Exorcising ambiguity from the Endangered Species Act: critical habitat as an example

by Dennis D. Murphy and Barry R. Noon

The Endangered Species Act of 1973 has challenged scientists perhaps more than any other legislation. In response, the scope of wildlife biology has been redefined and expanded, adaptive management has evolved into a population recovery technique, population viability analysis and other problem solving methods are being developed, and the very definition of a biological species is being reexamined.

Yet, despite this and other significant scientific input, the Endangered Species Act remains couched in language that is, well, unscientific. Key terminology bearing on listing of candidates, enforcement of prohibitions, and recovery of species is best described as vague or abstract. The terms endanger, threaten, conserve, jeopardize, modify, recover, and a welter of others are so inadequately defined as to compromise the ability of the Act to function. In the face of imminent Congressional reauthorization, all definitions in and interpretations of the Act will receive increased scrutiny.

Few concepts in the Endangered Species Act will be as enveloped in the swirl of controversy as will that of "critical habitat." In April 1991 the U.S. Fish and Wildlife Service designated nearly 12 milIion acres in the Pacific Northwest as critical habitat for the northern spotted owl — an action that has immense implication for the economy of the region and is assured to provoke strong responses from adversaries of the Act.

We want not to weigh in here with an opinion on that specific issue, but to note that Section 50 CFR 424.12 defines critical habitat as landscape areas that provide space, resources, cover, and sites for breeding, and are "representative of the historic geographical and ecological distributions of the species." That sounds like plain old habitat to us. We suggest that habitat that is critical ought to be a subset of total habitat, a subset defined by special characteristics. Critical habitat must incorporate the quantifiable concept ofpopulation viability and ought to refer to habitat that, assuming certain risks, should provide for long-term species survival. That distinction is particularly relevant for species experiencing rapid losses of habitat — a situation that may force some individuals to occupy marginally suitabIe habitat areas.

The sum of the critical habitats for a target species shouId support stable or increasing populations. The relationship bctwecn birth and death rates offers a meaningful, measurable criterion by which habitats of varying quality may be differentiated. One justification for estimating the relationship between the habitat of a species and the demography of that species is the principle that animals respond to habitat variation in an "adaptive" fashion. Habitat, including critical habitat, serves as the templet for the evolution of ecological strategies. In this light, we hypothesize that the suitability of any given habitat (from the view of an individual organism) is based on proximal cues that are uItimateIy tied to survival and reproductive success.

Formalizing a "theory" of animal-habitat relationships in such an cvolutionaiy framework serves two main purposes. First, it allows direct connections to be made bctwecn natural history observations, population studies, and evoIutionary trends- thus it establishes an underlying basis and justification for modcls of the relationship between habitat variation and variation in dcmographic parameters (fitness components). Second, the theory aIIows predictive statements about the behavior of species. Such predictions can offer guidance to planners who may choose to manage habitats to influence birth and death rates. This implicit cause-and-effect relationship between habitat and demography is the foundation of the practice of wildlife management.

Predictive models are valuable because they lend themselves readily to tests of their validity. For example, by manipulation of certain habitat parameters, we can examine whether the demographic attributes of a population will change correspondingly. Such models of habitat selection, couched in an ecological and evolutionary perspective and explicitly incorporating demographic information, are easily translated into a statistical framework for purposes of hypothesis testing. Research and monitoring programs then may serve as ongoing "experiments" to allow differentiation among management options.

Quite unfortunately, there is no shortage of opportunities to study the adaptive responses of species to habitat change. Many wildlife populations are experiencing dramatic losses and fragmentation of their breeding, foraging, wintering, and migration areas. Ultimatcly, these habitat changes will be expressed as changes in the values and variances of birth and death rates — the vital rates that determine whether a population persists or declines. It is imperative to focus our conservation efforts on those habitats that provide for population stability and growth.

Defining salient concepts and terminology like critical habitat in terms of biologically measurable parameters is a necessary first step, but alone will not solve the problem of ambiguity in the language of the Act. More exacting definitions will require explicit, testable hypotheses folIowed by the necessary experiments. Toward this end, we look for biologists to play a more substantial role in the future in interpreting and implementing the Endangered Species Act.

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