

SOUTH PACIFIC COMMISSION

A REPORT ON THE POTENTIAL FOR THE INTRODUCTION
OF TROCHUS (TROCHUS NILOTICUS)
TO TUVALU

Report prepared for the South Pacific Commission
and the Government of Tuvalu

by

Brian J. Parkinson
Conchologist

South Pacific Commission
Noumea, New Caledonia
August 1984



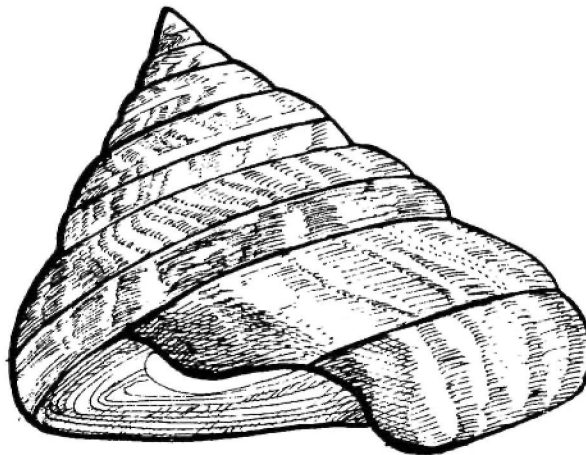
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1. INTRODUCTION

During a six-week mission to Tuvalu to assess the specimen shell resources of Tuvalu and advise the Tuvalu Government on how they might best be utilised, SPC consultant Mr Parkinson was asked by officers of the Fisheries Division to further advise on the possibility of introducing the commercial trochid, Trochus niloticus, into Tuvalu.

2. APPRAISAL

2.1 History of trochus introductions in the Pacific region

In the 1920s and 30s, the Japanese Colonial Administration introduced trochus into a number of islands of Micronesia in the North Pacific Ocean, and as a consequence of these introductions, trochus are now well established on the islands of Truk, Ponape and Ulithi in the Federated States of Micronesia, as well as on Saipan and other islands in the Northern Mariana Islands.

Since the 1950s, trochus have been successfully introduced into both the Cook Islands and French Polynesia. Although no figures are available for the Cook Islands, those introductions made into French Polynesia have been very impressive. A report in the South Pacific Islands Fisheries Newsletter of November 1973 says that in the period between November 1971 and June 1973, over 350 metric tons of trochus were harvested with a market value of about 5,000,000 CFP francs, equivalent then to about US\$70,000. It points out that the sum realised was "more than ten times the funds employed since commencement for work of transplantation and transport of shells".

2.2 Inspection of possible liberation sites

Over 35 sites on the atolls of Nukufetau and Funafuti were inspected during the Specimen Shell Survey of Tuvalu¹ and in addition, when the weather was suitable, possible liberation sites on the seaward sides of the barrier reefs of Funafuti and Nukufetau were examined.

Most of these areas on Funafuti were inspected with the aid of SCUBA equipment, as this was the most practical way of covering the largest possible area. As this equipment was not available in Nukufetau, inspections were carried out by free-diving.

Although a number of trochid species were seen, no shells of the commercial species Trochus niloticus were encountered. Many of the areas inspected are suitable for the establishment of trochus colonies, being similar to areas in the Pacific and eastern Indian Oceans which support large trochus populations. Profiles of suitable and unsuitable trochus habitats are depicted in Figures 1 and 2 respectively.

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1. Parkinson, B. The Specimen Shell Resources of Tuvalu (South Pacific Commission Consultant's Report) 1985.

During the field survey, particular attention was paid to sites around Funafuti Atoll, as these would seem to be the logical choice for the initial establishment of breeding colonies.

As trochus prefer areas of maximum water movement, i.e. such areas as the surge zone on the outer edge of reefs, initial releases should be made near Stations 29, 30 and 35.² In addition, supplementary liberations could be made at Stations 24, 25 and 36, as although these areas are inside the lagoon, the strong current present and large populations of Trochus pyramis there indicate suitable habitat.

2.3 Possible sources of shell stock

The author has examined the trochid collections in museums both in New Zealand and Australia. He also spoke to Fisheries Officers in Fiji and had previously examined possible sources of breeding stock during earlier surveys carried out for both the South Pacific Commission and as a result of New Zealand aid in a number of parts of Fiji. These investigations would suggest that the best possible source of parent stock for Tuvalu would be the Lau and Yasawa groups of islands or the north coast of Vanua Levu in Fiji.

2.4 Transportation of living shells

The introductions of trochus as carried out by the Japanese in Micronesia were all done by ship. In the Truk introduction, the voyage to Truk from Palau took five days and the shells were transported in tanks of circulating sea water. A total of 8 684 shells were transported and these had a survival rate of 78 per cent. On occasion trochus have been carried dry for up to three days but the mortality rate in these cases was much higher. In any event, transportation by sea should only be considered if the shells were to originate from Fiji, as in this case the Tuvaluan Fishing Boat could easily transport trochus in its bait-tanks for the three-day voyage from Suva to Funafuti. Here, the main logistical problem would be the accumulation of trochus at some convenient spot in Fiji for onward carriage to Tuvalu.

In the initial French Polynesian introductions only 40 trochus were airfreighted to Tahiti from New Caledonia, and these have formed the basis for a very successful industry. It is believed that these shells were carried in dampened sacks.

2. Parkinson, B. The Specimen Shell Resources of Tuvalu (South Pacific Commission Consultant's Report) 1985.

FIGURE 1: PROFILE OF A TYPICAL ATOLL BARRIER REEF.
THIS IS GOOD TROCHUS HABITAT.

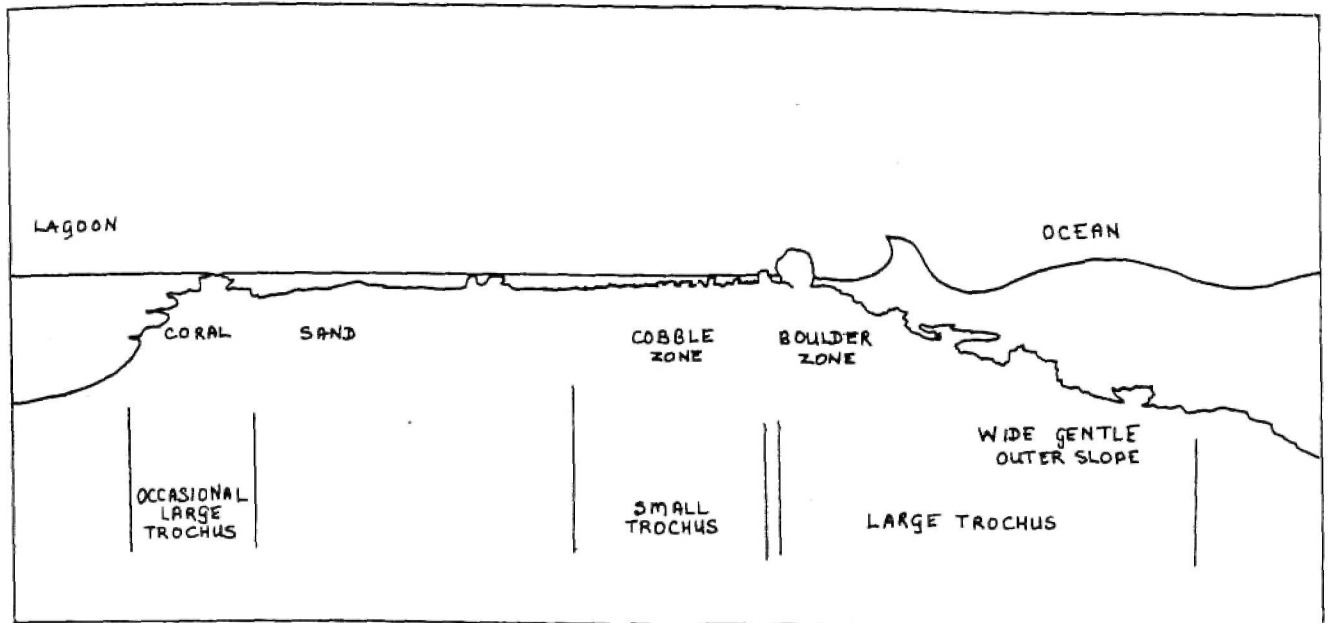
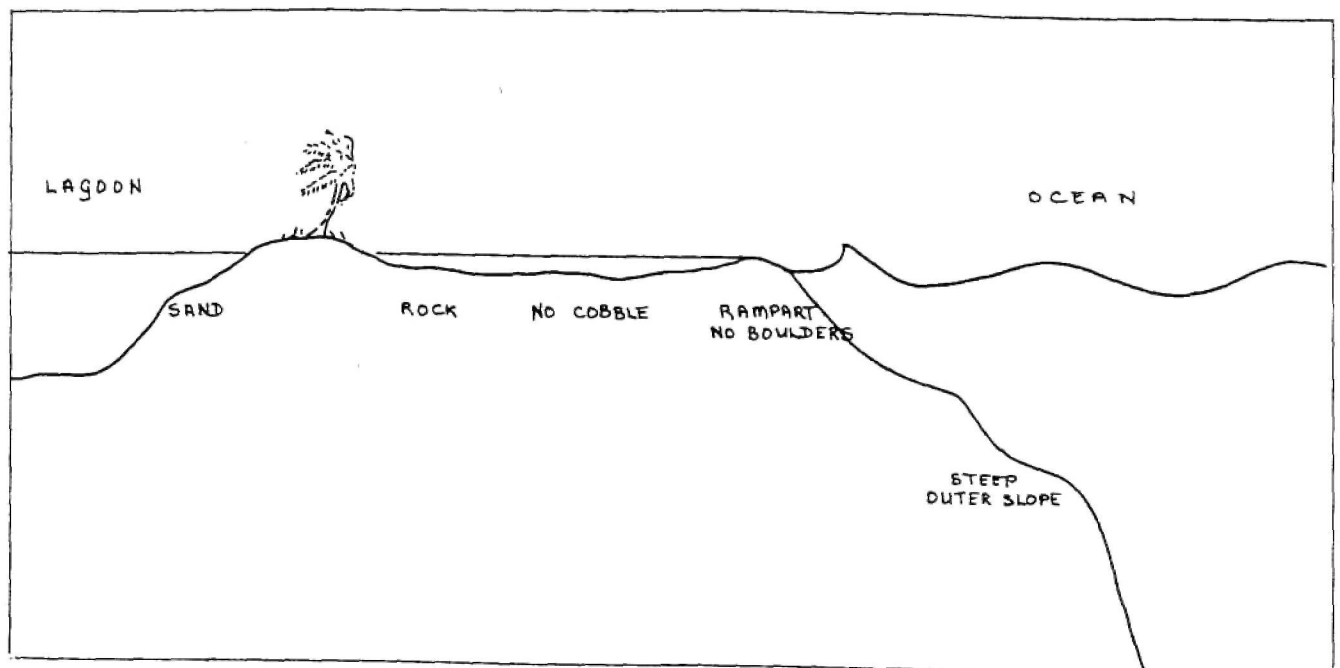


FIGURE 2: SCHEMATIC PROFILE OF BARRIER REEF, WEST FUNAFUTI ATOLL
SHOWING MASSIVE CYCLONE DAMAGE. UNSUITABLE FOR TROCHUS.



Source (Figures 1 and 2): McGowan, John A., *The trochus fishery of the Trust Territory of the Pacific Islands: A report and recommendation to the High Commissioner*, April 1958.

In the Cook Island introductions, the shells came from Fiji and were airfreighted to the Cooks using two different methods. The first consignment was carried in containers of sea water, and the second lot was transported dry in crates.

If the trochus are to be introduced from some source other than Fiji however, probably the best method would be that used by the aquarium trade for the transport of marine and freshwater fish. This consists of packing fish in a small amount of water in a strong plastic bag. The bags are then inflated with pure oxygen and packed in insulated cartons. All the materials needed for such shipments are readily available.

2.5 Notes on ecology of the trochus

When a new species is introduced into an area, there is a justifiable concern as to the effect the introduction will have on both the indigenous fauna and the environment. The following notes on the biology of Trochus niloticus suggest that this introduction will not be detrimental if carried out.

1. Where Trochus niloticus occurs naturally, and in areas where it has been introduced, it lives chiefly in the surge zone of the outer reef, at depths of between 2 and 15 metres.
2. The species is almost entirely vegetarian, feeding on algae and minute seaweeds. A complete list of trochoid food determined by stomach content analyses is given in Appendix 1.
3. Trochus appear to reach sexual maturity at about three years of age. At this stage the shell is between 6 and 8 centimetres in diameter, and the shell then continues to breed throughout its adult life. Trochus live for upwards of 13 years and adult specimens of up to 14 centimetres in diameter have been recorded. Trochus from the Andaman Islands live longer than those from the Pacific and this is attributed to more favourable living conditions.
4. The breeding season is chiefly during the warmest part of the year, but some spawning takes place throughout the year.

Under suitable conditions trochus are prolific breeders, and after an initial post-introduction period ban on collection to allow the shell to become established, it would then become a continuing source of revenue for Tuvalu.

3. DISCUSSION AND CONCLUSIONS

During this visit to Tuvalu, over 35 underwater sites on the atolls of Nukufetau and Funafuti were inspected in the course of this work on specimen shells, and many of the sites examined would appear to be very suitable for establishing breeding nuclei of trochus. In addition, a number of other areas from the Tuvalu Fisheries vessel also seem to be suitable release sites for initial liberations of introduced stocks of Trochus niloticus.

There are a number of non-commercial species of trochids such as Trochus pyramis and T. verrucosus which occur naturally in Tuvalu. In other parts of the Pacific and Indian Oceans which were visited by the author, these and other trochid species occur together with, and seemingly occupy the same ecological niche as, Trochus niloticus, and in areas where they occur naturally together, there seems to be little inter-specific competition.

In view of the above and because of the significant advantages to be gained from Trochus niloticus, it is recommended that serious consideration be given to introducing this species to Tuvalu. Trochus have now been successfully introduced into a number of countries in the Pacific region, where they now constitute both an important source of revenue, and an additional protein source in these countries.

Trochus niloticus occur naturally in both Fiji and Vanuatu, and stock from either of these countries could be used to establish the shell in Tuvalu. However, Fiji would seem to be the logical choice due to the current basing of the Tuvaluan Fishing Boat there, as this vessel could be used for transporting the breeding stock from Fiji to Tuvalu.

4. ACKNOWLEDGEMENTS

I would like to thank Mr Michael Batty of the Fisheries Division and Mr Jonathan Gaunt of the Handicrafts Division for their help in arranging the logistics of the consultancy. I would also like to thank Mr Batty, Mr Peter McQuarrie, Mr Selu Lini, and Andrew and Jeremy Huckin who acted as back-up divers during the diving inspection of the stations.

I am also grateful to Mr McQuarrie, Mr and Mrs Chris Rogers and Mr Misi Alotu for allowing me to inspect their private collections of Tuvaluan shells. Lastly, I would like to thank Dr Peter Hunt and Dr Tony Lewis of the Fijian Fisheries Division for providing information about the possible source of trochus shells for introduction to Tuvalu.

DIET OF TROCHUS NILOTICUS

From the Kagaku Nanyo (Science of South Seas) 1944 by Nagao Asano.

No large algae are found in the normal habitat of trochus, but only minute seaweeds. The trochus are generally herbivorous and the study of stomach contents of 20 specimens 560-75 mm in diameter gave the following results.

Animals	Foraminifera	present
	Porifera spicules	common
	Liolophura eggs	rare
	Gastropods	rare
	Pelecypods	rare
Plants	Cyanophyceae	
	Oscillatoria sp.	abundant
	Lyngbya sp.	common
	Tricnodesmium sp.	rare
	Bacillariophyceae	
	Thalassiothrix sp.	rare
	Rhizosolenia sp.	rare
	Chlorophyceae	
	Chaetomorpha sp.	rare
	Caulerpa sp.	rare
	Cladophoropsis sp.	rare
	Phaeophyceae	
	Spacelaria sp.	abundant
	Rhodophyceae	
	Rhodochorton sp.	rare
Peysonnelia sp.	rare	
Gelidielia sp.	rare	
Geranium sp.	rare	
