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Short communication

The impact of taxonomic change on conservation: Does it kill, can it save, or is it just irrelevant?

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ABSTRACT

The important question of taxonomy and its impact on conservation efforts was brought to general attention by Robert May in 1990 with a *News and Views* article in *Nature* entitled "Taxonomy as destiny." Taxonomy, however, has built-in instabilities that result in name changes, raising the question of whether name changes have a consistent impact on conservation efforts. Our review investigates three possible outcomes of taxonomic change, namely a positive impact on protection efforts, a hampering impact, or no measurable impact. We address these cases with a review of the relevant literature: specifically, government and conservation agency reports, scientific papers, and the general press, as well as correspondence with biologists active in plant and animal conservation. We found no evidence of a consistent effect of taxonomic change on conservation, although splitting taxa may tend to increase protection, and name changes may have the least effect where they concern charismatic organisms.

1. Introduction

The important question of taxonomy and its impact on conservation efforts was brought to general attention by Robert May in 1990 with a *News and Views* article in *Nature* entitled "Taxonomy as destiny." May commented on how an iguana-like reptile, the Brother's Island tuatara (*Sphenodon guntheri*) off the coast of New Zealand, was not recognized as a distinct species from *Sphenodon punctatus* and had therefore been ignored by protective legislation. When genetic data became available, the island's endemic population was deemed sufficiently distinct to justify special protection of its gene pool (May, 1990). The cover of the *Nature* issue was entitled "Bad taxonomy can kill" to highlight May's point. Assigning the terms good and bad to taxonomic research (or the resulting taxonomies) introduced a value-laden framework to the issue. Nevertheless, numerous papers took up the idea that "bad" taxonomy can hinder conservation (Funk et al., 2002; Gittleman and Pimm, 1991; Khuroo et al., 2007; Mace, 2004; McNeely, 2002; Russello et al., 2005). However, none appear to have addressed the definition of good and bad taxonomy. Since there are no accepted criteria for judging what is "good" taxonomy, a pragmatic approach is to consider the most recently published taxonomy, which typically will include better sampling and more genetic data, as better than the previous (old, "bad") taxonomic treatment that is being replaced on the basis of the new data.

All conservation—indeed, almost all biology—is based on taxonomy, part of which involves the proper identification of organisms. Such identification usually involves a scientific name assigned to the entity of interest, commonly a species name. No universal criteria exist for assigning taxon ranks, such as species or subspecies, or for establishing boundaries among taxa, such as between species or genera. As a result, taxonomic stability is an elusive goal, a fact well understood by systematists (Dubois, 2007; Heywood and Davis, 1963). Besides the subjectivity of ranking and circumscription, there are at least three additional causes of taxonomic instability. These are the continually improved knowledge of phylogenetic relationships, which can lead to the transfer of species names between genera, at least under a Linnean system of nomenclature (De Queiroz and Gauthier, 1990). A second cause is an increased understanding of gene flow, which could lead to lumping or splitting of taxa, even if previous circumscriptions were done objectively. A third source is the recognition of nomenclatural errors made earlier, for example, concerning priority or homonymy. These sources of taxonomic instability reflect scientific progress. Instability, therefore, is an expected outcome of active taxonomic research. Given this continuous change in taxonomic naming and classifying of organisms, it is important to know whether new ("good") taxonomies tend to positively impact conservation efforts, as implied by May's commentary or whether taxonomic change has no consistent impact on conservation efforts.

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There have been several reviews that have analyzed the number of species moving on and off of local red lists as a result of changes in taxonomy. These changes were due mainly to the adoption of narrower or wider species concepts or to the correction of nomenclatural errors (Garnett et al., 2003; Lozano et al., 2007). However, changes in status on endangered species lists often do not equate to changes in conservation efforts. In this study, we therefore focus instead on cases where taxonomic change had a direct effect on conservation funding or efforts towards monitoring and research. This may have biased us towards finding positive or negative effects, rather than no impact (see Section 4). The specific question we wanted to answer was: Are the effects of "improved" (new) taxonomies on conservation efforts consistent and hence predictable? Although our review is limited by its qualitative nature, consisting of a number of case studies, it includes a broad range of clades, from several countries, classified under a variety of conservation laws and systems. To our knowledge, this is the first attempt to objectively focus on the practical effects of taxonomic instability on conservation efforts.

2. Methods

2.1. Survey for information

We searched for species or populations on lists of threatened or endangered species whose protection had changed due to changes in taxonomic rank or circumscription. Change in protection was defined and categorized as described below. At the global level, the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species (IUCN Red List; www.iucnredlist.org) and the species listed in the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) were consulted. To determine changes in conservation status at regional or local levels and/or country legislation for protected species, we searched the following databases: US Fish & Wildlife Service (USFWS), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Species at Risk Act Registry (SARA) of Canada, the Joint Nature Conservation Committee (JNCC) of the United Kingdom, Bayerisches Landesamt für Umwelt (Bavaria State Environmental Agency, Germany), The British Columbia Conservation Data Centre (CDC) and the Missouri Species and Communities of Conservation Concern Checklist. We also looked for information in the World Wildlife Fund, the Nature Server and the Xerces Society for Invertebrate Conservation, given that these organizations are currently dealing with endangered species conservation programs. We surveyed journals focusing on conservation (*Biodiversity and Conservation*, *Biological Conservation*, *Conservation Biology*, *Conservation Genetics*, *Journal for Nature Conservation*), general journals that report on conservation (e.g., *Nature*), and we searched the databases Science Direct, Blackwell-Synergy, JSTOR and Biomed Central using the search terms "conservation status change," "taxonomic status change," and "propose change conservation," among others. Finally, we contacted experts from different branches and organizations concerned with nature conservation.

2.2. Impact of taxonomic change on conservation

Based on our initial findings and incorporating the terminology used in the 1990 *Nature* issue, we have separated our cases into three categories: (1) *taxonomy protects*, when the change had a positive effect on the conservation, for example, via increased efforts in monitoring programs; (2) *taxonomy is irrelevant*, when the change of rank or circumscription did not have any impact on the conservation status or efforts in conservation programs; and (3) *taxonomy kills*, when a taxonomic revision led to the decrease or discontinuation of conservation programs being carried out. A change in protection (conservation) was defined as increased or decreased monitoring of any kind, as well as increased or decreased funding for research on the respective organism.

3. Results

3.1. Taxonomy protects

We found numerous examples where a change in taxonomy led to increased efforts in conservation, in groups as diverse as plants, birds, frogs, dolphins, and giraffes. One example is the Chiricahua leopard frog (*Rana chiricahuensis*), whose current range is restricted to eastern Arizona in the United States (Table 1). This species was originally assigned to *Rana pipiens*, but was subsequently split into over two dozen species (Hillis, 1988), one being the Chiricahua leopard frog (Platz and Mecham, 1979). Because of the rapid extirpation of this frog from its historical range (Clarkson and Rorabaugh, 1989), the Chiricahua leopard frog was listed as threatened in 2002 under the Endangered Species Act of 1973 (ESA), whereas *R. pipiens* enjoys no special conservation status (Humphrey and Fox, 2002; Rorabaugh, 2002). In response to the listing, the Malpai Borderlands Group was formed (Glick, 2005), which is a group of private landowners and over 12 public institutions that has thus far protected over 30,350 ha of private land in the form of conservation easements.

A plant example where taxonomic change (i.e., new taxonomy, not necessarily a taxonomy arrived at by majority consensus) has led to increased protection is in the mountain ash (*Sorbus*) of central Europe. Recently, over 20 new species were described in this formerly poorly documented genus (Meyer et al., 2005; but see Aldasoro et al., 2004). All 20 are now found on the Bavarian Red List of Vascular Plants, with subsequent support for their conservation coming from the Bayerische Landesamt für Umweltschutz, the Naturpark Fränkische Schweiz, the foundation Schöpfung Bewahren Konkret, and other nature protection organizations, including several volunteer and benefactor agencies (Scheuerer and Ahlmer, 2003).

Similarly, conservation of the Ozark spring beauty (*Claytonia ozarkensis*) was beneficially affected by a taxonomic name change. This herb occurs sympatrically with congenerics in Arkansas, Missouri and Oklahoma. Specimens had been misidentified as *Claytonia virginica* or *Claytonia caroliniana* until a complete taxonomic revision of the genus resulted in the description of the new, previously overlooked species *C. ozarkensis* in 2006. This discovery triggered immediate protection efforts (Missouri Natural Heritage Program, 2009) due to the rarity of *C. ozarkensis*, which consists of only a dozen populations (G. Yatskievych, Missouri Botanical Garden, St. Louis, personal communication, 2008).

Another example of new taxonomy leading to increased conservation efforts is that of the California gnatcatcher, *Polioptila californica*. The California gnatcatcher was originally recognized as a species in 1881, but was lumped back with the black-tailed gnatcatcher (*Polioptila melanura*) half a century later because of similarities in plumage coloring (Grinnell, 1926). It was re-split from the black-tailed gnatcatcher in 1989, on the basis of distinctive song and morphology (Atwood, 1988; later confirmed by molecular studies; Zink et al., 2000). After recognition of its species status, the California gnatcatcher received greater habitat protection (from encroaching development) and better monitoring programs (Zink et al., 2000), in a variety of national and state parks (Atwood and Bontrager, 2001). As in the case of the Chiricahua leopard frog, the species from which the California gnatcatcher was split receives no special attention. Taxonomic research revealed the narrow geographic range of these species, bringing to light the need to protect them and this need was acted upon with increased conservation efforts.