WILDLIFE IN A CHANGING WORLD

An analysis of the 2008 IUCN Red List of Threatened Species™

Edited by Jean-Christophe Vié, Craig Hilton-Taylor and Simon N. Stuart

People all over the world are becoming increasingly aware of the growing challenges facing our future and of the vital

are now known to be facing extreme threat from overexploitation and habitat loss. The new insights presented here also help us to better understand the most likely differential responses and geographical patterns expected when the effects of global climate change begin to impact the world's most susceptible species. This cutting-edge work will provide predictive abilities to long-range planning and policy development as the effects of climate change are increasingly felt across the globe.

Through the dedicated efforts of thousands of scientists and practitioners, The IUCN Red List has become one of the most authoritative global standards supporting policy and action to conserve species around the world. We hope this *Analysis of The 2008 Red List* will provide you with new information and insights, which will motivate you to actions of unprecedented intensity and commitment on behalf of these

Preface

We live in a world with an overload of information bombarding us every day. Most people, wherever they live, know that wildlife – and by 'wildlife' we mean both animals from the smallest insect to the largest mammal, as well as plants – is to some extent 'endangered'. But what is not generally realized is what this really means – how much of our wildlife is threatened, by what, where, what the consequences are likely to be and if it really matters – to us or to our children.

The IUCN Red List of Threatened Species™ tells us the answers to many of these questions. With a long established history, it is the world's most comprehensive information source on the global conservation status of plant and animal species. It is based on an objective system for assessing the risk of extinction of a species. Species listed as Critically Endangered, Endangered or Vulnerable are regarded as threatened and therefore most in need of conservation attention.

However, The IUCN Red List is far more than a register of names and associated threat categories. Underneath the listings is a gold mine of additional information. This includes a rich compendium of information on threats (e.g., climate change or invasive species), on where the species live, and most importantly information on conservation actions that can be used to reduce or prevent extinctions.

This gold mine comprising the extensive database 'underneath' The IUCN Red List also allows us to undertake analyses to determine, for instance, trends in the status of threatened species, the geography of threatened species as well as analyses of different threats and conservation responses. Some of the results of these analyses are presented here.

Every sector, whether it be trade, financial, or health, has its metrics for monitoring trends. For biodiversity The IUCN Red List is that metric. Around 45,000 species have been assessed to-date. This is a tiny fraction (2.7%) of the world's described species (with current estimates of the total number ranging from 5 to 30 million). We now know that nearly one quarter of the world's mammals, nearly one third of amphibians and more than 1 in 8 of all bird species are at risk of extinction. This allows us to come to the stark conclusion that wildlife (the word used in more technical circles is *biodiversity*) is in trouble, and the extent of the current risk of extinction varies between different species groups. For this reason IUCN is increasing the number of conservation assessments of species in the marine and freshwater realms, and for plants and invertebrate groups. Some early findings of this work are presented here.

A frequent reaction to any release of an update to The IUCN Red List is 'Why does it matter?' As the Millennium Ecosystem Assessment of 2005 made clear, biodiversity constitutes and sustains all life processes on the planet. It contributes utilitarian ecosystem 'good and services' as well as cultural, aesthetic and spiritual values and ultimately a sense of identity. It is thus fundamental to human well being. It is increasingly appreciated that biodiversity loss and ecosystem degradation jeopardises human well being. Examples abound from around the whole world – destruction of grazing lands in Ethiopia by invasive species resulting in whole villages being abandoned; the US fruit industry being no longer able to rely on wild pollinators; and fisheries collapsing worldwide, to name but a few.

From all this 'gloom and doom' arises the question – 'What can we do about it?' Less often articulated in public is a further point – 'Is it even worth bothering given that the situation seems so bad?' In some ways we do not apologize for highlighting 'bad news'. IUCN believes that the release of The Red List acts as a clarion call for the drive to tackle the extinction crisis – and without those facts being made clear the world will not react. It is a 'wake up call' and used as such by governments, NGOs, and civil society as a whole to help spread their messages and educate the world about the need to conserve biodiversity.

The Red List release is also an opportunity for us to show that

conservation works. In 2008 we were able to report that the Black-footed Ferret *Mustela nigripes* moved from Extinct in the Wild to Endangered after a successful reintroduction by the US Fish

Acknowledgements

General

The IUCN Red List of Threatened Species™ is compiled and produced by the IUCN Species Programme based on contributions from a network of thousands of scientific experts around the world. These include members of the IUCN Species Survival Commission Specialist Groups, Red List Partners (currently Conservation International, BirdLife International, NatureServe and the Zoological Society of London), and many others including experts from universities, museums, research institutes and non-governmental organizations.

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To improve and expand the Red List assessment process, further development of the tools used is required. In order to support the new developments an IUCN Red List Corporate Support Group has been established. IUCN would like to acknowledge those organizations that have become members of the support group: Chevron, Electricité de France, Holcim, Oracle, Statoil, and Shell.

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Freshwater biodiversity: a hidden resource under threat

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Status of the world's marine species

Corals

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The IUCN Red List: a key conservation tool

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Biodiversity loss is one of the world's most pressing crises with many species declining to critically low levels and with significant numbers going extinct. At the same time there is growing awareness of how biodiversity supports human livelihoods. Governments and civil society have responded to this challenge by setting clear conservation targets, such as the Convention on Biological Diversity's 2010 target to reduce the current rate of biodiversity loss. In this context, *The IUCN Red List of Threatened Species*™ (hereafter The IUCN Red List) is a clarion call to action in the drive to tackle the extinction crisis, providing essential information on the state of, and trends in, wild species.

A highly respected source of information

The IUCN Red List Categories and Criteria are widely accepted as the most objective and authoritative system available for assessing the global risk of extinction for species (De Grammont and Cuarón 2006, Lamoreux *et al.* 2003, Mace *et al*. 2008, Rodrigues *et al.* 2006). The IUCN Red List itself is the world's most comprehensive information source on the global conservation status of plant and animal species; it is updated annually and is freely available online at www.iucnredlist.org (Figure 1). It is based on an objective system allowing assignment of any species (except micro-organisms) to one of eight Red List Categories based on whether they meet criteria linked to population trend, size and

Far more than a list

One of The IUCN Red List's main purposes is to highlight those species that are facing a high risk of global extinction. However, it is not just a register of names and associated threat categories. The real power and utility of The IUCN Red List is in what lies beneath: a rich, expert-driven compendium of information on species' ecological requirements, geographic distributions and

Species are easier to identify and categorize than ecosystems, and they nd

biodiversity indicators) that cover all the major ecosystems of the world.

The high profile, standards and scientific integrity of The IUCN Red List are maintained in the following ways: (i) the scientific aspects underpinning The IUCN Red List are regularly published in the scientific literature (Butchart *et al*. 2004; 2007; Colyvan *et al.* 1999; Mace *et al.* 2008); (ii) the assessment process is clear and transparent; (iii) the listings of species are based on consistent use of the Red List Categories and Criteria and are open to challenge and correction; (iv) all assessments are appropriately documented and supported by the best scientific information available; (v) the data are freely available through the World Wide Web to all potential users; (vi) The IUCN Red List is updated regularly (annually at present) but not all species are reassessed with each update – many assessments simply roll-over from the previous edition; and (vii) analyses of its findings are regularly published, approximately every four to five years, usually at the time of the World Conservation Congress (Hilton-Taylor 2000; Baillie *et al.* 2004; Vié *et al*. this volume).

From expert judgment to robust criteria

The first Red List Criteria were adopted in 1994 (IUCN 1994) after a wide consultative process involving hundreds of scientists. The IUCN Red List Categories and Criteria were revised in 2001 (IUCN 2001). They currently include nine categories and five quantitative criteria (Figure 4). The *Guidelines for Using The IUCN Red List Categories and Criteria* (http://www.iucn.org/redlist) have been developed and are updated on a regular basis; they provide detailed guidance on how to apply the categories and criteria and aim at providing solutions to specific technical issues to ensure that assessments are conducted in a standardized way across various plant and animal groups.

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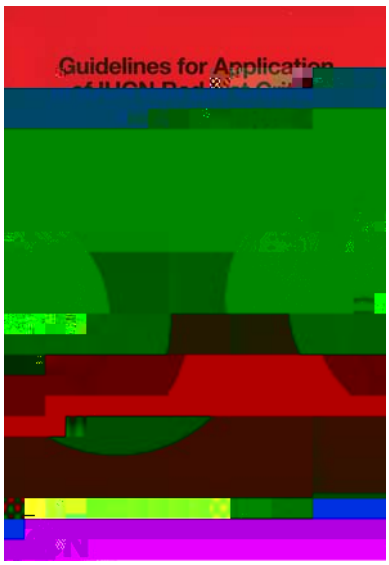
consideration of their policy implications.



the Red List is still the largest dataset of current information on species. It allows us to measure how little the diversity of life on our planet is known and how urgent the need is to expand the assessment work if we want to be in a position to track progress towards reducing biodiversity loss.

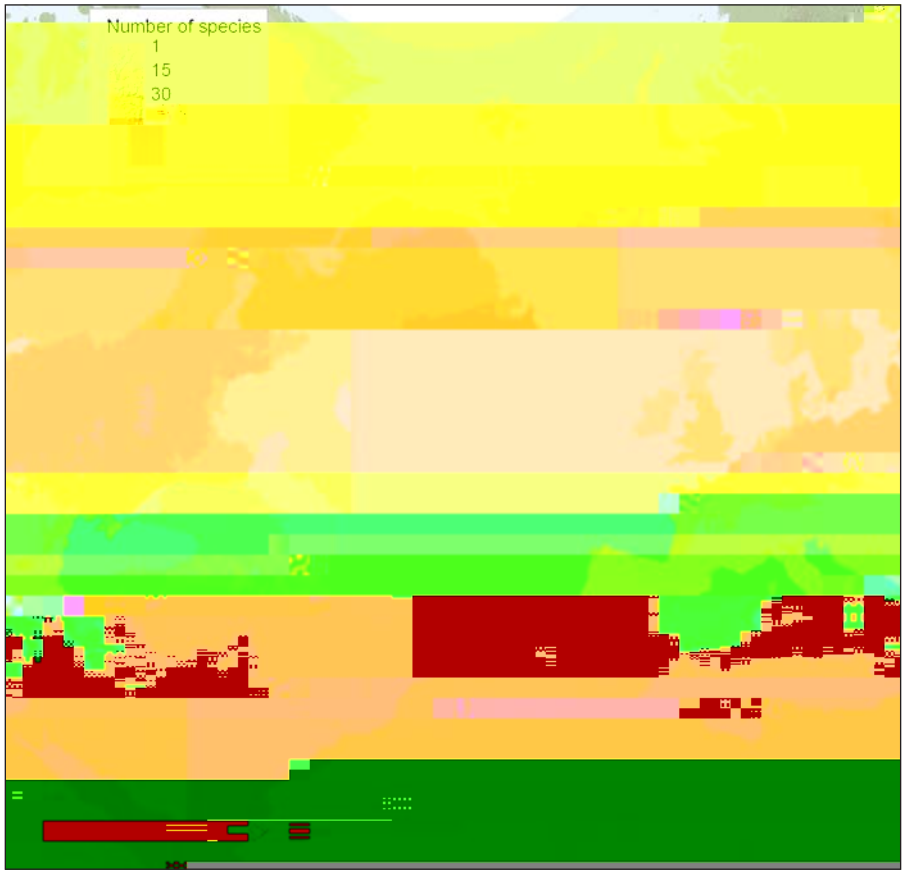


Figure 6. An example of a regional biodiversity analysis: threatened terrestrial mammal species richness in Europe.

Better links with regional and national Red Lists

The global IUCN Red List only includes information on species, subspecies or populations that have been globally assessed; regional and national level assessments are currently not included unless these are also global assessments (for example, a species that is only found in one country, (i.e., is endemic) and therefore has the same Red List status at both national and global levels).

For non-endemics, it is important to note that the status of a species at the global level may be different to that at a national level. In certain situations, a species may be listed as threatened on a national Red List even though it is considered Least Concern at the global level by IUCN and vice versa.

An increasing number of regional and national Red Lists are compiled following the *Guidelines for Application of IUCN Red List Criteria at Regional Levels* (Gärdenfors *et al.* 2001; IUCN 2003). IUCN is increasingly undertaking regional Red List projects, for example in Europe and in the Mediterranean region (Temple and Terry 2007; Cuttelod *et al*. this volume) (Figure 6). IUCN is also collaborating with other national Red List projects to incorporate their data, especially on national endemics, into the global IUCN Red List.

Regional and national lists are usually country-led initiatives, and are not centralized in any way; they differ from each other widely in terms of scope and quality but are very useful to guide conservation work at sub-global levels. IUCN and its Red List Partners are currently discussing how to disseminate the data in the national and regional Red Lists more effectively, especially those that are conducted using the IUCN standards.

A multitude of uses

The IUCN Red List can help answer many important questions including:

- What is the overall status of biodiversity, and how is it changing over time?

Fungi represent a very diverse component of biodiversity which is too often overlooked.
© Jean-Christophe Vié

Black-browed Albatross Thalassarche melanophrys - *Endangered. © Richard Thomas*

- How does the status of biodiversity vary between regions, countries and sub-national areas?
- What is the rate at which biodiversity is being lost?
- Where is biodiversity being lost most rapidly?
- What are the main drivers of the decline and loss of biodiversity?
- What is the effectiveness and impact of conservation activities?

The IUCN Red List is used in many different applications, some of which are outlined below as examples.

An indicator of biodiversity trends: The IUCN Red List Index

Governments have agreed various targets to reduce biodiversity loss. A global target of reducing or stopping biodiversity loss by 2010 has been adopted respectively by the Parties to the Convention on Biological Diversity (CBD) and the European Union. In 2000, the United Nations adopted the Millennium Development Goals (MDG) with Goal 7 aiming at ensuring environmental sustainability by 2015; this goal underpins the others, in particular those related to health, poverty and hunger. Tools are needed to monitor our progress towards achieving these targets and to highlight where we need to focus our conservation efforts. Indicators are vital in tracking progress in achieving these targets. The IUCN Red List Index (RLI) provides such an indicator and reveals trends in the overall extinction risk of sets of species (Brooks and Kennedy 2004; Butchart *et al*. 2005ab, 2007).

The development of reliable indicators requires robust baseline data; species data are still scarce for most species groups and have been collected in a variety of formats. Collecting the baseline information is certainly what requires the largest effort in terms of time, expense and the number of people involved. To respond to this challenge, IUCN and its partners have been putting extensive efforts in biodiversity assessment initiatives at global and regional levels to develop The IUCN Red List in a manner that allows the Red List Index (including various cuts of it) to be calculated and measured over time.

The *IUCN Red List Index (RLI)* has been officially included in various sets of indicators to measure progress towards the 2010 CBD target. It has also been recently adopted as an indicator to measure progress towards the UN MDG 7 goal. It will play a vital role in tracking progress towards achieving these targets, and beyond.

The RLI shows trends in the overall extinction risk of sets of species. It is based on the number of species that move between Red List Categories as a result of genuine improvements in status (e.g., owing to successful conservation action) or genuine deteriorations in status (e.g., owing to declining population size). The RLI shows the net balance between these two factors. It excludes non-genuine changes in Red List status resulting, for example, from improved knowledge, taxonomic changes, or correction of earlier errors (Butchart *et al.* 2004; 2007).

The proportion of species threatened with extinction is a measure of human impacts on the world's biodiversity, as human activities and their consequences drive the vast majority of threats to biodiversity.

Birds are the class of organisms for which all species (9,990) have been assessed the largest number of times (five times between 1988 and 2008). For this group, the percentage threatened increased from 11.1% in 1988 to 12.2% in 2008.

The RLI for the world's birds shows that their overall status (extinction risk) deteriorated steadily during 1988-2008. The RLI for birds in different regions shows that declines have occurred worldwide but regions differ in the overall extinction risk of

Informing Development and Conservation Planning

In regional and national resource management and development, The IUCN Red List can be used to guide management at scales ranging from local to national and sometimes regional levels. Examples include setting policies and developing legislation related to land-use planning,15(pted by by)Tj es and,rving r. Th*(t-m)Tn

of plants) assessment work is being undertaken with the aim of developing RLIs for each of these groups. For species groups that are composed of very large numbers of species (e.g., plants and invertebrates), a Red List Index will be calculated on the basis of a random sample of 1,500 species. This approach, pioneered by the Zoological Society of London, will allow trends in the status of a broader spectrum of biodiversity to be determined (Baillie *et al*. 2008; Collen *et al.* this volume).

Advising Policy and Legislation

The IUCN Red List data is used to inform the development of national, regional and sub-national legislation on threatened species protection, and also the development of national biodiversity strategies and action plans. It is also used to inform multi-lateral agreements such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Migratory Species (CMS), the Ramsar Convention on Wetlands, and the Convention on Biological Diversity (CBD). The Red List is recognized as a guiding tool to revise the annexes of some agreements such as the Convention on Migratory Species.

The IUCN Red List is also an important tool for implementing some elements of the Global Strategy for Plant Conservation adopted by the CBD in 2002, for example, Target 2 which calls for a preliminary assessment of all plant species and Target 7 aiming at conserving 60 per cent of the world's threatened species *in situ* (Callmander *et al.* 2005).

be threatened. These species represent a priority for future research including species-specific survey work and research into threatening processes across multiple species. The Red List is therefore used to identify species-specific survey work and ecological studies that need to be done. Using data gaps identified in the assessment process helps guide research and funding opportunities.

The IUCN Red List data also highlight general overarching threatening processes, such as emerging threats like climate change. The use of these data could greatly improve the quality of models predicting the impacts of climate change on biodiversity (Foden *et al*. this volume).

Guidelines for data use

The IUCN Red List is not intended to be used alone as a system for setting conservation priorities. Red List assessments simply measure the relative extinction risk faced by species, subspecies, or subpopulations. The Red List Category is not on its own sufficient to determine priorities for conservation action. To set conservation priorities, additional information must be taken into account (Miller *et al.* 2006)

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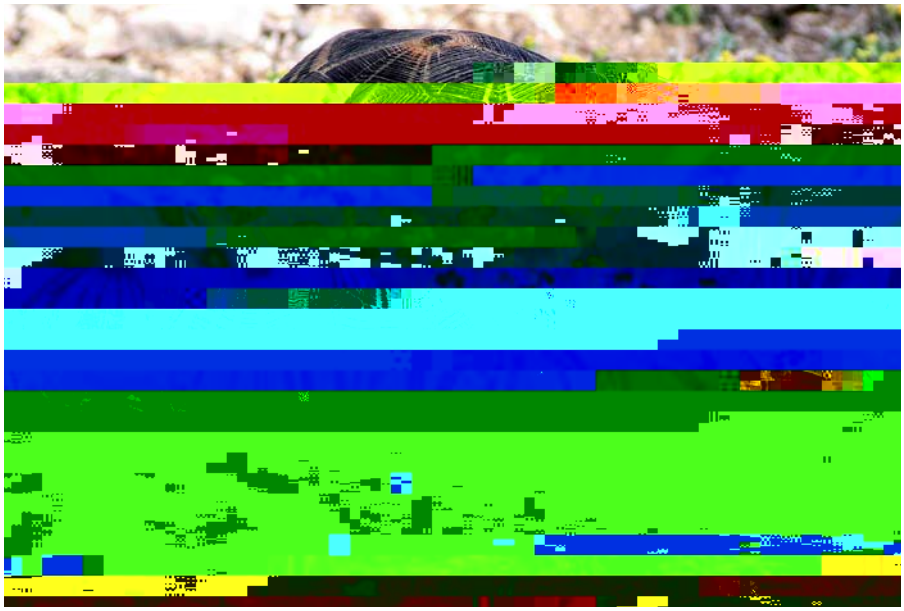
State of the world's species

Craig Hilton-Taylor, Caroline M. Pollock, Janice S. Chanson, Stuart H.M. Butchart, Thomasina E.E. Oldfield and Vineet Katariya

A species rich world

The magnitude and distribution of species that exist today is a product of more than 3.5 billion years of evolution, involving speciation, radiation, extinction and, more recently, the impacts of people. Estimates of the total number of eukaryotic species in existence on Earth today vary greatly ranging from 2 million to 100 million, but most commonly falling between 5 million and 30 million (May 1992, Mace *et al*. 2005), with a best working estimate of about 8 to 9 million species (Chapman 2006). But of these, just under 1.8 million are estimated to have been described (Groombridge and Jenkins 2002, Chapman 2006) although it has been argued that the number may be closer to 2

so that appropriate conservation actions can be taken (Mace *et al*. 2008). Given this focus together with the uneven taxonomic coverage and the fact that it may take many years to prove that a species is truly Extinct and can be listed as such on The IUCN Red List (Baillie *et al*. 2004), the number of extinctions on the Red List is significantly under-recorded. In order to record probable extinctions a 'Possibly Extinct' tag has been introduced which is used only against Critically Endangered listings (Butchart *et*



The Radiated Tortoise Astrochelys radiata *is found only on Madagascar. In 2008 its Red List status changed from Vulnerable to Critically Endangered. Wild Radiated Tortoises are collected for the international pet trade, and also for local use (food and pets), which is of greater concern for the species. Habitat loss due to agricultural expansion and invasive plant species also threaten the remaining wild population. © Anders Rhodin*

striking *Rafflesia* species (a close relative of which has the largest single flower of any flowering plant in the world) from the Philippines, and a bumble bee which has undergone dramatic declines in North America and exemplifies what is happening to other key pollinators world-wide.

The status of amphibians, birds, mammals and plants

In previous analyses of the Red List, the general analysis has looked at facts, figures and trends across all the major taxonomic groups. However, a more thematic approach has been adopted in this review and hence because freshwater and marine groups are covered in other chapters, the main focus of the rest of this chapter is on the terrestrial groups. In particular an analysis is presented of the three comprehensively assessed vertebrate groups for which we have a relatively rich knowledge, namely the amphibians, birds and mammals. Plants are also included, but are not analyzed to the same extent as the vertebrates because much of the supporting documentation for such an analysis is not yet available. The only invertebrate groups for which there is reasonable assessment coverage are the corals, dragonflies and freshwater crabs, but as these are all covered in other chapters, they are not discussed any further here.

Amphibians

CURRENT STATUS

The first comprehensive assessment of the conservation status of all amphibians was completed in 2004, and the results were included in the 2004 IUCN Red List. The amphibian assessment is one List. Thian asSihwatj T* ble aselatively ric
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Of the 38 known extinctions, 11 have occurred since 1980, including such species as the Golden Toad *Incilius periglenes* of Monteverde, Costa Rica. Among those amphibians regarded as 'Possibly Extinct', most have disappeared and have not been seen since 1980. Fortunately, a few amphibians that previously were thought to be Extinct have been rediscovered. For example, *Atelopus cruciger* was not seen in its

that threats vary between countries, or that there are other factors influencing the distribution of threatened species.

'Possibly Extinct', making a probable total of 153 bird extinctions since the year 1500.

Although 8,564 bird species (85.7%) currently are not considered threatened, 835 of these (8.4% of all known birds) are Near Threatened; the remaining 7,729 species are Least Concern.

Examining the current population trends for birds provides further confirmation that it is not just the threatened birds that are at risk as 40.3% of extant birds are recorded to be declining. A further 44.4% of bird species have stable populations and 6.2% are increasing. The population trend for 9.1% of birds is unknown or uncertain.

Geographic patterns

Bird diversity

Birds occur in all regions of the world, from the tropics to the poles. They also occur in vP4(tull y eers)-18(yhavbiate, rom the tJ T* (il

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be seen by examining the 20 countries with the highest number of birds (Table 5). Six of the richest seven countries for birds are within South America, with Colombia supporting the highest bird diversity in the world. Eighteen per cent of the world's bird species occur in Colombia (1,799 species), closely followed by Peru (1,772 species), Brazil (1,704 species) and Ecuador (1,578 species). The other regions with high bird species diversity are Africa and Asia. Six of the top 20 countries in Table 5 are in Africa, with The Democratic Republic of the Congo, Kenya and the United Republic of Tanzania having more than 1,000 bird species each. Within Asia, Indonesia supports the highest bird diversity (1,561 species), followed by China (1,237 species) and India (1,178 species).

Geography of threatened bird species

The global distribution of threatened bird species is shown in Figure 8. Nearly all countries and territories of the world (97%) hold one or more globally threatened species, which are national priorities for conservation action (BirdLife International 2008b). Regions that stand out as having particularly high densities of threatened species include the tropical Andes, Atlantic

115 threatened species respectively. These two countries also support high numbers of threatened endemic birds: Brazil has 71 and Indonesia has 67 threatened endemics (see Appendix 12), which places a particular responsibility on these countries to protect these species.

In Table 6 only the number of threatened species is given, and the number of Extinct species has been excluded. This is to highlight those countries that currently have the greatest responsibility towards protecting globally threatened bird species.

Combining the numbers of threatened birds (Table 6) and the proportion of threatened and Extinct birds in each country (Table 7) highlights those countries that are most severely affected by declines and losses of bird species.

Countries with the highest proportions of threatened and Extinct birds include

is Lake Natron in the United Republic of Tanzania, where around 2.5 million

There was insufficient information available to assess the status of 836 species (15%) hence these are listed as Data Deficient (DD). While a number of these DD listings are due to taxonomic uncertaintities, in many cases they are due to inadequate information on population size, trends, distribution and/or threats. Most (80%) of the Data Deficient mammals occur in the tropics and 69% are bats and rodents which are hard to catch because of their nocturnal habits and difficult to identify.

Geographic patterns

Mammalian diversity

Mammal species are found all across the globe, with the exception of the land mass of Antarctica. The global pattern of land and marine mammal diversity is shown in Figure 12. Regions with high diversity are clearly visible as darker patches on the global map. For land species, these regions are found in Mesoamerica and tropical South America, sub-Saharan Africa and South and Southeast Asia. Marine mammals occur throughout the world's oceans but peaks in diversity are found along all continental coastlines, as well as Japan, New Zealand, the Caribbean Sea, and the southern Indian Ocean and the ocean west of Mesoamerica.

Looking at mammal diversity from a country 0 -roW67 Twrsi80%T(TTEe)]T8)hese untry

this list, and there are actually only three mainland countries listed in the top twenty. This is a stark reminder of the inherent vulnerability of small range island endemic species to threatening processes. For most of these species, habitat loss is the most important threat, but invasive species are also having a significant impact and have in some instances led to rapid extinctions. Not surprisingly, Indonesia, ranked first for diversity as well as the number of threatened species, is still within the top 20 for percentage of threatened species.

Habitat preferences

A summary of the most important habitats for mammals is shown in Figure 14.

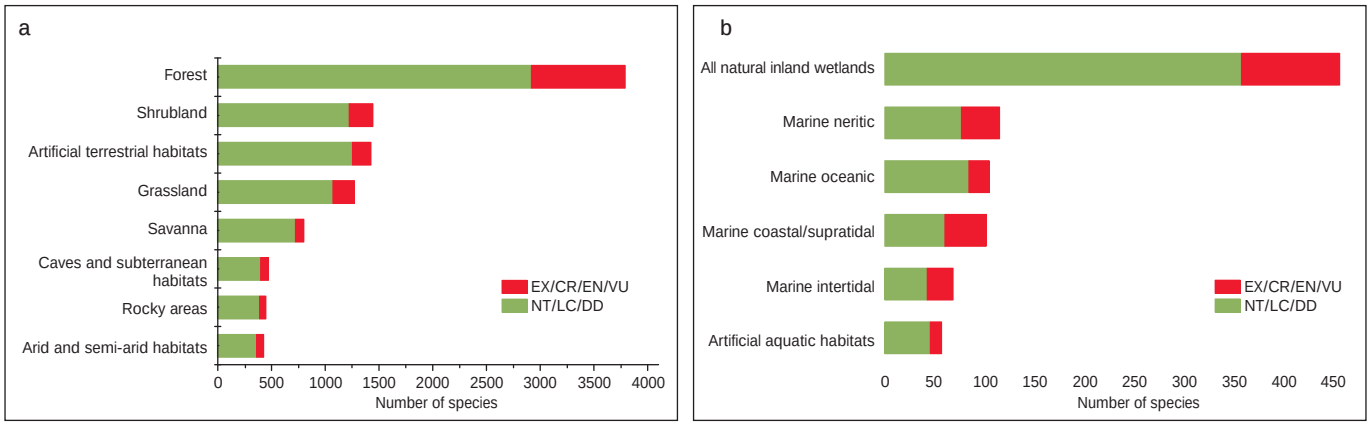

Figure 14. Habitat preferences of mammals: (a) terrestrial habitats, and (b) aquatic habitats.

not necessarily guarantee that a species will not be threatened; even though the impact of habitat loss may be lessened, some of these species are still being heavily impacted by utilization.

For aquatic species, the most common habitat is natural wetlands (mostly inland systems). Only 134 mammal species are recorded to occur in the marine environment and unsurprisingly occur in all the major marine habitats except for the deep benthic zone.

Threats

A summary of the numbers of mammal species affected by each threatening process is shown in Figure 15. By far the most significant threat to mammals is habitat loss with over 2,000 species (45% of which are listed as threatened) being negatively impacted. The second most important threat is utilization (primarily for food or medicine), with almost 1,000 species (50% threatened) affected, especially in Asia. The impact of invasive species is probably a little underestimated as only threats to extant species are included here, and a significant proportion of species now considered Extinct were driven to extinction by invasive species.

Figure 15. Major threats to mammals.

Plants

The 2008 *IUCN Red List* includes assessments for 12,055 species of plants, 8,457 of which are listed as threatened. However, as only about 4% of the estimated 298,506 described plant species have been assessed, it is not possible to say that based on The IUCN Red List that 3% of the world's flora is threatened.

Since the plant and animal Red Lists were combined in the *2000 IUCN Red List of Threatened Species*™ the number of plant assessments on the Red List has increased very slowly compared to other taxonomic groups. Of the 12,055 plants evaluated, 70% are listed as threatened (Table 1). This partially reflects a bias amongst the botanical community to focus primarily on the threatened species, but there is also a tendency to not report on the species that have been assessed as Least Concern. The focus on threatened

Box 4. Summary of results for mammals

- Nearly one-quarter (22%) of the world's mammal species are known to be globally threatened or Extinct, 63% are known to not be threatened, and 15% have insufficient data to determine their threat status.
- There are 76 mammals which have gone Extinct since 1500, two are Extinct in the Wild and 29 are 'Possibly Extinct'.
- The most diverse country for mammals is Indonesia (670), followed closely by Brazil (648). China (551) and Mexico (523) are the only other two other countries with more than 500 species.
- The country with by far the most threatened species is Indonesia (184). Mexico is the only other country in triple figures with 100 threatened species. Half of the top 20 countries for numbers of threatened species are in Asia; for example, India (96), China (74) and Malaysia (70). However, the highest levels of threat are found in island nations, and in particular the top three are islands or island groups in the Indian Ocean: Mauritius (64 %), Réunion (43 %) and the Seychelles (39%).
- Habitat loss, affecting over 2,000 mammal species, is the greatest threat globally. The second greatest threat is utilization which is affecting almost 1,000 mammal species, especially those in Asia.

Lions Panthera leo *in South Africa. The population of this Vulnerable species is declining, mainly because of retaliatory or pre-emptive killing by humans to protect life and livestock from this top predator. © Troy Inman*

species is clearly illustrated by the assessments of bryophytes (mosses, liverworts and hornworts), where the subset of 95 species was specifically chosen in order to "provide the public with general information as to which bryophytes are threatened with extinction" (Tan *et al*. 2000). The same is partly true of the assessments for ferns and fern allies (includes club mosses, spike mosses, quillworts and true ferns); in this case, the 211 species assessed (although only 1% of the species) represent a widely distributed geographic sample and so might be more representative of the threats faced by this plant group, but it would be misleading to extrapolate from these results to the whole group.

A strong bias in the plant assessments in the 2000 *IUCN Red List* was towards threatened tree species because of the inclusion of the 7,388 species (includes species in all categories from Data Deficient to Extinct) listed in *The World List of Threatened Trees* (Oldfield *et al*. 1998). That bias has been reduced slightly through the inclusion of non-tree assessments. However, the trees still form 66% of the plants on the 2008 *IUCN Red List* (7,977 species), 5,643 of which are listed as threatened.

Many of the recent plant assessments are now introducing a geographic bias

The Endangered Premnanthes amibilis *is endemic to the island of Soqotra (Yemen). It has a very small range, being restricted to a very specific part of the island where precipitation and mists are caught from monsoons. The trend for lower rainfall in the region is a particular threat to this plant. © Anthony Miller*

as they are single country or sub-country endemics (e.g., Cameroon, China, Ecuador, Madagascar, Mauritius, Namibia, Saint Helena, South Africa, Yemen (Soqotra), and the United States (Hawaii)).

the neighbouring areas in Myanmar and India; China alone has 130 species 34 of which are threatened. Other countries in Asia with high conifer diversity include Indonesia (54 species, 6 threatened), Malaysia (44 species, 15 threatened) and Japan (39 species, 5 threatened).

The distribution of cycads is much more restricted and patchy than the conifers with all species being confined to the tropical and sub-tropical parts of the world

For as long as humans have existed we have used the species around us for our own survival and development. Even today, with vast numbers of people living in towns and cities, seemingly far removed from nature, we still need plants and animals for our food, materials, and medicines, as well as for recreation and inspiration for everything from the sciences to the arts. In the developing countries, where wild animal and plant species can make a significant contribution to human diets and healthcare, maintaining a healthy biodiversity is of particular importance.

Biodiversity for food and medicine

It is estimated that 50,000 to 70,000 plant species are used for traditional and modern medicine (Schippmann *et al*. 2006). These species are vital to traditional healthcare systems in less-developed countries. For example, in some Asian and African countries, up to 80% of the population depends on traditional medicine for primary health care (World Health Organization 2008). Medicinal plants are also increasingly recognized as effective alternative treatments in developed countries. Herbal treatments, for instance, are highly lucrative in the international marketplace. Annual revenues for herbal treatments in Western Europe reached US$ 5 billion in 2003–2004; in China, sales totalled US$ 14 billion in 2005; and herbal medicine revenue in Brazil was US$ 160 million in 2007 (World Health Organization 2008).

Figure 19 shows the proportions of birds, mammals and amphibians used for food and medicine and compares threatened and non threatened species that are utilized in this way against species that are not utilized.

Figure 19a indicates that 14% of the world's birds are used for food and/or medicine although this is probably an underestimate. It is difficult to know how many individual birds are used, but it is estimated that between

but the diversity of species consumed is probably under-recorded and further studies will almost certainly reveal additional species not previously identified as being used in this way (Stuart *et al*. 2008). Amphibians have long been recognized for their value in traditional medicines and they are still collected for this purpose today. The potential value of amphibians to modern medicine is coming under increasing scientific study, with their diverse skin secretions being of particular interest (Stuart *et al*. 2008).

Threat status of species used for food and medicine

Figure 19b shows the proportions of threatened species within those bird, mammal and amphibian species that are used for food and medicine. Although 12% of all bird species are globally threatened with extinction (Table 1), a larger proportion (23%) of those species used for food and medicine are threatened. Mammals show a similar pattern: 21% of all species are known to be threatened (Table 1), but 36% of the species used for food and medicine are threatened. For amphibians, there is little difference between the proportion of threatened species within all known species (30%) (Table 1) and the proportion of species used for food and medicine that are threatened (28%). Many of the wild species used for food and medicine are threatened, some due to over-exploitation, some to different pressures such as habitat loss, and for others a combination of factors. Regardless of the causes, the diminishing availability of these resources threatens the health and well-being of the people who depend on them directly for food and medicine, and on wild collection as a source of income.

Trends in status of biodiversity for food and medicine

The RLI for birds used for food and medicine (Figure 20a) indicates that these species are more threatened than those that are not utilized in this way and that the conservation status of these species is also deteriorating at a slightly greater rate. The RLI for mammals shows a similar pattern (Figure 20b). In contrast to the birds and mammals, amphibians used for food and medicine appear overall to be less threatened than amphibians not used for these purposes (Figure 20c). However, the conservation status of these species is declining more rapidly than that of amphibian species not used for food and medicine.

At present, insufficient data are available to produce a meaningful Red List Index (RLI) for medicinal plants; only 109 species (0.7%) of medicinal plants have Red List assessments available for the years 1997 and 2008. Hence an analysis of these species is not included here.

The 2008 IUCN Red List – Good News or Bad?

The overwhelming message from the results presented in this chapter and in other chapters in this volume is that dm messa1es wtild is oasing species and that the dm mess ra

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The40s species that shoted m prvede vatio status(in 2008dto prvidce a)]TJ T* [ilimmher ofhopte.Cconservatio aectioes are

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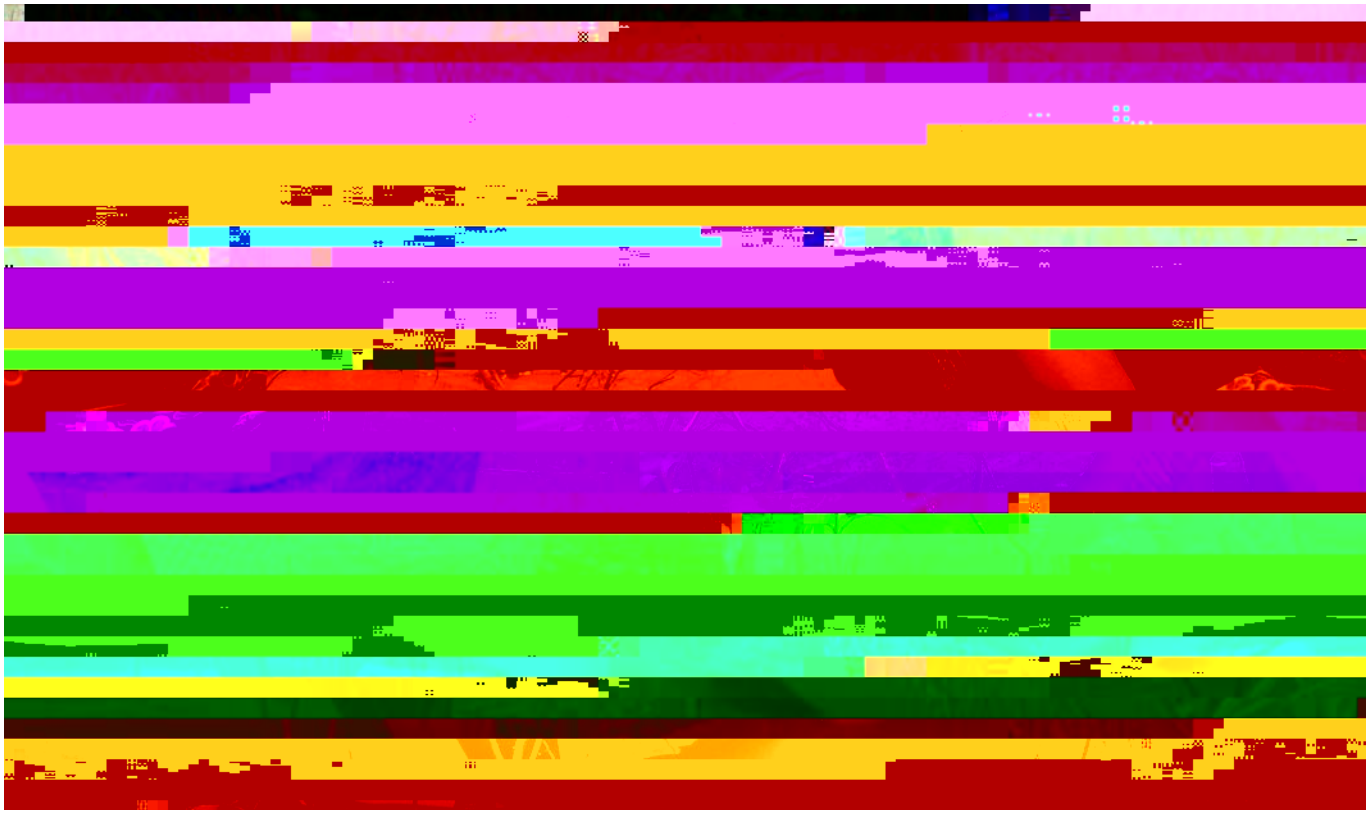
There are also many examples of

Group. IUCN, Gland, Switzerland and Cambridge, UK.
Groombridge, B. and Jenkins, M.D. 2002. *World Atlas of Biodiversity*. Prepared by the UNEP World Conservation Monitoring Centre. University of California Press, Berkeley, USA.
Hilton-Taylor, C. (compiler). 2000. *2000 IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland and Cambridge, UK.
IUCN Standards and Petitions Working Group.

Biodiversity in hot water

While freshwater habitats cover less than 1% of the world's surface (Gleick 1996), they provide a home for 7% (126,000 species) of the estimated 1.8 million described species (Balian *et al*. 2008), including a quarter of the estimated 60,000 vertebrates.

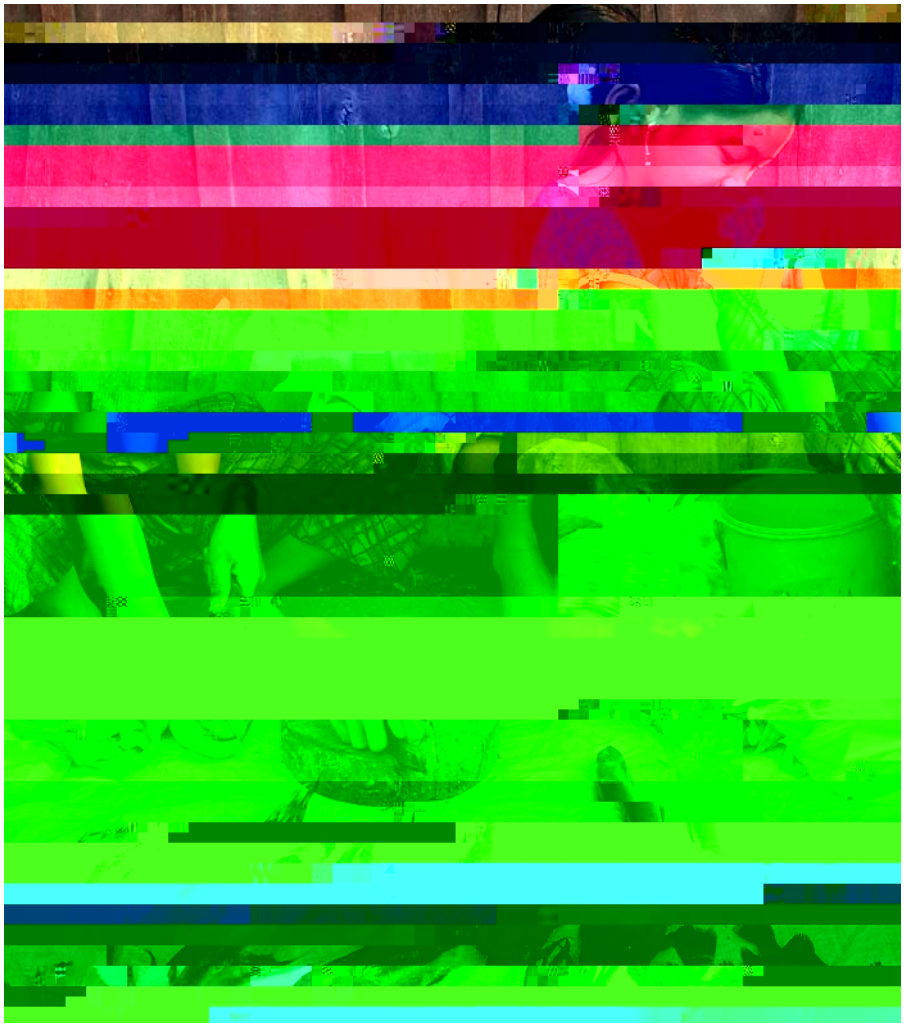
Freshwater ecosystems not only provide habitat for the survival of their component species but also enable the storage and provision of clean water for human use. They also provide many important goods and services ranging from food and building materials, to water filtration, flood and erosion control, and are a criti9o2s /T1_0 to 1eose. They also provuman Gleick poo prt9.37



IUCN has produced a *toolkit* (Springate-Baginski *et al.* 2009) that will assist in wetland conservation and development decision-making. It provides an assessment approach that ensures the links between biodiversity, economics and livelihoods are captured, with a particular focus on strengthening pro-poor approaches to wetland management.

considered as 'wastelands' ripe for conversion to alternative uses. As a result, many wetlands have been drained and converted for ostensibly more 'profitable' uses; 60% of Europe's wetlands have already been lost (UNEP/DEWA 2004) through conversion to alternative use or simply through lack of conservation over the last 50 to 100 years.

Globally, rapidly increasing human populations are putting ever-greater pressure on the goods and services supplied by freshwater ecosystems.



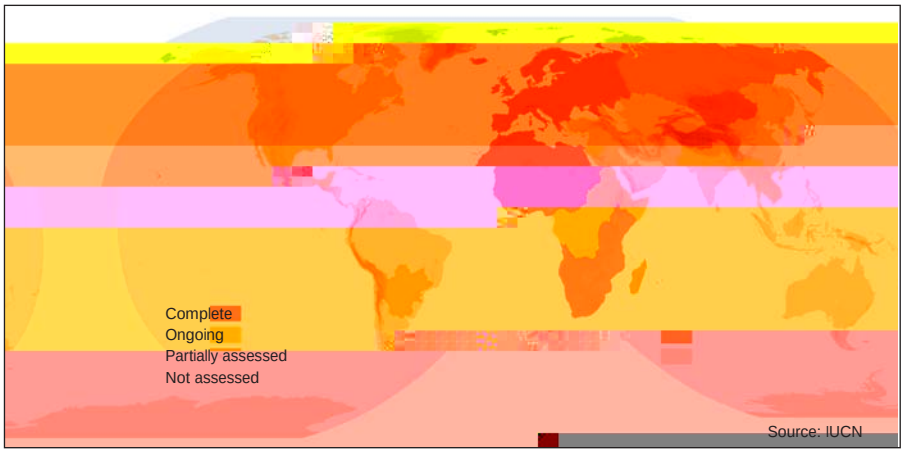
The long-term survival of many wetland-dependant species is therefore becoming more precarious as wetlands are increasingly exploited for human use. With the number of people living in water-scarce or water-stressed conditions projected to rise from 745 million in 2005 to 3.2 billion by 2025 (Population Action International 2006), it is therefore no surprise that global development objectives are firmly focused on the world's freshwater supply crisis. For example, the Millennium Development Goals (MDGs) include targets for halving the number of people without access to clean drinking water and sanitation by 2015. However, if we are not careful, the stage could be set for large-scale impacts to freshwater biodiversity. In order to avoid and mitigate major impacts to freshwater species and ecosystems, information on the status, distribution and value of freshwater biodiversity is urgently needed to inform the development planning process.

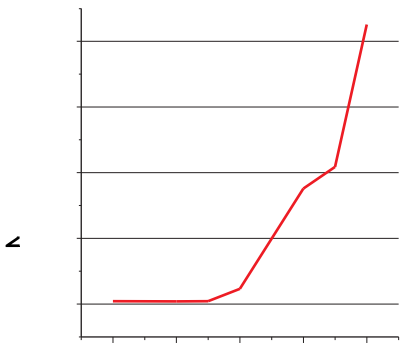
Data on freshwater species often exist, especially for the more developed catchment areas, but they are frequently widely dispersed in unpublished literature, and are hence effectively inaccessible, particularly in places where the greatest increase in development is taking place. Such data need to be easily and freely accessible, with species distributions available in a digital format, to enable a full understanding of the impact of developments on freshwater systems.

The information also needs to be more comprehensive (i.e., cover more taxonomic groups), reliable, robust and regularly updated. Without access to this information, development projects will not be able to mitigate or avoid actions that may have major negative impacts upon wetland biodiversity and the predominantly poor communities dependant on wetland resources.

Filling the information gap

IUCN is working with a number of partner organisations to fill the information gap on freshwater species by providing relevant data in a format suitable for use within development and conservation planning processes. This is being accomplished



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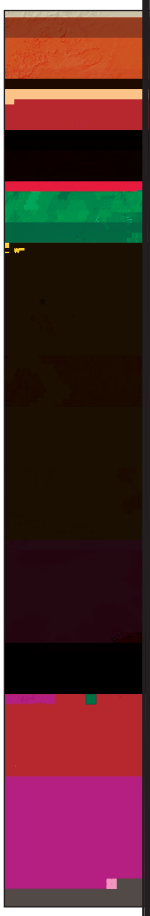

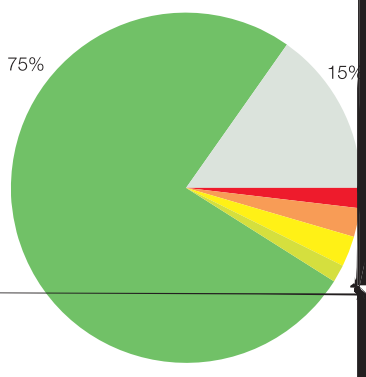
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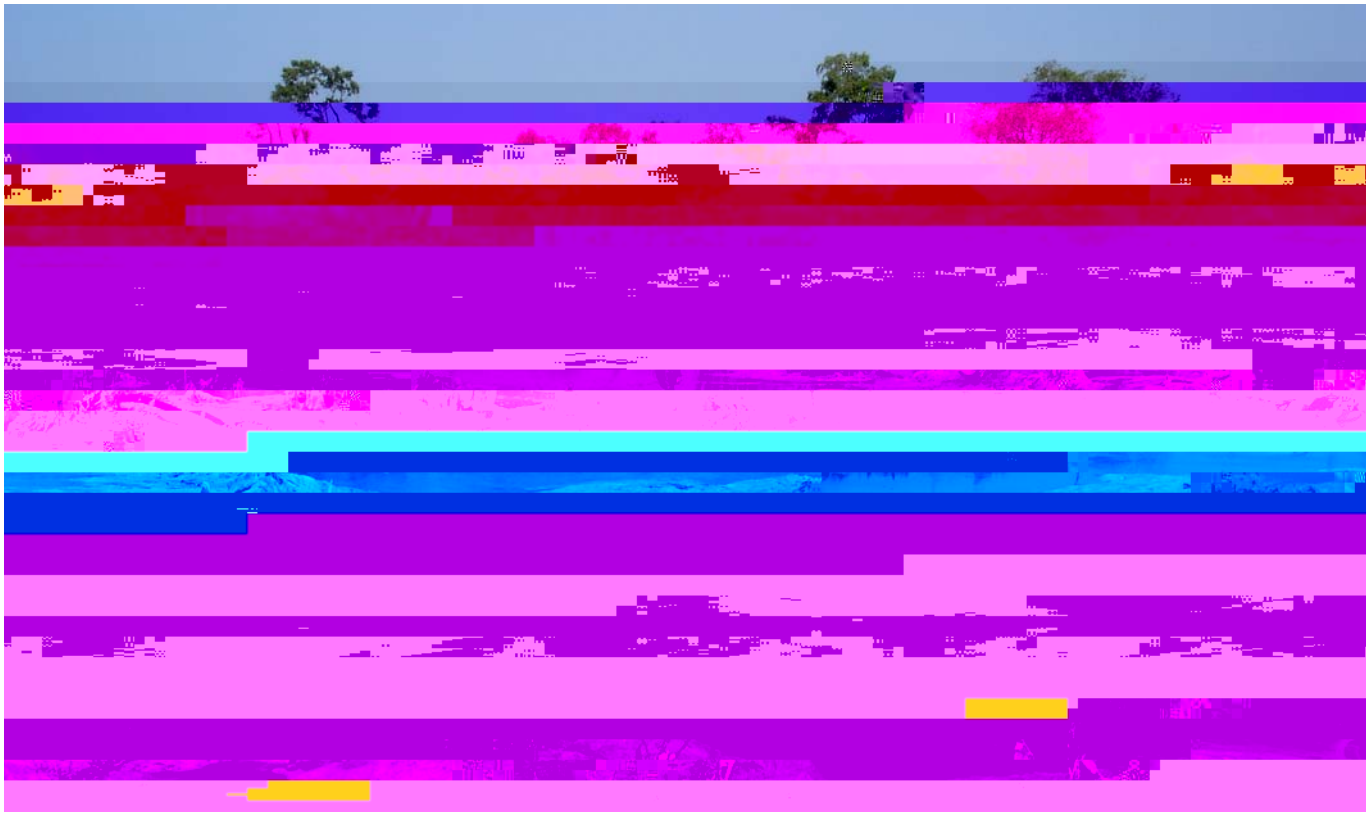
way for expanding agriculture and as a supply of fuel wood or charcoal. As an example, in Lake Tanganyika increased sedimentation has led to loss of rocky substrates along the lakeshore that provide important habitat for many of the endemic cichlid fishes (Gilbert 2003). Invasive alien species are also a major threat throughout the region in particular tohe



Global threat to freshwater crabs

All species of freshwater crabs have been globally assessed as part of the effort to increase the species diversity of The IUCN Red List; 16% of the species are threatened (Collen *et al*. this volume).

Key Messages

- *Freshwater biodiversity is extremely threatened*. Findings from the comprehensive assessments undertaken to date show freshwater biodiversity to be highly threatened, possibly more so than species in other systems. This is largely a result of: i) the high degree of connectivity within freshwater systems such that threats like pollution and invasive alien species spread more rapidly and easily than in terrestrial ecosystems, and ii) the rapidly increasing use and development of water resources with little regard to the requirements of the freshwater dependant species sharing the resource.

- *Public awareness of the threat to freshwater species needs to be raised.* The level of threat to freshwater biodiversity is extremely high, yet public awareness of this situation remains woefully low. Freshwater species are largely unseen by the general public, are not often considered as charismatic, and their values to people not well recognized. Conservation of freshwater species needs to be treated on a par with other more visible and charismatic species groups, such as birds and large mammals. Freshwater species need to be treated as being worthy of conservation in their own right, not simply as exploitable resources for human consumption. For example, in Europe fishes are primarily managed as agricultural resources and in many parts of the world molluscs are managed as fisheries resources, not as species of conservation significance – this is in stark contrast to the treatment of birds and mammals.

- *Freshwater species provide important ecosystem services.* Awareness of the ecosystem services provided by freshwater biodiversity needs to be raised. For example, the production of clean drinking water depends on the functions provided by many freshwater species yet this is rarely recognized. A single freshwater bivalve may filter more than seven litres of water a day – without keystone species such as these, the fisj T anWvicee eshwaterig0.1NS1 cs apcts s a dayral rgnizeunagSrig0.1NS1 cs eat to freshwahe le regard of the threat to freshw 1 T9pecie speciesIly leds to be o the treimhe [(ercemen0h 1 T)Te(she (cleae spT*J T*es)Tample, this iolTj (s)T and mammals.

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assessments alone do not conserve species. Increased support of *in-situ* conservation initiatives capable of addressing immediate known problems is needed. Furthermore, support should be given to *in-situ* conservation education programmes which increase awareness of the problems among the local community, highlight potential ramifications for the future, build support and identify and develop practical solutions.

- *Environmental Impact Assessments (EIAs) need to take better account of impacts to freshwater species.* EIA guidelines and legislation should aim to highlight potential impacts to freshwater species. EIA specialists should be encouraged to consult the information being collated through the biodiversity assessments conducted by IUCN, its partners and others.

- *The lack of existing information for many freshwater species needs to be rectified.* A significant proportion of freshwater species remain Data Deficient, in particular due to lack of taxonomic expertise to formally describe new species, and lack of spatial information on species distributions. This situation appears to be getting worse as the number of qualified taxonomists decreases and as opportunities for field survey become less frequent. For example, the provision of new location records for dragonflies has declined dramatically over the last 20 years. With an estimated 35% of the world's dragonflies assessed being classdeclined dramaticaned ata Deficient, ihers in hcurenety olitte ofportunitiyfor df cetter anformation on shere apecies. cAnincrease eld survey bomebned d]TJ T*[cwth aaxonomic etrin ng)for docal cxpertis,T15( )]TJ T*[cnd ah

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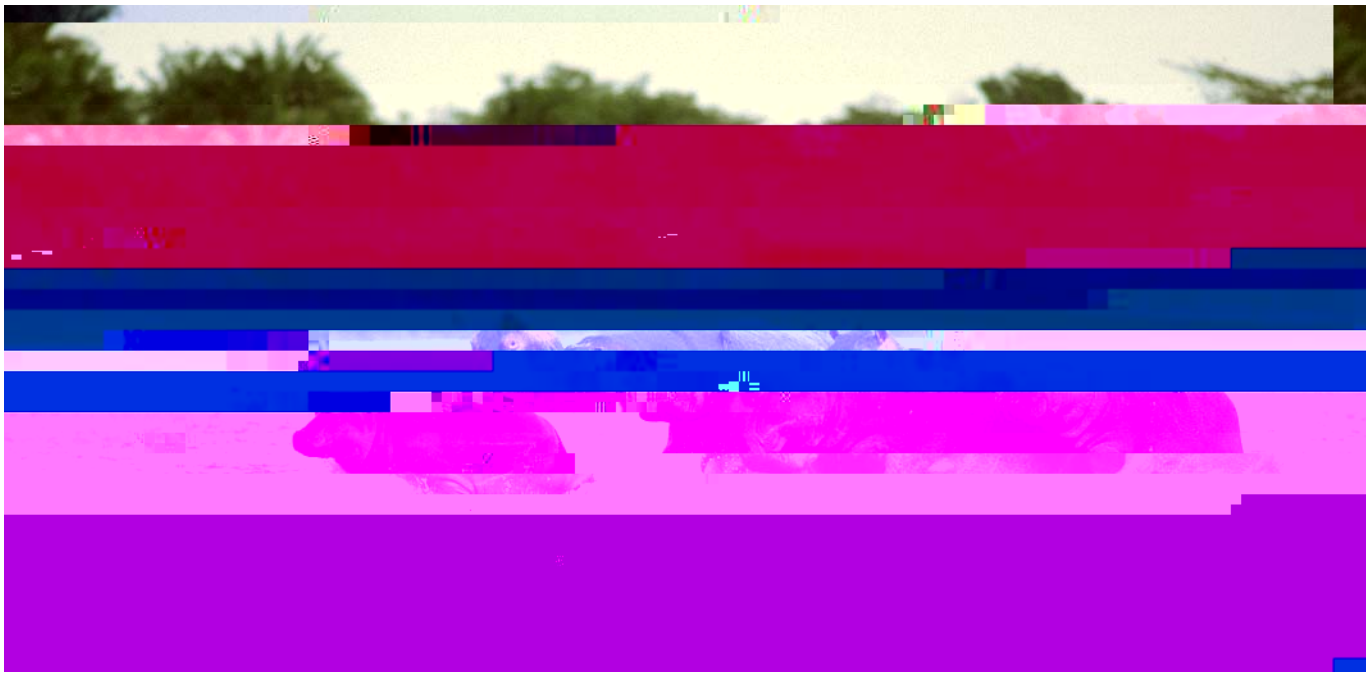

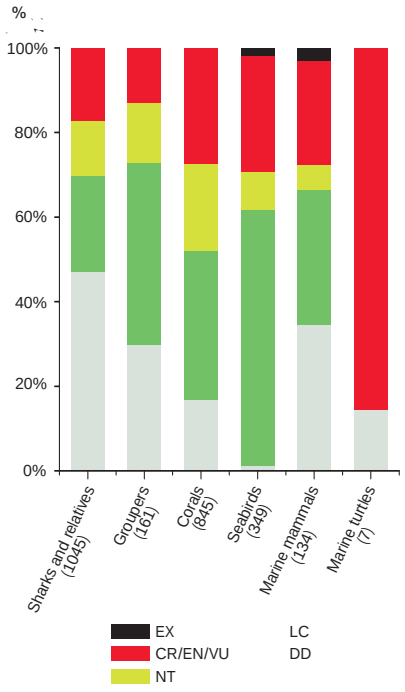
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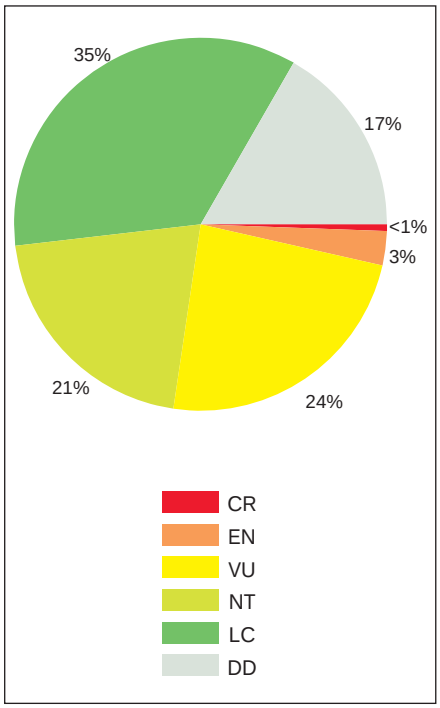
sharks (*Alopias spp.*) and the Porbeagle Shark *Lamna nasus* are all classified as Vulnerable, with some subpopulations of these species at even greater risk. Oceanic sharks are taken in large numbers in international waters. It is clear that wide-ranging, highly migratory sharks need international precautionary collaborative management, but very few countries have set catch limits for sharks and there are none in place on the High Seas. The Food and Agricultural Organization of the United Nations has urged countries and regional fishing bodies to develop and adopt Shark Management Plans, but only few have done so to date. The adoption of finning bans by fishing states, regional bodies and fisheries organizations is accelerating, which should increasingly prevent the fishing of sharks for their fins alone, but further coordinated measures are needed. A major obstacle to the formulation and implementation of management measures is the lack of data on a large proportion of species. Catches are largely unreported in many areas and improved monitoring systems are needed.

The IUCN/SSC Shark Specialist Group will continue to raise awareness about the plight of sharks and promote their effective management at national, regional and international levels. This will be done firstly, through the wide dissemination of the results from this first complete assessment for the IUCN Red List, which can be used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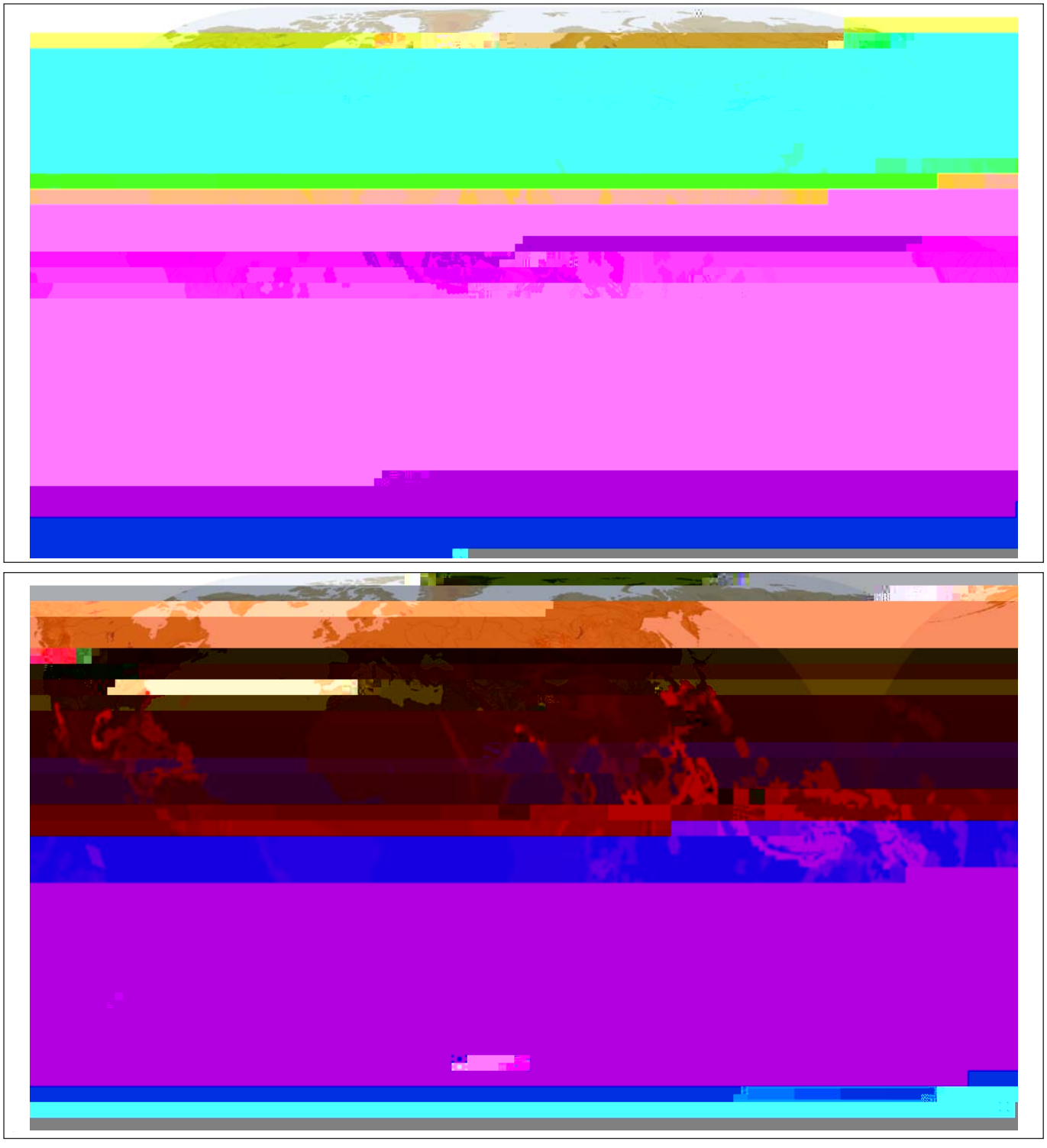
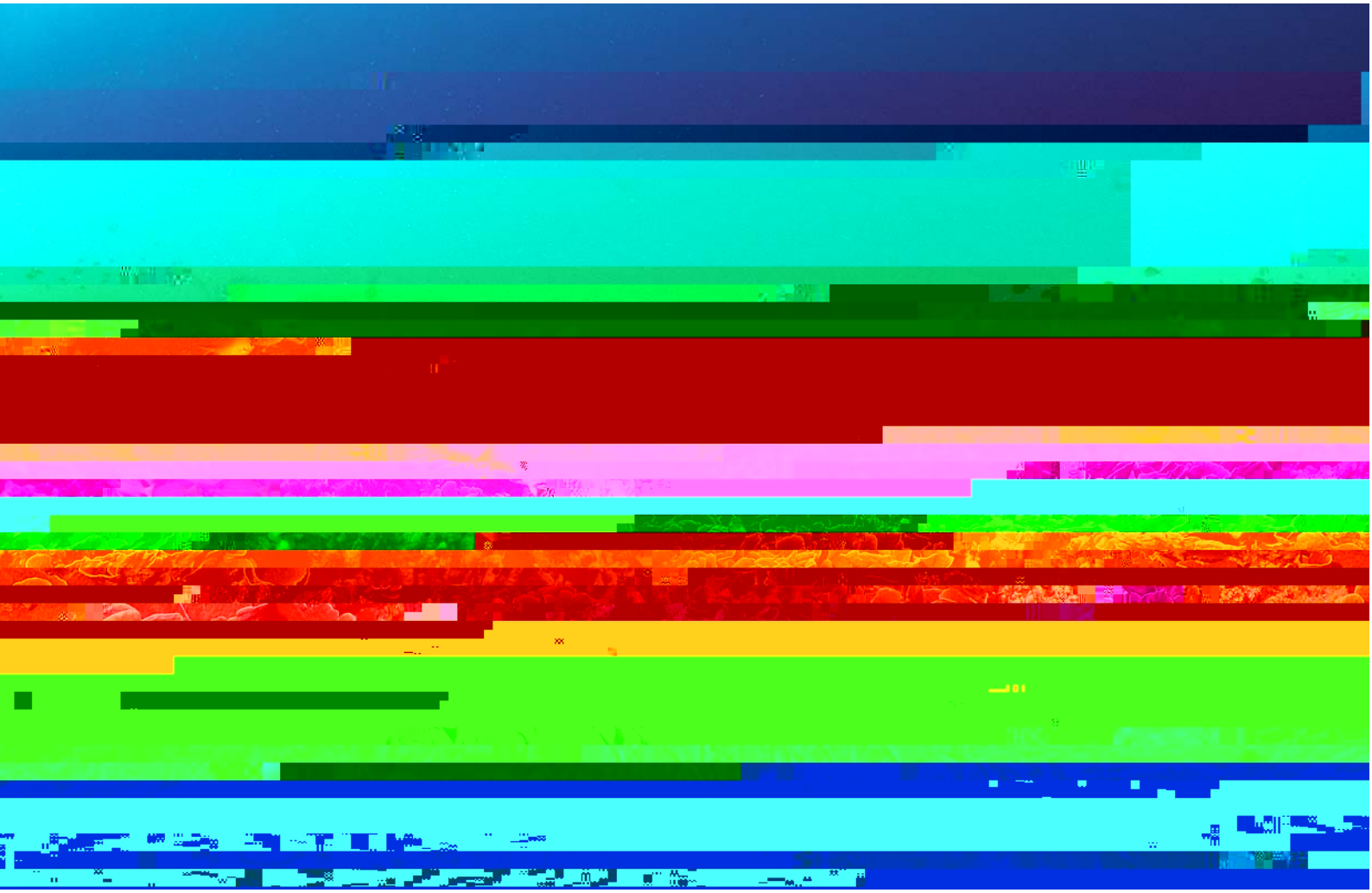
are taken in massive numbers from their spawning aggregations and maintained alive during shipment to Hong Kong, the global trade centre for live marine fish. The demand for live fish for the luxury restaurant trade in China is massive and expected to grow in tandem with increasing wealth in the region. As much as 20% of groupers landed globally are destined for the LRFFT. However, the populations of many preferred groupers are limited and already beginning to show the strain in some areas, with several species in the trade now listed in threatened categories or as Near Threatened.

In the tropical western Atlantic, the Nassau Grouper *Epinephelus striatus*, once the most important of all groupers in the landings of Caribbean islands, is now considered Endangered. Living for several decades and taking about five years to become sexually mature and spawning in aggregations, this species has proven biologically unable to withstand decades of heavy and uncontrolled fishing and is severely reduced throughout most of its range. Regional discussions are now being

Figure 3. The Indo-Malay-Philippine Archipelago or the "Coral Triangle" region has the highest coral species richness (a) and proportion of species in threatened categories (b).





The loss of coral reef ecosystems will have devastating effects on a wide spectrum of marine species, as well as for people and nations that depend on reef resources for their livelihoods and economic security. © Jerker Tamelander

conducted to seek proper protection of the species and to introduce much-needed monitoring and management measures. More than anything, a greater awareness is needed on the plight of this species.

The objectives of the IUCN SSC Grouper and Wrasse Specialist Group's work, after determining the conservation status of each grouper species, is to focus on those species that are most threatened, address major threatening factors, fill gaps in information and raise awareness of the problems these species face. In addition to Red List assessments, ongoing projects provide support and information to enable spawning aggregations to be managed and considered in protected marine area planning, and seek sustainable practices in the LRFFT and grouper mariculture in Southeast Asia. The need for regional as opposed to national-level management and conservation initiatives for groupers should be highlighted, as many grouper species are highly mobile as adults and all have a widely dispersive pelagic larval phase.

Corals

The world's known 845 species of reef-building zooxanthellate corals (order Scleractinia plus the families Helioporidae, Tubiporidae, and Milleporidae) have also been assessed for the first time (Carpenter *et al.* 2008).These reef-building corals are essential habitat for many species of fish and invertebrates making them the most biologically diverse ecosystems in the ocean. More than one-quarter of these corals (27%) have been listed in threatened categories, representing an elevated risk of extinction (Figure 2). Over 20% of species are listed as Near Threatened, and are expected to join a threatened category in the near future. Although approximately 17% of reef-building corals are listed as Data Deficient, more than half of these are in the family Acroporidae, which is characterized by species with high susceptibility to bleaching and disease. Primary threats to these reef-building corals are increased frequency and duration of bleaching and disease events that have been linked to the increase in sea temperatures, a symptom of global climate change. The impacts of these oceanographic environmental changes are also compounded by anthropogenic threats including coastal development, coral extraction, sedimentation and pollution. A further sinister threat to corals is ocean acidification as a result of increasing levels of atmospheric carbon dioxide. This is reducing ocean carbonate ion concentrations and the ability of corals to build skeletons.

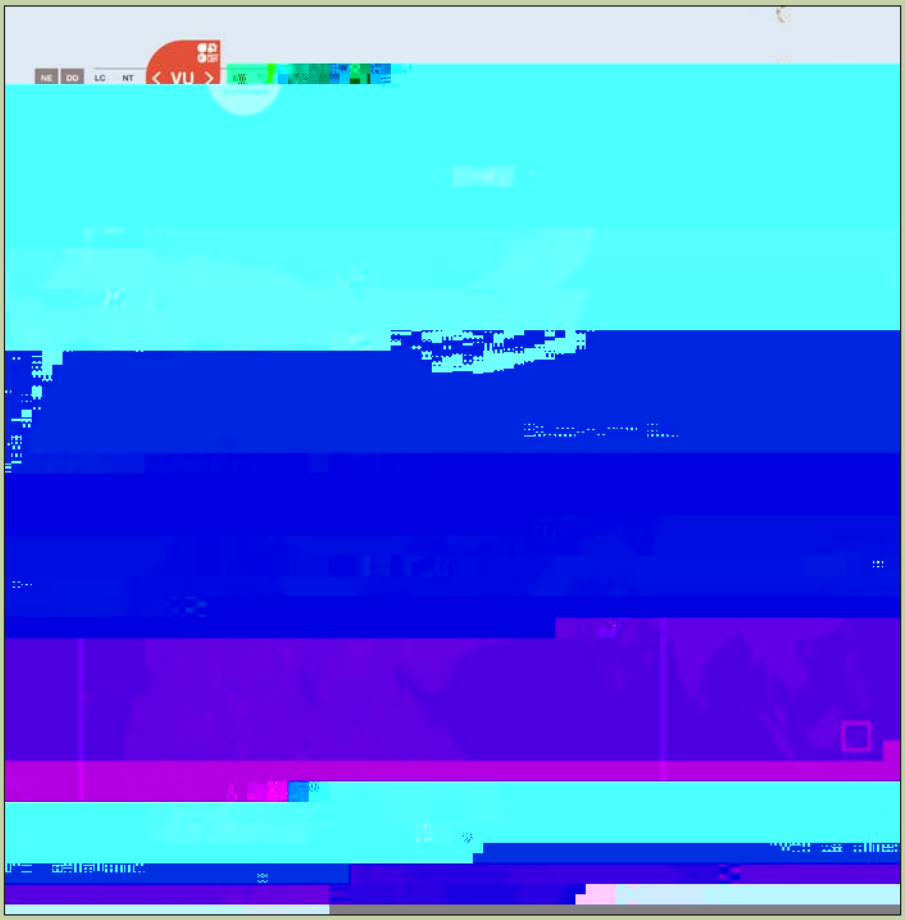
Globally, the Indo-Malay-Philippine Archipelago or the "Coral Triangle" has the highest number of species in threatened

categories. This region is also known as the epicenter of marine biodiversity, and has the highest coral species richness (Figure 3). Coral reefs in the Caribbean region have been impacted by recent,

The Sulawesi Coelacanth *Latimeria menadoensis*: A Living Fossil

A new addition to the 2008 Red List is the Sulawesi Coelacanth *Latimeria menadoensis*. Coelacanths are considered to be "living fossils," as they were thought to be extinct since the end of the Cretaceous period, until a specimen was found off the coast of South Africa in 1938. The Sulawesi Coelacanth was first recorded in 1997 when it was captured off the coast of Manado, Indonesia in the Sulawesi Sea. It is a relative of the Critically Endangered African Coelacanth *Latimeria chalumnae* which occurs in the Indian Ocean, and is known from Grand Comoro and Anjouan islands, the coast of South Africa, Madagascar, and Mozambique. Although the two Coelacanths from the two regions are outwardly identical, genetics show that they are actually separate species. The Sulawesi Coelacanth is only currently known from three locations and a small number of specimens, the most recent being caught in May 2007. Although the population status and trends of this species is unknown, it is believed to be a naturally small population. The Coelacanth in both regions live in caves and rocky slopes between 150 and 200 meters deep, is rarely captured, and very difficult to observe in its natural habitat.

Not much is specifically known about the biology and ecology of the Sulawesi Coelacanth, but what is known suggests that its life history traits are similar to the African coelacanth. Coelacanths are at high risk for extinction when subjected to threats because they are slow-growing and late to mature, and long-lived. They also typically produce a small number of eggs at one time. The Sulawesi Coelacanth that was caught in May 2007 in Bunaken National Marine Park was a pregnant female and had a number of large, orange-sized eggs. These large eggs are thought to hatch within the oviduct before the female gives birth to live young. Scientists in Indonesia, France and Japan are currently conducting research to better understand their reproductive biology.

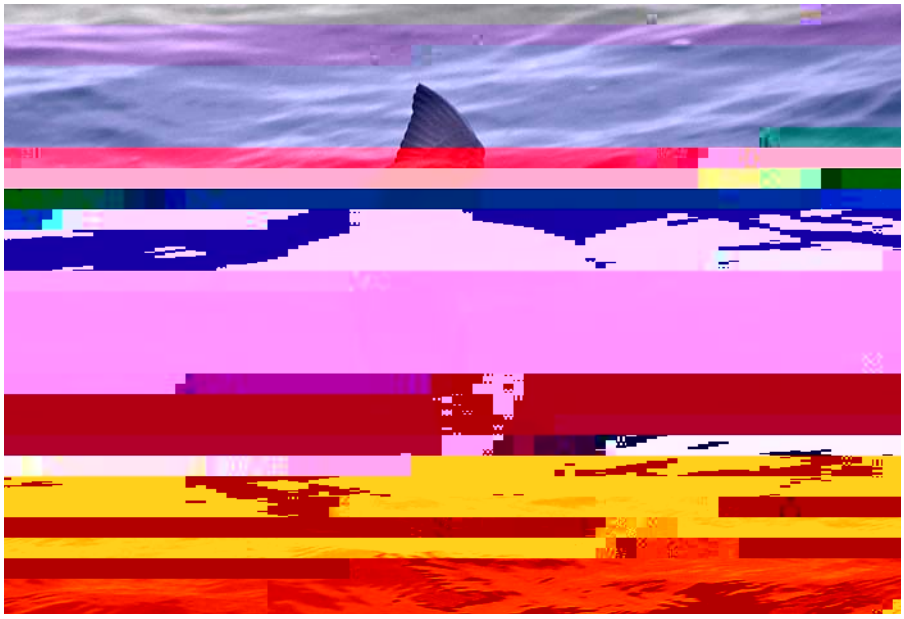


The Sulawesi Coelacanth lives in deep-water caves and rocky slopes, and is only known from a few locations along the northern Sulawesi coast, Indonesia.

Although the Sulawesi Coelacanth is poorly known, it is listed as Vulnerable given its life history, predicted small population size, and susceptibility to several threats, including capture as bycatch in deep shark nets, and by hook and line fisheries that target deepwater snapper. The Coelacanth is also sought after for large aquarium display, although no specimen has ever been successfully kept alive for this purpose. The African Coelacanth assessment is in need of updating due to new information since the last assessment made in 2000.

As awareness of the Sulawesi Coelacanth is increasing, more information is being collected about these mysterious fish. Now that the fishermen know that these fish are unique, there is a better chance of a catch being reported, and specimens being kept for further investigation. Better reporting may also give more insight into the size of the population, and the effects that bycatch may be having on the population of the Sulawesi Coelacanth. This Coelacanth is currently protected locally by Indonesian fishing regulations, and also internationally by the Convention on International Trade in Endangered Species (CITES Appendix I).

The Sulawesi Coelacanth Latimeria menadoensis *is considered a "living fossil," and has recently been added to the IUCN Red List of Threatened Species as Vulnerable. © Mark Erdmann*



Members of the IUCN SSC Marine Turtle Specialist Group are also discussing the potential for regional-scale assessments, as has been done with other taxonomic groups like sharks, and have recently completed regional assessments for Mediterranean and Hawaiian Islands turtles. The IUCN SSC Marine Turtle Specialist Group also continues to pioneer new methods for finer scale conservation priority setting for marine turtles through regular meetings that since 2003 have generated a number of useful priority setting tools including the Hazards List of the anthropogenic pressures that prevent marine turtle recovery; a Top Ten List of most threatened marine turtle

Broadening the coverage of biodiversity assessments

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

While species coverage in The IUCN Red List of Threatened Species™ 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.* this volume; Vié *et al.* this volume). 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 about 2.7% of

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 ptio[thhkilywha5( )]TJ T*[descwhaernhhkilws)yact)ore

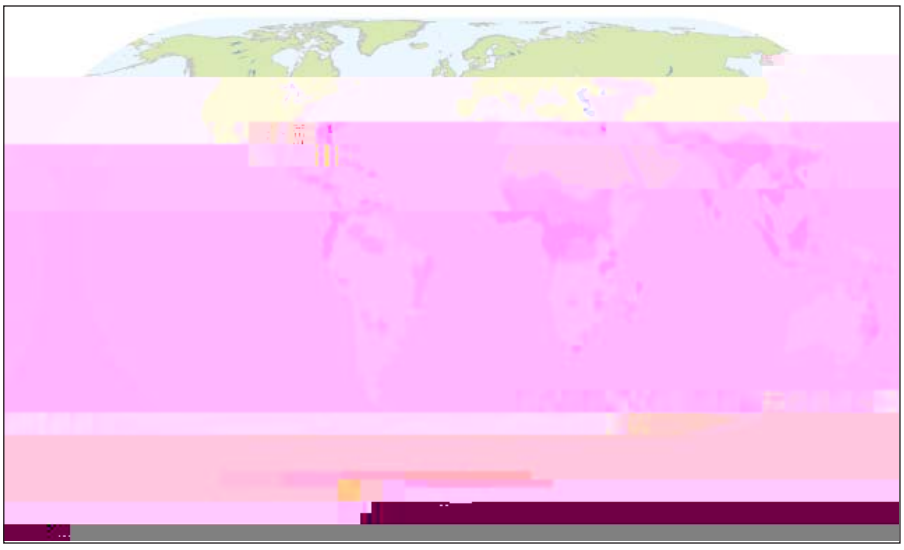
Figure 4. Proportion of reptiles in each Red List Category (a) and the major threats to globally threatened reptiles (b).

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 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.



al. 2008). The main message drawn from

lack of invertebrate coverage on the IUCN Red List to date, is particularly pressing in

(Hilton-Taylor *et al.* this volume), 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

gap: addressing disparity in global monitoring. *Tropical Conservation Science* 1: 75-88. Available online: http://tropicalconservations-18(va://)TJringabayC5a4.nbm/r

Species susceptibility to climate change impacts

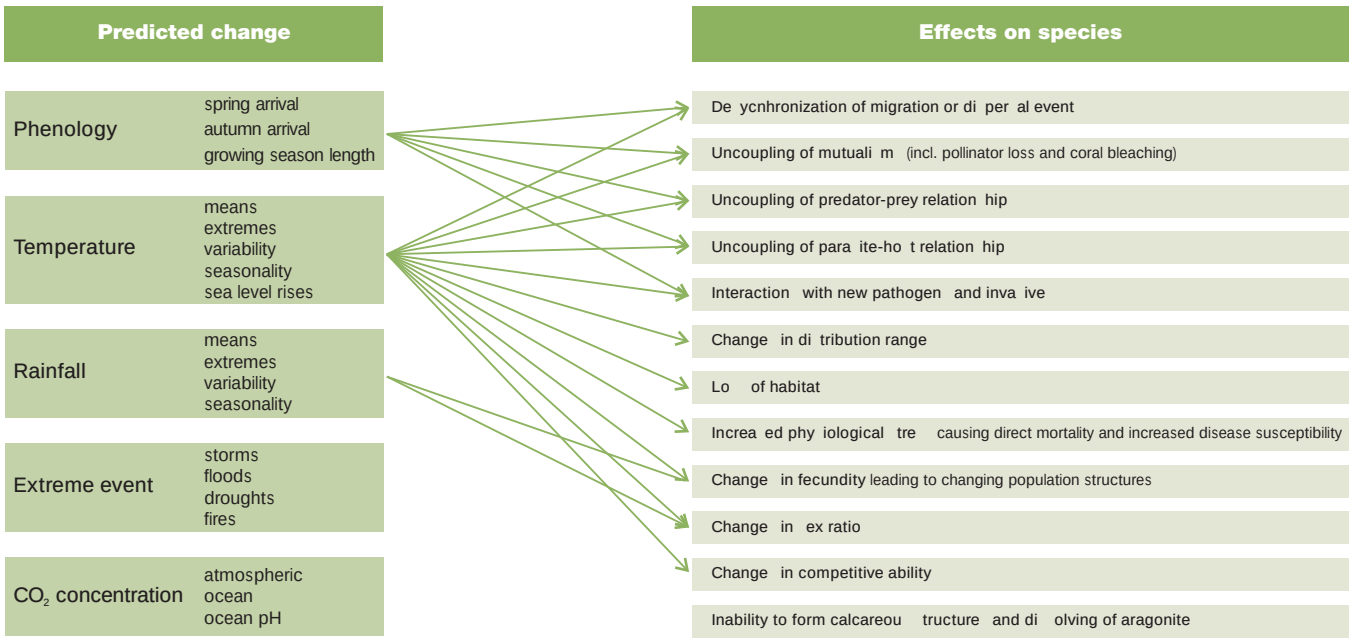
Wendy B. Foden, Georgina M. Mace, Jean-Christophe Vié, Ariadne Angulo, Stuart H.M. Butchart, Lyndon DeVantier, Holly T. Dublin, Alexander Gutsche, Simon N. Stuart and Emre Turak

Background

There is growing evidence that climate change will become one of the major drivers of extinction in the 21st century. An increasing number of published studies have documented a variety of changes attributable to climate change, for example changes in species breeding times and shifts in distributions (Figure 1). The Intergovernmental Panel on Climate Change concludes that approximately 20-30% of plant and animal species are likely to be at increasingly high risk of extinction as global mean temperatures exceed warming of 2-3ºC above preindustrial levels (Fischlin *et al*. 2007). Another synthesis study predicts 15-37% 'commitment to extinction' by 2050 of the wide range of regionally endemic and near-endemic species examined (Thomas *et al*. 2004). How can we predict which species will be most threatened by climate change, and how best can we mitigate the impacts?

To date, most assessments of species extinctions under climate change have been based on either isolated case studies or large-scale modelling of species' distributions. These methods depend on broad and possibly inaccurate assumptions, and generally do not take account of the biological differences between species. As a result, meaningful information that could contribute to conservation planning at both fine and broad spatial scales is limited. Conservation decision-makers, planners and practitioners currently have few tools and little technical guidance on how to incorporate the differential impacts of climate change into their plans and actions.

IUCN is developing assessment tools to identify the potential effects of climate change on species. The IUCN Red List Categories and Criteria were developed before climate change impacts on species were widely recognized, and although they



remain effective for identifying species that are undergoing declines in ranges or population sizes, they may need further refinement in order to identify the full suite of species at risk from climate change. A new initiative aimed at examining how the IUCN Red List Criteria can be used for identifying the species most at risk from climate change is underway. This study, although it forms part of the overall project looking at the impacts of climate change on species, is not discussed further here.

Methodological approach

General Circulation Models (GCMs) predict that climate change will affect different areas of the world to different degrees. But it is also widely recognized that not all species will respond in the same way, even to similar levels of climatic change. A species' individual susceptibility to climate change depends on a variety of biological traits, including its life history, ecology, behaviour, physiology and genetic makeup. Species exposed to large climatic changes in combination with intrinsic susceptibility to climate change face the greatest risk of extinction due to climate change (Figure 2).

We assessed susceptibility to climate change according to taxon-specific biological traits and present an analysis of the potential impacts of climate change on species based on an analysis of these traits. Using expert assessments for birds (9,856 species), amphibians (6,222 species) and warm-water reef-building corals (799 species), we examined the taxonomic and geographical distributions of the species most susceptible to climate change and compared these to the existing assessments of threatened species in The 2008 IUCN Red List of Threatened Species™ (herein The IUCN Red List; IUCN 2008). Specifically we address the following questions:

- What are the biological traits that make species potentially susceptible to climate change?
- How common are these traits in birds, thhese trai l 9 252.02ict herect 9.479inclu06n ne[The

- How do taxonomic and geographic concentrations of species that are potentially susceptible to climate change compare with those of threatened species?

What are the biological traits that make species most susceptible to climate change?

Through detailed consultations with a wide range of experts, we identified over 90 biological traits that may be associated with enhanced susceptibility to climate change. These were consolidated into five groups

threats, and additional information was gathered from published and unpublished data, online resources, literature and expert knowledge. While we attempted to address data gaps with experts' inferences and assumptions, numerous uncertainties remain. In summary, our results are based on the following assumptions: that species' susceptibility to climate change is associated with the possession of specific biological traits that we have identified; that the possession of any one of these traits increases the susceptibility of a species to climate change; and that our classification of each species according to these traits is accurate.

How common are these traits in the amphibians, birds and warm-water reef-building corals?

Birds

Eleven traits were selected for this relatively information-rich group. 3,438 of the world's 9,856 extant bird species (35%) possess traits that make them potentially susceptible to climate change. Of these, 1,288 species have between two and seven such traits with the majority of species qualifying due to specialized habitat and microhabitat requirements, and poor or limited opportunity to establish at new locations, particularly due to low maximum dispersal distances. We also examined any evidence of impacts of changing seasonal cues, confinement to narrow altitudinal ranges at high elevations, and dependence on five or fewer prey or host species.

Susceptibility to climate change in birds shows strong taxonomic and geographic patterns with all species considered susceptible within the Diomedeidae (albatross), Spheniscidae (penguin), Procellariidae, Pelecanoididae and Hydrobatidae (petrel and shearwater) families. Large families with particularly high levels of susceptibility include Turdidae (thrushes, 60%), Thamnophilidae (antbirds, 69%), Scolopacidae (sandpipers and allies, 70%), Formicariidae (antthrushes and antpittas, 78%) and Pipridae (manakins, 81%). In con quhigh el6aeiinwm3tudinal ransn( )]TJ T*[81%)Tjels of 81%lude Talbed ided Pipegre ScoAccitasae (manosy or(, ourkd o)Tjhawknd anteaglomanwaxityl

include Strabomantidae, Bufonidae (toads and true toads), Hylidae (treefrogs) and Plethodontidae (lungless salamanders).

Of the six traits used to assess amphibian susceptibility to climate change, those relating to specialized habitat requirements, poor dispersal and colonization ability, and disruption of interspecific interactions identified the majority of susceptible species. These included species occurring exclusively in habitats vulnerable to climate change; those with water-dependant larvae occurring exclusively in unbuffered habitats; those unable to disperse due to barriers such as large water bodies or unsuitable habitat; and those with small ranges in combination with very low population densities.

Emerging infectious diseases, such as chytridiomycosis, caused by the chytrid fungus *Batrachochytrium dendrobatidis*,

pipe coral). Due to insufficient information and taxonomic uncertainties, we were unable to assess the 46 other species in the group.

We found that 566 of 799 global warm-water reef-forming coral species (71%) are potentially susceptible to the impacts of climate change, while 253 species possess between two and six susceptibility traits. Families Acroporidae (including staghorn corals), Agariciidae

and Dendrophylliidae had particularly high numbers of susceptible species, while Fungiidae (including mushroom corals), Mussidae (including some brain corals) and Pocilloporidae (including cauliflower corals) possess relatively few.

Coral susceptibility assessments were based on 10 traits and most species qualified due to their sensitivity to increases in temperature both by adult polyps as well as free-living larvae; sedimentation; and physical damage from storms and cyclones. Poor dispersal ability and colonization potential proved a further important trait group and included larval longevity (as a proxy for maximum dispersal distance) and the presence of currents or temperatures as barriers to dispersal. Although climate change related ocean acidification is likely to become a serious threat to coral survival in the future (Kleypas *et al.* 1999; Royal Society 2005), we did not include it in susceptibility assessments due to sparse information about differentiation in species' aragonite decalcification rates. We plan, however, to include acidification impacts in the climate change exposure component of overall climate change vulnerability assessments.

Are the "climate-change-susceptible" species the same as those already identified as threatened on The IUCN Red List, or are they different?

For each taxonomic group, we assigned all species into the following four categories: (i) threatened (according to The IUCN Red List) and "climate-change-susceptible"; (ii) threatened but not "climate-change-susceptible"; (iii) not threatened but "climate-change-susceptible"; and (iv) neither threatened nor "climate-change-susceptible". A summary of the results is shown in Table 2.

The summaries in Table 2 and Figure 3 show that each taxonomic group faces different challenges in response to climate change. At 32%, the amphibians already have a very high number of threatened species. Seventy-five percent of these are also susceptible to climate change, greatly exacerbating their extinction risk. In addition, 41% of currently non-threatened species are "climate-change-susceptible".

The overall percentage of threatened birds is lower than those of the other groups assessed (12%), but most threatened birds (80%) are also susceptible to the impacts of climate change. In addition, a quarter of all bird species and nearly 30% of all non-threatened species are susceptible to climate change.

At 51%, corals have the greatest proportion of not threatened but "climate-change-susceptible" species of the groups assessed, while a further 19% of species are both susceptible and threatened. Corals are the only group in which non-threatened but susceptible species outnumber those that are neither threatened nor susceptible (21%), and they do so by more than two-fold. This suggests that if climate change becomes extreme globally, more than three quarters of all warm-water reef-building coral species could be at risk of extinction.

The large overlap between threatened and "climate-change-susceptible" amphibian and bird species means that, ideally, they may already be included in conservation prioritization strategies. However, the question above has more complex implications. Species that already face a high risk of extinction, irrespective of the threat type, are far less likely to be resilient to environmental and climatic changes. A large overlap between threatened and "climate-change-susceptible" species may therefore mean that climate change may cause a sharp rise in both the extinction risk and extinction rate of already threatened species. It is also important to identify susceptible species which, while currently not threatened, are likely to become so in the future as climate change impacts intensify. By highlighting such species before they decline, we hope to promote preemptive and more effective conservation actions.

Data Deficient Species

While Data Deficient species (i.e., those with insufficient information to conduct

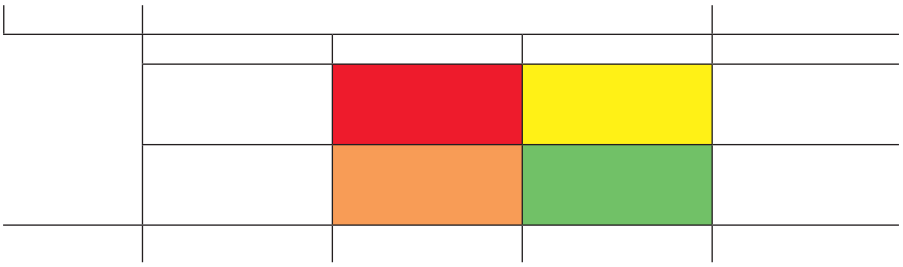


Table 2. The numbers and percentages of species assessed for "climate-change-susceptibility" and in the 2008 IUCN Red List for birds, amphibians and warm-water reef-building corals. These values fall into categories: (i) threatened and "climate-change-susceptible" (red); (ii) threatened but not "climate-change-susceptible" (orange); (iii) not threatened but "climate-change-susceptible" (yellow); and (iv) neither threatened nor "climate-change-susceptible" (green).

Red List assessments) represent only one per cent of bird species, 25% and 14% of amphibians and corals respectively fall into this Red List Category. Because a trait-based assessment of species susceptibility to climate change requires different information to Red List assessments, we were able to infer that 38 (58%), 679 (44%) and 94 (81%) of Data Deficient bird, amphibian and

inferences were made based largely on habitats (e.g., disease susceptibility) for amphibians. Due to particularly poor distribution information for most Data Deficient species, they were not included in the geographic analyses.

Where are the areas of highest concentrations of "climate-change-susceptible" species?

Although birds are generally a data rich group, range maps are not currently available for many of the non-threatened species, making meaningful analysis of global geographic trends in "climate-change–susceptible" species impossible. For this reason we are only able to present global geographical trends for amphibians and corals.

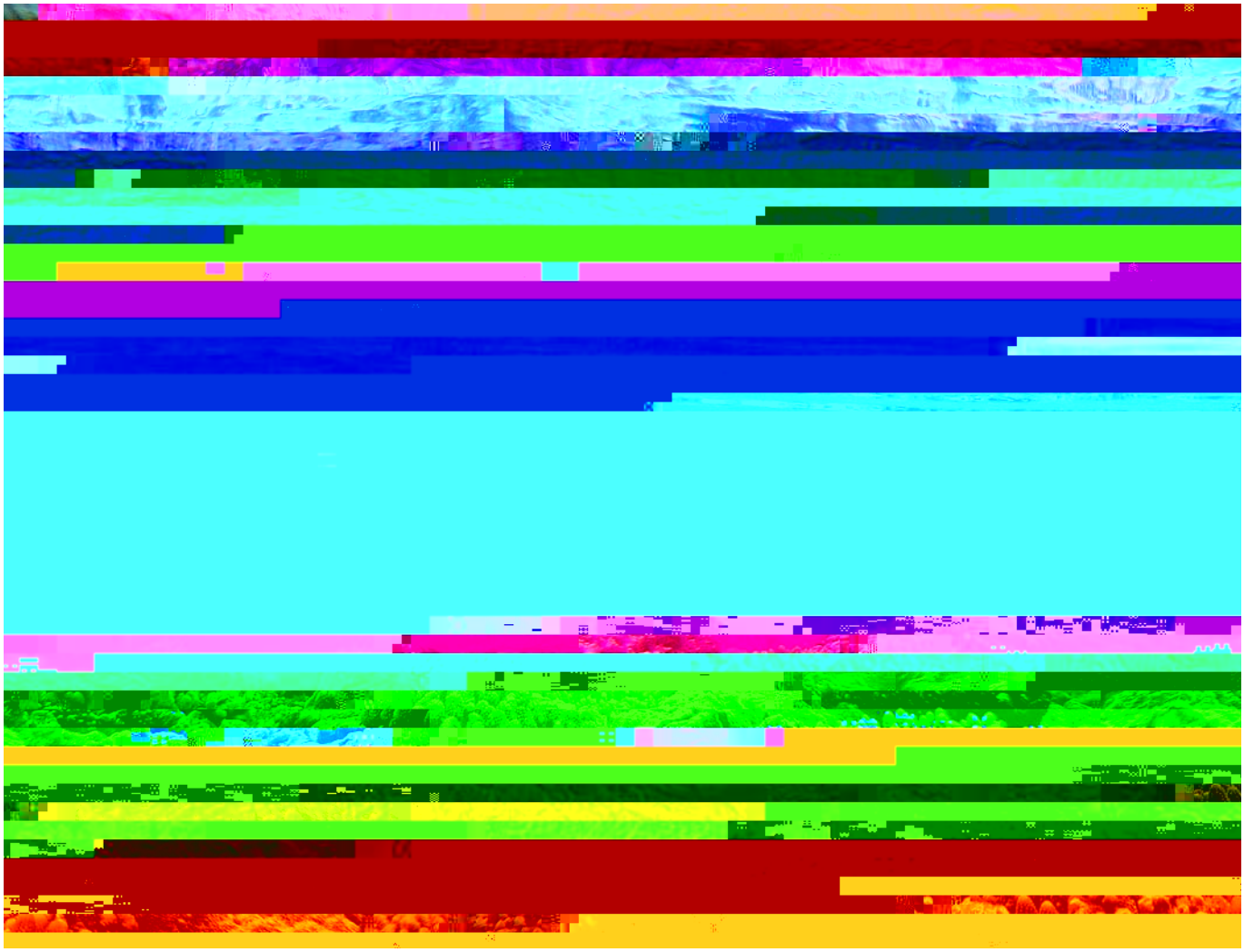
Amphibians

We identified high concentration areas by selecting areas with the top 10%, 5% and 2.5% of species richness (or nearest appropriate percentages when these were not distinguishable). For amphibians assessed as threatened and "climate-

the number of threatened and susceptible species relative to the total number of species in any one area (expressed as the percentage of species of interest relative to the total species number). This information complements high concentration areas of overall species richness and is particularly important for conservation planning at regional and global scales.

western Mexico; the east and south-east of Brazil; the East China Sea; and smaller areas around Australia. These areas are likely to be subject to rapid coral declines if they are exposed to large climatic changes.

In the long term we plan to compare the distribution of "climate-change-susceptible" species with areas of large climatic change exposure, based on General Circulation Model projections, which will allow us to identify species,



potentially conservation action for affected species.

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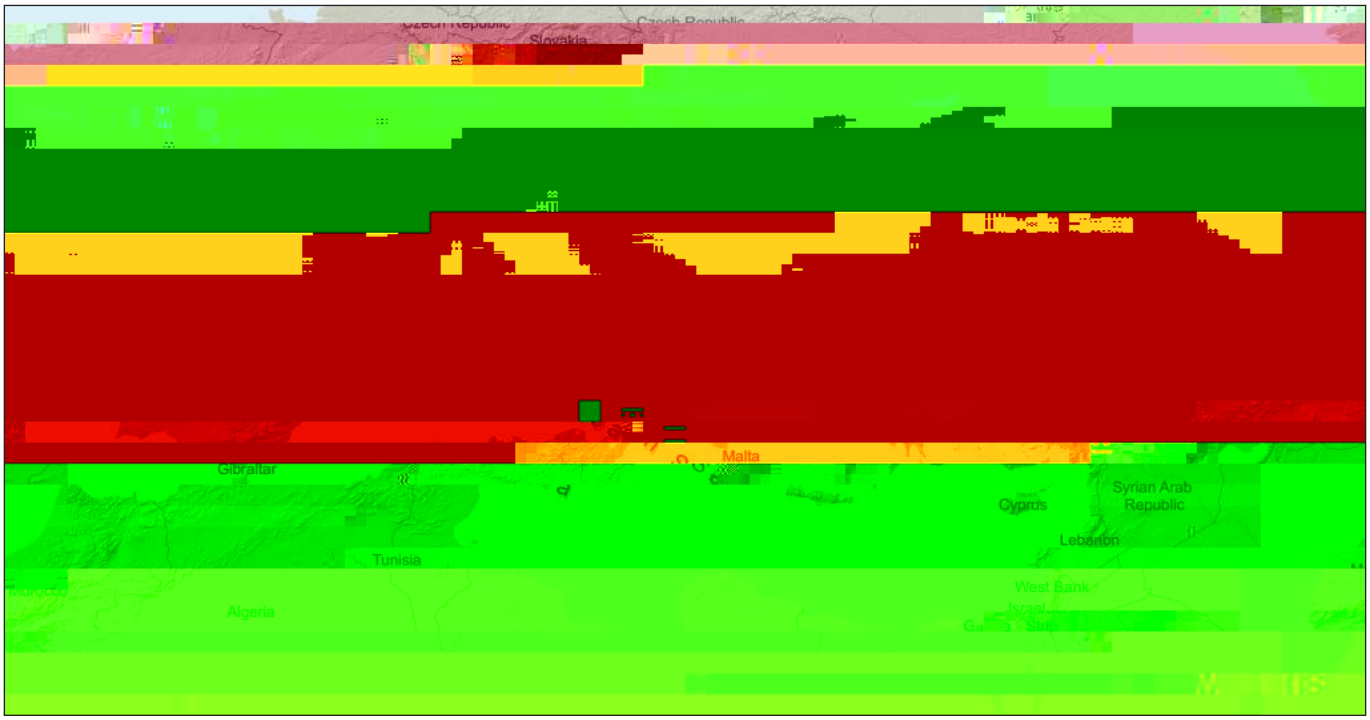
The Mediterranean: a biodiversity hotspot under threat

Annabelle Cuttelod, Nieves García, Dania Abdul Malak, Helen J. Temple and Vineet Katariya

presents. The Mediterranean is particularly noted for the diversity of its plants – about 25,000 species are native to the region, and more than half of these are endemic – in other words, they are found nowhere else on earth. This has led to the Mediterranean being recognized as one of the first 25 Global Biodiversity Hotspots (Myers *et al*. 2000).

Besides this great richness of plants, a high proportion of Mediterranean animals are unique to the region: 2 out of 3 amphibian species are endemic, as well as half of the crabs and crayfish, 48% of the reptiles, a quarter of mammals, 14% of dragonflies, 6% of sharks and rays and 3% of the birds. The Mediterranean is also hosting 253 species of endemic freshwater fish. Although the Mediterranean Sea makes up less than 1% of the global ocean surface, up to 18% of the world's macroscopic marine species are found there, of which 25 to 30% are endemic



of Europe and Africa use Mediterranean wetlands and other habitats as stopover or breeding sites.

The Human Factor

In addition to its thousands of species of fauna and flora, the Mediterranean region is home to some 455 million human inhabitants, from a wide variety of countries and cultures. Considerable economic disparities exist within the region, with the GNI per capita of the Mediterranean EU countries (USD 20,800) being ten times that of the North African ones (USD 2,100) (World Bank 2006). Poor people depend heavily on natural resources and the loss of biodiversity is undermining the potential for economic growth, affecting the security of populations (food, health, etc.) and limiting their options. On the other hand, economic development increases the pressures on the environment and hence conservation challenges and options in the region are driven by these economic inequities.

The region also receives a large number of visitors: in 2005, 246 million people – 31% of all international tourists – visited the Mediterranean, particularly its coastal areas (Blue Plan 2008). Many visitors to the region are drawn by its natural beauty, but heavy pressure from visitors and residents alike is causing severe environmental degradation. Urbanization, coastal development, pollution, and unsustainable exploitation of natural resources such as marine fish are just some of the many human activities that are leading to an ever-increasing number of Mediterranean species to be facing a high risk of extinction.

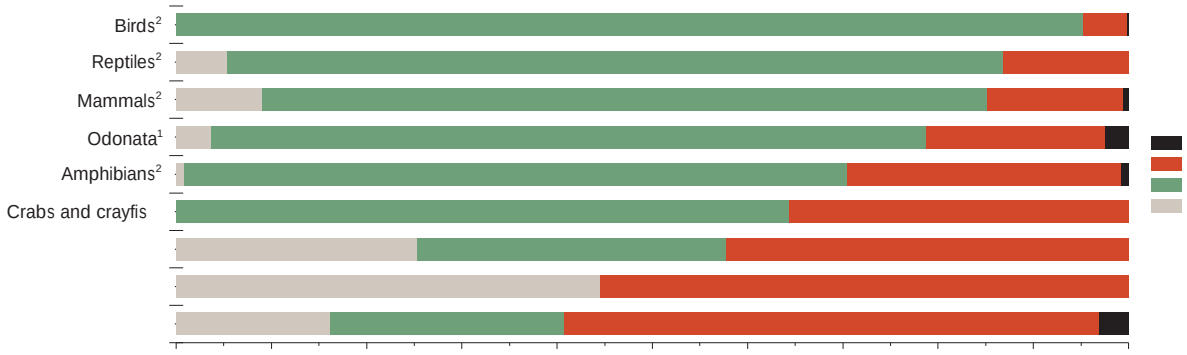
Assessing Mediterranean Species

Assessing the conservation status of species at the that of the North Af.667 TDiest8ganean, particum ɐvnhapecithe Northmenicye – the en

Table 1. *Numbers of species from Mediterranean countries assigned to each IUCN Red List category, by taxonomic group. Assessments carried out between 2004 and 2008 by IUCN and its partners. Data Deficient means that there is not enough information to assign the species to one of the other Categories, and it does not imply that the species is not threatened.*

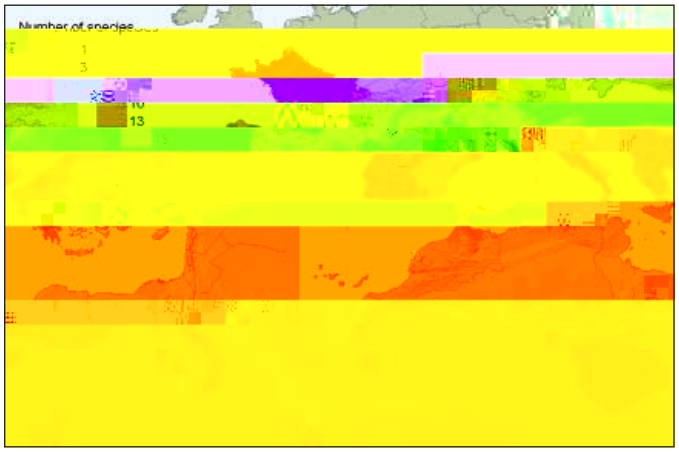
IUCN Red List Categories	Amphibians[1]	Birds[1]	Cartilaginous fishes[2]	Cetaceans[2,3]	Crabs and Crayfish [2,3]	Endemic Freshwater fishes[1,4]	Mammals[1]	Dragonflies[2,4]	Reptiles[1]	TOTAL
Extinct[5]	1	1	0	0	0	8	2	4	0	16
Critically Endangered	4	6	13	1	0	45	5	5	14	93
Endangered	13	9	8	2	3	46	15	13	22	131
Vulnerable	16	13	9	2	2	51	27	13	11	144
Near Threatened	17	29	13	0	4	10	20	27	36	156
Least Concern	63	543	10	0	5	52	231	96	253	1253
Data Deficient	1	0	18	4	0	41	30	6	19	119
TOTAL	115	601	71	9	14	253	330	164	355	1912
Endemic	71 (62%)	16 (3%)	4 (6%)	0 (0%)	7 (50%)	253 (100%)	87 (26%)	23 (14%)	170 (48%)	631 (33%)

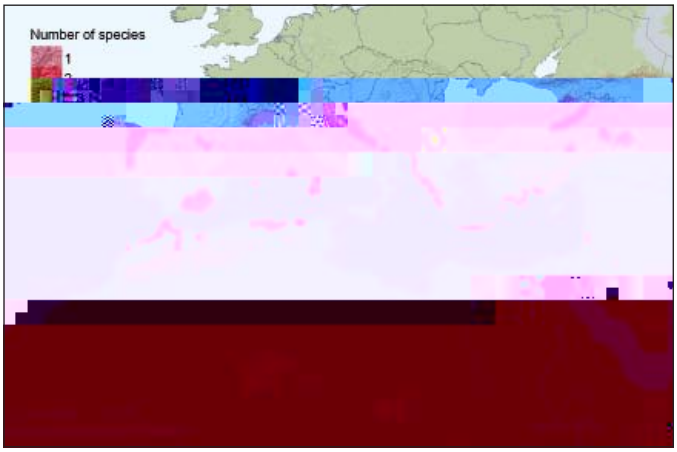
[1] Species assessed at the global level.
[2] Species assessed at the regional level.
[3] Preliminary data; still to be confirmed by the IUCN Red List Authority.
[4] Only the species occurring in river basins flowing into the Mediterranean Sea and adjacent Atlantic waters were included in the assessment (Smith and Darwall 2006).
[5] "Extinct" includes the categories Extinct, Extinct in the Wild and Regionally Extinct.

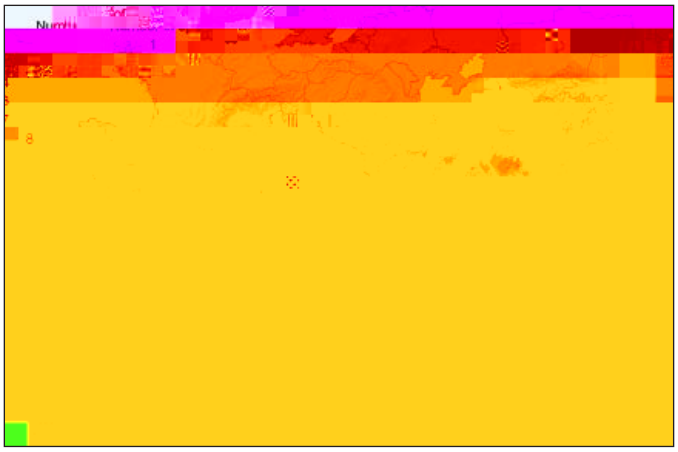


[1] *Species assessed at the regional level*
[2] *Species assessed at the global level*

Figure 2. *Percentages of Extinct, threatened, non-threatened and Data Deficient species in each major taxonomic group assessed.*







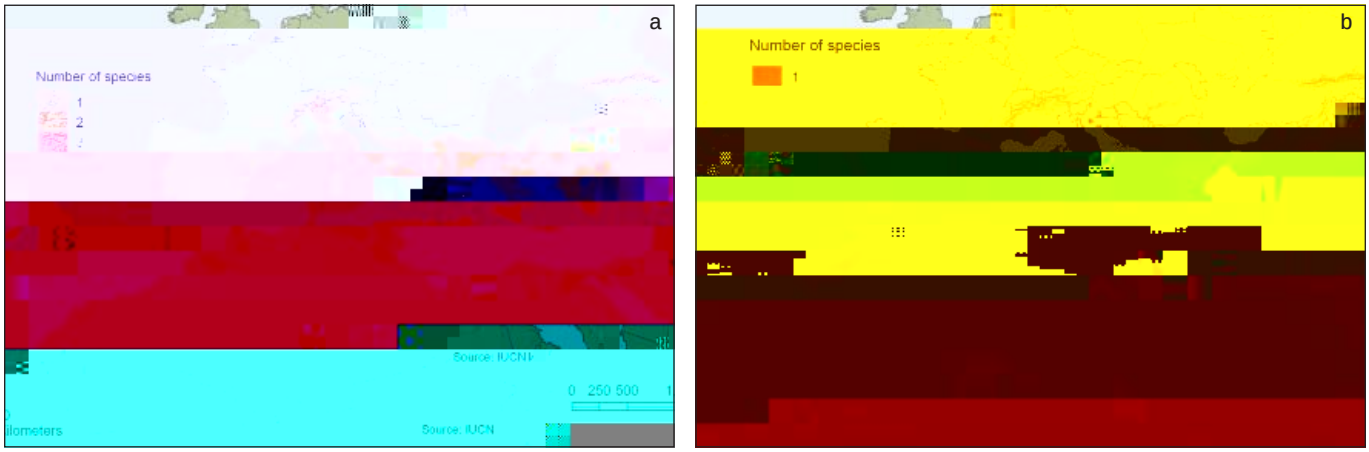


Figure 5. *Species richness of crabs in the Mediterranean basin (a) and species richness of regionally threatened crabs in the Mediterranean basin (b).*

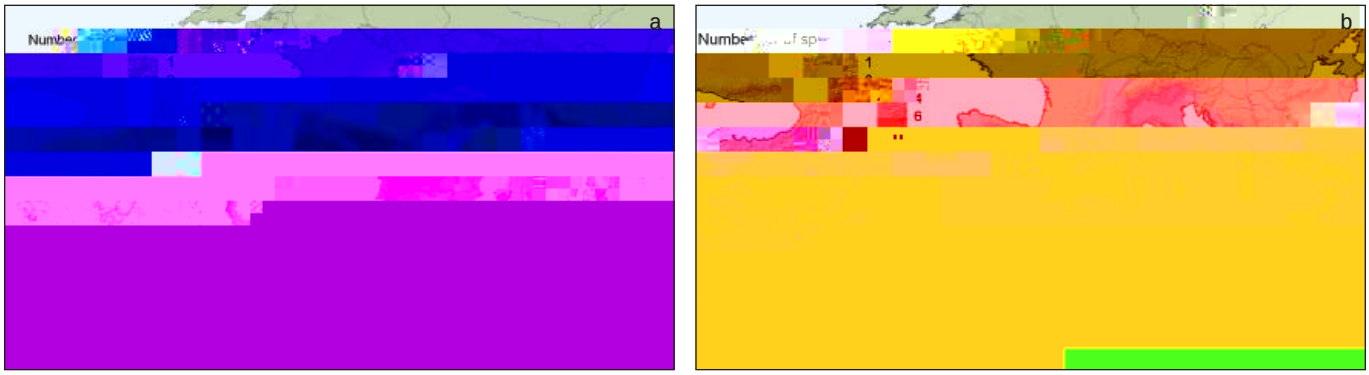


Figure 6. *Species richness of endemic freshwater fish in the Mediterranean basin (a) and species richness of threatened endemic freshwater fish in the Mediterranean basin (b).*

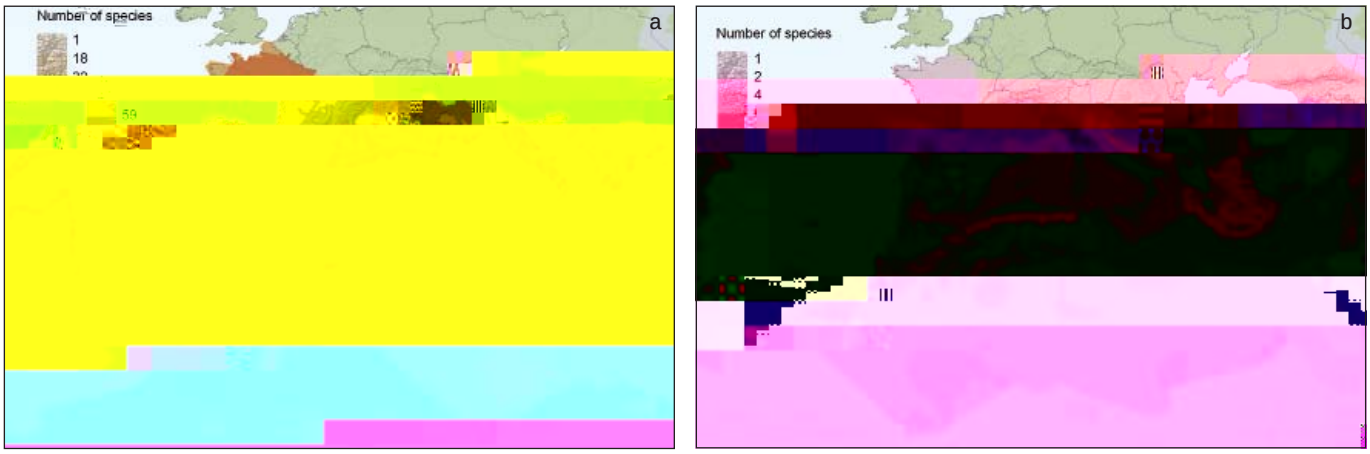
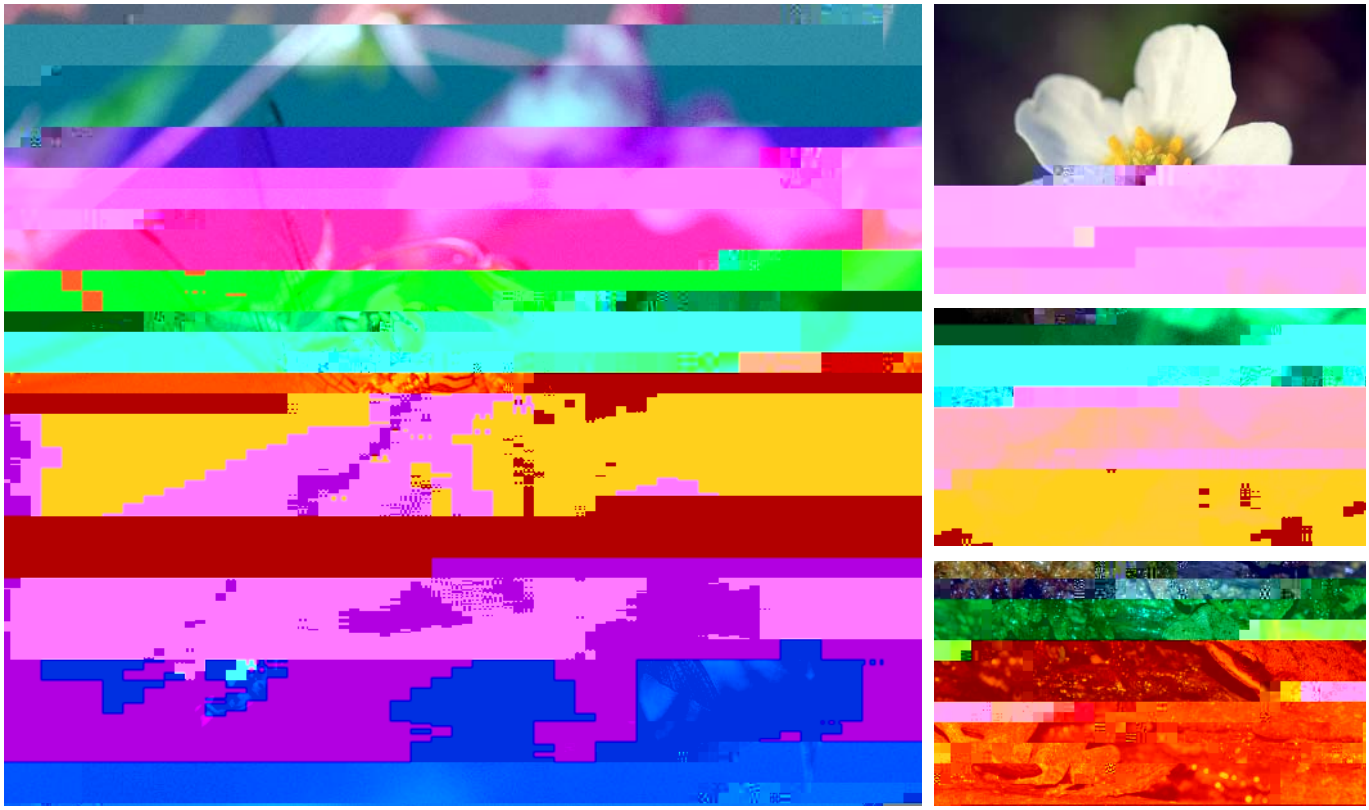


Figure 7. *Species richness of mammals (including cetaceans) in the Mediterranean basin (a) and species richness of globally threatened mammals (including cetaceans) in the Mediterranean basin (b).*

to be threatened. Sixteen species are already extinct in the region, including some endemics such as the Hula Painted Frog *Discoglossus nigriventer*, the Canary Islands Oystercatcher *Haematopus meadewaldoi* and seven endemic freshwater fishes: *Tristramella intermedia*, *Tristramella magdelainae*, *Alburnus akili*, *Chondrostoma scodrense*, *Mirogrex hulensis*, *Telestes ukliva* and *Salmo pallaryi*. These extinctions signify the definitive loss of an important part of the world's biological heritage.

The geographic distribution of species richness and threatened species richness, highlighting regions with greater concentrations of species at risk that should be given particular attention, is presented for each taxonomic group in Figures 3 to 9.

Freshwater habitats



Mediterranean freshwater-dependent species: Green Gomphid Ophiogomphus cecilia – *Least Concern © Jean-Pierre Boudot. Pond Water-crowfoot* Ranunculus peltatus – *Not Evaluated © Serge Müller.* Economidichthys pygmaeus – *Least Concern © Ioannis Rousopoulos. Pyrenean Frog* Rana pyrenaica – *Endangered © Lars Bergendorf*

the Balkans, the western part of Greece and the area from Turkey down to Israel. More information about the conservation status of amphibians and endemic freshwater fish are detailed in Cox et al. (2006) and Smith and Darwall (2006).

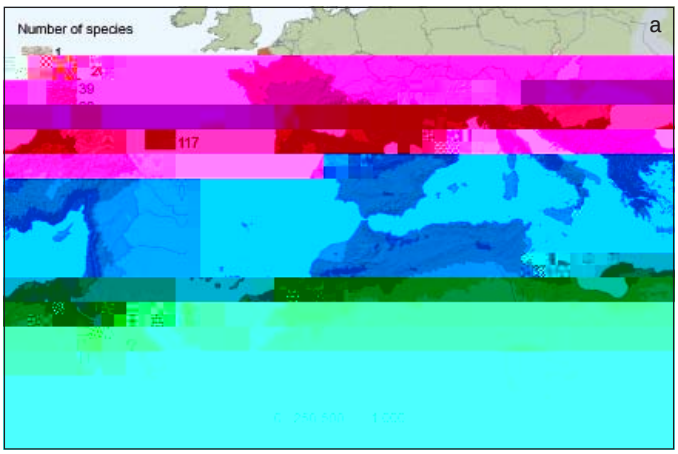
Some species, such as various amphibians and dragonflies, are particularly sensitive to water quality and considered to be good indicators of the health of freshwater systems. Monitoring the status of these freshwater species is therefore a key tool in the conservation of important Mediterranean wetlands.

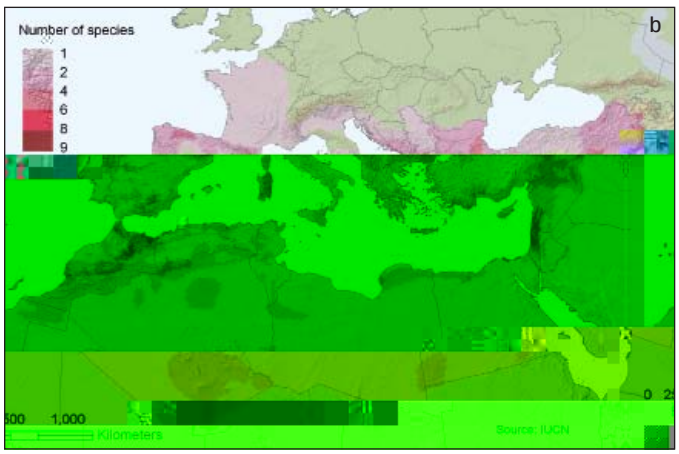
Terrestrial habitats

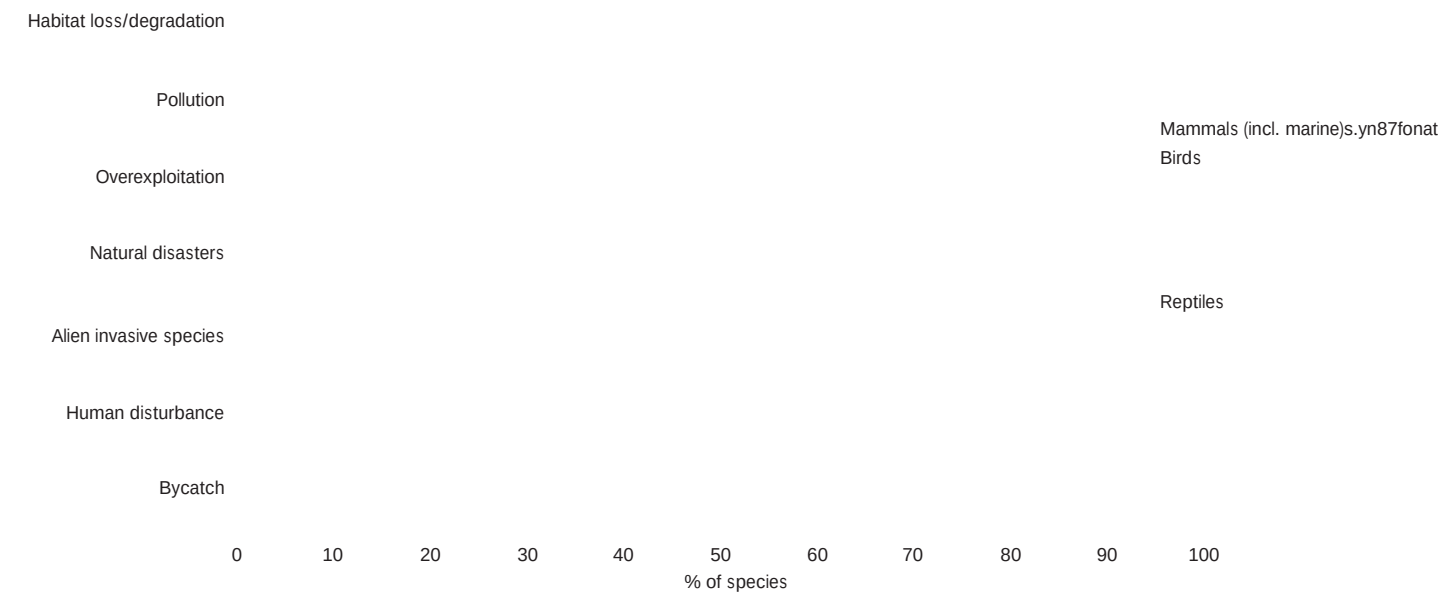
The Mediterranean region is made up of a mosaic of different terrestrial habitats, containing a diverse range of species, including 355 species of reptiles (Cox *et al.* 2006), 330 species of mammals, 106 species of amphibians, 158 species of dragonflies, about half of the species in these groups being endemic. There is also a high diversity of birds, invertebrates and plants. The initial results show that about 16% of the assessed terrestrial species are threatened with extinction.

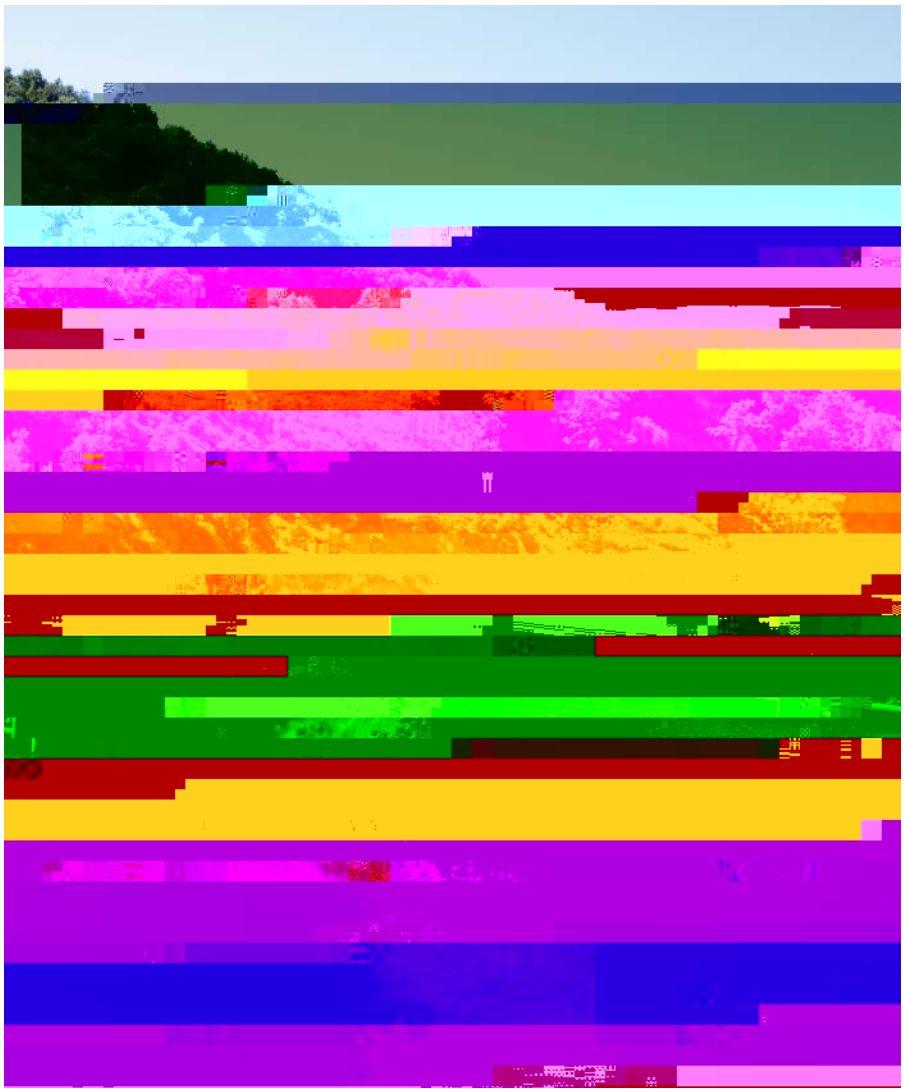
Based on these results, terrestrial species richness is shown in Figure 11a. It's interesting to note the Hoggar mountain region, in the south of Algeria, which is an important refuge for numerous species. However, this map is only indicative, as

Figure 11. *Species richness of terrestrial amphibians, mammals, dragonflies and reptiles in the Mediterranean basin (**a**) and species richness of threatened terrestrial amphibians, mammals, dragonflies and reptiles in the Mediterranean basin (**b**).*






Habitat loss/degradation
Pollution
Overexploitation
Natural disasters
Alien invasive species
Human disturbance
Bycatch
Mammals (incl. marine)s.yn87fonat
Birds
Reptiles
0
10
20
30
40
50
60
70
80
90
100
% of species



morbillivirus infection, and it is believed that PCBs played an important role by compromising the immune system of the affected animals.

Another type of pollution is noise pollution: in the Mediterranean Sea, the increasing levels of noise due to marine traffic are harming cetaceans by impairing their ability to communicate and to locate their prey.

Solid waste is also a serious problem: discarded plastic bags have caused the death of many marine animals such as turtles, birds or dolphins that mistake the bags for jellyfish and die from ingesting them. Runoff of agricultural fertilizers causes eutrophication of coastal waters and can result in the formation of "dead zones", where no oxygen is available and fish and crustaceans cannot survive (Diaz and Rosenberg 2008).

Overexploitation (Unsustainable Harvesting, Hunting and Fishing)

Overexploitation is a serious problem for Mediterranean species, affecting many threatened plants, reptiles, fishes, and other species. Overexploitation is driven by several causes: for example, demand for traditional medicines is threatening some plants, seahorses and mammals species. Illegal trade is also of major concern in the Mediterranean: the Critically Endangered Egyptian Tortoise *Testudo kleinmanni* is, for example, heavily affected by the illegal national and international pet trade. Increased fishing activities and more efficient fishing boats and gear have resulted in the overfishing and consequent decline of some fish species. Overexploitation is likely to be of major importance for some Mediterranean species groups (e.g., marine fishes and medicinal plants) for which comprehensive assessments have not yet been completed.

Natural Disasters

Many Mediterranean species are threatened by natural disasters or extreme climatic events, notably forest fires and droughts. The frequency of such events is expected to increase as a result of global climate change. Climate change models indicate that the Mediterranean region will experience decreasing rainfall and increasing sea temperatures (Bates *et al*. 2008), which will have an impact on the distribution and survival of species. Information collected during the Red List assessment process shows that populations of North African freshwater species such as molluscs and dragonflies are already shifting their ranges northwards in response to rising temperatures and decreasing availability of water – and there is a limit as to how far north they can movethere is a d

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- Species protection
- Site protection
- Conservation of the wider environment
- Communication and education
- Monitoring and research

The Gizani *Ladigesocypris ghigii* is a fish

Appendices

The IUCN Red List Categories and Criteria are the world's most widely used system for gauging the extinction risk faced by species. Each species assessed is assigned to one of eight different Categories (Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened and Data Deficient), based on a series of quantitative criteria.

Species classified as Vulnerable, Endangered and Critically Endangered are regarded as 'threatened'.

The threat category scales are an easy to use graphic element that clearly identifies the threat category of a species.

The scales can be used on signage, posters, in publications, etc. They can only be used in relation to a species that has been assessed and appears on The IUCN Red List. The scale must always be placed next to the name of the species.

There are alternative versions of the scale depending on usage. The preferred option is to use the long scale however where space is limited, the short scale, or a single button can be used. If the short scale or single button is used, then an explanation of the Threat Categories must appear nearby to ensure a

Appendix 6. Number of species in each Red List Category in each major animal taxonomic group (Class, Order)

IUCN Red List Categories: EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LR/cd - Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt - Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower Risk/least concern).

Class MAMMALIA												
Order	EX	EW	Subtotal	CR	EN	VU	Subtotal	LR/cd	NT	DD	LC	TOTAL
Afrosoricida	0	0	0	1	7	9	17	0	3	4	3	64
Carnivora	5	0	5	8	24	39	71	0	27	19	163	285
Cetartiodactyla	7	2	9	14	46	49	109	0	26	62	123	329
Chiroptera	5	0	5	25	53	99	177	0	77	204	687	1,150
Cingulata	0	0	0	0	0	4	4	0	5	3	9	21
Dasyuromorphia	1	0	1	1	6	5	12	0	10	4	47	74
Dermoptera	0	0	0	0	0	0	0	0	0	0	2	2
Didelphimorphia	1	0	1	1	0	7	8	0	2	17	67	95
Diprotodontia	7	0	7	14	15	16	45	0	16	2	76	146
Eulipotyphla	7	0	7	12	41	31	84	0	13	77	269	450
Hyracoidea	0	0	0	0	0	0	0	0	0	0	5	5
Lagomorpha	1	0	1	2	10	5	17	0	6	8	6	93
Macroscelidea	0	0	0	0	1	2	3	0	1	3	9	16
Microbiotheria	0	0	0	0	0	0	0	0	1	0	0	1
Monotremata	0	0	0	3	0	0	3	0	0	0	2	5
Notoryctemorphia	0	0	0	0	0	0	0	0	0	2	0	2
Paucituberculata	0	0	0	0	0	2	2	0	2	0	2	6
Peramelemorphia	3	0	3	0	4	2	6	0	1	3	9	22
Perissodactyla	0	0	0	5	5	3	13	0	1	0	2	16
Pholidota	0	0	0	0	2	0	2	0	4	0	2	8
Pilosa	0	0	0	1	1	0	2	0	1	0	7	10
Primates	2	0	2	37	86	78	201	0	23	56	133	415
Proboscidea	0	0	0	0	1	0	1	0	1	0	0	2
Rodentia	36	0	36	64	144	150	358	0	103	369	1,389	2,255
Scandentia	0	0	0	0	2	0	2	0	0	3	1	20
Sirenia	1	0	1	0	0	4	4	0	0	0	0	5
Tubulidentata	0	0	0	0	0	0	0	0	0	0	1	1
Subtotal (Mammalia)	76	2	78	188	448	505	1,141	0	323	836	3,110	5,488

Class AVES												
Order	EX	EW	Subtotal	CR	EN	VU	Subtotal	LR/cd	NT	DD	LC	TOTAL
Anseriformes	6	0	6	6	10	12	28	0	9	0	124	167
Apodiformes	2	0	2	9	15	11	35	0	24	8	374	443
Caprimulgiformes	0	0	0	3	2	3	8	0	10	4	100	122
Charadriiformes	4	0	4	10	11	17	38	0	34	0	278	354
Ciconiiformes	5	0	5	5	11	5	21	0	5	0	9	121

Class MAGNOLIOPSIDA												
Family	EX	EW	Subtotal	CR	EN	VU	Subtotal	LR/cd	NT	DD	LC	TOTAL
Grossulariaceae	0	0	0	2	0	2	4	0	0	0	1	5
Gunneraceae	0	0	0	0	0	1	1	0	0	0	0	1
Guttiferae	0	0	0	9	19	84	112	4	2	12	41	171
Hamamelidaceae	0	0	0	1	1	6	8	0	2	1	2	13
Hernandiaceae	1	0	1	2	2	2	6	0	4	2	1	14
Hippocastanaceae	0	0	0	0	0	1	1	0	0	0	0	1
Hoplestigmataceae	0	0	0	1	0	0	1	0	0	0	0	1
Huaceae	0	0	0	0	0	1	1	0	0	0	0	1
Humiriaceae	0	0	0	0	3	2	5	0	0	0	0	5
Icacinaceae	0	0	0	2	2	10	14	0	0	0	1	15
Illecebraceae	0	0	0	0	0	2	2	0	0	0	1	3
Illiciaceae	0	0	0	0	0	2	2	2	0	0	0	4
Irvingiaceae	0	0	0	0	0	0	0	0	1	0	1	2
Ixonanthaceae	0	0	0	0	0	2	2	0	0	0	0	2
Juglandaceae	0	0	0	0	4	9	13	0	2	0	4	19
Labiatae	0	0	0	8	6	18	32	0	4	2	1	40
Lacistemataceae	0	0	0	0	0	0	0	0	0	1	1	2
Lauraceae	0	0	0	24	50	125	199	12	21	11	34	277
Lecythidaceae	0	0	0	11	15	53	79	5	6	2	5	97
Leeaceae	0	0	0	0	0	0	0	0	1	0	0	1
Leguminosae	6	1	7	59	159	376	594	9	74	39	54	777
Leitneriaceae	0	0	0	0	0	0	0	0	1	0	0	1
Linaceae	0	0	0	1	0	2	3	0	0	0	0	3
Loasaceae	0	0	0	1	4	9	14	0	2	0	0	16
Loganiaceae	0	0	0	3	4	9	16	0	6	3	5	30
Loranthaceae	0	0	0	0	1	2	3	0	1	0	0	4
Lythraceae	0	0	0	2	2	5	9	0	0	0	3	12
Magnoliaceae	0	0	0	9	27	20	56	0	3	2	1	62
Malpighiaceae	0	0	0	2	5	9	16	0	0	4	1	21
Malvaceae	4	1	5	14	11	11	36	0	2	3	5	51
Marcgraviaceae	0	0	0	0	2	1	3	0	0	2	0	5
Medusagynaceae	0	0	0	1	0	0	1	0	0	0	0	1
Medusandraceae	0	0	0	0	1	1	2	0	0	0	0	2
Melanophyllaceae	0	0	0	2	1	1	4	0	1	0	2	7
Melastomataceae	0	0	0	25	96	148	269	1	28	8	2	308
Meliaceae	0	0	0	14	19	114	147	2	45	2	1	212
Melianthaceae	0	0	0	0	1	1	2	0	0	0	0	2
Meliosmaceae	0	0	0	0	2	2	4	0	0	1	0	5
Menispermaceae	0	0	0	2	3	3	8	0	2	0	0	10
Molluginaceae	0	0	0	0	0	0	0	0	0	0	1	1
Monimiaceae	0	0	0	7	5	7	19	0	3	0	2	24
Moraceae	0	0	0	7	15	24	46	0	3	1	2	52
Moringaceae	0	0	0	0	0	1	1	0	0	0	0	1
Myoporaceae	0	0	0	1	0	0	1	0	0	1	1	3
Myricaceae	0	0	0	1	1	1	3	0	0	0	1	4

Class MAGNOLIOPSIDA												
Family	EX	EW	Subtotal	CR	EN	VU	Subtotal	LR/cd	NT	DD	LC	TOTAL
Myristicaceae	0	0	0	4	8	142	154	5	27	7	3	225
Myrsinaceae	0	0	0	17	19	43	79	0	14	18	10	121
Myrtaceae	6	0	6	51	73	132	256	10	20	13	36	341
Nepenthaceae	0	0	0	5	11	35	51	7	3	8	1	85
Nyctaginaceae	0	0	0	1	6	2	9	0	2	1	3	15
Ochnaceae	0	0	0	2	2	10	14	0	2	3	3	22
Olacaceae	0	0	0	1	3	5	9	0	3	1	1	14
Oleaceae	0	0	0	7	5	8	20	2	2	2	1	27
Onagraceae	0	0	0	0	2	6	8	0	1	0	3	12
Opiliaceae	0	0	0	0	0	2	2	0	0	0	0	2
Oxalidaceae	0	0	0	1	3	3	7	0	1	0	4	12
Passifloraceae	0	0	0	0	11	9	20	0	2	1	5	28
Pedaliaceae	0	0	0	0	0	0	0	0	0	0	1	1
Piperaceae	0	0	0									

Caribbean Islands	Mammals	Birds	Reptiles	Amphibians	Fishes	Molluscs	Other Inverts	Plants	Total
Saint Vincent and the Grenadines	2	2	3	1	16	0	10	4	38
Trinidad and Tobago	2	2	5	9	19	0	10	1	48
Turks and Caicos Islands	2	2	4	0	14	0	10	2	34
Virgin Islands, British	1	1	6	2	12	0	10	10	42
Virgin Islands, U.S.	2	1	4	2	11	0	0	11	31
North America	**Mammals**	**Birds**	**Reptiles**	**Amphibians**	**Fishes**	**Molluscs**	**Other Inverts**	**Plants**	**Total**
Canada	12	16	3	1	26	2	10	2	72
Saint Pierre and Miquelon	3	1	0	0	1	0	0	0	5
United States	37	74	32	56	164	273	312	244	1,192

SOUTH AMERICA									
South America	Mammals	Birds	Reptiles	Amphibians	Fishes	Molluscs	Other Inverts	Plants	Total
Argentina	35	49	5	29	31	0	10	44	203
Bolivia	19	29	2	39	0	0	1	71	161
Brazil	82	122	22	30	64	21	15	382	738
Chile	21	32	1	21	18	0	8	40	141
Colombia	52	86	15	214	31	0	31	223	652
Ecuador	43	69	11	171	15	48	12	1,839	2,208
Falkland Islands (Malvinas)	4	10	0	0	5	0	0	5	24
French Guiana	6	0	6	3	2	10	0	16	52
Guyana	8	3	5	7	22	0	1	22	68
Paraguay	8	2	72	0	0	0	0	10	47
Peru	53	93	6	96	10	0	3	275	536
Suriname	7	0	5	1	2	00	0	26	59
Uruguay	10	24	4	4	2	80	1	1	72
Venezuela	32	26	13	71	29	0	19	69	259

OCEANIA									
Oceania	Mammals	Birds	Reptiles	Amphibians	Fishes	Molluscs	Other Inverts	Plants	Total
American Samoa	1	8	2	0	8	5	5	21	77
Australia	57	49	38	48	84	175	282	55	788
Christmas Island	1	5	3	0	5	0	1	61	31
Cocos (Keeling) Islands	2	0	1	0	7	0	1	70	27
Cook Islands	1	1	51	0	7	0	2	51	50
Fiji	6	1	06	1	11	3	87	66	190
French Polynesia	1	3	21	0	13	29	26	47	149
Guam	2	1	22	0	9	6	0	4	35
Kiribati	1	5	1	0	7	1	7	20	87
Marshall Islands	2	5	1	0	10	1	66	0	85
Micronesia, Federated States of	6	9	3	0	13	4	104	5	144
Nauru	1	2	0	0	8	0	6	20	73
New Caledonia	9	1	42	0	17	11	84	218	355
New Zealand	8	69	12	4	14	5	10	21	143
Niue	2	8	1	0	7	0	2	30	41

Oceania	Mammals	Birds	Reptiles	Amphibians	Fishes	Molluscs	Other Inverts	Plants	Total
Norfolk Island	0	1	52	0	2	1	29	1	41
Northern Mariana Islands	5	14	1	0	9	4	4	75	85
Palau	4	2	2	0	12	5	97	4	126
Papua New Guinea	41	36	9	11	38	2	167	142	446
Pitcairn	2	1	00	0	6	5	1	07	40
Samoa	2	7	1	0	8	1	5	22	73
2 152									

IUCN Red List Categories: EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LR/cd - Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt - Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower Risk/least concern).

The country and territory names used below are based on the short country names specified by the International Organization for Standardization (ISO) Maintenance Agency for ISO 3166 country codes (see http://www.iso.org/iso/country_codes/iso_3166_code_lists/english_country_names_and_code_elements.htm).

South & Southeast Asia	EX	EW	Subtotal	CR	EN	VU	Subtotal	LR/cd	NT	DD	LC	Total
Lao People's Democratic Republic	0	0	0	5	7	9	21	0	5	5	24	55
Malaysia	2	1	3	186	99	401	686	113	70	27	281	1,180
Myanmar	0	0	0	13	12	13	38	0	10	8	54	110
Nepal	0	0	0	0	2	5	7	0	2	1	24	34
Philippines	0	0	0	52	34	130	216	3	24	12	66	321
Singapore	0	0	0	11	13	30	54	8	20	2	109	193
Sri Lanka	1	0	1	78	73	129	280	5	1	3	15	305
Thailand	0	0	0	29	21	36	86	3	25	13	75	202
Timor-Leste	0	0	0	0	0	0	0	0	0	0	2	2
Viet Nam -3.559 Tw 0 15.795 0 Td (00)Tj /T1_2 1 Tf 0 Tc 0 Tw 8.23 0.004 Td (0)Tj /T1_1 1 Tf 3.559 Tc -3.559et Nam -3.559 Tw 15.795 0 Td (00)Tj /T1_2 1 Tf 0 T												

OCEANIA												
Oceania	EX	EW	Subtotal	CR	EN	VU	Subtotal	LR/cd	NT	DD	LC	Total
American Samoa	0	0	0	0	0	1	1	0	1	0	3	5
Australia	1	0	1	4	14	37	55	7	20	0	88	171
Christmas Island	0	0	0	0	0	1	1	0	0	0	0	1
Cocos (Keeling) Islands	0	0	0	0	0	0	0	0	0	0	2	2
Cook Islands	0	0	0	0	0	1	1	0	0	0	0	1
Fiji	1	0	1	21	13	32	66	0	19	3	43	132
French Polynesia	6	0	6	26	4	17	47	0	18	34	50	155
Guam	0	0	0	1	1	2	4	0	0	1	1	6
Micronesia, Federated States of	0	0	0	0	1	4	5	0	0	0	2	7
New Caledonia	3	0	3	28	65	125	218	37	4	0	17	279
New Zealand	0	0	0	2	7	12	21	3	15	1	16	56
Norfolk Island	1	0	1	0	0	1	1	0	0	0	0	2
Northern Mariana Islands	0	0	0	2	1	2	5	0	0	0	0	5
Palau	0	0	0	0	1	3	4	0	1	0	0	5
Papua New Guinea	0	0	0	14	15	113	142	0	33	19	70	264
Pitcairn	0	0	0	1	1	5	7	0	0	0	2	9
Samoa	0	0	0	1	1	0	2	0	1	0	2	5
Solomon Islands	0	0	0	0	1	15	16	0	10	14	20	60
Tonga	0	0	0	1	0	3	4	0	0	0	1	5
Tuvalu	0	0	0	0	0	0	0	0	0	0	2	2
Vanuatu	0	0	0	1	2	7	10	1	5	0	8	24
Wallis and Futuna	0	0	0	0	0	1	1	0	1	0	0	2

Caribbean Islands	Mammals		Birds		Amphibians		FW Crabs		Reef-forming Corals		Conifers		Cycads	
	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics
Anguilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antigua and Barbuda	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Aruba	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bahamas	2	1	2	0	1	0	0	0	0	0	0	0	1	0
Barbados	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Bermuda	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Cayman Islands	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Cuba	21	12	21	8	59	49	2	0	0	0	4	2	3	1
Dominica	0	0	3	2	1	1	0	0	0	0	0	0	0	0
Dominican Republic	1	0	0	0	10	9	0	0	0	0	1	1	0	0
Grenada	0	0	1	1	1	1	0	0	0	0	0	0	0	0
Guadeloupe	1	1	3	0	2	2	0	0	0	0	0	0	0	0
Haiti	2	0	0	0	2	2	0	0	0	0	0	0	0	0
Jamaica	7	3	32	6	21	17	0	0	0	0	2	1	0	0
Martinique	1	0	2	1	1	1	0	0	0	0	0	0	0	0
Montserrat	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Netherlands Antilles	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Puerto Rico	1	0	8	4	1	1	0	0	0	0	0	0	1	1
Saint Barthélemy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saint Lucia	1	0	5	3	0	0	0	0	0	0	0	0	0	0
Saint Martin (French part)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saint Vincent and the Grenadines	1	0	2	2	1	1	0	0	0	0	0	0	0	0
Trinidad and Tobago	1	0	1	1	7	7	1	0	0	0	1	0	0	0
Turks and Caicos Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Virgin Islands, British	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Virgin Islands, U.S.	0	0	0	0	1	1	0	0	0	0	0	0	0	0

North America	Mammals		Birds		Amphibians		FW Crabs		Reef-forming Corals		Conifers		Cycads	
	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics
Canada	5	1	0	0	0	0	0	0	0	0	0	0	0	0
Saint Pierre and Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0
United States	106	20	62	32	178	49	0	0	9	3	3	1	2	0

SOUTH AMERICA

South America	Mammals		Birds		Amphibians		FW Crabs		Reef-forming Corals		Conifers		Cycads	
	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics	Total endemics	Threatened endemics
Argentina	82	13	12	0	37	21	0	0	0	0	0	0	0	0
Bolivia	22	4	15	5	63	32	1	0	0	0	2	0	1	0
Brazil	183	55	197	71	496	26	13	1	8	0	4	0	0	0
Chile	17	5	11	3	29	12	0	0	0	0	1	1	0	0
Colombia	37	9	65	40	333	158	77	10	0	0	0	0	6	6
Ecuador	29	11	32	17	155	100	13	2	0	0	0	0	1	1

Genuine Improvements			
Loxodonta africana	African Elephant	VU	NT
Castor fiber	Eurasian Beaver	NT	LC
Leporillus conditor	Greater Stick-nest Rat	EN	VU
Pseudomys fieldi	Shark Bay Mouse	CR	VU
Pseudomys occidentalis	Western Mouse	EN	LC
Spermophilus suslicus	Speckled Ground Squirrel	VU	NT
Spermophilus washingtoni	Washington Ground Squirrel	VU	NT
Genuine deteriorations			
Panthera pardus	Leopard	LC	NT
Prionailurus planiceps	Flat-headed Cat	VU	EN
Prionailurus viverrinus	Fishing Cat	VU	EN
Spilogale pygmaea	Pygmy Spotted Skunk	LR/lc	VU
Aonyx cinerea	Asian Small-Clawed Otter	NT	VU
Mustela altaica	Altai Weasel	LR/lc	NT
Vormela peregusna	Marbled Polecat	LR/lc	VU
Arctocephalus galapagoensis	Galápagos Fur Seal	VU	EN
Neophoca cinerea	Australian Sea Lion	LR/lc	EN
Zalophus wollebaeki	Galápagos Sea Lion	VU	EN
Monachus schauinslandi	Hawaiian Monk Seal	EN	CR
Hemigalus derbyanus	Banded Civet	LR/lc	VU
Paradoxurus zeylonensis	Golden Palm Civet	LR/lc	VU
Cephalophus jentinki	Jentink's Duiker	VU	EN
Kobus megaceros	Nile Lechwe	LR/nt	EN
Axis kuhlii	Bawean Deer	EN	CR
Hydropotes inermis	Chinese Water Deer	LR/nt	VU
Rucervus eldii	Eld's Deer	VU	EN
Rusa timorensis	Javan Rusa	LR/lc	VU
Rusa unicolor	Sambar	LR/lc	VU
Sus barbatus	Bearded Pig	LR/lc	VU
Sus celebensis	Sulawesi Warty Pig	LR/lc	NT
Tayassu pecari	White-Lipped Peccary	LR/lc	NT
Amorphochilus schnablii	Smoky Bat	VU	EN
Coelops robinsoni	Malayan Tailless Leaf-nosed Bat	LR/nt	VU
Tadarida johorensis	Northern Free-tailed Bat	LR/nt	VU
Tadarida mops	Malayan Free-tailed Bat	LR/lc	NT
Nycteris tragata	Malayan Slit-faced Bat	LR/lc	NT
Lonchorhina fernandezi	Fernandez's Sword-Nosed Bat	VU	EN
Lonchorhina orinocensis	Orinoco Sword-Nosed Bat	LR/nt	VU
Platyrrhinus chocoensis	Choco Broad-Nosed Bat	VU	EN
Acerodon mackloti	Sunda Fruit Bat	LR/lc	VU
Eidolon helvum	Straw-Coloured Fruit Bat	LC	NT
Megaerops wetmorei	White-collared Fruit Bat	LR/lc	VU
Pteropus caniceps	North Moluccan Flying Fox	LR/lc	NT
Pteropus lylei	Lyle's Flying Fox	LR/lc	VU
Pteropus melanopogon	Black-bearded Flying Fox	LR/lc	EN
Pteropus niger	Mauritan Flying Fox	VU	EN

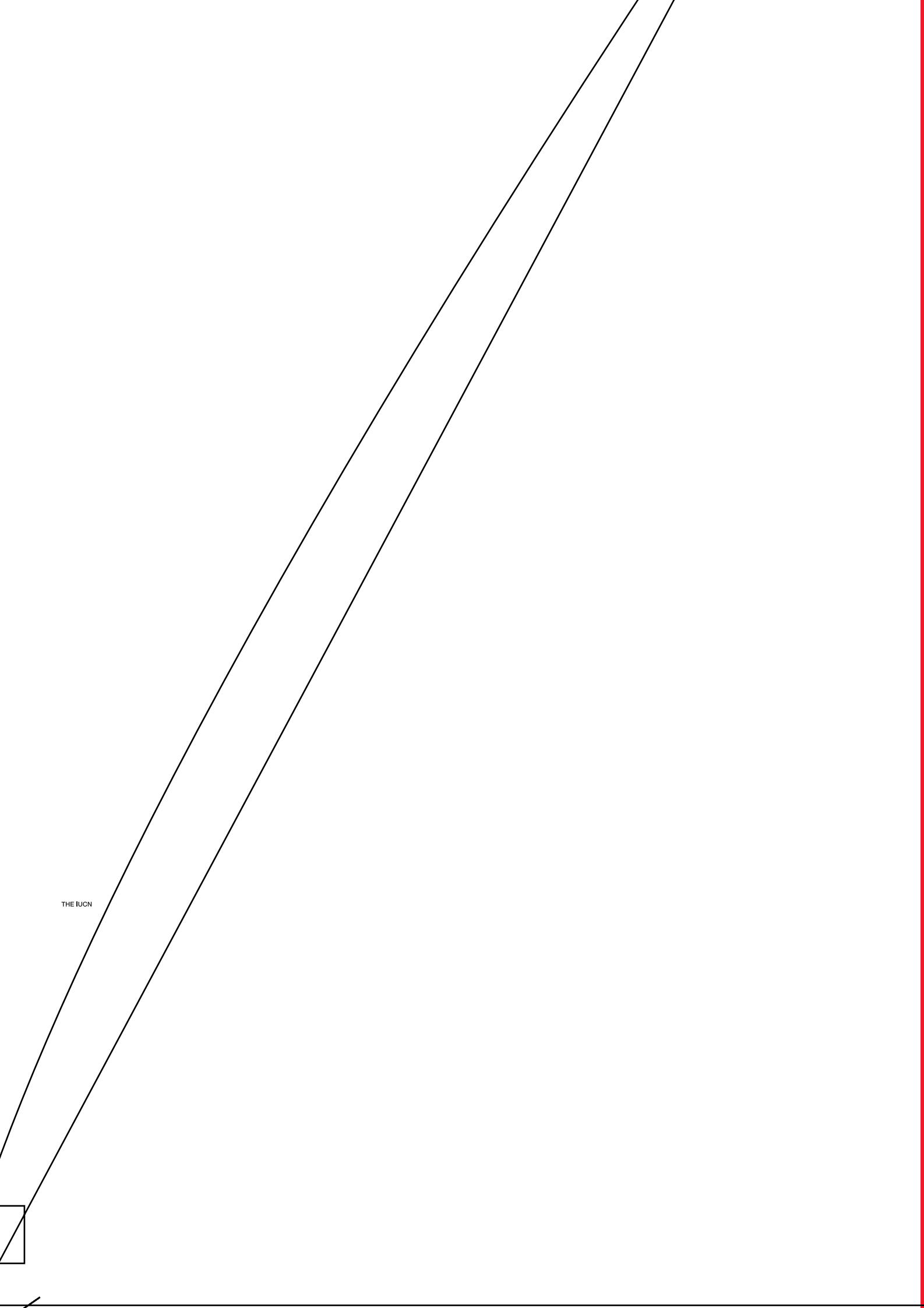
Genuine deteriorations			
Pteropus temminckii	Temminck's Flying Fox	LR/nt	VU
Pteropus vampyrus	Large Flying-fox	LR/lc	NT
Pteropus woodfordi	Dwarf Flying Fox	LR/lc	VU
Rousettus bidens	Manado Rousette	LR/nt	VU
Styloctenium wallacei	Stripe-faced Fruit Bat	LR/nt	VU
Rhinolophus cognatus	Andaman Horngs woodfordi		

Genuine deteriorations			
Hylobates muelleri	Müller's Bornean Gibbon	LR/nt	EN
Nomascus concolor	Black Crested Gibbon	EN	CR
Symphalangus syndactylus	Siamang	LR/nt	EN
Nycticebus coucang	Greater Slow Loris	LR/lc	VU
Tarsius bancanus	Horsfield's Tarsier	LR/lc	VU
Abrothrix illuteus	Gray Grass Mouse	LR/lc	NT
Abrothrix sanborni	Sanborn's Grass Mouse	LR/lc	NT
Akodon latebricola	Ecuadorean Grass Mouse	LR/lc	VU
Akodon surdus	Silent Grass Mouse	LR/lc	VU
Arborimus longicaudus	Red Tree Vole	LR/lc	NT
Arvicola sapidus	Southern Water Vole	LR/nt	VU
Calomys hummelincki	Hummelinck's Vesper Mouse	LR/lc	VU
Mesocricetus brandti	Brandt's Hamster	LR/lc	NT
Microtus oaxacensis	Tarabundi Vole	LR/nt	EN
Microtus quasiater	Japalapan Pine Vole	LR/lc	NT
Microtus umbrosus	Zepoal Tepec Vole	LR/lc	EN
Neotoma palatina	Bolano's Woodrat	LR/nt	VU
Reithrodontomys microdon	Small-toothed Harvest Mouse	LR/nt	VU
Reithrodontomys spectabilis	Cozumel Harvest Mouse	EN	CR
Sigmodon alleni	Allen's Cotton Rat	LR/lc	VU
Thomasomys hylophilus	Woodland Oldfield Mouse	LR/lc	EN
Wilfredomys oenax	Greater Wilfred's Mouse	LR/lc	EN
Xenomys nelsoni	Mag (3 0 Td (VU)Tj Coa/ni)Tj /T1_1 1 Tf 19.842 0 Td [(Ma		Mag (3 0 Td (Vus

Mesocricetus brandti

Genuine deteriorations			
Marmota vancouverensis	Vancouver Island Marmot	EN	CR
Petaurista nobilis	Bhutan Giant Flying Squirrel	LR/nt	VU
Petinomys genibarbis	Whiskered Flying Squirrel	LR/lc	VU
Petinomys lugens	Siberut Flying Squirrel	LR/nt	EN
Petinomys setosus	Temminck's Flying Squirrel	LR/lc	VU
Petinomys vordermanni	Vordermann's Flying Squirrel	LR/lc	VU
Pteromyscus pulverulentus	Smoky Flying Squirrel	LR/nt	EN
Ratufa bicolor	Black Giant Squirrel	LR/lc	NT
Rhinosciurus laticaudatus	Shrew-faced Squirrel	LR/lc	NT
Rubrisciurus rubriventer	Sulawesi Giant Squirrel	LR/lc	VU
Spermophilus perotensis	Perote Ground Squirrel	LR/nt	EN
Spermophilus xanthoprymnus	Asia Minor Ground Squirrel	LR/lc	NT
Spalax arenarius	Sandy Mole Rate	VU	EN
Spalax zemni	Podolian Mole Rat	LR/lc	VU

BIRDS			
Scientific name	Common name	2007 IUCN Red List Category	2008 IUCN Red List Category
Genuine improvements			
Ducula galeata	Marquesan Imperial-pigeon	CR	EN
Apteryx owenii	Little Spotted Kiwi	VU	NT
Genuine deteriorations			
Aythya baeri	Baer's Pochard	VU	EN
Sterna nereis	Fairy Tern	LC	VU
Eurynorhynchus pygmeus	Spoon-billed Sandpiper	EN	CR
Numenius arquata	Eurasian Curlew	LC	NT
Ducula finschii	Finsch's Imperial-pigeon	LC	NT
Ducula rubricera	Red-knobbed Imperial-pigeon	LC	NT
Reinwardtoena browni	Pied Cuckoo-dove	LC	NT
Centropus violaceus	Violaceous Coucal	LC	NT
Accipiter princeps	New Britain Goshawk	NT	VU
Pauxi pauxi	Helmeted Curassow	VU	EN
Tetrao mlokosiewiczi	Caucasian Grouse	DD	NT
Atrichornis rufescens	Rufous Scrub-bird	NT	VU
Coracina newtoni	Réunion Cuckooshrike	EN	CR
Corvus kubaryi	Mariana Crow	EN	CR
Loxops caeruleirostris	Akekee	EN	CR
Stipiturus mallee	Mallee Emuwren	VU	EN
Melidectes whitemanensis	Bismarck Melidectes	LC	NT
Mimus trifasciatus	Floreana Mockingbird	EN	CR
Megalurulus grosvenori	Bismarck Thicketbird	DD	VU
Sylvia undata	Dartford Warbler	LC	NT
Diomedea dabbenena	Tristan Albatross	EN	CR
Cacatua ophthalmica	Blue-eyed Cockatoo	LC	VU
Ninox odiosa	Russet Hawk-owl	LC	VU
Tyto aurantia	Bismarck Masked-owl	DD	VU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