

Assessing the Status of the World's Butterflies

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I remember vividly my first experience of the extraordinary diversity of tropical rainforests. Spectacular butterflies filled the air, and each individual I encountered seemed different from the last. In fact, habitats such as tropical forests are home to at least half of all species on Earth. These are also among the most threatened habitats globally, and it seems likely that many tropical forest insects and other invertebrates are threatened with extinction. We often hear about endangered birds, whales, or primates, but how many of us can name a globally endangered butterfly? That fewer than four hundred of the planet's eighteen thousand or so butterfly species have had their global conservation

status formally assessed by the International Union for Conservation of Nature highlights this disparity.

Butterflies are probably the best-known group of terrestrial invertebrates, but we still understand remarkably little about their conservation status globally. In comparison with birds and mammals—for which high-quality information on species distributions, status, and threats is often available—our knowledge about butterflies is slight. Thus, it is hardly surprising that vertebrates rather than invertebrates are typically used to set conservation priorities and to monitor trends in biodiversity. For example, indices showing changes in the status of birds, mammals, and amphibians are now used to track progress toward achieving the conservation commitments made by nations under the Convention on Biological Diversity. We know, however, that invertebrates are key players in many ecosystem functions and services, and that they are sensitive bellwethers of environmental change, so it would be helpful if they too could be included in these conservation indices.

To address this data gap, the IUCN is mounting a new effort to assess the status of the world's butterflies, the Red List Index for Butterflies (sampled approach), funded by the Esmée Fairbairn Foundation and the Institute of Zoology, part of the Zoological Society of London. The project draws together contributions from an informal network of



The IUCN is undertaking an assessment of the world's butterflies, based on a random sample of fifteen hundred species. This may include rare butterflies as well as common ones such as the orange tip (*Anthocharis cardamines*), shown here. Photograph by Silaev Andrey Aleksandrovich, iStockphoto.



The purple sapphire (*Heliophorus epicles*) has a dramatically different appearance with wings closed and open. Photographed in West Malaysia by Adrian Hoskins.

approximately thirty butterfly experts from all over the world. Currently we do not know what fraction of butterflies globally is at risk of extinction, whether levels of peril vary geographically or taxonomically, what the major threats to butterflies are, and whether these differ from those affecting other taxa. As coordinator of this project, I hope that our work will help to answer all of these questions and will push butterflies, as flagship invertebrates, higher up the worldwide conservation agenda.

The IUCN provides a standardized method for carrying out assessments of the conservation status of individual species and publishes them in the Red List. Species are assigned threat categories—"Least Concern," "Near Threatened," "Vulnerable," "Endangered," "Critically Endangered"—based on such factors as rates of population decline, population size, area of geographic distribution, and the degree of fragmentation of population and distribution. Those species in the categories "Critically Endangered," "Endangered," and "Vulnerable" are at high risk of extinc-

tion and are considered "Threatened."

Typically, these Red List assessments can be carried out from a desk rather than in the field, drawing together information from scientific publications and expert knowledge. Systematic compilations of data on conservation status for groups such as butterflies can allow conservationists to identify taxa, regions, or habitats that are of particular conservation concern. Furthermore, if the assessment process is repeated regularly, then trends can be measured over time. This is the logic applied in calculating Red List indices for use as a conservation monitoring tool; by comparing the number of threatened species in repeated re-assessments, conservationists can determine whether the global or regional status of sets of species is improving or deteriorating.

With eighteen thousand species, there are too many butterflies on Earth for us to assess the conservation status of them all. Instead, our strategy is to focus on a random subset of fifteen hundred species. A genuinely random sample should be representative of butterflies



The Indian fritillary (*Argynnis hyperbius*) has a wide distribution from East Africa across South and Southeast Asia to Japan, and south to New Zealand. Photograph by Masaki Ikeda.

more widely in terms of the geographic and taxonomic spread of species as well as being indicative of their conservation status, and thus should provide an unbiased assessment of butterflies as a whole. For example, we do not set out to investigate rare species that may be more likely to be threatened, nor do we sample fixed numbers of species from different countries or continents.

There is no up-to-date inventory of all butterfly species, which may surprise some people. Compiling such an inventory provided the first challenge in applying the Red List index approach, because a random subset of species for assessment purposes must be drawn from a comprehensive list. Fortunately, various butterfly experts have documented regional butterfly faunas for many parts

of the world, including, for example, the entire Neotropical realm. These lists provided the starting point for compiling a global species list.

The next challenge is to sort out some of the taxonomic confusion surrounding butterfly names. It is not easy to assess the conservation status of a species when its identity is uncertain! Butterfly taxonomy is in a constant state of flux, and much of the information available on particular species may be linked to incorrect or obsolete names. In particular, a great many butterfly names are synonyms—different names applied to the same species. Furthermore, historically, many species have been misclassified, and in many cases individuals have been misidentified, providing misleading information on distributions. All of these problems require considerable detective work to resolve.

Once these taxonomic problems have been adequately addressed, the next stage is to gather relevant information on the selected species, by consulting experts and by using whatever sources of information are available in the literature. For the relatively well-studied butterflies of Europe and North America, this is often straightforward; abundant information is typically available and experts are very familiar with the targeted species, even rare ones. In these cases we are able to calculate the area of distribution of each butterfly species, and in some cases we can even calculate approximate population sizes and trends. All of this information is useful for placing species into one of IUCN's threat categories.

The great majority of species, however, are little-known inhabitants of tropical forests, areas that are among

the most data-poor and most difficult to study. For example, around 20 percent of the world's butterfly species occur in Colombia, which represents less than 1 percent of Earth's land area. Many tropical forest species are known from a handful of records, and some from a single specimen alone. If, for instance, a species is known from one remote location in the forests of Central Africa but has not been recorded for fifty years, it is very difficult to know whether it is extinct, or is very rare, or has simply been overlooked. This is where evidence provided by regional butterfly experts can be invaluable. Even if they have never seen a particular species, they may know the localities where it has historically been recorded, whether the forest at these sites has been destroyed, and whether butterfly collectors (who are to thank for the large majority of records for these species) have searched the right locations at the right time. Many of these poorly known species may prove, with better study, to be much more widely distributed and experts may be able to infer from the behavior of related butterflies whether they are likely to have been overlooked elsewhere.

The results from the project should be ready by the end of the year, thanks to the participation and help of butterfly enthusiasts worldwide. One of the most rewarding aspects of this work has been the contacts I have been able to make with fantastically committed and knowledgeable lepidopterists, both amateur and professional, all around the world. In the short term I hope that the project will serve as a catalyst for further data sharing. It has already achieved one aim, formation of a new IUCN Butterfly Specialist Group, chaired by Xerces So-

ciety executive director Scott Hoffman Black. It may also inspire surveys in the field targeting particular species or sets of species that may be at risk: what butterfly enthusiast could resist the urge to travel to a remote rainforest in an attempt to rediscover a long-lost species? In the longer term, I hope that our work will ensure that butterflies get the recognition they deserve in terms of conservation planning and action—and that people will find it as easy to name a butterfly that is globally endangered as they do other more charismatic species.

Owen Lewis is an ecologist at the University of Oxford, UK. A lifelong butterfly enthusiast, he is particularly passionate about tropical rainforests and the processes generating and threatening their extraordinary biodiversity.



Well-camouflaged butterflies like the aptly named magnificent leafwing (*Coenophlebia archidona*) can be hard to spot. Such simple things can influence estimates of population size. Photographed in Peru by Adrian Hoskins.