

**A mouthful**

It is known that female catfishes attach their mouths to the anal region of the males during spawning. The significance of this bizarre trait has been discovered by some Japanese scientists from the laboratory of Animal Sociology at the Osaka City University. They have found that the sperm on being consumed pass through the female's intestine and are released along with her eggs into a temporary pouch formed by the bending of her pelvic fins.

The ability of bringing sperm and eggs together in a small enclosed area, thus protecting them from the turbulence of the sea and the unusually short alimentary canal appears to have made this unique form of reproductive behaviour possible.

**ENVIRONMENTAL SCIENCES****Sharing the blame**

*The discovery of the role played by pre-historic people in the extinction of several species of animals and birds gives the subject of biodiversity depletion and conservation strategies a new twist*

THE extinction of wildlife due to the harm caused by human activities in the modern world is well-documented and widely-known. For the more conspicuous groups of birds and mammals, rates of extinction have been estimated at about one species per year. Since the total number of species of living organisms is 2,000 times the number of birds and mammals, the overall rates of extinction may even exceed five species per day. With the continued destruction of tropical rainforests around the world and the higher susceptibility of lower forms of life to extinction, global extinction rates are expected to reach 100 species per day by the end of the 20th century.

However, it is now coming to light that the issue of extinction of species is not merely a product of the present-day human's prerogative. The world's pre-historic people appear to have contributed their own bit to species extinction. The presence of bones of birds that are known to be extinct, at archeological sites in Pacific islands show that the human-made biodiversity crisis began thousands of years ago.

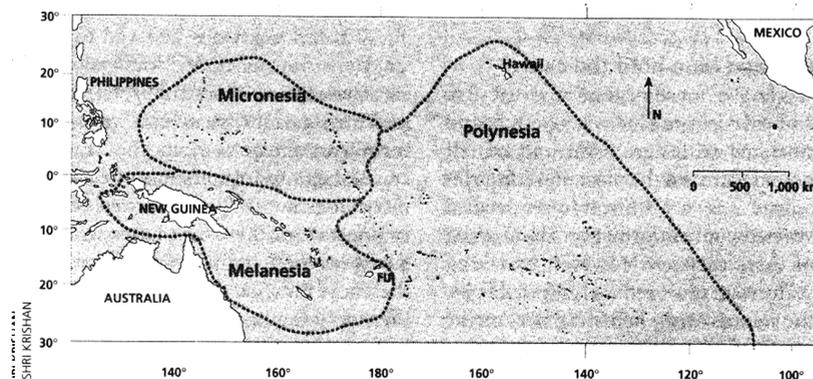
The colonisation of Melanesia, Micronesia and Polynesia appears to have begun about 30,000 years ago and was virtually complete nearly 1,000 years ago. The clearing of forests, cultivation of crops, rearing of domestic animals

and hunting of wildlife are some of the activities carried out by both pre-historic and present-day humans which can seriously impact the populations of certain species and lead to a reduction in their populations. The introduction of new predators and especially new pathogens — that inevitably occurs after human colonisation — are other important factors that affect the well-being of species. These factors can induce either the local or global extinction of species.

David W Steadman of the New York State Museum has estimated that an average of 10 species or populations have been lost on each of the approximately 800 islands in the Pacific ocean due to human activity during pre-historic times. This amounts to a total loss of 8,000 species. At least 2,000 of these appear to represent the global extinction of the entire species, a figure which accounts for the disappearance of about 20 per cent of the world's bird species. On five of the largest Hawaiian islands, 31 to 65 per cent of the birds have been driven to extinction since pre-historic human settlements were established. Flightless birds such as rails seem to be the most vulnerable to the impact of human settlement. This means that in addition to the reduction in species diversity the very nature of bird fauna has undergone qualitative changes.

The implications of so significant a

**The major island groups in the tropical Pacific ocean**



finding are many. From the point of view of analysing the biogeography and evolution of birds, these findings raise serious problems for any study that may be based solely on present-day or merely historical records of the distribution of birds. The repercussions of the discovery on conservation programmes would be even more serious. What is true of birds could largely hold good for other groups too and may be even more serious in the case of lower organisms.

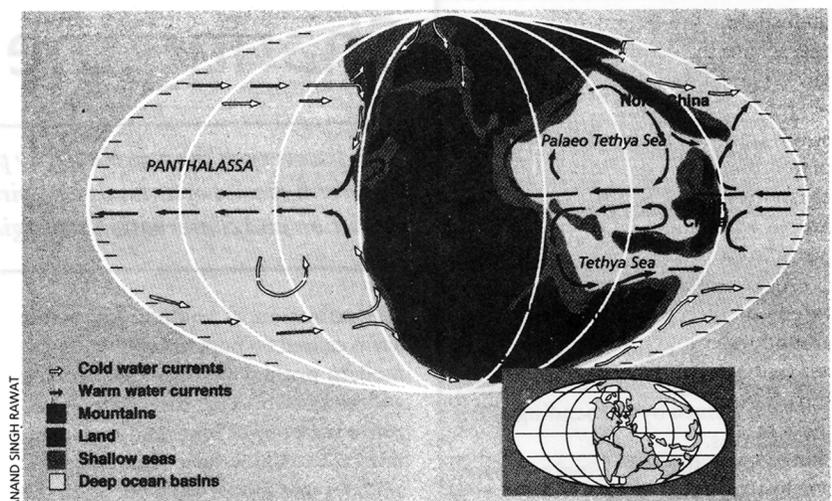
In addition, there is also the danger of people becoming complacent about their lifestyles once they get the feeling that their activities alone are not responsible for the extinction of other organisms. There is the risk of people justifying human activities that endanger wildlife and biodiversity and thus making efforts at conservation much more difficult to pursue.

On the other hand, these findings could help us put things in correct perspective specially since education on nature conservation is currently based too heavily on creating the impression that it is the ecologically-unfriendly lifestyle which is responsible for the biodiversity crisis and that if we lived in harmony with nature, as pre-20th century people supposedly did, we would solve many problems. It may now be possible to plan conservation strategies that are more realistic. A reorientation of public education on the causes of species extinction and the ways to mitigate the impact of human activities is urgently called for. ■

## Tryst with the Triassic

*The Triassic has been brought into sharper focus, thanks to fossilised evidence found in the US*

AFTER the Jurassic park, it is now the turn of a Triassic insect park. Unlike the make-belief Jurassic park which recreated the age of the dinosaurs, the Triassic insect park is real and original in that it existed millions of years ago. What remains of the park now is an unusually well-preserved collection of fossils located at the border between the states of Virginia and North Carolina in the US. The discovery of these fossilised



*The palaeogeography and palaeoceanography of the early Triassic period  
Present-day boundaries of the continents shown in the inset (below right)*

ferous, cyclical lacustrine sediments — that can be dated back to the Triassic period — not only provides an unique opportunity to understand the origin and evolution of various insect, plant and vertebrate forms but is also likely to alter our image of an age that existed 200 to 250 million years ago. The site provides the oldest definitive records of three orders of insects namely heteroptera, thysanoptera and diptera. Among the well-preserved specimens of insects found are plant hoppers, leaf hoppers, cockroaches, beetles, crane flies, moth flies, sucking bugs, thrips and caddis flies. They also reveal an unusual diversity of plants and some of the best preserved soft part anatomy of vertebrates.

Certain inferences drawn from discoveries at the park have turned two relatively well-established ideas on their head. Firstly, the Triassic was thought of as a period of relatively low insect diversity. High rates of extinction and low rates of speciation were believed to be responsible for the so called 'Triassic minimum in insect diversity'. Such a postulate may no longer hold good as the Triassic is proving to be as rich a period in insects as the neighbouring Permian (dating 248-186 million years) and Jurassic (dating 144-213 million years) periods.

The second idea being brought into question relates to the differences in the vertebrate fauna between the northern Laurasian and southern Gondwanan realms of the Triassic period. The differences seem paradoxical since a single supercontinent, the Pangaea, is known to have existed during this period. The

reliability of the dating of the rocks sampled from the Laurasian and Gondwanan regions are beginning to be questioned since the findings of well-preserved vertebrates in the Triassic insect park are expected to blur the distinction between the northern and southern Triassic vertebrate faunas. ■

## Tell me where

*The underground discharge of water and minerals to oceans is now known to be much more significant. This considerably reduces the weightage given to the contribution of rivers and streams to oceanic content*

WHERE do oceans derive their water and salts from? The textbook answer would say 'from the rivers'. Although the answer is correct, there are several other sources which can account for nature's water and mineral cycles. The weathering of ocean floors which yields minerals, the atmospheric deposition of dust and trace elements directly on the ocean surface and the direct flow of water into the sea through porous rocks known as SGWD (sub-marine groundwater discharge) are some of the other sources through which oceans get their water and minerals.

SGWD has become the focus of recent attention because of the measurement of trace elements, that are known to be naturally enriched in groundwater, for

quantifying the extent of water discharge into the oceans from groundwater. Willard S Moore of the department of geological sciences, University of South Carolina in the US has now estimated that levels of 226radium in the coastal waters of south-eastern US far exceed what might be feeding into the ocean from rivers.

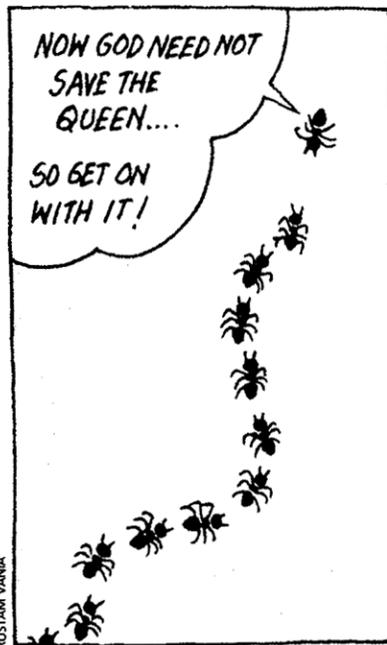
As a result, Moore estimates that the extent of direct discharge of underground water into the ocean is about 40 per cent of what the oceans get through run off from rivers and streams. Prior to these measurements, groundwater discharge was thought to be no more than one to 10 per cent of the discharge from rivers. These findings have altered our understanding of oceanic chemical balance. They also have serious implications for the conservation of potable groundwater in the coastal region because Moore's measurements have also suggested that salt water from the sea has of late seeped into underground freshwater reserves. Such intrusion is likely to continue and intensify as the sea level rises and the demand for fresh water increases. ■

## A will where there is a hill

*Ants have found ways by which to make up for the loss of the queen. The perpetuation of the species and the continued use of the elaborate nests built by the workers, following her death, is possible*

IN THE case of most ants, a single fertile queen monopolises reproduction while the workers build the nest, nurse the offspring and forage for food. In some cases the nests built are quite elaborate and offer good protection from various environmental factors such as heat and floods. Sometimes, the nest represents such a heavy investment of time and effort that it seems a pity to abandon it after the death of the queen. Fortunately the queens in many species are fairly long-lived.

However, in the case of ants with expensive nests and short-lived queens, the problem has found two different



solutions. In the genera *Formica* and *Camponotus*, daughter queens returning after mating are accepted into their mothers' nests so that they can continue to use the painstakingly-built nest. On the other hand, the Indian ponerine ant *Harpegnathus saltator*, being studied by Peters and Hölldobler, has solved the problem in its own way. Female workers, who in any case happen to be the queen's offspring, mate with their brothers and continue to reproduce long after the queen mother has died. In other words, the queen continues to reproduce by proxy because when her daughter workers mate with her sons and produce grandchildren, genetically speaking, it is equivalent to the continued reproduction of offspring by the queen herself. ■

## Springing a surprise

*Global warming has led to the early rejuvenation of vegetation in spring, a phenomenon that is causing a change in the annual carbon dioxide cycle. The northern hemisphere in particular, welcomes spring earlier now*

SPRING reaches the northern hemisphere a week earlier than it did twenty years ago. Charles Keeling of the Scripps

Institution of Oceanography at La Jolla, California, US, has recorded a sudden shift in the seasonal cycle of the concentration of atmospheric carbon dioxide, resulting in the early arrival of the northern spring. The published report comes in the wake of a meeting of signatories to the Climate Change Convention in Geneva to agree on a timetable for limiting global emissions of carbon dioxide (*New Scientist*, Vol 151, No 2038).

Keeling had begun measuring amounts of the gas on a bi-weekly basis way back in 1958, from the Mauna Loa peak in Hawaii. Since then he has been recording a rise in average concentrations of carbon dioxide and an increasing amplitude in its seasonal cycle. Keeling reports that the amplitude of the seasonal cycle at Mauna Loa has increased by 20 per cent since the early '60s. The increase is still greater in the Arctics, measuring 40 per cent at Point Barrow in Alaska.

Every year, there is a rise in the atmospheric levels of carbon dioxide as vegetation in the northern hemisphere stops growing and releases carbon. And every spring, levels of the gas fall as plants and trees resume growth and absorb carbon dioxide in the process. The decline in atmospheric carbon dioxide in the northern hemisphere during spring seems to have shifted forward by seven days. Keeling is of the opinion that global warming has caused the early rejuvenation of the world's woodlands, particularly in the northern hemisphere (the forests of Scandinavia, Siberia and Canada), and this has led to an increased uptake of carbon dioxide by the trees. These changes, according to Keeling, "suggest largescale responses of the carbon dioxide cycle to climate change".

"Keeling's work confirms that terrestrial vegetation is much more important to the carbon dioxide cycle, and so to global warming, than we once thought," says John Grace of the University of Edinburgh, who reported last year that virgin Amazon rainforest was growing faster due to global warming.

Keeling's arguments have been further substantiated by his observation that increases in the strength of the seasonal carbon dioxide cycle has occurred in jumps, coming about two years after an increase in average temperature. He also reports the lengthening of the growing season. ■