Water Quality Monitoring Project / Third Port, St. Croix

Baseline Report

July 5, 1989

Submitted by

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Island Resources Foundation, Inc.

SUMMARY:

Twelve permanent photoquadrats were set-up and photographed. Total suspended solids and secchi disk measurements were taken for the twelve quadrat stations and the four daily monitoring sites.

INTRODUCTION

In order to monitor the effects of the proposed dredging activity on the benthic communities adjacent to the Third Port Channel at the entrance to Martin Marietta, a series of photoquadrats containing coral were established. The quadrats will be inspected on a regular basis along with a simultaneous sampling of water quality parameters. Daily monitoring will be done at four selected monitoring sites where water clarity will be assessed using a secchi disk. Daily sampling will provide an early warning system of identifying increased levels of sediment from dredging activities. Steps to correct high levels of sediment can be dealt with on a daily basis.

METHODS AND RESULTS

Quadrat Analysis

Twelve permanent photoquadrats were established at locations shown in Figure 1. Where possible, quadrats set-up in 1987 were re-photographed. Stations 1, 2, 3 and 1A were photographed on 6-10-89. Station 1A is an alternate to station 1, as all the coral in station 1 had died between 6-87 and and 6-89.

Stations 4 through 12 were photographed on 6-24-89. Only stations 10, 11 and 12 were the found that had been established 1987. On stations 4, 5 and 6 the markers had disappeared probably washed away because they were located in a surf zone. Station 7, 8 and 9 could not be found even after extensive searching. New stations 7, 8 and 9 were established. Photographs of each of the 12 quadrats are appended to this report.

Stations 1, 2 and 3 are located on the western side of Ruth Island. This area is where a sediment plume might impact corals should the dredging produce high levels of sediment. The site is already heavily impacted by sediment probably produced by tanker activity coming and going from the Hess dock. As already noted, one of the quadrats photographed in 1987 no longer had live coral present. Species diversity of corals is very low being dominated by scattered heads of Diploria strigosa and Montastrea annularis. Also found are small patches of Porites porites, P. asteroides and Millipora alcicornis. The environmental assessment report prepared by Prince-Tams (1984) describes this area in transect (TR2C) noting only 1.8 percent live coral back in 1984. An additional photo is provided of the area showing the extensive damage caused by sediment.

Stations 4, 5 and 6 are located directly across the channel from where the dredging is to occur. It is the closest area where corals can be found and is directly down current from the dredging operations. Diploria strigosa is the dominant coral found in the area. Corals are only found in the surf zone to about 1 meter depth of water. Photographing a full meter square in such shallow water was extremely difficult. Since that was the closest corals to the dredge site it was necessary to photograph a representative sample. An additional photo is provided of the area showing the surrounding habitat and the depth of the water.

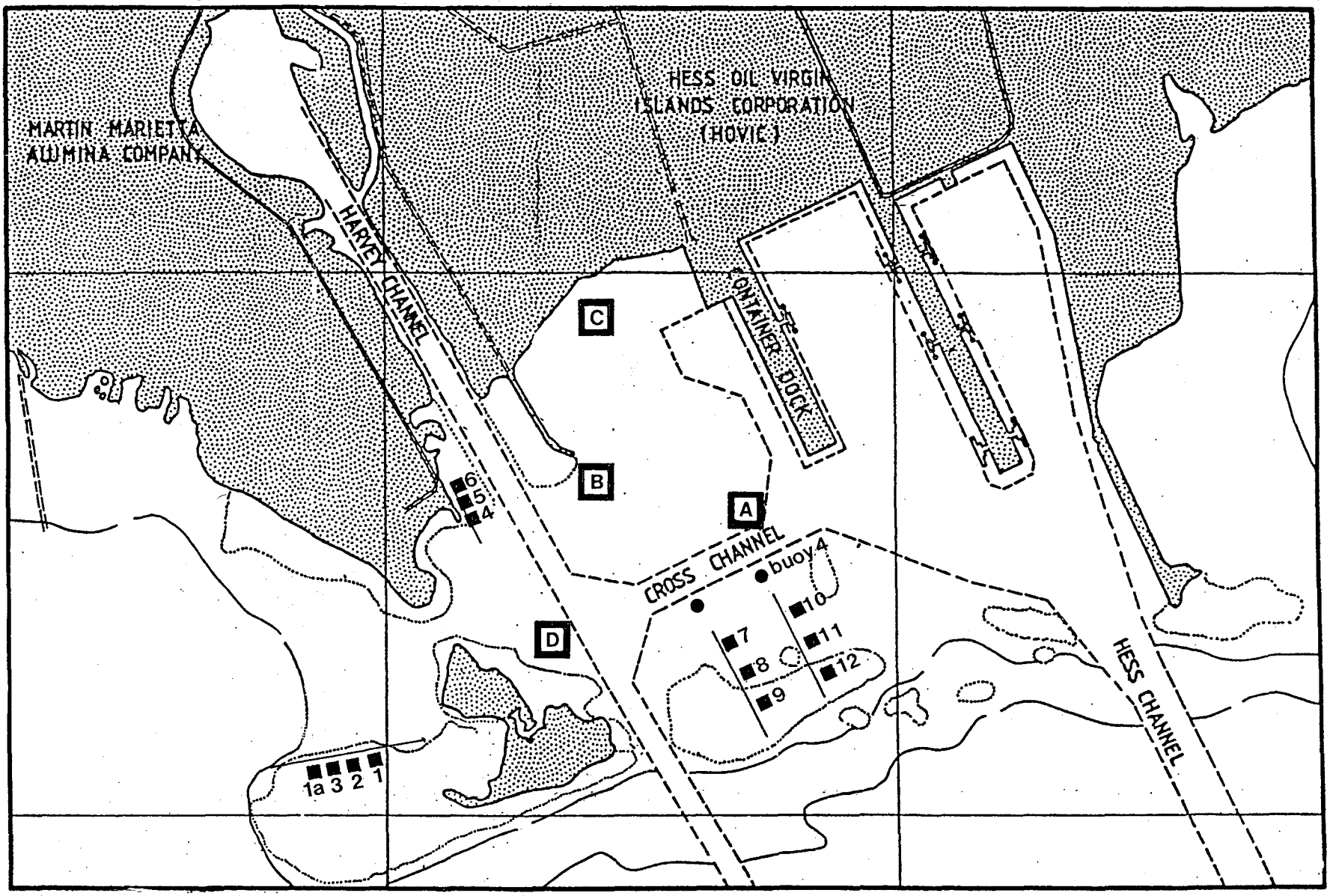

Figure 1. Location of the Daily Water Monitoring Stations: Channel Station [A], Jetty Station [B], Outfall Station [C] and Ruth Island Station [D]. Location of the photoquadrats numbered 1 through 12.

Stations 7, 8 and 9 are located on one transect and 10, 11, 12 on another transect both east of Ruth Island and across the entrance channel. The transects are up wind from the dredging site and are not expected to be impacted by sediment from dredging under the normal prevailing wind conditions. Quadrats 7, 8, and 9 are newly set-up and 10, 11 and 12 are quadrats that were set-up and photographed in 1987. As noted from comparing 1989 to 1987 photographs, extensive loss of corals has occurred. Because the photographic methods from 1987 differed from the present methods, quantitative measurements of the extent of the loss are not possible. However, there is obvious loss of corals and estimates can be made if necessary. This area is described in Prince-Tams (1984) as TR1C, TR1E and TR1F. Percent of live coral cover was estimated at between 5 and 10.

Secchi Disk Analysis

The Secchi disk to be used throughout this study is 20 inches in diameter with a white background accented for easy contrast with black stripes. Secchi disk depths were recorded at the four monitoring sites. At each of the quadrat locations the bottom was visible, therefore secchi depths are equivalent to water depths at those locations. The results are reported in Table 1.

A field sheet for June 10, 1989 is attached to this report. These field sheets will be used on a daily basis. All original field sheets will on file at Ocean Systems Research, Inc., 128 Gallows Bay along with all other water quality data.

Suspended Solids Analysis

Water samples were taken to measure total suspended solids at all 12 quadrat sites and the 4 established secchi monitoring sites. The results are presented in Table 1. Figure 2 provides a graph of the results.

Total suspended solids were determined by EPA (1983) Residue, Non-Filterable Method 160.2 (Gravimetric, Dried at 103-105°C). A Millipore filtrations system was used with pre-weighed 47mm diameter Gelman A/E glass fiber filter. Samples were weighed on a Sartorius Analytical Balance capable of weighing to 0.01 mg. The balance was certified in January, 1989 and is calibrated monthly with S-weighs according to EPA standards.

HISTORY

In May of 1987, twelve photoquadrats were established as a baseline for the Third Port dredging project. The dredging was delayed and now due to begin on July 10, 1989, over two years after the original baseline study.

Table 1. Water Quality for Third Port monitoring program.

Date	Stations	TSS(mg/1)	Secchi Depth(m)
6/10/89	#1	4.8	1.2 bottom
	#2	4.2	1.2 bottom
	#3	3.0	1.2 bottom
	#4	2.6	1.0 bottom
	#5	7.0	1.0 bottom
	#6	1.2	1.0 bottom
	#7	14.0	3.5 bottom
	#8	9.2	3.5 bottom
	#9	4.4	3.5 bottom
	#10	4.6	3.5 bottom
	#11	2.0	3.5 bottom
	#12	2.4	3.5 bottom
	#A	6.6	3.0+
	#B	13.4	3.0+
	#C	6.0	1.0 bottom
	#D	5.6	4.0+ bottom

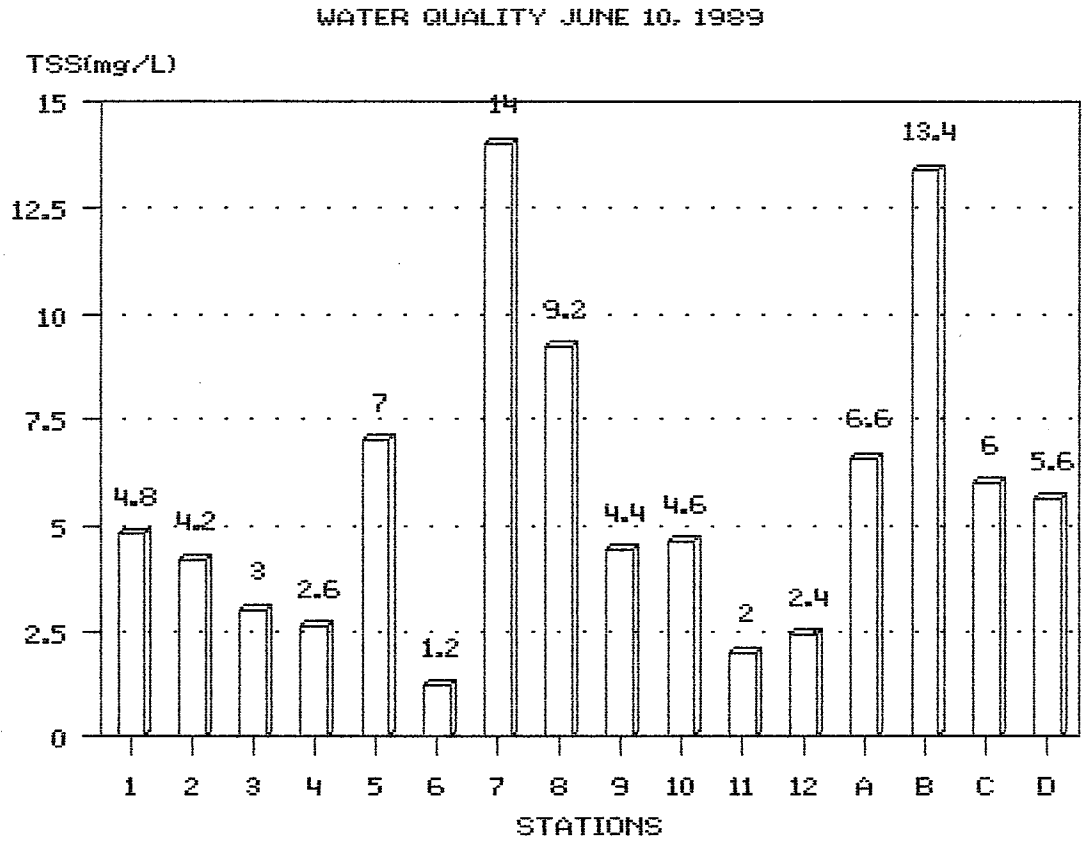

Figure 2. Total suspended solids (TSS) in mg/L on June 10, 1989.

Six of the original quadrats were found, one of which no longer contained any live coral. The other five quadrats showed drastic reductions in the percent of live coral. General observation of the area gives the impression of a reduction in live coral since the first study and an increase in suspended solids.

In August of 1987, a seagrass transplant was accomplished for the V.I. Port Authority as mitigation for enclosing and filling in of a coastline site which contained approximately 10 acres of seagrass. Monitoring of the seagrass transplant was done on a quarterly basis for 1988. During that time activity at the Hess plant increased and more and more tankers were observed calling at the port. An increase in the sediment level was noted with the increase in tanker activity. During the transplant phase, which was located west of Ruth Island, the bottom was visible from the surface most of the time. With the increase in tanker traffic, it has been impossible to see the bottom at the transplant site during any of the subsequent visits. Even though no quantitative data was collected, the decrease in visibility was very noticeable. I conclude that tanker activity, which causes a resuspension of sediments every time they enter the port, is impacting corals and causing them to die. The water quality data collected from this study, because it is done on a frequent basis, could quantify and clarify the amount and source of these sediments.

REFERENCES

EPA-600/4-79-020. 1983. Methods for Chemical Analysis of Water and Wastes. Environ. Monitoring and Support Lab., Cincinnati, Ohio.

Prince-Tams Joint Venture. 1984. Environmental Assessment Report for Third Port Project, South Shore - St. Croix - U.S. Virgin Islands, Vol 1 & 2, Prep. V. I Port Authority.

ACKNOWLEDGEMENTS

All photographs were taken by Michael Paul Herko. Water samples for total suspended solids was analyzed at Ocean Systems Research Water Testing Laboratory. Preparation for the study, diving and setting up transects was assisted by Thomas Eimer.

NO: 003

Daily Data Reporting Sheet

SECCHI DEPTH - VIPA DREDGE SITE - KRAUSS LAGOON, ST. CROIX, USVI

DAY Saturday DATE June 10, 1989 READING BY M.L.Coulston mlc

WEATHER rainy/cloudy WIND DIRECTION E/SE 15-25 SEA CONDITION rough

MORNING SURVEY (TIME 0900) (DREDGE OPERATING YES ____ NO X)

CHANNEL STATION [A] 3.0+

JETTY STATION [B] 3.0+

OUTFALL STATION [C] 1.0 bottom

RUTH IS STATION [D] 4.0+ bottom

DATA TRANSMITTED TO: _____ SIGNATURE _____

****

WEATHER _____ WIND DIRECTION _____ SEA CONDITION _____

AFTERNOON SURVEY (TIME _____) (DREDGE OPERATING YES____ NO ____)

CHANNEL STATION [A]_____

JETTY STATION [B]_____

OUTFALL STATION [C]_____

RUTH IS STATION [D]_____

DATA TRANSMITTED TO:_____ SIGNATURE _____

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DATA LOGGED AT BASE _____ BY _____

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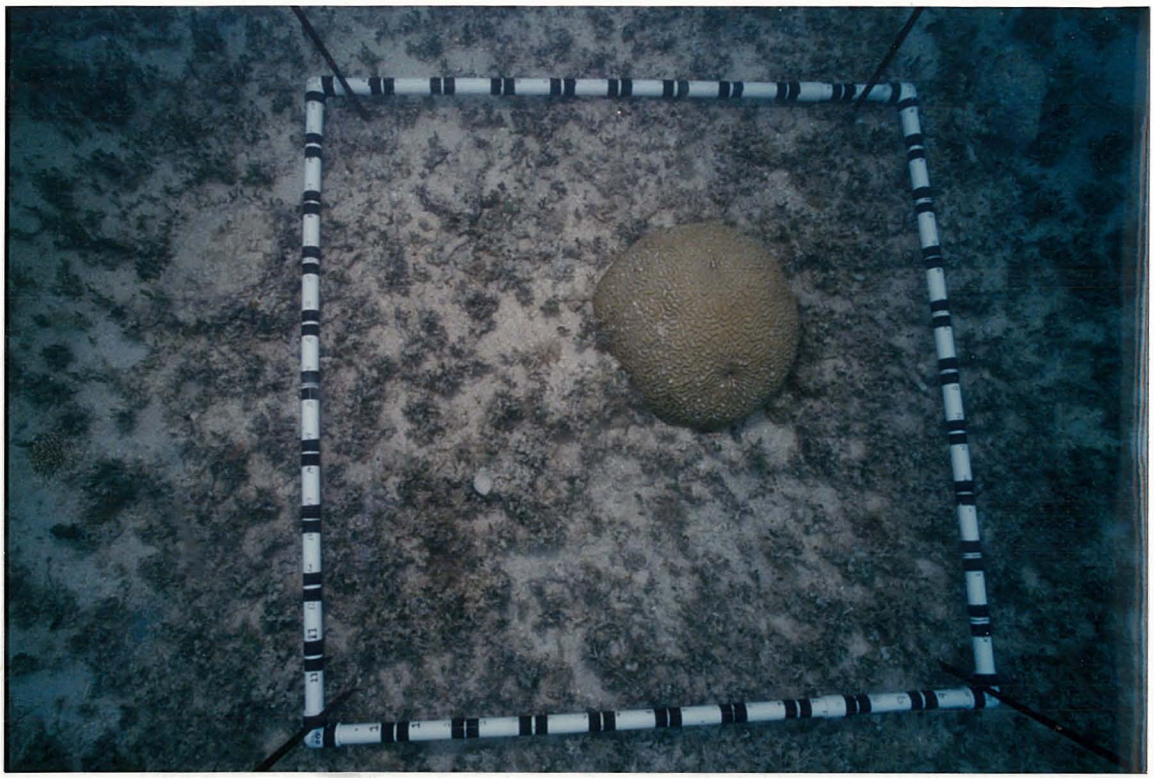
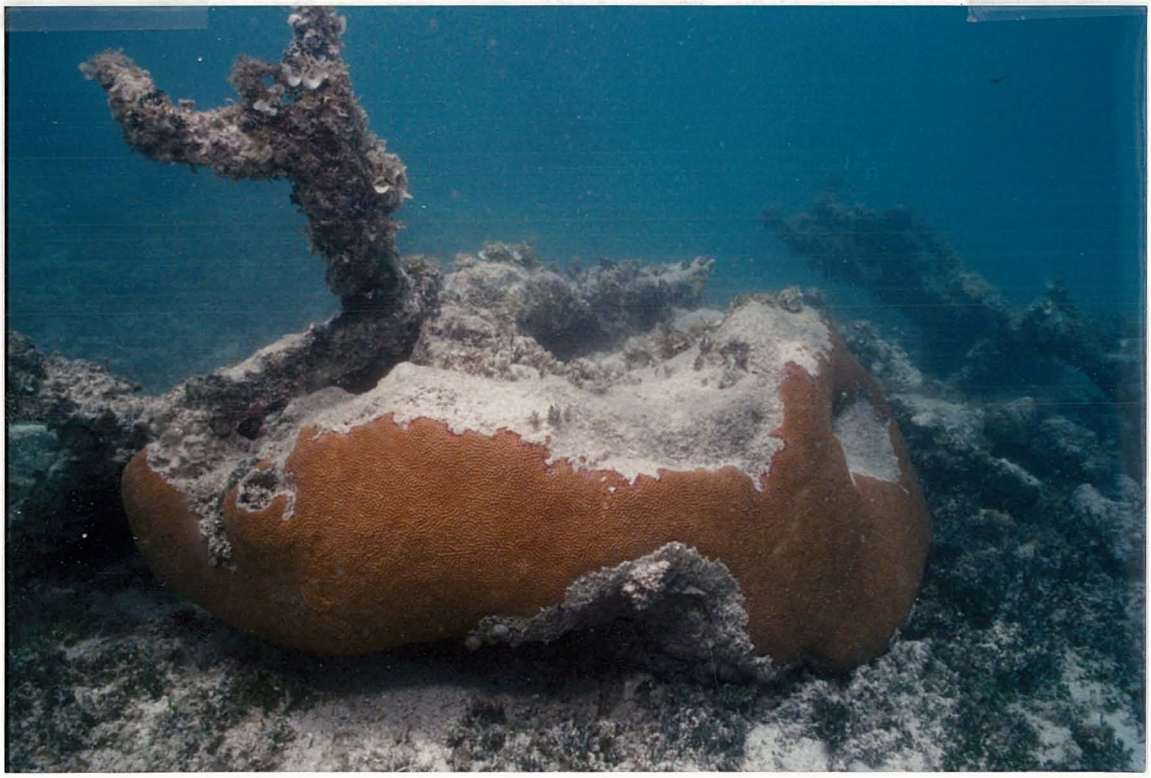
COMMENTS:

Winds 15-25K, weak tropical wave moving through the area. Strong currents made secchi disk readings difficult, that is why reading are expressed in value (+).



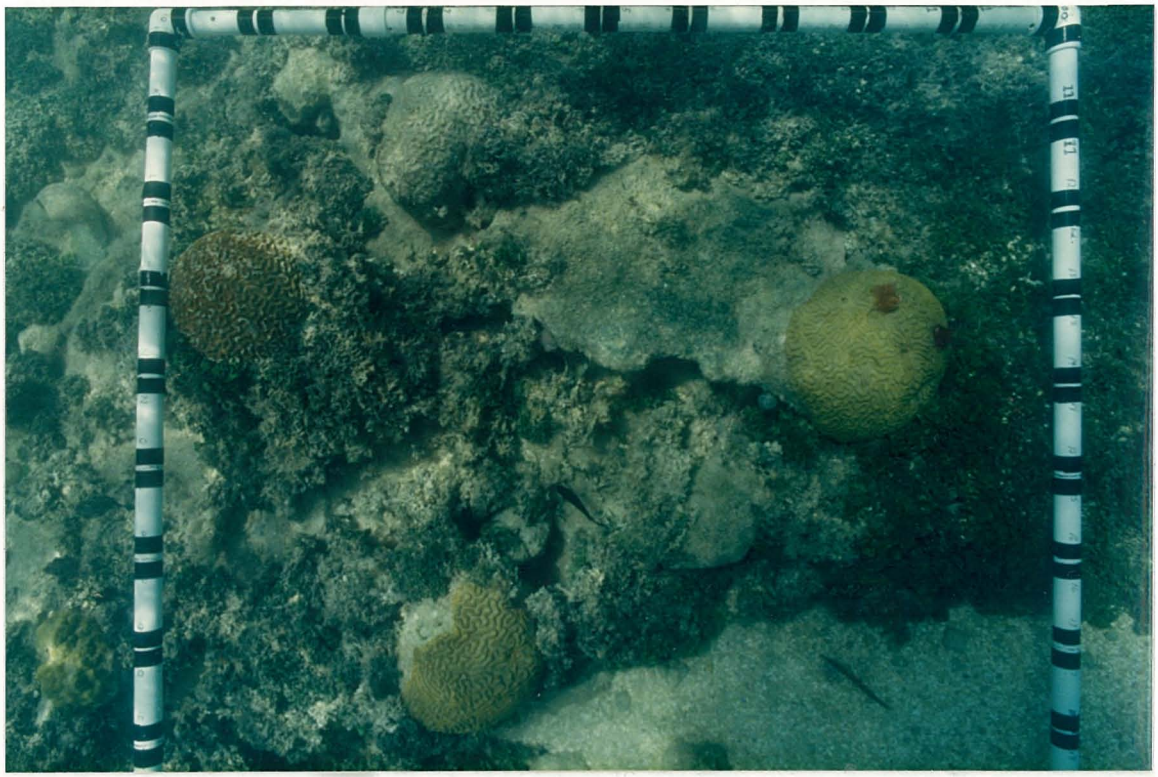
Photoquadrat (1): Single head of Diploria strigosa. Dominant species in the area with solitary heads separated by vast areas of sand-algal pavement.



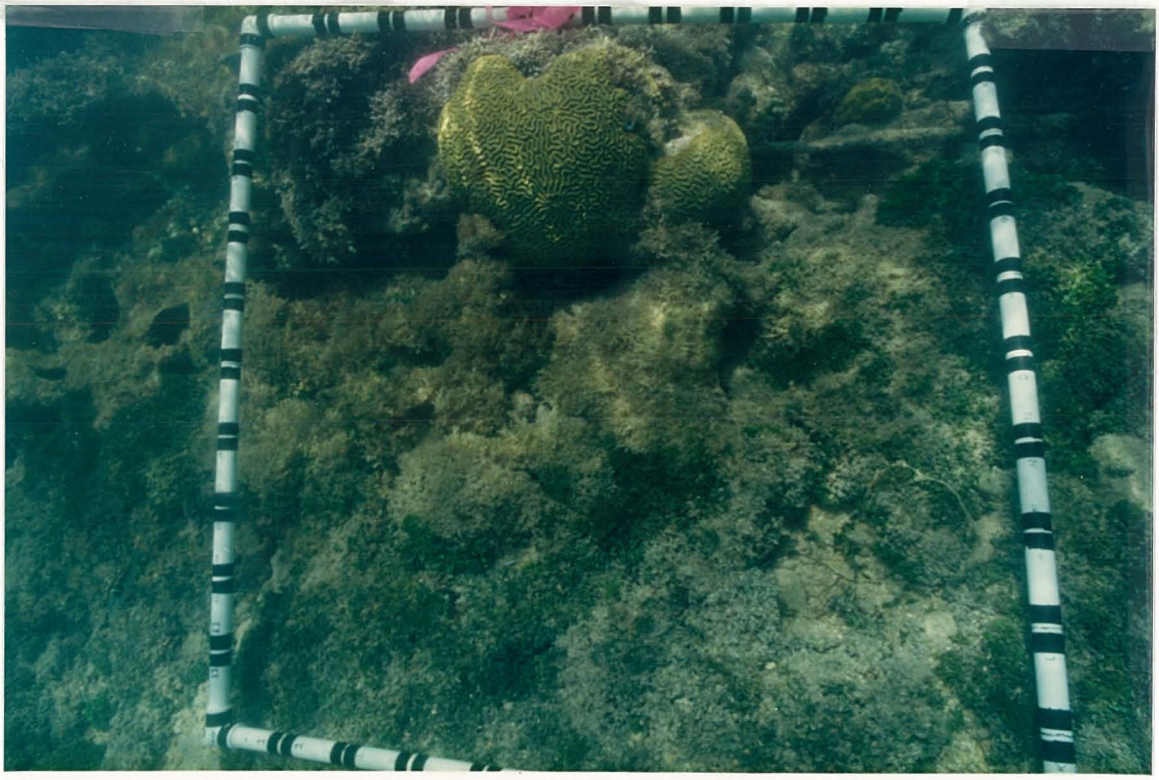
Coral (Diploria strigosa) typical of the area in which stations 1, 2, and 3 are located. Species diversity is very low and most corals have already been killed by sediment damage as seen in the above coral.

Photoquadrat (2): Small heads of Montastrea annularis. Also a dominant species in the area with similar small clumps separated by vast areas of sand-algal pavement.

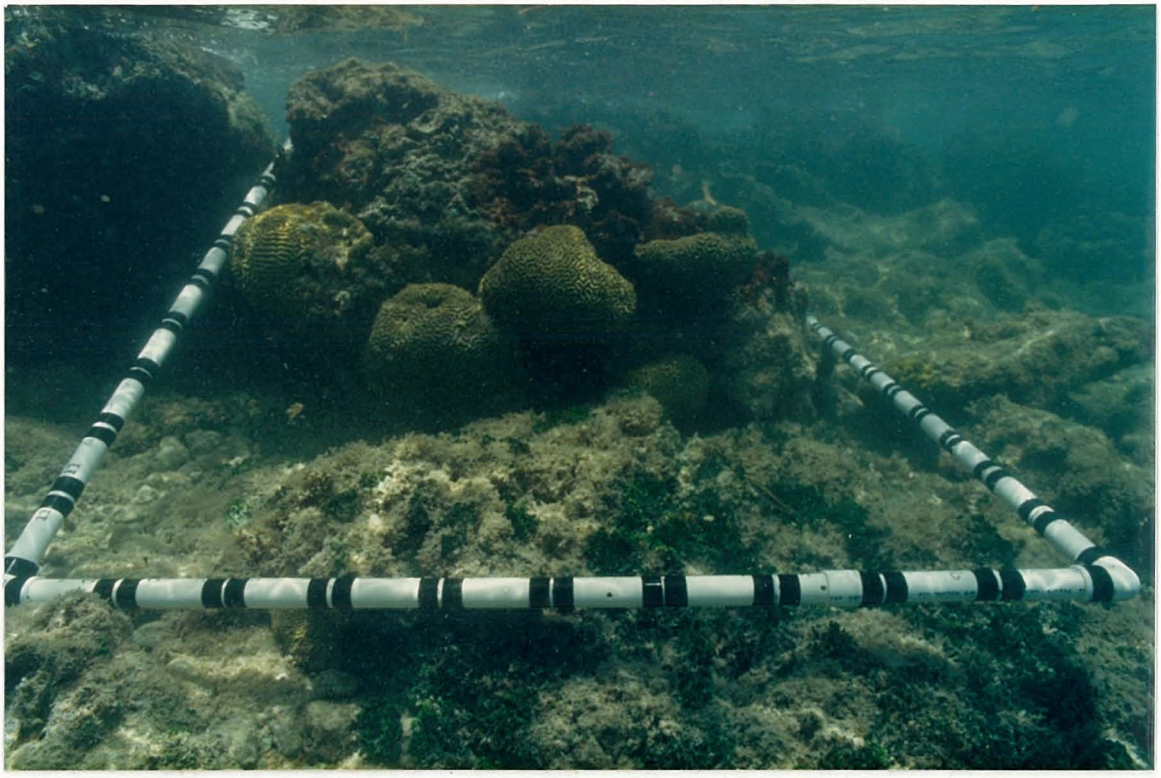
Photoquadrat (3): Small heads of Montastrea annularis with a patch of Porites porites situated in the middle of the clumps of star coral.



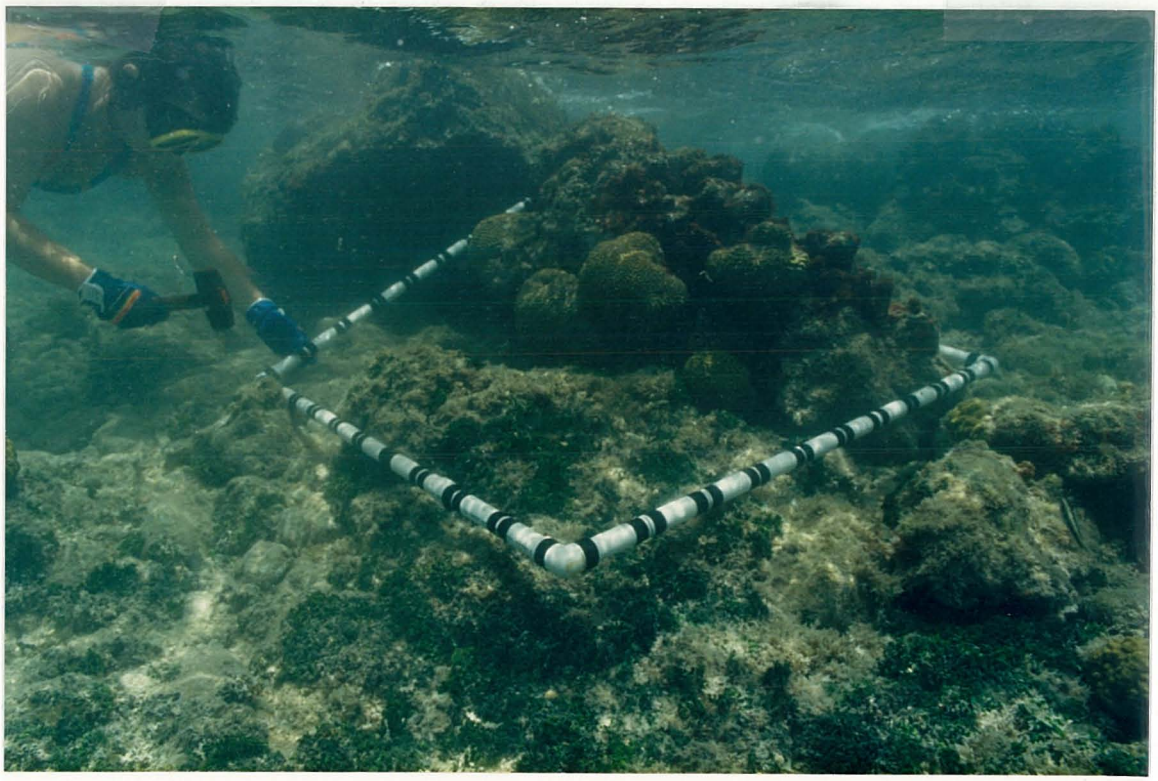
Photoquadrat (4): Small heads of Diploria strigosa. This area is on the opposite side of the channel from the dredge site and in less than 1 meter of water. It is the closest coral to the dredge site.



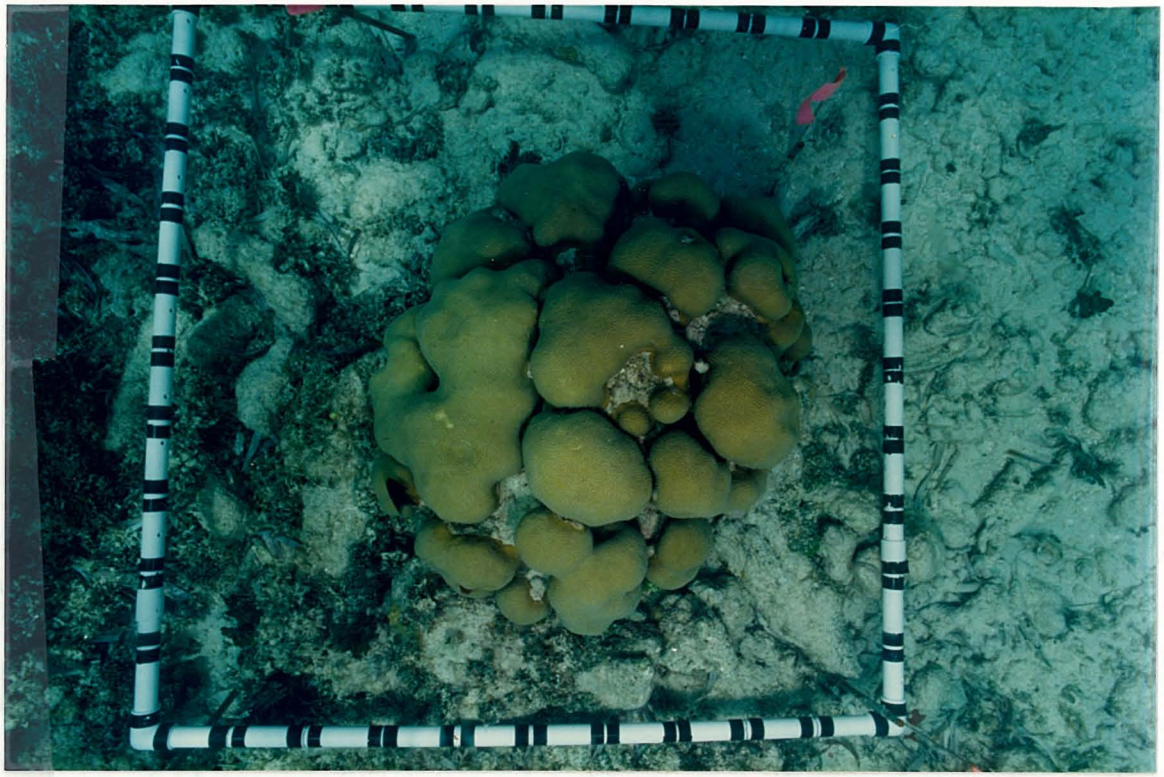
Photoquadrat (5): Small heads of Diploria strigosa. This species and several isolated patches of Porites asteroides are the only coral found in this area.



Photoquadrat (6): Small heads of Diploria strigosa.

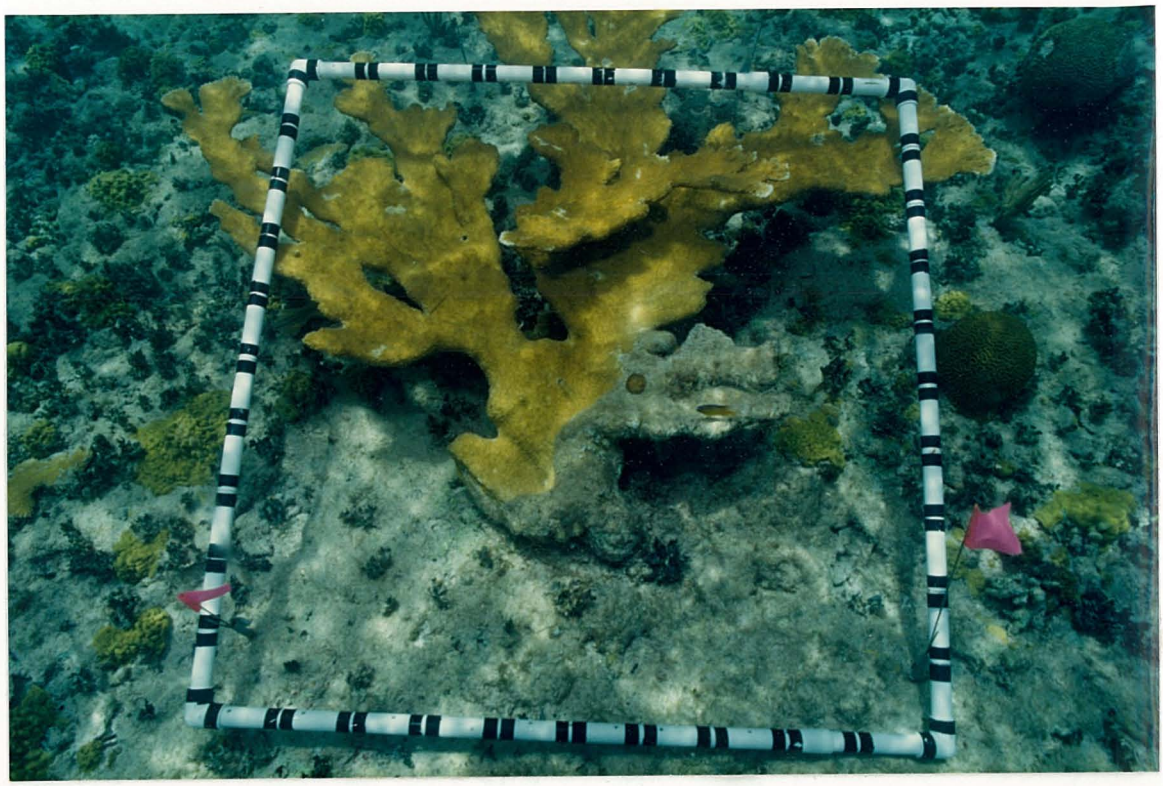


Small heads of Diploria strigosa same as above but shown at a different angle so that the surrounding habitat can be observed and the depth of the water.

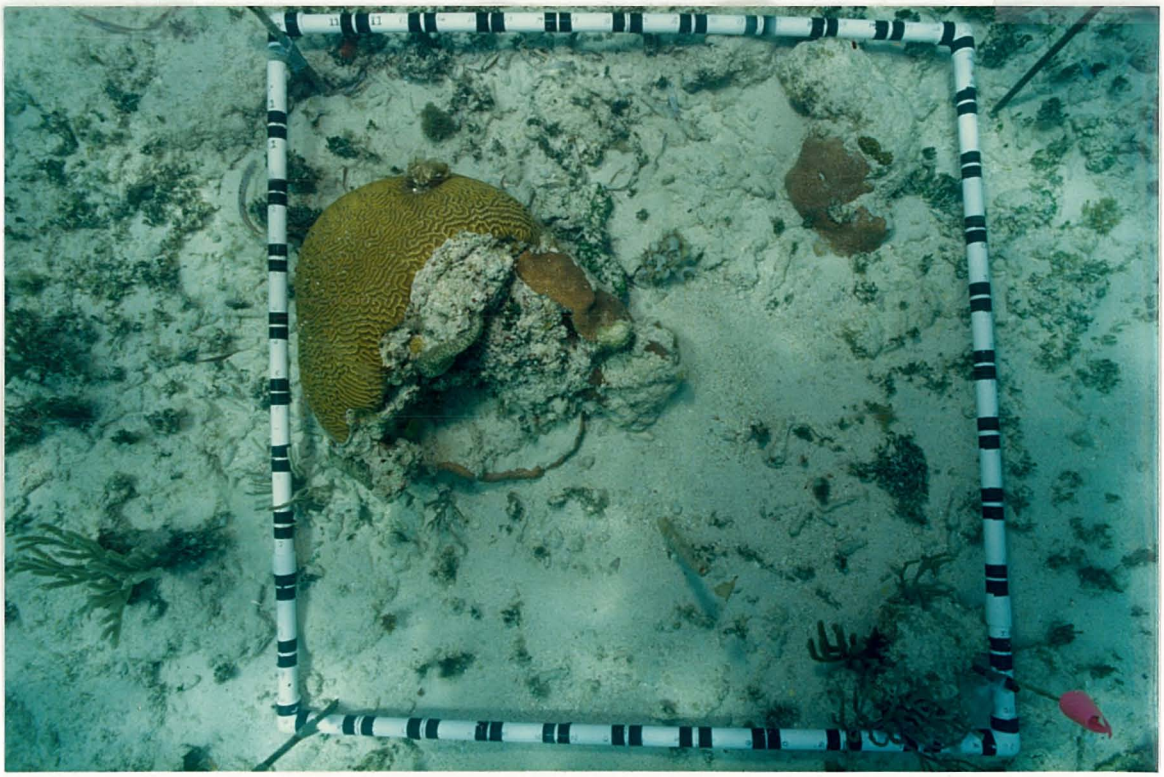


Photoquadrat (7): Montastrea annularis.

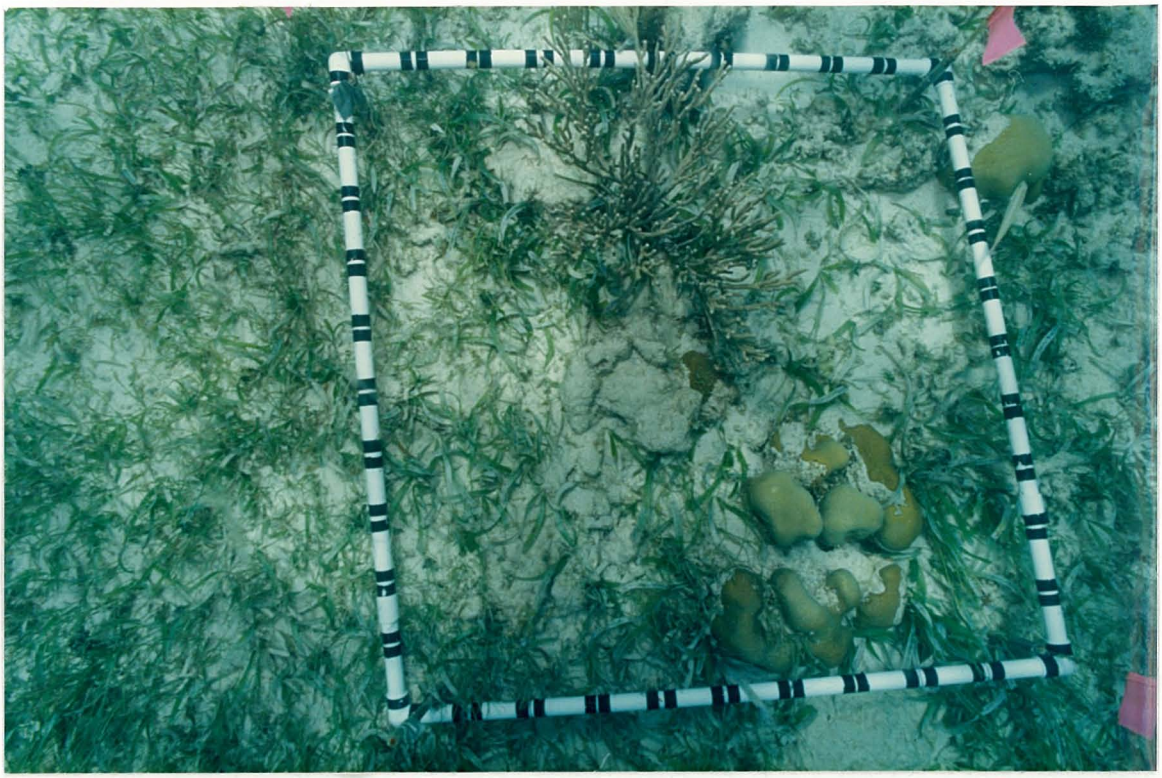
Photoquadrat (8): Large and small heads of Diploria strigosa several patches of Porites asteriodes and a small patch of Montastrea annularis.



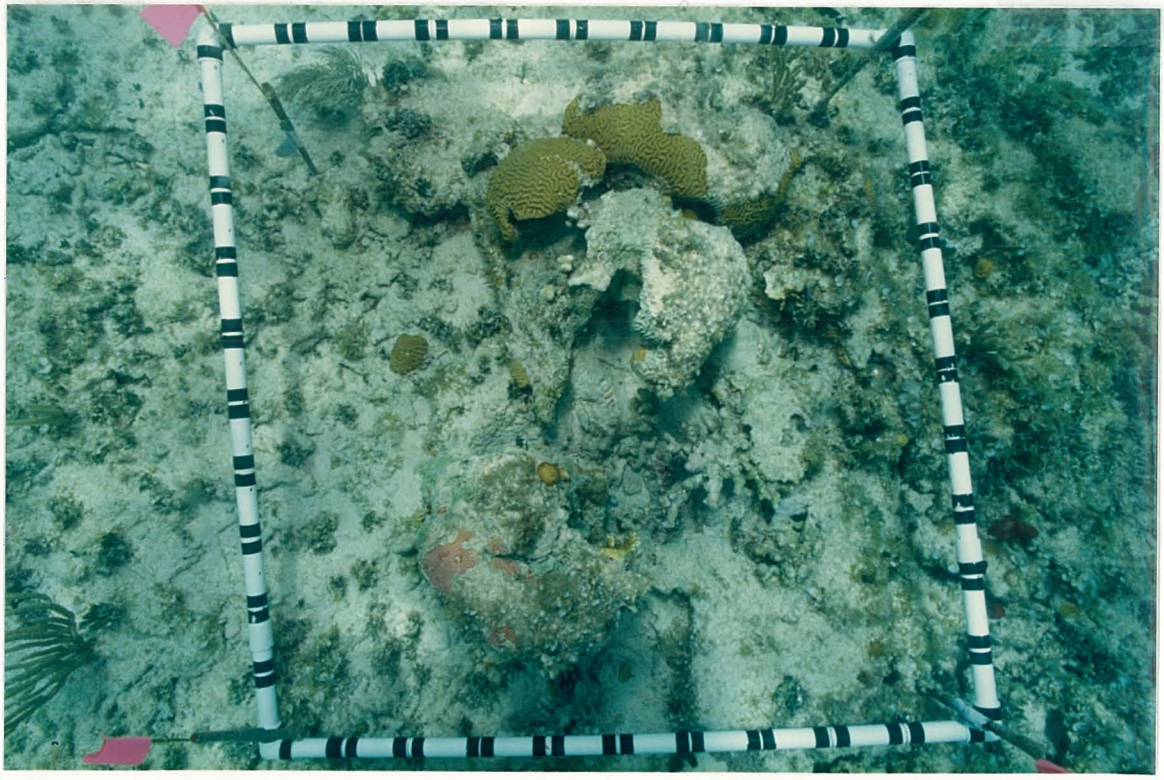
Photoquadrat (9): Acropora palmata and Porites asteriodes.



Photoquadrat (10): Diploria strigosa and Montastrea annularis.



Photoquadrat (11): An original 1987 quadrat containing Montastrea annularis.



Photoquadrat (12): An original 1987 quadrat containing Diploria strigosa and Porites porites.

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Water Quality Monitoring Project / Third Port, St. Croix
Progress Report

August 13, 1989

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SUMMARY:

Twelve permanently marked benthic quadrats were photographed on 8-13-89 and compared to photographs taken 6-10 and 6-24-89. Both sets of photographs are presented in this document to avoid any confusion as there have been corrections in the numbering system. Each quadrat was examined in detail by two biologist to evaluate changes.

INTRODUCTION

The effect of the dredging activity on the benthic communities adjacent to the Third Port Channel at the entrance to Martin Marietta is being monitored, in part, by photographing quadrats containing representative corals. The quadrats were first photographed on 6-10-89 and 6-24-89 and re-photographed on 8-13-89. Each quadrat is being carefully observed on a regular basis by Dr. Mary Lou Coulston and Mr. Hank Tonnemacher and all changes noted.

Water clarity is being monitored daily at four stations (Fig. 1: A, B, C and D) by Hank Tonnemacher using a secchi disk. His results, as well as total suspended solids analyzed on a weekly basis at all 16 stations, are reported weekly.

METHODS AND RESULTS

Quadrat Analysis

Twelve permanent quadrats were established at locations shown in Figure 1 (figure has been updated since the baseline report). The quadrat numbering system had been somewhat confusing as we tried to retain the 1987 quadrat numbers when establishing new 1989 quadrats. Because of this confusion and because we wanted the numbering system to represent consecutive stations rather than the clustered approach taken in 1987, we have standardized the numbering system. We have referenced in the text and on the photograph descriptions the old numbers that were originally used in 1987 or that were used in the baseline study. The station numbers used in this report now correctly reflect what has been presented in Figure 1 and will stand throughout the study.

Quadrats 1, 2, 3 and 1A were photographed on 6-10-89. Quadrat 1A is an alternate to quadrat 1, as all the coral in station 1 had died sometime between 6-87 and and 6-89.

Quadrats 4 through 12 were photographed on 6-24-89. Only quadrats 10, 11 and 12 were found that had been established 1987. Quadrats 4 through 9 were newly established. Photographs of each of the 12 quadrats, both the baseline and the 4 wk photos, are contained in this report.

The method used to quantitatively assess changes in the benthic community was to estimate percent live coral cover within each meter square. This was done by constructing a grid on the photograph by connecting lines from each 10 cm marking on the surrounding meter square. Estimates were made within each 10 cm^2 segment of the percent of live coral. Table 1 presents some calculations using this method. Some of the calculations have not been done, as yet, on quadrats that exhibit no observable change.

Observations by divers can probably best assess changes. The weekly and sometime daily observations by diver Hank Tonnemacher has been the best indicator so far of assessing the beginnings of damage. Observing the same corals day after day even the smallest changes are noted even when photographs fail to pick up these differences. Also the divers observed coral species that

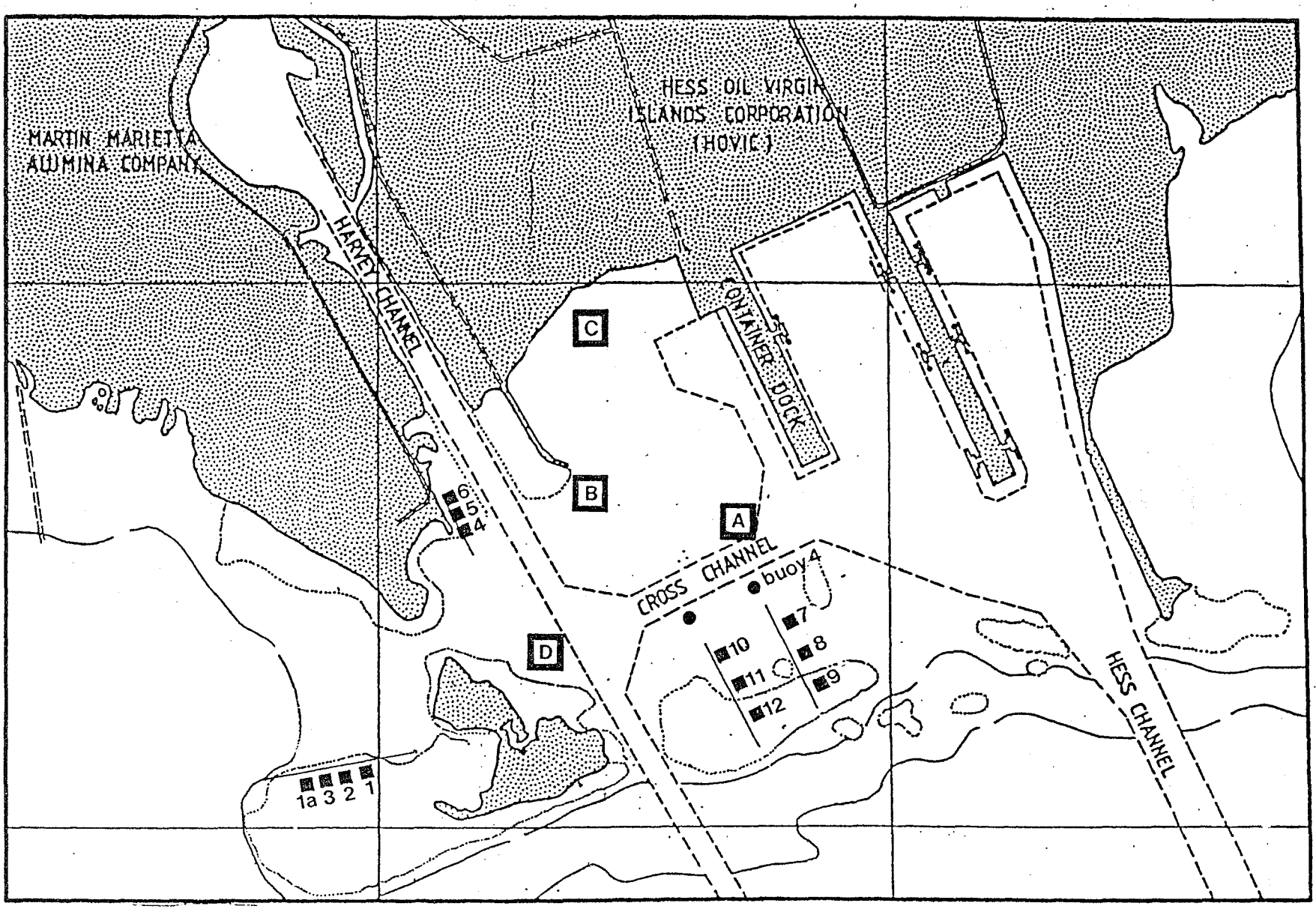

Figure 1. Location of the Daily Water Monitoring Stations: Channel Station [A], Jetty Station [B], Outfall Station [C] and Ruth Island Station [D]. Location of the photoquadrats numbered 1 through 12.

do not appear on the two dimensional photograph because they are too small or are hidden under ledges. So far, minor change appears in quadrat 4, 5 and 12 with major damage in quadrat 7. Patches of the coral Acropora palmata have died with subsequent algal growth have been reported in quadrat 7. The changes in quadrat 7 are readily observable in the photograph and are described and analyzed for quantitatively assessing the change.

Quadrats 1A, 2 and 3 are located on the western side of Ruth Island. This area is where the greatest impact to corals has been predicted to occur should the dredging produce high levels of sediment. The site is already heavily impacted by sediment possibly produced by tanker activity coming and going from the Hess dock or from wave action over the reef and currents running through the area. As already noted, one of the quadrats photographed in 1987 no longer had live coral present. A close-up photograph is presented of the Diploria head in quadrat 1A showing large particles of sediment, however, no damage was observed to the colony.

Species diversity of corals is very low in this area being dominated by scattered heads of Diploria strigosa, Siderastrea siderea and Montastrea annularis. Also found are small patches of Porites porites, P. asteroides, Eusmilia fastigiata and Millipora alcicornis. The environmental assessment report prepared by Prince-Tams (1984) describes this area in transect (TR2C) noting only 1.8 percent live coral at that time. An additional photo is provided of the area showing the extensive damage presumably caused by sediment an a patch of healthy E. fastigiata. Apparently E. fastigiata survives well in this area of low species diversity as numerous intact, healthy colonies were observed.

Quadrat 1A shows no change as determined by field observations. Particles of sediment have been observed on the coral head, but they appear to be removed by the coral tentacles or by the occasional strong currents through the area. Calculations were made of percent live coral cover from the photographs and are presented in Table 1. The percent cover calculation was done twice on the photograph taken during the baseline study showing little variation between calculations (8.8% and 8.7%). The calculation from the second photograph was lower (8.0%), however observations showed no damage.

Quadrat 2 shows no change as determined by field observations and visually comparing photographs. Calculations of percent live coral cover are lower in the photograph taken at the 4 wk observation (10.5%) than at the baseline survey (11.9%), however observations showed no damage or loss of coral.

Quadrat 3 shows no change as determined by field observations and visually comparing photographs. Calculations were made on the percent live coral cover from the baseline study photograph which showed 25.6% live coral cover with 20.8% M. annularis and 4.6% P. porites.

Quadrats 4, 5 and 6 are located directly across the channel from where the dredging is occurring. It is the closest area where corals can be found and is directly down current from the dredging operations. D. strigosa is the dominant coral found in the area. Corals are only found in the surf zone to about 1 meter depth of water. Photographing a full meter square in such

Table 1. Percent coral cover determined from gridding photographs taken at baseline study (6/10 or 24/89) and 8/13/89. Visual changes observed by divers are noted. The calculations was done twice from the same photograph in quadrat 1A to indicate repeatability.

Photoquadrat	6/10 or 24/89	8/13/89	Visual Change
1A	8.8% 8.7%	8.0%	none
2	11.9%	10.5%	none
3	25.6% (20.8% M.ann., 4.8% P.por)		none
7	from 8-13 photo 48.95%	46.10%	bleaching/death algal cover 2.85%
8	no change not computed		none
9	"		none
10	"		none
11	"		none
12	4.86% (4.15% D.str, .25% P.por, .46% other)	4.90% (4.45% D.str., .25% P.por .20% other)	suspected coral encroachment by algae

shallow water was impossible, therefore no quantitative analysis can be done on these corals.

Quadrat 4 has one coral head of D. strigosa which has tissue damage noted in the baseline study. To date it has shown no change. A photograph of the coral head taken at 4 wks is provided. The quadrat also contains P. porites and P. asteroides.

Quadrat 5 (reported as 6 in baseline study) was reported on 8-4-89 to have a worn area in one spot as determined from visual observation. A close-up photograph was taken on 8-17-89 to be later used for comparison.

Quadrat 6 (reported as 5 in baseline study) shows no change as determined from visual observation and from comparing photographs.

Quadrats 7, 8 and 9 are located on one transect and 10, 11, 12 on another transect both east of Ruth Island and across the entrance channel. The transects are upwind from the dredging site and are not expected to be impacted by sediment from dredging under the normal prevailing wind conditions. Quadrats 7, 8, and 9 are newly set-up and 10, 11 and 12 are quadrats that were set-up and photographed in 1987. As noted from comparing 1989 to 1987 photographs, extensive loss of corals has occurred in quadrats 10, 11 and 12. Because the photographic methods from 1987 differed from the present methods, quantitative measurements of the extent of the loss are not possible. However, there is obvious loss of corals and rough estimates can be made if necessary. This area is described in Prince-Tams (1984) as TR1C, TR1E and TR1F. Percent of live coral cover was estimated at between 5 and 10.

Quadrat 7 (reported as 9 in baseline study) is showing considerable change in the A. palmata. Based on the photograph taken on 8-13-89 the percent live coral cover was estimated at 46.1%. Using the same photograph, the percent live coral cover at baseline was 49.0%, thus there is a 2.9% loss. Observations by Hank Tonnemacher indicate that the coral polyps first became bleached and then they died and were replace by algal cover. Thus the white spots seen on the coral are dead coral covered with algae. This all happened since the baseline study on 6-24-89. Because of the change in the placement of the meter square between sampling dates, the photograph taken on 8-13-89 was used to calculate percent live coral cover. Since coral death was within this percentage the calculation is valid.

Other corals present in quadrat 7 are D. strigosa, P. porites and Agaricia agaricites.

Quadrat 8 shows no change. Other corals present in this quadrat are P. asteroides and M. annularis.

Quadrat 9 (reported as 7 in baseline study) shows no change. Other corals present in this quadrat are A. agaricites, D. strigosa and Madracis mirabilis.

Quadrat 10 shows no change. Quadrat 10 (reported in the baseline and 1987 as 11) has other corals present in the quadrat which are D. strigosa and P. porites.

Quadrat 11 shows no change. Quadrat 11 (reported in baseline and 1987 as 10) is an original 1987 quadrat dominated by D. strigosa and M. annularis.

Quadrat 12 . Quadrat 12 is one of the original 1987 quadrats. It is dominated by D. strigosa and P. porites. Several other corals were observed in the quadrat but are difficult to identify on the photograph. These colonies will be routinely examined during the weekly diver observation. There are small colonies of M. alcicornis, S. siderea, A. agaricites, P. asteroides and D. strigosa. Examining photographs from 1987 show that there has been considerable decrease in the percent of live coral cover especially of the two dominant species.

On 7-19-89 it was reported by Hank Tonnemacher that he felt that algae seemed to be encroaching on the live coral on the large D. strigosa head in quadrat 12. During the survey on 8-13-89, a cut nail was placed into the algae portion at the edge of the algal growth. A close-up photograph was taken at this time and will be evaluated later to determine if coral is actually being lost.

DISCUSSION

Changes have occurred in the corals on four of the twelve quadrats. These changes don't seem to be of major significance at presence except for quadrat 7 where portions of the A. palmata have died. It appears from the description that the A. palmata was a victim of the "bleaching" phenomenon described throughout the Caribbean and Florida. Since this occurrence was upwind of the dredging and the water quality of the area satisfactory, the bleaching can in no way be associated with the dredging operation.

At the present time all water quality data have been satisfactory and in accordance with the specification dictated by the Department of Planning and Natural Resources Division of Environmental Protection.

The monitoring will continue in the same rigorous manner which it has been accomplished to date. The corals exhibiting stress will be of particular concern as well as evaluating the health of all the corals in the quadrats.

REFERENCES

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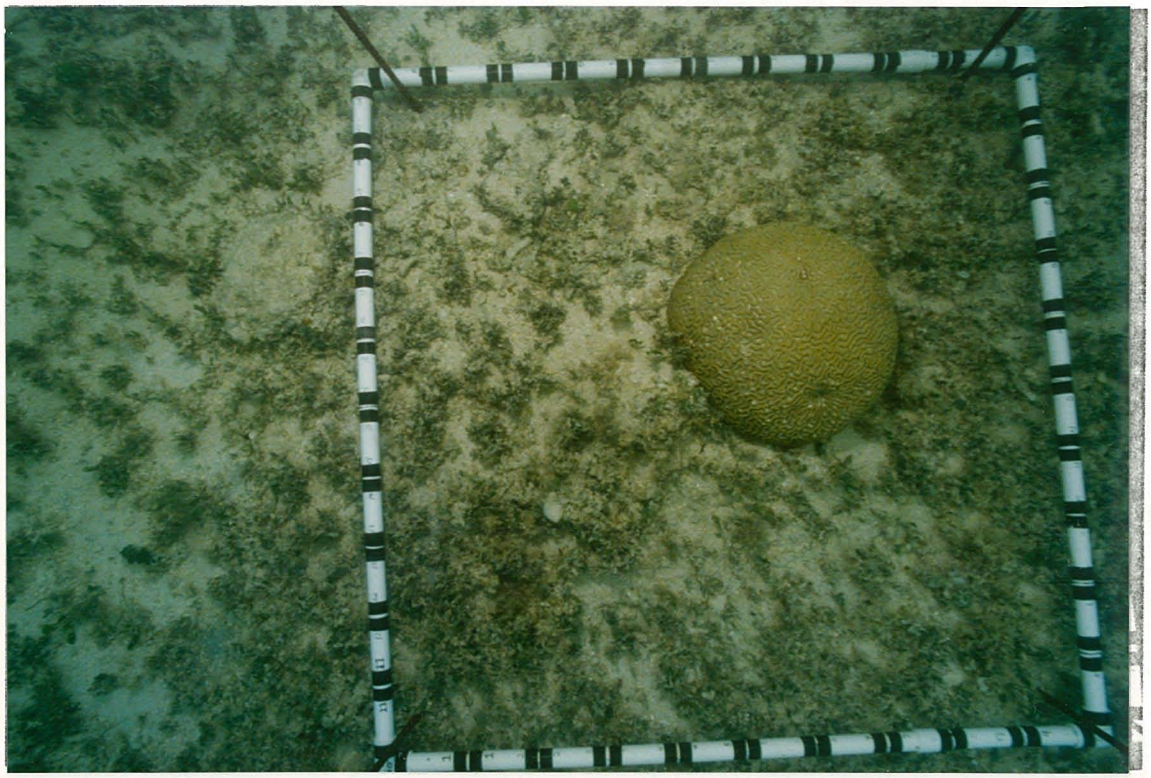
EPA-600/4-79-020. 1983. Methods for Chemical Analysis of Water and Wastes. Environ. Monitoring and Support Lab., Cincinnati, Ohio.

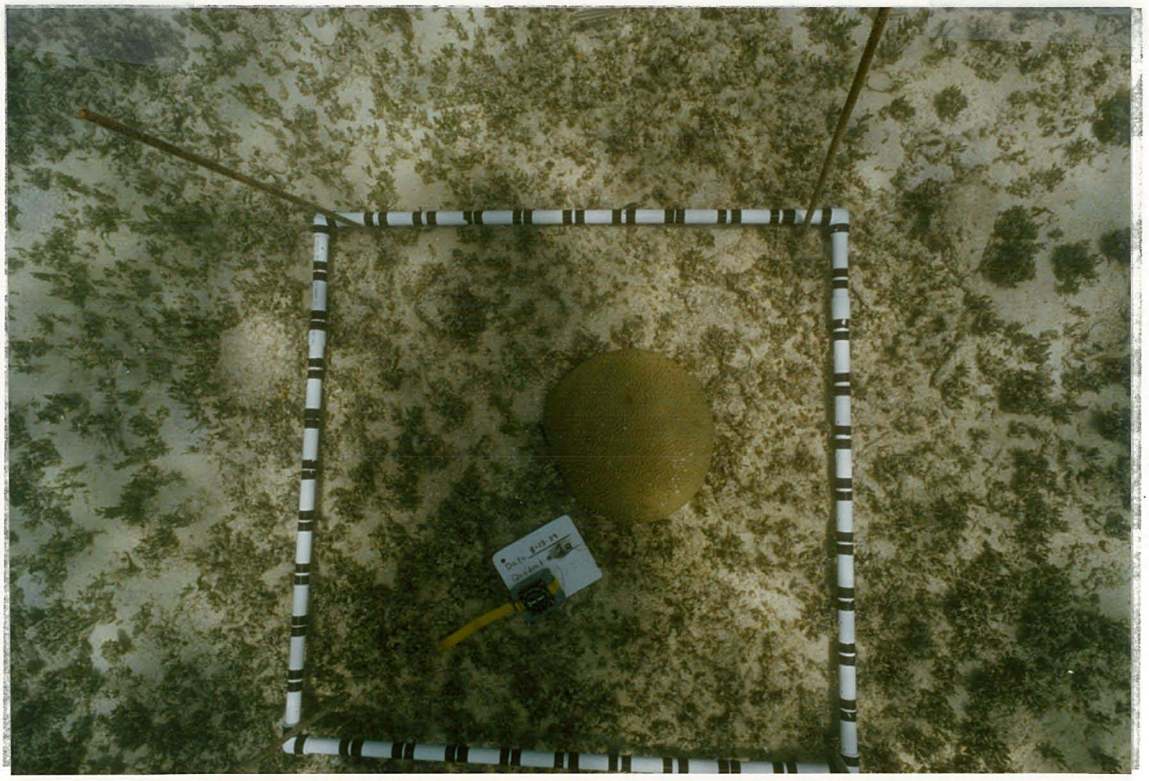
Prince-Tams Joint Venture. 1984. Environmental Assessment Report for Third Port Project, South Shore - St. Croix - U.S. Virgin Islands, Vol 1 & 2, Prep. V. I Port Authority.

ACKNOWLEDGMENTS

Photographs taken on 6-10-89 and 6-24-89 were by Michael Paul Herko. Photographs taken on 8-13-89 were by Henry Tonnemacher.



Photoquadrat (1A): Single head of Diploria strigosa taken on 6-10-89.

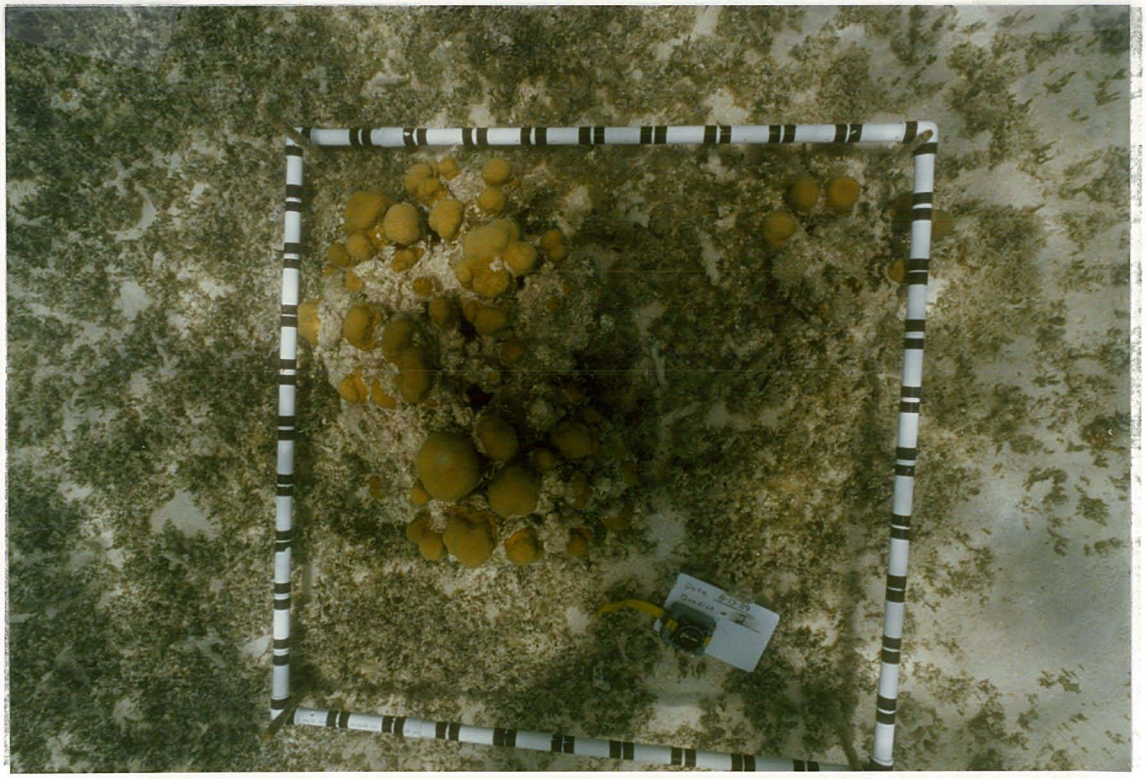


Photoquadrat (1A): Same as above taken on 8-13-89.

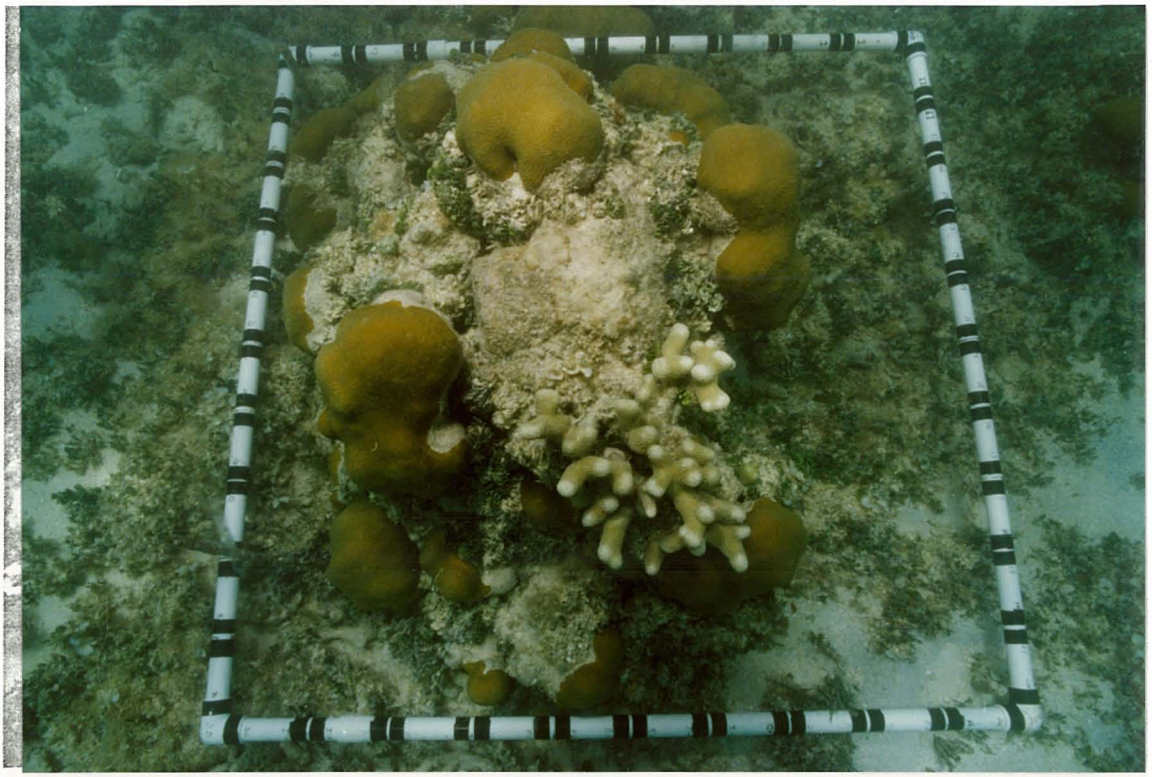
Photoquadrat (1A): Single head of Diploria strigosa close up showing sediment particles. However, no damage to coral was visible at the 8-13-89 observation.

Photo of reef area just south of station #2. A healthy colony of Eusmilia fastigiata is seen on a presumably sediment damaged head of Siderastrea siderea. Several such healthy colonies were conspicuous in this area where heavy sediment damage is evident.

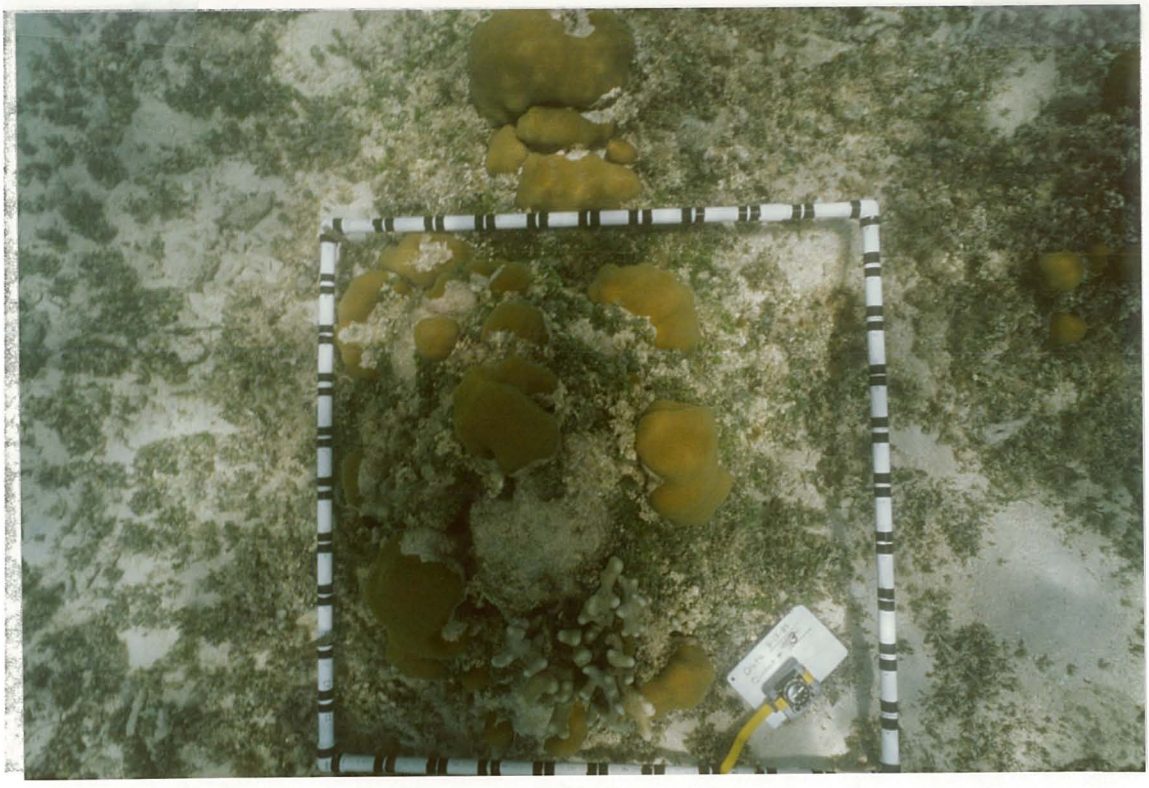
Photoquadrat (2): Small heads of Montastrea annularis taken on 6-10-89.



Photoquadrat (2): Same as above taken on 8-13-89.



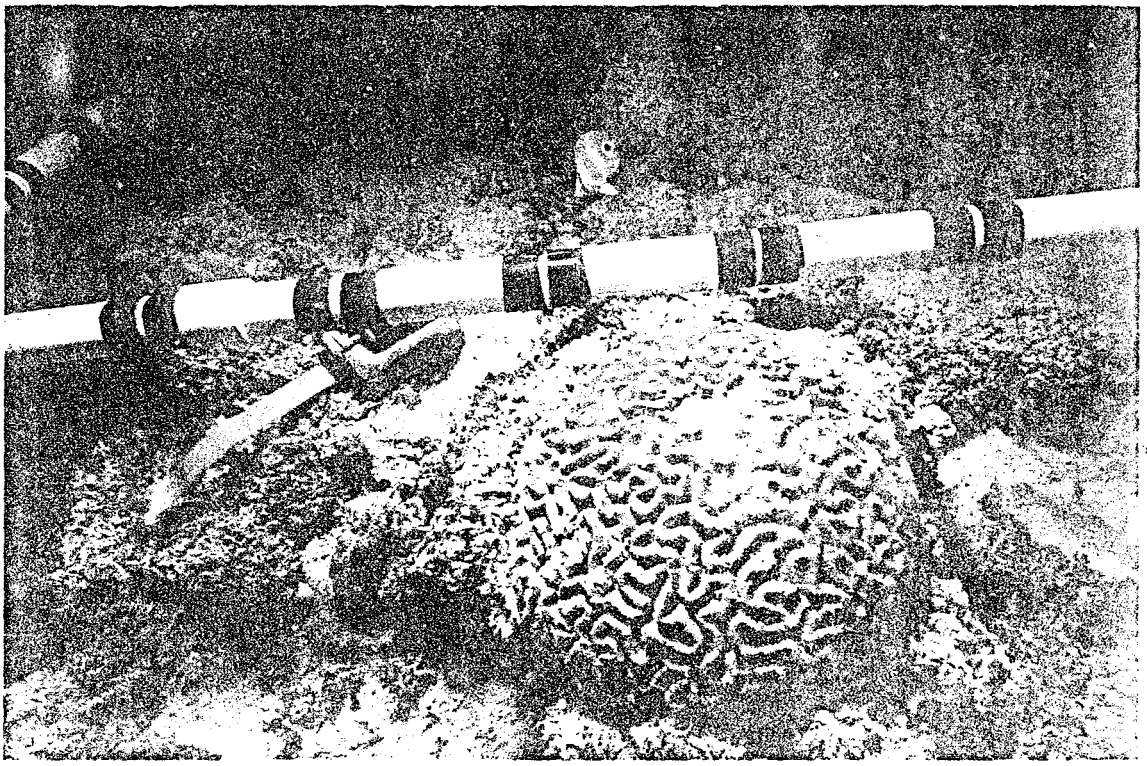
Photoquadrat (3): Montastrea annularis and Porites porites taken on 6-10-89.



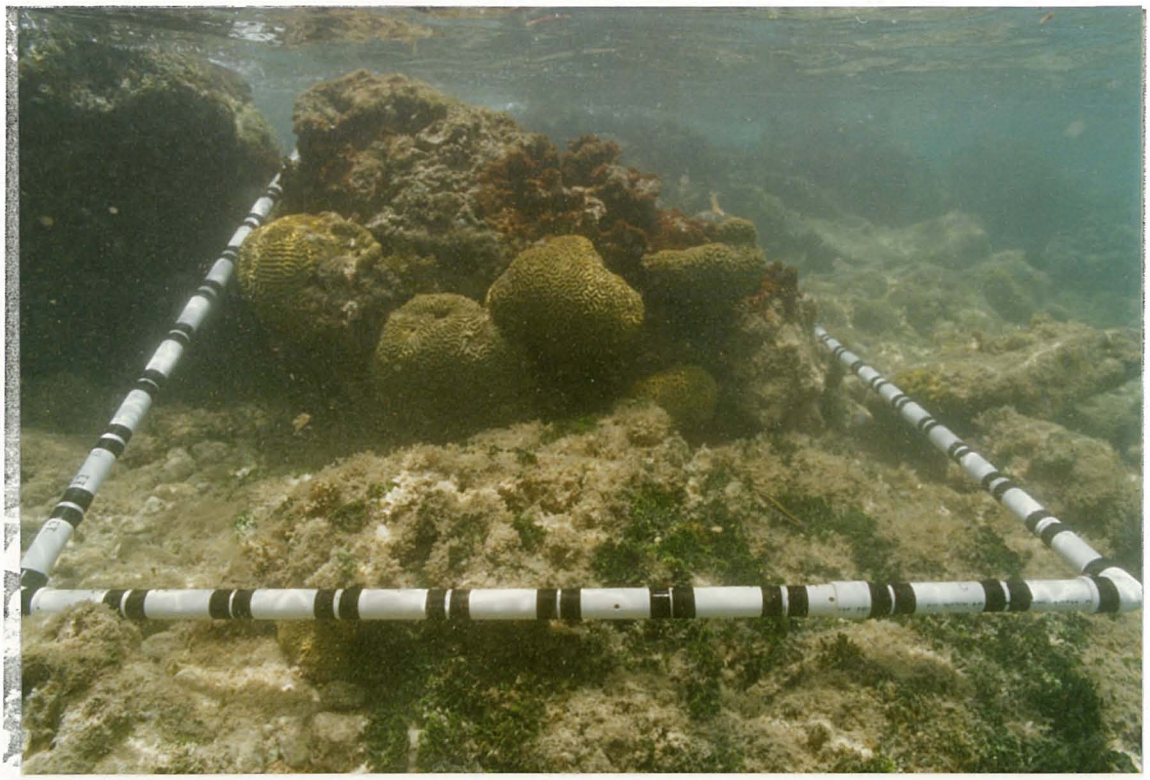
Photoquadrat (3): Same as above taken on 8-13-89.

Photoquadrat (4): Small heads of Diploria strigosa taken on 6-24-89. Porites porites and P. asteroides also present but not shown in photograph.

Photoquadrat (4): Same as above taken on 8-13-89 but at a different angle so that the P. asteriodes was visible. This angle will be used for all future photographs.



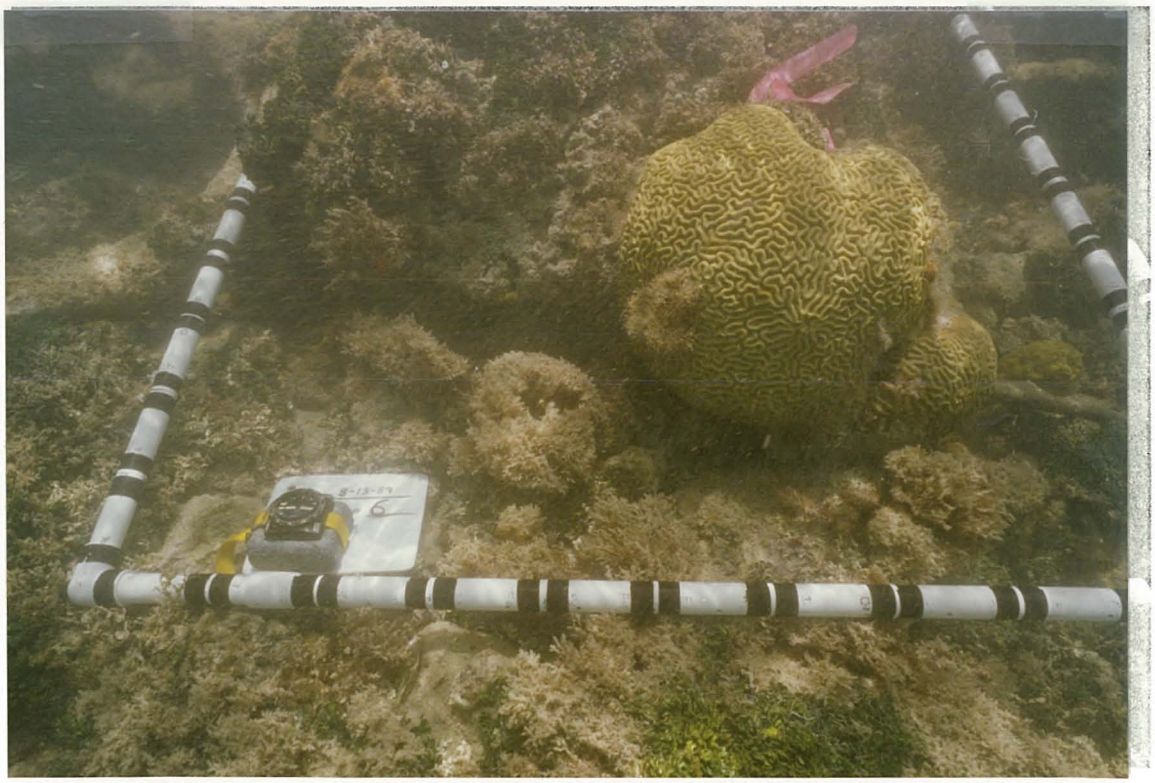
Photograph of the stressed coral head of Diploria strigosa found in quadrat 4.



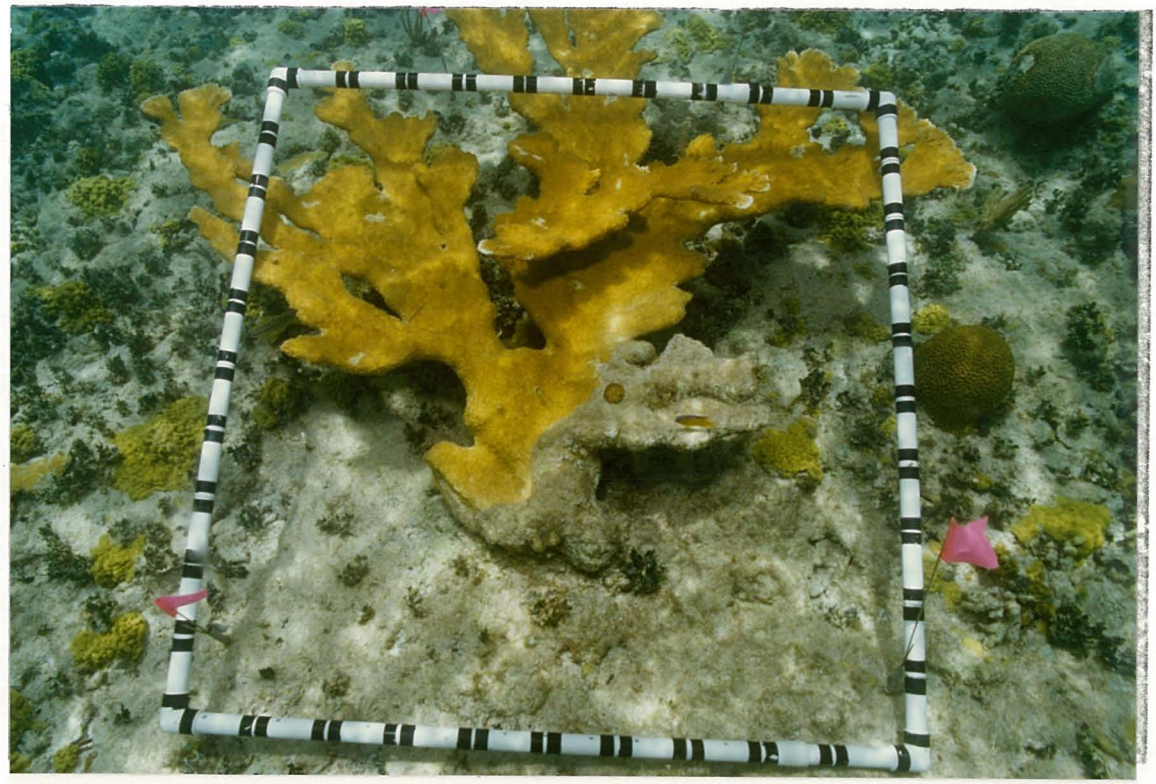
Photoquadrat (5): Small heads of Diploria strigosa taken on 6-24-89 (listed in baseline report as #6).

Photoquadrat (5): Same as above taken on 8-13-89.

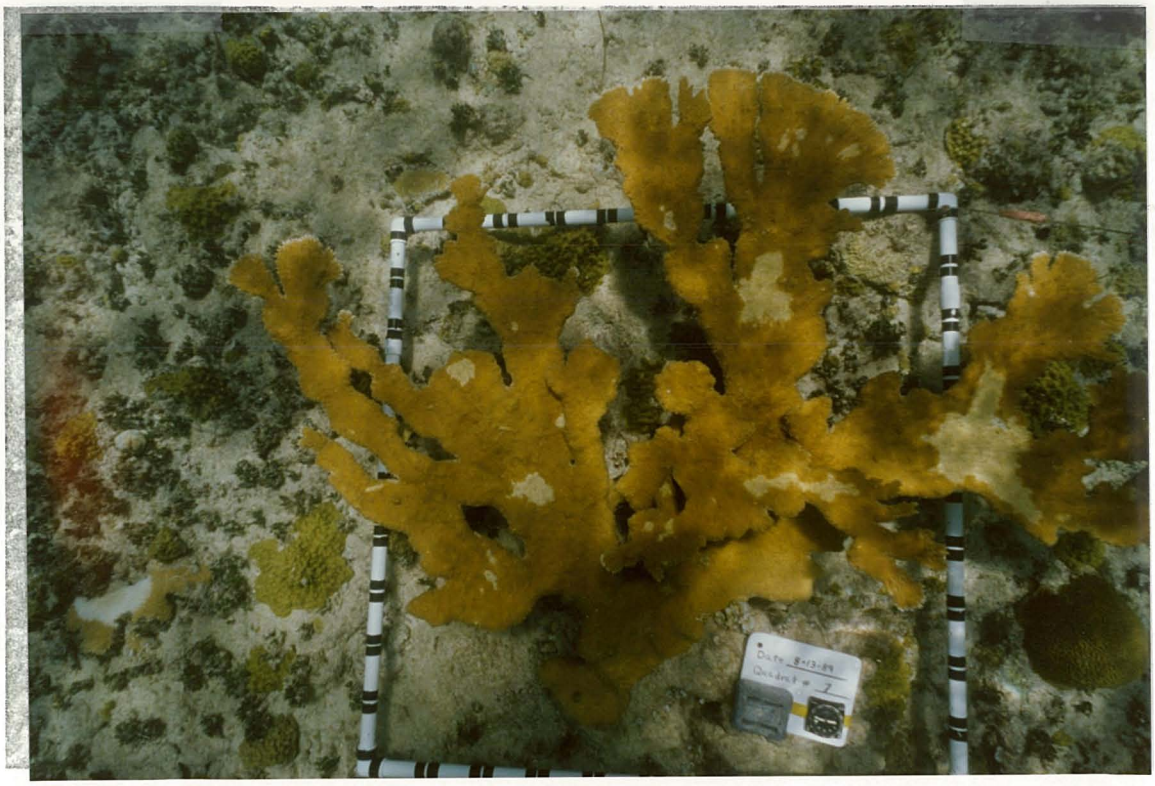
Photoquadrat (6): Small heads of Diploria strigosa and several patches of Porites asteroides taken on 6-24-89 (listed in baseline report as #5).



Photoquadrat (6): Same as above taken on 8-13-89.

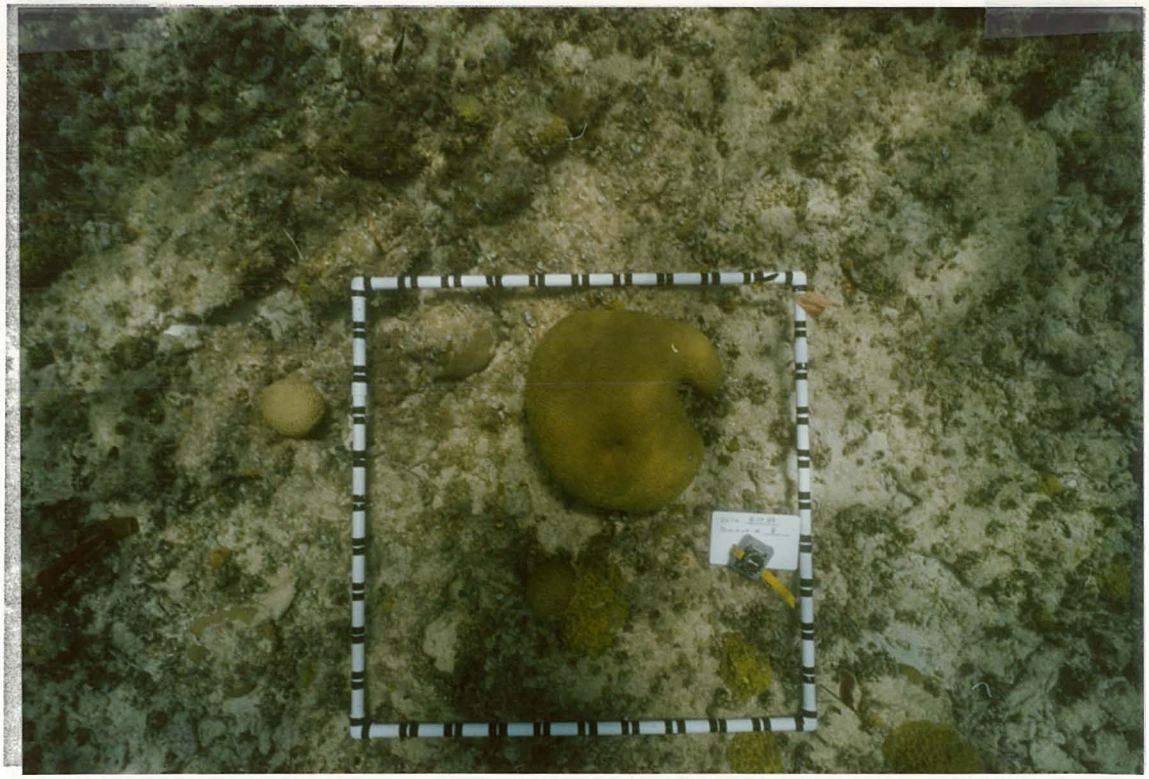


Photoquadrat (7): Acropora palmata with patches of Diploria strigosa, Porites asteroides and Agaricia agaricites taken on 6-24-89 (listed in baseline report as #9).



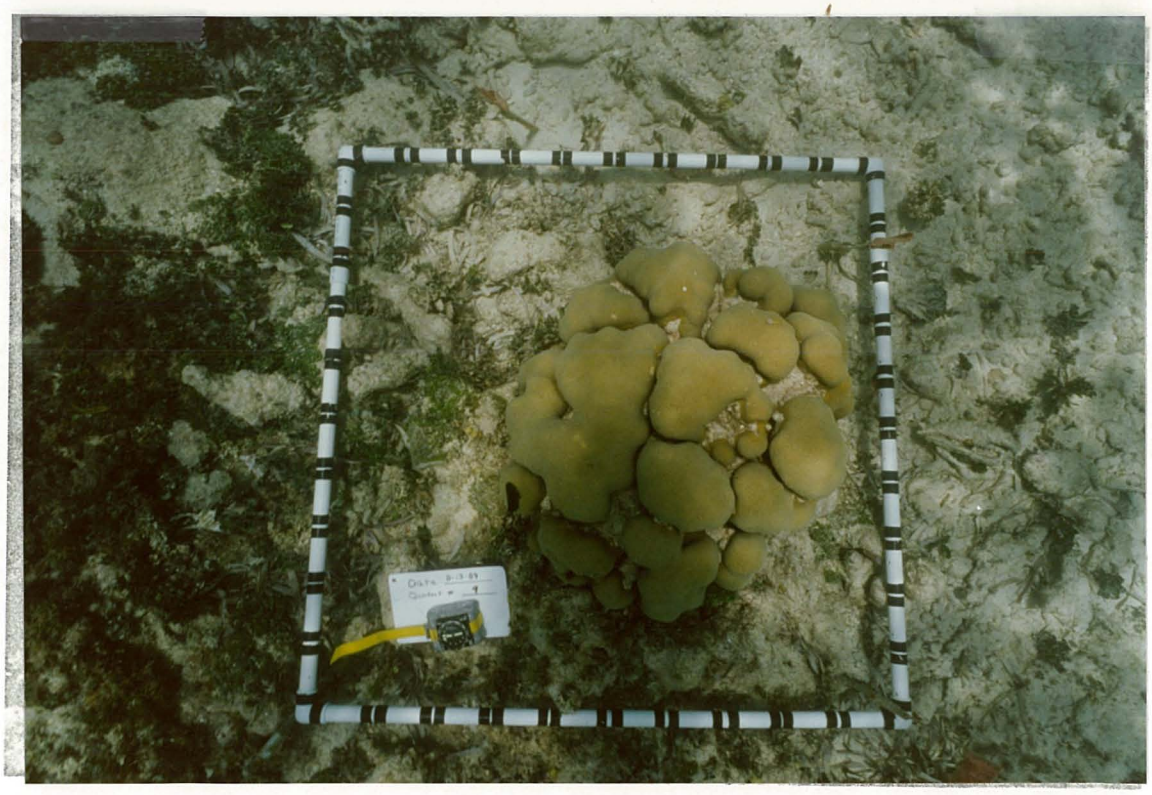
Photoquadrat (7): Same as above taken on 8-13-89.

Photoquadrat (8): Large and small heads of Diploria strigosa, several patches of Porites asteroides and a small patch of Montastrea annularis taken 6-24-89.

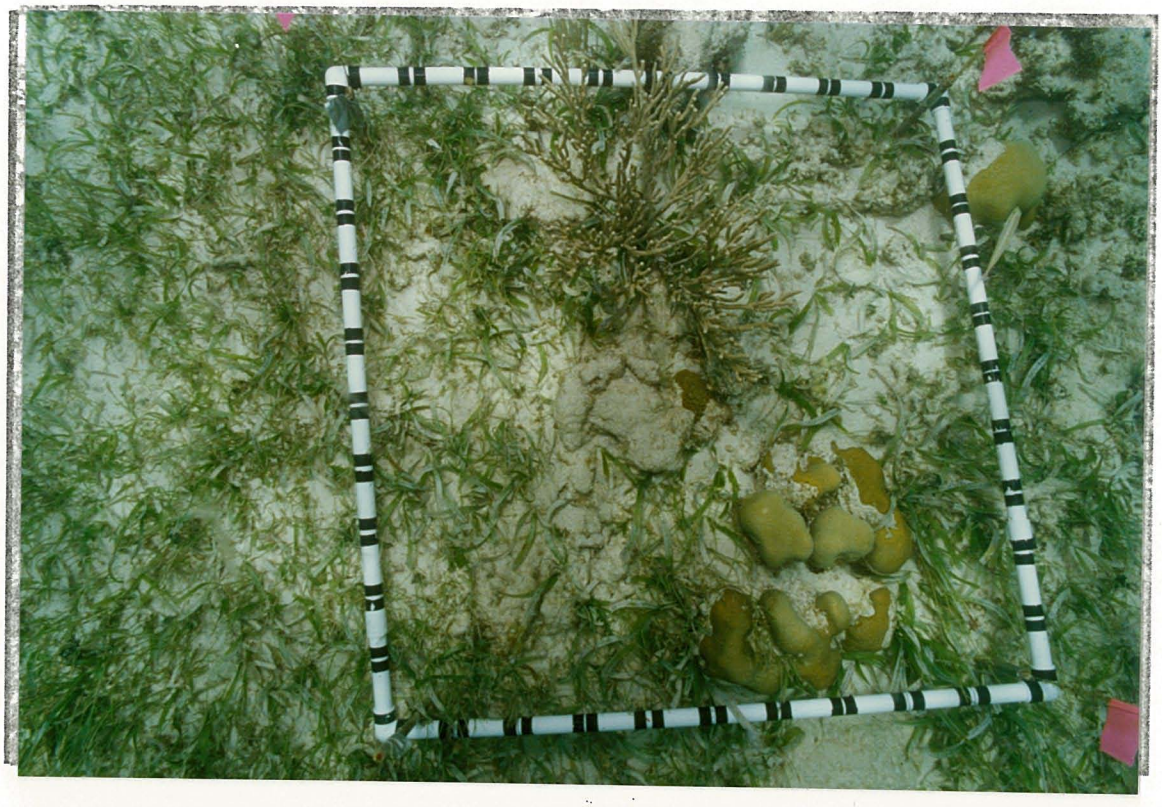


Photoquadrat (8): Same as above taken on 8-13-89.

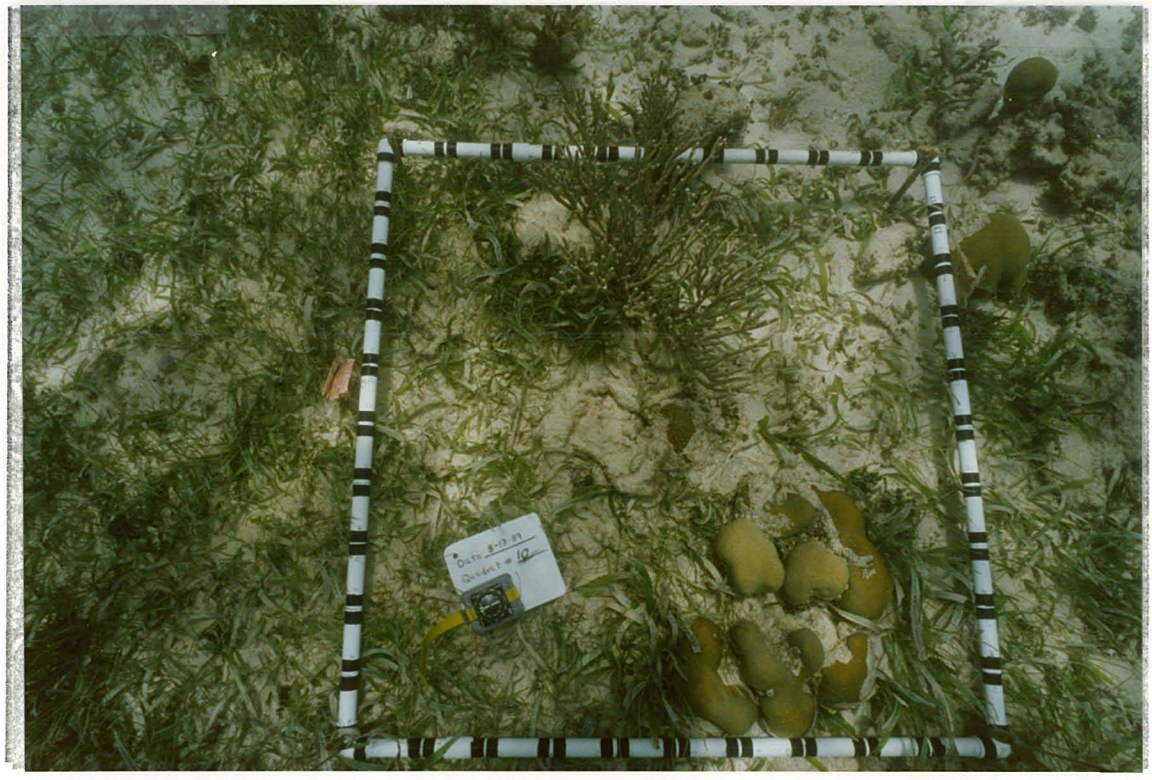
Photoquadrat (9): Montastrea annularis with small colonies of Agaricia agaricites, Diploria strigosa and Madracis mirabilis.



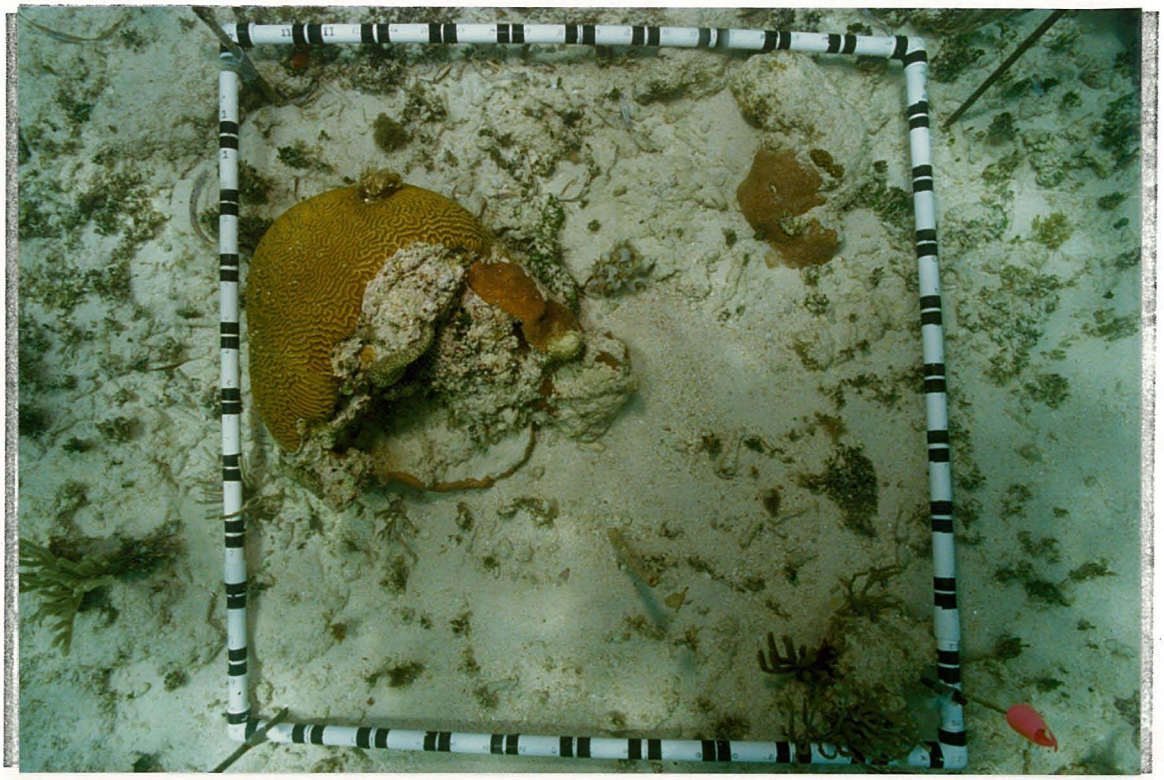
Photoquadrat (9): Same as above taken on 8-13-89.



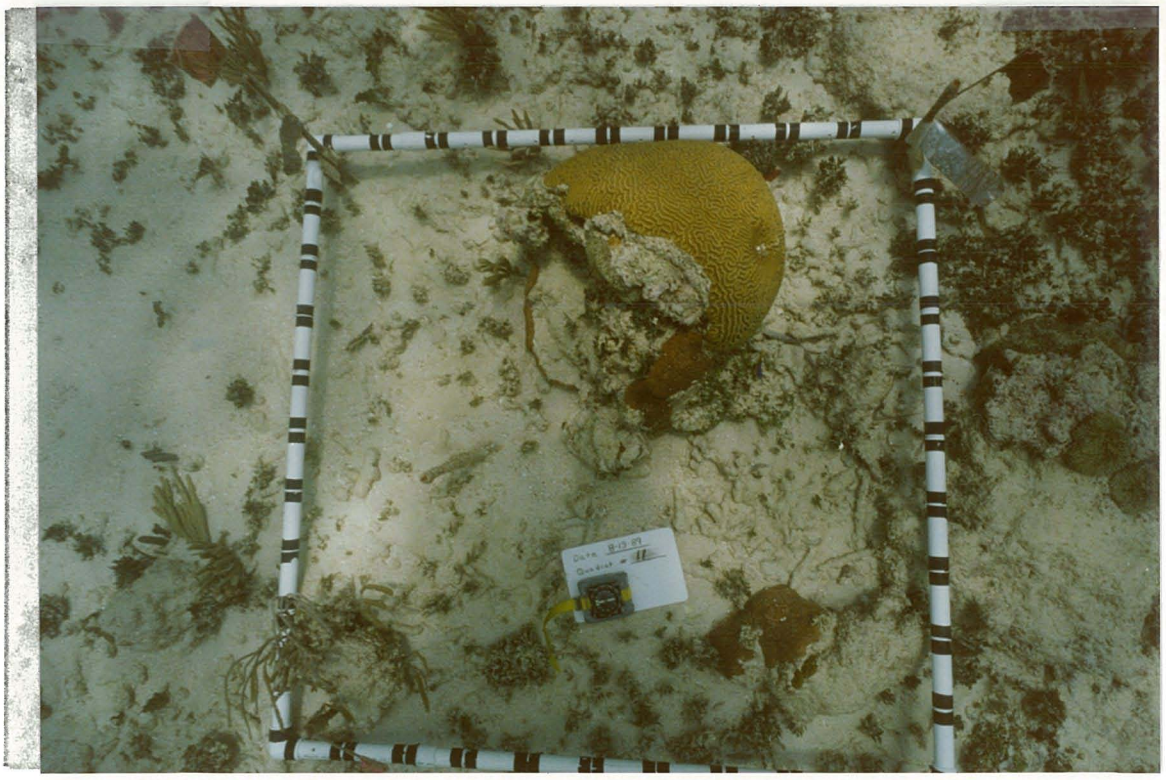
Photoquadrat (10): An original 1987 quadrat (#11) containing Montastrea annularis and two very small colonies of Diploria strigosa and Porites porites this photo taken 6-24-89.



Photoquadrat (10): Same as above taken on 8-13-89.



Photoquadrat (11): An original 1987 quadrat (#10) containing Montastrea annularis and Diploria strigosa with small colonies of Siderastrea siderea, Agaricia agaricites, Porites porites, and Madracis mirabilis. This photo taken 6-24-89 (listed in baseline report as #10).



Photoquadrat (11): Same as above taken on 8-13-89.

Photoquadrat (12): An original 1987 quadrat (#12) containing Diploria strigosa with small colonies of Porites porites, P. asteroides, Siderastrea siderea, Millipora alcicornis and Agaricia agaricites. This photo taken 6-24-89.

Photoquadrat (12): Same as above taken on 8-13-89.

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Water Quality Monitoring Project / Third Port, St. Croix

Progress Report

October 21, 1989

Submitted by

Mary Lou Coulston, Ph.D.

Island Resources Foundation, Inc.

SUMMARY:

Twelve permanently marked benthic quadrats were photographed before and after Hurricane Hugo on 9/13/89 and 10/10/89. Three of the quadrats were destroyed by the storm and can no longer be used in the monitoring study. Three new quadrats were selected and photographed and have replaced the original sites.

INTRODUCTION

All quadrats were photographed on 9/13/89 by Hank Tonnemacher and were surveyed by Hank Tonnemacher and Dr. Mary Lou Coulston on 9/16/89 just prior to Hurricane Hugo. Photographs taken of each quadrat are appended to this report. On 10/14, almost a month after Hurricane Hugo, the quadrats were revisited for inspection by Coulston and Tonnemacher. At that time Mr. Tonnemacher had relocated 11 of the original quadrats and photographed them on 10/10/89. Those photographs are also appended here and appear with their pre-Hugo counterpart. Quadrat 2 was never found, but the extensive amount of rubble and sand in the general area indicated that the site was buried. Quadrats 6 and 11 were photographed even though no coral remained present. Apparently the hurricane removed all the live coral from these two quadrats.

QUADRAT ANALYSIS

The following is a summary of the status of the twelve benthic quadrats following Hurricane Hugo:

Quadrat 1a	Intact, no visible change.
Quadrat 2	Buried under rubble and no longer visible.
Quadrat 3	M. annularis shows no change, P. porites was entirely destroyed.
Quadrat 4	Area severely scoured and increased sand deposits. Previously noted dying D. strigosa head shows further deterioration.
Quadrat 5	Intact, no visible change.
Quadrat 6	Solitary D. strigosa head gone, no other coral present.
Quadrat 7	Large portion of the Acropora palmata head broken off and not in the area.
Quadrat 8	Intact, no visible change.
Quadrat 9	The entire head of M. annularis was broken off and moved approximately .25m to the south and slightly tilted on its side.
Quadrat 10	M. annularis intact, but very noticeable sand deposits covering surrounding vegetation.
Quadrat 11	Head of D. strigosa gone and not located.
Quadrat 12	Area scoured, but live coral remains intact.

Three new quadrats were selected to replace Quadrats 2, 6 and 11. They are being numbered 2a, 6a and 11a. These were photographed by Tonnemacher on 10/18/89. The three new quadrats photographs also appear in this report.

Quadrat 2a is dominated by small heads of Montastrea annularis with some Diploria strigosa also present.

Quadrat 6a has one large head of D. strigosa and one small head Porites asteroides.

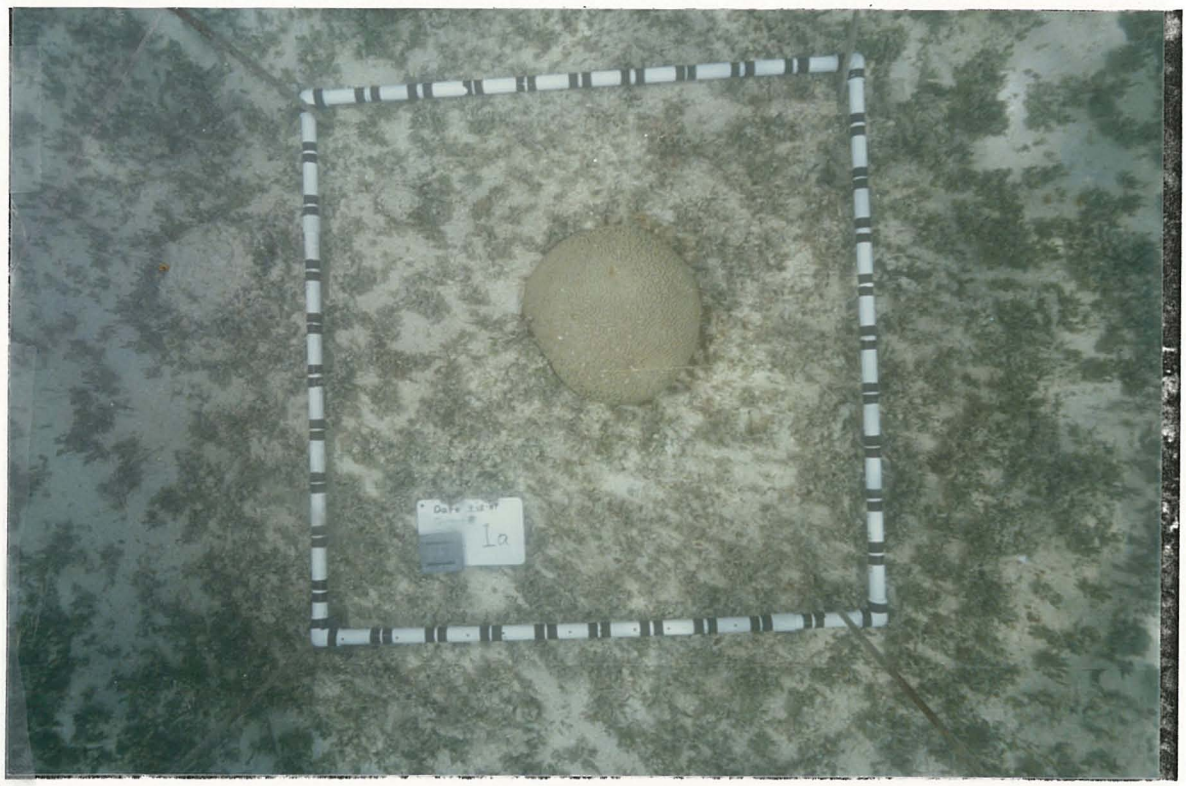
Quadrat 11a is a portion of a large head of M. annularis.

During the inspection on 10/14/89 it was noted that there was a noticeable filamentous green algal bloom in the area of quadrat 2a. The algae was identified as Chaetomorpha linum. It was only after the storm that this algae was observed here. The tremendous quantity of algae indicates a nutrient input entering the area.

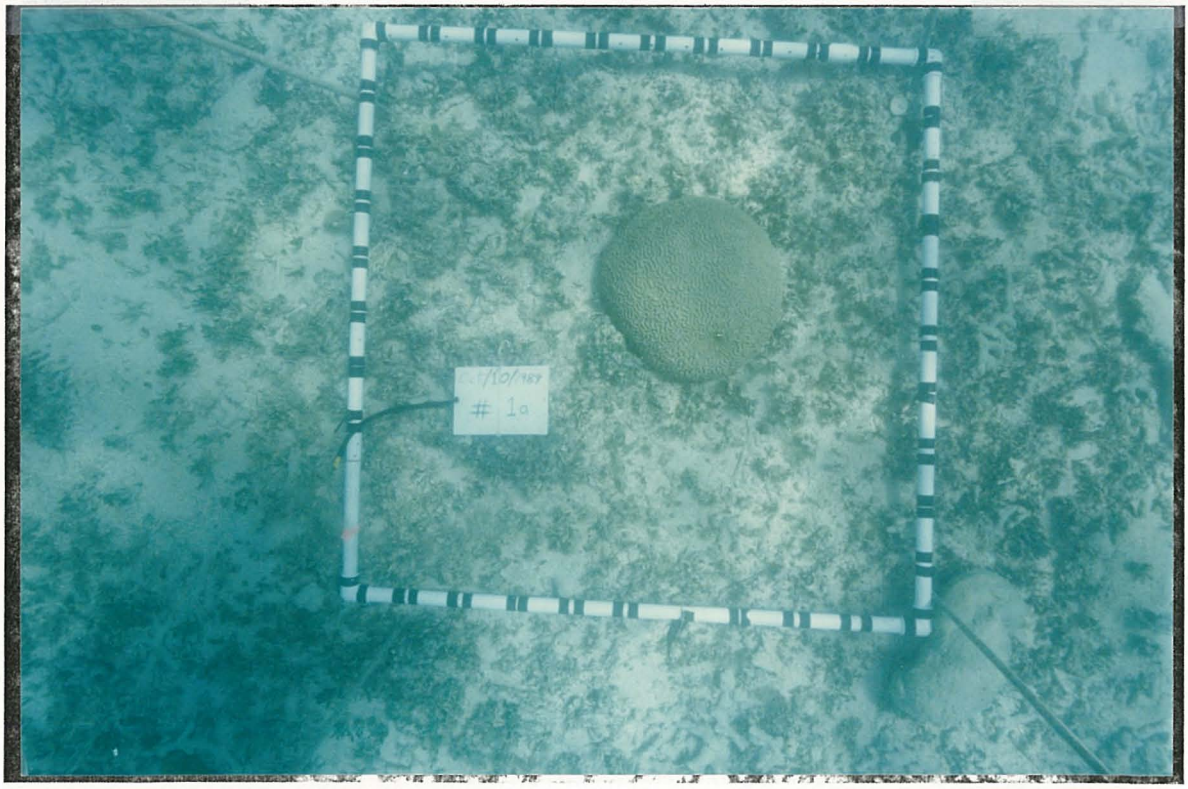
SUMMARY

Hurricane Hugo affected the study areas by causing damage and destruction to delicate coral such as A. palmata and P. porites. Even though there was much scouring, most of the large heads suffered little damage. Coral heads attached by narrow bases were broken off, moved and sometimes swept away. Three of twelve quadrats had all the coral removed and had to be replace by newly established quadrats for this study.

A general overview of the area indicated that delicate corals all around were destroyed. Large heads of A. palmata were seen broken off and strewn all around the area. White scars were visible where heads had been broken off from their bases. The seagrass beds seemed stable in most areas except where they were covered by debris and sand just behind the shallow reef areas. It appears that the algae (mainly Halimeda) and seagrasses acted to stabilize sediments of the area preventing considerable erosion. The amount of healthy, intact seagrass was impressive.



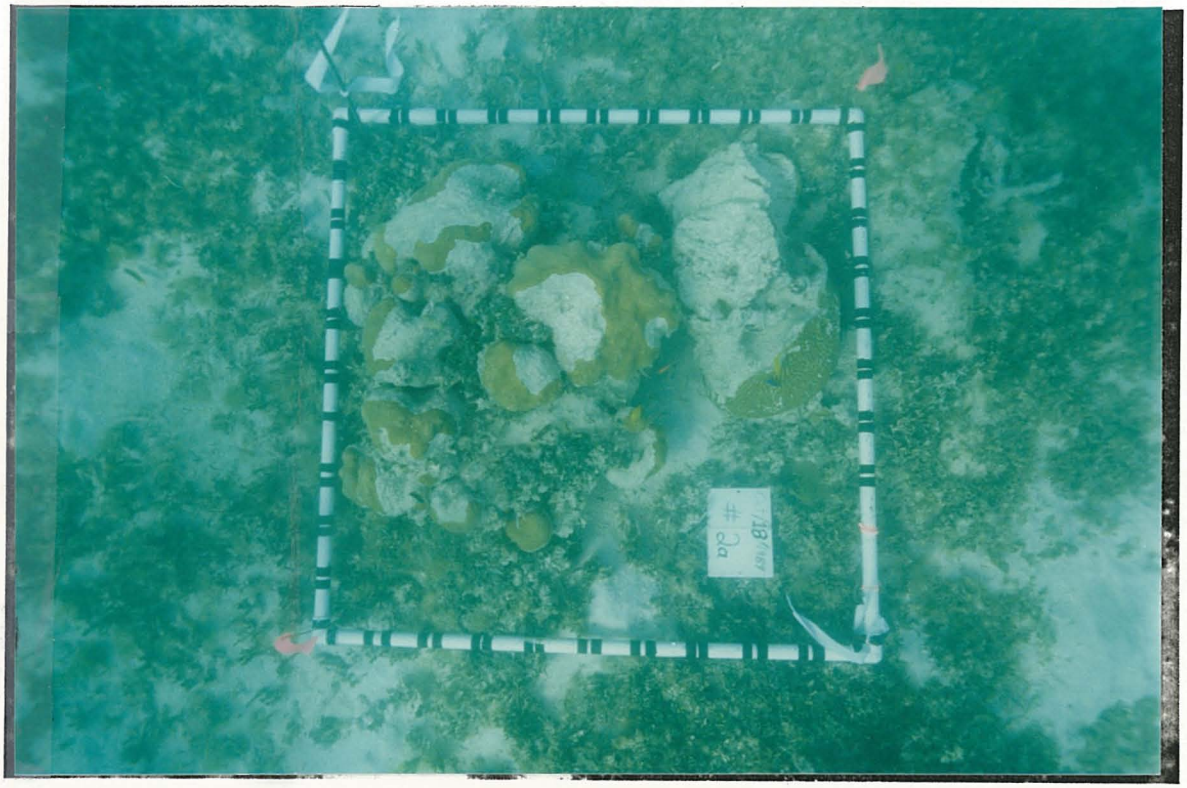
Quadrat 1a. Photograph taken 9/13/89.



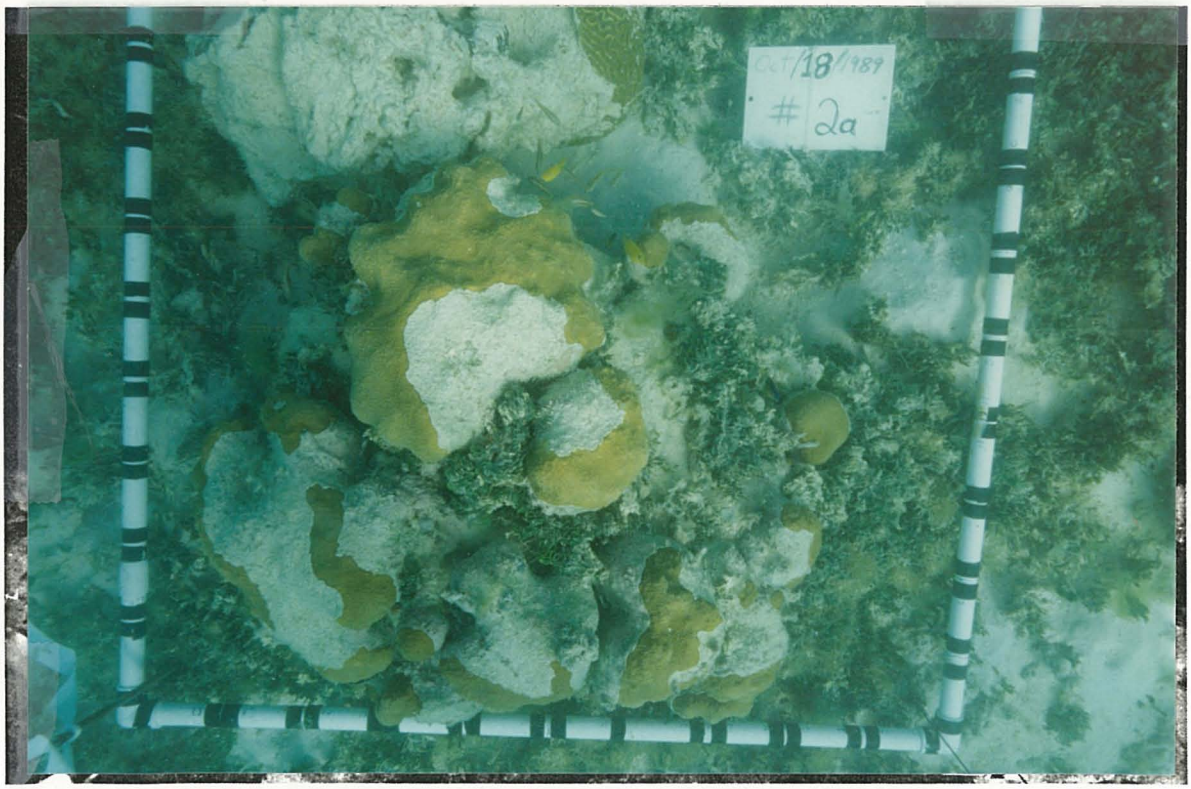
Quadrat 1a. Photograph taken 10/10/89. No visible change had occurred.

Quadrat 2. Photograph taken 9/13/89

Quadrat 2 site now buried under rubble.

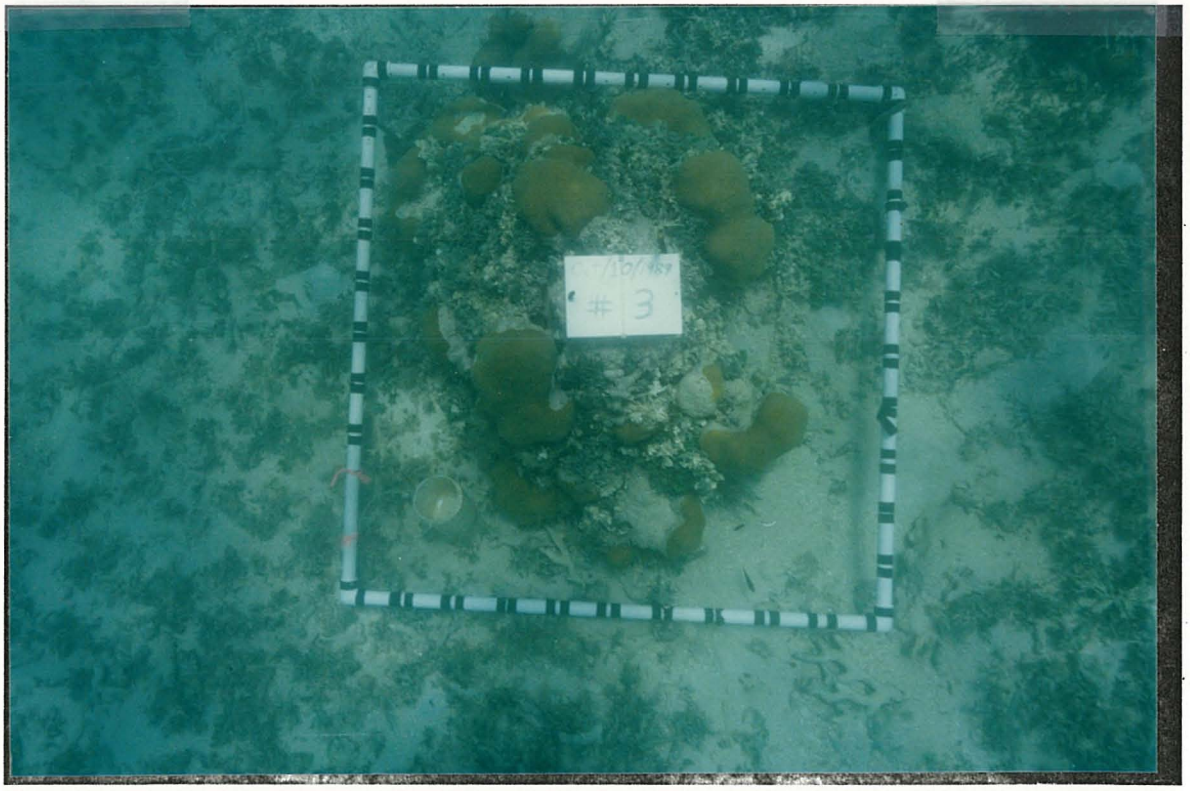


Quadrat 2a. Photograph taken 10/18/89. New site selected to replace 2.

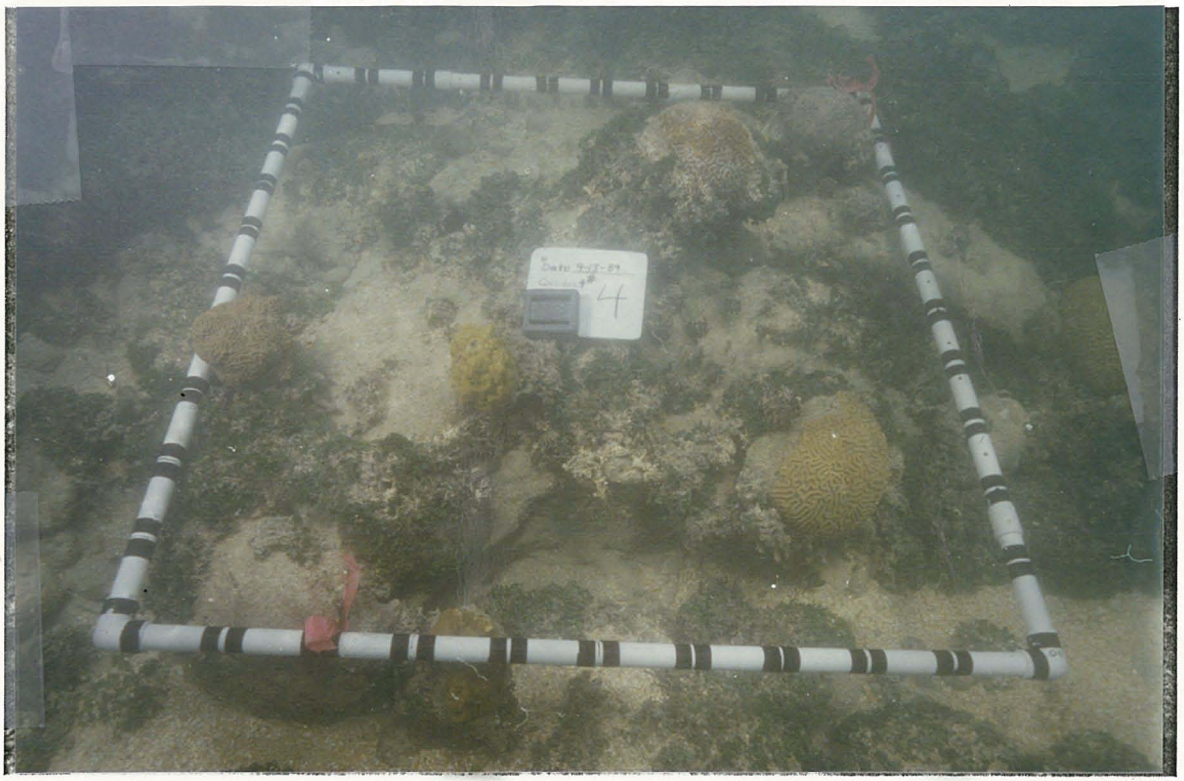


Quadrat 2a. Closer exposure of 2a for details and coral identification.

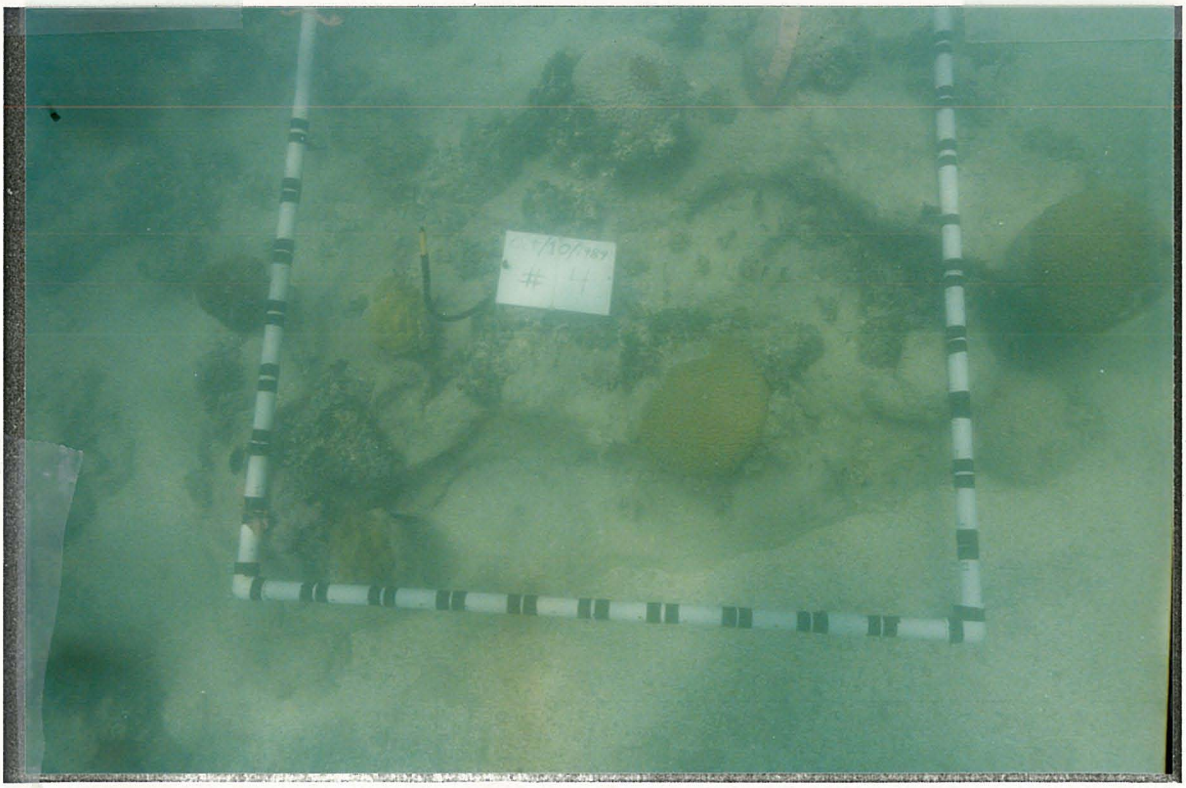
Quadrat 3. Photographed 9/13/89.



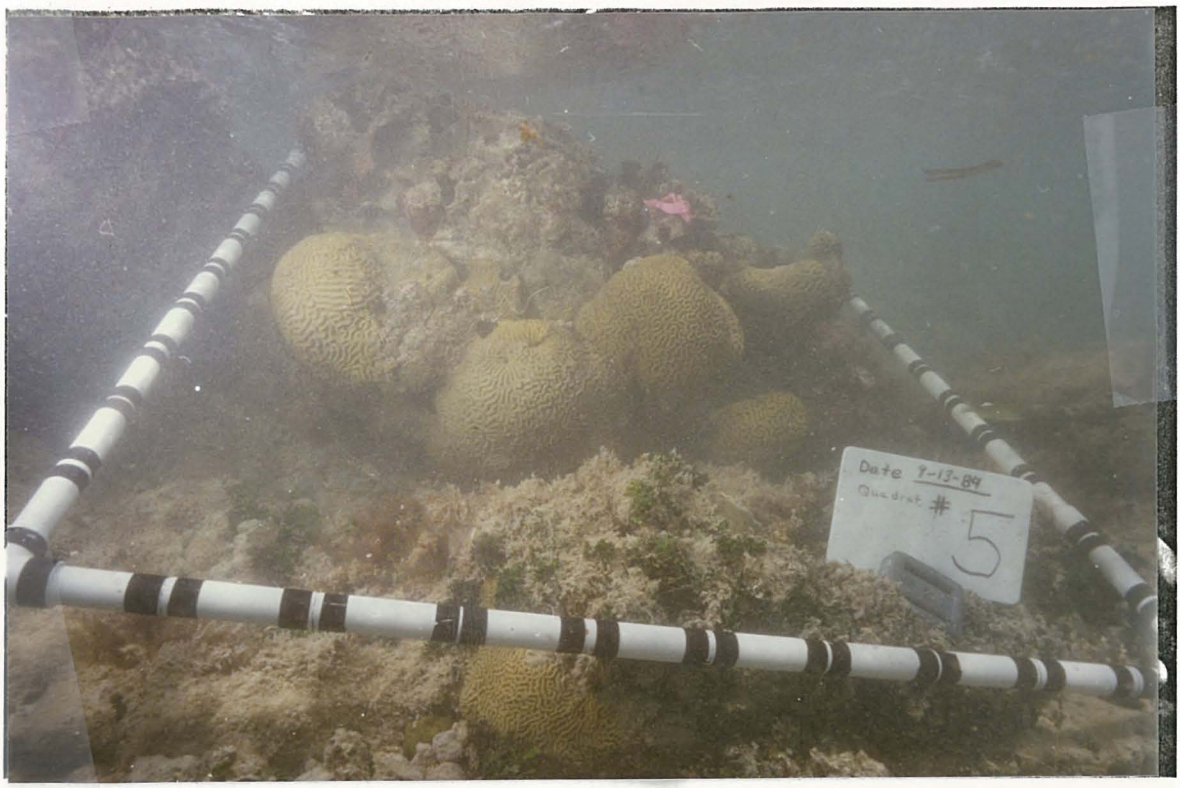
Quadrat 3. Photograph taken 10/10/89. All P. porites hadbroken off.



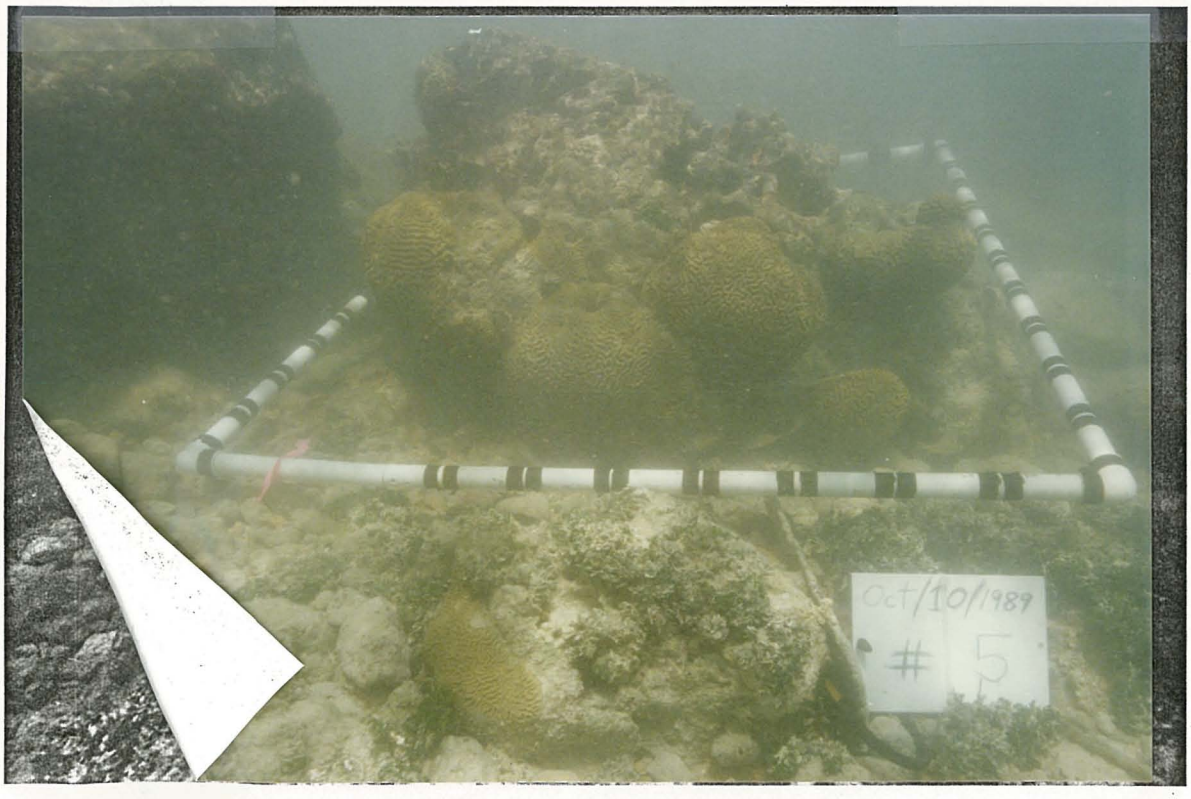
Quadrat 4. Photograph taken 9/31/89.



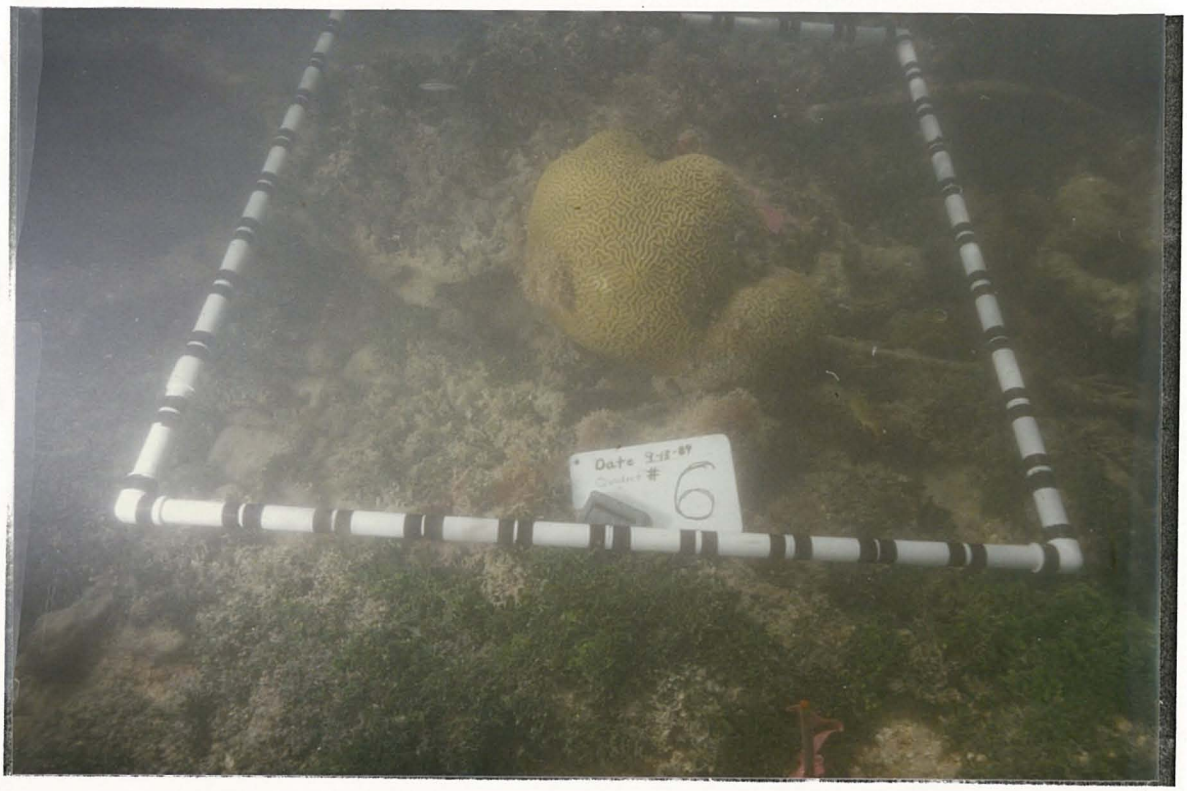
Quadrat 4. Photograph taken 10/10/89. Previously noted dying D. strigosa head shows further deterioration.



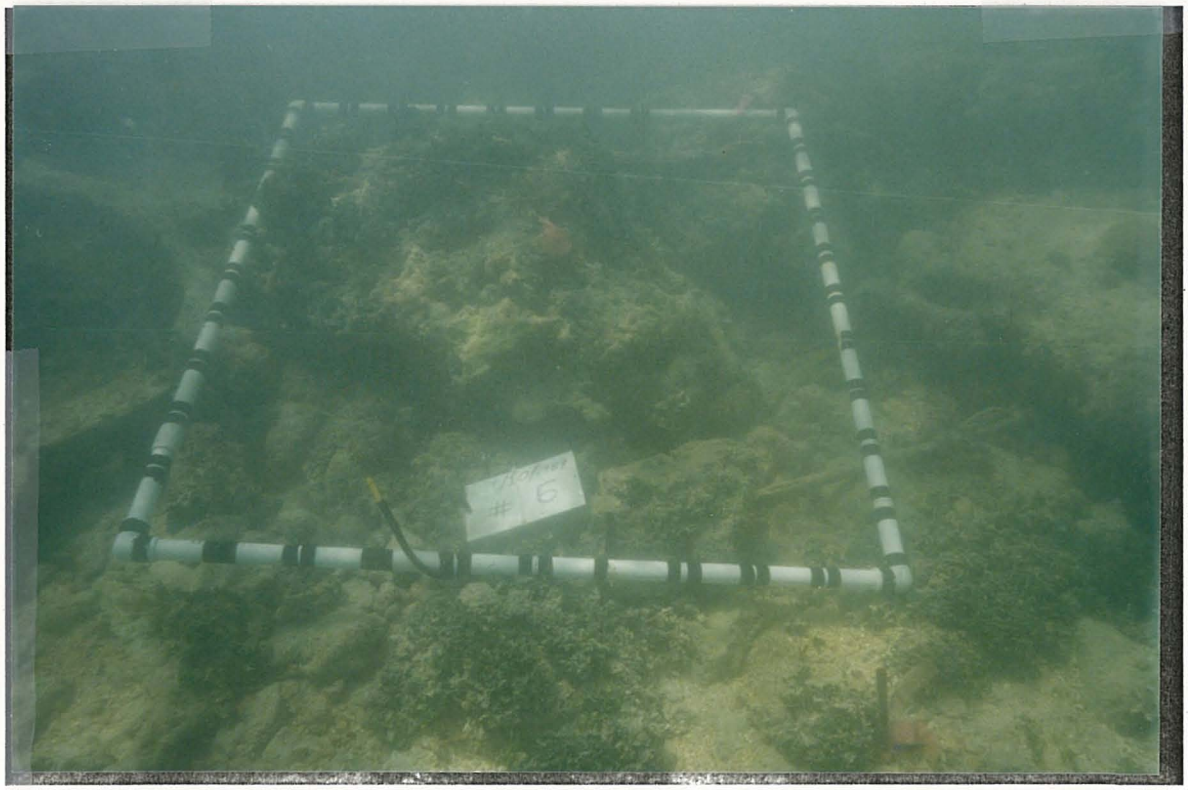
Quadrat 5. Photograph taken 9/31/89.



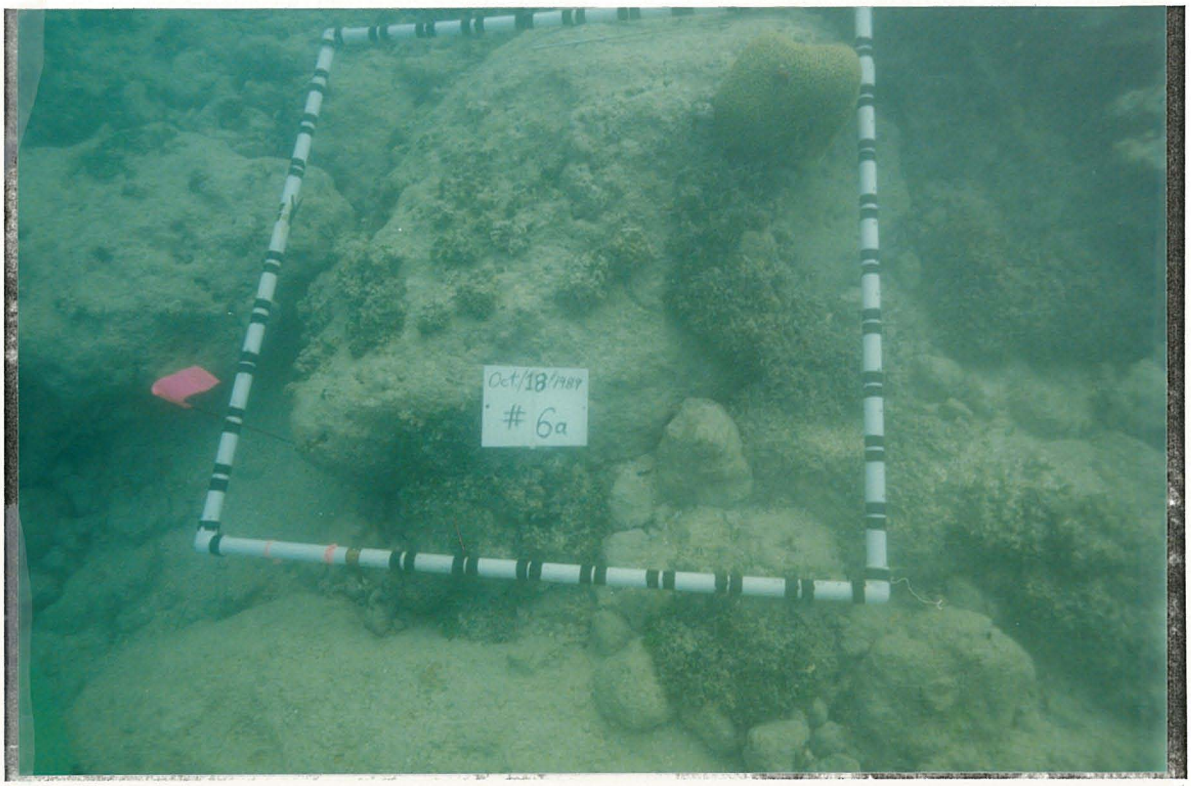
Quadrat 5. Photographed 10/10/89. No visible change noted.



Quadrat 6. Photographed 9/31/89.

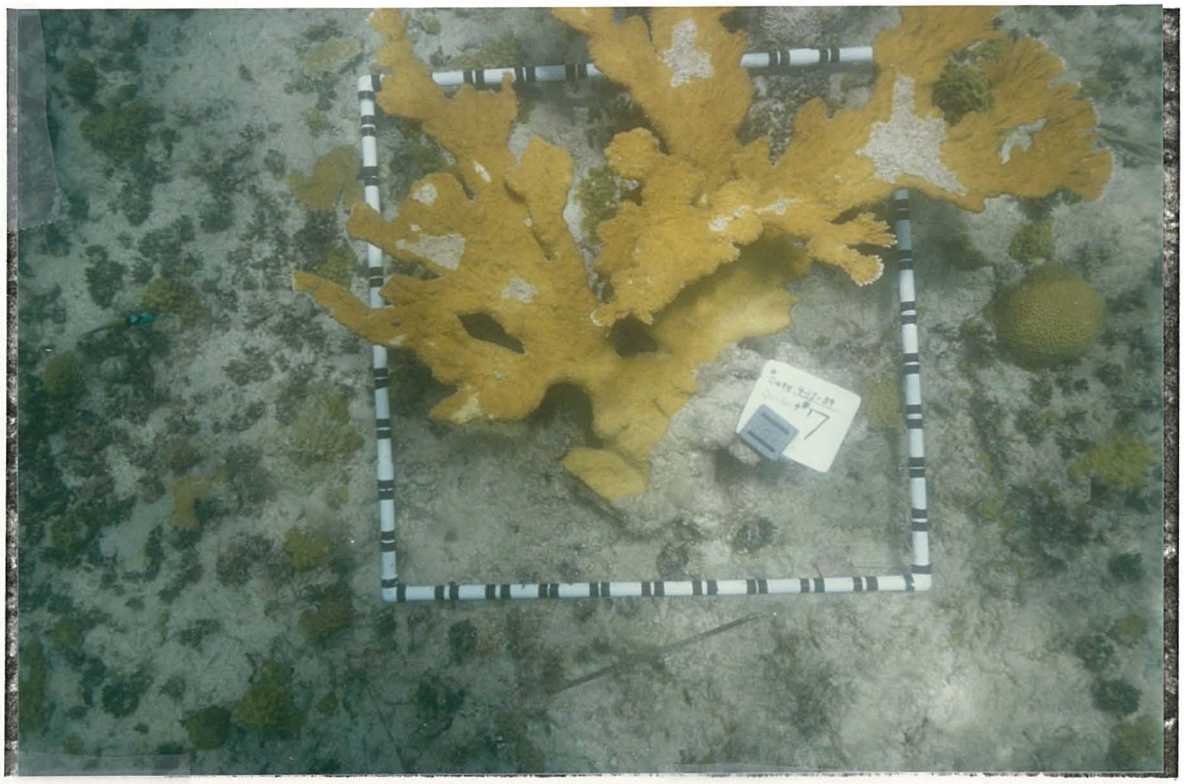


Quadrat 6. Photographed 10/10/89. D. strigosa head gone.



Quadrat 6a. Photographed 10/18/89. Replacement for quadrat 6.

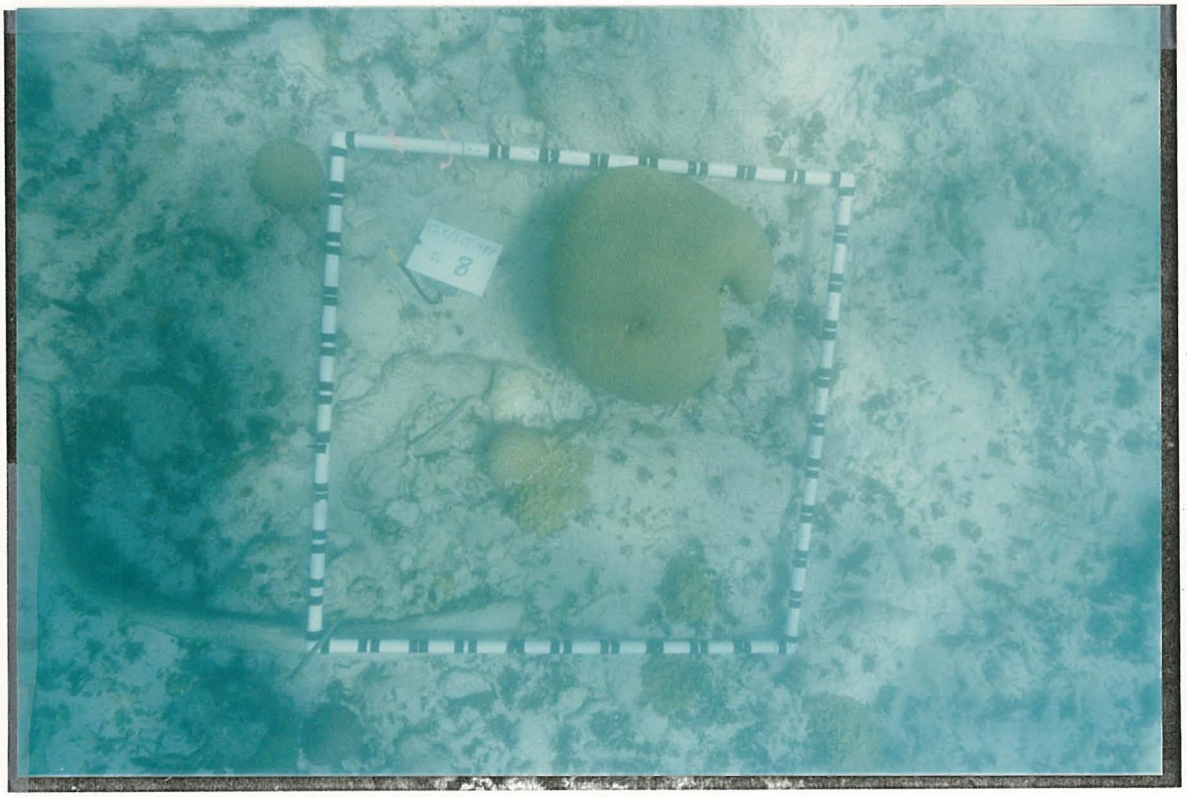
Quadrat 6a. Photographed 10/18/89. Close up showing greater detail of corals.



Quadrat 7. Photographed 9/31/89.

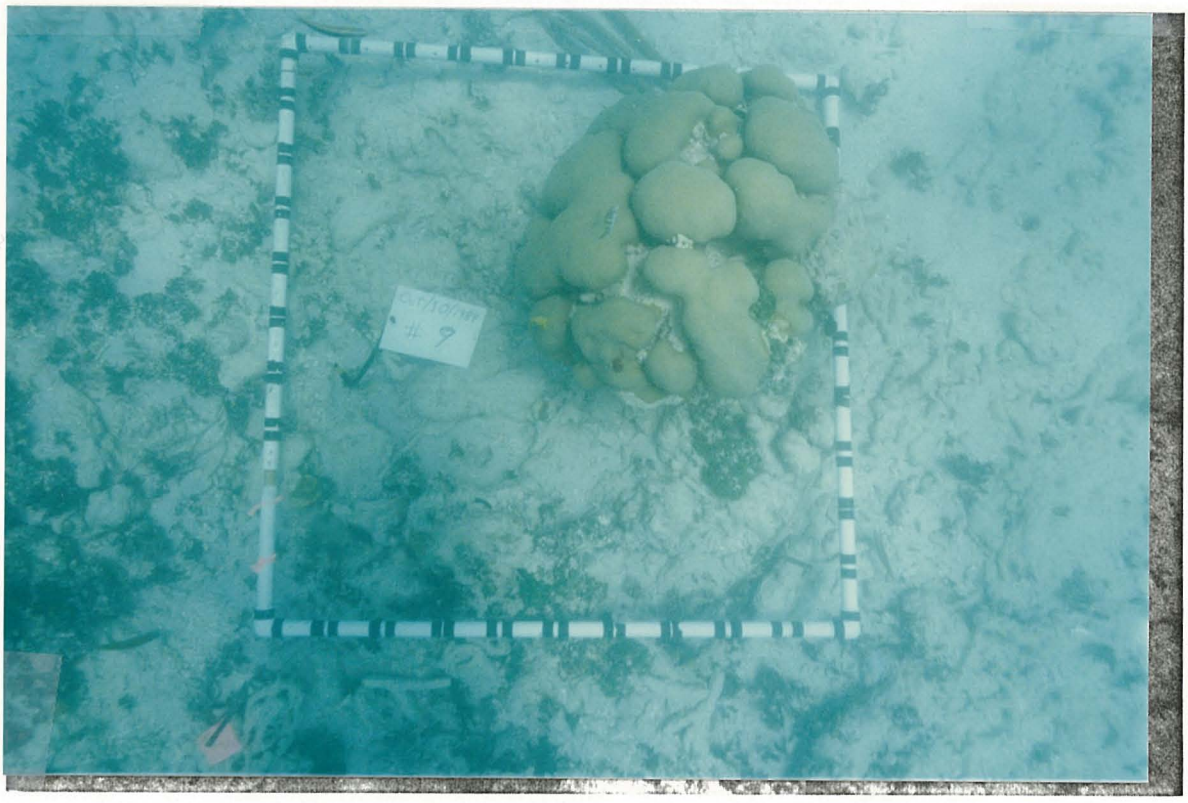
Quadrat 7. Photographed 10/10/89. Only a small portion of the A. palmata remains.

Quadrat 8. Photographed 9/13/89.



Quadrat 8. Photographed 10/10/89. No visible damage noted.

Quadrat 9. Photographed 9/13/89.

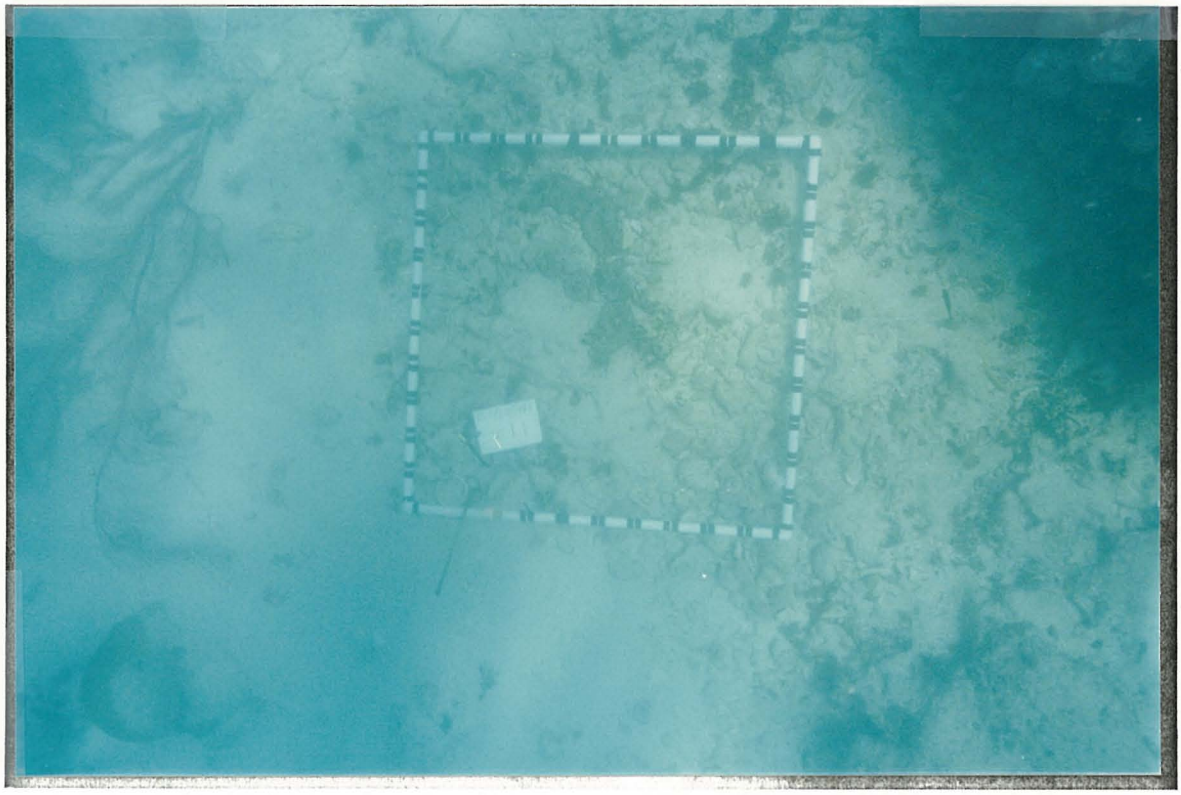


Quadrat 9. Photographed 10/10/89. Entire head was broken off and rested on its side approximate .25m to the south. Will continue to be used for analysis.

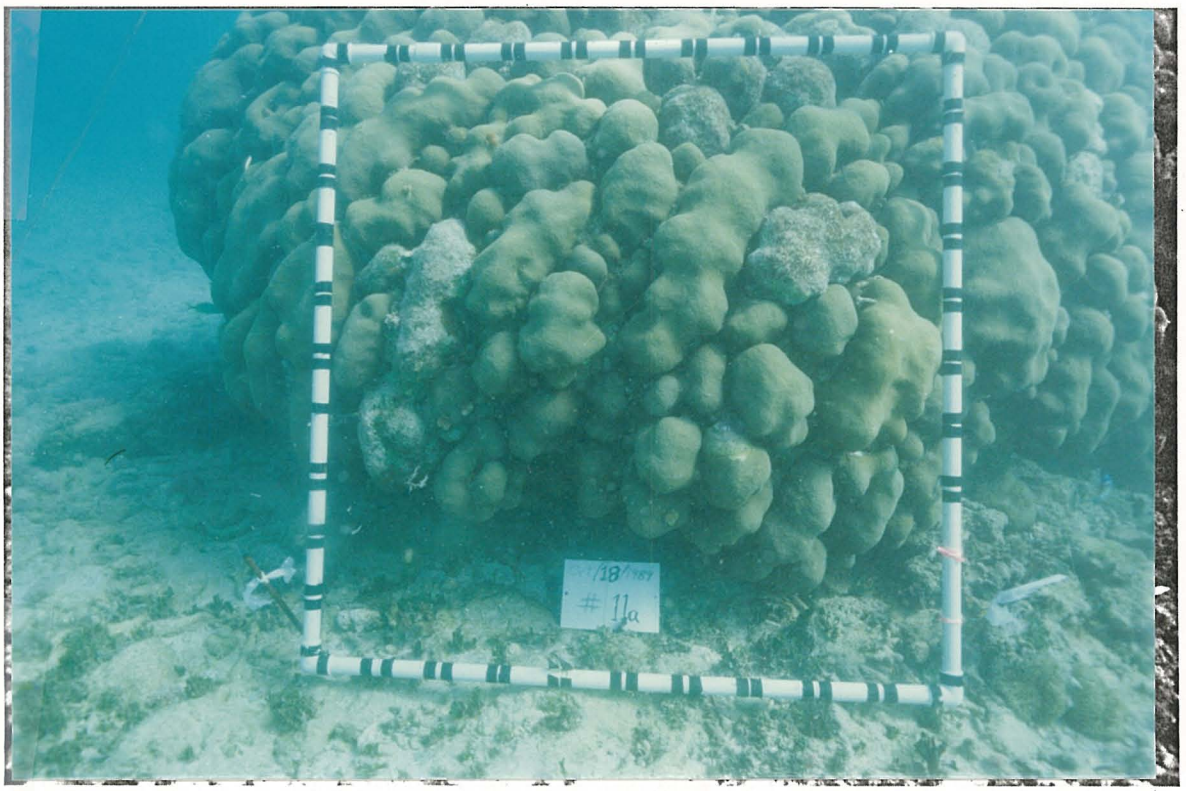
Quadrat 10. Photographed 9/13/89.

Quadrat 10. Photographed 10/10/89. Considerable sand scouring had occurred with corals being partially buried.

Quadrat 11. Photographed 9/13/89.

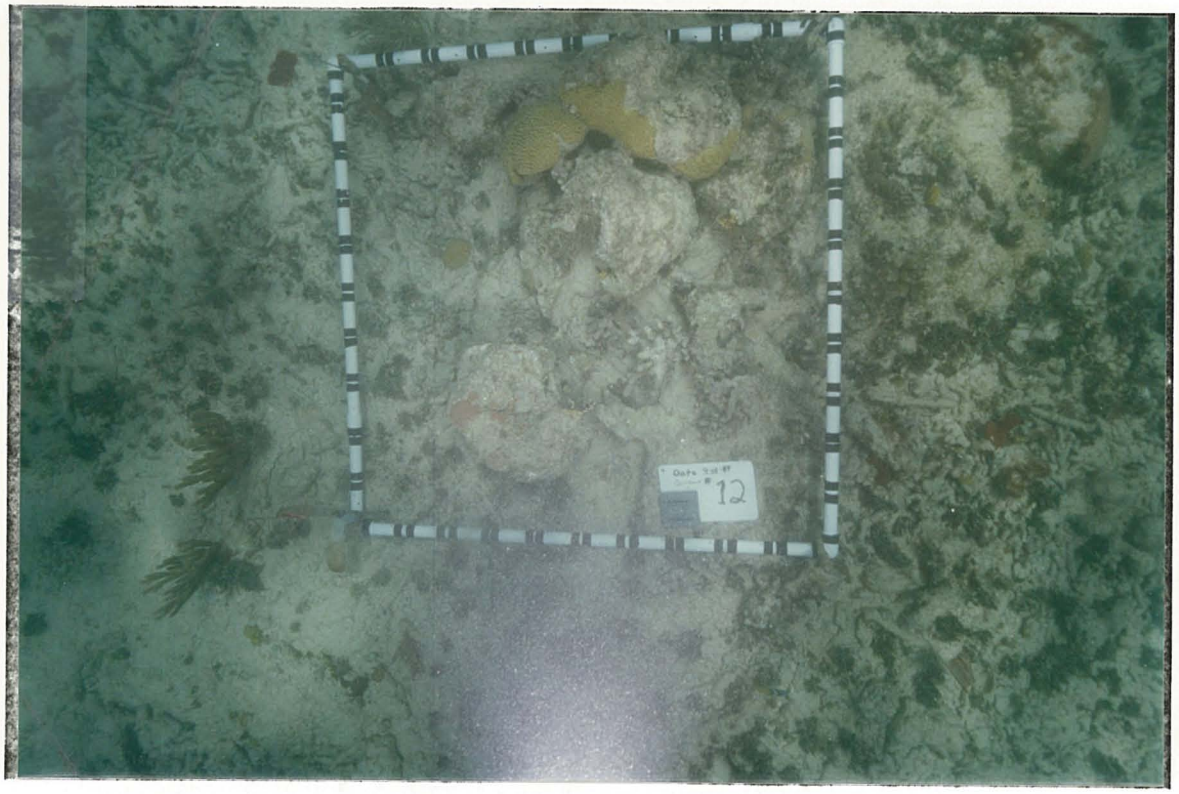


Quadrat 11. Photographed 10/10/89. Considerable sand scouring resulted in all coral being swept away.

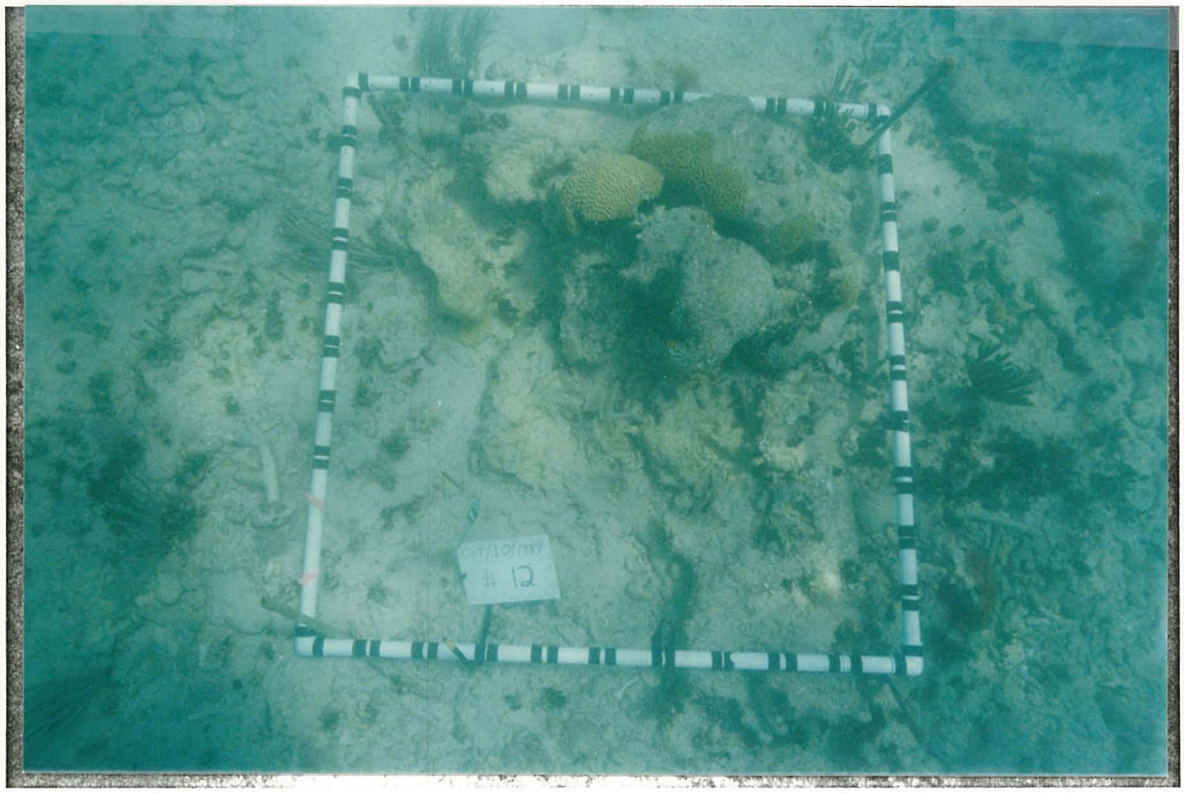


Quadrat 11a. Photographed 10/18/89. Replacement for quadrat 11. All coral is M. annularis.

Quadrat 11a. Close up showing greater detail.



Quadrat 12. Photographed 9/13/89.



Quadrat 12. Photographed 10/10/89. Area scoured, but live coral remains intact.