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Trochus in the Pacific Islands region:

A review of the fisheries,
management and trade



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Trochus in the Pacific Islands:

A review of the fisheries, management and trade

Robert Gillett, Mike McCoy, Ian Bertram, Jeff Kinch
and Aymeric Desurmont

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Acronyms and abbreviations

ACIAR	Australian Centre for International Agriculture Research
BMR	Bureau of Marine Resources (Palau)
DRMM	Direction des ressources marine et minières (French Polynesia)
FAO	Food and Agriculture Organization of the United Nations
FJD	Fiji dollar
FSM	Federated States of Micronesia
kg	kilogram
kg/yr	kilogram per year
ha	hectare
lb	pound (weight)
MFMR	Ministry of Fisheries and Marine Fisheries (Solomon Islands)
MIMRA	Marshall Islands Marine Resources Authority
MMR	Ministry of Marine Resources (Cook Islands)
MFMRD	Ministry of Fisheries and Marine Resources Development (Kiribati)
NZD	New Zealand dollar
PGK	Papua New Guinea kina
PICTs	Pacific Island countries and territories
SBD	Solomon Islands dollar
SPC	Pacific Community
t	tonnes
t/yr	tonnes per year
USD	United States dollar
VFD	Vanuatu Fisheries Department
VUV	Vanuatu vatu
XPF	Change franc Pacifique

Executive summary

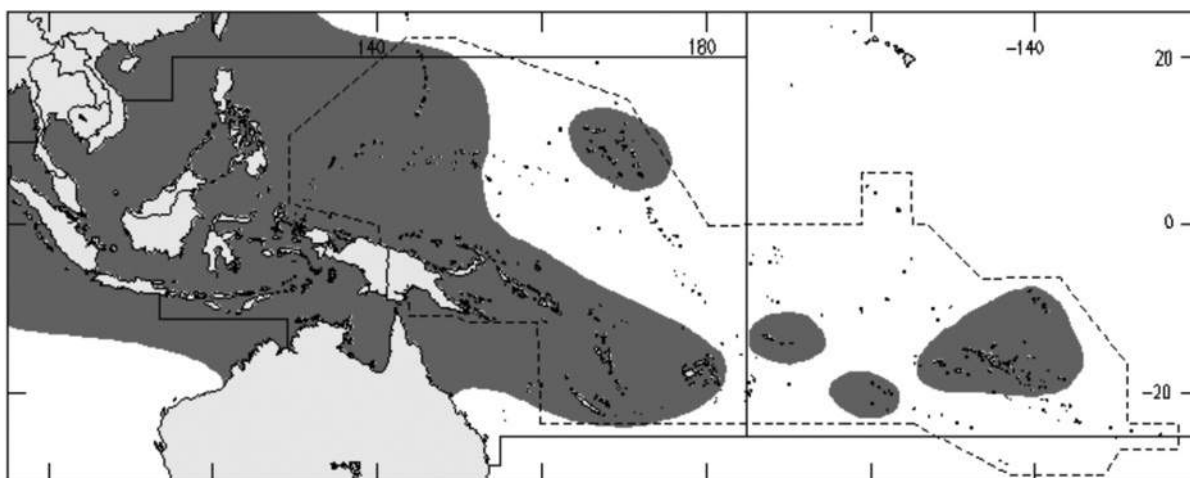
This report	• This report is an overview of the fisheries, management and trade of trochus in the Pacific Islands region. • The study involved visits to Pacific Island countries and territories where the trade is active or has been active in the recent past. Those visits resulted in the preparation of national trochus profiles, which are presented in Appendix 2 of this report. • Data in the profiles are extracted, compiled, compared, and used together with information from the literature and trochus wholesalers to portray the trochus fisheries and trade in the region and internationally. Topics of special interest are explored.
Pacific Island trochus production and trends	• An attempt was made to estimate the annual trochus exports from each country in the region, but as trochus data are often poor, estimates given in Table 1 of this report are largely a product of guesswork, and should not be considered very accurate. • After correcting for non-reporting, it is believed that the average annual commercial trochus production in the region in the late 2010s was around 1400 tonnes (t). • Comparing crude estimates of trochus production made in 1996 by a World Bank study to crude estimates made in 2019 by the present study, the annual production in the region appears to have fallen from 2300 t to 1400 t in 25 years, a drop of about 39%.
World trochus production	• In the last 25 years, world trochus production is estimated to have fallen from about 3900 t to 2020 t, a drop of almost 50%. • The Pacific Islands region is responsible for about 69% of the global production of trochus.
Domestic prices for trochus	• Table 4 gives recent prices paid for trochus in each country of the study. • All nominal national prices decreased during the last 25 years. The range of the change was a USD 0.25/kg drop in French Polynesia to a USD 2.30/kg drop in Fiji. • The fall of the price of trochus in real prices (i.e. adjusted for inflation) in the last 25 years is even more remarkable.
Trochus processing in the region	• The 1995 World Bank trochus study indicated that 32 trochus processing factories had been set up in 9 countries of the region. • In late 2019, only one trochus processing plant remained in operation, the Yon Tong Company located in Lami outside of Suva. It is only operating part time. • Reasons cited for the factory closures include competition with Asian factories, high cost of electricity, natural disasters, high cost of labour (in the French territories), dissatisfaction with national business conditions, and a shortages of raw trochus.
Trochus processing outside the Pacific Islands	• A few decades ago, China became the global epicentre of trochus button manufacturing, but that has changed recently. Many of the trochus factories in China either closed or moved their operations to Viet Nam, or to a lesser degree, Indonesia. • One trochus wholesaler estimated there are now only about 15–20 factories in the world that buy substantial amounts of trochus.
Product flow	Most of the trochus from the region is sent to Asia, with Viet Nam and China being the main destinations. Italy and Japan are also listed as destinations in customs data, but the volume is much less than that for Asia.
Cause of the low prices for trochus	The current low prices of trochus could be due to: • The poor current state of many of the economies in developed countries results in reduced demand for trochus. • Clothes in general are more casual these days and there is less use of buttons. • There is a general (but temporary) fashion trend away from using trochus buttons. • Some manufacturers and consumers have the attitude that it is wrong to disturb the natural ecosystem. • Substitution of other shell material for trochus in button manufacturing.

Some speculation on the future	In the future, there is likely to be a continuation of trends that have been going on for decades. These trends include: • Global trochus prices gradually falling. • Occasional increases or decreases in the demand for trochus due to fluctuations in the state of economies in developed countries, and fashion trends. • Occasional changes in the demand for trochus as opportunities arise and fade for substitution with other materials for buttons. • A gradual decrease in trochus abundance on the reefs in the countries of the region due to the ease of collecting and storing trochus and suboptimal management of some trochus fisheries.
The management of trochus fisheries	In six of the countries of the study, trochus is managed by a combination of size limits and a ban on the harvesting of trochus except in specific and short declared harvesting seasons. In five of the countries, there are no such declared seasons. In general, trochus appears to be better managed (e.g. greater abundance, less decline in production) in those places with both size limits and declared seasons.
Trochus reseedling	The use of reseedling as a trochus management tool is controversial. The present review suggests that trochus reseedling should, at best, be considered as a complement to restrictive fisheries management and not as a replacement.
Trochus transplantation	• There have been numerous attempts to introduce trochus to new areas in the Pacific Islands: at least 70 transplants have taken place between island groups in the region. • By late 2019, total trochus production in recipient countries since transplantation has been about 10,500–15,000 t.
Benefits from trochus fisheries	• Over the last 25 years, drops in trochus production and price combine to tremendously reduce the benefits produced by the trochus fishery of the region. • As an example, these two types of reductions have resulted in the real annual earnings to fishers from the Fiji trochus fishery in 2018 to only about 33% of what they were 25 years ago • Even though the Pacific Islands region is currently responsible for about 69% of the world production of trochus, there appears little the countries can do to improve the poor international price of trochus.
Recommendations	The recommendations of this study are in two main categories: 1. Improvements to domestic buying prices • Promote an increase in the number of buyers seeking raw trochus. • Obtain price information from neighbouring countries and from Asia. • Consider grading trochus before sale. • Promote good business relationships. 2. Improvements in the management of trochus fisheries • Realise that size limits as the sole management measure are insufficient to control overfishing of trochus. • Be aware that most well-managed trochus fisheries in the region have a ban on the harvesting of trochus except in specific and short declared harvesting seasons. • Recognise that there is considerable justification for an upper size limit, and that it is not more difficult to enforce both an upper and lower size limit than just a lower limit.

1.0 Introduction

1.1 Trochus and its trade

The commercial top shell (*Rochia nilotica*, formerly *Trochus niloticus*)¹ is one of the most economically important shellfish in the Pacific Islands region. The natural range of the species is from Wallis Island and the Lau Group of Fiji in the Pacific, to Madagascar in the Indian Ocean, and from Japan in the North Pacific to Queensland in the South Pacific. Trochus has been successfully transplanted to areas where it does not occur naturally, including many parts of Micronesia in the 1920s and 1930s, and to Cook Islands and French Polynesia in the 1950s.



Source: Poutiers 1998

Trochus shell is used in the manufacture of mother-of-pearl buttons and simple handicrafts. Trochus is also an important source of food for coastal communities where it occurs. The trade in trochus shell has historically been of great importance in the region. An appealing aspect of the trochus trade, especially for outer island communities, is that the shell is non-perishable and does not need to be refrigerated and can be stored for long periods until markets are accessible and/or prices are favourable.

Trochus is a relatively well-studied animal. Two trochus bibliographies have been published (Gail and Devambez 1958; Nash 1987). Most of the available documentation concerns trochus biology and the management of trochus fisheries. Four studies have, however, been carried out on the Pacific Islands trochus trade: Powell 1960; Carleton 1984; Philipson 1989; and Gillett 1996. Some of the major findings of these studies are provided in Box 1.

¹ Unless otherwise mentioned, all references to “trochus” in this report refer to *Rochia nilotica*.

Box 1: Previous studies of the Pacific Islands trochus trade.

Powell recommended:

- Economic feasibility studies for pre-processing trochus
- Establishment of quality standards
- Biological studies as a basis for management

Carleton stated:

- 60% of the world's supply of trochus is from the Pacific Islands region
- There is more scope for participation by Pacific Island countries in marketing and processing
- Prevailing prices in the Pacific means that PICTs have to accept prices that are available on the market as they lack economies of scale and are unable to affect the market price.
- Grading and sorting of trochus should result in a price increase
- Early 1980s efforts at processing would be successful

Philipson concluded that:

- If all the shell from the region is processed within the region, the export value of trochus would increase from USD 4 million to USD 10 million
- The manufacture of finished buttons should not be attempted at the present time

Gillett found that:

- Trochus harvests by PICTs during the period 1985–1994 was about 2300 t (t) annually, which equates to 59% of the global trochus harvest
- In 1994 about 800 t of trochus were processed by the 14 operational trochus factories in the region
- The majority of trochus-producing PICTs do not presently produce the amount of trochus needed to support even one optimally sized factory (about 120 t of raw trochus).
- The general state of the economy, fashion trends, and the use of substitutes are the dominant factors affecting demand

Another aspect of trochus is that its fishery is relatively easy to manage: much is known about its spawning behaviour, the animals are easy to count, the fishery can be easily monitored at the point of export, and advice on appropriate management is readily available in the literature. It is, therefore, not surprising that an often-cited example of a well-managed fishery in the region is the Aitutaki (Cook Islands) trochus fishery. What is surprising is that considering the ease of managing trochus, several countries in the region have trochus fisheries that are not well-managed.

1.2 This study

The last trochus trade study for the Pacific Islands region was commissioned by the World Bank in 1994, and the results were given in a detailed report (Gillett 1996, herein referred to as the World Bank trochus study) and in a summary report (ICECON 1997). In the 25 years since that study much of the attention on the trade of coastal fishery commodities has been focused on beche-de-mer, with relatively little attention on trochus. Fisheries staff at the Pacific Community (SPC) often receive requests from SPC member countries to supply information on trochus prices and other aspects of the trade. In addition, there are several countries of the region (i.e. Samoa, Tokelau, Tonga) where trochus has become abundant through transplantations, but in those places there has been no historical involvement in the trochus trade.

This study was commissioned in August 2019, along with a parallel study of the trade in aquarium products. The trochus study involved visits by either consultants of the study or SPC staff to countries that have significant involvement with the trochus trade in Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Marshall Islands, New Caledonia, Palau, Papua New Guinea, Solomon Islands and Vanuatu. Information was also obtained by phone from Guam, the Northern Marianas, and Wallis and Futuna where trochus is present but which have much less involvement in the trochus trade. Information from those PICTs is given in this report in Appendix 2.

Historically, publically available information on the trochus trade has been scarce, but with the recent shrinking of the industry, it is now even more difficult to obtain documentation on the commercial aspect of trochus. Consequently, to gain insight into the buying and selling of trochus it was necessary to obtain anecdotal information. Interviews for this study were conducted with trochus buyers, exporters, present and former processors, government fishery managers, and others familiar with the trade. Although information was obtained, there were two difficulties: 1) it was often not possible to verify some of the information, and 2) many of the informants were hesitant to talk about markets and prices for reasons of commercial secrecy.

In summary, the trade profiles for 10 countries (see Appendix 2) and other information obtained during the study are used to produce the main text of this report.

2.0 Historical aspects of the trochus fisheries and trade

Reviews of Japanese fishing in the South Pacific (Asano 1963; Kataoka 1983) state that trochus were fished in Palau in the late 1890s for export to London. Trial exports of trochus to Japan were made in 1898 and 1903 to feed a growing button manufacturing industry in the suburbs of Osaka.² The original source of trochus for the Japanese industry was the Dutch East Indies (especially Makassar), the Philippines and Borneo. Because of resource constraints in those areas after World War I, Australia, Palau and Yap became the biggest suppliers of trochus to Japan. At that time, most trochus in those three areas was harvested by divers from Hachijojima Island in Japan who primarily targeted sea cucumber. Annual trochus harvests from Palau and Yap reached a peak of 222 t (t) in 1926, but then tapered off, due to resource constraints. To overcome this supply problem, in 1928, the Japanese government started testing the transplantation of trochus to areas of Micronesia to the east of Yap.

Shell button manufacturing worldwide was interrupted by World War II and the demand for trochus fell dramatically. After the war, the trochus trade was revived. In the early to mid-1950s, annual trochus harvests reached an all-time high in many Pacific Island countries, including New Caledonia (700 t in 1956), PNG (1030 t in 1951), and Solomon Islands (717 t in 1954). There was a sharp downturn in the trochus trade in the late 1950s and early 1960s due to competition with plastic buttons. A resurgence in the demand for trochus started in the mid-1960s, apparently due to the fashion industry, which insisted on buttons with a natural appearance. Subsequently, annual quantities of trochus harvested in PICTs became driven by the price paid for trochus, resource status, and in some cases, the availability of alternative income sources.

2 Interestingly, one of the companies involved with those shipments was "Okeef Trading Company". It is likely that this was the company started by David O'Keefe, a well-known trader based in Yap, who gained fame transporting large pieces of Yap's stone money on his ships from Palau to Yap, and much later was the central character in the historical novel and romanticised movie, *His Majesty O'Keefe*.

3.0 Pacific Island trochus production and trends

Information on the annual production of trochus for PICTs obtained during the study is given in the national profiles in Appendix 2. Information from those profiles is used to construct Table 1.

Table 1: Summary of commercial production and export of trochus in Pacific Island countries.

Country	Available information on trochus production	Average annual exports in recent years (t/yr)
Cook Islands	In the period 2009–2019, two harvests occurred: 18.9 t in 2011 and 19.8 t in 2015.	4
Fiji	Export information is inconsistent and conflicting. Selectively using the various sources of data, a crude estimate is: a) raw trochus exports in the 2011–2018 period averaged 34 t/yr, and b) the raw trochus equivalent of the weight of button blanks exported was 192 t/yr. Therefore, in recent years, the annual trochus harvest was about 230 t/yr, but this could be highly inaccurate as there are conflicts between the databases (i.e. between Fisheries and Customs) and with information from the private sector.	230
Federated States of Micronesia	Pohnpei: The last trochus season was in 2014 for 136 t; Kosrae: last trochus export was in 2012 for 19 tons; Yap: last trochus export was in 2011 for 125 tons; Chuuk: No exports were recorded for the period 2008–2017 in FSM National Statistics, but some could have occurred, according to government officials in charge of monitoring the harvest.	30
French Polynesia	In the 10-year period 2009–2018 the annual harvest averaged 231 t/yr.	231
Guam	The current harvest for personal consumption is around 100 kg/yr. Trochus exports are banned.	0
Marshall Islands	January 2019 39.5 t were exported. In 2016, trochus from Enewetak was brought to Majuro, and sold and loaded into containers ³ , but there is no readily available information on the quantity.	16
New Caledonia	The average harvest since 2010 has been 154 t/yr	154
Northern Marianas	The only available information is from 1996 when the harvest was 3.9 t plus 1.7 t that were illegally harvested and confiscated, making 5.6 t total.	6
Palau	The last open season was June 2011 when 74.2 t were exported.	7
Papua New Guinea	Exports of trochus shell between 2008 and 2018 averaged 304 t/yr.	304
Samoa	About 263 t of export-sized shells were harvested in 2018, but none were exported.	0
Solomon Islands	The average annual harvest in the period 2015–2018 was about 125 t.	125
Tonga	About 38 t of trochus were exported in 2015 and 2016. For several years prior to that period, substantial amounts of trochus was harvested and eaten, but the shells were not exported.	8
Vanuatu	Hard copies of permits for trochus exports, and anecdotal information from the single trochus exporter, suggest that the average annual export for the period 2015–2019 was around 20 t.	20
Wallis and Futuna	The single harvest in the last five years (mid-2019) was about 25 t.	5
Total		1139 t

Source: Appendix 2 of this report

Note: Annual estimates that are considered to be especially inaccurate appear in *Italics*

3 Some handy “rules-of-thumb” in the trochus trade in the region are: a) A 20-foot container can hold about 17–19 t of raw trochus; b) a blanking machine requires about a tonne of raw trochus shell per month at full operation; c) for an optimum-sized blanking operation, about 10–12 blanking machines (or about 120 t of raw trochus shell) are required; d) the average yield of blanks from raw trochus is about 10–15%.

Several caveats are required for the information in the above table. In this study, the commercial production of trochus is taken to mean the harvested trochus that enters into the trochus trade and is exported, either raw or processed. It is recognised that in several countries trochus is harvested for domestic use (primarily the trochus meat), and that in trochus exporting countries some of the commercially harvested trochus is rejected due to poor quality shell. Because there is virtually no information available for those categories of trochus and because this study is focused on the trochus trade, the information in Table 1 (and especially the average annual harvests) largely equates to exported trochus.

The quality of trochus data is poor. In most PICTs, there is no system for tracking the production from coastal fisheries, but because trochus is largely an export commodity, it should be possible to estimate harvests from export data. In many countries, there are two systems of tracking exports of fishery products: 1) the government fishery agency's export permit system, and 2) the customs department export tracking system. Although these two systems should give identical results, for trochus exports they are often remarkably different (e.g. for Fiji and Solomon Islands). A trochus exporter with decades of experience in the trade believes that one source of problems with trochus export data is both fisheries and customs staff mixing up the units of volume (i.e. mingling kg, t and pieces). Another reason is that in several countries it appears that fisheries staff are not especially diligent at managing export permit paperwork, and consequently the nominal annual totals for various exported commodities are less than actual exports (i.e. some permit receipts go astray).

Due to the variable availability of data, the "Recent Years" of the table ranges from three to ten years. The "Average Annual Exports" of the table are the t of exports divided by the number of years in the latest period in which trochus export information is known.

The overall result of the poor data on trochus exports is that estimates given in Table 1 are largely a product of guesswork, and should not be considered accurate. The estimates of average annual exports in the table that are considered especially poor are given in italics.

Bearing in mind these reservations about data quality, the results of Table 1 are graphed in Figure 1.

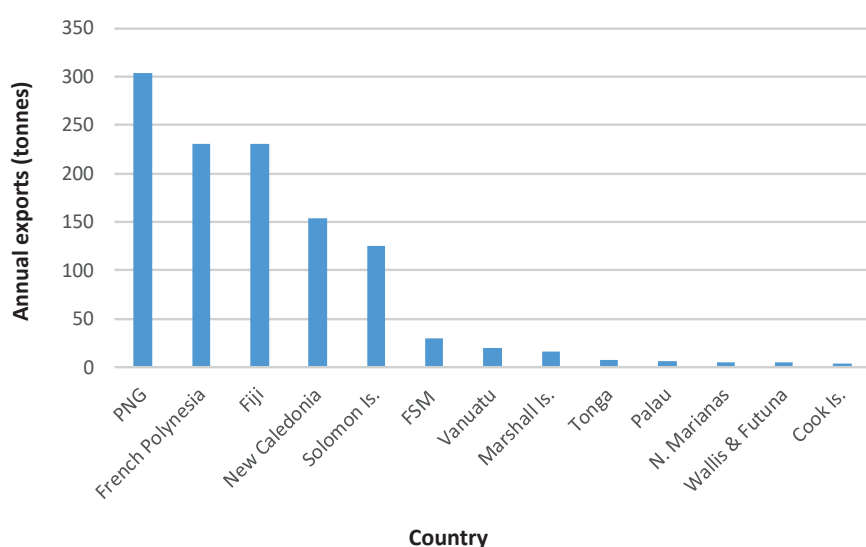


Figure 1: Average annual exports of trochus in recent years (in t).

Source: Table 1

The World Bank trochus study carried out a similar exercise in 1996 of estimating trochus production from PICTs and then compiling a regional total. That study revealed that on the basis of the best available documentation, PICTs harvested an average of 1829 t of trochus annually over the past decade. Adjustments were made, however, to account for the amount of non-reported trochus ⁴ and the regional total was increased by 25%. If a similar correction is applied to the estimate of trochus production obtained in the present study (1139 t/yr), the average annual commercial trochus production in the late 2010s is estimated to be around 1400 t.

On the basis of comparing crude estimates of trochus production for 1996 to crude estimates for 2019, annual production in the region appears to have fallen from 2300 t to 1400 t in 25 years, a drop of about 39%.

4.0 Trochus harvests outside the Pacific Islands region

4.1 Australia

In the early 1990s, Australia's annual trochus production was about 500 t, and at that time, the country was the world's largest producer (Gillett 1996). Australia had three main trochus producing areas: Torres Strait, Queensland East Coast, and Western Australia. Because the trochus fishery has declined remarkably in importance in recent years, it is difficult to obtain current statistics on trochus harvests. The readily available information is presented in Table 2.

Table 2: Recent trochus harvests in Australia.

Area	Annual trochus harvests	Source of information
Torres Strait	2016: 0.0 t 2017: 0.1 t	Woodhams J. and Mazur K. 2018.
Queensland East Coast	2014/2015: 21 t 2015/2016: 12 t 2016/2017: 0 t 2017/2018: 0 t	State of Queensland 2018
Western Australia	The annual harvest in the past decade has ranged between 2 and 15 t.	https://www.wafic.org.au/fishery/trochus-fishery/

It can be concluded that Australia is no longer a significant producer of trochus. Because this situation is largely a result of the low price paid for trochus and not overexploitation of the resource, if the price recovers, Australia has the ability to place a large amount of trochus quickly on the world market.

4.2 Indonesia

Historically, Indonesia has been of great importance in the global trochus trade, from being the major source of trochus at the beginning of the trade, to setting shell quality standards. In the early 1990s, Indonesia's annual trochus production was estimated to be about 475 t, making the country the world's second largest producer. This is despite a government decree in 1987 ⁵ that made it illegal to catch, possess, transport or trade trochus. According to industry sources, that decree is still in force. Ironically, Indonesia has the National Action Plan for Conserving Trochus 2016–2020 (Rencana Aksi Nasional Konservasi Lola Periode 2016–2020) issued by Indonesia's Ministry of Marine Affairs and Fisheries. That plan allows trochus harvesting following periods of conservation.

⁴ As most of the major trochus-producing Pacific Island countries had either a ban, limit or a heavy tax on raw trochus exports, there was an incentive to under-report amounts.

⁵ Decree No.12/1987 of the Ministry of Forestry

The latest official fisheries statistics for Indonesia show 46 t of trochus were caught throughout the country in 2014, with 37 t of that coming from Maluku Province. As those statistics can be woefully inaccurate, it is therefore necessary to use other means to estimate Indonesia's trochus production. There are several trochus processing factories in Indonesia, judging from information on the internet and from trochus wholesalers. The latter have indicated that the four or five significant trochus processing factories thought to currently exist would have a raw trochus throughput of about 500 t. In Appendix 2 of this report, Solomon Islands customs data show that a container of trochus was exported to Indonesia in 2018; therefore, not all of Indonesia's trochus factory requirements are met by domestic production. Given this complex and confusing situation it is simply not possible to make a reasonable estimate of trochus production in Indonesia in the short time frame of the present study. Nevertheless, for estimating global trochus production, Indonesia's annual trochus production is thought to be around 400 t.

4.3 Philippines

Legal instruments relevant to the trochus trade in the Philippines include:

- The Philippines Bureau of Customs' Consolidated List of Prohibited and Regulated Products for Export lists smooth top shell (*Trochus niloticus*) as a prohibited product.
- The 2001 Fisheries Administrative Order 208, which prohibits taking, gathering or causing to be taken, 27 species of gastropods, including *Trochus niloticus*.

It can be concluded then that the Philippines is no longer a major player in the trochus trade, although some illegal shipments are likely.

4.4 Global trochus production

The average annual world harvest for the early 1990s was estimated by the World Bank trochus study. In the present study, an attempt was made to replicate that estimate for the late 2010s. Trochus production estimates for PICTs, Australia, Indonesia, and the Philippines come from earlier sections of this report. As no information could be obtained on trochus production in Okinawa or other "minor areas" (e.g. Andaman Islands), the approach taken here for those areas is to assume a downward production trend, as experienced in most other areas.

Table 3 lists the results, which should be considered as indicative rather than accurate.

Table 3: World trochus production (in tonnes).

Area	Average annual harvests (in tonnes)	
	Early 1990s	Late 2010s
Pacific Islands	2,300	1,400
Australia	500	10
Indonesia	475	400
Philippines	200	10
Okinawa	200	100
Minor areas	225	100
Total	3,900	2,020

Source: Gillett (1996) and earlier sections of this report

Table 3 shows that over the 25-year period, world trochus production fell by almost 50%. Heslinga (1984) estimates that global production was about 5000 t in the early 1980s. This is compared to the recent estimates in Figure 2.

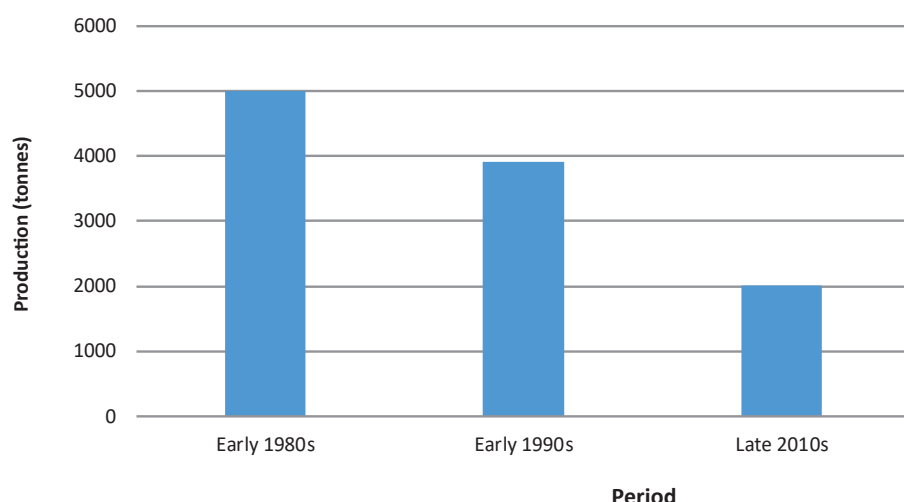


Figure 1: Average annual exports of trochus in recent years (in tonnes).

Source: Table 1

5.0 Domestic prices of trochus

Information on the latest selling prices for trochus is given in the national profiles in Appendix 2. While an attempt was made to obtain comparable information across the countries (i.e. 2019 prices at first sale), in many cases there have been no sales for several years. In two countries, trochus is graded, with a different price for each grade. In some cases, the first sale occurs in a main urban centre, while in others it is in the outer islands. Nevertheless, the available information on recent trochus prices is presented in Table 4, and those data are graphed in Figure 3.

Table 4: Prices for trochus at first sale in Pacific Island countries.

Country	1995 price/kg (local currency)	1995 price/kg (USD)	2019 price/kg (local currency)	2019 price/kg (USD)
Cook Islands	NZD 7.00 cleaned NZD 6.00 w/meat (last sale 1992)	4.55 3.90	Grade A NZD 5.50 Grade B NZD 3.30 Grade C NZD 1.20 (last sale 2015)	3.58 2.14 0.78
Fiji	FJD 6.25	4.60	FJD 5	2.30
French Polynesia	XPF 300 (last sale 1994)	3.16	XPF 310	2.91
Federated States of Micronesia	USD 1.15/lb (Pohnpei)	2.53	Kosrae (2012): USD 3.30/lb Yap (2011): USD 2.65/lb ⁶ Pohnpei: (2014): Grade A: USD 3.30/lb Grade B: USD 2.97lb	Kosrae (2012): 3.30/lb Yap (2011): 2.65/lb Pohnpei: (2014): Grade A: 3.30/lb Grade B: 2.97/lb
Marshall Islands	USD1.25/lb (last sale 1990)	2.75	USD 3.91	3.91

⁶ For the Federated States of Micronesia, Yap prices are export prices; others are buying station prices.

Country	1995 price/kg (local currency)	1995 price/kg (USD)	2019 price/kg (local currency)	2019 price/kg (USD)
New Caledonia	XPF 250	2.81	XPF 150	1.41
Palau	USD 1.40/lb	3.08	USD 2.20 (last sale 2011)	2.20
Papua New Guinea	PGK 4.50	3.49	PGK 6	1.73
Solomon Islands	SBD 11	3.28	SBD 15	1.76
Vanuatu	VUV 300	2.70	VUV 170	1.50
Wallis and Futuna	XPF 300	3.37	XPF 150	1.41

Note: As per Table 4 above,; a) for some countries, the years graphed were not 1995 and 2019; and b) for Cook Islands and the Federated States of Micronesia (Pohnpei), only grade A trochus is shown.

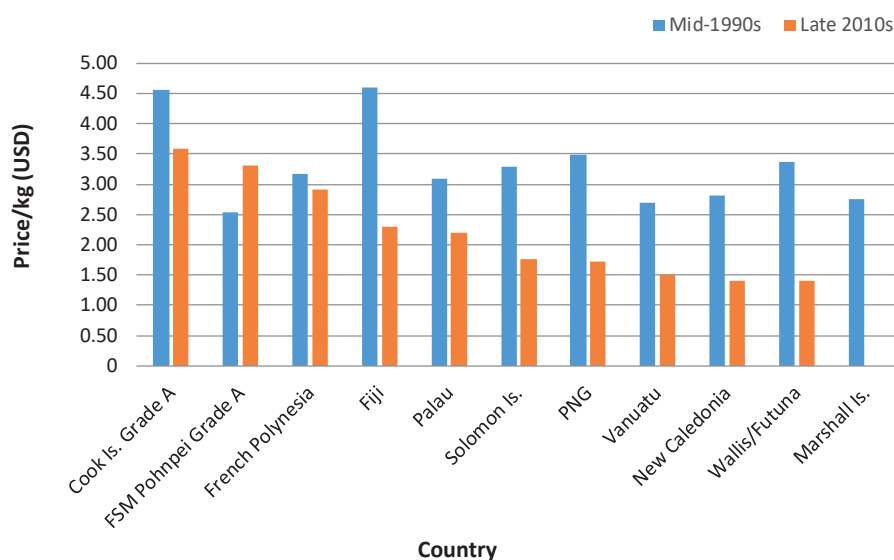


Figure 3: Pacific Island trochus prices in the mid-1990s and late-2010s (nominal prices).

Some observations can be made about Table 4 and Figure 3. All nominal prices dropped over the 25-year period ⁷. Price changes ranged from -8% in French Polynesia to -58% in Wallis and Futuna. In terms of absolute changes in nominal prices, the range of change was a USD 5.0 drop in French Polynesia to a USD 2.3 drop in Fiji. In recent years, the highest price paid for ungraded trochus was in French Polynesia while the lowest prices were in New Caledonia and Wallis and Futuna. In New Caledonia, interest in trochus harvesting continues despite low prices for the shell because XPF 1200 (= USD 11.28) is paid for a kilo of trochus meat.

The fall of the price of trochus in real prices (i.e. adjusted for inflation) in the last 25 years is even more remarkable. Taking Fiji as an example, inflation averaged 4% during the 1995–2019 period ⁸. In Fiji, the FJD 6.25 paid in 1995 would be FJD 16.02 in 2019 dollars, whereas the buying price in 2019 was FJD 5. Therefore, in real terms, the current buying price is only about 39% of what it was in 1995.

⁷ It is not possible to consider the Pohnpei price in this comparison. The recent Pohnpei price for trochus was for Grade A, whereas the older Pohnpei price was for ungraded trochus.

⁸ <https://www.theglobaleconomy.com/Fiji/Inflation/>

One feature of trochus prices in PICTs is that external buyers have relations with several countries and appear well-informed of what is happening in the trade in other countries, including prices. This is unlike many of the people arranging for trochus sales who often do not know the price of trochus in neighbouring countries. During the present study, it was learned that a trochus wholesaler based in New Zealand buys trochus from Cook Islands, Fiji, French Polynesia, Solomon Islands, and Wallis and Futuna. The last trochus harvest in Pohnpei was purchased by a Korean based in Fiji. A company with its headquarters in Hong Kong has buying arrangements in Vanuatu and Solomon Island. A greater knowledge of trochus prices by sellers in various PICTs would place them in a better negotiating position.

Other aspects of trochus prices were obtained (during the present survey) from trochus buyers and fishery managers were and include the following:

- In French Polynesia there is the idea of a “threshold price” for trochus, for which if the price drops lower, fishers stop harvesting. That threshold was XPF 300/kg in 2019.
- In some PICTs, the current price is so low that there are few dedicated trochus fishers. Trochus production, however, maintained in some countries by divers opportunistically picking up trochus while diving for sea cucumbers or spearfishing.
- There is the contention in some countries (e.g. Cook Islands) that grading trochus results in a higher overall revenue from a trochus harvest.
- In Solomons Islands, it is believed that during periods of low trochus prices there is merit in “keeping trochus in the water” and refraining from harvesting until prices improve; this is a concept that could be adapted to a management scheme involving only occasionally opening trochus to harvesting.
- As there is considerable risk with regard to business arrangements in the trochus trade, buyers indicate that they would pay a higher price to sellers with whom they have a long-term relationship in which trust has been built up.

In terms of domestic price improvements, the reality is that world market prices for trochus (see Section 8 below) largely set upper price limits, and there are limited opportunities to improve world prices by actions at the national level. Most possibilities for price increases are related to making sales transactions more efficient. The World Bank trochus survey discussed the issue of improving domestic prices, and concluded that efforts to increase the number of buyers bidding for trochus – where there are presently few – is probably the simplest mechanism to improve local prices. In addition, price improvements would be possible if the relationship between buyer and seller was based on confidence. The present survey indicates that greater knowledge of trochus prices in neighbouring countries, and possibly the grading of trochus, would also improve prices.

6.0 Trochus processing

The processing of trochus involves the fairly simple production of blanks followed by more sophisticated processing into finished buttons. An explanation of blank, button and byproduct processing is given in Box 2.

Box 2: The processing of trochus.

Blanks: Trochus shells are first sent to a factory where button blanks are produced. In this process, an operator cuts out blank discs using a special machine with a diamond-cutting ring. The largest discs are cut from the bottom surface of the shell, then from the first layer of the coil, the second and, in larger shells, the third. The size of the blank disc that can be cut is determined by the overall size of the shell and the position on the shell from which it is being cut – the further from the base, the smaller the button. The Japanese, who have dominated the industry in the past, call the base area a “ten”, the first coil the “first yoko”, the second the “second yoko” and so on. In smaller shells, say 2.5 inches across the base plate, it is not possible to cut from the “third yoko”; in shells over 3.5 inches the third yoko can be breached.

Buttons: The blanks that are so produced are passed on within the factory, or to another processing unit, where the upper and lower surfaces are cut away leaving a smooth blank of uniform thickness. At this stage, the button blanks are sorted for blemishes – incomplete disks, cracked outer surfaces, faults in the disc etc. The blanks are then turned on a special lathe where the centre section of the inner surface is cut down, so producing a lip to the button, its shape determined by the particular design followed. The buttons are then sent to a drilling unit where holes are drilled, again to the specification of a particular design. The buttons are polished using various techniques including acid treatment and rolling and polishing using paraffin wax. Finally, they are graded for thickness, bulk-packed and made ready for shipment to end users.

Byproducts: The waste shell resulting from the process of blank cutting is not discarded but is used as a raw material in various other processes. Most commonly the outer ring that is left after drilling the base plate is used in bracelet manufacture, fabrication of carvings, serviette rings and a variety of articles of simple jewellery requiring a good thickness of nacre. The rest of the shell is used in the manufacture of small beads used in necklaces. In each treatment, the shell undergoes a series of abrasive stages, in order to remove the outer calcareous layer and the inner “salt” (Japanese) or “sugar” (French) layer. In bead manufacture the shell is cut into small pieces and then rounded in a tumbling machine. The rounded beads are then polished and a single hole is drilled through the middle. Beads range from as little as a millimetre in diameter to 3 or 4 mm. Other artifacts can be carved from pieces of the waste material, and in some instances the whole shell is used in the manufacture of larger artifacts e.g. when polished the whole shell makes an attractive ornament, or is converted to items ice cream dishes.

Source: Carleton 1984

In the late 1800s, trochus from the Pacific Islands region was sent to Europe for processing. In the early 1900s, trial shipments of trochus from the region were made to Japan to supply a growing shell button industry around Osaka (Kataoka 1983). The first trochus blanking operation in the Pacific Islands was set up in Levuka, Fiji, in the early 1950s by John McGowan, an American developer. The original blanking machines and product samples are currently on exhibition in the Levuka museum. The World Bank trochus study indicated that after the Levuka operation, 31 other trochus-processing factories had been set up in 9 PICTs. All of those factories produced blanks, while two also produced finished buttons: AHPW in FSM (Pohnpei), and Yon Tong in Fiji. That study observed that trochus factories in PICTs have neither the low wage structure of the newly established ventures in China and Southeast Asia, nor the high technology of the European manufacturers, nor the long-established and vertically integrated nature of larger Japanese, Italian and Spanish companies.



Figure 4: Button blanks, a finished button, and a trochus shell.

Today, only one trochus processing plant remains in operation. The Yon Tong Company in Lami outside of Suva has 17 blanking machines, but only 6 are operational and are only used part time. The owner indicates that the factory has not been especially profitable for a decade, and he only continues to process trochus for nostalgic reasons. The operation is likely to close in the not-too-distant future “unless something big happens” (N. Yuen, Manager, Yong Tong Ltd., pers. comm.).

Other trochus factories that have closed recently include Solomon Shell of Honiara, Solomon Islands (ceased in June 2019); Hong Shell Products of Port Vila, Vanuatu (ceased after destruction by cyclone Pam in March 2015); and MSB in East New Britain, PNG (ceased in 2014). Reasons cited for the closures include competition with Asian factories, high cost of electricity, natural disasters, high cost of labour (in the French territories), dissatisfaction with national general business conditions, and shortages of raw trochus.

Regarding the shortage of trochus shells, the World Bank trochus study concluded that an optimum size trochus blanking operation would need 10–12 blanking machines, and that to fully utilize those machines, 112–130 t of raw trochus shell per year would be required. At the time of that study, only five PICTs had an annual trochus harvest of more than the 120 t, and several countries with trochus processing operations had excess processing capacity of over 200%. The study concluded that the excess processing capacity in many PICTs (or, as often stated by factory managers, “non-availability of raw product at reasonable prices”) was probably a major factor contributing to the high rate of failure in trochus processing.

Another factor affecting trochus processing in the region concerns productivity. At the 1991 South Pacific Commission Trochus Workshop, a presentation was made by the manager of a Vanuatu button factory. He stated that in Korea, a button blank worker produces about 20,000 blanks per day, while in Vanuatu a good operator produces between 6000 and 12,000 blanks per day.

7.0 Trochus processing outside the Pacific Islands region

There is little publicly available information concerning trochus processing outside the Pacific Islands region. Consequently, to gain insight into this aspect of the trade it was necessary to glean anecdotal information from participants outside the region who are involved in the trochus trade.

Currently, European countries import far less trochus for processing – only about 25–30% of what they did 25 years ago, according to a trochus wholesaler (N. Yuen, Manager, Yon Tong Ltd., pers. comm.) A trochus processor told of the demise of the largest finished shell button manufacturer in Europe (Bonetti of Italy) after the death in 2017 of its founder. Similarly, Toar S.A. was the major manufacturer of shell buttons in Spain, but it no longer exists. There are no longer any manufacturers of buttons of any kind in the United Kingdom.

A few decades ago, China became the global epicenter of trochus button manufacturing, but that has changed recently. According to several people interviewed, trochus button factory operators are finding it difficult to make a profit as they are being forced to sell at less than premium prices due to demand-and-supply issues. With high-end clothing makers experiencing less demand for expensive shirts and trochus harvesters unwilling to fish for trochus for less money, much of the burden in this situation falls on the trochus button factory operators. One of the few ways operators could cut costs was to move their button machinery to low-wage countries. Accordingly, many trochus factories in China either closed or moved their operations to Viet Nam or to Indonesia. This reported movement to Southeast Asia is consistent with the information obtained from customs departments in PICTs, which report that Viet Nam is the most common destination of trochus export consignments (see Appendix 2).

One trochus wholesaler (B. Shields, Ocean Shell, pers. comm.) estimated that there are now only 15–20 factories in the world that buy substantial amounts of trochus. Although an internet search shows what appears to be a large number of trochus button manufacturers in China⁹, it is likely that many of those companies actually make their buttons in Southeast Asia or process trochus as a small portion of their total button production.

8.0 Trochus marketing

8.1 Product flow

In the present study, information on the destination of raw trochus from PICTs was obtained from exporters, customs departments, and fishery officials. Data from each one of these sources has associated problems: trochus exporters have their need for commercial secrecy; customs data may not give the ultimate destination due to transshipment; and information from fisheries officials is often from unconfirmed reports. Nevertheless, the general picture that emerges is that most of the trochus from the region is sent to Asia, with Viet Nam and China being the main destinations. Italy and Japan are also listed as destinations in customs data, but the volume is much less than that for Asia.

The above destination information is similar to the indications in the trochus processing section of this report, which show that most trochus is now processed in Southeast Asia followed by China.

The destinations for raw and processed trochus from the region have change considerably in the past 25 years.

- In the early 1990s, raw trochus was sent mainly to (in descending order of importance) Korea, Japan and Italy.
- The 14 Pacific Islands trochus factories operating in late 1995 produced button blanks for shipment to Korea or, to a lesser extent, Japan where they underwent further processing and subsequent sale to Hong Kong or North America.
- Currently, according to customs data, the single trochus factory in the region (Suva) sends blanks to mainly China and Italy.

⁹ www.alibaba.com/showroom/trochus-shell-button lists about 50 manufacturers of trochus shell buttons.

The case of Italy as a destination for raw trochus and trochus blanks deserves additional attention, especially its persistence in the trochus trade. Apparently, Italian manufacturers attempt to offset labour costs by using high-technology manufacturing techniques, such as digital analogue photocell machines to turn buttons, lasers for carving, and robot transporters. Italian manufacturers have stated that, although Asian manufacturers can produce trochus buttons cheaper, Italy can deliver much faster and, therefore, can better cater to the high fashion market, which changes rapidly. Another aspect is that Italy has a huge number of apparel manufactures, and many centre their production on high-value clothes, which is the segment of the market most likely to use trochus buttons.

8.2 Current low prices for trochus and their causes

Current raw trochus prices are very low. The views of trochus exporters and a wholesaler on the general trend in prices are similar: 1) real trochus prices (i.e. adjusted for inflation) reached a peak in the early 1990s and have steadily and gradually declined since then; and 2) prices have dropped about 40% from their peak.

A hot topic in the trochus trade is the reason for the price drop. Several causes were cited during the present study by participants in the trade. These include:

- Economic reasons: Moderately affluent consumers of high-end shirts cannot afford the extravagance of the 1980s and 1990s, and the poor current state of many economies in developed countries results in the reduced demand for trochus.
- Clothes, in general, are more casual these days and buttons are used less.
- There is a general (but temporary) fashion trend away from trochus buttons.
- Some manufacturers and consumers believe that it is wrong to disturb the natural ecosystem.
- Other shell materials are being substituted for trochus: the use of pearl shell from culture operations is increasing, and there is greater use of Chinese freshwater mussel shells.

The substitution aspect mentioned above deserves some additional attention. Although some people cited the greater use of the black-lip pearl oyster (*Pinctada margaritifera*) from culture operations as a reason for low trochus prices, trochus exporters doubt this because of the inadequate supply of trochus and the difficulties with using the cultured material in blanking operations. They point out that it is more likely that the shell of freshwater mussels in China is responsible for any price drop due to the substitute shell material. This mussel is presumably the triangle mussel (*Hyriopsis cumingi*). About 1000 t of pearls are produced from this mussel species in China, and there is likely to be very large quantities of shell available.

No discussion of trochus prices would be complete without mentioning the competition of plastic buttons with trochus buttons. As mentioned in Section 2, there was a sharp downturn in the trochus trade in the late 1950s and early 1960s due to competition with plastic buttons. At present, the general thinking in the trade is that plastic buttons will probably not present a major threat in the future because their potential appears to have been developed as far as practical. This state of development is indicated by an Italian fashion designer who stated that polyester imitation is nowadays done so well that a non-professional eye cannot distinguish between real and imitated mother-of-pearl. Because polyester buttons have not displaced trochus to date, it is unlikely that they will in the future.

Although “fashion trends” appear to have a large effect on trochus prices, the way the clothing industry interacts with the trochus trade is complex. The World Bank trochus study had the resources to hire fashion consultants, and information was obtained from 56 designers, fashion houses, button distributors, apparel manufacturers, and up-market retailers in France, Germany, Italy, Japan, the United Kingdom, and the United States. Although the specific results of the investigation are now out of date, they reveal an important point: what influences the demand for trochus is considerably more complex than a simple fashion trend to use more or fewer trochus buttons. This is illustrated by the example of Italy (Box 3), which is just one of several very different markets for trochus buttons. The general fashion-oriented conclusion of the World Bank trochus study across all national markets studied was that the general state of the economy is the major influence on trochus demand (e.g. the United States), with the fashion trend being secondary. In other countries, however, these same influences operate but the relative importance is reversed (e.g. France). That finding does not appear to be time-sensitive and is probably relevant today.

Box 3: Trochus and the Italian fashion industry.

There are four segments of the Italian fashion industry that use trochus: high-quality men’s shirts (10% of trochus button usage), women’s clothing (60%), knitwear (20%), and sports-, beach- and night-wear (10%). The use of trochus buttons on high-quality men’s shirts is a tradition and not much fashion-induced variability is experienced. For women’s clothing and other items, the situation is somewhat different because the trochus button is not considered a continuous item, but an option that depends on the tastes of the fashion designer and fashion trends. Of the 30 clothing manufacturers contacted, 13 offered their perception on trochus buttons. One firm felt there would be less demand for trochus buttons in the future, while another felt there would be more. The other ones believed there would either be no marked change or had no strong feelings on future trochus button demand. In addition, one company stopped using trochus because of environmental concerns, and one company that had dropped trochus said it would use the product again if the price were reduced. Assuming economic conditions remain the same, it appears as though the demand for trochus from Italy should continue at the present level, with some oscillation due to fashion influences on the non-shirt segment of the market.

8.3 Some speculation on the future

In the absence of major developments and shocks in the trochus trade (which cannot be predicted), in the future there is likely to be a continuation of trends that have been going on for decades. These trends include:

- global trochus prices gradually falling;
- occasional increases and decreases in the demand for trochus due to fluctuations in the state of economies in developed countries and fashion trends;
- occasional changes in the demand for trochus as opportunities arise and fade for substitution with other materials for buttons; and
- a gradual decrease in trochus abundance on the reefs in PICTs due to the ease of collecting and storing trochus, and the sub-optimal management of some trochus fisheries.

There is the possibility that major developments could affect the trajectory of the above trends. As mentioned in Section 4.1, Australia was formerly the world’s largest producer of trochus, but is currently not a significant producer. But because this situation is largely a result of the low price paid for trochus, and not overexploitation of the resource, if the price should ever recover, Australia has the ability to quickly place a large amount of trochus on the world market, which could moderate price increases.

Another development that could affect the marketing of trochus was mentioned by a trochus wholesaler: brand clothing companies will want to know more about the source and sustainability of the trochus they use. As has been the case for other fisheries that supply markets in developed countries, there may be a demand (and subsequently a requirement) by clothing companies for certification of the trochus fishery.

The closing of the sole remaining Pacific Island trochus processor is anticipated. When that occurs, the region's involvement in the trochus trade will be confined to the export of shells only.

9.0 The management of trochus fisheries

Although the management of a trochus fishery is relatively simple ¹⁰, there is a great range in outcomes of the various management regimes in the region. There is general recognition that the Aitutaki trochus fishery in Cook Islands is one of the best, if not the very best, managed of any coastal fishery in the Pacific Islands. In fact, detailed case studies to document the success of that fishery have been undertaken (e.g. Nash et al. 1995). Gillett and Lam (1999) documented the successful trochus management regime at Ontong Java in Solomon Islands. By contrast, the management of the trochus fisheries in at least two countries of the region could be used as examples of how poorly managed fisheries can dramatically dissipate benefits.

The earliest management of a commercial trochus fishery in the region was in Palau in the early 1900s under the Nanyo Islands Fisheries Act (Asano 1963; Kataoka 1983). Currently, PICTs use a variety of measures to manage their trochus fisheries. The main national management measures are provided in the national trochus profiles (Appendix 2) and are summarised in Table 5.

Table 5: Summary of trochus management measures in the Pacific Islands region.

Country	Main management measures	Compliance information
Cook Islands	Management measures are by Island Council resolution. Aitutaki implements a very short harvest season, a total allowable catch quota for an open harvest season, and an 8-cm minimum and 11-cm maximum basal diameter size limit. The allowable catch is sub-divided equally into individual (fisher) quotas.	In the 2011 Aitutaki harvest, 3% of the total harvest was outside of the size limit.
Fiji	Fisheries regulations state that "no person shall take, be in possession of, sell, or expose for sale or export any trochus measuring less than 90 mm across the whorl." Exporters of trochus shell are required to be licensed and are subject to inspection.	Nobody has been cited for having trochus less than the minimum size for at least several decades.
Federated States of Micronesia	Yap: The Governor designates annual harvest season on advice from the Marine Resources Division after stock assessments. A complete harvesting ban exists unless an open season has been declared. Kosrae: Trochus regulations manage harvesting, selling, buying, stockpiling and/or processing trochus. Includes open and closed harvesting seasons, minimum 3-inch basal width, and a maximum basal width of 4 inches. Pohnpei: Open seasons are determined after surveys and rarely last more than one week. Permits are required for harvesters, and harvesting using scuba is prohibited. Chuuk: [no information available]	

¹⁰ There is general agreement among those with considerable fisheries experience in the region that if a country cannot manage its trochus fishery, it will have great difficulty managing any fishery

Country	Main management measures	Compliance information
French Polynesia	Main management measures include size limits (must be within 8 and 11 cm basal diameter width), a total ban on trochus fishing except for areas specifically opened for defined periods of time, a quota for those areas that are open to fishing, a requirement that all fishers be registered, and a ban on the transfer of harvested trochus from one community to another.	The local fisheries surveillance committees oversee trochus fishing and sales, and ensure compliance by fishers of the applicable rules.
Guam	Commercial exports of trochus from Guam have been banned for at least 20 years. In addition: a) the total harvest limit is 50,000 pieces per year; b) there is a minimum of 3-inch basal width for personal consumption, and 4 inches for commercial use, and c) all individuals harvesting trochus for commercial purposes are required to obtain a licence.	
Marshall Islands	The Fisheries Act vests the Marshall Islands Marine Resources Authority (MIMRA) with the authority to declare an open season not exceeding 3 months in any 12-month period. Taking or harvesting trochus is permitted only by a citizen living in an area where he or she has, in accordance with customary law, a right to fish. Minimum shell base size of 3 inches. MIMRA issues trochus fishing licences that specifically authorise the taking or harvesting of trochus. Permits from MIMRA are required for any introduction, transplant, or propagation of trochus. No person can acquire, accumulate or hold trochus for the purposes of sale, marketing or export without a permit. Management has been delegated from the national government to local governments.	In 2016 trochus from Enewetak was brought to Majuro, sold and loaded into containers. MIMRA was tipped off and stopped the shipment. The seller from Enewetak was fined an unknown amount for undersize trochus. There have been no such problems since that incident.
New Caledonia	Fishers must obtain an annual special fishing authorisation issued by the fisheries authorities. The Northern and Southern provinces environmental code stipulates "The fishing, transport, marketing, exposure to sale, sale, purchase, possession and consumption of trochus with a greatest diameter of less than 9 centimetres and more than 12 centimetres are prohibited." Each authorised trochus fisher must carry a measuring gauge when fishing. Undersized or oversized trochus must immediately be put back in the water.	Size limits are well respected, and buyers are careful not to buy undersized or oversized trochus. A full shipment of undersized trochus in the late 1980s was destroyed, sending a clear message that such an activity would not be tolerated.
Palau	Fishing for trochus is banned except when the national legislature opens the season by resolution. During open season, which historically has been limited to two weeks or less, only trochus more than 3 inches in diameter at the base can be harvested.	The Bureau of Marine Resources and the Department of Fish and Wildlife deploy staff to monitor delivery sites. The penalty for harvesting undersize trochus is USD 100 per trochus taken or purchased.
Papua New Guinea	The 2002 Notice of Prohibition of Taking Sedentary Resources (Government of Papua New Guinea, 2002) prohibits the taking of trochus by using scuba or hookah gear, as well as collecting trochus at night using underwater lights. This notice sets a size limit (only between 8 and 12 cm).	Compliance with the size limits is generally good as trochus is a major export commodity for PNG.
Solomon Islands	The main management measures for trochus are size limits (only between 8cm and 12cm), a ban on the export of trochus without a valid licence, and a tax on all fishery product, including trochus.	There is thought to be low compliance with the trochus size regulation.
Vanuatu	The national-level measures are: (1) A person must not take, harm, have in his or her possession, sell or purchase a trochus shell that is less than 9 centimeters or more than 13 centimeters in length, (2) A person must not export trochus except with an export permit, and (3) The maximum quantity of trochus that can be harvested within Vanuatu in a year is 550 t.	Senior fisheries staff feel that compliance with the size limits was better when the processing plants were operating.

Source: Appendix 2

The management measures listed Table 5 are those at the national level ¹¹, although in some PICTs, these and other measures are also used by lower levels of government.

In six of the PICTs, trochus is managed by a combination of size limits and a ban on the harvesting except in specific and short, declared harvesting seasons. In five PICTs, there are no such declared seasons. In general, trochus appears to be better managed (e.g. they are found in greater abundance, and there has been less of a decline in production) in those places with both size limits and declared seasons. Examples include Cooks Islands, French Polynesia and Palau. Intuitively, in situations with very high fishing pressure, it would seem that the overexploitation of trochus could not be halted by simply refraining from taking certain size classes. This contention is consistent with a conclusion of an SPC researcher who examined trochus production trends in Solomon Islands and concluded that “size limits alone are insufficient to control overfishing” (Lasi 2010).

There is another aspect of relying just on size limits as the main management measure. Declared seasons demand that government fishery agencies be closely engaged in the fishery because of the need to assess abundance and actively make declarations. In short, an agency must keep “their eyes on the ball” and pay close attention to the fishery. On the other hand, relying solely on size limits tends not to require nearly such active attention, although such a situation can result in little concern for the fishery and virtually no management. In one PICT where trochus was formerly important, there is no system of declared seasons, and so few fisheries officers are familiar with the fishery and nobody has been prosecuted for undersize trochus in many years.

It is interesting to note that no Melanesian country in Table 5 has a system of trochus management that features declared seasons.

All PICTs have size limits for trochus. Most have minimum and maximum limits, but some countries (Fiji, Marshall Islands and Palau) only have minimum size limits. The justification for the upper limit is that older shells are often of poor quality for making buttons but are more reproductively fecund than small individuals. Because enforcement is often the weakest link in the management of coastal fisheries in the region, it is worth noting that it is not any more difficult to enforce both minimum and maximum limits than just a minimum limit, so there appears to be little justification for not having maximum limits.

In the last 25 years, there have been several changes in the region regarding the management of trochus fisheries and trade.

- In the past, an important management objective for about half of the countries was to ensure sufficient trochus supplies for domestic trochus processing factories. With the demise of almost all such factories, that objective is no longer being pursued.
- The management of the more valuable and challenging beche-de-mer trade seems to have detracted from the interest and resources available to manage the trochus trade.
- The pronounced decline in trochus prices in recent years could be leading to less interest in managing what some fishery officers consider to be a dying fishery.
- There has been a general trend in the region to dedicate more management attention to offshore tuna fisheries and less to coastal fisheries, including the trochus fishery.

In terms of good management practices, SPC has produced a poster giving the main elements of a well-managed trochus fishery. The management recommendations of the poster are summarised in Box 4.

11 Except for FSM, where the management of all coastal resources is at the state level.

Box 4: SPC Poster: “Manage Your Trochus Fishery”.

The main recommendations of the poster are:

- Management plan and regulations: Develop a fishery management plan or review the existing one; impose relevant regulations and enforce them.
- Permanent closure: Close the fishery permanently and organise short open seasons. A good indicator to open the fishery is when population abundance is 500+ shells per hectare.
- Harvest control: Set harvestable sizes at 8–11 cm basal diameter width; set total quota by season and by exporter; estimate the stock by area and set a harvestable quantity at 30–40% of the harvestable stock.
- Licenses: Limit the number of export licences based on the size of the resource; promote the participation of locals in the industry where possible.
- Marketing strategy: Adopt a marketing strategy that ensures that the highest price is paid to fishers for their resource.
- Adult introduction: Adult introductions can be effective in developing a new fishery or replenishing a depleted stock if it is done in a suitable habitat, following recommended procedures.

The results of the present survey (and the experience of the authors) are consistent with the management recommendations of the poster – with one significant exception: adult introductions to replenish a depleted stock. That contentious management measure is discussed in the following section.

10.0 Reef reseedling

An important issue related to trochus management is the reseedling of overexploited reefs with trochus, with the objective of replenishing the stock¹². Because the methods for spawning and raising juvenile trochus are now well known, there has been considerable interest in using hatchery-reared trochus to rectify overexploitation problems, particularly in Vanuatu and Palau. In the past, the Australian Centre for International Agricultural Research has enthusiastically promoted trochus reseedling in the region as well as in Australia and Indonesia.

The use of reseedling as a trochus management tool is controversial. One view is that hatchery-raised trochus could be released on depleted reefs and their progeny could re-populate areas and eventually be plentiful enough to support fishing effort. Another view is that because the reefs have become depleted of trochus from excessive fishing pressure, simply adding trochus to the reefs does not address the root cause of the depletion. Other aspects of this debate are detailed below.

- In the short term, reseedling is politically appealing because it does not involve restricting fishing activity, and it gives the appearance that action is being taken to address overexploitation. In the late 1980s, researchers claimed that trochus reseedling should be considered to be experimental rather than a tried, tested and proven management intervention. This uncertainty has continued for a long time. An SPC report based on a survey in Vanuatu found that reseedling with hatchery-bred trochus has been promoted as a management tool, although this has largely remained experimental, with little evidence to suggest it is effective. (Pakoa et al. 2009).
- SPC’s advice on trochus reseedling has been equivocal. In this regard, the above point should be noted. In addition, the SPC Information Sheet for Fishing Communities (#11 on trochus) has a section on effective trochus management measures and options, but does not mention reseedling. However, the SPC poster “Manage Your Trochus Fishery” states that reseedling reefs with adult trochus can be effective in developing a new fishery or replenishing a depleted stock.

¹² In this report, placement of trochus on reefs that have been depleted is referred to as “reseedling”, whereas placement of trochus on reefs where they have not existed is called “transplantation”.

In considering the debate over trochus reseedling, some non-controversial observations can be made. The promoters of reseedling seem to have aquaculture backgrounds while those who are sceptical of the technique tend to be general fishery managers. All will agree that the cost of operating a trochus hatchery can be substantial, even if the original facility is aid-funded. Most people with knowledge of trochus management (even ardent supporters of reseedling) will agree that in the usual Pacific Island situation, trochus reseedling will not be successful in repopulating reefs without a concurrent major restriction of fishing effort. The contentious aspect of this last point appears to be the amount of effort that should be focused on reseedling versus an emphasis on management. Some past reseedling projects have duly acknowledged the need to improve management but put almost all project resources into reseedling.

In light of the above, the present review suggests that trochus reseedling should, at best, be considered as a complement to restrictive fisheries management and not as a replacement. Going further, this review agrees very much with the sentiment expressed by two fishery specialists 25 years ago: "The overtaxed capital and human management resources of typically small marine resource divisions are best allocated to alternative methods of trochus management, as opposed to being spent on a trochus hatchery for re-seeding purposes." (Ianelli and Clarke 1995).

A final comment on the reseedling debate concerns the notion that reseedling cannot hurt – but if it diverts attention away from the real issue of improving management, then reseedling can certainly be counter-productive.

11.0 Trochus transplantation

The natural distribution of trochus in the Pacific Islands is restricted to the western part of the region. North of the equator, the natural range was limited to the Palau (including the southwest islands) and Yap (but not the outer islands). South of the equator, trochus was found eastward to Wallis Island and the Lau Group of Fiji, but did not occur naturally in Nauru, the Gilbert Group or Tuvalu. The natural range of trochus in the region is, therefore, the areas southwest of a line drawn between Yap proper and Wallis Island.

Since the first trochus transplant about 90 years ago, there have been numerous attempts to introduce trochus to new areas in the Pacific Islands region. Starting with the Japanese work in the Western Caroline Islands in the late 1920s, at least 70 transplantations have taken place between island groups in the region. This movement of trochus has been well documented, including by Bour (1990) and Gillett (1996). That information is updated in Table 6, which provides the known international transplants into the Pacific Islands region since the mid-1990s.

Table 6: Trochus transplantations in the Pacific Islands region from the late 1990s to 2006.

Date	Origin/destination	Details	Information source
Aug 1996	Tonga to Niue	311 shells (progeny of an earlier transplant to Tonga) placed on near Namakulu and Tamakautoga villages	B. Pasisi, (then) Director of Agriculture, Forestry and Fisheries (pers. comm.)
Late 1990s	Fiji to Kiribati	Unknown number of shells transplanted to a quarantine facility in Tarawa and to an outer island	Mentioned by a Kiribati representative at an aquaculture meeting of the Pacific Community/ Australian Centre for International Agricultural Research (ACIAR) in July 2001
Late 1990s	Tonga to Samoa	Unknown number of shells transplanted from Tongatapu hatchery to Samoa	Mentioned by a Samoa representative at the SPC/ACIAR aquaculture meeting in July 2001
2003–2006	Fiji and Vanuatu to Samoa	898 shells transferred from Vanuatu to Samoa; placed at Saoluafata and Papa-i-Puleia; 428 shells transferred from Fiji to Samoa in two shipments; 360 of those shells placed near Saleapaga Village. Additionally, hatchery-reared juveniles were released in 2004.	Robert Gillett (pers. comm.) Steve Purcell (pers. comm.) Purcell 2019

The international trochus transplants occurred in several waves. The major ones occurred in:

- the late 1920s to the late 1930s by the Japanese from Palau and Yap to many locations in the Caroline, Mariana and Marshall islands;
- the late 1950s from eastern Melanesia to French Polynesia and Cook Islands; and
- the late 1980s and early 1990s by staff of the Food and Agriculture Organization of the United Nations (FAO) from Aitutaki (Cook Islands) and Fiji to Tokelau, Tonga, Tuvalu and Samoa.

Some of the international transplants were ineffective (e.g. to American Samoa and Hawaii), but there have been several remarkable successes, including the establishment of fisheries in Cook Islands, French Polynesia, FSM (Pohnpei), and the Marshall Islands (Enewetak). Dalzell et al. (1995) estimated that between 6500 and 12,000 t of extra trochus have been harvested over the years as a result of the transplantations. If that amount is updated through 2019, the extra trochus would now amount to 10,500 to 15,000 t. It is estimated that the descendants of the 80 live shells that arrived in French Polynesia six decades ago from two transplants have resulted in landings of 4138 t of trochus since collecting began in the territory in 1971.

Some information has become available on the results of relatively recent transplants.

- **Tonga:** In total, 1914 shells were transported to Tonga in three transplants (1992, 1994, 1995) and were placed on reefs in Vava'u, Ha'apai and Tongatapu, respectively. The first progeny of the transplanted trochus were noticed in Vava'u. In early 1998, several juveniles were found by Tonga Fisheries and Japan International Cooperation Agency staff near the Pangaimotu causeway. In addition, one large trochus was collected on a reef east of Falevai Village in Vava'u in April 2001. An SPC survey in mid-2008 at Tongatapu reported that: "Trochus coverage and density was indicative of a stock that was successfully colonising local reefs....the density of shells at the better locations reached an average of over 300/ha" (Friedman et al. 2009). According to the Licensing Officer of Tonga's Ministry of Fisheries, a Chinese partner was given a one-year permit for exporting trochus in October 2015, and another one-year permit was issued in October 2016. Apparently, the justification for allowing the export of trochus was that trochus was being harvested for food and the shells were being discarded. It is not clear how much trochus was exported, but fisheries officers stated that it was probably a few containers' worth (i.e. 38 t).
- **Samoa:** In total, 1326 shells were transported to Samoa from Vanuatu and Fiji between 2003 and 2006. Trochus population surveys conducted by the Fisheries Division in 2010 at six sites indicated that there were 100–200 trochus per hectare. Socioeconomic surveys in 2018 showed that about 263 t of export-sized shells were harvested across 170 villages during the year. In late 2019, there were slightly over 1000 people harvesting introduced trochus in Samoa (Purcell 2019; Steve Purcell, Associate-Professor in Fisheries and Aquaculture at Southern Cross University, pers. comm.)
- **Tokelau:** Tokelau received 2687 trochus shells in 1986, 1988 and 1989 combined. One juvenile trochus was found in December 1987. By 1994, trochus was common on Fakaofu Atoll. In October 2019, the mayor of Fakaofu (a former fisheries officer) stated that he was unsure of trochus abundance on Atafu and Nukunonu atolls. However, on Fakaofu, they were found on many parts of the reefs (e.g. inner reef, reef crest and outer reef slope) on the atoll's southwest (between Fenuafala and Nukumatau villages). Villagers do not bother them and are interested in them for meat or shell, at least for now (Gillett 1989; Mose Pelasio, Mayor of Faka'ofu, pers. comm.)
- **Tuvalu:** Trochus were shipped to Tuvalu in 1987 (220 shells), 1988 (4853 shells) and 1989 (2800 shells). The target atolls were Funafuti, Nukulaelae, Nukufetau, Nui and Nanumea. Several large trochus were spotted on the reef flat near Fualefeke Islet on the western side of Funafuti Atoll during a coral survey in May 2002, and on the lagoon side of Amatuku Island in mid-2004 (also during a survey). In November 2005, there were reports of trochus being common on the western side of Funafuti (Gillett 1988; T. Polasi, Principal Fishery Officer, Tuvalu Fisheries Department, pers. comm.).

Few, if any, trochus transplantations in the Pacific Islands were preceded by careful ecological studies to gauge the impact of introducing an exotic species. More recent operations have been justified on the basis of an apparent absence of negative environmental implications of the earlier transplantations. An examination of the trochus literature in the last 50 years shows only a few cases in which ecological impacts are mentioned.

- Sims (1984) noted that the abundance of the marine snail *Turbo setosus* in Aitutaki (Cook Islands) may have declined after introduction.
- Purcell (2019) discusses the transplantation of trochus to Samoa and mentions possible competition with local species of marine snails (*Tectus pyramis*, *Trochus maculatus*, *Turbo chrysostomus*). He indicates that those species were naturally not very abundant before the trochus introductions and no relationship was found between trochus abundance and abundance of native species. He also mentions the possible impacts of trochus on coral communities that have been impacted by climate change. Much of the coral in Samoa has died recently from increases in sea temperature. Because trochus grazes on algae that cover dead coral, there is the possibility that trochus could help to control algal overgrowth and promote coral settlement.

12.0 Other relevant observations

The trochus fisheries in the region are in a state of decline, in terms of both total production and prices. On the basis of comparing crude estimates of regional trochus production made in 1996 to crude regional estimates made in 2019, the production in the Pacific Islands region appears to have fallen from 2300 t to 1400 t in 25 years, a drop of about 39%. Likewise, prices paid to fishers for trochus have dropped substantially in the last 25 years in nominal terms in all countries of the region, and real prices have dropped much more. These drops in both trochus production and price have tremendously reduced the benefits of the trochus fishery of the region. Two examples illustrate this situation.

- In Solomon Islands, Ministry of Fisheries and Marine Resources trochus export data suggest that recent annual harvests of trochus are about 38% of what they were 25 years ago. At the current price paid to fishers of SBD 20/kg, the real buying price of trochus today is only 40% of what it was 25 years ago. These two types of reductions in combination result in the real earnings to trochus fishers in Solomon Islands as being only about 15% of what they were 25 years ago (see Appendix 2).
- In Fiji, current annual trochus exports are about 85% of what they were 25 years ago. The buying price of trochus today in real terms is only about 39% of what it was 25 years ago. These two types of reductions in combination result in the real earnings to fishers from the Fiji trochus fishery as being only about 33% of what they were 25 years ago. (refer to Section 5.0 on prices).

Another observation emanating from this study is that because trochus fishing can be done with very little gear, no boat and few skills, and the fact that the harvest does not need to be rushed to market, it is one of the few commercial fisheries suitable for poor people and people living in remote areas. Over the past 100 years, many of the most disadvantaged and vulnerable people living in the region have earned cash from trochus harvesting. Should trochus fisheries become even less viable than they are currently, those same people will be the ones to suffer the most from the demise. This situation appears similar to what happened to the copra trade in the region in the previous century, and little could be done to sustainably mitigate the problem.

Even though PICTs are currently responsible for about 69% of the world production of trochus (up from 59% 24 years ago; see Table 3), there appears to be little that countries can do to improve the poor international price of trochus. The World Bank trochus study in 1996 suggested that there be a trochus export tax on both raw and processed trochus products to improve global prices. In addition to the many difficulties associated with promoting and establishing such a regime for a commodity that is modest in overall value, due to the falling demand for trochus products, there is the possibility that such a tax could hasten the demise of the global trochus trade. It appears that efforts to improve prices to fishers and domestic wholesalers should focus on improvements to the trochus sales transaction process.

13.0 Recommendations

Several suggestions have been made in this report on how PICTs can improve the long-term benefits they receive from the trochus trade. In this section, suggestions that are especially important are gathered together and given as recommendations in three categories. These recommendations represent a balance between what could realistically be expected to help reinvigorate the trade in the region, and the concern of not investing too much effort into what could be a dying trade.

13.1 Improvements to domestic buying prices

Based on the experience gained in this study and previous work with trochus, there are opportunities for increasing the prices paid to fishers, but these are dependent on national circumstances. It is recommended that government fishery agencies and trochus sellers consider the following:

- Promoting an increase in the number of buyers seeking raw trochus. Contacting the people listed in Appendix 1 could result in expanding the number of people interested in the harvest.
- Obtaining price information from neighbouring countries and from Asia as this could improve the negotiating position of the seller.
- Obtaining the thoughts of prospective buyers on the value of grading trochus before sale, estimating the cost of the grading, and determining if grading is worthwhile.
- Taking into account the incorporation into a trochus management regime of some “trade-friendly” elements. This could include measures that produce a steady supply of trochus (prices can be depressed by large quantities of trochus coming on the market); any establishment of quotas should be in consideration of the capacity of a shipping container (18 t); and quotas or harvests should be scheduled (or avoided) according to world market prices for trochus.
- Promoting good business relationships. Trochus wholesaling is risky and those in the business have suffered from relationship problems in the past. Measures that build up the trust between buyer and seller – and/or that enhance long-term business relationships – can reduce risk and eventually increase prices.
- Creating additional domestic demand for trochus by promoting the manufacture of trochus handicrafts, as was done in Samoa (Purcell 2019).

13.2 Improvements in the management of trochus fisheries

In Section 9.0, the current management of trochus fisheries in the region is discussed, and several observations were made. Following from that discussion, it is recommended that individuals and agencies with trochus fishery management responsibilities:

- be aware that the relative ease of management of trochus fisheries does not equate to trochus fisheries not needing management;
- realize that size limits as a sole management measure are insufficient to control overfishing in trochus fisheries, and may result in government fisheries agencies losing their focus on trochus fisheries.
- be aware that most well-managed trochus fisheries in the region have a ban on the harvesting of trochus, except in specific and short declared harvesting seasons, and all countries should consider having such declared seasons.
- (for the three countries that have no upper size limits) recognise that there is considerable justification for the upper size limit and that it is not any more difficult to enforce an upper and lower limit than it is just a lower limit.
- carefully consider the contentious nature of trochus reseeding. At best, reseeding should be considered a complement to management for mitigating overexploitation. In the absence of effective and long-term fishing effort restrictions, reseeding will not come to the rescue.

13.2 Other recommendations

Some of the past studies of the trochus trade in the region have recommended greater involvement by local companies in trochus processing. During the present study, increased participation by PICTs in processing has been mentioned as a possible remedy for the current low trochus prices. An important observation on that approach is given in Section 6.0 of this report: trochus factories in the Pacific Islands have had neither the low wage structure of the newly established ventures in China and Southeast Asia, nor the high-technology of European manufacturers, nor the long-established and vertically integrated nature of the larger Japanese, Italian and Spanish companies. These comparative disadvantages are likely to persist into the foreseeable future. Accordingly, it is recommended that PICT government resources not be used to promote trochus processing.

Trochus wholesalers perform an important function in the trochus trade, including assuming much of the risk in sales transactions and being aware of developments, opportunities and prices in the trochus world. Wholesalers do, however, absorb significant profits along the value chain. In terms of PICTs deriving greater benefits from the trochus trade, there may be an opportunity for direct sales from Pacific Island businesses to overseas trochus factories. This approach carries significant risks, but those hazards can decline over time if trust is built up between the buyer and seller. It is recommended that Pacific Island trochus buyers investigate the advantages and disadvantages of selling trochus directly to overseas factories.

14.0 Concluding remarks

In the last 25 years, the global demand for trochus has fallen substantially. During that period, prices paid to fishers for trochus – and the volume of annual harvests – have dropped in all PICTs involved with in the fishery. Taken together, the lower prices and smaller harvests result significantly less income to trochus fishers. Further up the value chain, over 30 trochus processing operations have been established in the region, but only 1 is currently operating – and that one is likely to close soon.

Although the situation could improve, there are no indications of positive developments on the horizon. The most likely scenario is, therefore, a continuation of trends that have been going on for decades: continued decline in demand and prices.

Because global demand for trochus drives this decline, there are limited ways in which government fisheries agencies in the region can halt the downward trend. In most PICTs mitigation measures are largely limited to small interventions that could improve the price of trochus to fishers (Section 13.1) and striving for well-managed trochus fisheries (Section 13.2).



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Appendix 1: People contacted for this report and their addresses

Buyers and wholesalers recently involved in the region

Bruce Shields
Ocean Shell
80 Bath Road, Riverton
PO Box 42, New Zealand 9847
Tel: +64 3 234 9065
Email: shell@lumea.co

T & S Buttons Co. Ltd
Unit M2, M/F., Sun Cheong Industrial Bldg
2 Cheung Yee St., Lai Chi Kok, Kowloon, Hong Kong
Tel: +852 2742 5147
Website: www.tsbuttons.com

Bao Tin Produce Trading Service Transport Co. Ltd
Bin Duong Province, Viet Nam
Tel: +84 650 3883023
Fax 84 650 3883198

88 Baba Button Co. Ltd
Dungjang-chon, Denbu-jun, Laixi-shi
Qingdao, China

Shin Young Manufacturing Co. Ltd.
9-18 Noyoo-1 Dong Kwangjingu
Seoul, Korea

CV Kevinindo Angurah
Makassar City
Indonesia
Tel: +62 0411 5041762
Fax: 0411 4720818

Useful contacts for specific Pacific Island countries

Cook Islands

- Raymond Newnham, Director, Ora Moana Ltd.
Email: raymond@moanagemms.co.ck

Fiji

- Newton Yuen, Manager, Yon Tong Button Manufacturing Ltd.
Tel: +679 9244713. Email: yontong@connect.com.fj

French Polynesia

- J.Sangue, trochus buyer, Sangue Alimentation Animale.
Tel +689 87777357; email: jeanpierresangue@gmail.com

Marshall Islands

- South Pacific Austrading, Majuro, MH 96960.
Tel: +692 247 5555; fax +692 247 7777
- Long Island Apartments, PO Box 3491, Majuro, MH 96960

New Caledonia

- Armand Pala, marine products exporter.
Email: pala@lagoon.nc
- laora Export Sarl, marine products exporter.
Email: laora.export@mls.nc
- Sarl HRT, marine products exporter, Wigrial Mouzin.
Email: wmouzin@mls.nc

Palau

- Hanpa/Soon Seob Ha: +680 488 2777, +680 488 3898, +680 775 0777
(the only active buyer for the last season, 2011)
- Eberdong & Sons Co.: +680 488 1365, +680 779 4325
- Pin An: +680 775 7127
- Sarang Trading Co/Choi Mansung: +680 778 7013

Papua New Guinea

- Raymond Choong, Director, Asiapac, Alotau, Milne Bay Province.
Email: raymondchoong.png@gmail.com
- Reinhard Mangles, Director, Emirau Marine Products Limited, Kavieng, New Ireland Province.
Email: reinhardmangels@gmail.com
- John Chung, Director, United Seafoods Limited, Port Moresby, National Capital District.
Email: jc651016@gmail.com

Solomon Islands

- Deane Bosoboe, Solomon Shell Company.
Tel: +677 764 7231; email: solomonshellsupply@gmail.com
- Kou Foo, manager, Haiway Company.
Tel: +677 763 8638.

Vanuatu

- William Alie, Operations Manager, Hong Shell Products, Port Vila.
Tel 678 778 7364; email mahitwillie@gmail.com

Appendix 2: National trochus profiles

Information on trochus in Cook Islands

History of the trochus trade

- The first commercial harvest of approximately 200 t of trochus occurred in 1981 after the introduction of 40 trochus from Fiji to Aitutaki in 1957 (Sims 1985).
- Harvest and trade of trochus has not occurred annually. Trochus harvest was dependent on results of resource assessments.
- Prior to 2001, trochus were harvested for trade only from Aitutaki. Harvests for trade occurred in Rarotonga in 2001, 2002, 2003 and 2005, and from Manihiki in 2005.
- In 1997, 1.5 t of trochus were harvested from Palmerston Atoll. As these were of low quality (Passfield 1997), it is not known if this harvest was exported.

Volume of annual trochus harvests during the previous decade

- Ministry of Marine Resources (MMR) staff assists island and district councils and trochus shell buyers with grading and packing of trochus shell. Records of trochus volumes by island are kept by MMR.
- During 1985–1994, the World Bank trochus study indicated that the average annual trochus harvest in Cook Island was 14 t per year. MMR records show that in the period 1983–2008, 15 commercial trochus harvests occurred, and the average annual harvest was 16.5 t.
- In the period 2009–2018, two harvests occurred.
- The Ministry of Finance and Economic Management collects Cook Islands trade information, although it is difficult to separate trochus shell from pearl shell, in this database.
- The majority of Cook Islands trochus is sold to Italy and, more recently, to Japan.

Available information on prices paid to harvesters

- Trochus are purchased, cleaned (i.e. meat extracted and encrusted fouling removed and dried) and graded.
- Grades: A = a few blemishes at the very top. B = a few blemishes down to the third row on the “yoko”, C = a few blemishes right down the “yoko” but the “ten” is clean.
- Average price per kg was NZD 1.90 in the period 1983–1988, NZD 6.42 in the period 1989–1998, NZD 5.50 in the period 1999–2008, and NZD 4.45 in recent years. In 2015, prices for trochus shell grades were A: NZD 5.50, B: NZD 3.30, C: NZD 1.20

Domestic trochus processing

- There has been no trochus button processing in Cook Islands. Processing by fishers includes meat extraction and scraping the encrusting fouling. Shells are packed by grade as raw clean shell.

Trochus exports

- Over the past 10 years, one company, Ora Moana Ltd has been involved in the purchase and trade of trochus, when shells are available. The company would like to export more trochus, although trochus availability is dependent on a decision by the Island Council.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Trochus shell (in kg)	0	0	18,900	0	0	0	19,800	0		

Aquaculture of trochus

- Ad hoc trochus spawning and rearing experiments were conducted at the Aitutaki marine research facility and Penrhyn hatchery in the late 1990s and early 2000s. These experiments were primarily for staff training in spawning and rearing.
- Juvenile trochus from spawning attempts in Aitutaki were used to control algal growth in culture tanks for the rearing juvenile of giant clams. The hatchery-reared trochus were discarded onto lagoon patch reefs when they were too large (> 3cm basal width diameter) for clam culture tank algal control.

Trochus transplantations

- Following the introduction of trochus to Aitutaki from Fiji, in 1957, trochus were introduced to other southern group of islands in 1981, 1982 and 1983 from Aitutaki. Quantities introduced ranged from 300 to 3000 trochus per island reef system. 400–690 trochus were introduced from Aitutaki to the northern atolls (Manihiki, Rakangana and Penrhyn) in 1985 (Sims 1985).
- In the period 1989–2001, trochus were again introduced to the Southern Islands, from Rarotonga. Quantities range from 180 to 1000 adult trochus (Raumea 2001).

Management of trochus fisheries

- The Aitutaki Island Council has adapted the management of its trochus fishery since the first harvest. Aitutaki implements a very short harvest season, a total allowable catch quota for an open harvest season, and 8 cm minimum and 11 cm maximum basal diameter size limits. The allowable catch is subdivided equally into individual (fisher) quotas. Collected, cleaned and dried shells are inspected by fisheries officers during shell grading. The total allowable catch is determined through in-water resource surveys.
- These measures are by Island Council resolution.
- In the 2011 harvest, 3% of the total harvest was outside of the harvest slot size (8–11 cm) (Richard Story, Senior Fisheries Officer, pers. comm.).
- MMR staff were trained in conducting trochus resource assessments in 1992 by SPC, but currently none of those trained staff are with MMR. In 2014, 6 MMR staff were trained in invertebrate resources assessment, 3 of the 6 staff remain with MMR.
- There is ongoing, on a needs basis, MMR internal staff capacity building in invertebrate resource surveys.

Major trochus fishery issues in the country

- Trochus in Rarotonga are used primarily for subsistence food and local sale. During meat extraction, the shells are smashed, and so are not suitable for trade.
- From recent trochus resource assessments in Aitutaki by MMR, there are sufficient quantities to warrant commercial harvests. However, a commercial harvest has not occurred.
- The Island Council, with limited to no experience in the trochus trade, has attempted to source international trochus shell buyers, although these attempts have been unsuccessful.

Other relevant observations

- Trochus populations have not resulted in the establishment of to commercial viable levels in many islands in Cook Islands despite the introductions during the early 1980's and late 1990's. Trochus remain rare to common on many reef systems, excluding Rarotonga and Aitutaki where they are abundant. George (2014) states: it is not well-understood why trochus populations have not established on atolls of the Cook Island. Suitable trochus habitats may be limited in atolls of the Cook Island. Agricultural farming (e.g. oranges, bananas) were significant activities in Rarotonga and Aitutaki during the 1970's/80's. This activity may have altered reef systems to encourage growth of turf algae, which is a key component of trochus diet.
- Tourism has increased significantly in Aitutaki since the 80s/90s and the communities are involved in this sector, including the increase in marine related tourism activities. There is a general lack of interest by a large portion of the community to harvest and clean trochus shell. Trochus harvesting and cleaning is considered hard work.

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Information on trochus in the Federated States of Micronesia

History of the trochus trade

- Yap Island is the only place in the Federated States of Micronesia (FSM) where trochus naturally occurs. It has been harvested commercially at least since the period of German administration (1898–1914) when trochus were exported to Europe (London). Trial exports of trochus to Japan occurred 1898 and in 1903. Japan later became the dominant export destination after WWI. The trade, along with other export commodities such as copra, was monopolised by NBK (Nanyo Boeki Kabushiki Kaisha) until WWII interrupted regular trade with the Japanese home islands.
- Chuuk's first harvest occurred in 1939.
- After WWII, exports from what was then the Trust Territory of the Pacific Islands were handled exclusively by the United States Commercial Company and later Island Trading Company, both government monopolies during the early years of US administration. Pohnpei's fishery began in 1948, nine years after the first successful introduction.
- In the early 1950s, private or cooperative firms in Micronesia began handling export sales along with those for copra. It is not certain when outside buyers began visiting Micronesia to buy trochus, but by the 1980s it was the general practice and has continued until today.

Volume of the annual trochus harvests during the previous decade

- Records in Pohnpei and from the other three FSM states generally reflect the volume of trochus sold and exported. Information on total volumes harvested, including for undersized trochus returned to the sea are apparently not recorded.
- Pohnpei: 84 t were produced in first harvest in 1948. From 1948 to 1956, an average of 87 t were produced. The fishery may have been closed for 11 years from 1957 to 1968. From 1969 to 2005, 19 annual open seasons were declared with an average of 94.6 t/yr, a low of 27 t in 1976, and a high of 192 t in 1988. There are no records for the outer islands except for 2001 and 2005; it is likely that outer islands catch data was been lumped together with Pohnpei Island data.
- From 1984 to 1994, trochus production throughout FSM was high, averaging 206 t per year. Yap's portion in 1994 was 32 tons, valued at approximately USD 70,000.

See information on exports below

Available information on prices paid to harvesters

- Pohnpei 2014: Prices paid: Grade A USD 3.30/kg, Grade B USD 2.97
- The last trochus export from Kosrae was in 2012: 19 tons were valued at USD 63,000 or USD 3.30/kg
- The last trochus export from Yap was in 2011: 125 tons were valued at USD 330,000 or USD 2.65/kg

Domestic trochus processing

- Two button factories operated in Pohnpei during the late 1980s and early 1990s. The first factory was a private enterprise, the second was funded by the Pohnpei State government. Both enterprises failed due to a lack of regular raw material supply.

Trochus exports

- Pohnpei: The trochus fishery began in 1948, nine years after the first recorded successful introduction. The fishery may have been closed for 11 years, from 1957 to 1968.
- The last trochus season in Pohnpei lasted one week in 2014. During this time, an estimated 136 t dry weight was produced against a quota of 100 t. No calculation of total harvest value is available.
- The buyer for Pohnpei's trochus in 2014 was said to be a Korean based in Fiji. He was also said to have been the sole buyer during a previous harvest in 2011.
- Occasional harvests occurred in some of Pohnpei outer islands, but totals were much less than for Pohnpei Island. In 2010–2011, Sapwuafik Atoll produced 11 tons.
- The last trochus export from Kosrae was in 2012: 19 tons valued at USD 63,000 or USD 3.30/kg
- The last trochus export from Yap was in 2011: 125 tons valued at USD 330,000 or USD 2.65/kg
- No exports of trochus are recorded from either Chuuk or Pohnpei during the period 2008–2017 in FSM's National Statistics. Given that there definitely was a harvest in Pohnpei in 2014, some of these data presented in national statistics are called into question.

Aquaculture of trochus

- Trochus hatchery and nursery operations were conducted in Kosrae at the National Aquaculture Center in the early 1990s. Activities have apparently been discontinued for many years as the facility has been engaged in commercial production of giant clams and other aquarium products.
- Pohnpei State Government operated a trochus hatchery and released juveniles in the late 1980s with external funding. Results appeared not to have been cost-effective and were discontinued in early 1993.
- Pohnpei State indicated that Land Grant (College of Micronesia) is planning on raising trochus for stock enhancement. No further details.

Trochus transplants

Yap

- 1939 or 1940: trochus from Yap transplanted on Ulithi and deemed very successful
- 1985: 1979 shells transferred from Yap to Ifalik and Eauripik; 90 died enroute
- 1986: 3125 shells transferred from Yap to Eauripik, Elato, Lamotrek and West Fayu; 22 died enroute
- 1987: 2504 shells transferred from Yap to Fais, Ifalik and West Fayu; 77 died enroute
- 1991–1992 Yap Marine Resources Management Division successfully transplanted 1607 trochus from Ulithi and Woleai to five other atolls in the Yap outer islands.
- Early 1980s, 1991, 1996: trochus from Woleai Atoll were transplanted to Lamotrek, Elato and Ifalik

Pohnpei

- 1989: 500 shells transplanted from Pohnpei to Kapingamarangi, 500 from Pohnpei to Nukuoro
- 1990(?) 125 one-inch trochus were transplanted from Pohnpei to Pingelap Atoll

Kosrae

- 1959: Kosrae received 500 live trochus from Pohnpei that were released at 13 locations

Chuuk

- 1927–1931 total 6724 shells transferred from Palau to Chuuk (formerly Truk).

Management of trochus fisheries

Yap State management

- Yap State Code: Governor designates annual harvest season on advice from Marine Resources Division after stock assessments.
- A complete harvesting ban exists unless an open season has been declared.
- A stock assessment was conducted in 1987 by Yap Marine Resources Division, which showed a 25% stock reduction since a 1986 assessment; and a 60-day season for Yap proper was recommended.

Kosrae State management

- Kosrae State Trochus (Tukasungai) Regulations (2013) manage harvesting, selling, buying, stockpiling and/or processing trochus. Includes open and closed harvesting seasons, minimum shell width of 3 in (7.6 cm) and maximum size of 4 in (10 cm). All harvesting for commercial activities can only be made under an official permit, and all commercial buyers must have a licence issued by the Kosrae Island Resources Management Authority.
- Kosrae has a designated a trochus sanctuary.

Pohnpei State management

- Open seasons determined after surveys conducted by the Office of Fisheries and Agriculture (OFA). Since 2016, management has been the responsibility of the Forestry and Marine Conservation Division, Department of Research and Development.
- OFA completed a survey in 2019 and recommended a two- or three-day season. No dates set as of October 2019.
- There has been no training of staff of the Office of Fisheries and Agriculture or Marine Conservation Division related to trochus.
- Harvesting is done by permit open to all Pohnpeian citizens on Pohnpei. In 2014, approximately 2600 licences were issued for a total quota of 100 t. Harvesting with scuba is prohibited.
- Pohnpei Department of Fish and Wildlife (DFW) is responsible for enforcement. Pohnpei Department of Forestry and Marine Conservation is responsible for managing the harvest. OFA is responsible for conducting scientific studies and surveys, and making recommendations on harvest quotas.
- DFW also invites buyers to bid on trochus; in recent years only one buyer (Korean from Fiji) has made a bid. A trochus buyer's licence fee is USD 100.

Major trochus fishery issues in the country

Pohnpei

- Stagnant price is an issue. Although procedures are in place for a bidding process to select an overseas buyer, there has only been one firm interested for the last several harvests, and it is believed this is one of the reasons for the lack of increase in prices paid to producers.
- The system of granting licences and apportioning available quotas equally among licence holders can be abused. Some harvesters register their relatives who are not intending to harvest, and so gain excessive portions of the quota.
- Harvesters may illegally bring dry shells for purchase that have not been harvested during the season. The government appears unable to prohibit sales in some instances so that in the last harvest (2014), 136 tons were actually purchased by the buyer against a quota of 100 tons.

Yap

- Surveys in recent years have shown there is insufficient stock to enable a harvest.

Chuuk

- Chuuk has experienced an apparent continued decline in trochus stocks. A harvest in early 1980s was reported to be around 11 tons (1983 country report to Heads of Fisheries meeting). Subsequent surveys undertaken in 1987 found that even in optimum habitats on the barrier reef, the densest populations averaged only 37 trochus/ha. Surveys in subsequent years (1997) conducted in permanently marked transect areas of major trochus harvest and sanctuary sites showed fewer and fewer stocks.

Other relevant observations

- Pohnpei: There appears to be some political pressure placed on government officials to open or extend trochus harvests. OFA seems to be able to rely on their surveys to recommend a quota but adherence to the quota can be difficult.
- Availability of external funding to FSM during the late 1980s and early 1990s facilitated the spurt of transplant activity during those years. Activities mainly focused on transplanting from main islands to outer atolls.
- Throughout FSM there appears to be little follow-up on the status of trochus transplants to the outer islands and atolls, with the exception of one case in Yap. Staff turnover in marine resources and conservation departments, other pressing issues (e.g. sea cucumber exploitation), and the time required for trochus colonies to become firmly established in new environments all likely contribute to a lack of knowledge about trochus transplants. One thing that could be done, is to survey past transplant sites to ascertain the status of previous introductions.

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Information on trochus in Fiji

History of the trochus trade

- Trochus has been commercially harvested in the Pacific Islands since the early 1900s. The Fiji fishery is likely to have developed after the end of World War II when world demand for mother-of-pearl shell surged.
- A trochus button factory in Levuka operated for most of the 1950s.

Volume of annual trochus harvests during the previous decade

- In the period 1985–1994, the World Bank trochus study indicated that the average annual trochus harvest in Fiji was 274 t/yr. Estimates of harvests were made by the Fisheries Division using their sampling, knowledge of the trade, and information from trochus buyers.
- In recent years, the harvesting of trochus in Fiji has been a byproduct of the sea cucumber fishery. Sea cucumbers, being much more valuable than trochus, are a major activity of many commercial divers, with trochus being taken opportunistically or when diving for sea cucumbers is unfavourable. The sea cucumber fishery, however, was closed in May 2017.
- In recent years, the monitoring of the trochus trade has not been undertaken by the Ministry of Fisheries, so the only practical way of estimating the amount of trochus harvested is by monitoring exports, which is constrained by difficulties associated with each of the two separate export databases (Revenue and Customs Service, and Ministry of Fisheries).
- Using those two databases, in the section below on trochus exports, a crude estimate of the Fiji trochus harvest in recent years is 230 t/yr but this estimate is dubious.

Available information on prices paid to harvesters

- In 1994, the factory gate buying price for trochus in Fiji was USD 4.60/kg.
- In recent years, the factory gate buying price for trochus has been FJD 5/kg (USD 2.40)
- Trochus buyers pay less for low-quality shell (i.e. very large or worm damaged) and less if purchasing occurs away from Suva.
- In early 2019, trochus meat was sold for USD 7.20/kg at a retail shop in Labasa.

Domestic trochus processing

- The McGowan trochus button factory in Levuka started in 1952 but closed in the late 1950s when shell button prices fell due to competition with plastic buttons.
- The World Bank trochus study indicated that about 200 t of trochus were processed in Fiji in 1994, equating to about 72% of the annual national trochus harvest. In that year, the four companies processing trochus had a total of 52 blanking machines.
- The Fiji Fishery Resource Profiles indicate that in early 2017, there was one button-blank factory operating consistently, and reports of one operating sporadically. Both are located in the Suva area.
- The largest trochus processor has 17 blanking machines, but only 6 are operational and those are only used part time. The operations of the sporadic operator are a mystery, but it is unlikely that the business was still functioning in late 2019.
- The number of people employed in trochus processing was 57 in 1994, but that number has fallen considerably. The sole blanking factory operating employs the equivalent of about 10 people full time and about half are women.

13 According to the largest trochus processor in Fiji, the button blank yield from raw trochus is about 10–15%.

Trochus exports

- Three companies have been involved in recent years in exporting trochus: a) Yon Tong, raw trochus and button blanks; b) Shell Products, raw trochus and button blanks; and c) House of Pearls, raw trochus.

From the Ministry of Fisheries export permit database:

From the Revenue and Customs Service export database:

	2011	2012	2013	2014	2015	2016	2017	2018
Trochus shell (in kg)	0	44,900	87,400	3	19,800	64,000	19,000	36,002
Trochus button and blanks (pieces)	0	0	0	1,000,000	0	4,950	18,047	4,556

Notes:

1. The data from the Customs database above is for harmonised commodity (HS) codes 96062990 and 96063010.
2. In the Customs database, raw trochus cannot be disaggregated from coral and other items in HS code 05080000.
3. Anecdotal information from the Ministry of Fisheries, together with that of the largest trochus processor, indicates that three containers of raw trochus were exported in 2018, but the above data indicates 36 t were exported, which equates to two containers.
4. An enquiry to another Customs officer indicated that FJD 552,349.67 worth of raw trochus was exported in 2018. This amount, divided by the weight of the export (36,002 kg, according to Ministry of Fisheries database), results in a value per kg of FJD 15.34, which is much too high.
5. The only button blank producer in Fiji stated that blank exports in both the Fisheries and Customs data are inaccurate, citing the large difference in volumes between 2017 and 2018 as an example. He believes that one source of error is Fisheries and Customs staff mixing up the units of volume (i.e. mingling kilogrammes, tonnes and pieces).

- The above export information is inconsistent and conflicting, and is totally inadequate for making estimates of annual trochus harvests in the country. Nevertheless, on face value of the above data, the 2014–2018 average export of trochus blanks in the Customs data (24 t/yr) equates to about 195 t of raw trochus. Adding that quantity to the 2011–2018 average export of raw trochus (34 t/yr), suggests that in recent years the annual trochus harvest is about 230 t/yr.
- Since the late 1990s, there have been restrictions on exports from Fiji of raw trochus¹³, to encourage domestic processing. This was done under a Customs regulation and any trochus exports required an exemption issued by the permanent secretary of the ministry responsible for trade. Several years ago, the power to exempt was transferred to the “Management Authority as required under the Endangered and Protected Species Act 2002”. That act, however, states: “No person may export any specimen mentioned in section 3 except with an export permit”, but trochus is not mentioned in section 3, or in any part of the act.
- The Revenue and Customs Service export database indicates that trochus blanks are mainly shipped to Hong Kong, China and Italy in descending order of importance.

	2014	2015	2016	2017	2018	
Trochus button and blanks (kg)	5,304	4,199	55,451	54,187	2,768	121,909
Trochus button and blanks (FJD)	358,501	215,605	621,050	504,678	189,888	

Aquaculture of trochus

- From 2007 to 2007, trochus was cultured at the research facility of the Ministry of Fisheries at Makogai Island to the east of Levuka. This was a pilot project, intended at exploring the feasibility of producing trochus for reef reseeded. Funds came from the ministry’s regular budget.

Trochus transplantations

- There have been several transplantations of trochus from Fiji to neighboring countries. This includes shipments to Cook Islands (1957), Tuvalu, (1985 and 1987), Tokelau (1986), Samoa (1990 and 2003), Tonga (1992, 1994 and 1995), Niue (1992 and 1996), and Kiribati (late 1990s). The amounts transplanted ranged from 40 shells to 1200 per shipment. The source for most of the latter shipments was Lakeba in Lau.
- As Fiji is within the natural distribution of trochus, the moving of trochus within Fiji is considered to be reef reseeded.

Information on trochus in French Polynesia

History of the trochus trade

- Trochus do not occur naturally in French Polynesia but were transplanted to Tahiti from Vanuatu (40 shells) in 1957 and from New Caledonia (40 shells) in 1958.
- Commercial exploitation of trochus in French Polynesia began in 1971, 14 years after it was first introduced to Tahiti.
- The height of the trochus fishery was in the late 1970s. During that period, trochus – along with pearl shell – were French Polynesia's leading marine export products (Yen 1985).
- Currently, there is a single buyer in French Polynesia's trochus trade. He indicated he took over from his father who was in the business for many years. Other buyers dropped out of the business about four or five years ago due to the low price of trochus on the global market.

Volume of the annual trochus harvests during the previous decade

- The Direction des ressources marine et minières (DRMM) trochus booklet (DRMM 2017) distinguishes between three historical trochus harvesting periods:
 - o 1971–1980: Decade of the Windward Islands. There were 70 trochus fishing operations on Tahiti and Moorea in which 1148 t of trochus were harvested.
 - o 1981–1990: Decade of the Leeward Islands. There were 13 operations in the Windward Islands in which 148 t of trochus were harvested; 48 operations in the Leeward Islands for 184 t, and the beginning of operations in the Tuamotu Group, with 5 operations for 84 t.
 - o 1991–2000: Tuamotu decade. The fisheries in the Windward and Leeward islands disappeared while the Tuamotu trochus fishery took off, with 18 operations yielding 424 t.
- The best indicator of annual harvests of trochus are exports (see section below). Trochus exports, plus the amount of any processed trochus and the amount of trochus harvested but not exported (e.g. rejects), equates to the total harvest. For all practical purposes, the current trochus harvest equals trochus exports, noting that some trochus may be stockpiled for shipment in a subsequent year.
- The DRMM website indicates that in 2018 (when the fishery was only open at three communities on Tahiti), 221 fishers participated in the fishery and harvested 36.5 t of trochus worth XPF 11 million at first sale.

Available information on prices paid to harvesters

- During the 2018 sale of trochus on Tahiti, the price of trochus at first sale was XPF 299/kg.
- The sole trochus buyer in French Polynesia stated that the buying price per kg in mid-2019 was XPF 310/kg. The buying price in the Tuamotu Group is the same as that on Tahiti, but sellers are responsible for paying the freight to Papeete.
- DRMM staff indicate a threshold price paid to the harvester of XPF 300/kg, below which it is difficult to generate community enthusiasm for harvesting.
- The declared FOB (free on board) value of trochus (i.e. the total value of significant exports reported in DRMM's statistics divided by the weight of those exports) ranged from 296 to 557 XPF/kg during the 2013–2017 period.

Domestic trochus processing

- Three trochus blanking factories have been set up in French Polynesia: SNC Maohi Industries (started in 1990), Tahiti Shell Products (1990), and Patitifa Shell (1995, formed from the failed Tahiti Shell Products). In late-1995, there were two trochus blanking factories operating in Tahiti, with a total of 29 blanking machines (Gillett 1996).
- In October 2019, DRMM staff indicated that there had not been a trochus blanking factory operating in French Polynesia in over 15 years.
- The single buyer of trochus in French Polynesia, J.P Sangué, indicated that the closure of the trochus factories was due to the high cost of labour in the territory. The buyer states he has no intention of getting into trochus processing.

Trochus exports

- Trochus exports in the past ten years, according to DRMM (2018) and the DRMM website:

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Volume of trochus (t)	0	388	8	0	0	0	44 9	26 2	35 8	16 2	11 6	36 .5
Value of trochus (millions of XPF)	0	177	2	0	0	0	13 3	80	19 8	2	42	11

- The above statistics are thought to be accurate as they were collected at the point of export.
- It should be noted that annual exports do not always correspond to annual harvests due to stockpiling. For example, there were no trochus harvests in 2017; the exports that year were from harvesting in the previous year.
- The current sole trochus buyer in French Polynesia states that all of his trochus are sold in Asian markets.

Aquaculture of trochus

- There has been no significant aquaculture of trochus in French Polynesia.

Success of trochus transplantation

- Two international trochus transplants to French Polynesia have been undertaken:
 - In 1957, 1200 shells were shipped from Vanuatu to Tahiti in circulating water tanks; 40 shells survived the 15-day trip (Van Pel 1957).
 - In 1958, 40 shells were transferred from New Caledonia to Tahiti in damp sacks by aircraft (R. Powell, former Cook Islands fishery officer, pers. comm.)
- Transplants within French Polynesia have been summarised from a variety of sources:
 - From a World Bank report (Gillett 1996): 1963: Tahiti to Moorea (800 shells); 1963: Tahiti to Bora Bora (660 shells), Tahiti to Raiatea (400 shells); 1968: Tahiti to Manihi (120 shells), Tahiti to the Austral Islands (87 shells), Tahiti to Gambier (100 shells); 1969: Tahiti to the Tuamotu Islands (Tikehau 60 shells, Fakarava 170 shells, Takarua 64 shells, Anaa 60 shells, Pukapuka 100 shells, Rangiroa 355 shells); 1972: Tahiti to the Australs (500 shells), Tahiti to Tuamotu (Arutua 160 shells, Apataki n/a), Tahiti to Gambier (300 shells). Trochus were introduced into the Marquesas in the 1990s (DRMM 2017).
 - The descendants of 80 live shells that arrived in French Polynesia six decades ago have produced substantial trochus harvests. Using DRMM data for 2017 and 2018, it can be calculated that 4138 t of trochus were harvested since trochus collecting began in the territory in 1971 (i.e. from 1971 through 2018).

Management of trochus fisheries

- Yen (1985) gives the results of the first two stock trochus stock assessments in French Polynesia:
 - o The first assessment was done in 1971. It was estimated that the stock on Tahiti consisted of more than 10 million individuals, with a total biomass of 2547 t.
 - o In 1983–1984, Tahiti's total trochus biomass was estimated to be 605 t, which according to Yen, represented a decline of 76% during 13 years of managed stock exploitation.
- Prior to 2006, before an area had a trochus harvest, surveys were carried out for quota setting.
- In terms of management measures, in 1962 regulations were introduced that included closed seasons and bans on the culture and transport of trochus. These rules have been modified over the years.
- The current regulations are given in the DRMM trochus booklet. Open seasons, quotas, trochus sizes, and manner of sales are specified by the minister in charge of marine resources through decisions of the Council of Ministers.
- Currently, the main management measures are: size limits (must be within 8 and 11 cm), a total ban on trochus fishing except for areas specifically opened for defined periods of time, a quota for those areas that are open to fishing, a requirement that all fishers be registered, and a ban on the transfer of harvested trochus from one community to another.
- Violators of the regulations are subject to imprisonment for a period of between two and six months and/or a fine of XPF 150,000–300,000 per violation.
- The harvesting of trochus is strictly prohibited unless it occurs within the exploitation framework organised by the fisheries surveillance committee of the concerned community. For those communities where trochus fishing is to be opened, the mayor chooses four or five people to serve as a surveillance committee. That group has the responsibility of overseeing trochus fishing and trochus sales, and ensuring fishers' compliance with the applicable rules, such as quotas, open or closed zones, and hours of fishing. The surveillance committee pays special attention to the fulfillment of the quota so as to be able to announce the fishery's closure.
- DRMM has six steps for opening and managing trochus fishing at a specific area:
 1. Determining the areas and stakeholders for an opening of fishing
 2. Making a consultation visit to the concerned community
 3. Overseeing a first meeting of the surveillance committee, including choosing the buyer, and drafting a Council of Ministers regulation for the opening
 4. Overseeing a second meeting of the surveillance committee
 5. Opening the fishery
 6. Monitoring shell size and payment to fishers during trochus sales
- In 2006, the activities in the above steps were simplified, partly because there were no fishery openings in 2001–2005 due to the procedure being so cumbersome.
- According to DRMM staff, the trochus management regulations are reasonably well respected, with the possible exception of intense periods of harvesting when there is a great quantity of harvested trochus in a community.
- Current DRMM staff cannot recall any training or capacity building specifically for assessing or managing the trochus fishery.

Major trochus fishery issues in the country

- The trochus trade is dying. The real price of trochus today (FOB Papeete) is about one-third of what it was in 1990. In the absence of subsidies, the future of the trochus trade looks bleak and will largely be driven by factors beyond the control of stakeholders in French Polynesia.
- Trochus harvesting is labour intensive, and in French Polynesia there are very high opportunity costs for harvesting, except in isolated locations.

Other relevant observations

- The trochus fishery in French Polynesia appears to be very well managed.
- The DRMM trochus booklet is a convenient source of information on the trochus trade.

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Photo credit: Jeff Kinch

Information on trochus in the Marshall Islands

History of the trochus trade

- Trochus were transplanted by the Japanese in the mid-1930s from Palau and Chuuk to Jaluit, Majuro, Ailinglaplap, Arno, Ebon, Kwajalein and Enewetak atolls.
- There is no record from the literature accessed for this report of when the first harvests might have been made. Given that the first harvests by the Japanese in other Micronesian locations occurred at least nine years after transplanting, it is possible that no harvests were undertaken before WWII interrupted trade in the region.
- Several authors have noted that historical records of trochus harvests are especially poor in the Marshall Islands.
- In the 1960s, the Marshallese people harvested trochus only for subsistence purposes. One source says it was not until the 1980s that commercial activities began, and by that time, trochus on Majuro were already depleted and had greatly declined on other atolls.
- In 1992, there were three local trochus traders based in Majuro who purchased trochus that were sourced locally or from the outer islands. Typically, someone from an outer island who had organised the collection brought the shells to Majuro for a pre-arranged sale. One buyer indicated at the time that he exported shell purchased in Majuro to a buyer in Korea.
- In 1996, a Japanese buyer purchased 4.3 t of trochus from Ailinglaplap Atoll as part of a project organised by a local expatriate and funded by the US National Marine Fisheries Service.
- The Marshall Islands Marine Resources Authority (MIMRA) records indicate that trochus were purchased for export from fishers by local buyers in 2009 and 2019. There were likely more transactions in the intervening years but records were not digitised and some were lost or misplaced when MIMRA moved its offices in 2019.

Volume of the annual trochus harvests during the previous decade

- There is no single comprehensive listing of volume and/or value of trochus harvests in the Marshall Islands. Some records from previous years can be gleaned from published sources.
- According to Smith (1992), the volume and value of trochus harvests from 1987 to 1991 are as follows:

YEAR	LOCATION	AMOUNT (tonnes)	VALUE (US\$)	SOURCE
1987	Enewetak	100		1
	Enewetak	74		2
	?	?	179,000	3
1988	Enewetak	150		1
	Enewetak	130		2
	?	?	350,000	3
1989	Enewetak	98.75		4
	?	?	467,000	3
	Enewetak	31		5
	Ailinglaplap	15		5
1990	Mili/Jaluit	[23 bags]		4
	?	8	28,000	4
	?	38	178,800	2
	Enewetak	15		5
	Ailinglaplap	18.99		5
	Mili	10		5
	Arno	11		5
	Jaluit	0.36		5

1 = Wright, et al (1989), obtained from the Mayor of Enewetak and supported by a Majuro trochus buyer.

2 = Export records from Division of Revenue & Taxation, Ministry of Finance.

3 = Statistical Abstracts 1989/1990, Office of Planning & Statistics.

Available information on prices paid to harvesters

- In 1992, Smith reported that one buyer in Majuro said that cleaned shell from the outer atolls were purchased for USD 1.25/lb (USD 2.75/kg), or if shipped into Majuro for between USD 1.75 and USD 2.00/lb (USD 3.85–4.40/kg)
- In 1996, fishers on Ailinlaplap were paid USD 3.91/kg for trochus sold to local agents acting for a foreign buyer.
- In October 2019 in Majuro, a Chinese restaurant was said to pay USD 1/kg for live trochus. Trochus appear on the menu of the restaurant and an affiliate of the restaurant's owner was also identified as one of two trochus buyers in Majuro at the time.

Domestic trochus processing

- No trochus processing occurs in the Marshall Islands.
- The machinery to set up a small processing factory was reportedly on Majuro in the 1980s but never became operational.

Trochus exports

- In 1996, a Japanese buyer purchased 4.3 t of trochus from Ailinlaplap Atoll for USD 20,000 (USD 4.65/kg). Fishers were paid USD 3.91/kg, with the balance going to local merchants on the atoll who acted as collection, grading and shipping agents.
- The estimated trochus production and value for the period 1987–1992 is shown below.

Year	USD	Weight (t)	Source atoll
1987	179,000	100	Enewetak
1988	350,000	150	Enewetak
1989	467,000	145	Various
1990	179,000	100	Various
1991	176,000	?	Various
1992	176,000	?	Various

Source: RMI Office of Planning and Statistics, cited in SPC Trochus Information Bulletin #4, December, 1995

- In July 2009, 12,272 kg of trochus were exported to a buyer in Qingdao, China.
- In December 2009, 24,380 kg of trochus were exported to a buyer in Seoul, Korea
- In January 2019, 39,500 kg of trochus were exported to a buyer in Binh Duong Province, Viet Nam.

Aquaculture of trochus

- There have been no significant attempts at trochus aquaculture in the Marshall Islands. Two aquarium product export companies keep a few trochus in their tanks to clean algae. But neither company has an interest in culturing trochus.

Success of any trochus transplantation projects

- Trochus were introduced by the Japanese during Japan's administration of the Marshall Islands prior to WWII. Several authors cite the 1930s as years when transplants took place. An unpublished compendium of transplant dates, sources and locations gives the year as 1939 on two separate occasions: from Chuuk to Jaluit Atoll, and Palau to Jaluit. It is believed that the Japanese, either through government or private enterprises, then made subsequent transplants to Majuro, Ailinlaplap, Arno, Kwajalein and Enewetak.
- Comments (undated) on a Kwajalein diving website with accompanying photos mentions that trochus is abundant on hard substrate on intertidal, lagoon, pinnacle and seaward reefs at Kwajalein.
- Mention is made in the literature of an unsuccessful domestic transfer of trochus from an unknown location to Kili Atoll in 1954.
- Domestic transplants from an unknown source atoll in the Marshall Islands were made to Ebon, Aur and Maloelap atolls in 1984 in conjunction with a trolling resource survey funded by the US National Marine Fisheries Service. No detailed surveys have been done to determine if these transplants were successful.
- In the 2009 PROCFish report (Pinca et al. 1009), the authors mention a transplant operation in 1992 at Arno Atoll, but the report mentions that the slow rate of colonisation since the release suggests that the reef system is, in some way, not ideal for trochus.
- According to one MIMRA employee, in the late 1970s it was proposed to include trochus transplanting as post-typhoon assistance from the US government's Federal Emergency Management Agency office to Namdrik Atoll in addition to re-planting food crops, but the proposal was rejected.

Management of trochus fisheries

- MIMRA staff reports no stock assessments or surveys targeting trochus have been undertaken in recent memory. There may have been a couple of surveys undertaken in the 1980s but records are not available from those.
- A survey and subsequent report at Enewetak by Wright et al. (1989), recommended a 100-tonne quota for Enewetak in 1989, and this was confirmed as a reasonable amount in a report by Curren in 1994; however no quota has ever been put in place.
- A PROCFish survey of Likiep, Arno, Ailuk and Laura Island on Majuro was undertaken in 2007. No trochus – either live or dead shells – were found on Likiep and Ailuk. On Arno, a few were found, but not in commercial quantities. Laura (on Majuro) had the most trochus of the sites surveyed but also not in commercial quantities. The survey stated that there is no potential for commercial fishing of trochus at this time in the areas surveyed, and stocks are in need of ongoing protection in order to build them up to main aggregations, reaching a minimum of 500–600 shells/ha.
- Comments on a Kwajalein diving website (undated) mentions that Kwajalein authorities at the army base have placed trochus in a protected status to keep them from being collected.
- MIMRA staff are not aware of any capacity building or training undertaken at MIMRA with respect to trochus.
- Management measures are contained in national legislation, but management has been delegated from the national government to local governments. MIMRA officials believe they are still involved because the export of all marine products requires a permit from MIMRA.
- National legislation contained in the Fisheries Act, Title 51, Chapter 2, Section 219 vests MIMRA with the authority to declare an open season not exceeding 3 months in any 12-month period. In addition:
 - o taking or harvesting trochus is permitted only by a citizen living in an area where he or she has, in accordance with customary law, a right to fish;
 - o there is a minimum shell size limit of 3 inches;
 - o fishing licences for trochus are to be issued by MIMRA, which specifically authorises the taking or harvesting of trochus;
 - o permits from MIMRA are required for any introduction, transplant or propagation of trochus;
 - o If MIMRA determines that underwater operations or proposed underwater operations will, or may, interfere with a trochus bed, MIMRA may issue a permit for removal and transplanting of the bed at the expense of the person conducting or desiring to conduct the underwater operations; and
 - o no person is allowed to acquire, accumulate or hold trochus, or any part thereof, for the purpose of sale, marketing or export without a permit stating the maximum tonnage to be sold or exported, and the period of time during which such export is permitted.

- There are marine protected areas (MPAs) on 14 atolls, and only a few atolls have trochus. MPAs are no-take zones for all organisms.
- A Cabinet minute in 1996 declared an open season from July to September in 1996. This declaration is still cited as a de facto season, granting a trochus season each year.
- In 2016, trochus from Enewetak was brought to Majuro, sold and loaded into containers. MIMRA was tipped off and stopped the shipment. MIMRA employees subsequently measured the trochus and took out undersized shells from the shipment. The seller from Enewetak was fined an unknown amount. There have been no such problems since that incident.

Major trochus fishery issues in the country

- Records of trochus harvests and details of sales are lacking. One MIMRA official believes that management measures are needed to ensure that trochus continue to contribute to food security, particularly in the outer islands.

Other relevant observations

- Most of the trochus shell for export in recent years has been brought in by people from Enewetak. Trochus from other islands, including Majuro and Arno, may be collected from time to time and treated like copra (i.e. a commodity to be opportunistically collected and sold for ready cash). The existence of one or two buyers on Majuro who may stockpile such purchases for later export should not be discounted.
- MIMRA's management of trochus is somewhat lax with respect to the powers given to it by national legislation. This may be partly because the largest quantities harvested for sale come from Enewetak Atoll, which is far away from Majuro, thus making it difficult to follow the terms of the legislation. The MIMRA staff involved with inshore resources are also fully occupied with other areas of concern such as sea cucumber harvesting and export.
- There are no taxes on exports in the Marshall Islands. The lack of export data collection by Customs makes it necessary to rely on MIMRA for records of exports of all marine products; MIMRA does not, however, collect information on declared export values. A new Customs Act aimed at collecting export data to align the country with the relevant international convention has been prepared but not yet introduced for consideration.

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Information on trochus in New Caledonia

History of the trochus trade

- The first export record in New Caledonia (NC) dates back to 1907 (~900 t). Catches varied between 200 and 1000 t from 1918–1940; then dropped during WWII, rising to 500–1200 t from 1945 to the mid-1950s, dropping to less than 200 t for the following 20 years because of the nickel mining boom. Catches peaked to a record 1915 t in 1978, then dropped to less than 350 t in the following years.
- Two trochus button factories operated for a few years in the north of NC in the mid- to late- 1980s.

Volume of the annual trochus harvests during the previous decade

- In the period 1985–1994, the World Bank trochus study indicated that the average annual trochus harvest in NC was 222 t/yr (ICECON 1997).
- In recent years, the annual harvest of trochus in NC has fluctuated between 10 and 230 t, mostly because of the low prices paid to fishers.
- Exports of trochus shells are recorded by Customs. Catch volumes declared by fishers to the South Province and North Province fisheries authorities are also recorded, but they only represent a portion of the declared export volumes.
- The average NC trochus harvest since 2010 is 154 t/yr.

Available information on prices paid to harvesters

- In 1994, the declared export price for trochus in NC was XPF 475/kg, the price paid to fishers averaged XPF 250/kg.
- In the last five years, the declared export price for trochus in NC was XPF 420, the price paid to fishers averaged XPF 250/kg, which dropped in 2019 to XPF 150/kg.
- The price paid to fishers is roughly the same across NC, and does not vary according to location. The quality of shell cleaning may influence prices paid to fishers (XPF 200–250/kg in recent years). Bored and over- or under-sized trochus are rejected by buyers.
- In early 2019, fishers were paid XPF 1200/kg for trochus meat, and this has become the main incentive for trochus catches.

Domestic trochus processing

- No trochus processing is carried out in New Caledonia, thus shells are exported raw.
- From 1984–1988, one small factory (with four machines) operated in Gatope (Voh) on the west coast of Grande Terre (NC's main island). From 1987 to 1989, another factory (also with four machines) operated in Pouébo on Grande Terre's northeast coast. Despite NC government subsidies in the starting phase, operations were not profitable. The factories produced blanks, and not finished buttons. NC's high labour costs, lack of skilled operators, and trochus shell thickness, which had an impact on the lifespan of expensive cutting tools, were cited as the main reason for the non-profitability (Bernard Fao, Head of the Fisheries Bureau, pers. comm.). The experiment did not last long enough to create a reliable partnership with buyers who kept offering low prices due to, according to them, the low quality of blanks produced (Armand Pala, Manager, Sarl Nord Peche, pers. comm.).

Trochus exports

- Armand Pala, Manager, Sarl Nord Peche, has exported trochus since the early 1980s and continues to do so. Two other companies have been involved in recent years in the export of trochus: laOraExport and Sarl Holothurie Rusa. Both primarily export beche-de-mer.
- Catch data extracted from the Customs Department export database (kg):

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Trochus shell	227,720	143,840	175,478	226,818	127,040	146,257	87,829	10,000	84,840

Declared value of trochus exports extracted from the Customs Department export database (million XPF)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Trochus shell	103.7	68.3	86.3	105.6	60.8	74.6	42.2	4.6	31.6

- Catch data from the Southern Province fisheries agency (kg)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Trochus shell	46,100	30,441	31,441	54,549	34,116	4160	20,915	5854	3,596

- Catch data from the Northern Province fisheries agency (kg)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Trochus shell	42,413	38,841	34,037	40,162	25,051	29,134	16,013	0	10,290

- Trochus export value data

Notes:

6. The data from the Customs (ISEE/Direction Régionale des Douanes de Nouvelle Calédonie) database above is for code 0508.00.20: 'raw trochus, its powder and waste products'.
7. Customs data are reliable. They are not public but available to fisheries authorities through a convention.
8. Fishers' reported catches represent 20–50% of declared export catches.

Aquaculture of trochus

- Some trochus hatching experiments were done by IFREMER (the French Institute of research for the exploitation of the marine environment) in the 1980s. Nothing has been done since then.

Trochus transplantations

- In 1989, 5700 live trochus were shipped from the main island (Grande Terre) to Lifou (Loyalty Islands) where they were transplanted (Hoffschir et al. 1990). Only one live trochus was found eight years later close to the release site (Chauvet et al. 1998). There are, however, sporadic non-official reports of trochus sightings in Lifou, which may indicate that a small population remains.
- In 1958, 40 live trochus were exported from NC to French Polynesia (Van Pel and Devambez 1957; Powell 1960). This record is, however, doubtful as it may have been confused with the 40 live trochus – of the 1200 that were sent – that survived a 15-day shipment from Vanuatu to French Polynesia in 1957 (Yen 1985).

Management of trochus fisheries

- According to Bour and Hoffschir (1985), a well-managed NC trochus fishery would allow annual exports of 400 t of dry shells. This level of exports has never been reached since their report was published.
- The trochus fishery is considered a “special marine fisheries” for which fishers must obtain an annual special fishing authorisation issued by the fisheries authority. Renewal of the authorisation is linked to the provision of the fisher’s catch data logbook.
- A minimum size limit of 8 cm was imposed until 1983, when it was then raised to 9 cm. An additional maximum size of 12 cm has also been imposed, almost continuously, since then. Current Northern and Southern provinces’ environmental codes stipulate:
“The fishing, transport, marketing, exposure to sale, sale, purchase, possession and consumption of trochus with a greatest diameter of less than 9 centimetres and more than 12 centimetres are prohibited.” (DeepL translation)
- Each authorised trochus fisher must carry a measuring gauge when fishing. Undersized or oversized trochus must immediately be put back in the water.
- Size limits are well respected, and buyers are careful not to buy undersized or oversized trochus. The destruction, by Customs authorities, of a full shipment containing a small portion of undersized trochus in the late 1980s was a clear message.

Major trochus fishery issues in the country

- The fishery seems to have been driven more by the demand (and therefore, prices paid to fishers), and alternative and easier income-generating opportunities (e.g. work in the nickel mines), than by the availability of the resource.
- According to exporters, the international demand for trochus shell has been regularly diminishing since 2010. In 2019, the price paid to fishers was reduced to XPF 150 (against XPF 250/kg in preceding years), and two of the three established buyers have stopped buying because of significant amounts of unsold stock.
- It seems that the fashion industry, which is the main market for trochus shells, has switched to shirt-buttons made of oyster-shell white nacre (Armand Pala, Manager, Sarl Nord Peche, pers. comm.). This “disaffection” for trochus could, therefore, only be temporary, as are most preferences in the fashion world.

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Information on trochus in Palau

History of the trochus trade

- Trochus are found naturally in Palau and have a long history of being exploited. Reports indicate that exploitation occurred on a regular basis in the late 1990s, although harvest records date to the early 20th century and are particularly strong during the period of Japanese administration (1919–1945).
- Trochus has been harvested commercially in Palau at least since the period of German administration (1898–1914) when exports were to Europe (London). One source cites 1892 as the beginning of a trochus fishery in Palau. Trial exports of trochus to Japan occurred 1898 and in 1903. Japan later became the dominant export destination after the end of WWI. The trade in trochus, along with other export commodities such as copra, was monopolised by NBK (Nanyo Boeki Kabushiki Kaisha) until WWII interrupted regular trade with Japan.
- Palau and Yap were the source of numerous transplant operations undertaken between the two world wars. The Japanese administration's interest in transplanting to other islands in the Mandate was brought about by a growing market in Japan for raw material. Button manufacturing in Japan was mechanised in 1910, and Japan became the largest button manufacturer, replacing European countries that abandoned button manufacturing due to WWI.
- After WWII, exports from what was then the Trust Territory of the Pacific Islands were handled exclusively by the US Commercial Company and later Island Trading Company, both government monopolies during the early years of US administration of Palau.
- Concerns about the ability of the resource to sustain itself arose as fishing pressure increased throughout the 1980s. In 1989, the Palau national legislature (OEK) placed a moratorium on the harvesting of trochus for a period of three years for all states except Hatohebei and Sonsorol. In 1992, OEK designated an open season for the harvest of trochus in June of that year.
- The 1992 Division of Marine Resources Annual Report stated that “trochus shell was the single most valuable inshore marine resource for Palau in 1992.”
- A news report on the June 2005 harvest stated that companies from Japan, South Korea, China, Australia and Hong Kong were buying trochus from the two domestic buyers in Palau.
- A news report quoting the sole local buyer in the 2008 season stated that the trochus was purchased by three companies from Hong Kong, Japan and Korea.

Volume of the annual trochus harvests during the previous decade

- With the exception of the 2011 harvest, records in Palau generally reflect the volume of trochus sold and exported. Information on total volumes harvested, including those of undersized trochus returned to the sea, are not recorded. See trochus exports below

Available information on prices paid to harvesters

- During the 1988 harvest season prices paid in Kayangel, Palau's northernmost atoll, were USD 0.65/lb (USD 1.43/kg) compared with USD 1.40/lb (USD 3.08/kg) in Peleiliu, Aimeliik and Koror.
- According to the Bureau of Marine Resources 1992 Annual Report, local buying prices in 1992 were USD 1.40/lb (USD 3.08/kg).
- Prices paid to fishers in 2005 were reported as USD 1.65/lb (USD 3.63/kg) with meat and USD 1.70/lb (USD 3.74/kg) cleaned.
- During the last open season that occurred in 2013, trochus buyers were said to be paying around USD 2.20/kg for cleaned shell.

Domestic trochus processing

- There are no trochus processing factories in Palau.

Trochus exports

- A translation of harvest data presented in 1938 indicated that during to the Japanese administration, the largest harvest was in 1923 when 353 tons were recorded.
- According to a news report, the 2005 season resulted in approximately 400 tons being purchased by two local buyers in Palau.
- Another news report cited the 2008 season as producing 150 tons purchased by overseas buyers from the one local Palauan buyer.
- The last open season was conducted from 15–30 June 2011. The Palau Bureau of Budget and Planning's 2013 Statistical Yearbook Table 9.1, which states that the trochus harvest in 2011 was 350 pounds, is obviously an error. Information and copies of actual buyers' invoices obtained from the Bureau of Marine Resources for this study show the total amount produced in 2013 was 96.7 t wet weight, resulting in an exported dry weight of 74.2 t.
- The 2011 export sales invoices issued to overseas buyers in Indonesia and Viet Nam by Palauan exporters and shippers show a price paid by both buyers as USD 5600/tonne, for a total harvest value of USD 415,520.
- The table below, from the 1992 Division of Marine Resources Annual Report, gives export volumes and values for the years 1985–1992.

Trochus niloticus exports, Palau: 1985 to 1992

Year	Local Value US\$	Metric Tonnes	Change from Previous Year	
			Number	Percent
Average	660,942	110		
1992	645,398	229	-28	-10.9
1991	MORATORIUM			
1990	MORATORIUM			
1989	676,487	257	89	53
1988	n/a	168	81	93.1
1987	n/a	87	55	171.9
1986	n/a	32	-72	-69.2
1985	n/a	104		

(Export data from two shipping companies based in Palau)

Aquaculture of trochus

- In 1992, a trochus hatchery at the Palau Mariculture Demonstration Center was supported by the Japan International Cooperation Agency with equipment and the planned provision of an expert. According to the Marine Resources 1992 Annual Report, the activity was discontinued due to the unavailability of the expert and other problems.
- According to Palau's representative at an SPC trochus workshop in 1996 (Theofanes Isamu, Acting Chief, Division of Marine Resources, some reseedling of trochus on Palau's reefs occurred during the mid-1990s. He stated that there were no data available but the results looked promising.
- No aquaculture of trochus currently takes place, although it is planned to be undertaken by the government's Mariculture Demonstration Center at some point. According to the Bureau of Marine Resources, the purpose of such an activity would be for reseedling of the reefs, primarily for food security and perhaps harvest for export at some later date.

Success of any trochus transplantation projects

- During the period of Japanese administration, Palau was the source of numerous trochus transplants to other Micronesian islands during the Japanese administration.

Year	Destination	Number of shells
Prior to 1927	Truk (Chuuk)	unknown
1927–1931	Truk (Chuuk)	6,724
1930	Ngulu, Ngatik (Sapuwafik), Mokil, Puluwat, Sorol, Woleai, Ifalik, Kapingamarangi, Nukuoro	Unknown (included shells from Yap)
1937	Puluwat	unknown
1938	Saipan	2,974
1939	Pohnpei	6745
1939	Satawal	5,000
1939	Jaluit, Majuro, Ailinglaplap	unknown

- It is believed that transplants from Palau were unsuccessful in Kapingamarangi, Nukuoro, and Satawal
- Palau has not been known to have been the source of trochus for transplanting elsewhere after those shown above.

Management of trochus fisheries

- The Bureau of Marine Resources (BMR) is responsible for managing trochus. During open seasons, BMR is assisted by the Department of Fish and Wildlife, which provides enforcement.
- OEK (national legislature) opens the season by resolution, subject to further restrictions by state governments. The decision as to whether to open a season for harvesting is based on findings from stock assessment surveys conducted by BMR and other partner agencies. Certain areas can be declared closed by either the national or state governments during open seasons.
- During open season, only trochus greater than 3 inches in diameter at the base can be harvested. The criminal penalty for harvesting undersize trochus is USD 100 per trochus, taken or purchased.
- During the designated open season, there is no maximum amount that may be harvested.
- BMR deploys staff to monitor delivery sites where trochus are sold to licensed local buyers who must be Palauan citizens. Local buyers have connections with overseas buyers.
- In 2016, the Palauan government requested assistance of the Palau International Coral Reef Center (PICRC) to design a stock assessment survey, analyse data, and report on the main findings. The last prior assessment was done in 2002. BMR participated in both surveys. The 2016 assessment showed a significant reduction in both the trochus population and density of the population above the legal size limit. On the basis of the findings presented in the 2016 report, BMR recommended that no harvesting be conducted.
- BMR is in the process of conducting a resource survey in 2019 using the same methodology employed in 2016. As of early November, the team had covered all but 7 of the 100 sample sites used in the survey.

Major trochus fishery issues in the country

- According to BMR, when there is a harvest, the biggest issue is the low price paid to harvesters. This price has not changed for many years. Around USD 2.20/kg was paid to harvesters in the past.
- BMR points to two particularly destructive super-typhoons – Bopha in December 2012 and Haiyan in November 2013 – that caused significant damage to Palau's reefs and may have contributed to the low trochus numbers seen in the 2016 survey.

Other relevant observations

- The partnership with PICRC to survey trochus resources (2016) was beneficial to BMR and has been helpful in eliminating political considerations from the management of trochus by focusing solely on the status of stocks. The current 2019 survey is nearly complete and includes some assistance from PICRC
- BMR recognises the importance of providing extra income to Palauans through the harvesting of trochus. However, comparing the current economy and opportunities for personal income compared with the past, it is felt that trochus harvesting has a very limited ability to significantly increase incomes. BMR's Director believes that the social and financial benefits of conducting an occasional trochus harvest are worth the management efforts expended, but the prime focus on management of the resource should be for food security and ensuring biodiversity.
- The lack of a reef tenure system in Palau other than government ownership and the fact that almost all outboard-powered boats are high speed, contribute to accessibility and availability of nearly all reefs in Palau, from Kayengel in the north to Peleliu in the south. In fact, the 1992 Annual Report of the Marine Resources Division makes the point that the catch rate of trochus has quadrupled since the 1930s, with a fisher in 1992 being able to potentially collect as much trochus in one week as he could collect in one month in the mid-1930s.

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Information on trochus in Papua New Guinea

History of the trochus trade

- Trochus has been commercially harvested in Papua New Guinea (PNG) since the late 1800s.
- After WWII, the colonial administration took a stronger stance to develop a local cash economy, ready for eventual independence through a cooperative movement focused on the production of copra and the harvesting of trochus. Price fluctuations for both copra and trochus in the global economy, however, wreaked havoc with the cooperatives, causing extreme duress to their members. By Independence in 1975, a large majority of cooperatives in PNG had failed.
- Since independence, the trochus fishery and trade has operated in close association with international market demands.
- PNG's trochus harvest is associated with the harvesting of sea cucumbers. In April 2009, the National Fisheries Authority (NFA) imposed a moratorium on the sea cucumber fishery and beche-de-mer trade. This moratorium was lifted in April 2017. During the moratorium, there was a greater dependence by fishers on harvesting trochus and fishing for shark fin (Vieira et al. 2017).
- MSB (PNG) Limited previously processed trochus buttons but stopped in 2014 although it still continues to buy trochus shells for export. They began operations in 2004.

Volume of the annual trochus harvests during the previous decade

- In the period 1985–1994, Gillett (1997) indicated that the average annual trochus harvest in PNG was 368 t per year.
- As trochus is a marine commodity for export, harvesting rates should equate to export figures (see below) although some undersize, oversize and worm-damaged trochus are consumed by fishers in coastal and island areas of the country.

Available information on prices paid to harvesters

- Gillett (1997) reported that the buying price 1995 averaged around PGK 4.50/kg (USD/kg).
- In the late 1990s, the buying price for trochus shell averaged around PGK 4.00/kg (USD/kg).
- In late 2019, the buying price for trochus shell was PGK 6.00/kg (USD 1.70/kg).
- The change in price is reflective of the devaluation of the PGK in the late 1990s and the general fluctuations in trochus market prices.
- Trochus buyers pay less for low-quality shell (i.e. very large or worm-damaged).

Domestic trochus processing

- Gillett (1997) reported that 138 t of trochus was processed for buttons in 1993, representing 35% of the total harvest for that year.
- There is limited production of trochus into jewellery and handicrafts by artisans in coastal and island areas close to markets in PNG (Simard et al. 2018).

Trochus exports

- In the period 1950–1959, trochus exports averaged 594 t/yr with a peak of 1030 t exported in 1951 (Glucksman and Lindholm 1982).
- In the period 1960–1969, trochus exports averaged 343 t/yr, with a peak of 850 t exported in 1968 (Glucksman and Lindholm 1982).
- In the period 1970–1976, trochus exports averaged 286 t/yr (Glucksman and Lindholm 1982).
- In 1980, 400 t of trochus were exported from PNG (Chapau 1993).
- From 2008 to 2018, on average seven companies were involved in the export of trochus.
- In 2018, five companies were exporting trochus: Asiapac Limited and Kiwali Exports in Milne Bay Province, Emirau Marine Products Limited in New Ireland Province, MSB (PNG) Limited in East New Britain, and Seeadler Sea Products in Manus Province.
- Exports of trochus shell between 2008 and 2018 averaged 304 t/yr, with a peak of 630 t exported in 2008. Of note, 2008 was the year before NFA implemented the moratorium on the sea cucumber fishery and beche-de-mer trade in April 2009. Subsequently, more trochus was harvested in this period as fishers raced to fish for sea cucumbers.
- The average USD price for exported trochus shell declared by exporters to NFA between 2008 and 2018 was USD 4.35/kg, with a peak export price of USD 5.10/kg in 2009.
- Exporting companies employ several staff to purchase, clean, grade and pack trochus, depending on demand.
- The main export destinations for trochus shell from PNG between 2008 and 2018 in order of importance are Viet Nam, Japan, Hong Kong (Special Administrative Region), China, Italy, New Zealand, Singapore and South Korea.
- Exports of trochus buttons between 2008 and 2013 averaged 14 t/yr, with a peak of 41 t in 2012.
- The average USD price for exported trochus buttons between 2008 and 2013 was USD 26.05/kg.
- The main export destination for trochus buttons from PNG was Japan.
- While there is relatively reliable national export data available from NFA, there are some discrepancies for the years 2008–2013 and 2016, due to some shells being listed as “unspecified”. There were also issues with incorrect volumes and values due to poor data entry (i.e. decimal points in the wrong place). Subsequently, the figures for these years should be regarded as tentative only. Figures from 2014, 2015, 2017 and 2018 appear to be better as trochus is clearly demarcated in export figures for all shells exported (e.g. black lip pearl shell, *Pinctada margaritifera*, and to a lesser extent, green snail, *Turbo marmoratus*) in those years and have appropriate values assigned.

Aquaculture of trochus

- There were previous plans to trial trochus aquaculture at NFA's Nago Island Mariculture and Research Facility in the early 2010s. Despite there being a technician on site at the facility in 2011 and 2012 who had experience operating a trochus hatchery in the Northern Territory of Australia, no trials were conducted as it was not a priority activity of the Australian Centre for International Agriculture Research under their mariculture projects that were being conducted at the facility.

Trochus transplantations

- There have been no introductions to or transplantations within PNG because trochus occurs naturally the reefs.

Management of trochus fisheries

- Historically, the trochus fishery and trade was regulated by the 1891–1934 Pearl-Shell and Beche-de-mer Fisheries Ordinances of the Territory of Papua's Government (Government of Territory of Papua 1910, 1934) and the Australian government (Government of Australia 1953, 1970). These ordinances regulated areas of harvest, and how trade was to be conducted. The minimum measurement for trochus during this period that could be taken, removed, sold or exposed for sale or export, or which any shell dealer may purchase was 2.5 in (63.5 mm) exteriorly across the base of the shell.
- The 2002 Notice of Prohibition of Taking Sedentary Resources (Government of Papua New Guinea, 2002) prohibits the taking of trochus by using scuba or hookah gear as well as collecting trochus at night using underwater lights. This notice sets a minimum size for trochus that can be harvested at 80 mm (3.1 in) and a maximum size limit of 120 mm (4.7 in) exteriorly across the base of the shell.
- Compliance with the size limits is generally respected as trochus is a major export commodity for PNG.
- Companies purchasing and exporting trochus must be licensed by NFA.
- Trochus stocks in PNG have never been properly assessed, and there is no formal stock assessment survey programme done by NFA for trochus specifically, although stock assessments are conducted for sea cucumber stocks.
- In 2001, Skewes et al. (2003) conducted a stock assessment across the whole of Milne Bay Province for sea cucumbers, but other commercial marine sedentary species were also surveyed, including trochus. Results from this study showed that for Milne Bay Province, the estimated stock size was 74.0 t, with an estimated 0.77 trochus/ha. This estimated stock size for Milne Bay Province is regarded as being grossly underestimated. Estimating trochus abundance requires targeted sampling of their preferred habitat, which includes wave-impacted reef crests. Also, juvenile trochus are very difficult to sample as they are not only small, but also cryptic.
- In 2009, Hamilton et al. (2009) noted for the Northern Bismarck Sea of Papua New Guinea that there was evidence of overharvesting of trochus across this area, but the authors did not provide figures to substantiate this claim.

Major trochus fishery issues in the country

- The main issues with trochus are the international market demand and the subsequent low prices paid to both fishers and exporters. Trochus harvesting is also influenced by the sea cucumber fishery and beche-de-mer trade.

Other relevant observations

- There is little evidence that the removal of trochus from reef ecosystems has had any impact on the benthic or pelagic communities of the reef areas that the trochus fishery operates in. There may be some damage to the reef benthos when trochus are collected by fishers walking across reefs but their level of contact and impact is negligible. The impact of vessel damage or discharge on reef ecosystem is also considered to be low. It is unlikely that trochus has been poached by foreign fishing boats (e.g. Vietnamese blue boats) in PNG as they are of low value compared with high-valued target species such as teatfish sea cucumbers (*Holothuria whitmaei* and *H. fuscogilva*) and sharks for their fins.
- If NFA were to conduct stock assessments for trochus, these would need to be very site-specific as commercial-sized trochus (80–120 mm) inhabit narrow zones of coral rubble and pavement on the windward edges of reefs up to depths of 24 m.

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Information on trochus in Solomon Islands

History of the trochus trade

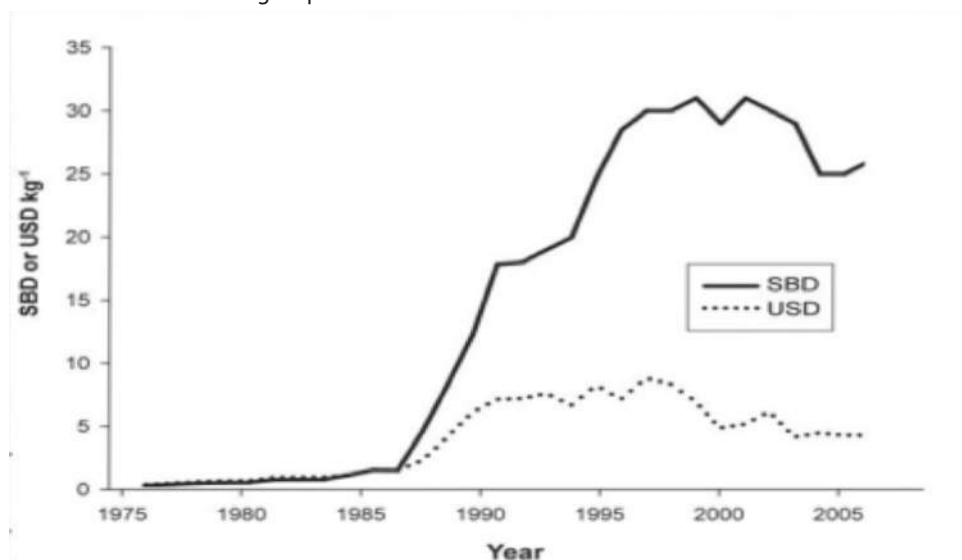
- Trochus harvesting in Solomon Islands expanded greatly after WWII. In the 1950s, trochus was one of the country's leading exports.
- In 1954, 717 t of trochus were exported, representing the highest annual production ever recorded from Solomon Islands (Lasi 2010).
- The first trochus processing plant was established in 1989 (Skewes 1990); in 1994, there were four trochus processing plants (Gillett 1995).
- In June 2019, the last trochus processing plant closed, but exports of raw trochus continued. According the licencing officer of the Ministry of Fisheries and Marine Fisheries (MFMR), in 2019 five companies had licences to export raw trochus.

Volume of the annual trochus harvests during the previous decade

- Using various sources, Gillett (1995) indicated that in the period 1985–1994 trochus harvests in the country averaged 412 t/yr.
- Between 2001 and 2006, national annual trochus catches averaged 108 t and were taken mainly from Choiseul, Western, Isabel and Malaita provinces, in descending order. (Lasi 2010)
- Export data (see section below) show that in 2018, 133.5 t of raw trochus and 2.9 t of button blanks were exported. Converting the button blank weight to raw trochus weight, the export data indicate that the annual trochus harvest in 2018 was about 157 t, and the average annual harvest in the period 2015–2018 was about 125 t.

Available information on prices paid to harvesters

- Lasi (2010) provides the buying prices for trochus in Solomon Islands. Although unstated, this is presumed to be the Honiara warehouse gate price.



- MFMR staff indicate that in the last three years, the price has been SBD 15–20.
- During the present survey, enquiries were made to three Honiara trochus buyers. The administration officer of the recently closed button factory indicated the buying price last June was SBD 20/kg. Chen Zhen Company stated a current buying price of SBD 15/kg. Kou Foo of Haiway Company stated a buying price of SBD 8/kg (down from SBD 15 a few months ago), saying sellers are advised to not harvest trochus until the world market price increases.

14 Staff of MFMR and a trochus buyer both report that this company has been saying for many months that it will “open soon”.

Domestic trochus processing

- A feasibility study for the establishment of a trochus processing plant was conducted in 1988 (Leqata 1997). It concluded that the establishment of such an industry would be both feasible and profitable for Solomon Islands. The first factory was established in 1989 and was expected to utilise 150 t/year when fully operational, and a second, with potential to process 400 t/yr, was commissioned in Honiara in 1990. (Skewes 1990)
- The World Bank trochus study states that in 1994 there were four trochus processing plants in Honiara: SOLSSA Fisheries Company, Kum Button Blanks Ltd., Homsil Company Ltd, and Linsen Company (Gillett 1995).
- In late 2019, there were no trochus processing plants operating. The last one – Solomon Shell Company Ltd – stopped operations in June 2019 after making a shipment of blanks and scraps.
- According to the former administration officer of Solomon Shell (D. Bosoboe), the factory is owned by a Hong Kong company, and is only temporarily closed while awaiting new management from Hong Kong 14. The company has 20 blanking machines and 7 finished button machines, which were purchased from a Honiara-based Korean-owned company, RoK & SI Ltd, when they stopped processing trochus. The major constraint to the profitability of Solomon Shell Company was the high cost of electricity. All of its blanks were sent to Viet Nam for further processing.

Trochus exports

- The trochus harvest information in a section above presumably came from export data, and was adjusted for any trochus processing.
- There are two sources of data on the recent annual exports of trochus: MFMR and the National Statistics Office (NSO). The tables below compare the two sources of data.

MFMR data	Volume and value	2014	2015	2016	2017	2018
Raw trochus	Volume (kg)	114,215	141,185	134,810	69,233	133,500
	Value SBD	2,094,520	1,009,298	1,239,290	461,631	949,500
Button blanks	Volume (kg)	18,000				2,948
	Value SBD	4,057,263				792,048
Trochus scraps	Volume (kg)	86,760	41,000			
	Value SBD	355,961	287,000			

Source: MFMR unpublished data; values are declared FOB values; blank cells indicate no exports occurred

NSO data	Value	2014	2015	2016	2017	2018
Raw trochus	Value SBD				598,567	981,849
Button blanks	Value SBD					1,009,223

Source: NSO unpublished data; values are declared FOB values; blank cells indicate no data were supplied

- There appears to be anomalies in the above tables.
 - o In the MFMR data, the annual declared FOB value of raw trochus divided by the weight is as low as SBD 6.67/kg, about a third of the buying price of trochus in that year.
 - o In the MFMR data, the declared FOB value of raw trochus should be the same as the NSO data, but it is 23% less for 2017 and 3% less for 2018.
 - o In the MFMR data, the declared FOB value of button blanks should be the same as the NSO data, but it is 22% less for 2018.
 - o The MFMR values for both raw trochus and blanks are less than the NSO values. The NSO values are those that are reported by exporters to the Customs and Excise Division. Because that division places export taxes on both raw trochus and blanks, there is an incentive for NSO values to be lower than MFMR values – but in the above tables, the opposite occurs.
- According to NSO data, Viet Nam is the main destination for exported raw trochus. In 2017, some trochus was also sent to China, and in 2018 some was also sent to Indonesia.
- There are export taxes on trochus. The government places export taxes on both raw trochus and blanks of 30% and 10%, respectively. Trochus scraps have no export tax.
- MFMR staff indicate there were five licensed trochus exporters in 2019: RK Marine, Chen Zhen, Oceanic International, Island Retail Products, and Dodo Trading. Another company, Haiway, appears to be buying trochus, albeit at a very low price.

Aquaculture of trochus

- There has been little, if any, culture of trochus in Solomon Islands.
- A few decades ago, two MFMR staff were sent to Japan to learn trochus culture techniques, but they did not get involved with trochus culture after their return to Solomon Islands.

Success of trochus transplantation

- There have been no trochus transplants to or from Solomon Islands.

Management of trochus fisheries

- A Forum Fisheries Agency report from three decades ago stated: Although stocks of trochus in Solomon Islands are virtually unstudied, a decrease in catches since 1991 suggests that the resource may be fully or over-exploited.”(Skewes 1990).
- According to Lasi (2010), from the late 1990s to the early part of 2000, trends in average annual production suggest serial depletion. This refers to the process when fishers exploit the closest productive reefs and then move on to other reefs when resources from nearby reefs become depleted. In so doing, national production remains fairly constant for a protracted period of time. It then, however, declines rapidly once all available reefs have been heavily fished.
- Surveys by SPC in 2006 were carried out at four locations in Solomon Islands. The report of the work (Pinca et al. 2009) states: a) Nggela has a relatively extensive and good habitat for adult trochus although suitable habitat for juvenile trochus, was less extensive. No high-density aggregations of trochus were identified; b) Marau has an extensive and good habitat for juvenile and adult trochus, although no aggregations were identified outside the barrier reef. The current population has very few large, old shells; c) At Rarumana, the outlook for the fishery is poor as density was very low and there were no high-density spawning aggregations; and d) At Chubikopi, trochus density was low, and no high-density spawning aggregations were identified.
- MFMR carried out surveys for trochus and giant clams in late 2018 to mid-2019 at one or two sites in each of the six provinces. The results generally indicate that trochus abundance is decreasing.
- There is currently no management plan for trochus, but there is the intention to use the above MFMR survey results for the formulation of a plan, which may be ready in the first quarter of 2020.
- The main management measures for trochus are contained in the Fisheries Management (Prohibited Activities) (Amendment) Regulations 2018. One of the prohibited activities in those regulations is to: fish for and retain, be in possession of, sell or buy any trochus under 8 cm or over 12 cm in diameter as measured across the base of the shell.
- Another measure applicable to the trochus fishery is contained in the Fisheries Management Act 2015, which states that no person shall engage in the export or import of fish, live fish or fish products without a valid licence.
- Lasi (2010) provides a recommendation for the management of the trochus fishery, stating that it is apparent from the sharp fall in production since the mid-1990s that size limits alone are insufficient for controlling overfishing. Instead, as evidenced from successfully managed trochus fisheries in Cook Islands and Palau, tightly controlled open and closed seasons are required.
- In some areas of the country, there are local rules controlling the harvesting of trochus. As an example, Ontong Java has placed bans on the taking of trochus in alternate years.
- In terms of training and capacity building for MFMR staff applicable to the management of the trochus fishery, the most recent activity was the mid-2019 New Zealand-funded course on inshore fishery compliance in which 15 people participated.

Major trochus fishery issues in the country

- According to MFMR staff, a hot issue is the situation created by trochus buying companies that do not respecting the size limits, and the ministry not being set up to carry out regular inspections.
- The low compliance with the trochus size regulation means there is virtually no management of the trochus fishery in the country. There is an urgent need to manage the trochus fishery but the political will to do so does not seem to exist.

Other relevant observations

- At SBD 20/kg, the real buying price of trochus today is only 40% of what it was 25 years ago. If recent MFMR trochus export data are correct, recent annual harvests of trochus are about 38% of what they were 25 years ago. These two types of reductions result in the real earnings by fishers from the trochus fishery being only about 15% of what they were 25 years ago.
- During the past decade, the beche-de-mer management scheme seems to have exhausted the political will for a trochus stock recovery through the relatively easy-to-enforce tool of an export ban.

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Information on trochus in Vanuatu

History of the trochus trade

- Trochus shell and sea cucumber were among the first commodities traded in Vanuatu along with sandalwood. Commercial harvesting of trochus for its shell is likely to have begun in the early 1900s during the rise in beche-de-mer trading in the Asia-Pacific region.
- Production figures for these early years are not available, except for a total of 60 t in 1921. Export data indicate high production in the 1970s followed by low production in the early 1980s; another boom production period occurred in the early 1990s followed by a gradual decline.
- Local shell prices have been stagnant over the last 20 years at around VUV 200–350/kg of shell (excluding meat).
- In 1979, the first trochus processing plant began operations. In total, nine such plants were established over the next four decades (Gillett 1995). In 2015, the last plant closed.

Volume of the annual trochus harvests during the previous decade

- In the World Bank trochus study (Gillett 1996), it is stated that during the 11-year period 1985–1994, the average annual trochus harvest in Vanuatu was 112 t.
- Because no trochus processing has occurred in Honiara since Cyclone Pam in March 2015, the amount of trochus exports largely equates to the annual trochus harvest, bearing in mind that trochus harvested one year could be stockpiled for export the following year.
- Pakoa et al. (2009) indicate that during the 12-year period 1995–2006, the average annual trochus harvest in Vanuatu was 93.3 t.

Available information on prices paid to harvesters

- In October 2019, the Port Vila warehouse gate buying price for trochus offered by the single buyer in the country (Hong Shell products) was VUV 170/kg. The buyer has agents in other parts of Vanuatu (Makekula, Epi, Banks) where VUV 150/kg is paid (W. Alie, pers. comm.)
- In the World Bank trochus study (Gillett 1996), it is stated that in mid-1994 the Port Vila factory gate buying price for trochus was VUV 300/kg. At that time there were three trochus processing operations in Port Vila, plus other buyers exporting raw trochus.
- In the past, when there were several buyers in the country, buyers would compete to buy shells, and prices varied only slightly between buyers (Pakoa et al. 2009).

15 There is some speculation that “550” is a typographical error, and that the intention was for a quota of “55” t.

Domestic trochus processing

- There is currently no trochus processing in Vanuatu. The last factory ceased operation after its building was damaged during Cyclone Pam in March 2015. The company that operated the factory is called Hong Shell Products Company (Vanuatu) Limited. It is currently the sole exporter of raw trochus, with 12 blanking machines, and has the intention of moving to a better building and re-starting the processing of trochus. It is at least partially owned by the TNS Button Company of Kong Kong (W. Alie, pers. comm.)
- The World Bank trochus study (Gillett 1996) indicated that in 1994, three trochus factories were operating, with six others not operating. In that year, 72.5 t of raw trochus (68% of the trochus harvest that year) was processed into button blanks.
- Amos (2007) states that in the late 1980s to mid-1990s, six processing factories were established in Port Vila and Santo to utilise local raw materials. Overcapacity due to limited resources resulted in the closing down of most of these factories that by 1999 only one processor was active in the country. The only operating factory, Hong Shell Product Ltd., imported raw trochus shells from Australia in 1999, which raised annual exports for that year to 498 t. Raw shell importation from Australia was discontinued due to poor shell quality as compared with local shells (Pakoa et al. 2009).
- At the 1991 South Pacific Commission Trochus Workshop, a presentation was made by the manager of a Vanuatu button factory who stated that Korean button blank workers produced 20,000 blanks per day while in Vanuatu a good operator produces between 6000 and 12,000 blanks per day.
- The marketing of trochus shell (buying and export) is currently protected for the local shell processing factories in the name of value adding. A review report of the shell industry in Vanuatu by the Fisheries Department in the 1990s, highlighted the impact of this protection policy, which, unfortunately provided for a much lower economic return of raw shell. Fishermen have been prevented from receiving fair and competitive prices for their shell. The existing ban on the export of raw shell, which restricts the buying of shells only to local processing factories, is proving to be disadvantageous to resource owners on Epi Island. The policy prevents competition in pricing, which prevents resource owners from getting the best price for their shells. (Pakoa et al. 2009)

Trochus exports

- The export of trochus button blanks ceased in early 2015 after Cyclone Pam.
- Data on exports of raw trochus are not readily available from Vanuatu Fisheries Department databases. Hardcopies of permits for the export of trochus, and anecdotal information from the single trochus exporter, allows an estimation of recent trochus exports in t:

2015	2016	2017	2018	2019 YTD
32	0	15.7	0	32

- Export data provided by the Vanuatu National Statistics Office gives recent exports of trochus in millions of vatu:

2015	2016	2017	2018	2019 YTD
27	21	5	0	5

- Historical trochus export data are given in several reports, but in some cases it is not clear whether the tonnage given is for raw shell, or blanks, or some combination of the two. The Vanuatu Fishery Resource Profiles lays out the situation unambiguously.

Processing and export figures for two trochus shell processing factories (1996–2003)

Year	Raw shells processed (t)	Button blanks (t)	Trochus scraps (t)	Raw shells exported (t)	Total value
1996	263.17	26.32	57.90	No exports	USD994,970.00
1997	306.39	30.64	34.10	11.64	USD847,841.00
1998	476.43	47.64	9.420	No exports	USD700,638.47
1999	279.00	27.90	No exports	No exports	USD697,000.00
2000	286.90	28.69	42.50	No exports	USD222,895.00
2001	305.97	30.60	56.416	No exports	USD806,900.00
2002	114.00	11.40	42.35	No exports	USD260,109.00
2003	157.60	15.76	-	No exports	USD493,200.30

- Export permits examined during the present survey show that raw trochus has been sent in recent years to Hong Kong (TNS Button Company), Japan and Viet Nam.
- According to Vanuatu Fisheries Department (VFD) staff, since the trochus processing factory closed in early 2015, there are no restrictions on the export of raw trochus.
- Under Fisheries Regulations Order No. 28 of 2009, a permit from VFD is required to export trochus.

Aquaculture of trochus

- Trochus have been produced at the VFD hatchery since the early 1980s to assess the potential of reseeded Vanuatu's reefs to enhance the fishery. The Australian Centre for International Agricultural Research has funded extensive research focusing on various aspects of trochus biology and aquaculture, including nutrition, seed production and community participation in stock management. Annual production from the hatchery is around 20,000 seeds, most of which are supplied to communities for restocking purposes. One of the major challenges faced in producing trochus in Vanuatu has been the deteriorating water quality of Port Vila Harbour where the trochus hatchery is located. (Teitelbaum and Rena 2008).
- In 2019, the old Fisheries Department buildings (including the tanks where trochus were formerly cultured) were demolished to make way for wharf construction.

Success of trochus transplantation

- In the late 1950s, trochus were transplanted from Vanuatu to Tahiti. The transplant was very successful. In the French Polynesia section of this report it is stated that 4138 t of trochus have been harvested since trochus collecting began in the territory in 1971.
- Trochus has been moved several times within Vanuatu (Pakoa et al. 2009), but that is more properly considered a trochus reseeded operation, rather than a movement of trochus to somewhere it did not previously exist.

Management of trochus fisheries

- Historically, there has been a considerable amount of trochus assessment in Vanuatu. The Vanuatu Fishery Resource Profiles indicate that the first trochus stock survey in Vanuatu was done by L.C. Devambe in 1959, and resulted in a four-year closure of trochus fishing. A second stock survey was conducted by the same researcher in 1961. This survey concluded that trochus stocks had increased. The results of this survey persuaded the government to re-open the fishery in 1962. Further stock surveys were carried out in 1990, 1991 and 1992. These surveys indicated that stocks were rapidly declining, and thus tighter management controls needed to be implemented to ensure the sustainability of the resource.
- The report of trochus research carried out in Vanuatu in 2008 (Pakoa et al. 2009) stated that occasional trochus assessments provided some information about the resource status but there were few follow-up surveys to determine trends. It was concluded that export figures remain the best available indicator for the status of the resource.
- In the period 2011–2013 two researchers from IRD (the French Research Institute for Development) were attached to the Fisheries Department. During that period, IRD carried out some trochus assessments.
- Pakoa et al. (2009) described the principle mode of fisheries management practiced by communities – the taboo system – which is based on customary marine tenure. This system was strengthened in the post-independence years through policies to empower local governments and communities. As a result, taboos were resurrected in many areas where the system had faded. Community-based management of marine resources became central to controlling the time and length of open seasons, harvest quantities and enforcement of minimum harvest sizes. VFD, on the other hand, directly controls the export of fishery products by issuing an exporting permit.
- In 2013, a draft Vanuatu National Trochus Fishery Management Plan 2013–2016 was prepared. It is a 17-page document that specifies many management measures. Some of the most important measures are: 1) a limited duration open season to be implemented at the national and provincial levels; 2) licences and permits covering the collection, purchase, sale, processing and exports of trochus products and as a means of recovering government costs; 3) a national annual total allowable catch, and areas closed to fishing; and 4) minimum and maximum trochus sizes. The management plan was not adopted, possibly because the management of other fisheries (e.g. coconut crab, sea cucumber) had a higher priority.
- Currently, national-level measures used to manage the trochus fishery are given in Fisheries Regulations 28 of 2009:
 - o A person must not take, harm, have in his or her possession, sell or purchase a trochus shell (*Trochus niloticus*) that is less than 9 centimeters or more than 13 centimeters in length.
 - o A person must not export trochus except with an export permit issued by the Director.
 - o The maximum quantity of trochus that can be harvested within Vanuatu in a year is 550 t 15.
- Senior VFD staff have expressed the opinion that compliance with size limits was better when processing plants were operating and that trochus size limits are currently not doing enough to effectively manage the fishery.
- In terms of capacity building for VFD staff for managing the trochus fishery, one person was attached to SPC for a year and gained considerable experience in coastal fisheries management. The IRD researchers mentioned above were involved in demonstrating assessments in support of trochus management.

Major trochus fishery issues in the country

- The current buying price for trochus is very low (much less than 25 years ago) and this may be, at least partially, due to having only one trochus buyer in the country – a situation likely to exacerbate low prices.
- Trochus processing produces employment benefits, but the need to restrict raw trochus exports to enable sufficient supplies for processing, results in lower prices to fishers. Balancing these two considerations is inherently political.

Other relevant observations

- A study was carried out to estimate the value added (i.e. contribution to gross domestic product) by certain fishery subsectors in Vanuatu. In 2013, the value added by the trochus fishery was USD 100,000, the aquarium trade USD 150,000, beche-de-mer USD 50,000, and game fishing USD1,600,000 (MacBio 2015).

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Information on trochus in other Pacific Island countries

The countries listed in this section are those that are known to have exported commercial quantities of trochus in the past, but that presently have limited involvement in the trade.

Guam

- Trochus was introduced to Guam in the 1950s, probably by fishers from Saipan.
- The commercial export of trochus has been banned on Guam for at least 20 years. A permit has been recently issued (October 2019) to a store that buys trochus from local fishermen. Because shells cannot be exported, it is believed they might be used to sell the meat and the shells cleaned and used for use in local handicraft or sold to tourists as curios.
- An estimate of the current harvest for personal consumption is around 100 kg/yr. Trochus are taken opportunistically for personal use by fishers during other fishing activities such as spearfishing.
- Anecdotal reports indicate that trochus is being purchased from local divers by the only permitted buyer for around USD 3/lb.
- In terms of fisheries management: a) the total harvest limit is 50,000 pieces per fiscal year (October to September); b) the minimum size that can be taken is 3 inches basal width for personal consumption, and 4 inches for commercial use; and c) all individuals who harvest trochus for commercial purposes are required to obtain a licence.

Northern Mariana Islands

- Trochus was likely introduced In 1938 when the Japanese administration transplanted 2974 trochus from Palau to Saipan.
- Trochus was commercially harvested at Saipan at least once in the 1950s, and harvesting probably occurred regularly throughout the 1960s and early 1970s, although no separate records are available for the Northern Marianas out of the total Trust Territory harvest.
- No trochus may be taken except during an open season as declared by the Secretary of the Department of Lands and Natural Resources, after consultation with the Director of the Division of Fish and Wildlife.
- There are two closed areas on a reef in Saipan where the taking trochus at any time is prohibited.
- A 1994 survey found trochus on Rota and Tinian islands, although not in commercial quantities.

Tonga

- In total, 1914 shells were transported from Fiji to Tonga in three shipments (1992, 1994 and 1995) and were placed on reefs in Vava'u, Ha'apai and Tongatapu, respectively.
- A Tongan and their Chinese partner were issued a one-year permit to export trochus in October 2015, and another one-year permit was issued in October 2016. Apparently, the justification for allowing the export of trochus was that trochus was being harvested for food and the shells were being discarded.
- It is not clear how much trochus was exported, but fisheries officers stated that it was probably a few containers' worth (i.e. ~ 38 t).

Wallis and Futuna

- In the global distribution of trochus, Wallis Island represents the farthest east where the species naturally occurs.
- There was a trochus harvest in mid-2019 in which 25 t were landed. The previous harvest was about 10 years ago.
- Earlier than 2019, there was no ban on the commercial harvesting of trochus but the low price cause a lack of interest.
- In 2019, fishers were paid XPF 150/kg (USD 1.41/kg) for trochus. A trochus wholesaler from New Zealand arranged the sale, and the shells were originally meant to be sent to Mauritius for processing, but the destination was changed to Viet Nam.

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