THE COMMERCIAL POTENTIAL OF PRECIOUS CORALS IN MICRONESIA PART 1 THE MARIANA ISLANDS

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Richard W. Grigg and Lucius G. Eldredge

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UNIVERSITY OF GUAM MARINE LABORATORY

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Cover Photo: Dive Station I, Agrijan, note the Cirripathes anguina (photo by R. W. Grigg).

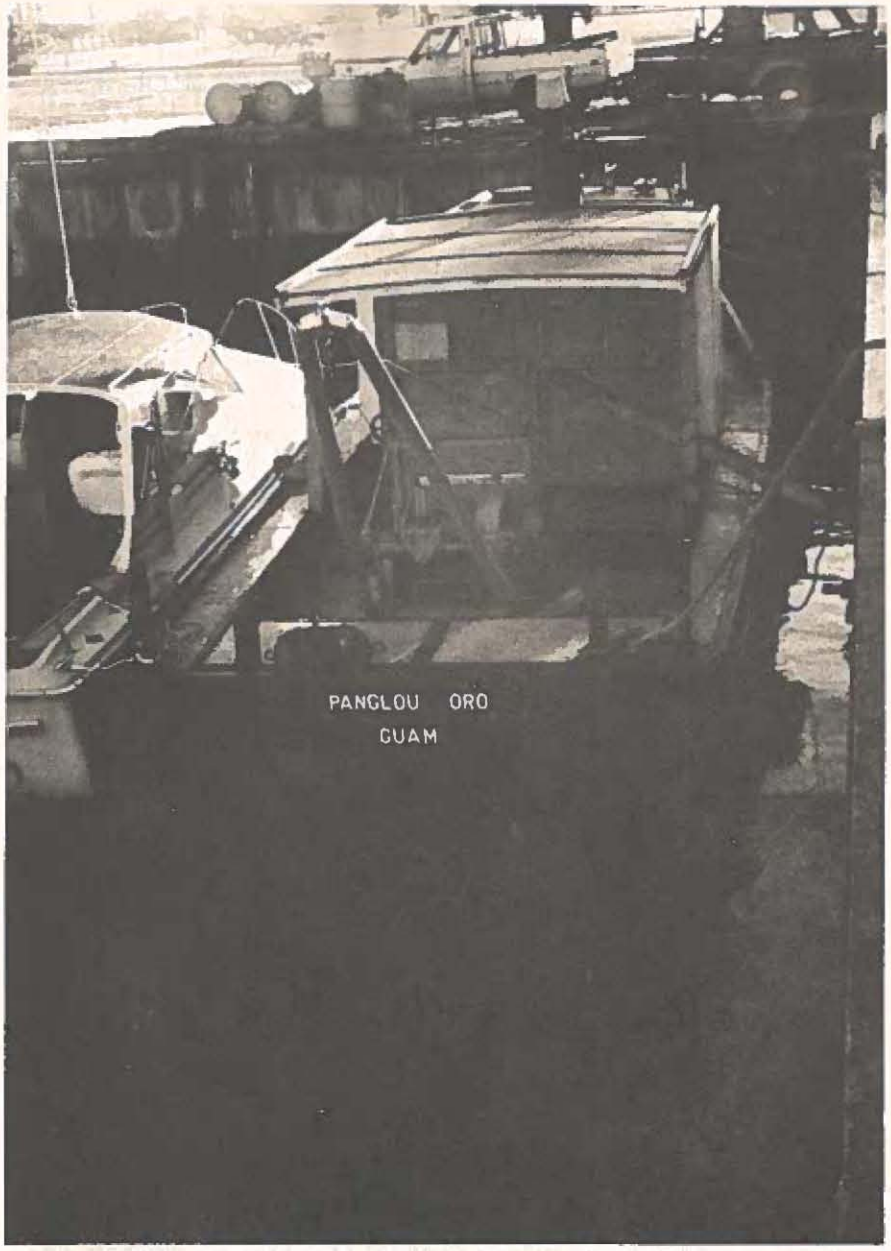

Figure 1. Panglau Oro at dock with winch and A-frame (photo by R. W. Grigg).

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INTRODUCTION

Man's use of precious coral for jewelry and artifacts dates back thousands of years. Until the beginning of the nineteenth century the only known sources of precious coral were the Mediterranean and the Red Sea. Hickson (1924) has described the early trade in both red and black coral. In 1801, red and pink coral (Corallium) was discovered in the Pacific by the Japanese, however, a coral fishery was not established in the Pacific until the Meiji Reform in 1868. Since that time, Japanese coral fishermen have been dredging Corallium from depths between 90 - 400 meters in areas bordering the western Pacific. The known distribution of commercial grade Corallium in the Pacific can be roughly approximated by constructing an arc which connects Hawaii, the Milwaukee Banks (32 N x 173 E, northwest of Hawaii) with Tokyo and the South China Sea (Grigg, 1970; Takahashi, 1942).

Black corals (Antipathes spp.) are known to exist in widely scattered areas throughout the Pacific at depths generally below 30 to 40 meters. However, very little is known about their quality and quantity outside of Hawaii. Other types of precious corals (gold and bamboo) are also known to exist in Hawaii, but as with the black corals, knowledge of their abundance and value elsewhere in the Pacific is virtually nonexistent.

In 1970 a research grant was awarded to the University of Hawaii by Sea Grant, to investigate the ecology of precious corals in Hawaii. Although the primary thrust of this program was aimed at establishing an independent coral industry in Hawaii, one of its goals was to transfer the experience gained in Hawaii to the Trust Territory of the Pacific Islands. Part I of this report presents the results of an exploratory survey for precious coral in the Mariana Islands. It contains the data of a survey designed primarily to locate pink coral (Corallium) between Guam and Saipan. The second part of the report is primarily an evaluation of black coral resources in Palau, in the western Caroline Islands. Parts I and II have been published separately; Part I as a University of Guam technical report, and Part II, as a Sea Grant Advisory report of the University of Hawaii. The overall program was jointly sponsored by Sea Grant through the University of Hawaii, the University of Guam, and the Trust Territory of the Pacific Islands.

METHODS

Locations of the survey was based primarily on two factors: 1) known records of distribution and abundance of Corallium and 2) logistics, both in terms of available facilities for the survey itself and later on, product fabrication and distribution. Criteria for the selection of specific stations was based on knowledge of the ecological requirements of precious corals, interviews and discussions with longtime fishermen in the Trust Territory, and the results of our dredge hauls.

Because of existing market demand, species of immediate economic significance include commercial grade Corallium spp. and Antipathes spp. Since these species occupy different depth zones (Corallium --90 - 400 m and Antipathes -- about 30 - 100 m) different methods of collectionmust be employed, Corallium is usually collected with dredges, whereas black coral is harvested by divers using SCUBA. Because of logistic problems, the dredging work was limited to areas between 100 and 400 m depth between Guam and Saipan in the Mariana Islands. A self-contained winch and A-frame equipped with a 9.8 horsepower Wisconsin gas engine and 3,000 feet of 3/8 oceanographic cable was installed on a 37-foot sampan, the Panglau Oro (Figure 1). The dredges, best described as tangle mops, consist of 100-pound round cement weights with several anchor bolts with attachment eyes for 6-foot long hanks of nylon mesh (4" stretch) netting. Dredging was accomplished by dragging the "coral mops" along the bottom. The weight serves to break the coral after which it is entangled in the nets. Dredge hauls typically lasted about one hour. Coral and other benthic organisms which were entangled were removed from the nets by hand. All material was either preserved in 70 percent alcohol or dried and stored in plastic bags. The entire collection has been stored at the Marine Laboratory at the University of Guam and can be referred by the title, "Pacific Deep Benthos Collection--Number 1." Part of the collection has been or will be shipped to experts in various parts of the world for identification (see Acknowledgements). It is envisioned that future additions to this collection will create at the Marine Laboratory in Guam a Pacific-wide center for collections of deep water benthos.

At several locations between Guam and Saipan, exploratory dives using SCUBA were taken to assess the abundance of black coral Antipathes spp.

RESULTS

Collections

Station and collection data are summarized in Table I. A total of 19 dredge hauls were successfully completed ranging between Guam

and Saipan at depths between 36 - 364 m (see Table I). The total collection includes about 40 species of gorgonians, 38 species of scleractinian corals (Appendix I), 10 species of black corals (Appendix II), several alcyonarians, 2 sponges (1 hexactinellid and 1 sclerosponge), 4 asteroids (Appendix III), several crinoids, and echinoids, 3 algae (Appendix IV), 2 crustaceans (Appendix V), and I fish (Uranoscopus). Further identification of this material awaits attention by specialists in each taxonomic category. This material marks the beginning of the Pacific Deep Benthos Collection which hopefully will grow with the advent of future expeditions.

Red and Pink Coral

Unfortunately, commercial grade Corallium was not found at any station in the Marianas. Several small dead branches of Corallium (probably C. elatius) were recovered at station 13 (Tinian channel), however, the quality was extremely poor (riddled with worm burrows). Takahashi (1942) also reported that Corallium was found in the channel between Tinian and Aguijan but that the quality was poor. Japanese fishermen, however, who still live on Rota and Tinian claim that in pre-World War II times, large quantities of red coral of high quality were recovered at depths near 60-- 80 fathoms (109-- 146 m) off these islands. One longtime resident of Rota who claimed to be a coral dealer 30 years ago, outlined the area off the leeward coast of Rota as especially productive. For this reason an entire day was spent dredging in this area. Eight dredge hauls were taken which ranged in depth between 98-- 164 m, however, no Corallium was found. Experience in Hawaii dredging for coral with tangle nets has shown the method to be very effective; i.e., Corallium is invariably collected in areas where it is abundant. Our failure to find Corallium off Rota, therefore, is undoubtedly an indication of its absence there. This experience illustrates the difficulty in interpreting information gained through interviews and discussions with fishermen.

Takahashi (1942) reports that high quality Corallium has been taken north of Pagan Island in the northern Marianas. In recent years, considerable quantities of red and pink coral have been found in the Bonin Islands immediately north of the Marianas. Apparently the southern limit of commercial grade Corallium in this island chain may be about 18° north latitude.

Black Coral

Of the ten species of black coral that were collected on the expedition, 4 have been identified (Appendix II). The remaining 4 have been sent for identification to Dr. Dennis Opresko at the

Museum of Comparative Zoology at Harvard University. Two of the eight species Antipathes dichotoma and Cirripathes anguina were collected using SCUBA at dive stations I (cover) and II (Table I). Although neither species were at abundant at these stations, divers in Guam have reported that A. dichotoma is abundant in some areas swept by strong currents at depths greater than 50 meters. Samples of A. dichotoma collected off Orote Point, were sent to the Gemnological Institute of America for gem quality analysis. Hardness of this coral ranged between 2 and 3 on the mohs scale, about the same as gem quality coral from Hawaii. Luster of the Guam black coral also proved to be favorable. These tests show that the quality of the black coral, A. dichotoma, in the Mariana Islands is sufficient for the commercial production of black coral jewelry. This is not surprising, since the bulk of the black coral used in the jewelry industry in Hawaii is coral of this species. It appears that the resource may not be present in sufficient abundance to support an industry, however, further exploration is needed (and recommended) before the extent and value of the resource can be accurately determined in the Mariana Islands.

RECOMMENDATIONS

1. The Marine Laboratory of the University of Guam should become the repository for all future collections in the western Pacific of deep benthos. As such it could become a future center for research in taxonomy and zoogeography of the Pacific basin.

2. Further exploration for pink coral (Corallium) should be conducted in the Mariana Islands north of 18° north latitude. Most likely depths are between 100 and 400 meters.

3. More exploration will be necessary before the black coral (A. dichotoma) resource in the Mariana Islands can be accurately assessed. At this time, the resource does not appear to be present in sufficient abundance to support a local industry. Part II of this report is a description of the black coral resources in Palau, where it is estimated that about 640 kilograms could be harvested annually without depleting natural populations. If the Trust Territory of the Pacific Islands does not become politically split, resources from Palau could be used to supply the manufacture of precious coral in the Mariana Islands where logistics now favor more efficient fabrication and distribution. It is likely that commercial quality black coral can be found in other island districts, adding to the potential supply from Palau.

ACKNOWLEDGEMENTS

This work would not have been possible without the support of the Marine Laboratory, University of Guam and the Division of Marine Resources, Trust Territory of the Pacific Islands. We wish to thank Peter Wilson for providing the original impetus for the survey. We also wish to thank Ted Tansy for technical support during and after the expedition. Masashi Yamaguchi located and translated the paper by Takahashi. Many of the organisms collected have been identified by experts. These people include the following: asteroida - A. M. Clark (British Museum of Natural History), scleractinian corals and hydrocrals - R. H. Randall (University of Guam), algae - R. T. Tsuda (University of Guam), fish - H. T. Kami (Guam Fish and Wildlife Service), and black corals - D. Opresko (American Museum of Natural History). Financial support of this research was provided by the Office of Sea Grant through awards to the University of Hawaii (Grant No. 04-3-158-29) and the University of Guam (Grant No. 04-5-158-45).

Table 1. Station Data of Survey

Dredge Haul	Date	Location	Latitude In/Out	Longitude In/Out	Depth (m)	Substratum	Notes on Collection
1	10-21-73	North of Ritidian Point, Guam	13° 40.6'N 13° 40.6'N	144° 52.0 E 144° 52.0 E	201	Rocky	nodules of Corallium algae, 1 gorgonian (no Corallium), 2 stony corals covered with red colonial foraminifera
2	10-21-73	North of Ritidian Point, Guam	13° 41.5'N 13° 42.1'N	144° 51.9'E 144° 51.8'E	245-327	Sandy w/ cobbles & few out-crops	sclerosponge, crinoids, few gorgonians (no Corallium), alcyconarian, cushion star
3	10-21-73	North of Ritidian Point, Guam	13° 41.3'N 13° 42.8'N	144° 52.4'E 144° 52.5'E	227-225	Rocky	many gorgonians (no Corallium), dendrophyllid corals, sclerosponges
4	10-24-73	Rota Banks	13° 47.0'N 13° 47.5'N	144° 57.2'E 144° 57.2'E	127-200	Dredging up rocky bank	many gorgonians (no Corallium), Antipathes c. f. ulex
5	10-24-73	Rota Banks	13° 48.2'N 13° 49.0'N	144° 57.7'E 144° 57.5'E	200-298	Rocky	missing*
6	10-25-73	Rota lee coast	14° 08.0'N 14° 08.3'N	145° 07.0'E 145° 07.1'E	127 135	Hard, flat, w/ rocky cobbles	no Corallium, Antipathes sp., Antipathathes c.f. ulex
7	10-25-73	Rota lee coast	14° 08.4'N 14° 09.0'N	145° 07.2'E 145° 07.5'E	124-136	Sand & cobbles partially rocky	no Corallium, Antipathes spp. (two), Antipathes c.f. ulex, Cirripathes spiralis

Table 1. (continued)

Dredge Haul	Date	Location	Latitude In/Out	Longitude In/Out	Depth (m)	Substratum	Notes on Collection
8	10-25-73	Rota lee coast	14° 09.3'N 14° 10.0'N	145° 07.9'E 145° 08.7'E	127	Sand & cobbles	no Corallium, Antipathes sp., Cirripathes spiralis
9	10-25-73	Rota lee coast	14° 10.2'N 14° 10.5'N	145° 09.0'E 145° 09.5'E	109-116	Sand & cobbles	no Corallium, Antipathes sp., Cirripathes spiralis
10	10-25-73	Rota lee coast (54 fm bank)	14° 11.2'N 14° 11.5'N	145° 10.6'E 145° 10.6'E	138-153	Rocky	many gorgonians, no Corallium, Antipathes sp.
11	10-25-73	Rota lee coast (54 fm bank)	14° 12.3'N 14° 12.5'N	145° 11.0'E 145° 10.6'E	98-164	Rocky dredging up slope	no Corallium, many gorgonians
12	10-25-73	Rota lee coast	14° 12.3'N 14° 12.5'N	145° 13.2'E 145° 13.4'E	124-135	Sand & cobbles	no Corallium Antipathes spp. (three), Antipathes c.f. ulex, 1 fish (Uranoscopus sp.)
13	10-27-73	Tinian channel	14° 52.7'N 14° 52.7'N	145° 34.7'E 145° 34.9'E	146-237	Rocky strong channel	1 piece dead Corallium, Antipathes spp. (two), Antipathes c.f. ulex Antipathes undulata
14	10-27-73	Tinian channel	14° 53'N 14° 53.2'N	145° 35'E 145° 35'E	106-164	Rocky, strong channel current	many gorgonians, no Corallium, many black corals
15	10-27-73	Tinian channel	14° 55'N 14° 55'N	145° 36.8'E 145° 37.0'E	116-146	Rocky, strong channel current	no Corallium, Antipathes undulata, Cirripathes sp.

Table 1. (continued)

Dredge Haul	Date	Location	Latitude In/Out	Longitude In/Out	Depth (m)	Substratum	Notes on Collection
16	10-27-73	Tinian channel	14° 54.2'N 14° 54.3'N	145° 36.6'E 145° 36.6'E	364	Sand & mud	Hexactinellid sponge
17	10-28-73	Saipan channel	15° 06.0'N 15° 06.5'N	145° 39.7'E 145° 39.3'E	246-273	Rocky, strong channel current	no Corallium, many gorgonians
18	10-28-73	Saipan channel	15° 6.1'N 15° 6.4'N	145° 40.1'E 145° 40.3'E	109-127	Rocky, strong channel current	many gorgonians, no Corallium
19	10-28-73	Bank west of Saipan	15° 09.2'N 15° 10.0'N	145° 36.8'E 145° 36.9'E	36-360	Dredging up bank	no Corallium, Antipathes spp. (two), Antipathes tanacetum
Dive Sta. 1	10-27-73	Aguijan	14° 51.4'N	145° 32.4'E	15-46	Limestone	Antipathes dichotoma, Cirripathes anguina
Dive Sta. 2	6-27-74	Guam (Orote Point)	13° 26.0'N	144° 37.4'E	25 75	Limestone (shear drop-off)	Antipathes dichotoma

APPENDIX I

List of scleractinian corals, hydrocorals, and sponges collected during survey. Identification by R. H. Randall, University of Guam.

Dredge Stations	Identification
4	Acropora rambleri (Bassett-Smith)
10	Alveopora ocellata Wells (1 dead, 1 alive)
10	*Astrosclera willeyana Lister (calcareous sponge)
3	Astya sp.
12,17	*Balanophyllia sp.
12	*Caryophyllia sp. 1
12	*Caryophyllia sp. 2
17	Caryophyllia sp. 3 (possibly Cyathoseras, solitary)
6	Caryophyllia sp. 4 (solitary)
6	*Cyathelia sp.
4	*Cycloseris sp. (dead)
13	Dactylotrochus cervicornis (Moseley)
4,13	Dendrophyllia sp. 1
17	*Dendrophyllia sp. 2
13	Dendrophyllia sp. 3
15	Dendrophyllia sp. 4
13	Dendrophyllia sp. 5
13	Dendrophyllia sp 6
15	Distochopora sp. 1
15	Distochopora sp. 2
12	Gardineria sp.
2,6	*Hydnophora sp. (ramose)
10	Leptoseris sp.
6	Leptoseris fragilis Milne Edwards and Haime
6,12,8	*Leptoseris hawaiiensis (Vaughan
11	*Madracis sp.
13	Madracis sp.
11,19,13	Madracis sp. cf. M. kauaiensis Vaughan
12	*Pachyseris sp.
4	Pocillopora sp. cf. P. molokensis Vaughan
17	Polycyathus sp. 1
13	Polycyathus sp. 2
6,7	*Psammocora n. sp.
17,15	Sclerhelia sp. 1
17,15	*Sclerhelia sp. 2
2	Seriatopora sp. (1 alive, 3 dead encrusted by algae)
9.8	*Seriatopora sp.

*dead specimens

Appendix I (continued)

Dredge Stations	Identification
2	*Seriatopora sp. cf. S. angulata Klunzinor
3	?Solenosmilia sp. (close to fossil Rhipidoygridae)
13,17	*Stylaster sp. (dead sponge coated)
4	Stylocoeniella guentheri (Bassett-Smith)

*dead specimens

APPENDIX II

Black corals collected during survey. Identification by R. W. Grigg, University of Hawaii.

Dredge Stations	Identification
4,6,7,12,13,14	*Antipathes* cf. *ulex*
13,14,15	*Antipathes undulata*
9	*Antipathes tanacetum*
7,8,9	*Cirripathes spiralis*
15	*Cirripathes* sp.
7,8,9,10,12,13,14,19	*Antipathes* sp. 1
7,12,13,15,19	*Antipathes* sp. 2
12	*Antipathes* sp. 3
Dive Stations	
1,2	*Antipathes dichotoma*
1	*Cirripathes anguina*

APPENDIX III

Asteroids collected during survey. Identification by A. M. Clark, British Museum (Natural History).

Dredge Stations	Identification
2	Podosphaeraster polyplax Clark and Wright
12	Ceratonardoa squamulosa (?) (Koehler)
15	Nepanthia briareus (Bell)
18	Nepanthia sp.

APPENDIX IV

Fleshy algae collected during survey. Identification by R. T. Tsuda, University of Guam.

Dredge Stations	Identification
7,11,19	*Halimeda opuntia* (L.) Lamx.
11	*Udotea geppi* Yamada
11,14	*Zonaria* sp. [Reported as *Zonaria stipitata* Tanaka and K. Nazawa by Tsuda (Micronesica 8:99, 1972); this is apparently a new species]

APPENDIX V

Crustacea collected during precious coral survey. Identification by L. G. Eldredge, University of Guam.

Station No.	Identification
12	Lambrus (Rhinolambrus) contrarius (Herbst)
13	Hoplophrys ogillyi Mac Culloch

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