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ABSTRACT

Effective and targeted conservation action requires detailed information about species, their distribution, systematics and ecology as well as the distribution of threat processes which affect them. Knowledge of reptilian diversity remains surprisingly disparate, and innovative means of gaining rapid insight into the status of reptiles are needed in order to highlight urgent conservation cases and inform environmental policy with appropriate biodiversity information in a timely manner. We present the first ever global analysis of extinction risk in reptiles, based on a random representative sample of 1500 species (16% of all currently known species). To our knowledge, our results provide the first analysis of the global conservation status and distribution patterns of reptiles and the threats affecting them, highlighting conservation priorities and knowledge gaps which need to be addressed urgently to ensure the continued survival of the world's reptiles. Nearly one in five reptilian species are threatened with extinction, with another one in five species classed as Data Deficient. The proportion of threatened reptile species is highest in freshwater environments, tropical regions and on oceanic islands, while data deficiency was highest in tropical areas, such as Central Africa and Southeast Asia, and among fossorial reptiles. Our results emphasise the need for research attention to be focussed on tropical areas which are experiencing the most dramatic rates of habitat loss, on fossorial reptiles for which there is a chronic lack of data, and on certain taxa such as snakes for which extinction risk may currently be underestimated due to lack of population information. Conservation actions specifically need to mitigate the effects of human-induced habitat loss and harvesting, which are the predominant threats to reptiles.

1. Introduction

Reptiles[1] and their immediate diapsid ancestors have had a long and complex evolutionary history, having first appeared on the planet in the late Palaeozoic Era, more than 250 million years ago (based on molecular phylogeny estimates and early fossil records: e.g., Hedges and Poling, 1999; Reisz et al., 2011; van Tuinen and Hadly, 2004). High rates of cladogenesis in the Triassic and Jurassic periods (Vidal and Hedges, 2009) produced a diverse group of animals adapted to almost every temperate, tropical and desert environment, and to terrestrial, freshwater and marine habitats. Reptiles play important roles in natural systems, as predators, prey, grazers, seed dispersers and commensal species; they serve as bioindicators for environmental health, and their often specific microhabitat associations provide the ideal study system to illustrate the biological and evolutionary processes underlying speciation (Raxworthy et al., 2008; Read, 1998). Reptiles generally have narrower distributional ranges than other vertebrates such as birds and mammals (Anderson, 1984; Anderson and Marcus, 1992), making them more susceptible to threat processes; however, it should be noted that there is some marked variation in range size between different clades of reptiles, so that generalisations and comparisons may not hold true universally [e.g., range sizes of snakes are generally larger than those of lizards (Anderson and Marcus, 1992)]. This combination of often small range and narrow niche requirements makes reptiles susceptible to anthropogenic threat processes, and they are therefore a group of conservation concern. Regional assessments in Europe (Cox and Temple, 2009) and southern Africa (South Africa, Lesotho and Swaziland; Bates et al., in press) indicate that one-fifth and one-tenth of reptilian species respectively are threatened with extinction. It has also been proposed that reptilian declines are similar in taxonomic breadth, geographic scope and severity to those currently observed in amphibians (Gibbons et al., 2000), although this claim was not quantitatively assessed by the authors. Reptilian declines have been attributed to habitat loss and degradation, as well as unsustainable trade, invasive species, pollution, disease and climate change (Cox and Temple, 2009; Gibbons et al., 2000; Todd et al., 2010).

A total of 9,084 species of reptiles have been described so far (Uetz, 2010), and new molecular evidence continues to unearth numerous cryptic species that had not previously been detected by morphological analyses (e.g., Adalsteinsson et al., 2009; Nagy et al., 2012; Oliver et al., 2009). Yet as a group, reptiles are currently poorly-represented on the IUCN Red List of Threatened Species, with only 35% of described species evaluated, and those that are evaluated were done so in a non-systematic manner (IUCN, 2011a). Although the Global Reptile Assessment (GRA) will in the long run address this bias, the current assessment process relies on regional workshops and the formation of IUCN SSC Specialist Groups for specific reptilian taxa, which introduces geographical as well as taxonomic bias into the analysis. Specifically, the Global Reptile Assessment has carried out comprehensive assessments for North America, Madagascar and New Caledonia, with complete endemic-only assessments having been carried out in the Philippines, Europe and selected island groups (Seychelles, Comoros and Socotra). As a result, there are still large geographical gaps which are only slowly being addressed, namely in Africa, Latin America, Asia and Australia. This limits our understanding of how threat processes affect reptiles, so that these taxa are often overlooked in conservation decisions, specifically because the geographical, taxonomic and threatened species bias still inherent in the current IUCN Red List for reptiles makes taking conservation decisions impractical.

We present the results of the first assessment of extinction risk in a randomly selected, representative and global sample of 1500 reptiles, as a shortcut for deriving group patterns on which to base sound global conservation action. We produce the first global species- and threatened species-richness maps for reptiles. The results highlight key regions, taxa and anthropogenic threat processes which need to be urgently targeted to effectively conserve the world's reptiles.

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[1] Here considered to include the various taxa that belong to the non-avian and non-mammalian amniotes: Crocodylia, Testudines and Lepidosauria (snakes, lizards, amphisbaenians, tuataras).