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# Conservation of Covert Species: Protecting Species We Don't Even Know

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ABSTRACT: **Advances in molecular biology and morphometrics are resolving systematic relationships at an unprecedented rate. As new species are discovered or recognized, the conservation burden becomes greater, emphasizing the need for protecting biodiversity at the level of major landscapes and ecosystems that are obviously composed of many species, including those not recognized as present. "Covert" species are those that (1) are hidden by faulty taxonomy, (2) possess significant intraspecific genetic variation, (3) have sibling species with poorly known distributions, or (4) are undescribed. In at least one case, a reptile species almost became extinct because of faulty taxonomy. Some species of recently described turtles are facing significant threats to their long-term survival, but as yet have no legal conservation status. Sibling species and undescribed species present special challenges to conservation. We can no longer afford the luxury of single-species conservation programs, nor wait for unidentified species to be described formally. Regional conservation efforts emphasizing the protection of communities that encompass sensitive as well as non-endangered species, including covert species, provide a proactive alternative to the tradition of listing single species for protective status.**

Before we can conserve turtles on a large spatial scale, we must understand turtle ecology on a large spatial scale.
—Vincent Burke, 1992

Taxonomy is the foundation of traditional conservation and the underlying basis for quantification of biodiversity (Daugherty et al., 1990). Not only do we need to know how to identify an organism before it can be effectively protected (King and Braziatis, 1971), we also need to know how many distinct organisms (taxa) are in a given area before we can calculate the most basic measure of biodiversity: the number of taxa present. As Avise (1989) noted, "taxonomic assignments inevitably shape perceptions of biotic diversity, including recognition of endangered species." In this essay we discuss the relationship between taxonomy and conservation, and the consequences of failing to recognize the association.

Advances in morphometrics and molecular biology are resolving systematic relationships at an unprecedented rate. New morphometric techniques such as the Procrustes method (Rohlf and Slice, 1990) and thin plate spline analysis (Bookstein, 1989) allow us to resolve subtle differences in morphology between taxa. The use of molecular genetic markers has also given us new insight into the relationships of various taxa, challenging some established relationships and identifying new species. However, as molecular techniques have allowed us to look at finer levels of resolution (e.g., hypervariable regions of the genome), every subunit of a species (local population, family unit, individual) may prove to be distinguishable from all others. Clearly, we need to evaluate new data carefully (Avise, 1989, 1994).

As new species are discovered or recognized, the overall conservation burden increases, emphasizing the need for protecting biodiversity at the level of major landscapes and ecosystems that are obviously composed of many species, whether we recognize them or not. Unfortunately, there will always be species that are cryptic, or covert, in the sense that they (1) are hidden by faulty taxonomy, (2) possess significant intraspecific genetic variation, (3) have sibling species with poorly known distributions, or (4) are undescribed for reasons of being undiscovered or because descriptions have not been published. These species present special conservation challenges that will be reviewed in this paper. Our main objective is to illustrate the problems generated by single-species-oriented, taxonomy-driven conservation programs, with an emphasis on turtle conservation. Finally, we offer our recommendations for solutions.

### Changes in Turtle Taxonomy and Perceived Diversity

Although it is widely known that we live in an era of massive global extinctions (Gibbons, 1993), we also live in an era of incredible discovery, with many new species being cataloged daily (Erwin, 1988). The rate at which species are described can be illustrated even by using turtles—a small group of familiar organisms, often assumed to be well known—as an example. The order to which turtles belong includes approximately 260 species (Ernst and Barbour, 1989). However, our perception of turtle diversity has changed significantly over the last several decades. While the majority of turtle species were described during the last century (Figure 1), many discoveries have occurred recently. New turtle species are being described on a regular basis, and each has its own suite of problems related to survival.

In the United States and Canada, the number of recognized species of turtles has increased by 48% in less than 45 years (Figure 2). The number of subspecies has also increased. Changes in perceived global turtle diversity in just the period 1986–1993 included the naming of seven new genera, 14 new species, and 20 new subspecies (Iverson, 1992; including species described by Ernst and Lovich, 1990; Lovich and McCoy, 1992). Unfortunately, 25 of the 54 native turtle species (Ernst et al., 1994) in the United States are in need of conservation action (Lovich, 1995).

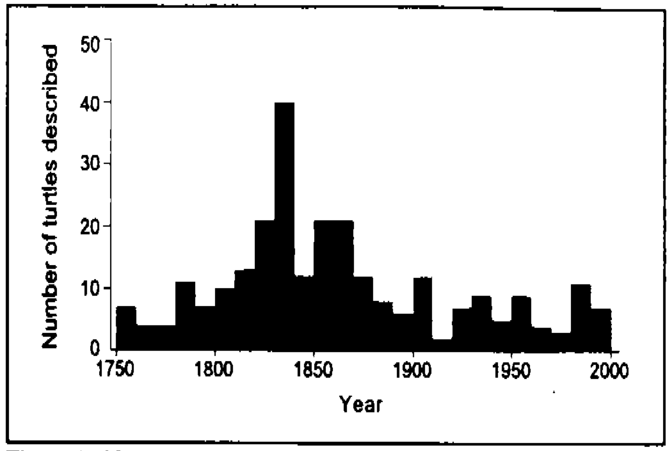


Figure 1. Number of turtle species described during five-year intervals. Dates for descriptions of taxa were taken from Iverson (1992) and updated with additional descriptions by Ernst and Lovich (1990) and Lovich and McCoy (1992).

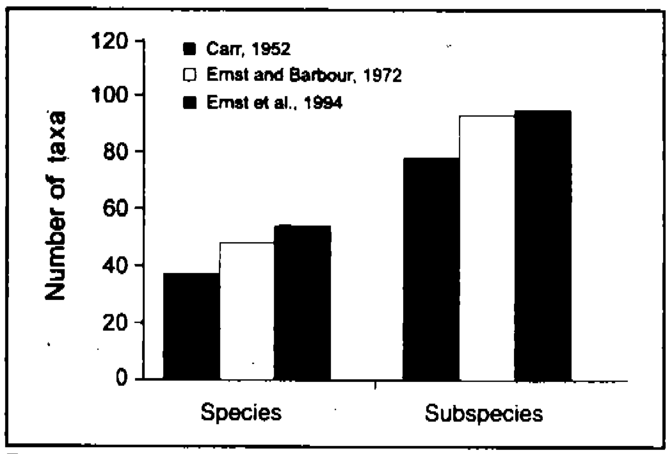


Figure 2. The number of turtle taxa in the United States as recognized in various references.

## Problems Associated with Taxonomy-driven Conservation

**Faulty taxonomy.** One of the worst mistakes we can make in our efforts to protect biodiversity is to allow the extinction of species because of a faulty taxonomy. The following examples show how the success or failure of conservation strategies often rests on the need for a solid taxonomic foundation. While recognizing the importance of good taxonomic research, we argue that single-species-oriented conservation programs may fail to adequately protect biodiversity because of faulty or fluid taxonomies and the presence of unrecognized species. Yet we also acknowledge that the public may rally around large, "flagship" species, and thereby set aside large areas of habitat that will also protect many small or unknown species.

Perhaps one of the best examples is provided by tuataras. Tuataras are an ancient lineage of reptiles almost universally recognized as containing a single species, *Sphenodon punctatus*. Conservation measures aimed at protecting the tuatara were based on the existence of the single species. However, in the 1800s taxonomists named two living and one extinct species. Subsequent research in this century proposed that the species *S. punctatus* comprised two subspecies (*S. p. punctatus* and *S. p. reischeki*). All of these taxonomic proposals were largely ignored until Daugherty et al. (1990) demonstrated significant morphological and genetic differentiation among living populations of this unique reptile. Their analysis provided strong support for recognition of two different species, *S. punctatus* and *S. guntheri*, and provisional recognition of the new subspecies of *S. punctatus*. One species, *S. guntheri*, is currently limited to one island with fewer than 300 individuals, while the subspecies *S. p. reischeki*, recorded only from Hauturu Island in Whangarei Bay, has not been seen in over a decade and is probably extinct. The failure to recognize documented taxonomic diversity of tuataras resulted in a lack of effort to prevent the extinction of a subspecies and the near extinction of a full species—a tragic loss of biodiversity.

Another example of a failure to recognize significant variation in what was originally described as a single wide-ranging species is shown by the Alabama map turtle, *Graptemys pulchra*. The species was originally described by Baur (1893) from specimens collected in the vicinity of Montgomery, Alabama. Subsequent workers extended the range of the species into several other drainage systems to the east and west of the Mobile Bay drainage system (Cagle, 1952). Detailed analysis of variation in *G. pulchra* (*sensu lato*) revealed that the "species" was actually composed of three taxa, *G. ernsti*, *G. gibbonsi*, and *G. pulchra*, that were separable on the basis of morphology, pattern, and mtDNA haplotypes (Lovich and McCoy, 1992). All three species are threatened by pollution and channelization (Lovich and McCoy, in press; McCoy and Lovich, in press a, in press b), and these threats are compounded by the restricted distributions of the individual taxa. As yet, no conservation plans exist for these species as they were formerly considered to be populations of a single widely distributed taxon.

It is important to note that faulty taxonomies can also lead to the protection of populations that show little evolutionary differentiation. Avise (1989) reviewed the case of the colonial pocket gopher, *Geomys colonus*, which was described as a species distinct from nearby populations of its congener *G. pinetis*. The species *G. colonus* was subsequently listed as a state protected species in Georgia. Later, molecular genetic surveys failed to demonstrate any consistent distinctions between nearby populations of the two congeners. Avise concluded that either the original species description of *G. colonus* was unwarranted, or that an original colony of true *G. colonus* had become extinct and was replaced by immigrants of *G. pinetis*. In this case, a faulty taxonomy resulted in an unwarranted listing and a loss of funding and resources that might otherwise have been directed toward a valid conservation need. A similar case of mistaken identity involves the dusky seaside sparrow, and the reader is referred to Avise (1989) for details.

**Unrecognized intraspecific variation.** A related situation is the failure to recognize significant genetic diversity within a species. A recent example is shown by data for the federally protected ("Threatened") desert tortoise, *Gopherus (Xerobates) agassizii*. This wide-ranging species occurs from southwestern Utah southward into California, Nevada, and Arizona in the United States, and into Sonora and Sinaloa states in Mexico. Recent work with mtDNA analysis has identified significant phylogeographic variation in the species (Lamb et al., 1989). Three haplotypes have been identified (some with several genetic variants) with a major break occurring at the Colorado River. Effective conservation of biodiversity requires protection of genetic diversity below the level of species. In recognition of this, the Recovery Plan for the federally "Threatened" Mojave metapopulation requires protection of the full spectrum of genetic variants (U.S. Fish and Wildlife Service, 1994).

**Sibling species.** Some species are "covert" in the sense that they are difficult to distinguish from other species (sibling species) that are sympatric. The difficulty in differentiating taxa results in poorly known distributions. For example, discrimination of the eastern mud turtle (*Kinosternon subrubrum*) and the striped mud turtle (*K. baurii*) north of Florida was long complicated by extensive character overlap. New techniques for differentiating the two species resulted in a dramatic range extension for *K. baurii*, which was formerly thought to live primarily in peninsular Florida. Recognition that *K. baurii* occurs as far north as Virginia is illustrative of the need to ensure adequate protection over large areas to protect sibling species. Details of the history of misidentification between these two species are provided by Lamb and Lovich (1990).

**Undescribed species.** In addition to the problems discussed previously, there will always be undescribed species. The lack of formal species descriptions can result for two primary reasons. First, a valid and distinctive species has gone undiscovered by science, a situation which, in all likelihood, will diminish each year, even in the tropics, and is especially true for many temperate regions. Secondly, some new species are known by individual investigators who have not published the formal descriptions. An example of this is the two color morphs of the dwarf salamander, *Eurycea quadridigitata*, in South Carolina. Although the two morphs have been suggested as representing two genetically distinct species (Gibbons and Semlitsch, 1991), a formal description is still forthcoming.

The plight of undescribed species is particularly acute given that as long as they are unrecognized they will have few champions for their protection, although we concede that many described but uncharismatic species also have few champions. Megadiversity areas in the tropics doubtless place many undescribed taxa, including turtles (Lovich, 1994), at great risk because of habitat destruction (Wilson, 1992). One basic solution for remedying the problem is the dedication of higher levels of funding to support alpha taxonomy. Another is not to rely on species identifications as the sole rationale for developing conservation programs.

**What Is the Alternative?**

The flux in our understanding of turtle taxonomy, and consequently diversity, underscores the need to move away from traditional single-species oriented conservation efforts. We can no longer afford the expensive luxury of single-species conservation programs, or wait for unidentified species to be described formally. Regional conservation efforts emphasizing the protection of sensitive as well as non-endangered species and communities provide a proactive alternative to the tradition of listing single species for protective status. Methods such as GAP analysis provide an objective technique for identifying target areas (Scott et al., 1993).

The difficulty of using a taxonomically based system for conservation is exemplified by Vane-Wright et al. (1991), who advocated a cladistic approach, or taxic weighting, in an effort to provide a systematic approach for evaluating the conservation merit of a species. In the title of their article they posed the question "What to protect?: Systematics and the agony of choice." One answer to their question is "protect habitat." Because habitat loss is the greatest threat facing most species (Mittermeier et al., 1992), habitat protection is one of the greatest conservation priorities. One of the recurring themes of the International Conference, "Conservation, Restoration, and Management of Tortoises and Turtles," was a reliance on "headstarting" threatened and endangered turtles. In addition to the warnings offered by Frazer (1992) regarding headstarting, it is important to emphasize that if you pay to raise a hatchling turtle for later release, at most you generate a turtle that may or may not live to reproduce. However, if you buy a hectare of land, you effectively preserve all species capable of surviving on that parcel. As Odum (1994) noted, "Much of the concern for biodiversity has focused on the species level even though it is self-evident that preservation of habitats is the key to conserving a diversity of species."

Thus, the only way to effectively conserve covert species, as defined in this essay, is to protect habitat. However, documenting that covert species are predominant in many habitats is a worthwhile research effort that can provide justification for broad-scale habitat protection. Ironically, we must promote habitat preservation in order to insure the preservation of covert species and genetic variants while simultaneously demonstrating that the presence of covert species is a frequent phenomenon.

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