REPORT ON THE CORAL SURVEY OF THE AGANA BAY REEF FLAT

By

Richard H. Randall

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INTRODUCTION

This report constitutes a field reconnaissance survey of the reef-flat platform in the vicinity of the Agana Channel, as outlined on the map titled,"Figure 4, Final Recommendation, Agana Small Boat Harbor, Guam, Plan of Improvements"(Fig. 1). This map was attached to. and is a part of the "Contract Purchase Order"(DACW84-76-M-0283)(vendor's copy).and was used to delimit the study area of the survey.

The "scope-of-work" was carried out as described and listed in the "Schedule of Service", and includes the following items:

1) a check list of coral species within the study area with a ranked or relative scale of dominance,

2) a map of the region showing the location of pockets of flourishing coral growth in the study area,

3) a discussion of the biological impact of the constuction and presence of breakwater structures within the study area, and

4) if necessary, recommendations on the realignment of the breakwaters to minimize damage to the living pockets of coral mapped in item (2).

The contract purchase order was received on Feb. 19, 1967, and signed and returned with the understanding that the work was to be completed and the report finished by March 16, 1967.

Methodology

A general reconnaissance survey of the study area was first conducted by snorkeling over the reef-flat platforms and inner fringing reef margin adjacent to both sides of the outer Agana Channel. The outer channel margin and channel slopes were similarly investigated. This reconnaissance showed that considerable variation occurred both in the distribution of areas with living coral and in the species diversity within each of these areas. Because of this variation the study area was divided into twelve zones, eight on the south side of the channel and fouf on the north side, as mapped in Figure 1. The abundance of each species within these zones was then made by recording their relative frequency of occurrence (Table 1). The relative scale used was: dominant (D) = the predominant species within a zone, abundant (A) = a species distributed throughout the entire zone, common (C) = a species with patchy or uneven distribution throughout the zone, occasional (O) = a species recorded generally from a single locality within the zone, and rare (R) = a species which occurred only once or twice within a zone. Table 1 also indicates the species in a ranked order

for the entire study area.

RESULTS

Description of the Study Area

South Side of the Agana Channel

Inner Reef Margin Zone

This zone is dominated by an algal mat consisting predominately of Amphiroa, Sargassum, and Caulerpa. The surface is constantly washed by waves and breaking surf and is generally swept free of unconsolidated sediments except for a fine-grained fraction which becomes entrapped in the algal mat. Beneath the algal mat the substrate consists of a flat reef-rock pavement with a few scattered shallow pools and depressions which contained an occasional small Porites lutea colony and a few living fragments of other corals (Table 1) which were eroded and transported from the adjacent outer reef margin zone. These living coral fragments are mostly alive at the present time, but generally die during the summer season low spring tides which coincide with midday insolation and reduced wave wash.

Outer Reef-Flat Pavement Zone

This zone consists of a flat reef-rock pavement which is for the most part generally exposed during low spring tides. Because of this periodic exposure it is devoid of corals except for a few small encrusting patches and spats found in shallow pools and depressions which retain water during low tides. These holes and depressions also contain fragments of living corals transported there from the reef margin during infrequent storms. These fragments also die during low spring tides during the summer months.

Inner Reef-Flat Coral Zone

This zone retains water during low spring tides and thus, supports a more abundant and diverse coral fauna. The zone is characterized by the presence of many scattered patches of arborescent Acropora aspera and microatoll-shaped Porites lutea colonies. Intersperced between these larger colonies are many small clumps of Pocillopora damicornis and Psammocora contigua. The substrate is covered with coarse sand and coral-algal-mollusk rubble intersperced with bare reef-rock patches here and there.

Inshore Sand Zone

This zone contains few corals and is characterized principally by a greater abundance of sand-sized sediments. It is also the location of a well-defined longshore current which is somewhat more turbid and mixed with freshwater. This current follows rather closely the shoreline and empties into the Agana Channel imediately north of the Agana Boat Basin.

Outer Channel Margin Zone

Structurally this zone is similar to the outer reef-flat pavement zone but borders the outer part of the Agana Channel and is slightly deeper and corals are more abundant. The principal difference is in the presence of small microatolls of Porites lutea, mounds of Millepora dichotoma, large angular blocks of reef-rock (to one meter diameter), and irregular sized boulder rubble scattered over the surface. These blocks and boulder rubble have been broken loose from the reef margin and transported by storm waves. Also abundant were living fragments of corals eroded from the reef margin zone. Considerable expanses of barren reef-rock were also present

Outer Channel Slope Zone

This zone consists of a steep to precipitous wall which borders the outer channel margin and at most places is buttressed at the lower part by blocky rubble, scattered coral colonies, and occasional large knobs and knolls of Porites lutea. Corals are not abundant but form scattered patches on the steep rocky slope and wall. Encrusting species of Montipora were more commonly encountered here on the deeper barren rocky habitats. Conspicuously also were occasional mounds of Millepora dichotoma.

Inner Channel Margin Zone

This zone consists of a narrow depressed area which borders the inner margin of the Agana Channel. Structurally it is somewhat like the inner reef-flat coral zone. Porites lutea is the dominant coral. The zone can be somewhat distinguished from the adjacent inner reef-flat coral zone by a greater abundance of encrusting Montipora species and fewer arborescent Acropora species.

Inner Channel Slope Zone

The slope along this zone consists of a low rocky wall about a meter or less high. The lower slope is buttressed by unconsolidated material and scattered coral colonies which, in turn, grade into the channel floor, consisting of sand and gravel-sized particles. An interesting aspect of this zone is that during extremly low tides water cascades from the channel margin into the lower level of the Agana Channel.

North Side of the Agana Channel

Inner Reef Margin Zone

Structurally this zone is in most respects like the reef margin on the south side of the channel. It is dominated by an algal mat similar to that found on the south side of the channel. Coral distribution is also similar, Porites lutea being the only coral found.

Depressed Reef Flat Zone

This zone consists of a narrow reef-rock pavement located between the outer tip of the Paseo Park and the slightly elevated inner reef margin zone. The area is dominated by stong longshore currents which sweep toward the Agana Channel. Corals are mostly absent in this rather barreh zone except for a few widely scattered encrusting patches of Porites lutea.

Channel Margin Zone

The channel margin zone consists of a blocky rubble platform which slopes downward to the steeply dipping channel slope. Except for a few scattered patches of Millepora dichotoma, and Porites lutea, corals were inconspicuous in this zone. Some of the larger pieces of blocky boulders have encrusting patches of Montipora and a few clumps of Pocillopora growing on their surface.

Channel Slope Zone

The slope on this side of the channel consists mostly of unconsolidated blocky rubble, sand, gravel, and coral-algal-mollusk rubble, intersperced here and there by local rocky outcrops and coral knobs. Most conspicuous in this zone were a few mounds of Millepora dichotoma and scattered clumps of Porites lutea and Pocillopora damicornis. Coral diversity and dominance are much less on this side of the channel than on the other.

Summary of the Coral Survey

In general coral diversity and dominance on the south side of the channel is greater on the inner reef-flat coral zone than on the outer reef flat pavement zone. The outer reef-flat platform is, for the most part, rather barren of corals. The channel margin and slopes are similar in coral diversity and dominance to that found on the inner reef-flat coral zone, but according to the proposed location of the west breakwater as shown on Figure 1, it does not impinge on these regions.

Coral diversity and dominance on the north side of the channel is extremly low, especially in the area of the east breakwater as shown on Figure 1. During our observation of the region to be occupied by this breakwater, we found less than five corals in the entire area.

BIOLOGICAL IMPACT OF THE CONSTRUCTION AND THE PRESENCE OF THE BREAKWATER STRUCTURES WITHIN THE STUDY AREA

The permanent effect of this project on the coral community can be divided into two categories. First, there will be damage by dredging berthing areas, building of temporary causeways, and the moving of dredging machinery and other equipment. These activities will, for the most part, remove or damage the coral communities in areas involved but will not remove the habitat

permanently from the marine environment. Instead, there will be a new environment which will provide habitat space for other marine organisms and possibly recolonization by some of the original coral fauna or others not previously found there.

Second, there will be a permanent removal of marine habitat by the construction of the east and west breakwaters on the reef-flat platforms. Although some reef-flat platform will be covered by these structures, their subtidal and intertidal surfaces may support new and varied marine communities.

The presence of the breakwaters will alter the normal water movement on the reef-flat platforms but the exact impact on the present coral communities would be difficult to determine. Considering the coral species now living on the reef-flat platforms, it is doubtful that changes in water movement would greatly effect them in light of the fact that the reef flat is already an unpredictable environment.

Dredge spoil and silt plumes generated br the dredging and construction could effect the coral communities in the immediate area. Adjacent areas may also be effected by currents carrying the silt and plume. In order to determine the effects from from these causes, a comprehensive knowledge of the currents in the area must be known.

Based upon the present coral distribution and dominance, it is doubtful whether realignment of the breakwater structures would appreciably reduce the impact on the coral community.

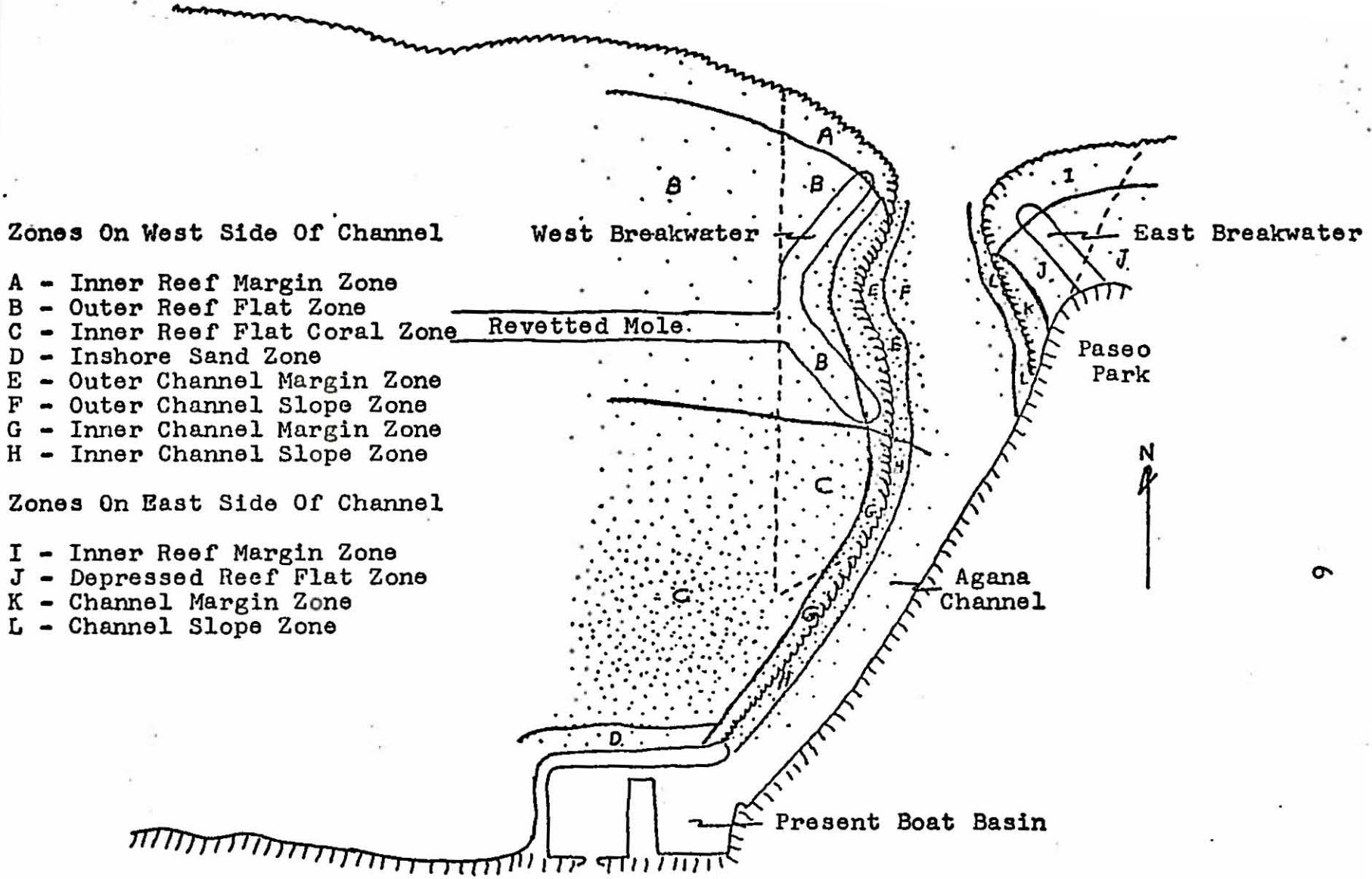

Figure 1. Map showing the study area (region within dashed lines), proposed east and west breakwaters and revetted mole, Agana Channel and adjacent reef-flat platforms, and reef zones (areas delimited by solid lines and letters A through L). Relative density and predominance of corals are indicated by the intensity of stippling

Table 1. Check list of coral species observed within the reef zones of the study area. The coral species are listed in descending order of predominance for the entire study area and by relative abundance within each reef zone (see Figure 1 for the distribution of reef zones and the section on methodology for an explanation of the relative abundance symbols).

Coral Species in Ranked Order	Reef Zones											
	A	B	C	D	E	F	G	H	I	J	K	L
Porites lutea Milne-Edwards and Haime	O	O	D	O	D	D	D	D	R	O	O	O
Pocillopora damicornis (Linnaeus)	-	R	A	O	A	A	A	C	-	-	O	O
Acropora aspera (Dana)	-	-	A	O	O	R	O	O	-	-	-	-
Psammocora contigua (Esper)	-	R	A	O	O	O	C	C	-	-	-	-
Psammocora stellata (Verrill)	-	R	C	R	O	O	C	O	-	-	-	-
Porites annae Crossland	-	R	O	O	C	C	O	O	-	-	-	-
Leptastrea purpurea (Dana)	-	R	C	O	C	C	C	C	-	-	-	-
Porites cocosensis Wells	-	R	O	R	O	C	C	O	-	-	-	-
Millepora dichotoma Forskaal	-	R	-	-	A	A	O	-	-	-	O	O
Montipora lobulata Bernard	-	-	-	-	O	O	O	O	-	-	R	-
Montipora verrilli Vaughan	-	-	-	-	O	O	R	O	-	-	-	-
Goniastrea retiformis (Lamarck)	-	R	C	O	O	C	C	O	-	-	-	-
Montipora sp. 1 (tuberculate)	-	-	-	-	O	O	-	O	-	-	-	-
Acropora palifera (Lamarck)	-	-	O	-	-	-	R	-	-	-	-	-
Acropora nana (Studer)	-	-	R	-	O	-	-	-	-	-	-	-
Heliopora coerulea (Pallas)	-	-	-	R	O	O	-	-	-	-	-	-
Pavona (Polyastra) venosa Ehrenberg	-	R	-	-	O	O	-	-	-	-	-	-
Acropora nasuta (Dana)	-	-	R	-	-	-	R	-	-	-	-	-
Montipora elschneri Vaughan	-	-	-	-	R	R	-	R	-	-	-	-
Pocillopora meandrina Dana	-	-	-	-	R	R	-	-	-	-	R	-
Euphyllia glabrescens (Chamisso and Eysenhardt)	-	-	R	-	R	-	-	-	-	-	-	-
Montipora foveolata (Dana)	-	-	R	-	-	-	-	-	-	-	-	-
Acropora surculosa (Dana)	-	-	R	-	R	-	R	-	-	-	-	-
Acropora murayensis Vaughan	-	R	-	-	-	-	R	-	-	-	-	-
Acropora digitifera (Dana)	-	-	R	-	-	-	-	-	-	-	-	-
Pavona divaricata Lamarck	-	-	R	-	-	-	-	-	-	-	-	-
Acropora valida (Dana)	-	-	R	-	-	-	-	-	-	-	-	-
Acropora conveza (Dana)	-	-	R	-	-	R	-	-	-	-	-	-
Pavona decussata Dana	-	R	-	-	-	-	-	R	-	-	-	-

Table 1. Continued

Coral Species in Ranked Order	Reef Zones											
	A	B	C	D	E	F	G	H	I	J	K	L
Pocillopora danae Verrill	-	-	-	-	-	R	-	-	-	-	R	-
Favia pallida (Dana)	-	-	-	-	R	-	-	-	-	-	-	-
Astreopora elliptica Yabe, Sugiyama, and Eguchi	-	-	-	-	-	-	-	R	-	-	-	-
Total Species 32	1	12	19	10	21	19	16	15	1	1	6	3
Living Coral Fragments Transported Into The Study Area By Storm Waves												
Acropora irregularis (Brook)	x	x	-	-	x	-	-	-	-	-	-	-
Acropora nana (Studer)	x	x	-	-	x	-	-	-	-	-	-	-
Acropora smithi (Brook)	x	-	-	-	x	-	-	-	-	-	-	-
Millepora platyphylla Hemprich and Ehrenberg	x	x	-	-	x	-	-	-	-	-	-	-
Pocillopora setchelli Hoffmeister	x	x	-	-	-	-	-	-	-	-	-	-
Pocillopora woodjonesi Vaughan	x	-	-	-	-	-	-	-	-	-	-	-
Total Species 6	6	4	0	0	4	0	0	0	0	0	0	0