The Heritage Foundation

BACKGROUNDER

No. 3300 | APRIL 16, 2018

Correcting Falsely "Recovered" and Wrongly Listed Species and Increasing Accountability and Transparency in the Endangered Species Program

Robert Gordon

Abstract

Numerous administrative actions should be taken to correct the record of species that are falsely claimed to have "recovered" and that have been declared endangered under the Endangered Species Act (ESA) using erroneous data. It is crucial to improve implementation, accountability, and transparency in the administration of the ESA. The recommendations and information here will help correct the record, provide guidance as to some of the species that may be suitable for delisting on the grounds of data error or extinction, improve the likelihood that future delistings are appropriately categorized, eliminate unnecessary regulations and further waste, and ensure scarce conservation dollars are better spent.

Introduction

In five years the Endangered Species Act (ESA) will reach the half-century milestone—and yet only 40 U.S. species have graduated from the program as "recovered," slightly less than one species per year. If not one more bird, beetle, or bear were added to the list of federally endangered animals and plants and somehow species recovered at 10 times that rate, it would take well over a century-and-a-half to work through the current list.[1] There is, however, no indication that the list of regulated species will stop growing.

Even worse, almost half of the "recovered" species—18 of 40—are federally funded fiction. They were never really endangered; like many species that remain on the endangered list, they were mistakes. With all the ESA's costs and burdens, it should perhaps come as no surprise that the U.S. Fish and Wildlife Service (hereafter "Service") is fabricating success stories to cover up

Key Points

- The Endangered Species Act (ESA) has been so ineffective in recovering species that the U.S. Fish and Wildlife Service has fabricated a record of success.
- Proclaiming mistakes as successful recoveries presents an inaccurate picture of the ESA and creates and obscures a number of other problems.
- In large part, ESA errors are attributable to the low bar for scientific data used to add a species to the list, the litigation-driven construct of the ESA, and—potentially—a bureaucracy as interested in accumulating authority as conservation.
- The Secretary of the Interior should correct false successes, accurately identify the basis for delisting many species as original data error, delist now erroneously listed species, and ensure that future delistings are attributed to the appropriate grounds.

This paper, in its entirety, can be found at **http://report.heritage.org/bg3300**

The Heritage Foundation
214 Massachusetts Avenue, NE
Washington, DC 20002
(202) 546-4400 | heritage.org

this unsustainable mess and substituting fluff for statutorily required reporting regarding the recovery program.

The ESA was ostensibly designed to conserve species threatened or endangered with extinction.[2] When a species has been recovered that species is supposed to be removed from the list of federally threatened and endangered species ("list") by a regulation citing "recovery" as the grounds for removal of the species (delisting). Species may also be delisted if it is determined that they are extinct or that the original data used to justify listing the species were in error.

The Service routinely falsely declares that a species that should have been delisted because of original data error has "recovered." This deceitful practice portrays mistakes as successes, distorting the most important measure of the program. It also triggers other mandatory actions further wasting taxpayer dollars, serves as a justification for the adoption of more restrictive land management practices by other agencies, obscures significant problems with the data used to justify listing species, and erodes the overall credibility of both the Service and the program.

The Secretary of the Interior should administratively correct these false successes, appropriately identify the primary grounds for delisting these species as original data error, prioritize the delisting of wrongly listed and extinct species, and ensure that future delistings are attributed to the appropriate grounds. Any post-delisting monitoring efforts implemented for falsely recovered species should be terminated, and post-delisting special management regimes implemented by agencies such as the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) for such species should be terminated as well.

Ultimately, measures need to be taken to raise the standards for data used in the designation of "threatened" and "endangered" species. Some actions that can be accomplished administratively are identified here. Additionally, the Secretary should return to incorporating meaningful data on the "status" of listed species into the biannual report to Congress that prior administrations stopped providing. Little meaningful data are now available for congressional oversight of recovery under the ESA. These and several other administrative reporting requirements could significantly improve accountability and transparency.

Background

Today there are some 2,340 species of which 1,661 are U.S. plants and animals on the federal list.[3] Conservation under the ESA is defined as recovering a species to the point at which protections under the law are no longer necessary.[4] When a species is recovered, it is to be delisted by a regulation that indicates the grounds for its delisting are recovery. Species may also be removed from the list if they are determined to be extinct or to have been originally added to the list using data that were in error.[5] When a species is delisted it essentially completes the cycle established by the law.

False Recoveries

Some 81 species have been removed from the list since its inception.[6] Of these, 13 were foreign species and will not be addressed here.[7] Of the remaining 68 species that are or were found at least in part within the United States, 11 species have been removed from the list as having gone extinct and 19 have been removed from the list on the grounds of original data error.[8] The remaining 38 species were officially removed from the list on the grounds that they "recovered." Unfortunately, almost half of these "recoveries" are false.[9] Many would be more accurately classified as "original data error" and likely include: Johnston's frankenia, Modoc sucker, white-haired goldenrod, Louisiana black bear (delisted in 2016), Oregon chub (2015), island night lizard (2014), Virginia flying squirrel (2013), Concho water snake, Lake Erie water snake, Maguire daisy, Tennessee coneflower (2011), Eggert's sunflower (2005), Tinian monarch (2004), Hoover's wooly star, (2003), American alligator (1987), and the Palau dove, Palau owl, and Palau fantail flycatcher (1985).[10] Additional information for some of these species can be found in Appendix A, Additional "Recovered" Species. Moreover, there are a substantial number of currently regulated species that were listed using erroneous data or are likely extinct. Many of these merit delisting or downlisting on the grounds of original data error. A table of 100 species that may fall into this group is included in Appendix B, Species Listed with Erroneous Data or Likely Extinct.

Examples of False Recoveries

Often the erroneous data used to list these species regard the estimated population or the extent of the species' range. Such errors are commonly profound,

often by an order of magnitude, off by a factor of 10, or even more. For example, when the Service listed Hoover's wooly star, a plant, it provided speculative information about the plant's numbers that indicated an already substantial population floor of over 35,000 to over 300,000 plants with "preliminary results" indicating an additional 28 populations.[11] However, even that already large estimation was a gross undercount. After Hoover's wooly star was listed, over 1,000 new sites were discovered with many falling within four meta-populations.[12] While the plant's numbers fluctuate, within the largest meta-population alone the Service reported the astounding approximation of 135 million plants.[13] The Service omits this figure from the final rule delisting this species as "recovered" but does acknowledge: "Large areas of potential suitable habitat remain unsurveyed, and it is likely that additional sites remain undiscovered."[14] Seeking to obscure this error the Service states, "Research efforts, **as part of the recovery process**, have shown that *Eriastrum hooveri* is more resilient and less vulnerable than previously thought" (emphasis added).[15] There was no recovery and so no "recovery process." Instead, the bureaucratic process exposed the original listing as bogus.

Similarly, the Service included the Tinian monarch, a small bird found on the Pacific island of Tinian, on the endangered list, likely as a result of misinterpreting a decades-old observation of some 40 to 50 Tinian monarchs to be a population estimate for the entire island.[16] Later, having determined there were tens of thousands of birds on the island and that the Tinian monarch was among the most abundant of birds there, the Service delisted the bird but attributed the delisting to recovery instead of the obvious cause of data error.[17]

Sometimes the errors are an overestimated or completely incorrect assessment of a threat to a species. For example, when the Service included the Concho water snake on the list, it considered the primary threat to be the pending construction of a reservoir.[18] The Service believed the reservoir would destroy the snake's habitat. After the reservoir was constructed, the snake occupied it, and the Service also determined that the snake's range was larger than previously believed.[19] Subsequently, the Service hailed the Concho water snake as a success story, stating the snake had been threatened by "habitat modification and destruction," but omits mention that concern about the reservoir was unfounded.[20]

Similarly, Eggert's sunflower, a plant found in Kentucky and Tennessee, was listed because of low numbers and a significant concern that many of 24 remaining populations were threatened by mowing and other routine roadside maintenance.[21] Subsequently, Eggert's sunflower discoveries brought the total to 287 sites in 27 counties, and the Service determined that the plants found along roadsides benefited from mowing.[22] While never endangered, the Service reports evaluating the potential impacts from 262 federal actions upon the species.[23]

Taxonomic error has also played a role in false recoveries. The Service announced the delisting of the Maguire daisy with a press release titled "[A]n Endangered Species Success Story," stating that the "population of the daisy was known to number seven plants when it was listed as endangered in 1985 but now numbers 163,000 plants within 10 populations.... It is the 21st species to be delisted due to recovery."[24] The Service's press release omitted that the daisy did not increase from seven to 163,000 plants. The larger number reflected more thorough surveys and the fact that the Maguire daisy and another plant that had been believed to be distinct were in fact the same species.[25]

Post-Delisting Monitoring of Species That Were Never Really Endangered

When the Service declares a species recovered, it is required to monitor the species after taking it off the list.[26] This requirement was intended to make sure species that had actually belonged on the endangered list did not slip back into an imperiled state, but it also applies to species falsely delisted as recovered. This would include, for example, Johnston's frankenia, a plant found in a few southern Texas counties. The Service delisted the plant in 2016 and proclaimed it another ESA success.[27] When the Service listed this plant in 1984, the agency reported it could only find about five populations totaling some 1,000 plants and expressed concern about "grazing pressure."[28] Subsequent surveys found over 4 million Johnston's frankenia by one estimate—and over 9 million by another.[29] While the estimate of 4 million plants was available by 1999, the plant was not delisted for more than a decade and a half.[30]

When it finally delisted the plant, the Service provided a 28-page post-delisting monitoring plan that anticipates expenditures of $100,000 over nine years to conduct remote sensing at 20 sites and on-site

assessments at nine sites.[31] As explained in the *Federal Register*, the Service's monitoring will make sure that threats, including "substantial human persecution," do not cause the plant's "relapse" into endangered status.[32]

Unjustified "Post-Delisting" Management

Falsely proclaiming a species recovered also results in other agencies implementing a more restrictive post-delisting management for the species. For example, the BLM and USFS treat a species that was falsely delisted as "recovered" as a "sensitive species" in the agencies' land and forest-management plans. When the Service delisted Hoover's wooly star, which numbered in at least the tens of millions, it noted, "However, BLM intends to designate [Hoover's wooly star] as a sensitive species and will continue to minimize impacts to the species at all known sites that are under its jurisdiction."[33]

Treatment of delisted species as sensitive species is required by the BLM's policy manual that states that "[a]ll federally designated candidate species, proposed species, **and delisted species in the 5 years following their delisting shall be conserved as Bureau sensitive species**" (emphasis added).[34] While BLM policy does not explicitly differentiate between species delisted due to recovery and those delisted due to data error or extinction, presumably the latter were not the intended focus. The BLM's manual lays out numerous guidelines for sensitive species in land use planning, implementation-level management on BLM lands, and entering into "agreements, assessments, and cooperative conservation strategies with other agencies, organizations, governments, and interested parties."[35] Similarly, according to a Forest Service manual, a "species that is removed from listing under the ESA **because recovery criteria have been met** is automatically added to the sensitive species list for a period of at least 5 years to ensure that its recovery is maintained and monitored" (emphasis added).[36]

Bureaucratic Costs

The process of listing species, designating critical habitat, preparing a recovery plan for the species, and the process of delisting the species all consume scarce conservation dollars. For example, the Service reported in 2014 that the "**median cost** for preparing and publishing a 90-day finding is $39,276; for a 12-month finding, $100,690; for a proposed rule with critical habitat, $345,000; and for a final listing rule with critical habitat, $305,000" (emphasis added).[37] These are just the bureaucratic costs of listing species, whether they are legitimately endangered or threatened—or were listed on the basis of erroneous data.

One example is the Virginia northern flying squirrel. The Service listed the squirrel, one of 25 U.S. flying squirrel subspecies, reporting that it was possibly threatened by competition with the southern flying squirrel and forest clearing.[38] The squirrel was considered extremely rare, discovered only as a result of 10 squirrels trapped in one Virginia and two West Virginia counties. When delisting the species as recovered more than two decades later, the Service stated that "its current range roughly approximates its historical range."[39] The "recovery," however, was a fraud, as most of this range was not the area originally searched. After listing, it was determined that a majority of the squirrel's range was actually in West Virginia. When surveys shifted into the squirrel's actual range, despite the small mammal being incredibly difficult to capture, over a 1,000 were trapped at 109 different sites in eight counties, indicating a much more substantial population.[40] The Service took the highly unusual step of adopting use of a new common name for the squirrel, the West Virginia northern flying squirrel.[41]

Although the subspecies had never really been endangered, the Service's website profile for the squirrel lists 13 *Federal Register* documents.[42] The *Federal Register* printing costs alone are likely over $22,000.[43] This does not include the costs to prepare these documents, as well as responses to litigation, a 62-page recovery plan and amendment, and a 70-page, five-year review and appendices.[44]

Expenditures by Federal Agencies

Other costs of species listing errors can be much larger. The Oregon chub, a minnow endemic to the Willamette River Drainage in Oregon, is a good example. When the fish was listed in 1993, only nine populations were known to exist, and it was believed to only inhabit 2 percent of its former range. After listing, enough new populations were discovered that the fish was downlisted from endangered to threatened. Subsequently, another 34 populations were discovered, and the Service eventually proclaimed the fish recovered.[45] While the fish was listed for over two decades, between 2005 and 2014 alone the Ser-

vice reports over $13 million in expenditures by 11 agencies and states including over $10,000,000 by the Department of Energy, $400,000 by U.S. Department of Agriculture, $300,000 by the Army Corps of Engineers, and $90,000 by the Department of Transportation.[46]

These figures are drawn from the annual species-by-species expenditure report required by the ESA and produced by the Service.[47] The most recent report (fiscal year 2015) indicates 31 federal government entities and states reported spending $1.507 billion on listed species.[48] This figure is clearly an underestimate as, for example, the USFS reported spending only $1.12 million and all of it dedicated to a single species.[49] This is implausible, as the prior year's report indicated USFS spent $45,983,888 on over 150 different species.[50] Additionally, these reports exclude all litigation costs. The lump sum expenditures for states are also clearly unreported, as several states are not included. For example, in the most recent report, 21 states, including California—one of the most heavily impacted states, if not the most—failed to report, as well many other states with likely significant expenditures, such as Georgia, Hawaii, Idaho, Kansas, Mississippi, New Mexico, South Carolina, Tennessee, and Texas.[51]

Economic Impact and Regulatory Burden

Even if a species should never have been listed, while it is listed, landowners or businesses whose actions might unintentionally harm a member are potentially subject to the ESA's fines and penalties. The Service can impose expensive—and even absurd—burdens on private property owners and businesses seeking immunity from potential civil and criminal liability under the ESA. The restrictions the Service sought to impose on behalf of the Lake Erie water snake are a good example.

The Lake Erie water snake is a subspecies of the abundant and widely distributed northern water snake. The most substantial differences are that the Lake Erie snakes are found on several islands in Lake Erie and differentiated primarily by having faded or altogether absent markings. The snake's population was estimated to be only 1,530 to 2,030 adults when it was listed in 1999.[52] These snakes take several years to reach sexual maturity, and in their first year of life have a low survival rate. Nonetheless, within just a few years of listing, the adult snake population was estimated to be 5,690, which, if correct, reveals either a truly miraculous population growth rate or a substantial underestimation at the time of listing.[53]

Although the snake's population was large enough to meet the recovery plan's overall target right after listing, it did not meet the plan's required population number for one of several islands. Additionally, the population targets had to be met or exceeded for a number of consecutive years before the snake would be delisted.[54] Service documents reveal surreal regulatory hurdles faced by a developer seeking to build seven homes on 15 acres during this time.

The Service sought easements on over five acres of lakefront property (to be donated to a nonprofit organization); the donation of $50,000 in in-kind contributions, including the construction of two snake hibernacula (dens where snakes hibernate) on each of seven residential properties; and the establishment of a homeowner's association to impose even more restrictions.[55] The list of homeowner's association's restrictions included ensuring no snake be within 20 feet when applying weed killer to poison ivy, not allowing cats outside, abiding by seasonal height and temperature restrictions for mowing, collectively providing up to $18,750 for snake research, and allowing researchers (possibly including those whose likely low population estimates were used to list the snake) to access the properties.[56] This is a small example of the heavy-handed regulatory process for just *one* of the nearly 1,700 listed species to which landowners and businesses are repeatedly subject across the nation.

Economic analysis conducted by the Service for designation of critical habitat for the Louisiana black bear provides a glimpse into costs on a larger scale. The bear is putatively a subspecies of the black bear, *Ursus americanus*, which itself is the most common of all bears. In fact, there are likely more black bears (near 1 million) than all bears of all other species combined, and the species is found in 46 of 50 states.[57] The Service declared the Louisiana black bear endangered in significant part because of threats from loss and fragmentation of its habitat, including from forestry.[58] The Service had particular concerns regarding the loss and promulgated a special rule to protect "actual and candidate" denning trees.[59] However, when the Service declared the Louisiana black bear recovered it acknowledged that "the **availability of den trees does not appear to be a limiting factor** in reproductive success as bears demonstrate flexibility in den use," and that nests were "located in

thick vegetation, **usually in areas logged within the past 1 to 5 years**...and are typically found within **felled tops and other logging slash**" (emphasis added).[60]

As the International Union for the Conservation of Nature (IUCN) notes, the "validity and integrity of this subspecies has been debated."[61] Ironically, the IUCN also states that the Service's conservation activities "linked a population that was believed to be native Louisiana black bears with a population that had previously been established by translocating [a different subspecies of] bears from Minnesota."[62] The IUCN notes that if the Louisiana black bear merits subspecies status, "the successful establishment of a conservation corridor reduced the purity of that genetic stock."[63] Additionally, non-Louisiana black bears from Arkansas wandered into the habitat of and interbred with Louisiana black bears.[64] The Service provides no overall population estimate for the black bear in its delisting, but from the convoluted data that are included, the population appears to be small. The Service's decision to delist this "subspecies" might be best explained by the compelling evidence indicating that the bear does not really merit subspecies status, including extensive genetic studies published the same year as the proposal to delist the "subspecies."[65] Nonetheless, when designating critical habitat, the Service estimated the economic impact of Louisiana black bear conservation efforts to range from $165.7 million to $202.9 million.[66]

False Recoveries Indicative of a Larger Problem

The many species wrongly delisted as "recovered" are indicative of a larger problem. The standards used in determining species to be endangered or threatened present a low bar. Consequently, while the prevalence of data error is unknown, it is clear there are many species that remain on the endangered list that should have never been listed. Appendix B provides information for 100 listed species that were or may have been erroneously listed but remain regulated under the ESA as well as a number that are possibly extinct. The possibly extinct species are included because this information is no longer reported (as was previously done in biannual reports to Congress, which is addressed later). Many of these species should be delisted based on data error or extinction.

When the Service listed the Iowa Pleistocene snail, one of the Appendix B species, there were concerns that it "could be 'wiped out' by avid collectors," as it was estimated that "probably fewer than 100 live individuals exist" at a single site.[67] There are now reportedly "38 known sites," and the most recent 5-Year Review states that "surveys suggest that snail abundance on the various occupied slopes ranges from 50 up to 205,000 individuals."[68] This vast undercounting will hopefully suffice as a basis to delist the species as otherwise the snail's recovery plan indicates a long-term program stating: "**With a return to glacial conditions** [the snail] will be resuscitated over a major part of the upper Midwest, provided its relictual areas are preserved and maintained" (emphasis added).[69]

Similarly, the running buffalo clover was described as "one of rarest members of North American flora" at the time of listing, with reportedly only 22 plants at two sites in one state.[70] One of the sites having 18 plants had been mowed, so the status of those plants was uncertain.[71] Since that time, better data have revealed 116 populations in 83 counties in seven states, that "new populations are being discovered almost annually," and that one West Virginia population alone has been estimated as high as 77,800 plants.[72]

Other currently listed "endangered" or "threatened" species have been determined to have similarly large numbers, such as the Nashville crayfish (with roughly 700,000 to 1,200,000 individuals in part of its range);[73] the painted snake coiled forest snail (at 1,568,221);[74] and the spring loving centaury, a plant (at 4,468,571).[75]

Other "endangered" or "threatened" species are not species at all but rather taxonomic errors, such as the red wolf, which actually is a coyote–wolf hybrid.[76] Annual expenditure reports show that the Service, other federal agencies, and states spent over $27,000,000 on the red wolf between 1996 and 2014.[77] This does not include economic impact, any funds expended by private groups, or any federal or state tax dollars spent in the almost three decades the wolf was listed between 1967 (under a predecessor law) and 1995.

Report to Congress

In addition to fabricating recovery successes, the Service has substituted nearly useless data for the recovery measurements "status" and "recovery

objective achieved" that were previously provided in the statutorily required biannual report to Congress on the recovery program.[78] The status and recovery objective achieved measurements were the only uniform non-anecdotal measurements collected that shed light on whether the ESA effectively conserves species.

The "status" measure has the possible values of "improving," "stable," "declining," "unknown," and "extinct." The final time species "status" was reported, 158 or almost 12 percent of listed species were claimed to be "improving."[79] This was an unexplained and extraordinary increase from just two years before when only 91 species were "improving."[80] However this occurred, it seems unlikely that a federal agency would cease reporting data that earnestly reflected favorably on the program. Additionally, upon examination, a number of these species owe this assessment, at least in part, to the discovery of erroneous data, species such as the Concho water snake, desert milkvetch, Oregon chub, palma de manaca, and Ute ladies'-tresses—all species addressed here or in Appendix B.

The Service also quit reporting a measurement known as "recovery objective achieved" after the 2005–2006 report. This is a percentage-based measurement that assigned each species a value indicating that 0 percent–25 percent, 26 percent–50 percent, 51 percent–75 percent, or 76 percent–100 percent of recovery had been achieved. The last year these data were reported, just over 2 percent of species fell in the 76 percent–100 percent range.[81] Among these were many species addressed here or in Appendix B such as Johnston's Frankenia, the Magure daisy, and the Virginia northern flying squirrel.[82]

In place of these measurements the Service now provides a number of less informative measurements, including the date a recovery plan was produced; whether the plan is final, a draft, or in revision; "number of actions implemented"; "estimated cost to recovery"; "estimated years to recover"; and the date of the last statutorily required five-year review for a species and the review's recommendation. Most of these are of little use.

The "number of actions implemented" is the total number of recovery actions identified in the implementation schedules of recovery documents that are considered completed. For example, two of the first species listed in the 2013–2014 report, the golden coqui (a frog) and the California red-legged frog, are reported to have 3 and 38 recovery actions implemented, respectively.[83] These, however, are the same numbers reported in two prior reports and somehow decreased since the fiscal years 2007–2008 report that indicated 6 recovery actions and 104 recovery actions had been completed, respectively.[84] Further, if a reader did not know to check prior years' reports that included the status measurement, it would not be evident that the Service believes, or previously believed, that the golden coqui is extinct.[85] Moreover, given that implementation schedules come from recovery planning documents that differ dramatically from species to species, the raw numbers are nearly if not entirely useless for comparison.

"Estimated cost to recovery" and "estimated years to recover" are likewise drawn from recovery plans or other similar documents. Recovery plans are not regulatory documents, and consequently these numbers are just estimates that have no force and are often incomplete, vague, or lacking altogether. Of the first page of species listed in the 2013–2014 report, 17 of 24 have no estimated recovery cost and no estimated time to recovery.[86]

The five-year review status recommendation is useful data. However, the data is collected every five years at best. By far the most common data provided for this field in the biannual report is "no change to listed status"—as is the case for the presumed-extinct golden coqui.[87]

Recommendations

Numerous administrative actions can be taken to address the false record created by the Service and to improve accountability and transparency in the administration of the ESA.

False Recoveries

- The Secretary should issue an order directing the Service to accurately identify the data that form the basis for removing or downlisting a species. The order could include other elements from those suggested below as part of a broader accountability and transparency effort.

- The Service should correct the record by identifying and revising the basis of delisting for those species that the Service has wrongly declared to have recovered. Those species for which removal from the list was wrongly attributed to recovery and that have been delisted for more than five

years are beyond the statute's requirement for post-delisting monitoring. As there is unlikely to be regulatory impact from issuing regulations correcting the basis for delisting these species, notice and comment may be unnecessary and corrections could be effective upon publication.

- Scarce conservation funds should be redirected from post-delisting monitoring for species falsely claimed to have been recovered.

- The BLM, USFS, and other land-managing agencies should no longer identify species that were in reality removed from the list on the basis of data error as species of special concern—and should redirect conservation expenditures and actions to those species legitimately on the list.

Listing and Delisting Species

- The Secretary should direct the Service to aggressively pursue the delisting of species listed using erroneous data or that are extinct.

- When delisting a species because the species has been found to be more numerous, have a greater range, face less severe threats than believed at the time of listing, or be taxonomically ineligible, the species should be delisted on the basis of original data error. This ensures that conservation dollars are spent where most needed. Similarly, when downlisting a species from endangered to threatened, a regulation should acknowledge any original data error, establishing an accurate record for subsequent administrative actions. Delisting these species could help comply with the Executive Order on Reducing Regulation and Controlling Regulatory Costs.[88]

- In the listing process, the Secretary should require: (1) a clear, concise, and enumerated summation of each five-factor threat with relative weighting and related population-level effects for each five-factor threat and the Service's confidence in this data; and (2) a clear summation of the known population and distribution of the species at the time of listing with as much numerical specificity as available (i.e., number of animals, populations, acres inhabited) and the Service's confidence in this data.

- All data used or relied upon in a listing decision should be publicly available prior to the proposed or final action.

Recovery and Expenditure Reports

- The measurements "status" and "recovery objective achieved" should be included in biannual reports to Congress.[89] If data were collected for previous years but not published, supplemental reports should be issued so that the data gaps may be filled to the extent possible.

- Litigation costs should be included in annual expenditure reports, including attorney's fees, as such expenditures are made by agencies following the ESA's requirement to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species."[90] Litigation expenses should be reported by agency and by species—but separately from general expenditures so as to make figures across years more comparable. Data should be requested both from the Department of Justice and the Department of the Treasury.

- The expenditure report should separately list any ESA Section 6 grant monies going to states that fail to report any expenditures. In a listing of each state's total expenditures, those states that did not report any expenditures should be identified. Failure to report expenditures should be taken into consideration in subsequent year's grant-making decisions.

- Letters transmitted by a reporting agency or state addressing the data provided for an annual species expenditure report should be included within the report. Such letters can provide valuable information regarding implementation of the program, particularly costs borne by an agency or state that may somehow fall outside the reporting parameters. Such correspondence was included in prior reports. Additionally, the Service could request that states gather economic impact data from counties or other political subdivisions and incorporate this separately.

- The Service should include data in expenditure reports on the value of land or interests therein (i.e., easements) that flow to third parties as a result of implementation of ESA regulatory or enforcement actions. While these are not expenditures, the Service reports land purchases separately in expenditure reports. The value of mitigation lands or easements or other such instruments that are purchased from, donated to, or otherwise transferred to nongovernmental organizations or other third parties as a result of a regulatory or enforcement action are essentially off the books. This information should be reported separately from land purchases and general expenditures—and should be reported by agency and by species.

- The Service and National Marine Fisheries Service should include in expenditure reports all funds, the value of real property or interests therein, and the value of in-kind services the agencies received as a result of regulatory or enforcement action. This information should be reported separately from land purchases and general expenditures and should be reported by species.

- The Department should produce a separate baseline report on the total acreage of mitigation lands, easements, or similar instruments that have been transferred as a condition of obtaining an incidental take permit or as a result of regulatory or enforcement actions taken under the ESA or other laws. This should list acreage by state and county and identify the new owner. The U.S. Geological Survey may be an additional repository of knowledge and data regarding these lands through its National Gap Analysis Protected Areas Database and its collaboration regarding data acquisition and standards with the National Conservation Easement Database.

- The Service should report annually on the acreage of all mitigation lands or interests in property such as easements or similar instruments that have been transferred to the Service or another entity as a term or condition of a Habitat Conservation Plan or other regulatory or enforcement action taken under the ESA or other laws.

Conclusion

The Endangered Species Act is not only costly but also has been so ineffective in reaching the ultimate goal of recovery that the Service has spent taxpayer dollars to fabricate a record of success.

It is not uncommon for doctors to misdiagnose patients. However, were a doctor to routinely claim he had cured patients whom he had misdiagnosed as "terminal," there would be consequences. If, for example, undercounting the plant Hoover's wooly star by more than 135 million does not qualify as "original data error," what would? The practice of falsely declaring species recovered increased dramatically during the Obama Administration, leading to headlines such as *Scientific American*'s "U.S. Endangered Species Recovery Surges to Record High."[91] Proclaiming mistakes as success presents an inaccurate picture of the ESA and obscures other problems.

Species have previously been appropriately delisted on the basis of data error—as was the case with 19 species including the Dismal Swamp shrew, Tumamoc globeberry, and Pine Barrens tree frog.[92] When a species' population or range was underestimated, a taxonomic classification was invalid, or threats were overestimated so that a species that would not have been listed was listed, the species should be delisted on the grounds that the original data were in error. This remains true even if the Service undertook activities that increased our knowledge of or directly benefitted the species. Failure to correct these false recoveries is an implicit acknowledgement of willful dishonesty.

Many currently listed species should be delisted on the grounds of data error—such as the red wolf, flat-spired three-toothed land snail, Hawaiian hawk, spruce fir moss spider, Todsen's pennyroyal, running buffalo clover, and black lace cactus. While over 50 species that were listed using erroneous data are identified in Appendix B, this list is by no means exhaustive. All of these species were listed prior to the year 2000—before several "mega-petitions" (petitions to list hundreds of species) hit—and there is little reason to believe later listings are more reliable.[93]

The recommendations and information here would help correct the record; provide guidance as to some of the species that should be delisted on the grounds of data error as well as extinction; improve the likelihood that future delistings are appropriately categorized; and improve accountability and transparency.

Many of these errors are attributable to the low bar for scientific data used to list species, the ESA's litigation-driven construct, and possibly a bureaucracy as interested in accumulating authority as in conservation. The law calls for the "best available scientific and commercial data" to be used in listing species. Unfortunately, the manner in which the Service has interpreted this directive does not require the data to be accurate, reliable or even sufficient to reach a scientific conclusion. In short, the "best available data" are often of poor quality—and sometimes not even made available to the public before listing. While some of the recommendations made here would improve the situation, this is a far larger problem that gets into the language of the ESA itself. The first steps, however, are acknowledging the seriousness of the problem, correcting the record, and ensuring it does not continue.

*—**Robert Gordon** is a Visiting Senior Research Fellow in Regulatory Policy in the Thomas A. Roe Institute for Economic Policy Studies, of the Institute for Economic Freedom, at The Heritage Foundation.*

Appendix A: Additional "Recovered" Species

American Alligator. The alligator was first listed under a law that preceded the ESA and was included among those species first regulated under the Act when it became law on December 28, 1973.[94] The Service delisted the alligator as a "recovered" species in 1987.[95] Writing for the National Wildlife Federation, T. A. Lewis recognized that same year that the "familiar and gratifying" recovery story of the alligator was "mostly wrong."[96] By July of 1975, when the ESA had been law for only one-and-a-half years, the Service reported "that significant losses of populations have occurred only in geographically peripheral and possibly ecologically-marginal areas. **Population levels in parts of South Carolina, Georgia, Florida, Louisiana, and Texas are high**, and, in many areas over these regions are considered to be ecologically secure" (emphasis added).[97] Reportedly, "[b]y 1975, the Florida Game and Fresh Water Fish Commission was responding to about 5,000 complaints per year involving 'nuisance' alligators that had ventured too close to humans, and it was relocating about 2,000 of them."[98] In 1979, the Service contacted the expert who had provided earlier population estimates and reported that "his original 1965 estimate of 35,000–46,600 animals within [Louisiana] was extremely conservative, and that 'a more realistic estimate of the 1966 statewide population would be about 100,000 animals.'"[99]

Island Night Lizard. The Service delisted the lizard as "recovered" in 2014[100] after having listed it as threatened in 1977.[101] The lizard is endemic to several California Channel Islands including San Clemente Island (SCI) and San Nicholas Island (SNI), which are maintained by the Navy, and Santa Barbara Island (SBI), which is maintained by the National Park Service.[102] The Service saw the primary threat to the lizard as stemming from introduced goats, deer, pigs, and other animals that damaged habitat.[103] The Service recognized the species was relatively abundant on the Navy's SCI and consequently listed it as threatened rather than endangered, noting "the Navy's goat removal program is inactive" and that the lizard's habitat on SBI and SNI were "reduced and any future reduction would seriously imperil the lizard's populations which occur there."[104]

California's Department of Fish and Game, as well as the Navy, opposed listing, and even the National Park Service "recommended that designation of critical habitat be deferred."[105] Although acknowledging potential harm from introduced species, an expert with the Natural History Museum of Los Angeles County, Dr. Robert L. Bezy, did not take a position on whether the lizard should be listed but reported that the lizard was "**widespread and abundant**" on SCI; was "restricted but locally common" on SNI; and that "on tiny Santa Barbara Island [he] found the lizard's habitat limited, and the species only moderately abundant at only one locality" (emphasis added).[106]

In a 2012 review of the lizard's status, the Service acknowledged that the lizard's available high-quality habitat is almost entirely (99.8 percent) on the Navy's SCI. The lizard was always plentiful on SCI, even if reduced, with SCI having 19,640 acres while SNI and SBI combined have only 37.7 acres.[107] In a petition to delist the lizard on SCI, the Navy provided a "crude population estimate" of 6 million to 10 million lizards on SCI alone at the time of listing.[108]

Modoc Sucker. The Modoc sucker, a seven-inch fish, was declared endangered in 1985.[109] The causes were presumed to be: human activities that caused erosion, particularly cattle grazing; the reduction of natural barriers that led to hybridization with a different sucker; and predation from introduced fish were believed to be threats.[110] The Service reported that the fish had been perilously reduced in number, that entire populations had been lost to hybridization, and that the fish's distribution had shrunk to just under 13 miles of rivers and streams.[111]

After listing, it was determined that the populations supposedly lost to hybridization were in fact not, with the Service stating that "the genetic data suggest that introgression is natural and is not caused or measurably affected by human activities."[112] The Service also found that suckers "have persisted in the presence of nonnative predators, and populations have remained relatively stable...prior to and since the time of listing."[113] The Service also concluded that "surveys completed since the time of listing reveal no evidence of historical natural barriers that would have acted as physical barriers to fish movement."[114] While cattle ranching did cause erosion, apparently the effect on the fish did not actually threaten it with extinction, as surveys after listing showed that the suck-

er "currently occupies its entire known historical range" which was, in fact, three times greater (42.5 miles) than estimated when the fish was declared endangered.[115]

Palau Dove, Palau Owl, and Palau Fantail Flycatcher. Three "recovered" species are birds native to islands in the western Pacific that make up Palau, formerly part of the United States Trust Territory of the Pacific and now a republic in free association with the U.S. According to the Government Accounting Office, "Although officially designated as recovered, **the three Palau species owe their 'recovery' more to the discovery of additional birds than to successful recovery efforts**" (emphasis added).[116] When listed in 1970, these birds were believed to be reduced in number from World War II habitat destruction.[117] However, surveys in the 1970s revealed the flycatcher was by then "common and widespread" and most abundant on Peleliu island, which had been destroyed during the war.[118] The owl possibly suffered some decline after infestation of its habitat by coconut beetles.[119] The beetle has a large spine that can pierce the owls' intestines when consumed.[120] The coconut beetle was controlled using pesticides. Surveys conducted in the 1970s of the Palau dove—previously considered to be rare—revealed a dove population "thought to be near the level before the arrival of man on these islands."[121]

Tennessee Coneflower. When the coneflower was listed in 1979, it was known from only three locations in Tennessee.[122] After listing, numerous additional colonies were located so that by 1989 there were an estimated 139,000 individual plants.[123] FWS data show that by 2005, 19 identified "natural colonies" contained 613,047 plants.[124] The FWS's delisting notice revealed some taxonomic uncertainty about this plant stating: "More recently, Binns et al.... revised the taxonomy of the genus *Echinacea* and in doing so reduced *Echinacea tennesseensis* to one of five varieties of *E. pallida*."[125]

White-Haired Goldenrod. The white-haired goldenrod is a plant that was declared endangered in 1988.[126] The plant occurs in the Red River Gorge within the Daniel Boone National Forest in three Kentucky counties. Surveys identified some 10,500 individual plants and a few more remote uncounted populations around the time of listing.[127] By the time of the 1993 recovery plan, the number of known populations had risen to 90 and individual stems, of which each plant may have many, were estimated to be 45,000.[128] Subsequently, Kentucky State Nature Preserves Commission surveys documented 116 populations and the Service reported that 11 of these had a minimum of 2,500 stems each. Twenty-seven populations had a minimum of 1,000 stems each.[129] The Service provided a total stem count of 174,357 in its rule delisting the plant.[130]

Appendix B: Methodology and Notations

For construction of Appendix B, information was drawn predominately from the Service's Environmental Conservation Online System database (ECOS). ECOS provides a "profile" for each listed species that may be retrieved by searching for the species by its common or scientific name. ECOS lists the states and U.S. territories in which a domestic species is known or believed to occur and provides a link to a list of U.S. counties where the species is known or believed to occur.

ECOS also provides links to other documents relevant to the species, including final and proposed listing and delisting rules and "5-year reviews." These documents were particularly relied upon for information in the columns reporting "information" believed about a species "at the time of listing" and "after listing/last observation." Often, information believed about the population, distribution, or perceived threats to a species at the time of listing is recounted in a 5-Year Review and was taken from there. In some instances, information was drawn from a recovery plan (noted with a "P"), and a link to the recovery plan is included on each species ECOS profile.

Additionally, in some cases information was drawn from the NatureServe Explorer database or Integrated Taxonomic Information System database (noted "N" and "I," respectively). At the bottom of each ECOS profile are links to the relevant record in the NatureServe Explorer or Integrated Taxonomic Information System databases. Additionally, if information was taken from the relevant record for the species in "The IUCN Red list of Threatened Species"—a separate database maintained by the International Union for the Conservation of Nature—this is noted with an "R." This database is available online and may also be searched by common and scientific names. The 5-year reviews were also relied upon for information regarding the "last observation" of a species that is possibly extinct. Additionally, for those species identified as possibly extinct, the notation "RTC" indicates the biannually produced "Report to Congress on the Endangered and Threatened Species Recovery Program."

Bolded text in the "Time of Listing" and "After Listing/Last Observation" fields indicates added emphasis. Scientific names are not italicized in these columns to make it more reader friendly. Under the column "Species," a single asterisk (*) next to a species name indicates the species was included on the ECOS list of "Species Proposed for Status Change or Delisting." A double asterisk (**) next to a species name indicates the species was previously downlisted.

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 1 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Alameda whipsnake *(Masticophis lateralis euryxanthus)*	Taxonomy	1997	—	"[A] study using short tandem repeat loci…to examine population dynamics of the Alameda whipsnake and mitochondrial DNA…to examine the phylogeny of the California whipsnake…**found no evidence the Alameda whipsnake phenotype forms an exclusive mtDNA genetic group.**"
Ash meadows gumplant (*Grindelia fraxinipratensis*)	Population-Range Underestimated / Threats Overestimated	1985	No population estimate provided.	"[T]he 2000 Environmental Assessment…estimated the entire Ash Meadows gumplant population to contain **81,000 plants within 2,260 acres**…. This number, based on visual estimates, **is a serious underestimate** of the total number of plants because a 2002 survey of the California population, which used transects to develop a population estimate, estimated **241,514** ± 69,660 plants within 88 acres." The latter number is a population estimate for a portion of the habitat occupied by the plant.
Ash meadows sunray (*Enceliopsis nudicaulis var. corrugata*)	Population-Range Underestimated / Threats Overestimated	1985	"At the time of listing, a population estimate…was not provided."	"In 2001…[the] population…was estimated at **1,849 individuals** in 15 minimum scale occurrences." "Results from the 2008–2010 Refuge wide survey estimate that **79,508** individuals are present…in 30 minimum scale occurrences."
Atlantic salt marsh snake *(Nerodia clarkii taeniata)*	Taxonomy	1977	"This action is being taken because of **the threats of habitat modification and resulting hybridization**, and provides Federal protection for the species. The Atlantic salt marsh snake is known only from coastal areas of Brevard, Volusia, and Indian River Counties in Florida."	"[C]oncluded that the probability of extinction in the next 100 years was zero." "**The taxonomic status of the [Atlantic Salt Marsh Snake] will remain controversial until a thorough, rigorous systematic assessment is conducted…**. [C]ontinued protection under the ESA is justified whether it remains a distinct subspecies or is designated as a distinct population." Response to 5-Year Review form question: "Is there relevant new information regarding application of the DPS policy that would lead you to consider listing this species as a DPS in accordance with the 1996 policy? – No."
Banded dune snail *(H. walkeriana)*	Population-Range Underestimated / Threats Overestimated	1994	"[I]t was considered a single species composed of two subspecies," one of which "was thought to be extinct." The other was believed to merit endangered status. "While cautioning that not enough data were available to make a more accurate estimate, Roth (1985) speculated that **as few as several hundred individuals** then existed in the remaining population of Morro shoulderband snails."	Subsequently, "these two subspecies [were recognized] as full species." The snail thought to be extinct was found at "**40 locations,**" "was observed to be common to abundant at approximately 20 locations within its distribution" with a range "**approximately 24 miles…long by 8 miles…wide.**" FWS recommended **delisting** this snail. The other snail (the Morro shoulderband) was determined to have a range of "**approximately 7,700 acres.**" "Additional individuals of the species in the Los Osos area are being **found every year and in a wider variety of habitat types.**" "It meets recovery criteria for **downlisting**."

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 2 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Black lace cactus (*Echinocereus reichenbachii var. albertii*)	Taxonomy	1979	—	"Zimmerman and Parfitt (2003) described **the taxonomic boundaries of infraspecific taxa, or varieties, of E. reichenbachii as 'nebulous and controversial.**' They found E. reichenbachi var. albertii to be intermediate between var. caespitosus and var. fitchii. Although their position on E. reichenbachii varieties did cast some doubt on the taxonomic standing of E. reichenbachii var. albertii, they did not take the step of formally placing it in the synonymy of another variety." / "Taxonomic Status: not accepted – synonym." (I)
Black-capped vireo* *(Vireo atricapilla)*	Population-Range Underestimated / Threats Overestimated	1987	"At the time of listing in 1987, approximately **350 individual birds** were known from **4 Oklahoma counties, 21 Texas counties and 1 Mexican state.**"	"The known breeding distribution now occurs in **5 Oklahoma counties, 40 Texas counties, and 3 states in Mexico.**" "[T]hese five large populations were estimated to consist of **14,418 adult males** in 2013–14." "In many local cases, it could be that increased survey efforts alone have resulted in larger known populations of black-capped vireos."
Bunched arrowhead (*Sagittaria fasciculata*)	Population-Range Underestimated / Threats Overestimated	1979	"Only **two extant populations** now exist. One of which has recently been greatly depleted and is now very vulnerable. Both populations occur on privately owned lands."	"[T]here are **37 colonies** presumed extant, distributed among **11 populations**." "Aggregating the last available size estimates for all extant colonies suggests that the total species range may consist of **97,500 to 120,000 rosettes.**"
Chapman rhododendron (*Rhododendron chapmanii*)	Taxonomy	1979	—	"These two varieties were considered two species by Kartesz (1994). Luteyn et al. (1996) accepted Duncan and Pullen's (1962) treatment, recognizing two varieties of one species. The Flora of North America circumscribed R. minus broadly considering R. m. chapmanii to be a distinct variety (www.efloras.org). The name R. minus Michaux var. chapmanii (Alph. Wood) was recently validated by Gandhi and Zarucchi (2009). Note: **A taxonomic study is encouraged for discerning whether the two varieties are really sufficiently distinct to maintain variety status or whether they should be lumped**."
Cumberland rosemary (*Conradina verticillata*)	Population-Range Underestimated / Threats Overestimated	1991	"[P]resently known from only three populations (44 colonies) in Tennessee and 1 population (4 colonies) in Kentucky."	"When this plan was published, there were fewer than ten locations known to have more than 100 clumps and probably fewer than 4,000 total clumps across all known colonies." "According to data from the Tennessee Natural Heritage Program (TDEC 2009), there currently are **94 extant occurrences in Tennessee.... [There] currently are four extant occurrences known from Kentucky**, all of which are located within Big South Fork National River and Recreation Area."
Cumberland sandwort (*Arenaria cumberlandensis*)	Population-Range Underestimated / Threats Overestimated	1988	"**[F]ive known [element occurrences]** of this species when it was listed."	"[N]ow **64 extant [element occurrences]** known."

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 3 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Davis' green pitaya (Echinocereus viridiflorus var. davisii)	Population-Range Underestimated / Threats Overestimated	1979	"[R]ange is small, as are the size of their populations: **a few hundred individuals** of Echinocereus viridiflorus var. davisii...(this estimate is based on the best available population data)."	"The recovery plan...states that E. v. davisii plants are evenly scattered at a density of 1 to 5 plants per m2 (0.09 to 0.46 plants per ft2) over an area of 50 m by 4 km or 20 ha (164 ft by 2.5 mi or 49.4 ac); this implies that the total population would be from **200,000 to 1,000,000**.... However, the recovery plan also estimates a total population of approximately **20,000** individuals. **Although this figure is one tenth [sic] to one fiftieth [sic] of the amount that the previous information indicates, the plan does not explain the discrepancy**." "McKinney (2000), based on a survey of three properties, concluded that E. v. davisii occurs throughout the Caballos novaculite formation, with a total population of more than **500,000**."
Decurant false aster (*Boltonia decurrens*)	Population-Range Underestimated / Threats Overestimated	1988	"**Twelve populations** are known to be extant **in five Illinois counties**, and **two populations**, one of which is divided into two subpopulations, are known in one **Missouri county**." "The increased amount of siltation is considered to be the main factor in the reduction of Boltonia decurrens."	"B. decurrens' range along the Illinois River can be considered a metapopulation with patches or local populations undergoing extinction and recolonization based primarily on the flood pulse of the Illinois River." "Surveys in 2011 at 19 of the 43 historical sites show that B. decurrens has recolonized previously vacant areas, and total population numbers approach the peak numbers observed in the early 2000's." "[T]he recovery team has observed that a population of Boltonia decurrens...may cover a larger geographic area...[and] **may best be described as a metapopulation in which B. decurrens colonizes and disappears from available habitat patches.**" Estimated cumulative population 1993: 0; 2000: >1,500,000; 2006–2010: 0; 2011: 1,000,000.
Delhi sands flower-loving fly *(Rhaphiomidas terminatus abdominalis)*	Population-Range Underestimated / Threats Overestimated	1993	"The **five remaining sites** occupied by the Delhi Sands flower-loving fly occur within an 8-mile radius circle on private land, totalling **between 350 and 700 acres.**"	"[W]e now estimate that approximately...**2,826 [acres]** of potential Delhi Sands flower-loving fly habitat remain.... Of the...2,826 [acres] of potential Delhi Sands flower-loving fly habitat**...900 [acres] are known to be occupied in 12 sites**." "We define occupied sites to be sites known to be occupied at the time of listing or where Delhi Sands flower-loving fly were subsequently **observed by biologists holding 10(a)(1)(A) recovery permits** issued by the Service."
Deseret milkvetch* (*Astragalus desereticus*)	Population-Range Underestimated / Threats Overestimated	1999	"The **only known population** of Astragalus desereticus consists of **between 5,000 and 10,000 individuals** growing in an area of less than 120 hectares (ha) (300 acres (ac))."	"[S]urvey and census...conducted...in 2008...found new plant sites.... In 2009, surveys were expanded and the updated **total population estimate was 197,277–211,915** juvenile and adult plants.... More plants likely occurred on private land." "[D]ata indicate that threats to...Deseret milkvetch...identified at the time of listing in 1999 are not as significant as originally anticipated." "Proposed for Status Change/Delisting"

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 4 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Dwarf flowered heartleaf (*Hexastylis naniflora*)	Population-Range Underestimated / Threats Overestimated	1989	"**24 known populations**"	"[T]otal number of **populations** has **increased roughly four-fold** (from 24 to **108**)."
Dwarf wedge mussel *(Alasmidonta heterodon)*	Population-Range Underestimated / Threats Overestimated	1990	"**10 small sites in 5 drainages in 4 states,**" 10 counties. "[T]here may be as few as 4 viable populations…[and it] was known from at least 70 locations in 15 drainages in 11 states and one Canadian province."	"[K]nown or believed" to be in **81 counties** and **10 states**. / **"16 drainages,"** and "estimated that there are **hundreds of thousands of DWM scattered within an approximate 75-mile stretch of the Connecticut River**." "[S]imply not enough in the South to warrant delisting." / "No historical population estimates exist, but findings by Strayer et al. (1996) are similar to observations by Ortmann (1919) and Clark (1981) that it forms sparse populations and was never numerous." (I)
Flat spired three-toothed land snail *(Triodopsis platysayoides)*	Population-Range Underestimated / Threats Overestimated	1978	"[A]mong rocks in a small area of less than one-quarter square mile [less than 160 acres] on the summit of Copper's Rock, Monongalia County, W. Va.... [T]here are about, **300 to 500 living individuals.**"	"[A]dditional survey work through 2006 has resulted in many new localities." "[P]resent known range of the species includes **99 element occurrences**.... The snail occurs on both sides of the gorge within an **approximately 14-mile stretch**, including portions of the major tributary ravines."
Gypsum wild-buckwheat* (*Eriogonum gypsophilum*)	Population-Range Underestimated / Threats Overestimated	1981	"Only **one population**…was known at the time of listing." "[T]otal estimated **population of 2,800.**"	"**[T]wo new populations** were discovered since the original listing decision. **Each** of these populations adds **between 16,000 and 18,000 plants** to the overall population estimate." "Proposed for Status Change / Delisting"
Harper's beauty (*Harperocallis flava*)	Population-Range Underestimated / Threats Overestimated	1979	"*Harperocallis flava* is known to occur in **three locations** in the Apalachicola National Forest in Florida. The Forest Service is actively managing two of these locations for perpetuation of this monotypic genus of lily. There is estimated to be less than [sic] **100 individuals** of this species, which places it in a very vulnerable position."	"[B]iologists visited 132 of the 144 historic [Apalachicola National Forest] locations between 2012–2015, and counted **3,704–11,273** flowering stems." "Originally, the Recovery Plan (1983) reported the species for Liberty County. Since then, the geographic distribution has extended to Franklin and Bay Counties.... In addition to the geographic distribution, the **number of populations**…has increased from three to **29**…due to better surveys."

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 5 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Hawaiian hawk* *(Buteo solitarius)*	Population-Range Underestimated / Threats Overestimated	1967	"The Hawaiian hawk was listed as endangered on March 11, 1967.... At that time, the best available data indicated that the number of Hawaiian hawks was in the **low hundreds**...and that extensive destruction of native forests had **reduced the quality of available habitat**."	"Tomich...suggested that in the late 1960's [sic] and early 1970's [sic] the population in one of the districts in Hawaii was more numerous than in earlier years." "(1969) surveys may have been the first indications that the Hawaiian hawk was indeed **more numerous than previously reported.**" "At the time of listing, the species was estimated to number somewhere in the low hundreds, although that figure may have been an underestimate." "[W]hereas the species was once thought to be restricted to undisturbed native habitat, it is now known to occupy disturbed habitat and also exploit alien prey species as a food resource." / "In 1985, the **population was estimated to be 1,400–2,500 individuals**.... A 1993 rangewide survey estimated 1,600 birds (including 1,120 adults, 560 pairs); a 1998 survey estimated 1,233 birds." (R) / "Proposed for Status Change/Delisting" (ECOS)
Heliotrope milkvetch (*Astragalus montii*)	Population-Range Underestimated / Threats Overestimated	1987	"Astragalus monfii is known from three populations, all entirely on public land in the Manti-LaSal National Forest. [The population on the western portion of Heliotrope Mountain in Sanpete County is] "divided between two sites.... The larger site, with about **2,000** individuals... and the smaller site, with fewer than **500** individuals.... The second population also occurs on Heliotrope Mountain... consists of about **4,000**.... The third population [is] also of about **4,000** individuals.... No other populations have been located."	"Population Size Comments: Franklin (2005) estimated that **2 million individuals** were present across three populations, with 65% of those individuals occurring at one site." (N)
Hines emerald dragon fly (*Somatochlora hineana*)	Population-Range Underestimated / Threats Overestimated	1995	"Historically, this dragonfly was reported from sites in Indiana and Ohio. Recent reports indicate that it is currently present at only **seven small sites** within Cook, DuPage, and Will Counties in **Illinois**, and at **six** sites in Door County, **Wisconsin**."	**42 sites** (P 2001) / "Since the issuance of the recovery plan...**29 additional sites** have been found within the four states (**Illinois, Michigan, Missouri and Wisconsin**) that make up the current range of the Hine's emerald dragonfly." / This makes 71 sites in four states.

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 6 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Iowa pleistocene snail (*Discus macclintock*i)	Population-Range Underestimated / Threats Overestimated	1978	"Iowa pleistocene snail…is a relic of preglacial times; it was once widespread but is now known **only from a cave….** [It] was first described and had long been known only as a fossil." "Probably **fewer than 100 live individuals** exist." "Solem believes that [the snail]… could be 'wiped out' by avid collectors."	"**38 known sites**" "Past surveys suggest that snail abundance on the **various occupied slopes ranges from 50 up to 205,000 individuals**."
Kentucky cave shrimp (*Palaemonias ganteri*)	Population-Range Underestimated / Threats Overestimated	1983	"This action is being taken because the only known population of this species occurs in Mammoth Cave National Park, where it faces the threat of contamination of the ground water supply to its habitat." "…[T]otal population size for the species [is estimated] to be about **500 individuals**."	"Tentative population estimates for each groundwater basin were provided in the recovery plan (USFWS 1988). These included Echo River Spring (**750 individuals**), Ganter Spring (**150**), Running Branch Spring (**300**), Mile 205.7 Spring (**50**), Pike Spring (**5,000 to 10,000**), Double Sink (unknown), Turnhole Spring (**unknown**), McCoy Blue Spring (**unknown**), and Suds Spring (**500**)."
Kern mallow (*Eremalche kernensis*)	Population-Range Underestimated / Threats Overestimated / Taxonomy	1990	"Historically, Eremalche kernensis was thought to have a very restricted range…. At the time of listing, E. kernensis was known from **only six locations** in this approximately 40 square mile area."	"Recent surveys and verifications of historic herbarium records have documented approximately **209 presumed extant occurrences in five counties**, but many of the old records remain unchecked and require updating, and not all field locations have been checked to determine if E. kernensis is still present." "The life history of E. kernensis exhibits ephemeral "boom and bust" cycles…. Obtaining an accurate assessment of the species' population status is made difficult, at best, under these conditions." "**Confusion over its taxonomic status has not been resolved with genetic studies conducted to date**." "The purpose of this study was to investigate whether or not E. kernensis was distinct from E. parryi. **The results of the study did not resolve E. kernensis as an evolutionarily distinct lineage**."

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 7 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Kern primrose sphinx moth (*Euproserpinus euterpe*)	Population-Range Underestimated / Threats Overestimated	1980	"This species had been thought extinct.... It was rediscovered in the Walker Basin, California,...in a small colony." "Intensive collecting has not revealed this moth outside the Walker Basin." "At the time of listing, the Kern primrose sphinx moth was **known from only the northwest portion of the Walker Basin, primarily on 4,000 square meters** (43,053 square feet) of a sandy wash."	"From surveys conducted in 2002 and 2003...**three populations** of Kern primrose sphinx moth were discovered for the first time at the Carrizo Plain in San Luis Obispo County, about 120 km (75 miles) west of the Walker Basin population.... Within the Carrizo Plain and in the Cuyama Valley there is a fairly wide distribution of potentially suitable habitat for the Kern primrose sphinx moth based on those habitat characteristics supporting known populations.... Within this surveyed area... [was] found three confirmed populations previously mentioned, **three more confirmed populations in later seasons, as well as several unconfirmed Kern primrose sphinx moth sightings**.... From surveys conducted in 2004 and 2005...**five populations of Kern primrose sphinx moth were also discovered** in the Cuyama Valley near New Cuyama and Ventucopa."
Kuenzler hedgehog cactus* (*Echinocereus fendleri var. kuenzleri*)	Taxonomic Issue / Population-Range Underestimated / Threats Overestimated	1979	"When listed as endangered, the known range of this cactus consisted of a **single population** of approximately **200 individuals**. As such, it was perceived to be upon the brink of extinction based on the threats at the time of listing. "	"In reality, Kuenzler hedgehog cactus exists across a much broader geographic range in **numerous populations that exceed the 5,000 plant downlisting criteria** based on observed abundance in the limited area surveyed." "At the time of listing, the most serious threat to such a small population was the elimination of plants in the wild by commercial and hobbyist collectors." "**A concern for the current status of this cactus continues to be the validity of E. f. kuenzleri as a taxon.**" "Proposed for Status Change/Delisting" / "Taxonomic Status: not accepted - synonym" (I)
Large-flowered skullcap** (*Scutellaria montana*)	Population-Range Underestimated / Threats Overestimated	1986	"Scutellaria montana is known from only **ten** locations in Georgia and Tennessee, and is endangered by timber harvesting."	"When the Service reclassified S. montana from endangered to threatened in 2002...there were **48** populations known, of which 22 were considered protected.... There currently are **164** extant occurrences known from Tennessee...and there are **52 extant occurrences** known from Georgia."
Lee pincushion cactus (*Coryphantha sneedii var. leei*)	Taxonomy	1979	—	"Taxonomic Comments: USFWS tracked as Coryphantha sneedii var. leei (8/93). **Coryphantha sneedii is morphologically variable and there is some question to the validity of its infraspecific taxa, their boundaries, and other closely related taxa** (FNA 2003b, Baker and Johnson 2000, and Baker 2007)." (N) / "Taxonomic Status: not accepted - synonym" (I)

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 8 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Lesser long-nosed bat* (*Leptonycteris curasoae yerbabuenae*)	Population-Range Underestimated / Threats Overestimated	1988	"Much debate surrounds the legitimacy of the 1988 listing of the LLNB, mostly centered around the population numbers and trends recorded from roost-site monitoring. At the time of listing, population numbers and trends used by FWS in determining the endangered status of the LLNB showed low numbers (~ 500 in Arizona) and a declining trend."	"Certain perceived historical threats (livestock grazing and fire) have been shown to not be as much of an impact on the viability of this species as previously thought." "[M]onitoring efforts have led to an increase in the number of known roosts throughout its range, from approximately 14 known at the time of listing to **approximately 75.**" "With a documented increase from an estimated 500 lesser long-nosed bats in the U.S. at the time of listing to over 100,000...may, in large part, **reflect a better approach to survey and monitoring**." / "Proposed for Status Change/Delisting" (ECOS)
Lloyd's mariposa cactus (*Echinomastus mariposensis*)	Population-Range Underestimated / Threats Overestimated	1979	"Both of these cacti are native plants of Texas and their ranges overlap into Mexico. Until recently the ranges of these two cacti had remained undeveloped and very remote. However, future development currently threatens these species and their habitats and will make these cacti more accessible to collectors."	"**More common than once thought, the species is abundant within its habitat with many healthy populations known. Threats include wild collection for the horticulture trade and road maintenance**." (N)
Louisiana quillwort (*Isoetes louisianensis*)	Population-Range Underestimated / Threats Overestimated	1992	"**[A]pproximately 10,000**"	"[M]ay be **at least 30,000.**"
MacFarlane's four-o'clock** (*Mirabilis macfarlanei*)	Population-Range Underestimated / Threats Overestimated	1979	"This plant is known only from three populations with a total of **20–25 individual plants**."	"[A]bout 3,500 ramets" in Oregon and "3,000–4,000 ramets in Idaho." "[R]amets per genet (genetic individual plant) varies." "Barnes (1996) estimated a mean of 4.88 ramets per genet."
Maguire primrose (*Primula maguirei*)	Population-Range Underestimated / Threats Overestimated / Taxonomy	1985	"[A]ll known populations collectively contained approximately **340 plants**."	"[T]he total number of plants across all known populations is **somewhere between 4,000 and 20,000.**" "[A] considerable amount of suitable habitat has yet to be surveyed." "Taxonomic changes indicate that P. maguirei is a subspecies, Primula cusickiana var. maguirei." / **"Taxonomic Comments: Holmgren (2005) and FNA (vol. 8, 2009) reduce Primula maguirei (= P. cusickiana var. maguirei) to varietal status under P. cusickiana." (N) /** "Taxonomic Status: not accepted - synonym" (I)

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 9 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Mexican flannelbush (*Fremontodendron mexicanum*)	Population-Range Underestimated / Threats Overestimated	1998	"[O]ne occurrence containing **fewer than 100** plants in the United States, and one occurrence in Mexico with no information."	"[W]e estimate…**approximately 6,000** F. mexicanum plants on Otay Mountain."
Minnesota dwarf trout lily (*Erythronium propullans*)	Population-Range Underestimated / Threats Overestimated	1986	"[K]nown at only **14 sites**…with a total of a **few hundred plants**."	"When the recovery plan was issued in 1987, there were 19 recorded populations. After an increased search effort, the DNR now recognizes **40 element occurrences** of the species. These additional occurrences include newly discovered populations and 'extensions' of sites that were already documented in 1987.... The sum total of the area covered by extant populations—57 hectares…—is greater than what was described in 1987 as a 'liberal' estimate of the area inhabited by E. propullans—30 hectares. [Footnote: "This includes only those occurrences whose boundaries have been mapped and whose boundaries have been entered into Minnesota DNR's natural heritage information system."] "[T]he known range has been extended significantly upstream.... Occurrences discovered after the species was listed in 1986 also seem to have extended the known range significantly downstream.... Undiscovered populations of E. propullans may exist."
Missouri bladderpod ** (*Physaria filiformis*)	Population-Range Underestimated / Threats Overestimated	1987	"[R]estricted to…**nine sites** within Greene, Dade, and Christian Counties. It is believed to be extirpated in Jasper and Lawrence Counties, Missouri." "[O]ccur on Missouri State highway rights-of-way and are subject to periodic mowing: four populations are on private land with no protection: and two populations are found within the Wilson's Creek National battlefield."	"New discoveries of Missouri bladderpod sites have **increased** the number of **known populations of the species by more than eight times**." "[T]he species is known from 66 sites in Missouri and 10 sites in Arkansas." At the largest bladderpod site in Missouri, "plants fluctuated from a few thousand in 1990, to 261,000+ in 1991, to a few thousand in 1992, to zero in 1993 and 1994, and then rebounded to highs of between 30,000+ and 137,000+ in 1995, and between 42,000+ and 114,000+ in 2011."
Nashville crayfish (*Orconectes shoupi*)	Population-Range Underestimated / Threats Overestimated	1986	"[C]urrently known only from Mill Creek and five of its tributaries… Historic collection records indicate that the Nashville crayfish has been taken from three other Tennessee localities: (1) Big Creek… (2) South Harpeth River…and (3) Richland Creek."	"The Big Creek and South Harpeth River records are believed to be 'bait bucket' introductions.... [S]pecimens of Nashville crayfish collected from Richland Creek were misidentified and the collections were annotated as the bigclaw crayfish." "**Estimates for Mill Creek were 1,854–3,217 individuals per 100 linear meters.**" "The species was **found to be evenly distributed in the remaining 23.5 miles of Mill Creek. Nashville Crayfish were also found in eight of the 15 tributaries to Mill creek**." A population for Mill Creek alone of 700,000 to 1,200,000 crayfish is derived with the above Service data.

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 10 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Navajo sedge (*Carex specuicola*)	Population-Range Underestimated / Threats Overestimated	1985	"At the time of listing in 1985, it was **known only from three springs** (considered then to constitute three populations), all within a mile stretch along this trail, and estimated to consist of about **700 individuals**."	"Per standardized methods, C. specuicola occupying gardens that are in the same canyon and within one kilometer (km) of each other are grouped as a single record (or population)." "Today, we know of a **total of 57 populations** cross the range of this species on lands managed by the Navajo Nation, National Park Service, Hopi Tribe, and Bureau of Land Management." "As of 2012, the NNHP had population size data on 33 of these as follows: **5 had 'thousands' of plants**, while the rest were evenly split between those with less than 100 plants and those with 100 to 1,000 plants." "The area within this **distribution, as mapped, is about…5,700 [square miles]**." "The difference in the number of populations between 1985, when the species was listed, and now is almost certainly due to increased survey effort, not a change in abundance." "[M]uch of the area where suitable Navajo sedge habitat occurs remains unsurveyed due to a canyon land terrain that limits both access into the area and into sites with suitable habitat."
Navasota ladies'-tresses (*Spiranthes parksii*)	Taxonomy	1982	—	"**They neither confirm nor reject the hypothesis that S. parksii and S. cernua are not genetically differentiated, or that the morphological differences could be due to environment or development factors.**" "Dueck and Cameron (2007) did not detect genetic differentiation between S. parksii and S. cernua in an analysis of the North American species of Spiranthes." "The authors state 'despite the fact that we have employed some of the most rapidly evolving DNA loci used routinely by plant systematists, we could **find no genetic differences** between S. parksii and the majority of S. cernua individuals in our study. Specifically, sequences from all individuals of S. parksii sampled were **found to be identical** to those obtained from the open-flowered phenotype of S. cernua from Texas.'"
Nellie cory cactus (*Coryphantha minima*)	Population-Range Underestimated / Threats Overestimated	1979	**"[A] few thousand** individuals of Coryphantha minima (this estimate is based on the best available population data)"	"The Recovery Plan…estimated that the total E. minima population was approximately **40,000 to 80,000** individuals spanning an area of 11 km by 50 m (6.8 mi by 164 ft), totaling 55 ha (136 ac). The plants were unevenly distributed, with dense clumps containing up to several hundred individuals per m2." "McKinney (2000), based on a survey of three properties, concluded that E. minima occurs throughout the Caballos novaculite formation, with a total population of **more than 1,000,000**."
Northeastern bulrush (*Scirpus ancistrochaetus*)	Population-Range Underestimated / Threats Overestimated	1991	"Eight of the **twelve extant populations** are extremely small, each having less than 70 flowering clumps."	"As of 2007, there were **113 extant populations** range-wide." Thirteen **populations had 1,000 or more stems, 34 had at least 251–1000 stems, and 36 had 51–250 stems**.

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 11 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Painted snake coiled forest snail (*Anguispira picta*)	Population-Range Underestimated / Threats Overestimated	1978	"[I]n Buck Creek Cove...Franklin County, Tenn., it has never been found elsewhere although it has been extensively searched for by several competent malacologists. The area is subject to periodic lumbering; this species is not found in habitats no longer having good cover and cannot survive such lumbering activities."	"[T]he Service estimates that the **total population** of A. picta was **approximately 1,568,221** snails as of 2010."
Palma de Manaca (*Calyptronoma rivalis*)	Population-Range Underestimated / Threats Overestimated / Taxonomy	1990	"[A]bout **275** individuals"	Taxonomic revision extended "the **species range to Hispaniola where the author states that it occurs throughout a wide area**." "The species was considered Vulnerable by the IUCN in 1988–96 but was **dropped from the Red List in 2006.**"
Penland beardtongue (*Penstemon penlandii*)	Population-Range Underestimated / Threats Overestimated	1989	"[P]opulation of approximately **5,000 plants**"	"Estimates from Ecotone 2010 surveys are approximately **1.4 million individuals**." (N)
Pitcher's thistle (*Cirsium pitcheri*)	Population-Range Underestimated / Threats Overestimated	1988	Found at **115 sites** in MI, WI, and IN, as well as 12 sites in Ontario, Canada. Extinct in IL.	"Of the **193 extant occurrences, 139 fit the definition of priority** occurrences (PO) as defined in the recovery plan. Michigan has 118 priority occurrences.... The 21 remaining priority occurrences consist of 9 in Wisconsin and 12 in Indiana." "Priority occurrences are element occurrences that have the following characteristics:...ranked A, AB, B, or C ." A = "population consisting of more than 5000 individuals"; B = "population of 500–5000 individuals"; and C = "population of 100–500 individuals."
Plymouth red-bellied turtle (*Pseudemys rubriventris bangsi*)	Taxonomy	1980	—	"[T]he proper common and scientific name of the endangered population of this species should be referred to as the 'Plymouth population of the Northern Red-bellied Cooter, Pseudemys rubriventris.'" / "Taxonomic Status: invalid - junior synonym" (I) / Genetic studies indicate the Plymouth red-bellied turtle does not merit subspecies status.

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 12 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Puerto Rican boa (*Epicrates inornatus*)	Population-Range Underestimated / Threats Overestimated	1970	"Boa populations presumably declined in both size and distribution during a period of intense deforestation on Puerto Rico in the late 1800s. This decline and apparent rarity prompted the Federal government to include the PR boa in the Endangered Species list in 1970."	"Much of the lack of information and the PR boa's apparent rarity has been attributed to observer's difficulties in visually detecting the species due to its cryptic coloration and habits. Some authors have established that based on the amount [sic] of individuals they found in their study area, and given the species detection difficulty, the PR boa is more abundant than generally perceived. In fact, **this species has been reported in about 90% of the municipalities of Puerto Rico**...and the Puerto Rico GAP Analysis Project illustrates almost the entire Island as having a probable occurrence of boas.... **[T]here is a general consensus that the boa is not as rare as previously thought**."
Puerto Rican nightjar (*Caprimulgus noctitherus*)	Population-Range Underestimated / Threats Overestimated	1973	"Kepler and Kepler (1973) estimated between 450–500 nightjar breeding pairs, mostly restricted to the Guánica Commonwealth Forest."	"Recently completed research on abundance suggests nightjars may be more numerous and widely distributed than previously reported." "[I]t is very likely that many of these new localities reported for the nightjar are simply **a result of expanded efforts by field biologists and amateur birders who are now familiar with the species**."/ "The most surprising finding was the amount of suitable habitat.... Most significantly, model results indicated only 18.6%...of suitable nightjar habitat occurs within protected areas." "The most recent density estimates available for the species are; Guánica Forest 1.93 ± 0.14 nightjar/ha, Susúa Forest 0.86 ± 0.07 nightjar/ha, and 0.99 ± 0.09 nightjar/ha at the El Convento reserve in the Guayanilla hills." Using these figures and acreage for just these areas from following sources yields a rough estimate of 9,000 birds. Guánica Forest: 4,000 hectares (UNESCO Man and the Biosphere Program, Biosphere Reserve Information: Guanica, http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?code=USA+35&mode=all); Susúa Forest: 1313 hectares (Puerto Rico Department of Environmental and Natural Resources, Bosque Estatal de Susúa, http://drna.pr.gov/documentos/p-022-de-noviembre-de-2007); and El Convento reserve: 862 acres (Para la Naturaleza, Annual Report 2016, http://www.paralanaturaleza.org/dl/PLN-Annual-Report-2016.pdf) (all accessed January 10, 2018).

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 13 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Red hills salamander (*Phaeognathus hubrichti*)	Population-Range Underestimated / Threats Overestimated	1977	"Within its range there are approximately 60,000 acres of habitat currently capable of supporting populations of the Red Hills Salamander." / "Of the approximately 60,000 acres of remaining habitat, approximately 60 percent is currently owned or leased by paper companies which use primarily clearcut techniques of forest management."	The salamander is difficult to survey as: "The salamanders rarely leave their burrows, and prey on invertebrates and land snails both inside the burrow and near the burrow entrance.... Evidence from field and laboratory research indicates the entire **RHS life cycle**, including breeding, oviposition, hatching and larval development, **may occur entirely within these burrows**." "Based on this information, it seems possible to estimate range wide salamander population by the following formula: (Burrows/m)x(salamanders/burrow)x(10,000 m /hectare)x(hectares/RHS range)=salamanders/ range.... However, we have not attempted to use this formula because at this time we still lack crucial information on the amount and quality of salamander habitat." "[E]stimated an RHS burrow occupancy rate of 0.8 salamanders per burrow"; "[E]stimates ranged from 2.6 to 9.4 burrows per 100 m2"; "They suggested that 54,900 acres were occupied by RHS." / Using these figures provides a population range of 4.6 million to 16.7 million salamanders.
Red wolf (*Canis rufus*)	Taxonomy	1967	—	"Dr. vonHoldt and her colleagues found that the genomes of Eastern wolves that lived in Algonquin Provincial Park in Ontario were half gray wolf and half coyote. Red wolves are even more mixed: Their genomes are **75 percent coyote and only 25 percent wolf**." ("DNA Study Reveals the One and Only Wolf Species in North America," *New York Times*, July 27, 2016.) Genetic studies indicate the red wolf is a coyote-wolf hybrid. / "Taxonomic Status: invalid - subsequent name/combination" (I)
Running buffalo clover (*Trifolium stoloniferum*)	Population-Range Underestimated / Threats Overestimated	1987	"[O]nly **a single extant population** of T. stofoniferum is known...and consists of only four individuals." "[O]ne of rarest members of North American flora"	"[K]nown or believed" to be in 82 counties in 6 states. / **The largest population is in WV**: "An estimated **76,000 plants** were seen in West Virginia in 2003, down from an estimated 77,800 seen in 1996" (P) / "[N]ew populations are being discovered almost annually." Of 116 populations there are **10 of a minimum of 1000+**, 29 that are 100–999, and 28 that are 30–99. "Therefore, with the discovery of 15 new natural populations, the apparent extirpation of 9 populations, and the introduction of 2 populations, running buffalo clover is **now found in 116 populations** throughout its range." / "104 extant occurrences known, but most populations (72%) are very small, C- or D-ranked occurrences of less than 100 rooted crowns. Nine occurrences (8%) are A-ranked quality with 1000 or more rooted crowns per site (one site in West Virginia with over 100,000 rooted crowns), and 20 occurrences (20%) are B-ranked quality with between 101–999 rooted crowns. Total estimated number of rooted crowns globally: 106,955." (N)
Santa Cruz cypress** (*Cupressus abramsiana*)	Population-Range Underestimated / Threats Overestimated	1987	"[F]ive small populations"	Estimate at time of recovery plan (1988) was 5,100 and 2005–2007 estimates **47,135**. "All three populations sampled cover a smaller aerial extent and support larger populations than previously thought."

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 14 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Siler pin cushion** (*Pediocactus* (=*echinocactus, =utahia*) *sileri*)	Population-Range Underestimated / Threats Overestimated	1979	"At the time of listing (1979) the amount of habitat was unknown and there were thought to be **less than 1,000 individuals**."	"They currently estimate there are **34,189 acres of habitat** and have documented **over 10,000 individuals** (BLM 2006)." "We have no information on the extent of habitat or populations of Siler pin cushion on Kaibab-Paiute lands or Utah State trust lands."
Small whorled pogonia** (*Isotria medeoloides*)	Population-Range Underestimated / Threats Overestimated	1982	"12 counties in 11 different States and one county in Ontario, Canada"	"[K]nown or believed" to be in 80 counties and 19 states. / "**Known populations have increased five-fold** since listing."
Snail darter** (*Percina tanasi*)	Population-Range Underestimated / Threats Overestimated	1975	"The snail darter... is known only from portions of gravel shoals in the main channel of the Little Tennessee River between River Miles 4 and 17 in Loudon County, Tennessee. River Miles 4 and 17 are shown on a map entitled 'Tellico [Dam] Project,' prepared by the Tennessee Valley Authority (TVA), Bureau of Water Control Planning, August 1965.... Tellico Dam would result in total destruction of the snail darter's habitat."	"After the species was listed in 1975, individuals were observed or collected in the mainstem [sic] Tennessee River, including in Watts Bar Reservoir (Loudon County, Tennessee), Chickamauga Reservoir (Hamilton, Meigs, and Rhea Counties, Tennessee), Nickajack Reservoir (Hamilton County, Tennessee), and Guntersville Reservoir (Marion County, Tennessee.... These discoveries along with discoveries of additional populations in four Tennessee River tributaries and successful establishment of snail darters in the Hiwassee River resulted in reclassification of the species to threatened status." TVA (2008) observed one snail darter in Citico Creek in 2007.... The Little Tennessee River was impounded by Tellico Dam and is the system where the snail darter was first discovered in 1973. The origin of the individual discovered in Citico Creek in **2007** remains unclear.... However, the fish may have also been a stray from a surviving population in the Tellico Reservoir impoundment of the Little Tennessee River."
Spring loving centaury (*Zeltnera amophila*)	Population-Range Underestimated / Threats Overestimated	1985	"[D]evelopment in the 1960s reduced the distribution to remnant patches of vegetation.... Development from 1970 through 1980 restricted the distribution further."	"[R]efuge wide surveys...were begun in 2008. As a result of these surveys, the **total population...is now estimated at 4,468,571.**... This increase is likely due to the fact that the recent surveys were the first comprehensive surveys undertaken for the species."
Spruce fir moss spider (*Microhexura montivaga*)	Population-Range Underestimated / Threats Overestimated	1995	"This spider is currently known from **four mostly small populations** located in western North Carolina and eastern Tennessee."	"Out of the **six montane populations, two**...appear to be **large** and relatively healthy. **Grandfather and Roan Mountain may also support large populations**. The populations at the northern and southern extent of the range are small and at risk." "[A] park-wide survey conducted within the Great Smokey Mountains National Park in 2004 **found the spider on three additional mountains**." The most recent survey **found the spider on an additional thirteen mountains across the Southern Appalachians**." (The latter included Virginia.)

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 15 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Tidewater goby* (*Eucyclogobius newberryi*)	Population-Range Underestimated / Threats Overestimated	1994	"**[O]nly 48** of the 87 [**localities** where the goby had been known to historically occur] were known to be occupied"	"**106 localities** are presumed to be currently occupied."
Tobusch fishhook cactus* (*Sclerocactus brevihamatus ssp. tobuschii*)	Population-Range Underestimated / Threats Overestimated	1979	"[N]o more than **200** plants"	"Tobusch fishhook cactus populations are now confirmed in eight central Texas counties.... In 2009, the Texas Native Diversity Database listed **105 element occurrences**, areas in which the species was present...**totaling 3,395 individuals**." / "Proposed for Status Change/Delisting" (ECOS)
Todsen's pennyroyal (*Hedeoma todsenii*)	Population-Range Underestimated / Threats Overestimated	1981	**750 plants in two populations in one mountain range**	More than **"several hundred thousand plant clumps" in "32 locations" in two mountain ranges.**
Uncompahgre fritillary butterfly (*Boloria acrocnema*)	Population-Range Underestimated / Threats Overestimated	1991	"**[T]wo verified major sites and two possible small colonies**"	"Currently, **11 known colonies** exist."
Ute ladies' tresses (*Spiranthes diluvialis*)	Population-Range Underestimated / Threats Overestimated	1992	"**Fewer than 10,000** individual plants are known to exist in the **10 known** populations...areas in **Colorado, Utah, and Nevada.**" "[A]ll populations are relict in nature."	"The total population size of Ute ladies'-tresses orchid is currently **estimated to be 60,000** individuals." "New occurrences have been documented in **Nebraska, Wyoming, Washington, Idaho**, Utah, and Colorado, substantially increasing the known range and estimated population size."
Vahl's boxwood (*Buxus vahlii*)	Population-Range Underestimated / Threats Overestimated	1985	"Only about **40 individuals** of the species are known to exist." "Although it was originally **thought to occur in St. Croix**, U.S. Virgin Islands, as well as in Puerto Rico, this **no longer appears to be correct**."	"[A]n estimated number of individuals for ***B. vahlii*** **is about 4,500 individuals in nine natural populations** in Puerto Rico and **St. Croix, USVI**." "He considers that B. vahlii might be more common and numerous on St. Croix than what people expect. He also indicated that the habitat has not been adequately surveyed."
Valley longhorn elderberry beetle (*Desmocerus californicus dimorphus*)	Population-Range Underestimated / Threats Overestimated / Taxonomy	1980	"Today, remnant populations are found in the few remaining natural woodlands and in some State and county parks."	"Number of **sites** from which the beetle is known has **increased from less than 10 to approximately 190**... primarily due to an increased effort to look for the beetle." "**Some biologists believe** the valley elderberry longhorn beetle **may simply be a color morph** of the California elderberry beetle **rather than a subspecies**."
Virginia round leaf birch** (*Betula uber*)	Taxonomy	1978	—	"It is apparently allied to B. lenta...**whether it constitutes a separate species or simply mutant individuals of B. lenta is a matter of controversy**. Seeds obtained from the original single extant population of **17 trees and grown at the U.S. National Arboretum have produced an apparent hybrid swarm** of offspring varying in leaf characteristics from those of B. uber to those of B. lenta (with which it occurs)," (efloras.org online database, search of "betula uber" (accessed December 18, 2017)).

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 16 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Wheeler's pepperomia (*Peperomia wheeleri*)	Population-Range Underestimated / Threats Overestimated / Taxonomy	1987	"When the recovery plan was approved, the Wheeler's peperomia abundance was estimated at **several hundred plants** on Monte Reseca and **almost twenty plants** at the Helipad Hill, both in Culebra Island."	"[A] rapid assessment of Wheeler's peperomia in Puerto Rico, [estimated] its population at **2,466 plants**." "During this review we have received information that Peperomia myrtifolila is frequently misidentified as P. wheeleri. Peperomia myrtifolia is a highly variable taxon distributed throughout the Lesser Antilles and the Virgin Islands." "**Presently, some species experts agree that P. wheeleri is not a distinctive species from P. myrtifolia because the major difference between the two species is the leaf shape and leaf apex…. Hence, some authors… treat P. wheeleri as a synonym of *P. myrtifolia.***"
Bachman's warbler (=wood), (*Vermivora bachmanii*)	Extinction	1967	—	"Bachman's warbler has not been confirmed in the United States since 1962 and was last observed in Cuba in **1984**." / "The last sighting was in the USA in **1988**, although there were eight unconfirmed reports of the species from Cuba between 1978 and 1988." (N) / "[I]t has not been reported since **1988.**" (R)
Bridled white eye (*Zosterops conspicillatus conspicillatus*)	Extinction	1984	—	Last observed **1983**. / "Extinct" (R)
Cook's holly (*Ilex cookii*)	Extinction	1987	—	Last observed **1960**. "On July 5, **2011**, professors from UPRM and a Service biologist visited the historical site for the species at Cerro Punta in the municipality of Ponce…. They collected a specimen of what they believe to be Cook's holly, but the sample is sterile (have neither flower nor fruit). The sample needs to be validated by a more detailed morphological study and probably through genetic studies. / "[E]xtinct." (RTC 2004)
Culebra island giant anole (*Anolis roosevelti*)	Extinction	1977	—	Last observed **1932**.
Eastern puma (=cougar)* (*Puma (=felis) concolor couguar*)	Extinction	1973	—	"We conclude that the evidence supports the hypothesis that pumas recently found in eastern North America are released or escaped captive animals, with the exception of some animals in Illinois, Wisconsin, and other Midwestern States that are dispersing from populations in the West. We also acknowledge that a few pumas may be dispersing into the Midwest and Southeast from populations in eastern Texas and Florida." "…led to the extirpation of most puma populations by **1900**… [W]e conclude that pumas that occupied eastern North America were extirpated." / "Proposed for Status Change/Delisting" (ECOS) "The final delisting of eastern puma due to extinction rule is effective February 22, 2018." (ECOS)
Eskimo curlew (*Numenius borealis*)	Extinction	1967	—	"[T]he rarity of potential sightings over the past several decades suggests the species is extremely rare or extinct." "The last record confirmed by physical evidence is a specimen collected in Barbados in **1963**." / "[N]o reliable sightings since **1987.**" (N)
Flat pigtoe (*Pleurobema marshalli*)	Extinction	1987	—	"No live or fresh dead shells of flat pigtoe have been observed since the species was listed." "Recommend delisting due to extinction"

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 17 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Fosberg's love grass (*Eragrostis fosbergii*)	Extinction	1996	—	"Last recorded observation of Eragrostis fosbergii was in **1996** at the same location in Waianae Kai, when five individuals were seen, none in flower but with some old inflorescences.... No more recent observations have been noted. The species is found in areas with large amounts of a more common species, Eragrostis grandis, and flowers must be examined closely to distinguish the two." / "E[xtinct]" (RTC 2004).
Golden coqui (*Eleutherodactylus jasperi*)	Extinction	1977	—	Last observed **1981**. / "No individuals have been reported over the last 20 years." (R)
Green blossom pearlymussel (*Epioblasma torulosa gubernaculum*)	Extinction	1976	—	"The last known collection" was "**35 years ago.**"
Ivory billed woodpecker (*Campephilus principalis*)	Extinction	1967	—	"[T]he last commonly agreed upon sightings of the species in Louisiana in the **1940s.**" (P)
Kauai O`o/ honeyeater (*Moho braccatus*)	Extinction	1967	—	"[T]he species has not been seen since **1989** on Kaua'i and **1987** on Hawai'i." / "E[xtinct]" (RTC 2004).
Kauai akialoa/ honeycreeper (*Akialoa stejnegeri*)	Extinction	1967	—	"[T]he species hasn't been observed since **1965**." / "[E]xtinct." (RTC 2004). / "It persisted in Kaua'i's Alaka'i Wilderness Preserve, but has not been recorded since **1969** despite intensive surveys in the region and is presumed extinct." (R)
Large kauai thrush/ kamao (*Myadestes myadestinus*)	Extinction	1970	—	"There is no new information regarding abundance, population trends, demographic features, or demographic trends as the species has not been observed since **1989.**" / "E[xtinct]" (RTC 2004).
Liliwai (*Acaena exigua*)	Extinction	1992	—	Last seen in **1957.** (P) / "E[xtinct]" (RTC 2004).
Little mariana fruit bat (*Pteropus tokudae*)	Extinction	1984	—	Last observed in **1968.**
Maryland darter (*Etheostoma sellare*)	Extinction	1967	—	Last observed in **1988.**
Maui akepa/ honeycreeper (*Loxops coccineus oachraceu*)	Extinction	1970	—	"[L]ast reported as an unconfirmed audio detection in **1995.**" / "E[xtinct]" (RTC 2004).
Kakawahie/Molokai creeper (*Paroreomyza flammea*)	Extinction	1970	—	"Using **1963** as the last reliable observation record for kakawahie, the authors determined the year **1985** as the upper 95% confidence bound for species extinction."/ "E[xtinct]" (RTC 2004).
Molokai thrush/ Olomao (*Myadestes lanaiensis rutha*)	Extinction	1970	—	"The last confirmed detection of olomao was in **1980.**" / "E[xtinct]" (RTC 2004).
O`u/honeycreeper (*Psittirostra psittacea*)	Extinction	1967	—	"**1989** (Kauai last confirmed detection)."/ "E[xtinct]" (RTC 2004).

APPENDIX TABLE B

Species Listed with Erroneous Data or Likely Extinct (Page 18 of 18)

Common Name (Scientific Name)	Possible Issue	Year Listed	Information at Time of Listing	Information After Listing / Last Observation of Likely Extinct Species
Oahu creeper (*Paroreomyza maculata*)	Extinction	1970	—	"The last well-documented observation of the O`ahu creeper was of two birds on December 12, **1985**, during the Waipi`o Christmas Bird Count." / "E[xtinct]" (RTC 2004).
San marcos gambusia (*Gambusia georgei*)	Extinction	1980	—	"Native to the San Marcos River, Texas; presumed extinct, due to habitat degradation, pollution, and hybridization; genetically pure individuals have not been found since **1983.**" / "Decline was due to reduced spring flows and pollution, including herbicide spraying along the river; introduced fishes; spread of an ornamental plant (elephant ears, Colocasia asculenta); **and, as species became rare, hybridization with *Gambusia affinis***." (N)
Scioto madtom (*Noturus trautmani*)	Extinction	1975	—	Last observed **1957.**
Southern acornshell (*Epioblasma othcaloogensis*)	Extinction	1993	—	"The most recent records for the southern acornshell were from tributaries of the Coosa River in the early **1970s**, and the Cahaba in the 1930s." (ECOS profile)
Stirrupshell (*Quadrula stapes*)	Extinction	1987	—	"No live or fresh dead shells of stirrupshell have been encountered since the species was listed." Recommendation: "Delist"
Tubercled blossom pearlymussel (*Epioblasma torulosa torulosa*)	Extinction	1976	—	The last known collection was "**48 years ago.**"
Turgid blossom pearlymussel (*Epioblasma turgidula*)	Extinction	1976	—	The last known collection was "**52 years ago.**"
Upland combshell (*Epioblasma metastriata*)	Extinction	1993	—	"The most recent records for the upland combshell were from the Conasauga River, Georgia, in **1988**, and from the Cahaba River, Alabama, in the early 1970s." (ECOS Profile)
White-necked crow (*Corvus leucognaphalus*)	Extinction	1991	—	Last observed in Puerto Rico **1963.**
Yellow blossom pearlymussel (*Epioblasma florentina florentina*)	Extinction	1976	—	The last known collection was "**50 years ago.**" / "This species is considered extinct but may be considered extant if taxonomic review reveals Epioblasma florentina florentina and Epioblasma florentina walkeri are conspecific. Glochidial hosts are not known." (N)
No common name (*Phyllostegia glabra var. lanaiensis*)	Extinction	1991	—	"As of 2010, the taxon was last seen in **1914** and no individuals or populations are currently known to exist.... In their latest annual report, the Plant Extinction Prevention Program (2010) included Phyllostegia glabra var. lanaiensis on their list of taxa that, after evaluation, are believed to be extinct. However, since the gulches and valleys of Lanaihale are rugged, steep-walled, and only rarely explored by botanists, there may be hope that the taxon still exists." / "E[xtinct]" (RTC 2004).

* Indicates the species was included on the ECOS list of "Species Proposed for Status Change or Delisting."
** Indicates the species was previously downlisted.

Endnotes

1. For brevity, "endangered" as opposed to "threatened and endangered" is used in some instances. In many respects, the Service has eliminated much of the distinction between endangered and threatened species through regulation. See Robert Gordon, "Take It Back: Extending the Endangered Species Act's 'Take' Prohibition to All Threatened Animals Is Bad for Conservation," Heritage Foundation *Backgrounder* No. 3267, December 7, 2017, https://www.heritage.org/government-regulation/report/take-it-back-extending-the-endangered-species-acts-take-prohibition.
2. The term "species" is used here and in some other instances in a legal, not a biological, sense. The Endangered Species Act of 1973 incorporates "sub-species" and the non-taxonomic unit "distinct population segment" within the term "species." See Endangered Species Act, "Definitions," Section 3(16), https://www.fws.gov/endangered/esa-library/pdf/ESAall.pdf (accessed January 24, 2018). Additionally, the Department of Commerce's National Marine Fisheries Service (NMFS) also uses the term evolutionarily significant unit (ESU), which is not found within the ESA. See National Marine Fisheries Service, "Policy on Applying the Definition of Species Under the Endangered Species Act to Pacific Salmon," *Federal Register*, Vol. 56, No. 224 (November 20, 1991), pp. 58612–58618, http://www.nmfs.noaa.gov/pr/pdfs/fr/fr56-58612.pdf (accessed September 20, 2017). Authority for implementation of the ESA resides with the Secretary of the Department of the Interior and the Secretary of Commerce, who have, respectively, delegated the FWS and the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service the tasks of administering the ESA. (NMFS is now more commonly referred to as NOAA Fisheries.) The agencies divvy up authority for different species based on taxonomic and geographical characteristics established in a memorandum of understanding.
3. U.S. Fish and Wildlife Service, "Listed Species Summary (Boxscore)," https://ecos.fws.gov/ecp0/reports/box-score-report (accessed November 30, 2017).
4. Under the ESA, conservation means "to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary." Endangered Species Act, Section 3(3).
5. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species: Fiscal Years 2005–2006," p. 27, https://www.fws.gov/endangered/esa-library/pdf/2005-6%20Report.pdf (accessed December 4, 2017). The Service states, "We may delist a species under the Act for three reasons: 1) because it is recovered, 2) because it is extinct, and/or 3) because the original data used to list the species were in error (i.e., because there is new information on the species' status, taxonomists have revised the species' classification, or other administrative reasons)."
6. U.S. Fish and Wildlife Services, "Delisted Species."
7. Ibid. The ESA is the U.S. implementing act for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Consequently, foreign species are included on the U.S. list. See Convention on International Trade in Endangered Species of Wild Fauna and Flora, March 3, 1973, https://www.cites.org/eng/disc/text.php (accessed January 24, 2018).
8. U.S. Fish and Wildlife Services, "Delisted Species."
9. For a number of the remaining 20 recoveries, their delisting is often attributable to events or causes unrelated to the ESA, from restrictions on the use of DDT or reduction in large-scale commercial whaling to actions that could have been carried out without the ESA. Some cases involve subspecies or lesser taxonomic units of species that are otherwise abundant. See Majority Staff Report,"Implementation of the Endangered Species Act of 1973," Committee on Resources, U.S. House of Representatives, 109th Cong., May 2005, http://www.eswr.com/docs/505/esaimplrprtresources.pdf (accessed January 24, 2018), and Robert E. Gordon, Jr., James K. Lacy, and James R. Streeter, "Conservation Under the Endangered Species Act," *Environment International*, Vol. 23, No. 3 (1997), pp. 359–419, https://www.sciencedirect.com/science/article/pii/S016041209700038X?via%3Dihub (accessed January 24, 2018). For example, the primary factor in the recovery of the bald eagle, Arctic peregrine falcon, peregrine falcon, and brown pelican is generally accepted to be restrictions on the use of DDT, which preceded and was unrelated to the ESA. Similarly, while the gray whale has substantially increased in number, the species has had a positive population trend for decades following a dramatic reduction in large-scale commercial whaling—*before* the ESA was enacted. Additionally, three of the recovered species are distinct population segments (DPS) or subgroupings of the humpback whale, which was originally listed as a full species. Subsequently, the humpback was divided into 14 foreign and domestic DPSs. Nine of these remain listed, while five were declared recovered. U.S. Fish and Wildlife Service, "Species Profile for Humpback Whale (*Megaptera novaeangliae*)," https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A02Q (accessed December 12, 2017). Additionally, some recovered species are subspecies or lesser divisions of the otherwise plentiful whitetail deer and Canada geese.
10. U.S. Fish and Wildlife Services, "Delisted Species." When the Palau species were listed and delisted, Palau was part of the United States Trust Territory of the Pacific, and so these birds are included among domestic species for this paper. Palau is now a republic in free association with the U.S. Additionally, the author petitioned for the delisting of the Tinian monarch and several other species addressed in this paper.
11. U.S. Fish and Wildlife Service, "Proposed Endangered or Threatened Status for Five Plants From the Southern San Joaquin Valley," *Federal Register*, Vol. 54, No. 143 (July 27, 1989), pp. 31205–31209, https://ecos.fws.gov/docs/federal_register/fr1568.pdf, (accessed November 30, 2017).
12. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Proposal to Delist *Eriastrum hooveri* (Hoover's woolly-star)," *Federal Register*, Vol. 66, No. 44 (March 6, 2001), p. 13475, https://www.gpo.gov/fdsys/pkg/FR-2001-03-06/pdf/01-5288.pdf#page=1 (accessed November 30, 2017).
13. Ibid, p. 13476.

14. Ibid. While the Service delisted Hoover's Woolly Star as recovered, the profile for the plant on the Service's ECOS website more honestly reports the species was "delisted due to original data error – new information discovered." U.S. Fish and Wildlife Service, "Hoover's woolly-star (Eriastrum hooveri) Species profile," https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=Q2TE (accessed February 6, 2018).
15. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removing *Eriastrum hooveri* (Hoover's woolly-star) from the Federal List of Endangered and Threatened Species," *Federal Register,* Vol. 68, No. 94 (October 7, 2003), p. 57832, https://www.gpo.gov/fdsys/pkg/FR-2003-10-07/pdf/03-25364.pdf#page=1 (accessed February 7, 2018).
16. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Final Rule To Remove the Tinian Monarch From the Federal List of Endangered and Threatened Wildlife," *Federal Register*, Vol. 69, No. 182 (September 21, 2004), pp. 56368–56373, https://www.gpo.gov/fdsys/pkg/FR-2004-09-21/pdf/04-20700.pdf#page=1, (accessed November 30, 2017).
17. Ibid. The Center for Biological Diversity (CBD) subsequently petitioned for the Tinian monarch to be re-listed and the Service indicated that listing "may be warranted." Center for Biodiversity, "Petition to List the Tinian Monarch (*Monarcha tatatsukasae*) as Threatened or Endangered Under the Endangered Species Act," December 11, 2013, https://ecos.fws.gov/docs/petitions/92000/483.pdf (accessed December 12, 2017), and U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; 90-Day Findings on 25 Petitions, Fish and Wildlife," *Federal Register*, Vol. 80, No. 181 (September 18, 2015), p. 56423–56432, https://www.gpo.gov/fdsys/pkg/FR-2015-09-18/pdf/2015-23315.pdf (accessed December 12, 2017). Among the threats CBD asserts in its petition are "stochastic [i.e., random] events" such as typhoons. The Tinian monarch has previously survived not only typhoons but also having its sole habitat, an island, subject to 43 days of naval bombardment, followed by bombing, artillery barrage, and an amphibious landing and fierce combat between U.S. Marines and Japanese forces—during a window in which the island was also struck by a typhoon. See Major Carl W. Hoffman, "The Seizure of Tinian," http://www.ibiblio.org/hyperwar/USMC/USMC-M-Tinian/index.html (accessed December 12, 2017).
18. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of the Concho Water Snake From the Federal List of Endangered and Threatened Wildlife and Removal of Designated Critical Habitat; Final Rule," *Federal Register*, Vol. 76, No. 208 (October 27, 2011), pp. 66780–66804, https://www.gpo.gov/fdsys/pkg/FR-2011-10-27/html/2011-27375.htm (accessed November 30, 2017).
19. Ibid.
20. U.S. Fish and Wildlife Services, "Recovery Success Stories: Concho Water Snake," October 27, 2011, https://www.fws.gov/endangered/what-we-do/ep-10.html (accessed November 30, 2017).
21. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for *Helianthus eggertii* (Eggert's Sunflower)," *Federal Register*, Vol. 59, No. 174 (September 9, 1994), pp. 46608–46611, https://ecos.fws.gov/docs/federal_register/fr2682.pdf (accessed December 11, 2017).
22. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of *Helianthus eggertii* (Eggert's Sunflower) From the Federal List of Endangered and Threatened Plants," *Federal Register,* Vol. 70, No. 159 (August 18, 2005), pp. 48485–48490, https://www.gpo.gov/fdsys/pkg/FR-2005-08-18/pdf/05-16274.pdf#page=1, (accessed November 30, 2017).
23. Ibid., p. 48485.
24. News release, "An Endangered Species Success Story: Interior Department's U.S. Fish and Wildlife Service Announces Delisting of Maguire Daisy," U.S. Fish and Wildlife Service, January 18, 2011, https://www.doi.gov/news/pressreleases/An-Endangered-Species-Success-Story-Interior-Departments-US-Fish-and-Wildlife-Service-Announces-Delisting-of-Maguire-Daisy (accessed December 4, 2017).
25. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of *Erigeron maguirei* (Maguire Daisy) From the Federal List of Endangered and Threatened Plants; Availability of Final Post-Delisting Monitoring Plan," *Federal Register*, Vol. 76, No. 12 (January 19, 2011), pp. 3029–3044, https://www.gpo.gov/fdsys/pkg/FR-2011-01-19/pdf/2011-1044.pdf (accessed November 30, 2017).
26. Endangered Species Act, Section 4(g).
27. U.S. Fish and Wildlife Services, "Endangered and Threatened Wildlife and Plants; Delisting the *Plant Frankenia johnstonii* (Johnston's frankenia) and Notice of Petition Finding," *Federal Register*, Vol. 68, No. 99 (May 22, 2003), pp. 27961–27969, https://www.gpo.gov/fdsys/pkg/FR-2003-05-22/pdf/03-12748.pdf#page=1 (accessed November 30, 2017).
28. U.S. Fish and Wildlife Services, "Endangered and Threatened Wildlife and Plants; Proposed Rule to Determine *Frankenia johnstonii* (Johnston's frankenia) To Be an Endangered Species, *Federal Register* Vol. 48, No. 132 (July 8, 1983), pp. 31414–31417, https://ecos.fws.gov/docs/federal_register/fr709.pdf (accessed January 30, 2018).
29. U.S. Fish and Wildlife Services, "Endangered and Threatened Wildlife and Plants; Delisting of the Plant Frankenia johnstonii (Johnston's frankenia)," *Federal Register* Vol. 76, No. 206 (October 25, 2011), p. 66019, https://www.gpo.gov/fdsys/pkg/FR-2011-10-25/html/2011-27372.htm (accessed February 7, 2018).
30. Ibid.
31. U.S. Fish and Wildlife Service, "Post-Delisting Monitoring Plan for Johnston's Frankenia (*Frankenia johnstonii*)," December 8, 2015, p. 4, https://ecos.fws.gov/docs/species/doc4753.pdf (accessed November 30, 2017).
32. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of *Frankenia johnstonii* (Johnston's frankenia) From the Federal List of Endangered and Threatened Plants," *Federal Register*, Vol. 81, No. 7 (January 12, 2016), pp. 1322–1335, https://www.gpo.gov/fdsys/pkg/FR-2016-01-12/pdf/2016-00158.pdf (accessed November 30, 2017).

33. U.S. Fish and Wildlife Services, "Endangered and Threatened Wildlife and Plants; Removing *Eriastrum hooveri* (Hoover's Woolly-Star) From the Federal List of Endangered and Threatened Species," *Federal Register*, Vol. 68, No. 194 (October 7, 2003), pp. 57836, at https://www.gpo.gov/fdsys/pkg/FR-2003-10-07/pdf/03-25364.pdf#page=1, (accessed November 30, 2017).
34. U.S. Bureau of Land Management, "Manual Transmittal Sheet 6840: Special Status Species Management," December 8, 2008, at https://www.blm.gov/sites/blm.gov/files/uploads/mediacenter_blmpolicymanual6840.pdf (accessed December 4, 2017).
35. Ibid.
36. U.S. Forest and Wildlife Service, "Forest Service Manual: Chapter 2670: Threatened, Endangered and Sensitive Plant Habitat," May 25, 2011, http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/95024_FSPLT3_3866561.pdf (accessed January 24, 2018).
37. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions," *Federal Register*, Vol. 79, No. 234 (December 5, 2014), p. 71496, https://www.gpo.gov/fdsys/pkg/FR-2014-12-05/pdf/2014-28536.pdf (accessed December 4, 2017).
38. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Final Rule Removing the Virginia Northern Flying Squirrel (*Glaucomys sabrinus fuscus*) From the Federal List of Endangered and Threatened Wildlife," *Federal Register*, Vol. 73, No. 166 (August 26, 2008), pp. 50226–50247, https://www.gpo.gov/fdsys/pkg/FR-2008-08-26/pdf/E8-19607.pdf#page=1 (accessed December 4, 2017).
39. Ibid.
40. Ibid.
41. Ibid.
42. U.S. Fish and Wildlife Service, "Virginia Northern Flying Squirrel (*Glaucomys sabrinus fuscus*)," https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A09R, (accessed December 4, 2017).
43. Office of Federal Regulations Publishing Services, Government Printing Office, https://www.archives.gov/files/federal-register/write/conference/publishing-billing.pdf (accessed January 30, 2018). At least 48 pages at $465 per page.
44. U.S. Fish and Wildlife Service, "Virginia Northern Flying Squirrel."
45. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removing the Oregon Chub From the Federal List of Endangered and Threatened Wildlife; Final Rule," *Federal Register*, Vol. 80, No. 33 (February 19, 2015), pp. 9125–9150, https://www.gpo.gov/fdsys/pkg/FR-2015-02-19/html/2015-02951.htm (accessed December 4, 2017).
46. See U.S. Fish and Wildlife Service, "Expenditure Reports," 2005–2014, https://www.fws.gov/endangered/esa-library/index.html (accessed December 4, 2017).
47. Endangered Species Act of 1973, Section 18(1).
48. U.S. Fish and Wildlife Service, "Federal and State Endangered and Threatened Species Expenditures: Fiscal Year 2015," https://www.fws.gov/endangered/esa-library/pdf/2015_Expenditures_Report.pdf (accessed December 14, 2017). Agencies, bureaus, and DOD branches reporting expenditures in 2015 include Animal and Plant Health Inspection Service, Forest Service, Natural Resources Conservation Service, National Oceanic and Atmospheric Administration, Air Force, Army, Defense Logistics Agency, Marine Corps, Navy, Army Corps of Engineers, Bonneville Power Administration, Southwestern and Western Area Power Administrations, Coast Guard, Customs and Border Protection, Federal Emergency Management Agency, Office of Science and Technology, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, National Park Service, Office of Surface Mining, U.S. Geological Survey, Federal Aviation Administration, Federal Highway Administration, Environmental Protection Agency, Federal Communications Commission, Federal Energy Regulatory Commission, Nuclear Regulatory Commission, Smithsonian Institution, and Tennessee Valley Authority.
49. U.S. Fish and Wildlife Service, "Federal and State Endangered and Threatened Species Expenditures: Fiscal Year 2014," https://www.fws.gov/endangered/esa-library/pdf/20160302_final_FY14_ExpRpt.pdf (accessed December 14, 2017).
50. Ibid.
51. U.S. Fish and Wildlife Service, "Federal and State Endangered and Threatened Species Expenditures: Fiscal Year 2015."
52. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of the Lake Erie Watersnake (Nerodia sipedon insularum) From the Federal List of Endangered and Threatened Wildlife," *Federal Register*, Vol. 76, No. 158 (August 16, 2011), pp. 50680–50702, https://www.gpo.gov/fdsys/pkg/FR-2011-08-16/pdf/2011-20104.pdf (accessed February 7, 2018).
53. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Threatened Status for Lake Erie Water Snakes (*Nerodia sipedon insularum*) on the Offshore Islands of Western Lake Erie," *Federal Register*, Vol. 64, No. 167 (August 30, 1999), pp. 47126–47134, https://www.gpo.gov/fdsys/pkg/FR-1999-08-30/pdf/99-22459.pdf#page=1 (accessed December 4, 2017). See also U.S. Fish and Wildlife Service, "Lake Erie Watersnake (*Nerodia sipedon insularum)* 5-Year Review: Summary and Evaluation," https://ecos.fws.gov/docs/five_year_review/doc2586.pdf (accessed December 4, 2017).
54. U.S. Fish and Wildlife Service, "Removal of the Lake Erie Watersnake (*Nerodia sipedon insularum*) From the Federal List of Endangered and Threatened Wildlife," *Federal Register*, Vol. 76, No. 158 (August 16, 2011), pp. 50680–50702, https://www.gpo.gov/fdsys/pkg/FR-2011-08-16/pdf/2011-20104.pdf (accessed December 11, 2017).

55. U.S. Fish and Wildlife Service, "Biological Opinion for the Issuance of a Section 10(a)(1)(B) Incidental Take Permit for Lake Erie Water Snake (*Nerodia sipedon insularum*) in the Long Point Homeowner's Association," May 2003, https://ecos.fws.gov/docs/plan_documents/bobs/bobs_188.pdf (accessed December 11, 2017), and U.S. Fish and Wildlife Service, "Final Environmental Assessment and Habitat Conservation Plan: Issuance of an Endangered Species Act 10(a)(1)(B) Incidental Take Permit to Long Point Home Owner's Association," May 2003, https://ecos.fws.gov/docs/plan_documents/neas/neas_189.pdf (accessed December 11, 2017).
56. Ibid.
57. International Union for the Conservation of Nature, "The IUCN Red List of Threatened Species: *Ursus americanus* (American Black Bear)," http://www.iucnredlist.org/details/41687/0 (accessed December 11, 2017).
58. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of the Louisiana Black Bear from the Federal List of Endangered and Threatened Wildlife and Removal of Similarity of Appearance Protections for the American Black Bear," *Federal Register*, Vol. 81, No. 48 (March 11, 2016), pp. 13124–13171, https://www.gpo.gov/fdsys/pkg/FR-2016-03-11/pdf/2016-05206.pdf (accessed December 11, 2017).
59. Ibid., p. 13141.
60. Ibid., p. 13126.
61. International Union for the Conservation of Nature, "*Ursus americanus*."
62. Ibid.
63. Ibid.
64. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of the Louisiana Black Bear from the Federal List of Endangered and Threatened Wildlife."
65. Emily Puckett et al., "Phylogeographic Analyses of American Black Bears (*Ursus americanus*) Suggest Four Glacial Refugia and Complex Patterns of Postglacial Admixture," *Molecular Biology and Evolution*, Vol. 32, No. 9 (May 2015), https://www.researchgate.net/publication/277086415_Phylogeographic_Analyses_of_American_Black_Bears_Ursus_americanus_Suggest_Four_Glacial_Refugia_and_Complex_Patterns_of_Postglacial_Admixture (accessed December 11, 2017).
66. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Louisiana Black Bear (*Ursus americanus luteolus*)," *Federal Register*, Vol. 74, No. 45 (March 10, 2009), pp. 10350–10409, https://www.gpo.gov/fdsys/pkg/FR-2009-03-10/pdf/E9-4536.pdf#page=2 (accessed December 11, 2017), and U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Louisiana Black Bear," *Federal Register*, Vol. 73, No. 219 (November 12, 2008), pp. 66832–66833, https://www.regulations.gov/document?D=FWS-R4-ES-2008-0047-0016 (accessed February 8, 2018). This range is the low from the range the Service determined using a 7 percent discount rate and the high from the range the Service determined using a 3 percent discount rate and includes post baseline costs for areas excluded from critical habitat designation. Some of the estimated impacts extended beyond the date the Louisiana black bear was listed. Additionally, in explaining its rationale for delisting, the Service highlights that various mechanisms (such as easements over 148,00 acres of private lands) are now available for the bear. The Service notes that 15 of 17 parishes (the Louisiana equivalent of a county) are projected to lose population (–11.3 percent on average) by 2030.
67. U.S. Fish and Wildlife Service, "Determination That Seven Eastern U.S. Land Snails Are Endangered or Threatened Species, Fish and Wildlife," *Federal Register*, Vol. 43, No. 128 (July 3, 1978), p. 28932–28935, https://ecos.fws.gov/docs/federal_register/fr223.pdf (accessed December 13, 2017).
68. U.S. Fish and Wildlife Service, "Iowa Pleistocene Snail: 5-Year Review: Summary and Evaluation," 2013, https://ecos.fws.gov/docs/five_year_review/doc4339.pdf (accessed December 13, 2017).
69. U.S. Fish and Wildlife Service, "National Recovery Plan for the Iowa Pleistocene Snail, Fish and Wildlife," 1984, p. 6, https://ecos.fws.gov/docs/recovery_plan/840322.pdf (accessed December 13, 2017).
70. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Proposal to Determine *Trifoiium Stoloniferum* (Running Buffalo Clover) To Be an Endangered Species," *Federal Register*, Vol. 51, No. 46 (March 10, 1986), pp. 8217–8220, https://ecos.fws.gov/docs/federal_register/fr1092.pdf (accessed December 13, 2017).
71. Ibid.
72. U.S. Fish and Wildlife Service, "Running Buffalo Clover (*Trifolium stoloniferum*)," Species profile, https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=Q2RE (accessed December 13, 2017); U.S. Fish and Wildlife Service, "Running Buffalo Clover (*Trifolium stoloniferum*): 5-Year Review: Summary and Evaluation," May, 6, 2011, https://ecos.fws.gov/docs/five_year_review/doc3646.pdf (accessed December 13, 2017); U.S. Fish and Wildlife Service, "Running Buffalo Clover (*Trifolium stoloniferum*) 5-Year Review: Summary and Evaluation, Fish and Wildlife," September 2008, https://ecos.fws.gov/docs/five_year_review/doc2407.pdf (accessed December 13, 2017); and U.S. Fish and Wildlife Service, "Running Buffalo Clover (*Trifolium stoloniferum*) Recovery Plan: First Revision," June 2007, https://www.fws.gov/midwest/endangered/plants/RBC_RPlanJune07.html (accessed January 24, 2018).
73. U.S. Fish and Wildlife Service, "Nashville Crayfish (*Orconectes shoupi*): 5-Year Review: Summary and Evaluation," February 7, 2017, https://ecos.fws.gov/docs/five_year_review/doc4988.pdf (accessed December 13, 2017).
74. U.S. Fish and Wildlife Service, "Painted Snake Coiled Forest Snail (*Anguispira picta*): 5-Year Review: Summary and Evaluation," July 29, 2016, https://ecos.fws.gov/docs/five_year_review/doc4803.pdf (accessed December 13, 2017).

75. U.S. Fish and Wildlife Service, "*Centaurium namophilum* (Spring-Loving Centaury): 5-Year Review: Summary and Evaluation," August 13, 2009, https://ecos.fws.gov/docs/five_year_review/doc2569.pdf (accessed December 13, 2017).
76. Bridgett M. vonHoldt et al., "A Genome-Wide Perspective on the Evolutionary History of Enigmatic Wolf-Like Canids," May 12, 2011, http://genome.cshlp.org/content/early/2011/05/12/gr.116301.110.full.pdf+html (accessed December 13, 2017).
77. U.S. Fish and Wildlife Service, "Expenditure Reports," 1996–2015, https://www.fws.gov/endangered/esa-library/index.html (accessed December 4, 2017).
78. Endangered Species Act, Section (4)(f)(3).
79. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species: Fiscal Years 2009–2010," https://www.fws.gov/endangered/esa-library/pdf/Recovery_Report_2010.pdf (accessed December 13, 2017).
80. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species: Fiscal Years 2007–2008," https://www.fws.gov/endangered/esa-library/pdf/Recovery_Report_2008.pdf (accessed February 7, 2018).
81. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species: Fiscal Years 2005–2006."
82. Ibid.
83. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species: Fiscal Years 2013–2014," https://www.fws.gov/endangered/esa-library/pdf/Recovery_Report_FY2013-2014.pdf (accessed February 7, 2018).
84. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species Fiscal Years, 2007–2008," https://www.fws.gov/endangered/esa-library/pdf/Recovery_Report_2008.pdf (accessed February 7, 2018).
85. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species Fiscal Years 2009–2010," https://www.fws.gov/endangered/esa-library/pdf/Recovery_Report_2010.pdf (accessed December 4, 2017).
86. U.S. Fish and Wildlife Service, "Report to Congress on the Recovery of Threatened and Endangered Species: Fiscal Years 2013–2014."
87. The Reports to Congress often have significant errors and unexplained information. For example, the 2011–2012 report states that the little Mariana fruit bat and bridled white eye (a bird) are "delisted due to extinction," but both species remain listed. The 2004 report indicates eight different Hawaiian birds are presumed extinct, as did the prior year's report, but these species are accorded "unknown" or "declining" status in subsequent reports.
88. Donald J. Trump, "Presidential Executive Order on Reducing Regulation and Controlling Regulatory Costs," January 30, 2017, https://www.whitehouse.gov/presidential-actions/presidential-executive-order-reducing-regulation-controlling-regulatory-costs/ (accessed December 18, 2017).
89. The Report to Congress and Expenditure report data should be provided online in easily accessible spreadsheet format.
90. Endangered Species Act, Section 7(a)(1).
91. Nisha Gaind, "U.S. Endangered Species Recovery Surges to Record High," *Scientific American*, August 17, 2016, https://www.scientificamerican.com/article/u-s-endangered-species-recovery-surges-to-record-high/ (accessed December 4, 2017).
92. U.S. Fish and Wildlife Service, "Delisted Species."
93. See, for example, Center for Biological Diversity, "Petition from Center for Biological Diversity to List 225 Species to Secretary Norton," May 4, 2004, https://ecos.fws.gov/docs/petitions/92210/643.pdf (accessed February 1, 2018); Center for Biological Diversity, "Petition to List 404 Aquatic, Riparian, and Wetland Species From the Southeastern United States as Threatened or Endangered Under the Endangered Species Act," April 20, 2010, https://ecos.fws.gov/docs/petitions/92210/1.pdf (accessed January 23, 2018); and news release, "404 Southeastern Freshwater Fish, Mussels, Crayfish, Birds, and Others Petitioned for Protection as Endangered Species," Center for Biological Diversity, April 20, 2010, https://ecos.fws.gov/docs/petitions/92210/1.pdf (accessed December 13, 2017).
94. U.S. Fish and Wildlife Service, "Endangered Species, Secretary of the Interior," *Federal Register*, Vol. 32, No. 48 (March 11, 1967), p. 4001, https://ecos.fws.gov/docs/federal_register/fr18.pdf (accessed December 13, 2017).
95. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Reclassification of the American Alligator to Threatened Due to Similarity of Appearance Throughout the Remainder of Its Range," *Federal Register*, Vol. 52, No. 107 (June 4, 1987), pp. 21059–21064, https://ecos.fws.gov/docs/federal_register/fr1263.pdf (accessed December 13, 2017).
96. T. A. Lewis, "Searching for Truth in Alligator Country," *National Wildlife*, September–November 1987.
97. U.S. Fish and Wildlife Service, "Proposal to Reclassify the American Alligator, Fish and Wildlife," *Federal Register*, Vol. 40, No. 131 (July 8, 1975), pp. 28712–28720, https://ecos.fws.gov/docs/federal_register/fr63.pdf (accessed December 13, 2017).
98. Mark V. Barrow, Jr., "The Alligator's Allure: Changing Perceptions of a Charismatic Carnivore," February 14, 2006, chapter in Mark V. Barrow, Jr., *Beastly Natures: Animals in Modern Environmental History*, http://environmentwriting.pbworks.com/f/alligatorchapter.pdf (accessed December 13, 2017).
99. U.S. Fish and Wildlife Service, "Reclassification of the American Alligator in Louisiana, Fish and Wildlife," *Federal Register*, Vol. 40, No. 153 (August l0, 1981), pp. 40664–40669, https://ecos.fws.gov/docs/federal_register/fr549.pdf (accessed December 12, 2017).

100. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removing the Island Night Lizard from the Federal List of Endangered and Threatened Wildlife, Fish and Wildlife," *Federal Register*, Vol. 79, No. 62 (April 1, 2014), pp. 18190–18210, https://www.gpo.gov/fdsys/pkg/FR-2014-04-01/pdf/2014-06576.pdf (accessed December 13, 2017).
101. U.S. Fish and Wildlife Service, "Determination that Seven California Channel Island Animals and Plants Are Either Endangered Species or Threatened Species," *Federal Register*, Vol. 42, No. 155 (August 11, 1977), pp. 40682–40685, https://ecos.fws.gov/docs/federal_register/fr152.pdf (accessed December 12, 2017).
102. Ibid.
103. Ibid.
104. Ibid.
105. Ibid.
106. Ibid.
107. U.S. Fish and Wildlife Service, "Island Night Lizard (*Xantusia riversiana)*: 5-Year Review: Summary and Evaluation," October 2012, https://ecos.fws.gov/docs/five_year_review/doc4104.pdf (accessed December 12, 2017).
108. U.S. Navy, "Petition to Designate San Clemente Island and San Nicholas Island Populations of the Island Night Lizard (*Xantusia riversiana*) as Distinct Populations Segments and Removal as Such from the Federal List of Threatened Species Pursuant to the Endangered Species Act of 1973," March 22, 2004, p. 5, https://ecos.fws.gov/docs/petitions/92100/809.pdf (accessed February 8, 2018).
109. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plan: Proposed Endangered Status and Critical Habitat for the Modoc Sucker ("*Catostomus miccrops*")," *Federal Register*, Vol. 49, No 21 (January 31, 1984), pp. 3892–3895, https://ecos.fws.gov/docs/federal_register/fr791.pdf (accessed December 14, 2017).
110. Ibid.
111. Ibid.
112. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of the Modoc Sucker From the Federal List of Endangered and Threatened Wildlife," *Federal Register*, Vol. 80, No. 235 (December 8, 2015), pp. 76235–76249, https://www.gpo.gov/fdsys/pkg/FR-2015-12-08/pdf/2015-30915.pdf (accessed December 14, 2017).
113. Ibid.
114. Ibid.
115. Ibid.
116. Government Accountability Office, "Management Improvements Could Enhance Recovery Program," December 21, 1988, http://www.gao.gov/products/RCED-89-5 (accessed December 14, 2017).
117. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Determination to Remove Three Palau Birds From the Lists of Endangered and Threatened Species," *Federal Register*, Vol. 50, No. 177 (September 12, 1985), pp. 37192–37194, https://ecos.fws.gov/docs/federal_register/fr1015.pdf (accessed December 14, 2017).
118. Ibid.
119. Ibid.
120. Ibid.
121. Ibid.
122. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Determination That *Echinacea tennesseensis* Is an Endangered Species, Fish and Wildlife," *Federal Register*, Vol. 44, No. 110 (June 6, 1979), pp. 32604–32605, https://ecos.fws.gov/docs/federal_register/fr294.pdf (accessed December 14, 2017).
123. U.S. Fish and Wildlife Service, "Recovery Plan for *Echinacea tennesseensis* (Tennessee Purple Coneflower)," 1989, https://ecos.fws.gov/docs/recovery_plan/891114a.pdf (accessed December 14, 2017).
124. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of *Echinacea tennesseensis* (Tennessee Purple Coneflower) From the Federal List of Endangered and Threatened Plants," *Federal Register*, Vol. 76, No. 149 (August 3, 2011), pp. 46632–46650, https://www.gpo.gov/fdsys/pkg/FR-2011-08-03/pdf/2011-19674.pdf (accessed December 14, 2017).
125. Ibid.
126. U.S. Fish and Wildlife Service, "Endangered and Threatened Wildlife and Plants; Removal of *Solidago albopilosa* (White-Haired Goldenrod) From the Federal List of Endangered and Threatened Plants," *Federal Register*, Vol. 81, No. 196 (October 11, 2016), pp. 70043–70059, https://www.gpo.gov/fdsys/pkg/FR-2016-10-11/pdf/2016-24249.pdf (accessed December 14, 2017).
127. Ibid.
128. Ibid.
129. Ibid.
130. Ibid.