

Background

There are roughly 1,200 species existing worldwide, with some 12 species considered suitable for commercial exploitation. Sea cucumbers in its processed commercial form are referred to as beche-de-mer, or as Trepang (Asian). The most desirable species for beche-de-mer are those with a thick wall (skin). Processing this species occurs through boiling, cleaning, sun drying, and in some cases smoking. The end product has a rubbery texture, and is considered an aphrodisiac and a delicacy by Chinese communities. Hence the demand for this product is high in countries such as China, Singapore, and Hong Kong. White teatfish, Sandfish and White sandfish appear to have greater value. Sea cucumbers have a history of overexploitation in the Pacific region. This is largely due to their relative easy to capture and poor or ineffective resource management.

Biology

Little is known on the biology of sea cucumbers. Sexes are separate and most take 2-3 years to attain reproductive maturity. Most commercial important species are detritus feeders, and occupy a variety of habitats including sand, coral, and at varying depths from the intertidal zone to depths of approximately 25 meters. They are asexual, reproducing through division (ie divide to form two individuals capable of reproducing) and also reproduce sexually, where fertilisation occurs externally (via a spawning event). Sea cucumbers are expected to have relatively low levels of recruitment. Growth rates are relatively slow and natural mortality is expected to be high on juveniles (hence their very cryptic nature) and to a lesser extent on adults.

Current Status

The most common species found in the Cook Islands are; Greenfish (rori matie), surf redfish (rori puakatoro), and the Lollyfish (rori toto). The surf redfish is commonly found along the surf zone. The Lollyfish and Greenfish are predominantly found amongst rubble and on the lagoon floor. Of the eleven species known to occur in the Cook Islands, five have commercial potential. However one species (Black teatfish) is extremely rare, and Prickly redfish is found at relatively low densities. Both these species are of higher value. Highest densities for Surf redfish occur on the surf zone. Greenfish and Lollyfish occur in greatest densities on the inner reef flat and within the lagoon.

Species, which exist in high abundance within the Cook Islands, are generally medium to low value. Prices are within the order of NZD6.00/kg for Surf redfish and NZD3.50 /kg for

Lollyfish and Greenfish. On average, 13 Surf redfish and 25 for Lolly and Green-fish are required to make up 1kg of dried beche-de-mer.

Very little exploitation exists, currently only one known commercial exporter of beche-de-mer operating. Previously (1980's) sea cucumbers were harvested and processed for export from Rarotonga and Palmerston, however the quantity remains unknown. Harvesting is primarily carried out on a subsistence basis, with seasonal harvesting for *Holothuria leucospilota* (matu rori), with the roe of the animal being consumed both raw and cooked (considered a local delicacy). This species is of little commercial importance.

Potential

The potential for commercial development of sea cucumbers appears limited. This is due to the relatively low commercial value of the most common species, and the relatively high investment of time and effort spent in processing for export. However the effort and materials required for processing are similar to that required for copra. Given the current price per ton of copra (NZD300-400), the returns from beche-de-mer are more rewarding (minimum earning of approximately NZD6,000/t of high grade beche-de-mer). Estimates of potential harvest limits and expected minimum value are given in table 2, it should be noted that stocks of surf redfish on other atolls in the Cook Islands with possibly greater potential have not been assessed.

Potential may occur in the Northern Cook Islands for limited development to supplement household income on a part time basis. However, competing interests in these areas (such as pearling) make this type of industry less appealing to the local community. A hypothetical scenario would be an industry based on rotational harvests between islands and pooling of beche-de-mer product for export from Rarotonga. This would make it easier to gain sufficient quantity so as to make export overseas viable.

Table 1. Common, scientific and local names for species of sea cucumbers known to exist in the Cook Islands.

Common	Scientific	Local	Commercial importance	Potential
Greenfish	<i>Stichopus chloronotus</i>	rori matie	Low	Moderate
Surf redfish	<i>Actinopyga mauritiana</i>	rori puakatoro	Medium	High
Lollyfish	<i>Halodeima atra</i>	rori toto	Low	Moderate
Black teatfish	<i>Microthele nobilis</i>	Rori u	High	Nil
Prickly redfish	<i>Thelenota ananas</i>	-	Medium	Low
Brown sandfish	<i>Bohadschia marmorata</i>	Rori Pua	No value	Nil
-	<i>Synapta maculata</i>	A'ei	No value	Nil
-	<i>Holothuria hilla</i>	-	No value	Nil
Leopardfish	<i>Bohads chiargus</i>	-	No value	Nil
-	<i>Stichopus horrens</i>	-	No value	Nil
Soft Black sea cucumber	<i>Holothuria leucospilota</i>	Matu rori (Rori Kaa)	No value	Nil

Table 2. Estimates of Surf redfish (Rori Puakatoro) standing biomass and preliminary harvest limits for some islands in the Cook Islands.

Island	Estimated Population (Numbers)	Total Allowable Catch. (Numbers)	Dry weight (kg)	Value (NZD) Average price (\$6.00/kg)
Rarotonga ¹	42,500	10,625	1,000	6,000
Aitutaki ^{2,3}	182,000	45,511	4,500	27,000
Palmerston ^{4*}	15,000	3,750	300	2,000
Takutea ⁵	4,000	1,000	80	500
Mauke ⁶	3,600	900	70	500
Atiu ⁷	11,700	2,925	250	1,500
Mitiaro ⁸	10,100	2,525	200	1,000

Note: these estimates are based on a precautionary harvest limit of 25% of the estimated existing biomass of Surf redfish.

*Some caution needs to be exercised to the validity of surf redfish estimates from Palmerston. Palmerston has similar reef area and structure to Aitutaki, surf redfish density is therefore expected to be similar to that estimated from Aitutaki.

Harvesting and Processing

Sea cucumbers are collected during low tide with SCUBA equipment used for harvesting species, which inhabit deeper waters. Although piecing techniques (spears) can be used this is not recommended as the method causes decreased value in the final processed product. Collected sea cucumbers are processed by gutting, boiling, cleaning, sun drying and in some cases smoking. The end product has a rubbery texture. The processing of beche-de-mer is well documented, we refer the interested readers to the publication, Sea cucumbers and beche-de-mer of the Tropical Pacific, A handbook for Fishers. This publication is held at the Ministry of Marine resources library and available on short-term loan. Figure 1 illustrates a summary flow diagram of the processing procedures for high value species. Attachment one outlines the processing procedures for surf redfish (rori puakatoro). This procedure is recommend if fishers are willing to sell processed surf redfish to a exporter base in Rarotonga (O'moana international). It should be noted that the length and weight of sea cucumber is reduced considerably after processing. The final product weighing approximately 10% of the original weight.

Figure 1. Processing procedures for sea cucumber (source: Sea cucumbers and beche-de-mer of the Tropical Pacific, Handbook no. 18 South Pacific Commission).

Marketing

The beche-de-mer market is complex and mainly controlled by Chinese business-persons. The major markets are Hong Kong and Singapore. For those new producers willing to enter the trade it is recommended that a small sample of each species processed be sent to a number of buyers in order gain a number of quotes. Beche-de-mer prices vary considerably throughout the year, however highest prices are obtained during the Chinese New Year season (February). For more information regarding the marketing of beche-de-mer we refer the interested reader to the publication "Sea cucumbers and beche-de-mer of the Tropical Pacific, A handbook for Fishers. Handbook no.18; 1994, South Pacific Commission, Noumea. This report is held in the MMR library and is available on short-term loan. More recent information will be made available as it comes to hand.

Resources Management

Due to the relatively low density combined with the relatively less attractive commercial value, the species is less likely to be fished to a level of no return (assuming international market prices remain stable). If beche-de-mer becomes uncommon due to over-collecting at one location/island, it may not be economical for collectors to pursue the resource. Such a feed back can control over-harvesting. Nevertheless, some simple restrictions on harvesting are advisable, not only to ensure that stocks do not become overly depleted, but also to ensure marine community balance and to guarantee that the resource is available and shared with other users, eg. subsistence consumers, conservationists and recreation divers.

The management of the fisheries should be under the control of local governing bodies with technical assistance provided by MMR. Possible management regimes include; minimum size limit (eg. 15 cm for unprocessed surf redfish), total allowable catch limit (25% of the standing biomass), seasonal closures, rotational harvest between islands, prohibiting collection using SCUBA equipment and the issue of licenses.

Summary

- Ø Little is known on the biology of sea cucumbers, however most commercially important species are detritus feeders, they reproduce asexually and sexually.
- Ø Little commercial exploitation exists. Subsistence harvesting occurs primarily for the roe of *Holothuria leucospilota* (matu rori).
- Ø The potential to commercially exploit sea cucumbers appears limited for the southern Cooks. Surf redfish (rori puakatoro) is the only species of significant commercial volume and value.
- Ø The quantity of various sea cucumbers in the northern Cooks is unknown, however is expected to be greater than the southern Cooks.
- Ø After harvesting, processing involves the gutting, boiling, cleaning and drying. Beche-de-mer may be packed in cardboard cartons or used flour sacks for export.
- Ø Management of the resource should take into consideration minimum size limits, total allowable catch, seasonal or rotational harvest closures.

A selection of useful addresses in the Beche-de-mer Industry

(source: Sea cucumbers and beche-de-mer of the Tropical Pacific, A handbook for Fishers. Handbook no.18, South Pacific Commission, Noumea)

Australia

Ausitops Pty Ltd
7 Beluga Street
Mount Eliza
Victoria 3930
Phone/Fax: 61-3-7879880

Imperial Seafoods Pty Ltd
PO Box 488
Capalaba Queensland 4157
Phone: 61-78-888768

Hong Kong

Asia Pelita Trading Ltd
19/F, Siu Ying Commercial Bldg
153 Queen's Road, Central
Phone: 852-5-8152183

Euroasia Holding Ltd
Rm 1101-1103, 11th floor
The Leader Commercial Building
54 Hillwood Road, Tsimshatsui
Kowloon
Phone: 852-3-669309/0
Fax: 852-3-7215021

Full Success Trading Co
Des Voeux Building
Romm 402
19-25 Des Voeux Road West
Sai Ying Pun
Phone: 852-5-487720
Fax: 852-8-582699

Heep Tung Hong
G.P.O. Box 407
Phone: 852-5-484029
Fax: 852-5-484029

Hillsdown (Hong Kong) Limited
Room 843, Swire House
Chate Road
Central, Hong Kong
Phone: 852-5-262338
Fax: 852-5-8681437

Hip Lien Hong Food Provision Co Ltd
54-56 Bonham Strand West
Ground Floor
Central
Phone: 852-5-418311
Fax: 852-5-423802

Hong Kong Pacific
Flat 11M
Mt Butler
111 Mt Butler Road
Jardine's Lookout
Phone: 852-8-738333
Fax: 852-8-905994

Kam Enterprise
1403 Manley Commercial Bldg
367-375 Queen's Road
Central
Fax: 852-5-440460

Dah Chong Hong Ltd
4-6th Floor, Hang Seng Bank Bldg
77 Des Voeux Road, Central
Phone: 852-5-261111
Fax: 852-5-290678

Nam Kwong N Co.
8th Floor
186-188 Des Voeux Road West
Phone: 852-5474563/3879
Fax: 852-5592400

Niceray Corporation Ltd
G.P.O. Box 9125
Phone: 852-7200734
Fax: 852-7200738

Okaya International (HK) Ltd
Shun Tak Centre
20th Floor
Room 2002
200 Connaught Road, Central
Phone: 852-5-488227
Fax: 852-5-464167

Oriental Marine Product Group
G.P.O. Box 251
Phone: 852-3-7790021

Tat hing Sharkfins Co. Ltd
Crocodile House
11th Floor, Room 1102
50-53 Connaught Road Central
Phone: 852-8-518918
Fax: 852-8-518971

Summer Sea Product Co Ltd
Rm 808-9 Wing Tuck Com'l Centre
177-183 Wing Lok Street West
Phone: 852-5456035
Fax: 852-5438570

Unique Commercial Distributors Ltd
G.P.O. Box 293
Phone: 852-5-278331
Success Food Trading Company Ltd
Sino Industrial Plaza
8th Floor Room 58
9 Kai Cheung Road
Kowloon Bay
Phone: 852-7-956585
Fax: 852-7-954528

Summer Commodities Trading Ltd
Rm 808-9
Wing Tuck Commercial Centre
177-183 Wing lok Street West
Phone: 852-5438570
Fax: 852-5438570

Tapon International Ltd
Unit 904, Hilden Centre
Zsung Ping Street
Hung Hom
Phone: 852-7662689
Fax: 852-3624390/7656530

Wellcome Co. Ltd
11 Tin Wan Praya
Aberdeen
Phone: 852-5-418311
Fax: 852-8-149547

Wing Cheing Marine Product
Hong Kong Plaza
19th Floor Room 1904
369 Des Voeux Road West
Sai Ying Pun
Phone: 852-5-448809
Fax: 852-8-581558

Wing Hop Lee Ltd
53 Bonham Strand West
Ground Floor, Central
Phone: 852-8-518918
Fax: 852-8-516971

Yick Tat Trading Co.
Rm 201, 81-85 Des Voeux Road
Phone: 852-5-407696
Fax: 852-5-597105

New Zealand

Asil Group Ltd
173 Victoria Street
Wellington
Phone: 64-4-3854888
Fax: 64-4-3854728

Singapore

Allied Aces (Pte) Ltd
Toa Payoh Central
P.O.Box 519, Singapore 9131
Phone: 65-2255366/2245868
Fax: 65-2246914

Amanda Foods Pte Ltd
#31-308 The Plaza
75500A Beach Road
Singapore 0719
Phone: 65-2919661

BNF Singapore Pte Ltd
Blk 1 Lorong 8
Toa Payoh Industrial Park
#01-1385
Singapore 1231
Phone: 65-3550462
Fax: 65-3550463

Chin Guan Hong (Sharksfins) Pte Ltd
17, North Canal Road
Singapore 0104
Phone: 65-5341096
Fax: 65-5342985

Chip Chiang
No.28, Hong kong Street
Singapore 0105
Phone: 65-5333475
Fax: 65-5339923

Hai Lee Seafood Trading Co
Block 25
Defu Lane 10
No. 01-205
Singapore 1953
Fax: 65-2808711

Hiang Fisheries
31 Waringin Walk
Phone: 65-448-5857
Fax: 65-448-5857

Hiap Heng Chang (S) Pte Ltd
5-6 North Canal Road
Singapore 0104
Phone: 65-5351888
Fax: 65-5357283

Malhar Traders
Robinson Road
P.O.Box 268
Singapore 9005
Fax: 65-5351640

Toyoto Tsusho (Singapore) Pte Ltd
79 Robinson Road
15-05 CPF Building
Singapore 0106
Fax: 65-2225674

Wah Seng Trading (1970) Pte Ltd
34 Carpenter Street
Singapore 0105
Fax: 65-5340480

Unigreat Resources Pte. Ltd
Blk 16, Wholesale Centre #01-99
Singapore 0511
Phone: 7760906
Fax: 65-7794239

References

- 1 Ponia., B. and Raumea. K., (1998). Rarotonga marine resources baseline assessment: Nikao raii, Aroko raii, Matavera raii, Tikioki raii, and Rutaki raii. Rep. to Cook Islands Ministry or Mar. Res. No.98/05 109 pp.
- 2 Ponia., B., (1998). Aitutaki marine reserve baseline assessment: Maina reserve, Motukitiu reserves and Ootu reserve. Rep. to Cook Islands Ministry or Mar. Res. No.98/02 52 pp.
- 3 Adams., T.J.H., Bertram, I., Dalzell, P., Koroa, M., Matoto, S.V., Ngu, J., Terekia, O., and Tuara, P., (in press). Aitutaki lagoon fisheries. South Pacific Commission, Noumea. New Caledonia.
- 4 Preston., G.L., Lewis, A.D., Sims, N.A., Bertram, I., Howard., N., Mauofenua, S., Marters, B.T., Passfield, K., Tearii, T., Viala, F., Wright, D., Yeeting, B., (1995). The marine resources of Palmerston island, Cook Islands. South Pacific Commission. *Insh. Fish. Pro. tech. doc.*; no. 10 . 61 pp
- 5 Ponia., B., Raumea, K., and Tatuava. S., (1998). Takutea reef resources baseline assessment. Rep. to Cook Islands Ministry or Mar. Res. No.98/08 30 pp.
- 6 Ponia., B. and Raumea. K., (1998). Mauke reef resources baseline assessment. Rep. to Cook Islands Ministry or Mar. Res. No.98/06 21 pp
- 7 Ponia., B. Raumea, K., and Tatuava., S., (1998) Atiu reef resources baseline assessment. Rep. to Cook Islands Ministry or Mar. Res. No.98/09 26 pp.
- 8 Ponia., B. Raumea. K, and Roi, N., (1998) Mitiaro reef resources baseline assessment. Rep. to Cook Islands Ministry or Mar. Res. No.98/11 24 pp.

Recommend processing procedures for Surf redfish (rori puakatoro) for O'moana International. Phone 25033; Fax 25034.

1. Place surf redfish in boiling container (eg. half drum) for boiling. There is no need to add water to the boiling container, liquid will be extracted from surf redfish when heat is applied.
2. Remove surf redfish from container approximately five minutes after water begins to boil and allow surf redfish to cool. Surf redfish can be placed in a container of salt water for rapid cooling.
3. To remove the gut contents a slit (about 3 cm) is made on the underside of the surf redfish (near the head) passing through the mouth. The surf redfish is squeezed to extract the gut contents.
4. Close up the slit by tying with a sting.
5. Place surf redfish (silt side down) on smoking trays and smoke in a smoko-house for 12-16 hours.
6. After smoking place surf redfish on drying racks (iron roofing) and allow three to five days for drying. During drying rotate surf redfish occasionally.
7. Pack beche-de-mer in clean sacks or cardboard boxes and store in a dry area.