

# Conservation-Reliant Species: Toward a Biology-Based Definition

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*The concept of conservation-reliant species has become increasingly prominent, particularly with species listed or under consideration for listing under the US Endangered Species Act (ESA). We have concerns about the trend toward what we see as an overly broad definition of conservation reliance. In addition to being of limited practical utility, overuse of the conservation reliant label can mask important legal and policy issues associated with species recovery and delisting. We propose a biology-based definition of conservation-reliant species—specifically, one based on the degree to which a species needs direct and ongoing human manipulation of its life cycle or environment in order to persist in the wild. This definition could assist managers in developing recovery priorities and allocating scarce recovery funds. In addition, a biological definition of conservation reliance could assist society and policymakers in considering whether the ESA's focus on self-sufficiency in the wild remains relevant as a definition of conservation success.*

*Keywords: conservation-reliant species, Endangered Species Act, listing, recovery*

**A**lthough it was coined only a few years ago (Scott et al. 2005), the term *conservation-reliant species* has quickly become prominent. Authors have applied this label to an extremely broad array of species (Scott et al. 2010), and a growing number of articles and a *BioScience* special section (Averill-Murray et al. 2012, Bocetti et al. 2012, Goble et al. 2012, Reed et al. 2012) have explored the implications of conservation reliance for restoring imperiled species, particularly in managing and recovering specific species protected under the US Endangered Species Act (ESA). The US Fish and Wildlife Service (USFWS), which, along with the National Marine Fisheries Service (NMFS), implements the ESA, has also begun to refer to select *endangered* species and *threatened* species as *conservation reliant* in discussing efforts to recover and delist these species. In an era characterized by ever-increasing threats to biodiversity, the notion of species characterized by a need for ongoing conservation efforts of indefinite duration seems to have struck a chord with increasing numbers of scientists and regulators alike.

The idea that some species may need long-term—perhaps perpetual—conservation efforts is useful in light of pervasive threats to biodiversity, such as invasive species; disruption of disturbance regimes important to maintaining biodiversity; and, of course, climate change. However, we believe that the definitions of conservation reliance in the scholarly literature to date cause confusion because they improperly mix legal and policy issues with what should be a biological concept. This failure to develop a definition of conservation-reliant species that describes species' biological rather than

legal status can lead to a variety of problems. Definitions of conservation reliance have become so overinclusive that they limit the concept's utility for prioritizing among potential conservation actions, as well as among the myriad species facing extinction. More important, many discussions of conservation-reliant species in scientific journals and in decisions by regulatory agencies do not contain clear and accurate explanations of how the concept of conservation reliance relates to the legal and policy aspects of listing and delisting decisions under the ESA. This void leads biologists and agencies alike to gloss over key legal issues involved in making these decisions and to overlook important policy choices involving society's vision of what species recovery means and what measures are necessary to protect these species from extinction.

We are convinced that at least some of the problems with the current definitions of *conservation-reliant species* stem from confusion about the legal aspects of adding and removing species from the ESA's *threatened* and *endangered* lists. We therefore explore how the law treats these issues, focusing especially on two important aspects: the degree to which the ESA emphasizes improving long-term management of imperiled species as a condition for delisting and the statute's requirement for species' self-sufficiency in the wild.

We then apply this information in order to propose a revised definition of *conservation-reliant species* that both clarifies the term and improves its utility for helping make conservation decisions. Our definition is grounded in conservation biology but is relevant to legal and policy decisions

about what it means to “recover” species and to remove them from the statute’s protected lists (or to avoid listing species as *threatened* or *endangered* in the first instance). We propose defining conservation reliance as a spectrum based on a species’ degree of self-sufficiency in the wild in the absence of human intervention—or, put conversely, the extent to which a species needs direct human intervention in its life cycle or environment (including its habitat and competitor and predator species) in order to persist at a secure level over time. Unlike some uses of *conservation reliance* to date, our approach is consistent with the ESA’s policy emphasis on self-sufficiency in the wild as a key aspect of species recovery under the statute.

We describe why this definition of *conservation-reliant species* is more accurate and more useful than previous definitions of the term. After reviewing the treatment of conservation-reliant species both in the literature and by the USFWS, we explain what we see as problems with current definitions of conservation reliance in light of important legal dimensions of recovery under the ESA. We then argue for reconceiving conservation reliance on the basis of the biology-based definition set forth above, which we feel can improve agencies’ efforts to set priorities and allocate resources in the recovery process and to better implement the ESA’s policy goal of restoring self-sufficient species in the wild. We end by exploring whether we should rethink the law’s current policy approach to recovering imperiled species in light of pervasive modern threats to their existence, our limited resources to address them, and the fact that some of these threats can probably only be managed rather than overcome.

### Development of the concept of conservation-reliant species

Box 1 provides previous definitions of *conservation reliance*. Doremus (2000, Doremus and Pagel 2001) was perhaps the first commentator to address conservation reliance. She suggested that some species may need to be listed under the ESA “forever,” citing threats from invasive species as something that is not likely to be remedied through regulation. Scott and colleagues (2005) first coined the phrase *conservation reliant* to refer to “species that can maintain a self-sustaining population in the wild only if ongoing management actions of proven effectiveness are implemented” (p. 386). Scott and colleagues (2010) later argued that conservation reliance is a “continuum encompassing different degrees of management” (p. 92), ranging from species that exist only in captivity; through those that require the release of captive-reared individuals; and, finally, to species that need only “periodic habitat management.” Goble and colleagues (2012) characterized *conservation-reliant species* as those facing threats that can be managed but cannot be eliminated. They also attempted to differentiate among species they deemed *conservation reliant*, arguing that some species rely on management actions to maintain their populations, whereas others depend on ongoing management

to stave off threats. Scott and colleagues (2005), as well as later authors (Averill-Murray et al. 2012, Bocetti et al. 2012), suggested that formalized species conservation strategies—termed *recovery management agreements* or *conservation management agreements*—should be put in place to protect conservation-reliant species over the long term and, therefore, to allow for delisting.

The relationship between species labeled by authors and agencies as *conservation reliant* and the ESA’s goal of recovering and ultimately delisting protected species has played a central role in the concept of conservation reliance, itself (box 2). Doremus (2000, Doremus and Pagel 2001) implicitly suggested that *conservation-reliant* species might never be able to be delisted, by arguing that some *threatened* or *endangered* species would never be able to be considered *recovered* and, therefore, delisted, because of the ongoing nature of the threats to those species. Although Scott and his coauthors (2005) did not contradict this idea, they left the door open to delisting species that they labeled *conservation reliant* by excluding from their definition of this term those species needing intensive human intervention to persist, citing as examples populations needing supplementation by captive-reared individuals (e.g., California condors and hatchery-reared salmon), manipulation of “large portions of a species population” (e.g., barging salmon smolts past dams to decrease mortality), and “frequent” translocations of individual species members to overcome anthropogenic dispersal barriers. Scott and colleagues (2005) reasoned that such species could not be considered *recovered* under the ESA and delisted because such measures are not consistent with the statute’s goal of conserving the ecosystems on which imperiled species depend.

Scott and his coauthors reconsidered this position a few years later, declaring that their previous work had “confused the concept of conservation reliant with the policy decision to delist a species” (Goble et al. 2012, p. 870). However, their refined description of *conservation reliant* still relies, at least to some degree, on a species’ listing status. Goble and colleagues (2012) asserted that, prior to their delisting, all *threatened* and *endangered* species are, by definition, *conservation reliant*. Goble and colleagues (2012) also maintain that species delisted as *recovered* should be considered *conservation reliant* if maintaining a recovered population requires “assurances that management will continue after delisting” (p. 870). Although this definition is not precise as to what constitutes ongoing “management” of listed species, it seems to abandon the authors’ position set forth in Scott and colleagues (2005) that *conservation-reliant* species do not include those requiring ongoing supplementation from captive populations, “frequent” translocation, or human manipulation of “large portions” of the population in order to sustain secure populations. Scott and colleagues (2005) had tied the exclusion of such species from those considered *conservation reliant* to the authors’ legal conclusion that delisting such species would be inconsistent with the ESA and, therefore, illegal, but Goble and colleagues (2012)

**Box 1. Definitions of conservation-reliant species.****Doremus (2000)**

“For most species, . . . the development of laws or regulations outside the ESA [Endangered Species Act] sufficient to protect the species against human impacts is a necessary prerequisite to delisting” (p. 11).

“Because state and federal laws other than the ESA provide little protection against either of the two primary threats, habitat destruction and exotic species, most listed species are likely to need the special protections of the ESA forever. Regulation does very little against the impacts of exotic species” (p. 23).

**Doremus and Pagel (2001)**

“Species faced with continuing threats will require continuing protection. Species not afforded that protection by background law will need the continuing protection of the ESA” (p. 1261).

We expect that the majority of currently listed species, both plants and animals, will need the protection of the ESA in perpetuity” (p. 1261).

**Scott and colleagues (2005)**

“[*Conservation-reliant* species are] species that can maintain a self-sustaining population in the wild only if ongoing management actions of proven effectiveness are implemented. A *self-sustaining* population should be able to remain stable or increase over time without human assistance to reproduction or dispersal in the wild. Although occasional translocations to maintain genetic diversity would not violate this notion of a self-sustaining population, frequent translocations to overcome anthropogenic dispersal barriers or to compensate for losses due to predation, disease, or other mortality factors would. . . .

“We would not consider species to be *conservation reliant* if they are dependent on releases of captive reared individuals . . . or manipulation of large portions of a species’ population rather than manipulation of its habitat. . . . Considering a species to be *recovered* on the basis of populations sustained only through captive propagation, removal from the wild, or artificial migration is inconsistent with the objective of the ESA to conserve ecosystems” (p. 386, italics added).

**Scott and colleagues (2010)**

“Conservation reliance is a continuum encompassing different degrees of management. It extends from species that occur only in captivity, through those that are maintained in the wild by releases from captive breeding programs and those that require continuous control of predators or human disturbance, to species needing only periodic habitat management. Although the intensity and frequency of management actions required varies among species at different points on this continuum, the common characteristic is that some form of management will be required, even after the biological recovery goals for a species have been achieved or exceeded, to prevent it from sliding back toward extinction” (p. 92).

**Goble and colleagues (2012)**

“On reflection, we now recognize that we confused the concept of *conservation reliant* with the policy decision to delist a species. By definition, all listed species are conservation reliant. The question is whether a species that has achieved recovery goals through management actions can be delisted as *recovered* without assurances that management will continue after delisting. If species-specific assurances are required, the species is conservation reliant” (p. 870).

**Averill-Murray and colleagues (2012)**

“Ongoing efforts to address the most important threats through the implementation of effective conservation actions and coordination at the landscape scale will be required to maintain self-sustaining populations in the long term and to prevent a recurrence of the threats that originally led to the species’ listing under the ESA” (p. 895).

asserted that the team made an effort to base its refined definition of conservation reliance on biological rather than legal factors.

Although Goble and colleagues (2012) sought to base their revised definition of conservation reliance on biological factors, in their new definition, they still attempted to distinguish *conservation-reliant* species from others on the basis of the type of regulations needed to protect a recovered

population. For example, Goble and colleagues (2012) reasoned that peregrine falcons are no longer *conservation reliant* after their delisting because “existing federal regulations. . . protect all birds used in falconry” (p. 870). Goble and colleagues (2012) also referenced *conservation-reliant* species as needing “species-specific” legal or management prescriptions, presumably distinguished from protections that are more widely applicable.

**Box 2. Conservation-reliant species and delisting.****Doremus (2000)**

“Delisting requires a finding that the threats to the species are sufficiently controlled that extinction is no longer likely. That, in turn, requires confidence that some mechanism other than the ESA will prevent activities that might cause extinction” (p. 29).

“Delisting should be understood as requiring the additional provision of regulatory security outside the ESA, such that the special regulatory protections of the ESA are no longer necessary” (p. 35).

**Doremus and Pagel (2001)**

“Delisting decisions must include careful attention to the extent of legal protection outside the ESA, which we refer to as *background law*. The regulatory protections of the ESA can be removed only if other mechanisms will protect the species against a recurrence of the threats that led to its placement on the protected list” (p. 1259, italics added).

“Delisting will always be infrequent and therefore will never mollify the law’s critics” (p. 1267).

**Scott and colleagues (2005)**

“The conservation-reliant species concept can assist in recovery by allowing a species whose population has stabilized at or above its recovery goals to be delisted, even though the threats to its existence can only be successfully mitigated rather than eliminated by ongoing conservation management” (p. 387).

**Scott and colleagues (2010)**

“For recovery to be lasting, recovery plans should also include an evaluation of the threats that are likely to continue when recovery goals have been met. The management actions necessary to ameliorate these long-term threats should be incorporated into recovery plans at the outset” (p. 95).

**Goble and colleagues (2012)**

See box 1.

“We need a tool kit of management structures that will facilitate the transition from listed to delisted” (p. 871).

**Bocetti and colleagues (2012)**

“Because the ESA provides or motivates the management tools needed to maintain the species, the threats to that species will return without an alternative plan to sustain the species after delisting. The difficulty therefore lies in crafting a regulatory mechanism to adequately replace the ESA after delisting and to provide the needed species-specific conservation management. We suggest that a [conservation management agreement] could serve as this mechanism” (p. 875).

At least in the few times it has employed the term, the USFWS has used the concept of conservation reliance specifically to support delisting species that require ongoing direct human intervention to maintain their populations at levels the agency deems *recovered* under the ESA. In its Wyoming gray wolf delisting proposal, the USFWS (2011) declared broadly that human intervention, such as translocation to maintain recovered populations, is necessary for *conservation-reliant* species and is “a well-accepted practice in dealing with population concerns” (p. 61816). Referring to delisting of the Yellowstone grizzly bear distinct population segment, the USFWS asserted that because of the species’ *conservation reliant* status, the agency planned to maintain a recovered grizzly population through active management, such as measures needed to limit mortality and protect bear habitat, and by maintaining genetic diversity through periodic artificial translocations (USFWS 2007a). Similarly, the recovery plan for the black-footed ferret suggests that the

species could be delisted as *recovered* even though translocations and regular augmentation from captive populations would be needed into the foreseeable future because of the continued impacts of sylvatic plague (USFWS 2013a). The agency also appears to contemplate delisting of species it deems *conservation reliant* because of a need for ongoing active management of habitat and other species. Labeling Kirtland’s warblers *conservation reliant* because the population will need ongoing habitat manipulation and control of parasitic cowbirds for the foreseeable future, the USFWS asserted that such conservation of the species “could be accomplished outside the purview of the Act” (p. 50)—that is, after the species is delisted (USFWS 2012a).

In summary, the concept of conservation-reliant species has evolved considerably over a relatively short time. As of this publication, the recent literature labels as *conservation reliant* all or at least an overwhelming majority of the species listed as *threatened* or *endangered* under the ESA.

The literature also labels as *conservation reliant* those species needing either active intervention or specific ongoing legal protections, excluding those found in existing state and federal laws, in order to maintain populations at levels considered biologically *recovered*. For *conservation-reliant* listed species, authors suggest that such protections can be in the form of recovery management agreements (Scott et al. 2005) or conservation management agreements (Bocetti et al. 2012) that set out enforceable and funded management plans to maintain the species and its habitat over time at recovered levels. Conservation strategy documents developed by the USFWS (e.g., USFWS 2007b) and conservation and management plans developed by state partners (e.g., MFWP 2006) would presumably also be included among such agreements. Conservation agreements designed to obviate the need to list a species under the ESA, which have been negotiated with increasingly frequency in recent years, would also appear to define their target species as *conservation reliant*.

Finally, leading proponents of the current conservation reliance concept appear to have reversed their previous view that species dependent on intensive human management—actions such as releases of captive-reared individuals and artificial migration—should not be classified as *conservation reliant* and should not be delisted (Goble et al. 2012). Although there are few agency pronouncements on the subject, the publications noted above indicate that the USFWS believes that it can delist species that require at least some active human intervention in order to maintain the genetic diversity of the target population, to reduce competitors, or to produce ecological conditions that approximate those produced by disturbance regimes that have been disrupted by human action.

### Problems with the current definitions of *conservation-reliant species*

We believe that definitions of *conservation-reliant species* in the current literature do more to create confusion than to provide a useful science-based tool for making decisions about species conservation. By inappropriately mixing biology with an inaccurate understanding of the law, the existing definitions encompass most or all species listed as *threatened* or *endangered*, as well as many other species of conservation concern, which makes the concept a less effective tool for setting recovery priorities among such species. In addition, overly inclusive definitions of *conservation-reliant species* can suggest or even justify recovery strategies and delisting decisions that are inconsistent with the ESA's focus on restoring species to the point at which they are self-sustaining in the wild.

Despite Goble and colleagues' (2012) professed effort to move toward a more biology-based definition of *conservation reliance*, the definition of this term in the literature remains tied to law in significant respects. Goble and colleagues (2012) emphasized the importance of the conservation reliance concept, in part, by pointing to Congress's "naïveté" in believing that existing federal and

state regulatory mechanisms would maintain secure populations of species that had recovered and been removed from the lists of *threatened* and *endangered* species. However, Goble and colleagues (2012) asserted that species such as the peregrine falcon are not *conservation reliant*, because the regulatory measures needed to protect the species after delisting are sufficiently general or were already in existence at the time the peregrine was first listed. Reed and colleagues (2012) also highlighted the relationship between conservation reliance and delisting, suggesting that the delisting of Hawaiian avifauna take place "within the context of conservation reliance" by putting in place plans for ongoing management interventions needed to improve the species' status to the point that they could be considered for delisting.

We think that these recent definitions of conservation reliance needlessly—and inaccurately—incorporate legal elements. It causes unnecessary confusion for scientists to coin a label for the need to improve existing laws and management for specific species in order to maintain secure postrecovery populations of these species. The ESA already incorporates this idea into the act's listing and delisting provisions. By requiring the USFWS and the NMFS to consider the "inadequacy of existing regulatory mechanisms" (16 U.S.C. 1533(a)(1)(D)) in deciding whether to list or delist a species, the ESA, itself, refutes the notion that Congress saw the recovery of *threatened* and *endangered* species as primarily a walk-away proposition—that is, that protections or ongoing management measures needed to maintain species after delisting would come through existing federal and state regulatory mechanisms rather than through conservation measures targeted at particular species. The requirement for an evaluation of regulatory sufficiency in listing and delisting decisions demonstrates that lawmakers were well aware that maintaining a recovered species' numbers and habitat over time and preventing human exploitation from again diminishing the species' numbers may require the creation of species-specific legal protections or management regimes over and above the status quo at the time a species was listed. Such protections can come from changes to federal, state, or local laws or through cooperative—but enforceable—means to implement additional protections and new management strategies (USFWS and NMFS 2003).

Therefore, the ESA itself contains a mechanism to encourage the modification of regulatory mechanisms that are inadequate to protect a species or its habitat at the time it is listed. Such changes to inadequate regulatory mechanisms are sometimes included as part of a specifically designed conservation strategy or an agreement between the USFWS (or the NMFS, for marine species) and a state or other partners to protect a species after delisting, as in the case of grizzly bears (USFWS 2007a, 2013b).

Alternatively, the relevant service may simply cite improvements in management aimed at a particular species in its determination that the species has recovered. For example, the USFWS (1980) noted the absence of state protections for Robbins' cinquefoil and its habitat and the difficulty

of enforcing US Forest Service restrictions on removing or damaging the plants in its decision to list the species as *endangered*. When delisting the species, the USFWS (2002) cited the development of specific measures by the US Forest Service to better protect the species and its habitat, including agreements for cooperation among the US Forest Service, the USFWS, and hiker groups to protect the species. Although Goble and colleagues (2012) and Scott and colleagues (2010) cited this delisting as an example of ongoing species-specific management that is a hallmark of conservation reliance, we see the ongoing measures to protect the cinquefoil as simply an essential part of the recovery and delisting scheme that Congress incorporated into the ESA itself.

The same holds true even for species at risk of extinction but not yet listed under the ESA. Responding to the wishes of states and a variety of stakeholders to avoid listings of various species, the USFWS and the NMFS have, in many instances, determined that the listing of a species was not warranted, significantly in part, because of new state or local laws, agreements, and conservation strategies designed specifically to improve ongoing protections for the particular species and its habitat (USFWS 2000, 2012b). In light of court decisions challenging such determinations, the USFWS and the NMFS's "Policy for the Evaluation of Conservation Efforts in Making Listing Decisions" (PECE Policy) requires the agencies to assess the likelihood that promised conservation actions will actually be implemented and the degree to which they are likely to be effective (USFWS and NMFS 2003). The USFWS and the NMFS have therefore used the ESA's consideration of the inadequacy of existing regulatory mechanisms to leverage enforceable and ongoing management commitments from federal agencies, states, and even private property owners to better protect species under consideration for listing. This has been occurring, and the USFWS and the NMFS have employed well-defined parameters in the PECE Policy to assess the adequacy of species-specific conservation measures when making listing decisions since well before the phrase *conservation reliance* was coined.

Improperly mixing science and law in describing the concept of conservation reliance can have important practical consequences. A term ostensibly based on science that duplicates existing legal requirements causes confusion; scientists have developed increasingly elaborate classification schemes (Goble et al. 2012) to describe what are ultimately legal decisions about listing and delisting under the ESA. An overly broad definition of conservation reliance that encompasses all or the vast majority of listed species also has little utility for differentiating among such species to develop sensible conservation priorities, supporting legal and policy discussions of what it means for a listed species to *recover*, or supplying managers and decisionmakers with any other useful information.

We are also skeptical of defining what should be a scientific term in part on the basis of murky distinctions between regulations on what species may need to achieve and what

constitutes the maintenance of a secure population or on the basis of the original date of those regulations. For example, Goble and colleagues (2012) asserted that peregrine falcons are no longer *conservation reliant* but acknowledge that the falcon's continued security relies in part on ongoing regulation of the take for migratory birds. However, these regulations apparently do not count for the purposes of deciding whether peregrines are *conservation reliant* because they were in effect before the species was listed or are not sufficiently species specific.

We submit that it makes little sense to define a term supposedly based on biology by attempting to make inexact distinctions among the programs and regulations needed to protect populations of a given species. Peregrines, for example, receive protections—as do most other birds native to the United States—under the 1918 Migratory Bird Treaty Act, but the USFWS enacted peregrine-specific limits on their use in falconry after the birds were delisted under the ESA. New site-specific restrictions on human activities at falcon-nesting sites are also common. In this light, are current take restrictions for peregrines new, old, or species specific? We think this question should be irrelevant to determining whether falcons are *conservation reliant*.

Finally—and perhaps most important—we are concerned that the USFWS and the NMFS are beginning to use the concept of conservation reliance to justify delisting decisions that are inconsistent with policy choices about recovery that are currently embedded in the ESA. As was noted above, the USFWS has referred to conservation reliance in connection with its efforts to label as *recovered* and delist species that still require what the agency calls *active management*—a term that the agency uses to describe direct and ongoing human manipulation of individuals in a target population (such as translocation to maintain genetic diversity) or of a species' environment (such as a control program for a competitor species). Goble and colleagues' (2012) most recent definition of *conservation-reliant species* also appears to include those dependent on such ongoing human interventions, which reverses the position taken by the team in an earlier paper (Scott et al. 2005) that such species should not be considered *conservation reliant*, because delisting them would not be consistent with the ESA.

We see this mixing of conservation reliance and delisting under the ESA as inappropriate because the law currently incorporates a policy that places emphasis on species' self-sufficiency in the wild as a hallmark of recovery and delisting under the ESA. The Wilderness Act of 1964, which defines the protected areas that it sets aside as "untrammelled by man, where man himself is a visitor who does not remain" (16 U.S.C. 1131c), initiated a remarkable dozen years during which Congress enacted most of the United States' major natural resource protection laws. Passed in 1973, the ESA also advances a preservation-oriented ethic characterized by a clear line between humans and the natural world. In the ESA's initial section setting forth the statute's purposes, Congress declared that the law aims to conserve both

*endangered* and *threatened* species and the ecosystems on which they depend. The statute defines *conserve* as including the use of all necessary methods to improve the condition of species and their ecosystems, including direct human interventions, such as habitat maintenance, live trapping, propagation, and translocation (16 U.S.C. 1532(3)). However, this same definition specifies that the ultimate goal for such conservation efforts is to improve species and ecosystems to the point at which such measures “are no longer necessary.” The ESA therefore sets out a clear line between listed and recovered species: The law allows for intensive human management in order to improve the state of listed species and their habitat, but the statute envisions that species that have recovered and can be delisted should exist in a state of natural self-sufficiency, without the need for the direct and ongoing human manipulation of individuals in the target species or of a species’ environment (i.e., actions that the USFWS has termed *active management*).

Other sources, including the USFWS itself, strongly support this reading of the ESA. The regulations for the implementing of the ESA define *recovery* as bringing species to the point at which they no longer need the protections of the ESA and stress the need to avoid adverse impacts on the species’ ability to persist in the wild (50 C.F.R. 402.02). The US Court of Appeals for the Ninth Circuit pointed to the ESA’s “Findings, purposes, and policy” section in explaining that “the purpose of the ESA is to promote populations that are self-sustaining without human interference” (*Trout Unlimited v. Lohn* 2009). The court also cited the statute’s legislative history as indicating that “the ESA is primarily focused on natural populations.” And apart from the service’s delisting discussions that reference conservation reliance, the USFWS has consistently stressed the statute’s intent to promote self-sustaining populations. The NMFS *Interim Endangered and Threatened Species Recovery Planning Guidance* document (2010) provides that recommendations in recovery plans are based on “ensuring self-sustaining populations in the wild” (p. 5.1-6), and the agency’s notices related to species recovery have for many years asserted that “the goal of this [recovery] process is the maintenance of secure, self-sustaining wild populations of species with the minimum investment of resources” (USFWS 1999, p. 46552). The USFWS has also emphasized in numerous listing and recovery plan decisions (e.g., USFWS 2013c) that recovery efforts are designed to “restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems” (p. 7886). For example, the USFWS (2013c) cited wolverines’ inability to disperse between core populations without human assistance as support for its proposal to list the species as *threatened*.

Because of the ESA’s present emphasis on self-sufficient populations in the wild, we suggest that a definition of *conservation-reliant species* should distinguish between species that merely need improved regulatory protections and those with populations needing direct and ongoing human manipulation of individuals or the environment of the target

species; otherwise, such a classification would have little utility in helping agencies and stakeholders understand when a species has recovered to the point that it can be removed from the ESA’s protected lists. The same holds true for assessing whether a species not currently listed as *threatened* or *endangered* is sufficiently secure not to need listing in the first instance. In the following section, we explore how an overly broad definition of *conservation reliance* can actually impede proper implementation of the law itself.

### Conservation reliance and practical consequences

Our concerns about current conceptions of conservation reliance go beyond scholarly debate. Because the ESA mandates that the USFWS and the NMFS make listing and delisting decisions solely on the basis of the best available science, concepts relating to biodiversity conservation that gain prominence in the scientific literature can influence real-world decisions with regard to implementing the ESA. In particular, we believe that confusion about the proper relationship between the biological concept of conservation reliance and determinations of which species need protection under the ESA leads the USFWS and the NMFS and stakeholders to give too little attention to the difficult legal and value decisions inherent in the listing and delisting process.

The USFWS’s use of *conservation reliance* in its proposal to delist gray wolves is one of several instances in which the agency has used conservation reliance in a manner that illustrates what we see as a principal danger of defining *conservation-reliant species* in a manner that improperly mixes law and science. In discussing postdelisting management of gray wolves in the northern Rocky Mountains, the USFWS noted that it plans to use assisted migration between possibly isolated wolf populations to the extent that such action is necessary to protect individual populations’ genetic diversity and, therefore, to maintain the wolves’ recovered status (USFWS 2011). Justifying its position that such measures are consistent with determining a species to be *recovered* and, therefore, removing it from the ESA’s protected lists, the USFWS (2011) reasoned that such “human intervention in maintaining recovered populations is necessary for many conservation-reliant species and a well-accepted practice in dealing with population concerns” (p. 61816). However, in our view, the service’s position confounds a question that should be one of science—*Are wolves a conservation-reliant species?*—with a question that requires legal and value judgments—*Is it acceptable to delist wolves as recovered even though they may require artificial translocation to maintain genetic diversity and, therefore, security from extinction?*

In other words, the definition of *conservation reliance* should not determine or even influence whether the ESA allows the delisting of species that require ongoing direct human intervention in order to maintain secure populations over time. Instead, this is initially a legal question that requires the interpretation of the vision for species conservation that lawmakers set forth in the ESA. And, because

Congress can always amend a statute, at a broader policy level, the question of how much human involvement is acceptable in managing *recovered* species ultimately involves determining the goals that we as a society wish to pursue in structuring our approach to conserving biodiversity. In our view, defining the circumstances and thresholds under which species may be removed from the ESA's protected lists requires value choices—choices that should not and indeed cannot be justified by references to conservation reliance.

We therefore support Goble and colleagues' (2012) suggestion that there is a need to decouple the concept of conservation-reliant species from the legal and policy choices inherent in making decisions about recovery, delisting, and listing under the ESA. As was noted above, however, the concept remains improperly entangled with the law in significant respects, which we feel impedes necessary legal and public policy discussions about how to best manage biological resources.

Returning to the example of gray wolves, proposals to delist wolf populations in the United States are always highly contentious, because a variety of economic and environmental interests have strong feelings about the species. These groups have very different perspectives on whether wolves can be delisted as *recovered* by relying on human translocations to facilitate genetic exchange between core populations or whether they can be deemed *recovered* and removed from the ESA's protected list only when managers have modified their land-use and wolf-management prescriptions in order to allow wolves to disperse between populations on their own through protected migratory corridors. Determining whether the ESA requires the USFWS to choose one over the other and which scenario makes the most sense for society presents difficult questions of law and policy. Answering such questions requires the USFWS to look closely at the ESA and to engage the public and stakeholders in a dialogue about how to manage the species. Furthermore, those who disagree with the service's ultimate resolution of this issue have an opportunity to test in court whether the USFWS's choice is consistent with the ESA, and those who still disagree with a decision that has been upheld in court are, of course, free to suggest that Congress amend the ESA to direct a different result. Although these processes may be messy, they are desirable in that they permit broad participation in the value-driven decisions involving how best to manage our biological resources. However, inaccurately casting the choice of how to best manage wolf dispersal as driven primarily by science—as occurred when the USFWS justified its Northern Rockies wolf delisting proposal by asserting that the ongoing artificial translocation of wolves is “well accepted” by the scientific community to maintain conservation-reliant species—effectively allows the USFWS to decide unilaterally what constitutes a *recovered* wolf distinct population segment under the guise of relying on the agency's technical expertise.

We propose two steps to avoid this negative outcome. The first is to emphasize that the biological term *conservation*

*reliance* is completely neutral on the legal and policy question of whether the USFWS and the NMFS may delist—or decide not to list in the first instance—species that depend on ongoing human interventions to maintain secure populations. Goble and colleagues (2012) explicitly attempted to clear up the team's previous confusion of conservation reliance with the law and policy of listing and delisting decisions, and we hope that the present article will also contribute to understanding the proper role for science and law in removing species from or adding them to the ESA's protected rolls.

Second, we suggest abandoning the definition of *conservation reliance* as described in previous scientific literature in favor of a clearer meaning based solely on biology. Crafting a biology-focused definition of the term that informs rather than justifies conservation choices made within the ESA's legal and policy framework will make the concept of conservation reliance far more useful to the USFWS and the NMFS in implementing the statute. Such a definition could also prove helpful to state regulators or governments of other countries in making decisions about species protection. In addition, a more focused definition of *conservation-reliant species* could assist policymakers and society in general as we consider how to best protect biodiversity from threats that are increasingly systemic rather than specific. We propose such a definition in the following section.

#### **A more functional definition of conservation reliance**

If we recognize that the concept of conservation reliance should be decoupled from listing and delisting decisions under the ESA, what practical benefits for conservation decisionmaking could the term provide? Goble and colleagues (2012) suggested that a species' degree of conservation reliance could help in developing sensible conservation priorities. Although we agree with this role for conservation reliance, the broad definition of this term in the current literature includes so many species that its ability to assist in prioritization efforts is modest at best. Moreover, it is unclear how to make distinctions among the many species that need additional regulatory measures in order to assign conservation priorities among these species. We therefore suggest eliminating any consideration of needed regulations, including any distinctions between general and species-specific regulations and whether regulations are existing or new, as a basis for defining conservation-reliant species. The term should be based on biology.

At the same time, we submit that conservation reliance should be relevant to implementing—as well as to discussions about potentially revising—society's value-based judgments for defining success in conserving biological diversity as reflected in the law. As was discussed above, the ESA currently emphasizes a species' self-sufficiency in the wild as a condition to determining that a *threatened* or *endangered* species has “recovered” sufficiently to allow for its delisting or that an unlisted species does not need the protections of the ESA. Because many similar laws and policies in states



and other countries also explicitly or implicitly set a similar goal of species recovery to self-sufficient populations, a science-based definition of *conservation-reliant species* that is nonetheless relevant to this policy goal may be useful even apart from decisions related to listing and delisting under the ESA.

Although scholars, agencies, and the public are generally supportive of the ESA's goal of species self-sufficiency in the wild (Doremus 1999), science now recognizes that attaining this benchmark may be difficult or impossible for some species, given threats that lawmakers did not conceive of 40 years ago. Threats to biodiversity stemming from climate change, pervasive exotic invasive species, and the disruption of important ecosystem processes and disturbance regimes often cannot be overcome simply by setting aside reserves, improving regulatory protections and management programs for species and their habitat, or similar means of promoting self-sustaining populations (Carroll et al. 2014). Rather, addressing such threats may demand continued direct human intervention in a species' life cycle, ongoing manipulation of its habitat, or control of other species—both to improve the current status of a target species and to ensure its persistence over time at a secure population level. If Congress were to revisit the law's present focus on species self-sufficiency, what role should human actions play in species conservation? A useful definition of *conservation reliance* should also provide information relevant to this question.

In light of the above considerations, we see not only an opportunity but a need for a term describing the degree to which the conservation of some species may not be able to fit the self-sufficiency paradigm still ensconced in the United States' key biodiversity conservation statute and in similar laws in other countries. We therefore propose to define *conservation reliance* as a spectrum representing the degree to which a species needs direct human intervention to manipulate individual members of that species at some point in their life cycle or the species needs direct human intervention in the form of ongoing physical or biological changes in its environment to persist in the wild.

The touchstone of this definition is biological self-sufficiency, not listing status or whether a population requires new or ongoing regulatory measures or conservation programs to maintain a secure population. The following thought experiment emphasizes the difference between our characterization of *conservation-reliant species* and definitions of the term based on a species' need for ongoing management: What would happen to a given species if all humans were to suddenly disappear from the planet? Some species labeled as *conservation reliant* by other authors because of their need of ongoing management—desert tortoises, for example—would have no barriers to population expansion and no unmet conservation needs, because the management needed by the species is primarily the regulation of human activities, such as direct take or habitat destruction by development. However, in the absence of humans, species

such as the northern spotted owl, the black-footed ferret, and Hawaiian songbirds would actually be in greater peril. Perhaps, these species' only hope of avoiding extinction lies in human intervention (sometimes termed *active management* by the USFWS) in the life cycle of individuals of the target species (e.g., continually augmenting the ferret population from captive populations to replace individuals lost to plague) or in ongoing physical or biological manipulation of the species' environment (e.g., continually controlling barred owls that outcompete their spotted-owl congeners).

Like the definition of *conservation reliance* in the literature to date, defining the term as we suggest results in a continuum, with the differences among *conservation-reliant* species determined by both the time and the social commitment to a species' self-sufficiency in the wild. Some species, such as the black-footed ferret and the *endangered* endemic birds in Hawaii, will probably need direct human intervention for centuries until they are able to evolve defenses to introduced pathogens and invasive competitors. Such species needing human intervention to persist over evolutionary timescales are *strongly conservation reliant*. On the other end of the spectrum, species such as the wolves in the Northern Rockies would, at present, be classified as only *weakly conservation reliant*. For such species, it is possible to eliminate the need for ongoing human intervention and still maintain secure populations by improving habitat protections in migratory corridors between the populations and restricting the take of individual animals in these areas. In the middle of the spectrum, it may be technically feasible to eliminate the human intervention needed to protect other species, but doing so would entail overcoming substantial physical and even legal barriers. Salmon runs whose restoration to self-sustaining populations would require the removal of dams that block or inhibit their migratory passage—which may require changes to the dams' authorizing legislation, as well as substantial decommissioning costs—serve as examples of *moderately conservation-reliant* species.

There are two important consequences of the spectrum of our version of *conservation-reliant species*. First, the USFWS and the NMFS could not delist any species classified as *conservation reliant*. This stems from the law itself; as was noted above, the ESA presently sets self-sufficiency in the wild as a standard for declaring a species legally *recovered* and therefore able to be delisted (or not at sufficient risk to need listing in the first instance). In addition, save for *strongly conservation-reliant* species that face threats with essentially no technical solution, human resource expenditures for specific conservation measures—and political willingness to actually carry out such measures—can directly influence the time frame over which species remain *conservation reliant*. For example, regulatory changes to protect habitat corridors and dispersing wolves could expeditiously obviate the need to physically transport individual wolves to maintain genetic diversity in the overall wolf population, which would make the wolves in the Northern Rockies no longer *conservation reliant*. The same holds true for dam

removal to benefit listed fish populations, although the resource expenditures and political resolve needed to take such action could be even greater than that needed to allow natural wolf dispersal.

Our biology-based, policy-relevant definition of *conservation reliance* as a species' dependence on ongoing direct human intervention can indeed assist in assigning conservation priorities. Under the current version of the ESA, the USFWS and the NMFS should protect species under the statute that need direct human intervention to stem their decline toward extinction but should avoid delisting *conservation-reliant* species, given the law's goal of recovered populations that are self-sufficient in the wild. This means that the USFWS is on the right track in moving to list wolverines, but the agency should not delist wolves and grizzlies in the Northern Rockies as *recovered* until managers succeed in restoring the natural connectivity between isolated populations needed to maintain these species' overall genetic diversity. The USFWS should also refrain from using conservation reliance as a supposedly scientific justification for delisting these species while they may still need human translocation to maintain genetic diversity.

A refined definition of *conservation reliance* also helps in deciding whether to reconsider the ESA's current emphasis on recovery of self-sufficient populations in the wild, particularly in light of threats to biodiversity that Congress did not foresee in 1973. Doremus (2000, Doremus and Pagel 2001) indicated that some species needing ongoing direct human management to persist would need ESA protections forever. However, Goble and colleagues (2012) raised some legitimate concerns about species that remain on protected rolls indefinitely. As the list of *strongly conservation-reliant* species grows because of climate change and similar pervasive threats, recognizing that *conservation reliance* describes a continuum of the degree of human intervention that a species requires will assist us in deciding whether we need to adjust our current policy that conservation success is the restoration of self-sufficient populations in the wild. Although we take no position on whether this is an appropriate course of action, society should make such a weighty choice deliberately and carefully, recognizing its enormous normative dimensions. A clearer, biology-based definition of *conservation reliance* can help facilitate such challenging discussions.

### Application of conservation reliance in decisionmaking

The example of the Kirtland's warbler illustrates the application of our definition of *conservation reliance*. Bocetti and colleagues (2012) described the need for ongoing human manipulation of the bird's habitat to compensate for the loss of the natural fire regime within the species' range. This species is, therefore, at least moderately *conservation reliant*. The return of a natural fire regime needed for a functional warbler habitat without human manipulation is within our technical capability, but acquiring sufficient habitat to restore natural fire regimes in northern Michigan would likely come

at a very substantial economic and political cost. As a consequence, rather than spending huge sums on habitat acquisition, it may make sense to continue much more modest expenditures on prescribed burning and to use other active forest management techniques that mimic the effects of fire. Considering a species' degree of conservation reliance in prioritizing expenditures of recovery funding could allow the diversion of recovery funds to species that are less *conservation reliant* and that have a greater chance of self-sufficiency in the wild. However, such a prioritization decision may also mean that—as Doremus (2000) predicted—warblers would remain on the ESA's lists forever, because they would never be self-sustaining in the wild.

The Kirtland's warbler—along with many other species—may also be *strongly conservation reliant* because of threats on its wintering grounds posed by climate change and sea-level rise. Although this may also require their indefinite listing under the ESA as the law now stands, perpetual listing of species with little or no likelihood of recovery in the foreseeable future can divert resources away from recovering more imperiled species and can involve a public perception challenge (Bocetti et al. 2012) for the ESA. Does this mean that it is time to revisit preservation-oriented goals set by Congress four decades ago, as society comes to grips with the scale and irrevocability of the changes that human beings have made to the biosphere? Should we rethink the ESA's fundamental goal of self-sustaining populations in the wild in favor of a more nuanced or modest notion of conservation success? Alternatively, perhaps the USFWS and the NMFS could make increased use of the *threatened* category, which allows flexibility in tailoring the ESA's protections, for *conservation-reliant* species whose status has stabilized in response to ongoing human interventions.

We believe that it is important for society and policymakers to consider these challenging questions. Doing so with a biology-based, policy-neutral definition of *conservation reliance* will not make these questions easier to answer, but it would avoid the confusion and policy biases inherent in recent formulations of the concept.

### Acknowledgments

This research was supported by a summer research grant from the Lewis and Clark Law School.

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