Service, and the University of Arkansas have recently committed about $30,000 each to this effort. Research is planned to begin in the summer of 2006 and will take about 3 years to complete.

Insects

Uncompahgre Fritillary Butterfly

The Uncompahgre fritillary butterfly *(Boloria acrocnema)* was discovered and identified as a new species in 1978, and listed as endangered in 1991. The Uncompahgre fritillary has rust-brown wings crisscrossed with black bars, and a 1-inch wingspan. Its habitat range is one of the smallest of North American butterfly species—patches of snow willow plants in alpine meadows above 12,000 feet, on northeast facing slopes, in the San Juan Mountains of southern Colorado. Two Uncompahgre fritillary butterfly colonies were initially found on Mount Uncompahgre and Redcloud Peak.

Threats

An FWS official reports that the greatest threats to the Uncompahgre fritillary butterfly are humans trying to collect it; and trampling of its larvae by humans and livestock. In addition, changes in climate, such as hotter or

drier weather, may be responsible for observed decreases in butterfly populations in certain years.

Role of Recovery Plan

FWS officials approved a recovery plan for the Uncompahgre fritillary butterfly in March 1994. The plan calls for 10 colonies of butteflies to be stable for 10 years before the species can be delisted. Tasks in the recovery plan that have helped improve the species' status include enforcing restrictions on collection; searching for new colonies; monitoring population status and climatic trends; and researching habitat requirements, threats, and propagation. Monitoring has identified nine additional colonies in the San Juan Mountains that appear to be stable. The colonies were found entirely on BLM and Forest Service land. To prevent collection and trampling of the species, the Forest Service and BLM erected signs to serve as notice to collection prohibitions and modified trails to divert hikers and livestock away from butterfly colonies. According to the FWS official, collectors are generally dissuaded by the signs and the presence of researchers in the area. Additionally, research has led to a better understanding of the species' habitat needs. FWS officials said that they may be able to delist the species around 2015.

Costs and Partnerships

According to an FWS official, about $40,000 was spent in fiscal year 2003 for recovery activities for this species—about $9,000 by FWS; $13,000 by the Forest Service, and $18,000 by BLM—primarily for research and monitoring. Three national forests have been involved in these efforts: the Gunnison National Forest has provided about $7,000 annually for at least the past 10 years, the Rio Grande National Forest has provided about $1,500 annually for the past 4 years, and the San Juan National Forest has provided about $1,000 annually for the past 2 years. BLM provides about $3,000 annually for research and monitoring, and has incurred additional costs for researchers' housing, trail maintenance, signage, and staff time. Additionally, the FWS official to whom we spoke estimates that, since 1991, FWS has spent about $9,000 annually for staff time and for a vehicle to access butterfly habitat.

Crustaceans

Socorro Isopod

The Socorro isopod (*Thermosphaeroma thermophilum*) was listed as endangered in 1978. The isopod is a freshwater crustacean about 4 to 13

millimeters long with a flattened, segmented body, seven pairs of legs, antennae on the head, and oar-like extensions on its last segment. It survives in warm water with a very narrow range of temperature and salinity. It is endemic to the outflow of Sedillo Spring, a thermal spring found near the base of the Socorro Mountains in New Mexico. The Socorro isopod is of particular scientific interest because it is one of only two freshwater isopods in the primarily marine *sphaeromidae* family.

Threats

FWS reports that the potential for habitat loss is the greatest threat to the Socorro isopod given its narrow habitat requirements and restricted distribution. The spring that the species depends on has been modified since the early 1900s, when a bathhouse was built to take advantage of its warm water. In addition, the aquifer that supplies water to the spring could be lost or degraded due to drought and/or human uses. The water rights to the spring and the bathhouse are privately owned, and there is no long-term conservation agreement with the property owner to protect the species.

Role of Recovery Plan

FWS approved a recovery plan for the Socorro isopod in 1982. FWS reports that they have completed all planned recovery actions deemed critical to the Socorro isopod's survival that are within their capabilities. These include stablizing and protecting the populations and their habitats, including a more secure water flow; and conducting additional research and monitoring. However, even before a recovery plan was in place for the isopod, an essential action was implemented that proved critical to the species' survival. Specifically, captive populations were established in 1977 in order to protect the species against extinction. These populations saved this species when, in August 1988, tree roots blocked the spring's flow and the wild population of Socorro isopods became extinct. After the spring's flow was restored in September 1988, isopods from the captive populations were reintroduced. The threat of extinction of this species was further mitigated in 1990, when Socorro isopods from the native and captive populations were introduced into a new facility called the Socorro Isopod Propagation Facility. This facility consists of eight cement tanks located in a secure area one-half mile north of the bathhouse, and is fed by water from the same spring. The population at this facility has been monitored monthly since November 1994, and FWS reports that it is stable.

However, FWS has yet to obtain a long-term conservation agreement with the private landowner although the landowner has taken steps to protect

the bathhouse and spring. FWS reports that the lack of an agreement means that the wild population will likely remain susceptible to extirpation for the foreseeable future. As a result, it is unlikely that the Socorro isopod will ever be delisted, although it may eventually be downlisted.

Cost and Partnerships

FWS reports that the Socorro isopod has been an inexpensive species to protect. One of the highest expenditures was $29,000 to build the propagation facility in 1989. Most of the recovery and maintenance costs have been funded with Section 6 grants to the state of New Mexico. Partners in the recovery efforts include FWS, the New Mexico Department of Game and Fish, the cities of Albuquerque and Socorro, and the private owner of the water rights and bathhouse at Sedillo Spring.

Plants

Ash Meadows Gumplant, Ash Meadows Sunray, and Spring-Loving Centaury

Three plants—the Ash Meadows gumplant *(Grindelia fraxino-pratensis)*, the Ash Meadows sunray *(Enceliopsis nudicaulis* var. *corrugata)*, and the spring-loving centaury *(Centaurium namophilum)*—were listed as threatened at the same time in 1985. Ash Meadows is a 50,000-acre region of desert uplands and spring-fed oasis in the Mojave Desert that straddles the California–Nevada border. FWS manages about one half of this area as the Ash Meadows National Wildlife Refuge. The Ash Meadows gumplant and spring-loving centaury are wetlands plants with similar habitat needs, while the Ash Meadows sunray is an upland plant that requires a much drier environment. The gumplant has yellow flowers and is a biennial or perennial that lives along streams and pools. The centaury has pink flowers and is an annual plant that occurs on moist to wet clay soils. The sunray has yellow flowers and is a perennial plant that occurs only in saline soil and limestone outcroppings in Nevada.

Threats

FWS officials report that the primary threats to the three plants, at the time they were listed, were development and water diversion that would have resulted from a planned resort community in the Ash Meadows region. An additional threat specific to the sunray was trampling by cattle and horses, and now this species is threatened by potential mineral development. Currently, the primary threat to the centaury and gumplant is from invasive plants. Five thousand acres of the wildlife refuge were agricultural lands that went fallow, and invasive species began to expand in the area. One

species, the Russian knapweed, is a particular threat to the centaury and gumplant because its woody stalks increase the likelihood of wildfires.

Role of Recovery Plan

The threat of development and water diversion to all three plants was eliminated when The Nature Conservancy purchased 12,654 acres in Ash Meadows; it was later sold to FWS to establish the Ash Meadows National Wildlife Refuge in 1984. Grazing was removed from the refuge in 1985. These actions occurred prior to FWS approving a recovery plan for the three Ash Meadow species, and nine others, in 1990. Recovery plan objectives include collecting basic information about the species and securing land and water rights. Land management activities essential to the species' recovery are carried out by FWS and BLM. Almost all of BLM's land is within the refuge and therefore managed by FWS. BLM also owns land surrounding the refuge and designated it as an Area of Critical Environmental Concern, which provides protection for the fish and wildlife resources occurring there.

These actions have been important for improving the outlook for the species, but FWS officials cannot estimate a recovery date for the centaury and gumplant because they are unsure how to control the invasive plants that threaten the species. In addition, while they report that they believe the sunray is abundant, delisting is precluded because much of its habitat remains open to clay mineral extraction. Although FWS has acquired some of the mineral rights in the clay deposits, other lands remain open to mineral development.

Costs and Partnerships

FWS officials report they cannot provide a recovery cost estimate for these three species because most of the recovery actions also help other species in the area. They report that the largest expense, by far, has been the acquisition of land and water rights. FWS operations and maintenance for the refuge are the second largest expense while stream restoration is a distant third, although FWS plans to increase these efforts.

Dwarf-Flowered Heartleaf

The dwarf-flowered heartleaf (*Hexastylis naniflora)* was listed as threatened in 1989. This plant species is usually no more than 6 inches tall and has dark, leathery, heart-shaped evergreen leaves, and beige to dark brown jug-shaped flowers. It occurs in a small portion of the upper piedmont region of North Carolina and South Carolina, where it grows in

streamside habitats and acidic soil on bluffs and adjacent slopes. At the time of listing, there were about 23 known populations in eight counties.

Threats

At the time of listing, threats to the species were residential and industrial development, conversion of habitat to pasture or small ponds, timber harvesting, and cattle grazing. FWS officials report that residential and industrial development is now by far the primary threat to the species. Most dwarf-flowered heartleaf populations are located on private property or in public utility and transportation corridors—areas that are being developed at much higher rates than when the species was listed. More than one half of the known populations were discovered during environmental reviews for proposed development projects, and FWS officials report that many of these populations have been at least partially impacted by these developments. The introduction and spread of riparian invasive plant species is also a threat.

Role of Recovery Plan

FWS has not approved a recovery plan for the dwarf-flowered heartleaf. The agency developed a draft in association with a status review in 1997, but because of the information gained during the review—including the discovery of new populations and concerns the recovery partners raised about taxonomy—the plan was never finalized. While found to be more abundant than originally thought (surveys have more than tripled the number of known populations and expanded the species distribution to 16 counties), the species was not proposed for downlisting after the 1997 review because some partners raised concerns as to whether or not the species' survival could be assured, given that the majority of known populations occur in a region of increasing development pressure. Partners expressing concerns included the North Carolina Plant Conservation Program, the North Carolina's Natural Heritage Program, university botanists, and consultants; these partners also raised questions about the taxonomy of the species, as well as the identification of the species at some of the known sites.

Although the current population estimates indicate that the species has the potential to be delisted, additional steps are needed to mitigate development. According to FWS officials, to address this threat, FWS first needs to determine which of the many populations are critical to the species' continued survival, and whether they are stable. Once those populations are identified, FWS would then need to obtain agreements from landowners or acquire land to ensure continued protection. FWS officials would like to quantify rates of habitat loss by examining available

development indicators, such as building permits, but have not obtained sufficient funding to do so.

FWS initiated another status review in 2004 to determine whether the species continued to warrant protection under the Endangered Species Act. If the review finds that the species still warrants protection under the act, FWS will propose recovery criteria, including specific actions for different locations and estimated costs. FWS expects to pursue delisting the heartleaf by 2015, pending the results of the status review. FWS officials believe they can carry out any needed steps for this species without a recovery plan.

Costs and Partnerships

Despite not having a final recovery plan, FWS works with other federal agencies, state agencies, and private organizations to address existing threats to the species. FWS officials could not estimate costs to recover this species, but said that most recovery actions have been funded through expenditures on Section 7 consultations. FWS has completed several consultations with the Federal Energy Regulatory Commission, the Environmental Protection Agency, the Department of Transportation, and associated state agencies, that have resulted in protections for some populations of the heartleaf. Monitoring and management programs are still being developed for many of these sites. Other partners that have assisted FWS in surveying and monitoring dwarf-flowered heartleaf populations include the North Carolina Plant Conservation Program, the North Carolina Natural Heritage Program, university botanists, and consultants.

Eggert's Sunflower

Eggert's Sunflower (*Helianthus eggertii*) was listed as threatened in 1997. Eggert's sunflower grows in Alabama, Kentucky, and Tennessee at the interface of woodlands and grassy openings. It thrives in tree stands with little woody understory, and tolerates a wide range of light conditions, moisture levels, and disturbance. It persists in, and may even invade, roadsides, power line rights-of-way, and fields that have suitable open habitat. The species was delisted in 2005 due to recovery and the discovery of additional populations.

Threats

FWS officials report that threats to Eggert's sunflower at the time of listing included: (1) fire suppression, because the species relies on periodic fires to maintain suitable habitat; (2) loss of habitat due to development; (3) invasion by nonnative plant species; (4) habitat impacts from maintenance

of roadsides and power lines, such as herbicide spraying and mowing; and (5) herbivory, including by insects and white-tailed deer.

Role of Recovery Plan

FWS approved a recovery plan for Eggert's sunflower in 1999. The plan's actions included prescribing fires, rescheduling mowing for road and power-line maintenance to times when it is less likely to harm the species, surveying the species, researching genetics, and establishing new populations. Officials report that the recovery plan accurately identified management actions necessary to recover this species, and noted that the species responded well to these actions. At the time of delisting, 20 geographically distinct, self-sustaining populations had been protected by conservation agreements.

Costs and Partnerships

Post-delisting activities include the monitoring of the 20 populations, under conservation agreements with public and private landowners, including Arnold Air Force Base, Mammoth Cave National Park, the Tennessee Wildlife Resources Agency, the City of Nashville, The Nature Conservancy, and the Kentucky Transportation Cabinet. FWS officials could not estimate the cost of this species' recovery, but estimated that the federal government has provided about 80 percent of the cost, while state agencies and private entities contributed the remaining 20 percent. FWS managed and coordinated the recovery efforts, so its costs include salaries for coordination, field work, and surveys.

Johnston's Frankenia

Johnston's frankenia (*Frankenia johnstonii*) was listed as endangered in 1984. The plant is a grayish or bluish-green low-lying shrub with small leaves and white flowers, and turns bright red in the fall. At the time of the listing, there were five known populations in two south Texas counties and in Mexico, with an estimated total of 1,500 individual plants. However, a 6-year study of this species resulted in the discovery of about 9 million plants in 58 populations in the United States and four populations in Mexico. FWS proposed delisting the species in 2003 and anticipates finalizing the delisting in 2006. FWS officials attribute the lengthy delisting process to the lack of staff—the lead botanist for the species resigned about 2 years ago and has not been replaced.

Threats

FWS officials report that they initially believed the primary threats to Johnston's frankenia were its low numbers, low reproductive potential, narrow range, and habitat modification by land management practices that included overgrazing, root plowing, and planting non-native grasses.

However, at the time of the listing, limited data were available for this species, partially because the species occurs primarily on privately owned land that was not readily accessible; also, little focused research had been conducted on the species.

Role of Recovery Plan

FWS officials approved a recovery plan for Johnston's frankenia in 1988, and attribute the proposed delisting to the achievement of the recovery plan's goals. A key task in the recovery plan was educating landowners and gaining their cooperation in order to allow study and monitoring of the species (through voluntary agreements) on private land. A botanist with the Texas Parks and Wildlife Department spent 2 years building trust and establishing working relationships with landowners, and an additional 4 years on monitoring research. This work led to the discovery of millions of other plants. Other important recovery tasks included conducting studies on the species' ecology and reproduction. Some of these studies revealed that, while the species' reproductive potential is lower than many flowering plant species, the frankenia appears to be adapted to the arid climate and saline soils it inhabits, and can use sporadic rainfall to germinate quickly.

Costs and Partnerships

FWS officials report that recovery efforts for Johnston's frankenia have cost over $250,000. FWS estimated its expenditures at about $200,000; the Texas Parks and Wildlife Department spent about $30,000; The Nature Conservancy spent about $4,000; and Texas State University spent about $20,000. FWS contracted with Texas State University to complete three recovery tasks: (1) reproductive biology studies; (2) ecological studies, including analyses of soil and the effects of land management practices; and (3) a geographical information system project to assess threats to the species.

Papery Whitlow-Wort

The papery whitlow-wort (*Paronychia chartacea*) was listed as threatened in 1987 and, at the time, was only known to inhabit south-central peninsular Florida. In 1991, a new subspecies (*Paronychia chartacea minima*) was discovered in the Florida panhandle; this subspecies is also considered as threatened under the 1987 listing action. The papery whitlow-wort is a short-lived herb with yellowish green branches and small cream-colored to greenish colored flowers. It grows close to the ground and forms small mats in disturbed, open, sandy sites such as road rights-of-way, recently cleared high pineland areas, fire lanes, and trails.

Threats

FWS officials report that the primary threat to the papery whitlow-wort is habitat loss due to residential, industrial, and commercial (including citrus) development.

Role of Recovery Plan

FWS officials approved a recovery plan for the papery whitlow-wort and 18 other Florida scrub and high pineland plant species in June 1996. The recovery actions identified in the recovery plan were primarily additional monitoring and protection of habitat. The south-central Florida subspecies may soon be delisted because land needed to accommodate this species was acquired or protected, and needed prescribed fire plans were implemented in 2000. Delisting the south-central Florida subspecies is pending, due to a lack of funding and FWS's evaluation of an upcoming study on the status of numerous Florida plant species (including the papery whitlow-wort). FWS officials report that they hope to delist the plant by 2010.

FWS officials report that the remaining efforts to delist the Florida panhandle subspecies include reviewing land management agencies' prescribed fire plans and practices for actions that could potentially harm the papery whitlow-wort. FWS officials said that the species has benefited from some conservation efforts, but it is not nearly as close to delisting as the central Florida subspecies.

Cost and Partnerships

FWS officials report that FWS recovery expenditures for the papery whitlow-wort have been minimal—about $19,000 from fiscal years 2001 through 2003. FWS did not have recovery expenditure data from its partners. The species has benefited from state funding and Section 6 funds to recover several other endangered species that share its habitat and are included in the multi-species recovery plan. Partners in recovery efforts for the papery whitlow-wort include the Florida Fish and Wildlife Conservation Commission, the Florida Division of Forestry, The Nature Conservancy, the Archbold Biological Station, and Princeton University (which is conducting the study on Floridian plant species). These partners have worked on restoration of the natural habitat, fire management, surveying, and demographic research.

Truckee Barberry

The Truckee barberry (*Berberis sonnei*) was listed as endangered in 1979. The plant is a small evergreen shrub originally thought to exist only near the Truckee River in California. However, a 1993 study reclassified the

plant and included it as part of a much more prevalent species. The Truckee barberry was delisted in 2003.

Threats

The threat, at the time of listing, was that only one known Truckee barberry population existed. This population was located on private property.

Role of Recovery Plan

FWS approved a recovery plan for the Truckee barberry in 1984. The objectives included protecting the only known population, surveying for other populations, and establishing new ones. Additionally, because FWS had only limited information on this plant's biology, the plan included actions for genetics research to clarify the relationship of the species to similar species, like the *Berberis repens*. These steps were critical to determining that the species was not unique but rather a part of a more common species.

Costs and Partnerships

FWS only had expenditure information for the delisting process, which took 3 years and about $33,000.

Uinta Basin Hookless Cactus

The Uinta Basin hookless cactus *(Sclerocactus glaucus)* was listed as threatened in 1979. The Uinta Basin hookless cactus is a spherical to cylindrical, spiny succulent that commonly grows from 2 to 3 inches in diameter and 2 to 6 inches in height. It occurs on rocky surfaces on river terrace deposits and lower mesa slopes between elevations of 4,500 to 6,000 feet along the upper Colorado and Gunnison Rivers in western Colorado, and the Green River in northeast Utah. At the time of listing, FWS reported that there were approximately 15,000 individual plants.

Threats

FWS officials report that the primary threat to the Uinta Basin hookless cactus is the demand for energy development in its habitat, which is primarily BLM land and the Uinta and Ouray reservations of the Northern Ute Tribe. According to the recovery plan, demand for energy development increased dramatically around the time the species was listed in 1979, and then decreased by 1990 when the recovery plan was issued. However, FWS officials said that the demand has increased again over the last several years, and that significant oil and gas development is in progress; additional development within the species habitat is pending. Additional threats include other development for highways, housing, and commercial purposes; recreation; and trampling by livestock. The species is a desirable horticultural specimen and, as such, is illegally collected.

Recovery Plan Role

FWS approved the Uinta Basin hookless cactus recovery plan in 1990. However, according to FWS officials, the recovery plan has not been fully implemented because it competes with many other species for funding. Needed actions outlined in the recovery plan include achieving a total population of 30,000 individuals, with at least 2,000 individuals in a minimum of six separate populations; protecting land to provide for long-term, undisturbed habitat; and conducting taxonomic studies on the species. However, FWS officials stated that funding levels have only allowed for completing a taxonomic study. FWS officials report they have been involved in Section 7 consultations with BLM concerning oil and gas leases affecting the cactus, and there have been adverse effect determinations. FWS officials are currently working with BLM and oil and gas companies to minimize the loss of cacti due to energy development in its habitat. FWS officials report that the cactus could be delisted in 10 to 20 years, assuming adequate funding is received and habitat protection measures are implemented.

Costs and Partnerships

FWS officials report that they cannot provide an accurate recovery cost estimate because comprehensive cost data do not exist. FWS estimated that, for the last 2 years, its field offices in Utah and Colorado have spent between $30,000 and $40,000 annually on the Uinta Basin hookless cactus and other plant species in the area, mostly for Section 7 consultations with BLM and monitoring. FWS has also worked, on a limited basis, with the Bureau of Indian Affairs and some conservation groups, but did not have any expenditure information for those entities.

Virginia Round-Leaf Birch

The Virginia round-leaf birch (*Betula uber*) was listed as endangered in 1978 and downlisted to threatened in 1994. It was the first tree protected under the Endangered Species Act. The Virginia round-leaf birch grows to about 40 feet tall and has dark bark and distinctive rounded leaves. It lives for about 50 years, and produces large quantities of seeds about every 5 years—a survival strategy that discourages seed eaters. The birch needs continually moist, well-drained mineral-rich soil that is largely free of debris so seeds can reach the ground and germinate. It also needs open forest canopies to allow seedlings to get sunlight. The species was thought to be extinct until 1975, when 41 trees were discovered in the Cressy Creek area of Smyth County in southwestern Virginia.

Threats

FWS officials report that most of the Virginia round-leaf birch population occurs on Forest Service land and that the primary threats to the species

when it was listed were its reproductive characteristics and distinct habitat needs. For example, studies have shown that seed viability is significantly lower in the round-leaf birch than in other dark-bark birches in the Cressy Creek area. Reproduction is also limited by long distances between pollen sources. Periodic droughts and floods, and herbivory (mostly by deer and rabbits), are also threats. Additionally, in the 1980s, vandalism by collectors led to the loss of numerous individual trees—10 of the original 41 trees, 30 seedlings that had grown as a result of Forest Service recovery actions, and 81 greenhouse seedlings grown by the National Arboretum. FWS officials report that the Virginia round-leaf birch does not currently have any imminent threats, however, due to its limited geographic range, it faces challenges such as drought and occasional flooding.

Role of Recovery Plan

Most of the Virginia round-leaf birch population is located in the Jefferson National Forest in southwestern Virginia. According to FWS officials, the Forest Service approved a management plan for the Virginia round-leaf birch in 1976, and FWS approved a recovery plan in 1982 with revisions in 1985 and 1990. FWS reported that several actions in the recovery plan have been especially effective for recovering the species—creating small openings in the canopy to allow sunlight to reach seedlings, removing plant debris from around the existing trees to allow their seeds to reach the soil and germinate, enclosing all the trees with chicken wire to protect them from herbivory, and, to stop vandalism by collectors, growing several trees in captivity and distributing seedlings to the public. Some actions taken by the Forest Service have also been important for the species, and were taken before the recovery plan was in place. Specifically, the Forest Service fenced the two mature trees that occurred in the Jefferson National Forest and conducted soil disturbance activities to encourage seed germination. FWS is awaiting the results of a status review of the species, which should be complete in 2006, before pursuing delisting. FWS hopes to begin the delisting process in the next 2 to 3 years for the species and have it delisted by about 2015.

Cost and Partnerships

FWS officials report that they cannot provide a cost estimate for recovery expenditures because most of the recovery activities were completed in the 1980s and much of the documentation is no longer available. The Forest Service and the Virginia Department of Agriculture and Consumer Services, which listed the species as endangered at the state level in 1979, have led recovery efforts. The Department of Agriculture and Consumer Services provided funding for cultivation of birch seedlings for distribution to arboreta, botanical gardens, and the public. Other partners include the National Arboretum, which coordinated the distribution of seedlings to the

public; various conservation organizations; universities; and private entities.

Comments from the Department of the Interior

United States Department of the Interior
OFFICE OF THE SECRETARY
Washington, DC 20240

AUG 14 2006

TAKE PRIDE IN AMERICA

Ms. Robin M. Nazzaro
Director, Natural Resources and Environment
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Ms. Nazzaro:

Thank you for providing the Department of the Interior the opportunity to review and comment on the draft U.S. Government Accountability Office report entitled, "Endangered Species: Many Factors Affect the Length of Time to Recover Select Species," GAO-06-730, dated July 12, 2006. In general, we agree with the findings.

The enclosure provides comments from the U.S. Fish and Wildlife Service. We hope these comments will assist you in preparing the final report.

Sincerely,

Acting Assistant Secretary for Fish and Wildlife and Parks

Enclosure

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