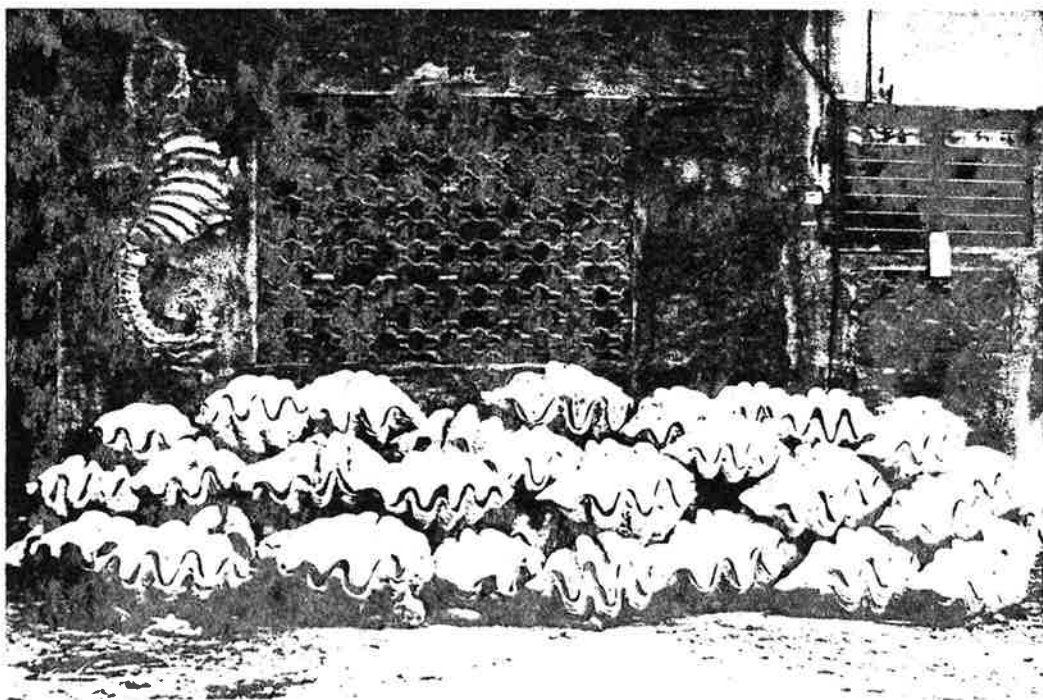


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Marine Conservation in the Philippines and Papua  
New Guinea with special emphasis on  
the ornamental coral and shell trade

Report on a visit to the Philippines and Papua New Guinea May-July 1981  
funded through a Winston Churchill Travelling Fellowship grant.

Susan M. Wells



Conservation Monitoring Centre,  
219c Huntingdon Rd.,  
Cambridge

August 1982

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The first part of the document is a letter from the Secretary of the State to the Governor, dated 18th March 1868. It contains a report on the progress of the work done during the year, and a list of the names of the members of the Council of the State.

The second part of the document is a report on the work done during the year, and a list of the names of the members of the Council of the State. It contains a detailed account of the various matters which have come before the Council, and the decisions which have been reached. It also contains a list of the names of the members of the Council, and the names of the various committees which have been appointed.

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## GENERAL INTRODUCTION

This trip was intended primarily to provide additional information on international trade in ornamental corals and shells to that provided by two reports recently produced on the subject (Wells 1981a and b). These reports illustrate the enormous increase in the trade since the 1960s, but also draw attention to the lack of available first hand information, particularly from countries where corals and shells are collected. The Philippines and Papua New Guinea feature in the trade to different degrees, providing an interesting contrast in the way in which they exploit their wildlife including marine resources, and illustrating particular aspects of the trade.

In the Philippines the coral and shell trade is well established and for many years was encouraged by the government. However the scale of the industry is now such that there is considerable concern over its long-term survival and, in the case of corals, over the effect the trade is having on their coral reefs which are some of the richest and most diverse in the world. Attention was drawn to the plight of Philippine coral reefs by the holding of the 4th International Coral Reef Symposium in Manila in May 1981 which was attended by over 300 coral reef biologists from all over the world (see Philippine section, Appendix A).

A survey by the University of the Philippines has shown that more than half the reefs are in a progressive stage of destruction. Threats to the reefs come from a wide variety of sources. Siltation and sedimentation are among the major destructive activities, (as a result of extensive deforestation leading to soil erosion), as well as pollution from industrial development and activities such as mining. Destructive fishing methods and the collection of coral for local uses such as building and for the international ornamental coral trade involves the removal of the basic structural framework of the reef.

The Philippines has been the leading exporter of ornamental corals for a number of years and concern over the size of the trade led in 1977 to a presidential decree prohibiting exports. Demand from the US and Europe is so heavy however that the trade has continued illegally. The Philippines is also the main supplier of ornamental shells, exports having increased markedly in the last decade. Unfortunately there are as yet very few data available on the ecological effects of collection on this scale but there have been anecdotal reports that some of the popular species are becoming increasingly difficult to find.

The difficulty of implementing effective legislation and enforcing it is also apparent in the Philippine Marine Parks Programme. Many areas have been designated reserves at different times by different government agencies, but little attempt has been made to enact the necessary legislation or to ensure that they are enforced. Currently the University of the Philippines in collaboration with the Bureau of Fisheries and Aquatic Resources is carrying out detailed surveys and drawing up management plans for a few selected pilot sites. International opinion and concern will, it is hoped, stimulate the Philippine government to channel greater efforts into the implementation of their recommendations. A more positive contribution which could be made by other countries would be to help the Philippines enforce its own legislation by prohibiting imports of Philippine corals. In the meantime a public awareness campaign to deter people from buying such corals might possibly diminish the demand.

A rather different situation exists in Papua New Guinea. Shells have been traded for many years on a small-scale, but only recently has the government taken any interest in promoting the trade. Ornamental corals are not traded, but shells are

now exported through a government administered agency. Papua New Guinea has one of the most advanced systems of wildlife exploitation in the world, with remarkably successful schemes for farming and trading in crocodiles and butterflies. The shell business was set up with similar principles in mind: that collection of the resource should be controlled and that collectors should be aware of the possibility of overexploitation, but that a much needed source of income could be provided for many isolated villages.

It was hoped that recommendations could be made for the management of the coral and shell trade on the basis of visits to these two countries. As it turned out, the enormous differences between the two countries and the many problems encountered in the trade, through political factors and lack of sound scientific data on which management plans could be made, preclude anything more than very general statements being made.

In general, the experience of the Philippines suggests that trade in ornamental corals should be seriously discouraged. It is to be hoped that coral exploitation will not be initiated in Papua New Guinea where the reefs are still in extremely good condition. However, the shell trade can clearly be a useful source of income and there is evidence that many species can support a reasonable harvest. Although the Papua New Guinea trade has been set up on a sound ecological and conservation basis, there are many problems in its management. In the Philippines, the trade is now so well established that it will be difficult to change the attitude of the fishermen who collect shells and dealers. However, education programmes and, if at all feasible, quotas for the potentially vulnerable species, could perhaps resolve some of the problems.

A certain amount of information not directly related to the ornamental coral and shell trade was collected during the trip and has been included since it provides background material and puts the trade in the context of other problems in marine conservation in the two countries. In particular the development of marine parks in the two countries is of particular importance when considering resources such as corals and shells. Other aspects of the shell trade other than ornamental shells have also been considered since they are closely related. Ornamental shells can be divided into those which are used primarily for purely decorative purposes and those which are considered specimen shells and for which conchologists may pay considerable sums of money. In fact there is a great deal of overlap between the two groups, particularly since so-called "rare" shells may become more readily available or species once abundant may become difficult to obtain. A further category of shell which is often traded by the same dealers is "commercial" shell, or the pearl oysters and trochus which have commercially valuable mother-of-pearl. An important point which must be borne in mind when reading this report is that the statistics used have come from a variety of sources and frequently those provided by local government offices do not tally with those provided by the national fishery departments. Furthermore dealers often differed in their replies to the same question about the trade and in the time available it was not possible to check which information was most reliable. It should be noted that the word 'conchologist' has been used for people who collect shells as a hobby and who provide the demand for ornamental shells, in order to avoid confusion in the text with the fishermen who collect shells to supply this market.



# THE CORAL AND SHELL INDUSTRIES OF THE PHILIPPINES

## Introduction

The Philippines, with a land mass of about 296,000 km<sup>2</sup>, is made up of an estimated 7,100 islands, the two largest of which are Luzon in the north and Mindanao in the south. The population numbers some 49 million and is increasing at a rate of around 3.7% a year and the density of 159 a sq.km. is nearly double the south-east Asian average. The country was colonised by Spain from 1565 to 1898 and as a result the population is predominantly Roman Catholic except in Mindanao in the South where there is a strong Muslim separatist movement. In 1898 the country was ceded to the USA until 1946 when independence was declared. Manila with Quezon City forms the capital, and is the largest city. The other three major cities are Davao, Cebu and Caloocan. Ancient land links with both Borneo and China have given the Philippines a richly varied wildlife and high degree of endemism is found within the fauna.

A large proportion of the population depends on coral reefs for its food, livelihood and, for the wealthier class, increasingly its recreation. Most of the large urban areas are in the coastal zone and 17 of the 25 cities with populations greater than 100,000 are situated on the coast. A large percentage of the country's exports is marine produce: fish, shrimps, lobsters, crabs, abalone, squid, scallops and a wide variety of other edible molluscs, mother-of-pearl shell of different kinds, ornamental shells, corals, sea cucumbers, shark products, sea urchins, seaweed, sponges and even jelly fish. Coral reefs are a particularly important source of such produce. They cover about 44,097 km<sup>2</sup> and include some of the richest fringing reefs in the world. Over 400 species in 72 genera have been described from Philippine waters, a figure comparable with the diversity of the Great Barrier Reef in Australia.

Recent estimates suggest that coral-reef related fisheries may represent about 10 - 15% of the marine fisheries production and even more if the contribution of coral reefs to offshore fisheries is taken into account. The reefs are one of the major attractions on which the Philippines is basing its fast-developing tourist industry. Increasing numbers of dive tour operators are springing up and new areas are continually being opened up to tourism. Coral reefs also play an important role in the protection of the coastline from erosion. Under natural conditions they suffer considerable damage each year from the monsoon rains and an average of 20 typhoons a year but generally they are able to repair such damage and are still thought to be the most effective barrier to Tsunamis or tidal waves.

However, coral reefs do not seem to be able to cope so well with human-induced destruction. An exhaustive survey by the Marine Sciences Center of the University of the Philippines at the end of the 1970s revealed that more than half the reefs are in stages of progressive destruction. In terms of live coral cover, 50% of the reefs were described as being poor, 25% as fair, 20% as good and only 5% as excellent. Those in poorest condition are not surprisingly in Luzon and the Visayas where the major cities are concentrated and the greatest environmental stresses operate. Only Palawan, the westernmost island which is still relatively isolated and underdeveloped has fair to good coral cover throughout its reefs (Marine Sciences Center, 1979).

Probably the most damaging factor operating on reefs at present is siltation or sedimentation. This prevents light reaching the coral, inhibits the growth of symbiotic algae on which the coral is to a large extent dependent, and hinders the

settlement of the planulae larvae. Most siltation problems are a consequence of extensive deforestation leading to erosion and consequent soil run-off. Timber is one of the main exports from the Philippines and since the Second World War logging has increased dramatically, although attempts have been made to decrease the rate of felling and increase the value of exports by only permitting the export of processed timber. There is now very little undisturbed rain forest left, except in the east of the archipelago and on Palawan; in 1978, for example, commercial logging accounted for over 1,000 km<sup>2</sup> of primary forests (Whitmore 1976; Myers, 1980). In 1976 it was estimated that only 38% of the country was still forested (only 20% with full canopy forest) compared with about 75% in the mid-1940s. Agricultural encroachment following logging ensures that there is little chance of regeneration and it is thought that if the present rate continues all forests will be gone by the end of this century. Slash and burn agriculture and exploitation of mangroves near coral reefs also contribute to the silt load, as do a variety of other factors such as off-shore and terrestrial mining, harbour dredging, oil drilling and industrial, urban and recreational development. Siltation is very difficult to control since often the activities causing it occur a long way from the site of damage. Furthermore the exact effect of silt on coral is still poorly known and much more research is needed. The effects of pollution are similarly poorly understood and difficult to control, but it is clear that oil spills, industrial wastes and other pollutants can have adverse impacts.

Other human-induced factors have an immediate impact on coral reefs. Blast fishing, although illegal, is still widespread throughout much of the Philippines. It has been estimated that at least 20-25 years are required for a blast-damaged reef to recover its climax condition. Blasted areas after ten years tend to be covered with a profusion of colonial sea anemones, filamentous and coralline algae and soft corals which may impede recolonisation by stony corals, since recovery probably takes place through the settlement of planulae larvae rather than through regeneration of fragments (Alcala and Gomez, 1979). Moro-ami fishing, a traditional method now used on a large-scale has also proved damaging. Rocks or other weights are tied to the base of nets which are towed along hitting the coral and scaring the fish out into the nets. At the end of the 1970s 49 moro-ami boats were operating off Cebu alone. Local people are beginning to discover that such practices can lead to a decline in fish yields and local authorities are fortunately beginning to take the lead in putting an end to such practices; for example, moro-ami fishing has been banned in Negros waters (White, 1981). Coral exploitation has given rise to a great deal of concern in recent years and is discussed in more detail below.

The shell trade does not have such immediately damaging effects on the environment, although in some instances dredges and nets can be destructive. Although many of the shells in trade are associated with coral reefs, there are also many which are taken from other coastal habitats such as sandy sea grass beds or muddy estuaries. The main concern over the shell trade is the extent to which some species may be being overcollected, since the scale of collection in the Philippines is enormous. This is discussed in detail in a later section.

## Coral Exploitation

Corals have been used in the Philippines for many centuries. One of the earliest uses may have been as a carving material since stone statues, resembling standing or squatting figures and called "Likha", were roughly hewn from brain coral by early Philippine people as funerary objects. However, large scale coral exploitation did not get underway until the early 1970s when ornamental corals became fashionable decorative items in the West and demand for coral as a building material increased. Most exploitation in the Philippines involves stony or reef-building corals, but increasingly interest is being shown in the precious and semi-precious coral resources of the country.

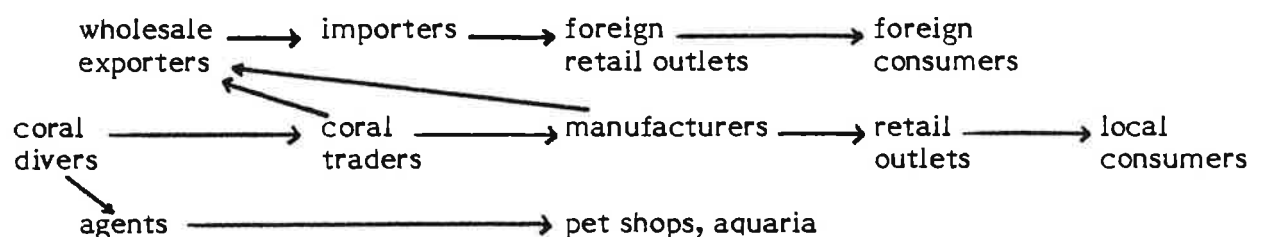
### Coral for Building

The use of coral as a building material is currently causing considerable concern. Usually the massive species such as Goniopora and Porites which make up the basic framework of the reef are used, and there is evidence that in certain areas their removal from the reef causes erosion of the associated beaches. Live corals rather than dead corals are used since they are easier to cut into tiles or blocks but large quantities are wasted since considerable skill is required. In most cases such coral is used for purely decorative purposes; for example, the new airport at Mactan, Cebu is decorated with coral tiles. Species such as the blue corals, Heliopora and coloured gorgonians which are used in inlay work may not even be recognisable as corals when the product is finished. Alternative materials are certainly available for such purposes and action should be taken to control this industry. In some places entire heads of coral are used to decorate gardens and streets, one example being the main square in Bolinao, Pangasinan. This practise is probably not widespread but where it occurs it will perpetuate the idea that coral is an inanimate material of no particular significance in the marine environment.

### Ornamental Corals

The ornamental coral trade uses the smaller branching corals which are nonetheless ecologically important since they provide shelter and food for many reef fish. Ornamental corals are now to be found in gift shops and department stores throughout the world, sold as souvenirs in seaside resorts far from any coral reef, as decoration for aquarium fish tanks or simply as ornaments for the mantelpiece.

Throughout the early 1970s, the Philippines was the main exporter of stony corals by several orders of magnitude. Exports increased dramatically from just over 200 tonnes in 1969 to over 1800 tonnes in 1976, about 60 per cent of which was destined for the U.S., the rest for Japan and Europe (Wells, 1981b). In 1977 the Marine Sciences Center of the University of the Philippines carried out a detailed market study of the trade. The distribution system of corals from source to final customer usually involves a number of middlemen:



It is not at all clear to what extent the divers are dependent on coral collection

for their livelihood, but it is almost certain that prior to the expansion of the trade they made their living as fishermen, collecting coral and shells as a sideline (Marine Sciences Center, 1979). It has been estimated that some 22,000 families depended on coral collecting and exporting at the height of the trade (Anon, 1979).

A study of the trade in Zamboanga on Mindanao in 1980 showed that there were then about 1200 coral divers in the region, mainly Samals (Muslims) and Badjaos (sea gypsies). About 200 operated in the Manalipa, Tabtabon and Santa Cruz islands, 500 in Saluping and other islands off Basilan and 500 in the Sulu Sea and off Tawi-Tawi, supplying 14 major exporters in Zamboanga City. The Samals use motorised bancas (outrigger canoes) with 5-10 divers per boat; the Badjaos use their large vintnas or sailing boats. The divers wear masks or goggles but have no SCUBA equipment; they usually spend one day dislodging the corals with a tool such as a crow-bar and come back the following day to collect the pieces in baskets or nets. More than 35 varieties of coral were being exported from Zamboanga in 1980 and a single diver could earn about 6-8 pesos (US \$1) a day collecting between 30 and 50 pieces (Alcera, 1981).

A similar system operated on Mactan Island, off Cebu in June 1981. Coral was being brought onto at least two beaches along the coast at Punta Inganio, the moderately remote north-eastern tip of the island. Motorised bancas were being used and the coral was said to be collected locally from around Bohol and the islands to the north and south of Mactan, although one collector said it came from as far away as Leyte. It is collected by free-diving down to a depth of 5m and metal bars are used to prize off the selected pieces; about 100 pieces are collected a day by a single diver. It is unloaded into shallow water where it is left for about three days, periodically being shaken to remove the organic matter as it rots. Once clean it is piled up to dry and bleach in the sun for a further three days. An estimated 50-80 fishermen are employed as part-time gatherers, working for five firms which supply the Cebu dealers. A further 60-70 people are employed cleaning and sorting the coral (Ross, 1982). At least 20 different varieties were identified (Table 1). According to the people washing the coral, dealers in Cebu usually specified the types required and came out to Mactan to collect their orders every week or so. Prices seemed to vary; one collector quoted 50c for a piece 30cm by 60cm; another 50c for a 'small' piece and 2 pesos for a 'larger' piece. Mushroom coral is reported to be most in demand, making up 62 per cent of the inventories of 22 Cebu dealers surveyed (Ross, 1982), with brown stem, brain and branch coral making up much of the remainder.

In the early 1970s government policies and export incentives strongly favoured the coral trade, and although a ban on the trade had been imposed in 1973, by 1977 the reefs had become noticeably depleted. In 1977, therefore the ban was re-imposed under Presidential Decree 1219 which prohibited the gathering and/or exporting of stony corals and the exporting of precious and semi-precious corals. The latter prohibition was the result of a number of incidences of poaching of precious corals by the Taiwanese. As a result of the ban customs export figures for stony corals showed a dramatic drop in 1977 and ceased altogether in 1978 (Wells 1981b). (The 1976 peak is probably partly attributable to anticipation of the ban on the part of the exporters and their rush to dispose of stocks). However, the Bureau of Fisheries and Aquatic Resources (BFAR) recorded exports of 3,682 cu.m. in 1978 (at a value of 2,358,701 pesos = US \$ 336,960) and 27,400 cu.m. in 1979 (at a value of only 973,349 pesos = US \$ 139,050), and analysis of import figures for other countries showed that exports indeed continued after the ban. A total of at least 962 tonnes were exported in 1978 and in 1980 the US alone imported over 236 tonnes of Philippine corals. Some of this left the country legally through Zamboanga City in the south, which was granted special dispensation, reportedly because of the difficulty of enforcing controls in the midst of the uneasy atmosphere created by the Muslim rebels. The decree

contained a number of loopholes however, (for example, coral already in stock could be exported) and since the government was slow to enact the necessary legislation, exports left areas of the country as well as Zamboanga. In 1980 Presidential Decree 1698 amended the previous legislation, improving facilities for enforcement, requiring all stock to be cleared within 15 days and forbidding the use of corals as building materials. The Philippine Constabulary, the Navy, the Coastguards and the Bureau of Customs are now responsible for enforcing the provisions of the decree.

In June 1981 the illegal trade was still flourishing, although coral and shell dealers I visited in Cebu and Zamboanga Cities were clearly aware of the current legislation (Appendix B). Cebu is now the centre of the current trade and many of the firms visited had corals piled up in their warehouses and in some coral was actually seen being loaded into vans. Not surprisingly the dealers did not wish to talk about the coral ban and some refused to be interviewed, although in every case interviews started with questions about the shell trade. The manager of Paulton's was prepared to discuss the shell trade very briefly but not the coral trade although outside a container was being loaded up with boxes of coral and there were large piles of stony and black corals in the yard. Filtrade had corals on display in their shop which catered for Japanese and American tourists as well as for overseas importers. Cebu Shell House is reportedly one of the biggest coral exporters; their current price list includes 22 varieties of coral (including sea fans); Orcullo Enterprises had crates of corals in one of its warehouses as well as large piles of black, organ-pipe and other stony corals in the yard. Rocan, Luvisiminda and Alcon Industries all had coral in their warehouses although it was not possible to tell to what extent this was being exported. Castilex Industrial Corporation had corals in crates in its warehouse and a number of varieties are illustrated in its brochure. Ponce's Shell Novelties lists about 14 varieties, and a letter accompanying the price list explains how coral can be exported in spite of the ban as fillers or labelled as shells (see Appendix C). Evaristo Zambo seemed to be exceptional in having ceased coral exports and the manager was clearly aware of the damage being caused to the reefs by the trade.

Retail prices vary according to type and size of coral. In 1981 Cebu Shell House coral prices ranged in price from \$0.03 for a 2.5cm-5cm piece of mushroom coral (*Fungia*) to \$2.80 for a 60cm piece of organ-pipe coral (*Tubipora*). At Ponce's Shell Novelties prices ranged from \$0.10 for a small piece of *Fungia* to \$2.50 for a large piece of brown stem (*Pocillopora*) and \$3.00 for a large black sea fan. In 1980, according to the study conducted in Zamboanga, prices were estimated for each cu.m. (cauliflower, lace and cluster corals were \$3,000 per cu.m.) or for each piece (e.g. Brown coral 25cm-30cm at \$0.35 (Alcera, 1981).

Zamboanga seems to have clamped down fairly firmly on exports since the ban came into force in May 1980. The local BFAR continued to record export statistics for coral up until July, but since then none has been recorded (Table 2). The 14 suppliers exporting from Zamboanga in 1980 included San Luis, Rocan, Stella Maris, Sergio Abrero, Nur Ningting, Profeta Marine Products, Ertan Specimen Shells, and Damsar. By June 1981 a number of firms (Nur Ningting, Laygan and Stella Maris) were apparently no longer active. Most firms visited reported that they no longer exported corals although their warehouses still seemed to have fairly large, if dusty, stocks (such as the Zamboanga Curio Shop and San Luis). The manager of Jose Co., one of the larger firms said that he believed controls were necessary but regretted that a total ban had been imposed. The price list for Ertan Specimen Shells has had the pages listing corals deleted. Two dealers, Profeta Marine Trading and San Luis, discussed very freely the problems that have arisen as a result of the ban. Importers tend to cancel their orders if corals cannot be supplied with shells - as one dealer put it 'coral and shells go together like coffee and milk'. As a result the shell trade is

suffering as well. Profeta Marine Trading had closed for two months and on re-opening had had to lay off a large number of workers. They maintained that a number of people depended on collecting corals and shells for their livelihoods and that it was not just a side-line occupation. Although the men could get alternative work in the construction industry, the women and children who clean and pack the corals and shells reportedly had no alternative. (At San Luis it was maintained that jobless coral divers were even going up into the hills to join the Muslim rebels!)

One of the reasons for the apparent relative ease with which the trade is continuing at Cebu is probably the difficulty of enforcement there. International deep-draft carriers are able to use Cebu port and so consignments can be loaded directly onto foreign ships. At Zamboanga, consignments, having been checked by BFAR are loaded into small Philippine boats for shipment to Manila, where they are checked again before loading onto foreign boats. Bribery is a widespread practice in Cebu. Two local coral reef biologists had witnessed the payment of a bribe in June 1981, when a police boat apprehended a boat laden with coral coming into Mactan; about P500 (US \$70) was handed over. Bribery is also said to occur at Customs and an employee of Sealink, one of the container firms, had seen corals going out with consignments of shells. It was easy to obtain photos of coral being packed and loaded in the various warehouses and on Mactan it was being brought into the beach quite openly; palm branches were laid casually across the piles of cleaned coral in a token attempt at concealment.

Judging from newspaper reports, Customs at Manila have now stepped up their vigilance. In February 1981, a lorry destined for Seattle and shipped by the Cebu Shell House was found to contain P500,000 (US\$70,000) worth of coral when checked at Manila. In July and August two further shipments bound for the U.S. were seized, both probably from the Zamboanga Sea Shell House. One contained corals and sea shells worth P500,000 (US\$70,000) and the other, weighing 20,000 kg, was valued at P1 million (US\$140,000).

#### Precious and Semi-precious corals

As yet there is no large-scale exploitation of precious (red) or semi-precious (black) corals in the Philippines, although substantial stocks of precious coral occur in the north, in deep waters off the Batan islands. These were discovered by the Japanese and for a time were exploited (illegally since they occur within the Philippine fishery zone) by both Japanese and Taiwanese coral fishing boats. If managed on a sustainable yield basis as the Hawaiian precious coral fishery is run, these beds could perhaps provide the Philippines with a useful source of income.

Semi-precious corals (Antipatharia spp.) are exploited primarily for the souvenir trade. Most of the black coral seen was said to come from Zamboanga, although other areas said to be rich in antipatharians include the Batan Islands, Palawan and the waters of Pangasinan, Zambales, Quezon, Bicol and Samar. Black coral is also used for jewellery of a fairly low quality which is exported or sold to tourists. Most souvenir shops in Mabini St., the tourist belt in Manila sold black coral jewellery and large colonies of black coral were on sale in the tourist markets. In Cebu, black coral either raw or worked was seen at Filtrade, Paulton, Orcullo Enterprises, Ponce's and Luvisiminda. The average price for a black coral bangle was 3-5 pesos (US\$0.5-1.0). In Zamboanga a number of the dealers made black coral jewellery in their factories. Black coral ornaments were also made by cottage industry shellcraft firms in Bolinao, Pangasinan, including "trees" of black coral with flowers and leaves made of fish scales and shells which were sold to dealers for 45 pesos (US\$6). The black coral came from Mindanao. Black coral is listed on Appendix II of CITES (Convention on International Trade in Endangered

Species of Wild Fauna and Flora), and since the Philippines has now ratified, permits should be issued for its export. It is to be hoped that the relevant legislation will be enforced since it will provide a means of finding out the quantities involved and of monitoring the trade.

Several other coral species are now being used for jewellery. The blue corals Heliopora and a similar red coral are used to make beads and as inlay for bracelets. A firm in Cebu makes jewellery out of the hydroid Distichopora sp. When polished this closely resembles precious coral and comes in a range of colours (orange, blue, violet, pink, white), which are incorporated into the skeleton as in precious corals. This particular firm obtained it from the Pacific coast of north Luzon, but it occurs in other parts of the Philippines, in moderately deep waters particularly under ledges or overhangs. The jewellery is made primarily for export and prices vary according to colour from P7 (US \$1) for a small red bracelet to P35 (US \$5) for a gold-coloured necklace.

## The Shell Trade

The Philippines is currently a major supplier of several different types of shells and shellcraft. For many years collectors have sought Philippine shells and the archipelago is well known for the richness of its marine mollusc fauna which includes a number of rare and highly valuable species. More recently the shellcraft industry has expanded enormously, encouraged by the government since the industry provides employment for large numbers of people. The following sections look at various aspects of trade in shells, both ornamental and rare or specimen shells, and in shellcraft, including the capiz shellcraft industry.

Much of the information was obtained through interviews with shell dealers in June 1981 (Appendix B). Many of them were reluctant or even refused to talk, possibly because they were also dealing in illegal corals. It transpired that a number of people had been carrying out surveys similar to mine either officially or out of personal interest, and there may well have been a fear that controls were shortly to be implemented on the shell trade. This was most apparent in Cebu, the centre of the illegal coral trade, where Filtrade, Cecilio's Multicrafts and Alcon Industries all refused to give information. The five dealers visited in Zamboanga were much happier to discuss the trade and, in particular, the effects of the coral ban on the shell business.

### Ornamental shells

This term is used for those shells which are bought primarily for decorative purposes and for the less rare and less valuable specimens bought by conchologists. The large, glossy, colourful species tend to be most popular but the revival in shell collecting as a hobby has meant that many of the smaller species are also involved. Exports of 'ornamental shells' from the Philippines have risen rapidly over the last decade, from just under 1,500 tonnes in 1970 to over 3,000 tonnes in 1979 (Wells, 1981). About 50% is destined for the US, the rest for Italy, Spain, the UK, the Netherlands, Hong Kong and a large number of other countries. US annual imports of marine shells from the Philippines averaged about 500 tonnes during the 1960s but increased over the 1970s to nearly 2,000 tonnes in 1979. Fishery statistics for the Philippines for 1979 indicate that 1,605 tonnes of ornamental shells and 1,685 tonnes of miscellaneous shells were collected.

The centre of the ornamental shell trade, like the coral trade, is Cebu in the Visayas, although many firms also have warehouses or head offices in Manila. Zamboanga in the south is the second major centre but shells are also collected from numerous areas around the coast and retailed in a number of towns. Most are destined for export although a small proportion is sold locally to tourists, mainly Japanese and American. The Philippine people are also becoming increasingly interested in this resource, both aesthetically and as an investment; many now hold valuable collections. Most of the dealers are primarily exporters, their premises consisting of an office, a display room and warehouses; a few had retail shops for tourists. They all reported that the majority of their exports went to the US and Europe (Table 3), and several firms have been in business for many years (Table 4). In Cebu and Manila business seemed to be good; Evaristo Zambo and Czarina Shell Novelties in Manila were both expanding and setting up shell museums to help attract custom. In Zamboanga the reverse was the case; three dealers had apparently closed down or gone bankrupt and many others looked distinctly run down and low on stock (especially Ertan Specimen Shells, although it had an impressive price-list, and Damsar). This was said to be a result of the coral ban, although one firm, San Luis said that it was able to survive on shells alone.



The route from collector to final consumer is complex and, as for corals, involves large numbers of middlemen (see section on coral trade). Collectors tend to deal in both corals and shells, sometimes as a side-line to fishing although some may depend on these for their main source of income. A study in the early 1970s found that very few people were dependent on the trade, but in 1981 the manager of San Luis reckoned that about 500-600 people were then dependent on it. It was mentioned several times that many fishermen have recently changed to shell-collecting which pays better than fishing.

A few of the larger exporters have their own boats which go round the villages or barrios buying up shells. Carfell has two boats which go around the barrios in the south for up to three month periods at a time; they also have their own collectors who dive for shells using the scaphander (primitive diving equipment) and in addition they obtain shells from collectors who come to the shop in Manila. Cecilio's Multicrafts and San Luis have their own collectors and buyers; San Luis, for example has a buyer stationed on Palawan. Evaristo Zambo sends out collectors and looks for new productive areas by searching beaches for shells which have been washed up and which might indicate a nearby rich source, or by investigating fishermen's catches. In many cases the collectors themselves go directly to the dealers. The Samals and Badjaos are the main collectors around Zamboanga and supply most of the firms there. Flora's Shell Shop on Mactan, Cebu, is supplied by collectors from Mindanao, Bohol and local barrios. Those dealing in the rarer specimen shells often obtain shells through exchanges with other dealers; for example, San Luis has arrangements with dealers in Cebu, and Carfell exchanges land snails with dealers overseas.

Prices have tended to rise as dealers compete with each other to attract collectors by offering better payment. Many of the the collectors are now aware of the value of different species on the world market and have also learned to identify the specimens they find. The large number of potential buyers has meant that dealers can also ask much higher prices on the overseas market and "bargains" are now hard to find. Even so there may be up to a 50% difference in price in different parts of the country (Leechman, 1981b). Some dealers try to reduce competition by specialising; Rocan in Zamboanga deals mainly in very good quality shells at higher prices. Another factor contributing to high prices is the number of middlemen involved; the exporter may be as much as fifth in line. Foreign buyers such as Americans and Japanese usually visit the dealers at least once a year, although rising air fares and hotel rates are said to be curtailing this (Leechman, 1981a). From the orders which are sent in the dealers instruct the collectors as to which species are in demand. One complaint which was regularly voiced was that overseas buyers frequently failed to pay, a factor which contributes to the riskiness of the business. Other factors said to have contributed to high prices include inflation, the Muslim troubles in Mindanao and the fact that some species are becoming difficult to find.

Most collecting is carried out in the summer months when conditions are good (Table 5). The shells are stockpiled and the time-consuming process of cleaning and processing continues throughout the year. Cleaning may be carried out either by the collectors or at the exporter's warehouse. Shells are generally soaked in an acid such as hydrochloric, unless they have a glossy surface in which case they are washed in water once the meat has been removed or allowed to rot. They are then brushed or scraped to remove any calcareous growth. Land snails are washed in fresh water. Some specimens, especially those destined for Europe are polished and then may be recorded as shellcraft for Customs purposes. Consignments may be sent out as often as four times a week from the larger exporters such as Orcullos.

Dealers were reluctant to reveal where particular species came from but it was

clear that although shells are collected throughout much of the Philippines (Table 6) different species are abundant in different areas. Most dealers reported the Western Visayas, the Sulu Sea and Palawan as their main sources. Evaristo Zambo obtained the commoner ornamental shells such as tritons and murex from local waters such as Bohol and Mactan but went further afield for specimen shells. According to Rocan some species are abundant everywhere such as spider shells (Lambis spp.), Cypraea vitellus and other small cowries. Carfell mentioned Davao and Palawan as important sources. The Zamboanga dealers obtained their stock mainly from the southern Philippines; San Luis for example said that collectors went to Davao, Palawan, the South China Sea and the Sulu Archipelago. The Zamboanga BFAR recorded exports of 1,312,134 kg of ornamental shells in 1980 which were probably collected throughout the Zamboanga and Sulu area. The Sulu Archipelago probably also sees considerable trade between Sabah and the Philippines, since there are strong ethnic links between the people of these areas. Much of the trade and movement here is probably illegal but the area is very difficult to police properly. The Bajau Laut people on Sabah, who came originally from Sibu and Tawi-Tawi in the Sulu Sea, trade most actively in shells. The commonest shell traded is Strombus luhuanus (which is edible); other species involved are Conus marmoreus, various cowries, Tridacna, Nautilus, Harpa articularis, helmet shells and trochus (E. Wood 1981 in litt.).

A huge number of species is involved in the ornamental shell trade and it was impossible in the time available and with the reluctance of many of the dealers to talk, to get any real impression of which species were being collected in greatest quantities. A market study of the Philippine shell trade being carried out at the University of the Philippines may go some way to answering some of these questions. In order to obtain some idea of species involved, six price lists were analysed for the species which were being offered most commonly and the results are given in Appendix D. It will be seen that the most popular are the large, colourful, glossy species such as tritons, clams, murex, etc. Well over 200 species are involved; San Luis said they exported about 70 different species; Evaristo Zambo used to prepare a 'beginners' set of assorted shells consisting of about 150 species of the commoner Philippine species, which were exported mainly to the US to encourage an interest in shell collecting. Some of the more popular species are discussed below.

Giant helmet shells - *Cassis cornuta* This species was seen in very large numbers (including many specimens 30cm or more in length) at several dealers' premises in both Cebu and Zamboanga (Filtrade, Orcullo, Flora's Shell Shop, Castilex, Rocan) and was said to be heavily in demand and still easy to obtain. Helmet shells are found in sandy areas in both shallow and deep water and prey on echinoids. Rocan obtained them mainly from the Sulu Archipelago, e.g. around Tawi-Tawi, but also as far north as Cebu; San Luis obtained them from the Sulu Sea; Castilex reported obtaining shells from Bantayan and Masbate. At Rocan it was said that they were particularly abundant in May but it was not clear whether this was to do with some seasonality in their life cycle or because the dealers offered good prices for them then. Prices varied from US\$0.50 for a 8-5cm shell to over US\$6 for a shell 30cm or longer.

Clams - Tridacnidae There are six species in this family, all of which occur in the Philippines and are involved in the shell trade. They are also taken extensively for food and in many parts of the Indo-Pacific there is clear evidence that they have been overexploited (IUCN, in prep.). The Bureau of Fisheries and Aquatic Resources records quantities taken for food but does not specify the species concerned. Production rose at the end of the 1970s: 243 tonnes in 1976; 664t in 1977; 1,635t in 1978 and 2,861t in 1979. Most came from the Samar Sea: 2,768t from the region around Albay, Camarines, Cantanduanes, Masbate and Sorsogon and 13t from the region of Samar, Leyte and Baliran; and the rest came from the

south: 70t from the Basilan, Sulu and Tawi-Tawi area; 3t from Zamboanga; 6t from the Aklan, Antique, Capiz, Iloilo and Negros area; and 1t from Davao. Exports of frozen clam meat rose from 3.149t in 1978 (destined for Japan) to 17.273t in 1979 (of which over 12t were destined for Hong Kong and the rest for Japan).

The giant clams, Tridacna gigas and T. derasa are in particularly heavy demand for their shells, which are used as wash-basins, church fonts and for a variety of other purposes, particularly in the US although they are also sent to Europe. They were seen in greatest numbers in Zamboanga and by all accounts they are now still abundant only in the southern Philippines; in the yards of most dealers shells measuring a metre across or more were being cleaned and the edges filed smooth. Collectors also go out as far as Palawan and the South China Sea for these species; Ertan Specimen Shells, Profeta Marine Trading, San Luis and Rocan all mentioned this area as the main source. Recently collectors have been obtaining the shells from the Japanese, Taiwanese and Vietnamese once the meat has been removed. The meat is probably removed by divers underwater and the shells left on the reef although there were reports of shells being thrown overboard.

Although the manager of San Luis thought there was no shortage of clams in the south, at Profeta Marine Trading it was mentioned that in the past their clam stock had been much larger. Castilex, in Cebu also mentioned that giant clams were becoming scarce; this dealer as well as other Cebu dealers such as Orcullo Enterprises (which exported giant clams to Portland, US) obtained clam shells from Zamboanga or Palawan. Prices ranged from US\$0.38/kg in Zamboanga to US\$0.9/kg in Cebu, and some of the larger shells, which can weigh over 100kg, may fetch up to US\$100.

Dealers in Cebu stocked mainly the smaller species such as T. maxima, T. squamosa and Hippopus hippopus. In San Luis, Zamboanga, small clams (possibly T. maxima) measuring about 30 cm across were being filed down to leave only the nacre, which formed a white, almost translucent bowl. These were being exported to Denmark as salad bowls. In the southern Philippines, T. squamosa tends to be brilliantly coloured, either yellow or orange, and large quantities were seen in all the dealers' premises. The coloured varieties are said to be in great demand and the manager of San Luis thought that it might eventually be necessary to control exploitation of these varieties. Prices of the smaller clams varied according to size and colour. H. hippopus was priced at about US\$0.26 a pair 8-13cm long, to US\$0.45/kg for specimens over 20cm long. T. squamosa varied from US\$0.2 for uncoloured shells to US\$3.5 for coloured specimens.

Giant Triton - Charonia tritonis This shell was seen at most dealers' and was on five of the six price lists analysed. Evaristo Zambo in Cebu said that he obtained them from local waters such as Mactan and Bohol but the majority of dealers said that they had to go further afield for them. Orcullo Enterprises obtained them from Zamboanga and Palawan; Rocan from the Sulu Archipelago; San Luis from Zamboanga and Jolo in the Sulu Sea. Both the Cebu Shell House and Flora's Shell Shop said that big specimens were particularly difficult to obtain although small shells were still fairly readily available elsewhere; the latter obtained large shells from Palawan. At Castilex they said that tritons were seasonal and scarce but could be obtained from Samar and Bicol. Prices ranged from US\$5 for specimens under 25cm to US\$20 or more for specimens longer than 36cm. There have been other reports of overcollection of the giant triton, particularly in Australia where it has been suggested that this is one of the factors contributing to the population explosion of the crown-of-thorns starfish, Acanthaster planci; the triton is known to be a predator on this and other echinoderms.

Volutes - Volutidae Volutes tend to fetch high prices since they are moderately

rare and have fairly restricted ranges. Cymbiola imperialis and Voluta aulica were often seen in dealers' warehouses. The former was reported by Orcullo Enterprises to have become rarer and and it was said to be available only in Zamboanga. In 1978 it was worth between US\$5 and US\$10 (Wagner and Abbott, 1978), depending on quality, although the 1981 price lists were asking only US\$2-6 for it. V. aulica is endemic to the southern Philippines and in 1978 was worth US\$40-60. It was advertised in 1981 price lists for between US\$15 and US\$150 and up to US\$5,000 for a sinistral specimen.

Other species Thorny oysters, Spondylus, were reported to be very common around Zamboanga. Nautilus are abundant in Cebu waters according to Rocan. Tiger cowries were seen in huge numbers in most dealers, but according to the manager of San Luis, they are not in great demand at the moment as East African specimens are larger. This is probably a natural phenomenon rather than a result of human exploitation. According to the manager of Rocan, cowries are found seasonally, which may be related to their breeding cycle.

### Land snails

Recently conchologists have shown considerable interest in land snail shells which have appeared in shell shops in the US and Europe in increasing numbers, many originating from the Philippines. Unfortunately very few people in the Philippines, including the dealers, could provide any information on these shells although it is well known that Philippine rainforests once harboured large numbers of endemic land snails. About 1,200 species have been described (Faustino, 1930), but dealers have great difficulty identifying them and many more are probably undescribed and unknown to science. Many are likely to become extinct as a result of the extensive and rapid deforestation which is taking place.

Six of the dealers I visited exported land snails, often in large quantities, and all appeared to stock similar species. Carfell had the biggest stock and had attempted to identify them all. They mentioned Mindoro and northern Luzon as sources; the snails were collected by local people and came from marshes as well as mountain forest habitats. Carfell also dealt in land snails from Papua New Guinea and the Caribbean which they obtained through exchanges with other dealers. Orcullo Enterprises stocked a large number of land snail shells including large striped ones from Negros. Rocan stocked shells from Mindoro, Samar and Negros, and Luvisiminda had large green and yellow shells also from Mindoro. Castilex had a large selection collected in Zambales, Zamboanga, Romblon, Marinduque and Mindoro which was identified (by the British Museum (Natural History)) as consisting of the following:

Helicostyla (Pachysphaera) annulata  
H. (Opalliostyla) leai  
H. florida  
H. (Cochlodryas) polychroa  
H. (Helicostyla) rehbeini  
Cochlostyla (Cochlostyla) marinduquensa  
C. (Cochlostyla) portei  
C. (Hypselostyla) cincinna  
C. (Rhymbocochlias) bicolorata  
Chloraea (Chloraea) dryope  
C. (Corasia) aegrota  
Calocochlia (Calocochlia) dubiosa  
C. (Calocochlia) sp. cf. C. (C.) albaiensis  
Hemiplecta sp. cf. H. panavensis  
Amphidromus quadrasi  
Canistrum stabilis

C. ovoides  
Cyclophorus lingulatus  
Chrysalis (Chrysalis) mindoroensis  
Obba (Obba) moricandi  
Phoenicobius aratus

The following species from the Philippines were on sale in Eatons Shell Shop in London in December 1980:

Amphidromus ?perversus  
Helicostyla (Cochlodryas) floridus (from Mindoro)  
Cochlostyla annulata (from Luzon)  
C. (Prochilus) fectilis  
Chrysalis (Dolichostyla) virgata (from Mindoro)  
Chloraea sp.

The current level of trade in land snail shells probably has little effect on snail populations, their greatest threat being deforestation through logging, slash and burn agriculture and other habitat destruction. Mindoro still has some suitable habitat in its remaining primary forest but this is threatened; species on Romblon, Marinduque and Masbate may be marginally less threatened since these are limestone islands and there is less demand for the land for agriculture.

A number of the dealers were very interested in these shells and would have been willing to co-operate in arranging visits to areas where they are found. It is recommended that some kind of survey should be carried out in the near future, making use of the knowledge of local people to locate different species, and drawing on the fact that large numbers are now turning up in trade. One method of obtaining specimens for scientific purposes would be to attempt a 'mopping-up' operation in the wake of the logging companies; the snails would be relatively easy to find amongst the fallen vegetation and since they would die anyway, their removal would have little effect on remaining populations. Healthy specimens could even be used to set up captive breeding colonies.

#### Rare or Specimen shells

The Philippines has long been famous for its rare shells, the most well known of which are almost certainly the Golden Cowrie, Cypraea aurantium and the Glory-of-the-Sea cone, Conus gloriamaris. For many such species, their rarity is mainly due to the fact that they are deep sea species, generally occurring in waters about 200m deep. With the discovery of new collecting methods, which are very simple, they are being found in ever increasing numbers. Serious conchologists now attempt to build up growth series of such rare species, and fine examples of the species mentioned above are exhibited in the Carfell Shell Museum.

Rare shells currently being collected in the Philippines include (Berdach, J. pers. comm; Zambo and Lopez, 1976):

Siquijor	<u>Cypraea valentina</u> , <u>C. leucodon</u> , <u>Conus gloriamaris</u> , <u>C. kentoki</u> , <u>Latiaxis</u> spp.
Balicasag	<u>Cypraea guttata</u> , <u>Conus kimioi</u> , <u>C. duvaseli</u> , <u>C.</u> <u>gloriamaris</u> , <u>C. kenoshitai</u> , <u>C. bullatus</u> , <u>C.</u> <u>neptunus</u> , <u>Latiaxis</u> spp., <u>Murex aculeatus</u> , <u>M.</u> <u>superbus</u>
Samar (Guinan)	<u>Cypraea aurantium</u>
Bohol	<u>Conus kenoshitai</u> , <u>Murex alabaster</u>
Balut I.	<u>Murex superbus</u> , <u>M. orchidfloris</u> , <u>M. miyokoae</u> , <u>Conus excelsus</u>

Mactan

Conus pertusus, C. circumciscus, C. bullatus,  
C. auricornus, C. gloriamaris, Murex elongatus  
M. triqueter, M. pellucidus, M. aculeatus, M.  
sauli; occasionally C. aurantium, C. guttata  
and in 1975 C. valentina

Mactan, and in particular the area around Punta Engana has become famous for its rare shells and a chapel has been erected, decorated with shells, in thanksgiving for the new found wealth of the fishermen. As well as C. gloriamaris, C. valentia and a number of rare murex are also found there, and in at least one village fishing has been abandoned since shells provide a better income.

Cypraea aurantium is mainly found off Eastern Samar and prices have remained fairly high because of its aesthetic appeal and popularity. Golden cowries are reported to be found occasionally off Punta Engana, and an American buyer in the Cebu Shell House who was organising a container shipment of shells to Miami was hoping to get 40 golden cowries. He maintained that he had bought 20 specimens that morning from fishermen who had come to his hotel. The Curator of Molluscs at the National Museum said that at the height of the glut 20-30 specimens were being obtained in a season in the Philippines but that this had now dropped to 10 and there were fears that they were being depleted. Immature specimens are increasingly being collected since juveniles can fetch as much as P400 (US\$57). Some dealers have asked the fishermen to leave immatures if they find them but not surprisingly this has had little effect since they know that the next fisherman to find the specimen will almost certainly take it. Cowries in general are still fetching high prices, sometimes as much as US\$ 7,000. On Siquijor, a C. leucodon found at Larena fetched P20,000 (US\$3,000) in 1981 and a smaller one from Bohol sold for P15,000 (US\$2,000).

In contrast the prices of cone shells are said to be dropping. One dealer reckoned he had lost a considerable sum of money on a specimen for which he had paid P21,000 (US\$3,000) and which he now thought was valued at P3,000 (US\$400). Conus gloriamaris seems to be particularly abundant at the moment. Evaristo Zambo said that it could be found all round Cebu and that prices had dropped to about US\$200. Flora's Shell Shop on Mactan, Cebu, had several specimens and was asking P500 (US\$70) for a small shell collected locally. On Siquijor and Balicasag islands the local fishermen were willing to drop prices to P200-300 (US\$30 - 45) but no further, presumably because Cebu dealers would be prepared to pay this amount.

Prior to 1970 rare shells were being collected in the Philippines by skin diving to a depth of about 25m. After 1976, a new method was developed which although inefficient, spread throughout much of the country. Nylon nets, 100-400m long and about 4m wide, are let down unbaited to a depth of about 100m, weighted with lead balls along one side and floats along the other. These are left overnight and pulled up the following morning, lifted from the weighted side so that the buoyancy of the floats on the other side creates a kind of bag. Many shells never reach the surface and fishermen spoke of seeing valuable specimens fall out as the net comes to the surface. Under good conditions as many as 100 nets were being set each night off Mactan in 1976 (Zambo and Lopez, 1976). This method has also been used off Punta Engana using a 1.5m x 50m net lowered to a depth of 60m (Dan, 1978). On some occasions fishermen leave living specimens in the sea until a buyer comes, in order to keep them in top condition.

At Lomangcapan Pt., Siquijor I. (off Negros Oriental) in June 1981 nets were being put down to 80m for three days, based on a method in use in Bohol. As in other areas it was a hit and miss method and sometimes only two shells of any

value were brought up in a month, although one of the collectors had a number of shells including a Conus gloriamaris. Collectors on Balicasag island reckoned that they found shells of value every week. A Conus neptunus worth P200, a number of rare Murex and some Latiaxis (a deep sea genus which is just beginning to come onto the shell market) had been brought up in a week. Balicasag fishermen put nets down in the deep water channel between Balicasag and Panglao Island at dusk and bring them up at dawn the following morning. The nets had a mesh of about 2sq cm., were about 0.5-1m wide and about 100m long, weighted on one side, and surprisingly in very bad repair and full of holes. Ordinary fishing canoes have been converted for deep-sea shell collecting by the addition of a spool to the prow around which the rope for the net is wound. About 12 boats were seen going out. On this particular island the village seemed to be fairly dependent on shell collecting. Most people are squatters, and the few barren acres of the island are government land, unfit for any kind of agricultural activity. The surrounding reefs however are extremely rich in fish; some collectors are part-time, some full-time and proceeds seemed to be shared between the families. Collecting in Siquijor was carried out in a similar way; one part-time collector mentioned that he had a government job. It was said that in this area more people had become dependent on shell collecting because the fish in the area had become less abundant; they could give no reason for this but it transpired that moro-ami fishing methods (see introduction) had been used there.

### Shellcraft

Shellcraft production has risen dramatically over the last decade, a trend which is reflected in the value of US imports from the Philippines. These rose from less than US\$1,000,000 in the 1960s to nearly US\$9,000,000 in 1976 (Wells, 1981a). The main centres of the trade are Manila and Cebu, but small businesses are found in villages and towns throughout the country, especially on the coast and smaller islands. Most of the shell dealers visited in June 1981 carry on some form of shellcraft trade as a sideline to their business in ornamental shells, and for some dealers it provides most of their income. The larger firms such as Filtrade, Paulton's, Alcon Industries, Luvisiminda and the Cebu Shell House have their own factories.

The industry is being encouraged throughout the Philippines by the Natural Resources Management Council (NRMC) and the Ministry of Human Settlements since shellcraft provides employment for large numbers of people who can work from their homes on a cottage industry basis. The extent to which women and children are involved is striking. In many cases women actually run the businesses since it is usual for wives to have jobs (most Filipino homes above a certain income have servants). Women and children are responsible for most of the skilled manual labour involved. Children as young as 5 or 6 years old were seen carrying out simple jobs such as threading shells; older children and women dealt with the more complex jobs or handled machinery.

Much of the shellcraft produced is low quality, destined for tourist resorts and souvenir shops in other countries rather than luxury stores. Handbags decorated with cowries (largely C. annulus), mats, animal figurines, lampshades and jewellery are among the main stock items. Smaller firms may specialise; Velez Enterprises dealt mainly in jewellery; Bernhells which had only been operating for three months was planning to supply goods to other exporters rather than export directly themselves. Marcellina Worldwide is a cottage-style industry in the suburbs of Cebu, where trinkets are made and semi-finished articles bought-up to be finished off. This firm had recently been part of another firm but had become independent presumably because of its success. There was evidence of large numbers of people turning their hand to the shellcraft industry as a result of the increase in demand.

In Zamboanga the shellcraft industry is not doing as well as in Cebu and Manila since firms are badly hampered by regular power cuts resulting in loss of power for the machinery used for cutting and polishing shells. The local people hope that the new hydroelectric power scheme which is under construction will restore the industry within the next few years. Rocan, San Luis and the Zamboanga Curio Shop all have the facilities for producing their own shellcraft but when I visited them no machines were in operation. As a result of the difficulty of ensuring regular work Profeta Marine Trading had lost many of their workers. Workers were usually paid on a piecework rate.

Bolinao in Pangasinan, northern Luzon, is a typical example of a small town where shellcraft is an important source of employment for many people. I visited two barrios there (one in Bolinao and one on the island of Dewey, near Santiago I.) both of which depend almost entirely on shellcraft. The shells are collected along the coast, around Santiago I. and the many other small islands which dot the coast in this area, by pushing a net stretched across a triangular-shaped frame through the upper layer of sand and sea grass in shallow water, generally at low tide or at night. Collectors anchor a small raft on which they place a basket for their collection and which can be towed back to the village.

Although the men generally do the collecting, women and children may also be involved collecting specimens from shallow water and rock pools. Two girls came into one of the shellcraft firms in Bolinao with a large bag for sale of tiny dove shells, small cowries and larger tiger cowries which they had collected from the beach and pools. The shells are separated out from the sand and mud and from other benthic organisms. Although some species are eaten most of those used in shellcraft are too small to make it worth while picking out the meat and so the baskets are left in the sun for 3-5 days for the meat to rot. The shells are then washed and sorted. Cowries and dove shells may be briefly cooked, turning them pale shades of yellow or cream, and some may be put in chlorox to bleach them completely. In Bolinao the shell collectors take shells directly to the managers of the various small businesses or bring them into the Saturday market. Small species are sold to shellcraft businesses by the can, for about 8-12P (US\$1.0-1.5). *C. caputserpentis* are sold for about 10c each or 5c when they are found in large numbers during the rainy season. Although most of the shells used at Bolinao are obtained locally, Anido's had clam shells which were reported to have been sent from Manila.

Most of the species used for shellcraft are small and occur in shallow water in rock pools and sea grass beds either just below the surface of the sand or on the vegetation. The commonest species used include small cowries, dove shells, olives, small cockles and winkles. The following species were being used in Bolinao and are probably representative of those used throughout the country:

Cypraea annulus  
C. moneta  
C. erronea  
C. caputserpentis  
C. helvola  
C. caurica  
Pyrene scripta  
Bulla vernicosa  
Vexillum plicarium  
Oliva carneola  
Strombus urceus  
Nassarius albescens



At Mactan, C. annulus, including many juveniles, are reportedly taken by the million for shellcraft (Zambo and Lopez, 1976). Large numbers of tiger cowries are used to make ornaments such as animal figurines. Broken and sub-quality shells are also used; for example broken conch shell may be used to provide pink colours for jewellery. Other colours are obtained by dyeing clam shell, using the nacreous interiors of the shells to give a glossy surface. Jewellery made from pieces of broken inlaid shell of different types is currently very popular. Other materials are also used in shellcraft. Capiz shell is treated separately in this report; black and other coloured corals are used in jewellery or as a base for ornaments; and the spines of the slate pencil urchin, Heterocentrotus mammillatus are used in huge quantities for wind-chimes and as parts of trinkets. This echinoderm is found throughout the Indo-Pacific and in the past the spines were used for writing on slates. No information seemed to be available on where these were collected or on their abundance. Most shellcraft manufacturers obtained shells from the same sources as ornamental shells.

Three firms were visited in Bolinao. Sylvia's Shellcraft had a shop in the main square where wind chimes, pot hangers and ornaments were sold to tourists and displayed to potential wholesale buyers. It was run by a comparatively young girl and had been in operation since 1967, registered as a NACIDA cottage industry. She had 8 workers and also produced some of the shellcraft herself, as well as buying the shells, either on visits to Dewey Island or at the market. Bolinao Shellcraft on the wharf did not produce their own stock but sold articles made by other people to dealers in Manila. Anido's Shellcraft was a cottage industry run by a woman from her home. She was unclear as to how many workers she had since they all worked from home; two girls who said that they worked for her were encountered sitting in the market place sticking shells on ornaments and packing them. The workers are supplied with shells and are paid piecework. The business had been running since 1976 and was proving to be profitable.

Many of the workers lived in the fishing barrio just outside the main centre of Bolinao. No one seemed to be aware of quite how much was produced but the barrio was clearly given over to the production of shellcraft, with shells littering the ground and women sitting on the verandahs engaged in threading shells etc. Between 15 and 30 shell-covered purses can be made by one woman a day; about 10 years ago when the industry first started they could get about P6 (US\$1.0) for such a purse but with increasing competition payment had dropped to P2.50 (US\$0.30).

On Dewey Island there were three family enterprises, each of which contracted work out to other villagers and supplied them with shells and other raw materials such as thread and frames which were obtained from Manila. One enterprise estimated they had about 50 workers, mainly women and children. Villages such as Dewey have been visited by staff from the BFAR who have explained to the local people how to set up and run a business, and the types of articles and designs required, in order to encourage the expansion of the cottage industry scheme. On Dewey about 24 different articles were being produced, the villagers themselves often altering or improving the designs. Finished articles are taken into Bolinao or the buyers may themselves visit the barrios to buy up stock and put in orders. Most of the Bolinao shellcraft goes to Manila for distribution and export.

### Capiz Shell

Few people can have failed to have noticed the recent influx into gift shops and department stores in Europe and America of lamp-shades, wind-chimes, boxes, trays and other items made of capiz shell (known in the Philippines as kapis) or the window-pane oyster, Placuna placenta. Of the five species in the genus Placuna, three occur in the Philippines: P. placenta, P. sella, and P. papyracea the

former of which is considered most valuable commercially. It occurs throughout the Indo-Pacific, from the Gulf of Aden, around India and the Malay Peninsula to the southern coast of China and the Philippines. Only the Philippines has really taken advantage of its commercial potential, although in 1975 a capiz shell fishery was reported in India off the coast of Bombay (Durve, 1975).

Placuna placenta has paper-thin, almost translucent valves measuring 12-17 cm in diameter and becoming increasingly opaque as the animal matures. Shells used commercially are usually medium-sized ones which are strong enough to be handled and cut but which have not lost their translucency. They are generally found in areas characterised by mud and sand, often in estuaries or areas associated with mangroves, but never on coralline coasts. They can survive salinities down to 20 ppt. and are frequently found in association with the scallop Amusium pleuronectes. Their normal depth range is 4-20 m but they may also be found intertidally or in deeper places. Characteristically they are found in large colonies of over 1,000 individuals, lying unattached on their valves on the sea bottom, usually covered with a very fine layer of silt or mud. Generally several colonies are found in the same area forming large beds (Magsuci et al., 1980).

The Chinese were probably the first to take advantage of the particular qualities of capiz shells, using them in place of glass in windows in their houses. Subsequently they became a characteristic of Philippine houses, the finely latticed windows filled with pieces of capiz shell about 5 cm square. It was not until the end of the First World War that their potential for the shellcraft industry was realised. An American, Harry Rosenburg, set up the first factory, producing lampshades and by 1927 capiz had become a major export commodity. Manufactured articles were exported to Europe, China, the US, Hong Kong and the British and Dutch Indies. Raw shells were sent in smaller quantities to the US and Hong Kong (Talavera and Faustino, 1931).

In the 1970s demand for capiz shell increased dramatically in association with the sudden revival of interest in shellcraft and products of natural materials for home decoration. The Filipinos were quick to take advantage of this situation. Exports of unworked capiz shell dropped at the beginning of the 1970s, from 80 tonnes in 1970 to a little over a tonne in 1972, most of which went to Hong Kong. In contrast the export of worked capiz shell had been escalating rapidly. Exports of capiz shell articles in the early 1950s were as follows: 1,516 pieces in 1951, 445 in 1952, 2,123 in 1953 and 2,000 in 1954; in 1976 just over a million articles were exported and in 1979 nearly three and a half million valued at over US \$2 million dollars. The quantities involved can be seen from the fact that between 1977 and 1978, 42,555,379,410 shells were gathered in Capiz province alone at an estimated value of 850,000,000 pesos (US \$ 121,000,000) (Magsuci et al., 1980). Production between 1976 and 1979 in the Philippines was as follows (Anon 1979):

1976	81 tonnes
1977	1,635 tonnes
1978	581 tonnes
1979	221 tonnes

Capiz shell is now a major export commodity although the number of firms which have sprung up has caused stiff competition and individual firms are in some instances finding that business is slackening.

Capiz shells are common in suitable habitat in most parts of the Philippines but are most abundant in particular areas and the fisheries are concentrated there. The Western Visayas are currently the most important areas; fisheries exist in Negros Occidental, Negros Oriental, northern Capiz (a province named in Spanish times after the shell which was washed up so abundantly on its beaches), Misamis

Oriental, Batan in Aklan province, Iloilo and further south in the Sulu Sea (Magsuci et al., 1980 and Table 7).

New areas are constantly being discovered in the coves and bays around Panay Island (Magsuci et al., 1980) although in 1981 the most abundant sources still seemed to be in Negros Occidental rather than Panay. In June 1981 capiz were being harvested off Oton but it was said that the season there would be very short as there were few shells. Different areas apparently produce shells of different quality; fishermen on Guimaras said that highest quality shells are to be found off Guimaras and Oton, (Iloilo) whereas shells from Roxas (Capiz province) have a brownish tinge.

Collecting generally takes place in the summer between February and May before the south-west monsoon sets-in and it becomes impractical to take the boats out and the water becomes turbid so that diving is difficult. In 1979 the peak of collecting seems to have been from February to May (Table 8). During the rest of the year those collectors for whom the capiz business is only a part-time job go back to their normal occupations, usually fishing or farming, while those who are dependent on it and the women and children continue with the lengthy process of cleaning, counting and packing.

During the season whole barrios become involved with the capiz harvest and may produce up to 200 tonnes or 640,000 pairs of shells a day. The shells must be gathered while the animals are alive or they lose their translucency. The processing factories and firms may have their own boats and divers; for example a factory visited in Oton owned 5 motorboats, each with three divers, who lived with their families in the factory grounds, and a shellcraft firm in Iloilo City pays eight divers, and maintains them, their boats and families. Divers come from far afield on hearing of an abundant harvest and a single barrio may end up with as many as 160 divers. Some villagers may become businessmen during the season and invest in hired bancas and divers. Divers usually go out several at a time, some to dive and some to man the boat at the surface. In shallow waters they collect by skin-diving, using wooden-framed goggles which they prefer to modern snorkelling equipment. In some areas shells are found in water shallow enough for wading; after powerful storms capiz shells may appear by the million in shallow areas. In deeper waters, down to about 8m, a compressor is used to provide air, a method which can be dangerous. 7 divers were reported to have lost their lives during the 1980 harvest at one of the barrios on Guimaras. The shells are groped for in the mud with hands and feet and are collected in bamboo baskets or nets. Divers may spend twelve hours a day under water, diving up to eight times. Usually in one day a single collector can gather two baskets full, containing approximately 6,000 pieces, for which they earn about 40 pesos (\$5). In the 1970s divers were earning up to 2,000 pesos (nearly US \$300) a month, considerably more than the average office worker (Ignacio, 1980; Magsuci et al., 1980).

I visited a barrio on Guimaras (Iloilo) island in June 1981, where the remains of the 1980 crop (collected between December 1979 and April 1980) were still being processed after the first year of commercial collection. The beds had been found by a commercial trawler from Negros and the crew had brought up about 5 boxes worth in their fishing nets and alerted the divers. 100 bancas had been in use at the village with people coming from Negros, Iloilo, Cebu and local villages as divers and processors. It was reported that the beds had been virtually fished out although according to the divers some small shells had been left. Some of the local people did not expect the fishery to recover for another ten years; others hoped for a second season within the year.

Divers usually sell the shells to the local people for cleaning and processing. If the meat is not used, the shells are left in the sun to dry out and the meat is

removed by shuckers either manually or using revolving drums. Although poorly paid for their work (0.2 pesos a basket) they sometimes receive the meat in part payment. They sell it to local people who consider it a delicacy and it is also used for feeding shrimps. It is said to have a much higher protein content than either mussels or oysters but much of it goes to waste since the shells are collected in such large numbers. On Guimaras island one barrio had had such a vast harvest in 1980 that the village dogs had become ill and died from eating rotting meat and the stench had been almost unbearable. (Rotting meat makes rich fertiliser however and it was said that the coconut crop had been particularly good).

Processing of the shells starts by soaking the valves in freshwater prior to treating them with acid (probably hydrochloric) to remove marks and the adductor muscle scar. The lustre may be brought up by brushing or scraping the shells with a piece of metal. Workers are able to clean about 2,000 shells a day. Having been dried, they are graded by size and quality and packed into large bamboo baskets containing 10,000 - 25,000 pieces which are sent away, or collected by buyers who come from the big towns. In some villages as on Guimaras the shells are cut to standard sizes before being sent away; a manual puncher is used for circular shapes or they may be cut into squares using large clippers. Prices of processed capiz vary according to quality and demand for the shell. Capiz from Iloilo and Negros fetch a higher price (20-25 pesos/1,000 pieces) than those from Capiz (7+ pesos/1,000 pieces). In some villages such as on Guimaras, shells are intentionally kept back in order to fetch better prices out of season when demand is higher.

A small proportion is still used for windows but the vast majority now go to making shellcraft articles, including lampshades, screens, trays, bowls, and also for making pearl essence for pearl beads. To make items such as bowls, the shells are soaked in hydrogen peroxide to soften them and are then moulded into the required shapes; usually two layers are pressed together, exterior to exterior so that both sides of the item show off the smooth glossy interior of the shells. Before they are soaked in hydrogen peroxide, the shells are also sometimes smoked over charcoal which turns them a delicate golden-brown through a reaction in the conchiolin of the shell. After the moulds have dried, a layer of fibre-glass is applied for strengthening and as protection, and the article is then polished. Most of the finished products are exported, but with the expanding tourist trade large numbers of articles also find their way into souvenir shops.

The largest factories are in Manila and Cebu but small factories have been set up near the fishing grounds to produce semi-finished goods. A factory in Oton, (Shellwood Industries), was visited which had been in the export business since 1969 and in 1972 had opened a larger branch in Manila; 2,000 workers were employed full-time. The Iloilo Shellcraft shop in Iloilo City also had their own factory as well as contracting work to another shellcraft firm. Capiz craft made up the bulk of their business although a little shellcraft was produced using other shells; competition with the Cebu firms was too great, however, to make the latter entirely economic. Designs for the capiz articles were produced by the daughter of the proprietor and included boxes (traditionally used as gifts for guests at weddings), wind-chimes, moulded plates and bowls and lampshades. Some were sold in the retail shop in Iloilo and large quantities were exported, 90% to the US, and smaller quantities to Canada, Australia, Japan and Europe.

#### Mother-of-pearl

The Philippines has been an important supplier of mother-of-pearl or 'commercial shell' since early this century (Talavera and Faustino, 1931). It is currently one of the top three exporters of gold-lip and black-lip pearl shell (Pinctada margaritifera and P. maxima) and trochus or top shell (Trochus niloticus), with Indonesia and Australia. In 1978 466,932 kg of unworked pearl shell were

exported, mainly to Japan and South Korea. Exports of trochus are destined mainly for Japan and Italy and have declined in recent years, from over 300 tonnes a year in the early 1970s to just over 120 tonnes a year in 1977 and 1978. Figures obtained from the BFAR show that in 1979 over 190 tonnes of pearl shell were collected and nearly 30 tonnes of trochus. Although foreign trade statistics do not list exports of a fourth commercially valuable species, green snail Turbo marmoratus, BFAR records the collection of over 32 tonnes in 1979 (Table 9).

Many of the dealers visited for the purpose of looking at the ornamental shell trade also dealt in commercial shells. Most pearl shell and trochus is collected in the south of the country around Zamboanga, whereas (at least in 1979) green snail comes from the Capiz area (Table 10). 1980 export figures for commercial shell from Zamboanga are given in Table 11.

In Cebu, Paulton Enterprises, Orcullo Enterprises and Luvisiminda all dealt in commercial shells. At Luvisiminda buttons and button blanks are made for export to Japan. The manager at Orcullo Enterprises obtained green snail from Palawan but said that it was now scarce and fetched 72P (US\$10) a kilo. In Zamboanga most of the dealers dealt in commercial shells particularly Profeta Marine Trading (trochus, green snail, black- and gold-lip pearl shell) and San Luis. The latter obtained trochus from Palawan for button blanks which were made on the premises and exported to Korea, Japan and Taiwan for finishing; unworked trochus was also exported for use in jewellery. 10% of the waste was bought locally and used in poultry food but the rest was exported to Taiwan at 15c/kg where it was turned into shellcraft and sold at about US\$ 1/kg. Green snail and abalone were also exported by this dealer. The proprietor of the firm complained about the fact that the Philippines were effectively being exploited by the importing countries who had the capital and facilities available for turning out mother-of-pearl craft. In Zamboanga in particular the lack of power and skilled labour meant that very little shellcraft could be produced, as explained earlier.

## Marine Parks

There is considerable confusion in the literature at the moment as to the number of existing marine parks and reserves in the Philippines and their status. Many of those quoted are in fact not recognised as marine parks in the sense in which IUCN defines them, and no mechanism exists within the national government to manage many of the areas. They have never been placed within the system of National Parks within Parks and Wildlife (Bureau of Forest Development, Ministry of Natural Resources) as no guidelines have been formulated or jurisdiction provided over marine areas (White, 1981).

The earliest marine park legislation passed in the Philippines was for Hundred Islands in Pangasinan, which were designated a National Park by Proclamation 667 in 1940. This legislation has never been enforced and no facilities have been created for its implementation. The area is a popular tourist resort and has many fine beaches but the coral reefs are now in very poor condition and the underwater portion of the Park has no legal protection in any case. Legislation was passed for Manila Bay Beach Resort National Park, Luzon in 1954, but this area is now used for a variety of purposes e.g. tourism, many of which are inconsistent with a National Park. Legislation also exists for Agoon-Damortis Shore and Territorial Waters, Luzon (1962)(White, 1981).

In 1970 the following marine sanctuaries were declared by President Marcos with the approval of WWF and are listed by Bjorklund (1974):

Cagayan I. (Sulu Sea)  
Camiguin I. (Misamis Oriental)  
Guinan Peninsula (E. Samar)  
Malampaya Sound (Palawan)  
Nasugbu (Batangas)  
Banguil Bay (Mindanao-Misamis Occidental)  
Polillo Is. (Quezon)  
Turtle Is. (Tawi-Tawi)

These areas have never been managed, except for Turtle Islands which have self-imposed guidelines for protecting a few of the turtle egg-laying sites(White, 1981).

The following were declared between 1970 and 1974 by presidential decree:

Southern Luzon Marine Biological Station  
Macajalar Marine Biological Station  
Puerto Galera Marine Biological Station and Reserve  
Matabungkay Bay, Luzon

The Biological Stations are primarily used for collecting marine organisms, an activity again not consistent with the purpose of a marine reserve, and the reefs at both Matabungkay Bay and Puerto Galera have been spoilt, very little coral remaining at the former (White, 1981). In 1973, Puerto Galera in Oriental Mindoro was designated a Man and Biosphere (MAB) Reserve, but no efforts have been made by MAB towards implementing the management plan which was drawn up (see below).

In 1978 the Philippine Tourism Authority (PTA) was responsible for the issue of Proclamation 1801 which listed a number of tourist zones or marine reserves to be under the administration and control of the PTA. These included 53 small islands, 5 coves, 3 peninsulas and 4 prominent stretches of beach. These zones were

proclaimed for their scenic and park potentials as wildlife sanctuaries and nature reserves although no criteria were provided for these two categories. Although the development of "superstructures" was not allowed, tourism was to remain the principal activity. Subsequent circulars described the general regulations governing activities within these areas e.g. industrial and commercial developments had to abide by the conditions of any environmental impact statement; tourism-oriented activities had to fulfill certain conditions; logging licences were to be revoked and swamps and marshes preserved for wildlife. Although it is stated that violators of these regulations would be subject to imprisonment or fines there has as yet been no enforcement. The list unfortunately was drawn up without the consultation of the Marine Parks Task Force which is trying to identify potential reserve sites through survey work. As pointed out by Gomez (White, 1979), the Proclamation has considerable flaws: its definition of a marine reserve being very vague and the area coverage of each site so broad that in one case the coastline of an entire province is included. Furthermore there is a major contradiction in the use of the same areas as wildlife areas and tourist resorts (National Environment Protection Council, 1980).

The development of marine parks in the Philippines is the official responsibility of the Marine Parks Task Force in the Natural Resources Management Centre (Ministry of Natural Resources). NRMC has drawn up a list of candidate sites for marine parks and reserves which include many of those listed above. These were ranked according to 8 major criteria:- 1) representativeness or uniqueness 2) habitat and species diversity 3) natural character 4) criticalness 5) accessibility 6) feasibility of development 7) educational and recreational potential 8) national and international significance. A number have been or are now being surveyed by either the Marine Parks and Reserves Development Programme (MPRDP) or the BFAR Coral Reef Team. From these, four pilot sites for development as marine parks have been selected: Sumilon Marine Park, Apo Reef, Sombrero I., and Panglao-Balicasag.

Sumilon Marine Park and Research Area at the southeastern tip of Cebu, is currently the only fully functional marine reserve in the Philippines. The island of 23 ha and its fringing reefs was set up as a reserve in 1974 by Silliman University in Dumaguete with the co-operation of the municipal government of Oslob, Cebu, which owns the island. A strictly protected area fronting the 750m shoreline on the western side of the island has been designated a marine life sanctuary where no fishing or collecting activities are allowed. Fishing using traditional methods is allowed in the remaining waters surrounding the island. The University has built a small field station and two rest houses and maintains a caretaker to monitor fishing and other activities and to patrol the sanctuary area. The Asia Foundation provided the initial financial support, which was continued by the United Board for Christian Higher Education and contributions from visitors to the island. Tourists regularly visit the island for snorkelling and SCUBA diving and several research projects have been carried out or are underway.

Monitoring of the fishery catch by local fishermen has shown increased yields over the past few years, suggesting that the setting aside of part of the reef as a marine sanctuary has indeed been beneficial. Furthermore, for snorkellers and SCUBA divers the fish have been found to be much more approachable within the sanctuary than outside it. The island and its surrounding waters were declared a National Fish Sanctuary in December 1980 in an attempt to improve protection of the sanctuary; the new mayor of Oslob is not sympathetic to the local conservation efforts. However, Sumilon is a good example of the fact that although national agencies may be well equipped to formulate policies, they tend to be ineffective in implementing operational programmes at the local level, a job which local institutions tend to be better at; hence the effectiveness of Sumilon compared with the nationally designated parks (White, 1979; White, 1981).

Apo Reef Marine Park (proposed as a national park in the new system for parks drawn up by the Department of Natural Resources in 1976 and created a tourist zone in 1978) is now a BFAR Coral Reef Research Project, the BFAR having been asked to implement management plans for the area in 1979. It is an extensive reef area lying 20 miles west of Mindoro and is rich in birds, turtles, fish, corals and other invertebrates. Diving is permitted but coral gathering is prohibited; fishing and collection of other marine organisms is prohibited in the core zone and movement within the turtle and bird sanctuaries is regulated during the breeding season. Legislation for marine park status is nearing completion.

Sombrero I., a small island near Anilao, Batangas, is currently being surveyed under the Marine Parks Programme of NRMCM and has been under consideration for marine park status since 1978; legislation is nearing completion. It provides good snorkelling and diving for underwater enthusiasts who visit from Manila. No information is available for the fourth pilot site, an area to the south of Bohol. Balicasag island has a squatters village of fishermen, who fish and collect shells from the surrounding coral reefs (see section on rare shells).

Palawan is perhaps another area which should be considered for the creation of marine reserves since it is still relatively unspoilt and by all accounts is one area where many overcollected species of molluscs are still abundant. A major study of the island is currently underway (Bruce, 1981).

#### Puerto Galera

Puerto Galera is situated on the north-western side of Oriental Mindoro, about two hours by road and ferry from Manila. In spite of its proximity to the capital, the island of Mindoro is relatively underdeveloped and still has fairly large areas of undisturbed forest (although much of its monsoon forest has been largely degraded to savannah), and very little in the way of industrial or commercial development. It is the home of the Iraya Mangyana, indigenous people who still use traditional skills and customs. The tamaraw, a dwarf buffalo is endemic to the south of the island, and there are several other endemic animals including birds (e.g. the Mindoro Imperial Pigeon Ducula mindorensis and the Mindoro Flowerpecker Dicaeum retrocinctum), fish and land snails (e.g. Chrysallis mindorensis). Mindoro is one of the main collecting areas for land snails for the ornamental shell trade. The coastal area of Puerto Galera is rich in coral reefs and marine life of important scientific value which led, in 1933, to the founding of the University of the Philippines Marine Biological Station there. Since then it has been an important research site, largely due to its diversity and accessibility and it is the type locality for a number of species, particularly corals.

Considerable changes have taken place since the 1930s, when there was no regular ferry service, the area was heavily forested, the beaches uninhabited, and there were only 27 houses in the town. By the 1950s the area behind the town was denuded of trees and illegal fishing was depleting the marine resources. Between 1960 and 1970 the population almost doubled and is currently about 13,000. Logging and marble mining are causing pollution and siltation, sand is removed from the beaches for glass factories in Manila and oil effluents reach the beaches from the refinery in Batangas. Coral has been used as a filling material in place of sand and gravel to protect the beaches from erosion, and at one time corals were being collected for the ornament trade.

Since about 1977 the area has been attracting a steadily increasing stream of tourists, initially mainly back-packers but increasingly wealthier holiday-makers and day-trippers or weekenders from Manila. Low budget beach cottages are appearing along beaches once of prime importance for research; new development plans include a marina and the current situation has been described as comparable



to that in Bali, Indonesia. Puerto Galera still features in holiday guides as an unspoilt paradise. The local people initially welcomed tourism as growth in the population had made it difficult to make a living. In 1975 the University of Philippines approved a project to carry out an inter-disciplinary study for the rational development of Puerto Galera, at the same time preserving the region's ecological balance. Their findings showed that the natural resources were indeed inadequate for the present human population (Mendoza, 1981, Anon, 1979).

A National Park and two game reserves were created in 1970 for the endemic tamaraw. On December 26th 1973 under Presidential Decree 354, Puerto Galera was declared a reservation under the Man and the Biosphere programme of UNESCO for the purposes of research and instruction. The reserve comprises 23,525 ha and consists of a core area of unmodified natural upland forest as well as areas of brushland, coconut plantations and other cultivated land. It includes the Mt. Malsimbo rain forest which has a wide diversity of plants as well as a number of endemic birds and terrestrial molluscs, and a variety of mammals, snakes and insects (Anon, undated).

Research and educational facilities were to be created at the site in the form of an outdoor Museum, and in May 1979 the MAB Programme of the Philippines authorised the establishment of an interpretative centre. Detailed plans for this have been drawn up to include a coral reef aquarium, a medicinal plant garden, a butterfly garden, a shell collection, provisions for researchers and a sales shop (Berdach, 1979). A building is available, as well as geological and biological specimens and a vehicle was scheduled to be made available for carrying personnel and visitors between sites in the reserve and the centre. However, since 1976 the MAB project itself has been virtually inactive. It is understood that funding has been obtained, but no money has become available for the implementation of the plans. There is currently much public concern, with articles in newspapers and magazines drawing attention to the problem. However no authority will take action, preferring to lay responsibility on the MAB programme in spite of the fact that this appears to be inactive.

In 1978 Proclamation 1801 shifted its status into that of tourist zone, tourism thereby taking priority over conservation. However, most tourists come for the marine life and unspoilt nature of the surroundings which are fast disappearing. Development of the area for tourism is going ahead rapidly. Although the University of the Philippines recommended moving the wharf from Puerto Galera itself to Baletero Bay (which is not of scientific value) to decrease pollution of the main Bay, this has been overruled. The harbour area is being expanded with shops and new buildings; and restaurants and hotels are increasing in number, particularly along the beaches. University of the Philippines' students now go elsewhere for their marine biology courses. In July 1981 the BFAR directed the local authorities to take action and the Municipal Board has approved an ordinance banning the collection of corals and marine life.

The role of MAB in the development of Puerto Galera as a reserve needs to be clarified immediately and action should be taken to ensure that future development of the tourist industry does not take place at the expense of the natural resources of the island.

## Conclusion

It is clear that marine resources are of immense importance to the Philippines, but also that there are manifold problems associated with their management. Philippine marine biologists and conservationists are currently working extremely hard to find solutions to some of the problems highlighted by this report and it is to be hoped that the international conservation movement will support them.

The greatest threat is almost certainly to the future survival of coral reefs, although the extent to which coral exploitation causes damage is controversial. There is evidence that coral communities are resilient to certain forms of damage, and commercially important corals have distributions extending well below the depth of ordinary coral collection which would serve as reproductive reservoirs for shallow-water recruitment. A comparative study has shown that in total live coral coverage, cover composition and number of genera recorded, a collected reef can be very similar to an area untouched by commercial coral collectors (Ross, 1982). Furthermore the commercially important species tend to be fast-growing corals with growth rates greater than a 3cm increase in diameter a year.

However, the reef of Punta Inganio is no longer considered commercially viable and in the study referred to above, most commercial species showed reduced colony density in the collected reef and the genus Seriatopora had disappeared altogether. The population structure may also be considerably altered. 71.8 per cent of the Pocillopora verrucosa population was immature on the collected reef compared with only 50.8 per cent on the other reef (Ross, 1982). Although several studies are currently underway to investigate growth rate and regenerative capacity of corals with a view to drawing-up management plans for this resource, there is still much research to be done. Some species may grow fairly fast, but there are indications that some are so slow-growing that any form of harvesting would be unwise. One study on Pocillopora has shown that it takes 4 years for a piece to grow to 11 cm. in diameter although a species of Acropora in Florida was observed to grow at 10 cm. a year (Shinn, 1975) and a study in the Philippines on Acropora pulchra showed a growth rate of 18.1 cm. a year (Yap and Gomez, 1981).

Eventually it might be possible to regulate trade using quotas, size limits, zoned areas for collection and a licensing system for collectors. In the long-term it might prove to be possible to farm coral by planting out small fragments but research in this direction is only just beginning. Coral gatherers and exporters are naturally anxious to revive the ornamental coral trade but until such time as sustainable yields can be calculated or some other form of management introduced, the total ban that already exists seems to be the only feasible way of preventing excessive damage to the reefs.

For such a ban to be effective, however, considerably more effort needs to be put into its enforcement than is currently the case. Firstly, importing countries and specifically the U.S. and European consumers, must contribute by prohibiting imports of Philippine corals. Corals have been added to the US Lacey Act which means that import into the US of corals illegally obtained in their country of origin is prohibited. This should have a major effect on the trade since most of the demand is in the U.S. No attempt has been made by any European country to control coral imports but the Philippines, having now ratified CITES, has the option of adding corals at least to Appendix III. Public awareness campaigns to deter people from buying ornamental corals should be set up in importing countries. Secondly, further efforts must be made within the Philippines to improve enforcement and inform the local people of the importance of their coral resources. Since many people clearly are dependent, at least for part of their

income, on the trade, alternative employment must be considered, such as mariculture.

It is clear that exploitation of and trade in shells play an important role in the current economy of the Philippines, in terms of the employment provided and the income generated from exports. Several people, however, fear that current levels of exploitation will not be sustained unless some form of management is introduced. The Curator of Molluscs at the National Museum expressed considerable fears as to the future of the shell trade, and believes it could end in 20 years if controls are not introduced. At least two of the dealers spoken to (Jose Co., Zamboanga Shellers and E. Zambo, Cebu) believe that the shell trade will need to be regulated. The manager of Carfell Shell Shop and Museum in Manila thought that some species had been overcollected. Within the constraints imposed by the competitiveness of the business, they try to point the problems out to their customers through occasional conservation-orientated articles in their magazine. The museum above the shop, as well as attracting potential customers, is also educational and informative.

Fortunately the importance of the shell trade has been appreciated by several organisations. The University of the Philippines is carrying out a market study of the shell trade for the Government, which will describe the structure of the industry, determine the demand for shells, pricing patterns and how these are influenced, evaluate foreign and domestic markets and make recommendations for its future management in the light of resource conservation and foreign exchange generation. A catalogue or inventory will identify the species in greatest demand and distinguish those in danger of stock depletion. 400 questionnaires have been sent out and dealers interviewed in the 3 major shell trade cities- Cebu, Zamboanga and Manila. The questionnaire will reveal details of species sold, quantities and other information on the trade in so far as the dealers are prepared to provide it.

The difficulty lies in proposing management procedures that can be enforced and that will also be effective, since so little research has been carried out on the effect of exploitation on these species. Some of the dealers, such as the Carfell Shell Shop, tell their collectors not to take juveniles but this is very difficult to enforce, particularly as collectors are unwilling to leave a shell if there is a possibility of it being found by someone else. Quotas and closed seasons would be equally difficult to enforce and more research on mollusc reproductive biology and the levels of harvest that could be supported is needed before such strategies could be implemented. Sanctuaries could be a more efficient way of preserving breeding stocks, although information on how larvae are carried is needed so that reserves could be positioned in areas with suitable currents. On Sumilon island for example where clams are taken for food, H. hippopus has disappeared from the non-protected side but is still to be found in the Sanctuary. Attention should also be paid to the deep-sea species since they are currently in such demand. Almost nothing is known of their distribution and abundance and it is conceivable that populations are small. For example, in an informal survey of collecting patterns for the rare cowrie Cypraea guttata in the Cebu area, it was found that fishermen had to move continually northwards along the coast as their usual collecting spots ceased to yield shells (Berdach, in press). Of Mactan the rare shell Murex elongatus was said to have been depleted through over collection (Zambo and Lopez, 1976). One factor in favour of rare shell populations at present is the inefficient fishing method used, but if this were to change much greater numbers might be caught. The Director of the Marine Laboratory at Silliman University expressed interest in setting up a project on rare shells, to look at the methods used by fishermen in different areas, monitor the species caught and carry out a survey in some of the known collecting areas using a better method in order to determine population size and distribution.

There is less concern over the shellcraft industry at present, but although stocks seem adequate now, thought should be given to the future survival of the trade. No studies have been carried out on the effect of shell collecting on most of the species involved in the shellcraft industry. It has been suggested that the huge exploitation of Cypraea annulus at Mactan for this purpose could cause local extinction of this species (Zambo and Lopez, 1976). At Bolinao collectors mentioned that now there were so many people involved they were having to move further along the coast to find the necessary shells. Large quantities of shells go to waste which seems unnecessary considering the fact that the shellcraft industry can make use of broken and scrap shells. At Bolinao the local Museum was attempting to instil a strong feeling for conservation into the local community, largely as a result of the efforts of a US Peace Corps Worker. The Curator of the Museum was continuing this work; a science club had been set up and slide shows had been given with speakers coming from Manila. Attempts had been made to explain to shell collectors that the present rate of exploitation and the methods used could well be damaging to the long term survival of the shellcraft industry. There is concern that the large nets may be destroying the sea grass beds and their associated benthic life, but unfortunately no action has been taken to remedy this. The NRMC and the Ministry of Human Settlements are producing an inventory of local handicrafts produced in the Philippines in line with encouraging cottage industries. In theory they should be interested in ensuring a sustainable yield of the species involved.

The capiz shell industry is unlikely to present any threat to the future survival of Placuna placenta and current supply seems to be meeting demand. The industry provides employment for large numbers of people; for example the shells collected at Oton in 1978 kept the people of two towns busy, cleaning and processing them until 1981, and in a number of towns workers displaced from the sugar industry have been employed. However, it would be preferable if the fishery were managed on a regulated basis since depletion of local populations tends to result in workers having to move in search of new grounds each year.

In a number of areas where capiz shells are collected, such as Negros Occidental, a few places in Iloilo (Oton, Migao, Tigbauan and Guimbal) and some parts of Capiz there seems to be a fairly regular peak of abundance every 3-4 years. Talking to local people in the Iloilo area revealed considerable confusion, however, as to how often the shells were collected commercially. The population dynamics of this species is still far from being understood and it may be that 'resurgent' populations are a natural characteristic. However, there is also evidence that fluctuations are caused by overfishing, since in places where exploitation is not as extreme, e.g. La Paz, (Iloilo), the shells can be collected every year; and in Oton the factory manager said that collection took place every year. The distribution of capiz in easily exploited beds tends to result in their being collected to the last shell which probably causes the loss of the fishery the following year. In an extreme case, at Tinagong Dagat, Capiz Province, the fishery was lost for twenty years (Magsuci et al., 1980). At the time of harvest capiz shells are generally spawning, and efforts have been made to encourage collectors to wait until this has definitely finished. However it is generally believed that the animal dies immediately after spawning and collectors are reluctant to wait since the shells lose their transparency when the animal is dead. Laboratory experiments have shown, however, that capiz do not die straight away. If dead shells are found in the beds this is more likely to be due to the overcrowding (A. Young, in litt., 5th Feb., 1982).

There are currently no controls on the sizes which can be taken and although only those shells with a diameter of 8-13 cm are commercially valuable, collection tends to be indiscriminate, and shells which are not wanted are thrown away. It

has been reported that shells collected in the mid-70s were bigger. Capiz collectors would presumably be keen to see the fishery run on a more regular basis and it is suggested that the introduction of size limits would prevent wastage and improve the quality of the catch. The local people are apparently already aware that some collection methods can be harmful to the harvest. In 1973 a trawl with a rake attached was used in Iloilo as a dredge, causing considerable damage to the sea bed and the loss of the capiz fishery for four years. When attempts were made to use this method again the local people complained so much that it was abandoned.

Successful culture of capiz shells was reported to be underway in the 1950s in Bacoor Bay in Cavite where juvenile capiz were being successfully transplanted from deeper to shallower water (Blanco, 1958). More recently transplantation has been tried in some of the barrios in Capiz province with encouraging results. Areas suitable for capiz culture are similar to those used for mussel and oyster farming and it may prove to be possible to rear all three species together. The juveniles are bought off capiz shell collectors at about 20 pesos (\$3) a box, which contains about 3,000 specimens and they are broadcast at low tide, taking care that shells are not piled on top of each other. Stocking density varies from 80,000-120,000 shells per hectare, depending on the availability of seedlings. After three to four months they are harvested; the usual growth during this time is from 3cm to 8-10cm. There is a survival rate of about 80-90%. Recommendations have been made for the siting of capiz farms: these should be located on protected mud-flats, free from excessive siltation, pollution and disturbance from fishing or motor boats. The area should be fenced and it should be near a source of young capiz. At present the main barrier to the setting up of capiz farms is lack of capital among the local people (Magsuci et al., 1980; Blanco, 1958)). At the SEAFDEC Aquaculture Department in Iloilo a project is being initiated to restock depleted beds and areas which have been harvested, with hatchery reared juveniles. Ultimately some of the bigger shellcraft firms might be prepared to invest in their own hatcheries.

Several suggestions have been made for the more effective management of the industry. Surveys of natural grounds should be carried out and studies on capiz cultivation encouraged. Areas suitable for culture should be delineated, permits issued to prospective farmers and controls over fishing and motor boats implemented in such areas. The dredge should be firmly prohibited as a collection method. To cut down on wastage, size limits should be imposed, except when juveniles are required for propagation or experimental purposes (Magsuci et al., 1981) and projects on reseedling should be encouraged.

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Table 1.

## Trade and scientific names of corals collected commercially for Cebu dealers (Ross, 1982).

<u>Acropora palifora</u>	Catch bowl
<u>A. hyacinthus</u>	Brush
<u>A. humilus</u>	Finger
<u>A. formosa</u>	Staghorn
<u>Acropora sp.</u>	Tree
<u>Pocillopora verrucosa</u>	Brown stem cluster
<u>P. damicornis</u>	White lace
<u>Merulina ampliata</u>	Merulina
<u>Pavona decussata</u>	Cactus
<u>Pectinia lactuca</u>	Lettuce
<u>Polyphyllia talpina</u> ,	Feather
<u>Fungia echinata</u>	"
<u>Seriatopora hystrix</u>	Birds nest
<u>S. caliendrum</u>	"
<u>Stylophora pistillata</u>	Cauliflower
<u>Halomitra stricta</u>	Bowl
<u>Lobophyllia costata</u>	Brain root
<u>L. corymbosa</u>	"
<u>Euphyllia glabrescens</u>	Brain trumpet
<u>Fungia fungites</u>	Mushroom
<u>F. danae</u>	"
<u>F. scabra</u>	"
<u>Millepora platyphylla</u>	Fire coral
<u>Tubipora musica</u>	Organ-pipe
<u>Heliopora coerulea</u>	Blue
<u>Platygyra daedalea</u>	Brain
<u>Favia spp.</u>	"

Table 2.

Export of non-precious corals from Zamboanga 1980

<u>Month</u>	<u>Kg.</u>	<u>Pesos</u>
January	8,259 (21,603 cu.m)	37,597.40
February	(46,136 cu.m)	52,460.00
March		
April	8,520	36,596.69
May	5,596	85,913.90
June	9,250	28,518.13
July	8,650	
Total for year (from different statistics)	54,196	276,799.76

(Countries of destination: mainly U.S., some to France)

Source: Zamboanga BFAR



Table 3.

<u>Cebu dealers</u>	<u>Country of destination for exports</u>
Evaristo Zambo	Europe e.g. Germany, Italy; US; Japan.
Paultons	US (especially large ornamental shells); Germany (especially specimen shells); UK.
Cebu Shell House	France (Marseille); Germany (Hamburg); Norway; Denmark.
Orcullo	US (Portland, Los Angeles, Honolulu).
Luvisiminda	US (Los Angeles); Belgium (Antwerp); Spain.
Flora's Shell Shop, Mactan	exports via an American buyer in Cebu; apparently has a number of Japanese buyers.
<u>Zamboanga dealers</u>	
Rocan	Belgium; Norway; UK (European consignments via Rotterdam); Japan (some Japanese clients visit the firm four times a year to place orders).
Jose Co.	Europe including UK (Southampton, Penzance).
San Luis	US (60-70% of total exports); Japan; Europe e.g. Spain, Germany, France, Italy, Greece, Portugal, UK (Southampton, Cornwall) often via Rotterdam.
Ertan Specimen Shells	US; Australia; Europe.
Zamboanga Curio Shop	US; Europe.
<u>Manila dealers</u>	
Carfell Shell Museum	US (mainly); also exchanges specimen shells e.g. Australia for PNG land snails and Japan for <u>Pecten</u> .

Table 4.

Length of times shell dealers have been in business

Evaristo Zambo	30 years
Cebu Shell House	7 "
Cecilio's Multicrafts	6 "
San Luis	30 "
Jose Co.	30 "
Carfell Shell Museum	11 "

Table 5.

Shells gathered in the Philippines in 1979 (Anon, 1980)

	<u>Ornamental shells</u>	<u>Miscellaneous shells</u>
January	42 975 kg	662 963 kg
February	145 235	112 365
March	46 354	55 537
April	89 682	34 565
May	59 728	80 378
June	103 491	88 589
July	302 544	133 915
August	512 314	219 260
September	213 471	97 850
October	63 196	12 052
November	-	36 629
December	<u>17 296</u>	<u>151 661</u>
Total	1,605 286	1,685 264

Source: Anon (1980).

Table 6.

Philippine fishery statistics record the following collecting areas for 1979:

	<u>Ornamental shells</u>	<u>Miscellaneous shells</u>
Quezon	276 816	4 900
Masbate	250 000	9 650
Zamboanga	212 616	31 119
Camarines	156 463	11 000
Cebu	141 827	104 532
Davao	114 270	4 807
Romblon	105 000	2 740
Aklan	92 000	5 030
E. Samar	78 615	32 517
Sulu	52 258	79 075
Negros Occidental	34 700	
S. Leyte	27 688	7 740
Mindoro Occidental	15 525	
Bohol	10 020	5 851
Palawan	9 655	15 860
Albay	8 375	16 176
Misamis	5 580	156 017
Marinduque	4 200	383 196
Manila Bay	3 230	1 000
Batangas	3 060	
Sorsogon	1 850	1 120
Catanduanes	0 988	2 479
Surigao	0 550	38 903
Bukidnon		383 190
Cotabato		40 334
Capiz		13 120
PFMA		12 625
Iloilo		7 310
Negros Oriental		6 838
Agusan		5 760
Lanao		1 005
Pangasinan		0 700
Antique		<u>0 670</u>
Total	1,605 2861	1,685 264

Source: Anon (1980).

Table 7.

Capiz shells collected in different regions, 1979

Negros Occidental	304,310 kg.
Mindoro Occidental	211,130 kg.
Cebu	188,765 kg.
Iloilo	131,680 kg.
Zamboanga	48,920 kg.
Capiz	48,020 kg.
Manila Bay	37,624 kg.
Palawan	21,465 kg.
Davao	10,000 kg.
Masbate	5,690 kg.
Sorsogon	5,115 kg.
Antique	5,000 kg.
Camarines	2,500 kg.
Sulu	2,240 kg.
Marinduque	350 kg.
Catanduanes	350 kg.
S. Leyte	80 kg.
Aklan	5 kg.
<u>Total</u>	<u>1,023,244 kg.</u>

Source: Anon (1980)

Table 8.

Quantities of capiz gathered in the Philippines in different months, 1979.

January	24,270 kg.
February	300,350 kg.
March	not recorded
April	205,100 kg.
May	203,920 kg.
June	52,019 kg.
July	8,220 kg.
August	24,490 kg.
September	5,020 kg.
October	173,610 kg.
November	5,775 kg.
December	15,470 kg.

Source: Anon (1980)

Table 9

	<u>Fishery products "gathered" kg.</u>		
	<u>Mother-of-pearl</u>	<u>Trochus</u>	<u>Green snail</u>
January	4,190	1,360	150
February	350		
March	21,197	1,320	
April	21,275	8,490	
May	28,333	3,730	445
June	13,190	530	28,325
July	42,790	700	
August	20,915	1,730	
September	15,710	6,895	
October	7,539	1,420	
November	13,413	740	1,850
December	1,630	2,750	1,550
Total	190,541	29,665	32,320

Source: Anon (1980).

Table 10

	<u>Gathered Fishery Products 1979 kg.</u>		
	<u>Mother-of-pearl</u>	<u>Trochus</u>	<u>Green snail</u>
Zamboanga	120,429	18,885	545
Quezon	16,170		
Cebu	13,475		
Sulu	11,219	2,600	
Iloilo	6,968	1,000	
Bohol	5,470		
Davao	4,680		
Surigao	3,417	670	
Manila Bay	2,164		
Masbate	2,135		
Capiz	1,380		28,325
Albay	930	440	
Misamis	850	388	
PFMA	500		
Marinduque	350	720	
S. Leyte	315	22	1,350
E. Samar	89	3,440	900
Palawan		60	150
Negros Occidental		900	
Davao		670	1,050
Cotabato		200	
Lanao		70	
Total	190,541	29,665	32,320

Source: Anon (1980).

Table 11.

Zamboanga BFAR export figures for commercial shell 1980.

Kg.	Gold-lip pearl shell	Black-lip pearl shell	Trochus
January	15,000		5,000
February	9,000	3,000	
March	10,300	1,100	1,000
April	28,670	2,000	
May	20,000		11,000
June	15,600		6,000
July	10,000		
August			15,000
September		4,500	
Total for whole year*	159,032	6,500	70,000

\* from different source.

## Appendix A

### 4th International Coral Reef Symposium

The 4th International Coral Reef Symposium was held in Manila, from 18th-22nd May 1981, the fourth in a series of quadrennial symposia under the auspices of IABO, the International Association of Biological Oceanographers. It was hosted by the University of the Philippines (UP) through the Marine Sciences Center, in cooperation with a number of Philippine government agencies and the UNESCO National Commission of the Philippines. International assistance was provided by UNESCO, the UNEP Regional Seas Programme and the Marine Laboratory of the University of Guam.

The theme was 'The Reef and Man' and some 290 papers were submitted on all aspects of coral reef biology, management, geology and associated subjects. The symposium was opened by Dr. Gomez, Director of the UP Marine Sciences Center who pointed out that it was a notable event for a number of reasons. It was the largest gathering of coral reef biologists in this series of symposia and attracted over 250 foreign delegates and over 300 local participants; there was an impressive number of speakers from developing countries, particularly from Southeast Asia.

Throughout the symposium the urgent need for conservation of coral reef resources was re-iterated as being of paramount importance. During the opening session, Dr. David Stoddart of Cambridge University pointed out that much of the current damage to coral reefs is due to the decline of traditional subsistence economies and the subsequent development of commercial enterprises, industry and tourism. This was emphasised by Dr. Bernard Salvat, Chairman of the IUCN Coral Reef Specialist Group in a more detailed paper given later in the Symposium, "Preservation of Coral Reefs - Scientific whim or economic reality". Dr. Stoddart emphasised that although further research and information are essential in order to devise satisfactory management plans for these resources, a change in attitude by local peoples and governments is required. The importance of coral reefs in the countries where they occur must be appreciated at all levels. Various management strategies are available for coral reefs, such as the creation of marine parks or controlling trade in coral reef species but two factors are essential for the successful implementation of such plans: the plan must contain provision for diversity of use, as exemplified by the management plan for the Great Barrier Reef which takes into consideration fishing, recreational uses and strict wildlife preservation; and national efforts must be encouraged by the international community e.g. the inclusion of coral reefs in the UNESCO list of World Heritage Sites. Reef scientists must now seriously direct their research activities toward the problems being created by the rapidly expanding impact of man on reefs.

Papers during the Symposium covered Fisheries, Environmental Stress, Resource Management and Marine Parks. Many papers were given on various aspects of pollution including the effects of tin mining, dredging, sewage effluents and sedimentation on coral reefs, which tended to emphasise the fact that there is still a great deal to be learnt about recovery rates of reefs and growth rates of coral themselves. Traditional and subsistence fisheries were discussed a number of times. Dr. Salvat pointed out that although in many areas reefs are being overexploited, in others their full potential is not being realised. The economic importance of traditional fisheries is now being fully appreciated and several studies are underway to look at species harvested, yields and traditional methods.

The conflict between the need for tourism in terms of the income it generates and the destruction it can lead to was discussed. Porfiero Castaneda of the Philippine Bureau of Fisheries and Aquatic Resources pointed out that the increasing interest in SCUBA diving (though not spear fishing) should be exploited as a long term

source of income, which could well outlast the financial gains to be made from the coral export trade.

The trade potential of coral reefs has been of interest to the Government and many Filipinos for some time. Earlier government policies provided incentives for coral exporters, but with the recognition of the deterioration of the reefs, a ban on coral collection and export was imposed in 1977. This has proved difficult to enforce, a number of loopholes having been left in the legislation, but the size of the subsequent illegal trade has made it clear that it is now the turn of consumer countries to implement controls on imports.

Not surprisingly there was considerable emphasis on the status of Philippine coral reefs. These cover about 44,000 sq. km and more than 400 species of coral in 78 genera have been described, making them some of the richest fringing reefs in the world; several new species were described in papers given at the symposium. Dr. Francisco Nemenzo, the leading coral reef biologist in the country, drew attention, in the opening session, to the fact that Filipinos themselves have paid little attention to their coral reefs in spite of their economic and scientific importance.

In the keynote address, Jose Leido, Minister of Natural Resources, referred to the extensive damage that coral reefs are undergoing in regions of dense human population as a result of many forms of pollution - from agriculture, industry, urban development, oil drilling - and from coral utilisation and the ornamental coral trade. He emphasised that the Philippine people themselves must be made aware of the value of their reefs, but he also called for consumer countries to implement controls on coral imports, especially from the Philippines. He stressed the importance of the relationship between scientists and politicians and the need for them to work together, as well as the need for encouragement of applied research on coral reefs.

Dr. Gomez's paper described the status of Philippine reefs and the results of the survey carried out by the Marine Sciences Center, which are to be used by the government in the creation of management plans. More than half the reefs are now in progressive stages of destruction; of the 523 sites surveyed, 41.9% were considered in poor condition, 28.9% were fair, 24.9% good and only 4.3% excellent. Most of the poor ones occur in Luzon, Mindoro and the Visayas, areas which are subject to greatest environmental stress. The main destructive activities are, in order of priority: a) siltation and sedimentation including pollution from mine tailings b) dynamite blasting for fish and c) coral collecting for both local use and the export market; increasingly the massive corals such as Goniopora and Porites which form the bulk of the coral reefs are being used for building materials.

The UNESCO Workshop on Coral Reef Management was held towards the end of the 4th International Coral Reef Symposium and its two main areas of concern were research and training priorities for coral reef management in Oceania, South Asia and Southeast Asia and the production of a UNESCO handbook on coral management. This was a follow-up to meetings held in 1979 (Hawaii) and 1980 (Papua New Guinea) and the objective was to identify management problems and produce a set of guidelines for each area. Discussions centred on the requirements of each country: the information needed, legal aid and enforcement aspects and the training and research programmes required. Many countries have encountered problems in the lack of strong coral reef research centres in the region. The Philippines however, has, through the Marine Sciences Center, produced a coral reef management plan and several other countries are now working at the national level.

The need for collaboration and cooperation between the various international bodies concerned with coral reef conservation was stressed. The UNEP South

Pacific Regional Seas Programme is drafting an action plan for coral reefs. A separate Southeast Asia Programme action plan (covering 5 countries) has also been adopted but needs money for its implementation. The plan includes a set of projects involving surveys of environmental stresses to coral reefs and mangroves.

The IUCN SSC Coral Reef Group meeting was held afterwards and copies of Newsletter No.3 distributed. This gives the most recent information available on the three main objectives of the group: a census of present coral reef parks and reserves and their status; a study of human activities which cause damage to coral reefs; and the mapping of areas of major degradation. The newsletter also includes articles on corals reefs in Micronesia, Southeast Asia and Sri Lanka, Singapore and Malaysia.

It emerged that both UNESCO and IUCN had been planning to produce sets of guidelines for coral reef management. To avoid duplication it was agreed that the task should be shared. The aim is to provide planners with the elements from which they can develop an appropriate solution to their own particular problems. It has become evident that a great many problems in coral reef areas have arisen because the findings of research and the experience of management elsewhere are not easily accessible to planners, managers, advisers and policy and decision makers.

IUCN is to produce leaflets in a fairly simple format directed at the general public and government planners to increase awareness of the problems and to attempt to influence general policy making. They will concentrate principally on human impacts on reefs and will include sections on collecting and fishing of reef species, pollution, dredging, tourism and introduction of alien species as well as many others. It was recommended that UNESCO should support the publication and distribution of the IUCN products.

The 5th International Coral Reef Symposium will be held in 1985 and is to be hosted by the French Government in Tahiti, organised by Dr. Bernard Salvat.



Appendix B

Coral and Shell Dealers visited June 1981

Alcon Industries	(P.O. Box 136) Cebu City
Roque A. Cantos Enterprises, Inc. (Rocan)	32c, Mina St., Mabolo 6401, Cebu City.
Castilex Industrial Corp.	(P.O. Box 108) Cebu City.
Cebu Shell House	(P.O. Box 642) Cebu City.
C & RD Shells & Shellcraft Co.	(P.O. Box 245) Cebu City.
Luvisminda Sea Shells Products Inc.	37, V. Rama Avenue, Cebu City.
Paulton Enterprises	Bonifacio St., Banilad, Mandaue City, Cebu.
Ponce's Shell Novelties and Gift Shop	(P.O. Box 571) Cebu City.
Velez Enterprises	2nd St., Happy Valley, Cebu City.
Evaristo J. Zambo	(P.O. Box 48) Cebu City 6401.
Filtrade	Cebu City
Orcullo Enterprises	Burgos St., Mandaue City, Cebu.
Flora's Shell Shop	Punta Engana, Mactan, Cebu.
Zamboanga Shellers	(P.O. Box 331) Zamboanga City.
Zamboanga Curio Shop Inc.	(P.O. Box 22) San Jose, Zamboanga City.
Rocan Shell Shop	(P.O. Box 241) San Jose, Zamboanga City.
Profeta Marine Trading	San Jose, Zambanga City.
San Luis	Zamboanga City.
Damsar Specimen Shell	(P.O. Box 358) Zamboanga City, 7801.
Ertan Specimen Shells	(P.O. Box 267) Zamboanga City.
Jose Co. Specimen Shell	(P.O. Box 64) Zamboanga City.
Carfell Shell Export	1786, A. Mabini St., Malate, Manila.
Czarina Shell Novelties	Pedro Gil St., Malate, Manila.
Iloilo Shellcraft Industry	M.H. del Pilar, Molo, Iloilo City.

Appendix C.



**Ponce's Shell Novelties**

HACIDA  
ASISTED

51 DON GIL GARCIA ST., CAPITOL SITE  
CEBU CITY, PHILIPPINES  
P. O. BOX 571  
J-317

PHONES  
7-60-40  
7-96-50

CABLE ADDRESS:  
(PONSHELL - CEBU)

MANUFACTURER \* WHOLESALER \* RETAILER \* EXPORTER \* IMPORTER

SUSAN M. WELLS

56 OXFORD ROAD, CAMB RIDGE, U.K.

MADAM:

I received your letter of inquiry for which I thanked you very much.

Enclosed is a partial price list of specimen shells and corals. Please specify in your next letter what kind of specimen shells you like because we have plenty of them, some are cheap ones, others are very expensive. What I am sending you are the ones which are not too expensive or not too cheap ones. Regarding corals we are banned from exporting them, however we can mix them with other items so we have to use them as fillers.

Hoping to make business with you.

Very truly yours,

*Priscillana M. Ponce*  
PRISCILLANA M. PONCE

"IMITATED BUT NEVER BEEN EQUALED"

## Appendix D

Shells involved in the Philippine Shell Trade August 1981

Six price lists were obtained and analysed for the most common species; the number of lists these occurred on is given in the right hand column.

<u>Scientific name</u>	<u>Common name</u>	<u>Occurrence</u>
<u>TRIDACNIDAE</u>		
<u>Giant Clams</u>		
Hippopus hippopus	Bear's Paw	5
Tridacna squamosa	Squamose China	5
T. gigas	Giant China	4
T. maxima	Elongate China	4
<u>CASSIDAE</u>		
<u>Helmets</u>		
Cassis cornuta		5
Casmaria erinaceus		5
Phalium bisulcatum		3
P. bandatum		2
P. glaucum		2
<u>STROMBIDAE</u>		
<u>Spider Conchs</u>		
Lambis chiragra	Fluted	6
L. truncata sebae	Giant	6
L. lambis	Common	5
L. millepeda	Millepede	5
L. scorpius	Scorpion	5
L. crocata	Orange	4
<u>Conchs</u>		
Strombus canarium	Dog	4
S. latissimus		4
S. lentiginosus	Silver	4
S. sinuatus	Lavender-marked	4
S. urceus	Little Bear	4
S. aurisdianae	Diana's	3
S. luhuanus	Strawberry	3
S. bulla		2
S. pipus	Butterfly	2
Tibia fusus		5
T. martinii		2
<u>MURICIDAE</u>		
<u>Murex</u>		
Chicoreus ramosus	Branched	6
C. palmarosae	Rose Branch	4
C. brunneus		3
C. torrefactus		3
Hexaplex cichoreus		5
Homalocantha scorpio		4
H. zamboi		3

MURICIDAE cont.Murex

Haustellum haustellum		3
Murex tribulus		3
M. pecten	Venus comb	3
M. hirasei		2
M. troscheli	Troschel's	2
Favartia balteata		2
Phyllonotus laciniatus		2
Pterynotus elongatus		3
P. alatus		2

CYMATIIDAETrumpet Shells

Charonia rubicunda		5
C. tritonis		5
Cymatium pileare		4
C. caudatum		3
C. lotorium		3
C. pyrum		3

CYPRAEIDAECowries

Cypraea arabica	Arabian	5
C. mauritiana	Humpback	5
C. tigris	Tiger	5
C. vitellus	Pacific Deer	5
C. annulus	Ring	4
C. argus		4
C. asselus		4
C. boivini		4
C. carneola	Carnelian	4
C. caurica		4
C. chinensis		4
C. cribraria	Sieve	4
C. erosa	Eroded	4
C. helvola	Honey	4
C. isabella		4
C. lutea		4
C. lynx		4
C. mappa	Map	4
C. onyx	Onyx	4
C. stolidia		4
C. talpa	Mole	4
C. teres		4
C. testudinaria		4
C. ziczac	Zigzag	4
C. caputserpentis	Snake's Head	3
C. cylindrica	Cylindrical	3
C. felina	Kitten	3
C. saulae		3
C. scurra	Jester	3
C. punctata	Punctate	3
C. cicercula	Chick-pea	2
C. eglantina	Eglantine	2
C. erronea	Wandering	2
C. gracilis	Graceful	2
C. labrolineata		2

CYPRAEIDAE cont.

Cypraea maculifera  
*C. miliaris*  
*C. moneta*  
*C. pallidula*  
*C. poraria*  
*C. staphylaea*

Ovula ovum

CONIDAE

Conus aulicus  
*C. capitaneus*  
*C. figulinus*  
*C. generalis*  
*C. imperialis*  
*C. litteratus*  
*C. marmoreus*  
*C. miles*  
*C. striatus*  
*C. ammiralis*  
*C. betulinus*  
*C. pennaceus*  
*C. geographus*  
*C. leopardus*  
*C. magus*  
*C. omaria*  
*C. textile*  
*C. thalassiarachus*  
*C. vexillum*  
*C. distans*  
*C. plaorbis*  
*C. quercinus*  
*C. tessulatus*  
*C. tulipa*  
*C. virgo*

MITRIDAE

Mitra papalis  
*M. mitra*  
*M. stictica*  
*M. eremitarum*  
 Vexillum rugosum

TURBINIDAE

Turbo argyrostomus  
*T. chrysostomus*  
*T. petholatus*  
*T. marmoratus*

Cowries

Reticulated 2  
 Money 2  
 Porous 2  
 False Egg 5

Cones

Courtly 4  
 General 4  
 Imperial 4  
 Lettered 4  
 Marbled 4  
 Soldier 4  
 Geography 3  
 Cloth of Gold 3  
 3  
 3  
 3  
 3  
 2  
 2  
 2  
 2  
 2

Mitres

Papal 6  
 Typical 5  
 Pontifical 4  
 3  
 3

Turbans

Silver Mouthed 4  
 Gold Mouthed 3  
 Tapestry 3  
 Green Snail 2

Cat's Eye (opercula)

<u>VOLUTIDAE</u>	<u>Volutes</u>	
Melo amphora		5
Cymbiola imperialis		5
C. vespertilio	Bat	3
C. aulica		2
<u>HARPIDAE</u>	<u>Harps</u>	
Harpa major		2
H. harpa		2
<u>TEREBRIDAE</u>	<u>Augers</u>	
Subula maculata	Marlinspike	5
S. areolata		2
S. dimidiata		2
<u>TONNIDAE</u>	<u>Tuns</u>	
Malea pomum		3
Tonna galea		2
T. fasciata		2
T. perdix	Partridge	2
<u>OLIVIDAE</u>	<u>Olives</u>	
Oliva annulata		2
O. carneola		2
<u>SCAPHOPODA</u>	<u>Elephant Tusks</u>	
Dentallium aprinum		3
<u>SPONDYLIDAE</u>	<u>Thorny Oysters</u>	
Spondylus regius		3
S. ducalis		2
S. sinensis		2
<u>LUCINIDAE</u>	<u>Lucinas</u>	
Codakia tigerina	Red-lipped Codakia	2
<u>PECTINIDAE</u>	<u>Scallops</u>	
Gloripallium pallium		2
<u>CYMATIIDAE</u>	<u>Tritons</u>	
Distorsio anus	Anal	4
D. reticulata		2
<u>EPITONIIDAE</u>	<u>Wentletraps</u>	
Epitonium scalare	Precious	2

CEPHALOPODA

Argonauta argo 2

FASCIOLARIIDAE

Spindles

Fusinus colus White 2

Tulips

Fasciolaria trapezium Horse 4  
F. filamentosa 2

HALIOTIDAE

Abalones

Haliotis asinina Donkey's Ear 4

VASIDAE

Vasum turbinellum 2

PTERIIDAE

Wing Oysters

Pteria penguin 2

POTAMIDIDAE

Horn Shells

Cerithium aluco 4  
C. rodulosum 3  
Rhinoclavis vertagus 3

Telescopium telescopium 2

NERITIDAE

Nerita communis 3

NATICIDAE

Polinices aurentius 4  
P. hepaticus 3

MAGILIDAE

Rapa rapa 3

BURSIDAE

Frog Shells

Bursa rubeta 2

COLUMBELLIDAE

Dove Shells

Columbella sp.

<u>TROCHIDAE</u>	<u>Top Shells</u>	
Trochus sp.		3
Angaria imperialis ?		2
Umbonium giganteum		2
<u>CARDIIDAE</u>	<u>Cockles</u>	
Corculum cardissa	Heart	5
Fragem unedo	Strawberry	4
<u>ARCHITECTONICIDAE</u>	<u>Sundial Shells</u>	
Architectonica perspectiva		3
<u>TURRIDAE</u>	<u>Turrids</u>	
Turris babylonia		2
<u>TURRITELLIDAE</u>		
Turritella terebra cerea		4
<u>CHAMIDAE</u>		
Chama sp.		2
	<u>Limpets</u>	3
<u>XENOPHORIDAE</u>	<u>Carrier shells</u>	2

Other Marine Specimens:

Venus flower basket	4
Barnacles	5
Sea horse	4
Sea urchin	4
Starfish	2



## THE SHELL TRADE IN PAPUA NEW GUINEA

### Introduction

Papua New Guinea comprises the eastern half of the island of New Guinea including all the islands making up the province of Milne Bay, the Bismarck Archipelago (made up of New Britain, New Ireland, Manus Province and other smaller islands) and the northern part of the Solomon Islands (Bougainville and Buka) and has a total land mass of about 474,000 sq.km. Colonised successively by the British, Dutch and Germans and most recently administered by the Australians, it attained independence in 1975. It is still one of the least densely populated countries in the world, with an average of 10 people a sq.km. and a total population in 1978 of about 3 million. Parts of the Highlands were not explored until the 1930s and in many areas western ideas and modern technology have barely made an impression. Most people live on the coast as subsistence fishermen or in the central highlands where they practise shifting cultivation.

One striking aspect of the country is that 86% of it is still forested. Much of this however is secondary growth, since shifting cultivation has had an important effect, altering most of the primary montane forest up to about 2,600m, as well as most of the lowland rain forest. The population growth rate is now high (2.7-3.5% p.a.) resulting in increasing pressure on the land, and many important habitats are being eliminated to be replaced by grassland and savannah which are perpetuated by firing. Such changes are being accompanied by a decline in soil fertility and inevitably soil erosion (Johns, 1975; Whitmore, 1976). As yet, this has had little effect on the coastal environment in terms of increased siltation loads (a problem in many south-east Asian countries) but this problem may lie not far off in the future. An impact statement is currently being prepared for the proposed port development in the Markham River estuary at Lae. There is concern that dredging could cause damage to the reefs further down the coast at Salamau if the currents carried the silt in that direction.

Papua New Guinea is famous for its numerous endemic plants (especially orchids), marsupials, birds (320 out of 670 species occurring there are endemic), insects and snails. The marine environment has been comparatively little studied but there is evidence that this is as rich and diverse as that on the land. Papua New Guineans are still to a large extent dependent on their native wildlife for food and other aspects of their culture, and are remarkable for the strong intuitive feeling that they have for conservation. This is reflected in the fact that Papua New Guinea has conservation written into its national constitution as one of the country's goals. Another unusual character of the country is that most of the land, even where it is uninhabited, is under native tenure which has considerable consequences for conservation. On the one hand this provides a safeguard, since it may prevent outsiders coming in and using the wildlife or land. On the other hand, since the State owns only about 4% of the land there are considerable problems involved in setting up national parks or totally protected reserves. Even if an owner sells or leases some of his land he may still retain certain rights. Similar systems operate on the coast and with marine resources; for example coral reefs tend to be owned by different fishing villages. One interesting solution to this problem has been the development of Wildlife Management Areas (WMAs) which are run by the local villagers. A number of such areas have been set up for particular species, including birds of paradise, butterflies, turtles and dugongs and others are being set up for the management of coastal resources. The local people are responsible for making their own rules to protect the wildlife, and these can be based on local conditions and practises; very often outsiders may not hunt or collect at all. Traditional resource ownership patterns have important implications for reef fishing since many are implicitly conservational, and it is

increasingly being recognised that those which are valuable should be incorporated into current management (Morauta et al., 1980).

The main purpose of my visit to Papua New Guinea was to study the shell trade, about which very little had been written. In view of the extensive efforts being made to manage many forms of wildlife in this country, it was expected that similar principles to those used in the development of, for example, the insect trade, were being applied in the development of the shell trade. This report is concerned primarily with my findings in this respect but during the course of my travels other topics concerned with marine resources were brought to my attention and are mentioned briefly towards the end.

## The Shell Trade

Shells have been used in Papua New Guinea by native people for many centuries in a variety of ways including currency, decoration, tools and magical purposes. Shells and shell artifacts are important elements in bride price payments in many areas. In Milne Bay red shell necklaces (called salouva and made from Spondylus), white shell armlets (called murali and made from clam shell) and crescent shells of pearl shell (called kina and made from Pinctada maxima) have been traded in for centuries in the ritual 'Kula Ring' which extends around the different islands in this province. The kina is still worn around the neck by men in many parts of Papua New Guinea and such is its significance in daily life that one of the modern coins has been named after it; the other unit of modern currency, the toea is also named after an original shell currency. Many shells have been used for money. 'Tambu' is still used in East New Britain, particularly for buying betel nut and lime. The shell is Nassarius camelus, a type of small whelk which is found abundantly near estuaries and in brackish water. The current extent of its use is indicated by the fact that the provincial government at Rabaul commissioned a survey of the species and its use in order to determine whether active management of the species was required. Local collecting grounds were being depleted and it was becoming necessary to import shells from other parts of New Britain. The survey however found that there was little likelihood of the species being threatened with extinction (Gwyther et al., 1980).

Another species collected in very large quantities is the money cowrie, Cypraea moneta, which is used for decorating masks and other artifacts particularly in the Sepik area. The false egg cowrie, Ovula ovum is regarded as a fertility symbol and used to decorate houses and for personal ornament. Shells are an important element in the trading routes from the coast up into the Highlands, gradually increasing in value with each change of hands. It is reported however that they are being used less often inland now as they are becoming more difficult to obtain. This is a result of the breakdown of traditional trading relationships and, in the Sepik Province is further compounded by transport problems since the river, which has always the main method of transport, is becoming increasingly blocked with Salvinia weed.

As in most countries the greatest use of molluscs in Papua New Guinea is for food. Strombus luhuanus is one species which is collected in large quantities from sandy bays for this purpose and the University of Papua New Guinea, in collaboration with Australian scientists is currently carrying out a study of this important food source. Often the shells of such edible molluscs are burnt to produce lime for chewing with betel nut in areas where coral is not available.

Export of shells for the ornamental shell trade is a more recent development. Papua New Guinea, like the Philippines, has an extremely diverse molluscan fauna which includes a number of species endemic to the region. New species are still being discovered and many are rare enough to fetch high prices on the collectors' market. Shell collecting has been a popular hobby with expatriates since pre-independence days, and an export trade has existed for some time, although this has always been small when compared with that of the Philippines.

Following Independence, legislation was passed prohibiting the export of shells for commercial purposes by expatriates, and shells can now only be marketed by nationally owned companies. In 1975 the Department of Business Development set up a shell agency with the aim of fully exploiting this resource and spreading the benefits of the cash income it could generate over a large number of people and provinces. Brian Parkinson, an expatriate who had previously run a shell business in Rabaul was appointed Technical Officer to help develop the trade and offered

his premises in Rabaul as a base for the new agency, New Guinea Shells. Although set up along similar lines to the Insect Farming and Trading Agency in Bulolo, the shell agency does not come under the responsibility of the Wildlife Division. This is presumably because the Department of Business Development is already responsible for other industries involving shells such as the commercial or mother-of-pearl shell trade.

The shell agency was initially planned as a fairly ambitious project, the ultimate aim being to include exports of black coral, bêche-de-mer (sea cucumbers), commercial shells and aquarium fish. So far only two outlets have been established, New Guinea Shells in Rabaul and Milne Bay Shells in Alotau which both deal in ornamental shells only. These are administered by the government and are still far from being run at a profit and are dependent on considerable government subsidies. Attempts were made to set up an outlet at Lorengau in Manus Province but for a variety of reasons this met with little success.

As with the Insect Farming and Trading Agency the aim of the shell agencies is to promote the rational use of shells, avoiding over-exploitation. However there is as yet no very organised system for collecting and shells are obtained in a variety of ways. In theory the staff of both agencies are expected to carry out 'extension' trips, similar to those made by the staff of the Insect Farming and Trading Agency, to outlying villages to encourage people to collect, help with identification, grading and marketing, and to buy up stock which has accumulated. New Guinea Shells has carried out several such trips, for example to the Northern Province where some 40 villages were visited. In some places such as Manus, staff from the Department of Primary Industry buy shells when on extension visits for other purposes and arrange to send them to Rabaul. Most shells are collected by villagers, fishermen and often school children at the various mission schools and shells may be sent directly to the agencies or taken there if the collectors live near enough. One of the most advanced aspects of the Papua New Guinea shell trade is a booklet which has been produced by the Department of Business Development to explain to local people how to collect shells and why conchologists overseas want them (Anon, undated). It is written in both English and pidgin and is distributed to villages and any interested potential collectors, and large numbers of people had, of their own initiative, requested copies. It describes how to clean shells and explains the importance of making sure that specimens are of high quality in order that the maximum value can be obtained on the export market.

New Guinea Shells is run by a Tasman islander from the north Solomons with some of his colleagues, four of whom have been trained by Brian Parkinson as divers. Diving is carried out at night since most species in demand are nocturnal, and when the technical officer is in Rabaul the divers go out about 3-4 times a week. Equipment has been provided by Brian Parkinson or bought with money from the government. To date diving has only been carried out around the Gazelle Peninsula on East New Britain and one of the neighbouring islands but has already produced a number of rare shells such as three specimens of Cypraea rabaulensis, (which sell for K90 (£70)), C. valentina, C. aurantium (the golden cowrie), and a number of rare cone shells. Such species tend to sell very fast and are a particularly good way of bringing in money. Diving is carried out down to 50m and baiting techniques may be used to collect some species, particularly the olive shells. Diving is facilitated by the use of a boat which was provided by the Department of Business Development and which is also used for survey work to find new productive areas. Eventually it should also be used for longer extension trips and follow-up work.

It is also planned to use dredging and netting methods for obtaining shells, based on methods used in the Philippines. Netting permits collection of the rarer and

more valuable species found down to 300m but can only be carried out on sandy bottoms. The nets are to be obtained from the Philippines, and if experiments at Rabaul prove the method to be successful nets would be provided to other villages. Dredging using a reinforced wire dredge cage has already been tried in Rabaul and also permits collection down to 300m. However it is expensive to set up as a boat and a winch are required, although it is thought that in shallow water a canoe could be used.

Rather surprisingly it was found that New Guinea Shells also obtains shells from the Philippines which are then exported as Papua New Guinean specimens. It was explained that this was necessary to fill all the orders since too few specimens are being collected locally.

Cleaning and packaging of locally obtained shells is carried out on the premises at Rabaul, if the collectors themselves have not already done this. In the villages the meat may be eaten but otherwise it is allowed to rot and is then picked or washed out. The shells are cleaned by soaking them in solutions of bleach or alcohol and are then rubbed with baby oil to restore their shine. Unlike dealers in the Philippines the agency also markets beach collected shells. These are sold mainly to tourists in the shop at Rabaul, and if exported may be returned if the quality is found to be unsatisfactory. The Rabaul shop generally stocks fairly poor quality marine shells but also large quantities of land snail shells which are particularly popular with the mainly American, Japanese and Australian tourists. It also sells a small amount of shell jewellery imported from the Philippines. Apparently the agency has a shell cutter and in the past used to produce its own jewellery but does so no longer.

Milne Bay Shells, the outlet in Alotau, was established in 1977 but so far has not been managed very satisfactorily. The shells collected in the region generally go to the Rabaul outlet for export or to Port Moresby for sale to the souvenir shops although large numbers of overseas orders are received. The future of the agency and its management was in some doubt in July 1981, and its export licence had been lost for failure to comply with government regulations. No extension work or active collecting had been carried out and annual sales were estimated at less than K5,000 (£3,750). Stock had accumulated on the premises, large boxes of murex, clams, tritons and helmet shells having been sent in from villages and small islands in the province, many coming via Samarai, the other main town in the Province.

A survey carried out by the technical officer showed Milne Bay to be one of the richest areas in the country for shells. Commercial shells and sea cucumbers have been collected for many years, and a Catholic mission was involved with shell exports for some 20 years. Five particularly promising areas have been identified for shells: Woodlark I., Rossel I., Tagula or Sudest I. (which is thought to be particularly good for rare shells), Misima I. and Normanby I. and it has been suggested that collecting stations should be set up in these areas.

About 95% of the shells collected through the agencies are exported and the turnover for New Guinea Shells in 1979 was estimated at K40,000 (£30,000). However the effort going into filling orders in 1981 did not suggest that a similarly high turnover would be reached that year. In spite of the large turnover in 1979 the business is not yet making a profit. According to Papua New Guinea trade statistics, between July 1975 and June 1976, 2,330 kg of ornamental shells were exported to Japan, Italy, Taiwan, Australia, Belgium, Bulgaria and the Netherlands. However, actual exports are probably much higher since import figures for other countries show that at least 187 tonnes were exported in 1977 and at least 197 tonnes in 1978 (N.B. these figures may include some commercial shell). Japanese imports of shells other than commercial shell from Papua New

Guinea have increased dramatically since 1970:

1970	3 019 kg
1971	2 084 kg
1972	16 561 kg
1973	10 359 kg
1974	28 972 kg
1975	48 630 kg
1976	26 877 kg
1977	16 815 kg
1978	27 258 kg
1979	17 170 kg

An analysis of overseas orders at New Guinea Shells, Rabaul, showed that most demand for specimens is in the US (Table 1). Besides the two government outlets, shells are sold in souvenir and handicraft shops in the larger towns and also from stalls along the roadside in Boroko, or in markets such as in Lorengau, Manus and Rabaul. These are well frequented by tourists and expatriates, and prices are very similar to those in New Guinea Shells.

#### Ornamental marine shells

Both New Guinea Shells and Milne Bay Shells list a large number of different species on their price lists. The list for New Guinea Shells includes, among others, over 90 different cone shells, 70 cowries and about 40 olive shells. An analysis of invoices at New Guinea Shells gave some indication of the species most in demand. 11 consignments of marine shells which included more than one specimen of each variety ordered were analysed. The following species featured most often:-

Species	No. of consignments	Total no. of specimens
<i>Oliva buloui</i>	4	28
<i>Cypraea coxeni</i>	4	23
<i>C. minoridens</i>	3	31
<i>Oliva coccinata</i>	2	42
<i>O. unizonalis</i>	2	42
<i>Cypraea ovum</i>	2	24
<i>C. ziczac</i>	2	25

In some cases these species are in demand because they are endemic to Papua New Guinea. *Oliva buloui*, for example, comes only from New Britain and *Cypraea coxeni* only from north New Guinea, New Britain and the Solomon Islands (Hinton, 1979). Shells collected in Manus waters included *Cassis*, *Murex*, *Nautilus* and a variety of cowries, olives and volutes.

There is a considerable difference at New Guinea Shells between the prices paid to the collectors and those obtained from consumers. Prices paid to collectors range from about one toea to about K10 per shell (except for the very rare specimen shells), but most are well under one kina (75p). Selling prices are often over a kina and the mark up tends to be well over 500%, rising to over 10,000%. Table 2 gives some examples of buying and selling prices and the mark up.

#### Giant Clams

Giant Clams did not feature particularly largely in the Papua New Guinea shell trade but are mentioned in view of their importance in the South Pacific as a

food. Papua New Guinea seems to be one of the few areas where all species are still relatively abundant. Milne Bay is a particularly rich area and in 1980 1,234 kg of clam meat were collected in this province. The inhabitants of some of the islands off Manus I. have clam gardens. Clams are brought in from the reef when still small and are placed on the sheltered flat where they are left to grow. They can then be eaten as needed and provide a source of food if bad weather prevents the boats going out to fish. On Andra I., which has about 150 villagers there were about 30 clam gardens, each belonging to a different family and containing about 12 clams of different sizes and species. They were situated some 20m from the shore on sand in about a metre of water.

In other areas however clam populations are said to be declining, largely due to the activities of Taiwanese and Japanese fishing boats which have apparently concentrated their efforts in Papua New Guinea waters since the strict enforcement of Australia's 200 mile economic zone. The boats take fish and a variety of marine invertebrates, particularly clams and other molluscs such as egg cowries. Boats have been seen fishing off Port Moresby and Milne Bay. Giant clams have also been taken from Manus waters by Japanese boats which remained below the horizon during the day and then came in at night for divers to comb the reefs with torches.

The police have been increasing their efforts to apprehend such boats. Three boats were apparently caught off Port Moresby in 1981 and two were caught in Milne Bay in May 1981. One of these, caught at Egom Atoll, had on-board the blade-like tools used for prizing clams open. The crew maintained that the meat was for their own use and not for commercial sale. Both boats were with a 'mother' ship which remained at some distance from the mainland and which was not sighted by the police. The first boat was charged with 'diving for, searching for and taking sedentary organisms' and the boat was confiscated and eventually sold back to the owner, and the captain was fined K12,500 (£9,375). The crew of the second boat was not prosecuted. Methods of punishment have proved to be a problem; it is difficult to deal with confiscated boats and small towns such as Alotau in Milne Bay have considerable difficulty in supporting the crew of such a boat during the period of the trial. It is also very difficult for villagers to get hold of the police boat quickly enough. On Manus it was suggested that villagers should have radio contact with the police to enable the boat to reach the incident much faster.

#### Land Snail Shells

Of all countries currently involved in the ornamental shell trade, Papua New Guinea is unique in the large number of land snails which are marketed. Over 400 varieties (including species, subspecies and colour varieties) have been described, many of which have very limited ranges and are confined to one island or one valley only (Hinton, 1979). Many have very attractive patterning and colouration which accounts for their popularity with foreign shell collectors. The manager of New Guinea Shells himself mentioned the recent big demand for land snails which started at the end of the 1970s. In 1979, a report to the Department of Business Development mentioned that the agency had back orders for 100,000 Xesta citrina.

The current price list for New Guinea Shells lists 88 species; the Milne Bay company lists 20 species, and at least 65 different species featured on 52 orders sent into New Guinea Shells. Of these, 14 (27%) were for land snails only, and a further 10 (19%) included land snails as well as marine shells. Tourists visiting the Rabaul shop buy large numbers of the more colourful varieties as souvenirs, and the invoices showed that these were also the most popular species with importers. Between January and June 1981, the species most in demand was Papustyla xanthochila from Bougainville, which has a white shell with a yellow

lip. 6,152 shells of this species in 8 orders were invoiced in this period, including 2 orders from Japan for 2,000 and 3,000 shells, 500 shells for Australia, 2 orders from the US for 150 and 100 shells, 100 shells for Taiwan, and 300 for Eaton's Shell Shop in the UK. This species as well as a number of other colourful ones were seen on sale in Eaton's Shell Shop in 1980. Other popular species include Megalacron klaarwateri from Manus I., Xesta citrina from the Huon peninsula, Papuina adonis from Bougainville I. and Forcatia globula from West New Britain (Table 3).

Invoices for shells brought in by collectors were also analysed for the same period (Table 4). Most were for shells from Bougainville and the Solomon Is. including 1,100 Papustyla xanthochila, 1,911 Placostylus palmarum and large numbers of two of the more common local East New Britain species Papustyla chancei and P. hindei. Most collecting is currently carried out on the islands off the north coast and at present there is comparatively little on the mainland and in the south of the country. Land snail shells are always collected by local villages and school children, the staff of the two shell agencies carrying out no collecting themselves. Prices tend to be fairly high and range from 60t to K3.50. The most expensive on the New Guinea Shells price list are Megalacron tabarensis mahurensis (from Mahur I. off East New Britain) and Papustyla novaepommerania (from Wide Bay, East New Britain) which both sell for K7.50. The mark up for land shells is rarely quite as great as that for marine shells but is still substantial, ranging from about 500 - 2,000%. Collectors are paid in the region of 5 - 25t a shell. Some examples are given in Table 5. Milne Bay Shells had large quantities of land snails in stock including Manus green tree snails Papustyla pulcherrima and species sent from the Solomon Is. Endemic land snails are found on the Louisiade Is. and the de'Entrecasteaux Group and land snails are also obtained from the Trobriand Is. and the mainland.

The Manus green tree snail is probably the most well known land snail as a result of the huge numbers that were collected for export in the 1970s, and the fact that it is by far the most attractive of all the land snails. It is listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), although very little detailed information is available on its conservation status. Some attempt to determine this was made during a visit to Manus Island in July 1981. As shown earlier, it did not appear in particularly large numbers in overseas orders with New Guinea Shells (although the manager said that considerable numbers go to Japan). This may be due to a number of reasons including the fact that it has been in trade for some time and so is no longer a novelty, and its listing on CITES may deter people from trading in it although trade is legitimate provided the appropriate export licences are issued. It is clearly still very popular with tourists to Papua New Guinea and with expatriates returning to Australia who take large numbers for their friends. Green snail shells are sold regularly in Lorengau market; on the day I visited the market, one stall had about 40 shells and another just 6. In the market they sell for about 40t each compared with K1.20 if bought by mail order from New Guinea Shells. Small numbers are used by Kara jewellers for earrings and necklaces, earrings selling for K26. A number of small boxes of shells were seen in the government offices at Lorengau, mainly of green tree snails, most of which had been brought in as a result of announcements which had been put over the radio since April 1981 saying that shells could be forwarded to Rabaul. The following shells had been invoiced:

#### Number of shells

Papustyla pulcherrima	832	
Megalacron novaegeorgensis	538	
M. tabarensis mahurensis	116	(possibly misidentified)
Rhynchotrochus taylorianus	70	



Megalacron melanesia	7
M. admiralitatis	6
Naninia citrina	8
Megalacron klaarwateri	5

However there seemed to be a very little interest among most of the local people in collecting shells for trade although they were all well aware of the demand for Papustyla pulcherrima. This lack of interest seemed to be largely due to the fact that no money had been received from New Guinea Shells for the shells which had been sent in. The Department of Business Development is responsible for shell collection on Manus, organising shipment of shells to Rabaul and when on extension trips around the smaller islands, encouraging villagers to collect. However, they were not sending further consignments off and were not buying in more stock until the Rabaul agency paid up. Occasionally collectors insisted on selling their shells at prices above the standard one in which case DPI refused to deal with them. One surprising fact was that officials in DPI had no idea that P. pulcherrima was listed on CITES or required a special export permit and Australian expatriates were also unaware of export controls.

There is evidence that in the past large scale collection of green snails took place on Manus I. A visitor in 1979 saw crates awaiting export to the US (Gagne, 1979) and the Lutheran mission was involved in exporting large numbers. Expatriates were known to export green tree snail shells in packing cases or through the mail. At one time efforts were made to set up a third branch of the New Guinea Shell Agency called Tinjal Shells to specialise in this and other Manus "specialities" but as a result of a number of problems including complaints about the poor prices to be paid to collectors, this never came to anything. It was reported that in the 1970s trees or at least branches were being cut down in order to obtain snails but there is no evidence for this. Ranching of the snails was even attempted by at least one person. This involved keeping snails caught in the wild in large cages in a garden, but apparently it met with little success.

Currently land snails are collected mainly from the region along the 'Highway', the road which runs along the ridge of hills from Lorengau, linking a number of villages with the north coast. This is the only easily accessible area of forest, and it is quite possible that the green snail occurs in many other parts of the island. Specimens are collected most easily in the early morning or at night since the snails are nocturnal, and they are most easily found in areas where the trees are being cut down for gardens or for new roads. A number of green tree snails was found at the side of the road in an area where a new road was being put through to the south coast. Papustyla pulcherrima appears to be relatively host specific and is found on a species of Dillenia and one of Astonia but also on other trees and one of the large climbing vines. They are usually found at a height of 5m or more and generally only 4 or 5 specimens are found on any one tree, clamped to the underside of the leaves during the day time. They are difficult to find, although the local people can generally find them after a bit of searching, even during the hotter parts of the day.

Although so little is known of the distribution and ecology of this species, it is probably not endangered at the moment since, although difficult to find on account of its behaviour and ecology, local people were able to locate specimens readily, and collecting is obviously much less intense than it was in the 1970s. However, like other tree snails the trees on which it is found have considerable timber potential and probably the greatest threat to the species is large scale logging. The north-west of the island has rich timber resources but at present access is difficult since most of the Manus population is concentrated on the coast and in the east of the island. A Japanese firm has shown interest in taking out a concession for commercial logging but at present the only use of the forest is for logging for subsistence purposes. Encroaching slash and burn agriculture could also have a considerable effect on the

ranges of these endemic snails over a period of time.

Most of the other snails found on Manus, such as Megalacron admiralitatis and M. novaeguineensis, are fairly prolific and are generally only found in inaccessible areas. One species however probably merits special attention. Megalacron melanesia is known only from a small area around a waterfall about 3km outside Lorengau, an area easily accessible to collectors. Although not a colourful species this is listed on the New Guinea Shells price list; it did not appear on any of the invoices but any future collection of it could have a serious effect. The Manus people show a great interest in their wildlife and natural resources (Kisokau, 1980) and a Development Plan for the province has just been drawn up. It is to be hoped that the important molluscan fauna endemic to the island will be taken into consideration in any major development of the timber resources. At present Manus islanders tend to be comparatively well off since they often have relatives in jobs in Port Moresby, and they have no great incentive to develop the province rapidly but there is no guarantee that this situation will continue.

The same principle applies to the land snails of other island areas in Papua New Guinea. In many cases snails involved in trade are still unknown to science, have never been properly described, and certainly never been studied in their natural habitat.

### Commercial Shells

Papua New Guinea has been one of the main exporters of mother-of-pearl since early this century. In 1978 it was the fourth largest supplier of trochus Trochus niloticus (after Indonesia, the Philippines and the Solomon Is.) and it is also one of the main suppliers of green snail Turbo marmoratus. Papua New Guinean exports of mother-of-pearl go largely to Japan, Europe and Taiwan (Table 6). Green snail is reported to be exported to Korea where it is used for furniture inlay on account of the opalescent colouring of the nacre. Trochus accounts for 1% of the total Papua New Guinea fishery exports and is of greater economic importance than the other three species. Trochus is still used for button-making and quantities are exported to the UK from where they are re-exported to a button factory in Spain. The waste is then sent to the Middle East where it is used for prayer beads. Commercial exports have fluctuated considerably since exports started early this century, as illustrated by Table 7. The most recent figures available are for 1978 when the Department of Fisheries recorded exports of 83 tonnes of trochus and 11 tonnes of green snail over a period of 6 months.

Commercial shell is collected in many areas off the coast of the mainland and around outlying islands such as Manus, New Ireland and New Britain. Milne Bay is a particularly important area for all species and has the largest beds of gold-lip (Pinctada maxima) pearl shell in the country, which were heavily exploited by divers early in the century. 1980 production of commercial shell in Milne Bay amounted to 7 tonnes of trochus, 1.2 tonnes of pearl shell and a small quantity of green snail. Green snail is found around Kavieng, New Ireland quite abundantly, but is not readily found near Rabaul. It is often spoiled by worm holes, and is more difficult to collect than trochus since it occurs on the outside of the reef at a depth of about 10m. Large quantities of trochus are collected around Kieta and Bougainville where a local person is very active in buying it up. The most productive areas in fact often tend to reflect as much the effort going into collecting and marketing the shells as the actual abundance. Cleaning and preparation is generally carried out by the exporter and involves hammering encrustations off and cleaning the shells with a wire brush. Trochus meat is eaten by the collectors.

Initially commercial shell was exploited by foreign fishing vessels. Subsequently it tended to be the Chinese traders who were responsible for exporting this commodity,

as well as the two large trading companies, Burn Philps and Steamships. There are still a few private traders but the larger companies are no longer involved and some of the smaller merchants now act as middlemen. The largest export agency is Gazelle Agencies which has a head office in Lae and a further outlet at Rabaul, but commercial shell is only one of a number of commodities that the agency trades in. It exports shells collected locally as well as that sent in from other parts of the country. In the past it also used to punch button-blanks but does so no longer. Chinese traders in Milne Bay send shell up to Lae as does Ron Knight's trading company at Lorengau in Manus, since it is no longer economical to export small quantities direct.

The Department of Primary Industry (DPI) has overall responsibility for the commercial shell trade and issues export permits, but its only active trading is in Milne Bay. The office of Business Development in this province is trying to encourage trochus collection as a village industry and it has been suggested that if prices improve serious collecting in this region would be worthwhile. The Provincial Fisheries Officer of the region, based at Samarai, buys up trochus, black-lip and green snail from villages which are no longer visited by the private traders and sells them to a small native trading company, Bonabona, when there is demand for the product. DPI in Port Moresby currently sees commercial shell as something of a sideline and would like to see all marketing dealt with by private companies, in spite of the fact that trochus is a fairly major export commodity.

There seemed to be general agreement that the commercial shell trade in PNG is going through a period of decline at present. This is accounted for by a number of factors including decline in demand on the world market, changes in trading relationships in PNG and possible overfishing. Overfishing probably occurred earlier this century and gold-lip and black-lip are now said to be rarely found within the limits of free diving. Trochus production dropped from 1,000 tonnes in 1913 to 358 tonnes in 1928. During the Second World War fishing stopped and stocks had a chance to recuperate but when it was resumed in 1954 stocks were rapidly depleted, production dropping from 800 tonnes in 1954 to 402 tonnes in 1956 (although exports were reportedly higher, see Table 7). A moratorium was introduced for a year and subsequently commercial fishing was permitted with the restriction of a minimum size limit of 6.25cm diameter. (Barletta, 1966; Glucksman, undated). Furthermore trawling and dredging of all commercial shell was forbidden. Size limits are said to be adhered to although it has been reported that they are no longer enforced; the price paid for small trochus however does not make it worth collecting specimens smaller than the minimum size limit. The manager of Gazelle Agencies mentioned that the average size of trochus is getting smaller at the moment and suggested overfishing as the cause, although he said that three years ago there was an excess of large specimens. Small shells are used mainly for buttons as there is less wastage than if larger shells are used. Other factors that suggest overfishing may be occurring include reports that trochus and green snail are much more abundant below the free diving limit than in easily accessible areas and that the yield and size of green snail has dropped markedly since previously prolific harvests in the Schouten Is. and off the south coast of Manus. In 1980 it was reported that output from Milne Bay was also declining (Anon, 1980) but there seems to be no real evidence for this and commercial shell appears to be still readily available. It has also been reported that the legislation concerning size limits is to be revised but no research has been carried out to provide information on which to base any revisions.

Other factors probably play an equally important role in the fluctuations of the commercial shell trade. Until the late 1950s many general merchants dealt in small lots of primary produce and had vessels which traded with outlying areas where they picked up small quantities of commercial shell. Such merchants now concentrate on centrally located operations since rising costs have made it uneconomical for vessels to visit remote areas and it is also unprofitable for companies to collect small

quantities of shell. It is also expensive to carry out the necessary extension work which would, according to the manager of Gazelle Agencies, necessitate employing an expatriate. However these problems may be counteracted by the increasing mobility of the villagers who are now able to bring shell to the depots themselves using public transport or their motorboats.

Prices of commercial shell on the world market tend to fluctuate greatly according to demand and other economic considerations, and are said to have declined since a peak in the late 1950s and early 1960s. In 1980 trochus was fetching KO.27/kg; gold-lip KO.21/kg and black-lip KO.26/kg. The manager of Gazelle Agencies reported that the maximum price paid for trochus in 1980 was in fact KO.75/kg. He pays collectors around Rabaul KO.40/kg; an agent on Kieta is paid KO.60/kg and local collectors on Kieta are paid only KO.20/kg. Green snail has recently fetched extremely high prices, said to be partly due to the import duty imposed on it by Korea. A single shell was worth as much as US\$12 and prices reached as much as US\$1,500/tonne. The Korean import duty has now apparently been removed which is said to have improved turnover.

The future of the commercial shell industry in Papua New Guinea is not entirely clear and some of the private traders were concerned about their businesses. The pearl farm at Samarai, which was once well known and is still billed as a tourist attraction, is now barely productive and exports very small quantities of mother of pearl and black coral jewellery. However the potential of Papua New Guinea as a commercial shell producing country is also recognised and a Japanese company had even expressed interest in setting up a button making factory in Rabaul.

## Other marine resources

### Black coral

Like giant clams, black coral has been depleted throughout much of its range through overcollection. Papua New Guinea, which unlike many tropical countries has no traditional use of black coral is one of the few countries where it is still relatively abundant. It can still be found in fairly large quantities off the coasts of Central Province and in Milne Bay, as well as Manus, New Ireland, East New Britain and the North Solomons. Tagula I. in Milne Bay is said to have particularly extensive black and precious coral beds.

There is no evidence that black coral is exported raw from Papua New Guinea. However it has been reported that Japanese and Taiwanese fishing boats have been taking black coral from the Port Moresby area, the north coast, and Manus. A Japanese company is said to have approached Kara Jewellers about buying raw black coral from this company, but was refused. The provincial government on Manus also received a request from Japanese interests for a concession to dredge for precious coral and to collect black coral, but when asked to discuss it with the government planning team they did not follow the proposal through. There are fears in Manus that black coral collection might be taken up commercially on a large scale by unscrupulous Papua New Guineans.

The main user of black coral in Papua New Guinea is Kara Jewellers, the largest jewellery company in the country with retail outlets in Port Moresby and Lae. They obtain most of their raw material from Central Province, Daru, the north coast and Manus. It was suggested that some came from the Philippines but this seems unlikely, and the manager of Kara Jewellers mentioned that he had heard that Philippine black coral had been overcollected in some areas. The main Kara factory is in Port Moresby where about 30-40 workers including apprentices are employed. A second outlet and workshop in Lae employs about 4 jewellery workers. Most of the jewellery produced is sold locally and to tourists, but the firm is trying to expand its export business, most of which is currently with Australia. Competition with the Japanese and Taiwanese who produce coral jewellery more cheaply may make this difficult.

A study of the black coral resources of Papua New Guinea was carried out several years ago with the aim of trying to determine if a commercial coral fishery could be set up (Tarr, 1978). This was however never followed through. The two most widespread species are Antipathes abies and the whip coral Cirripathes angina, which occur most abundantly at depths of 20-80m, although whip corals are found in water as shallow as one metre in some places, as at Salamau on the north coast. There are also a number of brown gorgonian corals which are suitable for exploitation. Colonies of Antipathes may attain 3-4m. in height and the diameter of the main stem is generally about 20-30mm although it may reach 80mm. It has been estimated that a commercial diving team could collect as much as 25-30kg in a single day's diving in some areas. Colonies are cut off at the base and it has been suggested that if large scale collection were to develop, colonies of less than 30mm diameter should not be taken.

The quality of the raw material and thus the price depends on how badly the stem is affected by worm and to what extent it has growth rings when cut in cross section, since these hinder polishing. The biological significance of the rings is not known, but they do not appear to be formed annually. After collection the coral is dried in the shade which may take as much as 3 months. It is then scraped and filed clean before polishing by hand with sand paper. Beads are cut and rough polished, the final polish being given once the piece of jewellery has been made up. The thicker stems may be used for paperweights. Dead coral can be used for

jewellery making but takes longer to polish which puts the price up. This is often found near beds of living coral and the proprietor of the Loloata Hotel on Lion Island in Bootless Bay uses it to make jewellery which he sells to tourists and day trippers from Port Moresby. A pendant made from dead black coral cost K9 in 1981.

It has been suggested a number of times that the trimmings from a coral colony which are too small for use as jewellery could be replanted to grow into new colonies, by tying them down with a material such as copper wire. Similar experiments were being carried out at Salamau near Lae, where colonies of whip coral were being transplanted from deeper water to shallower water to see if growth rates could be speeded up.

### Stony corals

Unlike many south-east Asian countries stony coral in Papua New Guinea does not seem to be used as a building material and there is no export of ornamental corals. Large quantities however are used for producing lime which is chewed with betel nut. The finely branching species, such as Acropora, are used. Having been dried in the sun the coral pieces are piled up in alternate layers with wood and burnt for about 24 hours when only the ashes remain. These are sieved through a basket, the fine lime powder falling through, leaving the wood ashes behind. Lime plays an important role in trade between different peoples and is produced from corals in many of the islands off the north east, including Manus and East New Britain. Around Rabaul it is thought that the deterioration of the reefs which has been noticed in some areas may be due to overcollection of corals for this purpose. In shallow waters near villages there was certainly evidence that a considerable amount of collection has taken place, and baskets of coral were seen drying near Keravat in East New Britain. Overcollection of coral is also said to have affected fish abundance in some areas.

### Turtles

Traditional use of turtles and their conservation are the subject of a large number of publications by the Wildlife Division which has had until recently a strong and active conservation programme for these animals. Apart from the traditional uses, a small amount of tortoiseshell jewellery is made for sale to tourists. The Morobe Cultural Centre at Lae sold tortoiseshell bangles from Tami and Kara Jewellers makes high quality jewellery from hawkbill shell. This is said to be brought in by local people or obtained from fishermen, and two large boxes of pieces of shell in the Port Moresby workshop were said to represent 6 months' collecting. The shell is flattened by heating it and then cut with a fretsaw and polished. There is no evidence that it is exported commercially.

### Coconut Crabs

Birgus latro, the Coconut Crab is said to be declining through much of the Indo-Pacific as a result of overcollection for food and the curio trade and through habitat destruction. An attempt was therefore made to determine its status in Papua New Guinea. Several people mentioned that it occurred on islands in Manus Province and that it was common in some parts of the Solomon Is. It has been suggested that the Papua New Guinea Coconut Crab may be a different subspecies or even species from that occurring further east in the South Pacific, such as on Vanuata. In some parts of Manus it is common, on occasion even being found in gardens in Lorengau. It is regarded as a delicacy, particularly the claws, but the local people eat it only rarely. Crabs are said to be preyed on by village dogs.

Few people seemed to know anything about its natural history and there was much

disagreement about what time of day and year it was most active, and whether it lived up trees or not. However a two hour search in a coconut plantation along a beach at night on Los Negros I. finally revealed a juvenile of about six months (with a blue carapace), a few feet up a coconut palm.

#### Sea Cucumbers, Tuna and Crayfish

Other studies of these resources have been carried out and no detailed information was collected pertaining to them on this trip. Sea cucumbers have been an important commodity for export at various times, particularly from Milne Bay. In 1980, 8.6 tonnes were approved for export in a six month period according to Department of Primary Industry fishery statistics. Overfishing has been reported but there was no detailed information on this. The bêche-de-mer industry is probably one which, like the shell trade, could be set up on a properly managed basis to provide additional income to villagers.

Tuna was said to be heavily overfished, but still makes up 95% of Papua New Guinea's fishery exports. An American company Starkist was involved and was working on the assumption that in 10 years time tuna fishing would no longer be commercially viable and so they were "making the most" of it now. Crayfish are reported to be overfished in the Torres Straits.

## Marine parks and Protected Areas

Detailed conservation legislation exists for the setting up of parks and Wildlife Management Areas and it is to be hoped that eventually the molluscan fauna will be considered in the establishment of further areas. The majority of protected areas are terrestrial and are generally oriented towards the protection of particular species such as certain birds of paradise. Since habitat destruction is the main threat to the many endemic land snails which are found in Papua New Guinea, in the long run it may well be necessary to establish reserves or Wildlife Management Areas for such species. One example is Megalacron melanesia, the snail endemic to a very small area near Lorengau, Manus (see above).

The concept of marine parks and reserves has only recently been introduced into Papua New Guinea, and the first marine park, Horseshoe Reef in Bootless Bay near Port Moresby, was gazetted in July 1981. An officer for marine parks has recently been appointed to the National Parks Board and several areas have been proposed for marine reserves, including Woodlark Is., Trobriand Is. and the Siassi Is. Lack of money and technical expertise are impeding survey work but it was apparent that the need for marine conservation had been fully appreciated, as had the need for many more marine reserves.

Tourism, as yet plays a fairly minor role in the Papua New Guinea economy but increasingly efforts are being made to develop it. Like the Philippines, one of the country's main attractions is its coral reefs and SCUBA diving and snorkelling is already very popular with the resident expatriates and the small number of tourists who visit the country. As noted earlier in the report on the Philippines, marine parks can fulfill two roles in the context of tourism by providing pristine areas of reef which will attract visitors and also ensuring that certain areas are protected from the less desirable activities of tourists, such as spearfishing and collecting of marine organisms.

One area of conflict which could arise is that areas with particular potential for development of the shell trade are likely to coincide with those considered particularly appropriate for reserve status. Areas identified as being particularly rich in shells include East New Britain, Manus, Finschafen and Siassi in Morobe Province; Wuvalu, Awa, Kaiviru, and Mushu in the Sepik; New Hanover in New Ireland, Milne Bay, Yule I. in the Gulf of Papua; Madang; Kandrian and Gasmata in West New Britain; the North Solomons; and Mortlock and the Tasmanians in the Outer Islands. Milne Bay is an area with some of the richest marine resources in the country including commercial shell, clams, oysters, crayfish, ornamental shells and beche-de-mer (sea cucumbers), most of which are underexploited. A number of areas within the province has been suggested as possible reserves and these should be considered when any development plans are drawn up.

It may be considered that WMAs are a more suitable form of protection for such areas. A few WMAs include coral reefs and other marine life although they have been set up specifically for turtles and dugongs, such as Maza WMA in Western Province and Ranba WMA on Long I. Other areas proposed include Rempi Islands Provincial Park (Madang); Idlers Bay Provincial Park, Port Moresby (used for snorkelling and as a beach resort by Port Moresby people); Motupore I. Marine Reserve (University of Papua New Guinea marine research station); Fly Is. Marine Reserve, Morobe Province; Rossel I.; Morobe Is; and also Bramble Haven in Milne Bay (Dahl, 1980). WMAs could also be considered for reefs rich in giant clams which are used by the local people for food but which are subject to theft by foreign fishing vessels.



## Conclusion

The Papua New Guinea shell trade is unique in that it has been set up in a manner which attempts to take into consideration the long term survival of the resource and could well be used as an example by other countries planning to expand similar businesses. Shell collecting is an activity which can be closely integrated with subsistence fishing (many of the species involved are edible), and terrestrial snail collecting can be integrated with subsistence agriculture since land snails are often most easily found where vegetation is being cleared for gardens. Papua New Guinea is showing increasing interest in its shell resources as exemplified by the production of a book on land snails which is due to be published shortly by the Department of Commerce to promote the trade and by a special stamp issue depicting 5 of the most attractive land snail species, which was released in October 1981.

The booklet produced by the Department of Business Development is a good example of the sort of educational guide that can be produced for collectors. It stresses among other things the following points which should be borne in mind by any shell collector.

- a) Young, old and marked shells which have little value on the shell market should be thrown back into the sea as breeding stock, if collected at all, and collectors should learn to be selective and remove only good shells in the first instance.
- b) In particular, juveniles should be left in the sea.
- c) Collecting areas should be changed at intervals to allow populations to replenish themselves.
- d) There should be as little wastage of shells as possible through breakage, bad cleaning or packaging procedures and collection of specimens which are not in demand.

Similar practices are insisted upon for the collection of butterflies and other insects by the Insect Farming and Trading Agency which also produces a booklet.

However there is evidence of a number of problems in the running of the shell trade as a viable economic business in Papua New Guinea, particularly when compared with the insect trade. It seems unfortunate that the shell trade has no connection with the Wildlife Division, apart from the licensing section. Staff of the Wildlife Division knew little about the running of the shell agencies and were given little information although they said they would like to be more closely involved. This would seem to be essential in the long run, since the shell trade is dependent on species of direct interest to the Wildlife Division in terms of their endemism and occurrence in vulnerable habitats. The staff of the shell agencies also have access to unique information on distributions of different species. Even staff of DPI in Port Moresby and Rabaul closely associated with other small scale businesses often had little idea of what was going on in the trade. Furthermore, collaboration with the National Museum is required since it has very few representatives in its collection of the enormous molluscan fauna of Papua New Guinea. It might be hoped that the shell agency could provide the museum with specimens, or that expatriate shell collectors on leaving the country would be willing to donate collections or specimens. Museum funds are currently said to be inadequate for buying up a collection. It should be noted that all butterflies of particular scientific interest which are collected by the Insect Farming and Trading Agency are donated to the National Collection as a matter of course. A

display of Papua New Guinea molluscs at the museum could help educate local people and visitors about the uniqueness of Papua New Guinea's fauna, the need for its conservation and its usefulness as a natural resource.

Currently the management of the shell business appears far from adequate. Both agencies (Rabaul and Milne Bay) have always run at a deficit and depend on large government subsidies. Lack of motivation among the local people is said to be a major factor accounting for this, and is a problem also encountered by the insect agency. However, the latter counteract this through active extension work and ensuring that collectors receive due financial reward for their activities. Shell collecting is perhaps harder work in that cleaning and packaging is a time-consuming and tedious process. However the slowness of the two agencies in paying collectors for their shells is clearly a deterrent, as are the discrepancies between the prices paid to collectors and those on the mailing list for overseas buyers as pointed out earlier. The Insect Trading agency has a standard mark up of 25% which covers packaging and postage etc., and the agency aims to be self supporting but not profit making. Staff in DPI in a number of provincial governments thought that shell collectors should be paid more. There is also evidence that prices on the list for importers are too high considering the world market. In general Papua New Guinea shells tend to be the most expensive which explains why the greatest sale currently appears to be in those species only available in Papua New Guinea. Lowering the prices might improve business in the commoner species. Greater sales could probably be made to tourists if the shop was better stocked and run more efficiently. During the author's visit to the Rabaul premises a coach load of Japanese tourists arrived, anxious to buy shells but unable to do so since no sales assistants were present.

A further deterrent to local collectors is the fact that it is made very difficult for other nationals wishing to set up shell collecting businesses to do so. Clearly there are a number of problems associated with such schemes, such as the need for capital, the ability of the person concerned to run the business along satisfactory lines and the problems of competition with the other agencies. However there was a strong feeling in areas such as Manus, that a locally operated firm could run a more efficient business with the assistance of DPI. Although the current status of the Milne Bay Shell Agency is not known, it was obvious that a great deal of work was required to get it fully operational. The Department of Commerce in the provincial government pointed out that the lack of expertise among the local people was a major problem and expressed the need for assistance in the form of an overseas volunteer. Proposals from the Technical Officer include efforts to set up other buying stations in different provinces, but these often seem to founder through lack of initiative or technical expertise and lack of extension work by the existing agency, as for example a scheme which was planned for the Siassi islands off the north coast.

Clearly such inefficiency is beneficial to the mollusc species concerned and it seems unlikely that current collecting pressure is having any effect on any particular species. Pressure on the Manus green tree snail, Papustyla pulcherrima, has died down but collecting and trade in this species should continue to be monitored. Perhaps the only species giving cause for concern are the other colourful land snails, especially P. xanthochila which according to invoices is currently leaving the country in large numbers. Although Papua New Guinea still appears to have abundant forest and suitable snail-habitat, this is being increasingly eroded by the need for agricultural land to support the expanding population. As the snails' habitat becomes compressed, the effects of collecting on some of these species may become more serious. Progress reports on the shell trade by the Technical Officer mention that should collection become excessive for any species, it would be limited. However, whether and how this could actually be put into practice has not been elaborated on. All commercial exports

are accompanied by permits from the Wildlife Division (with special permits for Papustyla pulcherrima, listed on Appendix II of CITES) but there was no evidence that these were monitored. Furthermore large quantities leave the country unrecorded with tourists and expatriates returning home.

Extensive survey work is required for the terrestrial molluscs of Papua New Guinea, both from a taxonomic, ecological and conservation point of view. Until more is known of the distribution of the species concerned it will be very difficult to make any constructive recommendations. The shell agencies themselves could help to provide such information by providing proper locality data with each specimen. This is the case at the Insect Farming and Trading Agency where each insect sent to the agency has to be accompanied by the correct locality data which are then recorded on the mapping scheme being developed there. The situation at the shell agency is that locality data are provided with specimens, but that they are taken from a standard list and so may not reflect the true collecting area, the list obviously being greatly simplified. Serious conchologists could be very disappointed on learning this and it could result in the reputation of the shell agency being damaged. One activity which should be strongly discouraged is the importing of Philippine shells which are then re-exported as Papua New Guinea specimens, a practice which is carried out for a number of marine shells and some land snails.

It is to be hoped that the management of the shell trade can be improved in line with its stated aims, which exemplify Papua New Guinea's advanced outlook on conservation. It is striking that environmental impact statements are now carried out before any major development is undertaken. A number were underway in July 1981 including a survey of the effects that the proposed Ok Tedi copper mining venture could have on the Fly River, and a survey of an area in Milne Bay where a major timber development scheme was to be launched. A proposal to set up a tuna canning factory in Lorengau harbour, Manus, had been turned down on account of the pollution it would cause. In two of the provinces visited, Manus and Milne Bay, comprehensive development plans had been drawn up for the regions and there is an increasing awareness of the importance of the country's natural resources. This is coupled with the renewed interest, to be found throughout the South Pacific, in traditional practices and methods of using such resources. Symposia have been held (Morauta et al. 1980) and at Lae the Man and Environment course run at the university includes studies on traditional fishing techniques and other village practices.

Unfortunately, since this study on the shell trade was carried out, and despite the growing effectiveness of Papua New Guinea's conservation efforts, a severe blow has been dealt as a result of the government recently axing a substantial portion of the Office of Environment and Conservation, and in particular the Wildlife Division. The dugong and coastal management programme, as well as the marine turtle project have been terminated, and the publications, education and information sections have been heavily reduced. The Insect Farming and Trading Agency has been moved to the Department of Primary Industry, and will now be administered under the same roof as the shell trade. Efforts are being made to reverse some of these changes and it is to be hoped that eventually not only will the Wildlife Division be able to function as it had done previously, but that the shell trade will be encouraged to develop along the same lines as the other wildlife exploitation projects.

Table 1

Overseas orders January - June 1981 New Guinea Shells, Rabaul

	Land Snail shells	Marine shells	Both	Total
US	4	6	3	13
Australia	2	2	2	6
Italy		5	1	6
South Africa	1	1	2	4
UK	2	1		3
Switzerland	1	1	1	3
Japan	2			2
Belgium		1	1	2
Germany		2		2
French Polynesia			1	1
Portugal			1	1
Taiwan			1	1
Spain			1	1
Brazil			1	1

Table 2.

Comparison of prices paid to collectors (buying) and those listed on the New Guinea Shells mail order list (selling) for a selection of shells

	Buying price K	Selling price K	Mark up %
Angaria delphinus	.02	.40	1,900
Architectonia perspectiva	.05	.50	900
A. radiata	.02	.40	1,900
Bursa bubo	.30	4.50	1,400
B. bufonia	.05	1.50	2,900
B. cruentata	.05	1.50	2,900
B. crumena	.01	1.50	14,900
B. granularis	.05	.75	1,400
B. rana	.03	.80	2,570
B. rosa	.05	2.20	4,300
B. rubeta	.30	1.25	3,170
Cassis areola	.01	.80	7,900
C. cornuta	1.00	2.00	100
C. rufa	.01	2.25	22,400
C. erinaceus	.03	.40	12,300
C. glaucum	.50	2.70	4,400
C. ponderosa	.05	.75	1,400
Conus aculeiformis	.20	2.00	900
C. acutangulus	.30	2.75	8,100
C. ammiralis	1.00	8.00	700
C. arenatus	.005	.75	14,900
C. aulicus	1.00	5.00	400
C. bullatus	10.00	30.00	200
C. magnificus	2.00	17.50	775

1 K = £0.75

Table 3

Analysis of invoices for Land Snails January - June 1981.  
New Guinea Shells, Rabaul

	No. of consignments	Total No. of shells
<i>Papustyla xanthochila</i>	8	6,152
<i>Megalacron klaarwateri</i>	4	599
<i>Xesta (Naninia) citrina</i>	4	540
<i>Papuina adonis</i>	4	317
<i>Forcatia globula</i>	4	217
<i>Placostylus miltocheilus</i>	4	165
<i>Papustylas pulcherrima</i>	3	154
<i>Papustyla chancei</i>	4	122
<i>Papuina hermione</i>	3	79
<i>Placostyla hargravesi</i>	4	71
<i>Megalacron novaegeorgensis</i>	3	67
<i>Rhynchotrochus wiegmanni</i>	4	58
<i>R. woodlarkianus</i>	3	45
<i>Ceratopoma fisheriana</i>	2	44
<i>Rhynchotrochus williamsi</i>	4	43
<i>Papuina mendana</i>	4	40
<i>Papuina gamelia</i>	3	37
<i>Chloritis hombroni</i>	4	36

At least 47 other species were recorded in smaller quantities.

Table 4

Shells brought or sent into New Guinea Shells

	No. of shells	
<i>Papustyla pulcherrima</i>	37)	Manus I.
<i>Forcatia buhleri</i>	54)	
<i>Megalacron admiralitatis</i>	4)	
<i>M. klaarwateri</i>	9)	
<i>Dendrotrochus cleryi</i>	1)	
<i>Papustyla xanthochila</i>	1,100)	Bougainville
<i>Papuina adonis</i>	200)	
<i>P. gamelia</i>	88)	
<i>P. mendana</i>	82)	
<i>P. macfarlanei</i>	20)	
<i>P. hermione</i>	115)	
+ one consignment of 379 unidentified land snails		
<i>Placostylus palmarum</i>	1,911)	Solomon Is.
<i>Papuina moticella</i>	136)	
<i>P. vexillaris</i>	73)	
<i>Papustyla chancei</i>	1,258)	East New Britain
<i>P. hindei</i>	894)	

Table 5

Buying and selling prices at New Guinea Shells  
for a selection of Land Snails

	Buying price k	Selling price k	Mark up %
Dendrotrochus cleryi	.02	.40	1,900
Forcatia buhleri	.05	1.00	1,900
F. globula	.10	.60	500
Megalacron admiralitatis	.05	.40	700
M. alfredi	.05	1.00	1,900
M. densestriata	.10	1.20	11,000
M. klaarwateri	.03	.30	900
M. melanesia	.25	3.50	1,300
M. novaegeorgensis	.05	.50	900
M. phaestoma	.05	1.00	1,900
M. spadicea	.05	1.30	2,500
M. tabarensis	.05	.80	1,500
Meloibba goldei	.20	3.50	16,500
Papuina adonis	.05	.50	900
P. donnaisabellae	.05	.60	1,100
P. gamelia	.05	.50	900
Papustyla pulcherrima	.20	1.20	5,000
P. xanthochila	.05	.60	1,100

Table 6

Papua New Guinea Exports of Commercial Shell  
July 1975 - June 1976

Country of Destination	kg.		
	Trochus	Green Snail shell	Pearl shell
Japan	91,701	26,630	8,788
Spain	54,309	25,000	
W. Germany	41,979	218	914
Italy	24,341		
UK	10,160		
Taiwan	5,110		300
Singapore		8,277	
Haiti			189
Total	227,600	60,125	10,191

Source: published government statistics

Table 7

Papua New Guinea Exports of Commercial Shell tonnes

	<u>Trochus</u>	<u>Green snail</u>	<u>Pearl shell</u>
1948	548	1	-
1949	522	3	-
1950	380	15	-
1951	1030	127	-
1952	528	248	3
1953	513	263	32
1954	703	216	-
1955	854	192	3
1956	766	201	15
1957	490	115	7
1958	423	31	24
1959	256	30	12
1960	347	33	14
1961	243	17	5
1962	246	24	31
1963	210	11	10
1964	360	13	25
1965	295	15	19
1966	201	7	17
1967	418	20	32
1968	850	24	21
1969	260	12	22
1970	441	17	51
1971	518	24	70
1972	359	20	43
1973	496	48	60
1974	512	66	26
1975	304	33	46
1976	228	60	10

Source: Gluckman (undated).

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