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BIODIVERSITY OF ECHINODERMS IN GULF OF MANNAR AND ITS CONSERVATION MEASURES

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Introduction

The Phylum Echinodermata, an exclusive marine phylum, comprising approximately 7,000 living species, and 13,000 fossil species, found from the intertidal area to the deep sea bed. This distinctive group of animals may be briefly defined as possessing a skeleton of calcium carbonate in the form of calcite inside their body and a unique water vascular system which helps in feeding, locomotion, and other functions; and a bilateral symmetry in the larval stage and more or less conspicuous pentiradial symmetry in adult form. Echinoderms have no head or brain, but they do have a central nerve ring that surrounds the mouth.

1. Echinoderm Diversity

Five extant classes of echinoderms are universally recognized: Asteroidea, Ophiuroidea, Echinoidea, Holothuroidea, and Crinoidea.

1.1 Class Asteroidea (sea stars, starfish)

The world ocean is known to have 2100 species of sea stars. Sea stars are one of the most familiar echinoderm species and an important predator species in the marine ecosystem. They are in size range as small as few centrimetres to a meter in diameter. Most of the sea stars are with five arms but some are having arms as many as 50. Crown of thorn is an important starfish which is known to cause considerable damage in the coverage of living coral reef world over.

The mouth of the sea star is located at the bottom, while feeding, the mouth is everted outside on the food and secreting the digestive enzymes on the food and this digested food is taken inside, while retracting the stomach. The sexes in sea stars are separate and the fertilization takes place outside in water. Some sea stars known to brood the eggs until it hatches.

1.2 Class Ophiuroidea (brittle stars, serpent stars, basket stars)

There are about 2000 extant species of opiuroids around the world oceans. As their name implies, brittle stars are extremely fragile. This class is one of the species numerous class among all echinoderm classes. Brittle stars are nocturnal animals feeding on suspended organic matter and microzooplankton using their tubefeet. In brittle stars also, the sexes are separate. The external fertilization depends on the mercy of the nature.

1.3 Class Echinoidea (sea urchins, sand dollars, heart urchins)

There are nearly about 800 species are found in the seas and oceans of the world. The echinoids are commercially important organisms. World over considerable aquaculture operation

of sea urchin is taking place in order to harness the gonad, which is a delicacy in countries like Japan and France. Echinoid lacks disctinct arm like structure but the body is covered by the calcium carbonate test, which is armoused with spines. The tubefeet and spines on the globular test help in the the movement of echinoids. Echinoids feed on the bottom organic material and plant material using their teeth "Aristotle lantern" located on the oral side of the test. The five anal pores situated on the aboral surface of the test. A sand dollar is a flat pan cake like organism covered by soft thin hair around its test. In sand dollar, the tube feet is projected through the porous petal like structure and these tube feet help in respiration

1.4 Class Holothuroidea (sea cucumbers, beche de mer)

There are approximately 1500 species of shallow water holothouroids found in the tropical shallow seas around the globe. They are soft with leathery outer skin, lie on the sea bottom on their sides. The mouth is surrounded up to 30 tentacles on the one end and the anus is situated on the opposite end. The tentacles around mouth secret mucus to capture planktonic organisms which are wiped off often by them. When sea cucumbers are disturbed, they evert their intestine through their anus but they are regenerated within a few weeks. In most sea cucumbers the sexes are separate but some are hermaphrodites. Sea cucumbers are commercially important organisms. Sea cucumbers are one of the important ecosystem functionaries and maintain the health of the reef ecosystem. The product of sea cucumber is called Beche-de-mer, which is a delicacy in south East Asian countries. In India, nearly 200 species of sea cucumbers are found in the coral reef colonies, of which 22 species are found in the Gulf of Mannar and Palk Bay regions. However, in India there is a ban on the collection and processing of this organism under the 1972 wild life protection act.

1.5 Class Crinoidea (sea lilies, feather stars)

Among the 650 species of living crinoids, 100 are stalked crinoid and 550 are feather stars. This group of organisms are very different from other echinoderm by having their mouth and anus on their upper surface in an open disc. Crinoids are filter feeders, using their arms which range from 5 to 200 in some cases.

Table.1
Comparison of echinoderm faunistic diversity from Gulf of Mannar and Palk Bay

Sl. No.	Class	No. of species in Gulf of Mannar (James, 1988 and Venkarataraman et.al. 2013)	Total echinoderm species diversity in India (Sastry, 2007)
1	Crinoidea	9	65
2	Asterioidea	29	158
3	Ophiuroidea	25	152
4	Echinoidea	24	113
5	Holothuroidea	22	163

2. Echinoderm exploitation and conservation issues

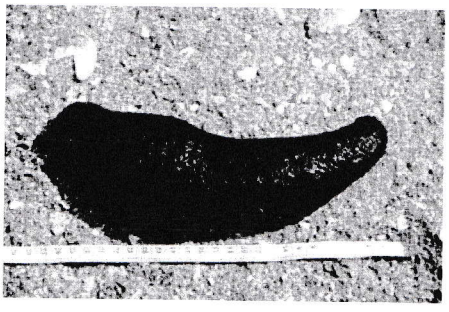
Echinoderms are gaining popularity among aquarists and account for about 17% of the global trade. Growing global pressures on the collection of echinoderms for various commercial enterprises have put these enigmatic invertebrates under threat, adding to the ongoing concern over the continued worldwide depletion of marine resources and, particularly, the ecological cascading effects of overfishing on the structure and functioning of entire ecosystems (Botsford et al. 1997. Of the five extant classes of echinoderms, only sea urchins and sea cucumbers are heavily exploited (Kelly, 2005). Sea urchins and sea cucumbers are under high commercial fishing pressure, and various aspects of their biology are likely to compound the impact of overexploitation of wild populations. Some species of sea urchin and sea cucumber are extremely long-lived, which tends to be an indicator of uncertainty in reproductive success (Ebert & Southon, 2003). In addition to overfishing, the emerging global trade in the collection of echinoderms for home aquaria, souvenirs and biomedical products is at a critical stage and certain species of echinoderms are now listed as threatened species. Fishery for *Asterias rubens* in Denmark (Sloan 1985). The Chinese have imported sea cucumbers for over 1000 yr from India, Indonesia and the Philippines but traders began gathering them from a wider area in the eighteenth and nineteenth centuries (Conand & Byrne, 1993).

3. Current conservation measures- Global outlook

On global scale, current controls of the management of echinoderm fisheries include closed seasons during times of spawning; gear restrictions; designation of no-take, marine-protected areas; daily catch limits; minimum legal size; prohibition of night fishing for nocturnal species; and restrictions on the use of SCUBA for harvesting (Toral-Granda, 2006). Rotational fishing has also been suggested as an appropriate harvest strategy for fisheries that occur on sessile and sedentary species, primarily because it allows higher spawning stock abundance than does an annual harvest strategy (Humble, 2005). One way to reduce the commercial exploitation of wild echinoderm stocks is to develop laboratory culture methods to produce individuals for commercial ends and this is being done to supply the food market (Kelly *et al.*, 1998).

3.1. Conservation measures practised in India

In India, nearly 200 species of sea cucumbers are found in the coral reef colonies, of which 22 species are found in the Gulf of Mannar and Palk Bay regions. Out of the 22 species, *Holothuria scabra* (sandfish), *Holothuria spinifera, Holothuria atra* and *Actinopyga echinites* were exploited and were exported in large number to Singapore from where they were distributed to Taiwan, China and Japan, where they are utilized for the preparation of soups, which are considered delicacies. The indiscriminate exploitation for this lucrative trade have resulted in overexploitation leading to endangering of the species in the wild. A lot of conservation



issues cropped up and a ban was imposed in 1982 by the Union Ministry of Environment and Forests on fishing sea cucumbers smaller than 75 mm in length. Subsequently, in 2002, a blanket ban on collection and trade on sea cucumber was imposed by listing this organism in Schedule I category of the Wildlife Protection Act of 1972. Schedule I contain the list of most endangered species and gives them highest level of protection. In spite of this ban, sporadic incidence of clandestine trade on sea cucumber and a number of incidences of confiscation of sea cucumber along Gulf of Mannar is reported by the Forest Department Wildlife Crime Control Bureau (WCCB). However, the livelihood issues of fishermen involved in sea cucumber fishing, incidental catches of sea cucumber in fishing gears and the problems emerging due to confiscation of illegal catch of sea cucumbers continue to be major issues in Gulf of Mannar and Palk Bay region.

3.2 Stakeholders' perspective

CMFRI has conducted several stakeholders meeting on the management measures of sea cucumbers in Gulf of Mannar and Palk Bay and the management measures emerged from the participants is outlined here;

3.2.1 Stock assessment

Stock assessment of existing biomass (Juveniles Adult) of different species of sea cucumbers has to be undertaken to assess the current status of the population consequent to the implementation of ban from 2001. Subsequently stock assessment of sea cucumber population can be conducted once in every five years. This study is also aimed to ascertain the breeding/spawning population of sea cucumber which should be above 20 per cent of the total population for maintaining healthy recruitment. The data thus generated can be utilized while reviewing management strategies.

3.2.2. Seasonal restriction/Closed season

The option for closure of sea cucumber fishing during peak spawning period of the year to enable successful breeding and recruitment can be considered for the commercially important species, if a decision to lift the blanket ban is made in future.

3.2.3. Research on standardization of commercial level seed production techniques of selected species of sea cucumbers and farming trials

It was recommended that the Central Marine Fisheries Research Institute can take up the standardization of seed production of selected species of sea cucumbers. Farming trials can also be undertaken to find out the feasibility of sea cucumber production through aquaculture.

3.2.4. Research on stock enhancement through sea ranching

It was recommended to enhance the wild population of sea cucumbers through land based hatchery production of juveniles and sea ranching the same at selected areas. It was suggested to obtain the required permission to collect the broodstocks of commercially important species for the purpose from the forest department. A monitoring programme to assess the impact of sea ranching has to be undertaken by the concerned research institution.

3.2.5 Lifting of ban for the collection of selected species of commercially important sea cucumbers

The fisherfolk participants unilaterally demanded the lifting of ban for the collection of three species of sea cucumbers *Holothuria scabra, H. spinifera, Actinopyga echinites*. Fisherfolk explained the deterioration of their livelihood because of the ban.

3.2.6. Database management

A detailed scientific investigation on the distribution, availability, abundance and biological parameters of sea cucumbers from Gulf of Mannar region should be undertaken in order to generate database for developing a management roadmap.

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