Evaluation and Recommendations for Use of Recovery Units   
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## Background

The vast majority of species listed under the U.S. Endangered Species Act (ESA) have not yet recovered. The threats facing these species are increasingly diverse, and the agencies responsible for their recovery are challenged with limited budgets that have not kept pace with the growing number of listed species. To help overcome this problem, conservationists must develop methods to improve the effectiveness of species recovery. The use of recovery units is an overlooked opportunity, one that can be easily implemented without amending the ESA or its regulations.

The two federal wildlife agencies responsible for implementing the ESA, the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS), have the discretion to designate recovery units for a species. Each unit is a subset of a species’ range that is essential to the species’ recovery—every unit must be recovered before the species can be recovered. Recovery actions and criteria may differ among recovery units, allowing for more targeted and flexible recovery planning. Because recovery units can be delineated according to many factors—genetic diversity, developmental stages, and ecosystem diversity—they can apply to a wide range of taxa.

Recovery units can enhance recovery in several respects, including by offering a species more protection from harmful activities. The Services may evaluate whether a federal actions may jeopardize the continued existence of a recovery unit, rather than an entire species. By focusing this analysis on a unit, the Services may be more likely to conclude jeopardy, as units are smaller than a species’ range and, thus, more likely to experience adverse effects as a whole. Units with a declining status may be especially vulnerable to jeopardy, while units that have exceeded their recovery targets may be extremely difficult to jeopardize. From this perspective, the use of recovery units can also increase the flexibility of ESA implementation by allowing the Services to alter the extent of section 7 protections based on the status of each unit. Units may even incentivize conservation by rewarding landowners who voluntary conserve a unit with less stringent section 7 measures.

Recovery units offer these and other benefits to ESA implementation, but whether federal agencies have taken advantage of these opportunities is largely unknown. We found no published empirical or qualitative analysis on recovery units, and even the number of species with units is unknown. Our analysis shows that only [31] out of 1364 species with recovery plans have recovery units, and 491 listed species do not have recovery plans finalized. The large number of species without units presents a practical and immediate opportunity to enhance species recovery without any changes to the ESA or its regulations.

## Proposed Project

The goal of this project is to determine whether recovery units have been used effectively in ESA implementation and to use the findings to identify opportunities to expand their use. To accomplish this goal, we will address the following objectives:

#### Objective 1: Quantify patterns of recovery unit designation.

**Q1:** How many recovery units exist, and what are their basic characteristics?

**Q2:** Are there factors that predict which species have recovery units?

#### Objective 2: Assess how recovery units are used in ESA implementation.

**Q3:** Do recovery plans explain how recovery units should be used?

**Q4:** Are recovery units explicitly considered during section 7 consultation?

**Q5:** Are recovery units explicitly considered in five-year status reviews?

**Q6:** Do recovery units lead to stronger conservation measures?

#### Objective 3: Estimate impacts on species recovery.

**Q7:** Do species with recovery units show greater improvement?

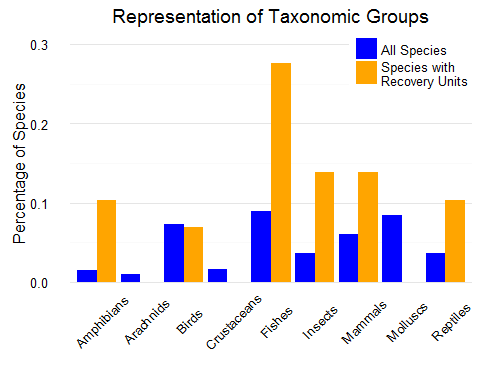
## Outcomes

This project will allow us to make specific policy recommendations to the Services on where recovery units should be designated, and how they can help recover species. The current backlog of listed species without recovery plans and the potential listing of hundreds of more species in the coming years provide many species to which these recommendations can apply.

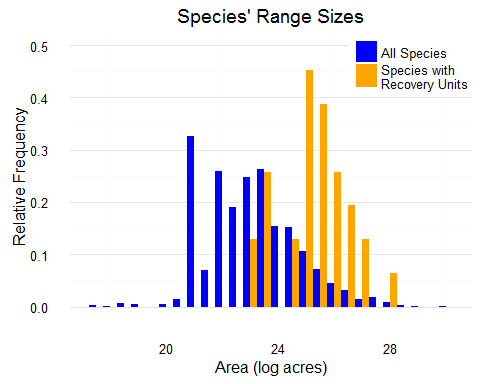
## Initial Analyses

We have conducted preliminary analyses addressing Objective 1 using the FWS online recovery plan database, and section 7 consultation data. These analyses compare the characteristics of all listed species with recovery plans (All Species, *n =* 1364) to the subset of those with recovery units designated (Species with Recovery Units, *n =* 31). The proposed analyses will ultimately include NMFS data.

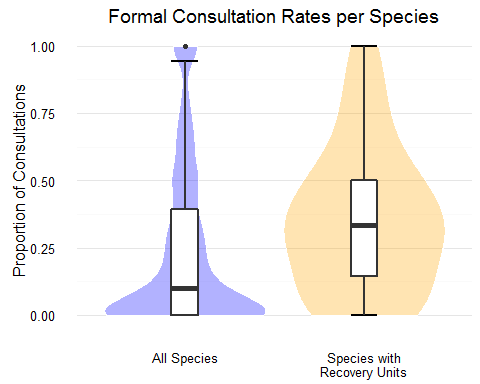
Use of recovery units appears to be biased towards specific taxa, both when plant species are (*X2* = 48.52, *df* = 9, *p* = 0) and are not considered (*X2* = 15.79, *df* = 8, *p* = 0.05). For example, only 9% of species with recovery plans are fishes, yet this taxon accounts for nearly 30% of plans with recovery units. In addition, amphibians, insects, mammals, and reptiles are overrepresented among species with recovery units (Fig. 1).

**Figure 1**. The distributions of all species with recovery plans (blue), and those with recovery units (orange) among taxonomic groups. Disproportionate use of recovery units for a taxon is indicated by discrepancies in bar heights within the taxon. Plants and lichens are not displayed.

Recovery units are also applied to species with larger ranges (*t32* = -9.63, *p* < 0.01), measured by the aggregate sizes of counties of occurrence for each species (Fig. 2). This may reflect greater need and/or evidence to designate geographic subsets among wide-ranging species.

 **Figure 2.** The distributions of the range sizes of all species with recovery plans (blue), and those species with recovery units (orange). Bar heights indicate the relative frequency of species with a given range size in each group.

The median rate of formal section 7 consultation (Fig. 3) was higher (*p* < 0.01) among species with recovery units (*x* = 0.33) than all species with recovery plans (*x* = 0.10). This may indicate that federal actions are more likely to trigger formal consultation when their effects are evaluated at the scale of recovery units. Alternatively, the services may designate recovery units for species that they anticipate will have a high rate of formal consultation.

**Figure 3.** Comparison of the proportion of section 7 consultations from 2008 – 2016 that were formal among all species with recovery plans (blue) and those with recovery units (orange). Box plots show the 5th, 25th, 50th, 75th, and 95th percentiles of the distribution of rates. Colored areas illustrate the shape of each distribution.