Sea Cucumbers

Sea cucumbers

- Sea cucumbers are echinoderms from the class Holothuroidea
- Sea cucumbers belongs to the genera Holothuria, Thelenota, Stichopus, Actinopygya, and Bohadschia)
- These are marine animals with a leathery skin and an elongated body containing a single, branched gonad.
- Usually sea cucumbers are found on the sea floor worldwide
- Most of the holothurian species have a wide range of distribution in the IndoPacific region

- Holothurians are found in all the oceans, at all latitudes and from the shore down to abyssal plains.
- Among the coastal commercial holothurians, the Aspidochirotid holothurians are predominant in the tropics while the Dendrochirotid are more common in temperate regions
- Most of the commercially important holothurians are found in the intertidal region to a depth of 20 meters.
- About 650 species of sea-cucumbers are known from various parts of the world of which 66 species of sea cucumbers are commonly exploited with the highest number (47) from Philippines.

World status of sea cucumbers

- Sea cucumbers are a traditional delicacy prized by Chinese and other Asian consumers for their dietary and curative properties.
- At least 70 countries are engaged in sea cucumber fishing and trade
- In the international seafood trade, the processed bodywall, known as beche-de-mer or trepang, has been a globally important trade commodity since the 16th century.
- Since the 1950s, in response to strong market demand and increasing prices, sea cucumber fisheries have undergone a rapid global expansion.

- The FAO database (FishstatJ version 2.12.2) lists the three major Chinese import markets for sea cucumbers (mainland China, Hong Kong, and Taiwan) as accountingfor 82.3% of global import quantity and 90.8% of globalimport value, including dried, salted or in brine, frozen, live, fresh or chilled, prepared or preserved sea cucumber.
- This value totaled 11,199 tons in quantity and US$ 433,457 million in value in 2011.
- Hong Kong was the leading importer of sea cucumber, accounting for 51.8% of total imports in quantity and 85.4% in value worldwide, but a major proportion of the sea cucumber imported into Hong Kong in all forms was re-exported to other parts of China and other countries
- However, China consumes much more sea cucumber than the import quantity suggests because of its,massive domestic production, including more than 200,969 fresh tons of sea cucumbers in 2014

Significance of sea cucumbers

Nutritional importance

- From nutritional point of view, the sea cucumber is an ideal tonic, higher in protein and lower in fat content and has impressive profile of high-value nutrients such as Vitamin A, Vitamin B1 (thiamine), Vitamin B2 (riboflavin), Vitamin B3 (niacin), essential amino acids, trace metals and minerals, especially calcium, magnesium, iron and zinc
- The protein content in sea cucumber is comparable to that of a hen’s egg and the very low fat content makes it ideal for people with high blood pressure.

Medicinal importance

- The sea cucumbers have long been recognized in the folk medicine system of Asian countries
- In traditional Chinese medicines, the sea cucumber is used for treating body weakness, impotency, debility of the aged, constipation due to intestinal dryness and frequent urination
- Recent research has indicated the presence of several bioactive compounds with anti-angiogenic, anticancer, anticoagulant, anti-hypertension, anti-inflammatory, antimicrobial, antioxidant, antithrombotic, antitumor, and wound healing properties

- Sea cucumbers also contain copious amounts of mucopolysaccharides, like chondroitin sulfate, which is known for reducing the arthritis pain and inhibit viruses such as herpes and is well known for HIV therapy
- Recently an increasing number of commercial products like juice, balm, liniment oil, cream, toothpaste, gel face wash, body lotion, and soap made from sea cucumber or its extracts are available in the market

Ecological importance

- They are often called the earthworms of the sea, and are responsible for extensive shifting and mixing of substrate and recycling of detrital matter into animal tissue and nitrogenous waste, which can be taken up by algae and sea grass
- Sea cucumbers contribute calcium carbonate to the coral reef's "chemical budget" and act like a natural antacid to neutralize other acidic environmental sources and also help in the recycling of suspended matter
- Sea cucumbers help to break down organic materials and redistribute the nutrients to the water column thus preventing hypoxia and other toxic substances going down in the sediment.

- When they ingest sand, the natural digestive processes in sea cucumber’s gut increase the pH of water on the reef where they defecate, countering the negative effects of ocean acidification.
- The ammonia waste produced when sea cucumbers digest sand also serves to fertilise the surrounding area, providing nutrients for coral growth and enhance productivity and turnover of benthic diatom communities

Sea cucumbers in India

- In India, the holothurians are mostly distributed in Andaman and Nicobar Islands, Lakshadweep Islands, Gulf of Mannar, Palk Bay and Gulf of Katchchh and in Malvan (Maharashtra), Ennore (Tamil Nadu), Kakinada Bay (Andhra Pradesh) and also along several parts of the mainland coast of India.
- However, the fishery and the ‘beche-de-mer ’ production existed in the Gulf of Mannar and Palk Bay.
- The fishery was around a millennium years old and was introduced by the Chinese, which provided livelihood to thousands of poor fisher folks in this region
- The sea cucumber fishery was artisanal in nature and consisted offishermen, who were divers, the processors who act as middlemen and the exporters.

Natural resources

- The habitats of the holothurians are diverse and vary from coral reefs, sea grass meadows, rocky, sandy, muddy shores, salt marshes and mangrove beds.
- Most of the adult stages are benthic, and a few larval stages are pelagic. In general, their distribution is patchy and several species are known to display specific habitat preferences.
- Generally they live on hard substrates, rocks, coral reefs, soft bottoms, on the sediment surface or buried in the sediment, or as epizoites on plants or invertebrates

Seagrass meadows

- Seagrass beds are important habitats for *H. scabra* and several other species since the larvae and juveniles of sea cucumbers rely heavily on seagrasses for settling cues and early life stages

Coral reefs

- Species of the genus Actinopyga are essentially coral dwelling forms. They live in the intertidal region on the coral reef
- *A. mauritiana* is a surf loving species being found very near the low water mark.
- *H. pyxis* occurs on the reef flats in Andaman Islands and is found always to live under the stones.

- The dorsal body wall of *A. echinites* is wrinkled with sand settling in the depressions and it is often found attached at the base of big rocks by curving its body
- *Bohadschia spp*. also live on the coral flats
- *B. vitiensis* lives on the reef flats and lies exposed during low tide with a thin coating of fine mud on the body

Mudflats

- Mudflats are by far the best habitats suitable for sea cucumbers as they are detritus feeders and feed on the organic matter present in the mud
- *H. scabra* is characteristic of muddy flats

- During low tide, a number of them can be seen in half-buried condition with their posterior end of the body always kept outside.
- Small forms (50 to 90 mm in length) are also seen to be lying freely on the muddy grounds during low tides.
- At some places 2 to10 specimens are distributed in an area of 5 sq.m.
- The species living in muddy flats are also found on sandy habitat.
- **Lagoons**
- The lagoons in the Lakshadweep waters are calm with very little disturbance and offer excellent habitats for the holothurians.

- *H. nobilis* , the most priced holothurian for ‘ beche-de-mer ’ is characteristic of the lagoons.
- There are two colour forms of this species; the white variety is usually found in deeper waters between 3 to 20 m.
- It is most abundant on clean sand in reef passages and near turtle-grass. The black variety is typically found in shallow waters at about 3m depth on clean sand bottoms where there is living coral and free movement of water.
- *Bohadschia argus* and *Stichopus chloronotus* are other common species found in the lagoons of Lakshadweep

Recent advances in breeding

- The Chinese and Japanese are pioneers in the aquaculture of the sea cucumber, *Apostichopus japonicus*
- Apart from these two countries some work has been completed on the production of sea cucumbers by the Koreans and the Russians
- James et al. (1988) produced juveniles of H. scabra for the first time in 1988 at Tuticorin in India
- Since 1988 this species has been bred in captivity on a number of occasions
- Following this same technology, juveniles of this species have been produced in Australia, Indonesia, New Caledonia, Maldives, Solomon Islands and Viet Nam in recent years

Conservation of sea cucumbers in India

- India exported 50 tonnes of processed sea cucumber in 1989, valued at US$ 0.2 million
- At present, the Government of India has completely banned collection, processing and export of all species of sea cucumbers from India as a conservation measure
- As a conservation measure, the Ministry of Environment and Forestry has listed the sea cucumber under wildlife protection Act 1972, which has caused severe impact on the fisher folks who depended on these resources.

Processing of sea cucumbers

- They are exploited for their dried end product or raw body wall or viscera, but mostly for the processed product called ‘beche-de-mer’, in French, ‘iriko’ in Japanese, ‘haisom’ in Chinese and ‘trepang’ in Indonesian.
- The Chinese are the traditional consumers and the Japanese, Koreans, Melanesians, Micronesians, Polynesians and Africans also consume beche-de-mer in significant ways and quantities
- The sea-cucumbers can be divided into three groups based on their commercial value viz. high value, medium value and low value.

- Holothuria scabra, H. nobilis and Thelenota ananas have high value, species such as Holothuria spinifera, Actinopyga echinites, A. miliaris, Bohadschia marmorata, B. argus, Stichopus variegatus and S. chloronotus have medium value and Holothuria atra andActinopyga mauritiana have low value.

Beche-de-mer processing

❑ Cleaning of the raw material

- After the sea-cucumbers are brought to the curing site, cleaning them before boiling is essential in clean sea water to remove dried slime, sand and other extraneous particles and left over gut and other entrils.
- While cleaning, it is desirable to squeeze the animals to remove the water obsorbed during storage

❑ Degutting

- A slit is made near the posterior end with a sharp knife
- They keep the animals flat on the sand with the upper side up and pierce the knife into the body and tear the posterior portion
- Immediately the intestine, gonads and the respiratory trees run out of the slit
- The cut should be neat so that the end product does not look ugly

❑ Boiling

- Boiling is an important step in processing the sea-cucumbers
- A saucershaped pan made out of cast iron is most suitable for boiling
- It is 90 cm in diameter and 60 cm in depth.

- The pan is filled with sea water 2/3 of its height and it is allowed to boil
- Then eviscerated sea cucumbers are transferred to the boiling sea water one by one and heated for 45 minutes with stirring until each piece has attained elasticity like a rubber ball
- During the process, scum, mud and slime are removed and the pan is refilled with clean water and reheated

❑ Burying

- The traditional method involves bacterial decomposition of the outer layer which is scrubbed-off by removing the chalky deposits embedded in the body wall.
- Bacterial decomposition is activated by burying in the moist sand. After boiling, the sea-cucumbers are cooled and kept moist inside pits in the beach and covered by sand.

- Normally the pits are rectangular and should be 100 cm long, 75 cm wide and 20 cm deep and as far as possible with an evenly flat floor
- The pits lined by gunny cloth
- Bacteria multiply fast and eventually cover the entire surface of the animal. The bacteria start penetrating into the body wall
- It is just enough if they penetrate 2 mm or so
- Therefore the time duration inside the pit is an important factor
- If the animals are kept for a longer time the body wall becomes too soft for further processing
- If the pit is not kept moist at the time of burying bacterial action may be slow and decomposition inadequate

❑Cleaning

- After 15-18 hours the material is removed from the pit and transferred to the basket and partially decomposed outer body wall is washed away by keeping in baskets in shallow water and trampling with feet
- Water is repeatedly poured during the operation
- In this way the decomposed outer chalky layer is washed away.
- Soft mud embedded in the outer skin is gone and also the lower milky white pigmentation is also washed away. The material is now cylindrical and rubber-like in texture. At this stage it is important to select those which have still white pigment for another round of boiling, burying and descumming.
- The quality of the final product depends on thorough cleaning.

❑ Second boiling

- Those which are free from all chalky deposits after thorough cleaning, are boiled once again in the sea water for another 45 minutes
- During the second boiling the products are thoroughly stirred
- By this second boiling all remnants of bacteria which destroyed the outer layer are killed.

❑ Drying

- Drying is one of the most important operations in the processing of sea-cucumbers.
- Sun drying is the best when compared to smoking.
- The products are removed from the pan with ring-net end pole.

- The material is transfered to drying platforms or trays for sun drying
- They should never be dried on sand as the sand sticks to the material which reduces the quality of the product.
- Sea cucumbers are dried until they are hard with only 8-10% moisture
- They can also be dried on palmyra mats or coir mats
- During rainy season drying can be done by smoking
- However smoked products are not preffered in the export market

❑ Packing

- On the completion of processing the product is graded on the basis of length, appearance,