



BROADENING THE COVERAGE OF BIODIVERSITY ASSESSMENTS

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The IUCN Red List of Threatened Species™



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Cover photo: *The Spiny Flanked Chameleon* *Chamaeleo laterispinis* (*Vulnerable*) is endemic to the Udzungwa region of the Eastern Arc Mountains in Tanzania. It is threatened by habitat degradation and loss, as less than a quarter of the original forest cover remains in Udzungwa, predominantly due to conversion for agriculture. This chameleon is also in decline because it is collected from the wild for the international pet trade.

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Broadening the coverage of biodiversity assessments

Ben Collen, Mala Ram, Nadia Dewhurst, Viola Clausnitzer, Vincent Kalkman, Neil Cumberlidge, Jonathan E. M. Baillie

While species coverage in The IUCN Red List of Threatened Species™ (herein 'The IUCN Red List') has increased in number each year since the inception of the Red Data Book in the 1960s, assessments have in general been restricted to the better known taxonomic groups. The number of described species still lags a long way behind the estimated global total species richness; even describing biodiversity remains a significant challenge, and so defining its status is larger still (Hilton-Taylor *et al.* 2008; Vié *et al.* 2008). However, a new initiative is being employed to broaden the taxonomic coverage of The IUCN Red List in order to better represent biodiversity, provide increased data coverage, enable a better understanding of biodiversity status, and to identify key regions and taxa that require greater conservation attention. Importantly, this will supply a broader range of species groups whose conservation status can be tracked over time. This will enhance the accuracy of key indicators of biodiversity change, and improve the breadth of information provided to inform key targets like Convention on Biological Diversity 2010 target and the UN Millennium Development Goals.

A broader view of biodiversity

The conservation status of less than 2.5% of the world's described biodiversity is currently known. Clearly this limits understanding of the impact of humans on biodiversity, and with it the ability to make informed decisions on conservation planning and action. One of the major challenges for The IUCN Red List is assessing the larger groups that represent



The Usambara Eyelash Viper Atheris ceratophora (Vulnerable) pictured here eating a frog (Afrixalus sp.) gets its name from the Usambara Mountains, part of the Eastern Arc range where it is found in Tanzania. This species is threatened by high rates of deforestation and habitat degradation due to agriculture and increasing human population, which is occurring throughout the Eastern Arc range. © Michele Menegon

the majority of the world's biodiversity. With these larger groups of less well-known organisms, a comprehensive survey of extinction risk for the whole group is not feasible. To illustrate the problem, consider the estimated 287,655 plant species of which roughly 85% have been described but of those around 4% have had their conservation status assessed (Baillie *et al.* 2004). Producing conservation assessments for the remaining 96% within a reasonable timeframe is not possible. However, the need for a broader view of the status of biodiversity is urgent. It has become increasingly clear that taxa differ in the relative level of threat they face, with

certain groups at higher risk of extinction than others (Baillie *et al.* 2004, Purvis *et al.* 2000). Determining the reasons for these differences is one of the key actions needed for proactive conservation. As a first step, increased coverage of baseline data is required for The IUCN Red List. A truly global picture of biodiversity requires coverage of all major taxonomic groups. We can no longer afford to base conservation decisions on a restricted and non-representative subset of species.

A new approach has been developed (Baillie *et al.* 2008) that takes a large random sample of species groups – just as when

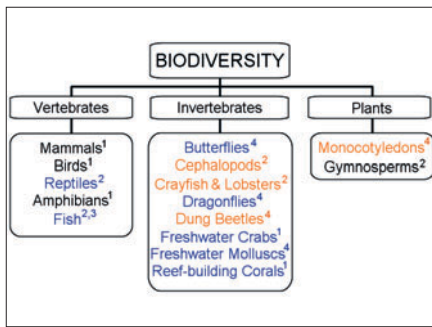


Figure 1. Groups being assessed using the sampled approach and comprehensively. 1 = Comprehensive assessment complete; 2 = Comprehensive assessment underway; 3 = Sample of Freshwater fish complete, marine fish underway; 4 = sampled approach group. Blue are phase 1 groups (2007-2009), orange are phase 2 groups (2008-2010).

forecasting election results, a poll of voters is taken. Using a random sample of 1,500 species from a group, this approach allows for the identification of the general level of threat to each group, the mapping of areas likely to contain the most threatened species, the identification of the main drivers of threat and helps pinpoint what key actions are required to address declines in the group. Results from this new approach are set to revolutionize our understanding of the status of the world's species. It has enabled an understanding of the conservation status of reptiles for the first time and the status of the world's terrestrial vertebrates (mammals, birds, amphibians, and reptiles) can be defined. In addition, it is now possible to describe and therefore address the threat faced by a number of the megadiverse groups of invertebrates. In turn, a greatly expanded understanding of the impact that humans are having on the world's species will be used to feed information into internationally important agreements aiming to address biodiversity loss.

The first results of this new approach to IUCN Red Listing, presented here, provides new insights into our understanding of the status of the world's species, and attempts to do so in a systematic way that can be built upon in time. Further assessments will be delivered in 2009 and 2010 (Figure 1).

Status of the world's terrestrial vertebrates

Understanding where threatened species are found aids conservation action, informs key biodiversity targets

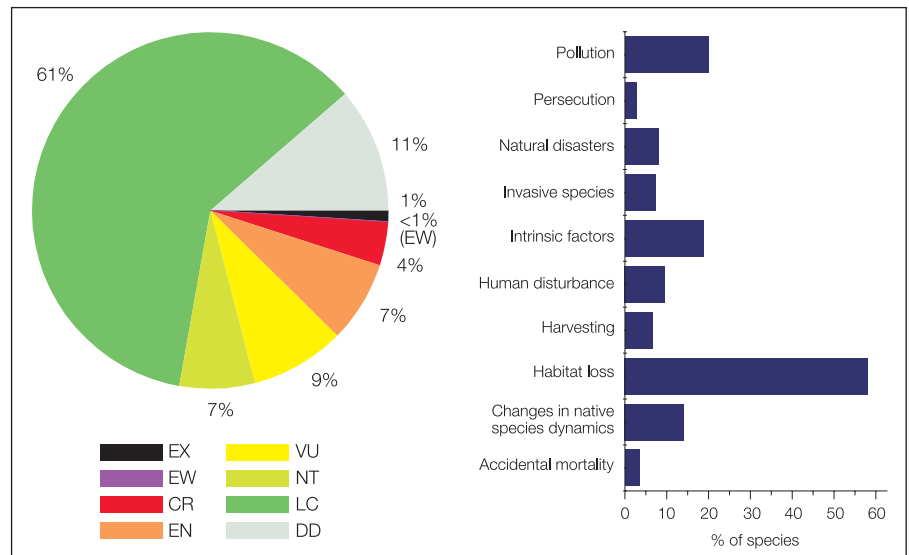


Figure 2. a. Proportion of terrestrial vertebrates in each Red List Category; **b.** the major threats to globally threatened terrestrial vertebrates. Note that birds are excluded from this analysis as they are coded against the new threat classification scheme (Salafsky et al. 2008).

and allows us to better evaluate human impact on biodiversity. Previously, the true proportion of threatened species amongst the under-studied vertebrate classes (reptiles and fish) has only been partially known. Combining the new assessments of reptiles with the new global mammal assessment data (Schipper *et al.* 2008), and updated datasets on amphibians (IUCN 2008) and birds (BirdLife International 2008), a more accurate picture of globally threatened terrestrial vertebrates can be drawn. These new data will aid in the efforts to move from monitoring, to prediction and pre-emptive action. Almost one in four (24%) terrestrial vertebrates within non Data Deficient categories are threatened with extinction (Figure 2a). The exact threat level is unknown, as the status of 2,601 Data Deficient species is undetermined, but ranges between 21% (assuming no Data Deficient species threatened) and 32% (assuming all Data Deficient species threatened).

Terrestrial vertebrates play a key role in the provisioning of many ecosystem services. Terrestrial ecosystems supply humans with raw materials, food and support livelihoods, so their healthy function is of great importance. Terrestrial vertebrates face several major threats that must be tackled in order to maintain terrestrial systems. The overwhelming threat to terrestrial species is loss and degradation of habitat, primarily through conversion of land to agriculture

and the impact of logging (Figure 2b - note that birds are excluded from this analysis, see figure legend). Of secondary importance is the impact of pollution and intrinsic factors such as limited dispersal and restricted ranges faced by small populations, particularly on islands. It is difficult to estimate the impact that climate change has already had, but it is clear that in the future this will be a dominant driver of extinction (Foden *et al.* 2008).

Neither species richness, nor threats to these species are evenly distributed across the planet (Sanderson *et al.* 2002). Threats to vertebrates vary across realms, according to the intensity and history of the threats. Unfortunately the regions that maintain the highest diversity also tend to be the most threatened, and usually the least well understood (Collen *et al.* 2008; Mace *et al.* 2005). The Indo-Malayan and Neotropical realms are consistently home to the greatest proportion of threatened species of terrestrial vertebrates. Oceanic islands also contain very high proportions of threatened species, for example Oceania, while having a comparatively low species richness maintains a highly at risk terrestrial vertebrate fauna (Figure 3). The final step in evaluating vertebrates is to produce assessments for fishes. This will be completed in the spring of 2009. This will enable, for the first time, the status of the world's fishes, and the status of the world's vertebrates to be reported.

The Lyre Head Lizard *Lyriocephalus scutatus* (Vulnerable) is endemic to the southwest wet zone of Sri Lanka. Habitat degradation caused by human activities including the clearing of land for agriculture, conversion to plantations, logging, mining, and the pressures linked with human settlements, have resulted in severe deforestation. It is estimated that only 5% of the original wet zone rainforest remains in Sri Lanka. The international pet trade may also pose a threat as individuals are harvested from the wild.
 © Ruchira Somaweera

The geography of reptile threat

Reptiles are an ancient, diverse and versatile group, present on all continents except Antarctica, having colonized many of the earth's habitats. The first evaluation of a representative sample of reptiles shows that over one in five (22%) reptiles in non Data Deficient categories are threatened with extinction (Figure 4a). The exact threat level is unknown, as the status of 284 Data Deficient species is undetermined, but ranges between 18% (assuming no Data Deficient species threatened) and 37% (assuming all Data Deficient species threatened). The great majority of species show a negative response to anthropogenic manipulation of habitat worldwide. The principle threats to reptile species are habitat loss and degradation. Additionally, overexploitation, principally through uncontrolled pet trade is a problem in certain families (Figure 4b).

The proportion of species threatened varies across reptile groups. For example, 43% of crocodylians are threatened. This contrasts with 12% of snakes, and 20% of lizards. Broad species level differences are likely to reflect differences in geography, range size, habitat specificity and biology, as well as threat intensity. Identifying the reasons for these differences among groups is a major goal for conservation biology. It is important to understand where threat impact is most intense, and work to reverse the process. This, in combination with identifying those attributes that predispose species to a higher risk of extinction will help predict outcomes of different future scenarios and therefore facilitate proactive conservation efforts. This will help to minimize human impact on biodiversity.



Indo-Malaya is the most species rich biogeographic realm for reptiles, as it is for many other species groups. The Indo-Malayan realm also has the greatest density of threatened (CR, EN, and VU) species (Figure 5). High levels of deforestation and over-exploitation are prevalent throughout the area, and are thought to be responsible for these elevated levels of threat. However,

it is in the Neotropical realm where the most species with an extremely high risk of extinction can be found. Almost half of the Critically Endangered reptiles are endemic to the Caribbean, Central or South America (43%), a percentage more than double that for any other realm. While the threats to reptiles in the Neotropical realm are not unique, predation by introduced

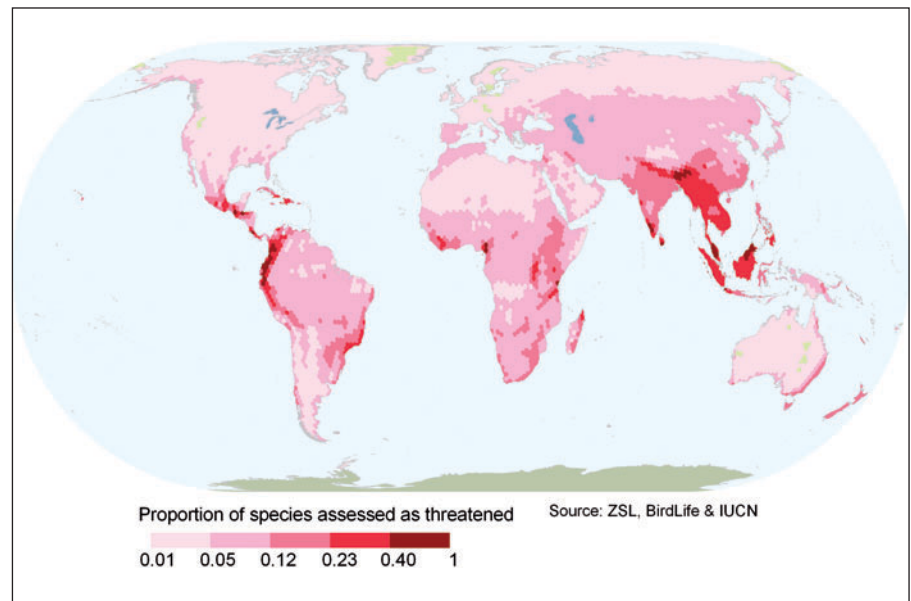


Figure 3. Threatened species richness map for terrestrial vertebrates (n = 9,606 species).

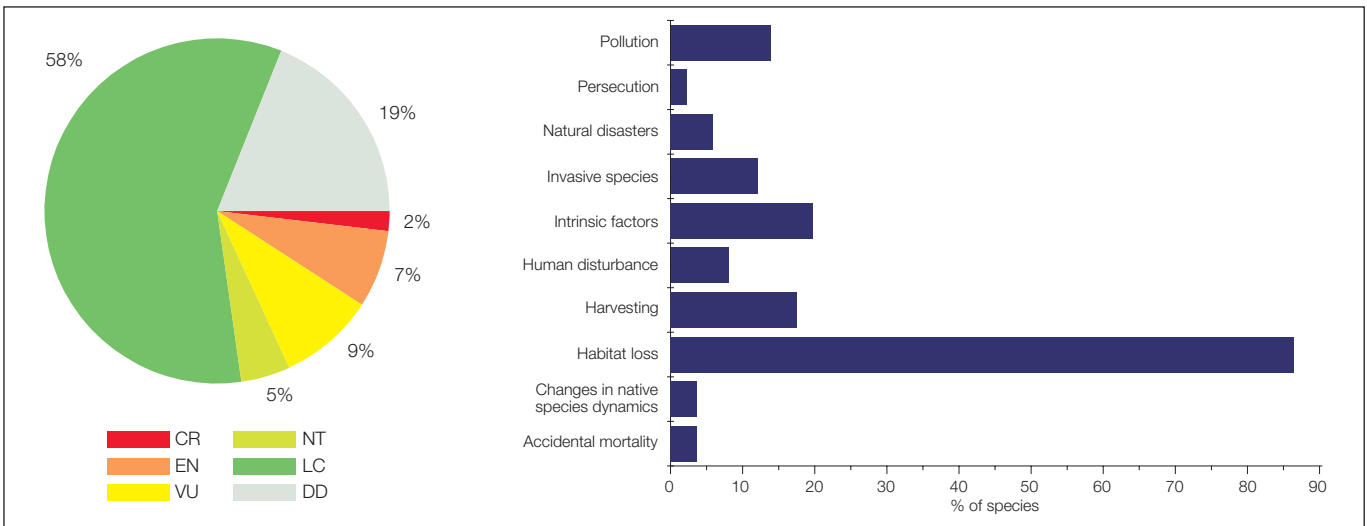


Figure 4. a. Proportion of reptiles in each Red List Category; b. the major threats to globally threatened reptiles.

mammals and habitat loss (primarily due to conversion of land for agriculture, urban development and tourism) are common problems. Approximately one in five Neotropical species are distributed in the Caribbean. These species are more likely to have narrower ranges, smaller populations, and limited genetic diversity because the distribution of these species is restricted to islands. Therefore, in the presence of threats, these island species are at a higher risk of extinction.

Although not all reptile species have been assessed, a random sample reveals new details about the threats faced by reptiles. Others have been updated from old 1996 assessments. In the well-known crocodile group, the Cuban Crocodile *Crocodylus rhombifer* has been uplisted to Critically Endangered (Box 1). New assessments of the IUCN Red List status for some of the more poorly known groups have also been possible. For example, amphisbaena (worm lizards) are little studied, due to their burrowing lifestyle (Box 2). Many of the group that can be assigned a category are Least Concern, protected from human impact by their burrowing habits. However, a number of species are listed in threatened categories, principally due to having restricted distributions in threatened habitats. Time will tell whether those classified as Data Deficient (DD) turn out to be threatened or not.

Assessments of species in nine families that have never before been red listed allow a more confident appraisal of the status of the world's reptiles. The threats to reptiles and regions where threatened species are concentrated that have been identified in this random sample pave the way for a comprehensive assessment of all reptile species, while providing timely status information for the CBD 2010 target. This approach allows identification of key attributes from which comprehensive coverage will allow finer scale analysis.

First globally representative groups of invertebrates on The IUCN Red List

Existing biodiversity information is strongly biased toward the terrestrial megafauna

and megafloora, and to temperate rather than tropical areas. However the highest extinction risk and therefore greatest loss of biodiversity is expected to be suffered by invertebrates (Dunn 2005, Thomas *et al.* 2004). These first invertebrate group assessments show a great range in extinction risk, with dragonflies and damselflies (Odonata) that could be assigned a conservation status the least threatened (14%) and corals the most threatened (32.8%) (Polidoro *et al.* 2008, Carpenter *et al.* 2008). The main message drawn from these invertebrate assessments is that current data suggest invertebrates may be just as threatened as vertebrates, and in certain taxa, more so. The status of different invertebrate groups is extremely variable; therefore generalising across invertebrates is not particularly meaningful.

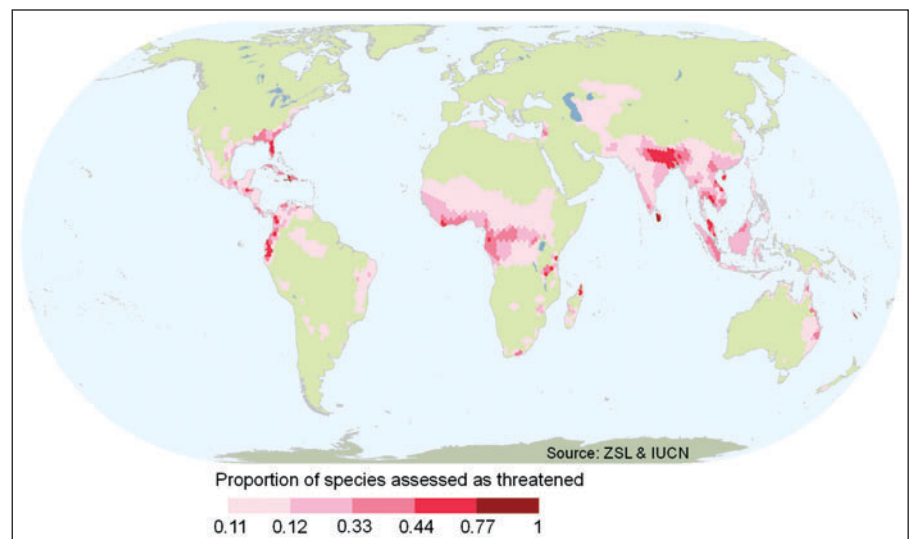


Figure 5. Threatened species richness map for reptiles (n = 244 species).

Box 1: Uplisting the Cuban Crocodile *Crocodylus rhombifer* (Cuvier, 1807)

The Cuban Crocodile is a species of freshwater crocodile renowned for its leaping ability, allowing it to prey on arboreal mammals. This species is a relict from the Pleistocene Era and has the narrowest distribution of any extant crocodylian due to its preference of peat swamp habitats. This unusual crocodile once had a wider distribution in the Caribbean but is now confined to the Zapata Swamp in Cuba with a smaller subpopulation in Lanier Swamp on the Isla de la Juventud off the southwest coast of Cuba. Like many other threatened species,

the Cuban Crocodile is negatively impacted by habitat degradation. In the past, intensive charcoal burning was the main cause of habitat loss, but now development of the tourism industry, land transportation, and agriculture are degrading the areas in which this species inhabits. Possible sea level rise because of global warming in the future could also degrade its swamp habitat. As well as these environmental threats to the Cuban Crocodile, this species is directly threatened by poaching for its meat. In 1996, the Cuban Crocodile was assessed as Endangered. However, recent genetic analysis has shown that extensive hybridization with the American Crocodile *Crocodylus acutus* (Cuvier, 1807) has taken place, probably over many centuries. Hybridization is a newly recognized major threat to the Cuban Crocodile because it is decreasing the genetic purity of this highly threatened species, which has just a small natural distribution remaining. A reassessment of the conservation status of the Cuban Crocodile has now listed this species as Critically Endangered.



The Cuban Crocodile Crocodylus rhombifer (Critically Endangered) is a species of freshwater crocodile renowned for its leaping ability, allowing it to prey on arboreal mammals. Hybridization with the American Crocodile, Crocodylus acutus is a newly recognized major threat to the Cuban Crocodile because it is decreasing the genetic purity of this highly threatened species, which has just a small natural distribution remaining. © John White.

Freshwater ecosystems provide raw materials, food and support livelihoods; they perform many important environmental functions and contribute to general human well-being. In spite of only covering about 1% of the total land surface, inland waters are home to around 126,000 aquatic species (Darwall *et al.* 2008). The results from the first freshwater invertebrate group assessed, the Odonata, show that 14% of

species in non Data Deficient categories are threatened with extinction (Figure 6). The exact threat level is unknown, as the status of 526 Data Deficient species is undetermined, but ranges between 9% (assuming no Data Deficient species threatened) and 44% (assuming all Data Deficient species threatened). However, Odonata only comprise a small invertebrate order, with above average dispersal ability

and wide distribution ranges, so results are likely not to be indicative of many other invertebrate groups. The majority of the threatened species in this group inhabit lotic (flowing) waters (Clausnitzer *et al.* in review). A combination of a more specialised ecology and the higher environmental pressure on these waters may provide the explanation for the increased risk to species in these habitats.

Box 2: The secret lives of fossorial reptiles

There are two main groups of burrowing reptiles – Amphisbaenia and Scolecophidia. Amphisbaenia, known as worm lizards, are mostly limbless species, uniquely adapted to a burrowing habitat, and occur on both sides of the Atlantic. The blind snakes belonging to the infraorder Scolecophidia, consist of snakes in the Typhlopidae, Leptotyphlopidae, and Anomalepididae families. These burrowing snakes are distributed in tropical and subtropical areas around the world. Burrowing reptiles are ecologically important because they aerate soil and help regulate the populations of insects such as ants and termites. There are over 600 species of burrowing reptiles within these two groups and an estimated half of these species are Data Deficient. Clearly, the fossorial nature of these species means that surveying is more problematic than for ground-dwelling or even arboreal species. Even though ranges are often narrow, the distribution of these species is still not fully understood, and this further highlights that too little effort is being put into researching these unusual and important reptiles. This situation is more worrying as it has been shown that habitat loss and degradation have a negative impact on burrowing reptiles because they are unlikely to occupy or re-colonize fragmented landscapes. Ground compaction is also a threat because it reduces the burrowing ability of these species. One in five of burrowing reptiles within non Data Deficient categories are considered threatened. Therefore more research is urgently needed into



The Speckled Worm Lizard Amphisbaena fuliginosa (Not Evaluated) is a burrowing reptile. This species was thought to be restricted to the rainforests of northern South America but has recently been discovered in Brazilian Cerrado, a dry savanna habitat. © Laurie Vitt

these species to better understand, not only the conservation status of them, but also their biology and ecology.

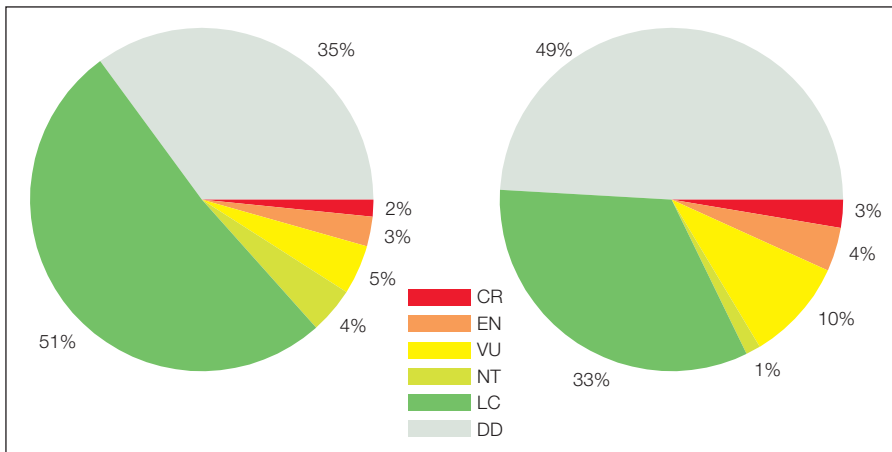


Figure 6. a. Proportion of freshwater crabs and b. Proportion of dragonflies and damselflies in each Red List Category.

Almost one fifth of the world's crabs are restricted to freshwater, a total of 1,281 species. Overlooked in comparison to their more speciose marine counterparts, they are distributed throughout almost all freshwater habitats in tropical regions. Traits such as low reproductive output in combination with fragmentation caused of human impact to freshwater habitats has resulted in relatively high threat levels in this group that is defined by high levels of endemism. A total of 32% of freshwater crabs in non Data Deficient categories are threatened with extinction (Figure 6). The exact threat level is unknown, as the status of 629 Data Deficient species is undetermined, but ranges between 16% (assuming no Data Deficient species threatened) and 65% (assuming all Data Deficient species threatened). The majority of the threatened species have highly restricted ranges. This exposes them to the impacts of human disturbance from habitat loss, particularly in forested regions, with alteration of water regimes and pollution being most frequently cited as cause of threat.

A map of the distribution of threatened species from the crabs and dragonflies reveals some centres of threat for freshwater systems (Figure 7). Marked concentrations of threatened species exist in Viet Nam, Thailand, Cambodia, Malaysia and the Philippines in Southeast Asia; Sri Lanka (Box 3) and the Indian Western Ghats in South Asia; and Colombia and Mexico in central and South America. These patterns are heavily influenced by the distribution of restricted-range species. Healthy freshwater invertebrate populations

are indicative of freshwater systems that are able to provide critical services, such as flood control, economic and livelihood benefits. However, river basin and wetland management is complex, as they are open systems with ill-defined boundaries.

Comparing invertebrates to vertebrates

Rather than differences between vertebrates and invertebrates *per se*, the assessments highlighted in this chapter, suggest that key differences exist between system and habitat, regardless of whether the species is a vertebrate or not. Freshwater groups are consistently at higher risk than their terrestrial counterparts, yet it is a system about which we still know very little. Restricted-range species tied to particular habitats are at greater risk in all systems (Box 4a) in comparison to wide ranging species with more generalist ecological requirements. While some of the major threatening processes differ between taxa (e.g., broadly speaking, over-exploitation is less of a threat for Odonata and crabs than for terrestrial vertebrates, particularly mammals), habitat loss and degradation represent major threats across all groups.

In situations where habitat loss is the primary cause of decline, it is reasonable to assume that there might be a positive correlation between declines in vertebrate and non-vertebrate populations. However, where threats such as exploitation or pollution are the cause of a decline, the expectation might be that trends observed in one set of species will not necessarily be indicative of population

trends in other species in the same ecosystem. The impacts of climate change remain complex, though an increased understanding of species biology may provide some clues (Box 4b) (Foden *et al.* 2008). Addressing the lack of invertebrate coverage on the IUCN Red List to date, is particularly pressing in view of the ecosystem services that they provide; therefore, it is important that they be assessed, inventoried, monitored, and protected (Rohr *et al.* 2007).

Evaluating trends in biodiversity

In order to mitigate biodiversity loss effectively, greater investment of conservation attention is required in tropical regions where there is the most to lose in terms of species richness, and where species groups have to date been largely ignored (Collen *et al.* 2008). Broad-reaching global legislation may provide an impetus for such investment. One important example is the CBD, under which the 190 signatory nations have ambitiously committed themselves to actions to “achieve, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national levels” (UNEP 2002). Assessing progress towards this important goal requires data on the status and trends in biodiversity for a given group, country or region.

Box 3: Sri Lankan freshwater crabs under threat

Sri Lanka is rich in freshwater crabs, with 49 out of its 50 species endemic to the island. The biodiversity assessment presented in this chapter listed 80% of all Sri Lankan freshwater crabs as threatened (Critically Endangered, Endangered, or Vulnerable), with a shocking 50% of all species CR, and possibly on the brink of extinction. The elevated levels of endemism and threat in Sri Lanka are surprisingly high considering the moderate size of the island (<65, 000 km²) and its close proximity to the Asian continental mainland. Threats to the Sri Lankan freshwater crabs include deforestation, pollution from excessive pesticide use, and the impact of alien invasive species on native species. Many of the threatened species of freshwater crabs have a limited distribution in the rainforests of the wet zone in the southwest part of the island, where they are increasingly under pressure from the rising human population density.



Johora singaporensis (Critically Endangered) is a freshwater crab that is endemic to Singapore. It was previously known from two locations, one of which is a nature reserve. However, despite intensive surveys this species has not been sighted in the nature reserve since the early 1990s, suggesting that it no longer exists in this location. Acidification of water is suspected to be the cause of this extirpation. The surviving population of this species is under severe threat due to recent development of the land, which has lowered the water table, and continuing decline in the quality of its habitat. © Peter Ng

IUCN and its partners are working towards this by evaluating change in conservation status with The IUCN Red List Index (RLI) (Butchart *et al.* 2004, 2005, 2007, Vié *et al.* 2008). By conducting conservation assessments at regular intervals, changes in the threat status of species in a taxonomic group can be used to monitor trends in extinction risk. As exemplified by the RLIs calculated for birds (Butchart *et al.* 2004) and amphibians (Baillie *et al.* 2004), robust trends in change in conservation status is achievable with regular assessment, and with retrospective assessment. Assessments can realistically take place every four to five years for the vertebrates and some plant groups, and at least every 10 years for all other groups (Baillie *et al.* 2008).

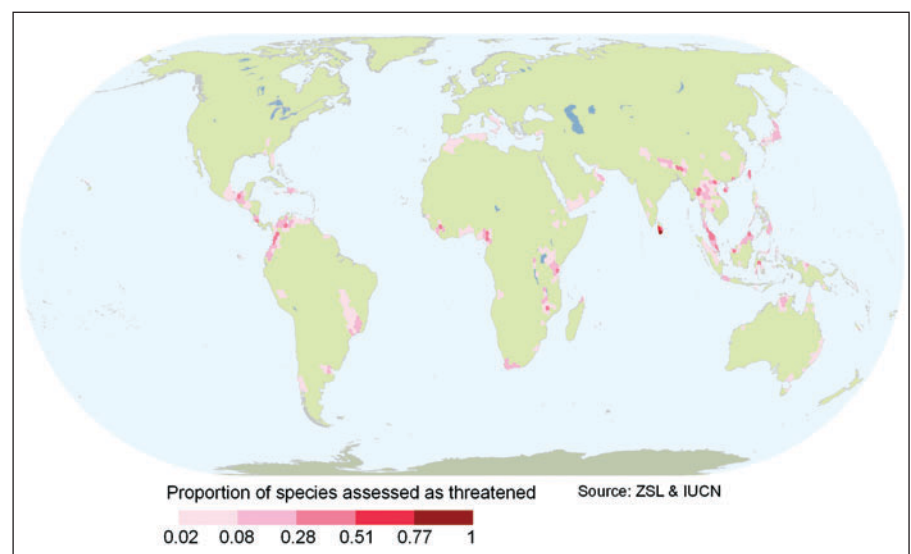
Delivery by 2010

The choice of groups for which this approach is being applied is currently limited by the presence of active networks of specialists, up-to-date species lists, and available data. However, by the

year 2010, the coverage of the IUCN Red List will have expanded to include eight groups of invertebrates, doubling invertebrate coverage on the Red List in

a systematic manner (Figure 1). Using the approach outlined here, this will not only provide insight into the conservation status of invertebrates, but also plant groups

Figure 7. Threatened species richness map for freshwater crabs (*n* = 210 species) and dragonflies and damselflies (*n* = 136 species).





Viridithemis viridula (Data Deficient) is a dragonfly endemic to western Madagascar. Only the female of this species is known to science and its habitat preferences have not yet been determined. Further research is needed before a more accurate assessment can be made. © Klemens Karkow

such as the monocots and other groups such as fungi. The results, when used to calculate the Red List Index, will provide a species-based biodiversity indicator that is considerably more broadly representative of all biodiversity than anything hitherto available. Finally it will provide a data set that will enable a broad range of trend indices to be generated ranging from specific taxonomic groups, to functional groups, to species trends in biomes, or biogeographic regions.

References

- Baillie, J.E.M., Collen, B., Amin, R., Akçakaya, H.R., Butchart, S.H.M., Brummitt, N., Meagher, T.R., Ram, M., Hilton-Taylor, C. and Mace, G.M. 2008. Towards monitoring global biodiversity. *Conservation Letters* 1: 18-26.
- Baillie, J.E.M., Hilton-Taylor, C. and Stuart, S.N. (eds). 2004. *2004 IUCN Red List of Threatened Species: a Global Species Assessment*. IUCN, Gland, Switzerland and Cambridge, UK.
- BirdLife International. 2008. *State of the World's Birds: Indicators for our Changing World*. BirdLife International, Cambridge, UK.
- Butchart, S.H.M., Akçakaya, H.R., Chanson, J.S., Baillie, J.E.M., Collen, B., Quader, S., Turner, W.R., Amin, R., Stuart, S.N. and Hilton-Taylor, C. 2007. Improvements to the Red List Index. *PLoS ONE* 2: e140. doi:110.1371/journal.pone.0000140.
- Butchart, S.H.M., Stattersfield, A.J., Baillie, J.E.M., Bennun, L.A., Stuart, S.N., Akçakaya, H.R., Hilton-Taylor, C. and Mace, G.M. 2005. Using Red List Indices to measure progress towards the 2010 target and beyond. *Philosophical Transactions of the Royal Society of London* 360: 255-268.
- Butchart, S.H.M., Stattersfield, A.J., Bennun, L.A., Shutes, S.M., Akçakaya, H.R., Baillie, J.E.M., Stuart, S.N., Hilton-Taylor, C. and Mace, G.M. 2004. Measuring global trends in the status of biodiversity: Red List Indices for birds. *PLoS Biology* 2: e383.
- Carpenter, K.E., Abrar, M., Aeby, A., Aronson, R.B., Banks, S., Bruckner, A., Chiriboga, A., Cortes, J., Delbeek, J.C., DeVantier, L., Edgar, G.J., Edwards, A.J., Fenner, D., Guzman, H.M., Hoeksema, B.W. et al. 2008. One-third of reef-building corals face elevated risk from climate change and local impacts. *Science* 321: 560-563.
- Clausnitzer, V., Kalkman, V.J., Ram, M., Collen, B., Baillie, J.E.M., Bedjani, M., Darwall, W.R.T., Dijkstra, K.-D., Dow, R., Hawking, J., Karube, H., Malkova, E., Paulson, D., Schütte, K., Suhling, F., Villanueva, R., von Ellenrieder, N. and Wilson, K. In review. Invertebrates enter the biodiversity crisis debate: the global threat status of dragonflies. Collen, B., Ram, M., Zamin, T. and McRae, L. 2008. The tropical biodiversity data gap: addressing disparity in global monitoring. *Tropical Conservation Science* 1: 75-88. Available online: http://tropicalconservationscience.mongabay.com/content/v1/08-06-09-Ben_Collen_et_al.pdf.
- Darwall, W., Smith, K., Allen, D., Seddon, M., Reid, G., Clausnitzer, V. and Kalkman, V. 2008. Freshwater biodiversity - a hidden resource under threat. In: J.-C. Vié, C. Hilton-Taylor and S.N. Stuart (eds.) *The 2008 Review of The IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland.
- Dunn, R.R. 2005. Modern insect extinctions, the neglected majority. *Conservation Biology* 19: 1030-1036.
- Foden, W.B., Mace, G.M., Vié, J.-C., Angulo, A., Butchart, S.H.M., De Vantier, L., Dublin, H.T., Gutsche, A., Stuart, S.N. and Turak, E. 2008. Species susceptibility to climate change impacts. In: J.-C. Vié, C. Hilton-Taylor and S.N. Stuart (eds), *The 2008 Review of The IUCN Red List of Threatened Species*. IUCN Gland, Switzerland.
- Hilton-Taylor, C., Pollock, C. Chanson, J. and Katariya, V. 2008. State of the world's

Box 4: Threats to dragonflies and damselflies

a. Restricted range damselflies

The Pemba Featherleg *Platycnemis pembipes*, a fragile black-and-white damselfly was first discovered in 2001 on the island of Pemba off the Tanzanian coast. Remarkably its nearest relatives occur on Madagascar, separated by 1,000 km of ocean. Although the species might have reached Pemba aided by strong monsoon winds, recent studies suggest it may be the survivor of an ancient African fauna that is now largely confined to Madagascar. The species only inhabits the single stream flowing through Pemba's last remnant of forest and is listed as Critically Endangered. The Pemba Featherleg shares this fate with two other East African damselflies of unknown origin. *Amanipodagrion gilliesi* (Critically Endangered) survives on a single stream in Tanzania's Usambara Mountains. It shares no similarities with any other known species. Equally unique is *Oreocnemis phoenix* (Critically Endangered), named for its bright red males. Streams on the high plateau of Mount Mulanje in Malawi, known aptly as 'the island in the sky' and a mere 24 km across, are its only known habitat. The plateau is made up of bauxite deposits: mining these would significantly impact the habitat.

b. Climate change impact on the Ancient Greenling *Hemiphlebia mirabilis*

The Australian endemic damselfly *Hemiphlebia mirabilis* (Endangered), the Ancient Greenling, is notable for its apparent archaic characters, its male mating displays and its biogeography. Originally thought to have been a Victorian endemic, the species was subsequently found in northeastern Tasmania and then on Flinders Island. This suggests that the species would have occupied the Bassian Ridge when it was exposed during glacial times and this may have been a dispersal route at some time. The species is cryptic within its reed habitat except when the males in particular display by waving their expanded, white anal appendages. The species breeds in open, sedge marshes with a low water level and seems to be capable of recolonizing habitats when they have become dry, probably surviving in the egg stage. In recent times, however, dry spells are longer and more frequent due to climate change and they pose a severe threat to this already rare species. The Ancient Greenling is not the only Australian dragonfly to be affected by climate change and it seems likely that dry spells will become a major driver for decline in the near future.

species. In: J.-C. Vié, C. Hilton-Taylor and S.N. Stuart (eds). *The 2008 Review of The IUCN Red List of Threatened Species*. IUCN Gland, Switzerland.

IUCN. 2008. The IUCN Red List of Threatened Species. Available online at: www.iucnredlist.org.

Mace, G.M., Masundire, H. and Baillie, J.E.M. 2005. Ecosystems and human well-being: Biodiversity. *Millennium Ecosystem Assessment*. Island Press, Washington DC.

Polidoro, B.A., Livingstone, S.R., Carpenter, K.E., Hutchinson, B., Mast, R.B., Pilcher, N., Sadovy, Y. and Valenti, S. 2008. Status of the world's marine species. In: J.-C. Vié, C., Hilton-Taylor, and S.N. Stuart (eds.). *The 2008 Review of The IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland.

Purvis, A., Agapow, P.-M., Gittleman, J.L. and Mace, G.M. 2000. Nonrandom extinction and the loss of evolutionary history. *Science* 288: 328-330.

Rohr, J.R., Mahan, C.G. and Kim, K.C.

2007. Developing a monitoring program for invertebrates: guidelines and a case study. *Conservation Biology* 21: 422-433.

Salafsky, N., Salzer, D., Stattersfield, A.J., Hilton-Taylor, C., Neugarten, R., Butchart, S.H.M., Collen, B., Cox, N., Master, L.L., O'Connor, S. and Wilkie, D.. 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. *Conservation Biology* 22: 897-911.

Sanderson, E.W., Jaiteh, M., Levy, M.A., Redford, K.H., Wannebo, A.V. and Woolmer, G. 2002. The human footprint and the last of the wild. *BioScience* 52: 891-904.

Schipper, J., Chanson, J., Chiozza, F., Cox, N., Hoffmann, M., Katariya, V., Lamoreux, J., Rodrigues, A., Stuart, S.N., Temple, H.J., Baillie, J.E.M., Boitani, L., Lacher, T.E., Mittermeier, R.A., Smith, A.T., *et al.* 2008. The status of the world's land and marine mammals: diversity, threat and knowledge. *Science* (in press).

Thomas, C.D., Cameron, A., Green, R.E., Bakkenes, M., Beaumont, L.J., Collingham, Y.C., Erasmus, B.F.N., Siqueira, M.F.D., Grainger, A., Hannah, L., Hughes, L., Huntley, B., Jaarsveld, A.S.V., Midgley, G.F., Miles, L. *et al.* 2004. Extinction risk from climate change. *Nature* 427: 145-148.

UNEP. 2002. Report on the sixth meeting of the Conference of the Parties to the Convention on Biological Diversity (UNEP/CBD/COP/20/Part 2) Strategic Plan Decision VI/26.

Vié, J.-C., Hilton-Taylor, C., Pollock, C., Ragle, J., Smart, J., Stuart, S.N. and Tong, R. 2008. The IUCN Red List: A key conservation tool. In: J.-C. Vié, C. Hilton-Taylor and S.N. Stuart (eds), *The 2008 Review of The IUCN Red List of Threatened Species*. IUCN Gland, Switzerland.

Geothelphusa ancylophallus (Least Concern) is a freshwater crab that is endemic to Taiwan. Although localized habitat loss and degradation, as well as problems associated with pollution are occurring in parts of its range, the current rate of decline that this species is experiencing is not significant enough to warrant listing in a threatened category. However, if the quality of this species' habitat continues to decline, this species will become threatened in the future. © Hsi-Te Shih





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