Governments participating in COP-IV were urged to take urgent steps to harmonize the provisions of TRIPS with the equitable benefit-sharing and prior informed consent (PIC) provisions of the CBD. What is urgently needed is a new global trade and transactions order—a 'TRIPS Plus'—where 'Plus' refers to equity and ethics in IPR claims. Since the same Governments are members of both the World Trade Organization and the CBD, there is a need for coordinated action in matters relating to biodiversity. In this context, the participants welcomed the recent move of the WIPO to consider questions relating to according recognition to traditional knowledge systems and informal innovations.

Pending the enactment of suitable legislation to give effect to the provisions of the CBD, they urged countries in this region to introduce immediately steps such as codes of conduct for both academic researchers and commercial entrepreneurs and companies, and information and material transfer agreements for the purpose of implementing the PIC and benefit-sharing provisions of the CBD.

Legislations to control matters relating to access to genetic resources and traditional knowledge is required but the legislation should be based on a sound understanding of the nature and extent of demand for genetic resources and should be linked to national needs and the legislation should be prepared through wide stakeholder participation.

In spite of the variability inherent in cultural and political systems and in spite of the complexities involved, it is essential that immediate national and regional action be taken to implement the PIC and benefit-sharing provisions of the CBD. An integrated package of legislative and non-legislative measures should be introduced, appropriate to the conditions of each country. While conservation and benefit-sharing measures need to be country-driven, there is scope and need for a Regional Biodiversity Access and Benefit Sharing agreement among countries in this region. They welcomed the call made by ASEAN for a common protocol on access and benefit-sharing among member-states. A request was made to SAARC countries to develop a similar common protocol. The Secretariats of ASEAN and SAARC were requested to initiate steps to promote consultation and information exchange which can lead to reciprocity and concerted action in matters relating to access to genetic resources among countries both within and outside the region.

The Governments could also facilitate private sector involvement in the commercialization of biodiversity through know-how licenses, material transfer agreements (MTAs) and information transfer agreements (ITAs). Suitable codes of conduct could be developed and enforced by the companies themselves.

Need for industrialized countries to enact legislation which supports the implementation of the PIC and benefit-sharing provisions of CBD was also discussed.

M. S. Swaminathan Research Foundation and IUCN are soon bringing out a joint publication on the recommendations to be followed by a detailed proceedings, including case studies and country papers.

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Declining amphibians

Amphibians became the first land-dwelling vertebrates when they developed from fishes over 350 million years ago, but the members of our four-footed ancestors are rapidly declining. Information regarding most amphibian declines is anecdotal. Factors that may be contributing to amphibian population declines include habitat destruction, excessive use of chemical pesticides and toxic effluent from industries.

In India so far, 205 plus species of amphibians have been recorded. Amongst various biogeographic zones, Western Ghats are the richest with 120 species of which 92 are endemic. According to the IUCN (International
Figures 1–10. 1. Kodungarai river in Anaikatty, ideal habitat for many semi-aquatic and aquatic amphibian species (B. K. Gupta); 2. The stream ecosystems of the tropical rainforest are prime amphibian habitat (B. K. Gupta); 3. Limnonectes rufescens in the hand from CZPCC site (B. K. Gupta); 4. Nyctibatrachus major lives among the boulders in rainforest (B. K. Gupta); 5. Indrana leptodactyla, a tiny thin-legged leaping frog, endemic to the Western Ghats (Photocentre); 6. Hylobatrachus ligerinus, once exploited for frog legs trade (Photocentre); 7. Rana temporalis, ideal species for exhibiting in zoos (B. K. Gupta); 8. Indrana brachypterus from undisturbed habitats (B. K. Gupta); 9. Bufo beddomei, tiny toad from rainforest (Photocentre); 10. Bufo petersii, rainforest toad (P. S. Sivaprasad).
Union for Conservation of Nature and Natural Resources) Red Data Book worldwide, there are 53 species of amphibians listed in the endangered category, of which 3 are from India. Amphibian researchers are inundated with reports of the disappearance of frogs, toads, caecilian and salamander species – all vulnerable because they have moist permeable skin. Amphibians are especially sensitive to climatic and chemical changes in their environment and therefore become natural pollution indicators, raising world-wide alarm.

The need of data

Information regarding most amphibian declines is anecdotal. For several species, range reductions are reported. Every now and then, new species are being reported. Research on amphibian ecology has just been in the process of initiation by various organizations, but it has historically lagged behind that of other vertebrate groups. So little is known about amphibians and till lately they have not been categorized. No species (except freshwater frogs in Schedule IV) are included in the Indian Wildlife (Protection) Act, 1972.

The first world-wide effort to assimilate data on the causes and consequences of amphibian declines was initiated by Declining Amphibian Populations Task Force (DAPTP) of the Species Survival Commission (SSC), The World Conservation Union (IUCN) based at United Kingdom.

What we do know

Over the years we have been dissecting frogs and toads in laboratories and conducting physiological studies. Frog legs trade was banned by Government of India in 1986. Till 1986, India was the biggest frog-leg exporting country in the world. It was earning substantial foreign exchange through the export of *Rana hexadactyla* (now called *Euphlyctis hexadactylus*) and *Rana igrina* (now called *Heleobatrachus tigrinus*). It is also being reported that during 1987 alone we consumed about 20 million frogs for dissection in schools. P. S. Sivapravad, a naturalist, says that amphibians could not be found in many of the locations where they were once numerous. Karthikeyan Vasudevan, a researcher from Wildlife Institute of India based at Valparai, Tamil Nadu says that fragmentation is causing tremendous pressure on the declining population of amphibians.

Herpetologists have witnessed the vanishing of amphibian populations. Biologists Jennifer C. Daltry and Gerard N. Martin working with the Centre for Herpetology, Madras Crocodile Bank Trust, rediscovered a potentially-threatened black narrow-mouthed *Melanobatrachus indicus* frog species in July 1996 from Vallakadavu Reserve Forest in Kerala. This was observed more than a century after Bedome’s original discovery. Indranil Das, Centre for Herpetology recorded more than ten species of frogs from India, which were never seen before and their identity is yet to be assigned. Strangely, we do not have much information on their ecology. Das, IUN/SSC South Asian Reptile and Amphibian Specialist Group, says it is time for *ex situ* conservation of amphibians. Identifying best practices in the long term would fulfill the dual need to breed threatened species in captivity for eventual reintroduction in the wild, and help zoos become self-sufficient. It is distressing that no zoo in our country has attempted to display them except at Coimbatore Zoological Park, during 1997–98. For this, assistance was provided by Gerald Durrell Memorial Fund, Jersey Wildlife Preservation Trust, UK. During a study, 4 species of Ranids were bred in captivity and later most metamorphosed frogs were released into the wild.

Why amphibians are declining

The threat of habitat destruction ultimately causes the shrinkage of amphibian populations. For example, out of 4 genera of anurans endemic to Western Ghats, *Nectophryne* and *Melanobatrachus* are the worst affected. The destruction, habitat fragmentation and modification of the habitat are probably the most serious causes of declining amphibian populations. By using IUCN Red List Criteria, a Conservation Assessment and Management Plan (CAMP) Workshop on Indian amphibians conducted in April 1997, identifies 10 species on the list of critically endangered (facing an extremely high risk of extinction in the wild).

Pollutants, too, may have altered amphibian populations world-wide. Evidence suggests that heavy use of pesticides, fungicides, herbicides and industrial chemical effluent may all act, impairing the reproduction and development of amphibians. Increase of stream water temperature in the rain forests is also being reported in the Nilgiris. S. Muralidharan, Ecotoxicology Division of Salim Ali Centre for Ornithology and Natural History (SACON), says that approximately 600 metric tonnes of pesticides in the form of granules and powder and 28,000 liters in the form of liquids are used every year in Nilgiri district alone. The pesticides include BHC, DDT, endosulfan. During rains, pesticides sprayed on crops eventually accumulate in temporary puddles by surface run-off. Since the frogs breed during the rain and release their eggs in the temporary puddles, the developing tadpoles face the ill-effects of the accumulated pesticides. Muralidharan also reported that rivers Bhavani and Cauvery are highly contaminated, and indicate high levels of heavy metal contamination. SACON’s R. Sivakumar, Environment Impact Assessment Division, reported about 1,00,000 metric tonne of stagnate in the Orathupalayam dam. Overall the results are indicative of very high pollution load.

In Periyakulam Wetland, Ukkadam, Coimbatore which holds a good population of the Indian frog, there are another 7 species of amphibians reported from the place which now houses municipal sewage from Selvapuram and Ukkadam. The industrial effluent is reported to be rich in inorganic pollutants such as salt and dyes.

Dangerous consequences of amphibian decline

A loss of amphibians will have a significant impact on the state of the environment as they are critical components of the many ecological communities and can directly benefit humans in some ecosystems. Adult amphibians are hunters of various animals including mosquitoes, flies, fish, birds and even small mammals. Also, amphibian larvae serve as food supply of aquatic insects, fish, mammals and birds. Destruction of frogs, toads, caecilians and salamanders thus has repercussions elsewhere in the food chain.
NEWS

From the perspective of humans, amphibians represent a storehouse of pharmaceutical discoveries as they carry valuable substances. Some of these compounds are already used as painkillers and in treatment of victims of traumas ranging from burns to heart attacks. Several amphibians have also been investigated for their antibacterial and antiviral properties. As amphibians disappear, potential cures for a number of maladies go with them. Save frogs and yourself as well!

ACKNOWLEDGEMENTS. I thank Gerald Durrell Memorial Fund of Jersey Wildlife Preservation Trust, United Kingdom for providing financial support and Coimbatore Zoological Park and Conservation Centre for academic cooperation.

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RESEARCH NEWS

Resolving single bubble sonoluminescence flash width

Vijay H. Arakeri

Single bubble sonoluminescence (SBSL), first studied and observed by Gaitan et al., is the phenomenon of light emission from a single gas bubble trapped at the pressure maximum of a resonant sound field in a liquid medium, generally water. One of the most striking aspects of SBSL was the estimated optical flash width being less than 50 picoseconds (ps); this upper estimate was based on the relation of a SBSL flash in comparison to a 34 ps laser pulse using a microchannel plate photomultiplier tube (MCP-PMT). Moran et al. put the estimate to be less than 12 ps using a streak camera; however, there have been some questions raised on the accuracy of these measurements. Most recently, two groups, Gompf et al. and Hiller et al. have resolved the optical flash width of SBSL using Time-Correlated Single Photon Counting (TC-SPC) technique which is well established in fluorescence decay time measurements. We first summarize the results from these two contributions, then briefly describe the technique and finally consider the implications of this important new development.

Previous studies have shown that the SBSL intensity is sensitively dependent on the type and concentration of the dissolved gas in the liquid, the acoustic drive pressure amplitude and the temperature of the liquid medium. Gompf et al. have found the measured SBSL flash width (characterized by full width at half-maximum, FWHM of the optical pulse) at room temperature to increase from about 60 ps at low gas (air) concentrations and low driving pressures to more than 250 ps at high gas concentrations and driving pressures near the upper threshold of SBSL. Hiller et al. find the flash widths to range from 35 ps for a bubble formed in a 20 torr solution of air in water at room temperature to 380 ps for a 300 torr solution of 1 per cent xenon in oxygen cooled to 4°C. They also found that for the same flash intensity, helium and xenon bubbles have the same flash widths, whereas it is smaller by a factor of about 3 for air bubble. Another very important finding which is common to both the groups is the fact that the measured flash widths are independent of the wavelength of light over a range of 200 to 800 nm. This type of information is only possible by the use of TC-SPC method to characterize SBSL flashes.

As pointed out by Gompf et al., to understand the principle behind the method, it is useful to consider a normal TC-SPC experiment as it is used to determine the fluorescence decay times. A short laser pulse, ideally much shorter than the decay time, excites the sample, and at the same time a fraction of this laser pulse acts as the start signal of a time-to-amplitude converter (TAC). The arrival of the first fluorescence photon is detected with a fast PMT which stops the TAC. Thus the time interval between the exciting laser pulse and the arrival of the first fluorescence photon is measured and stored in a multichannel analyser (MCA). Fluorescence is a random event and measuring the arrival time of the first emitted photon over a large number of events, typically 10⁶, and storing each time in the MCA then reconstructs the time-resolved decay. The main advantages of this method are (1) the good time resolution of about 10 ps, (2) the low intensity one needs for detection, (3) the high dynamic range and (4) the ability to discriminate different pulse shapes in different regions of a broadband optical spectrum. In contrast to fluorescence lifetime measurements, in the case of SBSL experiments, the TAC is started with a first photon from the SL pulse itself and it is stopped with the second photon from the same pulse. Since the start and stop pulses have the same statistical distribution, one then measures the autocorrelation of the pulse shape and the SBSL flash width can be obtained by deconvolution. The instrument width is determined with the help of a femtosecond laser pulse. Since TC-SPC is a sampling technique, an essential condition is that the pulse width be stable within measuring time. This to a large extent is satisfied in the case of SBSL; however, both Gompf et al. and Hiller et al. point out that the major source of error in their experiments are variations in bubble intensity, and a slow drift in the bubble contents if the experiments run over a long period. Both the groups have used electronic components with minimum jitter and MC-PMTs which have a small transit time spread; the claimed accuracy in the measured flash widths is of the order of ±10% for short pulses and ±5% for long pulses.