

# THE EXTENT OF CORAL, SHELL, AND ALGAL HARVESTING IN GUAM WATERS

MARINE LABORATORY  
UNIVERSITY OF GUAM

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Sea Grant Publication UGSG-77-10

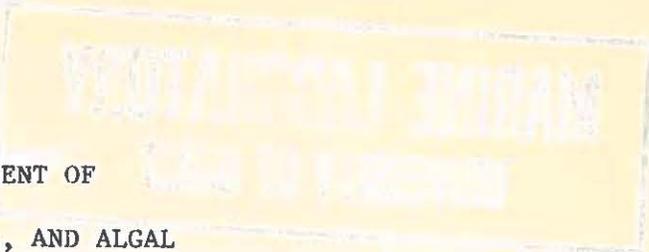
UNIVERSITY OF GUAM MARINE LABORATORY

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Cover illustration: Pocillopora elegans, Lambis lambis, Caulerpa racemosa; drawn by Leonor Lange-Moore.



THE EXTENT OF  
CORAL, SHELL, AND ALGAL  
HARVESTING IN GUAM WATERS

By

Steven E. Hedlund

Prepared For

The Coastal Zone Management

Section of the Bureau of Planning

University of Guam Marine Laboratory

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## INTRODUCTION

The single most important natural resource of a tropical Pacific island is its coral reef, for without the reef there would be no island. The coral reef acts as a barrier to reduce the force of wave action upon the land. In addition, the reef provides a natural habitat for a variety of plant and animal life which interact with the environment to form the most complex ecosystem in our world today. The people of Guam utilize the reef for recreational purposes as well as a source of food. Because of its beauty, economic and scientific value, along with the fact that it is potentially expendable, the coral reef has been designated as an area of particular concern on Guam.

Ten years ago scientists felt that coral reefs were so very fragile that man should not even think about harvesting the very substance from which they are composed. Today this attitude has changed and reef organisms are regarded as harvestable and renewable resources. However, these resources are potentially limited and therefore great care must be taken to conserve them and regulate their harvest.

In recent years, more and more people have begun collecting corals, shells, and algae for their ornamental beauty and food, and commercial harvesting has also increased greatly. In order to assess the extent and effect of harvesting these organisms from Guam waters, the Coastal Zone Management Section of the Bureau of Planning contracted the University of Guam Marine Laboratory (Graduate Student Steven E. Hedlund) to undertake such a study.

### Scope of Work

The specific objectives of this analyses are as follows:

- (1) to determine which species of corals, shells, and algae are being harvested and to what degree.
- (2) to determine where the majority of harvesting is being done, and provide maps based on such data.
- (3) to review and provide information on existing laws and their enforcement.
- (4) to make recommendations regarding protection of certain species, stricter law enforcement, or change in existing laws.

## METHODS

This study was divided into four sections, with the main emphasis being on the first section dealing with coral. The second section analyzes shells, followed by the third section which covers the algae. The fourth and final section concerns existing laws and their enforcement.

In order to ascertain which species of corals, shells and algae are being harvested and to what degree, along with harvest locations, a number of personal interviews were conducted with the owners, managers, and sales clerks of stores that were found to be selling these natural products.

In the case of corals, these interviews yielded information regarding species, prices and amounts marketed, and in some instances led to the source of supply. However, information was not freely given in certain cases and therefore information pertaining to harvesting locations is not that extensive.

It was found that only one store actually markets local shells to a very small degree, and an interview was conducted with the owner. Since local shells are not harvested regularly on a commercial level, a series of interviews were conducted with knowledgeable sources. These included amateur and professional conchologists, along with Andersen Air Force Base Shell Club members and various divers.

Currently, local edible algae are not marketed on a regular commercial basis. Therefore, what little data was gathered came mostly from a study being conducted by Dr. Roy Tsuda and the author regarding the mariculture potential of the red alga Gracilaria edulis. Additional information was obtained from brief interviews with local fisherman who sometimes gather edible seaweed.

Finally, in an effort to analyze and review existing legislation and enforcement of laws regarding coral, shell, and algae harvesting in Guam waters, interviews were conducted with Mr. Harry Kami, Chief of the Aquatic and Wildlife Resources Division-Department of Agriculture.

## RESULTS AND DISCUSSION

### Corals

The natural beauty of dried and mounted coral make it a much desired ornamental product of nature. Some species cut and polish nicely and

are thus in great demand by local jewelers. These are the two main reasons why corals are harvested from Guam waters, for ornamental use and jewelry work.

Information regarding the species, amounts, dates and sources of supply of locally marketed coral is presented in Table 1. From this data, estimates of the monetary value of annual commercial consumption were derived and can be found in Table 2.

An analysis of the data presented in Table 2 reveals that over the last two and one-half years the commercial market for locally harvested coral has been subject to fluctuation. In fiscal year 1975 a total of \$9,550 was sold as compared with \$8,425 sold in 1976. This is primarily due to an unreliable supply rather than a fluctuating demand. The increase to \$12,225 sold thus far in 1977 is due to the establishment of the Elmar Corporation L.T.D., which deals with expensive coral jewelry made from fossil and subfossil specimens.

Further analysis of the data from Table 2 showed that the most common species of coral which are harvested on a commercial level from Guam waters are, in order of importance (most exploited).

- (1) Acropora irregularis
- (2) Acropora spp. (fossil and subfossil origin)
- (3) Acropora acuminata
- (4) Antipathes dichotoma
- (5) Fungia fungites
- (6) Helipora coerulea\*
- (7) Tubipora musica\*

In an attempt to determine the locations of local harvesting activities, a number of interviews were conducted with the "sources" listed in Table 1.

Dr. Blair Sparks, the owner of Shells of Micronesia, was interviewed three different times, with each interview lasting no more than ten minutes. Although Dr. Sparks did not wish to discuss his business volume or harvesting location, some information was gathered regarding the latter through outside sources. Dr. Sparks son, Sam, is in charge of the collecting and his harvesting method involves breaking off huge coral heads at the base with a heavy iron bar. Figure 1 shows the main harvesting location and depth.

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\*At this time it is impossible to determine the extent that these two species are exploited due to the fact that information was not freely provided by the owner of the store where these species are sold. (See Table 1)

Table 1. Species, amounts, dates and sources of supply of locally marketed coral.

Store	Species	Amount (\$)	Dates	Source
Orient Co. (Julale)	<u>Acropora acuminata</u>	\$50-100/month	Jan. '75-May '76	Unknown Student
Blue Pacific Gift Shop (Fujita)	<u>Acropora</u> sp.	\$50/month	Jan. '75-Dec. '75	Unknown Naval Seaman
Continental Gift Shop	<u>Acropora irregularis</u>	\$50/month	Jan. '75-Jan. '76	World Shells (Dr. Blair Sparks)
Shells of Micronesia	<u>Acropora irregularis</u>	*	*	Dr. Blair Sparks
	<u>Heliopora coerulea</u>	*	*	(Owner)
	<u>Tubipora musica</u>	*	*	Mr. Sam Sparks
Elmar Corp. L.T.D. (I.T.C. Building) w/ outlets at Hilton, Gibsons, Int. Gift Ctr., Jennys Fashion, Joelle, Okadaya	<u>Acropora</u> spp. (fossil and sub- fossil origin)	\$2000/month	Jan. '77-June '77	Mr. Choi (Owner)
Gold Guild Custom Jewelry (Julale)	<u>Antipathes dichotoma</u>	\$25-50/month	Jan. '75-June '77	Mr. Mack
Tritons Treasures Jewelry	<u>Antipathes dichotoma</u>	\$25-50/month	Jan. '75-June '77	Mr. Mack
Duty Free Shoppers	<u>Acropora irregularis</u>	\$600/month	Jan. '75-Dec. '76	World Shells
	<u>Fungia fungites</u>	\$40/month	Jan. '75-Dec. '76	(Dr. Blair Sparks)

\*Information was not freely provided by owner.

Table 2. Estimates of the monetary value of annual commercial consumption of the most commonly harvested corals from Guam waters.

Species Harvested	1975	1976	1977	TOTAL
<u>Acropora acuminata</u>	\$ 900	\$ 375	--	\$ 1,275
<u>Acropora</u> spp. (fossil and subfossil origin)	--	--	\$12,000	\$12,000
<u>Acropora irregularis</u>	\$7,200	\$7,200	--	\$14,400
<u>Acropora</u> spp.	\$ 600	--	--	\$ 600
<u>Antipathes dichotoma</u>	\$ 450	\$ 450	\$ 225	\$ 1,125
<u>Fungia fungites</u>	\$ 400	\$ 400	--	\$ 800
TOTAL	\$9,550	\$8,425	\$12,225	\$30,200

\*Information was not freely provided by owner.

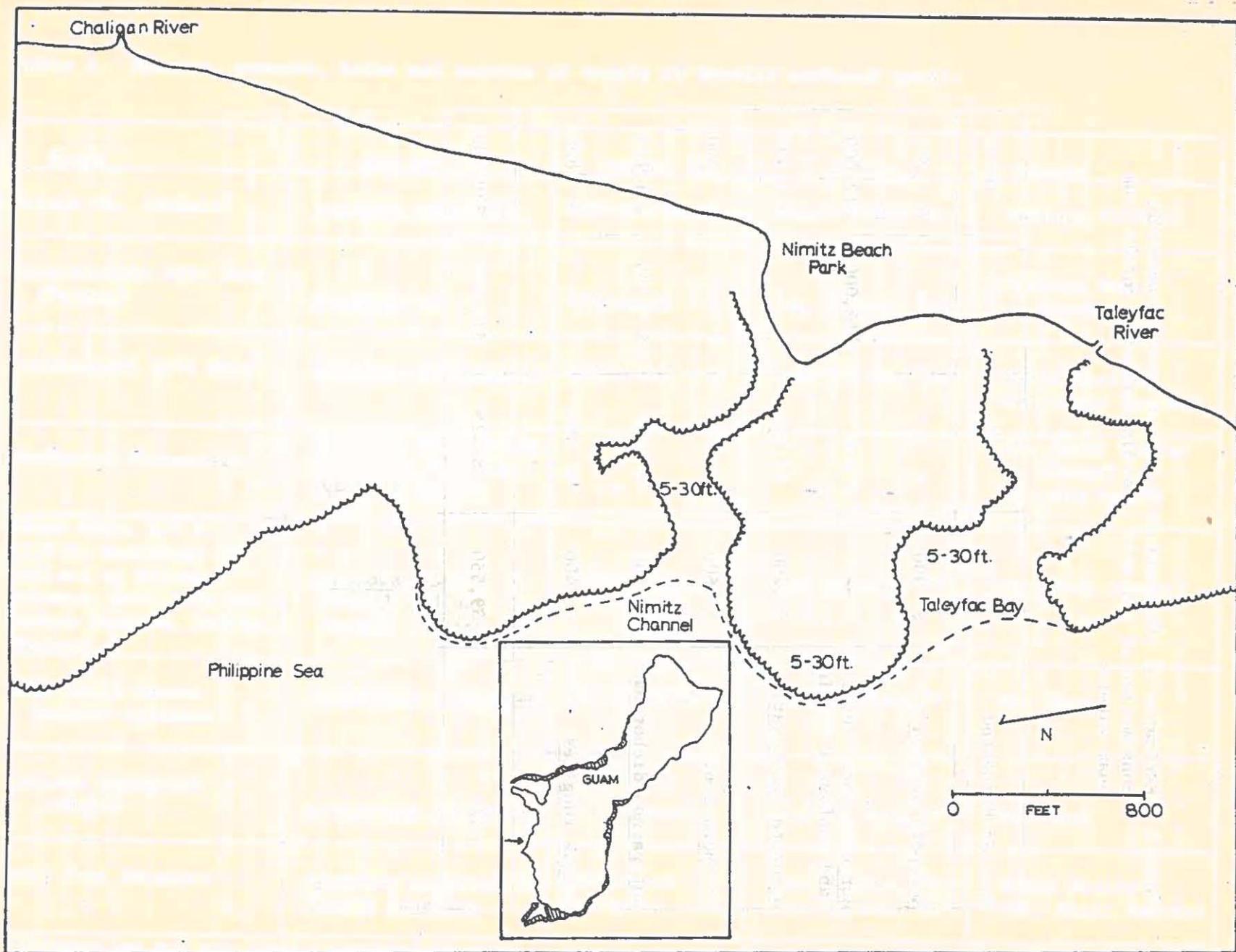


Figure 1. Location (indicated by dashed line) and depth at which *Acropora irregularis* is harvested.

Figure 1. Location (indicated by dashed line) and depth at which Acropora irregularis is harvested.

The founder and owner of Elmar Corp. L.T.D. (Natural Flower Coral) was interviewed twice for periods of one-half-hour. Mr. Choi stated that he harvested a number of times all around the northern tip of Guam. These are rather general data, and I therefore refer the reader to maps #77-89 in the Atlas of Reefs and Beaches of Guam. Mr. Choi's method of harvest involved a specially equipped boat with deep sea dredge. He stated that he dredged at depths between 100-1000 ft. The main species harvested were Acropora spp. of fossil and subfossil origin.

The only man working with the precious black coral on Guam is Mr. Mack, a science teacher at G.W.H.S. However, he only cuts and polishes, and does not actually collect the black coral Antipathes dichotoma. Mr. Mack obtains his coral from a couple of divers who wished not to be named. Their method of harvest involves sawing off large fans at the base. Figure 2 shows the main harvesting location and depth. In addition, a study conducted by Dr. Lucius G. Eldredge and Richard W. Grigg revealed that Antipathes dichotoma occurs off of Orote Point and has been harvested in past years on a small scale.

### Shells

The natural beauty of marine shells makes them a prime target for the collectors eye. The main reason shells are gathered from Guam's reef is for display in private collections. A very minute quantity is sold in the curio shop Shells of Micronesia, and some species are cut, polished and made into jewelry by local artists. At least six species of marine gastropods (e.g. marine snails) and numerous bivalves are gathered and eaten by the local population.

In recent years the number of shells to be seen on Guam's reef has been greatly reduced. In order to determine the most common species gathered along with amounts and locations of harvest, two interviews were conducted which yielded the following information.

From an interview with Mrs. Cheryl Richardson, a conchologist who has resided on Guam since 1973, and various members of the Andersen Air Force Base Shell Club, data were obtained regarding the most common species gathered islandwide along with their habitat preference. This information is presented in Table 3.

An interview conducted with Mrs. Richardson and Sergeant Jim Rogers, another very capable conchologist, yielded information regarding the most commonly shelled areas of Guam along with the most sought after species found in these areas. These data are presented in Table 4, and locations are indicated on a Guam map at 1:25,000 scale.

Sergeant Rogers has been collecting shells for over twenty years and lived on Guam from February 1961 until November 1962, at which time he was actively collecting. He returned to Guam in October of 1972 and

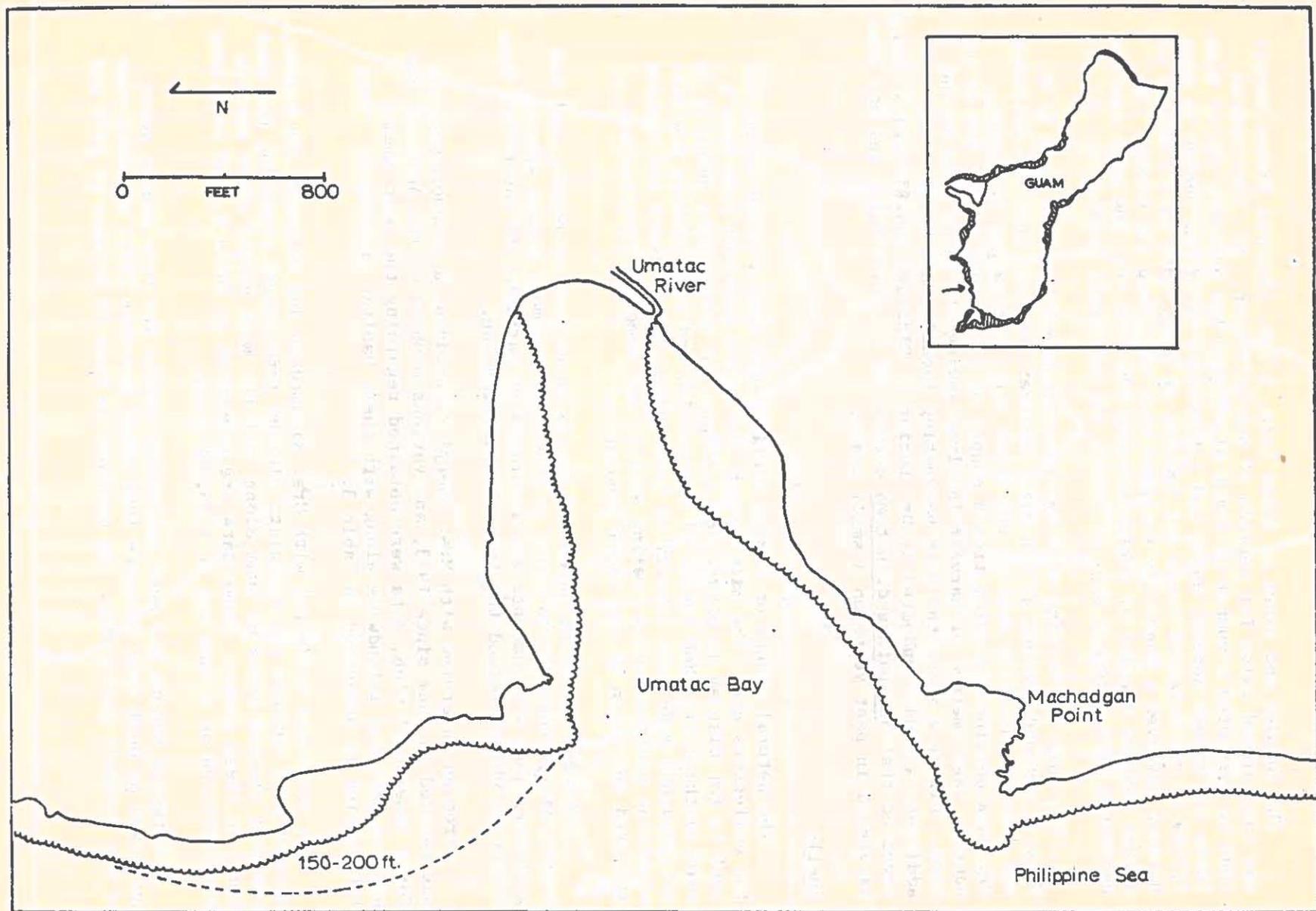


Figure 2. Location (indicated by dashed line) and depth at which *Antipathes dichotoma* is harvested.

Figure 2. Location (indicated by dashed line) and depth at which Antipathes dichotoma is harvested.

Table 3. Checklist of the most common species of marine gastropods gathered islandwide from Guam waters, along with their habitat preference.

SPECIES	HABITAT
<u>Conus eburneus</u>	Sand
<u>Conus pullicarus</u>	Sand
<u>Cypraea annulus</u>	Under Rocks
<u>Cypraea caputserpentis</u>	Reef Margin, Front
<u>Cypraea erosa</u>	Sand, Coral Rubble
<u>Cypraea moneta</u>	Sand, Coral Rubble
<u>Cypraea ventriculus</u>	Reef Margin
<u>Drupa morum</u>	Intertidal, Reef Margin, Front
<u>Drupa ricinus</u>	Intertidal, Reef Margin, Front
<u>Lambis lambis</u>	Sand
<u>Strombus luhuanus</u>	Intertidal
<u>Strombus mutabilis</u>	Intertidal
<u>Terebra affinis</u>	Sand
<u>Terebra dimidiata</u>	Sand
<u>Terebra maculata</u>	Sand

Table 4. The most commonly shelled areas of Guam, along with the most sought after species found therein.

LOCATION	SPECIES
Scout Beach (E. of Tarague)	<u>Conus ebraeus</u> <u>Thais aculeata</u> <u>Trochus incrassatus</u> <u>Trochus niloticus</u>
Tarague Beach	<u>Cypraea maculifera</u>
N.C.S. Beach	<u>Conus textile</u> <u>Cypraea maculifera</u>
Tumon Bay	<u>Cypraea lynx</u>
Adelup Point	<u>Conus textile</u> <u>Conus tigrinus</u>
Asan	<u>Conus imperialis</u> <u>Cypraea ventriculus</u> <u>Lambis truncata</u>
Piti - U.S.O. Beach	<u>Cypraea poraria</u> <u>Cypraea talpa</u> <u>Mitra spp.</u> <u>Terebra babylonia</u>
Apra Harbor (Hotel Warf, Pine Tree Cove, Jade Shoals, Western and Middle Shoals, Gab Gab Beach)	<u>Cypraea mauritiana</u> <u>Cypraea tigris</u>
North and South Tupalao	<u>Cypraea lynx</u> <u>Cypraea mauritiana</u> <u>Cypraea tigris</u> <u>Cypraea vitellus</u>
Rizal Beach	<u>Mitra terebralis</u>
Agat Beach	<u>Cypraea testudinaria</u>
Nimitz Beach-Anae Island	<u>Conus quercina</u>
Cocos Lagoon	<u>Cypraea tigris</u> <u>Conus leopardus</u> <u>Conus litteratus</u> <u>Lambis truncata</u>

thus was able to provide some interesting information regarding the change in shelling conditions over the last fifteen years.

Sergeant Rogers stated that both Tumon and Agana Bays were fantastic shelling areas in the early sixties. He attributed the drastically reduced gastropod populations not only to increased shelling, but more importantly to increased pollution in the last five years, especially in Agana Bay. The Cocos Lagoon area was also very rich in shell life many years ago and has been depleted mainly due to increased shelling. Sergeant Rogers stated that the helmet shell Cassius cornuta was very abundant in the Cocos area when he first came to Guam, and that only one specimen has been reported since his return in 1972. This species has been reported to inhabit sandy areas of the N.E. coast. Another gastropod whose population size has been severely decimated over the years is the triton trumpet, Charonia tritonis. This animal is a natural predator of the coral eating crown-of-thorns starfish, Acanthaster planci, and thus has been speculated to be an important factor in controlling its population size.

Four additional marine gastropods which are considered very rare include:

- (1) Cypraea aurantium
- (2) Oliva miniacea (form marrotti)
- (3) Strombus aurisdianae
- (4) Strombus bulla

Sergeant Rogers feels that the best way to help increase the population of shells in Guam waters is to educate the people. Ignorant shellers cause a great deal of irreparable damage by leaving rocks overturned and taking females with eggs. The public should therefore be made aware of the basic rules of shell collecting, i.e.,

- (1) do not take females with eggs;
- (2) do not leave rocks overturned;
- (3) take only one of each species;
- (4) try to gather large adults rather than immature juveniles;
- (5) try to gather dead shells rather than live ones.

These facts could be publicized through short radio broadcasts, newspaper articles, and signs posted at public beaches in both English and Japanese. In addition, new swimmers and divers should be made aware of these rules through their courses. In this way marine gastropods will have a better chance to reach reproductive maturity and increase their population size.

An interview with Dr. Blair Sparks, owner of the curio shop Shells of Micronesia, revealed that approximately \$100 in local shells are sold each month. These include a wide variety; and information regarding species and amounts marketed, along with location harvested, was not available.

Shells of Micronesia also sells earrings and pendants fashioned from the shell of Strombus luhuanus, a very common marine gastropod. The store Tritons Treasures also markets this jewelry created by local craftsmen. Creative art work from common shells should be encouraged.

At least six species of marine gastropods are known to be harvested as a food source. These include Turbo argyrostoma and Turbo setosus which are found on the reef margin, Vasum ceramicum and Vasum turbinellus found in coral rubble areas in the intertidal reef flat, Strombus luhuanus found in sandy areas of the inner moat regions of the reef flat, and Trochus niloticus found on the reef front and in intertidal areas.

Four species of marine bivalve were found to be harvested by local people as a food source. These include Codakia tigrina, Periglypta puerpera, Quidnipagus palatum and Tridacna maxima.

All of these bivalves are found islandwide in sandy intertidal areas with the exception of Tridacna maxima, which is found on the reef front.

### Algae

Probably the most important components of the coral reef ecosystem are the phytoplankton and algae, for without these the reef could not exist. These micro and macroscopic plants are the primary producers and thus provide food and energy for the multitude of other organisms inhabiting the reef. Besides being a source of food to many creatures which inhabit the reef, some species of macroalgae are eaten by man.

In an effort to determine which species of algae are harvested from Guam waters, along with amounts and locations of harvest, interviews were conducted with knowledgeable sources, i.e., fishermen and store owners.

A survey of island grocery stores and small markets revealed that currently no local algae is marketed on a regular basis. However, it was discovered that the green alga Caulerpa racemosa is sometimes sold at the Saturday morning flea market for 25¢ a pound. This alga, commonly known to Guamanians as "ado", is one of two marine algae eaten by local people. (Codium spp. was also marketed at the Flea market for 25¢ a pound, but only Filipinos eat this alga). The other seaweed that is harvested for food is the red alga Gracilaria edulis, better known as "chaguan tasi." This alga is currently being studied by Dr. Roy Tsuda and the author at the University of Guam Marine Laboratory, in relation to its possible mariculture potential. Although the local people on Guam are not heavy seaweed consumers, preliminary tests on the marketing of Gracilaria edulis were encouraging.

At the present time only two reef areas are known to be regularly harvested for algae. In Pago Bay the green alga Caulerpa racemosa is gathered and in Sella Bay Gracilaria edulis is harvested. These loca-

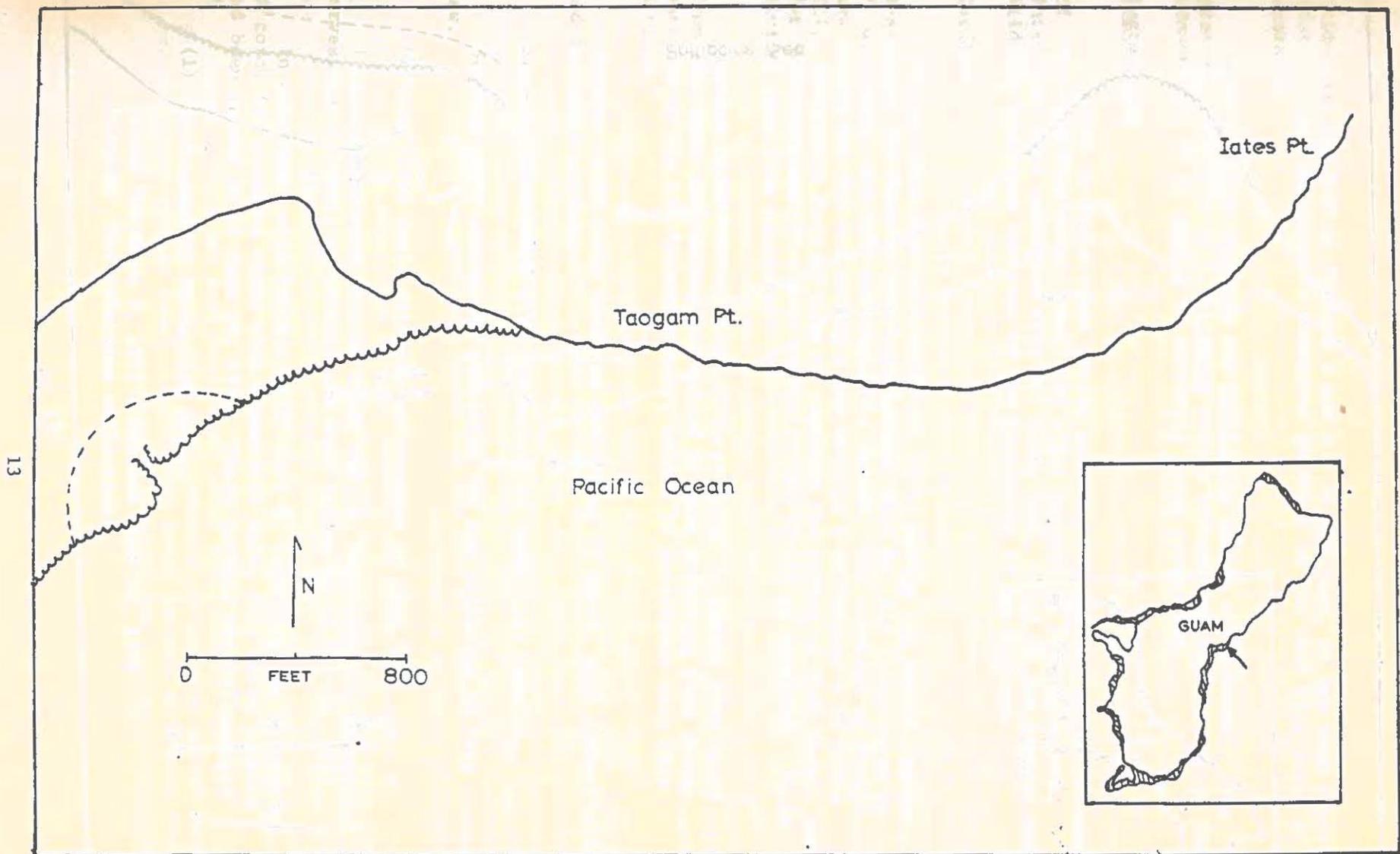


Figure 3. Location (indicated by dashed line) where the green alga *Caulerpa racemosa* is harvested.

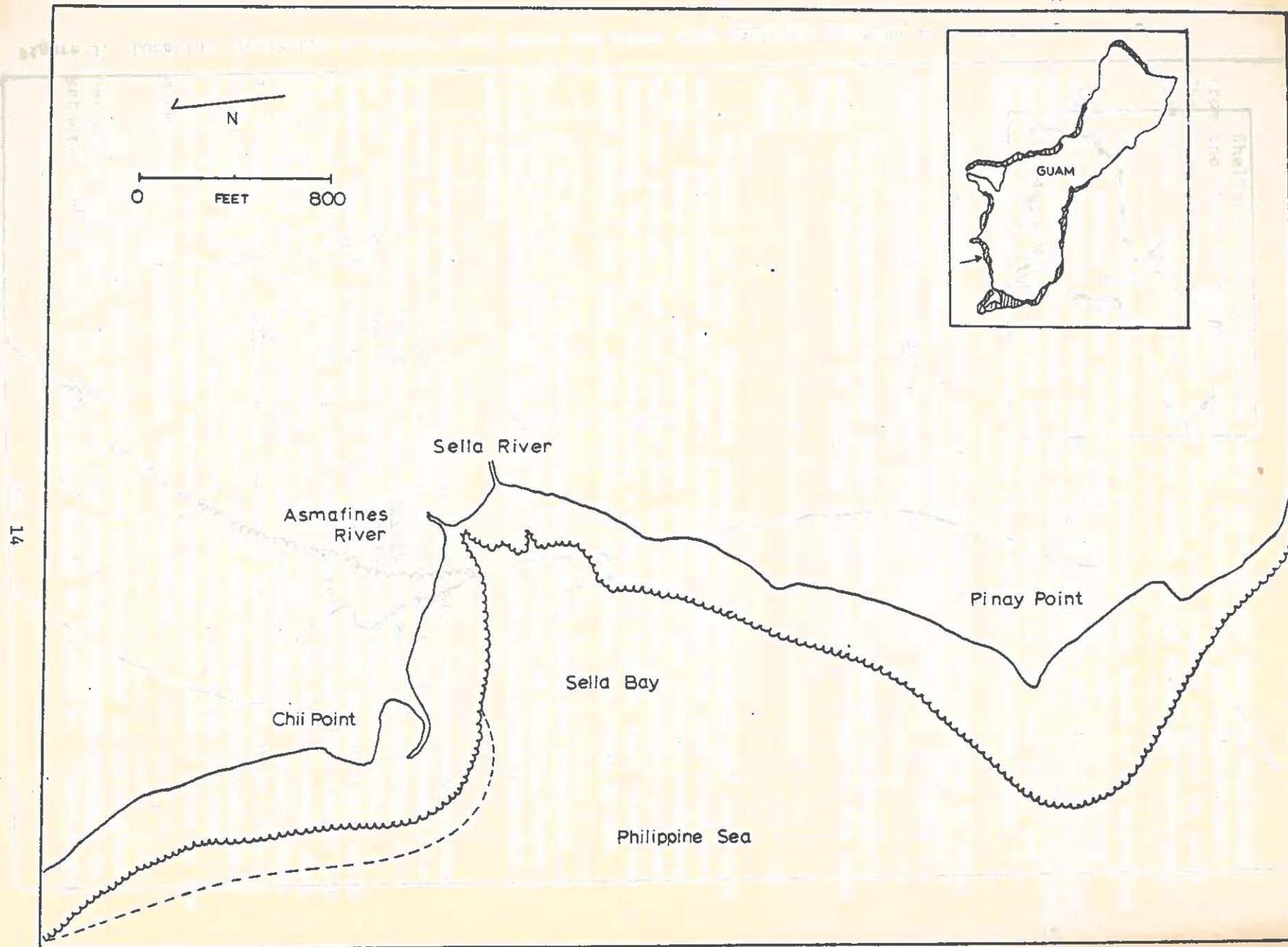


Figure 4. Location (indicated by dashed line) where the red alga *Gracilaria edulis* is gathered.

tions are depicted in Figures 3 and 4. In addition, it has been reported that Caulerpa racemosa is sometimes gathered on the reef flat south of Inarajan.

Both Caulerpa racemosa and Gracilaria edulis are seasonal. The greatest abundance of C. racemosa occurs between January-May, while the seasonality of G. edulis is currently being researched.

### Legislation

In order to analyze and review existing legislation and enforcement of laws regarding coral, shell and algal harvesting in Guam waters, interviews were conducted with Mr. Harry Kami, Chief of the Aquatic and Wildlife Resources Division of the Department of Agriculture.

### Corals

It was found that on October 30, 1974, during the second regular session of the Twelfth Guam Legislature, Bill No. 416 (introduced by F. G. Lujan), was duly and regularly passed. The creation of Public Law 12-186 was "An Act adding a new Article 4 to Chapter 4 of Title XIII, Government Code of Guam to regulate the taking of live coral, and for other purposes." A copy of Public Law 12-186 is appended. It is divided into five sections:

Section 12380 states, "It shall be unlawful to remove live coral from that area surrounding the Island of Guam extending from shore outwards to the ten fathom contour, except in accordance with this Article."

Section 12381 deals with the harvesting of coral, both commercially and for other purposes.

Section 12382 deals with the nature of commercial permits.

Section 12383 states the penalties for any violation of this law.

Section 12384 deals with the enforcement of this law.

In accordance with Section 12381 Part A, regarding the commercial harvesting of coral, no permits had been issued as of May 27, 1977.

In accordance with Section 12381 Part B, regarding the harvesting of coral for purposes other than commercial sale, only three permits had been issued as of June 28, 1977. These include the following:

- (1) Environmental Protection Agency

Issued December 9, 1975 - Expired June 30, 1976

Purpose: For reference collection.

Figure 4. Location (indicated by dashed line) where the red alga Gracilaria edulis is gathered.

(2) Aquatic Environments (Agat)

Issued June 12, 1975 - Expired June 13, 1975

Purpose: For aquarium use.

Issued February 24, 1977 - Expired March 4, 1977

Purpose: For aquarium use.

(3) Marine Laboratory (University of Guam)

Issued May 18, 1977 - Expires June 19, 1978

Purpose: Biological reference and research.

Over the last few years many hermatypic corals have been illegally harvested from Guam waters for commercial use. However, it is believed that a much larger quantity has been harvested illegally for purposes other than commercial sale. This includes individuals who gather for private collections and gifts, along with tourists who want a "souvenir" from Guam. Also, Acropora spp. are sometimes gathered to make "lime" for betelnut.

Interviews with coral gatherers and sellers revealed that few were aware of or concerned about existing laws relative to their activity. Clearly, a public information program is needed, especially if future regulations are to be respected. This could be accomplished through short radio broadcasts, newspaper articles and signs posted at public beaches in both English and Japanese.

The existing Public Law 12-186 which prohibits the taking of live coral above the depth of ten fathoms, is essentially a good law, however, it has been found to be unenforceable. (As of May 27, 1977 no arrests had been made). Mr. Harry Kami believes that the law would be more effective if it were amended to prohibit the taking of live coral at any depth rather than to just ten fathoms. This would require all persons wishing to collect live coral for any reason to apply for a permit or license. In this way all doubt regarding a harvesters legality would be alleviated.

In addition, given the present lack of enforcement personnel at the Division of Aquatic and Wildlife Resources, thought should be given to development guidelines that could be exercised at the sales level, for example a third copy of the receipt might be required for all sales and presented to the Division of Aquatic and Wildlife Resources, thus indicating the seller.

Mr. Dick Randall, the coral specialist from the University of Guam Marine Laboratory, believes that only three species of coral are rare enough to warrant total protection. These include Euphyllia spp., Plerogyra sinuosa, and Tubastraea aurea.

Mr. Randall also feels that certain areas should be set aside as underwater reserves with complete protection. One such area is in the vicinity of Anae Island, which is one of the fastest developing sections of reef around Guam. Other reserve areas might correspond with the Pristine Marine Environment study currently being conducted by the Coastal Zone Management Section of the Bureau of Planning.

In addition, certain areas of reef might be determined where controlled harvesting of live coral could be undertaken and monitored on a continuing basis. The establishment of reserve areas and harvestable areas of reef are both possible through Section 12382 Part B of the existing Public Law 12-186.

At this point in time the amount of live coral being harvested from Guam waters is not that great. An estimated 2,000 pounds of hermatypic (reef building) and precious corals are harvested annually. When compared to the biomass of even a small area of reef this amount is very negligible. The harvesting of dead corals of fossil and subfossil origin has no adverse effect on the reef and should be encouraged.

The hermatypic coral that is presently being exploited to the greatest extent is Acropora spp. This is also one of the most abundant corals in Guam waters and therefore commercial and private permits can be issued more freely to harvest these species. On the other hand the harvesting of the hermatypic corals Heliopora coerulea and Tubipora musica along with the precious black coral Antipathes dichotoma should be more restricted. There should be no restriction for harvesting corals of fossil and subfossil origin.

In order to more precisely determine the environmental impact of harvesting live corals, studies analyzing distribution patterns, growth rates, and abundance of the most commonly harvested species should be made. Some of these studies are presently being conducted by the faculty of the University of Guam Marine Laboratory. If the coral industry continues to expand in future years, certain stringent controls may be necessary to avoid overexploitation of this resource.

#### Shells

The only existing legislation regarding marine gastropods concerns the commercial harvesting of trochus shells. According to the Government of Guam Department of Agriculture regulation No. 28, the commercial harvesting of Trochus niloticus, is limited by size, season, area and requires a license. A copy of regulation No. 28 is contained herein. As of June 28, 1977 no arrests had been made and no one had applied for a license.

## Algae

At the present time no legislation exists regarding the harvesting of marine algae. It is very doubtful that such legislation would need to be enacted in the near future. In fact people should be encouraged to gather the edible seaweeds as a natural and cheap additional protein and mineral supply to their diet.

## RECOMMENDATIONS

It is hoped that the following recommendations regarding coral, shell and algal harvesting in Guam waters will be an aid to future management of these resources.

### Coral

1. Amendment of Public Law 12-186 Section 12380 to read, "It shall be unlawful to remove live coral from Guam's reef, except in accordance with this article."
2. In accordance with Section 12382 Part B;
  - a) Protection of the following species; Euphyllia spp., Plerogyra sinuosa, Tubastraea aurea;
  - b) Establishment of underwater reserves.
  - c) Establishment of reef areas where controlled harvesting could be undertaken and monitored on a continuing basis.
3. Requirement that all buyers furnish a third copy of receipts for all purchases to the Division of Aquatic and Wildlife Resources, indicating the identity of the person selling.
4. Public information program to educate coral harvesters and sellers of existing laws should be developed.
5. Study involving the analysis of distribution patterns, growth rates, and abundance of the most commonly harvested species should be intensified.

### Shells

1. Legislation should be enacted to protect the following species, Cassius cornuta and Charonia tritonis.
2. Public information program to educate shell gatherers about the basic rules of shelling should be developed.

### Algae

1. Brief public information program to make people aware of the nutritional value of edible algae.

#### ACKNOWLEDGEMENTS

I am especially grateful to Dr. Roy T. Tsuda who arranged for me to conduct this study, and reviewed the manuscript. His suggestions and criticisms along the way were very much appreciated.

Many thanks go to Dr. Lucius Eldredge who provided very useful literature, reviewed the manuscript and provided Sea Grant funds through which this report was printed.

Thanks also to Richard H. Randall who identified coral specimens, reviewed the manuscript and gave many helpful suggestions. Mike Gawel, as project coordinator, kept me in line and provided many stimulating suggestions. Russell Clayshulte and Richard Dickinson provided useful information regarding harvesting locations and shells respectively. Dave Gardner shot and printed all photographs.

Thanks to Mr. Harry Kami for providing a copy of existing legislation and offering very useful suggestions. Also, thanks to Mr. Mack, Mr. Choi, Dr. Blair Sparks, Mrs. Cheryl Richardson, Sergeant Jim Rogers, and many, many others who patiently answered my questions.

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PLATES

PLATE I

- a. The seven most common species of coral harvested from Guam waters:
1. Acropora acuminata
  2. Heliopora coerulea
  3. Antipathes dichotoma
  4. Tubipora musica
  5. Fungia fungites
  6. Acropora spp. (fossil and subfossil origin)
  7. Acropora irregularis
- b. Mounted specimens for sale in a local gift shop; from left to right; Acropora irregularis, Heliopora coerulea, Fungia fungites, Tubipora musica.
- c. Two endangered species of marine gastropods; (l-r) Cassius cornuta, Charonia tritonis.
- d. Two edible species of marine algae; (l-r) Gracilaria edulis, Caulerpa racemosa.

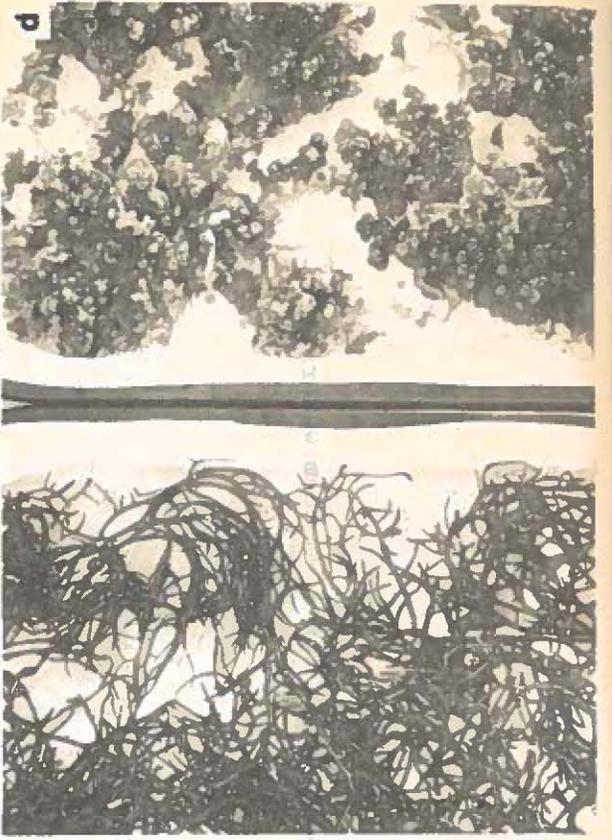
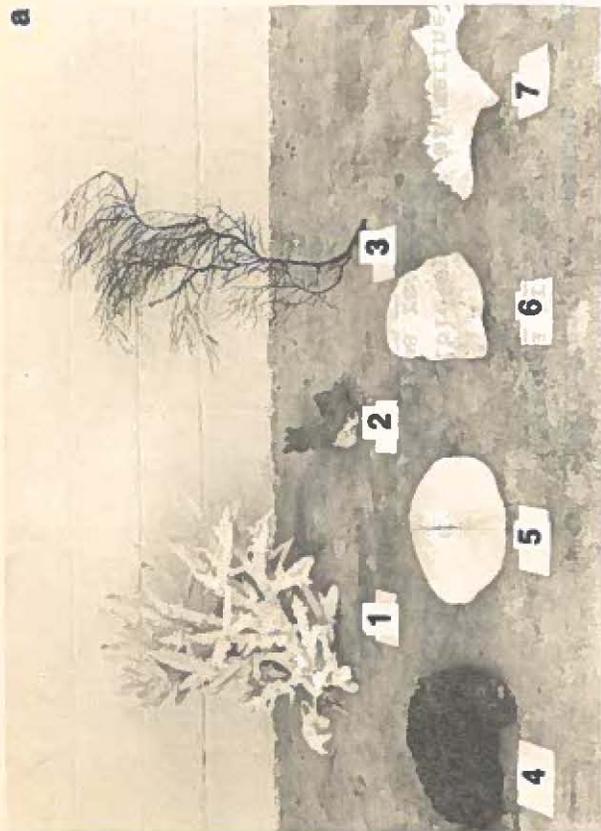
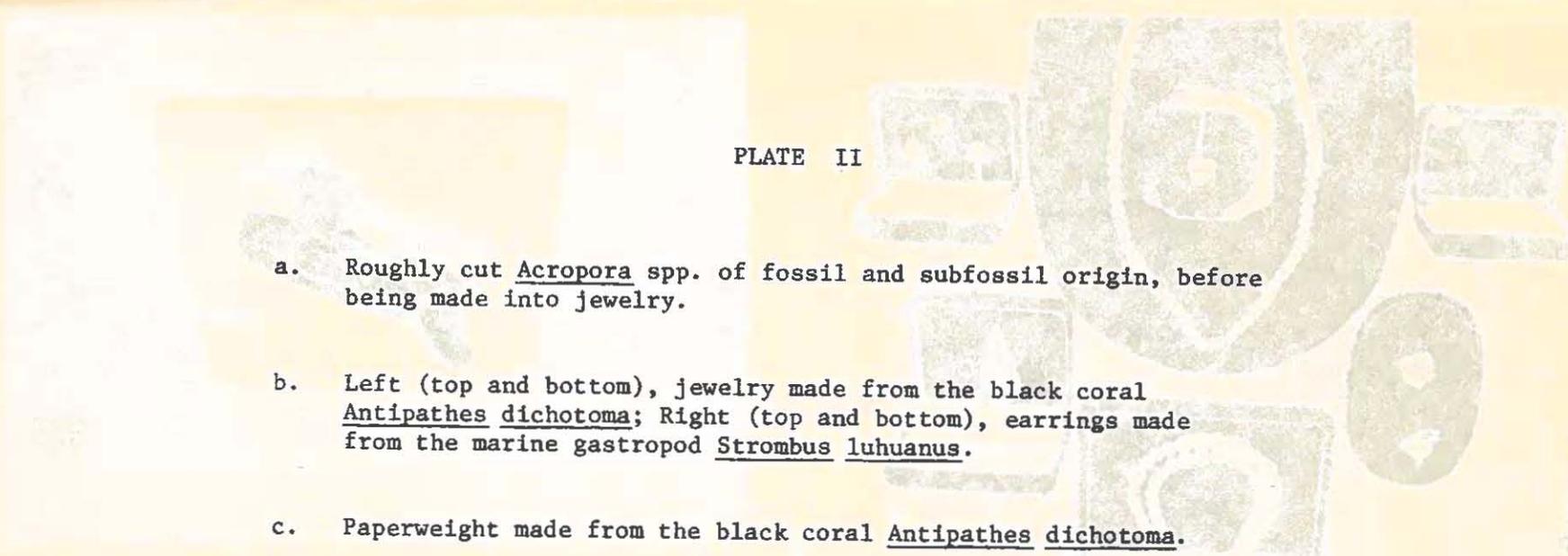
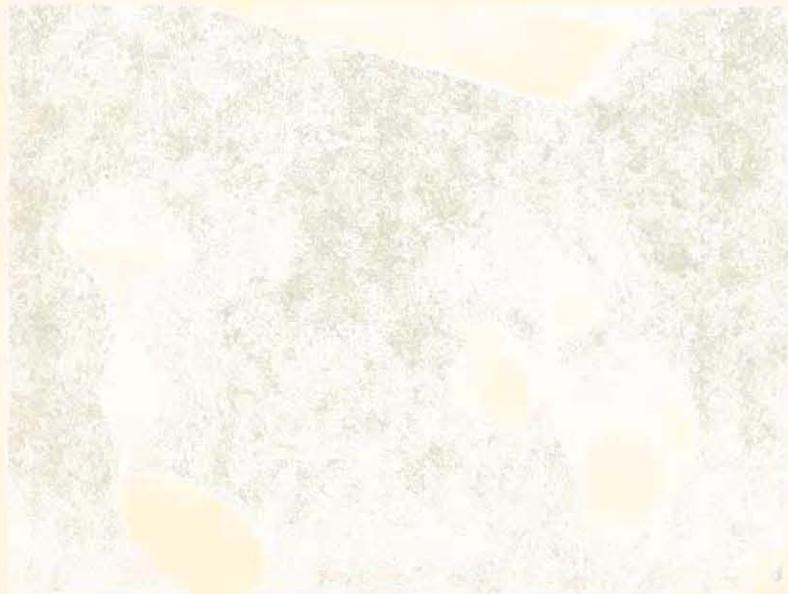
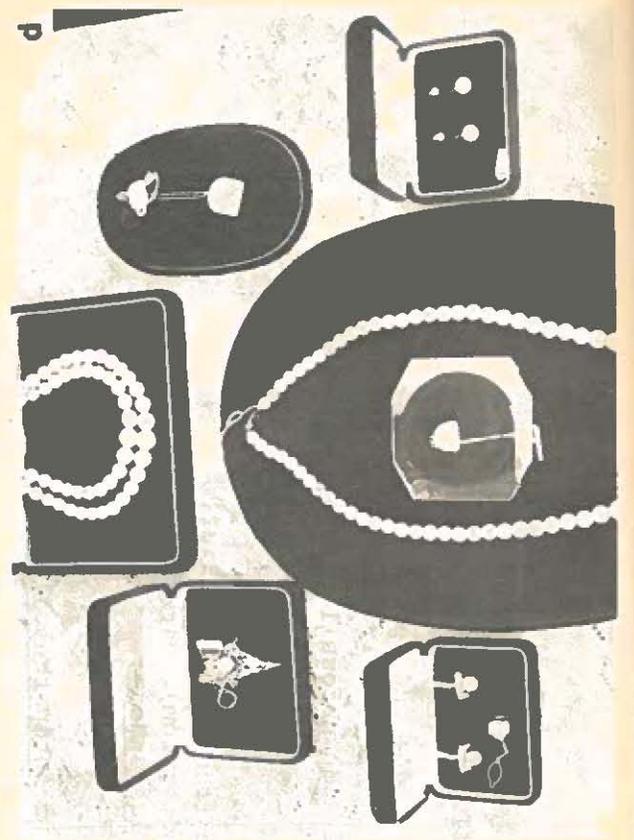
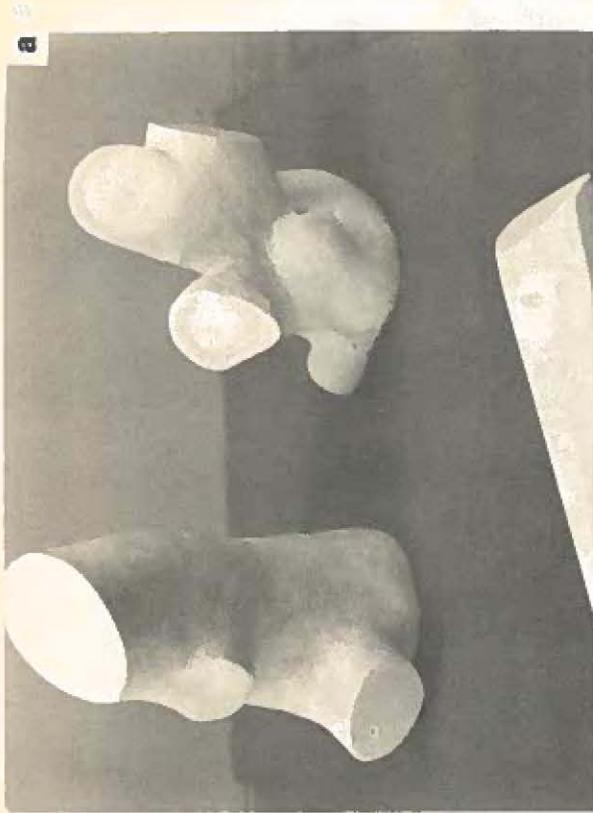


PLATE II

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- a. Roughly cut Acropora spp. of fossil and subfossil origin, before being made into jewelry.
- b. Left (top and bottom), jewelry made from the black coral Antipathes dichotoma; Right (top and bottom), earrings made from the marine gastropod Strombus luhuanus.
- c. Paperweight made from the black coral Antipathes dichotoma.
- d. Jewelry made from Acropora spp. of fossil and subfossil origin.



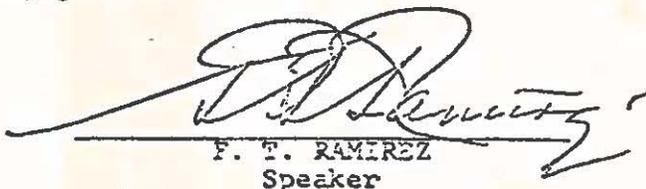


APPENDIX

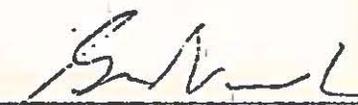
TWELFTH GUAM LEGISLATURE  
1974 (SECOND) Regular Session

CERTIFICATION OF PASSAGE OF AN ACT TO THE GOVERNOR

This is to certify that Bill No. 416, "An Act adding a new Article 5 to Chapter 4 of Title XIII, Government Code of Guam to regulate the taking of live coral, and for other purposes", was on the 30th day of October, 1974, duly and regularly passed.

  
F. T. RAMIREZ  
Speaker

ATTESTED:

  
G. M. BAMBA  
Legislative Secretary

This Act was received by the Governor this 8<sup>th</sup> day  
of November, 1974 at 3:05 o'clock \_\_\_\_\_ p.m.

  
KEITH L. ANDREWS  
Attorney General of Guam

APPROVED:

  
CARLOS G. CAYACHO  
Governor of Guam

DATED: NOV 20 1974  
1974 11.20

  
12-186

Bill No. 416  
Substitute Bill

Introduced by F. G. Lujan

AN ACT ADDING A NEW ARTICLE 5 TO  
CHAPTER 4 OF TITLE XIII, GOVERNMENT  
CODE OF GUAM TO REGULATE THE TAKING  
OF LIVE CORAL, AND FOR OTHER PURPOSES.

1 WHEREAS, it is the finding of the Legislature:

2 THAT, as island people, Chamorros have traditionally had  
3 strong cultural and life sustaining ties with their magnificent  
4 reefs which have been a source of food, recreation, and social  
5 importance;

6 THAT, the increased transient and permanent population,  
7 which has arrived as a consequence of the island's expanding  
8 tourist and construction industry and it's strategic importance  
9 as a military base, has upset the reef's fragile ecological  
10 balance;

11 THAT, the significant increase in inhabitants who are  
12 unaware and unconcerned of our traditional lifestyle and  
13 natural conservation practices has been responsible for the  
14 rape of numerous reef areas including Tumon Bay and Cocos  
15 Lagoon;

16 THAT, that Guam's fantastic coral fields are most  
17 threatened by this influx of souvenir hunting tourists and  
18 commercial exploiters;

19 THAT, it is in the best interest of the people of Guam  
20 that the taking of coral be regulated under the police power  
21 so that a balance can again be established between the people  
22 of Guam and her reefs; now therefore

23 BE IT ENACTED BY THE PEOPLE OF THE TERRITORY OF GUAM:

24 Section 1. A new Article 5 is hereby added to Title  
25 XIII, Chapter 4 of the Government Code of Guam to read as

1 follows:

2 "Article 5. Regulation of the taking of live coral.

3 Section 12330. It shall be unlawful to remove live  
4 coral from that area surrounding the Island of Guam  
5 extending from the shore of the island outwards to the  
6 ten fathom contour, except in accordance with this Article.

7 Section 12381. Harvesting of coral.

8 (a) The Commercial harvesting of coral may be  
9 conducted by obtaining a license from the Director of  
10 Agriculture and the payment of a fee as established by  
11 the Director.

12 (b) For purposes other than the sale of coral,  
13 live coral may be taken only by obtaining a license  
14 from the Director of Agriculture, such license being  
15 limited in time to a maximum of five (5) days at any  
16 given time and to a specific location from which the  
17 coral is to be taken, and for such license a fee may  
18 be charged. The Director may restrict the amount of  
19 coral to be taken under any license and may impose  
20 such other restrictions as may be necessary to insure  
21 the conservation of our coral fields.

22 Section 12382. Commercial permits. (a) Permits for  
23 the Commercial taking of coral may be issued by the  
24 Director of Agriculture upon the following conditions:

25 1. The permit must state the individual or  
26 individuals who will be taking the coral;

27 2. The permit must state the time, date and  
28 location from which the coral is to be taken;

29 3. The Director may limit each permit to a  
30 specified amount of coral to be taken, taking into  
31 account the location from which the coral is to be  
32 taken, the amount of living coral remaining and the

1           likelihood of damage caused to the reef area by the  
2           taking of the coral.

3           (b) The Director of Agriculture may, by regulation,  
4           establish a fee schedule based upon the amount and value  
5           of the coral to be taken commercially; establish areas  
6           on Guam where no coral may be taken, limited coral may  
7           be taken or unlimited coral may be taken, and impose any  
8           other restrictions necessary for the conservation of our  
9           coral reserves, all subject to the permits as required  
10          by this Article.

11          Section 12383. Penalties. Any violation of this  
12          Article or the regulations and permits issued pursuant to it  
13          shall be a misdemeanor punishable by a fine of not more  
14          than Five Hundred Dollars (\$500.00) or by imprisonment  
15          of not more than six (6) months or by both such fine and  
16          imprisonment for each offense.

17          Section 12384. Enforcement. This Act shall be  
18          enforced primarily by the Director of Agriculture and the  
19          Conservation Officers as authorized by Section 12302 of  
20          this Title and secondarily by Peace Officers defined in  
21          Section 951 of the Penal Code of Guam."

22          Section 2. The effective date of this Act shall be  
23          immediately. The enforcement of the provisions of this Act as  
24          it pertains to those who are required to obtain permits shall  
25          be thirty (30) days after the promulgation of regulations by  
26          the Director of Agriculture.

27          Section 3. The requirement of legislative concurrence as  
28          a prerequisite to the transfer of government owned property as  
29          imposed by Section 3 of Public Law 12-61 is hereby extended to  
30          all submerged lands owned by the government of Guam.

31          Section 4. Subsection V.A.v.4 of Section 2 of Part One of  
32          Public Law 12-150 is amended to read as follows:

1 "4. For contractual services, not to  
2 exceed the total of Twenty-Four  
3 Thousand Dollars (\$24,000) as  
4 follows:  
5 For commission projects, rental  
6 of office space, maintenance of  
7 office equipment, communications  
8 (overseas calls, cables), tele-  
9 phone, printing, hiring of graphic  
10 artist and copying machine, not  
11 to exceed \$ 24,000"

GOVERNMENT OF GUAM  
DEPARTMENT OF AGRICULTURE

REGULATION NO. 28

TAKING OF TROCHUS SHELLS

Pursuant to the authority vested in the Director of Agriculture by Sections 12007 and 12321, Government Code of Guam, the following regulations pertaining to the harvesting of trochus shells (Trochus niloticus) are hereby approved:

1. COMMERCIAL HARVEST OF TROCHUS

- a. SEASON: Commercial harvesting of trochus is allowed only during the months of May, June and July.
- b. HARVEST LIMIT: The total harvest limit of trochus shall be set by the Director of Agriculture before each season. Once this total is attained, the season will be closed for the year.
- c. SIZE LIMIT: The commercial harvesting of trochus shall be limited to shells with a base diameter of 4 inches or greater.
- d. AREA: The commercial harvesting of trochus is prohibited shore-ways of the outer edge of the fringing reef. This includes the lagoons and channels that extend shore-ways from the outer edge of the fringing reef.
- e. LICENSE: Each commercial trochus fisherman must obtain a license from the Department of Agriculture. The license fee shall be \$5.00.

2. HARVEST OF TROCHUS FOR HOME CONSUMPTION PURPOSES

- a. SEASON: For home consumption purposes, the harvesting of trochus shall be allowed all year round.
- b. SIZE LIMIT: For home consumption purposes, there will be no size limit except as provided in 2d.
- c. AREA: Harvesting of trochus for home consumption is allowed in all areas.
- d. BAG LIMIT: For home consumption purposes, each person is allowed no more than 50 pounds (shells included) per day; provided that not more than ten (10) pounds of which shall consist of shells with base diameters of less than two (2) inches.

3. FOR PURPOSES OF THIS REGULATION

- a. COMMERCIAL HARVESTING is defined as the harvesting of trochus for the purpose of selling either the shell or the meat.
- b. HOME CONSUMPTION is defined as the harvesting of trochus for use as food or other purposes for which no parts thereof are sold.

Dated this 8th day of March, 1968

/s/ Frank B. Aguon  
FRANK B. ACUON  
Acting Director of Agriculture