ENVIRONMENTAL MONITORING STUDY OF AIRPORT RUNWAY EXPANSION SITE MOEN, TRUK, EASTERN CAROLINE ISLANDS

PART A: BASELINE STUDY

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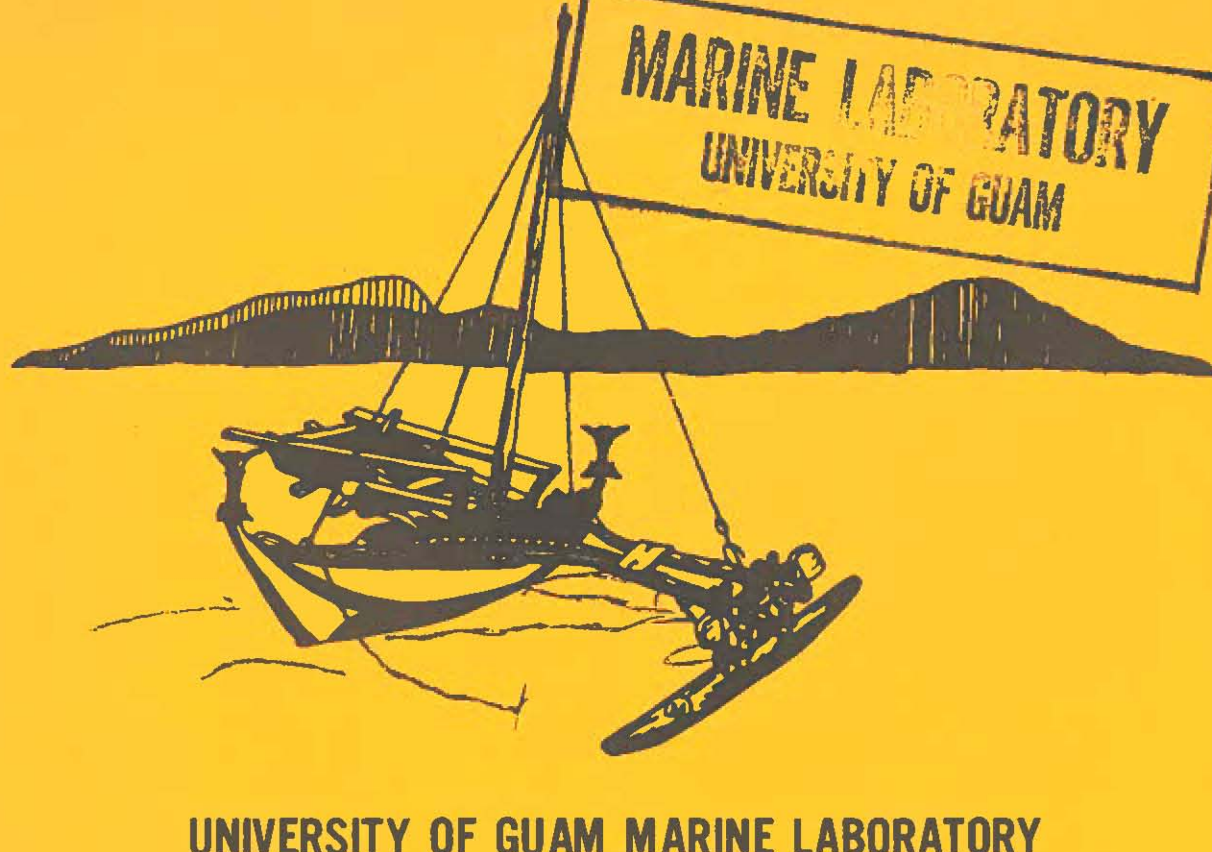

UNIVERSITY OF GUAM MARINE LABORATORY

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INTRODUCTION

Background

This report is the first phase of a study designed to monitor the effects of construction activities on the marine environment surrounding the airport runway on Moen Island, Truk. The existing airport runway is to be lengthened and widened to better accommodate air traffic through Truk. This runway expansion project will involve dredging of some 2 million cubic yards of coral from the Pou Bay and Metitiu dredge sites and using this material to extend the existing runway 1400 feet toward the southwest and 600 feet to the northeast. Additionally the runway will be widened and repositioned toward the northwest and dredged material will be used as fill in this area.

Because a construction project of this magnitude is potentially damaging to the nearby reef environment, the Marine Laboratory and the Water Resources Research Center of the University of Guam were contracted by the Department of the Navy, Pacific Division, Naval Facilities Engineering Command, to establish an environmental monitoring program to assess the impact of the construction activities on the marine environment. The first phase of the monitoring program is a pre-construction baseline study on the existing marine communities in the area. This is to be followed by a series of assessments during the course of the construction, and a final follow-up study after the construction is completed. Should unacceptable environmental impacts occur during the construction project, the monitoring program will allow these impacts to be detected so that the proper steps can be taken to ameliorate or avoid them.

Scope of Work

The Marine Laboratory has undertaken the following components of the pre-construction monitoring program:

a) Perform detailed current studies to document circulation patterns and to predict movement of materials to be generated during construction. Current velocities and directions should be taken under prevailing wind conditions, at different depths, and under rising and falling tide conditions sufficient to establish the physical characteristics of the study area during the study period.

b) Conduct benthic and fish surveys in the study area to confirm the abundance and distribution of corals, invertebrates, benthic flora and fauna, and fish populations identified in Devaney et al. (1975). Document any differences in the present marine community and that described by Devaney et al. (1975).

c) Prepare recommendations to mitigate against environmental degradation or destruction, or to substantiate preservation of areas of unique biological value.

d) On a one time basis, collect samples of fish from the study area and perform the necessary radioimmuno assay tests on the samples to establish a baseline on the levels of ciguatoxins present in the fish community. Conduct a review of existing or historical occurrences of ciguatera outbreaks in Truk Lagoon, particularly on Moen Island. Document the findings along with the ciguatoxin data.

Personnel

Steven S. Amesbury, Assistant Professor of Biology, Marine Laboratory, University of Guam--Fishes

Russell N. Clayshulte, Biology Graduate Student, Marine Laboratory, University of Guam--Invertebrates, currents, Physiography

Timothy A. Determan, Biology Graduate Student, Marine Laboratory, University of Guam--Corals

John R. Eads, Marine Technician, Marine Laboratory, University of Guam--Maintenance, currents

Steven E. Hedlund, Biology Graduate Student, Marine Laboratory, University of Guam--Marine Plants

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METHODS

Water Circulation

Water circulation patterns were determined primarily by the use of drift drogues. Drift drogues consisted of a 1-m tall aluminum vane with a cross shape (as seen in transverse section) suspended from a buoy by a length of line. The length of the line was varied to suspend the vane at two depths, in a surface water layer of 1-2 m, and a subsurface layer of 6-7 m. The drogues were released at selected monitoring stations and allowed to drift for measured periods of time. The drogue positions were determined by using a hand-bearing compass to triangulate on previously determined shoreline features. The time of drogue drift and distance travelled were used to determine water mass velocity. Drogues were released at different times during the tidal cycle to test for the effects of tide on patterns of water circulation. Wind direction and speed readings were obtained from the weather station on Moen so that the effect of wind on the drogue movement could be ascertained. Additional information on circulation patterns was obtained by releasing large patches of fluorescein dye in a line perpendicular to the shore at station 7. The movement of the dye patches with time was plotted. Paper plates were released along with the dye patches and their general movement was recorded.

Biological Monitoring Stations

We felt that any biological impact caused by the construction activities could most accurately be monitored by establishing specific monitoring stations within the study area and making quantitative transect measurements of the biota at the stations. Eight monitoring stations that coincided with the water quality stations were selected within the region of potential impact (Figure 2). They were located near the designated water quality boundary off the runway site and off anticipated major dredge spoil discharge points near the Pou Reef and Metitiu Reef dredge sites. At each station, an easily relocatable topographical feature (rubble mound or coral/rock pinnacle) was chosen (at some stations, two such features were chosen) and the site was marked with a buoy. A ninth station, well outside the zone of anticipated impact, was also selected to serve as a control. The depth and configuration of each transect site was recorded, and a transect line was laid across it. Quantitative assessments of the marine plants, corals, other invertebrates, and fishes were made along the transect line. At station 6, replicate assessments were made along transects 6A and 6B to estimate the amount of variability inherent in our censusing techniques.

Marine plants along the transect were quantified by a point-quadrat method which consisted of setting a 25 cm x 25 cm gridded quadrat with 16 internal points on the transect line every meter. Percent cover was calculated by dividing the number of points at which each species was seen by the total number of points (16 times the number of tosses) and multiplying by 100.

Two methods were used to census the stony corals communities at each station. The point-quarter method (Cottam et al., 1953) was applied along transects where scattered, discreet colonies of several species of coral were encountered. In zones of extensive coverage of a single species, a line-intercept method described in Smith (1974) was used, since the point-quarter method proved to be inefficient in terms of time. These zones included large patches of _Acropora_ sp. and mounds of _Porites_ sp.

Generally, for transects where the point-quarter method was applied, a series of 10 points at equal intervals along the transect line were selected. A second line was laid perpendicular to the transect line at each point. The area around each point was thus divided into four equal quadrants. In each quadrant, the coral closest to the point was located, and the diameter and distance of the colony center from the transect point was measured. A sample of the coral was taken and color and growth form were noted for later positive determination in the laboratory. If no coral was observed within a maximum distance of 1 m from the transect point in any quadrant, a point-to-coral distance of 100 cm (1 m) and a diameter of zero was recorded.

From these data, the following quantities were calculated:

$$\text{Total Density of All Species} = \frac{\text{Unit Area}}{(\text{Mean point-to-point distance})^2}$$

$$\text{Relative Density} = \frac{\text{Individuals of a species}}{\text{Total individuals of all species}} \times 100$$

$$\text{Density} = \frac{\text{Relative density of a species}}{100} \times \text{Total density of all species}$$

Percent Cover = Density of species X Average dominance value for species

$$\text{Relative Percent Cover} = \frac{\text{Percent cover for a species}}{\text{Total percent cover for all species}} \times 100$$

$$\text{Frequency of Occurrence} = \frac{\text{Number of points at which species occurs}}{\text{Total number of points sampled}}$$

$$\text{Relative Frequency of Occurrence} = \frac{\text{Frequency value for a species}}{\text{Total of frequency values for all species}} \times 100$$

The sum of the values for Relative Percent Cover, Relative Dominance and Relative Frequency of Occurrence equals the Importance Value for each species on each transect.

At two of the nine transects where the point-quarter method was applied, fewer than 10 transect points were sampled: Station 2 due to shortness of time (7 points) and Station 6B at which a mixed sampling scheme of both point-quarter (6 points) and line-intercept methods seemed appropriate.

The line-intercept method was applied at Station 4 (Transect 4B), Station 6 (Transect 6B in part), and Station 9. Species names and lengths of the intervals intercepted were recorded for each coral colony lying beneath the transect line. The line was considered to be a belt one cm wide extending along one side of the tape. The data was summarized in the following manner: (1) the number of times each individual species appeared along the line; (2) "relative occurrence" as determined by the dividing the number of intervals occupied by each species by the total number of intervals occupied by all species, the result multiplied by 100; (3) the total linear distance (cm) of each species along the belt; and (4) the total distance of intercept of all species per length of transect. Percent cover and relative percent cover was calculated from the latter two quantities.

The abundances of macroinvertebrate were quantified by swimming the lengths of the transects and counting the number of invertebrates within one meter to either side of the line. A meter stick was held perpendicular to the line with one end touching the line as the observer swam along the transect. Since the biological monitoring stations were discrete coral/rubble mounds, the area along the entire length of one side of the transect line was recorded as one transect count. Therefore, each station or station site had at least two invertebrate transects. In order to facilitate comparisons between stations the number of species per m^2 was computed.

Random swims were conducted around the monitoring stations for the presence of invertebrate species not associated with the monitoring mounds.

Fishes were censused by swimming the length of the transect line counting the number of each fish species seen within a meter of either side of the line. A list was also made of fish species seen on the mound but not encountered in the transect census.

General Reconnaissance

In order to obtain a general overview of the marine communities within the study area and to facilitate comparisons with an earlier study by Devaney et al. (1975), qualitative assessments of the biota were made in the Pou Reef dredge area and in several locations off the end and side of the existing runway. Species lists were compiled for these areas, and a subjective assessment of the relative abundance of different species was made.

Ciguatera Testing

It has been suggested that the creation of new benthic substrate by such activities as dredging and filling and blasting may provide conditions favorable for the outbreak of ciguatera fish poisoning. In order to assess the current levels of ciguatera toxicity in the study area, a variety of fishes were collected and samples of muscle and gonads sent to Dr. Yoshitsugi Hokama at the John A. Burns School of Medicine in Honolulu for radioimmunoassay. We also interviewed the Truk District Director of Health Services as well as several fisherman in order to obtain information on the frequency of ciguatera poisoning on Moen.

RESULTS AND DISCUSSION

General Description of the Study Area

Truk Atoll, in the Eastern Caroline Islands, is comprised of 19 high volcanic islands and numerous small coral islands scattered over a large lagoon. The airport study area is located on the northern side of Moen Island in the central eastern part of Truk lagoon. Moen, the second largest of the volcanic islands, is roughly triangular in shape and 11.7 square kilometers (km^2) in area (Fig. 1). The island is characterized by steep stream-dissected slopes and mountain peaks up to 370 m in elevation (Mount Terokin). Low coastal terraces of variable width border the steep volcanic slopes. A majority of the commercial and residential development is associated with the coastal terraces. Lagoon fringing reefs border the shorelines at most places around the island with the most extensive development along the northern shorelines.

The shoreline and general extent of the fringing platforms, mangrove swamps, patch reef areas, and offshore lagoon regions in the study area are shown in Fig. 1. Location names shown in this map are adapted, for the most part, from official place names. Those names that were coined by the study team to facilitate description of the region are underlined.

Mangrove swamp occupies the intertidal fringing reef platforms at many places and is particularly well developed along the northeast and eastern shorelines. *Rhizophora* species dominate the swamp and are usually densest lagoonward. The inner portions of the more well developed swamps have taller and more widely spaced trees with some open mud-flat areas. Generally, the mangroves are restricted to a narrow band adjacent to the shoreline. The water in the vicinity of mangrove development tend to be turbid, an apparent result of silty-clay suspension.

Small offshore patch reefs, some of which are partially exposed during low tides, are scattered around the island. One such patch reef lying between Moen and Falo Islands (Fig. 1) is being used as a water quality and biological monitoring station. The peripheries of these patch reefs typically have diverse coral growth with extensive algal and faunal communities.

The lagoon floor surrounding the airport runway and proposed dredge reef platforms is characterized by moderately gentle sandy slopes with numerous scattered mounds of coral (*Acropora*) and rubble. These mounds or rubble patches range in size from a few meters to more than 50 m across and are typically less than 10 m high. Rubble mounds are surrounded by fine to coarse grained biogenous sediments which are primarily *Halimeda*/coral sands with trace amounts of terrigenous clay, silt, and organic matter. *Halimeda* dominates the

Table 8. Size distribution, frequency, density and percent of substratum covered by stony corals at Station 5. Analysis includes relative values of frequency, density and percent of substratum covered from which an importance value is calculated. Field data was collected using the point-quarter method. The standard symbols used are the number of corals (n), arithmetic mean ($\bar{Y}$), and standard deviation (s), and range (w).

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameters (cm) n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density Per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
<u>Acropora affinis</u>	Dark pink flabbelate	1	57.0	-	-	.10	7.14	.080	5.88	2.63	14.56	27.58
<u>Acropora formosa</u> (Dana)	Light brown arborescent	3	55.0	0.0	-	.30	21.43	.242	17.65	40.64	40.64	79.72
<u>Acropora</u> sp. 4	Tan with light blue tips, tabulate	1	39.0	-	-	.10	7.14	.080	5.88	1.23	6.81	19.83
<u>Pocillopora</u> ramose No. 1	Dark tan cespitose	2	10.5	10.6	3.0-18.0	.20	14.29	.161	11.76	.27	1.49	27.54
<u>Porites lutea</u> Milne-Edwards and Haime	Massive lobate	8	26.8	18.3	6.0-55.0	.50	35.7	.645	47.06	6.52	36.10	118.87
Unidentified	Tan encrusting	1	8.0	-	-	.10	7.14	.080	5.88	.05	.28	13.30
<u>Distichophora</u> sp.	Dark blue, fennestrate	1	3.0	-	-	.10	7.14	.080	5.88	.02	.11	13.13
Total Density 1.37 Corals Per m^2 Total Percent Cover 18.06%												

Table 9. Size distribution, frequency, density and percentage of substratum covered by stony corals at Station 6A. Data was collected on two separate occasions to evaluate variations in data analysis. Analysis includes relative values of frequency, density and percent of substratum covered from which an importance value is calculated. Standard symbols used are the number of corals (n), arithmetic mean ($\bar{Y}$), standard deviation (s), and range (w).

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameters (cm)				Frequency	Relative Frequency	Density per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
		n	$\bar{Y}$	s	w							
May 24, 1978												
Acropora formosa (Dana)	Light brown arborescent	14	79.1	34.6	35.0-147.0	.80	44.44	.815	50.00	60.24	95.51	189.95
Acropora reticulata (Brook)	Scarlet tabulate	2	36.0	0.0	-	.20	11.11	.116	7.14	1.51	2.39	20.62
Acropora sp. 8	Bluish cespitose	3	8.3	2.9	5.0- 10.0	.20	11.11	.174	10.71	.13	.21	22.03
Pocillopora ramose No. 1		9	14.1	5.5	7.0- 21.0	.60	33.11	.524	32.14	1.19	1.89	67.36
Total Density 1.63 Corals per m^2												
Total Percent Cover 63.07%												
May 27, 1978 (Replicate Sampling)												
Acropora arbuscula (Dana)	Flesh with blue tips	2	16.4	18.33	3.5- 29.4	.20	9.52	.151	5.26	.66	.75	15.53
Acropora formosa (Dana)	Light brown arborescent	22	50.2	25.1	1.7-105.0	1.00	47.62	1.667	57.89	85.47	97.42	202.93
Pocillopora ramose No. 1	Small cespitose	12	12.6	3.7	7.4- 18.5	.70	33.33	.910	31.58	1.56	1.78	66.69
Porites lutea	Massive lobate	1	6.9	-	-	.10	4.76	.076	2.63	.04	.04	7.43
Total Density 2.88 Corals per m^2												
Total Percent Cover 87.73%												

Table 10. Analysis of corals data obtained at Station 6B on two separate occasions to evaluate variations in data analysis. The data was collected using point-quarter and line-intercept methods. Combined results are shown.

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameters (cm) n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density per m2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
May 24, 1978 (Rubble zone)												
Acropora formosa (Dana)	Light brown arborescent	1	17.3	-	-	.167	20.02	.156	14.29	.470	28.31	62.62
Acropora sp. 10		1	3.2	-	-	.167	20.02	.156	14.29	.016	.96	35.27
Acropora sp. 4	Tan with blue tips, tabulate	1	4.0	-	-	.167	20.02	.156	14.29	.026	1.57	35.88
Pocillopora ramose No. 1												
Porites (Synaraea) iwayamaensis Eguchi	Massive columnar	3	11.9	6.4	5.9-18.6	.333	39.92	.467	42.86	.751	45.24	128.02
		1	5.0	-	-	.167	20.02	.156	14.29	.400	24.10	58.41
Total Density 1.09 Corals per m^2												
Total Percent Cover 1.66%												

		Size Distribution of Colonies Diameters (cm) n	$\bar{Y}$	s	w	Relative Occurrence	Percent of Cover	Relative Percent of Cover
(Massive Porites mound)								
Pocillopora sp.	Light tan, bluish tips, cespitose	1	15	-	-	14.3	63.8	95.6
Porites lutea Milne-Edwards and Haime	Massive, lobate	6	53.8	66.1	7.0-181.0	85.7	3.0	4.4
Total Distance 1253 cm								
Total Percent Cover 66.8%								

Table 10 . continued

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameters (cm) n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
May 27, 1978 (Replicate Sampling) (Rubble Zone)												
Acropora formosa (Dana)	Light brown arborescent	3	14.2	9.6	8.4-22.8	.286	25.00	.297	27.27	.716	36.35	88.62
Acropora sp. 4	Tan with blue tips, tabulate	2	2.15	0.0	-	.286	25.00	.198	18.18	.013	.66	43.84
Acropora sp. 11	Flesh cespitose	1	15.5	-	-	.143	12.5	.099	9.09	.373	18.93	45.47
Pocillopora ramose No. 1	Small ramose	5	10.0	3.9	6.0-16.0	.429	37.5	.495	45.45	.874	44.37	153.30
Total Density 1.09 Corals per m^2												
Total Percent Cover 1.97%												

		Size Distribution of Colonies Diameters (cm) n	$\bar{Y}$	s	w	Relative Occurrence	Percent of Cover	Relative Percent of Cover
(Massive Porites mound)								
Acropora formosa (Dana)	Light brown arborescent	2	11.0	5.6	7.0-15.0	12.5	4.2	89.8
Pocillopora ramose No. 1	Small ramose	2	11.5	3.5	9.0-14.0	12.5	1.7	7.2
Porites lutea Milne-Edwards and Haime	Massive lobate	12	22.8	22.8	3.0-45.0	75.0	53.0	3.0
Total Distance 517 cm								
Total Percent Cover 59.0%								

Table 11. Size distribution, frequency, density, and percent of substratum covered by stony corals at Station 7. Analysis includes relative values of frequency, density, and percent of substratum covered from which an importance value is calculated. Field data was collected using the point-quarter method. The standard symbols used are the number of corals (n), arithmetic mean ($\bar{Y}$), standard deviation (s), and range (w).

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameters (cm) n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
Acropora formosa (Dana)	Light brown arborescent	3	8.7	5.1	3.0- 13.0	.30	17.65	.502	7.89	.51	1.32	26.86
Acropora sp.	Flesh, cespitose	1	20.0	-		.10	5.89	.168	2.63	.67	1.73	10.25
Acropora sp.	Blue cespitose	3	4.3	.57	4.0- 5.0	.10	5.89	.502	7.89	.10	.25	14.03
Echinophyllia aspera (Ellis and Solander)	Yellow, foliacious, large polyps (tentacles do not retract)	1	45.0	-	-	.10	5.89	.168	2.63	3.40	8.80	17.32
Euphyllia fimbricata (Spengler)	Flesh colored, large polyps (tentacles do not retract)	1	28.0	-	-	.10	5.89	.168	2.63	1.32	3.42	11.94
Goniastrea edwardsii	Light brown massive	1	5.0	-	-	.10	5.89	.168	2.63	.04	.10	8.62
Pavona multivensis	Tan, massive or encrusting	20	16.2	6.7	7.0- 37.0	.50	29.41	3.352	52.63	10.16	26.31	108.35
Porites lutea Milne-Edwards and Haime	Massive, lobate	7	32.4	31.5	7.0-101.0	.30	17.65	1.173	18.42	22.34	57.85	93.92
LT GRN ENCRUSTING	Light green, encrusting	1	7.3	-	-	.10	5.89	.168	2.63	.08	.21	8.73

Total Density 6.37 Corals per m^2
Total Percent Cover 38.62%

Table 12. Size distribution, frequency, density, and percent of substratum covered by stony corals at Stations 8A and 8B. Analysis includes relative values of frequency, density, and percent of substratum covered from which an importance value is calculated. Field data was collected using the point-quarter method. The standard symbols used are the number of corals (n), arithmetic mean (Y), standard deviation (s), and range (w).

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameters (cm) n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
Station 8A												
Euphyllia recta	Dark yellow, massive, large polyps (tentacles do not retract)	1	5.0	-	-	.10	6.66	.062	5.26	.016	.59	12.51
Lavia pallida (Dana)	Light yellow massive	3	10.7	10.4	4.4-22.6	.20	13.33	.186	15.79	.333	12.29	41.41
Mussa costata	Dark brown, meandroid	1	6.9	-	-	.10	6.66	.062	5.26	0.03	1.11	13.03
Porites lutea Milne-Edwards and Haime	Massive lobate	7	18.4	10.0	6.0-35.1	.50	33.33	.435	36.84	1.847	68.15	138.32
Porites sp. 2	Dark flesh ramose	1	19.0	-	-	.10	6.66	.062	5.26	.225	8.30	20.22
Goniopora sp. 2	Light yellow ramose	2	10.4	3.3	8.0-12.7	.20	13.33	.124	10.53	.142	5.24	29.10
Unidentified	Light yellow with sunken polyps	2	7.7	2.5	6.0- 9.5	.10	6.66	.124	10.53	.080	2.95	20.14
Favia speciosa (Dana)	Yellow, large polyps	1	5.9	-	-	.10	6.66	.062	5.26	.022	.81	12.73
Plesiastrea sp.	Yellow with red polyps	1	5.5	-	-	.10	6.66	.062	5.26	.019	.70	12.62
Total Density 1.18 Corals per m^2												
Total Percent Cover 2.71%												
Station 8B												
Acropora formosa (Dana)	Light brown arborescent	1	15.0	-	-	.10	5.56	.100	3.12	.225	.85	9.53
Acropora sp.	Flesh, ramose	1	2.4	-	-	.10	5.56	.100	3.12	.006	.02	2.45
Millepora exaesa Forskaal	Yellow, encrusting	3	12.8	2.4	11.0-15.5	.10	5.56	.302	9.38	.504	1.91	16.85
Pocillopora ramose No. 1	Cespitose or ramose	3	5.7	3.5	2.5- 9.5	.20	11.11	.302	9.38	.123	.46	20.95
Porites andrewsi Vaughan	Grey, ramose	2	47.6	5.7	43.6-51.6	.20	11.11	.201	6.25	4.59	17.35	34.71
Porites lutea Milne-Edwards and Haime	Massive, lobate	9	30.2	17.6	8.0-64.8	.50	27.78	.906	28.13	10.78		
Porites sp.	Flesh massive	11	24.1	18.3	6.9-69.3	.40	22.22	1.107	34.38	9.79	37.01	93.61
Lobophyllia costata Dana	Phaceloid	1	20.0	-	-	.10	5.56	.100	3.12	.416	1.57	10.25
Favia pallida (Dana)	Light yellow, massive	1	3.9	-	-	.10	5.56	.100	3.12	.015	.06	3.87
Total Density 3.22 Corals per m2												
Total Percent Cover 26.45%												

Table 13. Analysis of corals data collected at Station 9 using the line-intercept method.

SPECIES	COLONY DESCRIPTION	Length Distribution of Measurements (cm) n	$\bar{Y}$	s	w	Relative Occurrence	Percent Cover	Relative Percent Cover
Acropora formosa (Dana)	Light brown arborescent	11	131.9	98.1	20.0-340.0	42.3	51.2	63.7
Acropora sp.	Brown with white corallite tips, cespitose	1	195.0	-	-	3.8	6.9	8.6
Acropora sp.	Light tan with white corallite tips	1	10.0	-	-	3.8	0.4	0.5
Goniastrea pectinata (Ehrenberg)	Dark brown, massive	1	12.0	-	-	3.8	0.4	0.5
Pocillopora damicornis (Linnaeus)	Small cespitose	3	61.3	97.6	3.0-174.0	11.5	6.5	8.1
Pocillopora sp.	Heavy, lobate subramose	1	10.0	-	-	3.8	0.4	0.5
Porites (Synaraea) iwayamaensis Eguchi	Columnar, massive	8	51.9	52.4	5.0-151.0	30.8	14.6	18.2
Total Distance 2835.0 cm Total Percent Cover 80.4%								

Table 14. MACROINVERTEBRATES QUANTIFIED at monitoring stations. All monitoring sites have 2 transect counts, expect station 6 which has 4 counts. The number of the left in the station column is the total number of individuals observed and the number of the right is the number of individuals per m^2.

	STA.1 27 m^2	STA.1'	STA.2 9 m^2	STA.2'	STA.3a 6 m^2	STA.3a'	STA.3b 10 m^2	STA.3b'	STA.4a 18 m^2	STA.4a'	STA.4b 14 m^2	STA.4b'	STA.5 8 m^2	STA.5'
PORIFERA [number of species]	[9]	[8]	[3]	[3]	[4]	[3]	[2]	[2]	[5]	[5]	[3]	[1]	[6]	[7]
sponges sp.	34/1.3	20/.7	3/.3	6/.7	18/3	12/2	17/2.8	6/1	30/1.7	35/1.9	6/.4	5/.36	17/2.1	13/1.6
CNIDARIA														
hydrozoans							A*	A*					A*	A*
ANTHOZOA														
ACTINIARIA (Anemone)														
Radianthus spp.					0	1/.2								
ALCYONACAE (Soft coral)														
Lobophytum sp.														
Sarcophytum sp.			0	1/.1	1/.2	0			1/.06	1/.06	3/.21	0		
Sinularia spp.	18/.7	41/1.5			0	2/.3	0	1/.2[1]		2/.11	4/.3	0	55/6.9	25/3.1
Stereonephthya sp.	1/.04	0	0	1/.1							1/.07	3/.21		
Amthelia/Scympodium spp.	36/1.3	25/.9												
ANTIPATHARIA (Black coral)														
Cirripathes anquina	4/.15	2/.07	1/.1	0							3/.21	3/.21	1/.13	0
GORGONACAE (Fan coral)														
gorgonacean spp.	1/.04	0									2/.14	6/.4		
ANNELIDA														
POLYCHAETA														
SABELLIDAE (Featherworm)											1/.07	0	0	1/.13
MOLLUSCA														
GASTROPODA														
Lambis lambis														
Tectus pyramis	2/.07	0							1/.06	1/.06			0	3/.13
Trochus niloticus	2/.07	3/.1	1/.1						2/.11	1/.06				

*Abundant - Too numerous to count along transect

Table 14. continued

	STA.1 27 m^2	STA.1'	STA.2 9 m^2	STA.2'	STA.3a 6 m^2	STA.3a'	STA.3b 10 m^2	STA.3b'	STA.4a 18 m^2	STA.4a'	STA.4b 14 m^2	STA.4b'	STA.5 8 m^2	STA.5'
BIVALVIA														
Arca sp.	0	3/.1	44/4.9	88/9.8	6/1	7/1.2	4/.7	5/.5	1/.06	3/.17	62/4.4	86/6.1	19/2.4	0
Dendostrea hyotis			1/.1	0	0	1/.2	0	1/.1	1/.06	0	5/.37	4/.3	2/.25	1/.13
Atrina vexillum														
Pinna sp.											1/.07	2/.14		
Pteria loveni											0	5/.36		
Spondylus ducalis														
Tridacna squamosa	0	1/.07												
ARTHROPODA														
DIOGENIDAE (Hermit crab)														
Dardanus sp.													0	1/.13
ECHINODERMATA														
ASTEROIDAE (Starfish)														
Culcita novaeguneae											1/.07	1/.07		
Linckia multifora														
ECHINOIDEA (Sea urchin)														
Diadema setosum									0	1/.06				
HOLOTHUROIDAE (Sea Cucumbers)														
Bohadschia argus	1/.07	1/.04									1/.07	0		
Bohadschia graeffei											1/.07	0		
Holothuria atra					1/.2	1/.2			1/.06	1/.06				
Holothuria edulis														
Holothuria noblis														
sp 1 (yellow)														
Stichopus chloronotus	1/.04	0							1/.06	1/.06				
CRINOIDAE														
Comanthus bennetti	1/.04	0								1/.06		1/.07		
Comaster multifidus														
CHORDATA														
Didemnum ternatanum			125/13.9	304/33.8	0	6/1	1/.2	2/.3	2/.11	28/1.6		5/.36	A*	A*
Phallusia julinea	5/.2	10/.4							3/.17	2/.11	2/.14	3/.21	2/.25	1/.13

*Abundant - Too numerous to count along transect

Table 14. continued

	STA.6a 13 m2	STA.6a'	STA.6c 11 m2	STA.6c'	STA.6b 13 m2	STA.6b'	STA.7 15 m2	STA.7'	STA.8a 35 m2	STA.8a'	STA.8b 16 m2	STA.8b'	STA.9 30 m2	STA.9'
PORIFERA [number of species]	[4]	[5]	[4]	[3]	[8]	[8]	[4]	[5]	[6]	[4]	[4]	[3]	[3]	[4]
sponges sp.	18/1.4	14/1.1	21/1.9	11/1.	41/3.1	44/3.4	24/1.6	13/.9	129/3.7	148/4.2	47/2.6	34/2.1	10/.3	10/.3
CNIDARIA														
hydrozoans					A*	A*	A*	A*	A*	A*	A*	A*		
ANTHOZOA														
ACTINIARIA (Anemone)														
<u>Radianthus</u> spp.					1/.08	0	2/.13	7/.07	1/.03	1/.03				
ALCYONACAE (Soft coral)														
<u>Lobophytum</u> sp.									6/.17	2/.06			1/.03	0
<u>Sarcophytum</u> sp.														
<u>Sinularia</u> spp.														
<u>Stereonephthya</u> sp.							9/.6	12/.8	16/.46	14/.4	2/.13	10/.6		
<u>Anthelia/Scympodium</u> spp.														
ANTIPATHARIA (Black coral)														
<u>Cirripathes anquina</u>	3/.23	3/.23			1/.08	0	1/.07	0	3/.09	0				
GORGONACAE (Fan coral)														
gorgonacean spp.					2/.15	2/.15								
ANNELIDA														
POLYCHAETA														
SABELLIDAE (Featherworm)					0	2/.15	1/.07	1/.07			2/.13	0	0	4/.13
MOLLUSCA														
GASTROPODA														
<u>Lambis lambis</u>											0	1/.06		
<u>Tectus pyramis</u>	4/.3	3/.23	0	3/.3	1/.08	2/.14	0	1/.07					1/.03	0
<u>Trochus niloticus</u>	1/.08	1/.08	0	1/.09									1/.03	0

* Abundant - Too numerous to count along transect

Table 14. continued

	STA.6a 13 m^2	STA.6a'	STA.6c 11 m^2	STA.6c'	STA.6b 13 m^2	STA.6b'	STA.7 15 m^2	STA.7'	STA.8a 35 m^2	STA.8a'	STA.8b 16 m^2	STA.8b'	STA.9 30 m^2	STA.9'
BIVALVIA														
Arca sp.			0	1/.09	49/3.8	92/7.1	8/.5	3/.2					1/.03	1/.03
Dendostreas hyotis	5/.4	1/.08			1/.08	1/.08	1/.07	0	0	1/.03				
Atrina vexillum									0	1/.03				
Pinna sp.	1/.08	0												
Pteria loveni									1/.03	0				
Spondylus ducalis										1/.03				
Tridacna squamosa														
ARTHROPODA														
DIOGENIDAE (Hermit crab)							2/.13	0						
Dardanus sp.														
ECHINODERMATA														
ASTEROIDAE (Starfish)														
Culcita novaeguineae														
Linchia multifora			1/.09											
ECHINOIDAE (Sea urchin)														
Diadema setosum	1/.08	0							3/.09	6/.17			0	1/.03
HOLOTHUROIDAE (Sea Cucumbers)														
Bohadschia argus														
Bohadschia graeffei													1/.03	1/.03
Holothuria atra														
Holothuria edulis									0	1/.03	1/.06	0	1/.03	0
Holothuria noblis									1/.03	0				
sp 1 (yellow)							3/.02	0						
Stichopus chlorondus														
CRINOIDAE														
Comanthus bennetti														
Comaster multifidus					0	1/.08								
CHORDATA														
Didemnum ternatanum			3/.3	0	0	3/.23	0	2/.13					A*	A*
Phallusia julinea	0	1/.08			2/.15	1/.08	15/1	34/2.3	9/.26	16/.46	9/.56	2/.13	5/.17	5/.17

*Abundant - Toc numerous to count along transect

Table 15. Fishes censused on Transects 1, 2, 3A, and 3B. Total number of each species seen is indicated; asterisks denote species seen in the area but not seen on the transect.

SPECIES	TRANSECTS:	1	2	3A	3B
	TRANSECT LENGTH (m):	30	9.5	6.6	11.8
ACANTHURIDAE					
Acanthurus nigrofuscus				*	1
Ctenochaetus striatus		10	3	4	10
Naso juvenile		2			
Zebrasoma veliferum		3			
juvenile acanthurids				1	1
APOGONIDAE					
Paramia quinquelineata		2	2		3
BALISTIDAE					
Sufflamen chrysoptera		*			
BLENNIIDAE					
Ecsenius bicolor				*	
Meiacanthus atrodorsalis				2	1
CHAETODONTIDAE					
Chaetodon kleini		1	1		
C. trifasciatus		1	1		1
Heniochus acuminatus		*			
ELEOTRIDAE					
Ptereleotris tricolor		*			
HOLOCENTRIDAE					
Myripristis sp.					*
LABRIDAE					
Cheilinus fasciatus		*		1	
Cheilinus sp.		2			
Halichoeres hoeveni		12	4	11	10
H. marginatus		2			
Labrichthys unilineata		2			

Table 15. continued

SPECIES	TRANSECT LENGTH (m):	1 30	2 9.5	3A 6.6	3B 11.8
		TRANSECTS			
LABRIDAE (continued)					
Labroides dimidiatus		5	2		1
Macropharyngodon meleagris		3			
Stethojulis sp.				2	2
labrid sp. A					1
unidentified labrids		2			
POMACANTHIDAE					
Centropyge vroliki		1			
POMACENTRIDAE					
Amblyglyphidodon curacao		70			10
Chromis atripectoralis		2			
Chromis ternatensis (?)		4			
Chromis xanthura (?)		23	3		14
Dascyllus aruanus					*
Eupomacentrus fasciolatus		7			
Pomacentrus pavo		65	57	17	48
Glyphidodontops traceyi		5	1	1	2
Pomacentrus vaiuli		2		1	
pomacentrid sp. A				1	
pomacentrid sp. B				1	
juvenile pomacentrids			1	1	2
unidentified pomacentrids		1			4
SCARIDAE					
Bolbometopon bicolor		2			
Scarus ghobban		*			
scarid sp. A		*			
juvenile scarids		1			
SIGANIDAE					
Siganus puellus		1			
S. virgatus		4			
S. vulpinus		5			
ZANCLIDAE					
Zanclus cornutus					*
No. Species on Transect		28	10	12	16
No. Individuals on Transect		240	75	43	112
No. Individuals per m2		4.0	3.9	3.3	4.7

Table 16. Fishes censused on Transects 4A, 4B, and 5. Total number of each species seen is indicated; asterisks denote species seen in the area but not seen on the transect.

SPECIES	TRANSECT LENGTH (m):	TRANSECTS 4A (14.4)	4B (19)	5 (9)
ACANTHURIDAE				
Ctenochaetus striatus		4		1
APOGONIDAE				
Archamia fucata		9		32
Paramia quinquelineata				7
unidentified apogonids		220		65
BLENNIIDAE				
Ecsenius bicolor				2
CANTHIGASTERIDAE				
Canthigaster solandri		1		
CHAETODONTIDAE				
Chaetodon kleini		2		*
C. trifascialis				1
C. trifasciatus		*		
GOBIIDAE				
Gobiodon citrinus				1
LABRIDAE				
Cheilinus fasciatus		1		
Cheilinus sp.				*
Halichoeres hoeveni		7	15	7
Labrichthys unilineata			1	
Labroides dimidiatus		3	1	1
Thalassoma sp.		1		
Thalassoma juveniles		1	1	
unidentified labrids			1	
LETHRINIDAE				
Gnathodentex aureolineatus		2		
Monotaxis grandoculis		1		

Table 16. continued

SPECIES	TRANSECT LENGTH (m):	TRANSECTS 4A (14.4)	4B (19)	5 (9)
LUTJANIDAE				
Caesio juveniles				15
MONACANTHIDAE				
Oxymonacanthus longirostris			1	
MULLIDAE				
Parupeneus pleurostigma				*
P. trifasciatus			1	
PEMPHERIDAE				
Pempheris sp.		5		
POMACANTHIDAE				
Centropvge vroliki		3		
POMACENTRIDAE				
Amblyglyphidodon curacao		5	2	
Chromis atripectoralis		1		
C. xanthura (?)		1	24	
Dascyllus aruanus			2	
Glyphidodontops traceyi		4	1	
Pomacentrus pavo		47	51	133
P. vaiuli			2	1
Pomacentrid sp. A		1	1	
pomacentrid sp. C			11	
unidentified pomacentrids			1	1
SCARIDAE				
juvenile scarids			12	
SERRANIDAE				
Cephalopholis urodelus		*		
No. Species on Transect		20	17	13
No. Individuals on Transect		319	128	267
No. Individuals on per m^2		11.1	3.4	14.8

Table 17. Fishes censused on Transects 6A and 6B. Replicate censuses for both transects were made. Total number of each species seen is indicated; asterisks denote species seen in the area but not seen on the transect.

SPECIES	TRANSECT LENGTH (m):	6A 11	6A(rep) 12.5	6B 12	6B(rep) 13.2
ACANTHURIDAE					
Acanthurus nigrofuscus		1	3		3
Ctenochaetus striatus		4	2	7	11
Naso juvenile				1	
Zebrasoma scopas					*
APOGONIDAE					
Paramia quinquelineata					*
unidentified apogonids					*
BLENNIIDAE					
Meiacanthus atrodorsalis				1	
unidentified blenniids				1	
CANTHIGASTERIDAE					
Canthigaster valentini					*
CHAETODONTIDAE					
Chaetodon auriga				*	
C. citrinellus				1	1
C. ephippium			*		
C. kleini			*		2
C. trifascialis		*			
H. chrysostomus				1	
ELEOTRIDAE					
Ptereleotris tricolor					2
GOBIIDAE					
unidentified gobiids					1

Table 17. continued

SPECIES	TRANSECTS: 6A	6A(rep)	6B	6B(rep)
TRANSECT LENGTH (m):	11	12.5	12	13.2
HOLOCENTRIDAE				
Adioryx spinifer				1
Myripristis sp.		1	2	1
LABRIDAE				
Cheilinus sp.		2	1	4
Epibulus insidiator		*		1
Gomphosus varius	*			
Halichoeres hoeveni	3	7	7	7
Labrichthys unilineata	*			
Labroides dimidiatus	2	2	1	1
Pseudocheilinus hexataenia	2			
Stethojulis sp.		2		
Thalassoma juveniles			2	
labrid sp. A	1			*
labrid sp. B	*	1	15	2
LETHRINIDAE				
Monotaxis grandoculis	*			
LUTJANIDAE				
Caesio caerulaureus		4		
MULLIDAE				
Parupeneus bifasciatus			1	
POMACANTHIDAE				
Centropyge vroliki			4	
POMACENTRIDAE				
Amblyglyphidodon curacao	10	3	47	17
Amphiprion clarkii			*	2
Chromis atripectoralis	1			1
C. ternatensis (?)			1	*
C. xanthura (?)	2	2	10	13
Dascyllus aruanus	*	3		*
D. reticulatus				*

Table 17 . continued

SPECIES	TRANSECT LENGTH (m):	6A 11	6A(rep) 12.5	6B 12	6B(rep) 13.2
		TRANSECTS			
POMACENTRIDAE (continued)					
Dascyllus trimaculatus				*	6
Pomacentrus pavo				61	18
Glyphidodontops traceyi				1	*
Pomacentrus vaiuli		3	2	7	3
pomacentrid sp. A		5	3	2	5
pomacentrid sp. C			2	5	4
pomacentrid sp. D		1	3	1	
juvenile pomacentrids			*		1
SCARIDAE					
Scarus ghobban		2			
juvenile scarids		1	*	9	4
ZANCLIDAE					
Zanclus cornutus		*			
No. Species on Transect		14	16	24	24
No. Individuals on Transect		38	42	189	111
No. Individuals per m^2		1.7	1.7	7.9	4.2

Table 18. Fishes censused on Transects 7, 8A, 8B, and 9. Total number of each species seen is indicated; asterisks denote species seen in the area but not seen on the transect.

		TRANSECTS			
		7	8A	8B	9
SPECIES	TRANSECT LENGTH (m):	15	35	16	30
ACANTHURIDAE					
Acanthurus olivaceous			*		
A. xanthopterus					*
Ctenochaetus striatus		5	9	11	1
Zebrasoma scopas					2
APOGONIDAE					
Paramia quinquelineata		4	8	1	41
AULOSTOMIDAE					
Aulostomus chinensis					*
BALISTIDAE					
Balistapus undulatus					*
Sufflamen chrysoptera			1	*	
BLENNIIDAE					
Ecsenius bicolor		1			
Meiacanthus atrodorsalis		1			1
Plagiotremus tapeinosoma		1			
unidentified blenniids					1
CANTHIGASTERIDAE					
Canthigaster solandri			4		
CHAETODONTIDAE					
Chaetodon auriga			2		
C. bennetti					*
C. kleini		1	4	*	
C. melannotus					*
C. trifascialis		1			1
C. trifasciatus		3			2
C. ulietensis					*
Heniochus chrysostomus		*		*	
H. varius		*			
ELEOTRIDAE					
Ptereleotris microlepis			1		

Table 18. continued

SPECIES	TRANSECT LENGTH (m):	7 15	8A 35	8B 16	9 30
GOBIIDAE					
Amblygobius albimaculatus			5		
Gobiodon citrinus					*
unidentified gobiids			4		
HOLOCENTRIIDAE					
Adioryx spinifer		*			
Flammeo sp.		4			
Myripristis sp.		1		1	*
LABRIDAE					
Cheilinus fasciatus					1
C. undulatus					*
Cheilinus sp.		1	1		*
Gomphosus varius					1
Halichoeres hoeveni		5	17	13	38
Hemigymnus melapterus		*			*
Labrichthys unilineata		1			4
Labroides dimidiatus		4		1	*
Pseudocheilinus hexataenia		1			
Stethojulis sp.				1	
Thalassoma juveniles		2			
labrid sp. A			*	*	
LETHRINIDAE					
Monotaxis grandoculis		1		1	
LUTJANIDAE					
Caesio caerulaureus				25	
C. chrysozonus (?)				*	
Lutjanus fulvus			*		
MULLIDAE					
Parupeneus barberinus		*	1		1
P. bifasciatus				1	
P. pleurostigma			*		
P. trifasciatus		1	*		*
PEMPHERIDAE					
Pempheris sp.					2
POMACANTHIDAE					
Centropyge vroliki		*			

Table 18 . continued

SPECIES	TRANSECT LENGTH (m):	TRANSECTS 7 15	8A 35	8B 16	9 30
POMACENTRIDAE					
Amblyglyphidodon curacao		10	1	6	11
Amphiprion clarkii			2		*
Chromis atripectoralis		23			8
C. caerulea		*			
C. ternatensis (?)					*
C. xanthura (?)		10			9
D. aruanus				1	*
D. trimaculatus			4		
Plectroglyphidodon lachrymatus		2			2
Pomacentrus pavo		39	26		1
Glyphidodontops traceyi		3			13
Pomacentrus vaiuli		6	1	3	1
pomacentrid sp. A		2		1	1
pomacentrid sp. C			33	36	
pomacentrid sp. D					8
unidentified pomacentrids					1
juvenile pomacentrids			12	3	60
SCARIDAE					
Scarus ghobban				*	
scarid sp. A			*		
juvenile scarids			1	7	2
S. sordidus					2
SERRANIDAE					
Epinephalus sp.					1
Variola louti					*
SIGANIDAE					
Siganus puellus					1
S. spinus			1		
S. virgatus					4
S. vulpinus					3
SYNGNATHIDAE					
unidentified syngnathid		2			
ZANCLIDAE					
Zanclus cornutus					*
No. Species on Transect		27	21	16	30
No. Individuals on Transect		135	138	112	224
No. Individuals on per m^2		4.5	2.0	3.5	3.7

Table 19. Estimates of relative abundance of stony corals obtained at five sites on Moen in proximity to the Moen Airport, Truk. The following code is employed: abundant (A); Very Common (VC); Common (C); Rare (R).

Species Name	Pou Bay Causeway	Pou Bay SE Side	SW End Runway	NE End Runway	NW Side Runway
Acrhelia horrescens (Dana)			R		
Acropora delicatula (Brook)				R	
Acropora formosa (Dana)	R	A	C	A	A
Acropora hyacinthus (Dana)	R				VC
Acropora hystrix (Dana)			R		
Acropora rambleri (Bassett-Smith)			R		
Acropora reticulata (Brook)				VC	
Acropora rotumana (Gardiner)					R
Acropora surculosa (Dana)				R	R
Acropora syringodes (Brook)					
Acropora tenella (Brook)					
Acropora teres Verrill					R
Acropora virgata (Dana)			R		
Bikiniastrea laddi Wells			R		
Diploastrea heliopora (Lamarck)			C		
Favia pallida (Dana)			R		
Favia russeli			R		
Favia speciosa (Dana)		R	R		R
Favites abdita (Ellis and Solander)			R		
Favites complenata			R		
Fungia fungites (Linnaeus)		C		R	R
Fungia rapanda Dana		C			
Goniastrea pectinata (Ehrenberg)			R		
Goniastrea spectabolis	R				
Goniopora sp. 1			R		
Goniopora sp. 2					
Heliopora coerulea (Pallas)					R
Herpolitha sp.			R		

Table 19. continued

Species Name	Pou Bay Causeway	Pou Bay SE Side	SW End Runway	NE End Runway	NW Side Runway
Merulina laxa		R			
Millepora exaesa Forskaal					R
Montastrea certa			R		
Montipora colei Wells			R		
Montipora minuta Bernard			R		
Montipora tuberculosa (Lamarck)			R		
Montipora verrucosa (Lamarck)			R		
Pachyseris speciosa (Dana)			C		
Pavona (*Polyastra*) *obtusata* (Quelch)		R			
Pavona praetorta (Dana)			R		
Physogyra lichtensteini (Milne-Edwards & Haime)			C		
Platygyra daedalea (Ellis and Solander)	R		R		
Pocillopora damicornis (Linnaeus)	C	A	R	VC	C
Pocillopora danae (Verrill				VC	R
Polyphyllia talpina (Lamarck)			R		
Porites andrewsi Vaughan	R	C	A		R
Porites australiensis Vaughan	R	C			
Porites lutea Milne-Edwards and Haime	VC	A	A	R	R
Porites verrucosa		R		VC	R
Porites (*Synaraea*) *iwayamaensis* Eguchi		A	A		
Seriatopora caliendum					C
Seriatopora hystrix (Dana)			R		
Symphyllia recta (Dana)			R		
NUMBER OF GENERA EACH AREA:	6	7	18	4	8
NUMBER OF SPECIES EACH AREA:	8	12	30	9	15

TOTAL GENERA OBSERVED: 24
TOTAL SPECIES OBSERVED: 51

Table 20. Comparison of genera observed in four areas with those observed by Devaney et al. (1975) in comparable zones. Column (1) indicates observations in this report; Column (2) those of Devaney et al. (1975). Empty spaces indicate no genera were observed.

Genus (Subgenus)	Pou Bay Environs		SW End Runway		NE End Runway		NW Side Runway		Total No. Sites Reported	
	1	2	1	2	1	2	1	2	1	2
Acrhelia			X						1	
Acropora	X	X	X	X	X	X	X	X	4	4
Alveopora		X								1
Astreopora		X		X						2
Bikiniastrea			X						1	
Cyphastrea		X								1
Diploastrea			X	X					1	1
Echinophyllia				X						1
Favia	X	X	X	X			X		3	2
Favites		X	X	X					1	2
Fungia	X	X		X	X	X	X		3	3
Goniastrea	X	X	X	X					2	2
Goniopora		X	X	X					1	2
Heliopora						X	X		1	1
Herpolitha			X						1	
Hydnophora				X						1
Leptastrea		X		X						2
Leptoria						X				1
Lobophyllia		X		X		X				3
Merulina	X								1	
Millepora		X		X		X	X		1	3
Montastrea			X							
Montipora		X	X	X		X			1	3
Pachyseris		X	X						1	1

Table 20. continued

Genera (Subgenera)	Pou Bay Environs 1	Pou Bay Environs 2	SW End Runway 1	SW End Runway 2	NE End Runway 1	NE End Runway 2	NW Die Runway 1	NW Die Runway 2	Total No. Sites Reported 1	Total No. Sites Reported 2
<u>Pavona</u>		X	X	X					1	2
<u>Pavona</u> (<u>Polyastra</u>)	X			X					1	1
<u>Physogyra</u>			X	X					1	1
<u>Platgyra</u>	X		X	X					2	1
<u>Pocillopora</u>	X	X	X	X	X	X	X		4	3
<u>Podabacia</u>				X						1
<u>Polyphyllia</u>			X	X					1	1
<u>Porites</u>	X	X	X	X	X	X	X		4	3
<u>Porites</u> (<u>Synaraea</u>)	X	X	X	X				X	2	3
<u>Psammocora</u>						X				1
<u>Psammocora</u> (<u>Stephanaria</u>)						X				1
<u>Seriatopora</u>		X	X	X		X	X	X	2	4
<u>Symphyllia</u>			X	X					1	1
TOTAL NO. GENERA (Subgenera) PER SITE	10	19	21	25	4	12	8	3	42	59

Table 21. Qualitative assessment of marcoinvertebrates found at the monitoring stations, Pou Reef-flats, and edges of runway. The gastropods include only living species. The symbols used in the table are; A - abundant, C - common, R - rare, and + - present.

	STATIONS									REEF FLATS		RUNWAY EDGES			SW
	1	2	3	4	5	6	7	8	9	East Pou	West Pou	NE End	Center	SW End	Runway 50-80′
PORIFERA															
sponges spp	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
CNIDARIA															
HYDROZOA															
hydrozoan spp.	+	+	+	+	+	+	+	+	+	R	C	R	R	C	C
SCYPHOZOA															
Casseopeia sp					+	+		+			R			R	A
ANTHOZOA															
ACTINIARIA															
Radianthus spp.		+	+			+	+	+				R			R
ALCYONACAE															
ALCYONIIDAE															
Lobophytum sp	+					+		+		A	C	A		C	R
Sarcophytum sp	+	+	+	+	+	+		+		A	R	C		C	C
Sinularia spp.	+	+	+	+	+	+	+	+		A	C	C	R	C	C
Stereonephthya sp.	+	+	+	+		+									
XENIIDAE															
Anthelia/Sympodium spp	+	+			+	+				A	C	R			R
ANTIPATHARIA															
Cirripathes anquina	+	+	+	+	+	+	+	+	+						C
GORGONACAE															
gorgonacean spp.	+	+		+	+	+									R
ANNELIDA															
POLYCHAETA															
SABELLIDAE	+	+			+	+	+	+	+	C	C	R	R	R	R
MOLLUSCA															
GASTROPODA															
Biasicrura chimensis		+													R
Chicoreus brunneus				+	+		+								
Conus textile		+													
Cerithium echinatus		+		+	+			+							
Cymatium caudatum				+	+		+								

Table 21. continued

	STATIONS									REEF FLATS		RUNWAY EDGES			SW
	1	2	3	4	5	6	7	8	9	East Pou	West Pou	NE End	Center	SW End	Runway 50-80
MOLLUSCA															
GASTROPODA - continued															
Cypraea annulus	+			+						R	C		R		
C. arabica		+			+										R
C. argus		+													
C. cauica									+						
C. erosa	+														
C. isabella			+				+								
C. mappa		+													
C. moneta	+			+						R	C				
C. tigris		+						+	+					R	
Lambis lambis								+	+	R					R
L. scorpius									+						
Nassarius coronatus	+	+	+	+	+	+	+	+	+						C
Oliva annulata abla			+		+										
O. carneola				+	+	+									
Polinices tumidus					+						R				
Pterynotus triqueter		+			+										
Strigatella turturina		+													
Strombus dentatus					+		+	+							
S. gibberulus gibbosus		+			+	+									R
S. variabilis variabilis		+				+			+						
Tectus pyramis	+	+	+	+	+	+	+		+						
Trochus niloticus	+	+	+	+		C	+		+						
Vasum ceramicum		+			+									R	
BIVALVIA															
Arca sp.	A	A	A	A	C	A	C	+	+	R				A	C
Atrina vexillum		R	+			R		+		R	R				
Chamylus sp.	+	C		+		+			+	R	C		R		R
Dendostrea hyotis	A	A	+	+	+	A	+	+	+	R	C	C		R	R
Hippopus hippopus		R							+						
Lopha cristagalli	R	R					+	+	+						
Malleus albus		+								R					
M. irregularis										R	R				

Table 21 . continued

	STATIONS									REEF FLATS		RUNWAY EDGES			SW
	1	2	3	4	5	6	7	8	9	East Pou	West Pou	NE End	Center	SW End	Runwa 50-80
BIVALVIA – continued															
Malleus malleus										R	R				
Pinctada margaritifera	+	+		+		+	+		+	R					R
P. nigra										R	R				
Pinna sp.	+	+		+	+	+	+		+	R					
Pteria loveni	+	+		+		+			+						
Spondylus ducalis	+	+				+		+	+	R	R				
Tridacna crocea		+		+					+						
Tridacna squamosa	+	+	+						+		R				
ARTHROPODA															
DIOGENIDAE															
Dardanus spp.		+			+	+			+	C	A		R		
ASTEROIDEA															
Acanthaster planci		+							+						
Fromia monitis		+							+						
Linckia laevegata		+						+		R	R	R			
L. multifora	+	+				+		+	+	C	R		P		
Nardoa tuberculata									+						
Culcita novaeguineae	+	+		+		+		+	+						P
ECHINOIDEA															
Brissidae latecarinatus					+			+	+						
Diadema setosum	+	+	+	+	+	+		+	+	C	C				
Echinothrix diadema								+			R				
Laganam laganum					+		+								
Mespilia globulus											R				
Tripneustes gratilla										R	C	R			
HOLOTHUROIDAE															
Actinopyga echinites		+													
Bohadschia argus		+		+					+						
B. graeffei		+	+	+		+			+						C
Holothuria atra	+	+	+		+	+			+				R		
H. edulis	+	+						+	+		C			C	C
H. nobilis	+	+		+	+	+		+	+					C	R

Table 21. continued

	STATIONS									REEF FLATS		RUNWAY EDGES			SW
	1	2	3	4	5	6	7	8	9	East Pou	West Pou	NE End	Center	SW End	Runway 50-80
HOLOTHUROIDEA - continued															
Holothuria axiologa		+					+								
H. hilla		+							+						
H. impatiens											R				
H. sp. (white/yellow spots)					+			+						R	
Stichopus chloronatus	+	+					+		+	A	A	C	A	R	
S. horrens		+													
Synapta maculata										R	R				
Synapta sp.		+								R					
Polyplectana kefersteini										R	R				
sp. I (yellow mustard)	+	+		+		+		+	+	C	R	R	R		
sp. II (black/yellow ringed)	+					+	+			C	C		R	R	R
CRINOIDEA															
Comanthus bennetti		+		+		+									
Comanthus schlegeli		+				+									
Comaster multifidus		+				+									
CHORDATA															
ASCIDIACEA															
Ascidia gemmata	+	+		+		+		+	+	A	C				
Didemnum moseleyi	+							+	+	A	C				
Didemnum ternatanum	+	+	+	+	+	+	+	+	+	A	A	C	C		C
Phallusia julinea	+	+	+	+	+	+	A	+	+	R		C		C	C

Table 22. Qualitative assessment of fishes in Pou Bay Area. Column I: dredged area along causeway; II: sandy bottom dredged areas; III: dredged areas with rocks, corals, and other topographic features; IV: undredged reef flats, sandy areas; V: undredged outer reef flats and reef margin; VI: reef flat "craters." A=abundant; C=common; G=grouped (in aggregations); O=occasional; I=infrequent.

SPECIES	I	II	III	IV	V	VI
ACANTHURIDAE						
Acanthurus thompsoni				G	G	
A. triostegus					G	
A. xanthopterus	G					
Ctenochaetus striatus	I				C	
Zebrasoma scopas					I	
Z. veliferum			I		I	I
juvenile acanthurids					I	I
APOGONIDAE						
Apogon novemfasciatus			O			O
Paramia quinquelineata				C		O
Sphaeramia nematoptera	G					
unidentified apogonids	A			G		A
BALISTIDAE						
Rhinecanthus aculeatus				I		
BLENNIIDAE						
unidentified blenniids					I	
CANTHIGASTERIDAE						
Canthigaster bennetti					I	
C. solandri				I		
CARANGIDAE						
Caranx melampygus		I				
unidentified carangids		G				
CHAETODONTIDAE						
Chaetodon auriga					I	
C. bennetti			I			
C. citrinellus					I	
C. ephippium			I		O	
C. kleini					O	
C. melannotus					I	
C. trifasciatus					I	
C. ulietensis			I		I	
C. vagabundus					I	

Table 22. continued

SPECIES	I	II	III	IV	V	VI
GOBIIDAE						
Amblygobius albimaculatus			O	C		
unidentified gobiids		A		A	O	
LABRIDAE						
Cheilnus fasciatus						I
C. undulatus					I	
Cheilio inermis					I	
Halichoeres hoeveni	C				C	
H. margaritaceous					A	
H. trimaculatus					C	
Hemigymnus melapterus					I	
Labrichthys unilineata					I	
Labroides dimidiatus					I	
Stethojulis sp.	C			C		
juvenile labrids	I					
LETHRINIDAE						
Monotaxis grandoculis					I	
Scolopsis cancellatus	C				C	
LUTJANIDAE						
Lutjanus fulvus					I	I
Lutjanus sp.	I		I			
MUGILIDAE						
unidentified mugilids	G					
MULLIDAE						
Mulloidichthys samoensis					I	
Parupeneus barberinus				I		
P. trifasciatus					O	
POMACANTHIDAE						
Centropyge vroliki					I	
POMACENTRIDAE						
Abudefduf coelestinus	I				O	
A. sordidus	I					
Amblyglyphidodon curacao				G	A	
Dascyllus aruanus			O	I	O	
Eupomacentrus nigricans					C	
Plectroglyphidodon leucozona	O				A	
Pomacentrus pavo	C		C	O		O
P. vaiuli					I	
juvenile pomacentrids	I					

Table 22 . continued

SPECIES	I	II	III	IV	V	VI
SCARIDAE						
Scarus ghobban					I	
juvenile scarids					A	C
SIGANIDAE						
Siganus puellus					I	
S. spinus	G				G	
S. virgatus	I				G	
TETRAODONTIDAE						
Arothron sp.			I			
ZANCLIDAE						
Zanclus cornutus					I	
No. of Species	18	3	10	12	43	9

Table 23 . Qualitative assessment of fishes in the area off the southwest end of the runway. Column I:shallow reef flat adjacent to runway; II:offshore shallow reefs, 3-6 m deep; III:offshore deep reefs, 10-15 m deep; IV:offshore deep reefs, 15-20 m deep. Abundance symbols as in Table 22.

SPECIES	I	II	III	IV
ACANTHURIDAE				
Acanthurus lineatus	O			
A. nigrofuscus			O	
A. xanthopterus			I	
Ctenochaetus striatus	C	C	C	
Zebrasoma scopas			I	
Z. veliferum		I	I	
APOGONIDAE				
Paramia quinquelineata			O	
BALISTIDAE				
Balistapus undulatus			I	
Sufflamen chrysoptera				I
BLENNIIDAE				
Meiacanthus atrodorsalis			I	
unidentified blennies				I
CARANGIDAE				
unidentified carangids			I	
CHAETODONTIDAE				
Chaetodon auriga		I	I	
C. bennetti			I	
C. citrinellus		I		
C. ephippium		I	I	
C. kleini		O		
C. lunula			I	
C. trifasciatus		O	I	
C. vagabundus		I	I	
Heniochus chrysostomus		I	I	
H. varius			I	
ELEOTRIDAE				
Ptereleotris tricolor				C

Table 23. continued

SPECIES	I	II	III	IV
HOLOCENTRIDAE				
Adioryx spinifer			I	
Flammeo sammara			I	
Flammeo sp.		I		
Myripristis sp.		I	I	
LABRIDAE				
Cheilinus fasciatus			I	
Cheilinus sp.	I	I		
Epibulus insidiator			I	
Gomphosus varius	I	I		
Halichoeres hoeveni	O	I	O	
H. margaritaceous	C			
H. marginatus	C			
Hemigymnus melapterus		I		
Labroides dimidiatus			I	
Macropharyngodon meleagris	I			
Stethojulis sp.	O		I	
labrid sp. A			I	I
labrid sp. B			G	
LETHRINIDAE				
Lethrinus sp.			I	
Monotaxis grandoculis			G	
LUTJANIDAE				
Aprion virescens			I	
Lutjanus fulvus			O	
MONACANTHIDAE				
Oxymonacanthus longirostris		I		
MULLIDAE				
Parupeneus barberinus		I	I	
P. trifasciatus		I		
POMACANTHIDAE				
Centropyge bicolor			I	

Table 23. continued

SPECIES	I	II	III	IV
POMACENTRIDAE				
Amblyglyphidodon curacao		O	A	
A. leucogaster			G	
Chromis atripectoralis			A	
C. caerulea			A	
C. xanthura (?)			C	
Dascyllus aruanus			C	
Eupomacentrus nigricans	O	C		
Glyphidodontops leucopomus	C			
Plectroglyphidodon leucozona	O			
Pomacentrus pavo			C	C
Glyphidodontops traceyi			I	
Pomacentrus vaiuli	I			
pomacentrid sp. B		I		
pomacentrid sp. C			C	C
juvenile pomacentrids		I		
SCARIDAE				
Scarus dimidiatus			I	
S. ghobban			C	
S. venosus		O	O	
juvenile scarids	A	O	A	
SIGANIDAE				
Siganus puellus			I	
S. spinus	I			
S. virgatus		O		
S. vulpinus		I	I	
ZANCLIDAE				
Zanclus cornutus		I	I	
Number of Species	15	27	49	7

Table 24. Qualitative assessment of fishes off northeast end of runway and along northwest side of runway. Column I:northeast end near rock facing; II:northeast end shallow reef flat; III:northwest side, close inshore; IV:northwest side, shallow offshore. Abundance symbols as in Table 22.

SPECIES	I	II	III	IV
ACANTHURIDAE				
Acanthurus lineatus	A			
A. nigrofuscus	I			C
Ctenochaetus striatus		C		A
Naso sp.		I		
Zebrasoma scopas		I		I
BALISTIDAE				
Pseudobalistes flavimarginatus		I		
BLENNIIDAE				
unidentified blenniids		I		
CHAETODONTIDAE				
Chaetodon auriga		I		
C. citrinellus		I		O
C. ephippium		O		
C. kleini		I		O
C. lunula		I		
C. trifascialis		I		
C. trifasciatus		I		
C. vagabundus		I		I
FISTULARIIDAE				
Fistularia sp.				I
HOLOCENTRIDAE				
Myripristis sp.		I		
LABRIDAE				
Cheilinus fasciatus				I
C. undulatus		I		
Cheilinus sp.	I	I	I	I
Cheilio inermis		I		
Gomphosus varius		I		
Halichoeres hoeveni		I		O
H. margaritaceous	I			
H. marginatus	C	I	O	O

Table 24. continued

SPECIES	I	II	III	IV
Hemigymnus melapterus		O		I
Labrichthys unilineata		I		I
Labroides dimidiatus		I		
Macropharyngodon meleagris	O	I		O
Pseudocheilinus hexataenia		I		I
Stethojulis bandanensis				I
Stethojulis sp.	C		C	O
Thalassoma hardwicki		I		I
T. lutescens		I		I
T. quinquevittata			I	I
LUTJANIDAE				
Lutjanus fulvus		C		I
MONACANTHIDAE				
Oxymonacanthus longirostris		I		I
MULLIDAE				
Mulloidichthys samoensis		I		G
Parupeneus barberinus		I	I	
P. trifasciatus		I	I	
NEMIPTERIDAE				
Scolopsis cancellatus		I		I
POMACENTRIDAE				
Abudefduf coelestinus	I	I	I	
Amblyglyphidodon curacao		I		
Amphiprion melanopus				I
Chromis atripectoralis		I		I
Dascyllus aruanus		I		
Eupomacentrus albifasciatus		I		
E. nigricans		C		C
G. leucopomus	C			
Plectroglyphidodon dickii		I		I
P. leucozona	A	I	O	I
Pomacentrus vaiuli				I

Table 24. continued

SPECIES	I	II	III	IV
SCARIDAE				
<u>Scarus</u> <u>chlorodon</u>		I		
<u>S.</u> <u>venosus</u>	I	C		
juvenile scarids	G	A	C	A
SERRANIDAE				
<u>Epinephelus</u> <u>merra</u>				I
SIGANIDAE				
<u>Siganus</u> <u>argenteus</u>				G
<u>S.</u> <u>spinus</u>		G	I	I
<u>S.</u> <u>virgatus</u>		I		O
SPHYRAENIDAE				
<u>Sphyraena</u> juveniles				G
Number of Species	12	46	10	36

Table 25. Fishes assayed for Ciguatera toxicity

SPECIES	NUMBER OF SAMPLES
ACANTHURIDAE	
Ctenochaetus striatus	2
HOLOCENTRIDAE	
Myripristis sp.	1
KYPHOSIDAE	
Kyphosus cinarescens	2
LABRIDAE	
Cheilinus fasciatus	2
Epibulus insidiator	2
LETHRINIDAE	
Lethrinus sp.	1
LUTJANIDAE	
Aprion virescens	1
Macolor niger	2
POMADASYADAE	
Gaterin orientalis	3
SERRANIDAE	
Plectropomus maculatus	5
P. melanoleucus	1
Variola louti	1
Unidentified serranid	1

sandy lagoon slopes throughout the study area. Localized pockets, usually near the lagoon fringing reef margins and airport runway, contain moderately high amounts of silty-clay and organic detritus. The deepest nearshore depth is less than 40 m with a more typical lagoon slope depth of 20 m.

Pou Bay, on the eastern edge of the study area (Fig. 2), is a large partially enclosed embayment. Two large culverts at either end of the causeway allow exchange of lagoon and bay waters during tidal changes. The inner bay water is normally turbid due to moderate to heavy suspensions of silty-clay. Lagoonward of Pou Bay is an extensive fringing reef platform of irregular width. The reef platform shows considerable alteration near the causeway and adjacent western shorelines as a result of previous dredging activities. The fringing reef margin is very irregular with several large cuts or indentations. The major cut, Pou Channel, is lagoonward of the central portion of the causeway (Fig. 2). This channel receives a large quantity of the drainage water from Pou Bay. During outgoing tides the inner channel is extremely turbid with some clarity occurring by the time the water mass reaches the fringing reef margins. Water quality and biological monitoring stations are located on the east and west sides of the channel on the fringing reef margins (Fig. 3). The fringing reef platform west of Pou Channel is the largest proposed dredge site. Therefore, it is anticipated that Pou Channel will be one of the major exit points for silt laden water. Two additional water quality and biological monitoring stations were established on the east and west fingers of a large indentation (Fig. 4).

The smaller dredge site is adjacent to the northeast end of the airport runway and has been designated Metitiu Reef. The dredge is bordered on the eastern extent by a man-made rock pier which extends from the shoreline to the reef margin. Minor mangrove development is associated with the pier. Lagoonward of this pier a water quality and biological monitoring station was established (Fig. 5). The reef-flat platform is narrow with a uniform width. The inner portions of the reef-flat were previously dredged and as a result contain a moderate accumulation of silty-clay. Landward of Metitiu Reef is a narrow coastal terrace which gives way to the steep basaltic slopes of Mount Ton Azan. The quarry site located adjacent to Metitiu Reef has been designated Metitiu Quarry (Fig. 2).

The lagoon fringing reef bordering the airport runway is relatively narrow except for a large finger-like extension toward the southwest edge. The fringing reef adjacent to the runway shows considerable alteration from previous construction activities. Biological and water quality monitoring stations were established along the runway at the southwestern and northeastern ends and near the center (Fig. 6). These stations are in a sandy lagoon slope zone characterized by numerous small to large rubble mounds, rock/coral pinnacles and massive coral heads. The Point Gabert sewer outfall diffuser, at the southwestern end of the runway, is located near a monitoring station (Fig. 7). A prominent land orientation feature used to locate the central monitoring station is a small rise on the lower slopes of Mount Ton Azan, referred to as Point Iras (Fig. 2).

On the basis of overall gross morphology the study area can be divided into a number of physiographic divisions. The extensive shallow reef-flat platforms, lagoon slopes, lagoon floor, and patch reefs. Smaller divisions include the rubble mounds/pinnacles and large coral heads, Pou Channel, the fringing reef margin indentations, and the previously dredgedbasins on the fringing reef platforms.

Water Circulation

Drogue observations are plotted in Figs. 8 and 9 , and additional information is given in Table 1 . Initial field observations indicated that the drogue paths were usually influenced by the prevailing wind, which was generally from the east northeast at 4 - 14 knots with gusts up to 18 knots. There was an external wind effect on both the 1-m and 6-m drogues because of the extension of their floats above the water surface. Drift directions of the 1-m drogues followed the wind more closely than those of the 6-m drogues, particularly when the drogues were at some distance from the island. Despite the external wind effect, the drogues give a good indication of actual water movement in the upper six meters of the water column.

The circulation pattern in the study area is complex, and is affected by the wind, tides, and swell conditions. Swell conditions had the most pronounced effects at stations 1 and 2. The reefs east of Station 1 were observed to receive higher swell than those west of the station. Since the swell originates from the northeast passage, it is believed that Falo Island produces a shadow effect on most of the study area. Drogue paths at stations 1 and 2 (Fig. 8, A, B, M-Q) show a predominant west to northwest movement. This suggests that a mass of water is being funneled between Falo and Moen Islands in a westward directions, although on several occasions murky water and surface scum from Pou Channel was observed to flow eastward along the reef margin. The wind direction also appears to influence water movement in this area, but to a lesser extent. Drogue paths F (1-m and 6-m) were in more northerly direction during a wind shift toward the south-southwest (Fig. 8). The tidal phase appeared to have little or no effect on drogue drift directions at these stations, although it appears to have some effect on current velocities. The 6-m drogues had velocities ranging from 150 (Fig. 8 , B) to 414 (Fig. 8 , Q) m/hr during rising tides and 285 (Fig. 8 , N) to 493 (Fig. 8 , M) m/hr during falling tides. The 1-m drogues had velocities ranging from 368 (Fig. 8 , A) to 424 (Fig. 8 , P) m/hr during rising tides and 342 (Fig. 8 , O) to 1000 (Fig. 8 , M) m/hr during falling tides.

Drogue movement at Station 6 showed west to northwest drift (Fig. 9, C) and north drift (Fig. 9, G and E). Several large, barely emergent floating objects (e.g., a log) were observed to move in an easterly direction between stations 5 and 6. Also during several scuba dives at stations 5 and 6, the current was noted to be moving west. Speeds (Fig. 9, C) were relatively low, ranging from 92 to 94 m/hr. The northwest movement occurred during a falling tide and the north movement during a rising tide. Periodically there appears to be west flowing water mass which meets a northeast flowing water mass (flowing parallel to the runway) in the vicinity of this station. Scuba dives were made on August 5, 1978 at stations 5, 6, and 7. The current at Station 5 was flowing parallel to the reef margin in a west northwest direction, while the current at Station 7 was flowing in a northeast direction. The current at Station 6 was strong and in a northerly direction. The general current trend for Station 7 is a west flow (Fig. 9, H, J. L). The current velocities for the 6-m drogues were higher during falling (202 m/hr) than rising (102 m/hr) tides.

Drogue movement at Station 8 was variable (Fig. 9, D and R-X). Drift direction ranged from south to north northeast during falling tides. Under rising tide conditions the drift direction was predominantly toward the north northwest. The 6-m drogue velocities were generally low during both rising and falling tides ranging from 70 (Fig. 9, V) to 275 (Fig. 9, R) m/hr. The 1-m drogue velocities were also relatively low, ranging from 156 (Fig. 9, T) to 484 (Fig. 9, R) m/hr. Drogue paths T (Fig. 9) were observed to change flow directions during drift. The drogue initially moved in a west northwest direction then rapidly curved south. The 6-m drogue D (Fig. 9) moved in a north northeast direction. The 1-m drogue was observed to be moving in a similar direction at a much faster velocity and was subsequently lost. This same 1-m drogue was found the following day moving toward the study area. This suggests that there is a large reversing water mass in this portion of the lagoon.

Fluorescein dye studies were conducted off Station 7 on May 20 during a falling tide. The dye tracks were observed to move in a northeast direction. The dye patches were large and clearly visible from Mount Ton Azan. There was considerable diffusion and merging of patches after several hundred meters of northeast flow, but generally the patches drifted parallel to each other. Paper plates released with the dye patches were also observed to move in a northeast direction. The paper plates were observed near Station 6 by midafternoon. That evening at 2000 during a rising tide several of the plates observed at Station 6 were recovered at Station 8. This indicates that current reversals along the runway may be related to the tidal state, since the prevailing wind and swell conditions had not changed during this time interval.

Biological Monitoring Stations

The locations and physical characteristics of the nine environmental monitoring stations are as follows:

Station 1 - East of Pou Channel on a prominent outcropping of the East Pou Reef margin (Fig. 3). This lagoonward extension of the reef margin is bordered on the east and west by small sandy indentations. The station is ca. 20 m lagoonward of the central portion of the outcropping at a depth of 8 m, on the western side of a coral/sand ridge. The biological station is east of the buoy and runs perpendicular across the ridge. The biological station is 30 m in length along the transect axis with a width ranging from 4-14 m. The deeper east and west ends of the transect are at a depth of 12.2 m with the center at 6.1 m. The ridge has good coral growth with several massive coral/rock pinnacles in the immediate vicinity.

Station 2 - West of Pou Channel on a major extension of West Pou Reef (Fig. 3). A white channel marker is located on the lagoonward tip of the reef flat projection. The station is ca. 25 m lagoonward of this buoy in a large *Porites* coral head. The base of the *Porites* head is at a depth of 6 m. The surrounding area is sandy and rapidly descends to ca. 15 m lagoonward. The biological transect, across the long axis of the *Porites* head, is 9.5 m; the width of the head is ca. 5 m. The *Porites* head comes to within 3 m of the surface. There is extensive coral growth around the station with several large rubble/coral mounds northward.

Stations 3A and 3B - Off the east arm of a large indentation on the West Pou Reef margin (Fig. 4). East of the station is a large narrow indentation resulting from the West Pou Reef extension. Visible on the lagoonward tip of the east arm is a large table-top *Acropora* and base patch. This arm descends northward as a broad ridge to a depth of approximately 16 m. The station is 10-12 m north of the table-top *Acropora* at a depth of 8.5 m. Biological Station 3A is parallel to the reef margin with the buoy in the central portion of the coral/rubble mound. The biological transect is 6.6 m in length with depths ranging from 7-9 m. Biological Station 3B is lagoonward and adjacent to Station 3A. This station is a low rubble mound with several large coral/rock boulders. This mound is 11.8 m in length with a central width of 7.5 m. The depth ranges from 11 m on the lagoon side to 8.5 m toward the reef margin.

Stations 4A and 4B - Off the west arm of the large indentation on the West Pou Reef margin (Fig.4). The tip of the arm is composed primarily of coral rubble with a sharp slope to the lagoon floor on the west side. The gentle sandy slopes on the eastern side have numerous low coral rubble mounds. The station is lagoonward of the coral rubble tip on the western side of the ridge at a depth of 7.5 m. Biological Station 4A is parallel to the reef margin with the buoy at the eastern end of the coral/rubble mound. The transect is 19.0 m with depths ranging from 5.4-8.2 m. Biological Station 4B is approximately 10 m lagoonward on the western edge of the ridge. The station is a massive Porites coral head that is split into three major sections. The length of the head along the transect is 14.4 m and the maximum width is approximately 10 m. The inshore end is at a depth of 10.7 m and the lagoonward end at 12.2 m. The Porites head ranges in height from 3.7-5.5 m.

Station 5 - At the eastern edge of the Metitiu Reef dredge area (Fig. 5). The station is on a north-south line with the artificial rock pier. The buoy is attached to a coral/rubble mounds. The sandy slopes descend rapidly lagoonward (north) to depths in excess of 15 m. The biological transect is perpendicular to the reef margin with an inshore depth of 7 m and a lagoonward depth of 11 m. The mound is 8 m in length with a maximum width of 7.2 m. The top of the mound is 5.5 m below the surface.

Stations 6A and 6B - West of Metitiu Reef off of the northeast end of the runway (Fig. 6). Inshore and just west of the station is a small rocky jetty (length 35 m) with a small rock breakwater on the western side. The station is 85 m lagoonward of the tip of the rocky jetty at a depth of 7.5 m. The coral rubble mound is isolated by a narrow sand strip. Numerous coral/rubble mounds surround the station. Biological Station 6A is a rubble mound roughly circular in shape, 11 x 12.5 m on major axes. The edges of the mound are at a depth ranging from 6.4-6.9 m with a maximum central height of 2.4 m. Biological Station 6B is approximately 35 m northwest (direction 310°) of Station 6A. The eastern end of the transect is a low rubble mound with a massive Porites head off the western end. The station is 12.5 m long with widths ranging from 8 to 9 m. The base of the Porites head is at a depth of 8.3 m with a maximum height of 3 m. Numerous coral/rubble mounds surround the area, but the transect mound is isolated by sand patches.

Station 7 - Lagoonward of the central portion of the runway (Fig. 6). The station is midway between the 2000/3000 ft markers on the existing runway. The buoy is attached to a massive Porites head 140 m from the existing runway shoreline. The coral mound is surrounded by extensive sand slopes. The surrounding sand slopes have an average depth of 9 m. The transect is 15 m in length with a lagoonward depth of 8.8 m. The width of the Porites head is 12.5 m. The maximum height of the coral is 3.1 m.

Stations 8A and 8B - Lagoonward (north) of the southwestern end of the runway in the vicinity of the Point Gabert sewer outfall diffuser (Fig. 7). Station 8A is approximately 30 m northwest of sewer outfall diffuser and is 115 m from the runway shoreline. The low rubble mound ranges in depth from 10.4-12.5 m with a center depth of 8 m. The biological transect is perpendicular to the shoreline with a length of 35 m. The mound is surrounded by extensive sand patches. Biological Station 8B is shoreward near the sewer outfall pipeline. The station is on the west side of the pipeline between the 6th and 7th cement support block from the diffuser (not including 3 diffuser support blocks). The transect is parallel to the shoreline with a length of 16 m. The mound is a loose aggregation of small coral blocks with a width of 13 m. The mound ranges in depth from 5.1-6.1 m. There are numerous small coral blocks in the vicinity, athough the mound is relatively isolated.

Station 9 - On the eastern side of a large patch reef that lies approximately half-way between Moen and Falo Islands (Fig. 1). The periphery of the patch reef in the vicinity of the station rapidly descends to depths in excess of 20 m. The station is a large rubble mound surrounded by sand patches. The biological transect is on a northeast-southwest line with a length of 30 m. The mound has a maximum width of 24 m. The northeast end is at a depth of 12.1 m, while the southwest (patch reef end) has a depth of 5.1 m. The central portion of the mound comes within 1.5 m of the surface.

Marine Plants - A total of 47 species of marine plants were observed along and in the vicinity of transects 1-9 and in the runway and West Pou Reef reconnaisance areas. This represents good diversity, with an average of 17 species found at each transect or reconnaisance location. The Outer West Pou Reef site yielded the highest species diversity with 26 species, while transect 4B had the lowest with only 6 species.

Algal coverage in general was high, ranging from a high of 71% at transect 8A to a low of 20% at transect 4B. The average percent cover was 41% (Table 2). This high coverage was primarily due to the diversity of the substrate which in most cases was composed of both dead Acropora branches and sand. This combination proved ideal for both those algae that require a hard substrate for attachment and those that need a soft substrate in which their rhizoids can spread. An even distribution was found between these two types of algae with 7 transects dominated by those species requiring a hard substratum (Dictyota patens 2, 3A, 3B, 4A, 7; Microcoleus lyngbyaceus 5; Padina jonesii 8A), while 6 transects were dominated by algae requiring a soft substrate (Halimeda opuntia 1, 4B, 6A, 9; Halimeda cylindracea 6B, 8B) (Table 2).

The highest percent cover for a single species occurred at transect 8A where a vast bed of Padina jonesii accounted for 40% of the total 70% coverage.

In order to determine the accuracy of our sampling technique, replicate dives were conducted at station 6 (Table 3). The Jaccard coefficient of similarity (Sokal and Sneath, 1963) was calculated and found to be .58 for the replicate dives off transect 6A and .48 for transect 6B. These values will be useful in future studies to determine if there has been a change in the algal assemblage.

Corals

Station 1 - A 30 m transect was put down across an offshore knoll that was surrounded by sand flats. The point quarter method was applied. Results are shown in Table 4. The arborescent staghorn coral, Acropora formosa (Dana) and the columnar Porites (Synaraea) iwayamaensis Eguchi share nearly equal importance. A number of massive Porites heads, and scattered coralli of Pocillopora and Acropora branching corals also lay along the transect.

Station 2 - This station was located on a small mound consisting of scattered Porites lutea patches with occasional small Pocillopora ramose no. 1 coralli. The total percentage of substrate covered with live coral growth was slightly less than Station 1. Table 5 shows the results of data taken from a 9 m transect running across the top of the mound.

Station 3 - Transects were placed across two adjacent mounds of relatively jagged relief. The mounds appeared to be solid outcroppings covered with similar varied coral assemblages. Rather extensive accumulations of Acropora rubble were visible. The corals data from the two transects (6 m and 11 m respectively) were combined (Table 6). Total coral coverage was high with the massive coral Porites lutea and the columnar Porites (Synaraea) iwayamaensis sharing nearly equal importance. Scattered patches of branching corals (Seriatopora hystrix and four Acropora species) made up the bulk to the remaining cover.

Station 4 - Two transects were placed at Station 4. An 18 m transect was placed along a line compartmentalized as follows:

1) Sand flats and assorted coral rubble with scattered coral (0 m - 9 m);

2) A wall composed almost entirely of the massive columnar Porites (Synaraea) iwayamaensis (9 m - 12 m);

3) A gently sloping grade covered with individual coralli and several arborescent Acropora formosa thickets (12 m - 18 m).

An additional 12 m transect was run on an adjacent Porites lutea mound of great relief. The transect ran from base-to-base across the top.

The results of data analysis are shown in Table 7 . On the first transect, Porites (Synaraea) iwayamaensis dominated the community. The ramose Porites andrewsi and the staghorn coral Acropora formosa were nearly equal in importance with Seriatopora hystrix further down the scale. Three other ramose Acropora species and Pocillopora ramose No. 1 were encountered on the transect. Total percent cover at this transect fell below Station 3 but was higher than Stations 2 and 1.

As might be expected, the percentage of substrate covered on the Porites lutea mound was nearly 50 percent. No other coral species were encountered. The remainder of space was occupied by the green alga Halimeda or open space formed by cracks, fissures or dead coral.

Station 5 - This station was located on another offshore knoll that was extensively covered by thick accumulations of Acropora rubble. The rubble zone harbored a few scattered Pocillopora coralli that were quite small. The seaward half of the knoll was covered with several thin stands of Acropora formosa. A rocky pinnacle rose in the center of the knoll. A 9 m transect was placed across the top of the structure (Table 8). The data indicates overall density and percentage of substrate covered by live coral growth was quite low. The massive coral, Porites lutea, was of greatest importance with the greatest number of individual colonies and the highest relative frequency. However, the overall importances of branching corals (Acropora spp and Pocillopora sp) was nearly twice that of massive forms due to the presence of several Acropora thickets.

Station 6 - This station was selected for replicate measurements and is discussed below. Data are presented in Tables 9 and 10.

Station 7 - Station 7 was located on a large mound with a massive lobate thamnasteroid coral Pavona multivensis making up the substrate. Two transects were run. The first ran from base to base across the top of the longest dimension (15 m) and a shorter transect went across the width of the knoll. Corals data was obtained from the longer transect (Table 11). The species with the highest importance value was Pavona multivensis followed by Porites lutea, another massive form. The sum of the importance values of these two species is nearly four times that of the three species of ramose Acropora. Massive and encrusting forms clearly dominate the community of this station.

Station 8 - At this station, transects were placed at two locations. This first transect (8A) was placed across a broad knoll of gentle relief. The predominate cover was Padina sp. Coral coverage was limited to widely scattered coralli of small size. Transect 8A was 34 m long. The point-quarter method was applied (Table 12). Total percentage cover at Transect 8A was less than three percent, the lowest of all the transects. The most important coral species was Porites lutea, although the average diameter of the scattered heads was only 18 cm. Other important components were Favia pallida, a ramose Goniopora species, and a ramose Porites species. Mussa costata, Favia speciosa, Plesiastrea sp. and Euphyllia recta made up minor components.

Transect 8B was placed on a gentle slope near the Point Gabert STP outfall line approximately 100 m north of Transect 8A. The transect was 15 m long. Table 12 shows the results of data analysis.

The percentage of substratum covered by all coral species encountered was about 30 percent. Dominant species were two massive corals Porites lutea and a Goniopora species. A ramose coral Porites andrewsi, the hydrozoan Millepora exaesa and Pocillopora ramose No. 1 were of secondary importance.

Station 9 - In order to establish a control from which to compare change that might possibly occur at the other stations, an additional transect was run on an offshore knoll near a patch reef north-east of Moen. Presumably this station will be outside the immediate influence of dredging and filling operations during the airport reconstruction. The transect was 30 m long and passed over the top of the knoll. Table 13 shows the results. The line-intercept method was used here since the knoll was covered with thick stands of Acropora formosa. Individual colonies were impossible to discern. The arborescent Acropora formosa covered about 50 percent of the substrate beneath the transect belt. The columnar Porites (Synaraea) iwayamaensis covered approximately 15 percent of the substratum with densest coverage at the deeper more vertical margins of the knoll. The remaining species consisted of individual coralli or small patches.

Replicate transects at Station 6 - Transects were run on two separate offshore knolls. The first knoll is made up substantially of staghorn coral rubble. Small scattered Pocillopora coralli have established themselves on the staghorn accumulation. The offshore end of this mound is covered with patches of Acropora formosa. A 10 m transect was run across the knoll (Transect 6A).

The second knoll is located about 50 m northwest of the first. It is composed of two basic compartments: the southeast end is a gentle slope composed of thick accumulations of Acropora rubble. Coral cover is sparce and is primarily small Pocillopora colonies; the northwest end is a large Porites lutea head. A 10 m transect was laid across the knoll to include both compartments of the knoll.

Station 6 was selected for replicate measurements in order to estimate degree of variation in results that are to be expected. Therefore each transect was duplicated. Replicate transects were placed at or near the points used during the first sampling and laid in approximately the same orientation across the knolls. The results of both samplings of each transect are shown in Tables 9 and 10.

At transect 6A, Acropora formosa had the highest importance value with cespitose Pocillopora ramose No. 1 ranking second. The importance value of Acropora formosa was slightly higher as measured on the second occasion (202.93) compared to the first (189.95). These values were based on measurements performed on 14 discernable colonies with a mean diameter of 79.1 cm on the first occasion compared to 22 discernable colonies on the second occasion with a mean diameter of 50.2 cm.

Pocillopora ramose No. 1 measurement were almost equal on both occasions (67.36 and 66.69). Nine colonies were measured with a mean diameter of 14.1 cm on the first occasion, while twelve colonies were measured on the second occasion with a mean diameter of 12.6 cm.

Other species showed great variability. Acropora reticulata was encountered on the first sampling (Importance Value 20.62) and not on the second. Acropora arbuscula was not encountered on the first sampling, but appeared on the second (Importance Value 15.53).

There were other differences in importance values between sampling occasions. Generally, these variations would be expected since they are based on the chance encounter of only one or two colonies which have a low probability of appearing during additional sampling. These few coral species, however, may have large coverage, which contributes to higher importance values and greater total percent cover between samplings. It appears, therefore, that it is more useful for monitoring purposes to rely on the parameters of the major components of each coral community and to analyse how minor components affect overall percent cover and density values.

At transect 6B, the overall percentage of substratum covered with corals on the Acropora rubble zone proved to be quite close on both occasions although very sparse (1.66 percent vs. 1.97 percent). The rankings of species based on importance values were similar as well. Pocillopora ramose No. 1 had highest value on each occasion with Acropora formosa ranking second. The absolute values for importance between sampling occasions were different, however. On the first occasion, Pocillopora had lower value than the second (128.02 vs. 153.3). Acropora formosa results were similar (62.62 vs. 88.62).

On the massive Porites mound, percent cover for Porites was 63.8 percent on the first occasion and 53.0 percent on the second. Overall percent cover was 66.8 percent on the first occasion and 59.0 percent on the second. These variations were probably due to statistical variation caused by slightly different location of the transect line on each occasion.

Macroinvertebrates - The abundances and distribution of the larger and more conspicuous macroinvertebrates quantified on the monitoring transects are given in Table 14, and a checklist of invertebrates encountered on and in the vicinity of the monitoring mounds, Pou Reef-flat, and along the edges of the runway are given in Table 21. Filter-feeders were the predominant invertebrates (excluding corals) associated with the monitoring mounds. Sponges, hydrozoans, soft corals, the bivalves Arca sp. and Dendostreas hyotis (bear-claw clam), and the ascidian tunicates Didemnum ternatanum (white/green barrel ascidian) and Phallusia julinea (yellow tunicate) were the dominant fauna.

The diversity of sponges at the monitoring stations was impressive. A minium of 28 larger distinctive types, both in growth form and color, were frequently observed. Many of the sponge species were difficult to quantify due to their encrusting or creeping growth forms. Encrusting and creeping sponges with satellite growths were recorded as a single count. The number of individuals recorded on a transect does not necessarily reflect the surface coverage. The number of sponges per m^2 on the monitoring transects ranged from 0.3 (stations 2, 9, and 9') to 4.2 (transect 8a').

The replicate transects were generally similar in terms of individual sponges per m^2, although there were numerous replicate transects that had variations in the species composition. In the areas surrounding the mounds, the diversity and abundance of sponges dropped dramatically. This was due primarily to the lack of situable substrates.

The soft corals of the genera Sinularia and Sarcophytum were locally abundant. These soft corals were especially abundant in the shallower areas of Pou Channel and along the upper sandy ridges extending from the reef margins. Soft corals were commonly associated with the station mounds. Although, the number per m^2 was relatively low, ranging from .06 (transects 4a and 4a') to 6.9 (transect 5). Soft corals of the genera Lobophytum, Stereonephthya, Anthelia, and Sympodium were also quantified, but the abundances were generally low. The replicate transects were generally dissimilar in terms of individual soft corals per m^2.

The black wire coral (Cirripathes anquina) was commonly found at the station mounds. The abundance along the transects was low, ranging from 0.07 to 0.23 individuals per m^2. The abundance of this wire coral was observed to increase at the deeper patch reefs lagoonward of the monitoring stations.

Gastropods were, for the most part, rarely observed at the monitoring mounds. The predominant gastropods were Tectus pyramis and Trochus niloticus (edible top shell). Devaney et al. (1975) reported no live Trochus in the study area. Trochus were quantified on 9 transects and were observed at all monitoring stations. Since the abundance of Trochus was low, the oversight by Devaney et al. (1975) is understandable. The most abundant gastropod was Nassarius coronatus. This small gastropod was observed at all the monitoring mounds. The genus Cypraea was well represented with 9 species observed at various monitoring mounds. Stations 2 and 5 had the highest diversity of gastropods.

Bivalves were a major faunal component of the study area. The predominant bivalve species (Arca sp.) live as suspension-feeders inbedded in coral framework. In fact, these bivalves were almost exclusively found in heads of the coral Porites lutea. The abundance of Arca in Porites heads ranged from 0.1 (transect 1') to 9.8 (transect 2') individuals per m^2. These numbers are not entirely realistic since they represent distribution over the entire transect, while the bivalve was limited to the coral framework. The replicate transects were, for the most part, similar in terms of individuals per m^2. The large bear-claw clam (Dendostreas hyotis) was usually attached to the coral rock portions of the monitoring mounds. The abundance along the transects ranged from 0.06 (transect 4a) to 0.37 (transect 4b).

Dendostreas was very common along the edges of Pou Channel. In Devaney et al. (1975) this species was identified as Hyotissa hyotis (Linnaeus), which is a synonym. The more uncommon but frequently observed bivalves were Atrina vexillum (black pearl oyster), Pinna sp., Pteria loveni (in fan coral), Spondylus ducalis (spiny oyster), and Tridacna squamosa (giant clam).

The crown-of-thorns seastar Acanthaster planci (Linnaeus) and the cushion-star Culcita novaeguineae Muller and Troschel are two species of asteroids that feed on coral. Acanthaster was very rare in the study area, with only two large individuals observed. Culcita was relatively common, being observed at 6 of the stations. The most common asteriod was Linckia multifora. This starfish was observed at 5 of the stations and was common on the East Pou Reef. The sea urchin Diadema setosum was observed at 8 of the stations and was common on the East and West Pou Reef-flats. The sand dollar Brissidae latecarinatus was common in the sediments surrounding station 5, with as many as 20 per m^2 uncovered.

Holothurians were well represented with 17 species encountered. The holothurians Bohadschia graeffei, Holothuria atra, Holothuria edulis, and Stichopus chloronotus were the most frequently observed. The abundance of holothurians at the monitoring mounds was low. The sandy areas around the mounds usually contained the greatest concentrations. Stichopus chloronotus was abundant in the shallow waters of East and West Pou Reef-flat and the near shore area of the central portion of the runway. At the runway area, Stichopus was restricted to sand pockets. In 8 sand pockets that ranged in diameter from 3 to 6 m there was an average of 5 ± 1.5 Stichopus. In 3 sand pockets that were in excess of 20 m in diameter there were 27 to 53 Stichopus.

The didemnid tunicate, Didemnun ternatamum, was especially abundant at the monitoring stations and along the reef margins. The abundance of Didemnun ranged from .2 (transect 3b) to 33.8 (transect 2') individuals per m^2. There were 4 transects where Didemnum was too abundant to be quantified. This species was frequently observed to show clumped distribution. Therefore the similarity between replicate transects was generally low. The yellow tunicate, Phallusia julinea, was also common. This tunicate was quantified on 19 transects and observed at all stations. It was not observed in shallow waters near the reef margin and only rarely along the inner portions of Pou Channel adjacent to East Pou Reef. The abundance of Phallusia along the transects ranged from 0.08 (transects 6a' and 6b') to 2.3 (transect 7') individuals per m^2.

Fishes - The number of fish species observed at the transect stations varied from 10 to 30 (Tables 15 to 18), with a tendency for longer transects to harbor a larger number of species. Thirteen of the transects had rather similar fish densities, ranging from 1.7 to 4.7 per m^2, but three transects, 4a, 5, and 6b, had rather higher densities ranging from 7.9 to 14.8 per m^2. These higher densities were generally due to aggregations of apogonids and damselfish, particularly Pomacentrus pavo, on these transects. There was no apparent relationship between transect length and fish density.

The most frequently encountered fish species were Halichoeres hoeveni (15 transects), Ctenochaetus striatus (14 transects), Pomacentrus pavo (12 transects), Amblyglyphidodon curacao (12 transects), and Labroides dimidiatus (12 transects).

The biological monitoring program will be largely based on recensusing the biota at the nine sampling stations (13 transects) during the construction period. In order to assess the inherent variability in the censusing techniques, replicate transects were run at sites 6a and 6b (Table 17). The Jaccard coefficient of similarity (Sokal and Sneath, 1963) was used to measure the similarity between the replicate transects. This coefficient is equal to 1 when the two censuses result in identical species lists, and is equal to 0 when no species are common to the two censuses. For transect 6a the value of this coefficient was 0.43 (when species seen on the site but not on the transect census are included, the coefficient is equal to 0.40). For transect 6b, the coefficient was 0.41 (including species seen off the transect but within the site, 0.43). When future censuses are compared with these baseline censuses, similarity coefficients of 0.4 or greater would indicate that no significant change has occurred in the fish communities since the previous census.

General Reconnaissance

Marine Plants - The results of the qualitative reconnaissance surveys are shown in Table 2. It was difficult to compare our plant surveys with those of Devaney et al. (1975) as the information on marine plants in this latter report was rather sketchy. However, the patterns of distribution and abundance of the more conspicuous macroalgae and seagrasses (Halimeda spp., Sargassom spp., Padina spp., Caulerpa spp., Hydroclathrus clathratus, Turbinaria ornata, Thalassia hemprichii, Haliophila oualis, and Enhalus acorides) which we observed are in general agreement with the results reported by Devaney et al. (1975).

Corals - In order to evaluate the relative abundance and diversity of corals in the regions near Pou Bay and the Moen Airport, dives were conducted in four general areas; Pou Bay (near the causeway and the reefs to the southeast of the channel), the bottom southwest of the airport runway (from depths of 25 m to the shallow reef zone at the northeast end of the runway, and the shallow reefs at the side of the runway. Data and specimens were collected to determine if our findings were in agreement with those of Devaney et al. (1975).

Table 19 summarizes the relative abundance of stony corals at the four sites. The greatest diversity of corals (as determined by the number of genera and species)was found at the southwest end of the runway. In this region, the coverage of corals is low relative to those areas in shallow waters alongside the airstrip and at the northeast end. However, the pinnacles and outcroppings that are scattered over the bottom provide substrate for a relatively rich assemblage of corals. Eighteen genera and thirty species were located. The smallest numbers of corals and the fewest species occur in the highly turbid waters of Pou Bay. Six genera and eight species were located in these waters. Both cover and diversity increased as we moved southeast along the reef margin away from Pou Bay.

The northeast end of the runway and the region on the northwest side of the airstrip are comparable in that diversity (the number of coral species per area) is low but the percent cover is quite high. Acropora formosa patches cover the shallow water platforms in excess of 50 percent. Pocillopora sp, Seriatopora sp., and massive Porites heads are also of importance in these areas.

Table 20 attempts to compare the results of our observations on relative abundance and diversity with those of Devaney et al. (1975). The data is in agreement that the areas of lowest diversity are the shallows at the northeast end of the runway and the northwest side. The results also indicate that the area of greatest diversity is the southwest end of the runway. The Pou Bay data region ranks second in diversity after the southwest end. It should be borne in mind, however, that the percentage of substrate covered with live corals is generally low compared to the other sites investigated.

Generally, the Devaney team located more genera of corals than the UOG team did. There are several reasons why this may be so. First, the UOG team conducted a less intensive investigation of the sites than did the Devaney team, since this function was of secondary importance. Second, it is probable that the Devaney data includes the offshore pinnacles and knolls in their evaluations, while the UOG team confined themselves generally to the shallows. It is of some interest to note that both teams' data from the southwest end of the runway is quite comparable in the number of genera observed at that location. In this case, the UOG team included the offshore mounds and knolls in their analysis. These offshore structures harbor higher numbers of coral species than other areas.

Fish - The reconnaissance surveys revealed the presence of a reasonably diverse assemblage of fish species in the study area (Tables 22 to 24). In the Pou Bay area, greatest species richness was observed on the outer reef flats and reef margins in undredged areas (Table 22). Even within the dredged area a total of 29 species were seen. More fish species were seen in the Pou Bay dredged areas and outer reef flat/reef margin habitats during the present study than were recorded by Devaney et al (1975), but this latter report records a larger number of species from the reef flat "craters" than we observed. In general, the fish species lists compiled during our study are quite different from those compiled by Devaney et al (1975). The Jaccard coefficient of similarity between our Pou Bay outer reef falt/reef margin and the same habitat as consused by Devaney et al was only about 0.2.

Off the southwest end of the runway, Devaney et al recorded considerably more species of fish in the shallow reef areas than we did, although our offshore deep reef species counts were quite similar (Table 23). The Jaccard similarity coefficient between the species list of Devaney et al. for the offshore deep reefs and ours was 0.38 which is rather close to the values calculated for our own replicate transect runs (see above).

At the northeast end of the runway, Devaney et al. again observed somewhat more fish species than we did, but because our habitat boundaries did not coincide closely, meaningful similarity coefficients cannot be calculated.

In summary, the general character of the fish communities surveyed by Devaney et al. are similar to those we observed although the species lists may not coincide closely. But, as the replicate transect censuses reported above emphasize, high variability seems to characterize visual censusing of fish communities, even when little time elapses between replicate consuses.

Areas of Unique Biological Value

The study area contains a variety of habitats and a great diversity of marine life. Within the area covered by the general reconnaissance and the eight monitoring stations located near the water quality boundary, we recorded 47 species of marine plants, 31 genera of corals, and 145 species of fish. This may be compared with results of surveys performed by the University of Guam Marine Laboratory elsewhere in Truk Lagoon. At three other sites on Moen (Clayshulte et al., 1978) the following diversities were recorded: 36, 48, and 31 species of marine plants, 26, 35, and 13 genera of corals, and 55, 62, and 47 species of fishes. At a site on Dublon (Amesbury et al, 1977), 63 species of marine plants, 35 genera of corals, and 65 species of fish were recorded. At a site on Tol (Clayshulte et al., 1978), 68 species of marine plants, 36 genera of corals, and 136 species of fish were recorded. In comparison with these areas, the airport study site had an intermediate level of diversity among plants and corals, and a relatively high diversity of fish. Within the Truk Lagoon, there is a vast amount of reef area, most of it richly populated with a diversity of marine life. Without denying that the survey area off the runway is relatively rich and diverse, it is apparent that this area is not unique in this respect. The same types of habitats and the same species of marine organisms found at the study site can also be found elsewhere in Truk Lagoon.

Ciguatera Occurrence

Muscle and gonad samples from 24 fish specimens representing 13 different species (Table 25) were analyzed for ciguatera toxicity by Dr. Y. Hokama in Honolulu. His laboratory has established criteria for recognizing three levels of toxicity in fish samples: negative toxicity (< 350,000 counts per gram), borderline (between 350,000 and 400,000 counts per gram), and positive toxicity (> 400,000 counts per gram). Of the fishes tested, one species, *Macolor niger*, a member of the snapper Family Lutjanidae, was found to have borderline level of toxicity, and 2 species, *Ctenochaetus striatus* (surgeonfish Family Acanthuridae) and *Epibulus insidiator* (wrasse Family Labridae) showed positive levels of toxicity. In the case of *E. insidiator* only the gonads were positively toxic; the flesh was negative. The borderline and positive toxicity levels in *M. niger* and *C. striatus* were found in the flesh.

We interviewed Dr. Kiosi Aniol, the Truk District Director of Health Services. He has been associated with the hospital on Moen since 1954 and knows of no case of ciguatera attributable to eating fish caught near Moen. Those few cases of ciguatera which have been reported have been attributed to fishes caught in the barrier reef passes and to fishes caught elsewhere in the lagoon.

Conversations with local boat operators and fishermen tended to confirm the conclusions of Devaney et al. (1975) that ciguatera is apparently not a concern of fishermen on Moen. The demonstration of the presence of the toxin in the area suggests that food fishes are not commonly taken from the area or that the quantities of toxin injested are small enough that acute cases of toxicity have not occurred.

CONCLUSIONS

The complexity of currents and short duration of study makes it very difficult to predict the actual transport of dredge and fill spoil in the lagoon receiving waters. However, several general trends can be outlined. Dredge spoil from Pou Reef-flat will be transported, for the most part, in a west to northwest direction. The heavier fractions of the dredge spoil will settle out in the near reef margin lagoon waters. The finer silty-clay suspensions will be either transported along the reef margin toward Station 6 or swept off-shore toward Station 9. The biota presently existing along the reef margins from Stations 1 through 4 are already accommodated to stress from siltation and may be able to handle an increased load. The biotic community at Station 9 is not presently as well adjusted to receiving a stress from sediments and therefore may not be able to adjust to increased sedimentation.

Dredge spoil from the Metitiu Reef discharge point will usually be transported toward the northeast fill area of the runway. The heavier spoil fractions should settle out in the proximity of the fill area. The finer silty-clay fractions from both the dredge discharge and fill activities in the vicinity of Station 6 will generally be transported in northeast direction. The spoil plumes can also be transported in a northeast direction during certain tidal states. It is anticipated that the biotic communities in the vicinity of Station 6 will receive heavy stress from siltation.

Silt derived from fill spoil along the runway will probably be carried in a northwest direction. The outlying projection at the southwest edge of the runway will proably receive moderate to heavy stress from siltation. The lagoonward end should be able to accommodate the increased sedimentation.

There will probably be considerable sedimentation in the vicinity of Station 8 perhaps extending 'to Newacho Harbor. Fill spoil may be transported either toward the southwest projection or southward. The complexity of currents in this area makes it almost impossible to ascertain the actual transport regime. It is anticipated that the lagoon floor between Station 8 and Newacho Harbor will receive heavy sedimentation loads. We will establish an additional biological monitoring station south of Station 8 on our first trip under Part B of the contract. This will enable us to better assess the effects of environmental stress in this area.

The ability of benthic communities to reestablish themselves once they have been stressed by siltation depends upon the length of time over which excess siltation occurs and the amount of sediment which becomes deposited in the environment. Short bursts of silt stress would allow corals to cleanse themselves during silt-free periods and would increase their probability of survival. Protracted siltation stress will probably result in the death of coral colonies and the displacement or death of their associated flora and fauna. Reestablishment of the community will then depend on recolonization by coral planulae larvae or regenerative growth of coral fragments in the area. Settlement of coral planulae is subject to a number of environmental conditions including the availability of stable substrate, competition from algae, and predation by a variety of possible coral feeders. If new sediments resulting from the dredging and filling operations are rather quickly removed from the shallow reefs by currents and wave action, recolonization will be more readily accomplished. If the sediments remain in the area, being periodically stirred up, resuspended, and redeposited by the currents and waves in the area, recolonization will be inhibited.

The environmental stress due to excessive release of silt is the major potential threat to the marine environment beyond the water quality boundary. Because of the infrequency of the biological monitoring program of Part B, the monthly turbidity monitoring being carried out by the University of Guam Water Resources Research Center (WRRC) will be better able to detect potentially harmful levels of siltation soon enough so that steps can be taken to ameliorate the problem. Adherence to their turbidity guidelines is the most effective means of avoiding damage to the environment. Where appropriate, silt screens can be used to reduce the escape of suspended sediments from the dredging and filling sites.

Within the areas to be dredged and filled there will, of course, be complete destruction of the marine habitats and the associated marine organisms. Some mobile organisms, such as fishes, may leave the area, but it is likely that few of these will be able to reestablish them selves in other areas because of the presence of previously established individuals of the same or competing species.

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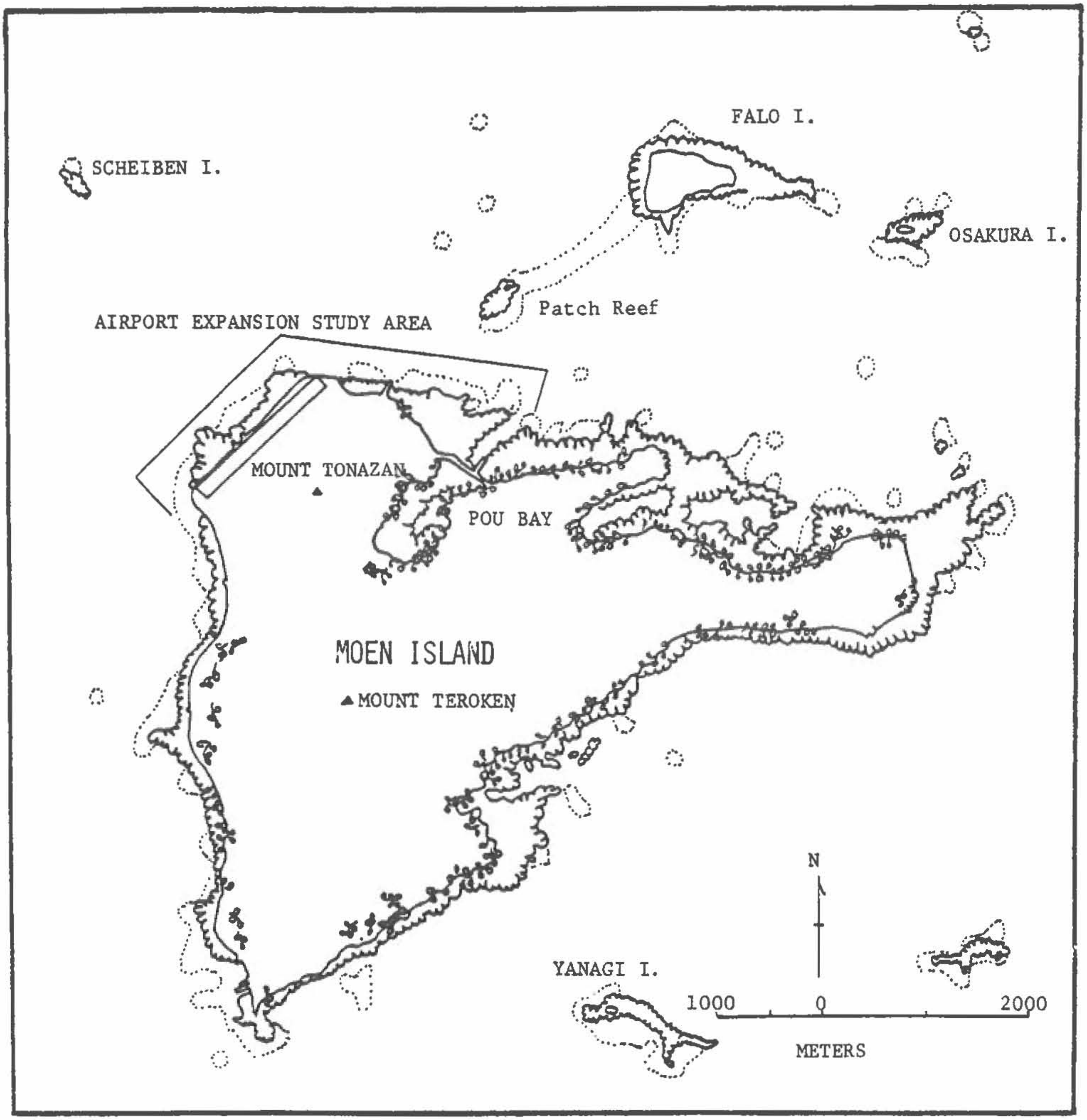

Fig. 1. Airport expansion study area on Moen Island, Truk. The small leaf-like structures indicate mangrove swamp. The dotted lines are patch reefs and/or shallow areas.

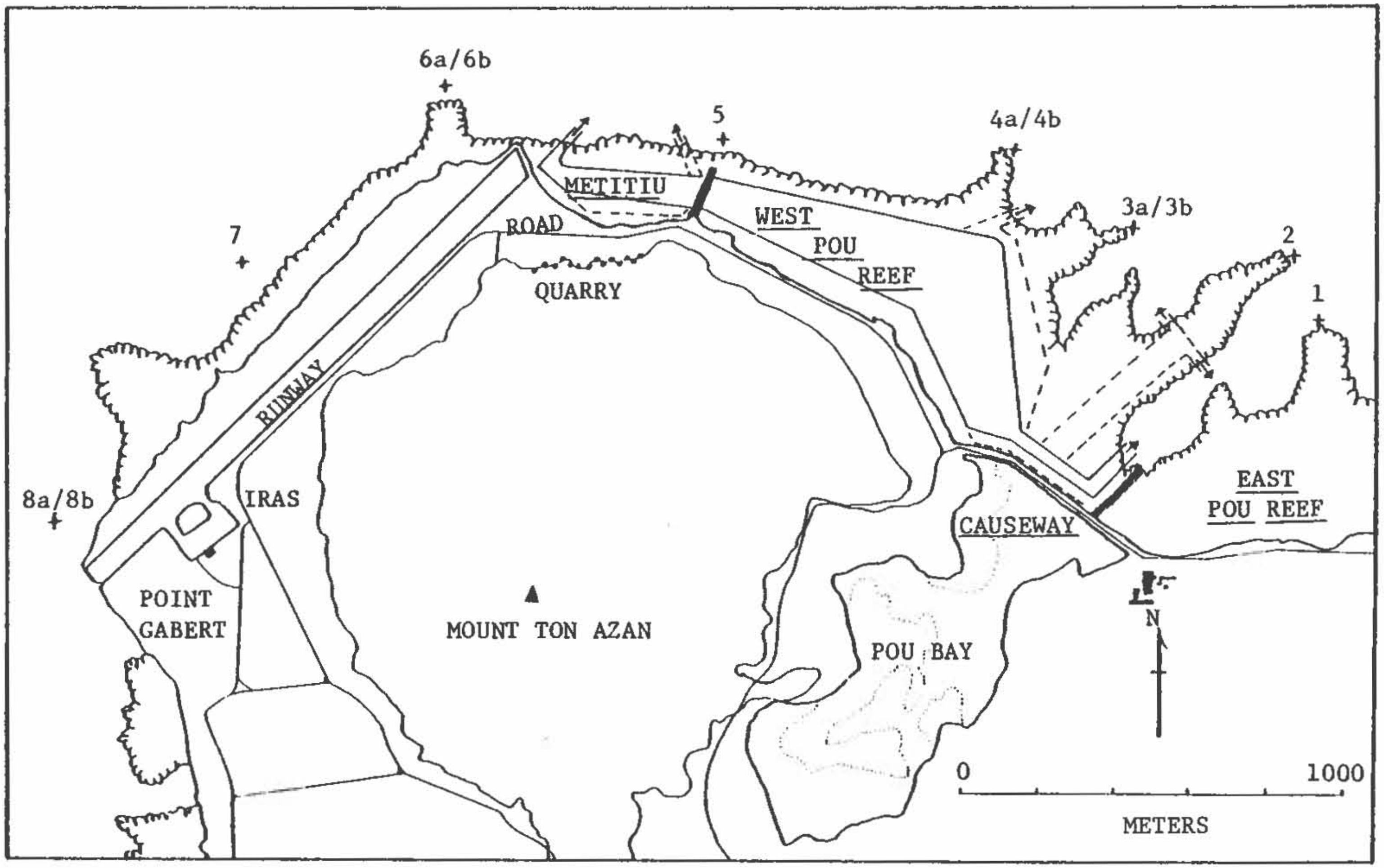

Fig. 2. Airport expansion study area and biological monitoring stations.

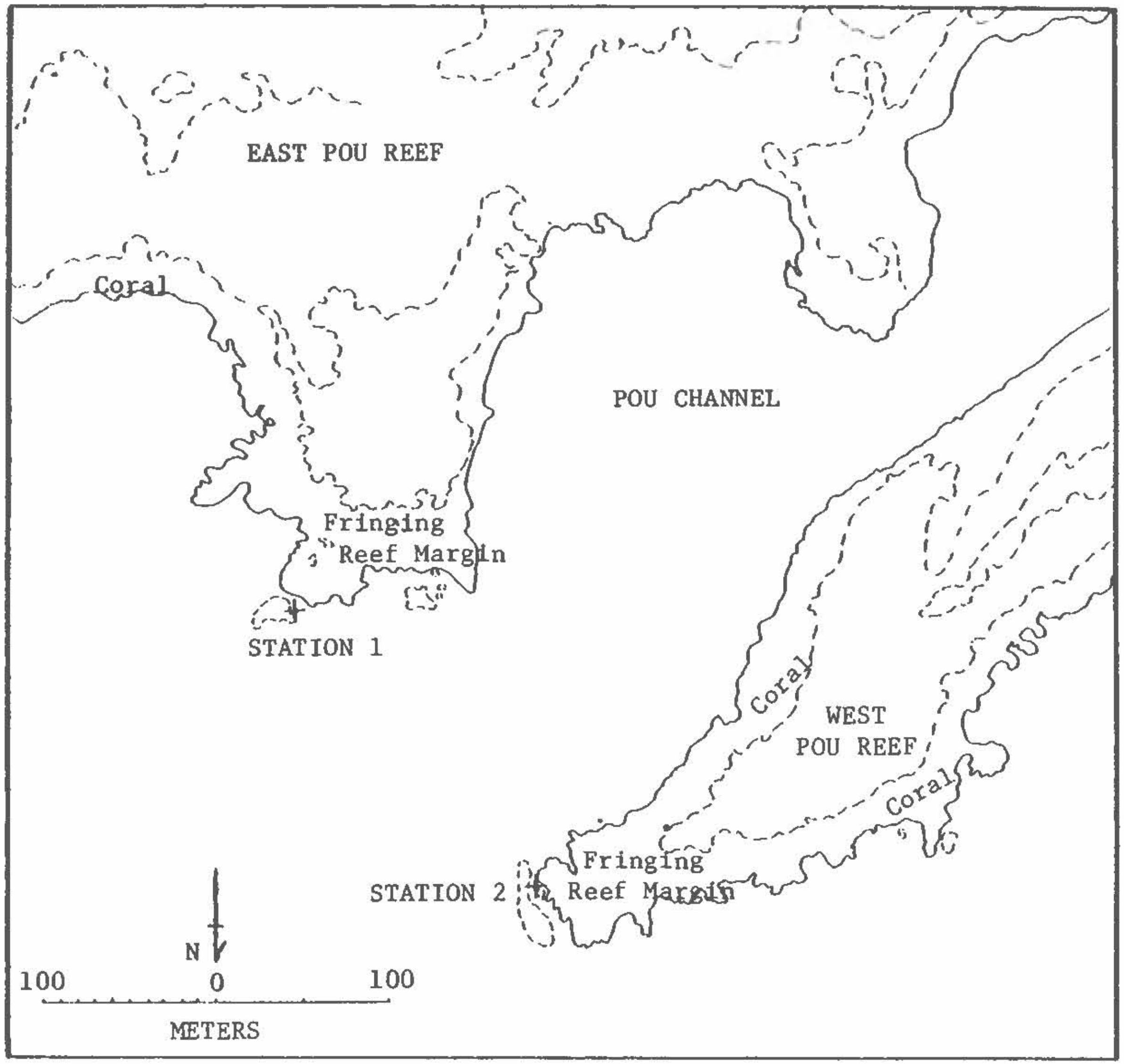

Fig. 3. Biological monitoring stations 1 and 2.

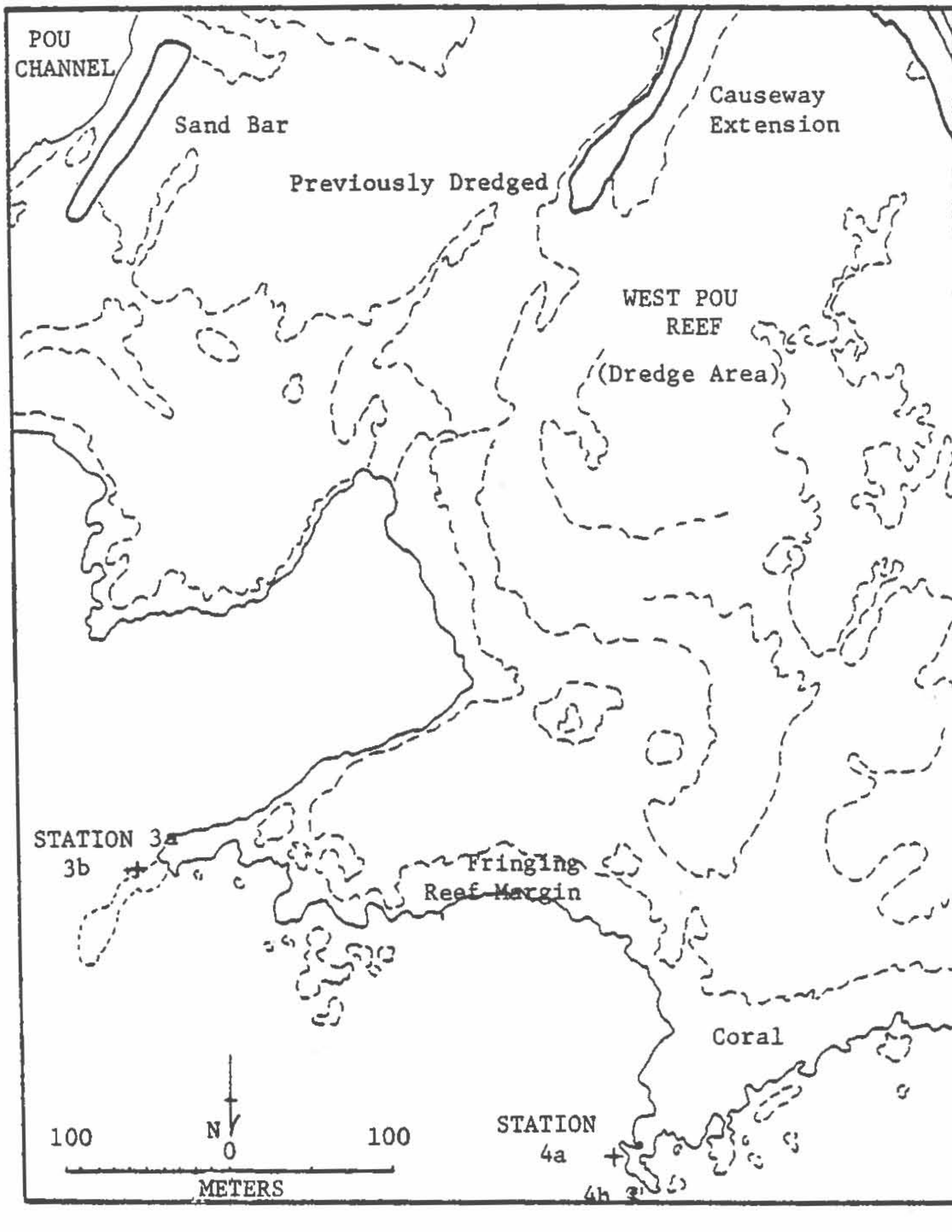

Fig. 4. Biological monitoring stations 3 and 4. The dashed line at Station 3 indicates a sandy ridge.

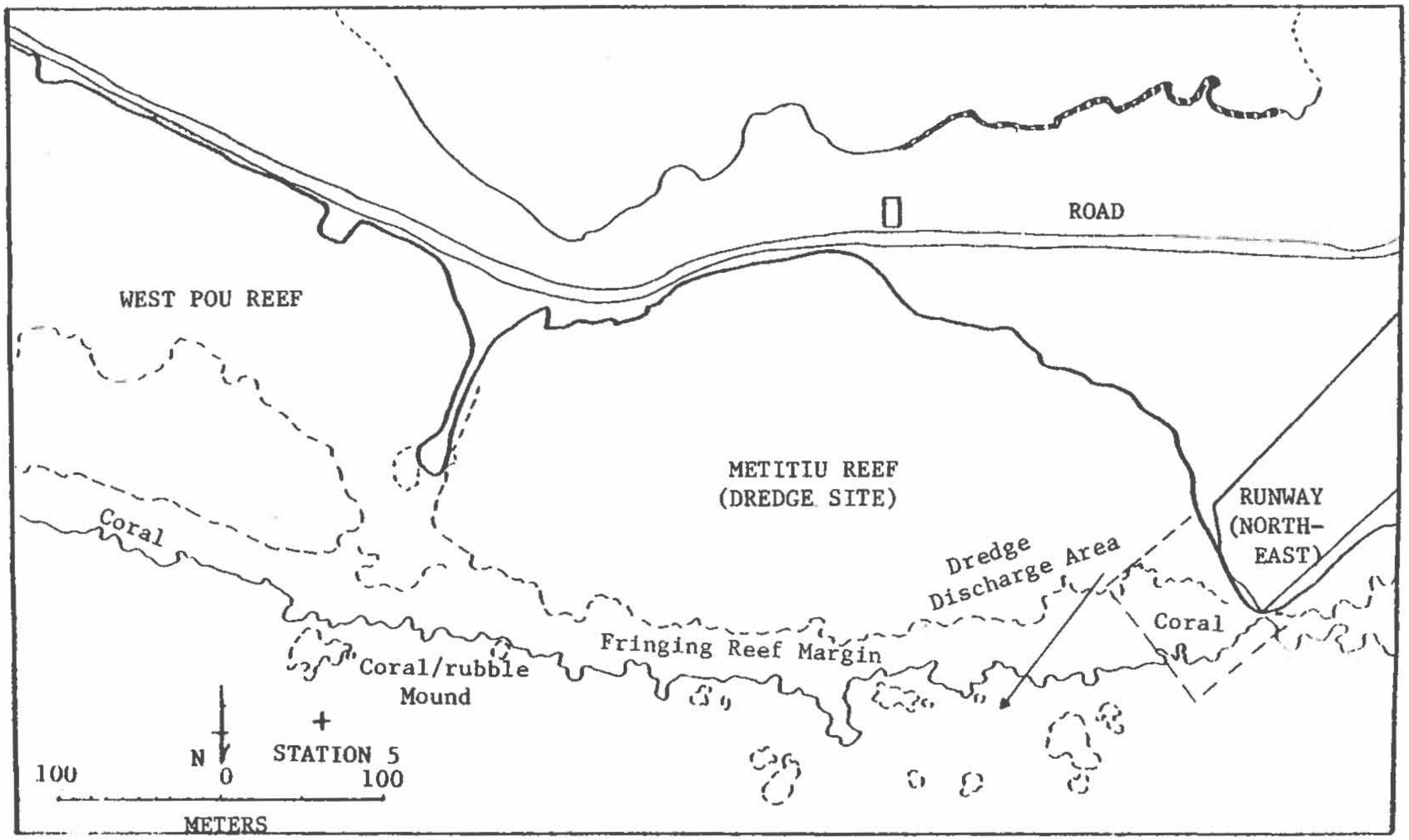

Fig. 5. Biological monitoring Station 5. The dashed line at the end of the runway indicates reconnaissance survey area.

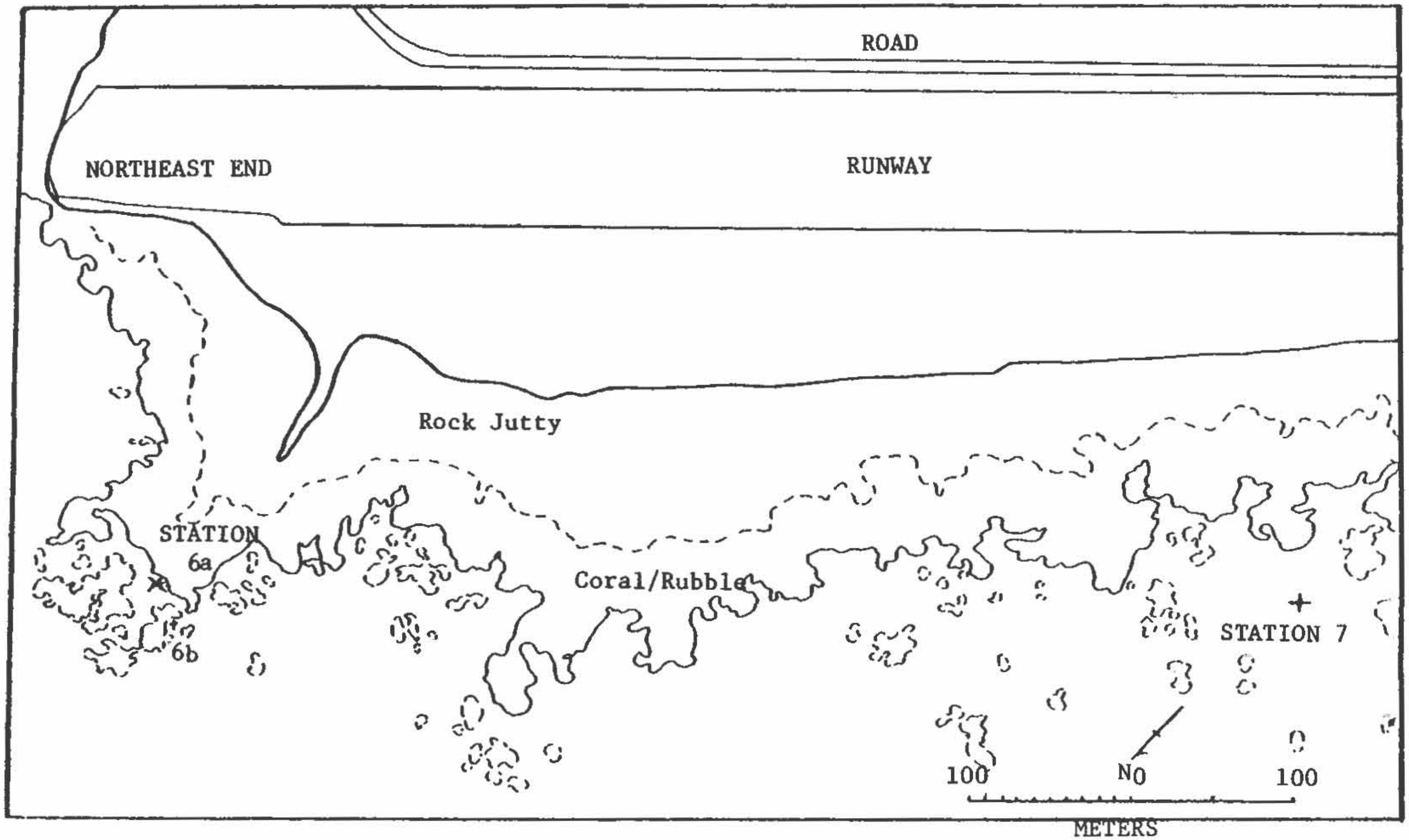

Fig. 6. Biological monitoring stations 6 and 7.

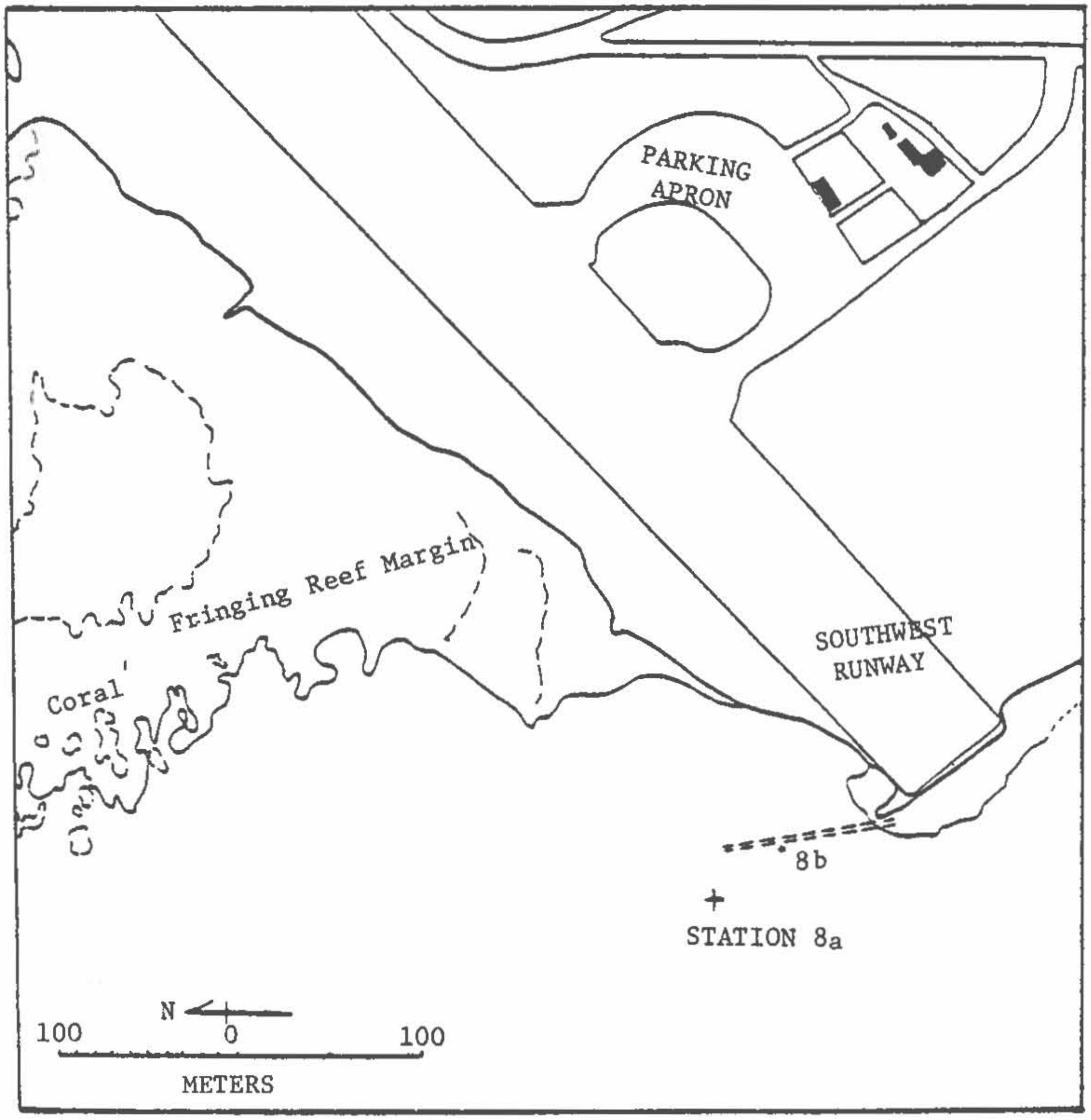

Fig. 7. Biological monitoring Station 8. The Point Gabert sewer outfall pipe is indicated by the row of double dash lines.

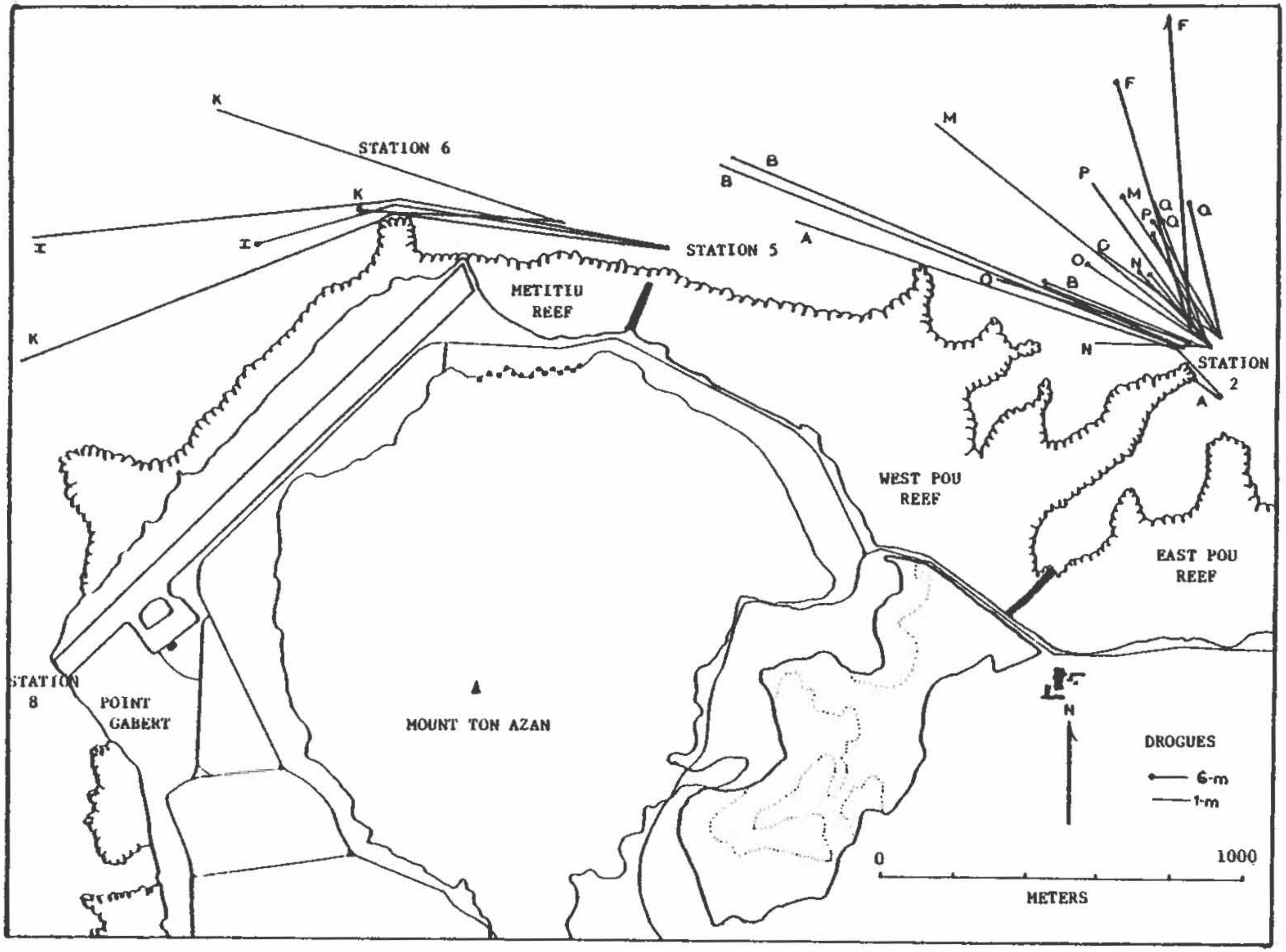

Fig. 8. Drift drogue paths released at monitoring stations 2 and 5. See Table 1 for wind direction and speed and tidal change.

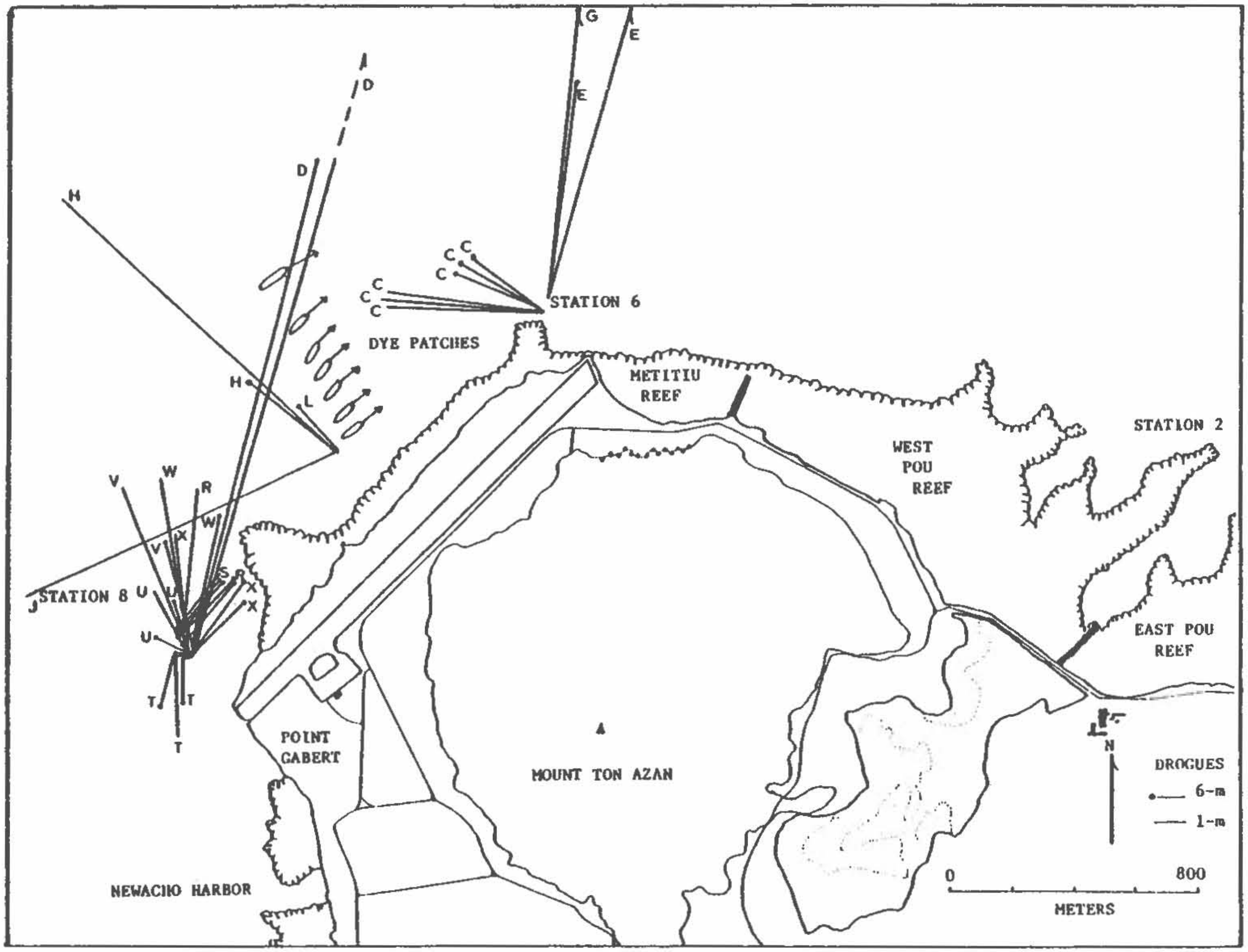

Fig. 9. Drift drogue paths released at monitoring stations 6, 7, and 8. The general movement of the fluorescein dye patches at Station 7 are indicated, circle with an arrow.

Table 1. Paths and velocities of drift drogues released at monitoring stations. The directions for drogue movements represent a straight line from the starting point to end point, even if the actual path travelled was curved. Directions indicated for drogue paths are those toward which the drogue is moving; wind directions are those from which the wind is blowing.

DATE	RELEASE STATION	DROGUE DEPTH	TIME IN	Δ TIME (min)	DISTANCE (m)	CURRENT VELOCITY m/sec	CURRENT VELOCITY m/hr.	DRIFT DIRECTIONS	WIND TIME	WIND DIR.	WIND VEL (Knots)	TIDE TIME	TIDE READING (ft)
May 18	2-A	6-m	0915	24	90	.06	225	315	0855	040	10	0818	1.6
		1-m	0915	225	1380	.10	368	295	0959	050	14		[+.3]
	2-B	6-m	0925	170	444	.04	157	271	1059	050	10		
		6-m	0925	170	426	.04	150	271	1157	070	12		
		1-m	0925	230	1420	.10	370	270	1255	130	14		
		1-m	0925	230	1428	.10	373	270					
May 18	6-C	6-m	1345	135	208	.03	92	308	1355	060	07	1338	1.9
		6-m	1345	135	210	.03	93	308	1455	060	12		[-.7]
		6-m	1345	135	212	.03	94	308	1555	120	07	1911	1.2
		1-m	1345	120	640	.09	320	275					
		1-m	1345	120	645	.09	322	275					
		1-m	1345	120	648	.09	324	275					
May 19	8-D	6-m	1244	236	1600	.11	407	013	1255	200	07	0841	1.3
		1-m	1244	*					1358	180	08		[+.6]
	6-E	6-m	1249	224	700	.05	187	007	1457	220	06	1421	1.9
		1-m	1249	224	1350	.10	362	015	1557	210	06		[-.8]
	2-F	6-m	1255	206	720	.06	210	342	1659	280	07	2004	1.1
		1-m	1255	214	1410	.11	395	355					
May 20	6-G	6-m	1045	250	1200	.08	288	005	0957	090	09	0913	1.1
									1457	050	07	1603	1.8

*Recovered on May 20 near station 9, moving toward study area.

Table 2. Species checklist of marine algae and seagrasses recorded along and in the vicinity of transects 1-9 and in the runway and West Pou Reef reconnaisance areas. (%)=percent cover of dominant species. (A)=abundant (>30% cover); (C)=common (2-30% cover); (R)=rare (<2% cover).

SPECIES	TRANSECT 1	2	3A	3B	4A	4B	5	6A	6B	7	8A	8B	9	RUNWAY S.W	N.E.	Central	WEST POU REEF Inner	Outer
CYANOPHYTA (blue-greens)																		
Microcoleus lyngbyaceus (Kutz.) Crouan		x	x		x		x(15%)		x	x		x	x		x(C)	x(C)	x(R)	x(R)
Schizothrix calcicola (Ag.) Gomont	x	x	x		x		x	x	x	x	x		x	x(C)	x(C)	x(C)		x(C)
Schizothrix mexicana Gomont	x		x								x	x	x	x(C)	x(C)			x(C)
CHLOROPHYTA (greens)																		
Avrainvillea obscura J. Ag.							x	x	x	x	x	x	x					x(C)
Boodlea composita (Harv.) Brand																		
Caulerpa cupressoides (West) C. Ag.	x		x								x	x					x(R)	x(C)
Caulerpa filicoides Yamada		x	x		x		x		x			x	x	x(A)		x(C)		
Caulerpa racemosa (Forsk.) J. Ag.			x					x		x	x		x	x(C)	x(A)	x(A)	x(A)	x(C)
Caulerpa sertularioides (Gmel.) Howe					x										x(C)	x(C)	x(C)	x(R)
Cladophoropsis sp.	x		x	x		x			x				x		x(R	x(R)		
Dictyosphaeria cavernosa (Forsk.) Boerg.										x			x		x(R)			x(R)
Halimeda cylindracea Decaisne	x		x				x	x	x(17%)	x	x	x(7%)		x(A)	x(A)	x(A)	x(C)	x(A)
Halimeda gigas Taylor			x				x				x	x		x(A)	x(A)	x(A)	x(A)	x(A)
Halimeda macroloba Decaisne	x	x	x		x		x	x	x	x	x		x	x(C)	x(R)	x(R)	x(A)	x(A)
Halimeda macrophysa Askenasy			x				x			x	x	x		x(C)	x(A)	x(C)	x(A)	x(C)
Halimeda micronesica Yamada	x		x		x			x	x		x		x	x(A)	x(A)	x(A)		
Halimeda opuntia (L.) Lamx.	x(12%)	x	x	x	x	x(11%)	x	x(22%)	x		x		x(11%)	x(A)	x(A)	x(A)	x(A)	x(A)
Neomeris vanbosseae Howe														x(R)		x(R)		
Rhipilia orientalis Yamada	x		x				x		x			x						
Tydemannia expeditionis W. v. Bosse			x		x	x	x			x		x	x					
Udotea argentea Zanard								x	x					x(R)		x(R)		
Valonia ventricosa J. Ag.						x					x			x(R)				

Table 2. continued

SPECIES	TRANSECT 1	2	3A	3B	4A	4B	5	6A	6B	7	8A	8B	9	RUNWAY S.W.	N.E.	Central	WEST POU REEF Inner	Outer
PHAEOPHYTA (browns)																		
<u>Dictyota bartayressii</u> Lamax.														x(A)			x(C)	x(R)
<u>Dictyota patens</u> J. Ag.	x	x(12%)	x(20%)	x(14%)	x(15%)	x	x	x	x	x(16%)	x	x	x	x(C)	x(R)	x(C)	x(C)	
<u>Hydroclathrus clathratus</u> (Bory) Howe																	x(R)	x(R)
<u>Lobophora variegata</u> (Lamx.) Womersley	x		x											x(C			x(R)	
<u>Padina jonesii</u> Tsuda											x(40%)			x(C			x(A)	x(C)
<u>Padina tenuis</u> Bory									x	x			x					x(R)
<u>Rosenvingea intricata</u> (J. Ag.) Boerg.					x			x			x							
<u>Sargassum polycystum</u> C. Ag.																	x(A)	x(R)
RHODOPHYTA (reds)																		
<u>Actinotrichia fragilis</u> Boerg.																	x(R)	x(R)
<u>Amphiroa foliacea</u> Lamx.													x					
<u>Amphiroa fragilissima</u> Lamx.				x													x(R)	x(R)
<u>Asparagopsis taxiformis</u> (Delile) Collins															x(C)			
<u>Centroceras clavulatum</u> (C. Ag.) Mont.								x			x							
Coralline red	x	x	x	x	x	x	x	x	x	x	x	x	x		x(C)	x(C)		
<u>Galaxaura fascicularis</u> Kjellman										x								
<u>Gelidiopsis intricata</u> (Ag.) Vickers	x	x	x	x			x		x	x	x	x						
<u>Hypnea pannosa</u> J. Ag.																x(R)		x(R)
<u>Liagora</u> sp.													x					
<u>Mastophora</u> sp.																x(R)		
<u>Polysiphonia howei</u> Hollenberg	x		x						x						x(A)	x(A)		x([illegible])
<u>Porolithan</u> sp.	x		x	x	x		x		x	x	x	x	x	x(C)	x(C)	x(C)	x(C)	x(C)
<u>Turbinaria ornata</u> (Turner) J. Ag.																x(R)	x(R)	x(R)

Table 2. continued

SPECIES	TRANSECT 1	2	3A	3B	4A	4B	5	6A	6B	7	8A	8B	9	RUNWAY S.W.	N.E.	Central	WEST POU REEF Inner	Outer
ANTHOPHYTA (seagrasses)																		
Enhalus acoroides (L.F.) Royle																	x(C)	x(A)
Halophila ovalis (R. Br.) Hook																		x(A)
Thalassia hemprichii (Ehrenb.) Aschers															x(C)	x(C)	x(C)	x(A)
TOTAL PERCENT (%) COVER/TRANSECT	50	24	45	38	45	20	51	41	51	41	71	25	30					
NUMBER OF SPECIES/TRANSECT OR IN IMMEDIATE VICINITY	15	9	21	6	12	6	15	10	20	14	17	17	17	18	20	21	21	27
TOTAL NUMBER OF GENERA	35																	
TOTAL NUMBER OF SPECIES	47																	

Table 3. Species checklist of marine algae recorded along and in the vicinity of transects 6A & 6B for the duplicate dives (1 & 2). (%)=percent cover of dominant species.

SPECIES	TR-6A 1	TR-6A 2	TR-6B 1	TR-6B 2
CYANOPHYTA (blue-greens)				
<u>Microcoleus</u> <u>lyngbyaceus</u> (Kutz.)		x	x	x
<u>Schizothrix</u> <u>calcicola</u> (Ag.) Gomont	x	x	x	
<u>Schizothrix</u> <u>mexicana</u> Gomont				x
CHLOROPHYTA				
<u>Caulerpa</u> <u>racemosa</u> (Forsk.) J. Ag.	x			
<u>Caulerpa</u> <u>filicoides</u> Yamada			x	x
<u>Caladophoropsis</u> sp.			x	
<u>Halimeda</u> <u>cylindracea</u> Decaisne	x	x	x(17%)	x(27%)
<u>Halimeda</u> <u>gigas</u> Taylor		x		x
<u>Halimeda</u> <u>macroloba</u> Decaisne	x	x	x	x
<u>Halimeda</u> <u>micronesica</u> Yamada	x	x	x	x
<u>Halimeda</u> <u>opuntia</u> (L.) Lamx.	x(22%)	x(18%)	x	x
<u>Rhipilia</u> <u>orientalis</u> Yamada			x	x
<u>Udotea</u> <u>argentea</u> Zanard	x		x	
PHAEOPHYTA (browns)				
<u>Dictyota</u> <u>patens</u> J. Ag.	x	x	x	x
<u>Padina</u> <u>tenuis</u> Bory			x	
<u>Rosenvingea</u> <u>intricata</u> (J. Ag.) Boerg.			x	x
RHODOPHYTA				
<u>Centroceras</u> <u>clavulatum</u> (C. Ag.) Mont.			x	
Corraline red	x	x	x	
<u>Galaxaura</u> <u>fascicularis</u> Kjellman			x	
<u>Gelidiopsis</u> <u>intricata</u> (Ag.) Vickers			x	
<u>Polysiphonia</u> <u>howei</u> Hollenberg			x	
<u>Porolithon</u> sp.		x	x	x
Number of Species/Transect or in Immediate Vicinity	9	10	19	11
Total Percent (%) Cover/Transect	41	37	51	66

Table 4. Size distribution, frequency, density and percent of substratum covered by stony corals at Station 1. Analysis includes relative values of frequency, density, and percent of substratum covered from which an importance value is calculated. Field data was collected using the point-quarter method. The standard symbols used are the number of corals (n), arithmetic mean ($\bar{Y}$), standard deviation (s), and range (w).

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies diameters (cm) n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density Per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
Acropora sp. 1	Ramose blue Acropora	1	4.0	-	-	.143	7.15	.022	3.2	.003	.023	10.37
Acropora sp. 2	Ramose delicate Acropora	1	4.0	-	-	.143	7.15	.024	3.2	.004	.030	10.38
Acropora formosa (Dana)	Light brown arborescent	8	57.4	46.6	10.0-109.5	.43	21.44	.181	25.8	8.362	64.32	111.56
Pocillopora ramose No. 1	Cespitose small Pocillopora	3	7.3	2.3	6.0- 10.0	.286	14.29	.068	9.7	.039	.300	24.29
Porites lutea Milne-Edwards and Haime	Massive lobate Porites	1	20.0	-	-	.43	7.15	.024	3.2	.039	.685	11.04
Porites sp. 1	Massive Porites	1	24.0	-	-	.143	7.15	.024	3.2	.129	.992	11.34
Porites (Synaraea) iwayamaensis Eguchi	Yellow columnar Porites	16	24.36	20.41	4.0-81.0	.714	35.18	.361	51.5	4.374	33.65	120.43
Total Density 0.70 Corals Per m^2												
Total Percent Cover 13.00%												

Table 5. Size distribution, frequency, density and percent of substratum covered by stony corals at Station 2. Analysis includes relative value of frequency, density and percent of substratum covered from which an importance value is calculated. Field data was collected using the point-quarter method. The standard symbols used are the number of corals (n), arithmetic mean ($\bar{Y}$), standard deviation (s), and range (w).

SPECIES	COLONY DESCRIPTION	n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density Per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
Pocillopora Ramose No. 1	Small cespitose	1	25.0	-	-	.143	16.7	.123	5.6	.77	7.6	13.2
Porites lutea Milne-Edwards and Haime	Massive lobate Porites	17	29.31	14.52	8.9-56.1	.714	83.3	2.077	94.4	9.38	92.4	186.8
Total Density 2.2 Corals Per m^2												
Total Percent Cover 10.15%												

Table 6. Size distribution, frequency, density, and percentage of substratum covered by stony corals at Station 3. Data from two small transects were combined and analyzed for relative values of frequency, density, and percent of substratum covered from which an importance value is calculated. Field data was taken using the point-quarter method. The standard symbols used are the number of corals (n), arithmetic mean ($\bar{Y}$), standard deviation (s), and range (w).

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameter (cm) n	$\bar{Y}$	s	w	Frequency	Relative Frequency	Density Per m^2	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
Acropora formosa (Dana)	Light brown arborescent	3	18.15	10.84	6.0-26.8	.20	.10	.236	8.82	.97	1.89	10.81
Acropora sp. 3	Light brown ramose	1	8.5	-	-	.10	.05	.078	2.90	.06	.12	3.07
Acropora sp. 4	Tabulate with blue tips	1	21.0	-	-	.10	.05	.078	2.90	.34	.66	3.61
Acropora sp. 5	Flesh colored tabulate	2	10.3	10.7	2.8-17.9	.20	1.0	.158	5.88	.26	.51	6.49
Porites lutea Milne-Edwards and Haime	Massive lobate	16	31.8	26.4	4.0-92.7	.80	.40	1.261	47.06	21.07	41.06	88.52
Porites (Synaraea) iwayamaensis Eguchi	Yellow columnar	6	71.7	20.1	43.8-99.0	.30	.15	.473	17.64	25.98	50.63	68.42
Seriatopora hystrix Dana	Calices form parallel lines along thin arborescent branches	4	20.8	11.0	9.2-35.8	.20	.10	.315	11.76	1.66	3.24	15.10
SAMPLE		1	35.3	-	-	.10	.05	.099	2.90	0.97	1.89	4.84

Total Density 2.68 Corals Per m^2

Total Percent Cover 51.31%

Table 7. Analysis of data from two transects at Station 4. Transect A data were collected using the point-quarter method and analyzed for absolute and relative frequency, density, and percent coverage of substratum. Transect B data were collected using the line-intercept method and analyzed for percent coverage of substratum.

SPECIES	COLONY DESCRIPTION	Size Distribution of Colonies Diameters (cm) n	Ȳ	s	w	Frequency	Relative Frequency	Density Per m²	Relative Density	Percent of Cover	Relative Percent of Cover	Importance Value
TRANSECT A												
Acropora formosa (Dana)	Light brown arborescent	2	86.1	47.0	52.9-119.4	0.20	10.53	.155	5.88	13.26	40.05	56.46
Acropora sp. 6	Drab ramose	2	8.7	0.4	8.3- 8.9	0.10	5.26	.155	5.88	.12	.36	11.50
Acropora sp. 7	Light yellow ramose	1	4.0	-	-	0.10	5.26	.078	2.94	.10	.03	8.23
Pocillopora ramose No. 1	Cespitose	2	9.6	4.1	6.7- 12.5	0.20	10.53	.155	5.88	.16	.48	16.89
Porites andrewsi Vaughan	Light green, short sub-ramose branches	8	22.3	11.8	6.6- 41.5	0.50	26.32	.621	23.53	3.87	11.69	61.54
Porites sp. 2	Massive	1	9.5	-	-	0.10	5.26	.078	2.94	.07	.21	8.41
Porites (Synaraea) iwayamaensis Eguchi	Yellow columnar Porites	14	31.6	16.1	6.9- 59.2	0.40	21.05	1.08	41.18	13.50	40.77	103.00
Seriatopora hystrix Dana	Calices form parallel line along thin arborescent branches	6	20.8	18.1	2.0- 43.9	0.30	15.79	.310	11.76	2.12	6.40	33.95

Total Density 2.64 Corals Per m²
Total Percent Cover 33.11%

SPECIES	Length Distribution of Colonies (Length in cm) n	Ȳ	s	w	Relative Occurrence	Percent of Cover	Relative Cover
TRANSECT B							
Porites lutea Milne-Edwards and Haime	18	32.4	31.1	2.0-106.0	100	46.6	100

Total Distance 1253 cm
Total Percent Cover 46.6%