



**CMFRI SPECIAL PUBLICATION**  
**Number 59**

भारत सरकार  
ICAR

**A HAND-BOOK ON  
INDIAN SEA-CUCUMBERS**

**CENTRAL MARINE FISHERIES RESEARCH INSTITUTE**  
Indian Council of Agricultural Research  
Dr. Salim Ali Road,  
Post Bag No. 1603, Tatapuram P.O.  
Ernakulam, Cochin 682 014, India

## CMFRI SPECIAL PUBLICATIONS

1. Pearl culture training : Long-term and short-term courses. 1977, 39pp.
2. Mariculture research and developmental activities. 1978, 48pp.
3. Summer Institute in breeding and rearing of marine prawns. 1978, 129pp.
4. Economics of the indigenous fishing units at Cochin : A case study. 1978, 24pp.
5. Seminar on the role of small-scale fisheries and coastal aquaculture in integrated rural development, Madras, 6-9 December 1978. Abstracts, 1978, 44pp.
6. Proceedings of the first workshop on technology transfer in coastal aquaculture held at Cochin, 23-24 July, and Mandapam, 27-28 July 1979. 1979, 96pp.
7. Manual of research methods for crustacean biochemistry and physiology. 1981, 172pp.
8. Manual of research methods for fish and shellfish nutrition. 1982, 125pp.
9. Manual of research methods for marine invertebrate reproduction. 1982, 214pp.
10. Analysis of marine fish landings in India : A new approach. 1982, 42pp.
11. Approaches to finfish and shellfish pathology investigations. 1983, 43pp.
12. A code list of common marine living resources of the Indian seas. 1983, 150pp.
13. Application of genetics in aquaculture. 1983, 90pp.
14. Manual of research methods for invertebrate endocrinology. 1983, 114pp.
15. Production and use of *Artemia* in aquaculture. 1984, 74pp.
16. Manual on marine toxins in bivalve molluscs and general consideration of shellfish sanitation. 1984, 100pp.
17. Handbook of diagnosis and control of bacterial diseases in finfish and shellfish culture. 1984, 50pp.
18. Proceedings of the workshop on sea turtle conservation. 1984, 109pp.
19. Mariculture research under the Centre of Advanced Studies in Mariculture. 1984, 136pp.
20. Manual on pearl culture techniques. 1984, 42pp.
21. A guide to prawn farming in Kerala. 1985, 96pp.
22. Water quality management in aquaculture. 1985, 96pp.
23. Hatchery production of penaeid prawn seed : *Penaeus indicus*. 1985, 41pp.
24. The present status of ribbonfish fishery in India. 1986, 49pp.
25. A practical manual for studies of environmental physiology and biochemistry of culturable marine organisms. 1986, 45pp.
26. Theorems in environmental adaptation. 1986, 50pp.
27. Bibliography of the publications by the staff of CMFRI 1948-85. 1986, 168pp.
28. The present status of our knowledge on the lesser sardines of Indian waters. 1986, 43pp.
29. Exploitation of marine fishery resources and its contribution to Indian economy. 1986, 32pp.
30. Seminar on potential marine fishery resources and its contribution to Indian economy. 1986, 32pp.

# A HAND-BOOK ON INDIAN SEA-CUCUMBERS

D. B. JAMES

P. S. B. R. JAMES

*Central Marine Fisheries Research Institute,  
Cochin 682 014*



भाकअप  
ICAR

**CMFRI SPECIAL PUBLICATION  
Number 59**

**CENTRAL MARINE FISHERIES RESEARCH INSTITUTE  
Indian Council of Agricultural Research  
Dr. Salim Ali Road, Post Bag No. 1603, Tatapuram P.O.  
Ernakulam, Cochin 682 014, India**

*LIMITED DISTRIBUTION*

*Published by* : **Dr. P. S. B. R. James,**  
Director,  
Central Marine Fisheries Research Institute,  
Cochin 682 014.

*Editing and Layout by* : **Dr. K. Rengarajan,**  
Senior Scientist,  
Central Marine Fisheries Research Institute,  
Cochin 682 014

*Front cover* : **Some Indian sea-cucumbers (Photos by Mr. S. Kandan).**

*Back cover* : **Sun-drying of sea-cucumbers.**

PRINTED IN INDIA  
AT PAICO PRINTING PRESS, ERNAKULAM, COCHIN - 682 035

## PREFACE

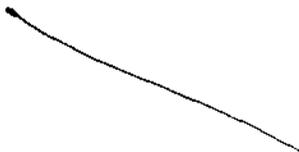
The Central Marine Fisheries Research Institute has been carrying out research on sea-cucumbers for the past 30 years on various aspects such as taxonomy, biology, ecology, zoogeography, toxicology, breeding and seed production in hatchery and culture. Unfortunately upto the present time there is no Hand-book on Indian Sea-cucumbers which is very much wanted by persons who are involved in the collection, processing and export, to identify commercially important species. Particularly when an unfamiliar species is collected they are at a loss to know whether it can be processed, if so what is the processing method. Different species of sea-cucumbers have to be processed in different ways. The local people are ignorant of the correct processing methods for various species.

The present Hand-Book provides keys and good colour photographs to identify commercially important sea-cucumbers in the field itself without resorting to laboratory examination. Some brief descriptions and information are given for each species regarding its characters, habits and distribution in the seas around India. Methods of processing and precautions to be taken during processing to enhance the value of the processed material are listed. For those who are interested to cook and taste *Beche-de-mer* some good recipes are given. At the end, a latest list of *Beche-de-mer* buyers from various countries is given. This will be very useful for our exporters.

I am sure that this Hand-Book will be very useful to all, from sea-cucumber collectors to processors and exporters of *Beche-de-mer*. I highly appreciate the efforts put in to go through the typescripts, suggestions given for improvements and editing of this Hand-book by Dr. K. Rengarajan, Senior Scientist and thank him.

Cochin - 682 014,  
24th January 1994.

Dr. P. S. B. R. James  
Director,  
C. M. F. R. Institute



## CONTENTS

<b>Preface</b>	<b>iii</b>
<b>Introduction</b>	<b>1</b>
<b>Resources and Distribution</b>	<b>3</b>
<b>Fishery</b>	<b>20</b>
<b><i>Beche-de-mer</i> Industry</b>	<b>23</b>
<b><i>Beche-de-mer</i> Recipes</b>	<b>35</b>
<b><i>Beche-de-mer</i> Market</b>	<b>41</b>

## INTRODUCTION

*Beche-de-mer* is a Frenchified Portuguese word for *Bicho-do-mar* simply meaning a sea-cucumber. *Beche-de-mer* is also widely known as *Trepang* which is a Malay word. Although the term *Beche-de-mer* refers to a sea-cucumber in trade parlance it refers to only processed sea-cucumber. It is known under different names in different languages. It is a Chinese delicacy and has become a part of life and tradition of the Chinese people to eat *Beche-de-mer* on festive occasions like the Chinese New Year. Its reputation as an aphrodisiac has undoubtedly enhanced its popularity. It is also credited with curative powers for ailments like high blood pressure and muscular disorders. In some Pacific Islands, fishermen take extracts of sea-cucumbers and put them in rock pools to stupefy fish and catch them. It is procured in dry form, soaked in water, cleaned and cooked in many delicious ways. It is rich in proteins and has low fat content and therefore good for persons having problem of cholesterol.

The processing of sea-cucumbers was introduced to India by the Chinese more than one thousand years back. The Chinese personally supervised the processing and took the material home. Till 1887 Chinese were stationed at Ramanathapuram, a small town in the southeast coast of India, for this purpose. After their departure the processing has fallen to disrepute due to short-cut methods employed to save time and money. The present day processing leaves much to be desired. During the past one thousand years only *Holothuria scabra* was processed along with *H. spinifera* to a minor extent. When the price of *H. scabra* shot-up in the international market in recent years this item was beyond the reach of common man. Therefore importers started looking for cheaper materials. As a result of this demand, *Actinopyga echinites*, *A. miliaris* and *H. atra* were introduced for processing from 1989, 1990 and 1991 onwards respectively from the Gulf of Mannar. In a situation like this the divers, processors and

certifying agencies are caught unawares as to their identity, processing methods and value for different species. Often the processors try to use the same processing methods employed for *H. scabra* due to ignorance, thereby spoiling the end product.

This well illustrated Handbook is brought out to meet the needs of the *Beche-de-mer* industry to identify the commercially important species. A field key and colour photographs are given, which enable one to identify the species in the field without resorting much to scientific investigation.

## RESOURCES AND DISTRIBUTION

Over 650 species of sea-cucumbers are known from various parts of the world. In the seas around India nearly 200 species are known. Of which 75 species are from the shallow waters within 20 metre depth. Of these only 12 species are of commercial value. Sea-cucumbers with large size and thick body wall are suitable for processing. 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* and *Actinopyga mauritiana* have low value.

The accurate identification of sea-cucumbers is done by studying the microscopic calcareous spicules which are embedded in the skin. This can be done only with the help of a microscope. Therefore a field key is given here both for the genera and species taking into account the important and conspicuous external characters and colour in living condition into consideration. Here keys are given only to cover all the 12 commercially important species from the seas around India.

### FIELD KEY TO THE COMMERCIALLY IMPORTANT GENERA OF HOLOTHURIANS

1. Anal opening surrounded by five teeth-like structure  
..... *Actinopyga*
- 1'. Anal opening not surrounded by teeth-like structure ...2
2. Anal opening surrounded by five groups of papillae ....  
..... *Bohadschia*
- 2'. Anal opening not surrounded by five groups of papillae  
.....3

- 3. Body more or less quadrangular with distinct papillae....  
..... *Stichopus*
- 3'. Body not quadrangular, but tubular, sometimes loaf-shaped  
..... 4
- 4. Body massive upto 800 mm length, dorsal papillae resem-  
bling leaf-like strucutre ..... *Thelenota*
- 4'. Body moderate in length upto 600 mm; papillae not expan-  
ded into leaf-like structures ..... *Holothuria*

**Genus *Actinopyga* Bronn, 1861**

Species belonging to this genus are either of medium value or low value. Two species are extensively processed from India since 1989.

**FIELD KEY TO THE SPECIES OF *ACTINOPYGA***

- 1. Colour completely black ..... *A. miliaris*
- 1'. Colour brown or brown and white ..... 2
- 2. Colour brown on upper side and white on lower side; often  
found near low water mark ..... *A. mauritiana*
- 2'. Colour completely brown with often sand deposits on upper  
side of body; mostly found in deeper waters ... *A. echinutes*

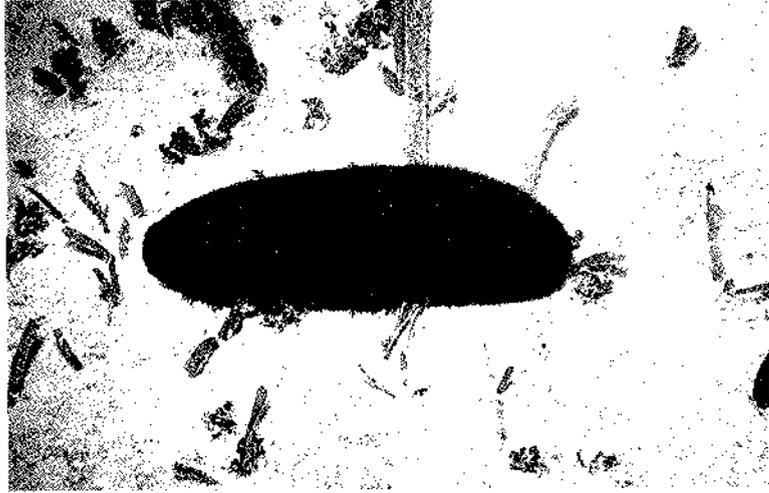
***Actinopyga miliaris* (Quoy & Gaimard) (Pl. I)**

*Common name* : Blackfish.

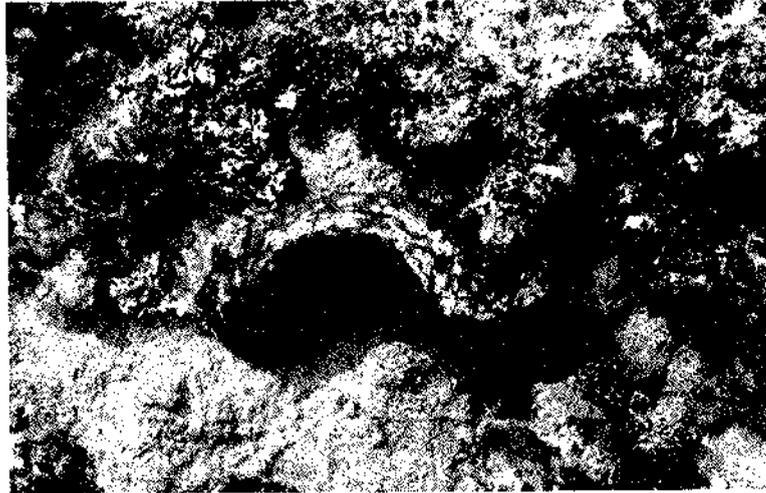
*Local name* : Pal Attai (in Tamil).

*Diagnostic characters and descriptions*

Black in colour. Length of the specimens ranged from 120 to 300 mm and the weight varied from 0.5 to 2 kg. Massive cylindrical forms with rough surface. Anal teeth very distinct.



I. *Actinopyga miltaris* (Quoy & Gaimard).



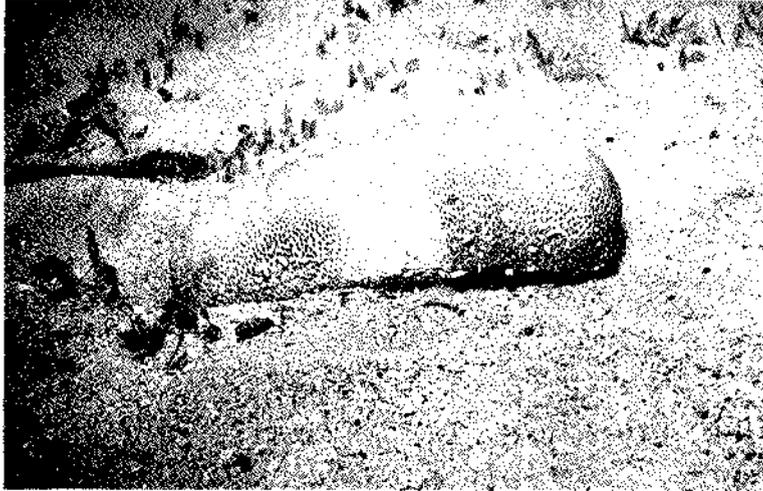
II. *Actinopyga mauritiana* (Quoy & Gaimard).



III. *Actinopyga echinites* (Jaeger) (Courtesy : Mr. K. Sachithanathan).



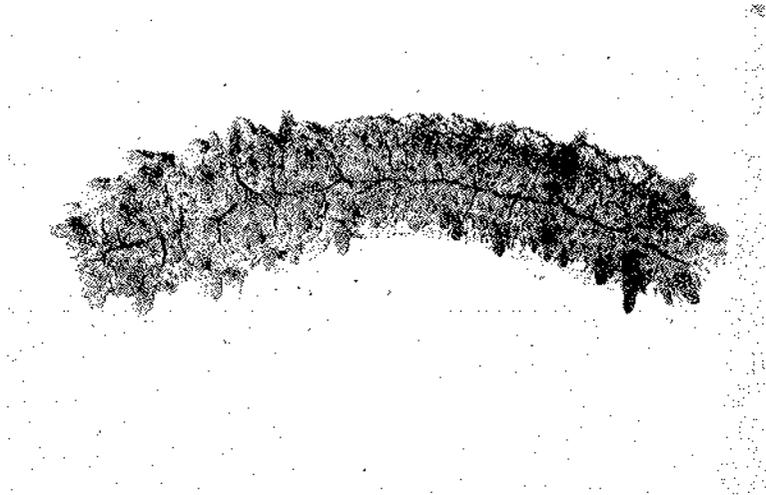
IV. *Bohadschia argus* Jaeger (Courtesy : Mr. K. Sachithanathan).



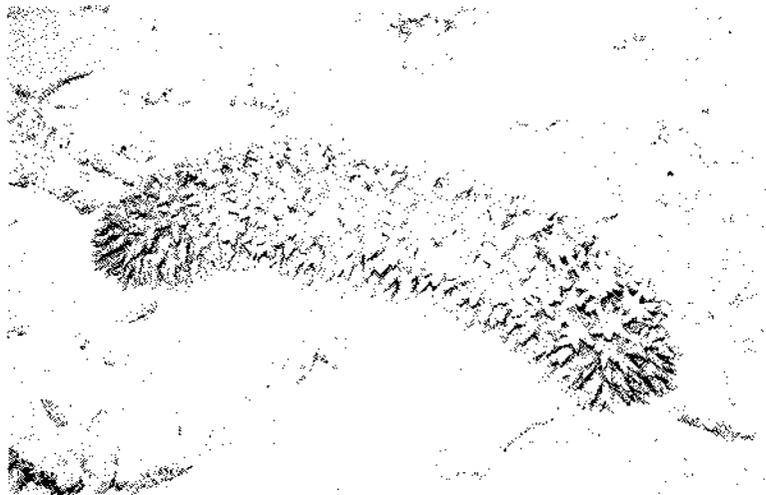
V. *Bohadschia marmorata* (Jaeger) (Courtesy : Mr. K. Sachithanathan).



VI. *Sichopus chloronotus* Brandt.



VII. *Stichopus variegatus* Semper.



VIII. *Thelenota ananus* (Jaeger) (Courtesy : Mr. K. Sachithanathan).

*Habitat* : Found mainly in waters less than 10 m depth on pure sand. They also live on the reef flats among live corals and on algal beds.

*Remarks* : This species is processed from 1991 and collected along off Tuticorin at a depth of 2 - 5 m. During 1991, 50 tonnes and during 1992, 22.5 tonnes were processed. The fishery for this species starts in January and extends upto May. During the peak season 100 - 150 sail boats are engaged in fishing this species. On an average in each boat six persons go for diving.

*Value* : Locally each fresh specimen is sold for at 5.00 and one kg of processed material costs Rs. 135.00. Roughly 20 processed specimens weigh one kilogram costing U.S. \$ 7.5.

*Distribution* : Gulf of Mannar, Andaman & Nicobar Islands and also the Lakshadweep Islands.

*Actinopyga mauritiana* (Quoy and Gaimard) (Pl. II)

*Common name* : Surf Red-fish.

*Suggested local name* : Vella Vairu Pal Attai (in Tamil). Refers to white underside.

*Diagnostic characters and descriptions*

The shape is cylindrical with a flat underside; length upto 300 mm and live weight varies from 0.5 to 1.0 kg. Colour in living condition is brick red above and white below. The tubefeet are firmly attached to rocks to prevent the animal from being washed away by the waves.

*Habitat* : Usually found where the surf breaks on the outside of the reef.

*Remarks* : There is no exploitation of this species from India now.

*Value* : One kg of processed material costs U.S. \$ 6.50.

*Distribution* : Andaman & Nicobar Islands, the Lakshadweep and the Gulf of Mannar.

**Actinopyga echinites (Jaeger) (Pl. III)**

*Common name* : Deep water Red-fish.

*Local name* : Paar Attai (in Tamil). Refers to its habit in *Paars*.

*Diagnostic characters and descriptions*

It grows to a large size of 300 mm and the live weight varies from 0.5 to 2 kg. Colour in the living condition is uniform brown. The body is wider in the middle and tapers and both the ends. The dorsal surface is wrinkled with fine sand settling over it.

*Habitat* : The fishing grounds are mostly off the chain of Islands in the Gulf of Mannar. The grounds are located between the islands and mainland at a depth of 3 - 7 m.

*Remarks* : At present beyond 7 m depth diving is not carried out since visibility is poor. The resource however seems to be good beyond 7 m depth. Sometimes they are found distributed in the intertidal region also as seen in the Andaman and Nicobar Islands and the Lakshadweep. 16.5, 4.5 and 0.8 tonnes were collected by diving during 1990, 1991 and 1992 respectively.

*Value* : It is a medium valued species and one kg of processed material costs only U.S. \$ 4.00.

*Distribution* : Gulf of Mannar, Andaman & Nicobar Islands and Lakshadweep.

**Genus *Bohadschia* Jaeger, 1833**

Massive forms with distinct anal papillae, often buried or covered with a fine coat of mud. Because of the Cuvierian tubules (sticky threads) processing is difficult. Species belonging to this genus have moderate commercial value.

**FIELD KEY TO THE SPECIES OF *BOHADSCHIA***

1. Colour black or brown with distinct 'eye' like spots all over the body ..... *B. argus*
- 1'. Colour variable, usually light brown with black spots.....  
.....*B. marmorata*

***Bohadschia argus* Jaeger (Pl. IV)**

*Common name* : Leopardfish or Tigerfish.

*Suggested local name* : Kannu Attai (in Tamil). Refers to eye-like spots all over the body.

*Diagnostic characters and descriptions*

Colour in living condition is brown or black. Body is cylindrical with very smooth surface. At the slightest disturbance the sticky threads are thrown out. It grows to a large size of 600 mm in length. Live weight is 1-2 kg. Distinct eye-like spots are found all over the body which are encircled with light yellow, white grey colours. In the Lakshadweep however, the specimens are black in colour. The eye-spots are seen in a particular angle.

*Habitat* : Occurs on coarse sand in 2-6 m depth. A few pieces of shell and coarse sand usually sticks to body.

*Remarks* : This species is abundant in Lakshadweep and not processed in India.

*Value* : It is a low valued species. One kg of processed material costs U.S. \$ 4.50.

*Distribution* : At present only from the Lakshadweep area.

***Bohadschia marmorata* (Jaeger) (Pl. V)**

*Common name* : Chalkyfish.

*Local name* : Nool Attai (in Tamil). Refers to thread-like tubules.

*Diagnostic characters and descriptions*

Colour highly variable. Colour golden brown with small brown dots. Sometimes the colour is yellowish brown with black spots. Body short and thick with the lower surface slightly flattened. It grows to a large size of 400 mm.

*Habitat* : Occurs on coarse coral sand at depths 2-6 m. It is also seen in the intertidal region covered by a coating of fine mud.

*Value* : It is a low valued species. One kg of processed material costs U.S. \$ 2.50 - 4.00.

*Distribution* : Gulf of Mannar, Andaman & Nicobar Islands and Lakshadweep.

**Genus *Stichopus* Brandt, 1835**

Some of the species belonging to this genus reach a massive length of 900 mm. Body will disintegrate and becomes gelatinous when taken out of water. Needs special treatment for processing.

**FIELD KEY TO THE SPECIES OF *STICHOPUS***

1. Body quadrangular with four rows of large finger-like processes. Colour dark green, appearing almost black in some shades of light ..... *S. chloronotus*
- 1'. Body massive and loaf-like with irregular brown patches on yellow grey background ..... *S. variegatus*

***Stichopus chloronotus* Brandt (Pl. VI)**

*Common name* : Greenfish.

*Suggested local name* : Pachha Mul Attai (in Tamil). Refers to green tubercles on the body.

*Diagnostic characters and descriptions*

Green in colour and quadrangular body. The tips of the finger-like processes are orange in colour. The tentacles and tubefeet are ash-coloured and the stalks of tentacles are white. It reaches a length of 300 mm.

*Habitat* : Usually found only beyond low water mark. Occurs in large numbers in the lagoons of some islands like Kiltan and Chetlat in Lakshadweep. It does not have the tendency to conceal its body.

*Value* : This species has medium value. One kg of processed material costs U.S. \$ 9.00. This species was once considered as non-commercial species.

*Distribution* : Lakshadweep and Andaman & Nicobar Islands. Once this species was abundant in the Palk Bay, but in recent years it has not been collected from the Palk Bay.

***Stichopus variegatus* Semper (Pl. VII)**

*Common name* : Curryfish.

*Local name* : Mul Attai (in Tamil) refers to 'spine-like' projections especially in young forms.

*Diagnostic characters and descriptions*

In the living condition dark yellow with irregular brown patches and pink tubefeet. It grows upto 900 mm.

*Habitat* : Occurs on algal beds and clean sand bottoms between depths 3-30 m. Massive forms occur in deeper waters in Andamans.

*Value* : One kg of processed material costs U.S. \$ 6-7.

*Distribution* : Lakshadweep, Gulf of Mannar and Palk Bay and Andaman & Nicobar Islands.

**Genus *Thelenota* Brandt, 1833**

Very massive forms with numerous large pointed teats in groups of two or three all over the upper surface. Yields high quality *Beche-de-mer*. Only one species is recorded from the seas around India.

***Thelenota ananas* (Jaeger) (Pl. VIII)**

*Common name* : Prickly Redfish.

*Suggested local name* : Segappu Mul Attai (in Tamil). Refers to red projections on the body.

*Diagnostic characters and descriptions*

Colour in live condition reddish-orange on the upper side. Tube-feet on the lower side bright orange. However the specimens from the Lakshadweep were brown on the upper side and bright orange on the lower side. This species grows to a massive size of 700 mm in length, live weight varies from 3 to 6 kg.

*Habitat* : On clean sandy bottom at a depth of 2-30 m rarely found in lagoons of Lakshadweep. Feeds exclusively on calcareous alga *Halmeda* sp.

*Value* : It yields high value *Beche-de-mer*. One kg of processed material costs U.S. \$ 11.50.

*Distribution*: Only from Lakshadweep.

**Genus *Holothuria* Linnaeus, 1764**

This is by far the most important genus for processing. Over one hundred species are known under this genus.

**KEY TO THE SPECIES OF *HOLOTHURIA***

1. Body like a loaf with very thick body wall. In the living condition about six pairs of lateral teat-like projections are seen; body with black and white patches .....  
..... *Holothuria nobilis*

- 1'. Body tubular, body wall not very thick. No lateral projections in the living condition ..... 2
2. Body completely black in colour; red colour comes off when live specimens are handled..... *Holothuria atra*
- 2'. Colour not completely black and no red colour comes off when live specimens are handled..... 3
3. Yellow transverse bands on the upper side of the body, lower side white with a number of black dots .....  
..... *Holothuria scabra*
- 3'. Body uniformly brown in colour; small stiff projections all over the body; highly burrowing form .. *H. spinifera*

***Holothuria nobilis* Selenka (Pl. IX)**

*Common name* : Teatfish or Mammyfish.

*Suggested local name* : Rotti Attai (in Tamil). Refers to loaf-like shape.

*Diagnostic characters and descriptions*

Body loaf shaped with teat-like projections when seen in water, massive, body wall thick, colour white with black blotches. It grows to a large size of 400 mm, live weight varies from 2-3 kg. Body wall is very thick from 10-15 mm.

*Habitat* : White form is most abundant on clean sand near turtle grass. Black form is found in shallow water of about 1-3 m on clean sand where there is live coral. Black forms occur in the lagoons of Lakshadweep with fine coating of sand.

*Value* : This is one of the valuable species. Each kg of processed material costs U.S. \$ 6.00-14.00 depending on the colour.

*Remarks* : It is abundant in some of the Islands of Lakshadweep. So far this species has not been recorded from the Gulf of Mannar and

Palk Bay. This is one of the most valuable species for processing. It occurs in two colour forms. The white one which is more valuable and is sometimes referred to as *H. fuscogilva*. The black variety is abundant in some of the Islands of Lakshadweep which can be exploited profitably.

*Distribution* : Andaman & Nicobars Islands and Lakshadweep.

***Holothuria atra* Jaeger (Pl. X)**

*Common name* : Lollyfish.

*Local name* : Kuchii Attai (in Tamil). Refers to stick-like shape on processing hence the name.

*Diagnostic characters and descriptions*

Specimens uniformly black in colour reach a length of 600 mm. When live specimens are handled a red fluid stains the hand. This red fluid is a toxin known as *holothurin*. Sometimes this species is found covered by a fine coating of sand.

*Habitat* : Occurs on the dead coral reef flats with sandy or muddy patches. It prefers areas where calcareous alga *Halmeda* sp. is abundant as it feeds on it. It usually occurs in 1-5 m depth. In some areas 10-15 specimens are found in 25 sq.m area. On the reef flat the length range is 200-300 mm and on the outer edge of the reef specimens reach 600 mm in length.

*Remarks* : Small quantities were processed in Andamans in 1976 for the first time. In the Gulf of Mannar and Palk Bay this species is processed from 1992. During the year 28 tonnes was processed. This species is induced to spawn on several occasions in the laboratory.

*Value* : As this species has low value, it is not processed all these years. One kg of processed material costs only U.S. \$ 0.80.

*Distribution* : Gulf of Mannar, Palk Bay, the Andaman & Nicobar Islands and Lakshadweep.

***Holothuria scabra* Jaeger (Pl. XI)**

*Common name* : Sandfish.

*Local name* : Vella Attai (in Tamil). Refers to white colour on underside.

*Diagnostic characters and descriptions*

It grows to a length of 400 mm and live weight varies from 0.5 to 1.5 kg, short and stout with blunt ends and prominent wrinkles on the upper side. Upper side is grey in colour with white or yellow horizontal bands. The lower side is white in colour with a number of fine black dots.

*Habitat* : Found in silty sand often near low saline areas and frequently on *Cymodocea* beds. It spends part of the day buried in the sand. It occurs from the intertidal region to 10 m depth. Juveniles are distributed near the shore and as they grow they migrate to deeper waters for breeding.

*Remarks* : This is the most widely used species in the world after *stichopus japonicus*. This is the most extensively processed species and also most expensive species from India today. It was also once processed at Andamans. The processing is slightly complicated due to excessive chalky deposits in the body wall. Seed was produced for the first time in 1988. Hatchery work is going on in this species.

*Value* : It is a high value species. One kg of processed material costs U.S. \$ 14.00-25.00 depending on size. In 1982 Government of India banned material less than 75 mm in length for export as a measure of conservation.

*Distribution* : Gulf of Mannar and Palk Bay and the Andaman & Nicobar Islands. Totally absent in Lakshadweep.

Table 1. *Sea-cucumbers available for processing from the seas around India*

Scientific name	Common name	Local name (in Tamil)	Where available for processing at present	Value in US \$ as on 1-5-'93 @
<i>Holothuria scabra</i>	Sandfish	<i>Vella Attai</i>	Gulf of Mannar, Palk Bay, Andamans	14.00-25.00
<i>Holothuria nobilis</i>	Teatfish/Mammyfish	<i>Rotti Attai*</i>	Lakshadweep*	6.00-14.00
<i>Thelenota ananas</i>	Frickly redfish	<i>Segappu Mul Attai*</i>	Lakshadweep*	11.50
<i>Stichopus chloronotus</i>	Greenfish	<i>Pachha Mul Attai*</i>	Lakshadweep*	9.00
<i>Actinopyga miliaris</i>	Blackfish	<i>Pal Attai</i>	Tuticorin (Gulf of Mannar)	7.50
<i>Stichopus variegatus</i>	Curryfish	<i>Mul Attai</i>	Andamans*	7.00
<i>Actinopyga mauritiana</i>	Surf redfish	<i>Vella Vairu Pal Attai*</i>	Lakshadweep, Andamans*	6.50
<i>Bohadschia argus</i>	Leopard/Tigerfish	<i>Kannu Attai*</i>	Lakshadweep*	4.50
<i>Actinopyga echinites</i>	Deep-water redfish	<i>Paar Attai</i>	Mandapam (Gulf of Mannar)	4.00
<i>Bohadschia marmorata</i>	Chalkfish	<i>Nool Attai</i>	Gulf of Mannar	2.50-4.00
<i>Holothuria spinifera</i>	Brown fish*	<i>Cheena/Raja Attai</i>	Gulf of Mannar, Palk Bay	2.00-4.00
<i>Holothuria atra</i>	Lollyfish	<i>Kuchii Attai</i>	Gulf of Mannar, Palk Bay Andamans* Lakshadweep*	0.80

\* Newly suggested name

+ No processing at present

@ Source : *Beche-de-mer* Information Bulletin No. 5 (Aug '93)

***Holothuria spinifera* Theel (Pl. XII)**

**Local name :** Raja Attai or Cheena Attai (in Tamil). Once this species was highly rated and hence the name Raja attai and the Chinese were after this species and therefore the name Cheena attai.

**Suggested common name :** Brownfish.

***Diagnostic characters and descriptions***

Colour uniformly brown with sharp projections all over the body. The lower side is generally lighter in colour. Sharp projections are found all over the body, hence the specific name *H. spinifera*.

**Habitat :** This species is never encountered in the intertidal region. It is found on clean sand and in slightly deeper waters. It is a highly burrowing form and buries completely into the sand.

**Value :** This species has low market value. One kg of processed material costs U.S. \$ 2.00-4.00.

**Remarks :** This species was once considered for its high quality, but in recent years this species is not preferred by the buyers. Now this species is processed along with *H. scabra* in the Gulf of Mannar and Palk Bay.

**Distribution :** Known only from the Gulf of Mannar and Palk Bay.

# 3

## FISHERY

Till to-day no special gear or net is devised exclusively to catch sea-cucumbers. They are defenceless animals and are easy to catch. They offer no resistance at the time of capture and also they do not try to escape. Often they enter trawl nets and *Thallu madi* as accidental catch. In some centres like Tondi and Ammapatnam the sea-cucumbers at present are collected by *Tallu valai*.

### *Methods of collection*

More than 95% of sea-cucumbers are collected by skin diving in shallow waters of 2-10 m. Four to six divers go in country boats with sails at sun rise and return in the afternoon. Even small boys are engaged in diving operations. The divers take net bags in which live sea-cucumbers are brought to the shore. In recent years the divers are using round aluminium plates for the feet as improvised flippers since rubber flippers are very expensive. Aluminium plates are used since they are light and also they do not rust when used in sea water. These 'flippers' give them greater mobility under water. They can cover greater distance under water with ease and collect more material.

Since sea-cucumbers are bottom dwellers they also enter into the trawlers accidentally as bycatch. With the introduction of trawling in early sixties in the Gulf of Mannar and Palk Bay more sea-cucumbers are collected by trawlers which are used for processing. With more and more introduction of trawlers more and more material is collected. Infact at Mandapam and certain other centres where large number of trawlers are operated, the entire material for processing comes only from the trawlers. Like this sea-cucumbers also enter *Thallu madi* during its operations.

### *Areas of collection*

At present sea-cucumbers are collected from a narrow strip in the Gulf of Mannar and Palk Bay. They are finished in the Gulf of

Mannar area from Pamban to Tuticorin and in the Palk Bay from Rameswaram to Mallipatnam. Along the Gulf of Mannar Chinnapalam, Vedalai, Mandapam, Periapatnam, Kilakkarai and Tuticorin are important centres. Sea-cucumber fishery did not exist in Tuticorin 20 years back, but today there is an organised industry and during the peak season sea-cucumbers worth of Rs. 10,000 to 15,000 are auctioned every day. In the Palk Bay, Rameswaram, Devipatnam,

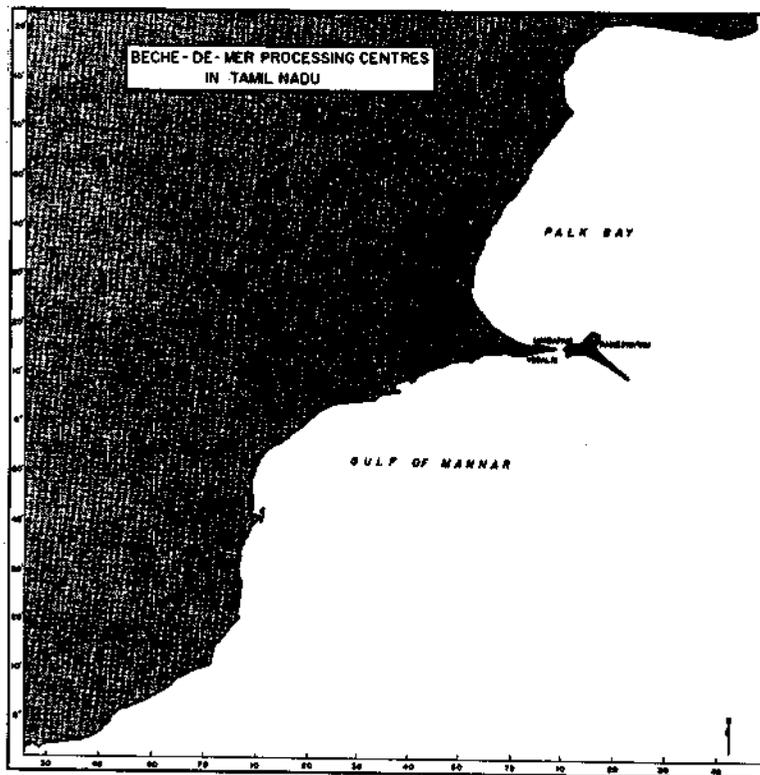


Fig. 1. *Beche-de-mer* processing centres in Tamil Nadu

Tirupalakkudi; Karangadu, Mullumonai, Tondi, Pasipatnam, Padupatnam, Kottaipatnam, Ammapatnam and Kattumavadi are the most important centres (Fig. 1). Tirupalakkudi is the most important centre along the Palk Bay where there is overfishing. *Holothuria*

*scabra* was chiefly collected around Port Blair, in North Andamans and also at Mayabunder and Diglipur. Earlier collections were made even at Landfall Island which is the northernmost of the Andaman Group of Islands. At Lakshadweep holothurians were collected for processing at Kiltan and other islands. Some years back processing took place at Kavaratti and also at Androth, but at present there is no industry. At present there is no processing in Andaman and Nicobar Islands and also at Lakshadweep.

#### *Seasons of collections*

Sea-cucumbers are collected round the year. In the Palk Bay fishing is conducted from March to October, the peak season being April and May and in the Gulf of Mannar fishing is conducted from October to March with peak season in December and January. March and October are transition months to switch over the fishing from Palk Bay to the Gulf of Mannar and *vice versa*. The Palk Bay and Gulf of Mannar become rough during October to March and March to October respectively. When the sea becomes rough due to high velocity winds the waters gets mixed up and become turbid. Due to poor visibility fishing is suspended during rough season. During the monsoon season also the processing is done. The material is dried by smoking, but in the International market sun-dried material is preferred.

## **BECHE-DE-MER INDUSTRY**

The *Beche-de-mer* industry is very ancient in India. The Chinese had constant trade with southern India for more than thousand years. Customs records are available for the export of *Beche-de-mer* from 1898 onwards from the Madras Presidency. In the middle of last century there was good processing in the Lakshadweep and in recent times there is no processing. In Andamans also there was good processing in mid seventies around Port Blair, but at present there is no processing due to the ban imposed by the Andaman and Nicobar Administration.

All countries which produce *Beche-de-mer* do not consume. Some of the countries consume, export and also import, while some countries like India produce *Beche-de-mer* only to export to other countries.

### *Methods of processing*

Different species of sea-cucumbers are processed in different ways. The Chinese when they introduced the processing in India taught the correct method of processing for *Holothuria scabra*. The same method is used for processing *Holothuria spinifera* and *Bohadschia marmorata*.

### *Processing method for Holothuria scabra, H. spinifera and Bohadschia marmorata*

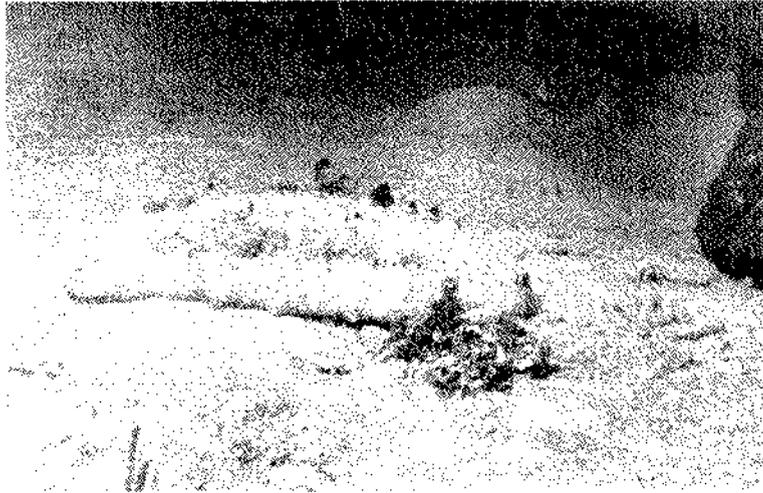
After the sea-cucumbers are brought to the curing site, cleaning them before boiling is essential in clean sea water to remove dried slime, sand and other extraneous particles and left over gut and other entrails. While cleaning, it is desirable to squeeze the animals to remove the water absorbed during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

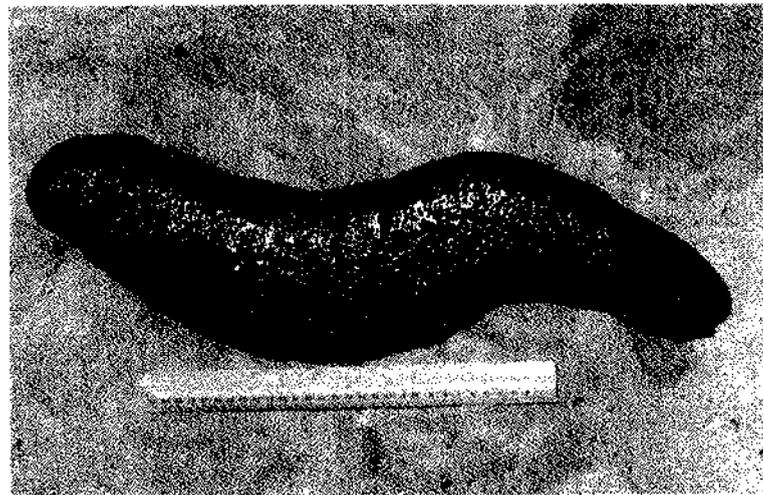
pierce the knife into the body and tear the posterior portion. Immediately the intestine, gonads and the respiratory trees run out of the slit. The cut should be neat so that the end product does not look ugly. Women and small girls also take part in this operation.

*Boiling* : Boiling is an important step in processing the sea-cucumbers since the final product depends on the shape of the vessel used and the stirring to which it was subjected while boiling. It is the usual practice of the fishermen to seal oil drums of 200 l at both ends and cut a rectangular opening in the horizontal position. Sometimes an oil drum is cut into two and the bottom half is used as boiling pan. This may be the best in the given circumstances, but it is not very suitable. The iron drum easily gets rusted on coming in contact with the sea water and the whole operation is very unhygienic. A saucer-shaped pan made out of cast iron is most suitable for boiling. It is 90 cm in diameter and 60 cm in depth. In some places aluminium vessels are used for boiling especially when the material on hand is less. Copper and brass vessels should not be used for boiling. The boiled body juice is exceedingly corrosive to metals. Hence the boilers must be carefully emptied and rinsed out with clean water at the end of each days operation. The fire place is simple in construction using locally available material. The most important point to be considered is concentrating the heat for intensive heating of the pan. On a beach or in a windy place an open fire tends to impart low heat to the pan. This takes more time and more fuel. The pan is rested in a circular wall of clay 90-100 cm high. The fire mouth should face windward side and this facilitates concentration of heat on the pan. Holes are kept at the sides to facilitate the escape of smoke. First two third of the pan is filled with good sea water. Coconut husks are used to start the fire. Coconut shells, mangrove wood and some hard wood gives a good combination to produce uninterrupted and intense fire and heat. The flames should constantly be touching the lower surface of the pan during boiling. Slackness or relaxation by the processor or attendant is detrimental to the quality of the product.

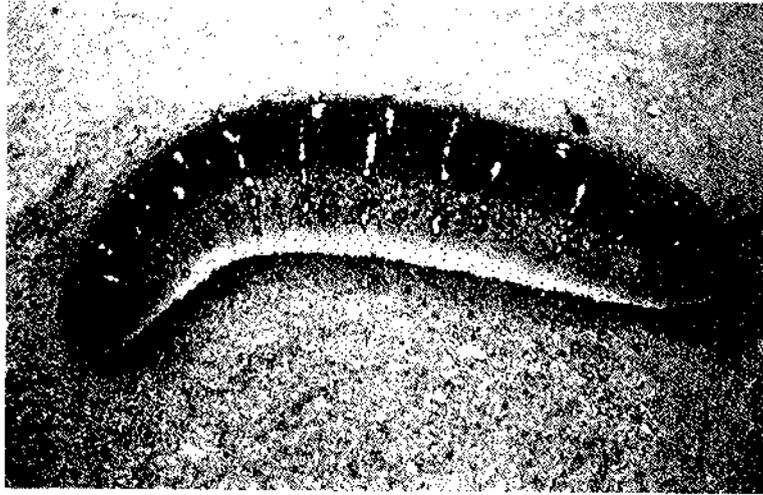
The sea-cucumbers should be introduced one by one. They have to be slid down along the inside wall of the pan. If dropped into



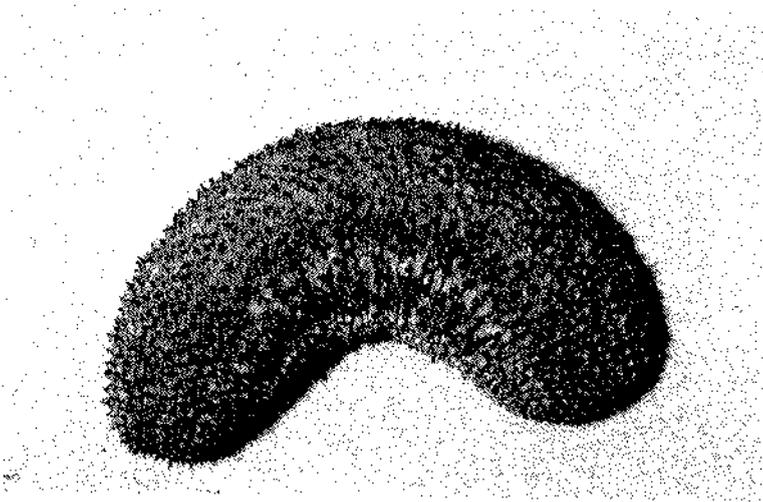
IX. *Holothuria nobilis* (Selenka).



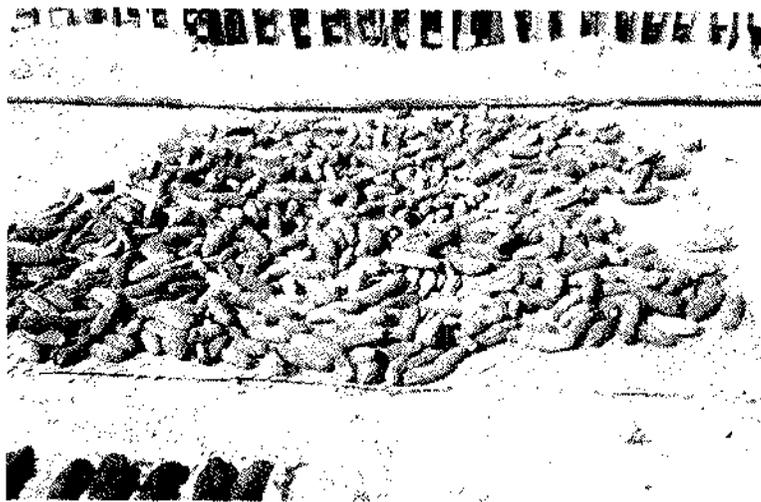
X. *Holothuria atra* Jaeger.



XI. *Holothuria scabra* Jaeger.



XII. *Holothuria spinifera* Theel.



XIII. *Actinopyga echinites* dried on palmirah mats.



XIV. *Actinopyga mollaris* dried on gunny bags.



XV. *Holothuria atra* being degotted.



XVI. *Holothuria atra* dried on palmirah mats.

the pan carelessly hot water splashes out. Sea-cucumbers should not be introduced in bulk since this brings down the temperature of water suddenly. When the height of the water rises to nine tenth of the height of the pan the introduction of the sea-cucumbers is stopped. Spatula ended pole is used as stirrer. Stirring should continue for the next fortyfive minutes at intervals of three minutes during the first twenty minutes and at five minutes intervals during the later period. Usually *Holothuria scabra* takes fortyfive minutes to boil. We can check whether it is properly cooked or not by picking-up a sea-cucumber and dropping it vertically down on a stone. If the piece bounces like a rubber ball, the material is ready for the next stage of processing. If the bouncing is nil or poor the boiling has to be continued for a further period of ten minutes before checking again. A distinct cooked odour is emitted at the end point of boiling. A pole with ring net is used for removing the sea-cucumbers from boiling pan. The material removed from the pan is allowed to cool on the sand. Some more clean sea water is added to the pan to make up for what had been lost and heat the water again to boil. Then the next batch of sea-cucumbers is introduced. The same water can be used for the next 3-4 batches.

*Burying* : Only in case of *Holothuria scabra*, *H. spinifera* and *Bohadschia marmorata*, burying is carried out after boiling. Cleaning the sea-cucumber after boiling is necessary for the above mentioned species. The outer layer of the skin with thick coating of calcareous particles has to be removed to make the product acceptable to the market. 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 pit is 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. Proper care is necessary to select the site of burial. Most of the beaches near the villages are polluted with faecal matter. Some areas are not suitable for burying. Clean sandy beaches where little human activity, are the best sites for burying the sea-cucumbers. The cooled sea-cucumbers are arranged in a single layer and packed densely and covered with jute-hessain sac. Water is sprinkled over the sac and the pit is closed with sand and the area is marked.

*Cleaning* : After 15-18 hours the sea-cucumbers are removed from the pit and put into palm-leaf baskets. The sea-cucumbers by now would have a decomposed outer layer. When handled pasty material comes off. In the usual practice sea-cucumbers which are boiled in the evening are removed from the pit next morning. The sea-cucumbers are filled to the half of the baskets and are carried to the sea. The mouth of the basket is covered and they are put in knee deep water. It is then trampled with feet when one person pours water. 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 transferred 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.

*Smoking* : Smoking is restored to during the rainy reason and also when the sun light is not enough. Smoking also serves as sterilizing agent. There is a portable dryer known as Jaffna dryer. It is made up of drying trays kept in racks inside a drying house. Hot air and smoke comes out from on opening of a 44 gallon drum in which the fire is lit. The drum is placed horizontally under the trays. Mangrove wood or ordinary fire wood is used. The drying trays have wooden frames with wire mesh. In the portable unit three separate sections are assembled as one unit. The lower portion holds the hearth, the middle portion holds the trays and the top portion forms the roof. Asbestos or flat galvanised sheets are used with wooden frames for support. The trays slide into the middle section and the drum containing the hearth is placed beneath them. Standard copra dryers are also frequently used. Solar dryers are another alternatives.

*Processing method for Holothuria nobilis (Teat-fish)*

The Teat-fish is first squeezed assuming that the internal organs have been eviscerated while storing in fish boxes. They are introduced one by one slowly into boiling sea water. Relatively fewer number should be handled at a time to give individual care during boiling. It tends to float as it seals water and air inside. The body wall break if it is not properly attended. Specimens are taken out and punctured at the mid-dorsal region and put back into the boiling pan for the completion of the cooking process. The sea-cucumbers should be stirred frequently using a wooden spatula. The teat-fish should be boiled for 30-45 minutes. Since it does not become elastic, the bouncing test is not applicable for this species. They are removed with a long handled ring-net. They are then cooled by placing on raised platform or wooden plank. They are cut open along the mid-dorsal line leaving some portion at the anterior and posterior ends. If there are any left-out visceral portions, they are washed out using lukewarm water. Then the sea-cucumbers are again boiled for another 15-20 minutes. The animals now shrink and the body wall

becomes hard. They are removed after second boiling and cooled. Wooden splinters of 3-5 cm long are placed between the cut edges of the upper wall to expose the interior. This enables to dry quickly since the body wall is very thick. They are then dried on the drying platforms for four to five days depending on the sun light.

*Holothuria nobilis* is one of the most valuable sea-cucumbers for processing. Its importance is next only to *Holothuria scabra*. In some of the islands of Lakshadweep this species occurs in large numbers. However at present there is no processing of this species.

*Processing method for Actinopyga echinites and Actinopyga miliaris*

For these two species burying is not necessary after boiling. After collection, the sea-cucumbers are put in a heap to allow them to eviscerate. Due to over crowding most of the specimens eviscerate. Then the sea-cucumbers are put in sea water and boiled for half an hour. Usually 300 to 500 animals are boiled at a time. After boiling they are removed and put as a heap on the shore and covered by polythene sheet. Next day morning they are first cleaned and if there are pieces of intestine sticking to them, they are removed. Then the material is dried for 4 or 5 days depending on the size of the specimens (Pl. XIII and XIV). *Actinopyga echinites* is processed from 1990 and *A. miliaris* is processed from 1991 from the Gulf of Mannar.

*Processing method for Holothuria atra*

No burying is involved for this species after boiling. The specimens are brought to the shore and put in a heap. Normally this species does not eviscerate due to over crowding. Slits are made at both the ends since this species grows to a length of 600 mm. Then the specimens are squeezed at both the ends to remove the internal organs (Pl. XV) and cleaned in clean sea water. The specimens are boiled in sea water for half an hour. They are removed and stored in a heap in the evening covering by polythene sheet. Next day internal organs sticking to them are removed, again boiled for ten minutes and dried. Since the body wall is thin it becomes like a stick on drying. In three or four days the material can be completely dried (Pl. XVI).

A list of indicative grades and values has been given in South Pacific Commission *Beche-de-mer* Information Bulletin (No. 5 of August, '93) as on 1-5-'93. From this list, it is seen that *Holothuria scabra*, *Holothuria nobilis* (White variety) and *Thelenota ananas* are the most valuable species for processing.

*Precautions to be taken during processing*

The value of processed material not only depends on the species used, but also on the size, shape, colour, appearance and texture. Therefore the following precautions have to be taken during processing to enhance the quality of the processed material.

1. While cutting the animal for evisceration the cut should be neat.
2. The evisceration should be complete by squeezing the animals.
3. Specimens of the same species and same size should be boiled together.
4. Sea-cucumbers should be introduced into boiling sea water one by one.
5. During boiling the fire should be fierce and intense.
6. During boiling the material should be properly stirred. The more the material rolls during boiling, the more cylindrical shape it gets. The value is more for perfectly cylindrical forms.
7. In the case of *Holothuria scabra* the white chalk-like material should be completely removed.
8. *Holothuria scabra* should not be buried for too long period, since the bacteria in the sand eats away the flesh.
9. Species like *Bohadschia marmorata* and *B. argus* which have profuse sticky threads should be eviscerated at sea itself.
10. Rusty oil drums should not be used for boiling. It is best to use saucer-shaped cast iron pan which allows the material to roll during stirring. Aluminium vessels can also be used if the material on hand is less.

11. Processed material should be dried on raised platforms and also on palmyrah mats or gunny bags. The material should never be dried on the beach.
12. During the rainy season and also when the sun is not bright, the material should be smoked.

**BECHE-DE-MER RECIPES\***

*Beche-de-mer* is the processed and dried form of sea-cucumber, cooked in many delicious ways. It is a delicacy for the Chinese and forms a regular part of their diet. High quality *beche-de-mer* is expensive. One kilogram of quality *beche-de-mer* costs US \$ 25.00. It is rich in protein and low in fat content. Some of the delicious preparations from *beche-de-mer* are presented below.

**SEA-CUCUMBER AND FISH SOUP***Ingredients*

1 Sea-cucumber, 1 oz Yellow fish, 1 Bamboo Shoot, 1 TBSP Chopped Ham, 6 spring onion sections, 4 slice ginger, 1 TBSP Chopped coriander, 1½ TSP Salt, 1 TSP wine, 1 egg white, a little pepper, 1 TBSP corn-starch, 2½ TSP salt, a dash of MSG, 4 cups stock.

*Method*

1. Blanch sea-cucumber in water and add spring onion ginger and wine. Remove and rinse in cold water. Cut into small pieces. Boil bamboo shoot and cut into small pieces.

2. Remove head of yellow fish. Slit open from the back. Remove centre bone and fin. Trim fish meat and cut into cubes. Marinate in (1) for ten minutes.

3. Fry spring onion section, ginger in 2 TBSP oil till fragrant. Add stock. Remove spring onion, ginger. Add bamboo shoot, sea-cucumber and (2). Bring to boil before add in fish. Thicken with corn-starch mixture before scoop on bowl. Sprinkle with chopped ham and coriander.

---

\* The authors are thankful to Miss. Devakie Nair of Fisheries Research Institute, Malaysia and to Mr. N. G. Henry of Prince Departmental Centre, Singapore for providing the recipes presented here.

### BRAISED SEA-CUCUMBER AND SHRIMP ROE

#### *Ingredients*

2 lbs sea-cucumber, 3 spring onion, 4 slices ginger, one TBSP shrimp roe. (1) 3 TBSP Soy sauce, one TSP sugar, 1 TBSP. Ginger water, a dash of MSG, a dash of sesame oil, 1 TBSP corn-starch.

#### *Method*

1. Slice sea-cucumber diagonally. Add one spring onion, 2 slices ginger, 1 TSP wine together with half a pot of water. Bring to boil. Blanch sea-cucumber to remove the unpleasant smell. Rinse in cold water. Drain and leave aside.

2. Heat 2 TBSP oil. Add in spring onion section and ginger. Stir fry for a while. Add sea-cucumber. Fry well. Lastly add (1) and shrimp roe. Stir well and remove.

### BRAISED CHICKEN WING WITH SEA-CUCUMBER

#### *Ingredients*

1 lb sea-cucumber, 12 pieces centre part of chicken wing, 1 small piece ginger, 3 spring onion, 1 TSP wine, 1 TBSP soy sauce. (1) 2 TBSP Soy sauce, 1 TSP sugar, 1 TSP wine 1/4 TSP pepper, 2 TBSP water, a little MSG and sesame oil, 1 TSP Corn starch.

#### *Method*

1. Marinate chicken wing in soy sauce for a while. Drain and deep fry till golden. Remove and arrange in bowl. Add 1 TSP wine, section of spring onion and ginger. Steam for 20 mts till chicken wing is cooked. Overturn on plate.

2. Make spring onion, ginger and water to boil. Blanch sea-cucumber to remove unpleasant smell rinse and leave aside.

3. Heat 2 TBSP oil. Add in sea-cucumber, spring onion and ginger. Fry well before add in (1). Pour over chicken wing to thicken.

### SEA-CUCUMBER WITH PORK/CHICKEN

#### *Ingredients*

1<sup>3</sup>/<sub>4</sub> lb wet sea-cucumber, 2 scallion (spring onion), 4 slices ginger, 2 cloves garlic, 3 oz snow peas ¼ carrot, 4 oz broiled pork/chicken, 1 TBSP sherry, 1 TSP salt ½ TSP MSG, 1 TSP Sugar, 2 TSP sesame oil, 1 TBSP Soya sauce, 1/8 TSP black pepper.

#### *Method*

1. Stir-fry scallion, ginger and garlic in 1 TBSP oil and 1 TBSP sherry. Then add in 3 cups water to boil. Blanch sea-cucumber for 3 minutes to remove its strong smell. Drain off liquid.

2. Stir-fry scallion, ginger and garlic in 2 TBSP oil. Add sea-cucumber, broiled pork/chicken.

3. Add in carrot and snow peas, then add in sauce.

4. Put in 1 TBSP corn-starch paste for thickening.

### ASSORTED MEAT IN BROWN SAUCE

#### *Ingredients*

60 g pig's liver, ½ pig's kidney, 60 g lean pork, 60 g ham, 60 g chicken meat, 1 abalone, 1 sea-cucumber, 1 squid, 1 scallop, 2 mushrooms ½ bamboo shoot, 3 spring onion, 2 slice ginger and 3 cups stock.

#### *Seasonings*

1¼ TSP salt, 1 TSP sugar, 1 TBSP dark soy, 1 TBSP wine, pinch of pepper ½ TSP sesame oil, 3 TBS corn-starch with water.

#### *Method*

1. Slice liver, kidney, squid, marinate with 1 TSP wine, 1 TSP ginger juice and 1 TSP corn-starch for 20 mts.

2. Slice pork, marinate with sugar, light soy and corn-starch.

3. Slice chicken, marinate with ½ TSP wine, ½ TSP ginger juice, ½ egg white and a little corn-starch, for a while.

4. Boil sea-cucumber adding ginger, spring onion and wine, continue to cook for a moment.

5. Steam scallop after soaking. Slice and steam mushrooms.

6. Slice bamboo shoot, ham and abalone. Chop ginger and spring onion for further use.

7. Prepare a pan of water and bring to boil. Add in raw ingredients to simmer for a while. Drain.

8. Heat the pan until hot, add 1 TBSP oil, add chopped ginger and spring onion. Sprinkle with wine then add in stock and bring to boil. Pour in all the ingredients to simmer. Add seasoning and stir in corn-starch solution to thicken. Serve hot.

### **BRAISED MIXED VEGETABLES WITH SEA-CUCUMBER**

#### *Ingredients*

1 roll Japanese bean-curd, 3 TBSP oil, 10 pieces young mushrooms, 20 pieces straw mushrooms, 2 pieces sea-cucumber, 2 TBSP Chinese rice wine, 2 TBSP oyster sauce, 2 TBSP light soya sauce, ¼ litre chicken stock, 30 pieces snow peas, 2 TBSP corn-flour, 0.5 litre water, 2 tomatoes, 100 g carrots, quartered, 100 g cauliflower, cut into small portions.

#### *Method*

Slice Japanese bean-curd into 8 pieces and deep fry until golden brown and set aside. Heat oil in clay pot and add all vegetables, rice wine, oyster sauce, light soya sauce, chicken stock and sea-cucumber. Boil sea-cucumber with small piece of ginger before introducing into the clay pot (just to remove the smell). Add tomatoes and snow peas. Add corn-flour (mixed with water) to chicken gravy. Cover pot and simmer immediately.

### **HOT AND SOUR SOUP (REGIONAL DISH-PEIPING)**

#### *Ingredients*

3 pieces sea-cucumber, 1 square been-curd, 1 oz Szechuan cabbage, 2 oz pork, ¼ Bamboo shoot, 1 scallion, 1 small piece ginger, 1 egg, 1½ TSP MSG, 2 TSP salt, 2 TBSP white vinegar, 1½ black pepper, 1 TBSP soy sauce, 2 springs parsley, 6 cups soup stock, 2 TBSP corn-starch, 1 TSP sesame oil, 5 TBSP water.

#### *Directions*

1. Shred sea-cucumber, bean-curd, Szechuan cabbage, pork, bamboo shoot, Scallion and ginger separately.
2. Beat egg as egg mixture.
3. Combined seasonings : Mix 1½ TSP Salt, 2 TBSP vinegar, 1½ TSP black pepper and 1 TBSP soy sauce in the bowl, stir evenly.
4. Cut Parsley.

#### *Method*

1. Boil sea-cucumber soup stock and combined seasonings and all kinds of shreds to soup, then boil again.
2. Mix 1 TBSP corn-starch with 5 TBSP water add to soup while stirring evenly.
3. Add egg mixture to soup, stir slowly then remove, sprinkle with parsley and one TBSP sesame oil and serve.

### **SEA-CUCUMBER WITH PORK (REGIONAL DISH-CANTON)**

#### *Ingredients*

1¼ lb wet sea-cucumber, 2 scallions, 3 slice ginger, 2 garlic cloves, 3 oz broiled pork, ¼ carrot, 1¼ TBSP sherry (wine), 1 TSP salt, ½ TSP MSG, ½ TSP sugar, ⅛ black pepper, 1 TSP sesame oil, 1 TBSP soy sauce, 1 TBSP hot soy bean paste, 3 oz snow peas, 1 TBSP corn-starch, 5 TBSP oil, 4 cups water.

*Directions*

1. Cut sea-cucumber length-wise into long strips (about 2½ long to give the appearance of quantity).
2. Slice scallion, ginger and garlic.
3. Slice broiled pork.
4. Boil carrot and slice.

*Methods*

1. Stir-fry scallion, ginger and garlic in 1 TBSP oil, add one TBSP sherry and 3 cups water to boil, blanch sea-cucumber for 3 mts to remove its strong smell, drain-off liquid.

2. Stir-fry scallion, ginger and garlic in 2 TBSP boiling oil, add sea-cucumber, broiled pork ½ TBSP sherry, 1 cup water, 1 TSP salt, ½ TSP MSG, ½ TSP sugar, 1/8 TSP black pepper, 1 TSP sesame oil, 1 TBSP soy sauce and 1 TBSP hot soy bean paste to the pan and cover it, bring to boil. Add carrot and snow peas, then add 1 TBSP corn-starch paste to thicken sauce and 2 TBSP oil, serve.

**BECHE-DE-MER MARKET**

Hong Kong is the world's largest market for *Beche-de-mer* followed by Singapore and other countries. From India *Beche-de-mer* is mainly exported to Singapore. From there it is re-exported to Hong Kong and other countries. The list of buyers given below is the latest (*Beche-de-mer* Information Bulletin, 5, Aug. '93). This list has to be up-dated from time to time since new companies enter into business and some old ones cease to be in *Beche-de-mer* business. Full addresses from eight countries with Telephone, Telex and FAX numbers are given to facilitate immediate contact. However this list is by no means exhaustive.

**MALAYSIA** (Malaysia imports most of its *beche-de-mer* from Singapore and does not generally deal directly with producing countries)

**WENG YEANG CO SDN BHD**

PO Box 554 - 57 Leboh Pantai - 10770 Penang  
Malaysia  
Tel : 0463811; Fax : 60-4-635954; Telex : MA 40688

**HAI LEE SEA FOOD (M) TRADING COMPANY**

No. 6B Jalan Cahaya 15  
Taman Cahaya 6800 Ampang-Selangor Darul Ehsan  
Malaysia  
Tel : 9849477, 9846268; Fax : 03-2210055

**EVERGREEN FRUITS & VEGETABLE CO**

2.02, 2nd Floor, Wisma Stephens  
Jalan Raja Chulan - 50200 Kuala Lumpur, Malaysia  
Tel : 2412267, 2412269; Telex : 31457 DYN AV NA

**SINGAPORE**

**SARIANO CO**

40 Wilkinson Road, Singapore  
Telex : RS 25283

**SEAKING TRADING CO**

45A Jalan Membina, Singapore  
Tel : 271 7230

**ENG THONG (PTE) LTD**

74 South Bridge Road, Singapore 0316  
Tel : 222 0701

**YONG THAI TRADING CO**

65 Telok Ayer Street, Singapore 0104  
Tel : 222 7192

**CHOON HONG MARINE PRODUCTS**

51 North Canal Road, Singapore 1  
Tel : 434073

**A. M. ABDULLAH SAHIB & CO**

Maxwell Post Office No. 19, Singapore 9000  
Telex : Rs 29847 AMAH

**ASIA SEAFOOD COMPANY**

353-A Circuit Road, Block 64, Singapore 1337  
Tel : 7384077; Telex : RS 24200 TMSR

**WEISOON MARKETING PTE LIMITED**

Block 1057, Eunos Ave 3, #04-69  
Singapore 1440  
Tel : 7457432, 7473902; Telex : RS 38103 WECO

**HIAP HENG CHNG (S) PTE LTD**

5-6 North Canal Road, Singapore 0104  
Tel : 5351888; Fax : 5357283  
Telex : RS 25106 FIBEACH

**HAI LEE SEA FOOD TRADING COMPANY**

Block 25, Defu Lane 10 - No. 01-208  
Singapore 1963  
Tel : 2805489; Fax : 2808711  
Telex : RS 50791 HLSFTC

**HIAN FISHERIES SERVICES**

31 Waringin Walk  
Singapore 1441  
Fax : 4485857; Telex : RS 24200 TMSR TM 5809

**KWANG YEO HENG**

30 Hong Kong Street  
Singapore 0105  
Tel : 65 5338830; Fax : 65 5324141  
Telex : RS 24200 TMSR TM 2138

**YONG HONG**

16 North Canal Street  
Singapore 1

**DANIEL OEI ENTERPRISES**

G80 Katong Shopping Centre, East Coast Road  
Singapore 15

**NG ENG WHAT**

14 New Bridge Road  
Singapore 1

**PHOON HUAT & CO. (PTE) LTD**

GPO Box 2414, 171 Bencoolen Street  
Singapore 7

**TAIWAN** (Most of its *beche-de-mer* imports are from Hong Kong  
and Singapore)

**TRANSWORLD ENTERPRISES CO**

4A, No. 1 Alley 6, Lane 303  
Nanking East Road, Section 3  
Taipei, Taiwan  
Cable : TWENTER

**OCEAN BAY FISHERIES**

10-1 Floor, No. 127 Sec. 2  
Yen Ping N. Rd, Taipei  
Taiwan

**INDIA**

**SUNKAMAL INTERNATIONAL**

1st Floor, 70 Moore Street  
Madras 600 001  
India

Tel : 519577, 520108; Fax : (44) 517-966, 517-466  
Telex : 41 6937 PCO A IN

**USA**

**THE INTERSOURCE COMPANY**

18600 Ala Moana Blvd 405  
Honolulu  
Hawaii 96815

**WENIX INTERNATIONAL CORP.**

Suite 641 - 800 S. Figueroa Street  
Los Angeles - CA 90017  
USA

**TEDDY S. LLANA**

PO Box 233 - Majuro  
Marshal Islands 96960

**HONG KONG**

**NAM KWONG N CO**

PO Box 3042, 8th Floor  
186-188 Des Voeux Road West, Hong Kong  
Tel : 547-4563, 547-3879; Fax : 599-2400  
Telex : 75 371 NKCHK HX

**TAI HING INTERNATIONAL (TRADING) LTD**

PO Box 5690, 308-309 International Building  
141 Des Voeux Road Central, Hong Kong  
Tel : 541-2724, 543-7191; Fax : 852-815-2669  
Telex : 852647 TAIHI HX

**SEA SOURCES MARINE PRODUCTS (HK) CO. LTD**

Flat 'A', 2nd Floor, Central Building  
6-14 Centre Street, Hong Kong  
Tel : (852) 5592286; Fax : (852) 5590287  
Telex : 72088 SEAHK HX

**WINSON TRADERS (HK) LTD**

501 Wong House, 26/30 Des Voeux Road  
West Hong Kong  
Tel : 5406706, 5406484; Telex : 85005 WTGRP

**KIT HENG CHUNG (HK) LTD COMPANY**

1st Floor, 155 Des Voeux Road West, Hong Kong  
Tel : 473560; Telex : 65520 CCPHK

**EUROSIA HOLDING LTD**

Rm 1101-1103, 11th Floor  
The Leader Commercial Building  
54 Hilwood Road, Tsimshatsui  
Kowloon, Hong Kong  
Tel : 3669309; Telex : 37598 EUHOL HX

**KWONG HING HONG**

3 Wilmer Street, 1st Floor, Hong Kong  
Tel : 5478443, 5490054; Telex : 61649 PATHK HX

**UNIQUE COMMERCIAL DISTRIBUTORS LIMITED**

GPO Box 293, Hong Kong  
Tel : 5278331; Telex : 61497 UNIWHA HX

**SUMMER SEA PRODUCT CO. LTD.**

#808 Wing Tuck Commercial Centre  
177-183 Wing Lok Street West, Hong Kong  
Tel : 5456035; Fax : 5438570; Telex : 65362 SUTCO HX

**ORIENTAL MARINE PRODUCT GROUP**

GPO Box 251, Hong Kong  
Tel : 37790021; Fax : 852-788-0734  
Telex : 38179 OMPG HX

**FULL SUCCESS TRADING CO**

Room 402, 19-25 Des Voeux Road West  
Hong Kong  
Tel : 3-687851, 689808; Telex : 38247 TOWIL HX

**EASTERN PEARL INTERNATIONAL CO**

Room 1101-2, Seaview Comm Bldg  
21-24 Connaught Road West, GPO 5409, Hong Kong  
Tel : 5408184; Telex : 74279 SHARK HX

**HEEP TUNG LONG**

13th Floor Wing Yue Building  
60-64 Des Voeux Road West, GPO Box 407  
Hong Kong  
Tel : 5468313, 5467005; Fax : 5484029  
Telex : 60195 HEEP HX

**CHI FU COMPANY**

1st Floor, 14 Possession Street, Hong Kong

**TAI YEONG TRADING CO**

Rm 501, 6th Floor, Lee Kiu Building  
51 Jordan Road, Kowloon, Hong Kong

**STEVEN INTERNATIONAL LIMITED**

6th Floor, 70 Wellington Street, Hong Kong  
Tel : 5222892, 2251778; Telex : 62883 SIL HX

**HILLSDOWN (HONG KONG) LTD**

Room 843, Swire House, Chate Road Central  
Hong Kong  
Tel : 5262338; Fax : 58681437  
Telex : 81740 HLSDN HX

**CANADA**

**BDM INTERNATIONAL**

305 London Drive  
Beaconsfield, Qc  
Canada H9W 5Z1  
Fax : (514) 426 2931

**ITALY**

**SIRIO LAGUNARE**

Via Brendole 53  
30174 Mestre, Venice  
Italy  
Tel : 041-914588; Fax : 041-916418  
Telex : 420611 SIRILA I

**UNITED KINGDOM**

**FODECO (UK) LTD**

Mariowe House, 103 Station Road  
Sidcup, Kent DA 15 7ET  
United Kingdom  
Tel : 81-300-5501; Fax : 81-300-0198  
Telex : 895 1558

**LCL TRADING**

140 Oakwood Drive, Lordswood  
Southampton SO1 8EP  
United Kingdom  
Tel : (0703) 738121; Fax : (0703) 738121

31. An appraisal of the marine fisheries of West Bengal. 1987, 32pp.
32. An appraisal of the marine fisheries of Orissa. 1987, 36pp.
33. An appraisal of the marine fisheries of Andhra Pradesh. 1987, 52pp.
34. An appraisal of the marine fisheries of Tamil Nadu and Pondicherry. 1987, 63pp.
35. An appraisal of the marine fisheries of Kerala. 1987, 42pp.
36. An appraisal of the marine fisheries of Karnataka & Goa. 1987, 104pp.
37. An appraisal of the marine fisheries of Maharashtra. 1987, 46pp.
38. An appraisal of the marine fisheries of Gujarat. 1987, 51pp.
39. An appraisal of the marine fisheries of Lakshadweep and Andaman & Nicobar Islands. 1987, 18pp.
40. National symposium on research and development in marine fisheries, Mandapam Camp 16 - 18 September 1987 (Abstracts). 1987, 112pp.
41. A manual for hormone isolation and assay. 1987, 46pp.
42. Manual of techniques for estimating bacterial growth rates, productivity and numbers in aquaculture ponds. 1987, 28pp.
43. Nutritional quality of live food organisms and their enrichment. 1987, 28pp.
44. An evaluation of fishermen economy in Maharashtra and Gujarat - A case study. 1988, 80pp.
45. Motorization of country craft in Kerala - an impact study. 1989, 74pp.
46. Atlas of clam resources of Karnataka. 1989, 56pp.
47. Annotated bibliography of commercially important prawns and prawn fisheries of India. 1989, 326pp.
48. The Indian Oil sardine *Sardinella longiceps* Valenciennes - An annotated bibliography. 1990, 80pp.
49. Hatchery production of Pearl oyster spat : *Pinctada fucata*. 1991, 36pp.
50. Annotated Bibliography of the Silverbellies (Pisces : Leiognathidae). 1992, 220pp.
51. Bibliography (Part 2) - The Publications by the staff of Central Marine Fisheries Research Institute 1986-1990. 1992, 112pp.
52. The Indian mackerel *Restrelliger kanagurta* (Cuvier) - An annotated bibliography. 1992, 126pp.
53. Mariculture research under the Postgraduate Programme in Mariculture - Part 2. 1993, 176 pp.
54. Mariculture research under the Postgraduate Programme in Mariculture - Part 3. 1993, 155pp.
55. Mariculture research under the Postgraduate Programme in Mariculture - Part 4. 1993, 134pp.
56. Mariculture research under the Postgraduate Programme in Mariculture - Part 5. 1993, 154pp.
57. Hatchery techniques and culture of the Sea-cucumber *Holothuria scabra*. 1994, 40 pp.
58. An annotated bibliography on Sea-cucumbers. 1994, 92 pp.
59. A Hand-book on India Sea-cucumbers. 1994, 48 pp.