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Short communication

Amphibian conservation: Are we on the right track?

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ABSTRACT

Amphibian declines and extinctions are a worldwide concern. Conservation priorities for amphibians should target threatened taxa (taxonomic targets) and regions with high levels of species endemism (geographical targets). Does published research on amphibian conservation reflect the global taxonomic and geographic priorities? I surveyed six years (2000–2005) of 10 conservation and herpetological journals (*Amphibia–Reptilia*, *Animal Conservation*, *Applied Herpetology*, *Biodiversity and Conservation*, *Biological Conservation*, *Conservation Biology*, *Copeia*, *Herpetologica*, *Journal of Herpetology and Oryx*), and analyzed all articles on amphibians. Attention indexes were calculated for orders, threatened species and biogeographic realms. I also examined how well research from tropical developing nations (with high levels of richness and endemism) are represented in the international literature. Attention indexes results show that the most studied amphibian order is Caudata, whereas Gymnophiona is the least studied one. The same trend is observed for threatened species, with threatened Caudata species receiving proportionally more attention than threatened Anura and Gymnophiona. The biogeographic realms that receive most attention by amphibian conservationists are: Oceania, Nearctic and Palearctic. However, the Neotropical, Afrotropical and Indomalayan are the regions with higher species diversity. Forty-one countries contributed articles, but the majority of amphibian conservation research is conducted by North American and western European researchers. There is urgent need for capacity building in tropical developing nations. Amphibians are more threatened and are declining more rapidly than either birds or mammals. However, amphibian conservation is still misplacing its focus in lower-biodiversity regions and non-threatened species. If such trends are not changed, the consequences for the persistence of amphibians worldwide may be dire.

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1. Introduction

Global biodiversity loss is currently a major international concern, with some estimates suggesting that the present rate of

extinction is between 1000 and 10,000 times greater than the natural background rate (Pimm and Brooks, 1997; Baillie et al., 2004). Amphibian populations are declining throughout the world (Wake, 1991; Alford and Richards, 1999; Houlahan

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et al., 2000; Blaustein and Kiesecker, 2002; Stuart et al., 2004). Habitat loss, exotic species and over-harvesting are the best-documented causes of such declines (Alford and Richards, 1999; Stuart et al., 2004). However, amphibian declines and extinctions have been documented in many areas not obviously affected by habitat loss or other threats (Laurance et al., 1996; Pounds et al., 1997; Lips, 1998, 1999; Wake, 1998; Pounds, 2001). The mechanisms underlying amphibian declines are complex, and several causal factors are probably involved (Alford and Richards, 1999; Blaustein and Kiesecker, 2002; Stuart et al., 2004). Hypothesized causes include: habitat loss and modification, introductions of non-indigenous species (Kats and Ferrer, 2003), over-harvesting, UV-B radiation, chemical contaminants (Blaustein et al., 2003), emerging infectious diseases (Daszak et al., 2003) and climate change (Carey and Alexander, 2003).

More than 1800 amphibian species are globally listed as threatened, 34 as extinct and one as extinct in the wild (IUCN, 2007). Although many declines are due to habitat loss and exploitation, unidentified processes threaten 48% of rapidly declining species (Stuart et al., 2004) and such gap in knowledge seriously impairs our capacity to devise conservation actions to reverse such trends. The level of threat to amphibians is undoubtedly underestimated because 1294 species (22.5%) are too poorly known to be assessed and are listed as data deficient (DD) (IUCN, 2007). According to the Global Amphibian Assessment (IUCN et al., 2006), the number of species that are not listed officially as extinct because exhaustive surveys are still needed to establish their disappearance, but that can no longer be found and are listed as possibly extinct, also raises concern (122 species), meaning that the number of extinct amphibians may in fact be much higher than presently recognized.

My objective is to assess if conservation herpetologists give proper attention to amphibians, taking into account the most threatened amphibian orders, the most important areas for global amphibian diversity, and providing a picture of where in the world most of amphibian conservation research is done.

2. Materials and methods

I surveyed six years (2000–2005) of amphibian conservation articles, published in five international conservation journals (Animal Conservation, Biodiversity and Conservation, Biological Conservation, Conservation Biology and Oryx) and in five international herpetological journals (Amphibia-Reptilia, Applied Herpetology, Copeia, Herpetologica and Journal of Herpetology) and analyzed all contributed papers clearly dealing with amphibians. Articles were categorized by order when possible. Threatened species were those considered as critically endangered (CR), endangered (EN), and vulnerable (VU) by IUCN (2007). A taxonomic attention index (AI_{taxon}) was obtained for orders, dividing the number of papers for each order by the number of species of the same order, providing a general picture of attention to orders. A threat attention index (AI_{threat}) was obtained dividing the number of articles dedicated to threatened species by the number of threatened species in each order. A biogeographic attention index (AI_{biogeog}) was also calculated for biogeographic realms,

by dividing the number of papers for each biogeographic realm by the number of species found within that region. I also examined how well research from developing nations and their scientists were represented in the international amphibian conservation literature. The motivation for this stemmed from the hypothesis that widely available conservation literature is biased towards regions of the world that are more affluent but of lower conservation concern, and that scientists conducting research in lower-income countries are often from richer nations. To evaluate this, I collected information on where the study was conducted (see AI_{biogeog} above) and the country of affiliation of the authors of each article.

The availability, through peer-reviewed journals, of relevant information on taxonomy, biology, population status, threats and protection measures proposed or achieved, is an important component for the recovery strategy for a threatened species. An analysis of international conservation and herpetological journals in the last years can offer an indirect index of attention for amphibians by conservation herpetologists. The journals considered admittedly represent only a fraction of the existing conservation literature on the topic. Amphibian conservation articles are also published in other journals in related fields (e.g. ecology, genetics and wildlife management) and regional journals. The nine journals considered are truly international in scope and subjects and offer considerable guarantee on the quality of the papers published. Therefore, they are a good sample of the current research on amphibian conservation.

3. Results

A total of 242 articles focusing on amphibian conservation were found in the time period analyzed. However, a considerable portion of them focus on higher-level approaches (e.g. studying patterns of vertebrate diversity) than addressing species-specific or order-specific issues for amphibian conservation (Table 1).

The AI_{taxon} shows that Caudata is the order that receives most attention by conservation herpetologists whereas Gymnophiona is the least studied one (Table 1). In general, values for AI_{taxon} were small, mainly due to the relatively small number of published articles compared to the total number of species in each order. The trend is the same for threatened species, with AI_{threat} being higher for Caudata and lower for Gymnophiona (Table 1), but with values being even smaller. A comparison between $AI_{\text{non-threat}}$ (obtained dividing the number of articles dedicated to non-threatened species by the number of non-threatened species in each order) and AI_{threat} also shows that most of the published research in amphibians focuses on non-threatened species ($AI_{\text{non-threat}} > AI_{\text{threat}}$) (Table 1), and Caudata, is the amphibian order that has the largest discrepancy between total number of articles and articles dedicated to threatened species. Even though Gymnophiona has the smallest absolute number of species (both total and threatened), it is important to notice that it had only one single article dedicated to it, and not even one threatened Gymnophiona was graced with a conservation study in the last 5 years ($AI_{\text{threat}} = 0$).

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