Taxonomic uncertainties and conservation assessment of the Western Ghats

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The Western Ghats are amongst the 18 biodiversity hot-spots recognized globally. These hills are known for their high levels of endemism expressed at both higher and lower taxonomic levels. Conservation assessment has heavily relied on the endemic biodiversity as an attribute. However, taxonomic uncertainties that prevail have frustrated biologists in exercises leading to conservation assessment in the Western Ghats. The paper briefly highlights this, paying special attention to the endemic biodiversity.

CONSERVATION assessment of any given geographical space is to 1) state in quantitative terms the uniqueness of that area and 2) to qualitatively distinguish it from other similar areas. Biogeographers and conservationists have assessed the conservation values of geographical areas based on various attributes. Of these, species richness and the levels of endemism expressed in them have been popular. Conventionally, higher conservation values have been attributed to geographical areas wherein biodiversity richness and endemism are expressed at higher taxonomic levels, thereby identifying biodiversity centres, hot-spots and reserves[1–3].

Endemism is considered to be an important attribute in conservation assessment. Endemism is in general expressed at various taxonomic levels; from localized populations, races and species to genera, families and orders. Endemism above the level of orders, i.e. in classes or phyla are more difficult to find except in the oceans. Thirteen animal phyla, for instance, are endemic to the oceans. At a lower taxonomic level, orders can be endemic to vast geographical areas like those of continents. Take for example ostriches in Africa. They belong to the order Struthioformes, which is endemic. Endemic families appear at even smaller geographical scales. The family Uropeltidae amongst snakes is endemic to Western Ghats and Sri Lanka. We then find endemic genera, species, subspecies/races and populations. Such forms of endemic biodiversity emerge at scales of subregions, provinces and landscapes.

Endemism as mentioned earlier can be measured at any taxonomic level. In conservation assessment exercises, the magnitude of endemism at any given level is expressed as an absolute number or fraction relative to the total biodiversity therein. Such expressions while useful, are very sensitive to the systematic and taxonomic correctness of the organisms under concern. Uncertain systematic position and taxonomy of organisms can play havoc in conservation assessment. In what follows, I wish to highlight certain difficulties in conservation assessment posed by taxonomic uncertainties limiting myself to the endemic biodiversity of the Western Ghats.

The Western Ghats are amongst the 18 globally recognized biodiversity 'hot-spots'. These hills of southwestern India have been attributed this status thanks to the high levels of endemic forms of biodiversity – of genera, species and races, as well as the severe threats to such biodiversity posed by humans. Of those that we have recognized and named, it is generally accepted that nearly 2000 species of higher plants, 84 species of fishes, 87 species of amphibians, 89 species of reptiles, 15 species of birds and 12 species of mammals are endemic to the Western Ghats[4–7]. The existing number of endemic species amongst lower animals (with the exception of butterflies), lower plants and microorganisms remains unknown even today.

Taxonomic uncertainties exist at various levels in the Western Ghats' biodiversity. As apparent from taxonomic literature and check-lists of species, nomenclatural and systematic changes are more frequent at higher taxonomic levels, especially generic, than at the level of species. For example, let us consider endemism in amphibians at the generic level. Four out of 19 genera of anurans found in the Western Ghats are endemic (21%). *Melanobatrachus, Nyctibatrachus, Nannobatrachus* and *Ranixalus*, amongst frogs, were considered endemic to the Western Ghats[8]. More recently *Ranixalus* has been merged with *Indirana*, a genus erected from *Rana* with all its 9 species endemic[9]. Current nomenclature changes at the generic level have merged *Nannobatrachus* with *Nyctibatrachus* and erected *Hoplobatrachus* out of *Rana* (S. K. Dutta, pers. commun). While the total number of genera of anurans in the Western Ghats has remained unchanged, the endemic genera are just 3 (16%), viz. *Melanobatrachus, Nyctibatrachus* and *Indirana*. The Indian Pond or Green frog, the much maligned amphibian, was known as *Rana hexadactyla* till about 1990 (ref. 8). In 1992, it became *Occidozyga hexadactyla*[9].

Currently, it is *Euphlyctis hexadactyla* (S. K. Dutta, pers. commun). These examples are just illustrative of taxonomic uncertainties at the levels above the species that we can highlight.

There are several other examples highlighting taxonomic uncertainties at the level of species as that in fish (*Danio aequipinnatus* vs *D. malabaricus*[10]), lizards (*Calotes rouxi* vs *C. ellioti*[11,12]), and *Psammophilus* species[12]. I am not a systematist and hence the least competent in reviewing nomenclatural changes and the associated uncertainties. My concern is about how these affect ecological and biogeographical analysis and interpretation of biodiversity and hence conservation assessment of the Western Ghats.

Lists of species have conventionally been the starting point in the conservation assessment. Such lists, except maybe in the case of birds, are quite full of taxonomic uncertainties. Such uncertainties are the results of 1) a genuine difficulty faced by systematists in correctly ascertaining the taxonomic status of an organism as that discussed above and 2) the difficulty in accessing adequate information against which confirmation is possible. Whereas the first type of uncertainty is typical of systematics, the second can be avoided.

The Western Ghats are currently the biogeographic province of focus in the context of biodiversity inventorying and management. Several new initiatives, the chief being that wherein local undergraduate college teachers have been deployed[13], are being currently taken to better understand the biodiversity – patterns of distribution, endemism and loss, in the Western Ghats. Such exercises aimed at developing inventories, analysing biodiversity patterns and assessing specific localities for their conservation value in the Western Ghats rely heavily on taxonomic and biogeographical literature. Unfortunately in India, such literature is scattered, often published in non-peer reviewed journals and inaccessible. As a result, frequently, mistaken identities lead to publications claiming species endemic to Western Ghats (e.g. *Rana keralensis*) as occurring in northeastern India[14] or the Andaman and Nicobar Islands[15] and those endemic to Sri Lanka, in the Western Ghats[16].

It is heartening to see that more and more efforts are being made to understand and monitor India's biodiversity. Efforts such as using students to do this extensive job[17] need tremendous encouragement and support from our scientific community. What is however lacking is a concerted effort to update and make available the correct taxonomic status of at least the fraction of India's biodiversity that has been so far identified, especially in biodiversity hot-spots.

In this 'information age' we should make every effort to have databases of local and provincial biodiversity, especially of globally important areas such as the Western Ghats, and render them electronically accessible through the internet. Such databases should provide information on current taxonomy of every known organism, the synonyms and sources, a directory of museums where specimens are available for reference, experts who could be consulted and the geographical range over which the organism is definitely known to occur. Conservation assessment of the Western Ghats will thus be made more effective than it has been hitherto.

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