REINTRODUCTION: An Assessment of Endangered Species Act Experimental Populations

June 2021

ENVIRONMENTAL POLICY INNOVATION CENTER

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Suggested Citation
Sapienza, H & Li, Y-W. 2021. An Assessment of Endangered Species Act Experimental Populations. Washington, D.C.: Environmental Policy Innovation Center.

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Front cover
The Guam rail population was reintroduced to Rota Island in 1989. Credit: Smithsonian's National Zoo. California condors will soon gain a fourth wild population with their release into Redwood National Park. Credit: USFWS Pacific Southwest. A raft of threated Southern sea otters. Credit: USFWS Endangered Species.

ENVIRONMENTAL POLICY INNOVATION CENTER

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EXECUTIVE SUMMARY

Efforts to reintroduce species of animals and plants back into areas from which they have disappeared is one of the most frequently used techniques available in wildlife conservation. For example, Chicago's Lincoln Park Zoo maintains a database that tracks more than 2,350 release events of 200 bird species dating back to 1903. Those reintroductions are often successful both in reestablishing populations of endangered species and in preserving evolutionary diversity.[1] Many of these reintroductions have occurred under the Endangered Species Act and have been implemented by federal or state agencies or private organizations.

The conservation science and policies for establishing new populations now face different challenges: climate change over the next 20-40 years will likely make completely new geographic areas the preferred or required habitat for many species' survival. Techniques and policies developed to restore species to their historic ranges are now instead needed to facilitate translocating populations and establishing them in more suitable habitats given these threats. We believe that climate-induced introductions need to occur much more frequently and quickly in the future in order to save a greater fraction of the species that will be stranded when conditions change in their current habitat.

One of the policy tools established under the Endangered Species Act (ESA) to facilitate reintroductions of endangered and threatened species is called an experimental population. The authorization for federal agencies to create experimental populations was added to the law in 1982 by the unanimous consent of Congress. Designation of an experimental population is needed only for one reason: the potential regulatory consequences of reintroducing a federally protected species into an area creates concerns among land managers, landowners, and businesses and communities in those areas that can potentially undermine support for the reintroduction. By creating this authority, Congress allowed federal agencies to significantly reduce the regulatory conditions and protections that apply to experimental populations.

Since 1982, the U.S. Fish and Wildlife Service and National Marine Fisheries Service have used this policy tool to designate 81 populations of 52 protected species as experimental. Many of those designations have resulted in the establishment of new populations of species.

This report reviews all of those designations, public funding associated with their implementation, and evidence of the success or failure of experimental designations to capture information about this tool for the first time. Further, the report offers recommendations for improving the use of this tool.

The following policy and program changes are the most important that we identified for increasing the ease and effectiveness of experimental population designations to establish more populations of endangered and threatened species in the future:

- ***Eliminate the requirement that experimental populations remain wholly separate from other (natural) populations to facilitate more genetic interchange and to reflect the practical reality that animals will often move in surprising ways that do not reflect legal distinctions.***
- ***Develop guidelines that explain to agency staff and the public the conditions under which experimental population designations and other ESA authorities should be used.***
- ***Unlike animals, endangered and threatened plants do not need experimental population designations due to their comparatively low regulatory protections. However, this distinction should be more clearly articulated as a means of removing potential barriers to plant reintroductions beyond experimental designations.***

- ***Between 2020-2050, climate change will necessitate the translocation of hundreds of species from their historic ranges into new habitats, but current U.S. Fish and Wildlife Service regulations require that all existing habitat must be "altered and destroyed" before this can occur. The agency needs to revise this limitation.***
- ***Our most important recommendation is that the Services track the status of experimental populations and report to the public whether the designation is effective, successful, and important to the species' conservation. We found no types of ESA documents that reliably communicated this information.***

Figure 1: *American burying beetles were reestablished in Missouri as an experimental population. The species has now been downlisted to threatened. Credit: Missouri Department of Conservation.*

INTRODUCTION

To successfully conserve many species, conservationists need to expand their numbers and distribution. Often, this requires reintroducing a species into portions of its historic range where populations have been extirpated. Further, reintroductions outside of a species' historic range may become increasingly necessary as climate change shifts ranges outside of historic boundaries. For example, much of the natural area that remains in the Florida Keys is expected to be underwater in the coming decades, making it impossible to conserve species endemic to the islands such as the Florida Key deer and Key Largo woodrat without translocation to suitable habitat.

When Congress amended the U.S. Endangered Species Act (ESA) in 1984, they addressed the need for reintroductions. Section 10(j) of the ESA allows the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS), together called the Services, to reintroduce populations of a species under certain conditions and to manage those populations more flexibly than regular populations of the same species. FWS in particular has used this authority to reintroduce a number of high-profile species including the whooping crane, black-footed ferret, California condor, and red wolf. These iconic species, however, represent only a sliver of all ESA species and all biodiversity in America. Plants and invertebrates, for example, make up 73% of domestic ESA species. Despite the importance of these lesser-known species to conservation, little is known about the extent to which they have benefited from the designation of experimental populations. In fact, no study to date has examined how the Services implement experimental populations across all species.

The main purpose of this report is to address this knowledge gap in order to inform future reintroductions of ESA species. We identified and reviewed the status of every population for which the Services have created a section 10(j) rule. Our goal was to address three questions:

1. ***In what situations do the Services reintroduce species using experimental designation?***
2. ***How often are experimental populations established successfully and what are the reasons?***
3. ***How can the Services improve implementation of experimental population authorities?***

Part I of this report provides detailed background on experimental populations, with an emphasis on the ESA protections that these populations can and cannot receive. Part II describes the methods for our study. Part III describes our results, providing an overview of when, where, and how the Services use their experimental population authority. Part IV presents five key findings from our study. Part V concludes with recommendations for how the Services and their conservation partners can make experimental population reintroductions more effective.

BACKGROUND ON SECTION 10(J) EXPERIMENTAL POPULATIONS

In unanimous 1982 amendments to the ESA, Congress introduced section 10(j) to allow the Services to create "experimental" populations of a listed species. Specifically, the provision authorizes the agencies to establish any population of an ESA species "outside the current range of such species if the Secretary determines that such release will further the conservation of such species."[2] Through regulations, the agencies have defined an experimental population as one that the Services have designated as experimental "but only when, and at such times as the population is wholly separate geographically from non-experimental populations of the same species."[3] If an experimental population overlaps with a nonexperimental population, then individuals of the former are afforded the same ESA protections as the latter.[4]

Section 10(j) also recognizes two types of experimental populations: essential and nonessential. The Services' regulations define an essential experimental population as one "whose loss would be likely to appreciably reduce the likelihood of the survival of the species in the wild."[5] If an experimental population does not meet this definition, it must be classified as nonessential. This distinction is important because nonessential populations receive fewer ESA protections than essential populations in two respects. First, a nonessential population cannot receive designated critical habitat.[6] Second, a nonessential population is treated as a species proposed for listing for purposes of section 7 of the ESA, except when the population occurs within a National Wildlife Refuge System or National Park System. This means that outside of those areas, nonessential populations are not protected by the section 7 prohibition on jeopardizing the continued existence of a species.[7] Instead, a federal agency must merely confer with the Services on activities that are likely to jeopardize a nonessential population but are not required to refrain from those activities. The Services have taken ample advantage of the increased regulatory flexibility for those populations: the agencies have never designated any experimental populations as essential, even populations that appear to squarely meet the definition of an essential population. We discuss this pattern in greater detail later.

Another form of regulatory flexibility for all experimental populations is that they must be treated as "threatened" even if the species is listed as "endangered." The prohibitions of section 9 of the ESA apply by default only to endangered species. Threatened species receive section 9 protections only on a case-by-case basis through a rule issued under section 4(d) of the ESA. Thus, all experimental populations receive section 9 protections only to the extent that the 4(d) rule for a population provides those protections. To date, all 4(d) rules for experimental populations have provided fewer protections than the full suite of protections under section 9 (see section I for details). This is unsurprising, because the regulatory flexibility afforded by 4(d) rules is often crucial for private landowners, local governments, and others to support (or at least not object to) the reintroduction of an ESA species.

Figure 2: *The Bay Checkerspot Butterfly reintroduction occurred in San Mateo County without a section 10(j) rule. Credit: USFWS Pacific Southwest.*

For many experimental populations, a key issue is where they can be reintroduced. As explained earlier, one requirement is that an experimental population must be "wholly separate" from its nonexperimental counterpart.[8] This requirement appears in the ESA and thus applies to both of the Services. Scholars have criticized the requirement on several grounds, including that it encourages the isolation of experimental and nonexperimental populations. Another requirement specific to the FWS regulations is that the reintroduction must be within the "probable historic range" of a species, unless its primary habitat has been "unsuitably and irreversibly altered or destroyed."[9] The NMFS regulations do not create this requirement, thus affording the agency more flexibility to help a species adapt to climate change before its habitat has been destroyed.[10] For both of the Services, reintroductions may occur outside of a species' current range at the time the experimental population is designated.[11]

Although the Services may use their section 10(j) authority to reintroduce species, nothing in the ESA requires the agencies to use this authority for reintroductions. FWS and states, for example, have reintroduced a variety of species under other ESA authorities, including section 10(a)(1)(A), which allows the agency to issue permits for activities "for scientific purposes or to enhance the propagation or survival" of listed species. Using this very broad authority, both of the Services have issued recovery permits to allow reintroductions, including for Bay checkerspot butterfly, Snake River sockeye salmon and 10 other west coast salmon populations, and numerous plant species.[12] ESA safe harbor agreements are yet another mechanism for reintroductions and one that relies on the same section 10(a)(1)(A) permit authority as recovery permits. FWS has used safe harbor agreements for a number of reintroductions, all without establishing a section 10(j) experimental population.[13]

Unfortunately, the Services do not track in any database the number of reintroductions they authorize through authorities besides section 10(j) or track reintroductions that do not even require a federal authorization. Further, copies of many safe harbor agreements are not posted online[14] nor are most recovery permits. To further complicate matters, plant reintroductions might be especially difficult to track because plants are not protected by the ESA's section 9 take prohibition. As a result, there is no need to authorize take through a recovery permit as part of a reintroduction. Because those permits are generally not posted online, we cannot readily assess how frequently they authorize plant reintroductions. This paucity of data on reintroductions outside of section 10(j) makes it impossible to calculate the percentage of all reintroductions that use this authority or assess whether the characteristics of section 10(j) experimental populations are similar to those that rely on other authorities. Thus, the reintroductions covered in this report may represent only a minority of all ESA reintroductions, but the exact percentage is undeterminable without considerably more work.

METHODS

The primary goal of our study was to evaluate the effectiveness of section 10(j) experimental populations.[15] We thus considered only populations covered by a section 10(j) rule and not those reintroduced through other authorities such as safe harbor agreements. Additionally, we considered species for which an experimental population reintroduction never occurred despite the existence of a section 10(j) rule.

To create a list of species that fit these criteria, we used the species search on the Environmental Conservation Online System (ECOS)[16] and set the search criteria as "Experimental Population, Nonessential (EXPN)" for the Federal Listing Status. This generated a list of 46 species currently associated with one or more section 10(j) rules for an experimental population. We additionally used the search criteria "Experimental Population, Essential (EXPE)" for the Federal Listing Status. However, no essential experimental populations have been established thus far. The ECOS page for Species with 10j Experimental Population Rules[17] provides a similar, though not identical list. We compared these lists to ensure we included every record of a past section 10(j) rule. Further, we browsed the ECOS species profiles for all species delisted from the ESA for any mention of a section 10(j) rule; this process added the gray wolf, grizzly bear, and Delmarva fox squirrel to our list of species with experimental populations. Finally, we conducted a keyword search in the Federal Register database for "experimental population" and found two instances of experimental populations for the Chinook salmon as well. This process generated a list of 52 species with 81 total experimental populations.

***Figure 3**: The now-recovered Delmarva fox squirrel was reestablished in Deleware through 10(j) and spread to areas outside the 10(j) boundary. There are 11 successful reintroduced populations, some of which have created new populations.*

For those species within the scope of our project, we primarily relied on documents uploaded by FWS to each species' profile on ECOS. These included five-year reviews, recovery plans, Federal Register documents associated with the establishment of a section 10(j) rule, and species status assessments. If those documents lacked adequate information on the status of an experimental population, we then examined news sources and conservation publications. These secondary sources were particularly useful for species such as the wood bison, for which no recovery plan or five-year review is publicly available on the ECOS species profile.

Using the primary and any secondary sources of information for a species, we sought to answer the following questions:

1. Did reintroductions occur for this species?
2. What was the timing of the reintroductions in relation to the section 10(j) rule?
3. Where are the locations of the reintroductions in relation to the section 10(j) rule(s) boundaries?
4. Have reintroductions been attempted within the terms of a section 10(j) rule? If not, why?
5. If attempted, has reintroduction within the terms of a section 10(j) rule succeeded?
6. What are the primary factors leading to the success or failure of a population? We coded each factor according to whether it contributed positively or negatively to the reintroductions.

In communicating the results of our analysis, we focused on trends related to the timing and location of reintroductions, and those for taxonomic groups and recovery priority numbers. Further, we included funding data for each species in this analysis, as reported in the FWS expenditure reports from 2003-2017. We used the results of the framework analysis to generate the main findings discussed later in this report.

OVERVIEW OF EXPERIMENTAL POPULATIONS IN PRACTICE

Since 1982, the Services have created section 10(j) rules for 81 populations covering 52 ESA species. These include well-known species such as the California condor, black-footed ferret, and whooping crane, and many lesser-known species such as Anthony's riversnail (snail), orangefoot pimpleback (freshwater clam), and spotfin chub (fish). This section provides an overview of those rules, including the species they cover.

We evaluated the number and relative percentage of experimental populations by taxonomic group. Figure 4 shows the number of animal species with a section 10(j) rule. The chart excludes plants because, as discussed in a later section, no plant species has ever been reintroduced using the section 10(j) authority. Among all species with experimental populations, clams, fishes, and mammals are overrepresented when compared to the percentage of these species among all U.S. listed species. By contrast, birds, insects, and snails are underrepresented, while amphibians, arachnids, crustaceans, and reptiles are unrepresented. Of particular note is the absence of experimental populations for reptiles and amphibians, even though some of these species have been reintroduced through other ESA legal authorities. Given the relative ease with which many of reptiles and amphibians can be reintroduced, they illustrate the potential for future section 10(j) rules to cover a more diverse group of species.

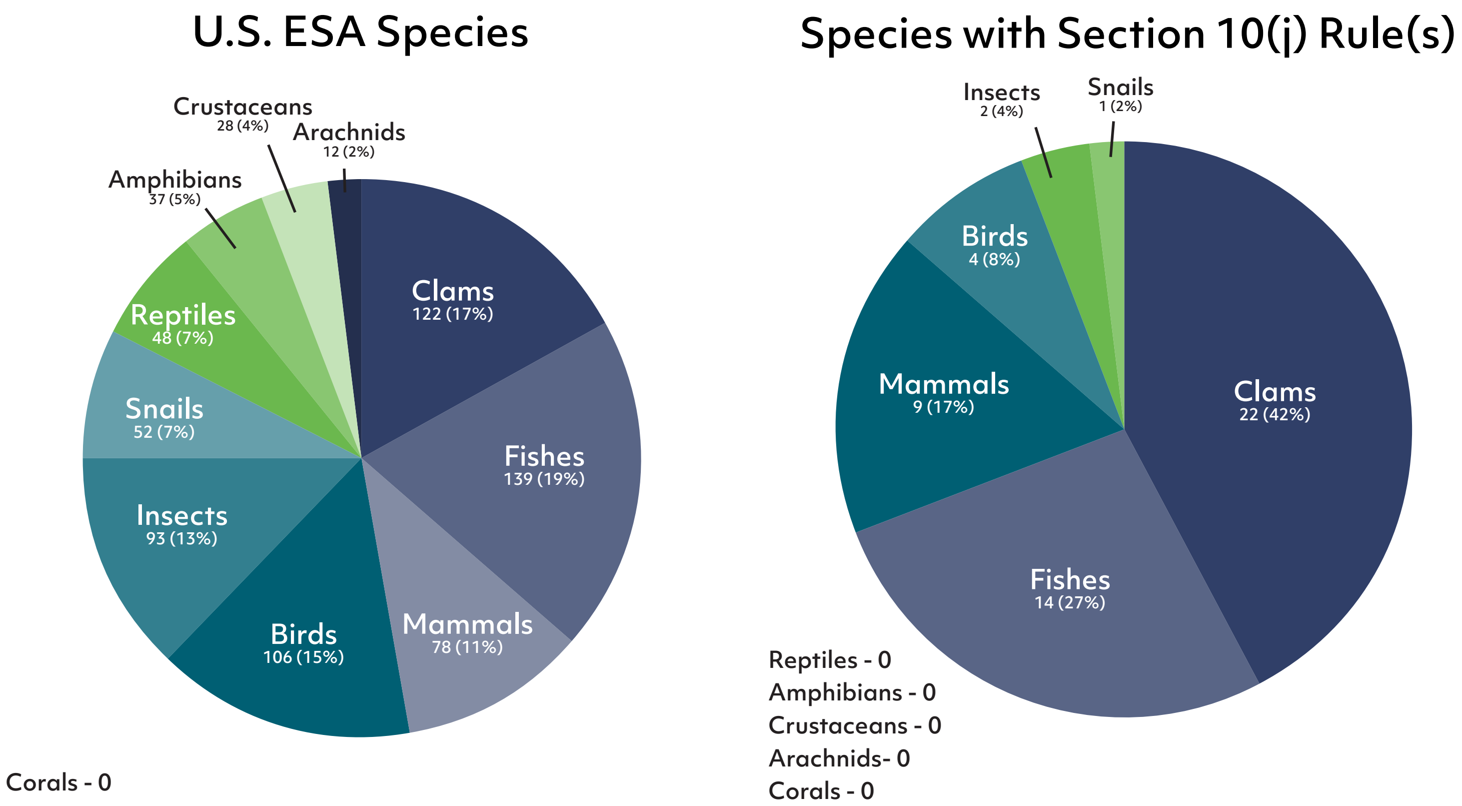

Figure 4: *Total number and percentage of U.S. animal species listed under the ESA and species with section 10(j) rules species by taxonomic group.*

Timing and Location of Reintroductions

As discussed earlier, section 10(j) is not the sole authority for reintroductions. For some species with section 10(j) experimental populations, the Services have also authorized reintroductions of other populations using other authorities, such as recovery permits. To understand when and where reintroductions have occurred relative to section 10(j) rules, Table 1 summarizes the timing and location of all reintroductions for species with section 10(j) rules.

Nearly 44% of the geographic areas targeted by a 10(j) rule for a population never received a reintroduction after the rule was adopted. Taken collectively, however, 56% of populations established by section 10(j) rules led to reintroductions. We classified each of these reintroductions into one of the following categories:

1. Those that occurred only after the section 10(j) rule was finalized and only within the section 10(j) area;
2. Those that occurred only after the section 10(j) rule was finalized and both outside and within the section 10(j) area; or
3. Those that occurred both before and after the section 10(j) rule and both outside and within the section 10(j) area.

The middle row of Table 1 ("only outside of section 10(j) area") represents reintroductions that occurred separate from a section 10(j) rule. For those populations, a section 10(j) rule likely has had little to no effect on conserving the species. All of the species in this category are freshwater mussel and fish species covered by multispecies section 10(j) rules from 2001 and 2007. Further, of the 23 species for which no reintroduction occurred before or after a section 10(j) rule, all but one (grizzly bear) fall under these two rules. We discuss the effect of these section 10(j) rules in our Main Findings section.

Finally, the category at the intersection of "only before section 10(j) rule" and "only within section 10(j) area" represents a peculiar case in which the section 10(j) area is established within an area where a prior reintroduction of the same species had occurred. The whooping crane is the only species that belongs to this category. FWS established an experimental population in the Rocky Mountain area when only three non-breeding adults remained.[18] These adults did not constitute a "population" and thus the "wholly separate" requirement was not violated when establishing the experimental population. FWS never actually reintroduced a population under the terms of the section 10(j) rule.

Figure 5: *Twenty-five eastern states are covered as an experimental population for whooping cranes.*

<table>
<tr><th colspan="2"></th><th colspan="4">Timing of reintroduction(s)</th></tr>
<tr><th colspan="2"></th><th>Only after section 10(j) rule</th><th>Only before section 10(j) rule</th><th>Both before and after section 10(j) rule</th><th>No reintroduction before or after</th></tr>
<tr><th rowspan="3">Location of reintroduction(s)</th><th>Only within section 10(j) area</th><td>21 populations
Anothony's riversnail (2001)
Bull trout (2011)
Chinook salmon (2013)
Chinook salmon (2014)
Colorado pikeminnow (1985)
Dromedary pearlymussel (2001)
Gray wolf (1994; Idaho)
Gray wolf (1994; YNP)
Mexican wolf (1998)
Oregon silverspot butterfly (2017)
Red wolf (1991)
Red wolf (1986)
Rio Grande silvery minnow (2008)
Sonoran pronghorn (2011)
Southern sea otter (1987)
Topeka shiner (2013)
Whooping crane (1993)
Whooping crane (2001)
Whooping crane (2011)
Wood bison (2014)
Yellowfin madtom (2002)</td><td>1 population
Whooping crane (1997)*</td><td></td><td rowspan="3">23 populations
Anthony's riversnail (2007)
Appalachian monkeyface (2007)
Cracking pearlymussel (2001)
Cracking pearlymussel (2007)
Cumberland monkeyface (2001)
Cumberland monkeyface (2007)
Dromedary pearlymussel (2007)
Fanshell (2007)
Finerayed pigtoe (2001)
Finerayed pigtoe (2007)
Grizzly bear (2000)
Orangefoot pimpleback (2007)
Pygmy madtom (2007)
Ring pink (2007)
Rough pigtoe (2007)
Shiny pigtoe (2001)
Shiny pigtoe (2007)
Slender chub (2007)
Yellowfin madtom (2007)
Yellow blossom (2001)
Tubercled blossom (2001)
Turgid blossom (2001)
White wartyback (2007)</td></tr>
<tr><th>Only outside section 10(j) area</th><td>3 populations
Alabama lampmussel (2001)
Purple Cat's paw (2001)
Winged mapleleaf (2001)</td><td>3 populations
Birdwing pearlymussel (2007)
Duskytail darter (2007)
Spotfin chub (2007)</td><td>5 populations
Clubshell (2001)
Cumberlandian combshell (2001)
Cumberlandian combshell (2007)
Cumberland bean (2001)
Cumberland bean (2007)</td></tr>
<tr><th>Both outside and within section 10(j) area</th><td>10 populations
American burying beetle (2011)
Black-footed ferret (1991)
Black-footed ferret (1994, SD)
Black-footed ferret (1994, MT)
Black-footed ferret (1996)
Black-footed ferret (1998)
Black-footed ferret (2000)
Guam rail (1989)
Oyster mussel (2001)
Oyster mussel (2007)</td><td></td><td>15 populations
Birdwing pearlymussel (2001)
Black-footed ferret (2003)
Black-footed ferret (2015)
Boulder darter (2005)
California condor (1997)
California condor (2021)**
Delmarva fox squirrel (1984)
Duskytail darter (2002)
Northern aplomado falcon (2006)
Smoky madtom (2002)
Spotfin chub (2002)
Spotfin chub (2005)
Steelhead (2013)
Woundfin (1985)
Yellowfin madtom (1988)</td></tr>
</table>

Table 1: *Timing and location of reintroductions relative to section 10(j) rule (for each experimental population). *The whooping crane does not violate the "wholly separate" requirement because there was no "population" of the species in the section 10(j) area when the experimental population was reintroduced. ** The 2021 condor reintroduction is scheduled for later this year and, thus, this report presumes it will occur.*

Timing of Section 10(j) Rules

We considered three aspects of when section 10(j) rules were established: the year of establishment; the number of years between when a species was listed and when it received its first section 10(j) rule; and whether a section 10(j) rule was established before the species received a final recovery plan. Below, we discuss each of these aspects.

Figure 6 shows in five-year increments the year that each rule was established. For rules that covered multiple species, we counted each species individually to fully capture the extent of the rules. The number of rules during each 5-year increment has always been under ten, except from 2000-2009, when FWS finalized two multispecies rules (in 2001 and 2007) for freshwater mussel, fish, and snail species in the southeastern U.S. (FWS region 4).

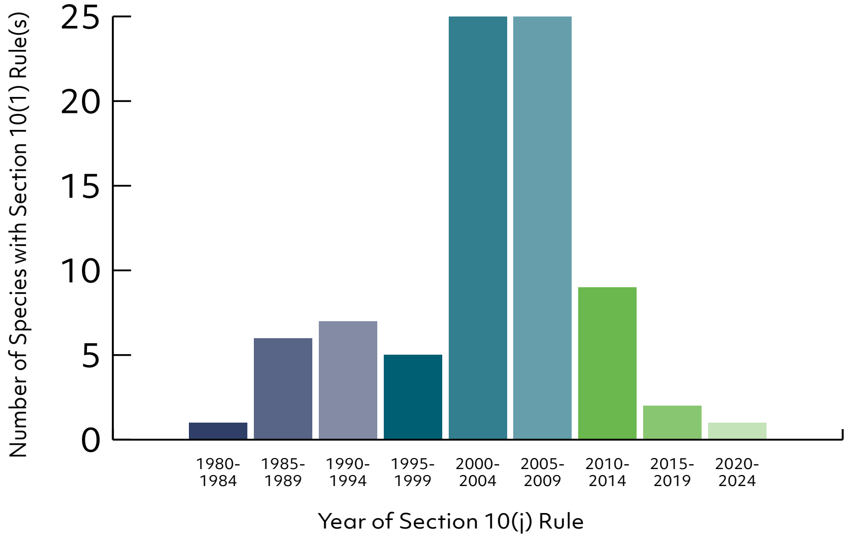

Figure 6: *Number of populations with section 10(j) rules established per 5-year increment.*

The second aspect of timing we assessed was the gap between when a species was listed and when the first section 10(j) rule for the species was finalized (Figure 8). This gap is important to understand how soon after listing does a species benefit from a section 10(j) rule. Although some species have multiple section 10(j) rules, we used only the year of the first rule to avoid biasing our analysis in favor of those species. For 8 (15%) species, a section 10(j) rule was established within the first decade of listing. For most species, at least a decade passed before a section 10(j) rule was finalized, with 40-year gaps for the wood bison and Sonoran pronghorn.

Figure 7: *In 2011, FWS established a section 10(j) rule for the endangered Sonoran subspecies of pronghorn in Southern Arizona. Credit: Yellowstone NPS.*

The third aspect of timing we considered was whether the first section 10(j) rule for each species preceded their most recent final recovery plan. (Figure 9). This information is useful to understanding the extent to which a recovery plan informed the establishment of an experimental population. For 68% of populations, the latest recovery plan was published before the establishment of the section 10(j) rule. For a smaller number of species, however, the opposite is true, and management of the experimental population is incorporated into the subsequent recovery plan.

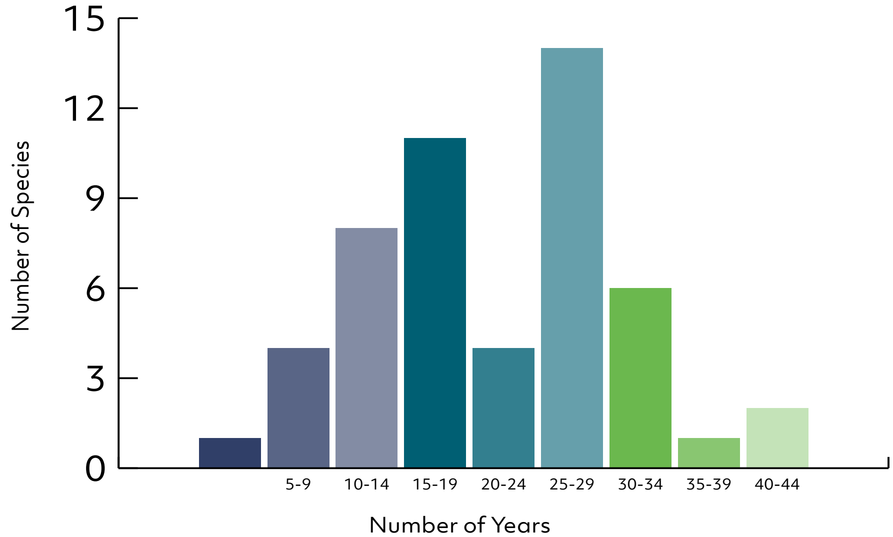

Figure 8: *Number of years between listing under the ESA and establishment of the first section 10(j) rule for each species.*

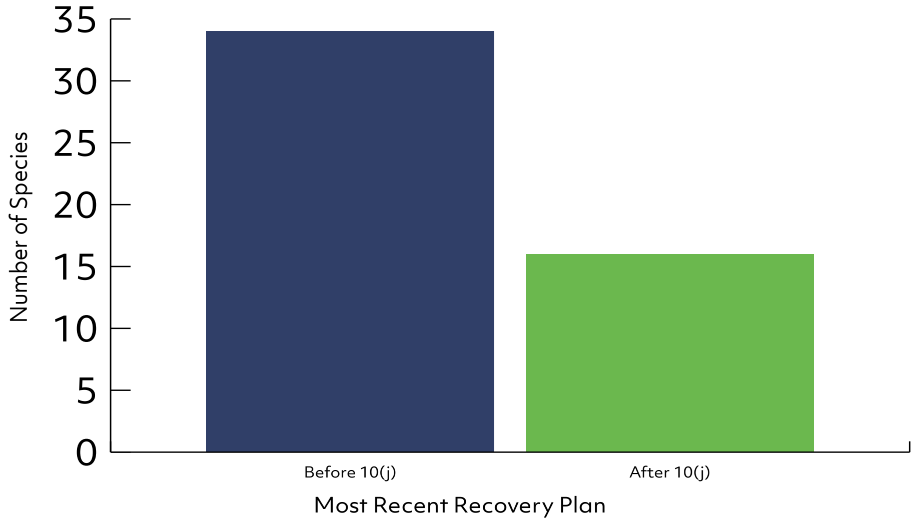

Figure 9: *Timing of the first section 10(j) rule for each species relative to the most recent recovery plan.*

Figure 10: *Endangered black-footed ferret, with eight current experimental populations established by section 10(j) rules. Credit: USFWS Mountain Prairie.*

Experimental Populations by FWS Region

We compared total counts of species and experimental populations by FWS regional office, displayed in Figure 11. With the exception of Region 4 (the southeastern U.S.), the number of species is 5 or fewer for each region. Because of the multispecies rules in 2001 and 2007, region 4 has the largest number of species (32) covered by section 10(j) rules. In regions 4 and 6, the number of populations is considerably larger than the number of species, because certain species had more than one section 10(j) rule. For Region 6, the black-footed ferret currently has eight section 10(j) rules; for Region 4, 15 species are covered by at least two section 10(j) rules.

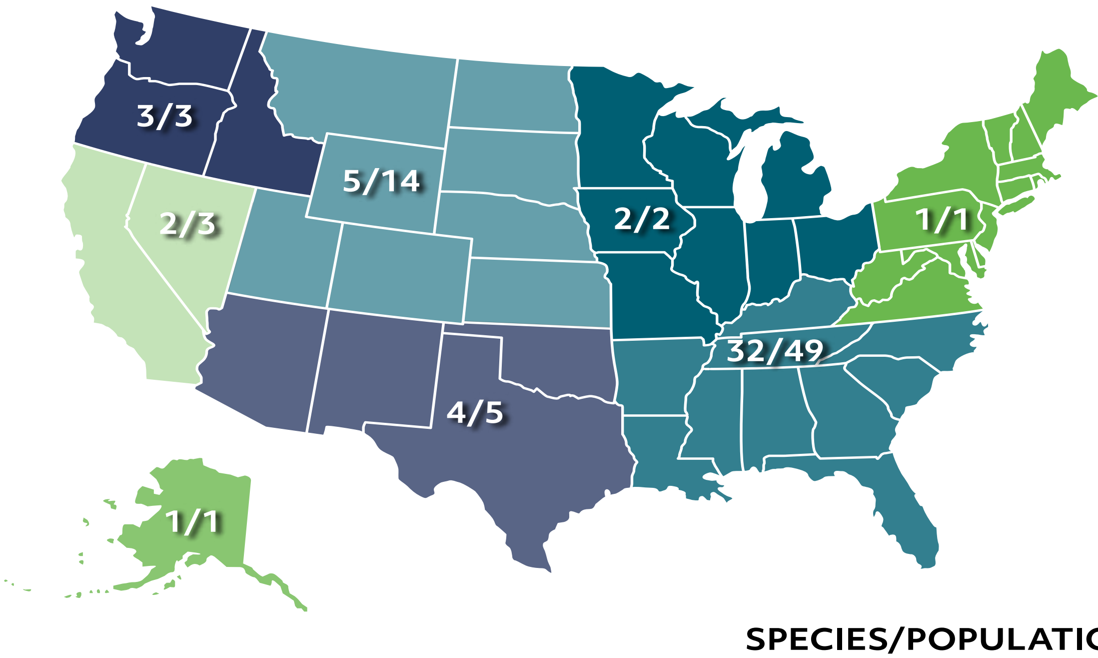

Figure 11: *Map of FWS regions. For each FWS regional office, the number of species within 10(j) rules and the number of experimental populations. Region 4 in the southeast has by a large margin the greatest number of species and populations.*

Recovery Priority Numbers

The Services use recovery priority numbers (RPNs) to signify the degree of threat and potential for recovery for each listed species.[19] Table 2 displays the percent of experimental populations and overall listed species based on these two factors. Although these percentages are similar in most categories, the percentage of 'high threat-low recovery potential' species (RPNs of 4, 5, and 6) is 14% higher for experimental populations. All but two of these species (California condor and red wolf) are freshwater mussel, snail, and fish species.

		Degree of Threat		
		High	Moderate	Low
Recovery Potential	High	23% / 30%	17% / 24%	6% / 4%
	Low	52% / 38%	2% / 4%	0% / 0%

Table 2: *Recovery Priority Numbers for experimental populations (left) and overall listed species (right) grouped by degree of threat and recovery potential as indicated by the Services' RPN classification. Although the classification also considers taxonomic uniqueness, we omitted this factor in our table for simplicity.*

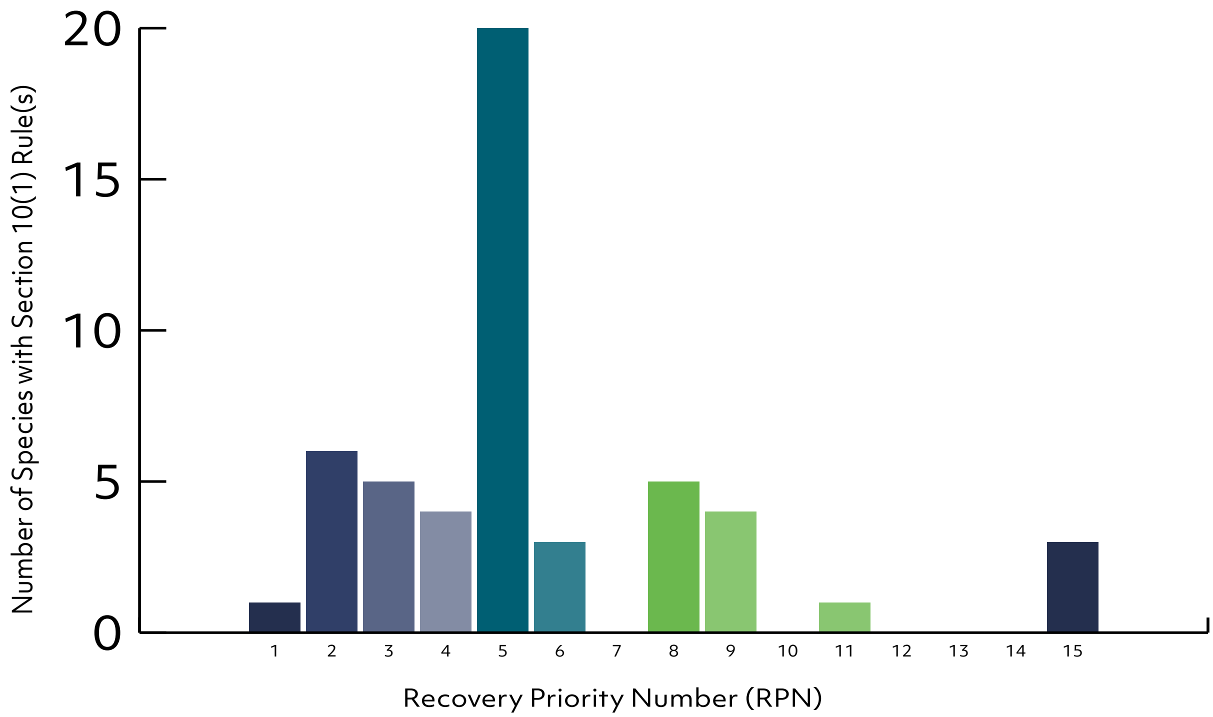

Figure 12: *Recovery Priority Numbers (RPNs) for species with section 10(j) rules. RPNs 4-6 represent species with a "low" potential for recovery and a "high" degree of threat.*

Funding

Collectively, state and federal agencies report spending $235 million on all experimental populations between 2003-2017. Table 3 displays the total funding as reported in the FWS expenditure reports from 2003-2017.[20] These reports did not separate funding based on experimental population status until 2003 and are currently publicly available through 2017. For these years, we totaled the expenditures reported for both the species and the experimental population(s). Funding for the latter is not a subset of the former, and thus can be considered separately. Given that some populations were established later than 2003 and others have not been consistently funded each year, we included the range of funding years and the average expenditures for only the years that the population was funded.

All experimental populations with funding totals over $1.3 million represent high-profile species supported by significant investments from the Services and other conservation organizations. These include the black-footed ferret, California condor, bull trout, and Mexican wolf, as reported in Table 3. For populations below that $1.3 million threshold, many represent poorly known species, particularly freshwater fish and mussels.

Figure 13: *Wood bison on the highway. Credit: CC BY-NC 2.0 Ted LaBar.*

For the three species with $0 of reported funding for experimental populations—Chinook salmon (Middle Columbia River ESU), wood bison, and Oregon silverspot butterfly—reintroductions for these populations did occur. FWS established the Oregon silverspot butterfly population in 2017, and thus may not have contributed funding to the reintroduction until the years following. However, the section 10(j) rules for the wood bison and Chinook salmon (Middle Columbia River ESU) occurred several years earlier, with reintroductions initiated soon after. Expenditures related to these reintroductions were not reported in the table and may have been included in the species-level expenditure totals instead.

Species Name	Amount of Funding (2003-2017)			
	Experimental Population Total	Funding Years for Population	Average per Year for Population	Average per Year for Species
Colorado pikeminnow	$34,407,796	2003-2017	$2,293,853	$5,830,795
Rio Grande Silvery Minnow	$17,556,635	2010-2017	$2,194,579	$8,758,092
Mexican wolf	$32,516,623	2003-2017	$2,167,775	$43,400
Grey wolf	$29,459,385	2003-2017	$2,104,242	$4,587,049
Black-footed ferret	$27,554,842	2003-2017	$1,836,989	$1,576,287
Whooping crane	$22,536,453	2003-2017	$1,502,430	$2,138,630
Grizzly bear	$18,977,793	2003-2017	$1,265,186	$6,786,205
Red wolf	$17,847,901	2003-2017	$1,189,860	$340,699
Bull trout	$3,462,099	2014-2017	$865,525	$34,121,404
Topeka shiner	$1,500,660	2014-2017	$500,220	$827,033
California condor	$7,387,704	2003-2017	$492,514	$2,028,102
Sonoran pronghorn	$3,292,968	2011-2017	$470,424	$1,284,861
Northern Aplomado Falcon	$4,853,850	2006-2017	$404,488	$746,246
Steelhead	$1,362,712	2014-2017	$340,678	$46,371,272
Woundfin	$2,634,451	2003-2016	$188,175	$644,842
Southern sea otter	$1,531,480	2003-2012	$170,164	$893,870
Finerayed pigtoe	$1,130,022	2004-2017	$125,558	$93,961
Shiny pigtoe	$1,070,578	2005-2017	$107,058	$90,321
Delmarva fox squirrel	$660,052	2003-2013	$66,005	$355,650
Guam rail	$800,069	2003-2017	$57,148	$520,224
Winged mapleleaf	$583,326	2003-2017	$53,030	$346,606
Alabama lampmussel	$392,843	2004-2017	$43,649	$62,032
Chinook salmon	$72,181	2014-2015	$36,091	$8,536,504
Orangefoot pimpleback (pearlymussel)	$168,232	2010-2015	$33,646	$172,615
American burying beetle	$123,014	2014-2017	$30,754	$1,102,166
Yellowfin madtom	$415,344	2003-2017	$29,667	$45,002
Ring pink (mussel)	$24,400	2008-2008	$24,400	$76,931
Cracking pearlymussel	$170,509	2004-2017	$24,358	$231,433
Clubshell	$298,744	2004-2017	$21,339	$309,222
Spotfin Chub	$281,549	2003-2017	$18,770	$155,955
Fanshell	$113,144	2009-2017	$16,163	$258,345
Oyster mussel	$216,572	2003-2017	$15,469	$98,982
Cumberland bean (pearlymussel)	$142,001	2003-2017	$11,833	$91,856

Cumberlandian combshell	$140,527	2003-2017	$10,038	$400,469
Birdwing pearlymussel	$126,519	2005-2017	$9,732	$148,125
Smoky madtom	$92,199	2003-2015	$8,382	$29,009
Pygmy madtom	$58,600	2007-2017	$8,371	$25,368
Purple Cat's paw (pearlymussel)	$85,302	2005-2017	$7,755	$48,102
Tubercled blossom (pearlymussel)	$73,113	2003-2016	$7,311	$10,487
Rough pigtoe	$57,157	2010-2017	$7,145	$105,377
Duskytail darter	$82,780	2003-2016	$6,898	$288,781
Boulder darter	$40,823	2005-2015	$6,804	$270,765
White wartyback (pearlymussel)	$22,832	2010-2015	$4,566	$136,796
Dromedary pearlymussel	$41,274	2005-2017	$3,440	$59,075
Turgid blossom (pearlymussel)	$16,184	2007-2017	$3,237	$2,919
Appalachian monkeyface (pearlymussel)	$14,223	2011-2017	$2,845	$38,155
Anthony's riversnail	$28,159	2003-2017	$2,560	$13,777
Cumberland monkeyface (pearlymussel)	$20,320	2010-2017	$2,540	$151,539
Slender chub	$800	2011-2012	$400	$36,018
Yellow blossom (pearlymussel)	$1,196	2012-2017	$399	$3,569
Chinook salmon	$0	n/a	n/a	$30,479,185
Oregon silverspot butterfly	$0	n/a	n/a	$553,008
Wood bison	$0	n/a	n/a	$227,343

Table 3: *Amount of funding for each species with a section 10(j) rule from 2003-2017. Given that not every species receives funds each year, we provide the range of funding years and the average amount of funding across the total number of years for which both the experimental population and species received funding. In the final column, the average per funding years for the species exclude those expenditures specifically designated for the experimental populations. For species with more than one section 10(j) rule, expenditures for those experimental populations are aggregated together.*

Analysis of all experimental populations revealed trends important to understanding the conditions under which these reintroductions are successful or unsuccessful. The following main findings were particularly significant in informing our recommendations for future section 10(j) rules.

1. The existence of a section 10(j) rule does not assure a reintroduction.

56% of section 10(j) rules have led to a reintroduction of the covered species, but the existence of a rule does not assure a reintroduction, as has been the case for 35 designations. In some cases, the reasons for this lack of follow-through are unclear. For 23 populations, however, the Services cite a range of ecological and biological factors for the lack of reintroduction efforts. These include unsuitable habitat, uncertainty regarding techniques for establishing reintroduced populations, and a lack of available individuals for captive propagation. As explained further below, these factors were particularly important in understanding the lack of reintroduction for many freshwater invertebrates covered by the 2001 and 2007 southeastern multispecies rules. For only one species, the grizzly bear, was landowner opposition the reason a reintroduction did not proceed.

Table 4 identifies all the reasons we encountered for lack of follow-through. These reasons are not mutually exclusive, and multiple reasons may contribute to the lack of follow-through for a single population. Additionally, we assigned these reasons based solely on the primary and secondary sources we reviewed. It is likely that these sources did not identify all the reasons that certain reintroductions never occurred. As a result, Table 4 provides only a partial list of reasons.

Reasons cited for reintroduction not occurring despite section 10(j) rule	No. of populations
Not enough individuals to allow for a reintroduction (e.g., unsuccessful captive propagation, lack of captive facilities for propagation)	15
Habitat not suitable for reintroduction or threats not sufficiently addressed	13
Techniques for establishing reintroduced specimens unknown.	12
Reason unclear or not given	9
Species extremely rare and not observed in long time	6
Required surveys of suitable reintroduction areas not completed.	4
FWS lacks confidence in success of reintroduction	3
Species likely extinct	2
Opposition from states, landowners, or others (specify who)	1
FWS specifically identifies the lack of funding or resources for reintroduction	0

Table 4*. Ecological and biological factors are the most commonly cited reason in ESA documents for not reintroducing a population covered by a section 10(j) rule.*

To better understand why FWS did not follow through on some of the reintroductions, we examined in greater detail the invertebrate species in the 2001 and 2007 southeastern multispecies rules. The 2001 rule covered sixteen mussel and one snail species, all with an experimental population area centered on a proposed reintroduction site downstream of the Wilson Dam in the Lower Tennessee River. The 2007 rule covered fifteen mussel, one snail, and five fish species, with an experimental population area in the French Broad and Holston Rivers of Tennessee.

Three of the 17 (18%) invertebrate species in the 2001 rule saw reintroduction attempts, whereas this was the case for only one invertebrate species in the 2007 rule. After the 2007 rule was finalized, a single reintroduction occurred in the French Broad and Holston Rivers for the oyster mussel (*Epioblasma capsaeformis*). This reintroduced population was deemed "unsuccessful," and the number of individuals continues to decline with no further attempts to supplement the population with individuals. The species' 5-year review attributes this failure to the unsuitability of the habitat in the experimental population area. As a result, no further reintroductions have been attempted in the French Broad and Holston Rivers for the other fifteen invertebrate species in the 2007 rule. The 5-year review for the Cumberlandian combshell mussel explains:

Figure 14: *Endangered oyster mussels bound for Powell River. Credit: USFWS.*

> *"In 2007, the Service finalized a Non-Essential Experimental Population (NEP) for the Oyster Mussel, a close relative of the Cumberlandian Combshell, in the lower French Broad and lower Holston Rivers. As part of the NEP, Moles (2014) translocated 800 adult oyster mussels from the Clinch River, Tennessee to the French Broad River in Tennessee. One year later, less than 40 percent of translocated mussels were observed, with further declines observed over the next two years. After a period of 3 years, less than 10 percent of translocated oyster mussels were observed (Moles 2014). Males had higher retention rates than females, but both sexes experienced declines in growth, and less than half of females were able to undergo gametogenesis post-stocking. Gravid females did retain high fertilization success throughout the study (> 95 percent) (Moles 2014). Based on these results and due to high flows from Douglas and Cherokee Dams, Cumberlandian Combshell restoration efforts are currently not a recommended option in the French Broad and Holston Rivers.[21]"*

The 5-year review for the Cumberland monkeyface similarly explains that the species has not been reintroduced in the experimental population area "due to limiting water quality and habitat factors" that have impeded the successful establishment of other species in the 2007 rule.[22] Thus, until this obstacle is overcome, we expect no further reintroduction attempts under the 2007 rule.

Figure 15: *The grizzly bear's section 10(j) rule never led to a reintroduction.*

Similar reasons contributed to the lack of reintroductions for species under the 2001 multispecies rule, although with less consistency and clarity than the reasons cited for the lack of reintroductions in the French Broad and Holston rivers after the failed oyster mussel population. For those species in the 2001 rule, FWS references a variety of ecological and biological factors mentioned above. In most cases, these reasons are interconnected and collectively make it difficult to reintroduce many of these invertebrate species.

Given the controversy surrounding certain highly profile reintroductions (e.g., red wolf), we had predicted at the outset of this project that many proposed reintroductions would have been impeded by federal, state, or local opposition. Only the proposed grizzly bear reintroduction, however, encountered opposition strong enough to prevent a reintroduction. Finalized in 2000, the section 10(j) rule for the grizzly bear created an experimental population area within the Bitterroot ecosystem, a formerly occupied portion of the species range in Idaho and Montana. Only a year later, however, FWS published a proposed rule to remove the section 10(j) rule. That proposal was never finalized, but FWS has also never pursued a reintroduction under the 2000 rule.[23] The reasons for the lack of follow-through with the Bitterroot area reintroduction are unclear from FWS's public documents. The Center for Biological Diversity blames the situation on political interference coinciding with the change of presidential administration in 2001.[24] Further, in a study involving semi-structured interviews of individuals with land-based occupations, Carlos L. Velado of the University of Montana found that while most people have positive attitudes toward grizzly bears, the majority were opposed to reintroduction.[25] Thus, for the grizzly bear, sociopolitical factors were the reason no reintroduction has occurred. It's worth noting that grizzly bears have now colonized the Bitterroot Mountains on their own.

2. Many reintroductions occur without or separate from a section 10(j) rule for the species

The section 10(j) authority creates the impression that it provides the only means of reintroducing species. As explained earlier, however, ESA reintroductions can also occur under other authorities. The 81 section 10(j) rules in our study represent only a portion of all reintroductions of ESA species. The total number of reintroductions is very difficult to determine because the Services do not systematically track reintroductions authorized under other ESA authorities, such as section 10 recovery permits. Nonetheless, we encountered several categories of reintroductions that have occurred without or separate from a section 10(j) rule for a species.

- *Plant reintroductions*. Although plants make up 56% of all US listed species, no plant species has ever been covered by a section 10(j) rule. This does not mean that no plants have been reintroduced. In fact, Lesage, Press, & Holl (2020) reported between 25 and 38 ESA plant introductions or reintroductions in California, as identified on FWS's Environmental Conservation Online System database.[26] Another example is the Forest Service's reintroduction of seven populations of the blowout penstemon flower in Nebraska. It is entirely possible that the number of ESA plant species with reintroductions exceeds the number of species covered by a section 10(j) rule. Because plants are not covered by the ESA take prohibition nor do their reintroductions typically generate controversy, we can understand why FWS has never written a section 10(j) rule for a plant species.

- *Reintroductions that predate a section 10(j) rule*. For 4 species covered by a section 10(j) rule, one or more populations were reintroduced before the rule was finalized but not after. For all of these situations, this sequence of events was not apparent until we reviewed the 5-year review for the species. Thus, the fact that a species has a section 10(j) rule does not necessarily mean that a reintroduction occurred under the terms of that rule.

- *Reintroductions that occur strictly outside the section 10(j) rule area*. For 11 populations, the reintroductions occurred entirely outside the section 10(j) experimental population area. This is another situation where a section 10(j) rule appears not to have played a role in a reintroduction. All 11 of the populations are freshwater mollusks or fish species, for which there was no indication of conflict with land or water use. By contrast, 21 populations had reintroductions that occurred only under the terms of a section 10(j) rule. Most of these are high profile or potentially controversial species, thus requiring the regulatory flexibility of a 4(d) rule that accompanies a section 10(j) population.

The potentially large number of reintroductions that have occurred without a section 10(j) rule suggests that the time and cost of developing those rules may be warranted for only some ESA species, particularly those likely to trigger landowner opposition. For other species, the section 10(a)(1)(A) authority likely provides a more streamlined approach to reintroducing a species.

Figure 16: The Pacific fisher reintroduction in 2015 occurred without the authority of a section 10(j) rule. Credit: Mount Rainier NPS.

To further illustrate the limited role of certain section 10(j) rules, we examined the two reintroductions for the northern Aplomado falcon—one with a section 10(j) rule and another without. In 2006, FWS finalized the rule to establish a population in New Mexico and Arizona. FWS viewed the experimental population designation as the fastest method for returning the species to this area; given the more lenient land use restrictions of section 10(j) rules, this reintroduction method was "less controversial to land managers and increased the number of reintroduction sites."[27] Reintroductions occurred consistently from 2006 to 2011 in the section 10(j) area. But avian predators like the great-horned owl caused very high mortality rates that ultimately led to the failure of this experimental population, with all tagged birds presumed deceased by January 2013. By contrast, FWS began a reintroduction program in 1978 for the species in south coastal Texas before section 10(j) was added to the ESA. The agency released 927 falcons from 1978 to 2013, and this population continues to thrive. The success appears attributable to the use of artificial nest towers to protect falcons and their nests from predators. These towers were not used with the section 10(j) experimental population, increasing the birds' vulnerability to predators. Thus, whether or not a reintroduction for the species succeeded had little to do with section 10(j) and far more to do with the deployment of effective conservation techniques.

Figure 17: The experimental population of northern Aplomado falcons did not succeed, though the non-experimental population in Coastal Texas thrives in comparison. Credit: CC BY 2.0 bgwashburn.

3. Whether an experimental population succeeds or fails can depend on a variety of factors, with threat alleviation as the most frequently cited factor.

For forty-five populations with a section 10(j) rule, a reintroduction occurred for the experimental population. However, the degree of success for these reintroductions varied extensively, ranging from failed populations with no plans for further reintroduction to fully self-sustaining populations that do not require management.

Figure 18: *Reintroduction of the bull trout to the Clackamas River in Oregon has been one of the most successful experimental populations thus far, though continued monitoring and augmentation are necessary to ensure its success. Credit: USFWS Mountain Prairie.*

Fourteen experimental population reintroductions (31% of those attempted) have failed. For just one of these, the northern Aplomado falcon, FWS indicated the potential for future reintroduction attempts in the 5-year review. In contrast, 24 attempted reintroductions led to some level of success, with seven others requiring more time to evaluate the status. For 14 of these 24 populations, the Services achieved substantial success, including for the American burying beetle, Anthony's riversnail (2001), black-footed ferret (1994), bull trout, California condor, duskytail darter (2002), gray wolf (Idaho), gray wolf (Yellowstone National Park), Guam rail, Mexican wolf, steelhead, Southern sea otter, whooping crane (2011), and wood bison. While these successful populations represent a range of taxa, many of them belong to iconic, flagship, or high-profile species. Those species generally receive disproportionately more funding than poorly known species, thus increasing the likelihood that their experimental populations will succeed. Further research is needed to determine the nature of the relationship between a species' public appeal and the success of its experimental population.

Table 5 summarizes the factors we identified related to the success or failure of the experimental populations in our study, based on information presented in 5-year reviews and other documents we reviewed. The rows present the status of each population, using categories we created (the Services have not developed a consistent approach to categorizing the status of reintroduced populations). Thus, the intersection of each column and row represents the number of times a factor was mentioned for a population with the corresponding status. We developed these categories based on the various stages of reintroduction success reported in 5-year reviews and other documents. Our goal is for these categories to be neither too general nor detailed, and to describe the status of experimental populations sequentially as they approach the highest level of success. Below is the description of each factor:

- **Resiliency** - The ability of a population to withstand demographic or environmental variation. As resiliency increases, so does the likelihood of a successful reintroduction.
- **Suitable habitat** - The presence of suitable habitat for the reintroduction.
- **Threats** - The extent to which threats to the reintroduced population have been addressed.
- **Resources** - The extent of financial or other resources for the reintroduction.
- **Stakeholder support** - The extent of support from landowners or other stakeholders for the reintroduction.
- **Persistence** - The extent of persistence with reintroduction efforts for the species, especially in light of failures.
- **Learning from past reintroductions** - The extent to which the Services learned from past reintroduction efforts for the species.
- **Knowledge of reintroduction measures** - The extent of knowledge of techniques to successfully reintroduce the species.

If a factor was not explicitly or implicitly presented in these documents, we did not identify it. As a result, our summary only captures the factors the Services identify, which are surely a subset of all the factors responsible for the success or failure of an experimental population. To fix this knowledge gap, future 5-year reviews should document all of the factors relevant to a reintroduced population. The review for the winged mapleleaf offers an example and includes an appendix with the reintroduction plan for the species. The plan was an excellent resource for us to understand the history of reintroduction efforts for the species and the factors that contributed to success and failure.

The presence or absence of threats to each reintroduced population is the most common explanation for the current status of reintroduced populations. In reality, the nature of threats should be a factor that helps explain the outcome of *every* reintroduction. Another key reason is the suitability of habitat, which we regard as a subset of the presence or absence of threats: improved habitat implies a reduction in threats, all else being equal. We view Table 5 as a starting point for future efforts to better understand the relationship between the status of an experimental population and the factors that contribute to that status. If the Services were to better document the factors, they and their conservation partners would be able to learn from past failures and successes.

Figure 19: *Release of a black-footed ferret at one of the 29 reintroduction sites established throughout the western United States, Mexico, and Canada. Credit: USFWS Mountain Prairie.*

Status of population	No. of populations	Resiliency	Suitable habitat	Threats	Resources	Stakeholder support	Persistence	Learning from past reintroductions	Knowledge of reintroduction measures
It has failed (no plans for further reintroduction)	13	7 (0 / 7)	9 (0 / 9)	7 (0 / 7)	2 (2 / 0)		2 (0 / 2)	2 (2 / 0)	2 (2 / 0)
Initial reintroduction failed but plans for future reintroduction	1			1 (0 / 1)			1 (0 / 1)		
Not enough time has passed to evaluate success	7		4 (3 / 1)		2 (2 / 0)		1 (1 / 0)		1 (1 / 0)
Minor success but significant additional efforts needed	10		4 (2 / 2)	8 (2 / 6)	7 (7 / 0)	3 (2 / 1)	6 (6 / 0)	4 (4 / 0)	4 (4 / 0)
Some but not all populations are self-sustaining	0								
Stable or improving only with continued human intervention	5		4 (4 / 0)	3 (2 / 1)	4 (4 / 0)	1 (1 / 0)	5 (5 / 0)	3 (3 / 0)	1 (1 / 0)
Population may currently be self-sustaining, but additional time and/or data needed to verify that status	4	2 (2 / 0)	4 (4 / 0)	3 (3 / 0)	2 (2 / 0)	1 (1 / 0)	2 (2 / 0)		1 (1 / 0)
Fully self-sustaining (no human intervention needed)	5	3 (3 / 0)	3 (3 / 0)	2 (2 / 0)	2 (2 / 0)	2 (2 / 0)	1 (1 / 0)		

Table 5: *Factors referenced by FWS as contributing to the success or failure of each experimental population, separated based on the current status of the population. We include total counts for each factor as well as whether it influenced the outcome of the experimental population positively (in parentheses, left) or negatively (in parentheses, right). Suitable habitat and threats were the most commonly cited factors for each status category.*

4. How FWS approaches a section 10(j) rule can vary considerably across species, especially depending on level of controversy

Although the text of section 10(j) is relatively straightforward, how FWS implements this authority varies considerably. In our research, we found that for socially controversial species, the section 10(j) rules and their implementation bear little resemblance to the rules for most poorly known species. This disparity underscores FWS's broad authority to tailor section 10(j) rules to the sociopolitical context surrounding a reintroduction. To illustrate this point, we examine section 10(j) rules on the two extreme ends of the controversy spectrum.

On one end are rules for various freshwater aquatic species in the southeastern U.S. Some of the covered species were reintroduced even before the rules were finalized, and others were reintroduced after the final rules but outside of the section 10(j) boundaries (Table 1). For example, the Cumberland bean and the Cumberlandian combshell were both reintroduced only outside of the boundaries established in the 2001 and 2007 rules for the species. The 4(d) rules for these species exempt all incidental take, "such as recreation (e.g., fishing, boating, wading, trapping, or swimming), forestry, agriculture, and other activities…." We found no opposition to the reintroductions. Indeed, the two rules generated only six public, none from environmental groups, and all of which supported the rule. Further, both rules were covered by a categorical exclusion under the National Environmental Policy Act (NEPA).

Figure 20: *Though initially controversial, the Mexican wolf reintroduction in southern Arizona and New Mexico has achieved substantial success. Credit: CC BY-NC 2.0 Mark Dumont.*

We find it difficult to imagine that such a straightforward, low-key approach would have been possible for any of the socially controversial reintroductions. The Mexican wolf reintroduction, for example, has been the subject of extensive public scrutiny and litigation. FWS first issued a section 10(j) rule for the species in 1998 and revised that rule in 2015 in response to litigation, after soliciting peer review comments from 6 scientists and after inviting 84 federal and state agencies, local governments, and tribes to participate as cooperating agencies in developing the NEPA environmental impact statement for the rule. The 2015 rule was then challenged by environmental and hunting groups, and a court struck down the rule as "arbitrary and capricious" in violation of the Administrative Procedure Act.[28] The court found that although the rule would promote the short-term survival of the species, it would not further recovery in contravention of the ESA's requirement that the release of an experimental population "further the conservation of [the] species." The problem was the provisions of the rule that capped the number of reintroduced animals and created more flexibility to manage human-wolf conflicts in response to opposition to the reintroduction from certain states and private landowners.

The striking differences between these two examples illustrate that section 10(j) rules and their implementation must be understood in the context of the sociopolitical factors that surround each reintroduction. Unlike the processes for ESA listing and incidental take permitting, both of which are governed by detailed rules and policies, the contours of section 10(j) rules and their accompanying 4(d) rules are largely left to the Services' broad discretion. No handbook or nationwide policy exists for how to draft and implement either type of rule. This gap leaves the Services with tremendous flexibility to decide how much legal process and public outreach are needed in each situation. For example, even though the 2001 freshwater species rule covered 16 species and the 2007 covered 21 species, both received the lowest level of NEPA review (categorical exclusion). By contrast, the Mexican wolf rule warranted the highest level of NEPA review (environmental impact statement). Contrasts like this are worth highlighting because although controversial reintroductions are the most salient in the minds of the public and lawmakers, the administrative costs and sociopolitical conflicts associated with those reintroductions are often not problems for low-profile reintroductions. In fact, based on our analysis of 5-year reviews and other documents, we estimate that approximately 65% of the populations with section 10(j) rules present low-conflict scenarios for reintroduction. This number does not even include the unknown but large number of populations reintroduced without any section 10(j) rules. Considering that plants and invertebrates alone make up nearly 73% of US listed species, many opportunities exist for noncontroversial reintroductions.

5. Significant regional differences and interspecific disparity exist in funding for freshwater species with section 10(j) rules

Although we provided funding data for all species with experimental populations in the results section (Table 3), a deeper look at the fish and invertebrate species reveals disparities in funding among section 10(j) populations.

With over $34 million in reported expenditures, the Colorado pikeminnow population received nearly double the funding of the next most-funded fish or invertebrate species. Even though extremely well-funded, this population is now extirpated. Established in 1985, reintroductions for the population occurred in the Salt and Verde rivers in the Gila River subbasin from 1985-1990. These reintroductions did not lead to an established population, and no augmentations have occurred in the Salt River since. However, the Verde River was stocked annually from 2002-2010 and 2015-2017, with little success in establishing a population. This program ended in 2018 with no plans for future reintroductions in the experimental population area. Uncertainty remains as to why these reintroduced fish did not survive in the Gila River subbasin. FWS believes that reduced river flow conditions due to drought and competition with nonnative predatory fish species may have contributed to the lack of an established population.[29] A now terminated effort, this extirpated experimental population represents a very costly failure. Further, it exemplifies funding disparities when compared to experimental populations for other fish and invertebrate species.

Figure 21: *Endangered freshwater mussels. Credit: USFWS Northeast.*

Many fish and invertebrate species in Table 3 have multiple section 10(j) rules, particularly from the 2001 and 2007 multispecies rules. For many of these species, no population establishment was attempted. In most cases, the expenditure reports do not separate funding by experimental population and instead include all spending related to populations with the "EXPN" designation as one sum. However, the annual expenditure reports explicitly list funding in many cases for unestablished populations. Given the information provided in five-year reviews for these species, no explanation exists for how and why this funding was used for these populations. For example, the birdwing pearlymussel is one species covered by the multispecies section 10(j) rule both in 2001 for the Wilson Dam and in 2007 for the French Broad and Holston Rivers. While the latter reintroduction never occurred for the birdwing pearlymussel, the expenditure reports list funding for that population from 2009-2012 and 2015-2016, totaling $60,370. These expenditures may include field surveys or salaries for employees involved in assessing potential reintroductions, but these disparities in funding data require additional clarity, especially given the lack of information in FWS documents about how funding is spent. Further, these expenditures for reintroductions that did not occur often exceed the total expenditures for some populations with active reintroduction effort. This brings into question whether funding is adequately allocated to the fish and invertebrate populations with the greatest potential.

Finally, geographic disparity in funding is evident for the freshwater species with section 10(j) rules in Table 3. For nearly all these experimental populations with funding totals under $1.3 million, the species' ranges occur in the FWS's Southeast Region 4 Office, while those above that benchmark fall to the west of that region. Both Chinook salmon populations are exceptions to this pattern, although their section 10(j) rules were established much later than the rules for most fish and invertebrate species in Table 3(thus funding for their reintroductions may not be adequately represented in the expenditure reports). The most well-funded fish are highly valued species, either with regard to their importance to the fishing industry or in connection to overall conservation efforts for western river ecosystems. These reasons may explain the inequity in funding across all fish and invertebrate species with experimental populations, but the actual reasons remain unclear to the public.

Figure 22: *Chinook salmon in California's Central Valley. Credit: USFWS Pacific Southwest.*

POLICY RECOMMENDATIONS

It is clear that experimental population designations create benefits for the conservation of many species. However, there are many opportunities to improve how the Services implement their section 10(j) authority. Pursuing those improvements will be especially important given the critical role of reintroductions and other types of translocations to conserving species in light of climate change. We describe below the most important recommendations from our research.

1. Eliminate the "wholly separate" requirement for section 10(j) populations

Experimental populations reintroduced under section 10(j) must be kept "wholly separate geographically" from non-experimental populations of the same species. This requirement, the result of a legislative compromise when the ESA was amended in 1982, creates several problems for species recovery, including encouraging isolation of experimental and non-experimental populations, thus undermining genetic exchange. It also presupposes that reintroduced individuals will largely stay within the boundaries of the experimental population area. This assumption was never true and will only become less true with climate change. One solution, proposed by the late Frederico Cheever and partially adopted by FWS, is to eliminate the wholly separate requirement and instead adopt a "species zoning" approach. Under this approach, FWS can still manage individuals within a reintroduction area more flexibly than individuals outside of the area. No geographic separation is required, nor does the lineage of an individual matter. By eliminating these complications, experimental populations can play a larger role in recovery and become easier to manage. In any future amendments to the ESA, Congress should consider removing or modifying the wholly separate requirement.

2. Develop guidelines for reintroducing species through section 10(j) and other ESA authorities

The variety of authorities for reintroducing ESA species can raise questions about the optimal authority to use in any particular situation. For example, although FWS has issued section 10(j) rules for many freshwater species, it has not always relied on those rules for a reintroduction. In those situations, the time and resources to develop the rule may have been better spent on other tasks. Further, the "wholly separate" requirement for experimental populations can impede genetic exchange between those and normal populations of a species, thus making section 10(j) rules a potentially less attractive option than section 10 recovery permits. Our study allowed us to only begin understanding some of the factors that explain why the Services use a particular authority. To facilitate future reintroductions, we recommend that the agencies develop guidelines for their staff and for conservation partners to understand when to use each authority. Our assumption is that the time and cost of developing a section 10(j) rule are higher than that for section 10 recovery permits and other authorities for reintroducing species. If correct, then section 10(j) rules may be an option of last resort when reintroducing species.

3. Clarify guidance for the use of section 10(j) rules to facilitate plant reintroductions

It appears that no section 10(j) rule will ever be needed for a plant reintroduction. This would have been unknown to us but for completing the study. Confirming this basic observation, if true, can lower the perceived barriers to reintroducing plants. To facilitate more threatened and endangered plant reintroductions, the Services should ask states and other federal partners to help document how many plant populations they have already established. By collecting and publishing this information, the agencies can remove a barrier from future efforts to create more plant populations.

4. Eliminate the "altered and destroyed" requirement for reintroductions outside species' historic range.

Because of a restriction in FWS regulations, animals like the Key deer and Key woodrat could not be introduced into mainland Florida before the entirety of their Florida Keys habitat was altered or destroyed. Audubon Society scientists have modeled new ranges under 3.0-degree temperature increases for hundreds of birds like the golden-fronted woodpecker, Audubon's oriole, and the endangered golden-cheeked warbler. Those models show that habitat outside their historic range will dominate the birds' suitable habitat under this climate change scenario. However, this regulatory language similarly prohibits any advance effort to help establish the birds in these refuges. The FWS should eliminate this restriction in its regulations to increase the potential of experimental population designations for species conservation.

Figure 23: *Species like the endangered Key deer face the destruction of their native habitat due to climate change and rising sea levels. Credit: USFWS Southeast.*

5. Develop and apply methods to periodically assess status of section 10(j) populations and factors that contributed to status.

Our most important recommendation is for the Services to track and publicly report on the status of experimental populations and the factors that contributed to each species' status. We found no types of ESA documents that reliably contained this information. Although 5-year reviews were the most informative types of documents, they did not always contain information on the status of experimental populations. Even when that information was present, it was often difficult to find, lacking in detail to understand status, or presented inconsistently across species. More often, SSAs contained better information on experimental populations, as they are almost always more comprehensive than 5-year reviews. Many species, however, do not have SSAs. To ensure that conservation resources are well spent, the Services should provide a better system to track and communicate population status and the factors responsible for the status.

As a starting point for tracking population status in a consistent manner, we recommend considering the following simple framework that allows the Services to categorize the status of one or more experimental populations of a species. We developed these categories based on the various stages of reintroduction success reported in 5-year reviews and other documents.

- Reintroduction has not been attempted.
- Reintroduction failed, with no plans for further reintroduction.
- Initial reintroduction failed but plans exist for future reintroduction.
- Not enough time has passed to evaluate the success of reintroduction.
- Minor reintroduction success but significant additional efforts needed.
- Some but not all reintroduced populations are self-sustaining.
- Reintroduced population(s) are stable or improving but only with continued human intervention.
- Reintroduced population(s) may currently be self-sustaining, but additional time and/or data needed to verify that status.
- Reintroduced population(s) are fully self-sustaining, with no human intervention needed.

The Services should also consider tracking changes in the status of experimental populations in terms of abundance, distribution, and threats to complement the more general metric we propose.

Another information gap is understanding the factors that contributed to the status of an experimental population. This information is crucial to learning from past mistakes and successes and ensuring that conservation dollars are spent wisely. In our review of ESA documents, we found it especially difficult to understand these factors because those documents contained little to no information on the factors. Even when information was provided, it was unclear whether all of the primary factors responsible for a population's status were described. Earlier, we presented the following eight

Figure 24: *Biologists at the Smithsonian Conservation Biology Institute prepare captive-bred female Guam rails for repatriation to native habitat. Credit: CC BY-NC-ND 2.0 Smithsonian's National Zoo.*

factors that we identified as responsible for the status of experimental populations: population resiliency, suitable habitat, threats, conservation resources, stakeholder support, persistence of reintroduction effort, learning from past reintroductions, and knowledge of reintroduction measures. The Services should consider these factors in any attempts to document why the status of experimental populations change over time.

THE FUTURE OF EXPERIMENTAL POPULATIONS

To our knowledge, this report reflects the first effort to survey the status of experimental populations. We were surprised to discover the large number of reintroductions that have occurred without a section 10(j) rule or separate from the terms of a section 10(j) rule. We were also surprised by the large number of species that have never seen a reintroduction despite receiving a section 10(j) rule. These findings suggest that for certain species, the Services should prioritize other authorities to reintroduce populations. Other findings in this report underscore the need for further research on the status of reintroduced populations of ESA species regardless of whether they were reintroduced under section 10(j), and the factors that contributed to the status. That analysis, however, remains difficult until the Services provide this type of information in a more consistent, structured, detailed, and accessible manner. For example, we spent far more time than we expected to determine whether section 10(j) rules led to reintroductions. Further, the ESA documents available to the public describe only some of the factors that contributed to the success or failure of a reintroduction. For most reintroductions, we were still unable to come even close to fully understanding why it succeeded or failed. Better tracking and reporting of species status is the foundation for evidence-based conservation and should be a priority for the Services as they embark on the next 50 years of conservation under the ESA.

Figure 25: *A California condor, recovering from the brink of extinction, soars above Los Padres National Forest. Credit: USFWS Pacific Southwest.*

Endnotes

[1] Charles Thévenin, Maud Mouchet, Alexandre Robert, Christian Kerbiriou, & François Sarrazin, Reintroductions of birds and mammals involve evolutionarily distinct species at the regional scale. PNAS 115, 3404-3409 (2018). doi.org/10.1073/pnas.1714599115

[2] 16 U.S.C. § 1539(j)(2)(A).

[3] 50 CFR § 17.80(a); 50 CFR § 222.501(a).

[4] 50 CFR § 17.80(a); 50 CFR § 222.501(a).

[5] 50 CFR § 17.80(a); 50 CFR § 222.501(a).

[6] The Services may but are not required to designate critical habitat for essential experimental populations. 50 C.F.R. § 17.81(f).

[7] The other section 7 prohibition--destruction or adverse modification of critical habitat--does not apply to any experimental population because no such population can receive designated critical habitat, as discussed earlier.

[8] For more on the "wholly separate" requirement, see Cheever, Frederico (2001) "From Population Segregation to Species Zoning: The Evolution of Reintroduction Law under Section 10(j) of the Endangered Species Act," Wyoming Law Review: Vol. 1: No. 1, Article 8.

[9] 50 C.F.R. § 17.81(a).

[10] 50 C.F.R. § 222.502(a).

[11] FWS regulations use the term "current natural range" without defining it. When NMFS adopted its experimental population regulations in 2016, it concluded that "natural" could cause confusion and thus simply refers to "current range."

[12] See Karrigan Bork, Listed Species Reintroductions on Private Land—Limiting Landowner Liability under the Endangered Species Act, 30 STAN. ENVTL. L.J. 177, 199-200 (2011).

[13] Id. at 205.

[14] U.S. Fish and Wildlife Service Conservation Plans Reports, https://ecos.fws.gov/ecp/report/conservation-plans-type-region

[15] When referring to experimental populations throughout this paper, we only include populations covered by a section 10(j) rule.

[16] U.S. Fish and Wildlife Service, ECOS Species Search, ecos.fws.gov/ecp0/reports/ad-hoc-species-report-input

[17] U.S. Fish and Wildlife Service, Species with 10j Experimental Population Rules, ecos.fws.gov/ecp/report/species-tenj

[18] U.S. Fish and Wildlife Service, Final Rule to Designate the Whooping Cranes of the Rocky Mountains as Experimental Nonessential and to Remove Whooping Crane Critical Habitat Designations From Four Locations, 62 Fed. Reg. 38932, (1997).

[19] For experimental populations under the authority of NMFS, the Service uses a different RPN classification system, though still determined by the degree of threat and potential for recovery. For those species (steelhead and Chinook salmon), we converted the assigned RPN to one in the FWS system, using the appropriate taxonomic grouping for each.

[20] U.S. Fish and Wildlife Service, Endangered Species Act Document Library, https://www.fws.gov/endangered/esa-library/index.html

[21] U.S. Fish and Wildlife Service, Cumberlandian Combshell [*Epioblasma brevidens* (Lea, 1861)] 5-Year Review, (November 5, 2019).

[22] U.S. Fish and Wildlife Service Southeast Region Asheville Ecological Services Field Office, Cumberland Monkeyface (*Quadrula intermedia*) 5-Year Review, (February 26, 2021).

[23] U.S. Fish and Wildlife Service, Biological report for the grizzly bear (*Ursus arctos horribilis*) in the Lower-48 States, (January 31, 2021).

[24] Center for Biological Diversity, Petition for a Revised Reintroduction Rule for the Grizzly Bear in the Selway-Bitterroot Ecosystem, (December 18, 2014).

[25] Carlos L. Velado, The University of Montana, Grizzly Bear reintroduction to the Bitterroot ecosystem : perceptions of individuals with land-base occupations, (2005).

[26] Josephine C. Lesage, Daniel Press & Karen D. Holl, Lessons from the reintroduction of listed plant species in California. Biodivers Conserv 29, 3703–3716 (2020). doi.org/10.1007/s10531-020-02045-y

[27] U.S. Fish and Wildlife Service New Mexico Ecological Services Field Office, Northern Aplomado Falcon (*Falco femoralis septentrionalis*) 5-Year Review: Summary and Evaluation, (August 26, 2014).

[28] Ctr. for Biological Diversity v. Jewell, No. CV-15-00019-TUC-JGZ (l) (D. Ariz., 2018).

[29] U.S. Fish and Wildlife Service Department of the Interior Upper Colorado Basin Region 7, Species Status Assessment Report for the Colorado pikeminnow *Ptychocheilus lucius*, (March 2020).