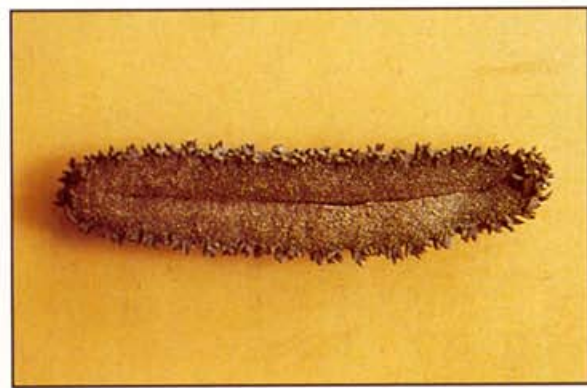


# SEA CUCUMBERS AND BECHE-DE-MER

*of the Tropical Pacific*



A HANDBOOK FOR FISHERS



SOUTH PACIFIC COMMISSION  
NOUMEA, NEW CALEDONIA



South Pacific Commission

Handbook no. 18  
(revised edition, 1994)

**SEA CUCUMBERS AND BECHE-DE-MER OF THE TROPICAL PACIFIC**  
**A HANDBOOK FOR FISHERS**

Revised edition of *Bêche-de-mer of the South Pacific Islands*, 1974, and *Bêche-de-mer of the tropical Pacific*, 1979

(Published with financial assistance from the Government of the United Kingdom)

South Pacific Commission  
Noumea, New Caledonia  
1994

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# PREFACE

The first edition of this handbook, published in 1974 under the title *Bêche-de-mer of the South Pacific Islands*, was based on work by K. Sachithanathan, beche-de-mer consultant to the former South Pacific Island Fisheries Development Agency (SPIFDA) which was a UNDP/FAO regional fisheries project.

The second edition, published in 1979 under the title *Bêche-de-mer of the Tropical Pacific*, was extensively revised by M. Gentle, SPC beche-de-mer biologist, with the assistance of C. Conand, then of the Office de la recherche scientifique et technique outre-mer (ORSTOM). Much of the text was rewritten and the chapter on processing was considerably expanded.

This third edition was prepared by C. Conand, now of the Université de Bretagne Occidentale (France), to whom SPC is much indebted. Recent data on the biology of these species and their commercial value, acquired in the course of a study carried out by ORSTOM (Noumea Centre), enabled the text to be updated. Further improvements to the processing, packaging and marketing sections were made by Steve Roberts, SPC Post-harvest Fisheries Adviser. We are indebted to the Fiji Fisheries Division for the drawings of the processing procedures which have been adapted from its training flip chart on beche-de-mer processing.

In this edition one species of no commercial value has been replaced by a low-value species, and an estimate of the average density of each species in its marine habitat included. The processing method for sandfish, which has become one of the most valued products and is now exported from a number of Pacific Island countries, is set out in detail. The section on marketing has been rewritten and the list of processed beche-de-mer buyers updated. Lastly a short bibliography has been added for readers wishing to explore the subject further.

Publication of this handbook has been made possible by the financial support of the Government of United Kingdom, to whom the South Pacific Commission would like to express its sincere appreciation.

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# INTRODUCTION

Holothurians or sea cucumbers (also incorrectly called 'sea slugs') are collected for processing into a dry food product called beche-de-mer or trepang which is exported to Asian markets; sold for local consumption, boiled; or eaten raw, as, for example, in Japan. In the islands of the tropical Pacific, harvesting and processing sea cucumbers into beche-de-mer have been practised since the eighteenth century. In the past they provided the basis for a prosperous fishery in the Pacific region. The Chinese, for whom beche-de-mer is a traditional food, taught Pacific Islanders their processing techniques, and the beche-de-mer trade generally remained in their hands. Exploitation continued throughout the nineteenth and twentieth centuries, except for interruptions during the two world wars. Sea-cucumber fishing is an important artisanal activity in Fiji, the Solomon Islands, Papua New Guinea and New Caledonia, but other island countries also periodically show interest in this marine resource.

Sea cucumbers are abundant in the South Pacific. They form an important part of the bottom fauna within the reefs. The shallow-water lagoons enclosed by the many reefs, islands and islets offer these animals a wide variety of suitable habitats; some species live in deeper waters. They move about slowly over the bottom, feeding mainly on sediment. Some species bury themselves in sandy mud, others crowd into coral or rock crevices.

In order to be suitable for marketing, sea cucumber species must be large, plentiful in easily accessible areas, and have a thick body wall.

Sea cucumbers are harvested by hand at low tide on the reef flats, or by diving in the deeper waters close to the reefs. They are usually processed near the collecting grounds. If a few basic rules are followed, storing the product poses no particular problem, because once dried it does not require refrigeration. The Hong Kong and Singapore markets are within reasonably easy reach of the Pacific Islands, many of which are linked to them by regular shipping lines. Properly dried, good-quality beche-de-mer produced in the South Pacific is well liked by Chinese consumers and can fetch high prices.



# GLOSSARY

<b>Anal teeth</b>	Usually five in number: each a hard, calcified triangular structure about 3 mm long embedded around the anus (rear opening)
<b>Anterior</b>	Situated at the front end of the body, at or near the head.
<b>Cloaca</b>	A common cavity for the release of waste products
<b>Cuvierian tubules</b>	Sticky, white threads or ribbon-like structures which are thrown out from the anus of some species as a defence mechanism
<b>Dorsal</b>	On or near the back
<b>Habitat</b>	The place where an animal is usually found, e.g. near living coral, among sea grasses, etc.
<b>Papillae</b>	Conical growths or lumps on the surface of the body wall, variable in different species
<b>Posterior</b>	Situated at the rear end of the body
<b>Retractable</b>	That can be retracted or drawn back in
<b>Spicules</b>	Microscopic, chalky particles in the body wall, of variable shapes, used for species identification
<b>Teats</b>	See 'Papillae'
<b>Tegument</b>	Scientific name of the sea cucumber's body wall, edible and processed into dried beche-de-mer
<b>Tentacles</b>	Modified tube feet; retractile and located around the mouth, used to collect food
<b>Terrigenous</b>	Sea-bottom sediment derived from erosion of land
<b>Trepang</b>	Malaysian name for processed sea cucumbers
<b>Tube feet</b>	Small water-filled tubes used for locomotion; present in great numbers mainly on the underside of beche-de-mer
<b>Ventral</b>	Side of the body where the belly is located (normally the part of the body in contact with the sea bed)



# EXTERNAL AND INTERNAL FEATURES OF SEA CUCUMBERS

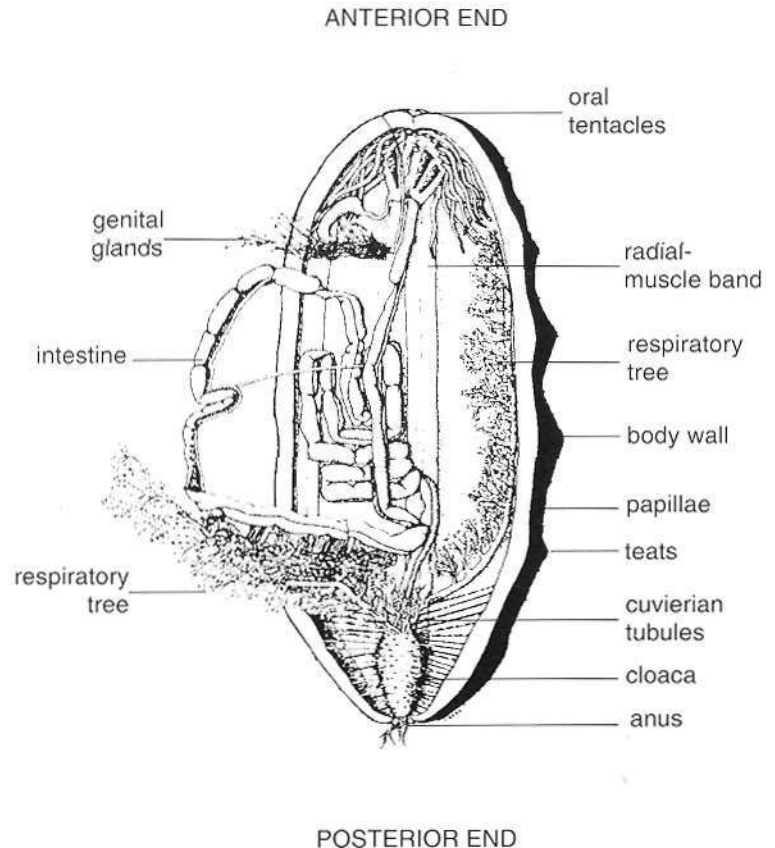
Sea cucumbers are cylindrical, elongated or worm-like in shape. They are found in a variety of colours ranging from pitch black to white and light yellow, and are generally designed to blend in with their habitat. Underneath (on the ventral side), the colour is lighter, sometimes milky white. Sizes vary too, with the commercial varieties growing to 50 to 80 cm. The body wall of many species is smooth, although some have papillae or tubercles on the dorsal (back) and ventral sides. Spicules are present over the body of some species, giving a rough feel to the surface. The thickness of the body wall also varies from species to species, with the thicker-walled varieties being commercially more valuable.

A circle of retractile tentacles surrounds the mouth. When feeding these spread out and look like a flower. The gut is a coiled tube containing mostly debris-laden sand particles. The excreta of sea cucumbers are easily recognisable on the sea bottom as coiled tubular threads of sand.

At the posterior end near the cloaca is the respiratory tree. This is a branched tubular structure which pumps seawater in and out through the cloaca for respiration. It is black or dark brown in colour.

Sticky, white thread-like structures called cuvierian tubules are sometimes found inside near the cloaca. In some species these have a defensive function, being thrown out when the animal is disturbed.

There are other important organs inside the body cavity for excretion and reproduction. The reproductive organs are prominent and visible only during the breeding season.



Anatomical features of sea cucumbers



**COMMERCIALLY VALUABLE SPECIES  
OF SEA CUCUMBERS  
IN THE TROPICAL PACIFIC**





# SANDBISH

*Holothuria (Metriatyla) scabra* and *H. scabra* var. *versicolor*

**Size** Length: 25–45 cm

**Shape** The body is oval and stout with flattened ends; *H. scabra* has prominent wrinkles on its upper surface and is generally smaller and lighter than the *versicolor* variety.

**Colour** *H. scabra* has a grey to greenish upper surface with many fine black spots, and a creamy lower surface. The *versicolor* variety is more variable in colour, ranging from beige (uniform or with black spots) to uniform black.

**Habitat** Present in large numbers in habitats under terrigenous influence. *H. scabra* is often found on inner reef flats and near estuaries, and its density may reach several hundred individuals per hectare. The *versicolor* variety prefers deeper waters of bays or lagoons. Its average density is about 100 animals per hectare. They often spend part of the day buried in the silty sand.

**Value** This species is in great demand and fetches high prices.

**Processing** Sandfish require a special processing method to remove the hard outer layer of the skin containing the spicula (see p. 31). This animal should not be slit along its length. A small cut at the posterior end to assist gutting is all that is required.



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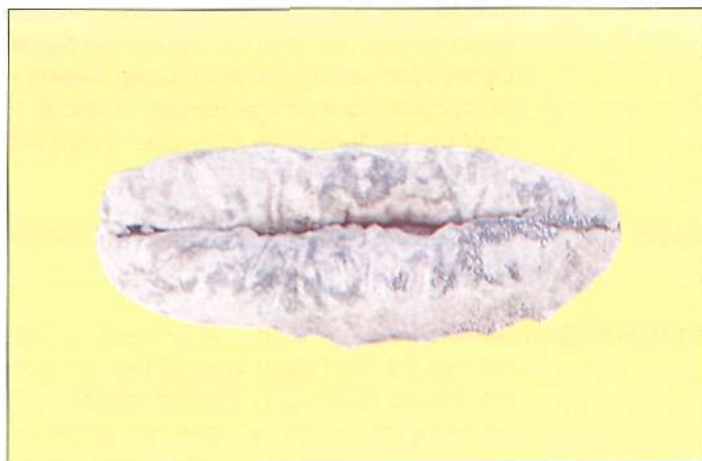
# BLACK TEATFISH

*Holothuria (Microthele) nobilis*

Size	Length	:	30 – 40 cm
	Width	:	10 – 15 cm
	Body wall thickness	:	10 – 12 mm
	Live weight	:	2 – 3 kg
Shape	A flattened oval in shape. Six to eight teats on each side give this species its English name. Five anal teeth are present.		
Colour	<i>H. nobilis</i> is generally black, but small specimens have cream or orange flecks. The body is often covered with a fine coating of coral sand.		
Habitat	The white and black species normally occur in different habitats — <i>H. nobilis</i> is more common on shallow reef bottoms that are not subject to terrigenous influence. Average density is about 10 animals per hectare. Young specimens, usually few in number, are found on turtle-grass beds.		
Value	This species is in great demand by beche-de-mer processors because it fetches high prices.		
Processing	See processing method described on page 28. During processing a straight cut is made in the body wall along the back (i.e. upper dorsal side), up to 3 cm from each end of the animal.		



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# WHITE TEATFISH

*Holothuria (Microthele) fuscogilva*

Size	Length	:	30 – 40 cm
	Width	:	10 – 15 cm
	Body wall thickness	:	10 – 12 mm
	Live weight	:	2 – 3 kg
Shape	A flattened oval in shape. Six to eight teats on each side give this species its English name. Five anal teeth are present.		
Colour	The colour ranges from yellowish white to grey-brown. The body is often covered with a fine coating of coral sand.		
Habitat	<i>H. fuscogilva</i> is more common on coral slabs near reef passages or at the foot of the lagoon-side reef slopes. Average density is about 10 animals per hectare.		
Value	This species is in great demand by beche-de-mer processors because it fetches high prices.		
Processing	See processing method described on page 28. During processing a straight cut is made in the body wall along the back (i.e. upper dorsal side) up to 3 cm from each end of the animal.		



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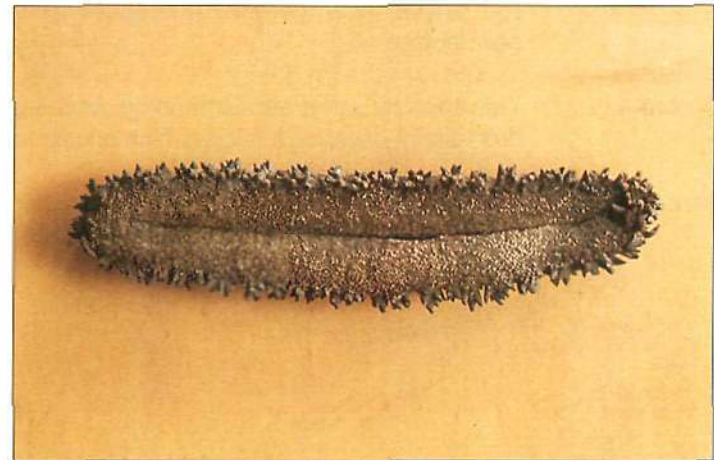
# PRICKLY REDFISH

*Thelenota ananas*

Size	Length	:	40 – 70 cm
	Width	:	10 – 15 cm
	Body wall thickness	:	15 – 20 mm
	Live weight	:	1 – 6 kg
Shape	Very distinctive appearance because of numerous large pointed teats in groups of two or three all over the body surface. There are numerous large tube feet on the flat underside.		
Colour	Reddish-orange, with the teats darker than the body surface. The tube feet on the underside are bright orange.		
Habitat	Found at depths of 2 to 30 m on clean sand bottoms or on slabs near large coral heads. Fairly low average density of about 20 animals per hectare.		
Value	The demand for this fairly common species has grown over recent years. It is now commonly harvested and processed for export to China, attracting quite high prices.		
Processing	Similar processing method to teatfish (see page 28). The body-wall slit is made along the length of the animal, on the flat underside, to within 3 cm of each end.		



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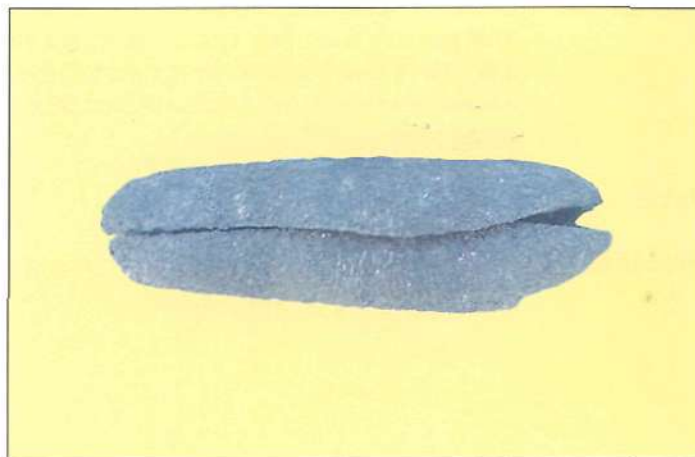
# DEEP-WATER REDFISH

*Actinopyga echinites*

Size	Length	:	15 – 30 cm
	Width	:	8 – 10 cm
	Body wall thickness	:	7 mm
	Live weight	:	0.5 – 1 kg
Shape	The body is wider in the middle, tapers towards the ends and has a slightly wrinkled dorsal surface. Three rows of tube feet on underside and five anal teeth.		
Colour	Brick-red above, lighter orange on the underside. The body is generally covered with a fine coating of sand.		
Habitat	This species is abundant on reef flats and the upper part of coastal reef slopes, on sandy bottoms, turtle-grass beds and among living corals. Average density is a few hundred animals per hectare.		
Value	Low to medium commercial value, which is partly made up for by the high population density.		
Processing	Processed like teatfish. Can be processed without cutting, or with a long slit along the length of the animal (depends on the target market).		



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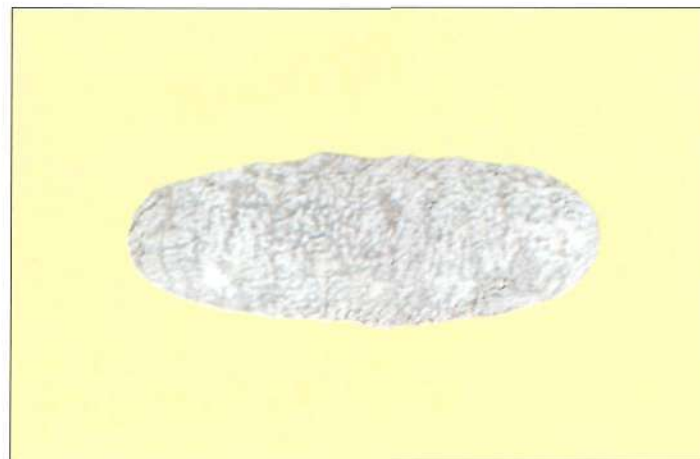
# STONEFISH

*Actinopyga lecanora*

Size	Length	:	40 cm
	Width	:	9 cm
Shape	Large sea cucumber, spindle-shaped when static and highly elongated when active. It has a ventral mouth surrounded by 20 tentacles. Anus is surrounded by 5 anal teeth. The upper surface is sparsely covered in small papillae.		
Colour	Varies considerably, but there is always a very light-coloured patch around the anus. The dorsal surface is often brown with white mottling. Some specimens appear paler, with grey patches on a cream background.		
Habitat	Lives at depths from 0 to 20 m on hard substrates. This species is entirely nocturnal. In the daytime, it is often found under large stones, in gaps in reef slopes or in sheltered areas affected by tidal currents.		
Value	Low commercial value.		
Processing	Processed like teatfish. However it should be processed without cutting.		



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# SURF REDFISH

*Actinopyga mauritiana*

Size	Length	:	20	–	30 cm
	Width	:	8	–	10 cm
	Body wall thickness	:	6 mm		
	Live weight	:	0.5	–	1 kg
Shape	Almost cylindrical but with a flat underside. Three rows of tube feet on the underside and five anal teeth.				
Colour	Looks very much like the deep-water redfish, <i>Actinopyga echinites</i> , but its body does not have a coating of sand.				
Habitat	Found only on the outside of reefs, where the surf breaks and where there is no terrigenous action, at depths of between 0 and 5 m. The tube feet are very firmly attached to the seabed to prevent the animal from being carried away by the waves. Average density is several hundred individuals per hectare.				
Value	Low to medium commercial value, partly made up for by the high population density.				
Processing	Processed like teatfish. However it should be processed without cutting.				



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# BLACKFISH

*Actinopyga miliaris*

Size	Length	:	20 – 30 cm
	Width	:	8 – 12 cm
	Body wall thickness	:	8 mm
	Live weight	:	0.5 – 2 kg
Shape	Cylindrical with five anal teeth and tube feet arranged in three rows on the underside.		
Colour	Black, sometimes with a dark brown underside.		
Habitat	Found mainly in water less than 3 m deep on reef flats among living coral (often in the same places as the black teatfish, <i>H. nobilis</i> ) and in turtle-grass beds. Average density is several hundred individuals per hectare.		
Value	Low to medium commercial value, which is partly made up for by the high population density.		
Processing	Processed like teatfish. However it should be processed without cutting.		

**Note:** The genus *Actinopyga* includes several large species, each of which is distributed rather differently. *A. miliaris* is commercially the most rewarding one because it is very abundant in easily accessible habitats.



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# BROWN SANDFISH

*Bohadschia marmorata/vitiensis*

Size	Length	:	15 – 35 cm
	Width	:	8 – 10 cm
	Body wall thickness	:	5 – 10 mm
	Live weight	:	0.5 – 2 kg
Shape	Body short and thick with lower surface only slightly flattened. Sticky, white threads (cuvierian tubules) extruded through anus if the animal is disturbed.		
Colour	Uniformly distributed small dark-brown dots at the base of the tube feet contrast with a golden brown background. The underside is lighter in colour.		
Habitat	Common in shallow waters and buries itself in the silty sands of calm waters where there is no ter-rigenous action, at depths of 2–15 m. Average den-sity is about 50 individuals per hectare.		
Value	Low commercial value.		
Processing	Processed like teatfish, but without cutting. Pro-cessing should be done with great care because the body wall of this species tends to fall apart after harvesting and during boiling.		



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# LOLLY FISH

*Holothuria (Halodeima) atra*

Size	Length	:	10 – 50 cm
	Width	:	3 – 8 cm
	Body wall thickness	:	2 – 6 mm
	Live weight	:	0.2 – 1.5 kg
Shape	Cylindrical with a smooth body surface.		
Colour	Black, always with fine covering of sand except for the circular patches along the sides (see illustration). If the body surface is rubbed vigorously a red fluid is discharged.		
Habitat	This is the most common species in the region and can be found in most types of habitats. Average density is several hundred animals per hectare, but may reach several thousand per hectare in some atoll lagoons.		
Value	Only the large specimens have some commercial value. Care must be taken not to confuse this species with the other black species, <i>Actinopyga miliaris</i> , which is more valuable.		
Processing	Processed like teatfish. However it should be processed without cutting.		



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# PINKFISH

*Holothuria (Halodeima) edulis*

Size	Length	:	20	—	30	cm
	Width	:	3	—	6	cm
	Body wall thickness	:	2	—	5	mm
	Live weight	:	0.2	—	0.4	kg
Shape	Cylindrical, similar to <i>Holothuria atra</i> .					
Colour	Upper surface dark brown to black with pink areas mostly along the sides. Underside pink. Unlike <i>H. atra</i> , its body is not sand-coated.					
Habitat	Common in numerous lagoon bottom habitats. Average density is about one hundred individuals per hectare.					
Value	Little commercial value. Its small size results in it being classified under the lowest grade 'lolly' fish.					
Processing	Processed like teatfish. However it should be processed whole without cutting.					



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# ELEPHANT'S TRUNK FISH

*Holothuria (Microthele) fuscopunctata*

<b>Size</b>	Length	:	40 – 60 cm
	Width	:	10 – 15 cm
	Body wall thickness	:	8 – 12 mm
	Live weight	:	2 – 4 kg
<b>Shape</b>	Upper surface convex, underside slightly flattened. Prominent wrinkles on the upper side. A notch in the body indicates the position of the anus.		
<b>Colour</b>	Dark orange or rust-brown above, with pale grey sides and underside.		
<b>Habitat</b>	10–30 m deep, often on very fine sand. Frequently occurs in groups. Like the sandfish, this species is able to bury itself. Small specimens are rare. Average density is a few dozen individuals per hectare.		
<b>Value</b>	Little commercial value despite its large size. This species does not have a good flavour.		
<b>Processing</b>	Processed like teatfish. During processing a straight cut is made in the body wall along the back (i.e. upper dorsal side) up to 3 cm from each end of the animal.		



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# GREENFISH

*Stichopus chloronotus*

Size	Length	:	10	–	30	cm
	Width	:	3	–	6	cm
	Body wall thickness	:	2	–	6	mm
	Live weight	:	0.2	–	0.4	kg
Shape	Roughly square in cross-section with large prominent papillae at each corner of the square. Body surface otherwise smooth. Many tube feet in three rows on underside.					
Colour	Very dark green, appearing almost black; the papillae are orange-tipped.					
Habitat	On reef flats or on broken-coral rubble, at depths of 0 to 5 m in areas where there is much water movement. Average density is several hundred individuals per hectare.					
Value	Low commercial value. Sometimes it is classified as the lowest grade because of its small size.					
Processing	Processed like teatfish, but without cutting. Processing should be done with great care because the body wall of this species tends to fall apart after harvesting and during boiling.					



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# CURRYFISH

*Stichopus variegatus*

Size	Length	:	20	–	25	cm
	Width	:	6	–	12	cm
	Body wall thickness	:	6	–	10	mm
	Live weight	:	0.8	–	2	kg
Shape	Roughly square in cross-section. Upper side convex with a rough surface bearing many tubercles. Underside flat, with many tube feet.					
Colour	Quite variable. Typically dark yellow with irregular brown patches. Some specimens are almost white or greenish. The tube feet are pink.					
Habitat	In turtle-grass beds, on sediment or silty sand bottoms in areas where terrigenous action occurs, at depths of up to 30 m. Average density about 50 individuals per hectare.					
Value	This species has a medium to low commercial value.					
Processing	Processed like teatfish but should be handled with great care because its body wall tends to fall apart after harvesting and during boiling. Some markets prefer processed animals with no cuts, while others will accept a slit along the length of the animal.					



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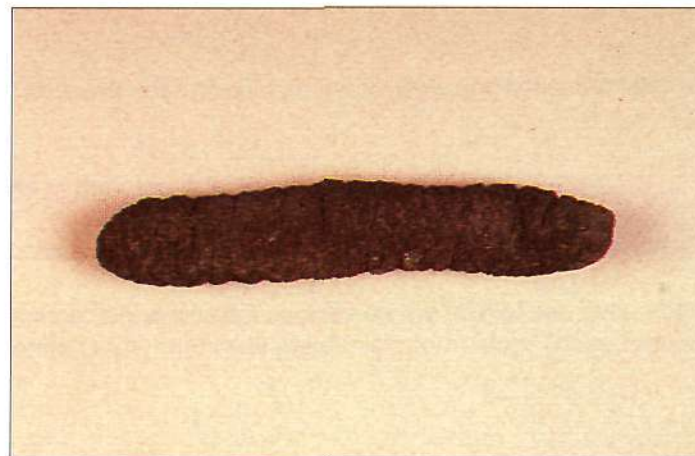
# AMBERFISH

*Thelenota anax*

Size	Length	:	80 cm
	Width	:	15 cm
Shape	Large sea cucumber, quadrangular in cross-section. The upper surface is rounded while the lower surface is very flat. The body wall is thick and smooth. The ventral mouth is surrounded by 18 blunt tentacles. The upper surface is covered in rounded tubercles. Warty growths form an unbroken line along the side of the body.		
Colour	The upper surface of the largest specimens is uniformly cream or grey, sometimes with brown patches. The lower surface is cream. The younger the specimen the brighter the colouring.		
Habitat	On coral sand or shell rubble bottoms at depths of between 12 and 30 m.		
Value	Low commercial value.		
Processing	Similar processing method to teatfish (see page 28).		



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# HARVESTING AND HANDLING ON BOARD

Sea cucumbers are easy to harvest from reefs, lagoons and deeper coastal waters. They are harmless, move slowly and do not resist being collected. It is important, however, to catch and handle the animals carefully because the quality of the final dried product and therefore the market value depend on how well this is done.

There are a number of procedures for harvesting sea cucumbers. The one used will depend on their habitat and the equipment available to the collector. In shallow water, particularly at low tide, sea cucumbers can be collected easily on foot. In deeper waters down to 10 m, snorkeling or free-diving from a boat or canoe is necessary. Alternatively, if the water is clear, a shooting-lead or rope-spear (also called a **dri-bomb** in Fiji) can be used to spike and collect sea cucumbers from a boat. The shooting-lead is a 3–4 kg weight tied to a rope, with a 3 cm straight barbed spike firmly attached underneath. This is lowered into the water over a selected sea cucumber on the seabed and the weight allowed to drop the last few centimetres so that the spike penetrates the skin. The hooked animal should be lifted carefully into the boat and removed gently from the spike; try not to damage it further.



During harvesting it is important to take only the large sea cucumbers. The small ones should be left to grow and collected later when they have reached a good size. There are two reasons for this:

- (1) Harvesting small sea cucumbers will eventually result in the loss of the resource; there will be none left;
- (2) Small animals produce dried products that will not meet the required size grading and therefore will not fetch good prices.

There may also be regulations in force setting a limit for each of the commercially important species on the size of sea cucumber that can be harvested. It is important to know these regulations. The local Fisheries Department will have this information. These regulations are designed to protect the long-term health of the fishery.

It is important to keep the harvested sea cucumber alive and clean until ready for processing. Any pieces of coral and sand stuck to the skin must be removed by washing in seawater. These particles can become embedded in the soft body wall, damaging the skin. Away from their natural aquatic environment sea cucumbers become flaccid and soft, taking on the shape and fitting into whatever they are laid on or in, possibly marking their surface permanently. They should therefore be placed on a flat, smooth surface in a single layer. Shallow plastic fish boxes with smooth surfaces are ideal. If sea cucumbers are stacked on top of each other, the outer skin of the body wall is likely to break down. This will cause tears to appear after processing; the product will be down-graded because of these. Sandfish are an exception because they have a tougher body wall with many spicules. These animals can be placed on top of each other. They will flatten out, remaining alive. The prickly redfish requires special care as the large pointed teats are easily damaged if the animal is not handled properly.

Keep harvested sea cucumbers shaded and damp. This can be done by covering them with sacks or leaves kept wet with seawater (not fresh water, as this can damage the skin). If the harvest has not been good and the animals are to be kept overnight or for extended periods, they can be placed in a deep pool in the reef close to shore, or a small seawater pond can be constructed to hold them until enough animals have been collected to start processing. For enclosed ponds a regular change of seawater is necessary.

# PROCESSING

## EQUIPMENT

Only simple equipment is required:

1. A **large container for boiling the beche-de-mer** and a **stirrer**. A shallow container is best since it allows more uniform heating and makes it easier to inspect and stir the sea cucumbers. A 200 litre (44 gallon) drum cut in half lengthwise and **thoroughly** cleaned is the most commonly used container. In Fiji it has become more popular to cut the drum in half crosswise. This apparently leads to more efficient heating and is less wasteful on fire-wood. Ideally a thicker-walled cast-iron container should be used. This would retain more heat and therefore help provide steadier, more continuous heat for more efficient boiling.
2. A **wire mesh basket** for easy inspection and removal of the beche-de-mer during boiling, or a **mesh scoop**. There should be no sharp projecting ends of wire anywhere in the mesh since these would damage the delicate skin of the product.
3. A **very sharp knife** (and a **sharpening stone** to keep the knife sharp) for cutting, slitting and gutting.
4. A **smoke-drying shed** or **copra dryer** with **drying trays** of steel mesh on wooden frames. This consists of a lower chamber where the fire is maintained and an upper chamber where the cooked sea cucumbers are placed on mesh trays for smoke-drying. The dryer can be made from a wooden or galvanised steel frame and sheets of corrugated or flat iron sheets for the outer walls. A door in the front provides access for loading trays of product. The trays are either wood or steel-framed and the mesh is most commonly made from chicken wire. Other types of steel mesh are available, which are better than chicken wire since this can damage the skin of the product, especially when the wire is broken.



5. **Drying racks** or **iron sheets** for sun-curing the smoked beche-de-mer.

6. **Miscellaneous equipment and materials:**

- dry clean sacks made of hessian or woven polypropylene,
- firewood and coconut husks for fuel,
- buckets for carrying seawater,
- string or vines and small sticks (2.5 to 4 cm long).

## PROCEDURE

This is simple but must be carried out with care if good-quality products are to be obtained. The following technique is used for teatfish but can generally be applied to all species (Fig. 1), except sandfish which requires a special treatment (see page 31). Depending on the species of sea cucumber, minor changes in procedure may be needed to suit requirements of certain markets.

Boiling is the most important step in processing. Incorrect cooking can irreversibly damage the product by causing splitting of the skin or other faults that will only show up at the drying stage.

**First boil** Fill the container with clean seawater and bring it to the boil. It is very important to bring the water to the boil **before** adding the live sea cucumbers to the container. Sort the sea cucumbers according to size. Only boil those of a similar size together, as the cooking time needed varies according to size. If the sea cucumbers have been kept in seawater for some time, allow them to naturally evacuate any internal water. Gently squeezing the body will assist this process. Immediately put the animals into the boiling water one by one while stirring, making sure that each one is completely covered with water. Do not allow any to remain partly out of the water as the skin could split. To ensure uniform heating do not put too many animals into the water at once.

Stir continuously and examine frequently. Cooking time for the first boil depends on the size of the animals and may be as short as a few minutes. The best way to judge the cooking time is by inspection. If the sea cucumbers start to swell too much you will need to pierce them. This can happen quickly, so you must keep a close watch. If they are left to boil too long at this stage they will burst.



***Piercing the body wall during the first boil (optional)*** —

This procedure releases the build-up of pressure caused by too much water and air inside the cooking animal. Make a short longitudinal slit about 4 cm long, along the centre line of the back, to let the water out. For *Thelenota ananas* (prickly redfish) the slit must be made on the underside, with the animal laid flat on its back. For species that should not have a slit along the length of the body a small cut in the posterior end through the anus will suffice.



After piercing continue to boil for about another 10 to 15 minutes. Continue to stir gently and frequently, to ensure uniform cooking. When the ends of the sea cucumber become rubbery like a rubber ball, the first boiling is complete. This will not be hard to recognise. Remove the cooked sea cucumbers from the container and immerse them in fresh seawater to cool down.

**Slitting and removal of gut**

Make a straight slit down the centre line of the animal (along the back for teatfish, and the underside for prickly redfish), to within 3 cm of each end, incorporating the cut made during the first boiling. Open up the beche-de-mer and empty out the loose gut contents. Cut out the organs that run through the centre, removing the anal teeth and any loose tissue, using the hands only. Do not remove the strips of tissue running down the length of the inner walls of the body cavity (the longitudinal muscle bands). Wash out with clean seawater.

**Second boil**

Follow the same procedure as for the first boil. Cook for 15–40 minutes, stirring continuously. Exact boiling time will again depend upon the size of the animal. The sea cucumbers will shrink slightly and gradually become hard. This hardness is the best way to gauge cooking time, so inspect them frequently. Check the cut edge of the animal too; if it no longer feels slimy, but rather dry and rubbery, the second boiling is complete. Remove the sea cucumbers quickly from the container and put them into cold seawater to cool. They are now ready for smoke-drying or sun-drying.

**Smoke-drying** The fire in the smoker can be made with coconut husks or firewood. The fire should be small, producing constant heat. If the fire is too hot, it will overcook the sea cucumbers, reducing their value. The fire should therefore be tended regularly.

To prepare sea cucumbers with long body slits for smoking (teatfish, prickly redfish, etc.), open them up one at a time and place a short stick, not more than 2.5 to 4 cm long, across the cut to keep the sides apart. This helps speed up the drying process. Place the cooked sea cucumbers on the smoking tray with their slit side down so that the inner part of the body is exposed to the heat of the fire. Do not turn them over during smoking — always leave the split side facing down. Place the cooked sea cucumbers (including the uncut ones) on the trays in such a way that they do not touch each other and that similar sizes are put together on the same tray. Put the trays of smaller ones at the top and the larger ones at the bottom closer to the fire.

Periodically rotate the trays around in the dryer. Move the tray on the bottom rung to the top rung and move all other trays down a rung. This ensures uniform drying.

The sticks holding open the long slits should be removed about half-way through the drying process, when the insides of the animal feel dry to the touch. The sea cucumbers can now be tied up with string or vines to help close up the slit edges, especially if they are misshapen.

Smoke-drying is usually completed within 24–48 hours. The exact drying time will depend upon many factors, such as the drying temperature, the size of the animals and the weather. Judge the dryness of the product by feeling the inside surface. Take particular care to check inside the ends, as they will be the last areas to dry completely.

### **Sun-curing**

Brush off any soot, ash or dirt that has accumulated during the smoking. Place the product in the sun on a clean, dry surface. It is preferable to use drying racks for sun-curing because the product can then dry on both sides simultaneously. These are simply wood-framed tables with a fixed mesh top (chicken wire, steel mesh, plastic mesh or fishing nets). Alternatively, mesh trays, similar to the ones used in the smoker, can be placed directly onto the table frame.

Curing can take as few as four or five days, or as long as one to two weeks, depending on the size and species of sea cucumber, and, of course, the weather. It is important to avoid exposing the product to rain at any time — contact with fresh water is not good for it. Use plastic sheets to cover the curing product if rain threatens, or, if using trays, move them indoors. When sun-curing is complete, a powdery substance will appear on the surface of the beche-de-mer.

Remove the string from the tied beche-de-mer and brush off any dirt or sand. The product should now be ready for packing and storing. If, after examining the product, you find it somewhat soft and damp, you will have to repeat the smoking and sun-curing process. A properly dried and cured beche-de-mer is easy to recognise with a little experience.

**Note:** Smoke-drying may be replaced by sun-drying. This depends on the target market for which the beche-de-mer is being prepared. Some buyers prefer beche-de-mer without the smoky odour and flavour. The buyer of the product is the person to provide guidance on this.

## Special method for processing sandfish

A different procedure must be used for sandfish (*Holothuria scabra* and *H. scabra* var. *versicolor*) in order to remove the chalky spicules in the body wall (Fig. 2).

- Gutting** This species usually loses its guts after harvesting. If this has not happened (especially for the *versicolor* variety), make a short slit, 2–3 cm long, in the anus (posterior end). Press the water and guts out by firmly squeezing the body wall.
- First boil** This step is the same as for the other species. Boiling time can range from a few minutes to one hour. When the sandfish are cooked, take them out to cool.
- Burying** The traditional method of removing the chalky spicules in the body wall is to bury the boiled and cooled sandfish in a 20–30 cm deep sand-pit. A clean, uncontaminated part of the beach above the tidal line is ideal. Pack the sandfish into the pit, cover them with a hessian/jute sack soaked in seawater and finally cover them with sand. The outer layer of the body wall will decompose by bacterial action. This will take about 12 to 18 hours. Remove the sandfish, then wash them in sea-water and rub them vigorously to remove the outer decomposed layer containing the hard chalky spicules. If the decomposition process has not removed all the hard spicules, repeat the boiling and burying processes.
- Second boil** The sandfish are boiled again in seawater for about 40–45 minutes, with continuous stirring.
- Smoke-drying** Most markets prefer dried sandfish to be **unsmoked**. If the buyer requests a smoked product, follow the procedure described on pages 29–30.
- Sun-curing** The sandfish should be arranged in a single layer, preferably on drying racks that allow the air to circulate freely above and below them. Follow the procedure described on page 30.

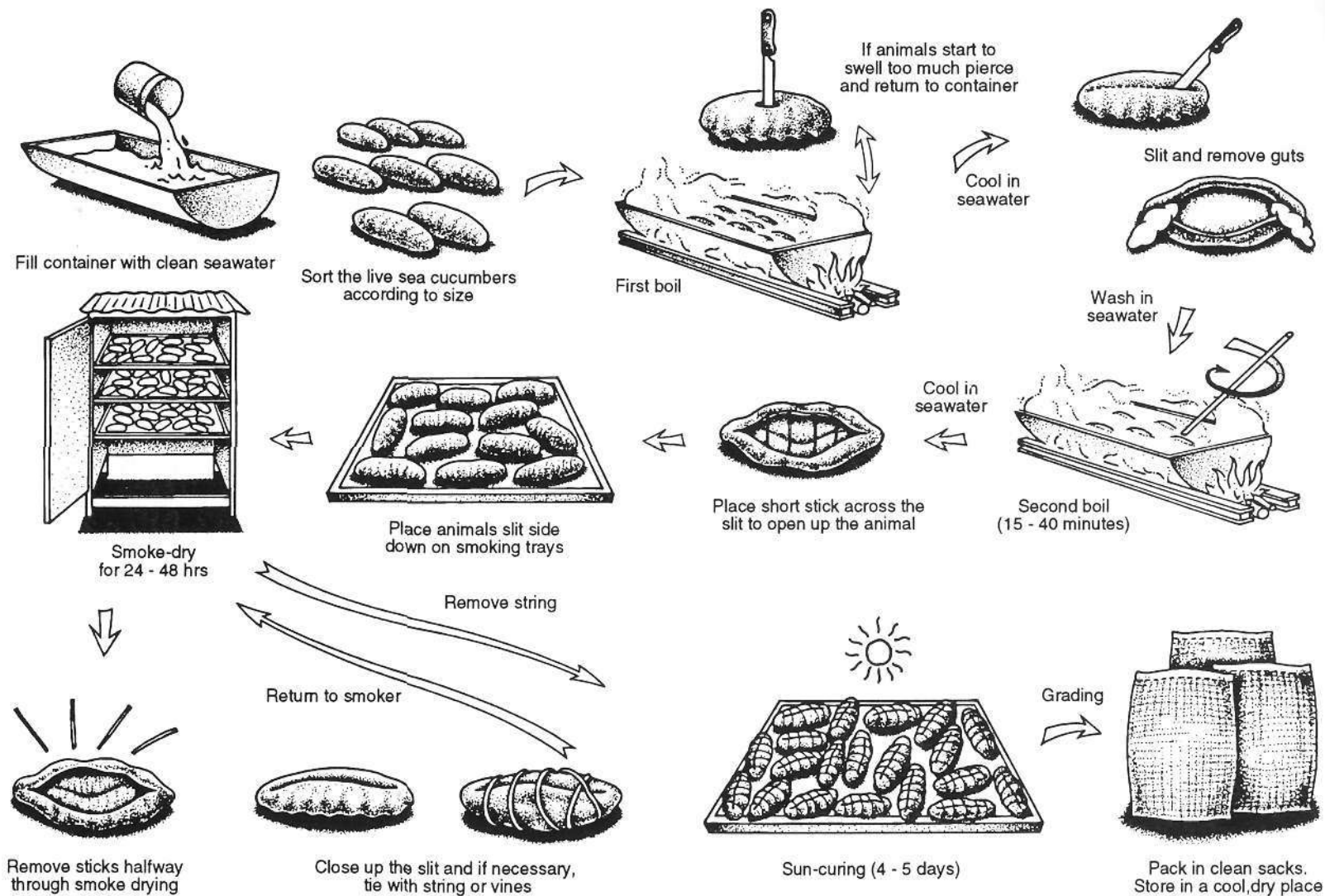


Figure 1. Processing sea cucumbers



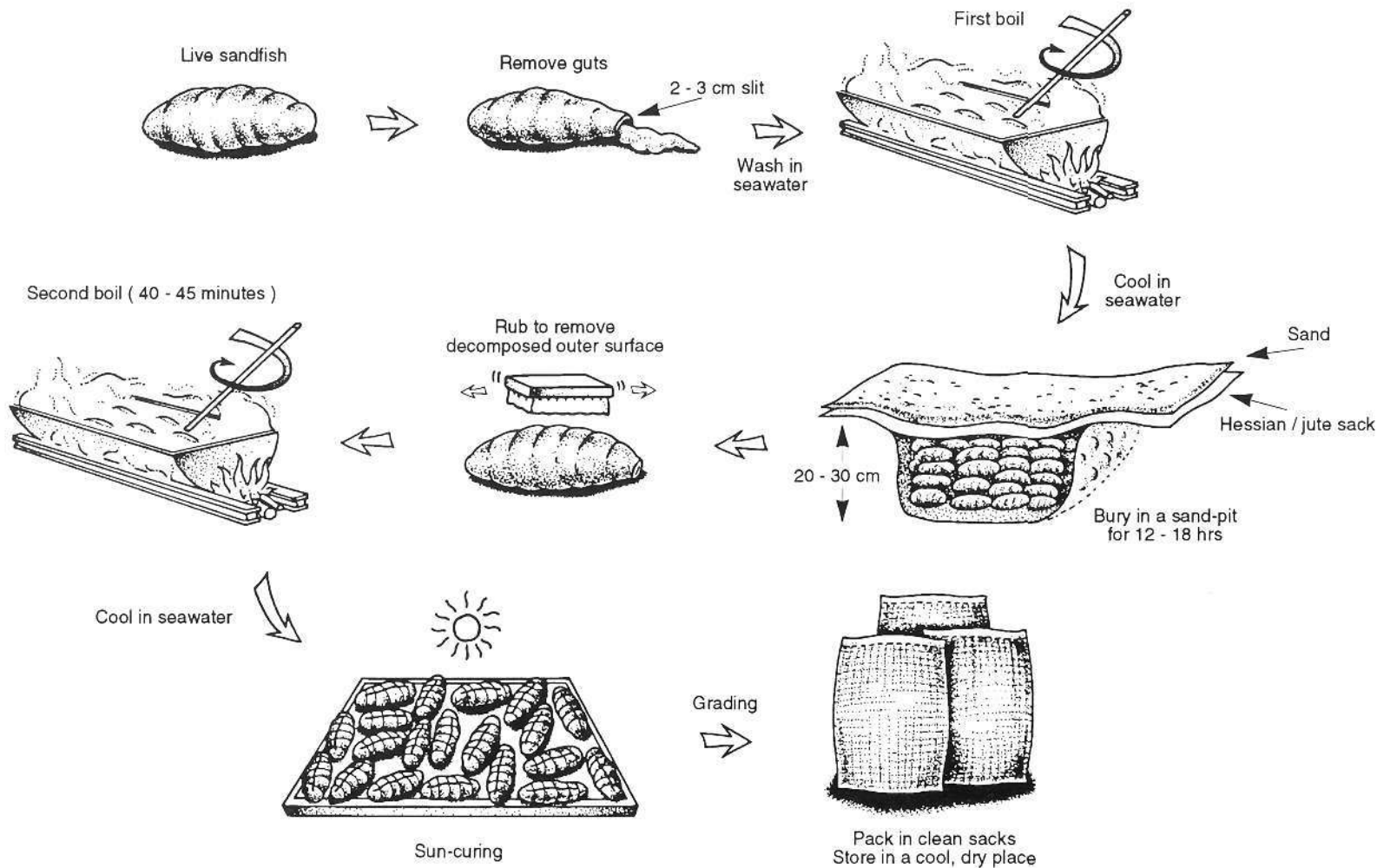


Figure 2. Processing sandfish

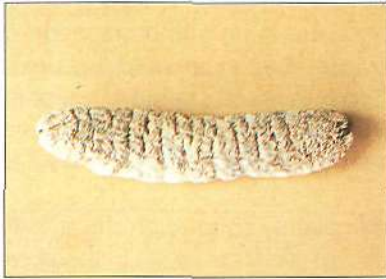
## CHANGES IN LENGTH AND WEIGHT DURING PROCESSING

Processing causes a considerable decrease in both length and weight. Shrinking starts during the boiling processes and continues during smoke-drying and sun-curing. Weight loss is high because of gutting and dehydration, both essential for a properly preserved beche-de-mer product. Decreases in length and weight vary with the species, the size of the individual sea cucumbers, the shape of the species and the thickness of the body wall. Average values, based on various trials, are given below.

SPECIES		LENGTH (CM)			WEIGHT (GM)		
Common name	Latin name	Initial state	Dry product	%	Initial state	Dry product	%
White teatfish	<i>Holothuria fuscogilva</i>	52	23	44	4200	320	8
Black teatfish	<i>Holothuria nobilis</i>	37	19	51	1800	150	8
Sandfish	<i>Holothuria scabra</i>				370	20	5
Sandfish	<i>H. scabra</i> var <i>versicolor</i>	37	14	38	1600	100	6
Deep-water redfish	<i>Actinopyga echinites</i>	19	9	47	330	37	11
Deep-water redfish	<i>Actinopyga echinites</i>				470	15	3
Blackfish	<i>Actinopyga miliaris</i>				2500	76	3
Prickly redfish	<i>Thelenota ananas</i>	58	22	38	4000	190	5

# GRADING

To produce the best possible product, carry out every processing step very carefully. You will then have beche-de-mer that are all top quality and will fetch the highest price. Common defects that will cause the product to be downgraded are insufficient drying, small sizes, mixed sizes, twisted shape, smoke-dried when sun-cured is preferred (e.g. sandfish), bad flavour, incorrect incisions, damaged body wall, and inadequate cleaning (see photos). If the drying time was too short or moisture was absorbed later there is a danger that the beche-de-mer will become mouldy. When this happens, clean the surface of mould and repeat the smoking and drying processes.



Outer spiculy layer not removed (sandfish)



Misshapen (surf redfish)



Shrunk too much due to overcooking (black teatfish)



Badly cut, cut has not closed properly (white teatfish)

Examples of poor-quality beche-de-mer

The following are the main factors that determine the commercial grade of beche-de-mer products:

<b>Species</b>	Separation into species is the first step in grading. The three grades given here are based on prices paid for quality product and consumer preference:  <i>High grade</i> Sandfish, white teatfish, black teatfish <i>Medium grade</i> Prickly redfish <i>Low grade</i> Deep-water redfish, stonefish, surf redfish, blackfish, brown sandfish, lolly fish, pinkfish, elephant's trunk fish, greenfish, curryfish, amberfish
<b>Size</b>	As a rule, the larger the size the better the grade. Unfortunately there is no standardisation of size grades. They vary with different markets and even with different retailers. They are often expressed as very large (XL), large (L), medium (M), small (S), very small (XS). Each size class is defined by a length range, a weight range or (now more common), the number of individual beche-de-mer per kilogram. Small sizes attract very low prices. It is best not to harvest sea cucumbers that yield small product. Leave these to grow larger for collecting later.
<b>Appearance</b>	Regular shapes are preferred to distorted, twisted, shrunken or unevenly shaped products. All cuts must be clean, straight and in the right place and on the correct side of the body. For example, a slit in the upper part of the prickly red fish or a long slit appearing in a species which requires no cutting will result in a lower grade.
<b>Moisture content</b>	The product must be hard and <b>completely dry</b> . The most common quality problem encountered in the South Pacific is inadequate drying, which can make the product become misshapen and mouldy. If the damage is not too severe it can be re-dried, otherwise it will have to be thrown away. Beche-de-mer stored in a humid atmosphere can also absorb moisture and become damp and mouldy. If this happens they should be re-dried and the storage method improved.



## Grading characteristics of some of the most common beche-de-mer species

SPECIES	APPEARANCE/SMELL	CUTS	COLOUR	SIZE
<b>Sandfish</b>	Straight or slightly bent. Large numbers of grooves around the body. No smoky smell.	Small slit only in the posterior end through anus.	Upperside – brown-black to black; underside – greyish brown.	Large = 8–12 pieces/kg, 10–15 cm in length
<b>White teatfish</b>	Flat and straight with teats clearly visible. Powdery surface a desirable attribute. Distinct smoky smell with no off-odours.	One single, long straight cut in the upper part of the body. The cut must be fully and evenly closed.	Different shades of grey-brown.	Large = 3–6 pieces/kg, 18–24 cm in length
<b>Black teatfish</b>	Flat and straight with teats clearly in view. Powdery surface a desirable attribute. Distinct smoky smell with no off-odours.	One single long straight cut in the upper part of the body. The cut must be fully and evenly closed.	Powdery cover is greyish brown, but the skin surface underneath is black.	Large = 4–6 pieces/kg, 18–24 cm in length
<b>Stonefish</b>	Flat, roughly oval shape. Shallow grooves around the body. Pleasant smoky smell.	None	Brown-black	Size = 6–12cm
<b>Surf redfish</b>	Flat, long oval shape. Upper surface has a rough appearance, while the lower surface looks smoother with a distinct downward pointing mouth at one end. Pleasant smoky smell.	None	Brown-black	Common size = 7.5–15 cm
<b>Blackfish</b>	Chunky, roughly oval-shaped body with pointed ends with white anal teeth visible at open end. Upper surface has a slightly rougher appearance than the lower surface. Distinct mouth on lower surface. Pleasant smoky smell.	None	Black	Common size = 8–12 cm
<b>Amberfish</b>	Long and straight, covered in small warty growths on top and sides. Mouth is on the underside. Pleasant smoky smell.	Small slit in anus	Brown-black	Size around 12 cm

Adapted from *Beche-de-mer grading features as used in Hong Kong* by David C. Cook and Julie Palaso Cook, Hong Kong Pacific.



# PACKING AND STORING

Copra/hessian sacks are still commonly used for packing and shipping the finished product. Woven plastic sacks of the same size have also become more common. Although convenient for the beche-de-mer processor, and quite acceptable for their own storage purposes, this type of packaging has a number of disadvantages when it comes to shipping beche-de-mer overseas:

## Product protection

The distribution chain for beche-de-mer can be long and involved, requiring storage at less-than-ideal wharf facilities and transportation often on the open deck of a ship. Although, once processed, beche-de-mer can withstand a reasonable amount of physical abuse, they are still susceptible to moisture damage and contamination. Prolonged exposure of sacks to sea spray or contamination with engine oil are fairly common occurrences. Wooden crates or cardboard cartons lined with plastic which can be properly sealed are better alternatives.

## Size

Buyers often complain that the beche-de-mer sent to them are not sorted into sizes, and that mixed species are sometimes put in the same sack. This problem can be alleviated by using smaller packs. Cartons are ideal. It is much easier to make up small (10, 15 or 20 kg) batches of beche-de-mer of the same species and same size. Cartons are easy to seal and can be stacked conveniently while in storage.

## Labelling

Sacks are quite difficult to label securely. Labelling requirements have become more demanding. Information that needs to be provided on containers includes:

- Shipping address (name and address of the buyer),
- Consigner's address (name and address of supplier),
- Accurate description of contents (species and size-grade of beche-de-mer),
- Weight of contents.

It is much easier to provide this information on a wooden crate or cardboard carton. A further advantage is that a brand name can be used, providing an added marketing and promotion possibility.

Cartons and boxes are more acceptable to shipping lines. They are easier to handle and are not abused in the same way as sacks of produce.





# MARKETING

The beche-de-mer market is complex and mainly controlled by Chinese merchants. Some beche-de-mer producing countries are exporters only. In others, which have large Chinese communities, part of the beche-de-mer production is sold for local consumption. In some cases, the product transits through several markets. At the present time, world production of beche-de-mer is shipped mainly to the two largest markets of Hong Kong and Singapore. Taiwan imports reasonable volumes of beche-de-mer. China also imports a significant quantity, but this market is generally controlled by traders in Hong Kong and Singapore.

Hong Kong is currently the main market, and the volumes imported are increasing. Over six thousand tonnes of beche-de-mer were imported in 1990, the Philippines and Indonesia being the main suppliers. Re-exports usually go to the People's Republic of China and to Korea.

In the mid-1980s the Singapore market was expanding at the rate of about five per cent per annum, peaking in 1988 at twelve hundred tonnes. Over one thousand tonnes were imported in 1990, mainly from the Indian Ocean and the Philippines. Re-exportation is chiefly to Malaysia.

Prices vary considerably between merchants and also vary somewhat according to season; they are usually greatest just before the Chinese New Year, when consumption is highest. Producers new to the trade will need to send samples to a number of potential buyers in one of the two largest importing countries to get a quote. Hong Kong traders are more familiar with products from the South Pacific, so this is probably the best place to start. A small number of each species of beche-de-mer produced will have to be sent.

Once a satisfactory quote has been obtained it is advisable to make secure financial arrangements with the purchaser to cover payment for any consignment. The normal procedure is to arrange for the buyer to issue an irrevocable letter of credit (LC) to a bank in your country. The bank will release the funds when advised by the buyer that the consignment has reached its destination in good order. The manager of your local bank can provide more advice on LCs.

The countries and territories of the tropical Pacific export comparatively small volumes of beche-de-mer to Hong Kong and Singapore, their contribution accounting for no more than 10 per cent of the total annual tonnage imported to these markets. However, because the products are of good quality, they fetch fairly high prices, which means that their contribution to the total value of imports is higher.

Pacific countries may well take a larger share of the world market if producers comply more strictly with buyers' demands as regards choice of species and processing techniques and if they can regularly supply products of consistently good quality.



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Unique Commercial Distributors Ltd  
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Telex: 61497 UNIWA HX

Wellcome Co. Ltd  
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Aberdeen  
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Unigreat Resources Pte. Ltd  
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### **Solomon Islands**

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### **United States**

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### **Western Samoa**

Chang Island Produce Ltd  
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Western Samoa

# COMMON NAMES OF BECHE-DE-MER IN OTHER LANGUAGES

## Sandfish

Mandarin	<i>paishen</i>
Cantonese	<i>pak-sum/thuk-su</i>
Hokkien/Teochew	<i>peh-sim</i>
Fijian	<i>dairo</i>
Palauan	<i>rebotel</i>
Samoa	<i>fugafuga ai</i>

## Teatfish

Mandarin	<i>yenshen</i>
Cantonese	<i>sack-ngum/sac-sum/ ngum-sum</i>
Hokkien/Teochew	<i>oo-boh sim/cheeok-sim</i>
Cook Islands Maori	<i>rori-u</i>
Fijian (black species)	<i>loaloe</i>
(white species)	<i>sucuwalu</i>
I-Kiribati (black species)	<i>terommama</i>
(white species)	<i>temaimmama</i>
Motu (PNG) (black species)	<i>tamasi loremana</i>
(white species)	<i>tamasi kurukuruna</i>
Palauan	<i>bakelungal</i>
Pohnpeian (FSM)	<i>matchip</i>
Rarotongan	<i>rori-u</i>
Samoa (black species)	<i>susuvalu uli</i>
(white species)	<i>susuvalu pa'epa'e</i>

## Solomon Islands Pidgin

Tahitian	<i>susufish</i>
Tongan	<i>rori iu</i>
Tokelauan	<i>huhuvalu</i>
Trukese (FSM)	<i>kahiujju</i>
	<i>machonpech</i>

## Prickly Redfish

Mandarin	<i>meihuashen</i>
Cantonese	<i>mui-fah-sum</i>
Hokkien/Teochew	<i>boey-hwa-sim</i>
Fijian	<i>sucudrau</i>
I-Kiribati	<i>teuningauninga</i>
Motu (PNG)	<i>ratarata</i>
Palauan	<i>temtami</i>
Rarotongan	<i>ngata type</i>
Samoa	<i>faatafa or sauai</i>
Tahitian	<i>rori euta</i>
Trukese (FSM)	<i>lachcha</i>

## Deep-water Redfish

Cantonese	<i>hung hur sum</i>
Hokkien/Teochew	<i>Ang-her-sum</i>
Fijian	<i>dri-tabua</i>

## Surf Redfish

Cantonese  
Hokkien/Teochew  
Cook Islands Maori  
I-Kiribati  
Motu (PNG)  
Rarotongan  
Samoan  
Tahitian

*hung hur sum*  
*ang-her-sum*  
*rori pua*  
*tawaeura*  
*dubana kahakaka*  
*rori puakatoro*  
*Mama'o*  
*rori papa'o*

## Blackfish

Mandarin  
Cantonese  
Hokkien/Teochew  
Fijian  
Motu (PNG)  
Palauan  
Samoan  
Tongan  
Trukese

*hsiao-wu-yuan shen*  
*siew-wu-yuen-sum*  
*or-sim*  
*dri,dri-dakai*  
*dubana karemana*  
*eremrum*  
*loli aa'u*  
*mokohunu*  
*chon*

## Brown Sandfish

Mandarin  
Cantonese  
Hokkien/Teochew  
Cook Islands Maori  
Fijian  
I-Kiribati  
Tahitian

*chishen*  
*chi-sum*  
*chi-sim*  
*rori puakatoro*  
*vula*  
*uninganibakoa*  
*rori ruahine*

## Lolly Fish

Mandarin  
Cantonese  
Hokkien/Teochew  
Cook Islands Maori  
Fijian  
I-Kiribati  
Palauan  
Pohnpeian (FSM)  
Rarotongan  
Samoan  
Tahitian  
Tokelauan  
Trukese (FSM)

*wutiao*  
*wu-thiew-sum*  
*or-theow-sim*  
*rori toto*  
*loliloli*  
*ten tabanebane*  
*esengl*  
*kotop*  
*rori toto*  
*loli*  
*rori toto*  
*loli*  
*perijan*

## Pinkfish

Mandarin  
Cantonese  
Hokkien/Teochew  
Samoan

*wu-tiao shen*  
*wu-thiew-sum*  
*or-theow sim*  
*sea amu'u*

## Elephant's Trunk Fish

Mandarin  
Cantonese  
Hokkien/Teochew  
Fijian

*hsiangpishen*  
*cheong-pei-sum*  
*cheeowu-pee-sim*  
*dairo-ni-cakau*

## Greenfish

Mandarin	<i>hsiaofangshen</i>
Cantonese	<i>siew-fong-sum</i>
Hokkien/Teochew	<i>seow-boey-hwa-sim</i>
Cook Islands Maori	<i>rori matie</i>
Fijian	<i>tarasea</i>
Rarotongan	<i>rori matie</i>
Samoan	<i>maisu</i>

## Curryfish

Mandarin	<i>yushen</i>
Cantonese	<i>yoke-sum</i>
Hokkien/Teochew	<i>gheck-sim</i>
Samoan	<i>sea</i>





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