of brown, red and yellow to almost all kinds of habitat like rocks, boulders, stones, hillsides, tree trunks, forest cover and various artificial substrates in and around Kumaon hills[6].

Liverworts and mosses, the pioneer invaders on barren hills, provide seed beds to other vegetation, retain moisture and add organic matter to make the environment congenial for forest establishment. They are of immense use in biomonitoring and phytoremediation studies. However, these plants have received minimum attention from Indian botanists.

Due to rapid urbanization and pressures inflicted by the inexorable growth of the human population, landslide, forest fire, mass harvesting by professionals and researchers and other anthropogenic activities, the gene pool inherent in the Himalayan belt is being lost at an alarming rate. Further, the insurgency on other Indian hill spots has resulted into many fold increase in mobile population, thereby intensifying the bryo-wealth depletion. Therefore, there is an urgent need to protect this unique cryptogamic mosaic of our fragile and developing Himalayan ecosystem. The indigenous population of high altitudes utilizes a wide range of biological resources in diverse ways[7].

In most of the Indian universities, bryophytes such as *Pellia*, *Marchantia*, *Porella*, *Frullania*, *Lejunia*, *Dumortiera*, *Notothylus*, *Targenia*, *Anthoceros*, *Cyathodium* and *Riccia* are dealt with at graduate and postgraduate level. These plants are required in large quantities for laboratory work. A few of them are rare while others are vulnerable. During collection, generally the scientific suppliers and students studying various biological courses harvest the bryo-vegetation completely without leaving a single plant for regeneration. Besides, unskilled people collect and destroy mosses in large amounts for orchards, nurseries and packaging material.

Bryological communities belong to comparatively small, fragile and disturbed ecosystems. Furthermore, the small size of individual plants increases their vulnerability due to inappropriate observation and collection techniques. It is incumbent upon bryologists to recognize the ecological importance, sensitivity and vulnerability of bryophytes to the changing environment and to promote a code of conduct for field trips.

To enrich bryo-wealth it is necessary:

(i) to prepare an inventory of common and rare bryophyte species and revise it annually;

(ii) to shortlist the bryophytes being used as study material at graduate and postgraduate level;

(iii) to promote a code of conduct for field trips of both commercial exploiters and researchers;

(iv) to develop moss garden at various locations;

(v) to prepare legislation to avoid mass harvesting;

(vi) to develop a proper framework to ensure the tightened compliance of legislations;

(vii) to restrict field work and collection in sensitive areas having endemic population;

(viii) students to be always accompanied by senior staff members.

(ix) to submit information periodically for publication on the *Red Data Book*.

(x) Three-dimensional natural and original pictures should be used as a software tool for study of bryophytes instead of live or preserved material.

These plants are fast vanishing from their habitats without being scientifically catalogued or studied. There is need for a fresh checklist by re-exploring various natural habitats. Central and State Government organizations, various funding agencies, and botany students at universities and colleges should contribute in this exploration of the botanical wealth of our country[8]. Uncontrolled scraping of bryophytic layer from Kumaon hills by commercial exploiters who indulge in this type of illegal business, tolerated by forest authorities, naturalists and environmentalists, is another cause of the vanishing Himalayan greenery. Today, there is a need to protect this lush green Himalayan bryo-wealth from such intrusions. Otherwise the liverwort and moss species may vanish, some of them even before being scientifically catalogued.

1. Madhyastha, M. N. and Rekha, P. D., *Curr. Sci.*, 2005, **88**, 1356–1357.
2. Maikhuri, R. K., Rao, K. S., Kandari, L. S., Joshi, R. and Dhyani, D., *Curr. Sci.*, 2005, **88**, 1480–1486.
3. Nautiyal, S., Maikhuri, R. K., Semwal, R. L. and Rao, K. S., In *Research for Mountain Development: Some Initiatives and Accomplishment*, Himalayan Publication, Gyanodaya Prakashan, Nainital, 1998, pp. 357–374.
4. Raeymaekers, G., *J. Hattori Bot. Lab.*, 1987, **63**, 219–230.
5. Banerjee, L. K., In Proceedings of National Workshop on Environmental Statistics, Goa, 1998.
6. Pant, G. B. and Tiwari, S. S., *Geophytology*, 1989, **19**, 167–172.
7. Farooquee, N. A. and Saxena, K. G., *Environ. Conserv.*, 1996, **23**, 75–80.
8. Kore, B. A., *Curr. Sci.*, 2004, **87**, 1642–1643.

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Is Gulf of Mannar heading for marine bioinvasion?

Sharma *et al.*[1] have comprehensively delineated the threat of 'invasive species' to biodiversity. To understand the impact of species invasion it is important to evaluate the consequences of species addition in an ecosystem. 'Over 40% of all imperiled US native plants and animals are at risk because of invasive species'. A report[2] claims that invasives cost the US alone, more than 140 billion dollars yearly. Even in India, a number of exotic species have acclimatized and have in turn affected the native species. Any species could become invasive if it is deliberately introduced to new areas in which it can outcompete the native species and disrupt the ecological balance.

The 'global invasive species database maintained by the world conservation union

(IUCN) lists two algal species, viz. *Caulerpa taxifolia* and *Undaria pinnatifida* among the list of 100 most invasive species'[2]. Of late, an exotic marine algal species is on the verge of becoming invasive in Southern India. *Kappaphycus alvarezii*, a fast-growing alga known to absorb high amount of nutrients from sea water is under rampant cultivation at the Gulf of Mannar biosphere reserve. This genus, reportedly indigenous to Indonesia and Philippines, was introduced to India in 1995 for cultivation purpose. The commercial significance of *Kappaphycus* lies in its role in production of an industrially lucrative polymer called Carrageenan.

The entrepreneural venture of seaweed cultivation undertaken by Pepsi Foods Limited (PFL) along with CSMCRI (Central Salt and Marine Chemicals Research Institute) spans over 100 hectares area for Carrageenan production, with an estimated annual yield of 100 tons (wet weight) per hectare. After the initial venture of PFL into the mariculture of *Kappaphycus*, the local organizations in Mandapam region are giving impetus to the fisherfolk to undertake cultivation of this commercially viable species. Though this proposition is undoubtedly a lucrative option for the farmers, it does raise some doubts about the status of other marine flora members.

Of late, some of the scientist divers, who have visited the area for collection of biological samples, have observed that *K. alvarezii* was found occupying quite a large subtidal area indicating that this species has started spreading in the region. As a precautionary measure, it is necessary to control this species, in order to prevent massive invasion, as in the case of a green alga *Caulerpa taxifolia*. Indigenous to the tropics, a sprig of this alga was dumped into the sea from Monaco's oceanographic museum and today it has spread over a substantial area of the Mediterranean Sea. This has resulted in the loss of local and endemic seaweed species of the region.

Reports are available[3] on 'the free-living populations of *Kappaphycus*' and its deleterious effects on the endemic corals in Hawaii. Though vegetative propagation is supposedly safe, it can be speculated that in case of environmental changes, propagation through spores may not be impossible. Hence, impact assessment survey comprising a detailed investigation is required to assess the growth and abundance of *K. alvarezii* and its rate of encroachment over the native flora.

1. Sharma, G. P., Singh, J. S. and Raghubanshi, A. S., *Curr. Sci.*, 2005, **88**, 726–734.
2. Susan McGrath, *Natl. Geogr. Mag.*, 2005, 93–117.
3. http://www.surialink.com/abc_eucheuma/1/3.htm

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Teira batfish, *Platax teira* (Forsskal, 1775) in Pudhumadam coastal waters, drifted due to the tsunami of 26 December 2004

The tsunami of 26 December 2004 has wrecked havoc along the coast of Tamil Nadu in the southeast part of India. Although the Gulf of Mannar and Palk Bay coasts of Tamil Nadu were saved by the barrier-like protection given by the island nation of Sri Lanka, the tsunami had flushed enormous quantities of water mass into the Gulf of Mannar that many of the islands have their shores eroded and a large number of coral colonies around the islands got either uprooted or broken[1]. The surging flood of the tsunami also caused substantial siltation on the corals closer to the island shores in the Gulf of Mannar.

The Gulf of Mannar has a chain of 21 islands stretching along a distance of 140 km from Rameswaram island in the north to Vaan island in the south (Figure 1). All the islands have rich coral grounds around them. They form either fringing-type reefs or they are in large patches forming coral gardens in shallow waters. All the islands are located 5 to 10 km away from the mainland coast of the Gulf of Mannar.

The tsunami that devastated the coast of Tamil Nadu had also brought with it new varieties of fishes, as reported by a number of fishermen. An underwater biofouling panel (UWBFP) system which was erected near Pudhumadam coast (N 09°16.246′ and E 078°59.847′) in the year 2002 was being monitored regularly at fortnightly intervals. After the tsunami, underwater observations made on 5 January 2005 showed the presence of a pair of adult teira batfish, *Platax teira*[2] (Figure 2) at a depth of 3 m, which had possibly drifted from the islands towards the coast due to the tsunami. Although this species is not common on the Indian side of the Gulf of Mannar, it is known to be present in the Sri Lankan waters. Therefore, it is possible that these fishes were drifted and carried by the tsunami. These drifted fishes might have taken shelter in the UWBFP system near the Pudhumadam coast of the mainland.

Morphometric measurements (Table 1) of the fish were based on underwater photographs in relation to those of the standard size panels (20 × 20 × 2.5 cm), when the fish were swimming close to them. The fishes belong to the family Ephipididae. They are hardy and peaceful animals. The dorsal fin is lengthier than the pelvic fin. Young ones prefer plant thickets for camouflage. The food preference[3] of this fish is algae, crustaceans, molluscs and other invertebrates. The underwater biofouling panels at Pudhumadam had large number of invertebrates such as crustaceans (crabs and shrimps), molluscs (oysters), worms[4] and algae[5]. Therefore, these fishes might have taken shelter in the UWBFP system because of the availability of food. These fishes normally prefer bright light but no direct sunlight and hence were found at 3 m depth.

The distinct morphological characteristics include yellowish silvery body with a black bar running across the eye. Another dark bar from the origin of dorsal