

(IUCN) lists two algal species, viz. *Caulerpa taxifolia* and *Undaria pinnatifida* among the list of 100 most invasive species². 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 entrepreneurial 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 available³ on 'the free-living populations of *Kappaphycus*' and its deleterious effects on the endemic corals in Ha-

waii. 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 broken¹. 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 bio-fouling 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 Ephipidiidae. They are hardy and peaceful animals. The dorsal fin is lengthier than the pelvic fin. Young ones prefer plant thickets for camouflage. The food preference³ of this fish is algae, crustaceans, molluscs and other invertebrates. The underwater bio-fouling panels at Pudhumadam had large number of invertebrates such as crustaceans (crabs and shrimps), molluscs (oysters), worms⁴ and algae⁵. 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

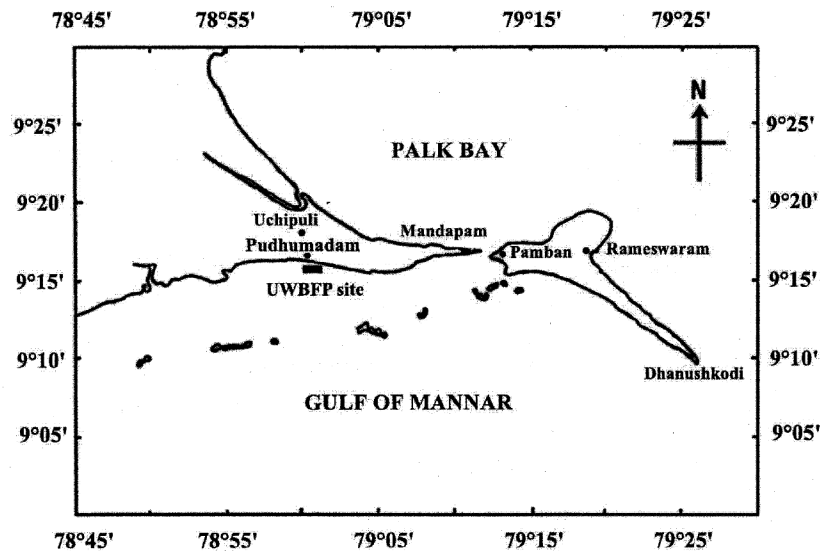


Figure 1. Study site at Pudhumadam coast.

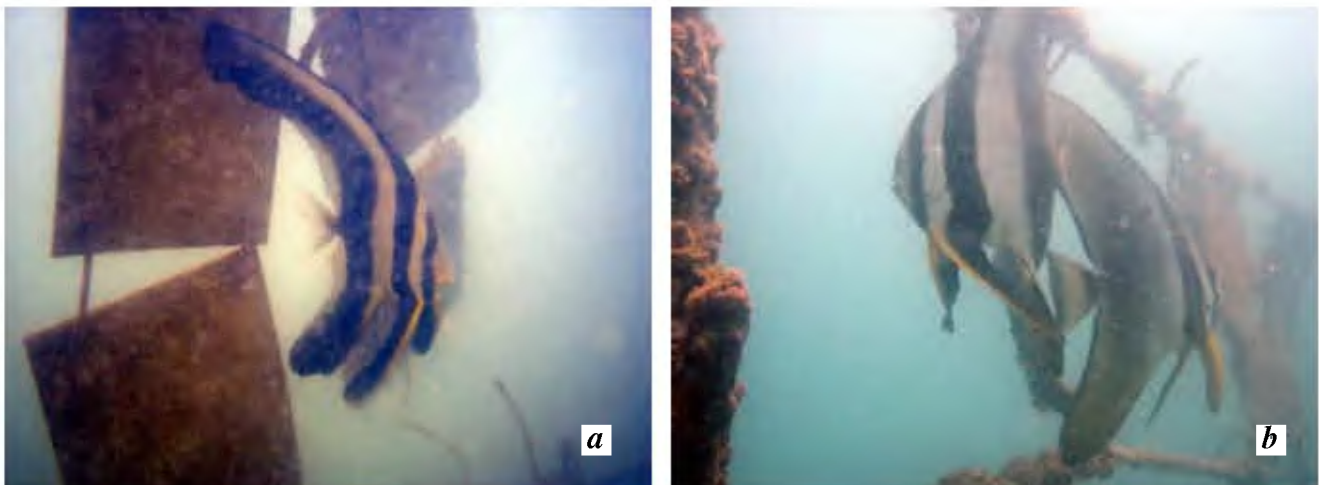


Figure 2 a, b. Teira batfish, *Platax teira*, swimming along the underwater biofouling panel system at Pudhumadam.

Table 1. Morphometric measurements of teira batfish, *Platax teira*, observed at Pudhumadam coastal waters

<i>In situ</i> observation	Measurement (cm)
Standard length	10.00
Total length	12.16
Dorsal fin	22.16
Pectoral fin (large)	12.61
Pelvic fin	16.94
Caudal fin (length)	02.03
Caudal fin (width)	04.59
Eye ball (diameter)	00.81
Fin span (dorsal to pelvic)	29.73
Body depth	08.10

fin runs down and across near the edge of the operculum to the base of the pec-

toral fin near the belly, where it encloses a black blotch. A third black vertical black bar from the posterior of the dorsal fin runs across the body near the caudal peduncle all the way to the posterior of the pelvic fin. Median fins are dusky yellow with black margins posteriorly². Pelvic fin is blackish. The standard length of the fish is approximately 1.2 times that of its body depth. The fish can attain a maximum standard length of³ 50 cm.

The tsunami of 26 December 2004 travelled a distance of over 1800 km from Sumatra island in just 2 h and struck the Tamil Nadu coast in India. Reports of local fishermen finding new varieties of fishes in Tamil Nadu coast might have been due to the tsunami carrying distant

fish populations. Normally, natural sea water currents are known to carry various marine organisms including fish to different places in the vast stretches of the oceans. Therefore, distribution of the same species of fish at different geographical locations is possible. Unlike the currents, the tsunami, because of their speed and quantity of water mass, can carry populations of fishes from long distances to different geographical locations of the oceans in a short time. The appearance of the teira batfishes in the present study along Pudhumadam coast is therefore the definite result of tsunami flow of December 2004. These fishes are normally found in coral reef environments and seaweed-rich marine ecosystems. Their

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dislocation to a place like Pudhumadam coast may not be conducive for survival. On the other hand, fishes which get drifted to rich habitats will have the benefit of survival and establishment of new populations. Thus, it can be discerned that although fish populations may get dislocated periodically because of such unusual tsunami, they may also get redistributed in the vast stretches of the oceans. Unless they are dislocated to incompatible places, this in turn may help populations of different species of fishes to establish in different geographical locations of the oceans and thus expand

their geographic distribution and survival.

1. Kumaraguru, A. K., Jayakumar, K., Wilson, J. J. and Ramakritinan, C. M., *Curr. Sci.*, 2005 (communicated).
2. Fishbase, 2005, <http://www.fishbase.org/Summary/SpeciesSummary.cfm?ID=5739&genus name=Platax&speciesname=teira>.
3. Burgess, W. E., Axelrod, H. R. and Hunziker, R., Dr. Burgess's Mini Atlas of Marine Aquarium Fishes, Mini Edition. TFH Publications, Inc. USA, 1997, p. 1023.
4. Kumaraguru, A. K., Report, Department of Ocean Development, Government of India, 2005.

5. Marimuthu, N., Wilson, J. J., Muthuraman, B., Magesh, S. and Kumaraguru, A. K., *Seaweed Res. Uthn.*, 2004, **26**, 41–46.

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Structure and tectonics of Kutch basin and earthquakes

Several shortcomings ensuing from faulty interpretations significantly damaged the efficacy of a study of geology *vis-à-vis* seismicity in a recent paper by S. K. Biswas¹ on 'A review of structure and tectonics of the Kutch basin, western India, with special reference to earthquakes'. Beginning from the title itself, the author created an impression that the entire sedimentary ensemble in the Kachchh region represents a single-basin evolutionary history. Instead of taking note that barring the Jurassic ensemble, none of the other deposits are linked with any rifting process, he envisaged a basin evolutionary model (illustrated in figure 4), which is a gross misrepresentation of geology of the area.

A major slip-up in the paper is the assumption that the 'Kachchh rift' evolved within the Mid-Proterozoic Aravalli–Delhi fold belt that swings to E–W in the Kachchh region. This is fallacious, as no swing in the NE–SW Delhi trend is observed all along its length. There is also no outcrop of the Delhi–Aravalli rocks from the southernmost tip of the Aravalli Mountains, to provide information about any swing. Further, no westward swing is also implied in Krishnan's writings², which might have enthused the author's thoughts. It seems that the author is unaware of the suggestions³ that the Kachchh faults are new features formed during the Reunion Plume outburst.

Talking about the basin architecture (without discriminating between basins formed during different geological events), the author mentions about the southward-

tilting asymmetric rift basin. The ascribed geometry matches with the present-day architecture of the rocks caused by the Quaternary neotectonic deformation⁴, and contradicts the author's own suggestion of westerly palaeoslope. An intriguing feature in the paper is the description of a median high (MH). Apart from the diverse nomenclature used ('median' in figures and 'meridional' in the text), the author never tried to precisely state what it truly is! Instead, he goes on making utterly confusing and mutually contradictory statements.

The author wrongly asserts that the positive Bouguer anomalies along the lineaments indicate that these are basement highs. First, it is not true that the positive anomalies form any linear pattern but instead have highly irregular and patchy occurrences³. Secondly, the basement highs (made of sialic rocks) are unlikely to produce gravity highs of the types mapped in the region.

The author's interpretations on rifting and faulting are marred by clumsy presentation. He has used abbreviations for faults and uplifts in figure 2, without mentioning them in the 'index' or 'figure caption'. In figure 3, one single fault is named NRFL on the top and KMF below. The statement that the basin contains footwall uplifts is contradicted by what is shown in figure 3, where the uplift is on the hangwall side. Further, identification of foot/hangwall is difficult because the fault NRFL/KMF in the uppermost part (in figure 3) is almost vertical. Similarly, his descriptions of fault

movements are quite confusing. He mentions about E–W striking primary master faults having characteristics of strike-slip faults. He then talks of 'uplifts', 'upthrows', and 'horsting' and 'down tilting' along the same set of faults. To deepen the confusion further, the author continues with descriptions like 'strike-slip movement resulting inversion' and 'development of flower structures'. All these, according to him, are the result of 'convergent wrench movements' caused by 'transpressional tectonics'. Going through such a description is truly a bewildering experience.

1. Biswas, S. K., *Curr. Sci.*, 2005, **88**, 1592–1600.
2. Krishnan, M. S., *Geology of India: Burma*, Higginbothams, Madras, 1960, p. 536.
3. Roy, A. B., *Gondwana Res.*, 2003, **6**, 487–500.
4. Merh, S. S. and Chamyal, L. S., *Proc. Indian Natl. Sci. Acad.*, 1997, **63**, 1–98.

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Response:

I am surprised to note A. B. Roy's comments on my paper, which are only derogatory remarks without logic and supporting