Echinoderm diversity and its conservation

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The Phylum Echinodermata, an exclusive marine phylum comprising approximately 7,000 living species and 13,000 fossil species, is found from the intertidal area to the deep sea bed. This unique group of animals has a skeleton made of calcium carbonate in the form of calcite inside their bodies and a unique watervascular system that helps them eat, move around, and do other things. As larvae, they have bilateral symmetry, and as adults, they have more or less noticeable pentiradial symmetry. Echinoderms have no head or brain, but they do have a central nerve ring that surrounds the mouth.

Echinoderm Diversity

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

Class Asteroidea (sea stars, starfish)

The world's oceans are 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 a size range as small as a few centimetres to a metre in diameter. Most of the seastars have five arms, but some have as many as 50. The crown of thorns is an important starfish that is known to cause considerable damage to living coral reefs the world over.

The mouth of the seastar is located at the bottom, and while feeding, the mouth is everted outside on the food, secreting the digestive enzymes on the food, and this digested food is taken inside while retracting the stomach. The sexes in seastars are separate, and fertilisation takes place outside in the water. Some seastars are known to brood the eggs until they hatch.

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

There are about 2000 extant species of ophiuroids in the world's oceans. As their name implies, brittle stars are extremely fragile. This class is one of the most numerous species of echinoderms among all. Brittle stars are nocturnal animals that feed on suspended organic matter and microzooplankton using their tubefeet. In brittle stars, the sexes are also separate, and external fertilisation depends on the mercy of nature.

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

There are nearly 800 species found in the seas and oceans of the world. The echinoids are commercially important organisms. A considerable aquaculture operation of sea urchins is taking place in order to harness the gonad, which is a delicacy in countries like Japan and France. The echinoid lacks a distinct arm-like structure, but the body is covered by the calcium carbonate test, which is armoured with spines. The tubefeet and spines on the globular test help in the movement of the echinoids. Echinoid feed on the bottom organic material and plant material using their teeth, the "Aristotle lantern," located on the oral side of the test. The five anal pores are situated on the aboral surface of the test. A sand dollar is a flat, cake-like organism with soft, thin hair around its test. In sand dollars, the tube feet are projected through the porous petal-like structure, and these tube feet help in respiration.

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 and lie on the sea bottom on their sides. The mouth is surrounded by up to 30 tentacles on one end, and the anus is situated on the opposite end. The tentacles around them secrete mucus to capture planktonic organisms, which are often wiped off by them. When sea cucumbers are disturbed, they evert their intestine through their anus, but they are regenerated within a few weeks.In most seacucumbers,s 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. However, in India there is

a ban on the collection and processing of these organism under the 1972 wild life protection act.

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 is very different from other echinoderms 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.

Sl.No.	Class	No. of species in Gulf of Mannar (James, 1988)	Total echinoderm diversity in India(Sastry, 2007)
1	Crinoidea	9	65
2	Asterioidea	26	158
3	Ophiuroidea	19	152
4	Echinoidea	19	113
5	Holothuroidea	22	163

Table.1 Comparison of echinoderm faunistic diversity from the Gulf of Mannar

Echinoderm exploitation and conservation issues

Echinoderms are gaining popularity with aquarists and account for about 17% of the global trade. More and more people around the world are collecting echinoderms for commercial purposes, which puts these strange invertebrates in danger. This adds to the worry about the continued loss of marine resources around the world, especially the effects of overfishing on the structure and function of whole 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 years from India, Indonesia, and the Philippines, but traders began gathering them from a wider area in the eighteenth and nineteenth centuries (Conand& Byrne 1993).

Current conservation measures

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 purposes, and this is being done to supply the food market (Kelly et al. 1998).

Conservation measures practiced in India

In India, nearly 200 species of sea cucumbers are found in coral reef colonies, of which 22 are found in the Gulf of Mannar and Palk Bay regions. Out of the 22 species, *Holothuriascabra* (sandfish), *Holothuriaspinifera*, *Holothuriaatra*, and *Actinopygaechinites* were exploited and exported in large numbers to Singapore, where they were distributed to Taiwan, China, and Japan, where they are utilised for the preparation of soups, which are considered delicacies. The indiscriminate exploitation for this lucrative trade would have resulted in overexploitation, leading to the endangering of the species in the

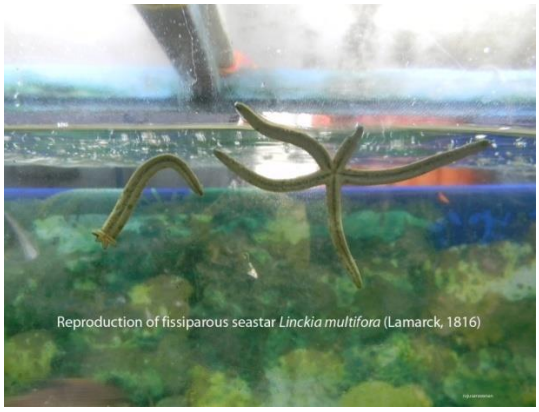
wild. The Union Ministry of Environment and Forests imposed a fishing ban on sea cucumbers smaller than 75 mm in length in 1982 as a result of numerous conservation-related issues. Subsequently, in 2002, a blanket ban on collection and trade of sea cucumber was imposed by listing this organism in the Schedule I category of the Wildlife Protection Act of 1972. Schedule I contains the list of the most endangered species and gives them the highest level of protection. The Forest Department/Wildlife Crime Control Bureau (WCCB) reports sporadic instances of illegal sea cucumber trade and a number of instances of sea cucumber confiscation along the Gulf of Mannar in spite of this ban. However, the livelihood issues of fishermen involved in sea cucumber fishing, incidental catches of sea cucumber in fishing gear, and the problems emerging due to the confiscation of illegal sea cucumbers continue to be major issues in the Gulf of Mannar region.

Sea star *Astropecten indicus from the trawler Discardsfrom Mangalore coast*

Sea star *Protoreasterlinckii* from Gulf of Mannar

Sea star *Pentacerasteraffinis*from Gulf of Mannar

Sea star *Pentacerastercumingi*from Gulf of Mannar



sea star *Linckiamultifora* (Lamarck, 1816)

from Gulf of Mannar

Pin cushion star*Culcitaschmideliana* (Retzius, 1805)
from Gulf of Mannar

Test of sea urchin *Echinolampas ovata*

from Gulf of Mannar

Test of sea urchin *Lovenia elongata*

from Gulf of Mannar

Test of sea urchin *Temnoplureus toreumaticus*

from Mangalore coast

Test of irregular seaurchin(Sand dollar)*Clypeasterrarispinus*from Mangalore coast

Sea urchin *Stomopneustes variolaris*

from St. Mary's Island off Malpe,

South Canara coast

Test of irregular sea urchin

*Echinodiscusauritus*from Gulf of Mannar

Sea cucumber*Holothuria leucospilota*

from St. Mary's Island off Malpe, South Canara coast

Sea cucumber *Holothuriascabra* from the Palk Bay-Dhanushkodi waters.

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