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KOROR, PALAU
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MARINE SURVEY OF HELEN REEF
PALAU DISTRICT
12 - 17 APRIL 1975

CONDUCTED BY:

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TO BE PRESENTED TO

DISTRICT ADMINISTRATOR
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REQUESTED BY:

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PREPARED BY:

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Helen Reef is a small atoll lying on the southern-most border of Palau District, Trust Territory of the Pacific Islands, at aproximately 3° N lat. and 131° E long. It is about 24 km in its north-south dimension and 9 km in its east-west dimension (Hester and Jones, 1974) and contains a small sand island about one ha (hectare) in area situated in the northern part of the lagoon. The island consists of coconut trees and other low vegetation and is a major roosting area for several species of sea birds and also serves as a laying site for gravid sea turtles. The barrier reef and lagoon reefs (patch reefs) harbored, until recently, large populations of Tridacnid clams (giant clams), several of which are highly valued for their meats and shells. The family Tridacnidae includes 6 species, all of which are limited in distribution to the Indo-Pacific faunal region (Rosewater, 1965). The following are the Palauan equivalent names for Tridacnids: Tridacna gigas, otkang; T. derasa,kism; T. maxima, melibes; T. squamosa, ribkungl; T. crocea, oruer; and Hippopus hippopus, duadeb.

In March, 1972, a group of biologists from the Honolulu Laboratory of National Marine Fisheries Service were called upon by the Division of Marine Resources, Trust Territory of the Pacific Islands, to conduct a survey of Helen Reef and asses standing stocks of Tridacnid clams. They concluded that population levels of Tridacnids were high at the time of their survey (Hester and Jones, 1974). Preceeding that survey it had been known that foreign fishing vessels had been frequenting Helen Reef and captured Taiwanese fishing vessels since then have shown their holds to be full of Tridacnid muscles, turtles, and Trochus. Within the last several months, Taiwanese fishing vessels have been captured by the Trust Territory Field Trip vessel at Helen Reef with alarming frequency. For this reason, the Palau Marine Resources Office chartered the Oceanic Society's official flagship "New World" in

. 1975, to carry a team ...logist... ...Helen Reef so that a resurvey could be made. The purpose of this survey was to asses population levels of important marine organisms which are presently being exploited by foreign fishing vessels and to some extent by the Trust Territory flagship. Particular emphasis was placed on assesing Tridacnid clam stocks. The methods used in the survey were designed to be used as standard methods for future surveys so that more meaningful comparisons and conclusions can be drawn on the marine status of Helen Reef in the future. A terrestrial survey of Helen Island was conducted by a representative of the Palau Conservation Office and his report should be forthcoming as an addendum to this report.

METHODS

Straight line transects, 2 m in width, were used almost exclusively in this survey. Transects on the barrier reef were made by swimming with an inflatable boat from the lagoon slope normal to the reef as far into the surf zone as circumstances allowed. In some cases, because of currents, the transects began in the surf zone and ran to the lagoon slope. Tridacnid clams and Trochus lying within the transect path of two meters were counted and recorded on underwater writing boards. Patch reefs within the lagoon were transected from the lagoon slope on one side to the lagoon slope on another side. The only deviation from the transect methods were two areal tows which were made along the lagoon terrace and which followed the contour of the lagoon slope. Counts, however, were limited in these tows to a 2 m path as in the transects. Turtle counts were made as they were sighted during the four and one half day stay within the lagoon. Strong winds and high seas prevented survey of the outer reef front and terrace. Positions and measurements were figured from the Navy Hydrographic Office chart of Helen Reef, No, 6072, 1st edition, April 1944.

Tridacnid Clams

Figure 1 presents a map of Helen Reef showing the localities of stations made during this survey. Table 1 presents data calculated from live Tridacnid clam counts according to each station. Standing stock estimates for each clam species found on Helen Reef are presented in Table 2 and are compared with the 1972 estimates made by Hester and Jones (1974).

Turtles

A total of 13 green turtles (Chelonia mydas) and 2 hawksbills (Eretmochelys imbricata) were sighted in the water during the survey. These counts do not include 5 greens and 1 hawksbill observed tied aboard the Trust Territory field trip vessel Micronesian Princess which was anchored in Helen Reef lagoon on April 14.

Trochus

Only 12 Trochus were counted in the water. However, Trochus are more commonly found outside the reef along the reef margin in Palau proper and it is assumed the same would be true for Helen reef. Weather and sea conditions prevented survey outside the reef. Approximately 100 Trochus (including the meat) were observed in the reefer aboard one of the two Taiwanese fishing vessels which are presently grounded on the northeastern barrier reef near Helen Island

Other Conditions

The authors considered general reef conditions to be relatively normal except for the conspicuous presence of thousands of empty Tridacnid clam shells. Only three Acanthaster planci (Crown-of-thorns starfish) and several feeding scars were observed. There was no evidence of dynamiting and reef

fish populations appeared to be at very high levels. The authors observed no evidence of oil or fuel spills from the grounded Taiwanese vessels.

DISCUSSION

Because of limited manpower and time, Tridacna crocea was not counted. This species was extremely abundant and was usually omnipresent. Tridacna squamosa is either extremely rare on Helen Reef (Hester and Jones, 1974) or is so morphologically similar to T. maxima as to be almost indistinguishable. Only three T. squamosa were indentified (2 live 1 dead) during this survey and the authors are not completely positive of their identification. Hardy and Hardy(1969) apparenlty found no difficulty distinguishing between T. squamosa and T. maxima in Palau proper.

The results of this survey show that Helen Reef has been systematically harvested of at laeast three species of Tridacnid clams; T. gigas, T. derasa, and H. hippopus. The graveyard appearance (empty shells) on the reef suggests that only the fleshy portions of these species have been harvested. This is reinforced by captured Taiwanese fishing vessels having their holds filled with clam muscles, but with no traces of the shells (and mantles in most cases). Many of the empty shells on the reef appeared to be several years old, i.e, they were entrusted with algae, sponges, corals, and other invertebrates. About 50 shells were unidentifiable because of weathering and deterioration. This suggests that the exploitation of tridacnid clams on Helen Reef has been proceeding for several years. By contrast, Hester and Jones (1974) made no mention of sighting empty shells in their 1972 survey and even suggested that a moderate fishery for T. gigas and T. derasa might be initiated with caution. It must be assumed from their report that the clam population on Helen Reef had not been exploited to a noticeable extent of the time of their

y (March, 1972) and t[illegible] exploitation probably

after March, 1972. At the time of our survey, exactly 3 years later, th only clams which had not been decimated were T. crocea and T. maxima. Those apparently have no commercial valve. Standing stock estimates mad by Hester and Jones (1974) for T. gigas (49.8×10^3) and T. derasa (32.8×10^3) contrast sharply with our figures of 8.6×10^3 and 12.9 x 1 respectively, and exemplify the rampant exploitation of these two specie during that 3 year period. Our survey also showed that T. gigas and T. derasa have been exploited at depths up to 20 m which is around the maximum depth Tridacnids are found (Hardy and Hardy, 1969). This sugges that sophisticated diving gear such as SCUBA or HOOKA may have been used harvest the deeper clams.

Although our standing stock estimate of H. hippopus (47.3×10^3) higher than the estimate of 44.6×10^3 made by Hester and Jones (1974), survey covered a total area of 24,838 m^2 and we counted only 22 live H. hippopus verses 458 dead (95.4%). Clearly H. hippopus has also been w exploited. We counted only 4 live T. gigas (206 dead, 98.1%) and 6 live T. derasa (168 dead, 96.5%).

Life span estimates of Tridacnids reportedly range up to 100 year and several short term growth rate experiments have suggested that T. gigas may grow about 5 cm in valve length per year (Bonham, 1965; Rosewater, 1965 If this is true, T. gigas may take about 20 years to reach a valve length of 1 m. No data is available on the growth rates of T. derasa and H. hippopus. The recovery of T. gigas on Helen Reef to the previous population level of 49.8×10^3 reported by Hester and Jones (1974) would probably take longer than a decade.

Present population levels of turtles at Helen Reef are impossible to estimate because there have been no previous estimates and their mobility [illegible]. We counted a total of 15 (13 green, 2

the entire barrier reef, seems quite low. The senior author spent 4 days at Helen Reef in 1969 and recalls sighting many more turtles than during the present survey.

CONCLUSIONS

The tridacnid clams, T. gigas, T. derasa, and H. hippopus have been well exploited on Helen Reef by human factions, i.e., foreign fishing vessels Any further exploitation of these clams will almost certainly reduce the chances for these species to successfully repopulate Helen Reef.

RECOMMENDATIONS

1. Helen Reef should be resurveyed in 1 or 2 years employing the same methods as were used in this survey. If possible, the same transect locations should be surveyed to provide more precise information on the status of Tridacnid population levels.

2. Enforce government field trip ship orders concerning the removal of wildlife from Helen Reef during field trip ship visits

3. There is a possibility that the National Aeronautics and Space Administration Earth Resources Technology Satellite program (ERTS) or Earth Resources Observation Satellite program (EROS) could be used to sense foreign fishing vessels poaching on Helen Reef. Further inquiries into the feasibility of this concept could be made

4. Helen Reef could be established as a preservation and conservation area and could be opened up as an international scientific study area Participating nations would form a club and Palau would act as the host country. Members could sponsor and finance a research/patrol vessel with onboard laboratories and speeds capable of reaching Helen Reef from Palau in a day and a half to apprehend poachers. The boat could be crewed by participating countries including Palau and could be used for scientific expeditions to Helen Reef. This would bring increased revenue to Palau, enlighten relations with participating countries, bring increased knowledge to the district by participating in the scientific programs, and allow for the preservation of Helen Reef.

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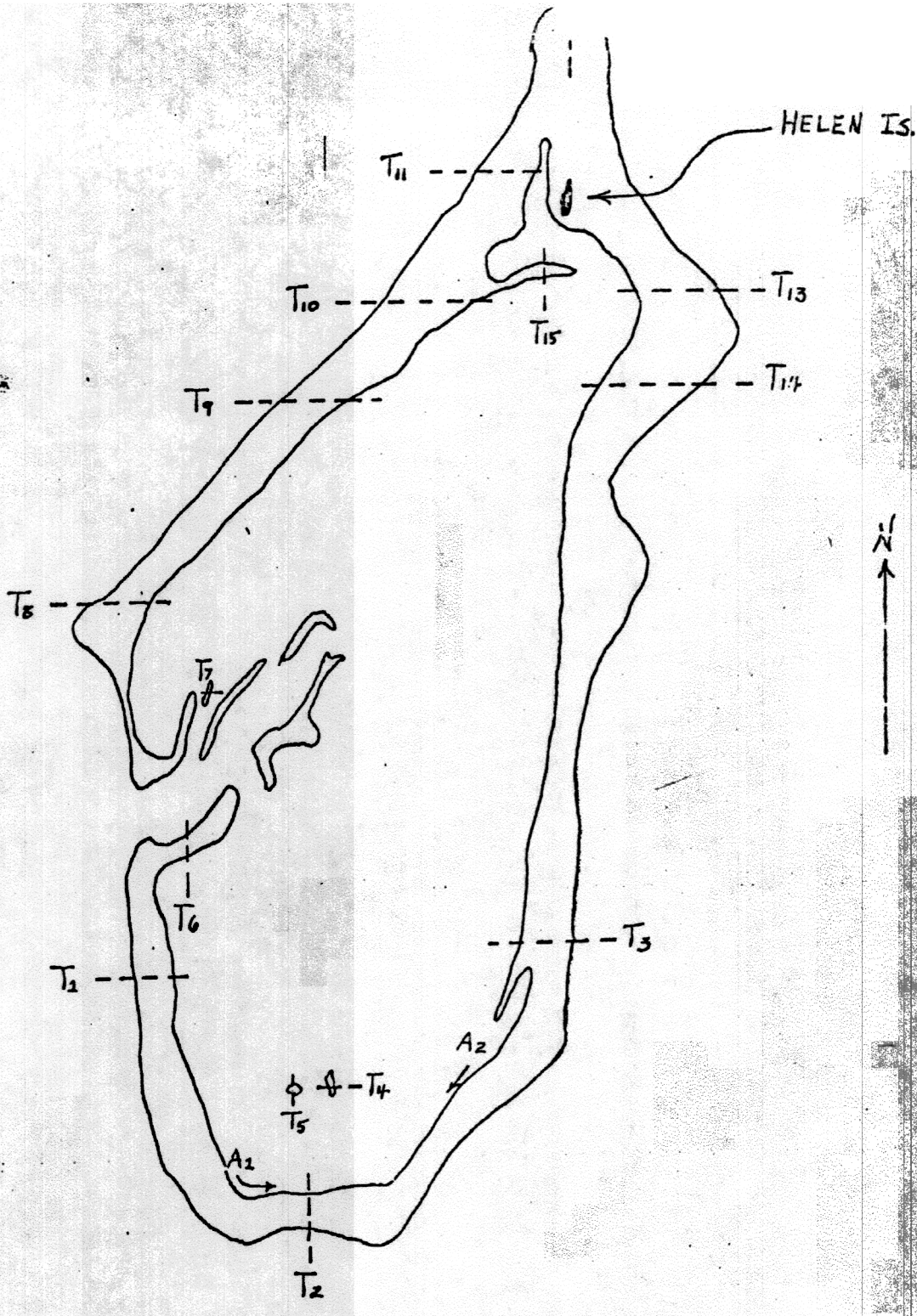

Figure 1. Localities of survey stations made on Helen Reef.
T = transect. A = areal tow. Map not drawn to scale.

Table 1. Survey data of live Tridacnid clams taken from transects and areal tows. T = transect. A = areal tow. Tridacna crocea not included.

Station	Location and direction of transect or areal tow	Reef type	Length of transect or areal tow (m)	Area surveyed (m^2)	Nos. of live species counted	Density of clams per 100 m^2
T_1	2° 51' 10" N lat. 131° 44' 16" E long. 270° true	Barrier Reef	645.2	1290.3	5-T. maxima 1-H. hippopus	0.4 0.1
T_2	2° 48' 46" N lat. 131° 45' 06" E long. 180° true	Barrier Reef	645.2	1290.3	3-T. maxima	0.2
	2° 51' 24" N lat 131° 48' 23" E long. 90° true	Barrier Reef	967.7	1935.5	60-T. maxima 1-H. hippopus 1-T. squamosa	3.1 0.1 0.1
T_4	2° 50' 33" N lat. 131° 45' 48" E long. 270° true	Patch Reef	483.9	967.7	27-T. maxima	2.8
T_5	2° 50' 24" N lat. 131° 45' 30" E long. 180° true	Patch Reef	322.6	645.2	51-T. maxima 1-T. gigas	7.9 0.2
T_6	2° 52' 13" N lat. 131° 45' 03" E long. 180° true	Channel Reef	483.9	967.7	49-T. maxima 1-T. derasa	5.1 0.1
	2° 53' 13" N lat. 131° 44' 56" E long. 270° true	Patch Reef	322.6	645.2	53-T. maxima 1-T. gigas 1-T. derasa	8.2 0.2 0.2
T_8	2° 54' 42" N lat. 131° 45' 14" E long. 270° true	Barrier Reef	967.7	1935.5	61-T. maxima 1-T. derasa 2-H. hippopus	3.2 0.1 0.1

Table 1. continued

Station	Location and direction of transect or areal tow	Reef type	Length of transect or areal tow (m)	Area surveyed (m^2)	Nos. of live species counted	Density of clams per 100 m^2
T_9	2° 56' 20" N lat. 131° 46' 53" E long. 270° true	Barrier Reef	967.7	1935.5	39-T. maxima 2-T. derasa 1-T. squamosa	2.0 0.1 0.1
T_{10}	2° 58' 00" N lat. 131° 48' 16" E long. 270° true	Barrier Reef	1129.0	2258.1	44-T. maxima	2.0
T_{11}	2° 59' 05" N lat. 131° 48' 30" E long. 270° true	Barrier Reef	806.5	1612.9	43-T. maxima 3-H. hippopus	2.7 0.2
12	3° 00' 30" N lat. 131° 48' 55" E long. 0° true	Barrier Reef	645.2	1290.3	2-T. maxima	0.2
T_{13}	2° 58' 06" N lat. 131° 49' 24" E long. 90° true	Barrier Reef	1612.9	3225.8	137-T. maxima 1-T. derasa 9-H. hippopus	4.3 0.1 0.3
	56' 30" N lat. 49' 51" E long. 90° true	Barrier Reef	1129.0	2258.1	4-T. maxima 6-H. hippopus	0.1 0.3
T_{15}	2° 58' 00" N lat. 131° 49' 00" E long. 180° true	Patch Reef	322.6	645.2	37-T. maxima	5.7
1	2° 49' 00" N la 131° 44' 30" E long Direction variable	Lagoon terrace	483.9	967.7	2-T. maxima	0.2
2	2° 50' 30" N lat. 131° 47' 30" E long. Direction variable	Lagoon terrace	483.9	967.7	12-T. maxima 2-T. gigas	1.2 0.2

Table 2. Summation of survey data for Tridacnid clams found on Helen Reef. Standing stock estimates are based Hester and Jones' (1974) figure of 5,340 ha as suitable habitat for Tridacnid clams on Helen Reef.

Species	Alive	Dead	Percent alive	Percent dead	Estimate of standing stock	1972 Estimate of standing stock*
T. gigas	4	206	1.9	98.1	8.6×10^3	49.8×10^3
T. derasa	6	168	3.5	96.5	12.9×10^3	32.8×10^3
T. maxima	629	23	96.5	3.5	1.4×10^6	1.7×10^6
T. crocea	Omnipresent	--	--	--	---	3.7×10^6
T. squamosa	2	1	66.7	33.3	4.3×10^3	--
H. hippopus	22	458	4.6	95.4	47.3×10^3	44.6 x [illegible]

*Data from Hester and Jones (1974).