

The invertebrates – a conservation

The series of IUCN *Red Data Books* on mammals, birds and reptiles is familiar to many people interested in conservation. The latest publication breaks new ground, being the first volume on animals without backbones, the invertebrates. Of all living things, the invertebrates have received least attention from conservationists, perhaps because they are often inconspicuous or poorly known. Governments and international organisations generally take an interest only in those relatively few species considered to be man's enemies, the pests and disease carriers. The usefulness to man of many invertebrates is rarely emphasised, yet shrimps and lobsters are the bases of important fisheries, many invertebrates have potential medical use, and others, like earthworms and pollinating insects, play vital ecological roles. Conservation organisations also give the group a low priority, perhaps worried that the panda-loving public will withdraw its support if donations are seen to go to spiders, snails and other lowly animals.

About 1.4 million invertebrates are known to science, compared with 0.25 million flowering plants and only 46,000 vertebrates. Some 75 per cent of invertebrates are insects, including not only the familiar ants, butterflies, dragonflies and beetles, but also more obscure groups such as

stoneflies, caddis flies and thrips. The remaining 25 per cent comprises an extraordinarily diverse variety of animals including the plant-like sponges and corals, the worms and leeches, the familiar snails, slugs and shellfish, and the starfish and sea urchins. The habitats of invertebrates are as diverse as their appearances, ranging from the ice-caves and glaciers which are home for the earwig-like grylloblattids, to the deepest ocean trenches where bizarre tube-dwelling worms up to 2 m long have been found. Hundreds of new invertebrates are described each year and there are certainly millions more to be discovered. The *Invertebrate Red Data Book* draws attention to the main areas of ignorance, and examines a number of test cases in detail, many for species which require immediate attention.

The selection of species for inclusion was no easy task. The information needed to fulfil the criteria of the IUCN categories (Endangered, Vulnerable etc.) is often missing for invertebrates, even though there may be clear evidence that some form of conservation action is necessary. Nevertheless, basic data are needed before funding agencies can consider conservation proposals. How is it possible to document and propose action plans for these poorly known animals?

The invertebrates include groups with life-styles that have not previously been considered in *RDBs*. For example, many invertebrates are parasites and pests, raising moral questions about their conservation. Great effort is put into attempts to eradicate such species, but it is questionable whether they should be driven to extinction. Genetic diversity, even in these

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new look at species

N. Mark Collins and Susan M. Wells

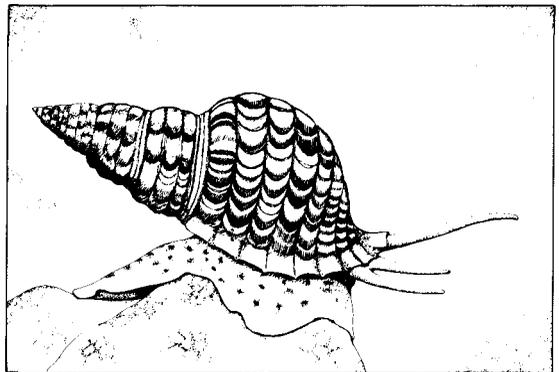
species, could be an asset for the future. Endangered vertebrates may harbour invertebrate parasites which are themselves endangered. An example is the pygmy hog sucking louse *Haematopinus oliveri* which lives only on the very rare pygmy hog *Sus salvanius* in northern India. In general, however, parasites and pests cannot be considered a priority when the needs of obviously beneficial invertebrates are so great.

A fresh look at categories

Threatened communities

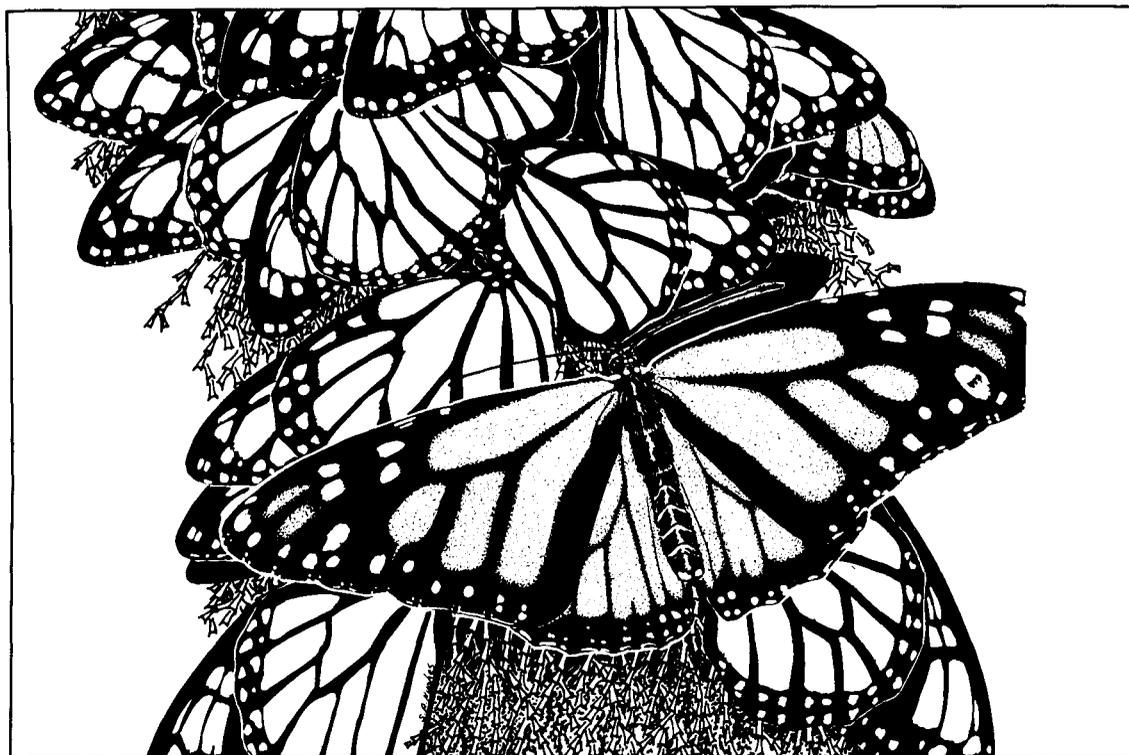
For any conservation proposals to be successful, they must be put to funding agencies in a clear and concise way, with the problems and the proposed solutions set out within an organised framework. One way of achieving this is to introduce new categories such as Threatened Community. This is defined as 'a group of ecologically linked taxa occurring within a defined area which are all under the same threat and require similar conservation measures', emphasising the large number of invertebrates which can become endangered through single events or through human activities in a small area. The montane rain forest of the Usambara Mountains in Tanzania is one such example. Apart from its unique birds and plants, it is the home of insects and snails found nowhere else, including five butterflies, 17 solitary wasps, 18 snails in the genus *Gulella* and many earwigs, millipedes and beetles. All are threatened by increasing human encroachment on the forest for planting of tea and cardamom, subsistence agriculture and timber operations.

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The giant triton, prized by shell collectors and used as a trumpet in the Indo-Pacific, is a naturally rare species that could be seriously threatened by heavy collection (Sarah Anne Hughes).

The Threatened Community category is also useful for marine invertebrates. It is still very difficult to estimate population sizes and to map distributions of marine species, although the development of scuba diving equipment, underwater cameras and deep-sea submersibles has dramatically increased our knowledge of marine life. Human activities are unlikely to cause the extinction of species of marine invertebrates, but many populations are experiencing local depletions. Furthermore, entire communities such as coral reefs, salt-marshes and mangroves are suffering extensive damage which will affect their invertebrate life. One example given in the *Invertebrate RDB* is the largest coral atoll in Indonesia, Taka Bone Rate, which supports a high diversity of molluscs and other marine invertebrates, including threatened species such as giant clams *Tridacna* spp. and the giant triton *Charonia tritonis*. Damaging fishing methods have destroyed large areas of reef and many



The monarch roosts in millions in forest sites which are the focus of conservation efforts by both the Mexican and US Governments (*Sarah Anne Hughes*).

species have become severely depleted through over-collection.

Commercially threatened

Exploitation of invertebrates, particularly of marine forms, is in fact unlikely to lead to species extinction. Most invertebrates have much higher reproductive capacities than vertebrates, and consequently can withstand uncontrolled harvesting without becoming extinct. However, over-collection can have serious effects, particularly if the population is already critically depleted or naturally small, if there is a high value per individual (such as the rare butterflies and molluscs which become collectors' items), or in the few cases of species with low reproductive rates. The category Commercially Threatened permits consideration of the many marine invertebrates that are of economic importance to man and whose populations are threatened as a sustainable resource.

The trade in shrimps is believed to be the world's most valuable industry in a wild animal, and many other marine invertebrates provide, or have the capacity to provide, a substantial source of revenue. Unfortunately human population growth has led to excessive subsistence fishing in many areas, and in others the impact of commercial fisheries has been greatly increased by the introduction of modern and sometimes damaging techniques. The queen conch *Strombus gigas* is a major food resource in the Caribbean where it has been exploited by subsistence and commercial fisheries for centuries. In recent years stocks have been depleted around most of the islands and a major international effort is now being directed at conch mariculture or farming, with the ultimate aim of restocking depleted grounds. Precious corals *Corallium* spp., long prized as a material for making carvings, have also been seriously over-fished. The Mediterranean, once the centre of the coral industry, is practically devoid of commercially viable beds. Pacific

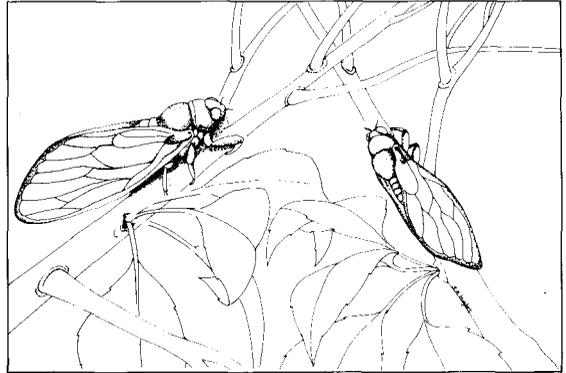
precious corals now dominate the world market, but already there is evidence of over-exploitation of these stocks. These examples illustrate the importance of managing valuable invertebrate resources in a way that ensures sustainable utilisation.

Threatened phenomenon

This new category is concerned with threats which affect large aggregates of organisms but do not threaten the species as a whole. The best example is the monarch butterfly *Danaus plexippus* which migrates south and gathers in millions to roost through the winter in certain coniferous forests of Mexico and California. The species itself is very common, but the spectacular roosts are highly vulnerable to human disturbance.

The scale of the problem

The *Invertebrate RDB* describes only a minute proportion of the world's threatened invertebrates. The examples chosen illustrate the huge range of invertebrates which are under threat from man all over the world, and also the different levels of threat. The examples given are not necessarily the species in greatest danger. Two examples of species which are in no immediate danger but for which a threat is perceived are the white-clawed crayfish *Austropotamobius pallipes* and the periodical cicadas *Magicicada* spp. The crayfish has a fairly wide distribution throughout the waterways of Europe and is still abundant in

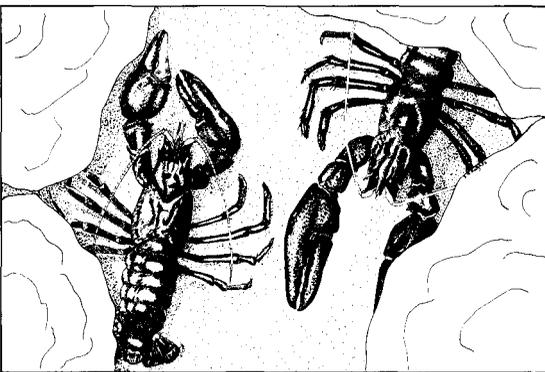


Several year-broods of the periodical cicada, which takes up to 17 years to mature, are already extinct and others are threatened by woodland destruction (Sarah Anne Hughes).

parts of France, Switzerland and Ireland, but some populations have been heavily reduced by pollution and the crayfish plague. This is a fungal infection from North America which has periodically broken out in Europe with disastrous consequences for the native species. The potential for such outbreaks is increasing with the rapid growth in imports of North American crayfish for aquaculture. Since *A. pallipes* has considerable commercial potential in its own right, there is a strong incentive for its conservation.

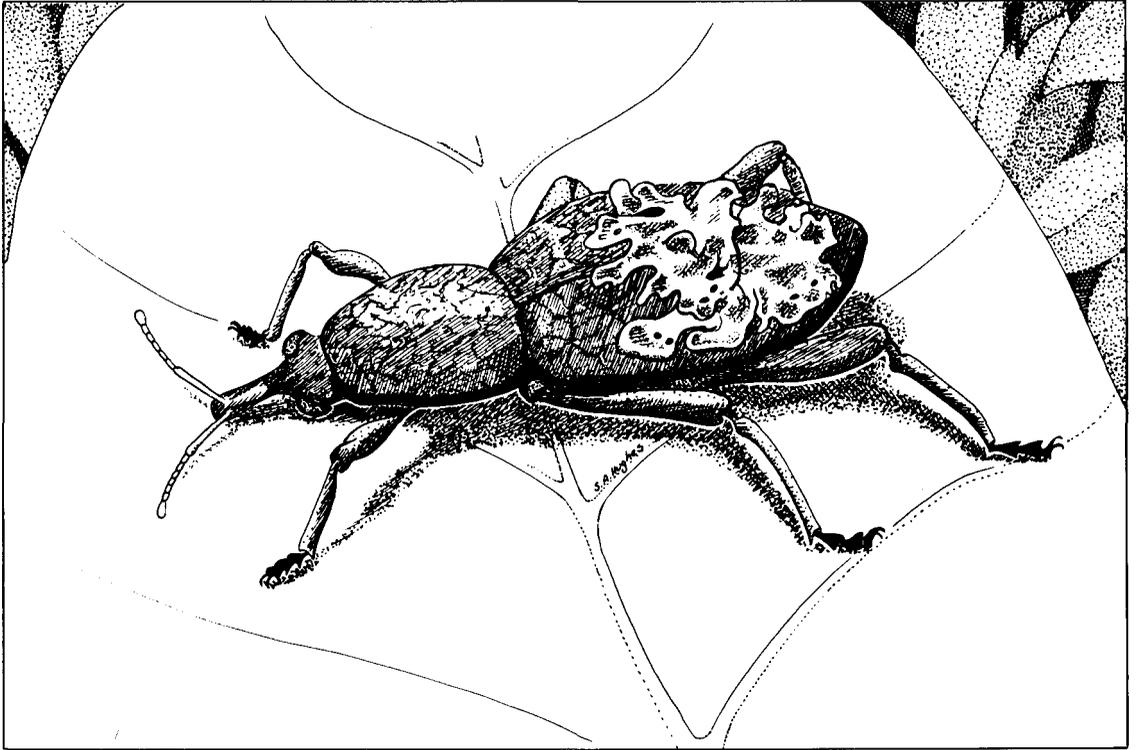
The periodical cicadas *Magicicada* spp. of the USA, are most unusual insects in that they take up to 17 years to mature. When they are finally ready, the adults all emerge at the same time, hundreds of thousands of them filling the air with their ear-piercing song. In different parts of the country the cicadas mature in different years, but always after the same period of maturation. The different year classes are called broods and there is generally only one brood in one place. The cicada species are still very widespread but two broods are already extinct, and others are threatened by the steady destruction of woodlands. They tend to be forgotten because the nymphs live underground and are not noticed between the rare appearances of the adults.

In contrast to the slow and steady alterations to habitat which are affecting the cicadas, some invertebrate species may be destroyed by a single event and are aptly described as endangered. The young stages of the Tasmanian torrent midge



The white-clawed crayfish in common in some parts of Europe, but fungal disease and pollution are depleting its populations (Sarah Anne Hughes).

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The lichen weevil carries its camouflage on its back, but this will not protect it from the felling of its forest habitat on Mt Kaindi in Papua New Guinea (Sarah Anne Hughes).

Edwardsina tasmaniensis are confined to a single waterfall in a river which would have been diverted if the dam on the Lower Gordon River had proceeded. Loss of habitat is clearly the major threat to invertebrates and nowhere is this more apparent than in tropical rain forests where the timber industry, slash and burn cultivation and other human activities are thought to be causing a daily reduction in the variety of invertebrate life. In Papua New Guinea for example, Queen Alexandra's birdwing *Ornithoptera alexandrae*, the largest butterfly in the world, with a 25 cm wingspan, is seriously endangered by destruction of lowland forest for oil palm plantations and the timber industry. Another threatened insect in Papua New Guinea is the lichen weevil *Gymnopholus lichenifer*, an extraordinary beetle that carries a camouflaging collection of lichens, liverworts, mosses and fungi attached to special hairs and spines on its back. This uniquely adapted insect is confined to Mt Kaindi, which is being gradually cleared for gold-mining, timber and agriculture. With the study of

invertebrates in rain forest still at such an early stage, it is inevitable that many other species will be lost before they are known to science.

However, extinctions are not only occurring in the remote rain forests of South America and South East Asia. A long-horned grasshopper collected in 1937 in the Antioch Dunes of California lay unnoticed in a museum collection until 1977, when it was described as a new species. A search for more specimens proved fruitless in the now devastated dune area, spoilt by poor management and human disturbance. The species was aptly named — *Neduba extincta*. In 1977 a similar disaster befell two tiny, eyeless and transparent species of flatworm which were discovered for the first time in a spring in Virginia, USA. Searches of adjacent springs have failed to reveal any further specimens and they are now probably both extinct, the small area on which they depended having been turned into a car park.

The way ahead

Since the 1970s national interest in invertebrate conservation has greatly increased, primarily for insects but also for other groups. Australia, New Zealand, the USA and several European countries have begun to document their threatened invertebrates. Legislation has followed in some cases and the USA now has 49 invertebrates protected under the Endangered Species Act, with recovery plans for many of them already in progress. In Britain the Wildlife and Countryside Act protects 14 insects, three snails and two spiders. Most European countries, including Britain, put emphasis on habitat protection without legislation for particular species, although the number of national 'Red Books' for invertebrates grows every year.

Serious concern for invertebrates is spreading and they are sometimes at the centre of major conservation issues. A recent case at San Bruno Mountain in the heart of San Francisco has brought insects into the headlines. Two federally protected butterflies, the mission blue *Icaricia icarioides missionensis* and the San Bruno elfin *Incisalia mossii bayensis*, held up development there for five years until a contentious loophole, introduced at the last reauthorisation of the Endangered Species Act, permitted the builders to go ahead (see News and Views in this issue). The monarch butterfly roosts in California and Mexico have been the subject of an important bilateral effort to safeguard their future. Both the US and Mexican Governments have set aside protected and managed roosting areas.

It is emphasised in the *Invertebrate RDB* that the areas where most efforts are being made — North America, Europe and Australia — are not the regions where most invertebrates are at risk. Without doubt these are the tropical areas of South America, Africa and South East Asia, where human populations are expanding rapidly

into the world's greatest concentrations of animal and plant species. The value of invertebrates in ecological terms and as a resource for the future must not be overlooked in the siting and design of protected areas. They should be considered more fully as important sources of food, natural predators and herbivores for biological control, genetic material for research and medicine, and as valuable indicators of environmental impact. More investment in basic taxonomic and ecological research is needed, and a greater input into invertebrate conservation programmes.

ffPS has shown an increasing interest in invertebrates. The upward trend can be detected in *Oryx*, with various insects, molluscs and marine crustaceans appearing in three notes in 1980, five in 1981 and eight in 1982. Also in 1982 a substantial grant from the *Oryx* 100% Fund was used to set up a 'snailarium' at the Jersey Wildlife Preservation Trust for the highly endangered *Partula* snails from Moorea in the Pacific Society Islands (see *Oryx* 16(4), page 299). Next year a project to survey the threatened snails of the Madeiran archipelago will be supported by ffPS. The *Red Data Book* draws attention to just a few of the many projects on invertebrate conservation that require action and it is hoped that in future the interest in animals without backbones will gain still further momentum.

Full references for all species and statements in this article, and acknowledgments to the many people who have helped in its production, will be found in the *IUCN Invertebrate Red Data Book* compiled jointly by S.M. Wells, R.M. Pyle and N.M. Collins, published by IUCN and available from ffPS, at £14.00 including postage and packing (for airmail add £9).

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