

In this issue

Courtship, mating and egg laying in *Tylototriton verrucosus*

The salamander is a most unusual animal! Although it looks very much a reptile and can pass off, to most untrained eyes, as an aquatic lizard, it is actually an amphibian, albeit one with a permanent tail! Salamanders are amphibians of the order Caudata (also called Urodela). This taxon includes the newts, a group of rough-skinned species, and the true smooth and wet-skinned salamanders, all included within the family Salamandridae. Salamanders can be morphologically distinguished from other amphibians (frogs and caecilians) most obviously by the presence of the above-mentioned tail in all larvae, juveniles and adults, and by having limbs set at right angles to the body with forelimbs and hindlimbs of approximately equal size.

Many salamanders have a biphasic life cycle containing an aquatic larval form with external gills, and a metamorphosed terrestrial adult form that breathes by lungs and/or through moist skin. Some species lack metamorphosis and retain a larval appearance throughout their life, whereas other species lack the aquatic larval stage and hatch on land as terrestrial forms that resemble miniature adults. The general association of lungs with terrestrial animals and gills with aquatic ones is not universally true among salamanders; terrestrial plethodontid salamanders lack lungs and breathe through the skin, whereas aquatic adult amphibians lack gills and use lungs to breathe. Salamanders are carnivorous in the larval, juvenile and adult stages of their life cycles and prey mainly on small arthropods.

Although India has a rich diversity of amphibians across a variety

of ecological habitats, it presents a rather unusual counter-intuitive picture of displaying only a single species of salamanders – the Himalayan Crocodile Newt or *Tylototriton verrucosus* – found only in small lakes and pools within the moist temperate forests of the eastern Himalaya. It is, however, rather surprising that in spite of its inclusion in the Endangered category of Schedule I of the Indian Wildlife (Protection) Act of 1972, very little is still known about the ecology, biology and conservation status of this rare amphibian.

Although most amphibians do not always present themselves as attractive beings to most people, over the last two decades, this otherwise fascinating group of animals has emerged as a promising group of organisms in which to study the evolution of sexual behaviour. The spectacular range of biological diversity is nowhere more exuberantly displayed than in the mating systems of many frogs, toads and salamanders. On **page 693** of this issue, Roy and Mushahidunnabi describe the courtship and mating behaviour of the Himalayan Crocodile Newt and provide detailed data on the variability in behavioural patterns exhibited by different copulating pairs. As in most amphibians, mating is achieved through the act of amplexus in which the male climbs onto the back of the female and clasps her firmly, after which the eggs are usually laid either freely in the water or attached to aquatic vegetation. Unlike most amphibians where the eggs are externally fertilized by sperm directly released by the male into the water, however, this salamander displays internal fertilization with the eggs being fertilized within the body of the female. Why has natural selection chosen certain common strategies of reproduction that characterize all

amphibians? How, in contrast, did certain group-specific traits arise? Why, for example, do most amphibians display external fertilization while the Himalayan Crocodile Newt female prefers to fertilize her eggs within the safety of her body? Has the latter reproductive strategy evolved naturally as a species-specific trait or is it more characteristic of populations that today face environmental stress and uncertain futures? More comparative studies, especially in the wild, should, one day, provide us some of these answers. Time, however, seems to be running out.

With the relentless march of development that seems to invariably and increasingly intrude into India's protected areas, the future seems rather bleak for our plants, our animals and our indigenous peoples. The only way we can stem this loss is through a complete involvement of every concerned Indian to know more about our awe-inspiring diversity of biological forms and devise ways to protect them from future extinction. We must not only learn, we must also do.

Anindya Sinha

Ancient Indian data on astronomical events

The cosmic explosion on 4 July 1054 AD concerns the supernova remnant, the Crab Nebula. This event, which must have been spectacular, was noted not only by the Chinese astronomers but also by some laymen amongst the American Indians and in the Middle East, in the form of writings and rock carvings. Are there recordings of the event from the Indian subcontinent? J. V. Narlikar and Saroja Bhate address this issue on **page 701**. The study was supported by the

Indian National Science Academy under the 'History of Science' program.

Astronomy is said to have begun in India with Aryabhata in the 5th Century AD and to have *flourished* for several centuries. It is against this background, that the team from Pune, led by Narlikar and Saroja Bhate, has carried out investigations. It is based on extensive searches of archival materials at several libraries, and institutions scattered all over the country; it has

included meetings and interviews with many scholars of ancient history and Indology. After painstaking sieving of plausible evidences, culled from sources as disparate as *Mahabharata*, *Puranas* and Sanskrit literature, the authors have ended up with some seven – somewhat ambiguous – notings that they may be offered as Indian recordings of the Crab Nebula supernova explosion.

The authors have concluded that 'this (effort) at first sight, seems a disappointing end to a quest in his-

tory of science' but they have kept the doors open for 'if any scholars in future wish to resume the quest'! The authors surmise that 'the explanation may be that there was not much written tradition in India at the time, the emphasis of scholarship being on reading the ancient texts, rather than creating new ones'.

K. R. Rao