

CURRENT STATUS: IMPORTANCE FOR SEA CUCUMBERS (HOLOTHURIANS) FARMING & THEIR CULTURE TECHNIQUES

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ABSTRACT

The ever-growing demand for sea cucumber in the export trade, consequent overexploitation and inadequate management measures have resulted in depletion of stock in the world. A sea ranching goal in the management of sea cucumber fisheries should be to safeguard the reproductive capacity of breeding stocks, so that the resources are available to future generations. In India, sea cucumbers are distributed in the Gulf of Mannar, Palk Bay, Lakshadweep Islands, Andaman and Nicobar Islands and the Gulf of Kutch. However, the fishery and trade existed mainly in the Gulf of Mannar and the Palk Bay, providing livelihoods to scores of poor fishermen inhabiting the region. I would like to request that CMFRI, Kochi, Kerala, organise hands-on training of sea cucumber farming and take the initial steps toward commercial cultivation for increase the valuable stock.

Keywords: Sand fish, Beche-de-mer, Wildlife, Echinodermata, Sea cucumber, Aquaculture.

INTRODUCTION

Holothurians commonly known as Sea cucumbers/Sand fish (*Samudri Khera* in Hindi), which are commercially important echinoderms, forming global seafood catches, and provide employment for more than 3 million fishermen globally. Sand fish are prime seafood resources, harvested throughout the world predominantly for the raw body wall, viscera, or to produce dried and other health products, which are exported to eastern Asian markets. However, in recent years, the wild stock of holothurians is continuously decline due to the increasing demand in international markets and the overharvesting.



Fig. 1: Cultivation of Sea cucumber (experimental phase) in RRC-CMFRI, Madapam, Tamil Nadu.

In the early 1980s, Indian fisheries faced the global scenario of stock decline, and as a regulatory measure, the Ministry of Environment, Forests & Climate Change (MoEF & CC), Government of India implemented a size regulation (MLS as 75mm.) on the export of 'beche-de-mer' in 1982, but this regulation was not much effective, the Government imposed a blanket ban in the year 2001, and all species of holothurians protected under the Indian Wildlife (Protection) Act, 1972. Indian sea cucumbers fishery was restricted mainly to the Gulf of Mannar and Palk Bay and the moratorium imposed by the government affected the income of coastal communities whose livelihood was dependent on the collection, processing, and trade of sea cucumbers.

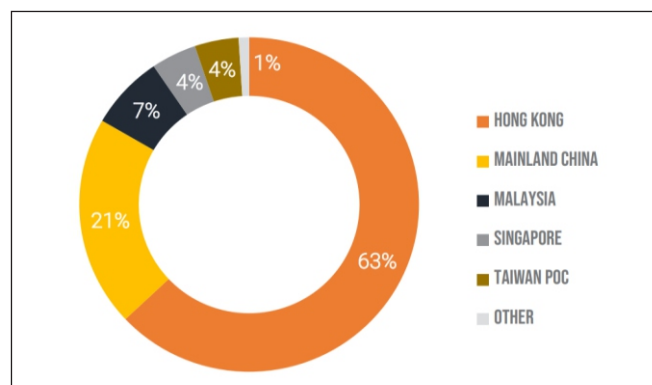
Sea cucumber resource in India:

Overall, 650 species of sea-cucumbers are distributed in the world, about 200 species have been recorded from the Indian Ocean. Andaman and Nicobar Islands are the home for sea cucumbers, followed by Lakshadweep Islands, Gulf of Mannar, Palk Bay and Gulf of Kutchchh. Only 12 species are of commercial value and are harvested for preparing 'beche-de-mer'. *H. nobilis* is the most valuable species of Lakshadweep and Andaman and Nicobar Islands for 'beche-de-mer'

preparation. *H. scabra* are also commercially important species, which are found in the Andamans, Gulf of Mannar and Palk Bay.

Significance of sea cucumbers: Many species are also harvested in small quantities for aquarium trade and display. 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. Holothurians are economically important for their nutritional and medicinal properties, contain high protein levels, low sugar & fat content, no cholesterol and are used in Traditional Chinese Medicine (TCM). They are also rich in bioactive compounds which have various medicinal benefits and health functions, especially in arthritis problems.

Commercially, the product '*beche-de-mer*' can be graded into low, medium or high economic value depending upon the species, appearance, abundance, colour, odour, thickness of body wall, and market trends and demands. Different species also have different tastes and textures, and certain species are used for preparation of specific dishes. 'Konowata', the fermented or pickled guts or intestine and 'Kuchiko', the prepared and dried sea cucumber gonad are considered delicacies. In the USA, the body wall is consumed in tablet form.



Sea Cucumbers: Countering the Illegal Trade

Vulnerability, trade and socio-economic relevance: Sea cucumbers are one of the valuable fisheries, internationally known as a superfood. Increase in demand in the international market along with the ease of harvesting and low cost of processing has augmented holothurian fishing and trading in the Indo-Pacific region. Inadequate fishery management practices and anthropogenic impacts also affect the commercial stock of sea cucumbers. Sea cucumber populations are particularly vulnerable due to many reasons. Primarily, harvesters can easily and effectively capture the shallow water holothurians. Second, late age at maturity, slow growth, high longevity, low rates of recruitment make some species vulnerable to overfishing and slow population replenishment.

Trend of sea cucumber trade: Initially the trade was largely controlled by the Chinese. The Chinese traded with South India and Sri Lanka for one thousand years for '*beche-de-mer*' and pearls. Later the trade shifted to two main markets namely, Hong Kong & Singapore. Hong Kong is the largest importer for sea cucumber products in Asia—importing approximately 56 million kg from the world over the past eight years (**Fig 3**). The '*beche-de-mer*' production in India is exclusively export-oriented and the bulk of the export from India goes to Singapore.

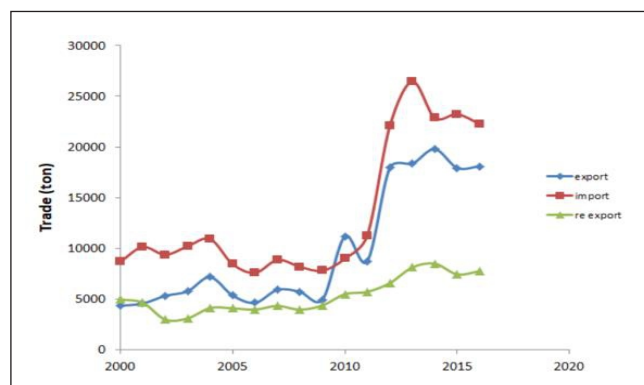


Figure 3: The top importers (kg) for sea cucumber products in Asia, 2012–2019 and Sea Cucumber Trade in the World.

Sea cucumber crime: A "seafood mafia" is plying the waters between India and Sri Lanka to satisfy China's appetite for an increasingly rare delicacy. The number of criminal incidents in both India and Sri Lanka involving sea cucumbers has increased from no more than eight in 2015 to no less than 58 in 2020.

Sea Cucumber farming: Why?

Global stocks of sea cucumbers have declined over the years, mostly due to overharvesting in many countries. Therefore, sea cucumber aquaculture can offer a solution to the enhancement of sea cucumber population and it is also of vital importance to control and manage natural stocks and harvesting.

While the worldwide amount of sea cucumber aquaculture was 25 tons in 2002, it increased up to approximately 223000 tons in 2017. The amount of sea cucumber aquaculture in 2017 accounts for 81% of the total sea cucumber production (FAO, 2017).

In India, Aquaculture production of *H. scabra* is low and is generally still in the experimental phase, they release larvae of sea cucumber into sea, this practice called sea ranching. Research on aquaculture production of tropical sea cucumber species in India was initiated by ICAR-CMFRI in 1987 and the research team succeeded in the seed production of *H. scabra* for the first time. India is blessed with suitable habitat

for sea cucumber culture Andaman & Nicobar and Lakshadweep.

- No artificial feed required, so economically viable
- Wide abundance of economically important species in local and International markets.
- According to a January 2020 *Hindustan Times* report, a kg of sea cucumbers can fetch about Rs 50,000 and some fishermen could earn Rs 2 lakh in a single day.

Life Cycle of sea cucumber:

Holothurians usually spawn in the late afternoon or evening or during night. During spawning male releases the spermatozoa first followed by release of eggs by female. Male lifts the anterior end and performs swaying movements, start releasing sperm (1-2 hrs.), Females if nearby start releasing the eggs. One adult female releases 1 million eggs (spherical, yellow in colour 180-200 micron size). Eggs are spherical, about 180 to 200 microns in size. About 20-30 minutes after fertilization the first polar body appears. The first cleavage takes place after 15 minutes and in 3 hours the blastula is fully formed. The gastrula is fully formed after 24 hours. The auricularia larva hatches out after 48 hours. The doliolaria larva grows within 10 days. After 2-3 days it develops into pentactula stage, they transform into juveniles within one month.

Hatchery and nursery production: Induced breeding technology of Sea cucumber was developed by Central Marine Fisheries Research Institute (CMFRI) in 1988.

1: Hatchery Operation:

1. Broodstock maintenance unit
2. Spawning unit
3. Larval rearing unit
4. Algal culture unit

1.1: Brood stock Maintenance or conditioning:

Brood stock is usually collected from the wild & conditioned in tanks with sandy-mud substrate and flow-through seawater. FRP tanks of 1 ton capacity with 6" thick sand at the bottom are used for keeping the breeders. Brooders are stocked @20-30 in one tank. Tank is filled with filtered, clear sea water of 32-35 ppt salinity. Water changed every day and sand changed every fifteen days. Feeding is done with fresh algae (ground into a fine paste) once a week. As the paste settles to the bottom they ingest the same along with the sand. They are fed with a mixture of powdered Sargassum, formulated feed and *Navicula sp.* slurry. If the feeding is not proper the animals get shrunken and the gonads are reabsorbed. Tanks kept in an air conditioned room (18-25 degree Celsius).

1.2: Spawning unit:

Spawning is carried out in rectangular FRP tanks of about 100 liter capacity. The Provision of an immersion heater, thermometer and aerator in the tanks for thermal stimulation

of spawners. Thermal stimulation is done by increasing the temperature of the water from 3-5 degree Celsius. This induces the sea cucumbers to spawn.

1.11: Natural spawning: The Male and female may release the gametes into the surrounding water naturally without any artificial stimulation.

1.12: Stripping: The Animals are cut open from the dorsal side. Ovary is punctured and eggs are released. Testis is taken out and cut into pieces. Sperm and eggs mixed along with sea water.

1.13: Stimulation through drying and powerful jet of water: Breeders conditioned earlier are used. Water in the broodstock's tank removed and animals dried in shade followed by a powerful jet of water. Then after 1-2 hrs the animal exhibits swaying movements in the tank and releases gametes.

1.3: Larval rearing unit:

After the spawn and eggs are released, the breeders are removed from the tank carefully. The fertilized eggs are removed to the rearing tanks. The Auricularia larva hatch after 48 hours. Healthy ones occupy the surface while the dead ones settle at the bottom and are siphoned out. Healthy larvae are collected in a sieve and released into larval rearing tanks containing clean, filtered seawater @300-700 nos./l.

Larva is fed on microalgae like: *Isochrysis galbana* *Dicrateria*, *Dunaliella*, two times a day about 20000 to 30000 cells per ml of rearing tank water is sufficient initially. After 4 to 5 days, the larvae may be fed with mixed culture of phytoplankton mainly having *Chaetoceros*.

Table 1: Optimum parameter for holothurians culture.

Parameters	Ideal range
Temperature	27-29 degree Celsius
Dissolved oxygen	More than 5 ppm
pH	6-9
Salinity	26-32.7
Ammonia	70-430mg/m ³

Under the above conditions of rearing, the auricularia develops to Doliolaria larva on 10th day. The doliolaria larva transforms into Pentactula larvae within 2-3 days. The Pentactula is the creeping stage. Late Doliolaria larva settle on hard surface in the tank. Hence artificial settling bases are provided: (Polythene sheets with algae and diatoms settled on them. Polythene sheets suspended in sea water holding tanks filled with filtered algal extract) for them to settle. After 1 month, large size juveniles of 15-20mm size are separated and put in tanks with very fine sand @200-500 nos./m².

1.4: Algal culture unit:

The hatchery should have an algal culture unit to provide sufficient quantity of algae such as *Isochrysis galbana*, *Dicrateria*, *Dunaliella*, *Chaetoceros*.

Sea ranching of sea cucumbers: Rocky sites with abundant macrophytes and sandy-muddy bottoms are preferred as release areas.

Future opportunities and challenges

The development of extensive sea cucumber aquaculture has resulted from continuous advances in all nursery practices and grow-out procedures. Overall, the success of sea cucumber aquaculture depends on optimum environmental conditions. Many diseases and parasites occur during culture, particularly in pond aquaculture. Thus, it is necessary to have effective procedures for diagnosis of pathogenic agents and employ antibiotic or pest eradication treatments carefully. Further research is needed to determine the pathogenic agents and the safest and most effective treatments can be chosen.

The potential for sustainable, profitable and socially equitable, innovative holothurian farming is unlimited for India. Sustainable aquaculture and stock improvement programmes could help restore stocks and Best Management Practices (BMP), and adaptive governance could be implemented to avoid mistakes of past fishery policies. Hence scientific research on Indian holothurians needs to be promoted with special emphasis on sustainable farming techniques, stock enhancement through ranching and biotechnological drug discoveries.

Conservation of sea cucumber: Sea cucumbers are listed under Schedule I of the Wildlife Protection Act, 1972 and are

also protected under the Convention on International Trade in Endangered Species (CITES).

Lakshadweep unveils the world's first sea cucumber conservation reserve: Dr KK Mohammed Koya Sea Cucumber Conservation Reserve, which Extends over a 239 square km radius of Cheriyapani reef.

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