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Part Three

FEBRUARY 1991

NATIONAL SYMPOSIUM ON RESEARCH AND DEVELOPMENT IN MARINE FISHERIES

MANDAPAM CAMP

16-18 September 1987

Papers Presented
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CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

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RESEARCH, CONSERVATION AND MANAGEMENT OF EDIBLE HOLOTHURIANS AND THEIR IMPACT ON THE BECHE-DE-MER INDUSTRY

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ABSTRACT

Very little research has been done on the edible holothurians form India. Although more than seventy species of holothurians are known from the shallow-waters of India only about ten species are found to be economically important. At present one species viz., *Holothuria (Metriatyla) scabra* Jaegaer is almost exclusively used in the Gulf of Mannar and Palk Bay and also in Andamans for the preparation of *beche-de-mer*. There are already indications of fishing pressure affecting the stocks. It is therefore necessary to collect data on catch, effort and length composition and also to study age and growth, length at first maturity, spawning, fecundity, development and culture, recruitment and dispersion to take necessary conservation methods to manage and monitor the resource rationally. The impacts of these studies on the *beche-de-mer* industry are discussed in detail in the paper.

INTRODUCTION

Although more than seventy species of holothurians are known from the shallow- waters of Indian seas, only about ten species are edible after processing them into a product known as *beche-de-mer*. Eventhough the *beche-de-mer* industry is a very ancient one having been introduced by the Chinese nearly thousand years ago, surprisingly very little attention has been paid to the industry. At present on an average, materials worth of Rs.20 lakhs is exported from India annually. In 1982 Government of India put a ban on the export of material below 75 mm size as a measure of conservation and this has resulted in a crisis for the industry with large quantities of material remaining in godowns. Since there is no internal market for the product the industry is agitating to get the ban lifted for the export of material already processed. The author has recently conducted a survey along the Palk Bay and the Gulf of Mannar coasts to study the present status of the industry. The data collected clearly indicate that there is fishing pressure in some pockets. To save the industry, overfishing should be avoided. The available resources should be properly managed by insisting on size restrictions at the time of capture and also observing closed fishing seasons . Much research needs to be done on the biology of holothurians such as age and growth, longevity, length at first maturity, spawning, fecundity, development and culture, recruitment and dispersion to take up necessary conservation methods and to manage and monitor the resources rationally. The industry should be introduced in Lakshadweep where holothurians which yield best quality beche-de-mer occur in good numbers. Processing should also be extended to various islands in Andaman and Nicobar group where the resource is good. In this way the industry can be diversified by processing other species of holothurians which are more valuable and occur in Andaman and Nicobar Islands and also at Lakshadweep.

RESEARCH

Very little research has been done on the edible holothurians of India. On the mainland the industry is restricted only along the Gulf of Mannar and Palk Bay. *Holothuria (Metriatyla) scabra* (Pl.I, A) and *Holothuria (Theelothuria) spinifera* (Pl.I,B) are at present used in the preparation of *beche-de-mer* on the mainland. The second species is not preferred by the merchants and the price offered is also very low. The exporters often remove them when purchasing this product.

James (1973, 1983) reported on the *beche-de-mer* resources from India and the sea cucumber resources from Andamans. There are a few papers which mention holothurians from the Indian region like those of Bell (1887) from Andamans, Thurston (1927) and Bell (1889) from Rameswaram, Thurston (1890) from the Gulf of Mannar, Thurston (1894) from Tuticorin and Pamban, Gravely (1927) from Krusadai and neighbourig islands, Gravely (1941) from Madras, Gideon *et al.* (1957) from Gulf of Kutch, Sane and Chhapgar (1962) from Bombay, Rao (1968) from Waltair, Gopalakrishnan (1969) from Gulf of Kutch, Rao (1973, 1975) from Andamans,

Mary Bai and Ramanathan (1977) from Kanyakumari, Parulekar (1981) from Malvan, Soota *et al.* (1983) from Andamans and Mukhopadhyay and Samanta (1983) from Lakshadweep. Surprisingly economically important holothurians were not listed by any one of them except Bell (1887), Parulekar (1981) and Soota *et al.* (1983) who listed 11 species as economically important for *beche-de-mer*. The present author initiated work on Indian echinoderms in 1963 and as a result of his efforts a number of papers have been published on the taxonomy of holothurians (James 1967, 1968,1969,1983,1986 a, 1986 b). As a result of his study one new family and some new species and several new records were brought to light.

Very little work has been done on the biology of holothurians particularly commercially important forms. Krishnaswamy and Krishnan (1987) have worked on the reproductive periodicity of *Holothuria (Metriatyla) scabra* and have stated that it has two spawning peaks, one in July and another in October. Mary Bai (1978) has published an account of the anatomy and histology of *Holothuria (Metrityla) scabra* and in 1980 she brought out a monograph on the same species giving details about the histology and anotomy and compiling the lists of species known from the Indian region. James (1978) has recorded a juvenile of *Holothuria (metriatyla) scabra* from algae from Mandapam (Palk Bay) in June. It is gratifying to note that detailed work on the biology of *Holothuria (Metriatyla) scabra* and *Holothuria (Theelothuria) spinifera* both used for *beche-de-mer* and on the hatchery development in *Holothuria (Metriatyla) scabra* has been taken up in CMFRI. Recently a break through was achieved in inducing this species to spawn in the laboratory for the first time in India by thermal stimulation. The fertilized eggs were successfully reared through various stages like Dipleurula, Auricularia, Doliolaria and Pentactula by feeding them on *Isochrysis galbane* and mixed culture of diatoms. They settled down to the bottom of the tank on the tenth day and were growing fast. The details of this breakthrough is given in James *et al.* (in press). There are now over 32,000 juveniles which are fed on the powder prepared from algae like *Ulva, Sargassum* etc. Some of them have grown to 20 mm in length in 40 days. This growth rate is high when compared to the growth rate in Japanese and Chinese farms. Now another project is taken up on the culture of *Holothuria (Metriatyla) scabra* making use of the seed produced in the hatchery. The success in the hatchery and culture of the species will go a long way to solve the shortage of material for the industry.

Some experiments have been conducted recently on the transportation of live material from Sethubavachatram to Mandapam covering 240 km by road to find out how they withstand transportation over long distances. Altogether ten holothurians belonging to the species *Holothuria (Metriatyla) scabra* were transported to Mandapam stocked in the aquarium. In the next three days six of them died and the rest of them were successfully transported to Tuticorin (135 km) by road and stocked in the hatchery without further mortality. On two occasions ten specimens of *Holothuria (Metriatyla) scabra* were transported by train from Tuticorin to Madras covering a distance of 650 km without any mortality. From the above experiments it is seen the specimens withstand better when they are transported during nights when the temperature is low.

James (1985) made an atttempt for the first time to culture *Holothuria (Metriatyla) scabra* by collecting juveniles and stocking them in enclosed area at Port Blair (Andamans). In February, 1978 a total of 462 juveniles ranging in length from 65 to 160 mm (modal class 81-90 mm) were collected from Seasostris Bay and broadcast in an enclosed area of 1.5 hectares near Aberdeen Jetty where the bottom was partly muddy and partly sandy. At the end of July, 1978 they had grown to 190-290 mm. The results were also published in CMFRI Newsletter (Anon, 1978). The incomplete experiment gave some indication of the possibilities of semiculture of holothurians. The most important aspect of culture is the development of hatchery system. As stated above success has been achieved in inducing the holothurians to spawn in the laboratory and to rear their larvae successfully.

HISTORY OF BECHE-DE-MER INDUSTRY

The *beche-de-mer* industry is very ancient in India. According to Hornell (1917) Chinese had constant trade with Southern India for more than thousand years. There is documented evidence to show that the Chinese had contacts with Periapatnam on the Gulf of Mannar coast since the twelfth century onwards. In search of *beche-de-mer* the Chinese men came to the shores

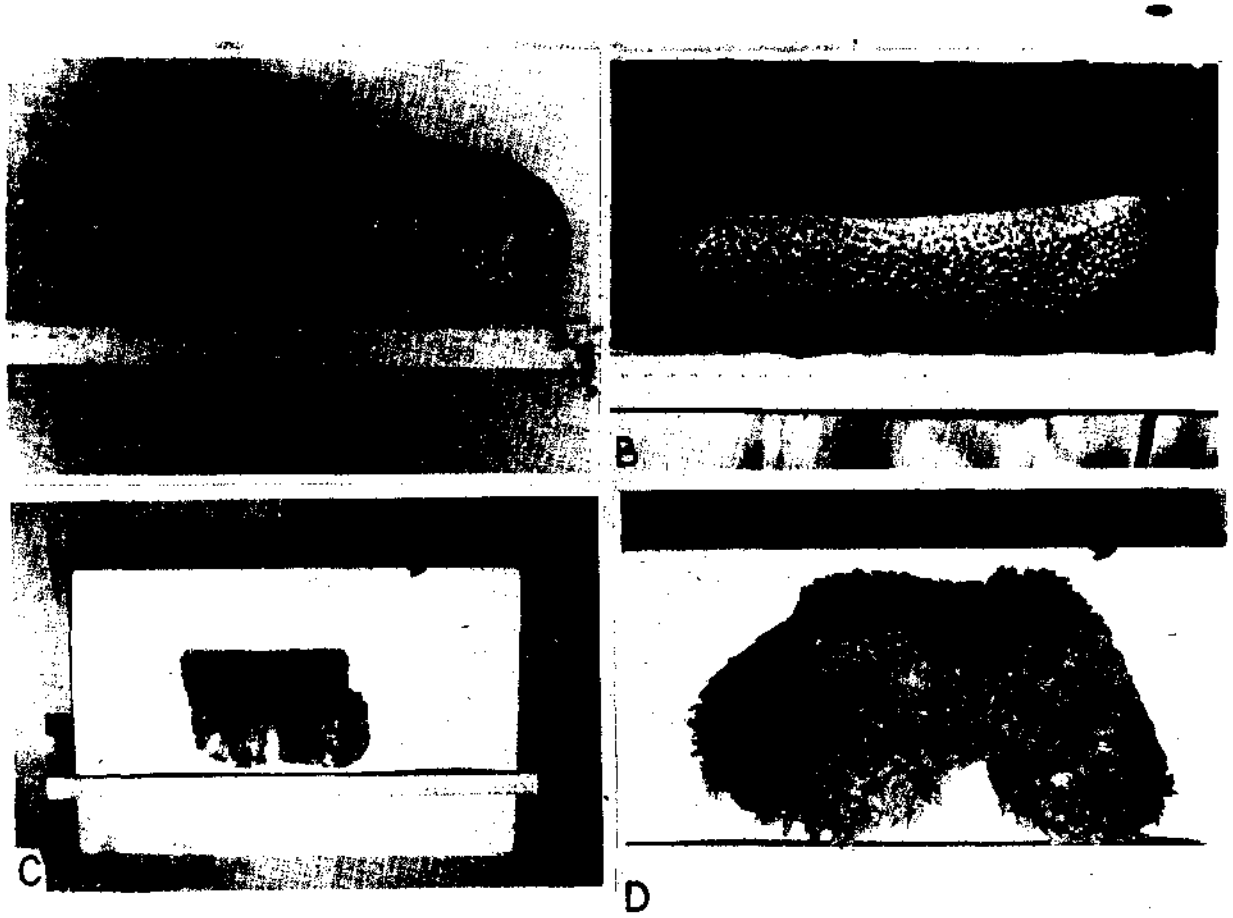
of Southern India and other places. Custom records are available for the export of *beche-de-mer* from 1898 onwards from the Madras Presidency. According to Mannadiar (1977), in Lakshadweep where there is no industry now it appeared to have flourished there once. Sir. W. Robinson who visited the South Canara Islands in 1844 -'45 reported that during the fishing season good many of the islanders were employed by the coastal Moplah merchants in the preparation of *beche-de-mer*. It had very good demand for the Chinese market at Bombay. But slowly the industry began to decline and by the time Mr. W.G. Underwood visited the islands in 1881-'82 the trade has almost died out. They were processed and sent to Mangalore in 'odams and then shipped to China. When the external demand declined the people neglected this industry and quite naturally it became extinct. The chief reason for the untimely death of the industry might have been the difficulty in transporting the material from a port like Mangalore on the West coast to China directly. Today from Madras it is easily transported to Signapore and Hongkong from where it is re-exported to China. Kloss (1903) states that Andamans is known for the *beche-de-mer* in ancient times. Later in recent years it is revived through the efforts of people from Tamil Nadu who are well conversant with the preparation of the product from the holothurian *Holothuria (Metriatyla) scabra*. However, they are ignorant of the processing methods for other species of holothurians and therefore the resource remains untouched till today though they can yield much more valuable *beche-de-mer* than the one from *Holothuria (Metriatyla) scabra*.

Collier (1830) was the first person who gave an account of the *beche-de-mer* of India. Hornell (1917) wrote a classical paper on the *beche-de-mer* industry, its history and recent revival. Though this paper mainly deals with the industry in the Gulf of Mannar and Palk Bay he has given some history of the *beche-de-mer* industry of Lakshadweep which is non existant today. Panning (1944) has summerised the *beche-de-mer* industy in various parts of the world including India. A number of publications have been issued on the subject in recent years by Jacob (1973), Shenoy (1977) and Durairaj (1982). Adithiya (1967) has described the industry from Sri Lanka. This country started a *beche-de-mer* processing factory in Mannar in 1974. Mr. Sachithananthan, FAO processing expert brought out a hand book for the fishermen on *beche-de-mer* of South Pacific Islands. This was edited by Baird (1974). Information on the *beche-de-mer* resources of India, the sea cucumber resources of Andamans and on quality improvement in *beche-de-mer* are available in James (1973, 1981, 1986a, 1986b). Sachithananthan (1986) published a paper on handling and processing of the sea cucumber *Holothuria (Metriatyla) scabra*. Eys (1986) published on the international market for the sea cucumber. The Ministry of Tourism, Marine and Forestry of the United Republic of Tanzania conducted a National Workshop on *beche-de-mer* during July 29th to August 2nd, 1985. It is very interesting to note that Robertson *et al.* (1987) showed for the first time that the Atlantic sea cucumber *Cucumaria frondosa* can also be processed and has export market. Recently James (1987) has published a paper on the prospects and problems of *beche-de-mer* industry in Andaman and Nicobar Islands.

Even as early as 1898 *beche-de-mer* worth of Rs. 15,380 was exported from India to Straits. The industry which was good during 1903- '05 exported *beche-de-mer* worth of Rs. 24, 300 in 1905 and this gradually decreased to Rs. 600 by 1913. In earlier years *beche-de-mer* from India and Sri Lanka used to be clubbed together and exported. From 1910 onwards accurate data is available as imports from Sri Lanka to India were stopped. The average export from India during 1898-'10 was 5534 kg. Since 1910 annual Indian export had fallen to 1,359 kg. This is partly due to First World War and partly due to the reduction in the wholesale rates at Penang. The history of the trade was one of definte fluctuations and the same has been documented by Hornell (1917). Hornell entered the *beche-de-mer* industry in 1916 when the trade was at an ebb and tried to revive the same on scientific lines (Hornell, 1917). He set up a Government experimental Factory for *beche-de-mer* at Tirupalakudi in 1915 and showed how it could be run on profitable lines.

The story of *beche-de-mer* industry in Lakshadweep is somewhat different. As stated earlier during 1844-'45 a good industry existed which died in 1881- '82. When Hornell visited Kiltan Island in 1908 he saw small quantitites of *beche-de-mer* processed from three species. Judging from the local names he has given, they are *Holothuria (Microthele) nobilis* (Pl.I, C), *Bohadshia argus* and *Actinopyga mauritiana* which are abundant even

today. He also noted that the methods of curing were different from those practised in the Palk Bay. They resembled the methods of processing adopted in Australia and Polynesia. Obiviously these methods were introduced by the Chinese. Ayyanger (1922) who made a survey of the fauna and fishing industries of the Lakshadweep noted that the *beche-de-mer* industry which was a success for sometime at Androth had been abandoned due to epidemic of cholera and this was attributed to the insanitary condition in which the curer kept his yard at that time. He states that at Kiltan it was once practised but no traces of the industry are found today. The failure is attributed to poor prices for the processed product. *Thelenota ananas* (Pl. I,D) is an important species from the Lakshadweep.



Pl. I *A. Holothuria (Metrityla) scabra* *B. Holothuria (Theelothuria) spinifera*
C. Holothuria (Microthele) nobilis *D. Thelenota ananas*

In recent years the Fisheries Department of Lakshadweep made some attempts to revive the industry. In 1967 they sent two persons to Rameswaram for one month to learn the processing of holothurians. They returned and processed different species of holothurians in the same method adopted for *Holothuria (Metriatyla) scabra*. They processed mostly *Holothuria (Microthele) nobilis* and handed over the samples to the Fisheries Department. Immediately after this one person from Madras came to Androth and processed nearly seven tonnes of *Holothuria (Microthel) nobilis* by paying a royalty of Rs. 1.00 per kg to the Administration. He procured specimens by paying five or ten paise for each specimen. He processed *beche-de-mer* at Kavaratti also. Fisheries Department restricted the collection of the specimens below 15cm size. After two years he wanted to return to Lakshadweep but the Administration did not give permission.

At Kiltan there is a place even today known as *Koka Pulikkayar* which means a place to boil

sea cucumbers. About 60-70 years back one person who is still living at Chetlat used to process *Holothuria (Microthele) nobilis* at Chetlat. He used to cut each specimen into four bits and boil and dry them. He used to process 5-10 specimens per day and was paid Rs. 30.00 per kg those days. In a year he could process only 20-30 kg. When every one started rediculing him for boiling sea cucumbers he finally gave up. The copper vessel used for boiling sea cucumbers is still available.

As stated earlier Andamans was once famous for *beche-de-mer* and later it was not processed there since the islands chiefly served only as penal settlement. In recent years people from Tamil Nadu have started processing *Holothuria (Metriatyla) scabra* at Andamans particularly around Port Blair even though more valuable species like *Actinopyga mauritiana*, *A. echinities* and *A. miliaris* occur there due to ignorance of their value and processing methods. Still processing is going on in a small scale. This has to be extended to other islands where resource is available.

PRESENT STATUS OF THE INDUSTRY

Since the prices offered for *beche-be-mer* in recent years is attractive there is an attempt to collect, process and export more material. In 1986 Hong Kong market offered US $ 17.00 per kg for large size *Beche-de-mer* (13-15 cm) processed from *Holothuria (Metriatyla) scabra*. 25-35 pieces weigh a kg. The export which was 91 tonnes in 1975 has gradually fallen to 11 tonnes in 1985. This is partly due to the ban imposed by the Government of India in 1982 on the export of material less than 7.5 cm in size. This was later relaxed to clear the accumulated material and this accounts for 71 tonnes export in 1983. In recent years large forms have become rare particularly around Tirupalakudi where intensive fishing is done since time immemorial. Thus while average size of the fresh holothurian *Holothuria (Metriatyla) scabra* collected from Tirupalakudi was 155 mm forming only 29% of the total. Those collected at Tuticorin had an average length of 217 mm which formed 70% of the collections there.

The increase in the percentage of smaller specimens at Tirupalakudi clearly indicates that this species is overfished. The percentage of small sized *beche-de-mer* increased during the year 1979-86. *Beche-de-mer* of 3-4" size which formed only 33% during '79-'80 increased to 80% during 1985-'86. Details of percentage of different sizes during the years 1979-86 are given in Table. I. The demands in foreign markets like Hong Kong and Singapore are more and they require about 10-20 tonnes per month and the suppliers in India are unable to meet the heavy demand. Lured by the high price offered and also due to the high demand they resort to processing small and immature forms thus endangering the stocks of the species. To meet the heavy demand in Kilakarai they are now processing *Bohadschia marmorata and Stichopus chloronotus*. If the industry has to be saved, conservative measures have to be taken up immediately and the industry should be diverted to other places especially Lakshadweep islands where there is no processing at all. It should also be extended to various islands in Andaman and Nicobar group where there is good resource. Even on the mainland the industry has been introduced at Tuticorin recently. Prior to 1970 not a single holothurian was fished and processed at Tuticorin. But today there is an organised industry where about 50 boats are engaged in diving operations for holothurians and daily Rs. 10,000 to 15,000 worth of holothurians are fished. Since this is a virgin area all the holothurians fished are large and the average size is 217 mm care should be taken to see that they are not over exploited.

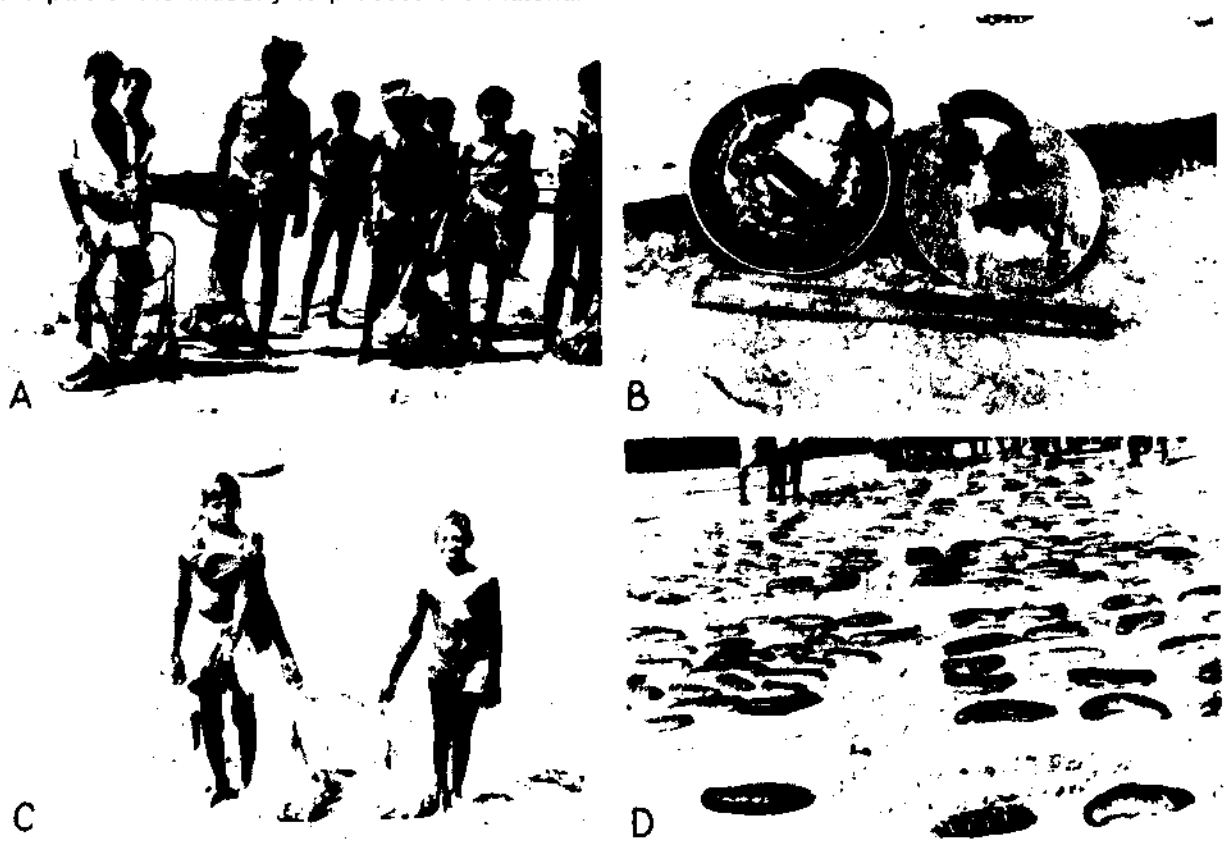
The details of fishing for holothurians at different places between Rameswaram and Tuticorin along the Tamil Nadu coast are given in Table 2. From this Table it is seen Rameswaram, Tirupalakudi and Sethubavachatram on the Palk Bay and Tuticorin on the Gulf of Mannar side are good centres for holothurians. Percentage of specimens above 7.5 cm are less in Tirupalakudi and Kattumavadi (20-30%).

At Rameswaram most of the holothurians landed are large. Tirupalakudi appears to be the main centre for holothurian collection since very long. Most of the holothurian divers hail from Mullimonai. At Tondi only one person is engaged in holothurian processing. In Pudupatnam most of the divers come from Tirupalakudi, Karangadu and Mullimonai. At Kottaipatnam one person is engaged in this industry for the past 15 years. Here large specimens fetch Rs.4.00 for each piece. *Beche-de-mer* above 7.5 cm is sold at Rs. 120 to 130 per kg. Each kg may contain 22-25 pieces. At Kattumavadi also only one person is engaged in processing holothurians for the past

25 years. There are no local divers in the village but drivers from Periapatnam and Kilakarai camp there and dive for holothurians during the season. At Mallipatnam only one person is engaged in holothurian processing for the past 20 years. There are no local divers in the village. Divers from Periapatnam regularly camp here during June and collect holothurians. At Tuticorin before 1970 there was no beche-de-mer industry. Here daily about Rs. 10,000 to 12,000 worth of holothurians are auctioned. About two tonnes of *beche-de-mer* are processed in a month(PP.II).

Kilakarai is the main centre for the export of *beche-de-mer*. At present there are three merchants there and two merchants in Ramnad exporting the material. Each merchant exports 20-25 tonnes of *beche-de-mer* annually. Small quantities are sent as accompanied baggage by air from Madras. Smuggling of material to Sri Lanka is now suspended due to disturbed conditions during 1987-'88.

In the last 20 years some changes have taken place in the industry. There has been an effort on the part of the industry to process the material in more hygenic manner due to the present day attractive prices offered. Material from India used to be rated low when compared to the product from Sri Lanka since the processing was done under most unhygenic conditions. Now nowhere the material is dried on the ground. It is always dried on coir rope mats. This will eliminate sand and other dirt sticking on to the material. In many places aluminium vessels are used for boiling the holothurians instead of rusted iron drums. James (1973) suggested the use of aluminium vessels in the place of iron drums. Now these have to be replaced by saucer-shaped pans preferably made out of hindalium. In the past two years divers are using round aluminium plates (Pl. II, B) for the feet as flippers. This enables them to cover greater distance under water with ease. This may also prove to be counter productive at times since the divers try to pick up all material irrespective of size with ease. Now regular fire wood is used in the place of dry cocount and palmyra leaves. The charcoal from the fire wood is collected and sold to hotel which gives additional income.



Pl. II

A. Divers returning after days catch B. Aluminium plates used as 'flippers' C. Boys returning after days catch D. *Holothuria (Metriatyls scabra* arranged in rows on sand before auction at Tuticorin

Table 1. Size-wise export of beche-de-mer (in kg)

Size	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
4"-6"	7031	4756	2054	3596	3051.5	2851	2123
	(16.9%)	(14.21%)	(3.06%)	(7.48%)	(3.8%)	(18.52%)	(19.5%)
3"-4"	13987	9332	6986	19192.5	22643	12545	8765
	(13.7%)	(27.89%)	(10.4%)	(39.93%)	(28.22%)	(81.48%)	(80.5%)
2"-3"	18301	15867	45675	22370.5	39021	–	–
	(44%)	(47.42%)	(66.59%)	(46.54%)	(48.64%)	–	–
Below 2"	2182	3502	13373	2906	15495	–	–
	(5.25%)	(10.46%)	(19.95%)	(6.04%)	(19.31%)	–	–
Total	41501	33457	67088	48065.0	80210.5	15396	10888

Source: Data compiled from the invoices registered in the MPEDA Regional Office, Madras.

PROBLEMS FACING THE INDUSTRY

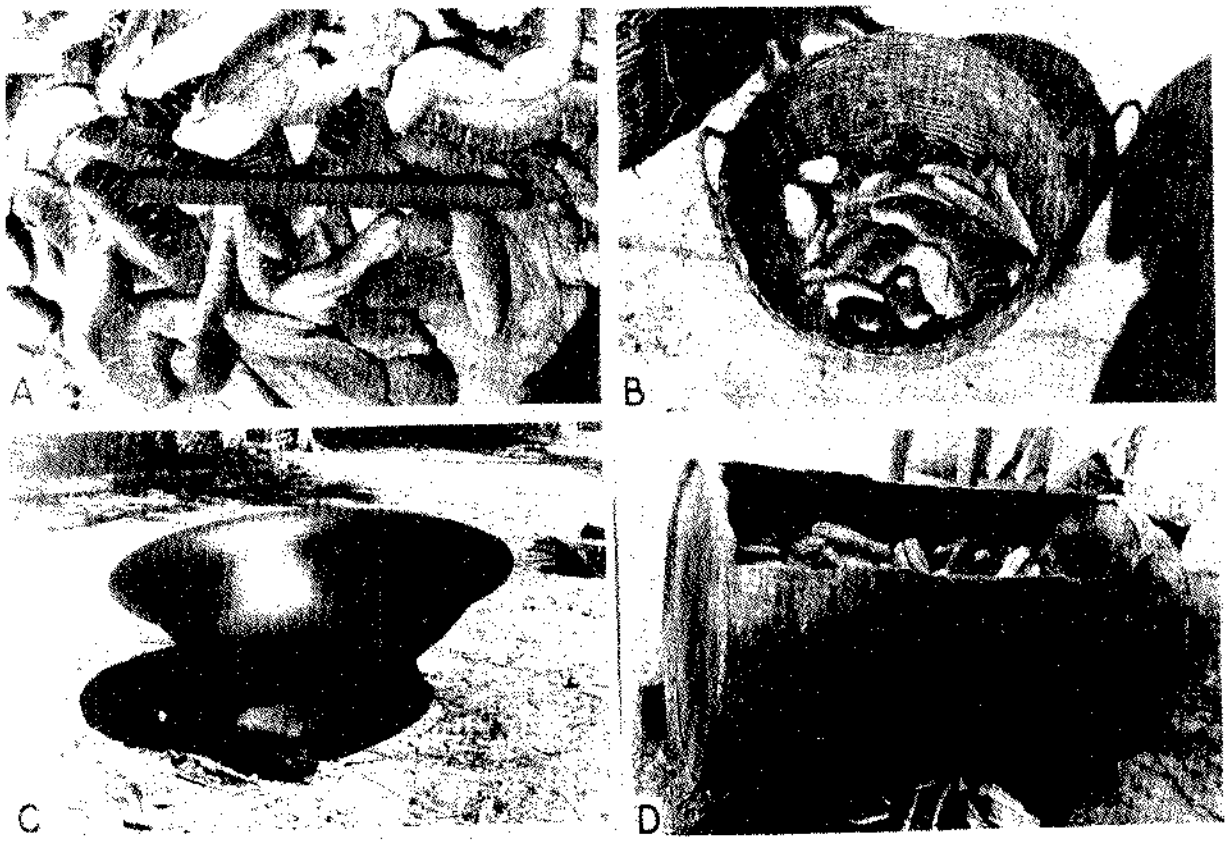
Singapore and Hong Kong need about 500 tonnes of *beche-de-mer* annually. The industry is in short supply of material for processing. This is largely due to the fact that they concentrate on a narrow strip of sea in the Gulf of Mannar and Palk Bay and exploit only two species *viz.*, *Holothuria (Metriatyla) scabra* (Pl. III, A & B) and *Holothuria (Theelothuria) spinifera*. No survey seems to have been conducted in the Palk Bay. Some information is available on the populations of *Holothuria (Metriatyla) scabra* off the shores of north-west coast of Sri Lanka (Palk Bay, Gulf of Mannar and Kalpitiya). This species is found to be distributed in depths of 6-20 metres. Production is estimated to be about 100-150 tonnes per annum. However ther is no information on the potential yield (Anon 1984). It is surprising that Salvadori(1961) recorded holothurians only in one station out of 168 stations covered by him and his team in the pearl and Chank beds in the Gulf of Mannar. In order to overcome the shortage of material the fishermen may launch out to other places like Andaman and Nicobar Islands and the Lakshadweep. In Andaman and Nicobar Islands there are more than 500 islands. No survey has been conducted in these islands for sea cucumbers. Good resources must be available in some of the islands which have not been visited so far by the persons invloved in the industry. In Andaman and Nicobar Islands and the Lakshadweep, holothurians which have much higher value than *Holothuria (Metriatyla) scabra* are available. Also the islands of Lakshadweep have to be exploited where there is no industry at present. In Lakshadweep the best quality holothurian *Holothuria (Microthele) nobilis* occurs in good numbers around some of the islands. In Lakshadweep another valuble holothurian is *Actinopyga mauritiana*. At Andamans at present *Holothuria (Metriatyla) scabra* is processed chiefly around Port Blair. Other valuble holothurians at Andamans are *Actinopyga mauritiana, A. echinites* which occur in good numbers. Other species like *Actinopyga miliaris and A.lacanora* are rare. These are not processed due to ignorance of their value and the ignorance of the processing methods. In fact the processing is more simpler for these species and the prices offered also more attractive. Another problem faced by the industry is the low price offered in the international market when compared to the product from Sri Lanka. This is due to the fact that the Indian material earned a bad name since it is processed under less hygenic conditions and also the final product is less attractive. The shape of the material is fixed during processing and this can be set right by using a flat saucershaped pans (Pl. III, C) instead of oil drums (Pl. III,D). The material has to be constantly stirred while boiling to get perfect cylindrical shape which is of utmost importance in deciding the price in the International market .

FUTURE PROSPECTS FOR THE INDUSTRY

The *beche-de-mer* industry in India has a bright future if it switchs over to other grounds like Lakshadweep and the various islands of Andaman and Nicobar which has the best quality holothurians for *beche-de-mer*. The industry has to diversify to other areas and other species. In the Andaman and Nicobar group there are more than 500 islands and if material is collected from islands which have not been tapped so far the rewards will be great. In order to encourage processing of other species it is necessry to send processed samples to Singapore and Hong Kong and ascertain the present rate. This will encourage the local people to take up processing of other species. James (1986) gave some suggestions to improve the quality of *beche-de-mer*. A workshop has to be conducted for persons involved in the industry to teach them how to process the material on scientific lines. This is very important step to be urgently taken up. The breakthrough achieved in inducing *Holothuria (Metriatyla) scabra* to spawn in the laboratory for the first time in India by thermal stimulation and later successfully rearing the larvae to juveniles will go a long way to solve the shortage of material faced by the industry. At present there are more than 32,000 juveniles in the size of 3-26 mm.

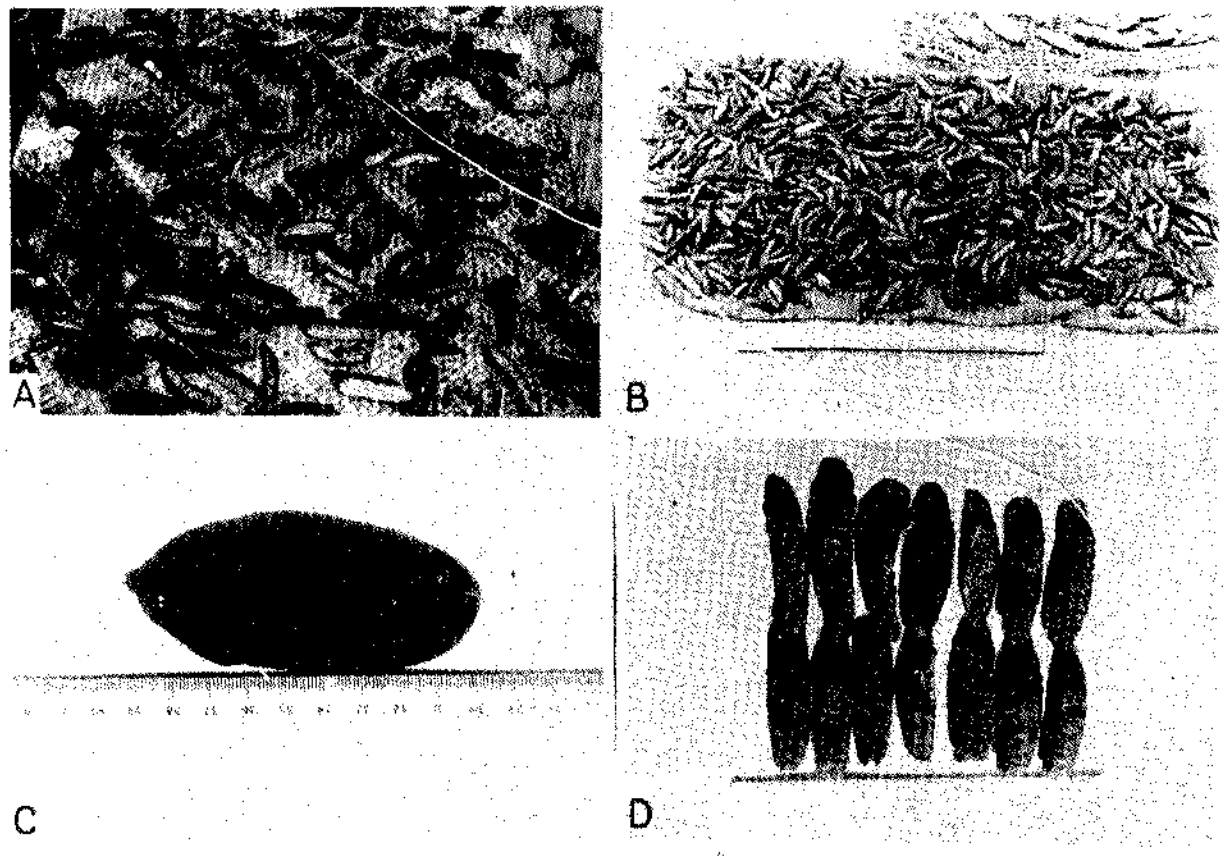
CONSERVATION

James (1985) has already pointed out that *Holothuria (Metriatyla) scabra* and *Holothuria (Theelothuria) spinifera* are likely to be endangered unless conservation methods are taken. Silas *et. al.* (1985) have reported on the depletion of the holothurian *Holothuria (Metriatyla) scabra* populations in the Gulf of Mannar. Government of India took a right decision in 1982 to put a ban on the export of *beche-de-mer* below the size of 7.5 cm size. The 7.5cm specimens



Pl. III

A. *Holothuria (Metriatyla) scabra* put as a heap before degutting B. *Holothuria (Metriatyla) scabra* being transported in basket C. Flat saucer-shaped pan used for boiling at Tondi. D. Conventional oil drum used for boiling.



Pl. IV

Beche-de-mer Of: A. *Holothuria (Metriatyla) scabra* dried on mat B. *Holothuria (Metriatyla) scabra* from Tirupalakudi, mostly undersized C. *Actinopyga miliaris* D. *Actinopyga echinites*

Table 2. Details of fishing for holothurians between Rameswaram and Tuticorin along Tamil Nadu Coast

Place	No. of boats engaged	Method of collection	Average landings per day (No.)	% of specimens above 7.5 cm
Rameswaram	60	Diving	500	67
Tirupalakudi	50	-do-	400	30
Karangadu	20	-do-	100	-
Tondi	-	Thalluvali	-	-
Periapatnam	7	Thalluvali	105	40
Pudupatnam	1	Diving	-	-
Kottaipatnam	1	-do-	125	-
Ammapatnam	-	Thalluvalai	15	-
Kattumavadi	-	Diving		20
Sethubavachatram	10	Diving/Thalluvali	1000	68
Mallipatnam	-	Diving	-	-
Tuticorin	30	-do-	1000	70

will be 200 mm in length in living condition. At this length *Holothuria (Metriatyls) scabra* is immature. It is essential to allow the animals to spawn atleast once in their life time to replenish the stocks. If this is not done the populations will be depleted drastically as it happened in and around Tirupalakudi. The average size of the material collected at Tirupalakudi is only 155 mm. Tirupalakudi, Mullimonai and Karangadu form the core area for the divers and the fishing pressure in a very restricted area is too much, leading to clear overfishing. At Tuticorin the industry has started recently and there is no over exploitation. The average size of the holothurians fishing is 127 mm which is above safe level. In this connection it is pertinent to note that *beche-de-mer* of *Holothuria (Metriatyla) scabra* exported from East Africa, Indonesia and Singapore is 10-18 cm in length. Although *Holothuria (Metriatyla) scabra* breeds round the year, it has two spawning peaks one in July and other in October as stated earlier. It is better not to collect and process the material round the year for two reasons. The first reason is that it can be quickly dried in the sum during January to May. Sun dried material is preferred to smoke dried ones in export market. Smoke dried product also incurs additional expenditure by way of fuel. The second reason is in summer there is no breeding peak. June to December may be declared as closed season.

MANAGEMENT

In any industry if a species has to sustain the industry it has to be judiciously managed without over exploiting the same. This becomes all the more important since we are ignorant of several aspects of its biology such as age and growth, spawning and fecundity, recruitment, distribution, size at first maturity and other aspects of its biology. Unless these aspects of biology are known it is highly dangerous to exploit the species indiscriminately. In case of holothurians over exploitation can easily take place as the animals are defenceless and almost stationery and offer no resistance when caught. Therefore to conserve the resource, regulation regarding the size at collection should be insisted. This can be strictly implemented by the Tamil Nadu Fisheries Department as they do in case of collection of chanks. Since the area of fishing is same for both, this can be easily monitored. The landing centres for holothurians are also limitted and therefore it can easily be regulated. Material below the size of 200 mm in length may be banned from catching. Even if they are caught and brought to the shore they can be put back into the sea since they live out of water for a long time. There should be closed seasons for the holothurian collection especially during the peak spawning periods, July and October. The active season for diving should be closed down by the end of June. The water in the Palk Bay also becomes somewhat turbid and rough preventing the divers to conduct their operations effectively. In fact the season in the Gulf of Mannar starts from October when the sea is calm. From November onwards the monsoon sets in and drying becomes a problem and therefore the processing is not in fully swing. It is interesting to note that the Lakshadweep Administration took the first conservation measures for holothurians when it restricted the collection of *Holothuria (Microthele) nobilis* below the size of 150 mm when processing was practiced during 1968 at Androth and Kavaratti Islands.

Apart from size restrictions and closed seasons which have to be strictly implemented attempts should be made to culture the species to agument production and boost up export. James (1985) made an attempt to culture *Holothuria (Matriatyla) scabra* at Port Blair by collecting juveniles and stocking them in enclosed areas (PL. V, A-D). In this type of work the first step is to locate the beds where juveniles are in large numbers. One such area could be Kundagal gut near Mandapam where juveniles of *Holothuria (Metriatyls) scabra* were seen buried during the low tide.

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