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Sunny Isles
Artificial Reef Monitoring Project
Sixteenth Quarterly Report - September, 1995

PREPARED FOR

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I. Study Summary and Final Update for September, 1995

Three types of artificial reef modules were placed directly on a natural reef in 60 feet of water off Sunny Isles as part of an effort to restore the habitat and mitigate dredge damage. The three artificial reef types included a small dome-shaped module (D module), a low-relief rectangular module composed of cemented coquina rock (R module) and a high relief, rectangular structure with large internal volume (M module). A total of 30 modules (11 domes, 10 R's and 9 M's), plus 30 control stations for fishes, and 10 disturbed control stations for invertebrates and plants were studied over eight successive calendar quarters, and semi-annually thereafter. An undisturbed reef control transect was initially monitored in 1990 and was also employed for comparison. The modules and control sites were examined for the purpose of monitoring the colonization and community development of invertebrates, plants and fish fauna relative to the natural substrate, as well as evaluating the effectiveness of the module designs in restoring the reef habitat. These structures differed in their ability to attract numbers of individuals and numbers of species of both fishes and invertebrates.

A. FISH & MOTILE INVERTEBRATES

1. Numbers of Individuals

All modules showed a steady increase in the number of fish during the first 18 months after deployment. The M's continued to show increases in the second year in contrast to D's and R's. By the end of the second year, 8485 individuals (greater than 5 fold more than the end of the first year) were associated with the modules. However this number varied considerably in subsequent surveys as described below. Throughout the study, the M modules attracted the highest number of individuals, while the domes had the smallest number. All module types attracted significantly more types of fish compared to the control sites.

2. Types and Number of Species

September, 1995: The total fish population continued to fluctuate primarily due to migration of grunts and snappers onto and away from the modules. This survey found a total of 4426 fishes on the modules, of which 2748 (62.1%) were various grunt species (genus *Haemulon*) and 648 (14.6%) were snappers (genus *Lutjanus*). This total number of fish is considerably lower than the

8164 total found in April, 1995, but similar to the total found at the end of 1994, when 4608 fish were found. The total number of species found on the modules during the current survey was 55, down from 62 found in the previous survey, but one more than was found in December, 1994.

Of the current total, 2872 fish were associated with the M-modules. A total of 39 species were recorded on the M's during this survey, 94.1% of which were species of grunts and snappers. This represents an increase of 79 individuals, and a decrease of 5 species over last year (December, 1994). The same number of species was recorded on the M-modules during the previous survey (April, 1995) but compared to April, the number of individuals was reduced by 51.8% in the present survey, due to a decrease in the number of grunts. The diversity index during the current survey (H= 0.86) was lower than the Domes and higher than the control reefs. It was also higher compared to the diversity index obtained from the M-module fish fauna in April, 1995 (H= 0.66).

The R-modules were associated with 1017 fish, representing a slight decline in numbers from 1994. Of the R-module fish, 42 species were documented, of which 65.8% were grunts and snappers. By comparison, at the end of 1994 there were also 42 species, but only 36 were found in April, 1995. The diversity index (H= 0.83) was similar to that of the M-modules, and was somewhat lower than it was in April, 1995 (H= 0.96).

The Dome modules were associated with 537 fish, representing an increase of about 10% over the previous year. Thirty five species were found on the Domes, of which 51.6=8% were grunts; snappers represented only 10 individuals on these modules. There were also 35 species recorded on the Domes in December of 1994, compared to 39 species found during April, 1995. The diversity index (H= 1.11) for the Domes continued to be the highest of all the modules. The same diversity index was obtained during the April, 1995 survey of the Domes.

The control sites on the natural reef continued with the lowest number of species (31). This was the same number of species found in April, 1995, but was an increase over the 26 species recorded during December, 1994. The number of individuals on the control sites during September, 1995 was 558, 21 more than were found on the Domes. However, there were distinct compositional differences, including a very small percentage of grunts (6.3%) on the control sites. The diversity index (H= 0.52) of the control sites was clearly the lowest of all the study sites, and was lower than in the previous survey (April, 1995: H= 0.89).

3. Correction for Module Size

When numbers of individuals are adjusted for size (numbers of individuals divided by surface area) the M modules continue to have a higher number of fish per ft^2 (M= 2.2), but not significantly higher than the D modules (D= 1.7). The R-modules continued to be significantly lower in this regard (R= 0.6 individuals per ft^2). The M modules had a greater average number of individuals per module (M= 287.2, R= 101.7 and D= 48.8 individuals), while the M and R-modules had the highest number of species (17.0 and 16.2 respectively). The D modules had a lower number of species per module than the other two types (12.3), but attracted a greater number of fish species per unit area than either the R or the M-modules. The R modules continue to appear to be less attractive on a fish per square foot basis.

Conclusions: On the basis of absolute number of species and individuals the modules were generally more successful in supporting more individuals and species compared to the natural reef. In terms of number of fish species, both overall and per unit surface area, the Dome modules continue their superiority to the other module types. The benefit of this type of module includes its small size and high cost:benefit ratio. However, fewer numbers of fish are attracted to these structures. It is possible that more and different types of fish inhabited the internal volume of these modules, but the underside of the domes could not be examined due to their small access holes. The M modules are superior in attracting a larger total number of fish, mostly haemulonids, but also a large number (600) of lane snappers, which are absent from the other modules and from the natural reef. However, because of their size, the M-modules are more expensive to manufacture and are more susceptible to storm damage.

2. INVERTEBRATES & PLANTS

At the end of the second year 1512 individuals and 51 species of invertebrates and plants were recorded on the modules. This represented over a 4 fold increase in individuals and a 3 fold increase in the number of species since the end of the first year. Sponges were clearly the dominant colonists, followed by compound ascidians. During the June, 1994 survey, a total of 1317 invertebrate and plant individuals and 49 species were recorded. In December, 1994 we recorded 1167 individual and 45 species on the modules, compared with the April, 1995 survey, in which we found 40 species and 1308 individuals. In the last survey (September, 1995) there

were 37 species and 1154 individuals. Sponges, (especially *Holopsamma helwigi*), were still the dominant organisms.

Of the 27 species found on the control sites, 10 were found only there, but these species were only composed of 45 individuals total, 25 of which were sponges. In December, 1994, we found 29 control species, 10 of which were found only there, with a total of 11 individuals. The control sites have changed relatively little, but appear to be recovering slowly. On the other hand there were 20 species (up from 16 in December, 1994) found on the modules but not on the controls. The remaining species were held in common. In contrast, of the 49 species recorded in December, 1994, only 14 (29%) were found on both the modules and the controls.

1. Types and Numbers of Individuals

As in the previous surveys the sponge *Holopsamma helwigi* is the most common species, along with two other species *Callyspongia vaginalis* and *Iotrochota birotulata*. The next most common invertebrate is the fire coral *Millepora alcicornis* (102 individuals). In all, 18 species of sponges (14 in December), and 18 species of soft and stony corals (11 in December) are currently populating the modules. New species continue to be recorded at all sites, and judging from the coral populations, the modules are becoming more reef-like with time. However, unlike the fish populations, the number of invertebrate taxa has not clearly leveled off, and are still in the process of change. The number of invertebrate individuals on the three module types is not significantly different, ranging from 402 on the domes to 372 on the M's and 380 on the R's. All three sites have considerable sponge populations with *H. helwigi* composing 35-45% of all invertebrates. In contrast, the control sites contain only 214 individuals, only 6% of which are *H. helwigi*.

Total number of species found during the present survey are highest on BC stations (27) followed by the Dome and R-modules (both 26). The M-modules had the fewest species (18). The diversity index is highest on the R-modules (H= 1.02), but the BC stations have a higher index (H= 0.95) than either the M or Dome modules (H= 0.87 and 0.88, respectively). These indices have not changed appreciably since mid-1994. The higher index on the BC sites is due to species that are often found only once, then disappear, and are not biologically meaningful.

In the December, 1994 survey, the highest average number of species and individuals per module was found on the Domes, but in April, 1995 as well as in the current survey it was the R modules

that had the highest average number of species (10.5), as well as highest diversity index. The Domes had the highest average number of individuals until the current survey, in which the M-modules had a somewhat higher number (41.3 vs. 36.5 for the Domes). The R-modules had a slightly lower number of individuals per module (34.5) but the lowest were the BC stations (23.8 individuals per quadrat).

2. Correction For Size

When the number of invertebrate and plant individuals or species was expressed on a unit surface area basis, the D modules continued to outperform the other types. While the M and R modules were not significantly different from one another, both modules outperformed the control sites in terms of number of individuals. In number of species per ft^2, the Domes fared better than R and control sites (BC). There were no significant differences between R and BC sites, and the M-modules had fewer species per unit area than any of the other modules or the control sites.

Conclusions: Invertebrate and plant colonization patterns do not appear to have become established enough to make more than general statements. The R-modules contain several species (e.g., *Lima lima* the file shell) that prefer shaded pocket and cleft substrate from the grouted surfaces on the sides of this module type. Thus such species are not present on the other modules and contribute to higher number of species per module on R-modules. However in terms of total number of invertebrate species per module type, number of individuals per module type, number of invertebrates per ft^2 and number of species per ft^2, the Dome modules appear to be superior to the other types. More colonization time will be required to establish equilibrium of invertebrate individuals and species before a final determination of merit can be made.

II. INTRODUCTION

During September, 1995, plants, invertebrates and fishes were surveyed on the artificial reef modules placed off Sunny Isles, Dade County, Florida. Thirty modules of three different designs were examined, including 11 rough domes (#'s 18, 19, 20, 21, 22, 25, 30, 34, 42, 43 and 50); 10 Reef Replacement modules (#'s 2, 4, 7, 14, 15, 16, 17, 21, 22, and 23) and 9 M-types (#'s 1-10 with #6 missing due to storm damage). An odd number of Domes are surveyed due to historical accident, and either 10 or 11 R modules, due to difficulty in finding R-5. This module is not included in the data base every quarter (e.g., missing in December, 1992, included in December, of 1994), was missed in April, 1995 but was included in the current survey.

III. FIELD METHODS

This report marks the second of the semi-annual, rather than quarterly surveys, and the end of the 3rd year of study. In keeping with the previous increments of quarters, we refer to this report as the 16th quarter, signifying that it represents the status of the artificial reef modules 48 months after deployment. This is the final survey of this series.

A. INVERTEBRATES

Beginning in November, 1991 10-11 examples of each of the three module types were selected by their proximity to two connected transect lines extending 280 meters from the southern to the northern end of the study area. The 11 Dome modules selected were those encountered along the transect line that were of the rough surface construction only. These were designated D-18, 19, 20, 21, 22, 25, 30, 34, 43, 49 and 50 (see site map for position). The 10 M2 modules we examined were M-1, 2, 3, 4, 5, 6, 7, 8, 9 and 10. The 11 R-modules examined were numbered R-2, 4, 5, 7, 14, 15, 16, 17 21, 22, and 23. The location of these structures are shown in Fig. 1. Thus a total of 32 modules were studied initially. However, as a result of Hurricane Andrew module M6 was destroyed and this was deleted from the survey list. The remaining 31 modules were surveyed throughout the two-year period. In addition, ten squares 4.9 ft per side (=23.76 ft^2 or 2.25 m^2) constituted control quadrats (Barren Controls or BC stations) that were prepared in the vicinity of the modules. These plots were cleared of all benthic invertebrates by and plants with wire brushes for the purpose of comparing colonization of barren, natural substrate with the modules. One station, BC 19 was discontinued for monitoring after January, 1994 when it was

discovered that all boundary stakes were missing. BC 8 had to be estimated due to the absence of two of the four stakes, and BC 39 could not be located during the latest survey.

B. PHOTOGRAPHIC AND VISUAL SURVEYS

The surveys of invertebrates/algae employed a photographic arrangement consisting of A Nikonos camera and a 28mm lens placed on a fixed-distance PVC quadrupod that photographed a 18x28 inch quadrat (=0.33m^2). A photographic transect was made over each module by successive quadrat photographs, always beginning with the identity plate and continuing along the longest axis of the module. Dome modules required 4 photographs to complete each transect, R modules required 6-7 photographs, and the larger M modules required 7-8. Each transect was also carefully surveyed by eye, with counts individual taxa recorded *in situ*. The total transect area surveyed was necessarily different depending on the module type. Each M-module transect constituted 12.75 ft^2, each R-module transect was 12.0 ft^2 and each Dome module transect was 6.0 ft^2. The total of all transect areas (10 M-modules, and 11 D and R-modules) was thus 325.5 ft^2, compared to 195 ft^2 of control transect and 240 ft^2 of barren control area. These surface area differences were normalized to a ft2 basis for the purpose of reporting invertebrate data.

C. FISHES

Total counts of fishes and motile invertebrates were made simultaneously by two biologists. Both approached the modules to within 3 meters. One remained stationary and recorded on underwater census forms while the second diver videotaped the site while swimming around it, maintaining the 3 meter distance (*cf.*, Bortone *et al.*, 1986). After one complete revolution, both biologists moved in to search the void spaces of the module for cryptic species. Graduated meter sticks carried by both biologists were used to estimate fish sizes in cm standard lengths. Standard length is a basic ichthyological measurement which is defined as the distance from the tip of the snout to the end of the last vertebra, excluding the caudal or tail fin. Control sites were also sampled in the same manner as the modules. Video and written records were later compared and combined to provide the final data set for each site. The data sheets included the reference site along with the corresponding data for each module.

IV. STATISTICAL METHODS

A. Standard Parametric Analyses of Study Sites

One way analysis of variance (ANOVA) on fish populations was performed on the four site types (D, M, R, and C, with samples sizes of 11, 10, 9, and 30, respectively) using both number of individuals per site and number of species per site as the data. For invertebrates and plants the four site types were the D, M, and R modules and the Barren Controls (BC's), with samples of 11, 9, 10, and 9, respectively. The tests (independent samples) were performed on each combination of site types to determine which site types were significantly different in mean numbers of fishes or invertebrates and plants and mean number of species per site type with means based upon sample sizes as listed above. In order to determine whether the control sites could be treated as a single group, they were first analyzed for differences in the mean number of individuals and mean number of species within the group using an ANOVA.

B. Diversity Index

Shannon-Weiner Diversity indices (H, using logarithm to the base ten) were calculated for each site type based on both the number of species and the number of individuals per species. Separate indices were calculated for both fish and invertebrates for each module type and control. The lowest possible value of H is zero. This would occur when all individuals in a population belong to one species. As the number of species increases, so does the value of H. The number of individuals also affects the diversity index. If a small number of species account for most of the individuals, the value of H will be lower than if all species are represented by equal numbers of individuals.

V. STATISTICAL ANALYSIS

A. FISHES AND MOTILE INVERTEBRATES

1. Raw Data and Parametric Comparisons by Anova and T-Tests

The raw data for the controls and the three module types are presented in Tables F1 and F2, with data summarized by study site type in Table F3. Summary statistics for the four site types are given in Table F4.

Among the three module types (D, M, R), the number of individuals on a single module varied from 9 to 868 and the number of species on a single module varied from 8 to 23 (Tab. F4). The highest average number of individuals, and the highest average number of species were found on the M modules. The lowest average number of individuals and the lowest average number of species were found on the D modules. The control sites had a lower average number of individuals and average number of species than any of the three module types.

There were significant differences among the four study site types (D, M, and R modules plus the control sites), in both average number of fishes and average number of species (Table F5; ANOVA results). The control sites had a lower average number of individuals and average number of species than the D, M and R modules (Table F5; t-test results). The D modules had lower average numbers of fishes and species compared to both the M and R modules. The average numbers of fishes and species were not significantly different between the M and R modules.

2. Differences In Module Size.

The three module types were of different sizes and shapes. The D modules had the smallest surface area (Table F6). The M modules had approximately 4 times the surface area of the D modules while the R modules had approximately 5 times the surface area of the D modules. The M modules had the highest absolute amount of internal void space. However, relative to surface area, the D modules had the highest amount of internal void space (reflected in low Surface Area:Volume ratio) while the R modules had the lowest void space.

In absolute numbers, the M modules had the highest average number of individuals per module and the D modules had the lowest average (Table F4). If corrected for the difference in size (by dividing average numbers by surface area), the M modules still have the highest average, but it is not significantly higher than the D modules (Table F7; Figure F1). The average number of individuals per ft^2 for the R modules was lower than the D and M modules.

In terms of the average numbers of species per module type, the M modules had the highest average number of species and the D modules had the lowest (Table F4). When corrected for the differences in module size, the D modules had a significantly higher average number of species per unit area than both the M and R modules. The R modules had a significantly lower number of species per unit area compared to the M modules (Table F7; Figure F2). The D modules have attracted a similar cumulative number of species as the larger M and R modules (Figure F5, Table F10). Even though the R modules had the largest surface area, their relative lack of internal space (high Surface Area:Volume ratio) makes them less attractive to large numbers of fishes, particularly those species that maintain territories.

3. Shannon-Weiner Diversity Index.

The Shannon-Weiner Diversity Indices (H) were 1.11, 0.86, and 0.83 for the D, M, and R modules types respectively. The lower diversity indices on the M and R modules were due to the combined overwhelming abundance of the grunts (*Haemulon* sp.; refer to Statistical Analyses: Diversity Indices for a further explanation of the factors affecting the value of H). The C control sites had a diversity index of 0.52 for comparison (Table F4).

4. Comparisons Between All Sampling Periods: Number of Fishes.

The average number of fishes at the control sites has been relatively stable, with the exception of a decreased average number of fishes in the fifth quarter (April '93; Figure F3). The average number of fishes at the M and R modules has been consistently higher than at the D modules and C sites. The M modules have shown the greatest fluctuations, primarily due to the size of schools of grunts observed. The average number of fishes on the M modules was at its highest in the previous quarter (Apr. '95, 596 fishes/module). The D modules have maintained a relatively consistent average number of fishes since December '92.

5. Comparisons Between All Sampling Periods: Number of Species.

The average number of species on the C sites has been consistently lower than the three module types (Figure F4). Among the modules, the M modules had the highest average number of species and have shown little change since May '92. The average numbers of species on the D and R modules have shown transitory increased averages in the 7th quarter (August '93) and again in the 12th quarter (January '95).

A plot of cumulative number of species by sampling period (rarefaction curve) demonstrated that relatively low numbers of new species continue to be recorded, although at least one new species was recorded at each site type during this quarter (Figure F5; Table F10).

One new species were recorded at the C sites this quarter (*Aetobetus narinari*). This species has not been previously recorded at any of the module types. Two new species were recorded on the D modules (*Apogon* spp., and *Ginglymostoma cirratum*). Both of these species have been previously recorded at both the M and R modules. One new species was recorded on the M modules (*Acanthurus chirugus*), which has not been previously recorded in this study. Three new species were recorded on the R modules (*A. chirugus, Haemulon melanurum, and Equetus punctatus*). Each of these species has also been recorded on the M modules, with E. punctatus also previously recorded on the both the D and M modules.

The total number of species found throughout the study was highest on the M modules (77 species). The D and R modules had similar cumulative numbers of species (67 and 71, respectively), while the C sites had the lowest (61). Many of the species recorded during the study have been noted at each of the four site types. As might be expected, some species were restricted to the modules (*Mycteroperca phenax, Equetus spp, Abudefduf saxatalis*).

6. Comparisons Between All Sampling Periods: Diversity Index.

Shannon-Weiner Diversity indices for each sampling period were plotted (Figure F6). The diversity on the M modules has declined sharply, primarily due to the combined increasing dominance of grunts and gray snapper. The increase in abundance of the grunts on the D and R modules in more recent sampling periods has decreased the diversity at these sites, but not to the extent shown on the M modules.

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List of Figures: Fishes and Motile Invertebrates

STATISTICAL RESULTS

B. SESSILE INVERTEBRATES AND PLANTS

1. Raw Data and Parametric Comparisons by ANOVA and t-tests for Sessile Invertebrates.

The raw data for benthic sessile invertebrates at the modules and barren control sites are given in Table I1, and summarized for each site type in Table I2. Summary statistics are found in Table I3.

The number of individuals per single module ranged from 16 to 64 among the three modules types (D, M, and R) and from 11 to 38 among the barren control sites (Table I3). The highest average number of individuals was found on the M modules, while the lowest was found on the barren control sites.

The number of species ranged from 5 to 13 on the modules and from 6 to 12 on the barren control sites. The highest average number of species was found on the R modules and the lowest average on the barren control sites.

There were significant differences among the four site types (D, M, R, and BC) in average number of individuals and in the average number of species (Table I4, ANOVA results). The barren control sites had a lower average number of individuals than the D, M, and R modules (Table I4, t-test results). However, the D, M and R modules did not differ from each other. With regard to average number of species, the R modules had a higher average than the M modules, but was not significantly different than the D modules or BC sites (Table I4). The D modules, M modules and the BC sites were not significantly different in average number of species.

2. Differences In Size of Modules and Barren Controls.

The three module types were of different sizes and shapes. The D modules had the smallest surface area (Table I5). The M modules had approximately 4 times the surface area of the D modules while the R modules had approximately 5 times the surface area of the D modules. The M modules had the highest absolute amount of internal void space. However, relative to surface area, the D modules had the highest amount of internal void space (reflected in a low Surface Area to Volume ratio) while the R modules had the lowest (high Surface Area to Volume ratio). The Barren Control sites were flat surfaces with an area of 2.25 m2 (23.76 ft^2) per quadrat.

Differences in area sampled on the module types were corrected by dividing average numbers of individuals and species by the square footage sampled (Table I5).

The average number of individuals per ft^2 on the Barren Control sites was significantly lower than the average number of individuals per ft2 found on each of the module types (Table I6; Figure I1). Among the module types, the D modules had a higher average number of individuals per ft^2 than both the M and R modules. The average number of individuals per ft^2 on the M and R modules was not significantly different.

With regard to average number of species per ft^2, the D modules had a higher average than the M modules, R modules and BC sites (Table I6; Figure I2). The average for the M modules was lower than the R modules and the BC sites. There was no significant difference between the R modules and the BC sites.

While the D modules had the smallest surface area, the shape of the module (either in terms of outer contour or the amount of internal void space) appeared to be more favorable to colonization by benthic invertebrates than either the M or R modules (as reflected in average number of individuals per ft^2 and average number of species per ft^2). However, after the first two years of survey, the benthic invertebrate faunal community of the D modules was still not similar to the Undamaged Reef community sampled in November, 1991 (see 1st Quarterly Report, or 8th Quarterly Report, January 1994).

3. Shannon-Weiner Diversity Index for Sessile Invertebrates.

The Shannon-Weiner diversity indices (H) for the D, M, and R modules were 0.881, 0.875 and 1.018 respectively (Table I3; refer to Statistical Analyses: Diversity Indices for further discussion of factors affecting H). The barren control sites had a diversity index of 0.955. *Holopsamma helwigi* was the most abundant species on the modules (45% of individuals on D modules; 41% on M modules; 35% on R modules). *Dictyota* sp. was the most abundant species on the BC sites (47% of individuals).

4. Comparisons Between All Sampling Periods: Numbers of Individuals.

Data on benthic invertebrates were not collected from the modules during the first and second quarters of this study due to lag time in colonization. The average number of individuals at the BC sites has changed little through time (Figure I3). At the modules, the averages were relatively constant during the third and fourth sampling periods (May and August '92), but showed a significant increase during the fifth sampling period (December '92, first sampling after Hurricane Andrew), and again during the eighth sampling period (January '94).

5. Comparisons Between Sampling Periods: Numbers of Species.

The average number of species at the BC sites increased in the 12th quarter (Figure I4). The modules have shown both increases and decreases in average number of species. The M and R modules have remained relatively constant since the 8th quarter (January '94).

A plot of the cumulative number of species by sampling period (rarefaction curve) demonstrated that new species were recorded each sampling period (Figure I5; Table I8). The cumulative number of species found throughout the study was highest on the BC sites (49 species), closely followed by the R modules. This is misleading, since many of these species occurred at low densities during a single sampling period and then disappeared. Clearly, the benthic invertebrate fauna has not yet stabilized and will continue to change.

New species were recorded at all study sites this quarter. Two new species were recorded on the BC sites (*Agaricia* sp. and *Pseudoceratina crassa*); three species on the D modules (*Montastrea annularis, Diploria* sp., *Pseudoplexura* sp.); two species on the M modules (*Agaricia* sp., *Dictyota* sp.) and two species on the R modules (*Dictyota* sp., *Stephanococoenia michelini*). This was the first recording of two of these species in four years of sampling (*Pseudoceratina crassa* and *Diploria* sp.).

6. Comparisons Between All Sampling Periods: Diversity Index.

A plot of the Shannon-Weiner Diversity Indices (H) for each study site by sampling period reflected the high rate of turnover in benthic invertebrate fauna (Figure I6). The diversity on the

M modules has remained fairly consistent throughout the study. The D modules, R modules, and BC sites all demonstrated wide fluctuations.

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VII. LITERATURE CITED

Bortone, S.A., J.J. Kimmel and C.M. Burdick. 1989. A comparison of three methods for visually assessing reef fish communities: Time and area compensated. Northeast Gulf Sci. 10: 85-96.

Gauch, H.G., Jr. 1982. Mutivariate Analysis in Community Community Ecology. 298 + x pp. Cambridge University Press, New York.

Krebs, C. J. 1989. Ecological Methodology. 654 + xii pp. Harper and Row Publishers, New York.

Pielou, E. C. 1984. The Interpretation of Ecological Data. 263 + xi pp. Wiley Publ. Co., New York.

Rohlf, F. J. 1988. NTSYS - pc. Numerical Taxonomy and Multivariate System. 148 + viii pp. Applied Biostatistics Inc., New York.

APPENDIX A

TABLES AND FIGURES

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LIST OF FIGURES FOR SESSILE INVERTEBRATES

Table F1. Raw data for 16th quarter sampling (9/95) of fishes at control sites, coded by nearest module type (D, M, R).

SPECIES	COMMON NAME	CODE	D18	D19	D20	D21	D22	D25	D30	D34	D43	D49	D50	M1	M2	M3	M4
Aetobatus narinari	Spotted eagle ray	AETn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holocentrus rufus	Longspine squirrelfish	HOLr	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Serranus tigrinus	Harlequin bass	SERt	0	1	0	1	0	1	0	0	1	1	0	0	0	0	1
Serranus tabacarius	Tobaccofish	SERt	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hypolplectrus unicolor	Hamlets	HYPu	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Pseudupeneus maculatus	Spotted goatfish	PSEm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anisotremus virginicus	Porkfish	ANIv	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haemulon sciurus	Bluestriped grunt	HAEs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haemulon plumieri	White grunt	HAEp	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetodon ocellatus	Spotfin butterflyfish	CHAo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetodon sedentarius	Reef butteflyfish	CHAs	0	0	0	0	0	0	0	0	2	0	0	2	0	2	0
Acanthurus bahianus	Ocean surgeon	ACAb	0	1	1	1	1	0	1	0	0	0	0	0	1	1	1
Acanthurus coeruleus	Blue tang	ACAco	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Pomacanthus paru	French angelfish	POMp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holacanthus bermudensis	Blue angelfish	HOLb	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Holacanthus ciliaris	Queen angelfish	HOLc	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Holacanthus tricolor	Rock beauty	HOLt	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
Chromis insolatus	Sunshinefish	CHRi	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Chromis scotti	Purple reeffish	CHRs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pomacentrus partitus	Bicolor damselfish	POMp	3	0	9	5	6	6	0	6	6	4	8	6	0	6	8
Pomacentrus variabilis	Cocoa damselfish	POMv	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0
Bodianus rufus	Spanish hogfish	BODr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Halichoeres garnoti	Yellowhead wrasse	HALg	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Lachnolaimus maximus	Hogfish	LACm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thalassoma bifasciatum	Bluehead wrasse	THAb	5	4	7	3	10	8	0	8	20	5	10	8	20	4	10
Scarus croicensus	Striped parrotfish	SCAc	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Sparisoma viride	Stoplight parrotfish	SPAv	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Sparisoma aurofrenatum	Redband parrotfish	SPAa	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0
Cantherhines pullus	Orangespotted filefish	CANp	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Diodon holacanthus	Balloonfish	DIOho	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Canthigaster rostrata	Sharpnose puffer	CANr	0	0	0	1	1	1	0	0	0	0	0	0	1	0	1
NUMBER OF FISHES			9	11	19	11	21	17	3	15	32	10	19	18	25	14	23
NUMBER OF SPECIES			3	6	5	5	7	5	3	3	7	3	3	5	6	5	7

Table F1. Raw data for 16th quarter sampling (9/95) of fishes at control sites, coded by nearest module type (D, M, R).

SPECIES	M5	M6	M7	M8	M9	M10	R2	R4	R7	R14	R15	R16	R17	R21	R22	R23
Aetobatus narinari	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Holocentrus rufus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Serranus tigrinus	0	0	0	1	1	0	0	1	0	1	0	1	0	0	0	1
Serranus tabacarius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypolplectrus unicolor	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Pseudupeneus maculatus	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Anisotremus virginicus	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Haemulon sciurus	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
Haemulon plumieri	0	0	0	0	0	0	20	0	4	0	3	4	1	0	0	0
Chaetodon ocellatus	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0
Chaetodon sedentarius	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Acanthurus bahianus	1	0	2	1	2	0	0	1	1	0	0	1	2	2	1	0
Acanthurus coeruleus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pomacanthus paru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Holacanthus bermudensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holacanthus ciliaris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holacanthus tricolor	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
Chromis insolatus	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
Chromis scotti	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Pomacentrus partitus	7	8	4	7	6	15	7	5	5	3	4	2	5	5	5	5
Pomacentrus variabilis	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Bodianus rufus	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Halichoeres garnoti	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Lachnolaimus maximus	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0
Thalassoma bifasciatum	0	10	5	5	10	20	0	7	0	11	8	10	0	5	20	10
Scarus croicensus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Sparisoma viride	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Sparisoma aurofrenatum	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Cantherhines pullus	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Diodon holacanthus	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Canthigaster rostrata	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
NUMBER OF FISHES	9	19	13	16	22	43	32	15	12	18	17	18	10	18	30	19
NUMBER OF SPECIES	3	3	5	6	6	8	3	5	5	5	5	5	4	9	7	5

Table F2. Raw data for 16th quarter sampling (9/95) of fishes at modules (D, M, R).

SPECIES	COMMON NAME	CODE	D18	D19	D20	D21	D22	D25	D30	D34	D43	D49	D50	M1	M2
Ginglymostoma cirratum	Nurse shark	GINc	0	0	1	0	0	0	0	0	0	0	0	0	1
Holocentrus rufus	Longspine squirrelfish	HOLr	0	0	0	0	0	0	0	0	0	0	0	0	0
Epinephelus cruenatus	Graysby	EPIc	0	1	0	0	0	0	0	1	0	0	0	0	1
Hypolplectrus unicolor	Hamlets	HYPu	0	1	0	0	0	0	1	1	0	0	0	0	1
Pseudupeneus maculatus	Spotted goatfish	PSEm	1	0	0	0	0	0	0	0	0	0	0	0	0
Apogon sp.	Cardinalfish	APOsp	0	0	0	0	0	0	0	0	0	1	0	0	0
Lutjanus analis	Mutton snapper	LUTa	0	0	0	0	0	0	0	0	0	0	0	0	0
Lutjanus griseus	Gray snapper	LUTg	0	0	0	0	0	0	0	0	5	0	5	0	5
Lutjanus synagris	Lane snapper	LUTs	0	0	0	0	0	0	0	0	0	0	0	0	0
Anisotremus surinamensis	Black margate	ANIs	0	0	0	0	0	0	0	0	0	0	0	4	0
Anisotremus virginicus	Porkfish	ANIv	0	0	5	0	0	0	2	0	0	2	0	2	2
Haemulon aurolineatum	Tomtate	HAEa	0	4	0	0	0	0	5	5	10	1	8	0	0
Haemulon sciurus	Bluestriped grunt	HAEs	0	4	0	0	0	5	20	10	15	0	10	15	20
Haemulon flavolineatum	French grunt	HAEf	5	15	10	5	10	5	5	5	10	0	10	20	20
Haemulon plumieri	White grunt	HAEp	10	15	20	10	15	5	0	10	15	1	0	100	20
Haemulon melanurum	Cottonwick	HAEm	0	0	0	0	0	0	0	0	0	0	0	0	0
Equetus lanceolatus	Jacknife fish	EQUl	0	0	1	0	0	0	0	0	0	0	0	0	0
Equetus puctatus	Spotted drum	EQUp	0	0	0	0	0	0	0	0	0	0	0	0	2
Equetus acuminatus	High-hat	EQUa	4	0	0	0	0	1	2	0	6	1	0	0	1
Equetus umbrosus	Cubbyu	EQUu	0	0	0	0	0	0	1	0	0	0	0	0	0
Chaetodon ocellatus	Spotfin butterflyfish	CHAo	0	0	0	2	0	0	0	0	0	0	0	0	0
Chaetodon capistratus	Four-eye butterflyfish	CHAc	0	0	2	0	0	0	0	0	0	0	0	0	0
Chaetodon sedentarius	Reef butteflyfish	CHAs	0	0	0	2	0	0	0	0	0	0	2	2	0
Acanthurus bahianus	Ocean surgeon	ACAb	5	0	0	1	3	0	1	1	0	2	1	5	2
Acanthurus coeruleus	Blue tang	ACAco	0	0	0	0	1	0	0	0	0	0	0	0	0
Acanthurus chirurgus	Doctor fish	ACAch	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetodiptierus faber	Spadefish	CHAf	0	0	0	0	0	0	0	0	0	0	0	0	0
Pomacanthus arcuatus	Gray angelfish	POMa	0	0	0	0	0	0	0	0	0	0	0	0	0
Pomacanthus paru	French angelfish	POMp	0	0	0	0	1	0	0	0	0	0	0	0	0
Holacanthus bermudensis	Blue angelfish	HOLb	0	0	2	0	0	0	0	0	0	0	0	0	0
Holacanthus ciliaris	Queen angelfish	HOLc	0	0	0	0	0	0	0	0	0	0	0	1	0
Holacanthus tricolor	Rock beauty	HOLt	0	1	1	1	0	1	1	1	0	0	0	3	1
Abudefduf saxatilis	Sergeant major	ABUs	0	1	0	1	0	1	0	0	0	0	0	0	12
Chromis cynaneus	Blue chromis	CHRc	1	1	1	0	0	1	2	0	2	0	2	1	9
Chromis multilineatus	Brown chromis	CHRm	0	1	0	0	0	0	0	0	0	0	0	2	0
Chromis insolatus	Sunshinefish	CHRi	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F2. Raw data for 16th quarter sampling (9/95) of fishes at modules (D, M, R).

SPECIES	COMMON NAME	CODE	D18	D19	D20	D21	D22	D25	D30	D34	D43	D49	D50	M1	M2
Chromis scotti	Purple reeffish	CHRs	0	2	0	0	0	1	0	0	0	0	0	5	4
Pomacentrus partitus	Bicolor damselfish	POMp	0	0	0	0	0	0	0	0	0	0	0	0	0
Pomacentrus variabilis	Cocoa damselfish	POMv	0	1	0	0	1	1	1	0	2	1	1	0	0
Bodianus rufus	Spanish hogfish	BODr	0	2	1	0	2	1	2	0	0	0	0	2	2
Clepticus parrai	Creole wrasse	CLEp	0	0	0	0	0	0	0	0	0	0	0	0	0
Halichoeres garnoti	Yellowhead wrasse	HALg	1	1	1	0	0	1	0	1	0	0	0	0	0
Lachnolaimus maximus	Hogfish	LACm	1	0	0	0	0	0	0	0	0	0	0	0	0
Thalassoma bifasciatum	Bluehead wrasse	THAb	10	9	20	0	10	20	10	5	10	10	5	20	10
Scarus croicensus	Striped parrotfish	SCAc	0	4	1	3	0	5	1	1	1	0	1	0	2
Sparisoma viride	Stoplight parrotfish	SPAv	0	0	0	0	0	0	1	0	0	0	0	0	0
Sparisoma aurofrenatum	Redband parrotfish	SPAa	0	1	1	4	1	0	2	0	1	0	1	0	0
Gobiosoma oceanops	Neon goby	GOBo	0	0	0	0	0	0	0	0	0	0	0	0	0
Cantherhines pullus	Orangespotted filefish	CANp	0	0	0	0	0	0	0	0	0	0	0	1	1
Canthigaster rostrata	Sharpnose puffer	CANr	1	1	0	0	1	1	1	0	1	0	1	1	1
Lactophyrys quadricornis	Scrawled cowfish	LACq	0	0	0	0	0	0	0	0	0	0	0	0	0
Panulirus argus	Spiny lobster	PANa	0	0	0	0	1	0	0	0	0	0	0	1	0
Stenopus hispidus	Banded coral shrimp	STEh	0	0	0	0	0	0	0	0	0	0	0	0	0
NUMBER OF FISHES			26	49	44	22	33	22	43	34	65	9	39	162	103
NUMBER OF SPECIES			10	18	14	9	10	14	17	11	12	8	12	16	20
FISHES PER SQ.FT.			0.929	1.75	1.571	0.786	1.179	0.786	1.536	1.214	2.321	0.321	1.393	1.241	0.789
SPECIES PER SQ.FT.			0.357	0.643	0.5	0.321	0.357	0.5	0.607	0.393	0.429	0.286	0.429	0.123	0.153

Table F2. Raw data for 16th quarter sampling (9/95) of fishes at modules (D, M, R).

SPECIES	M3	M4	M5	M6	M7	M8	M9	M10	R2	R4	R7	R14	R15	R16	R17	R21	R22	R23
Ginglymostoma cirratum	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Holocentrus rufus	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1
Epinephelus cruenatus	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	2	0	1
Hypolplectrus unicolor	0	0	1	0	1	1	1	0	0	1	0	0	0	0	1	0	1	1
Pseudupeneus maculatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Apogon sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lutjanus analis	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Lutjanus griseus	0	20	5	2	25	10	20	25	0	0	0	0	0	0	0	2	3	20
Lutjanus synagris	0	300	0	0	0	0	300	0	0	0	0	0	0	0	0	0	0	0
Anisotremus surinamensis	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Anisotremus virginicus	0	2	4	2	0	3	0	0	3	0	0	2	0	0	0	0	0	2
Haemulon aurolineatum	0	0	0	15	10	0	0	10	0	5	0	0	2	0	0	5	0	20
Haemulon sciurus	10	400	30	60	10	30	400	30	2	10	5	5	5	5	0	20	5	0
Haemulon flavolineatum	10	40	30	40	20	20	40	20	10	20	20	20	10	30	15	35	30	40
Haemulon plumieri	40	100	100	20	5	30	100	10	30	30	50	30	25	100	15	5	20	20
Haemulon melanurum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Equetus lanceolatus	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Equetus puctatus	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Equetus acuminatus	0	0	2	0	1	0	0	0	0	1	0	1	0	0	2	1	0	0
Equetus umbrosus	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Chaetodon ocellatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Chaetodon capistratus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetodon sedentarius	2	1	2	2	0	0	0	0	1	2	0	0	0	2	1	2	0	0
Acanthurus bahianus	4	1	0	3	2	0	0	2	6	3	1	2	1	1	2	2	4	1
Acanthurus coeruleus	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Acanthurus chirurgus	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Chaetodiptierus faber	0	0	0	0	0	1	0	0	0	0	0	9	0	0	0	0	0	0
Pomacanthus arcuatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Pomacanthus paru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holacanthus bermudensis	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Holacanthus ciliaris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holacanthus tricolor	0	0	1	0	1	0	0	2	0	0	0	2	0	0	1	0	0	0
Abudefduf saxatilis	0	0	3	4	7	1	1	6	0	4	1	0	1	2	1	2	6	0
Chromis cynaneus	0	0	5	2	8	4	0	2	3	2	1	2	1	5	0	4	2	0
Chromis multilineatus	0	0	1	0	2	0	0	1	0	1	0	0	1	0	1	0	0	0
Chromis insolatus	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	0	1

Table F2. Raw data for 16th quarter sampling (9/95) of fishes at modules (D, M, R).

SPECIES	M3	M4	M5	M6	M7	M8	M9	M10	R2	R4	R7	R14	R15	R16	R17	R21	R22	R23
Chromis scotti	0	0	0	0	10	2	0	2	5	0	0	2	0	5	2	5	0	5
Pomacentrus partitus	2	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	3	0
Pomacentrus variabilis	1	0	1	2	1	1	0	0	1	0	0	0	0	0	1	1	1	1
Bodianus rufus	1	1	2	0	2	0	2	2	2	3	3	2	1	3	2	0	2	0
Clepticus parrai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Halichoeres garnoti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Lachnolaimus maximus	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0
Thalassoma bifasciatum	20	0	0	0	10	10	0	20	20	15	10	20	0	5	10	0	35	5
Scarus croicensus	1	0	1	4	4	0	0	2	0	2	1	1	1	1	1	0	1	0
Sparisoma viride	0	0	1	1	0	0	0	2	1	1	0	0	0	0	0	0	1	1
Sparisoma aurofrenatum	1	0	1	1	0	1	0	1	1	2	1	0	1	0	0	0	1	3
Gobiosoma oceanops	0	0	0	0	0	0	0	0	5	0	0	0	0	0	3	0	0	0
Cantherhines pullus	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0
Canthigaster rostrata	2	0	1	0	1	2	1	1	1	0	0	1	0	0	0	1	1	0
Lactophyrys quadricornis	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Panulirus argus	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0
Stenopus hispidus	0	0	2	3	0	0	0	0	0	2	1	0	0	0	0	0	0	0
NUMBER OF FISHES	72	865	190	152	109	106	868	117	71	83	81	77	48	156	50	99	78	116
NUMBER OF SPECIES	14	10	21	14	23	17	14	21	22	18	11	14	12	14	20	17	17	17
FISHES PER SQ.FT.	0.552	6.628	1.456	1.165	0.835	0.812	6.651	0.897	0.444	0.519	0.506	0.481	0.3	0.975	0.313	0.619	0.488	0.725
SPECIES PER SQ.FT.	0.107	0.077	0.161	0.107	0.176	0.13	0.107	0.161	0.138	0.113	0.069	0.088	0.075	0.088	0.125	0.106	0.106	0.106

Table F3. Summary of raw data for 16th quarter (September, 1995) of fishes at modules (D, M, R) and controls (

SPECIES	COMMON NAME	CODE	D	M	R	C	TOTAL
Ginglymostoma cirratum	Nurse shark	GINc	1	2	1	0	4
Aetobatus narinari	Spotted eagle ray	AETn	0	0	0	1	1
Holocentrus rufus	Longspine squirrelfish	HOLr	0	2	1	2	5
Epinephelus cruenatus	Graysby	EPIc	2	6	3	0	11
Serranus tigrinus	Harlequin bass	SERt	0	0	0	12	12
Serranus tabacarius	Tobaccofish	SERt	0	0	0	1	1
Hypolplectrus unicolor	Hamlets	HYPu	3	5	4	2	14
Pseudupeneus maculatus	Spotted goatfish	PSEm	1	0	3	2	6
Apogon sp.	Cardinalfish	APOsp	1	1	0	0	2
Lutjanus analis	Mutton snapper	LUTa	0	0	1	0	1
Lutjanus griseus	Gray snapper	LUTg	10	112	25	0	147
Lutjanus synagris	Lane snapper	LUTs	0	600	0	0	600
Anisotremus surinamensis	Black margate	ANIs	0	6	0	0	6
Anisotremus virginicus	Porkfish	ANIv	9	15	7	2	33
Haemulon aurolineatum	Tomtate	HAEa	33	35	32	0	100
Haemulon sciurus	Bluestriped grunt	HAEs	64	1005	57	5	1131
Haemulon flavolineatum	French grunt	HAEf	80	260	230	0	570
Haemulon plumieri	White grunt	HAEp	101	525	325	35	986
Haemulon melanurum	Cottonwick	HAEm	0	0	1	0	1
Equetus lanceolatus	Jacknife fish	EQUl	1	0	3	0	4
Equetus puctatus	Spotted drum	EQUp	0	3	1	0	4
Equetus acuminatus	High-hat	EQUa	14	4	5	0	23
Equetus umbrosus	Cubbyu	EQUu	1	1	0	0	2
Chaetodon ocellatus	Spotfin butterflyfish	CHAo	2	0	2	4	8
Chaetodon capistratus	Four-eye butterflyfish	CHAc	2	0	0	0	2
Chaetodon sedentarius	Reef butteflyfish	CHAs	4	9	8	9	30
Acanthurus bahianus	Ocean surgeon	ACAb	14	19	23	22	78
Acanthurus coeruleus	Blue tang	ACAco	1	2	1	1	5
Acanthurus chirurgus	Doctor fish	ACAch	0	1	1	0	2
Chaetodiptierus faber	Spadefish	CHAf	0	1	9	0	10
Pomacanthus arcuatus	Gray angelfish	POMa	0	0	1	0	1
Pomacanthus paru	French angelfish	POMp	1	0	0	1	2
Holacanthus bermudensis	Blue angelfish	HOLb	2	4	0	1	7
Holacanthus ciliaris	Queen angelfish	HOLc	0	1	0	1	2
Holacanthus tricolor	Rock beauty	HOLt	6	8	3	5	22
Abudefduf saxatilis	Sergeant major	ABUs	3	34	17	0	54
Chromis cynaneus	Blue chromis	CHRc	10	31	20	0	61
Chromis multilineatus	Brown chromis	CHRm	1	6	3	0	10
Chromis insolatus	Sunshinefish	CHRi	0	1	5	5	11
Chromis scotti	Purple reeffish	CHRs	3	23	24	1	51
Pomacentrus partitus	Bicolor damselfish	POMp	0	2	10	166	178
Pomacentrus variabilis	Cocoa damselfish	POMv	8	6	5	4	23
Bodianus rufus	Spanish hogfish	BODr	8	14	18	2	42
Clepticus parrai	Creole wrasse	CLEp	0	0	10	0	10
Halichoeres garnoti	Yellowhead wrasse	HALg	5	0	1	3	9
Lachnolaimus maximus	Hogfish	LACm	1	0	3	4	8
Thalassoma bifasciatum	Bluehead wrasse	THAb	109	90	120	243	562
Scarus croicensus	Striped parrotfish	SCAc	17	14	8	2	41
Sparisoma viride	Stoplight parrotfish	SPAv	1	4	4	3	12
Sparisoma aurofrenatum	Redband parrotfish	SPAa	11	5	9	6	31

Table F3. Summary of raw data for 16th quarter (September, 1995) of fishes at modules (D, M, R) and controls (

SPECIES	COMMON NAME	CODE	D	M	R	C	TOTAL
Gobiosoma oceanops	Neon goby	GOBo	0	0	8	0	8
Cantherhines pullus	Orangespotted filefish	CANp	0	4	1	2	7
Diodon holacanthus	Balloonfish	DIOho	0	0	0	3	3
Canthigaster rostrata	Sharpnose puffer	CANr	7	10	4	8	29
Lactophyrys quadricornis	Scrawled cowfish	LACq	0	1	0	0	1
Panulirus argus	Spiny lobster	PANa	1	1	3	0	5
Stenopus hispidus	Banded coral shrimp	STEh	0	5	3	0	8
NUMBER OF FISHES			537	2872	1017	558	4984
NUMBER OF SPECIES			35	39	42	31	55

Table F4. Summary statistics of fish data for the four study site types (D, M, R, and C)

MODULE	N	Diversity Index H	Total # fish	Range	Total # species	Range	Most common species	
D	11	1.11	537	9 to 65	35	8 to 18	*Haemulon sp*	n=278
							Thalassoma bifasciatum	n=109
							Acanthurus bahianus	n=14
							Equetus acuminatus	n=14
M	10	0.86	2872	72 to 868	39	10 to 23	*Haemulon sp*	n=2103
							Lutjanus synagris	n=600
							Lutjanus griseus	n=112
							Thalassoma bifasciatum	n=90
R	10	0.83	1017	48 to 156	42	11 to 22	*Haemulon sp*	n=644
							Thalassoma bifasciatum	n=120
							Lutjanus griseus	n=25
							Chromis scotti	n=24
C	31	0.52	558	3 to 43	31	3 to 9	*Thalassoma bifasciatum*	n=243
							Pomacentrus partitus	n=166
							Haemulon plumieri	n=35
							Acanthurus bahianus	n=22

Module	N	$\bar{X}$ of fish per module	s.e.	$\bar{X}$ species per module	s.e.
D	11	48.82	5.21	12.27	0.96
M	10	287.20	97.27	17.00	1.31
R	10	101.70	9.79	16.20	1.09
C	31	17.97	1.46	5.06	0.29

Table F5. Comparison of the average number of fishes and the average numbe of species at the four study site types (D, M, R, and C) for fishes.

One-Way Analysis of Variance (ANOVA)

Number of fishes:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	3	564,002	188,001	12.603	<0.001
Within	58	865,183	14,917		

The calculated F-value indicates that there are significant differences among the means of the populations (p<0.001).

Number of species:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	3	1,686	562	73.808	<0.001
Within	58	441	7		

The calculated F-value indicates that there are significant differences among the means of the populations (p<0.001).

T-tests (independent samples, separate variance)

Mean number of fishes:

Sites	df	t	p	
D vs M	19	-2.45	0.023	M higher
D vs R	19	-4.77	<0.001	R higher
M vs R	18	1.90	0.071	
D vs C	40	5.71	<0.001	D higher
M vs C	39	2.77	0.008	M higher
R vs C	39	8.46	<0.001	R higher

Mean number of species:

Sites	df	t	p	
D vs M	19	-2.91	0.009	M higher
D vs R	19	-2.69	0.014	R higher
M vs R	18	0.47	0.649	
D vs C	40	7.16	<0.001	D higher
M vs C	39	8.91	<0.001	M higher
R vs C	39	9.85	<0.001	R higher

Table F6. Surface area of each module type (D, M, R) in sq.ft.

	D	M	R
Surface Area (ft2) of module	28	130.5	160
Void Space (ft3) of module	7.1	71.6	12
Area/Volume of module	3.9	1.8	13.3
Area (ft2) sampled per module	28.0	130.5	160.0
% Area sampled per module	100%	100%	100%
Number of modules sampled	11	10	10

Average numbers of individuals and species per unit area sampled (sq.ft.).

Site Type	$\bar{X}$ of individuals per ft2	Std. err.	$\bar{X}$ of species per ft2	Std. err.
D	1.74	0.19	0.439	0.034
M	2.20	0.75	0.131	0.010
R	0.64	0.06	0.104	0.006

Table F7. Comparison of the average number of fishes per sq.ft. and the average number of species per sq.ft. at the four study site types (D, M, R, and C) for fishes.

One-Way Analysis of Variance (ANOVA)

Number of fishes per sq.ft.:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	2	13.00	6.503	3.361	0.048
Within	28	54.18	1.935		

The calculated F-value indicates that there are significant differences among the means of the populations (p=0.048).

Number of species per sq. ft.:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	2	0.74	0.369	73.122	<0.001
Within	28	0.14	0.005		

The calculated F-value indicates that there are significant differences among the means of the populations (p<0.001).

T-tests (independent samples, separate variance)

Mean number of fishes per sq.ft.:

Sites	df	t	p	
D vs M	19	-0.60	0.563	
D vs R	19	5.65	<0.001	D modules higher
M vs R	18	2.09	0.048	M modules higher

Mean number of species per sq.ft.:

Sites	df	t	p	
D vs M	19	8.67	<0.001	D modules higher
D vs R	19	9.61	<0.001	D modules higher
M vs R	18	2.27	<0.001	M modules higher

Table F8. Standardized occurrence (as % of total number) of most common fishes (n>15).

SPECIES	COMMON NAME	CODE	D	M	R	C
Epinephelus cruenatus	Graysby	EPIc	0.4	0.2	0.3	0.0
Serranus tigrinus	Harlequin bass	SERt	0.0	0.0	0.0	2.2
Hypolplectrus unicolor	Hamlets	HYPu	0.6	0.2	0.4	0.4
Lutjanus griseus	Gray snapper	LUTg	1.9	3.9	2.5	0.0
Lutjanus synagris	Lane snapper	LUTs	0.0	20.9	0.0	0.0
Anisotremus virginicus	Porkfish	ANIv	1.7	0.5	0.7	0.4
Haemulon aurolineatum	Tomtate	HAEa	6.1	1.2	3.1	0.0
Haemulon sciurus	Bluestriped grunt	HAEs	11.9	35.0	5.6	0.9
Haemulon flavolineatum	French grunt	HAEf	14.9	9.1	22.6	0.0
Haemulon plumieri	White grunt	HAEp	18.8	18.3	32.0	6.3
Equetus acuminatus	High-hat	EQUa	2.6	0.1	0.5	0.0
Chaetodon sedentarius	Reef butteflyfish	CHAs	0.7	0.3	0.8	1.6
Acanthurus bahianus	Ocean surgeon	ACAb	2.6	0.7	2.3	3.9
Chaetodiptierus faber	Spadefish	CHAf	0.0	0.0	0.9	0.0
Holacanthus tricolor	Rock beauty	HOLt	1.1	0.3	0.3	0.9
Abudefduf saxatilis	Sergeant major	ABUs	0.6	1.2	1.7	0.0
Chromis cynaneus	Blue chromis	CHRc	1.9	1.1	2.0	0.0
Chromis multilineatus	Brown chromis	CHRm	0.2	0.2	0.3	0.0
Chromis insolatus	Sunshinefish	CHRi	0.0	0.0	0.5	0.9
Chromis scotti	Purple reeffish	CHRs	0.6	0.8	2.4	0.2
Pomacentrus partitus	Bicolor damselfish	POMp	0.0	0.1	1.0	29.7
Pomacentrus variabilis	Cocoa damselfish	POMv	1.5	0.2	0.5	0.7
Bodianus rufus	Spanish hogfish	BODr	1.5	0.5	1.8	0.4
Clepticus parrai	Creole wrasse	CLEp	0.0	0.0	1.0	0.0
Thalassoma bifasciatum	Bluehead wrasse	THAb	20.3	3.1	11.8	43.5
Scarus croicensus	Striped parrotfish	SCAc	3.2	0.5	0.8	0.4
Sparisoma viride	Stoplight parrotfish	SPAv	0.2	0.1	0.4	0.5
Sparisoma aurofrenatum	Redband parrotfish	SPAa	2.0	0.2	0.9	1.1
Canthigaster rostrata	Sharpnose puffer	CANr	1.3	0.3	0.4	1.4
% OF FISHES			96.5	99.0	97.1	95.3
% OF SPECIES			65.7	64.1	64.3	58.1

Table F9. Occurrence of grunts (Haemulon species) at each of the four study site types by quarter. Occurrence is presented as total number of grunts at the site type and as % of total number of fishes at the site type.

Quarter		D	M	R	C
1	# Grunts	9	29	87	0
	% Total	6%	7.7%	19.7%	0%
2	# Grunts	12	87	114	97
	% Total	7%	20.2%	28%	19.1%
3	# Grunts	26	88	256	47
	% Total	13.1%	13.6%	38.1%	6.6%
4	# Grunts	19	123	191	173
	% Total	6.8%	18.3%	26.5%	24%
5	# Grunts	272	616	1220	65
	% Total	56%	47.9%	75.6%	9.7%
6	# Grunts	722	1504	1339	17
	% Total	77.6%	70.4%	83.5%	5.1%
7	# Grunts	345	3475	1033	32
	% Total	58%	89.9%	73.8%	7.3%
8	# Grunts	493	4955	1656	64
	% Total	71.5%	85.6%	82.3%	14.5%
10	# Grunts	327	2725	720	192
	% Total	70.0%	79.5%	66.5%	36.4%
12	# Grunts	258	2166	951	43
	% Total	53.6%	77.5%	71.3%	10.0%
14	# Grunts	298	4906	803	28
	% Total	55.6%	82.3%	69.7%	5.4%
16	# Grunts	278	1825	645	40
	% Total	51.8%	63.5%	63.4%	7.2%

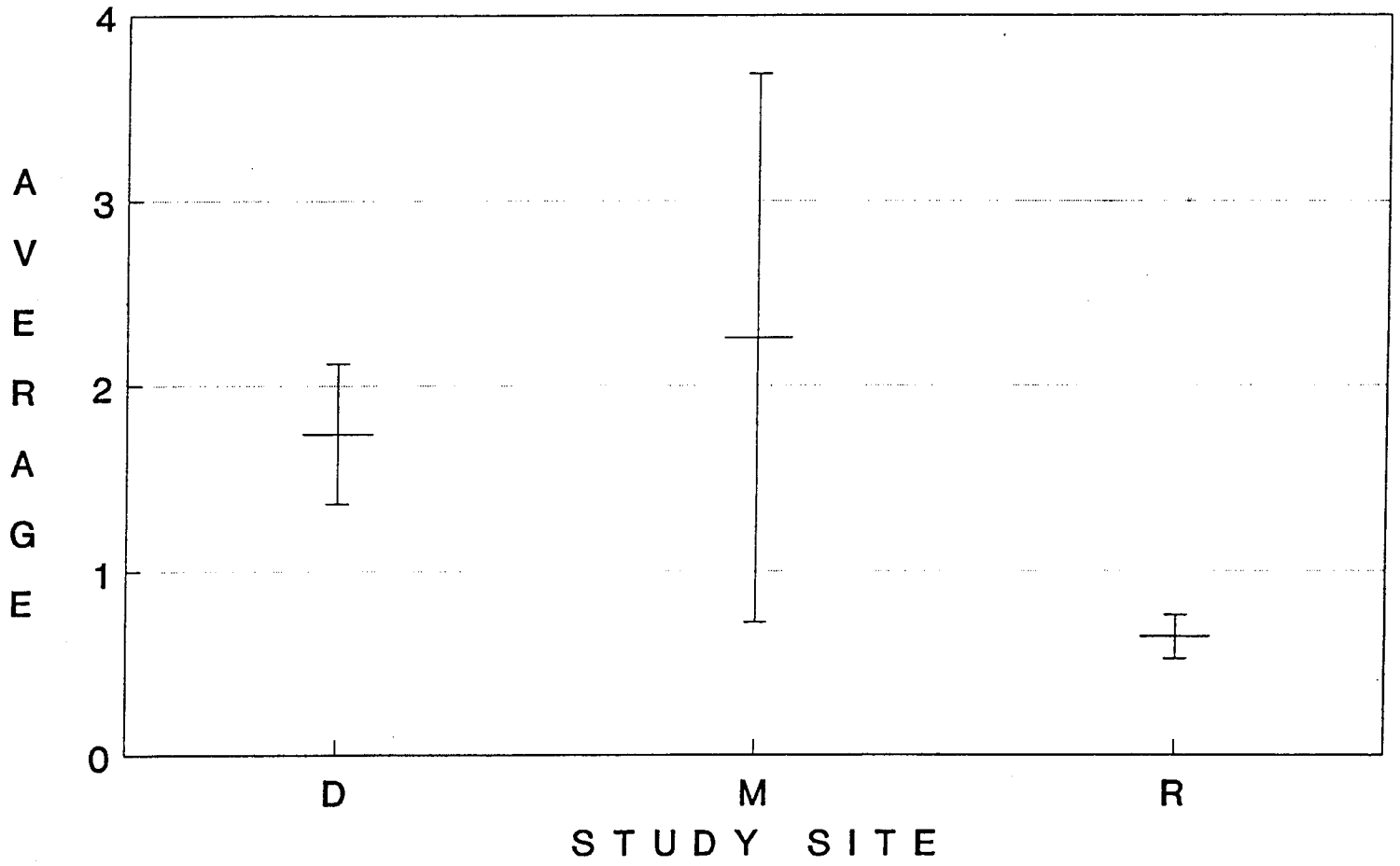
Table F10. Quarter in which fish taxa were first recorded at the modules (D,M,R) and controls (C).

Genus/species	D	M	R	C
Ginglymostoma cirratum	16	4	1	---
Dasyatis americanus	---	14	---	---
Urolophus jamaicensis	---	---	---	1
Aetobatus narinari	---	---	---	16
Gymnothorax funebris	---	5	1	2
Synodus intermedius	---	---	---	2
Aulostomus maculatus	1	1	1	3
Holocentrus rufus	2	2	5	2
Priacanthus arenatus	---	---	---	1
Rypticus maculatus	---	2	---	---
Epinephelus cruentatus	1	1	1	1
Epinephelus morio	1	1	2	---
Mycteroperca microlepis	---	1	---	---
Mycteroperca phenax	3	4	3	---
Mycteroperca bonaci	---	---	14	---
Serranus tigrinus	14	2	2	1
Serranus tabacarius	2	---	---	1
Hypoplecturus unicolor	1	1	1	2
Pseudupeneus maculatus	2	2	1	2
Apogon spp	16	5	14	-
Seriola dumerili	7	7	4	4
Seriola zonata	---	2	---	---
Caranx bartholomaei	5	---	5	3
Caranx ruber	1	2	3	5
Ocyurus chrysurus	1	1	1	4
Lutjanus analis	1	1	5	7
Lutjanus buccanella	10	10	4	---
Lutjanus griseus	1	1	1	5
Lutjanus synagris	---	1	1	---
Diplodus holbrooki	---	1	---	5
Anistoremus surinamensis	---	1	2	---
Anisotremus virginicus	1	1	1	4
Haemulon aurolineatum	6	6	6	-
Haemulon flavolineatum	3	3	3	---
Haemulon plumieri	1	1	1	3
Haemulon sciurus	3	1	1	3
Haemulon melanurum	---	14	16	---
Equetus lanceolatus	1	2	1	---
Equetus punctatus	14	5	16	---
Equetus acuminatus	1	1	2	---
Equetus umbrosus	14	14	---	---
Chaetodon ocellatus	1	1	1	5
Chaetodon capistratus	5	4	4	7
Chaetodon sedentarius	1	1	1	1
Acanthurus bahianus	1	1	1	1
Acanthurus coeruleus	1	1	1	3
Acanturus chirgus	---	16	16	---
Acanthurus randalli	7	---	---	---
Chaetodipterus faber	4	1	3	12
Kyphosus spp	-	6	-	-
Pomacanthus arcuatus	1	2	1	2
Pomacanthus paru	1	1	2	1

Table F10. Quarter in which fish taxa were first recorded at the modules (D,M,R) and controls (C).

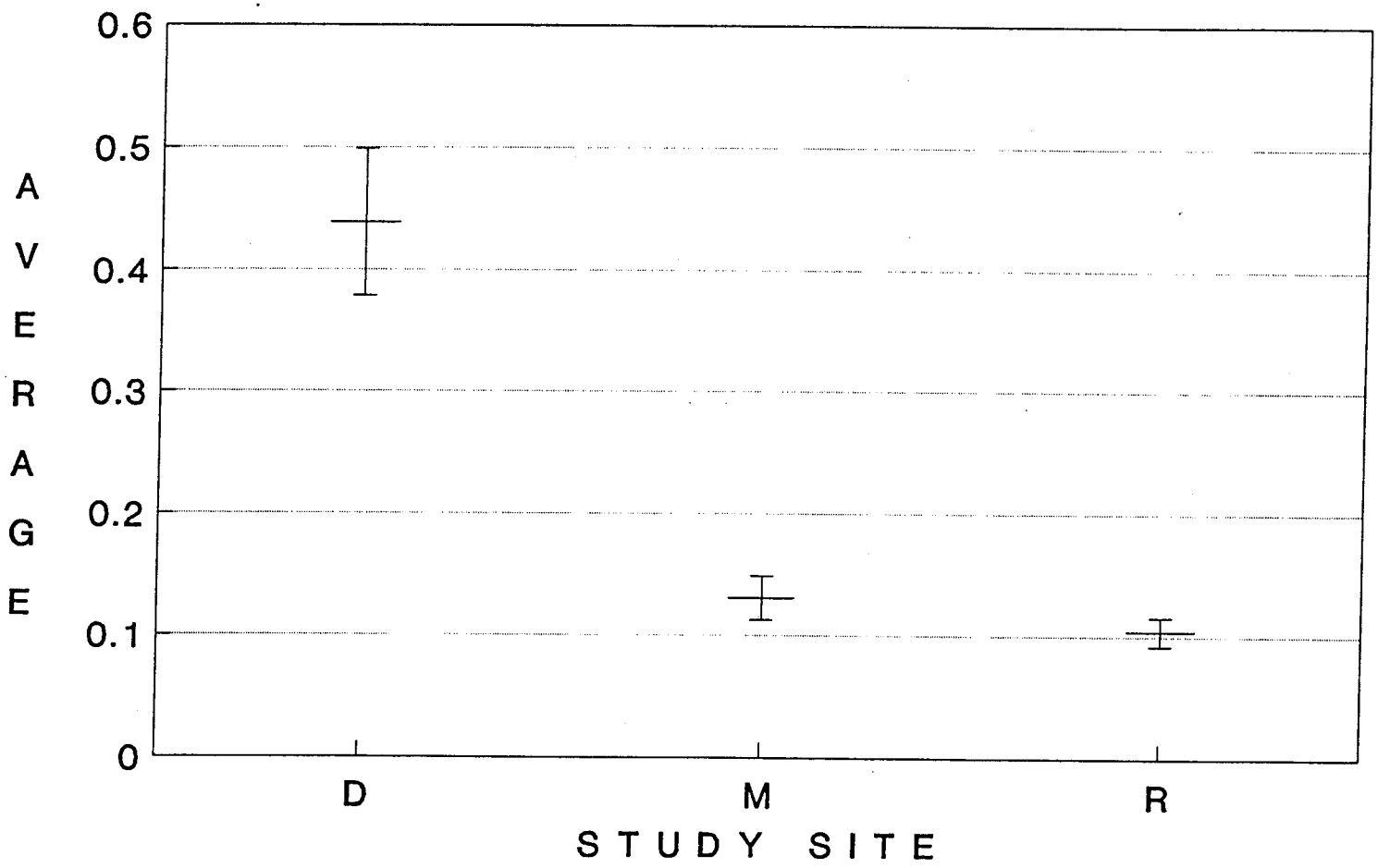
Genus/species	D	M	R	C
Holacanthus bermeudensis	2	2	1	1
Holacanthus ciliaris	1	1	3	3
Holacanthus tricolor	1	1	1	1
Abudefduf saxatilis	2	1	2	—
Chromis cyaneus	2	2	5	2
Chromis multilineatus	5	4	4	5
Chromis insolatus	4	2	3	8
Chromis scotti	1	2	1	5
Pomacentrus leucostictus	5	6	6	1
Pomacentrus partitus	1	1	1	1
Pomacentrus variabilis	3	3	3	5
Bodianus pulchellus	7	4	12	14
Bodianus rufus	2	1	1	2
Halichoeres garnoti	1	2	1	2
Haliochoeres bivitatus	6	-	-	-
Lachnolaimus maximus	1	1	1	3
Thalassoma bifasciatum	1	1	1	1
Scarus croicensus	3	3	4	6
Scarus taeniopterus	-	6	-	14
Sparisoma viride	2	4	4	3
Sparisoma aurofrenatum	1	1	1	1
Echeneis neucratoides	—	—	1	—
Gobiosoma oceanops	—	5	16	—
Scorpaena plumieri	—	6	2	2
Monacanthus hispidus	3	2	6	4
Balistes capriscus	3	1	3	3
Balistes betula	4	4	1	—
Cantherhines pullus	1	1	1	1
Diodon holacanthus	—	—	—	2
Diodon histrix	—	14	—	—
Canthigaster rostrata	1	1	1	1
Lactophrys quadricornis	3	6	2	2
Lactophrys triqueter	—	5	4	2
Lactophrys trigonus	—	—	—	12
Scyllarus spp	—	7	—	—
Synodus foetens	—	—	—	8
Gymnothorax moringa	7	—	—	3
Serranus baldwini	—	—	—	3
Spoerhoides spengleri	6	—	3	—
Clepticus parrai	5	6	6	-
Scarus coeruleus	8	6	8	-
Calamus leucostis	6	-	-	-
CUMULATIVE NUMBER OF SPECIES	67	77	71	61

Figure F1 Average number of fishes per sq.ft. +/- 2 Std.err.



If error bars do not overlap, means are significantly different.

Figure F2 Average number of species per sq.ft. +/- 2 Std.err.



If error bars do not overlap, means are significantly different.

Figure F3 Average number of fishes at four study sites by sampling period.

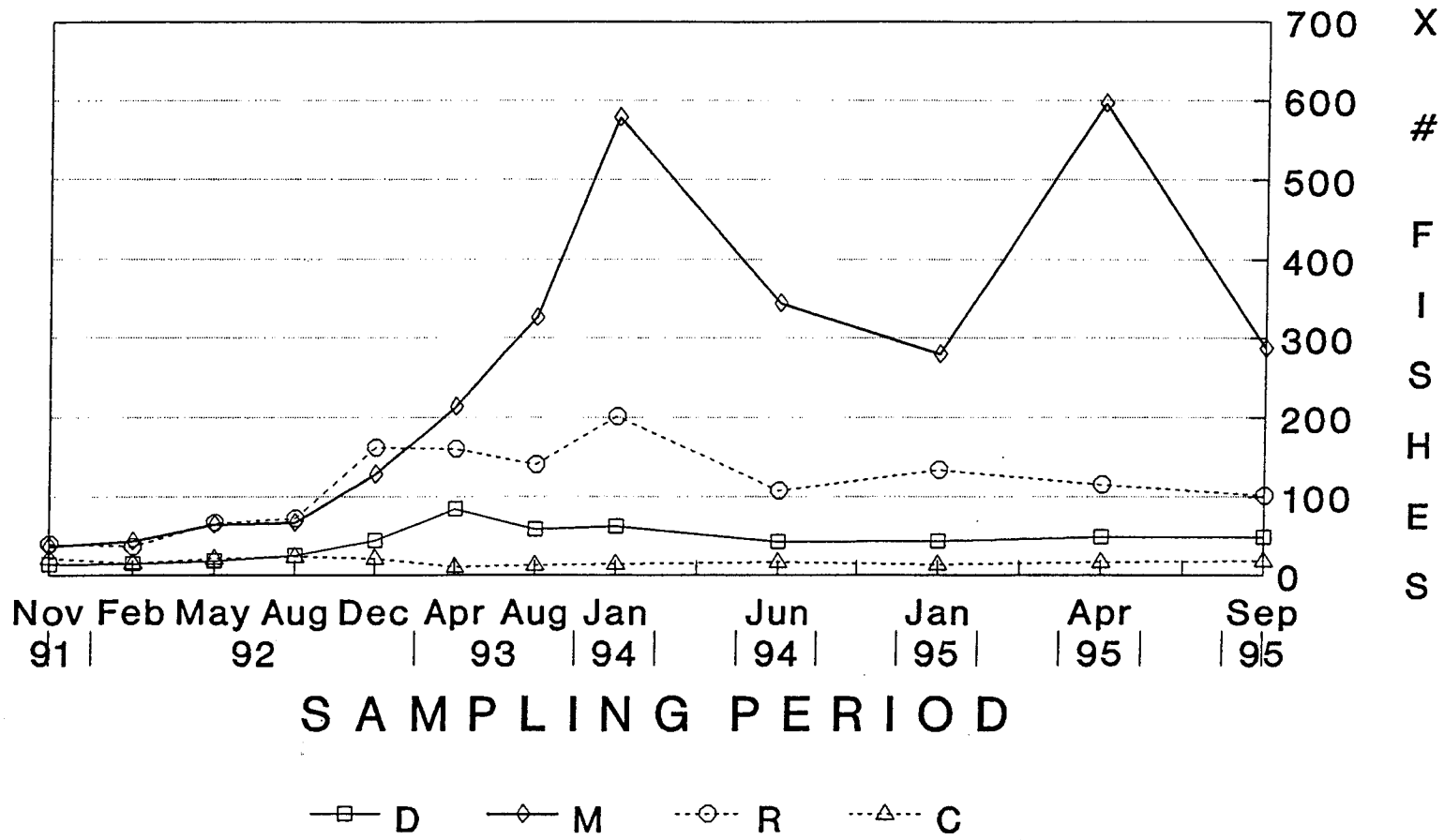


Figure F4 Average number of species at four study sites by sampling period.

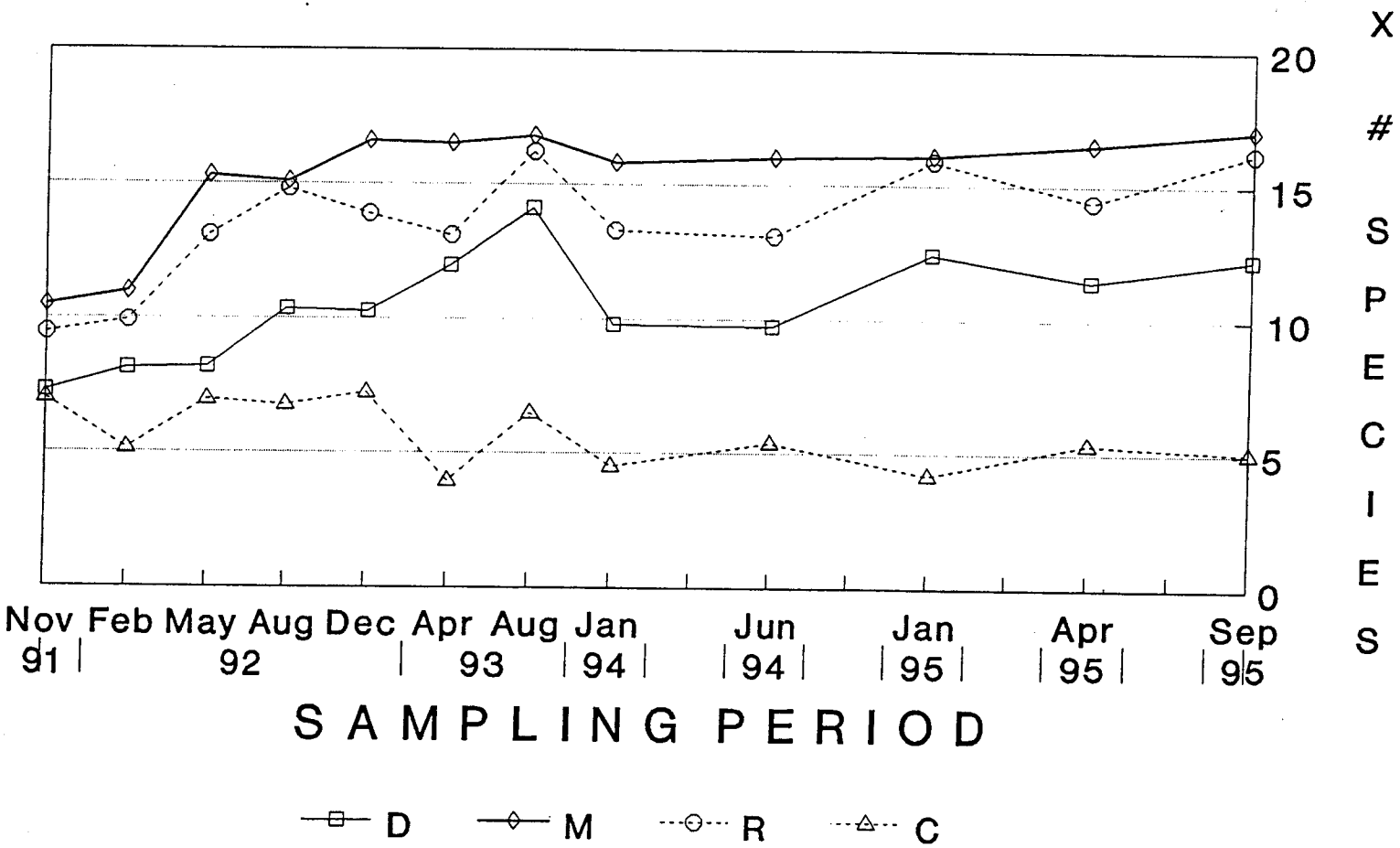


Figure F5. Rarefaction curve for the cumulative number of fish taxa.

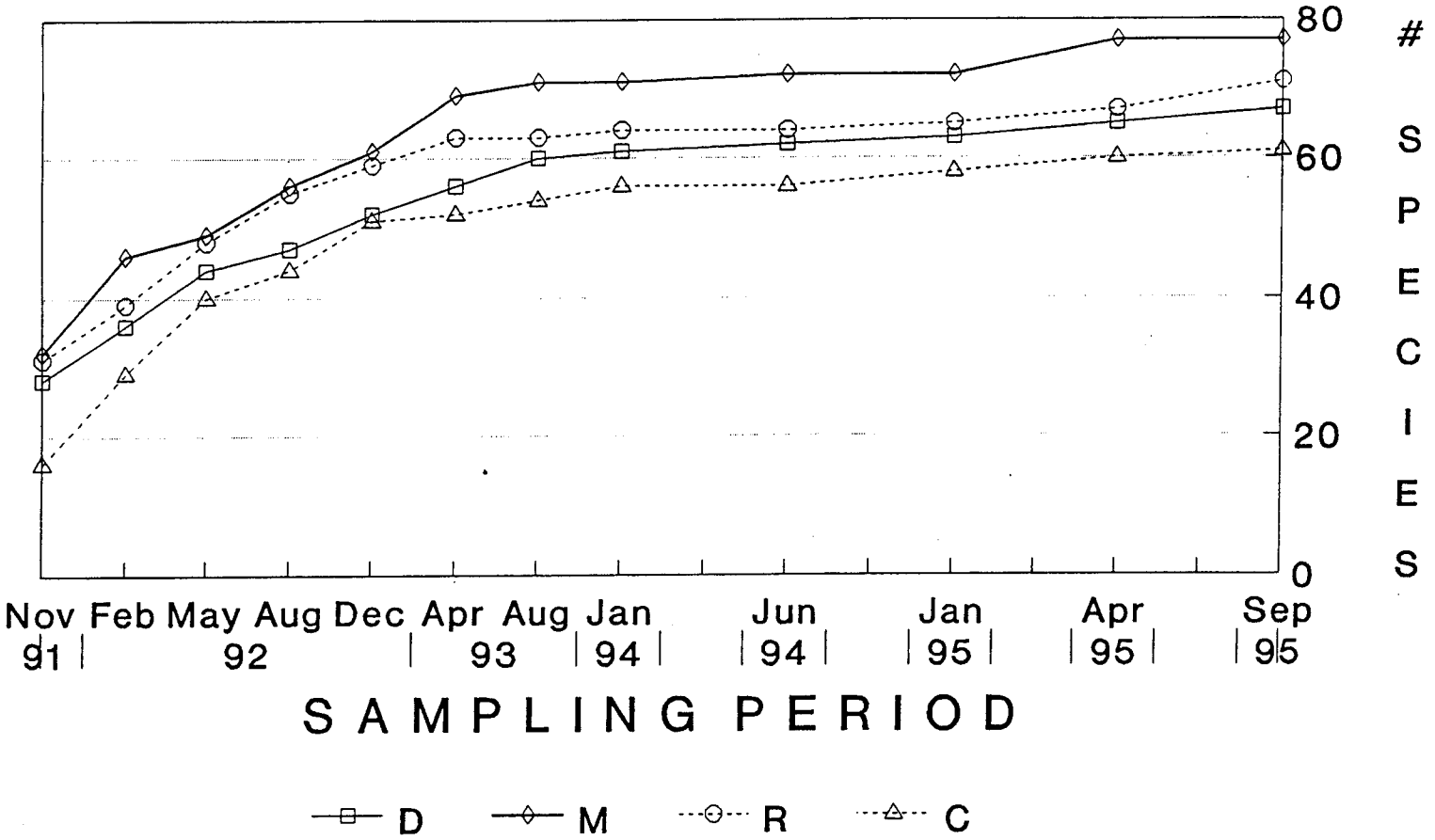


Figure F6 Shannon-Weiner diversity index (H) for fishes by sampling period.

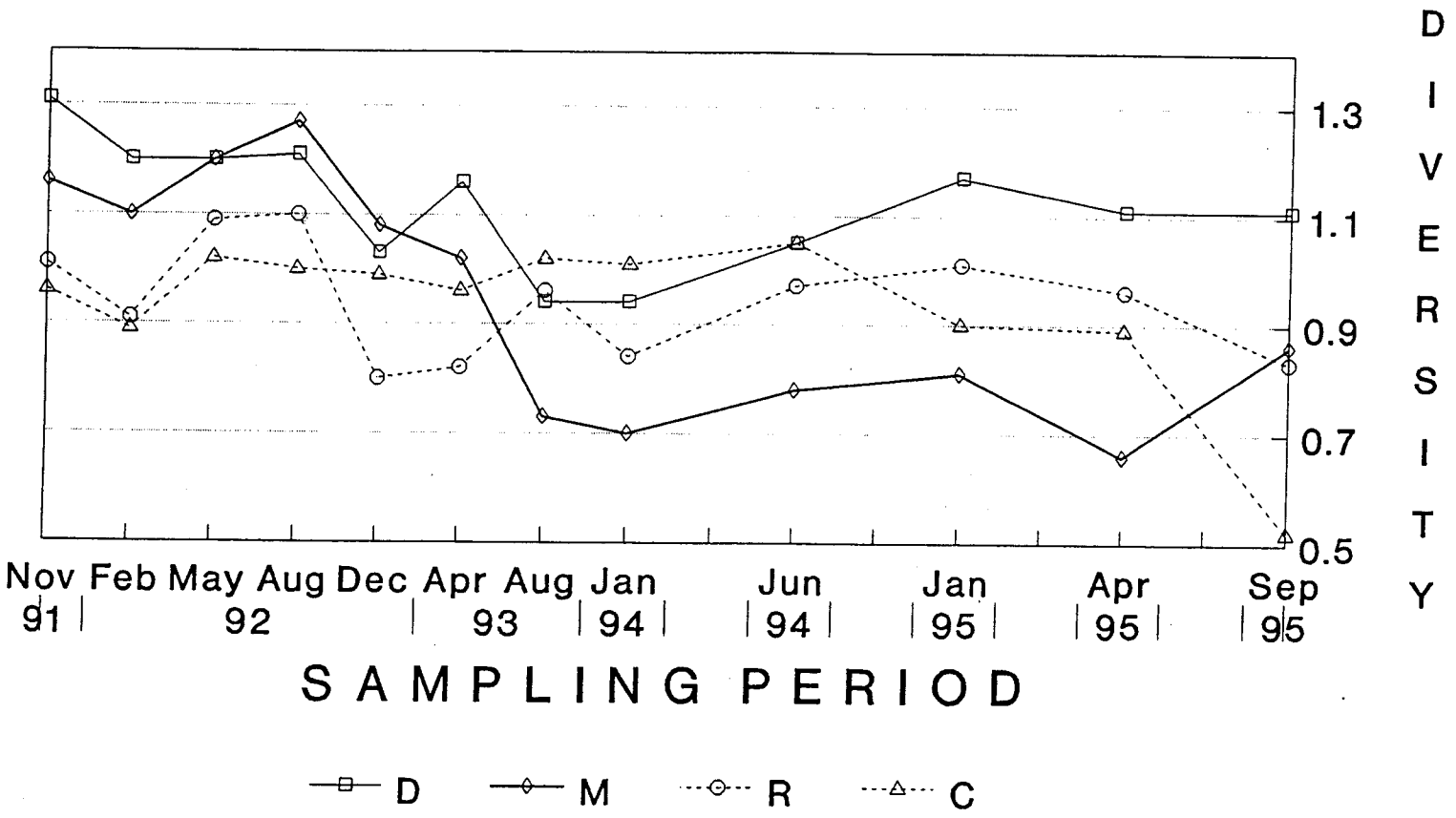


Table I1. Raw data for 16th quarter sampling (9/95) of benthic invertebrates at modules (D, M, R) and barren controls (BC).

SPECIES	CODE	D18	D19	D20	D21	D22	D25	D30	D34	D43	D49	D50	M1	M2	M3	M4
Agaricia sp	AGAsp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Aplysina cauliformis	APLc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Briareum asbestinum	BRIa	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Callyspongia fallax	CALf	1	3	2	0	1	1	0	0	0	0	0	1	1	0	1
Callyspongia plicifera	CALp	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Callyspongia vaginalis	CALv	0	3	2	3	2	4	3	4	3	10	1	3	9	10	3
Cliona delatrix	CLId	1	1	0	2	2	0	0	0	0	0	0	0	0	0	0
Dasychalina cyathina	DASc	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Dichocoenia stokesii	DICs	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Dictyota sp.	DICsp	0	0	0	0	20	20	0	0	0	0	0	0	0	20	0
Diploria sp	DIPsp	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dysidea sp.	DYSsp	3	8	2	2	1	1	1	1	8	0	3	3	4	1	2
Eunicea sp.	EUNsp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eusmilia fastigiata	EUSf	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haliclona rubens	HALr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Halimeda goreaui	HALg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holopsamma helwigi	HOLh	18	20	20	20	12	18	13	20	4	20	17	20	18	20	10
Iotrochota birotulata	IOTb	0	0	0	1	1	2	2	0	0	1	2	19	3	5	3
Ircinia sp	IRCsp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lima lima	LIMl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meandrina meandrites	MEAm	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Melanostigma nigromaculat	MELn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Millepora alcicornis	MILa	1	7	3	4	7	4	2	4	5	4	1	3	0	2	2
Montastrea annularis	MONa	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Montastrea cavernosa	MONc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mussa sp	MUSsp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Niphates digitalis	NIPd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Niphates sp.	NIPsp	0	0	1	0	0	0	1	0	0	0	0	1	0	3	0
Plexaura flexuosa	PLEf	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Porites sp.	PORsp	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0
Psuedoceratina crassa	PSEcr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psuedoplexaura sp	PSEsp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scerlatinian sp	SCEsp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea sidera	SIDs	0	0	1	0	4	0	1	0	2	0	4	0	0	0	0
Siderastrea sp.	SIDsp	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Spirastrella coccinea	SPIc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spondylus americanus	SPOa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sponge unid.	SPONG	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Stephanocoenia michelini	STEm	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0
Stolonica sabulosa	STOs	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table I1. Raw data for 16th quarter sampling (9/95) of benthic invertebrates at modules (D, M, R) and barren controls (BC).

SPECIES	CODE	D18	D19	D20	D21	D22	D25	D30	D34	D43	D49	D50	M1	M2	M3	M4
Telesto riisei	TELr	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1
Thalysias sp	THAsp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trematooecia aviculifera	TREa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Udotea sp.	UDOsp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulosa reutzleri	ULOr	1	1	1	1	0	0	0	0	0	0	1	0	2	0	0
Watersipora sp.	WATsp	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Xestospongia muta	XESm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NUMBER INDIVIDUALS		36	47	32	34	51	55	23	30	24	37	33	53	42	64	22
NUMBER OF SPECIES		13	9	8	8	10	11	7	5	7	6	11	9	10	9	7
Individuals per unit area		6.00	7.83	5.33	5.67	8.50	9.17	3.83	5.00	4.00	6.17	5.50	4.16	3.29	5.02	1.73
Species per unit area		2.17	1.50	1.33	1.33	1.67	1.83	1.17	0.83	1.17	1.00	1.83	0.71	0.78	0.71	0.55

Table I1. Raw data for 16th quarter sampling (9/95) of benthic invertebrates at modules (D, M, R) and barren controls (BC).

SPECIES	M5	M7	M8	M9	M10	R2	R4	R5	R7	R14	R15	R16	R17	R21	R22	R23	BC
Agaricia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aplysina cauliformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Briareum asbestinum	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1
Callyspongia fallax	3	0	0	0	0	0	2	4	0	0	1	1	1	0	3	1	0
Callyspongia plicifera	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	2	0
Callyspongia vaginalis	5	11	2	5	6	2	8	0	6	2	6	1	4	3	6	3	1
Cliona delatrix	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	1	0
Dasychalina cyathina	0	0	0	0	3	0	1	0	0	0	0	0	1	0	0	0	1
Dichocoenia stokesii	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Dictyota sp.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Diploria sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dysidea sp.	2	8	3	3	0	4	4	0	6	3	1	3	5	7	0	5	0
Eunicea sp.	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Eusmilia fastigiata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haliclona rubens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Halimeda goreaui	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holopsamma helwigi	16	20	12	20	15	4	8	11	11	10	10	15	18	6	19	20	0
Iotrochota birotulata	3	1	1	5	9	0	2	2	5	1	1	1	3	8	4	4	0
Ircinia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lima lima	0	0	0	0	0	0	0	4	3	2	2	2	0	3	2	1	0
Meandrina meandrites	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
Melanostigma nigromaculat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Millepora alcicornis	2	4	2	5	5	2	3	2	0	1	4	2	3	7	5	6	0
Montastrea annularis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Montastrea cavernosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mussa sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Niphates digitalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Niphates sp.	0	1	2	2	0	1	1	0	5	1	1	0	1	2	0	0	0
Plexaura flexuosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porites sp.	0	0	0	1	0	0	0	0	0	0	0	3	1	0	1	0	0
Psuedoceratina crassa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psuedoplexaura sp	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0
Scerlatinian sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea sidera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Spirastrella coccinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spondylus americanus	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0
Sponge unid.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Stephanocoenia michelini	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	1
Stolonica sabulosa	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0

Table I1. Raw data for 16th quarter sampling (9/95) of benthic invertebrates at modules (D, M, R) and barren controls (BC).

SPECIES	M5	M7	M8	M9	M10	R2	R4	R5	R7	R14	R15	R16	R17	R21	R22	R23	BC3
Telesto riisei	2	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Thalysias sp	0	0	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0
Trematooecia aviculifera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Udotea sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulosa reutzleri	3	0	0	1	0	0	2	0	0	4	0	0	2	0	0	0	3
Watersipora sp.	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Xestospongia muta	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
NUMBER INDIVIDUALS	36	46	22	44	43	16	35	30	39	30	32	33	41	36	41	47	12
NUMBER OF SPECIES	8	7	6	9	8	8	13	11	9	12	13	12	12	7	8	11	10
Individuals per unit area	2.82	3.61	1.73	3.45	3.37	1.33	2.92	2.50	3.25	2.50	2.67	2.75	3.42	3.00	3.42	3.92	0.51
Species per unit area	0.63	0.55	0.47	0.71	0.63	0.67	1.08	0.92	0.75	1.00	1.08	1.00	1.00	0.58	0.67	0.92	0.83

Table I1. Raw data for 16th quarter sampling (9/95) of benthic invertebrates at modules (D, M, R) and barren controls (BC).

SPECIES	BC8	BC14	BC19	BC20	BC21	BC27	BC30	BC37
Agaricia sp	0	0	0	1	0	0	0	0
Aplysina cauliformis	3	1	1	2	0	0	0	2
Briareum asbestinum	0	0	4	0	1	1	3	0
Callyspongia fallax	0	0	0	0	0	0	0	0
Callyspongia plicifera	0	0	0	0	0	0	1	0
Callyspongia vaginalis	3	1	1	0	0	0	0	3
Cliona delatrix	0	0	0	0	0	0	0	0
Dasychalina cyathina	1	2	0	0	0	1	1	0
Dichocoenia stokesii	0	0	0	0	0	1	0	0
Dictyota sp.	0	20	1	20	20	0	20	20
Diploria sp	0	0	0	0	0	0	0	0
Dysidea sp.	0	0	0	0	0	0	0	0
Eunicea sp.	0	0	2	0	0	1	0	0
Eusmilia fastigiata	0	1	0	1	0	0	0	0
Haliclona rubens	0	0	0	0	0	1	0	0
Halimeda goreaui	0	0	0	0	0	0	1	0
Holopsamma helwigi	1	1	1	1	1	3	4	1
Iotrochota birotulata	0	0	0	0	0	0	0	1
Ircinia sp	1	0	0	1	0	0	0	0
Lima lima	0	0	0	0	0	0	0	0
Meandrina meandrites	0	1	1	0	0	1	1	1
Melanostigma nigromaculat	0	0	0	0	0	0	0	0
Millepora alcicornis	0	0	0	0	0	0	0	0
Montastrea annularis	0	0	0	0	0	0	0	0
Montastrea cavernosa	1	0	0	0	0	1	0	0
Mussa sp	0	0	1	0	0	0	0	0
Niphates digitalis	6	1	2	1	1	0	0	3
Niphates sp.	0	0	0	0	0	0	0	0
Plexaura flexuosa	0	0	0	0	0	0	0	0
Porites sp.	0	0	0	0	0	0	0	0
Psuedoceratina crassa	0	1	0	0	0	0	0	0
Psuedoplexaura sp	0	0	0	0	0	0	0	0
Scerlatinian sp	0	0	0	0	0	0	0	0
Siderastrea sidera	0	1	0	0	0	0	0	0
Siderastrea sp.	0	0	0	0	0	0	0	0
Spirastrella coccinea	0	1	0	1	2	0	0	0
Spondylus americanus	0	0	0	0	0	0	0	0
Sponge unid.	0	0	0	0	0	0	0	0
Stephanocoenia michelini	3	1	1	1	0	0	3	1
Stolonica sabulosa	0	0	0	0	0	0	0	0

Table I1. Raw data for 16th quarter sampling (9/95) of benthic invertebrates at modules (D, M, R) and barren controls (BC).

SPECIES	BC8	BC14	BC19	BC20	BC21	BC27	BC30	BC37
Telesto riisei	0	0	0	0	0	0	0	0
Thalysias sp	0	0	0	0	0	0	0	0
Trematooecia aviculifera	0	0	0	0	0	0	0	0
Udotea sp.	0	0	0	0	1	1	3	0
Ulosa reutzleri	0	0	0	0	0	0	1	0
Watersipora sp.	0	0	0	0	0	0	0	0
Xestospongia muta	0	0	0	0	0	0	0	0
NUMBER INDIVIDUALS	19	32	15	29	26	11	38	32
NUMBER OF SPECIES	8	12	10	9	6	9	10	8
Individuals per unit area	0.80	1.35	0.63	1.22	1.09	0.46	1.60	1.35
Species per unit area	0.67	1.00	0.83	0.75	0.50	0.75	0.83	0.67

Table I2. Summary data for 16th quarter sampling (9/95) of benthic invertebrates at modules (D,M,R) and barren controls (BC).

SPECIES	CODE	D	M	R	BC	TOTAL
Agaricia sp	AGAsp	0	1	0	1	2
Aplysina cauliformis	APLc	0	0	0	9	9
Briareum asbestinum	BRIa	0	3	2	10	15
Callyspongia fallax	CALf	8	6	13	0	27
Callyspongia plicifera	CALp	0	1	6	1	8
Callyspongia vaginalis	CALv	35	54	41	9	139
Cliona delatrix	CLId	6	0	7	0	13
Dasychalina cyathina	DASc	1	3	2	6	12
Dichocoenia stokesii	DICs	1	0	1	1	3
Dictyota sp.	DICsp	40	20	1	101	162
Diploria sp	DIPsp	1	0	0	0	1
Dysidea sp.	DYSsp	30	26	38	0	94
Eunicea sp.	EUNsp	0	0	2	3	5
Eusmilia fastigiata	EUSf	0	0	0	2	2
Haliclona rubens	HALr	0	0	0	2	2
Halimeda goreaui	HALg	0	0	0	1	1
Holopsamma helwigi	HOLh	182	151	132	13	478
Iotrochota birotulata	IOTb	9	49	31	1	90
Ircinia sp	IRCsp	0	0	0	3	3
Lima lima	LIMl	0	0	19	0	19
Meandrina meandrites	MEAm	3	0	2	5	10
Melanostigma nigromaculat	MELn	0	0	3	0	3
Millepora alcicornis	MILa	42	25	35	0	102
Montastrea annularis	MONa	1	1	0	0	2
Montastrea cavernosa	MONc	0	0	0	2	2
Mussa sp	MUSsp	0	0	0	1	1
Niphates digitalis	NIPd	0	0	0	15	15
Niphates sp.	NIPsp	2	9	12	0	23
Plexaura flexuosa	PLEf	1	0	0	0	1
Porites sp.	PORsp	4	1	5	0	10
Psuedoceratina crassa	PSEcr	0	0	0	1	1
Psuedoplexaura sp	PSEsp	1	0	4	0	5
Scerlatinian sp	SCEsp	1	0	0	0	1
Siderastrea sidera	SIDs	12	0	0	1	13
Siderastrea sp.	SIDsp	4	0	0	1	5
Spirastrella coccinea	SPIc	0	0	0	4	4
Spondylus americanus	SPOa	0	0	4	0	4
Sponge unid.	SPONG	1	1	0	1	3
Stephanocoenia michelini	STEm	5	0	3	11	19
Stolonica sabulosa	STOs	5	0	2	0	7
Telesto riisei	TELr	0	11	0	0	11
Thalysias sp	THAsp	1	0	5	0	6
Trematooecia aviculifera	TREa	0	0	1	0	1
Udotea sp.	UDOsp	0	0	0	5	5
Ulosa reutzleri	ULOr	5	6	8	4	23
Watersipora sp.	WATsp	1	4	0	0	5
Xestospongia muta	XESm	0	0	1	0	1
NUMBER INDIVIDUALS		402	372	380	214	1368
NUMBER OF SPECIES		26	18	26	27	47

TABLE I3. Summary statistics of benthic invertebrate data for the four study site types (D, M, R, BC).

MODULE	N	Diversity Index H	Total # indiv.	Range	Total # species	Range	Most common species	
D	11	0.881	402	23 to 55	26	5 to 13	*Holopsamma helwigi*	n=182
							Millipora alcicornis	n=42
							Dictyota sp	n=40
							Callyspongia vaginalis	n=35
M	9	0.875	372	22 to 64	18	6 to 10	*Holopsamma helwigi*	n=151
							Callyspongia vaginalis	n=54
							Iotrochota birotulata	n=49
							Dysidia sp.	n=26
R	11	1.018	380	16 to 47	26	7 to 13	*Holopsamma helwigi*	n=132
							Callyspongia vaginalis	n=41
							Dysidea sp.	n=38
							Millipora alcicornis	n=35
BC	9	0.955	214	11 to 38	27	6 to 12	*Dictyota sp*	n=101
							Niphates digitalis	n=15
							Holopsamma helwigi	n=13
							Stephanocoenia michelini	n=11

Module	N	$\bar{X}$ of indiv. per module	s.e.	$\bar{X}$ species per module	s.e.
D	11	36.55	3.14	8.64	0.73
M	9	41.33	4.50	8.11	0.42
R	11	34.55	2.44	10.50	0.65
BC	9	23.78	3.27	9.11	0.56

TABLE I4. Comparison of the average number of individuals and the average number of species at the four study site types (D, M, R, and BC) for benthic invertebrate data.

One-Way Analysis of Variance (ANOVA)
Number of individuals:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	3	1,497	499	4.53	0.009
Within	36	3,967	110		

The calculated F-value indicates that there are significant differences among the means of the populations (p=0.009).

Number of species:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	3	34	11	2.897	0.048
Within	36	141	4		

The calculated F-value indicates that there are significant differences among the means of the populations (p=0.048).

T-tests (Independent samples, separate variance)
Mean Number of Individuals:

Sites	df	t	p	
D vs M	18	-0.873	0.318	
D vs R	20	0.503	0.625	
M vs R	18	1.326	0.199	
D vs BC	19	2.816	0.011	Module higher
M vs BC	17	3.155	0.006	Module higher
R vs BC	19	2.637	0.016	Module higher

Mean Number of Species:

Sites	df	t	p	
D vs M	18	0.623	0.548	
D vs R	20	-1.951	0.062	
M vs R	18	-3.133	0.006	R module higher
D vs BC	19	-0.515	0.618	
M vs BC	17	-1.149	0.172	
R vs BC	19	1.664	0.110	

Table I5. Surface area of each module (D, M, R) and barren control (BC) quadrats, and correction of average number of individuals and species for differences in surface area.

	D	M	R	BC
Surface Area (ft2) of module	28	130.5	160	
Void Space (ft3) of module	7.1	71.6	12	
Area/Volume of module	3.9	1.8	13.3	
Area (ft2) sampled per module	6.0	12.75	12.0	23.76
% Area sampled per module	21%	10%	8%	
Number of modules sampled	11	9	11	9

Site Type	X of individuals per ft2	Std. err.	X of species per ft2	Std. err.
D	6.09	0.52	1.439	0.120
M	3.24	0.35	0.637	0.033
R	2.88	0.20	0.879	0.054
BC	1.00	0.14	0.759	0.046

TABLE I6. Comparison of the average number of individuals per sq. ft. and the average number of species per sq.ft. at the four study site types (D, M, R, and BC) for benthic invertebrates.

One-Way Analysis of Variance (ANOVA)
Number of individuals per sq. ft.:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	3	134	45	35.904	<0.001
Within	36	45	1.24		

The calculated F-value indicates that there are significant differences among the means of the populations (p<0.001).

Number of species per sq. ft.:

Source	df	Sum of Squares	Mean Squares	F-value	p
Between	3	3.89	1.30	21.36	<0.001
Within	36	2.19	0.06		

The calculated F-value indicates that there are significant differences among the means of the populations (p<0.001).

T-tests (Independent samples, separate variance)
Mean number of individuals per sq. ft.:

Sites	df	t	p	
D vs M	18	4.516	<0.001	D module higher
D vs R	20	5.719	<0.001	D module higher
M vs R	18	0.889	0.389	
D vs BC	19	9.408	<0.001	Module higher
M vs BC	17	5.919	<0.001	Module higher
R vs BC	19	7.634	<0.001	Module higher

Mean number of species per sq. ft.:

Sites	df	t	p	
D vs M	18	6.351	<0.001	D modules higher
D vs R	20	4.205	0.001	D modules higher
M vs R	18	-3.802	0.002	R modules higher
D vs BC	19	5.220	<0.001	Module higher
M vs BC	17	-2.116	0.048	BC higher
R vs BC	19	3.395	1.684	

Table I7. Standardized occurrence (as % of individuals) of most common benthic invertebrates.

SPECIES	CODE	D	M	R	BC
Aplysina cauliformis	APLc	0.0	0.0	0.0	4.2
Briareum asbestinum	BRIa	0.0	0.8	0.5	4.7
Callyspongia fallax	CALf	2.0	1.6	3.4	0.0
Callyspongia plicifera	CALp	0.0	0.3	1.6	0.5
Callyspongia vaginalis	CALv	8.7	14.5	10.8	4.2
Cliona delatrix	CLId	1.5	0.0	1.8	0.0
Dasychalina cyathina	DASc	0.2	0.8	0.5	2.8
Dictyota sp.	DICsp	10.0	5.4	0.3	47.2
Dysidea sp.	DYSsp	7.5	7.0	10.0	0.0
Holopsamma helwigi	HOLh	45.3	40.6	34.7	6.1
Iotrochota birotulata	IOTb	2.2	13.2	8.2	0.5
Lima lima	LIMl	0.0	0.0	5.0	0.0
Meandrina meandrites	MEAm	0.7	0.0	0.5	2.3
Millepora alcicornis	MILa	10.4	6.7	9.2	0.0
Niphates digitalis	NIPd	0.0	0.0	0.0	7.0
Niphates sp.	NIPsp	0.5	2.4	3.2	0.0
Porites sp.	PORsp	1.0	0.3	1.3	0.0
Siderastrea sidera	SIDs	3.0	0.0	0.0	0.5
Stephanocoenia micheli	STEm	1.2	0.0	0.8	5.1
Stolonica sabulosa	STOs	1.2	0.0	0.5	0.0
Telesto riisei	TELr	0.0	3.0	0.0	0.0
Thalysias sp	THAsp	0.2	0.0	1.3	0.0
Ulosa reutzleri	ULOr	1.2	1.6	2.1	1.9
% OF INDIVIDUALS		97.0	98.1	95.8	86.9
% OF SPECIES		65.4	73.6	73.1	48.1

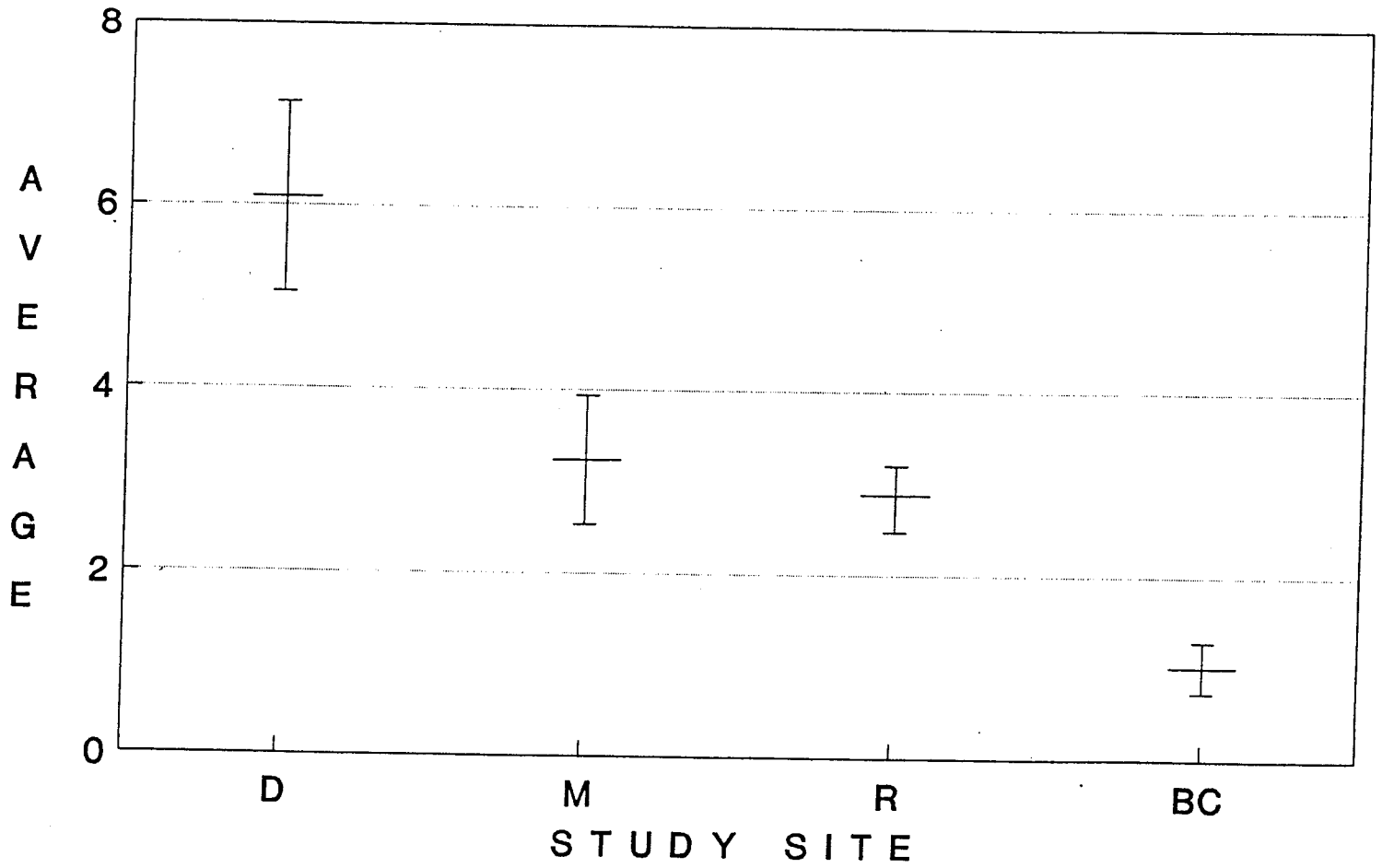
Table I8. Quarter in which invertebrate species were first recorded on the modules (D, M, R) and barren controls (BC). Sampling of modules and final barren control sites did not begin until the third quarter.

Genus/species	D	M	R	BC
Agaricia sp.	—	16	8	16
Aplysina	10	—	—	4
Ascidia nigra	4	—	3	—
Briareum asbestinum	8	3	12	3
Callyspongia fallax	3	12	3	5
Callyspongia plicifera	8	8	8	5
Callyspongia vaginalis	5	5	6	3
Cinachyra sp	—	—	—	12
Cliona delatrix	10	12	10	—
Cyanobacterial mats	—	—	—	6
Dasychalina cyathina	14	14	14	8
Diadema antillarum	—	—	10	—
Dichocoenia stokesi	12	—	14	3
Dictyota sp.	3	16	16	3
Diploria sp.	16	—	—	—
Didemnid unid.	4	3	4	7
Dysidea sp.	6	6	6	6
Echinometra lucunter	3	3	3	—
Eucidaris sp.	5	4	4	—
Eunicea sp.	—	—	6	3
Eusmilia fastigata	—	—	—	3
Haliclona rubens	—	—	—	3
Halimeda goreaui	—	—	—	3
Holopsamma helwigi	3	5	5	3
Hydroids	—	6	—	—
Iotrochota birotulata	7	7	8	7
Ircinia sp.	12	—	14	6
Leucosolenia sp.	—	—	6	—
Lima lima	4	4	3	3
Meandrina meandrites	8	—	7	3
Melanostigma nigromaculata	—	4	4	—
Millepora alcicornis	6	7	4	7
Mithrax sp.	—	6	—	—
Montastrea annularis	16	14	10	5
Montastrea cavernosa	—	—	—	5
Mussa sp	—	—	—	12
Mycale sp.	—	—	—	8
Mycetophyllia sp.	—	—	—	5
Niphates digitalis	—	—	—	3
Niphates erecta	10	—	—	3
Niphates sp.	10	8	8	12
Octopus sp.	—	—	6	—
Panuluris argus	—	5	4	—
Parasmittina sp.	3	3	4	—
Plexura flexuosa	14	—	—	12
Porites sp.	10	8	14	—
Pseudoceratina crassa	—	—	—	16
Pseudoplexura	16	—	10	—

Table I8. Quarter in which invertebrate species were first recorded on the modules (D, M, R) and barren controls (BC). Sampling of modules and final barren control sites did not begin until the third quarter.

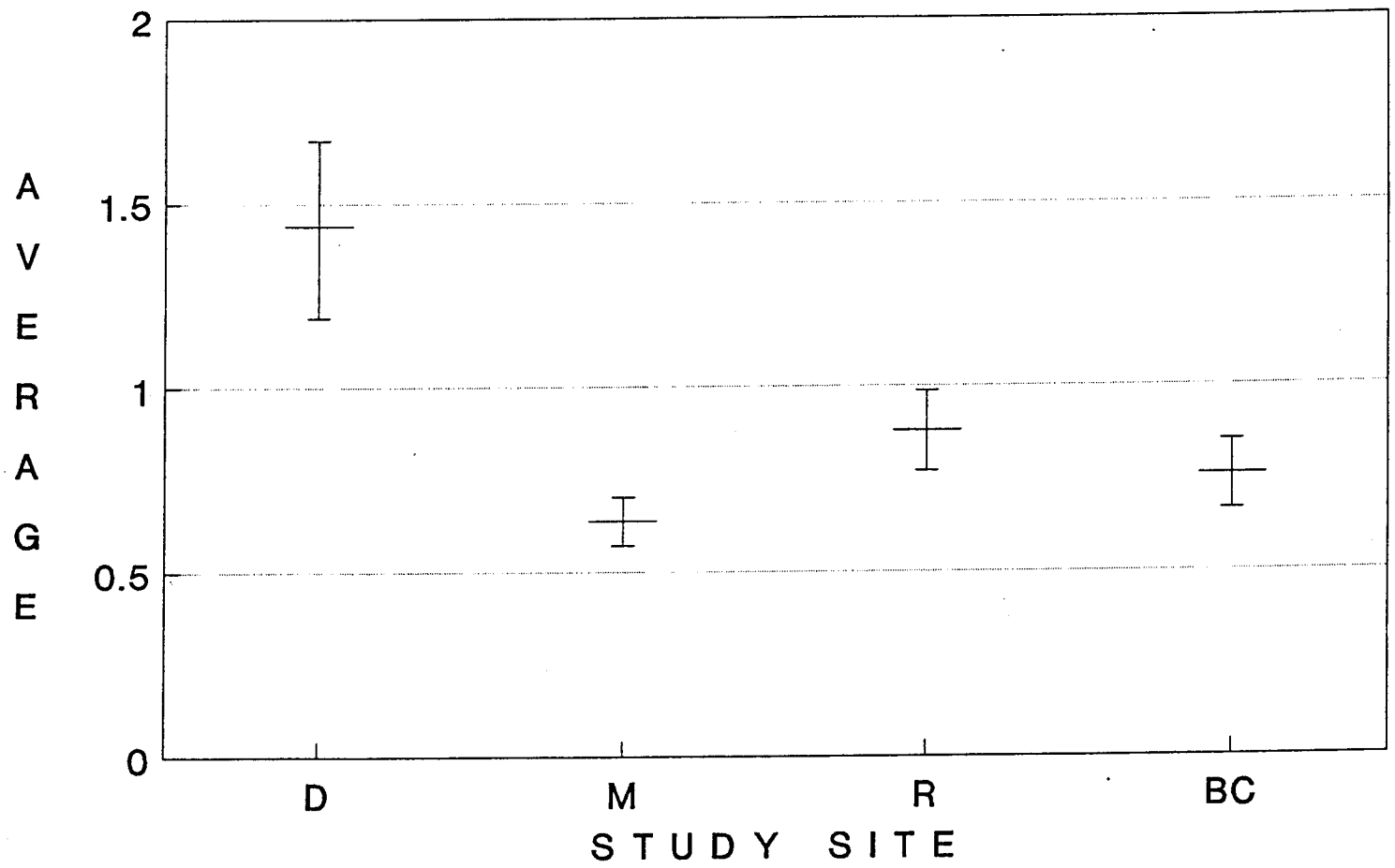
Genus/species	D	M	R	BC
Reteporellina sp.	5	5	5	5
Sabella sp.	—	3	3	3
Serpula sp.	—	3	3	—
Siderastrea sidera	8	—	—	3
Siderastrea sp.	12	—	—	7
Spirastrella coccinea	—	—	—	3
Spondylus americanus	4	3	3	12
Sponge unid	5	5	5	6
Stenopus hispidus	3	3	3	—
Stenorhynchus seticornis	4	3	3	—
Stephanocoenia michelini	12	—	16	4
Stolonica sabulosa	3	3	3	3
Styella plicata	—	4	4	—
Teichaxinella morchella	—	—	—	5
Telesto riisei	—	3	5	—
Thalysias sp	14	10	12	—
Trematooecia aviculifera	10	8	8	—
Udotea sp.	—	3	3	3
Ulosa reutzleri	7	8	6	3
Verongia longissima	—	—	—	4
Watersipora sp.	4	3	4	6
Wrangelia argus	5	10	—	4
Xestospongia muta	—	—	6	5
CUMULATIVE NUMBER OF SPECIES	42	40	48	49

Figure I1. Average number of individuals per sq.ft. +/- 2 Std.err.



If error bars do not overlap, averages are significantly different.

Figure I2 Average number of species per sq.ft. +/- 2 Std.err.



If error bars do not overlap, averages are significantly different.

Figure I3 Average number of benthic invertebrates at four study sites by sampling period.

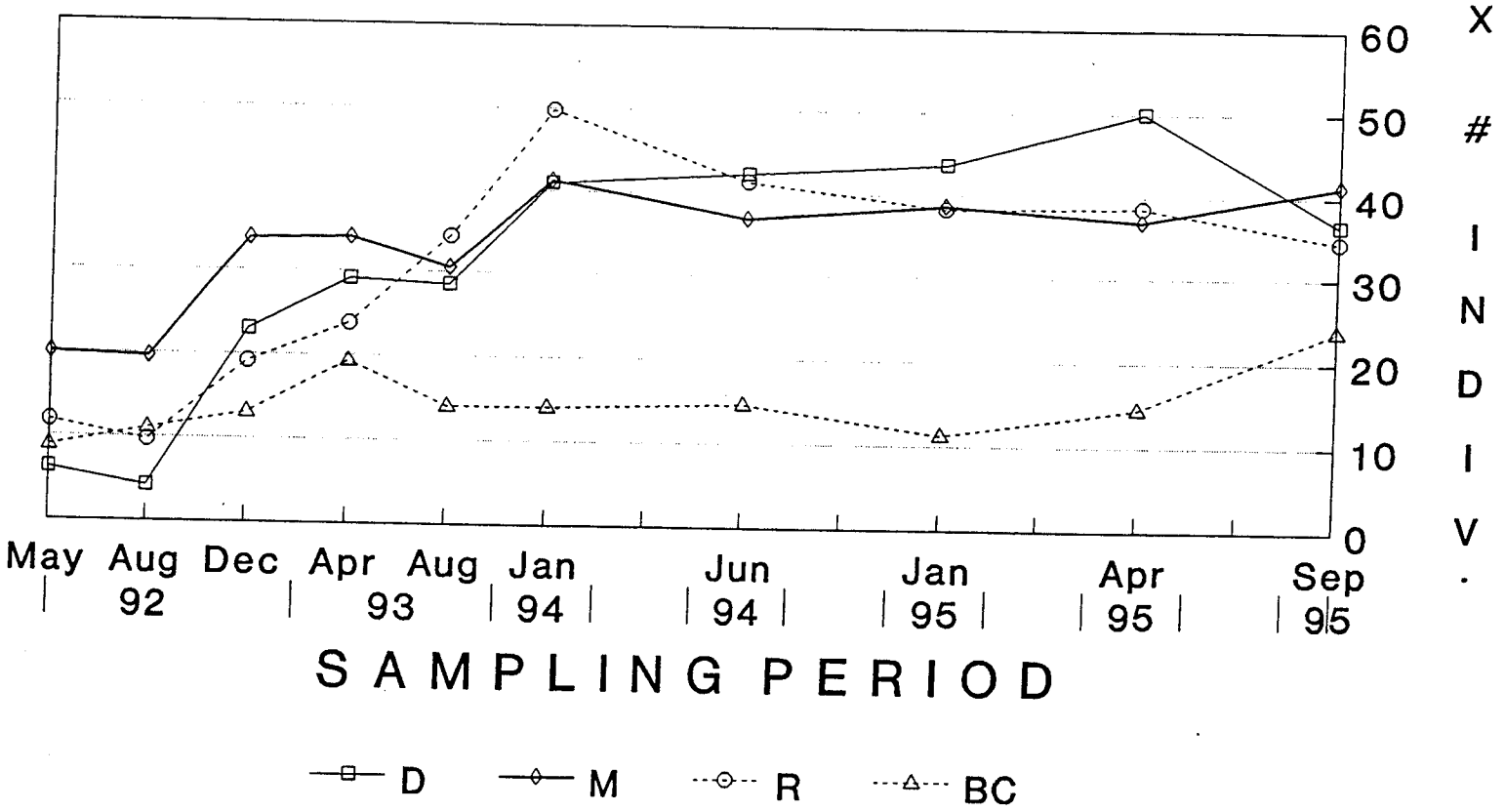


Figure 14 Average number of benthic invertebrate species at four study sites by sampling period.

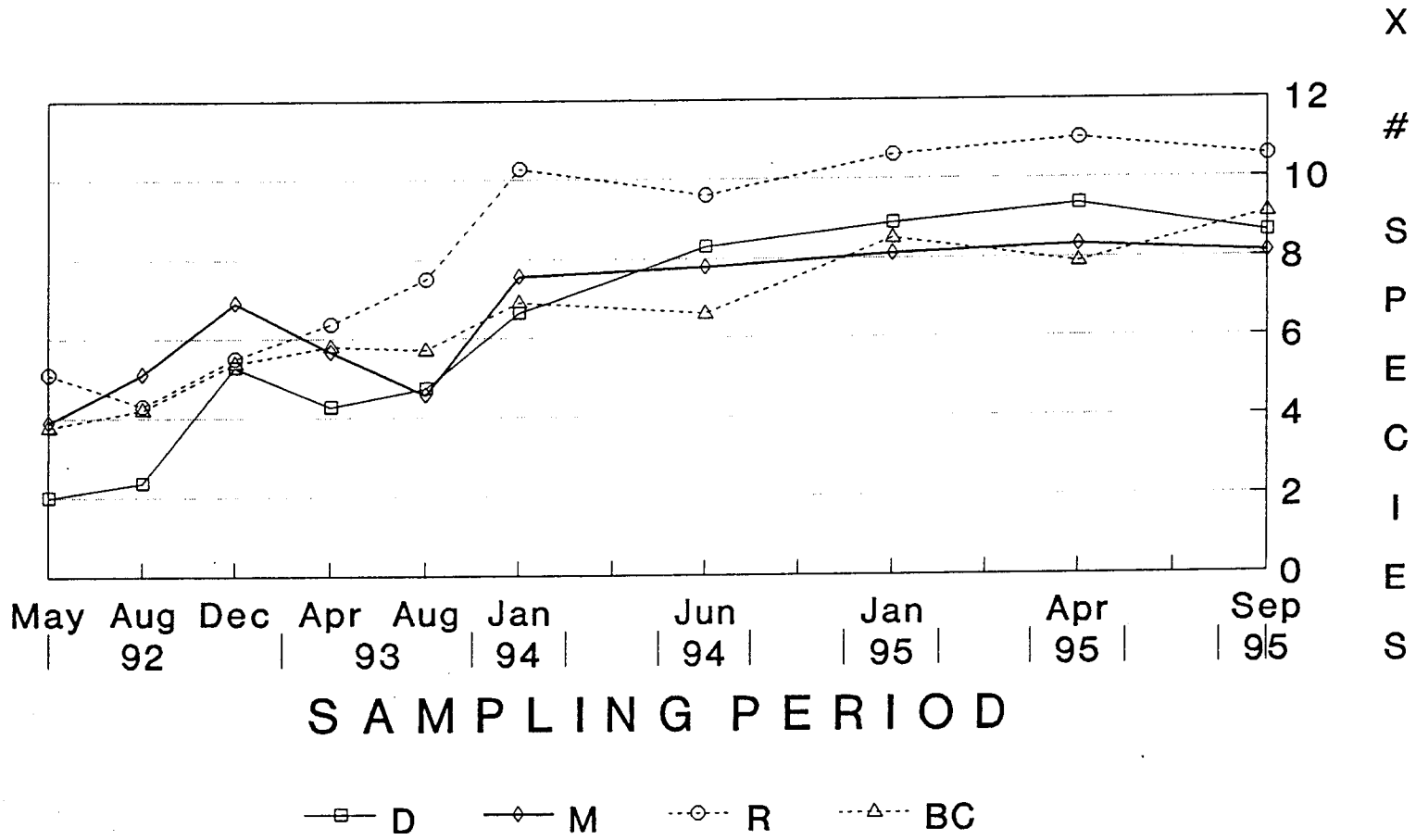


Figure I5. Rarefaction curve for the cumulative number of invertebrate taxa.

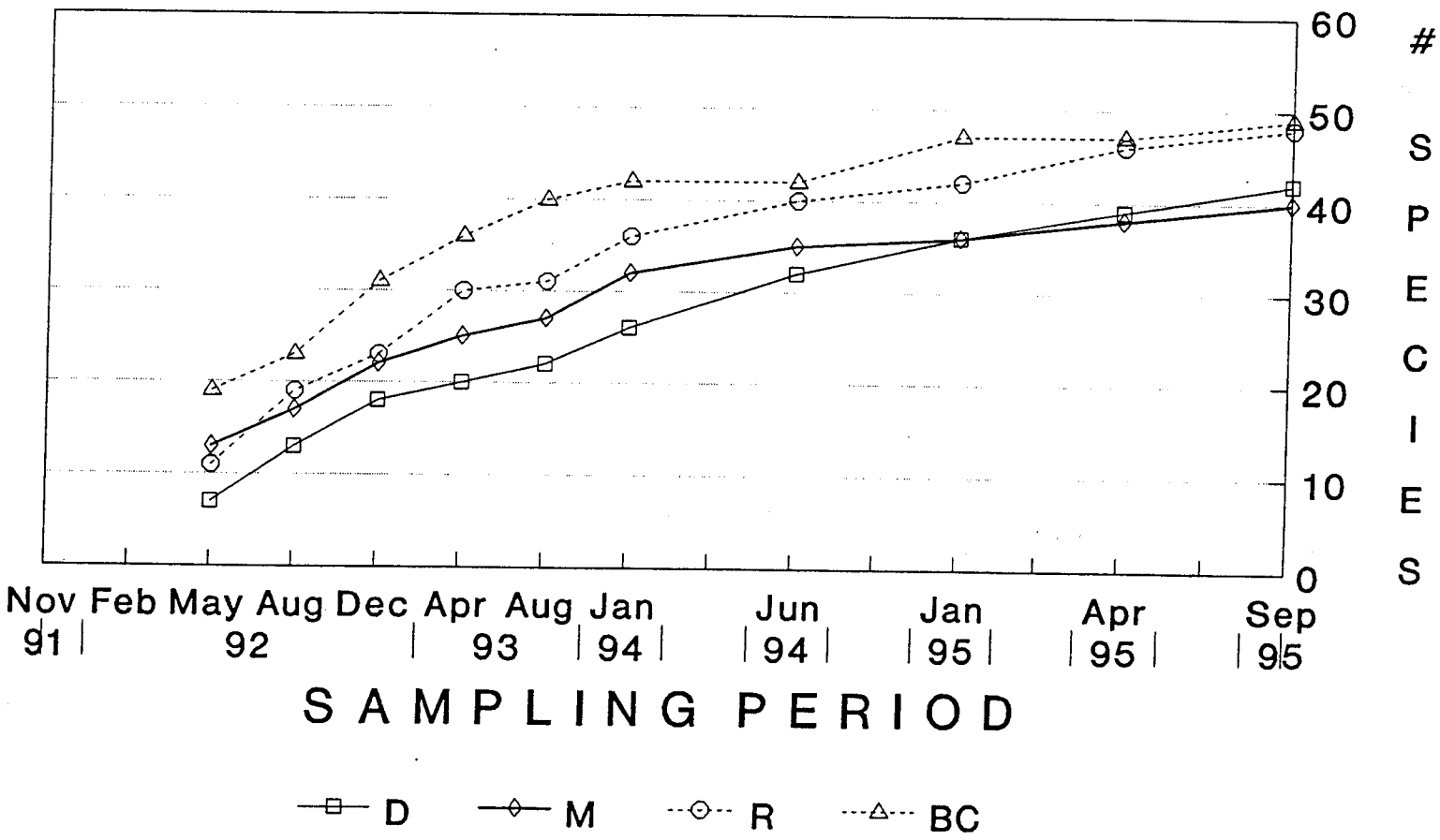
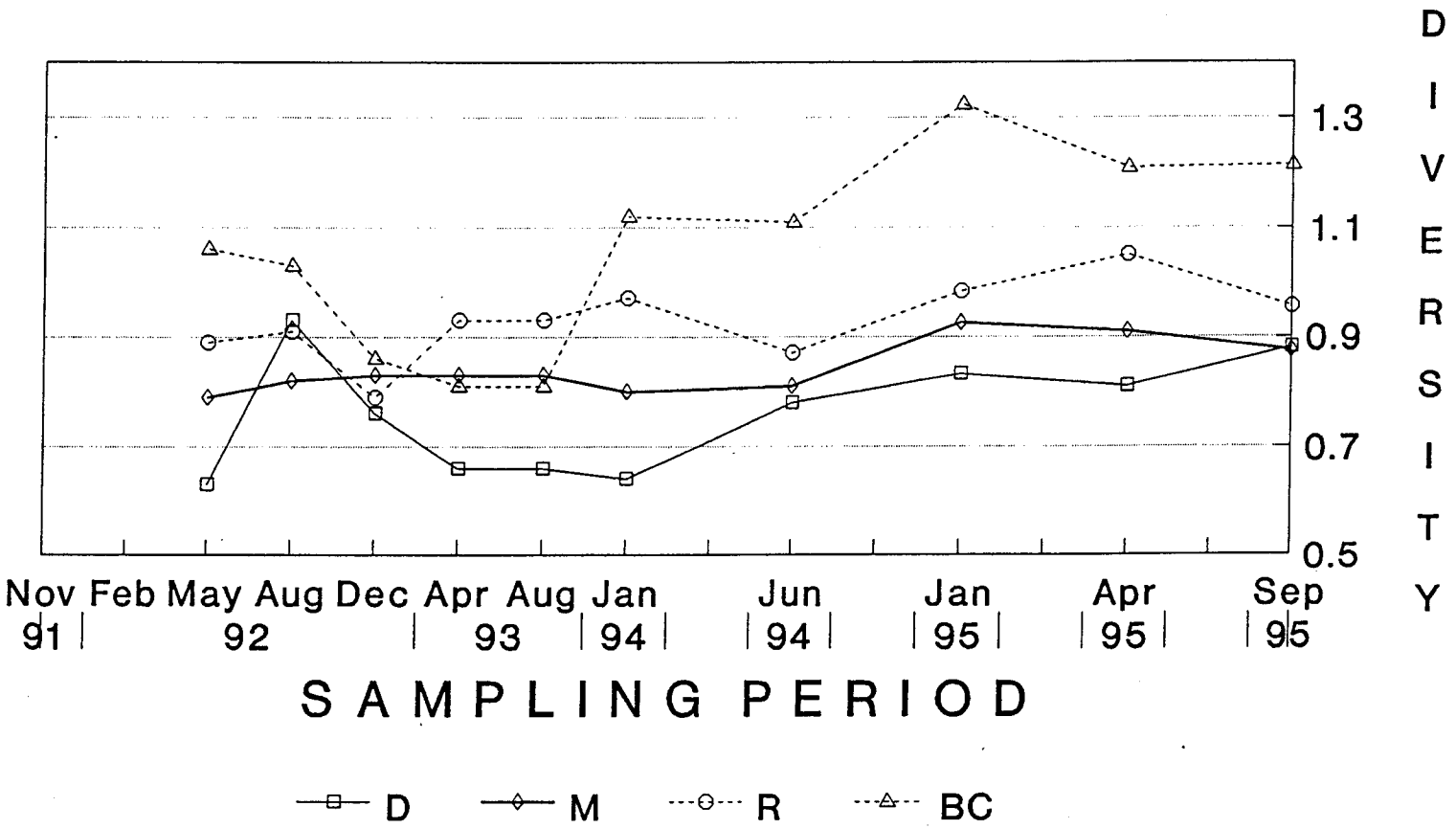


Figure 16 Shannon-Weiner diversity index (H) for invertebrates by sampling period.



APPENDIX B

HISTORY OF INVERTEBRATE AND PLANT COLONIZATION

OF MODULES AND CONTROLS AS OF SEPTEMBER, 1995

NOTATION: **Data in left column indicates current population for each species; population history is shown in parenthesis to the right with the code: (#of individuals:month/year of sample)**

Domes

D-18

18 Holopsamma helwigi (Porifera) (1:12/92; 7: 4/93; >20:8/94; >20 thru 9/95
3 Dysidea sp. (Porifera) (1:12/92; 4/93; 4: 8/93; 4:1/94; 6:6/94; 2:12/94; 1:4/95)
1 Thalysias juniperina (Porifera) (1:4/95)
0 Aplysina cauliformis (Porifera) (1:6/94; 1:12/94; 0:4/95)
1 Ulosa reutzleri (Porifera) (1:4/95)
0 Niphates sp. (Porifera) 1:12/94; 0:4/95
1 Cliona delatrix (Porifera) (1:12/94; 1:4/95)
0 unidentified didemnid sponge (1:4/95)
1 Callyspongia fallax (Porifera) (1:4/95)
1 Millepora alcicornis (fire coral) (2:8/93; 1:1/94; 1:6/94; 3:4/95)
1 Pseudoplexaura sp. (Gorgonacea-**new**)
1 Meandrina meandrites (Scleractinia) (1:1/94; 1:6/94; 1:12/94; 1:4/95)
1 Siderastrea sp. (Scleractinia) (1:1/94; 2:6/94; 2:12/94; 1:4/95)
1 Stephanocoenia michelini (Scleractinina-**new**)
1 Unidentified juvenile scleractinian (**new**)
0 Parasmittina sp. (Bryozoa) (2:12/92; 0:4/93 and thereafter)
0 Lima lima (file shells-in Keyway)(2:12/92; 0:4/93; 1:8/94; 0:1/94; 0:6/94; 1:12/94; 1:4/95)
5 Stolonica sabulosa (Ascidia)(1:12/92; 7:4/93; 0:8/93; 4:1/94; 2:6/94; 5:12/94; >20 4/95)
0 unidentified didemnid (Ascidia) (1:12/92; 1:4/93; 1:8/93; 1:1/94; 1:6/94; 1:12/94; 0:4/95)

D-19

0 Dictyota sp. (2:6/94 only Phaeophyta)
0 Wrangelia argus (Rhodophyta) (0:12/92; >20:4/93; 0 since 8/93)
>20 Holopsamma helwigi (Porifera)(3:12/92; 10:4/93; >20:8/93;
>20: l/94; >20:6/94; >20:12/94; 16: 4/95)
3 Callyspongia vaginalis (Porifera) (1:12/92; 1:4/93; 1:8/93; 1:1/94; 4: 6/94; 3:12/94; 3: 4/95)
3 Callyspongia fallax (Porifera) (1:8/93; 0:1/94; 0:6/94; 0:12/94; 1:4/95)
1 Ulosa ruetzleri (Porifera)(6:12/94; 3:4/95)
0 tufted white sponge (unidentified)(1:12/94; 1:4/95)
1 Cliona delatrix (Porifera-**new**)
8 Dysidea sp. (Porifera) (3:8/93; 2:1/94; 5:6/94; 20:12/94; 18: 4/95)
7 Millepora alcicornis (fire coral) (1:1/94; 4:6/94; 1:12/94; 1:4/95)
1 Meandrina meandrites (Scleractinia) (1:6/94; 1:12/94; 1:4/95)
3 Siderastrea sp. (Scleractinia) (2:12/94; 1:4/95)
0 Dichocoenia stokesii (Scleractinia) (1:4/95)
0 Stenopus hispidus (cleaning shrimp in keyway) (1:8/93; 1:1/94; 1:6/94;
0 thereafter)
0 Stolonica sabulosa (Ascidia) (4:12/92; >20:4/93; 0:8/93; 8:1/94; 5:6/94; 6:12/94; >20:4/95)
0 unid. didemnid (Ascidia) (1:12/92; 1:4/93; 0:8/93; 0:1/94; 0:6/94; 1:12/94; 0 thereafter)

0 Lima lima (bivalve in keyway) (1:12/92; 0 since 4/93)
0 Reteporellina sp. (Bryozoa)(1:12/92; 0 since 4/93)
0 Trematooecia sp. (Bryozoa) (1:6/94; 0 therafter)

D-20 (knocked off base; toppled into valley)

0 Dictyota sp. (Phaeophyta) (1:6/94 only)
0 Wrangelia argus (Rhodophyta) (>20:12/92; >20:4/93; 0 since 8/93)
>20 Holopsamma helwigii (Porifera) (0:12/92; 11:4/93; >20 since 8/93)
2 Callyspongia vaginalis (Porifera) (3:1/94; 4:6/94; 4:12/94; 4:4/95)
2 Callyspongia fallax (Porifera)(0:12/92; 1:4/93; 0:8/93; 1:1/94; 1:6/94; 0:12/94; 0:4/95)
0 Aplysina cauliformis (Porifera) (1:6/94; 0:12/94; 0:4/95)
2 Dysidea sp. (Porifera) (1:8/93; 1:1/94; 1:6/94; 0?:12/94; 3:4/95)
1 Ulosa reutzleri (Porifera) (1:1/94; 1:6/94; 1:12/94; 1: 4/95)
0 Iotrochota birotulata (Porifera) (4:12/94; 0:4/95)
0 Thalysias juniperina (Porifera) (1:4/95)
1 Niphates sp. (Porifera-**new**)
3 Millepora alcicornis (fire coral) (2: 8/93; 3:1/94; 4:6194; 1:12/94; 2:4/95)
0 Briareum asbestinum (Gorgonacea) (1:12/94; 0:4/95)
1 Siderastrea siderea (Scleractinia) (1:12/94; 1:4/95)
0 Dichocoenia stokesi (Scleractinia) (1:12/94; 1:4/95)
0 Spondylus americanus (spiny oyster) (1:12/92 1:4/93; 1:8/93;
0 since 1/94)
0 Reteporellina sp. (Bryozoa) (1:12/92; 0 since 4/93)
0 Stolonica sabulosa (Ascidia) (>20:12/92; >20:4/93; 0?:8/93; >20:1/94; 2:6/94; >20:12/94; 15:4/95)

D-21

0 Dictyota sp. (Phaeophyta) (5:6/94 only)
>20 Holopsamma helwigi (Porifera) (4:12/92; >20 since 8/93)
2 Dysidea sp. (Porifera) (2:12/92; 1:4/93; 2: 8193; 2:1/94; 5:6/94; 2:12/94; 0?: 4/95)
3 Callyspongia vaginalis (Porifera) (1:12/92; 0:4/93; 0:8/93; 0:1/94; 3:6/94; 4: 4/95)
0 Callyspongia fallax (Porifera) (1:12/92; 0:4/93; 0:8/93; 0:1/94; 2:6/94; 0?:12/94; 1:4/95)
1 Iotrochota birotulata (Porifera) (2:1/94; 0?:6/94; 3:4/95)
1 Ulosa reutzleri (Porifera) (1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Niphates erecta (Porifera) (1:6/94; 0:12/94; 0:4/95)
0 Ircinia sp. (Porifera) (1:12/94; 1:4/95)
2 Cliona delatrix (Porifera-**new**)
4 Millepora alcicornis (fire coral) (0:12/92; 1:4/93; 3:8/93; 0:1/94; 4:6/94; 6:12/94; 5:4/95)
0 Stolonica sabulosa (Ascidia) (9:12/92; >204/93; 1:8/93; >20:1/94; 5:6/94; 9:12/94; >20:4/95)
0 Spondylus americanus (spiny oyster) (0:12/92; 2:4/93; 0 thereafter)
0 Lima lima in keyway (file shell) (0:12/92; 2:4/93; 0 thereafter)
0 Parasmittina sp. (Bryozoa) (0:12/92; 1:4/93; 0: thereafter)
0 Siderastrea siderea (Scleractinia) (1:6/94; 1:12/94; 1:4/95)
1 Stephanocoenia michelini (Scleractinia) 1:4/95

D-22

>20 Dictyota sp. (Phaeophyta) (5 previously recorded only on 6/94)
0 Wrangelia argus (Rhodophyta) (0:12/92; >20:4/93; 0 since 8/93)
12 Holopsamma helwigi (Porifera) (3:12/92; >20 from 4/93 to 12/94)
1 Dysidea sp. (Porifera) (0:12/92; 2:4/93; 4:8/93; 4:1/94; 6:6/94; 2:12/94; 4: 4/95)
0 Ulosa reutzleri (Porifera) (2:8/93; 2:1/94; 1:6/94; 0:4/95)
2 Cliona delatrix (Porifera) (3:6/94; 1:12.94; 1: 4/95)
2 Callyspongia vaginalis (Porifera) (1:1/94; 1:6/94; 1:12/94; 1:4/95)
1 Callyspongia fallax (Porfiera-**new**)
1 Iotrochota birotulata (Porifera) (3:12/94; 0?: 4/95)
7 Millepora alcicornis (fire coral) (1:8/93; 1:1/94; 2:6/94; 5:12/94; 4:4/95)
4 Siderastrea siderea (Scleractinia) (2:1/94; 0?:6/94; 1:12/94; 1:4/95; 1:4/95)
0 Parasmittina sp. (Bryozoa) (l:12/92; 0 since 4/93)
1 Watersipora sp. (Bryozoa) (1:12/92; 1:4/93 0?: 8/93; 1:1/94; 0?:6/94; 0?:12/94; 1:4/95)
0 Reteporellina sp. (Bryozoa) (l:12/92; 0:4/93; 0:8/93; 1:1/94; 0:6/94; 0:12/94)
0 Stenopus hispidus (cleaning shrimp) (1:8/93; 1:1/94; 0 since 6/94)
0 Stolonica sabulosa (Ascidia) (9:12/92; 4:4/93; 1:8/93; 5:1/94; 1:6/94; 4:12/94; 1:4/95)
0 Ascidia nigra (Ascidia) (l:12/92; 0:4/93; 1:8/93; 1:1/94; 0 since 6/94)

D-25

>20 Dictyota sp. (Phaeophyta-new)
18 Holopsamma helwigi (Porifera)(7:12/92; >20:4/93; >20:8/93; >20:1/94; >20:6/94; 12:12/94; >20: 4/95)
1 Dysidea sp. (Porifera) (3: 12/92; 4: 4/93; 6: 8/93; 3:1/94; 9:6/94; 5:12/94; 4: 4/95)
0 Dysidea etheria (Porifera) (1:12/92; l:4/93; 1:8/93; l: l/94; 0 thereafter)
1 Callyspongia fallax (Porifera) (2:12/92; 2:4/93; 0:8/93; 0: l/94; 0:6/94; 0:12/94)
4 Callyspongia vaginalis (Porifera) (3:1/94; 5:6/94; 5:12/94; 1?: 4/95)
1 Dasychalina cyathina (Porifera) (1:4/95)
0 Ulosa reutzleri (Porifera) (1:12/94; 1:4/95)
2 Iotrochota birotulata (Porifera-**new**)
4 Millepora alcicornis (fire coral) (1:1/94; 3:6/94; 6:12/94; 6:4/95)
0 Siderastrea siderea (Scleractinia) (3:12/94; 1:4/95)
0 Dichoceoenia stokesi (Scleractinia) (1:12/94; 1:4/95)
1 Montastrea annularis (Scleractinia-**new***)
2 Porites sp. (astreiodes?) (Scleractinia-**new**)
1 Stephanocoenia michelini (scleractinia) (1:12/94; 1:4/95; 2:4/95)
0 Briareum asbestinum (Gorgonacea) (1:1/94; 1:6/94; 1:12/94; 1:4/95)
0 Lima lima (3:12/92; 0:4/93; 0:8/93; 0: 1/94; 0 since 6/94)
0 Unid. serpulid polychaete in keyway (1:8/93; 1:1/94; 0 since 6/94)
0 Stolonica sabulosa (Ascidia) (7:12/92; >20:4/93; 0:8/93; 3:1/94; 2:6/94; 5:12/94; 9:4/95)
0 Unid. brown ascidian (1:12/92; 0:4/93; 0:8/93; 0 since 1/94)
* possibly misidentified previously as D. stokesi due to small size

D-30 (not sampled 12/94)

0 Wrangelia argus (Rhodophyta) (0:12/92; >20:4/93; 0 since 8/93)
0 Dictyota sp. (Phaeophyta) (1:8/93; 0:l/94; 1:6/94; 0:4/95)
3 Callyspongia vaginalis (Porifera) (1:8/93; 0:1/94; 1:6/94; 3:4/95)
0 Callyspongia fallax (Porifera) (0:12/92; 1:4/93; 0 since 8/93)
1 Dysidea sp. (Porifera) (7:12/92; 4:4/93; 8:8/93; 3:1/94; 7:6/94; 2:4/95)
13 Holopsamma helwigi (Porifera) (0:12/92; 2:4/93; 10:8/93; 18:1/94; >20:6/94; >20:4/95)

2 Iotrochota birotulata (Porifera) (1:1/94; 1:6/94; 0: 4/95)
0 Ulosa reutzleri (Porifera) (3:6/94; 2:4/95)
1 Niphates sp. (Porifera-**new**)
2 Millepora alcicornis (0:12/92; 1:4/93; 1:8/93; 2:1/94; 1:6/94; 1:4/95)
0 Lima lima in keyway (0:12/92; 2: 4/93; 0 since 8/93)
0 Watersipora sp. (bryozoa) (0:12/92; 1:4/93; 1:8/93; 0 since 1/94)
0 Parasmittina sp. (8:12/92; 0 since 4/93)
0 Stolonica sabulosa (Ascidia)(15:12/92; >20:4/93; 0:8/93; >20:1/94;1?:6/94; 15:4/95)
1 Siderastrea siderea (Scleractinia-**new**)

D-34 (could not locate; not sampled 4/95)

0 Dictyota sp. (Phaeophyta) (>20 Aug. 92; 0 thereafter until >20 on 6/94)
>20 Holopsamma helwigi (Porifera) (4:12/92; 15:4/93; 10:8/93; 19:1/94; >20:6/94; >20:12/94)
1 Dysidea sp. (Porifera) (0:12/92; 2:4/93; 3:8/93; 0:1/94; 1:6/94; 2:12/94)
0 Callyspongia fallax (Porifera) (1:12/92; 0:4/93 ?; 2:8/93; 0:1/94; 2:6/94; 0:12/94)
4 Callyspongia vaginalis (Porifera) (3:1/94; 2:6/94; 7:12/94)
0 Iotrochota birotulata (Porifera) (1:1/94; 0:6/94; 0:12/94)
0 Ulosa reutzleri (Porifera) 1:12/94
0 Niphates sp. (Porifera) 1:12/94
0 unid. brown Porifera (1 Aug. 92; 0 thereafter)
1 Unid. white sponge-**new**
4 Millepora alcicornis (fire coral) (1:8/93; 1:1/94; 3:6/94; 3:12/94)
0 Siderastrea radians (Scleractinia) (0:12/92; 1:4/93; 0: thereafter)
0 Meandrina meandrites (Scleractinia) (1:1/94; 0:6/94; 0:12/94)
0 Stenopus hispidus in keyway (2:12/92; 0 thereafter)
0 Watersipora sp. (1 Aug. 92; 0 thereafter)
0 Stolonica sabulosa (>20:12/92; >20:4/93; 0??:8/93; >20:1/94; 0?:6/94;
8: 12/94)
0 unidentified didemnid (ascidian) (1:12/94)

D-43

>20 Dictyota sp. (Phaeophyta) (1:6/94; 0:12/94; 0: 4/95)
0 Wrangelia argus (Rhodophyta) (>20:12/92; >20:4/93; 0 since 8/93)
4 Holopsamma helwigi (Porifera)(5:12/92; >20:4/93; >20:8/93; >20: 1/94; >20:6; 12:12/94; 13:4/95)
0 Callyspongia fallax (Porifera) (2:12/92; 1:4/93; 3:8/93; 1:1/94; 0:6/94; 0:12/94)
3 Callyspongia vaginalis (Porifera) (1:1/94; 3:6/94; 2:12/94; 5:4/95)
0 Callyspongia plicifera (Porifera) (1:1/94; 1:6/94; 0:12/94)
0 Ulosa reutzleri (Porifera) (1:1/94; 1:6/94; 2:12/94; 2:4/95)
0 Iotrochota birotulata (Porifera) (1:12/94)
8 Dysidea sp. (Porifera) (0:12/92; 1:4/93; 3:8/93; 5:1/94; 7:6/94; 4:12/94; 6:4/95)
5 Millepora alcicornis (fire coral) (0:12/92; 1:4/93; 2:8/93; 1:1/94; 1:6/94; 1:12/94; 1:4/95)
2 Siderastrea siderea (Scleractinia) (1:12/94; 0?:4/95)
1 Stephanocoenia michelini (Scleractinia) (1:12/94; 1:4/95)
1 Diploria sp. (clivosa?) (Scleractinia-**new**)
0 unidentified didemnid ascidian (1:8/93; 1:1/94; 0:6/94; 0:12/94)
0 Stolonica sabulosa (Ascidia) (4:12/92; >20:4/93; 0??: 8/93; >20:1/94; 1?:6/94; >20:12/94; 10:4/95)
0 Eucidaris sp. in keyway (1 Dec. 92; 0 thereafter)

D-49 (module slid into valley 8/92) not sampled 6/94 or 12/94)

0 Wrangelia argus (Rhodophyta) (0:12/92; >20:4/93; 0 since 8/93)
>20 Holopsamma helwigi (Porifera) (9:12/92; 13:4/93; >20 thereafter)
0 Callyspongia fallax (Porifera) (1:12/92; 3:4/93; 2:8/93; 1:1/94; 3:4/95)
0 Dysidea sp. (Porifera) (0: 12/92; 1:4/93; 2:8/93; 4:1/94; 1:4/95)
10 Callyspongia vaginalis (Porifera) (1:12/92; 0:4/93; 0:8/93; 1:1/94; 12:4/95)
1 Iotrochota birotulata (Porifera) (1:1/94; 0?:4/95)
0 Ulosa reutzleri (Porifera) (2:4/95)
4 Millepora alcicornis (Fire coral) (3:4/95)
1 Plexaura flexuosa (Gorgonacea) (1:4/95)
0 Diploria sp. (Scleractinia) (1:4/95)
1 Porites sp. (Scleractinia) (1:4/95)
0 Stolonica sabulosa (Ascidia) (>20:12/92; >20:4/93; 0:8/93; 0:1/94; >20?:4/95)
0 Reteporellina sp. (Bryozoa) (1:12/92; 0:4/93; 0 since 8/93)
0 Lima lima in keyway (1 Aug. 92; 0 thereafter)
0 Stenopus hispidus (1:8/93; 0: thereafter)

D-50

0 Wrangelia argus (Algae) (>20:12/92; >20:4/93; 0 thereafter)
0 Dictyota sp. (Phaeophyta) (>20:6/94 only)
0 Unid. fluorescent red calcareous alga at module top (1:8/93; 2:1/94; 1:6/94)
17 Holopsamma helwigi (Porifera) (1:12/92; 18:4/93; >20:8/93; >20:1/94; 16:6/94; >20:12/94; >20:4/95)
3 Dysidea sp. (Porifera) (0:12/92; 2:4/93; 7:8/93; 11:1/94; 13:6/94; 2:12/94; 5:4/95)
0 Callyspongia fallax (Porifera) (0:12/92; 3:4/93; 5:8/93; 0:1/94; 1:6/94; 0?:12/94; 2:4/95)
1 Callyspongia vaginalis (Porifera) (5:12/94; 2:12/94; 1:4/95)
1 Ulosa reutzleri (Porifera) (1:6/94; 1:12/94; 2:4/95)
0 unid. brown Porifera (1 Aug '92.; 0 thereafter)
0 unidentified black sheet (Porifera) (1:4/95)
2 Iotrochota birotulata (Porifera) (1:8/93; 0:1/94; 1:6/94; 0:12/94; 0:4/95)
0 Niphates sp. (Porifera-) (1:12/94; 0:4/95)
1 Millepora alcicornis (Fire coral) (2:6/94; 3:12/94; 5: 4/95)
1 Meandrina meandrites (Scleractinia) (1:6/94; 1:12/94; 1:4/95)
4 Siderastrea siderea (Scleractinia) (1:6/94; 3:12/94; 3:4/95)
1 Stephanocoenia michelini (Scleractinia) (3:4/95)
1 Dichocoenia stokesii (Scleractinia) (1:4/95)
1 Porites sp. (astreoides?) (Scleractinia-**new**)
0 Parasmittina sp. (Bryozoa) (1:12/92, 0 thereafter)
0 Watersipora sp. (Bryozoa) (1 Dec. 92; 0 thereafter)
0 Stolonica sabulosa (>20: 12/92; >20:4/93; 1??:8/93; 0:1/94; 1:6/94; 9:12/94; >20:4/95)
0 Lima lima (2 Aug. 92; 0 thereafter)
0 Stenopus hispidus in keyway (1 Aug. 92; 0 thereafter)
0 Diadema antillarum in key (1:12/92; 0 thereafter)

Reef Replacement Modules

R-2

4 Holopsamma helwigi (10: 8/93; 9: 1/94; 16:6/94; 7:12/94; 7:4/95)
0 Callyspongia fallax (2:12/92; 5:4/93; 8:8/93; 8:1/94; 0:12/94; 2:4/95)
2 Callyspongia vaginalis (Porifera) (2:6/94; 3:12/94; 3:4/95)
1 Callyspongia plicifera (Porifera-**new**)
0 Ulosa reutzleri (0:12/92; 1:4/93; 1:8/93; 0:1/94; 1:12/94; 0:4/95)
4 Dysidea sp. (0:12/92; 2:4/93; 12:8/93; >20:1/94; 10:6/94; 3?:12/94; 8:4/95)
1 Niphates sp. (Porifera) (1:1/94; 0:12/94; 0:4/95)
0 Iotrochota birotulata (Porifera) (1:12/94; 0:4/95)
1 Cliona delatrix (Porifera) (1:4/95)
2 Millepora alcicornis (2:8/93; 4:1/94; 2:6/94; 6:12/94; 3:4/95)
1 Dichocoenia stokesii (Scleractinia) (1:4/95)
0 Melanostigma nigromaculatus (0:12/92; 4:4/93; 0:8/93; 0:1/94; 0:12/94; 2:4/95)
0 Lima lima (6:12/92; 3:4/93; 6:8/93; 4:1/94; 3:6/94; 3:12/94; 2:4/95)
0 Spondylus americanus (Bivalvia) (1:1 /94; 0:12/94; 1:4/95)
0 Parasmittina sp. (1:12/92; 0:4/93; 6:8/93; 6:1/94; 0:12/94; 0;4/95)
0 Watersipora sp. (Bryozoa) (2:12/94; 0:4/95)
0 Stolonica sabulosa (1:12/92; 0:4/93; 1:8/93; 10:1/94; 0:6/94; 1:12/94; 6:4/95)
0 Echinometra lucunter (0:12/92; 2:4/93; 0 thereafter)
0 Eucidaris sp. (Echinoidea) (1:12/94; 0:4/95)
0 unid. didemnid ascidian (2:12/92; 2:4/93; 0:8/93; 0:1/94; 0:6/94; 1:12/94; 1:4/95)
0 Unidentified erect ascidian (1:4/95)

R-4

8 Holopsamma helwigi (Porifera) (11:6/94; 12:12/94; 8:4/95)
4 Dysidea sp. (9:8/93; >20:1/94; 13:6/94; 9:12/94; 7:4/95)
8 Callyspongia vaginalis (Porifera) (2:6/94; 9:12/94; 7:4/95)
2 Callyspongia fallax (Porifera) (7:8/93; 4:1/94; 0:6/94; 0:12/94; 2:4/95)
2 Iotrochota birotulata (Porifera) (2:6/94; 0:12/94; 0:4/95)
2 Ulosa reutzleri (Porifera) (2:8/93; 1:1/94; 1:6/94; 5:12/94; 7:4/95)
1 Niphates sp. (Porifera) (1:4/95)
1 Dasychalina cyathina (Porifera) (1:4/95)
1 Cliona delatrix (Porifera-**new**)
3 Millepora alcicornis (5:8/93; >20:1/94; 4:6/94; 5:12/94; 2:4/95)
0 Agaricia sp. (fragilis ?) (Scleractinia) (1:1/94; 0:6/94; 0:12/94; 0:4/95)
1 Stephanocoenia michelini (Scleractinia-**new**)
0 Parasmittina sp. (3: 8/93; 3: l/94; 0 thereafter)
0 Reteporellina sp. (Bryozoa) (1:12/94; 1:4/95)
1 Spondylus americanus (0:12/92; 1:4/93; 1:8/93; 1:1/94; 1:6/94; 2:12/94; 1:4/95)
0 Lima lima (6: 12/92; l:4/93; 4: 8/93; 3:1/94; 6:6/94; 0:12/94; 0:4/95)
0 unid. didemnid ascidians (6:12/92; 2:4/93; 0:8/93; 0:1/94; 0:6/94; 1:12/94; 0:4/95)
0 unidentified purple compound ascidian (1:6/94; 1:12/94; 1: 4/95)
1 Stolonica sabulosa (Ascidia) (6:1/94; 0:6/94; 1:12/94; 0:4/95)

R-5 (Not surveyed Dec . 92; Jun. 94; Dec . 94)

11 Holopsamma helwigi (5:4/93; 8:8/93; >20:1/94; 4:4/95)
0 Dysidea sp. (3:4/93; 2: 8/93; 1:1 /94; 0:4/95)
4 Callyspongia fallax (1:4/93; 0:8/93; 1:1/94; 6:4/95)
1 Callyspongia plicifera (Porifera) (1: l/94; 1:4/95)
0 Callyspongia vaginalis (Porifera) (1:1/94; 0:4/95)
2 Iotrochota birotulata (Porifera) (4:1/94; 4:4/95)
0 Ulosa reutzleri (Porifera) (1:1/94; 5:4/95)
1 Cliona delatrix (Porifera) (1:4/95)
2 Millepora alcicornis (0:4/93; 1:8/93; >20:1/94; 2:4/95)
1 Briareum asbestinum (Gorgonacea) (2:4/95)
2 Pseudoplexaura sp. (Gorgonacea) [dead at the bases: 4/95] (1:4/93; 2:8/93; 2:1/94; 2:4/95)
1 Stephanocoenia michelini (Scleractinia-**new**)
0 Melanostigma nigromaculatus (Sabellidae) (1:1/94 only)
4 Lima lima (0:4/93; 3:8/93; 3:1/94; 2:4/95)
0 Parasmittina sp. (4:4/93; 3:8/93; 3:1/94; 0:4/95)
0 Trematooecia aviculifera (Bryozoa) (2:1/94 only)
0 Reteporellina sp. (Bryozoa) (l:1/94 only)
1 Stolonica sabulosa (1:4/93; 0: 8/93; 1:1/94; 6:4/95)
0 Diadema antillarum (Echinodermata) (1:4/94 only)

R-7

11 Holopsamma helwigi(1:12/92; 13:4/93; >20:8/93; >20:1/94; >20:6/94; 11:12/94; 10:4/95)
6 Dysidea sp. (0:12/92; 1:4/93; 3:8/93; 3:1/94; 7:6/94; 3:12/94; 10:4/95)
0 unid. red sponge (0:12/92; 3:4/93; 0:8/93 & thereafter)
6 Callyspongia vaginalis (Porifera) (4:6/94; 4:12/94; 4:4/95)
1 Callyspongia plicifera (Porifera) (2:6/94; 1:12/94; 1:4/95)
0 Callyspongia fallax (2:12/92; 2:4/93; 3:8/93; 3:1/94; 1:6/94; 0:12/94; 0:4/95)
5 Iotrochota birotulata (Porifera) (2:12/94; 1:4/95)
5 Niphates sp. (Porifera-**new**)
1 Cliona delatrix (Porifera) (1:4/95)
0 Millepora alcicornis (Fire coral) (1:6/94; 1:12/94; 1:4/95)
0 Eunicea sp. (Gorgonacea) (1:6/94; 1:12/94; 0:4/95)
1 Meandrina meandrites juvenile (1:8/93; 1:1/94; 1:6/94; 2:12/94; 1:4/95)
0 unidentified scleractinian juvenile (Scolymia??) (1:6/94; 1:12/94; 0:4/95)
3 Lima lima (0:12/92; 1:4/93; 1:8/93; 1:6/94; 0:12/94; 0:4/95)
0 Spondylus americanus (1:12/92; 1:4/93; 1:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Parasmittina (1:12/92; 0: thereafter)
0 Watersipora sp. (2:8/93; 2:1/94; 0 thereafter)
0 Reteporellina sp. (Bryozoa) (1:12/92; 0 thereafter)
0 Ascidia nigra (0:12/92; 2:4/93; 0 thereafter)
0 didemnid ascidian (2:12/92; 0:4/93; 1:8/93; 1:1/94; 0:12/94; 0:4/95)
0 Stolonica sabulosa (Ascidiacea) (1:12/94; 7:4/95)

R-14

10 Holopsamma helwigi (0:12/92; 3:4/93; >20:8/93; 11:1/94; 15:6/94; 8:12/94; 8:4/95)
3 Dysidea sp. (2:2/92; 3:4/93; 6:8/93; 9:1/94; 6:6/94; 2:12/94; 3:4/95)
0 Callyspongia fallax (1:12/92; 1:4/93; 1:8/93; 1:1/94; 0:12/94; 0:4/95)
2 Callyspongia vaginalis (1:8/93; 1:1/94; 2:6/94; 3:12/94; 2:4/95)
1 Callyspongia plicifera (Porifera) (1:4/95)
1 Iotrochota birotulata (Porifera) (5:1/94; 12:6/94; 2:12/94; 0:4/95)
4 Ulosa reutzleri (Porifera) (2:1/94; 0:6/94; 0:12/94; 0:4/95)
1 Niphates sp. (Porifera) (1:12/94; 3:4/95)
2 Thalysias juniperina (Porifera-**new**)
1 Millepora alcicornis (Fire coral) (5:12/94; 1:4/95)
2 Eunicea fusca (0:12/92; 1:4/93; 1:8/93; 1:1/94; 1:6/94; 2:12/94; 1:4/95)
0 unidentified scleractinian (Scolymia sp. ?) (1:1/94; 2:6/94; 1:12/94; 0:4/95)
0 unid. serpulid polychaetes (3:12/92; 0 thereafter)
2 Lima lima (5:12/92; 1:4/93; 3: 8/93; 6:1/94; 5:6/94; 2:12/94; 1:4/95)
1 Spondylus americanus (1:12/92; 3:4/93; 1:8/93; 2:1/94; 4:6/94; 3:12/94; 2:4/95)
0 Reteporellina sp. (1:8/93; 0 thereafter)
0 Ascidia nigra (1:12/92; 0 thereafter)
0 Stolonica sabulosa (Ascidia) (3:1/94; 0:6/94; 1:12/94; 0:4/95)
0 Echinometra lucunter (1:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Diadema antillarum (Echinodermata) (1:4/95)
0 Eucidaris tribuloides (Echinodermata) (1:4/95)

R-15

1 Dictyota sp. (Phaeophyta-new)
10 Holopsamma helwigi (0:12/92; 9:4/93; 16:8/93; >20:1/94; >20:6/94; 13:12/94; 9:4/95)
1 Callyspongia fallax (2:12/92; 5:4/93; 3:8/93; 0:1/94; 0:12/94; 0:4/95)
6 Callyspongia vaginalis (1:8/93; 2:1/94; 3:6/93; 6:12/94; 5:4/95)
1 Dysidea sp. (0:12/92; 3:4/93; 0:8/93; 5:6/94; 1?:12/94; 5:4/95)
1 Iotrochota birotulata (porifera) (4:1/94; 2:6/94; 3:12/94; 2:4/95)
0 Ulosa reutzleri (Porifera) (1:6/94; 2:12/94; 1:4/95)
1 Cliona delatrix (Porifera) (1:6/94; 2:12/94; 1:4/95)
1 Niphates sp. (Porifera) (1:4/95)
2 Thalysias juniperina (Porifera-**new**)
0 Telesto riisei (1:8/93; 1:1/94; 0:12/94; 0:4/95)
4 Millepora alcicornis (fire coral) (>20:1/94; 1?:6/94; 6:12/94; 7:4/95)
0 Meandrina meandrites (Scleractinia) (1:4/95)
1 Stephanocoenia michelini (Scleractinia-**new**)
0 Melanostigma nigromaculata (1:8/93; 0:1/94; 2:6/94; 1:12/94; 1:4/95)
0 Reteporellina sp. (Bryozoa) (2:12/92; 0 thereafter)
0 Watersipora sp. (5:8/93; 1:1/94; 0 thereafter)
0 Trematooecia aviculifera (Bryozoa) (1:1/94; 0 thereafter)
2 Lima lima (3:8/93; 4:1/94; 2:6/94; 2:12/94; 1:4/95)
1 Spondylus americanus (1:8/93; 2:1/94; 2:6/94; 1:12/94; 2:4/95)
0 Stolonica sabulosa (2:12/92; 0:4/93; 0:8/93; 0:1/94; 0:6/94; 0:12/94; 9:4/95)
0 Styella plicata (Ascidia) (1:6/94; 0 therafter)
0 Diadema antillarum (Echinodermata) (1:6/94; 0 thereafter)
0 Eucidaris sp. (1:12/92; 1:4/93; 2:8/93; 1:1/94; 1:6/94; 1:12/94; 0:4/95)

R-16

15 Holopsamma helwigi (0:12/92; 13:4/93; 15:8/93; >20:1/94; 15:6/94; >20:12/94; 9:4/95)
3 Dysidea sp. (0:12/92; 5:4/93; 4:8/93; 12:1/94; 3:6/94; 2:12/94; 7:4/95)
1 Callyspongia vaginalis (Porifera) (1:1/94; 1:6/94; 0?:4/95)
0 Callyspongia plicifera (Porifera) (1: 1/94; 1:6/94; 2:12/94; 1:4/95)
1 Callyspongia fallax (7:12/92; 7:4/93; 3:8/93; 0:1/94; 2:12/94; 1:4/95)
1 Iotrochota birotulata (Porifera) (1:1/94; 0:6/94; 2:12/94; 6:4/95)
0 Ircinia sp. (Porifera) (1:4/95)
1 Xestospongia muta (0?:2/92; 1:4/93; 1:8/93; 1:1/94; 1:6/94; 1:12/94; 1:4/95)
0 Leucosolenia sp. (0:12/92; 1:4/93; 0:8/93; 1:1/94; 0:12/94)
0 Cliona delatrix (Porifera) (1:6/94; 1:12/94; 0:4/95)
0 Ulosa reutzleri (Porifera) (3: 6/94; 3:6/94; 1:12/94; 1:4/95)
1 Thalysias juniperina (Porifera) (1:12/94; 0?:4/95; 1:4/95)
2 Pseudoplexaura sp. (Gorgonacea) (2:1/94; 4:6/94; 3:12/94; 3:4/95)
1 Briareum asbestinum (Gorgonacea) (1:6/94; 1:6/94; 1:12/94; 0?:4/95)
2 Millepora alcicornis (fire coral) (1:1/94; 1:6/94; 2:12/94; 2:4/95)
3 Porites sp. (astreoides?) (Scleractinia) (1:4/95)
0 Melanostigma nigromaculatus (Sabellid polychaete) (1:6/94; 0:12/94; 0:4/95)
0 Ascidia nigra (1:12/2; 0 thereafter)
2 Lima lima (7:12/92; 0: 4/93; 1:8/93; 1:1/94; 4:6/94; 0?:12/94; 6:4/95)
0 Spondylus americanus (0:12/92; 1:4/93; 0 through 12/94; 1:4/95)
0 Parasmittina sp. (1:12/92; 0 thereafter)
0 Stolonica sabulosa (Ascidia) (7:1/94; 0:6/94; 0:12/94; 3:4/95)

R-17 (possibly ran wrong transect on 6/94)

18 Holopsamma helwigi (0:12/92; 10:4/93; >20:8/93; >20:1/94; 15:6/94; >20:12/94; 16:4/95)
5 Dysidea sp. (0:12/92; 7:4/93; 10:8/93; 17:1/94; 16:6/94; 6:12/94; 15:4/95)
1 Callyspongia fallax (0:12/92; 1:4/93; 1:8/93; 0: 1/94; 0:6/94; 0:12/94; 4:4/95)
0 Callyspongia plicifera (Porifera) (1:12/94; 0:4/95)
4 Callyspongia vaginalis (Porifera) (1:1/94; 1:6/94; 2:12/94; 4:4/95)
3 Iotrochota birotulata (Porifera) (1:1/94; 1:6/94; 6:12/94; 2:4/95)
1 Dasychalina cyathina (Porifera) (1:4/95)
1 Niphates sp. (Porifera) (1:12/94; 1:4/95)
2 Ulosa reutzleri (Porifera) (1:4/95)
1 Cliona delatrix (Porifera) (1:4/95)
3 Millepora alcicornis (1:8/93; 1:1/94; 1:12/94; 0:4/95)
0 Briareum asbestinum (Gorgonacea)(1: 6/94; 0:12/94; 0:4/95)
0 Montastrea annularis (Scleractinia) (1:6/94 only)
1 Porites sp. (astreoides?) (Scelractinia-**new**)
1 Meandrina meandrites (Scleractinia) (1:4/95)
0 Lima lima (3:12/92; 1:4/93; 4:8/93; 3:1/94; 1:6/94; 2:12/94; 0:4/95)
0 Parasmittina sp. (2:12/92; 5:4/93; 0 thereafter)
0 Reteporellina sp. (Bryozoa) (3:1/94; 0 thereafter)
0 Trematooecia aviculifera (Bryozoa) (1:1 /94; 0 thereafter)
0 Watersipora sp. (1:8/93; 1:1/94; 0 thereafter)
0 Stenopus hispidus (1: 12/92; 0: 4/93; 0: 8/93; 0: 1/94)
0 unidentified didemnid ascidian (1:1/94; 0 thereafter)
0 Eucidaris sp. (Echinodermata) (1:1/94; 0 thereafter)
0: Stolonica sabulosa (Ascidia) (2:12/94)

R-21

6 Holopsamma helwigi (0:12/92; 5:4/93; 10:8/93; 10:1/94; 14:6/94; 9:12/94; 13:4/95)
7 Dysidea sp. (2:12/92; 8:4/93; 4:8/93; 10:1/94; 16:6/94; 11:12/94; 9:4/95)
0 Callyspongia fallax (2:12/92 6:4/93; 7:8/93; 2:1/94; 1:6/94; 4:12/94; 0:4/95)
3 Callyspongia vaginalis (1:8/93; 3:1/94; 2:12/94; 5:4/95)
0 Callyspongia plicifera (Porifera) (1:4/95)
8 Iotrochota birotulata (Porifera) (3:6/94; 3:12/94; 0:4/95)
0 Ulosa reutzleri (0:12/92; 1:4/93; 0:8/93; 0:1/94; 1:12/94; 1:4/95)
2 Niphates sp. (Porifera) (1:4/95)
7 Millepora alcicornis (0:12/92; 1:4/93; 3:8/93; 1:1/94; 5:6/94; 7:12/94; 5:4/95)
0 Melanostigma nigromaculatus (2:12/92; 1:4/93; 1:8/93; 2:1/94;
0 thereafter)
3 Lima lima (5:12/92; 2:4/93; 5:8/93; 3:1/94; 2:6/94; 0:12/94; 1:4/95)
0 Stenopus hispidus (2:12/92; 0:4/93; 0 thereafter)
0 Stenorhynchus seticornis (1:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Echinometra lucunter (urchin) (1:12/92; 0 thereafter)
0 Eucidaris sp. (urchin)(1:12/92; 0:4/93; 0:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Ascidia nigra (2:12/92; 0 thereafter)
0 Styella plicata (Ascidia) (2:12/94; 0:4/95)
0 Stolonica sabulosa (Ascidia) (5:4/95)

R-22

19 Holopsamma helwigi (0:12/92; >20:4/93; >20:8/93; >20: l/94; >20:6/94; >20:12/94; 14:4/95)
0 Dysidea sp. (0:1 2/92; 3:4/93; 7:8/93; 7:1/94; 6:6/94; 2:12/94; 4:4/95)
3 Callyspongia fallax (2:12/92; 3:4/93; 3:8/93; 1:1/94; 1:6/94; 1:12/94; 1:4/95)
6 Callyspongia vaginalis (Porifera) (2: l/94; 3:6/94; 3:12/94; 4:4/95)
4 lotrochota birotulata (Porifera) (1:1/94; 1:6/94; 2:12/94; 0:4/95)
0 Cliona delatrix (Porifera) (1:6/94; 1:12/94; 0:4/95)
0 Ulosa reuztleri (Porifera) (1:12/94; 0:4/95)
0 Niphates sp. (Porifera) (1:4/95)
5 Millepora alcicornis (fire coral) (>20?:1/94; 1:6/94; 1:6/94; 3:12/94; 1:4/95)
1 Porites sp. (astreoides?) (Scleractinia-**new**)
0 Melanostigma nigromaculata (1:12/2; 1:4/93; 0 thereafter)
1 Trematoecia avicularia (Bryozoa-**new**)
2 Lima lima (2:12/92; 0: 4/93; 6:8/93; 2:1/94; 7:6/94; 4:12/94; 0:4/95)
0 Spondylus americanus (Bivalve) (1:4/95)
0 Watersipora sp. (3:8/93; 0 thereafter)
0 Ascidia nigra (0:12/92; 1:4/93; l: 8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Stolonica sabulosa (Ascidia) (4:12/94; 1:4/95)

R-23

>20 Holopsamma helwigi (0:12/92; 20:4/93; >20:8/93; >20:1/94; >20:6/94; >20:12/94; >20:4/95)
1 Callyspongia fallax (0:12/92; 6:4/93; 3:8/93; 4:1/94; 4:6/94; 0:12/94; 1:4/95)
3 Callyspongia vaginalis (1:8/93; 2:1/94; 1:6/94; 0:12/94; 4:4/95)
2 Callyspongia plicifera (Porifera) (2:1 /94; 1:6/94; 1:12/94; 2:4/95)
5 Dysidea sp. (3:12/92; 9:4/93; 3:8/93; 4:1/94; 4:6/94; 1?:12/94; 4:4/95)
0 Ulosa reutzleri (Porifera) (1:1/94; 2:6/94; 2:12/94; 1:4/95)
1 Cliona delatrix (Porifera) (1:6/94; 0:12/94; 0:4/95)
0 Niphates sp. (Porifera) (1:6/94; 1:12/94; 0:4/95)

0 Dasychalina cyathina (Porifera) (1:4/95)
4 Iotrochota birotulata (Porifera) (1:6/94; 3:12/94; 1:4/95)
6 Millepora alcicornis (2:8/93; 2:1/94; 3:6/94; 8:12/94; 4:4/95)
0 Briareum asbestinum (Gorgonacea) (1:12/94; 0:4/95)
0 Diploria clivosa (Scleractinia) (1:12/94; 0:4/95)
0 Reteporellina sp. (Bryozoa) (1:1/94; 0:6/94; 0:12/94;0:4/95)
3 Melanostigma nigromaculata (sabellid polychaete-**new**)
1 Lima lima (0:12/92; 1:4/93; 1:8/93; 2:1/94; 4:6/94; 4:12/94; 4:4/95)
1 Spondylus americanus (0:12/92; 1:4/93; 0 through 4/95)
0 Echinometra lucunter (2:12/92; 1:4/93; 0 thereafter)
0 Eucidaris sp. (1:8/93; 1:1/94; 0:6/94; 1:12/94; 0:4/95)
0 Stolonica sabulosa (1:12/92; 0:4/93; 0:8/93; 0:1/94; 1:6/94; 5:12/94; 8:4/95)
0 Ascidia nigra (1:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)

M-Modules

M-1

>20 Holopsamma helwigi (1:12/92; >20:4/93; >20:8/93; >20:1/94; >20:6/94; 8?:12/94; 19:4/95)
3 Dysidea sp. (4:12/92; 2:4/93; 4:8/93; 13:1/94; 6:6/94; 0?:12/94; 9:4/95)
3 Callyspongia vaginalis (Porifera) (4:6/94; 7:12/94; 2:4/95)
1 Callyspongia fallax (0:12/92; 7:4/93; 9:8/93; 9:1/94; 8:6/94; 0:12/94; 3:4/95)
19 Iotrochota birotulata (Porifera) (6:1/94; 8:6/94; 6:12/94; 8:4/95)
1 Niphates sp. (Porifera) (2:1/94; 0?:6/94; 1:12/94; 1:4/95)
0 Ulosa reutzleri (Porifera) (1:6/94; 0:12/94; 1:4/95)
1 Unidentified Porifera (1:4/95)
3 Millepora alcicornis (fire coral) (20:1/94; 3:6/94; 5:12/94; 1:4/95)
2 Telesto riisei (0:12/92; 2:4/93; 2:8/93; 2:1/94; 3:6/94; 6:12/94; 1:4/95)
0 Reteporellina sp. (5:12/92; 0 thereafter)
0 Parasmittina sp. (0:12/92; 2:4/93; 0 thereafter)
0 Watersipora sp. (Bryozoa) (4:12/94; 0:4/95)
0 Ascidia nigra (2 Aug. 92; 0 thereafter)
0 Unid. brown didemnid ascidian (0:12/92; 1:4/93; 0 thereafter)
0 Panulirus argus (1:12/92; 0:4/93; 0:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)

M-2 (module moved 8/92 but undamaged)

0 Wrangelia argus (Rhodophyta) (1:6/94; 0 thereafter)
18 Holopsamma helwigi (0:12/92; >20:4/93; >20:8/93; >20:1/94; 6:6/94; 10:12/94; 0??:4/95)
1 Callyspongia fallax (1:12/92; 0:4/93; 2:8/93; 1:1/94; 0:6/94; 0:12/94; 1:4/95)
9 Callyspongia vaginalis (Porifera) (4: l/94; 4:6/94; 3:12/94; 3:4/95)
1 Callyspongia plicifera (Porifera) (1:12/94; 0?:4/95)
3 Iotrochota birotulata (Porifera) (5:1/94; 5:6/94; 2:12/94; 1:4/95)
2 Ulosa reutzleri (Porifera) (1:1/94; 1:6/94; 1:12/94; 3:4/95)
4 Dysidea sp. (8:12/92; 8:4/93; 6:8/93; 15:1/94; 5:6/94; 4:12/94; 4:4/95)
0 Thalysias sp. (Porifera) (1:6/94; 0:12/94; 0:4/95)
0 Niphates sp. (Porifera) (3:12/94; 0:4/95)
0? Millepora alcicornis (fire coral) (5:1/94; 8:6/94; 1?:12/94; 6:4/95)
2 Telesto riisei (0:12/92; 3:4/93; >20:8/93; 5:1/94; 1?:6/94; 8:12/94; 1:4/95)
1 Montastrea annularis (Scleractinia) (1:4/95)
0 Parasmittina sp. (4:12/92; 4:4/93; 0 thereafter)
1 Watersipora sp. (1:8/93; 0 through 4/95)
0 Trematooecia aviculifera (Bryozoa) (1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Melanostigma nigromaculata (1 Aug. 92; 0 thereafter)
0 Ascidia nigra (1 Aug. 92; 0 thereafter)
0 Unid. didemnid ascidian (0:12/92; 1:4/93; 0:thereafter)
0 Stolonica sabulosa (Ascidia) (2:1/94; 0:6/94; 0:12/94; 5:4/95)

M-3 (module moved into valley 8/92)

>20 Dictyota (Phaeophyta-**new**)
>20 Holopsamma helwigi (0:12/92; 13:4/93; >20:8/93; 17:1/94; >20:6/94; 12:12/94; 17:4/95)
1 Dysidea sp. (2:12/92; 6:4/93; 0 ??: 8/93; 9:1/94; 2:6/94; 1:12/94; 6:4/95)
0 Callyspongia fallax (3:8/92; 2:12/92; 1:4/93; 5:8/93; 0:1/94; 0:6/9; 1:12/94; 3:4/95)
10 Callyspongia vaginalis (2:8/93; 2:1/94; 7:6/94; 1:12/94; 4:4/95)
5 Iotrochota birotulata (Porifera) (3:1/94; 3:6/94; 3:12/94; 3:4/95)

0 Ulosa reutzleri (Porifera) (1:4/95)
3 Niphates sp. (Porifera) (1:4/95)
0 Telesto riisei inside (3 Aug. 92; 0 through 12/94; 1:4/95)
2 Millepora alcicornis (Fire coral) (1:6/94; 1:6/94; 1:12/94; 0:4/95)
2 Briareum asbestinum (Gorgonacea) (1:12/94; 0?:4/95)
1 Agaricia sp. (Scleractinia-**new**)
0 Melanostigma nigromaculata (0: 12/92; 1:4/93; 0 thereafter)
0 Parasmittina sp. (15:12/92; 1:4/93; 0 thereafter)
0 Watersipora sp. (1:12/92; 2:4/93; 0?:8/93; 0 thereafter)
0 unidentified didemnid ascidian (1:1/94; 0 thereafter)
0 Mithrax sp. (1:8/93; 1:1/94; 0 thereafter)
0 Unid. bivalve (1:8/93; 1:1/94; 0 thereafter)
0 Ascidia nigra (1:8/93; 1:1/94; 1:6/94; 0?:12/94; 1:4/95)
0 Stolonica sabulosa (1:8/93; 0 thereafter)

M-4 (moved into valley 8/92; could not photograph long side or ID plate.

New transect: short side adjacent to ID plate
10 Holopsamma helwigi (4:12/92; 13:4/93; >20:8/93; >201/94; 15:6/94; 12:12/94; 14:4/95)
2 Dysidea sp. (Porifera) (3:1/94; 2:6/94; 1:12/94; 1:4/95)
1 Callyspongia fallax (2:12/92; 3:4/93; 3:8/93; 0:1/94; 0:6/94; 1:12/94; 0:4/95)
3 Callyspongia vaginalis (Porifera) (2:1/94; 2:6/94; 0:12/94; 7:4/95)
3 Iotrochota birotulata (Porifera) (4:1/94; 1:6/94; 3:12/94; 10:4/95)
0 Ulosa reutzleri (Porifera) (1:6/94; 0:12/94; 1:4/95)
0 Unidentified Porifera (1:4/95)
1 Telesto riisei inside (3 Aug. 92; 0 through 4/95)
0 T. riisei (outside module) (0:12/92; 3:4/93; 3:8/93; 0:1/94; 0:6/94; 8:12/94; 0:4/95)
2 Millepora alcicornis (fire coral) (1:1/94; 1:6/94; 1:12/94; 1:4/95)
0 Porites sp. (Scleractinia) (1:1/94; 0 thereafter)
0 Parasmittina sp. (4:12/92; 1: 4/93; 0 thereafter)
0 Watersipora sp. (1:12/92; 1:4/93; 1:8/93; 0 thereafter)
0 Spondylus americanus (1:12/92; 0:4/93; 0:8/93; 0:1/94; 0:6/94; 2:12/94; 0:5/95)
0 Stolonica sabulosa (2:12/92; 0:4/93; 0:8/93; 3:1/94; 0:6/94; 0:12/94; 5:4/95)
0 unidentified didemnid ascidian (1:1/94; 0 thereafter)
0 Mithrax sp. (M. spinosissimus ?) (0:12/92; 1:4/93; 0 thereafter)

M-5

16 Holopsamma helwigi (11:12/92; 18:4/93; >20:8/93; >20:1/94; >20:6/94; 13:12/94; 14:4/95)
2 Dysidea sp. (1:12/92; 2:4/93; 3:8/93; 1:1/94; 3:6/94; 0?:12/94; 3:4/95)
3 Iotrochota birotulata (1:8/93; 6:1/94; 4:6/94; 4:12/94; 4:4/95)
5 Callyspongia vaginalis (1:8/93; 5:1/94; 6:6/94; 8:12/94; 9:4/95)
3 Callyspongia fallax (Porifera) (1:1/94; 2:6/94; 0:12/94; 1:4/95)
3 Ulosa reutzleri (Porifera) (1:12/94; 2:4/95)
2 Millepora alcicornis (Fire coral) (1:6/94; 4:12/94; 1:4/95)
2 Telesto riisei (0:12/92; 3:4/93; 0 ??: 8/93; 3:1/94; 3:6/94; 2:12/94; 0?:4/95)
0 Parasmittina sp. (10:12/92; 6:4/93; 0 thereafter)
0 Watersipora sp. (2:12/92; 0:4/93; 1:8/93; 0 thereafter)
0 Ascida nigra (2 Aug. 92; 0 thereafter)
0 Didemnid ascidian (1:8/93; 0 thereafter)
0 Spondylus americanus (1 Aug. 92; 0 thereafter)
0 Stenopus hispidus (2 Aug. 92; 0 thereafter)

0 Stolonica sabulosa (Ascidia) (7:12/94; 0:4/95)

M-6: module destroyed by hurricane- no survey

M-7 (No ID Plate!)

>20 Holopsamma helwigi (9:12/92; 10:4/93; 15:8/93; 15:1/94; 12:6/94; >20:12/94; 16:4/95)
8 Dysidea sp. (2:8/92; 4:12/92; 10:4/93; 12:8/93; 15:1/94; 12:6/94; 7:12/94; 10:4/95)
0 Callyspongia fallax (0:12/92; 4/93; 3:8/93; 1:1/94; 2:6/94; 0:12/94; 5:4/95)
11 Callyspongia vaginalis (0:12/92; 1:4/93; 3:8/93; 2:1/94; 10:6/94; 9:12/94; 10:4/94)
0 Callyspongia plicifera (Porifera) (1:1/94; 1:6/94; 0:12/94; 1:4/95)
1 Iotrochota birotulata (Porifera) (4:1/94; 3:6/94; 1:12/94; 6:4/95)
0 Ulosa reutzleri (Porifera) (1:12/94; 0:4/95)
0 Unidentified black sheet Porifera (1:4/95)
1 Niphates sp. (Porifera-**new**)
4 Millepora alcicornis (Fire coral) (1:1/94; 0?:6/94; 1:12/94; 3:4/95)
1 Telesto riisei (octocoral) (1:6/94; 0:12/94; 0:4/95)
0 Parasmittina sp. (8:8/92; 11:12/92; 11:4/93; 5: 8/93; 0 thereafter)
0 Watersipora sp. (Bryozoa) (7:12/92; 0:4/93; 5: 8/93; 0 thereafter)
0 Spondylus americanus (3:8/92; 0:12/92; 0:4/93; 0:8/93; 0:1/94; 2:6/94; 1:12/94; 1:4/95)
0 Lima lima (Bivalve) (1:4/95)
0 Ascidia nigra (2:8/92; 0: 12/92; 0 thereafter)
0 Reteporellina sp. (2:12/92; 0 thereafter)

M-8 (module on side; transect facing up)

12 Holopsamma helwigi (Porifera)(2:12/92; 8:4/93; 15:8/93; >20:1/94; 14:6/94; 7:12/94; >20: 4/95)
0 Callyspongia fallax (Porifera) (0:12/92; 1:4/93; 0:8/93; 0:1/94; 2:6/94; 0:12/94; 0:4/95)
2 Callyspongia vaginalis (Porifera) (3:1/94; 1:6/94; 3:12/94; 5:4/95)
1 lotrochota birotulata (Porifera) (2:1/94; 5:6/94; 2:12/94; 4:4/95)
3 Dysidea sp. (Porifera) (2:12/92; 0:4/93; 0:8/93; 0:1/94; 4:6/94; 4:12/94; 2:4/95)
2 Niphates sp. (Porifera-**new**)
0 Cliona delatrix (Porifera) (1:12/94; 0:4/95)
2 Millepora alcicornis (1:8/93; 1:1/94; 0:6/94; 6:12/94; 4:4/95)
0 Parasmittina sp. (5:8/92; 6:12/92; 4:4193; 2:8/93; 0 thereafter)
0 Watersipora sp. (1:12/92; 2:4/93; 1:8/93; 1:1/94; 1:6/94; 1:12/94; 0:4/95)
0 Eucidaris sp. (1 Aug. 92; 0 thereafter)
0 Stenorhynchus seticornis (1 Aug. 92; 0 thereafter)
0 Stenopus hispidus (2 Aug. 92; 0 thereafter)
0 Spondylus americanus (2 Aug. 92; 0 thereafter)
0 Lima lima (1 Aug. 92; 0 thereafter)
0 Styella plicata (1 Aug. 92; 0 thereafter)
0 Stolonica sabulosa (>20:12/92; 1:4/93; 0:8/93; 1:1/94; 4:6/94; >20:12/94; 1:4/95)

M-9 (module cracked & broken in places but ok for cont'd analysis)

>20 Holopsamma helwigi (5:12/92; 12:4/93; 18:8/93; 19:1/94; >20:6/94; 12:12/94; 6:4/95)
3 Dysidea sp. (2:12/92; 4:4/93; 6:8/93; 5:1/94; 5:6/94; 3:12/94; 4:4/95)
5 Callyspongia vaginalis (Porifera) (6:6/94; 5:12/94; 6:4/95)
0 Callyspongia fallax (0:12/92; 2:4/93; 0:8/93; 1:1/94; 1:6/94; 0:12/94; 0:4/95)
5 Iotrochota birotulata (Porifera) (1:6/94; 12:12/94; 0:4/95)

1 Ulosa reutzleri (Porifera) (1:12/94; 1:4/95)
2 Niphates sp. (Porifera) (1:12/94; 0:4/95)
0 Dasychalina cyathina (Porifera) (1:4/95)
5 Millepora alcicornis (Fire coral) (2:1/94; 4:6/94; >20:12/94; 3:4/95)
1 Porites sp. (astreoides?) (Scleractinia-**new**)
2 Watersipora sp. (4:8/92; 5:12/92; 4: 4/93; 5:8/93; 2:1/94; 4:6/94; 4:12/94; 2:4/95)
0 Parasmittina sp. (4:12/92; 3:4/3; 0 thereafter)
0 Stenorhynchus seticornis (3:8/92; 1:12/92; 0 thereafter)
0 Spondylus americanus (3:8/92; 0:12/92; 0:4/93; 0:8/93; 0:1/94; 1:6/94; 1:12/94; 0:4/95)
0 Melanostigma nigromaculata (3 Aug. 92; 0 thereafter)
0 Styella plicata (1 Aug. 92; 0 thereafter)
0 Stolonica sabulosa (Ascidia) (6:12/94; 0:4/95)

M-10

15 Holopsamma helwigi (0:4/93; >20:8/93; >20:1/94; >20:6/94; 15:12/94; >20:4/95)
0 Dysidea sp. (1:12/92; 0:4/93; 1:8/93; 3:1/94; 0?:6/94; 5:12/94; 8:4/95)
6 Callyspongia vaginalis (1:12/92; 1:4/93; 0:8/93; 3:1/94; 3:6/94; 1:12/94; 1:4/95)
0 Callyspongia fallax (0:12/92; 1:4/93; 1:8/93; 1:1/94; 3:6/94; 1:12/94; 1:4/95)
9 Iotrochota birotulata (Porifera) (1:1/94; 2:6/94; 8:12/94; 4:4/95)
0 Ulosa reutzleri (Porifera) (1:12/94; 0:4/95)
0 Niphates sp. (Porifera) (1:4/95)
3 Dasychalina cyathina (Porifera-**new**)
3 Telesto riisiei (Octocorallia) (2:1/94; 2:6/94; 2:12/94; 4:4/95)
5 Millepora alcicornis (Fire coral) (1:1/94; 1:6/94; 1:12/94; 5:4/95)
1 Briareum asbestinum (Gorgonacea-**new**)
0 Stolonica sabulosa (Ascidia) (1:6/94; 1:6/94; 3:12/94; 5:4/95)
0 Parasmittina sp. (10: 8/92; 8:12/92; 3:4/93; 0 thereafter)
1 Watersipora sp. (1:12/92; 2:4/93; 1:8/93; 0?:1/94; 1:6/94; 1:12/94; 0?:4/95)
0 Spondylus americanus (Bivalvia) (1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Stenorhynchus seticornis (2 Aug. 92; 0 thereafter)
0 Ascidia nigra (6:8/92; 5:12/92; 0 thereafter)
0 Diadema antillarum (I Aug. 92; 0 thereafter)
0 Melanostigma nigromaculatus (1:12/92; 0 thereafter)
0 Reteporellina sp. (Bryozoa) (3:12/92; 0 thereafter)
0 unidentified ascidian (1:6/94; 0:12/94; 0:4/95)

Barren Controls

BC-3

0 cyanobacterial mats (>20:6/94; 0 thereafter)
0 Wrangelia argus (Rhodophyta) (>20 Aug. 92; 0 thereafter)
0 Dictyota sp. (Phaeophyta) (1: 8/93; 0 thereafter)
0 Holopsamma helwigi (2:12/92; 2:4/93; 1:8/93; 0:1/94; 1:6/94; 0:12/94; 1:4/95)
1 Haliclona rubens (1:8/92; 0:12/92; 0:4/93; 1:8/93; 1:1/94; 2:6/94; 1:12/94; 1:4/95)
1 Niphates digitalis (2:8/92; 1:12/92; 0:4/92; 1:8/93; 2:1/94; 0?:6/94; 2:12/94; 5:4/95)
1 Dasychalina cyathina (Porifera) (1:1/94; 0:6/94; 0:12/94; 1:4/95)
1 unidentified porifera (3:1/94; 0:6/94; 0:12/94; 1:4/95)
1 Callyspongia vaginalis (1:8/93; 1:1/94; 1:6/94; 1:12/94; 1:4/95)
1 Ircinia sp. (Porifera-**new**)
3 Ulosa reutzleri (Porifera) (1:1/94; 2:6/94; 1:12/94; 4:4/95)
0 Aplysina cauliformis (0:12/92; 2:4/93; 0 thereafter)
0 Teichaxinella morchella (1 Dec. 92; 0 thereafter)
1 Briareum asbestinum (Octocorallia) (1:12/92; 1:4/93; 1:8/93; 1:1/94; 0?;6/94; 1:12/94; 1:4/95)
0 Dichoecoenia stokesi (Scleractinia) (1:12/92; 1:4/93; 1:8/93; 1:1/94; 1:6/94; 1:12/94; 0:4/95)
1 Siderastrea sp. juvenile (Scleractinia) (1 Aug. 92; 0 through 4/95)
1 Stephanocoenia michelini juvenile (Scleractinia) (1:12/94; 1:4/95)
0 Spondylus americanus (Bivalvia) (2:12/94; 0:4/95)
0 Stolonica sabulosa (5:12/92; 2:4/93; 0:8/93; 0:1/94; 0:6/94; 1:12/94; 1:4/95)
0 unidentified ascidian (4:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Opisthognathus aurifrons (jawfish) (2:12/92; 0 thereafter)

BC-8 (2 stakes missing; quadrat estimated)

0 Halimeda goreauii (Chlorophyta) (2 in August; 0 thereafter)
0 Wrangelia argus (Rhodophyta) (>20: 12/92; >20:4/93; 0 thereafter)
0 Udotea sp. (Chlorophyta) (7: 8/93; 0 thereafter)
1 Holopsamma helwigi (2:12/92; 2:12/92; 3:4/93; 0:8/93; 1:1/94; 0:6/94 0:12/94; 2:4/95)
6 Niphates digitalis (1:12/92; 1:4/93; 2: 8/93; 2:1/94; 2:6/94; 1:12/94; 1:4/95)
1 Dasychalina cyathina (1:8/93; 1:1/94; 2:6/94; 1:12/94; 2:4/95)
3 Aplysina cauliformis (0:12/92; 1:4/93; 1:8/93; 1:1/94; 1:6/94; 1:12/94; 2:4/95)
3 Callyspongia vaginalis (2:8/92; 1:12/92; 0:4/93?; 1:1/94; 1:6/94; 1:12/94; 1:4/95)
0 Callyspongia plicifera (Porifera) (1:12/94; 0:4/95)
0 Ulosa reutzleri (1:12/92; 0:4/93; 0: 8/93; 0:1/94; 1:12/94; 0:4/95)
0 Haliclona rubens (1 Aug. 92; 0 thereafter)
1 Ircinia sp. (Porifera) (1:12/94; 1:4/95)
0 Iotrochota birotulata (Porifera) (1:12/94; 0:4/95)
0 Briareum asbestinum (Gorgonacea) (1:12/94; 0:4/95)
3 Stephanocoenia or Siderastrea juveniles (1:12/92; 1:4/93; 2:8/93; 4:1/94; 5:6/94; 5:12/94; 4:4/95)
0 Reteporellina sp. (Bryozoa) (1:12/94)
0 Montastrea annularis (?) juv. (I Dec. 92; 0 thereafter)
0 Dichocoenia stokesii (Scleractinia) (1:1/94; 0:6/94; 0:12/94; 0:4/95)
1 Montastrea cavernosa juv. (Scleractinia) (1:1/94; 0:6/94; 0:12/94; 1:4/95)
0 Eusmilia fastigiata (Scleractinia) 1 Aug. 92; 0 thereafter until 4/95; 1:4/95)
0 Mycetophyllia juv. (l Dec. 92; 0 thereafter)
0 Stolonica sabulosa (1 Dec. 92; 0 until 1:12/94; 3:4/95)

BC-14

0 Cyanobacterial mats (>20:12/92; 0:4/93; 0:8/93; 0:1/94; >20:6/94; 0:12/94; 0:4/95)
0 Wrangelia argus (Rhodophyta) >20:12/92; >20:4/93; 0 thereafter)
0 Udotea sp. (Chlorophyta) (4:8/93; 0 thereafter)
>20 Dictyota sp. (Phaeophyta) (1:8/93; 0 through 4/95)
2 Dasychalina cyathina (Porifera) (2:1/94; 1:6/94; 1:12/94; 1:4/95)
1 Spirastrella coccinea (Porifera) (1:1/94; 0:6/94; 0:12/94; 0:4/95)
1 Holopsamma helwigi (1:12/92; 0:4/93; 1:8/93; 1:1/94; 6:6/94; 2:12/94; 3:4/95)
1 Niphates digitalis (0:12/92; 2:4/93; 1:8/93; 1:1/94; 0?:6/94; 1:12/94; 3:4/95)
0 Niphates erecta (Porifera) (1:1/94; 0:6/94; 0:12/94; 0:4/95)
1 Callyspongia vaginalis (1:8/93; 2; 1/94; 2:6/94; 1:12/94; 2:4/95)
0 Ulosa reutzleri (1 Aug. 92; 0 thereafter)
1 Aplysina cauliformis (Porifera) (1:12/94; 1:4/95)
1 Pseudoceratina crassa (Porifera-**new**)
1 Eusmilia fastigiata (1:12/92; 0:4/93; 1:8/93; 2:1/94; 0?6/94; 1:12/94; 1:4/95)
1 Meandrina meandrites (1:8/93; 1:1/94; 0?:6/94; 1:12/94; 1:4/95)
1 Siderastera siderea (Scleractinia) (1:4/95)
1 Stephanocoenia michelini (Scleractinia-**new**)
0 Dichocoenia stokesii juv. (Scleractinia) (2:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Stolonica sabulosa (1:12/92; 1:4/93; 1:8/93; 10:1/94; 0:6/94; 1:12/94; 0:4/95)

BC-19: All stakes missing: 1/94; not sampled further in 1995

0 Halimeda goreauii (1 Aug 92; 0 thereafter)
1 Dictyota sp. (>20:8/92; 0:12/92; 0:4/93; 1 8/93; 1:1/94; 0:6/94)
0 Wrangelia argus (0:12/92; >20:4/93; 0:8/93; 0:1/94; 0:6/94)
2 Niphates digitalis (2:8/92; 0:12/92; 2:4/93; 1:8/93; 1:1/94; 2:6/94)
1 Holopsamma helwigi (5:9/92; 3:12/92; 3:4/93; 1:8/931:1/94; 1:6/94)
1 Callyspongia vaginalis (Porifera) (3:6/94)
0 Callyspongia fallax (1:8/93; 1:1/94; 0:6/94)
1 Aplysina cauliformis (Porifera)
0 Dasychalina cyathina (Porifera) (1:6/94)
0 Ulosa reutzleri (Porifera) (1:6/94)
0 Haliclona rubens (1 Aug. 92; 0 thereafter)
0 Xestospongia muta (1 Dec. 92; 0 thereafter)
0 Mycale sp. (Porifera) (1:1/94)
0 Spirastrella coccinea (1 Dec. 92; 0 thereafter)
2 Eunicea fusca (Octocorallia) 3:8/92; 4:12/92; 4:4/93; 8/93; 2:1/94; 3:6/94)
4 Briareum asbestinum (1:12/92; 2:4/93; 1:8/93; 2:1/94; 0?:6/94)
0 Dichocoenia stokesii (1:12/92; 0:4/93; 1:8/93; 0:1/94; 1:6/94)
0 Montastrea cavernosa (1:8/93; 0:1/94; 0:6/94
0 Siderastrea radians (1:8/93; 0:1/94; 0:6/94)
1 Stephanocoenia michelini (Scleractinia)
1 Meadrina meandrites (Scleractinia)
1 Mussa? (Scleractinia)
0 Stolonica sabulosa (0:12/92; 3:4/93; 1:8/93; 1:1/94; 0:6/94)

BC-20 (could not locate 12/94 or 4/95)

Current sample taken 15 months since prior sampling period
0 Halimeda goreauii (1:12/92; 0:4/93; 1:8/93; 0:1/94; 0:6/94; 0: 6/94)
0 Wrangelia argus (>20:12/92; >20:4/93; 0:8/93; 0:1/94; 0:6/94; 6:4/94)
>20 Dictyota sp. (1:8/93; 0:1/94; 0:6/94)
0 Dasychalina cyathina (Porifera) (1:6/94)
0 Haliclona rubens (porifera) (1:6/94)
1 Ircinia sp. (Porifera-**new**)
1 Spirastrella coccinea (Porifera-**new**)
1 Holopsamma helwigi (0:12/92; 2:4/93; 5:8/93; 0:1/94; 4:6/94)
0 Callyspongia fallax (1 Dec. 92; 0 thereafter)
1 Niphates digitalis (1:8/93; 1:1/94; 0:6/94)
2 Aplysina cauliformis (Porifera) (1:1/94; 3:6/94)
0 Meandrina meandrites (in sand) (1:12/92; 1:4/93; 0: 8/93; 0:1/94; 0:6/94)
1 Eusmilia fastigiata (Scleractinia-**new**)
1 Agaricia sp. (Scleractinia-**new**)
1 Stephanocoenia michelini (Scleractinia-**new**)
0 Stolonica sabulosa (2:12/92; 1:4/93; 0:8/93; 1:1/94; 0:6/94)

BC-21

1 Udotea sp. (Chlorophyta) (8:8/92; 0:12/92; 1:4/93; 7: 8/93; 0:1/94; 2:6/94; 0:12/94; 1:4/95)
>20 Dictyota sp. (5:8/93; 0:1/94; 1:6/94; 0:12/94; 0:4/95)
0 Halimeda goreauii (1:8/93; 0 thereafter)
0 Wrangelia argus (>20:12/92; >20:4/93; 0 thereafter)
0 Cinachyra sp. (Porifera) (1:12/94; 0:4/95)
0 Aplysina cauliformis (Porifera) (1:12/94; 0:4/95)
0 Unidentifed yellow sponge (Porifera) (1:4/95)
1 Holopsamma helwigi (0:12/92; 2:4/93; 0:8/93; 0:1/94; 1:6/94; 1:12/94; 0?:4/95)
0 Ulosa reutzleri (0:12/92; 1:4/93; 1:8/93; 0:1/94; 1:6/94; 2:12/94; 1:4/95)
2 Spirastrella coccinea (1:8/92; 0:12/92; 1:4/93; 0:8/93 0:1/94; 0:6/94; 1:12/94; 1:4/95)
1 Niphates digitalis (1:8/92; 0:12/92; 1:4/93; 0:8/93; 0:1/94; 1:6/94; 0?:12/94; 1:4/95)
1 Briareum asbestinum (Gorgonacea-**new**)
0 Stephanocoenia michelini (1:8/92; 0 thereafter)
0 Montastrea cavernosa juv. (1 Dec. 92; 0 thereafter)
0 Siderastrea siderea (Scleractinia) (1:12/94; 0:4/95)
0 Stolonica sabulosa (1:12/92; 1:4/93; 0:8/93; 10:1/94; 0:6/94; 2:12/94; 8:4/95)

BC-27

1 Udotea sp. (3:12/92; 0:12/92; 0:4/93; 7:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)
0 Halimeda goreauii (2 in Aug. 0 thereafter)
0 Wrangelia argus (>20:12/92; >20:4/93; 0 thereafter)
0 Aplysina sp. (0:12/92; 1:4/93; 0 thereafter)
3 Holopsamma helwigi (2:8/92; 1:12/92; 4:4/93; 6:8/93; 5:1/94; 2:6/94; 0:12/94; 4:4/95)
0 Niphates digitalis (0:12/92; 1:4/93; 1:8/93; 3:1/94; 3:6/94; 1:12/94; 1:4/95)
0 Iotrochota birotulata (Porifera) (1:6/94; 0:12/94; 0:4/95)
1 Haliclona rubens (Porifera) (1:12/94; 0?:4/95)
0 Callyspongia vaginalis (Porifera) (1:12/94; 1:4/95)
1 Dasychalina cyathina (Porifera) (1:12/94; 1:4/95)
0 Ircinia sp. (Porifera) (1:12/94; 0:4/95)
0 Spirastrella coccinea (Porifera) (1:12/94; 0:4/95)

1 Eunicea fusca (1 Aug. 92; 0 until 9/95)
1 Briareum asbestinum (Gorgonacea-**new**)
1 Dichocoenia stokesii (Scleractinia) (1:6/94; 1:12/94; 0?:4/95)
0 Siderastrea siderea (Scleractinia) (1:6/94; 1:12/94; 0:4/95)
0 Stephanocoenia michelini (Scleractinia) (1:12/94; 1:4/95)
1 Meandrina meandrites (Scleractinia-**new**)
1 Montastrea cavernosa (Scleractinia-**new**)
0 Stolonica sabulosa (3:12/92; 1: 4/93; 0:8/93; 1:1/94; 1:6/94; 1:12/94; 5:4/95)
0 Unid. didemnid ascidian (1:8/93; 0 thereafter)

BC-30

0 Wrangelia argus (0: 12/92; >20: 4/93; 0 thereafter)
1 Halimeda goreaui (1 Dec.93; 0 thereafter until 6/94; 3:6/94); 0:12/94; 0:4/95
3 Udotea sp. (7:8/93; 0:1/94; 3:6/94; 1:12/94; 2:4/95)
>20 Dictyota sp. (Phaeophyta) (1:6/94; 0:12/94; 0:4/95)
4 Holopsamma helwigi (0:12/92; 1:4/93; 3:8/93; 1:1/94; 3:6/94; 1:12/94; 4:4/95)
0 Dysidea sp. (0:12/92; 1:4/93; 0:8/93; 0:6/94; 0:12/94; 0:4/95)
1 Callyspongia plicifera (ptly. hidden) (1:12/92; 1:4/93; 0:8/93; 1:1/94; 1:6/94; 1:12/94; 1:4/95)
0 Haliclona rubens (1:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)
1 Ulosa reutzleri (Porifera) (1:1/94; 0?:6/94; 1:12/94; 2:4/95)
0 Spirastrella coccinea (Porifera) (1:6/94; 1:12/94; 1:4/95)
0 Teichaxinella sp. (Porifera) (1:12/94; 0:4/95)
1 Dasychalina cyathina (Porifera) (1:12/94; 2:4/95)
3 Briareum asbestinum (1:12/92; 0:4/93; 0:8/93; 3:1/94; 2:6/94; 3:12/94; 5:4/95)
0 Siderastrea siderea (hidden) (1:12/92; 1:4/93; 0:8/93; 3:1/94; 0:6/94; 0:12/94; 0:4/95)
1 Meandrina meandrites (1:12/92; 1:4/93; 1:8/93; 1:1/94; 1:6/94; 1:12/94; 1:4/95)
3 Stephanocoenia michelini (porifera) (1:12/94; 1:4/95)
0 Stolonica sabulosa (1:12/92; 1:4/3; 0:8/93; 3:1/94; 0:6/94; 0:12/94; 1:4/95)

BC-37

0 Udotea sp. (4:8/92; 0:12/92; 1:4/93; 11:8/93; 0:1/94; 0:6/94; 0:12/94;1:4/95)
0 Wrangelia argus (0:12/92; >20:4/93; 0 thereafter)
>20 Dictyota sp. (Phaeophyta) (1:6/94; 0:12/94; 0:4/95)
1 Holposamma helwigi (0:12/92; 2:4/93; 1:8/93; 0:1/94; 1:6/94; 1:12/94; 2:4/95)
2 Aplysina cauliformis (1:8/92; 0:12/92; 1:4/93; 0:8/93; 2:1/94; 1:6/94; 2:12/94; 2:4/95)
3 Niphates digitalis (2:12/92; 2:4/93; 2:8/93; 2:1/94; 2:6/94; 1:12/94; 1:4/95)
3 Callyspongia vaginalis (1:8/93; 1:1/94; 1:6/94; 0:12/94; 0:4/95)
0 Ircinia sp. (0:12/92; 1:4/93; 0 thereafter)
0 Thalysias juniperina (Porifera) (1:4/95)
1 Iotrochota birotulata (Porifera-**new**)
0 Briareum asbestinum (Gorgonacea) (1:12/94; 2:4/95)
0 Eunicea sp. (0:12/92; 1:4/93; 0:8/93; 1:1/94; 1:6/94; 1:12/94; 0:4/95)
0 Millepora alcicornis (1:8/93; 1:1/94; 1:6/94; 0:12/94; 0:4/95)
0 Siderastrea siderea (Scleractinia) (2:12/94; 0:4/95)
1 Meandrina meandrites (Scleractinia) (1:12/94; 0?:4/95)
1 Stephanocoenia michelini (1:8/93; 1:1/94; 1:6/94; 0?:12/94; 1:4/95)
0 Reteporellina sp. (Bryozoa) 1 Dec. 92; 0 thereafter)
0 Stolonica sabulosa (1:12/92; 1:4/93; 0:8/93; 1:1/94; 0:6/94; 0:12/94; 0:4/95)

BC-39 Could not locate for 9/95 sampling period

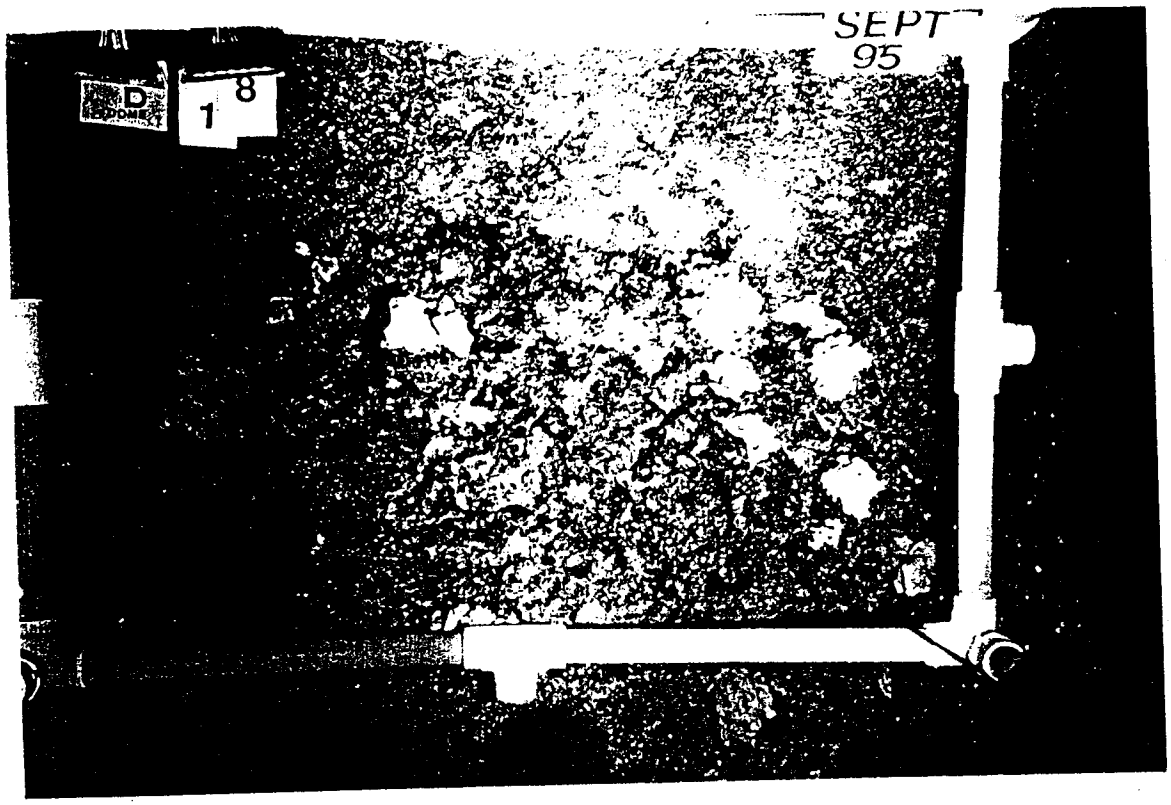
3 Udotea sp. (11:12/92; 1:4/93; >20:8/93; 1:1/94; 2:6/94; 0:12/94)
0 Dictyota sp. (2:8/93; 4:6/94; 0:12/94)
0 Halimeda goreauii (3:12/92; 0 thereafter)
0 Wrangelia argus (>20:4/93; 0 thereafter)
0 Callyspongia fallax (Porifera) (1:1/94; 0:6/94; 0:12/94)
5 Holopsamma helwigi (3:8/92; 1:12/92; 15:4/93; 4:8/93; 2:1/94; 4:6/94; 3:12/94)
0 Dysidea sp. (0:12/92; 2:4/93; 0:8/93; 0:1/94; 0:6/94; 0:12/94)
2 Ulosa reutzleri (1:12/92; 0:4/93; 1:8/93; 1:1/94; 1:6/94; 1:12/94)
2 Niphates sp. (Porifera) (3:12/94)
0 Briareum asbestinum (Gorgonacea) (1:12/94)
1 Plexaura flexuosa (Gorgonacea) (1:6/94; 1:12/94)
0 Dichocoenia stokesii juv. (1 Dec. 92; 0 thereafter)
0 Montastrea cavernosa juv. 1 Dec. 92; 0 therafter)
0 unid. juv. scleractinian (1:8/93; 0:1/94; 0:6/94; 0:12/94)
0 Siderastrea siderea juvenile (Scleractinia) (1:12/94)
0 Watersipora sp. (0:12/92; 1:4/93; 0 thereafter)
1 Stolonica sabulosa (7:8/92; 3:12/92; >20:4/93; 0:8/93; >20:1/94; 0:6/94; 3:12/94)

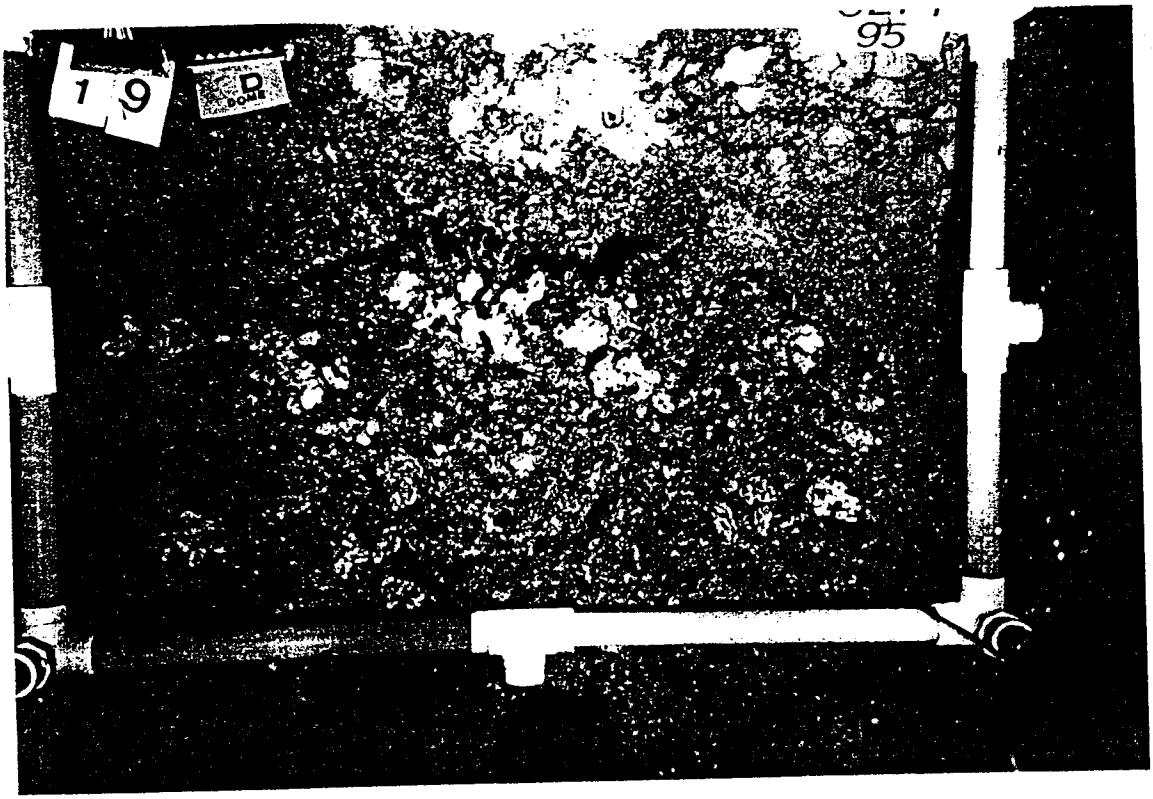
APPENDIX C

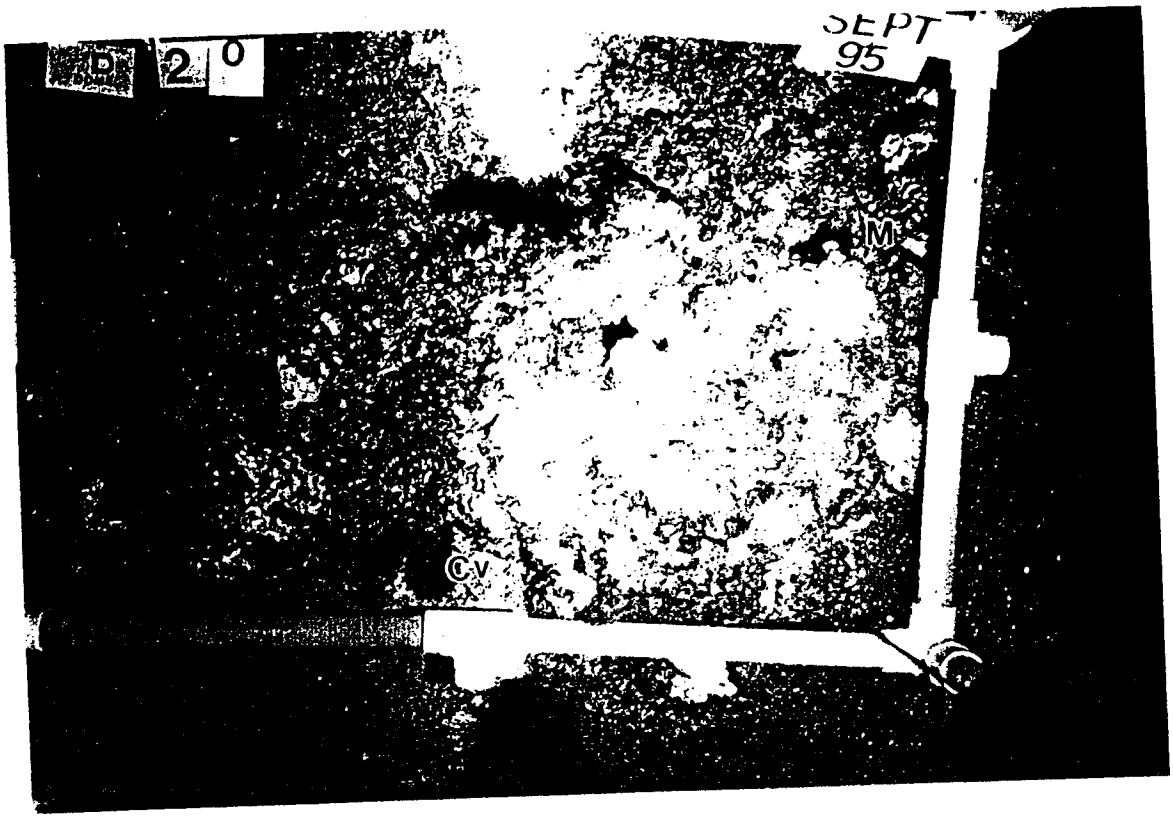
PHOTOGRAPHIC LOG

APPENDIX C: PHOTOGRAPHIC LOG ABBREVIATION KEY

Symbol	Abbreviation
Ba	Briareum asbestinum
Cf	Callyspongia fallax
Cv	Callyspongia vaginalis
Dc	Dasychalina cyathina
Ds	Dysidea sp.
M	Millepora alcicornis
Hh	Holopsamma helwigi
Ib	Iotrochota birotulata
D	Dictyota
Ll	Lima lima
P	Porites cf. P. astreoides
Ps	Pseudoplexaura sp.
Sa	Spondylus americanus
Sc	Spirastrella coccinea
T	Telesto reesi


SEPT
95
18


95
19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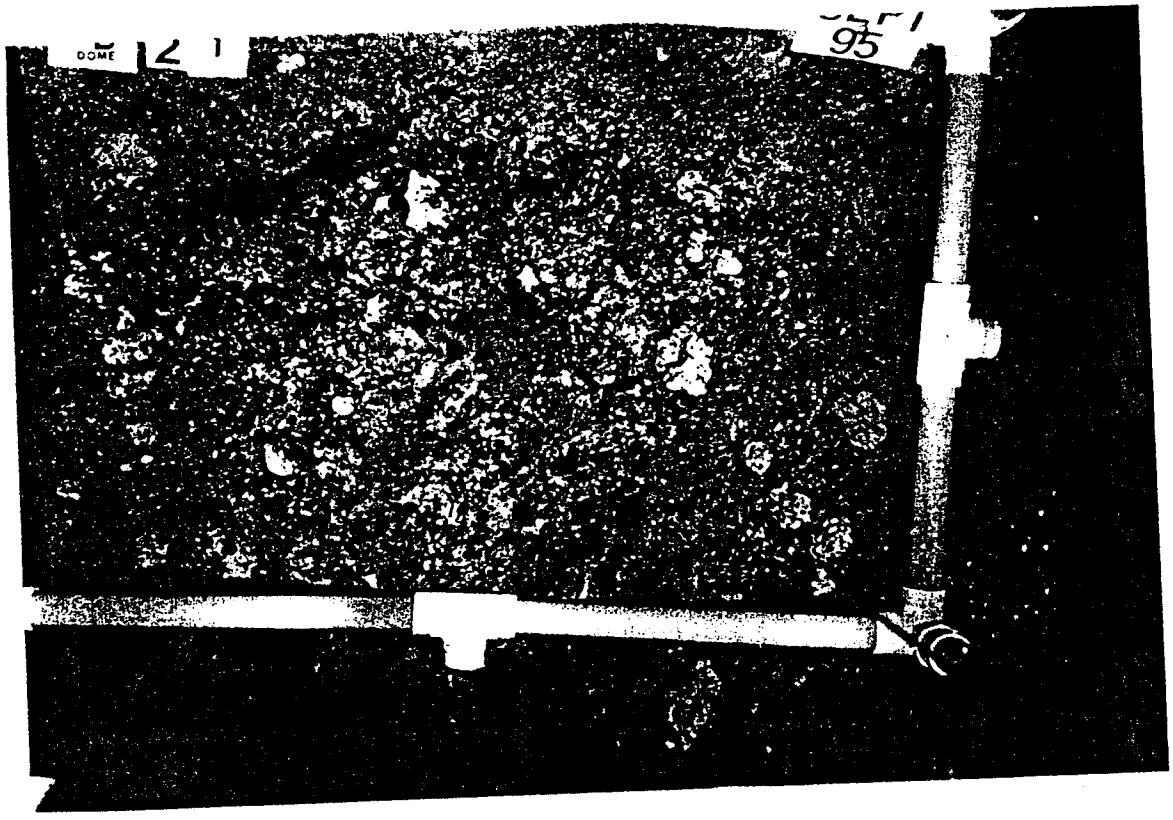
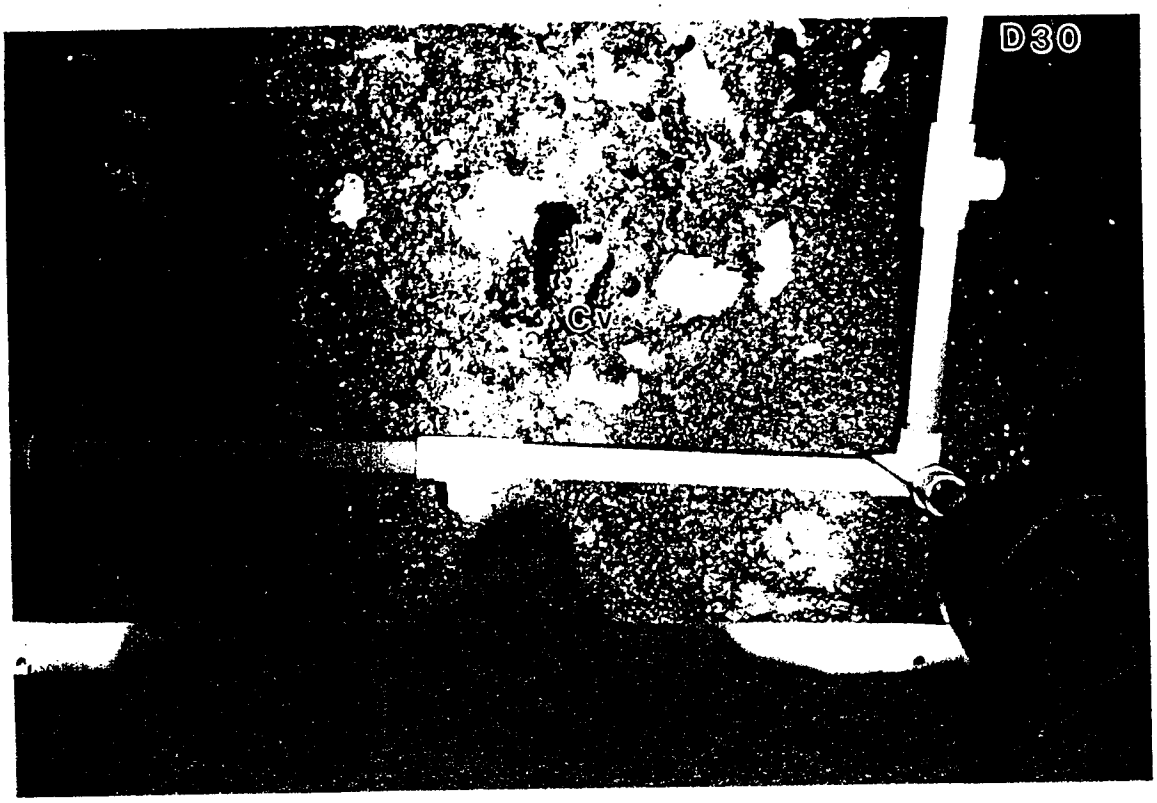
SEPT
95
M
CV


DOME
95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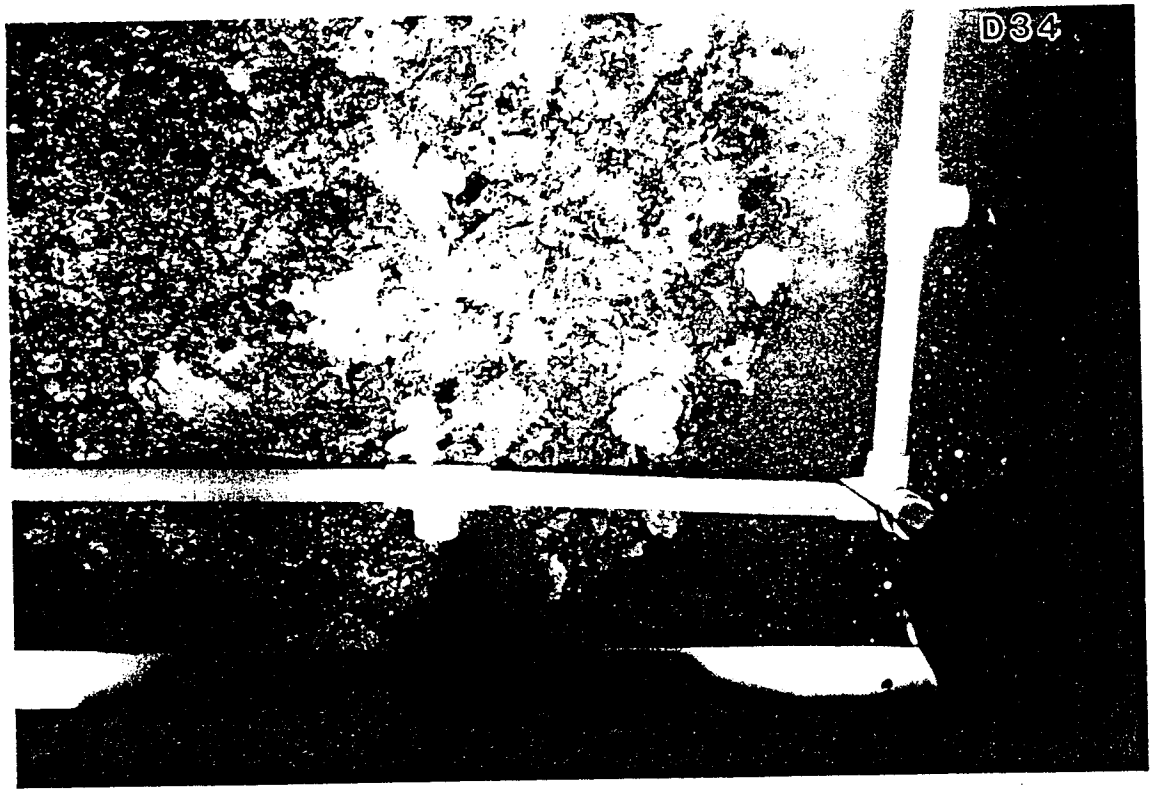
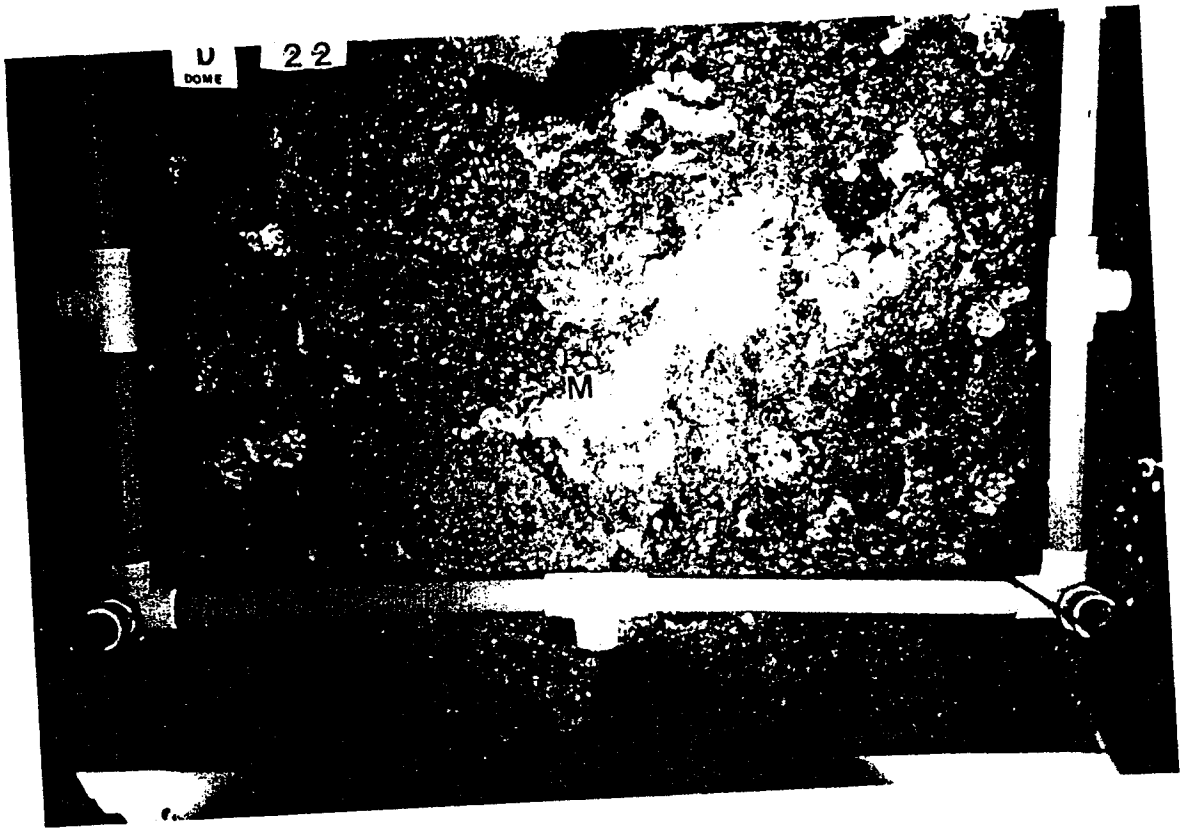
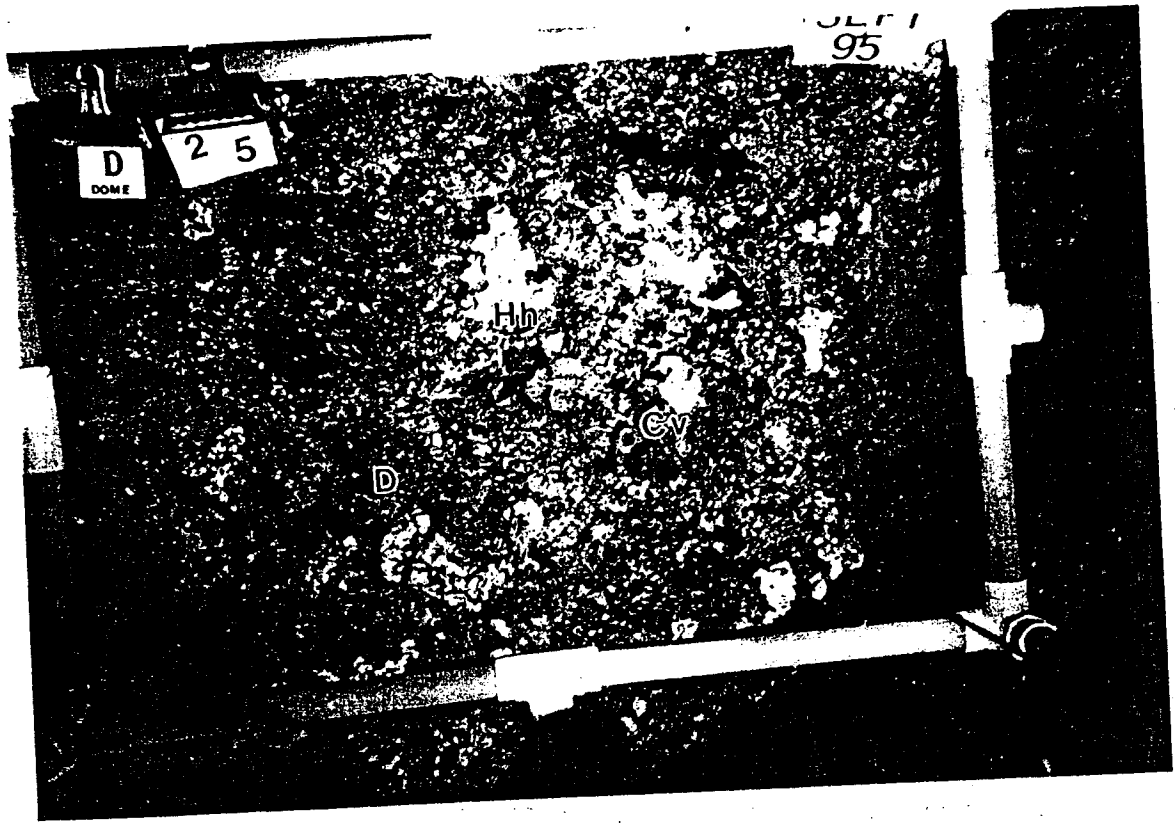
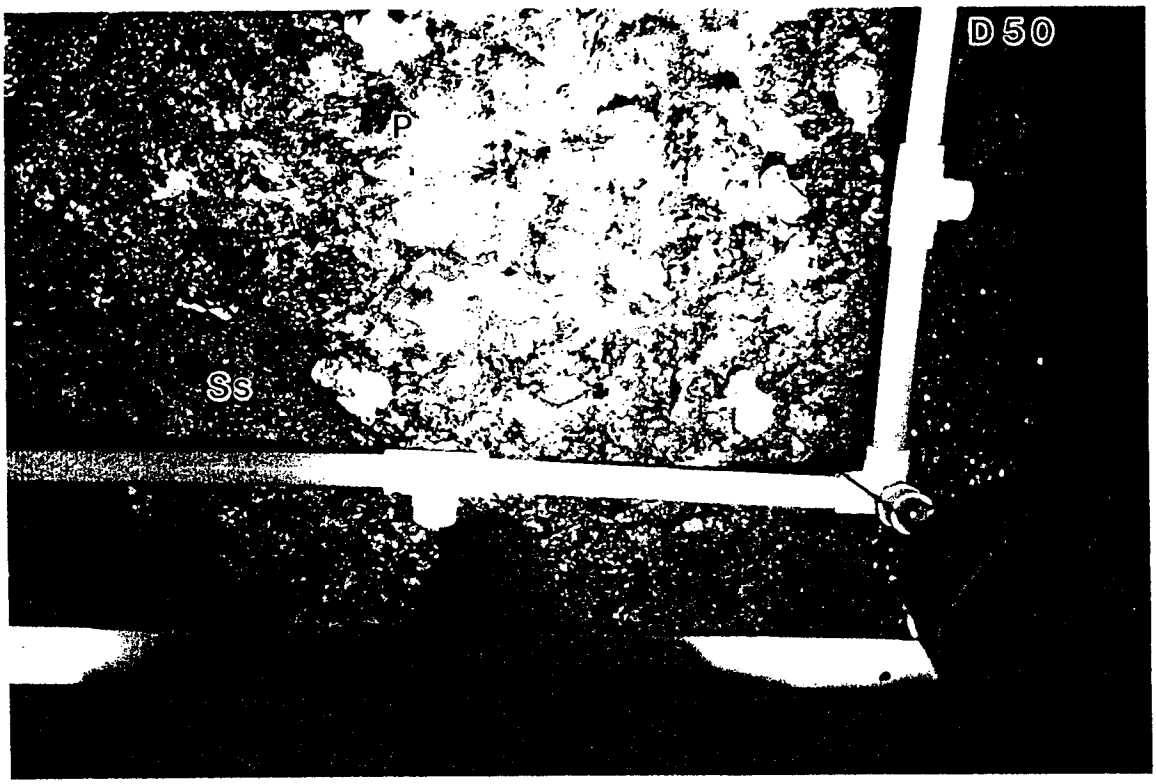
Cv


D34


U
DOME
22
M


95
D
DOME
25
Hh
CV
D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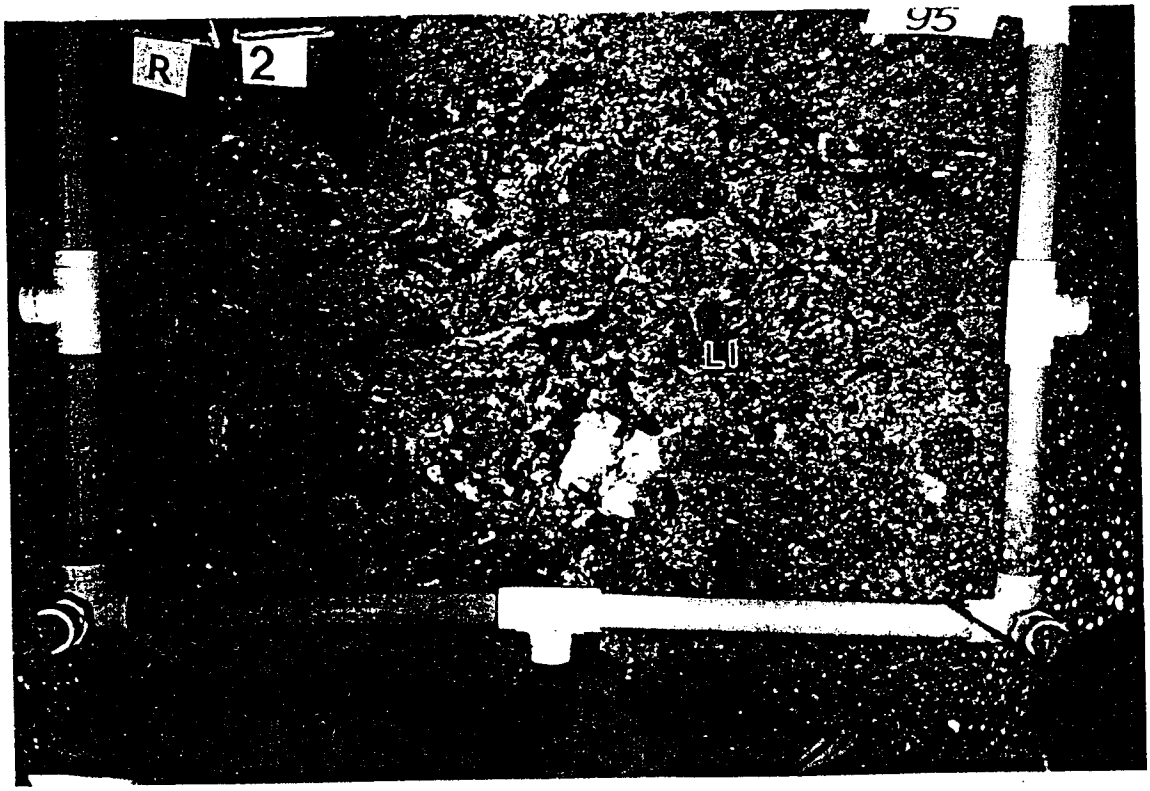
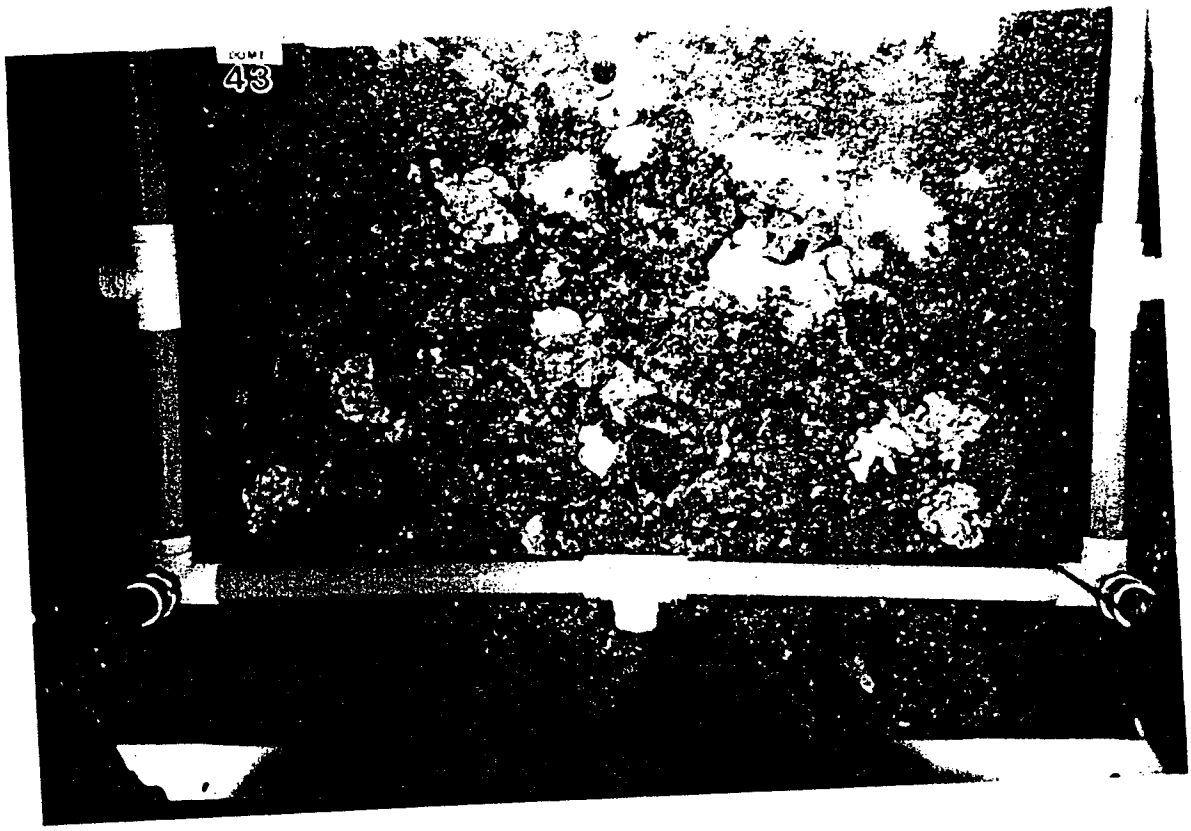
P
Ss


95
R
2
LI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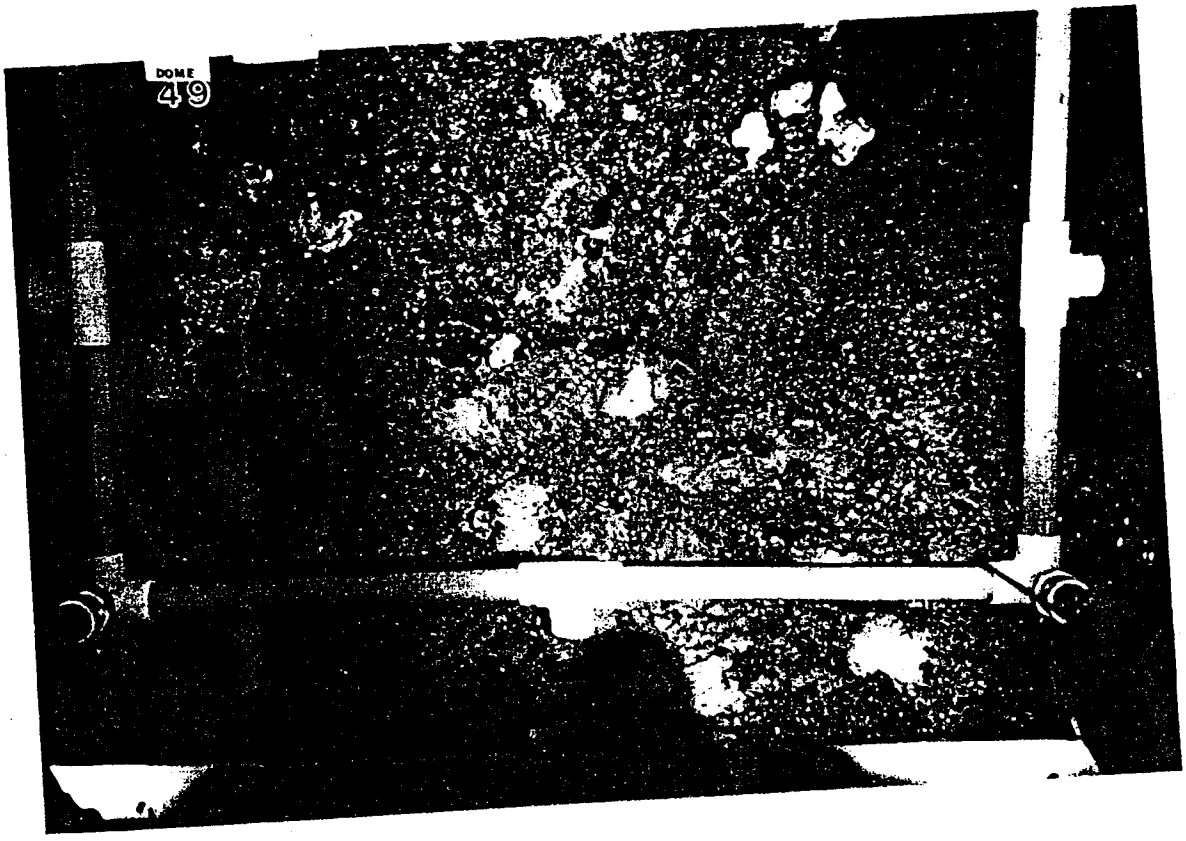
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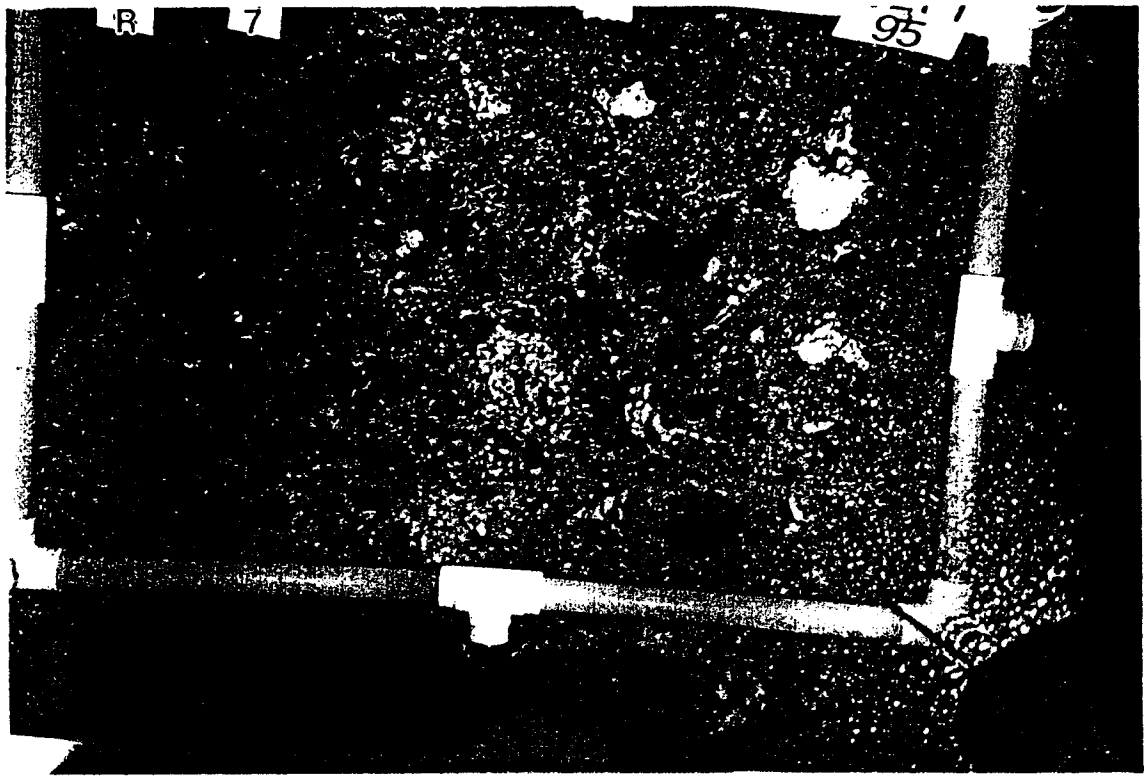
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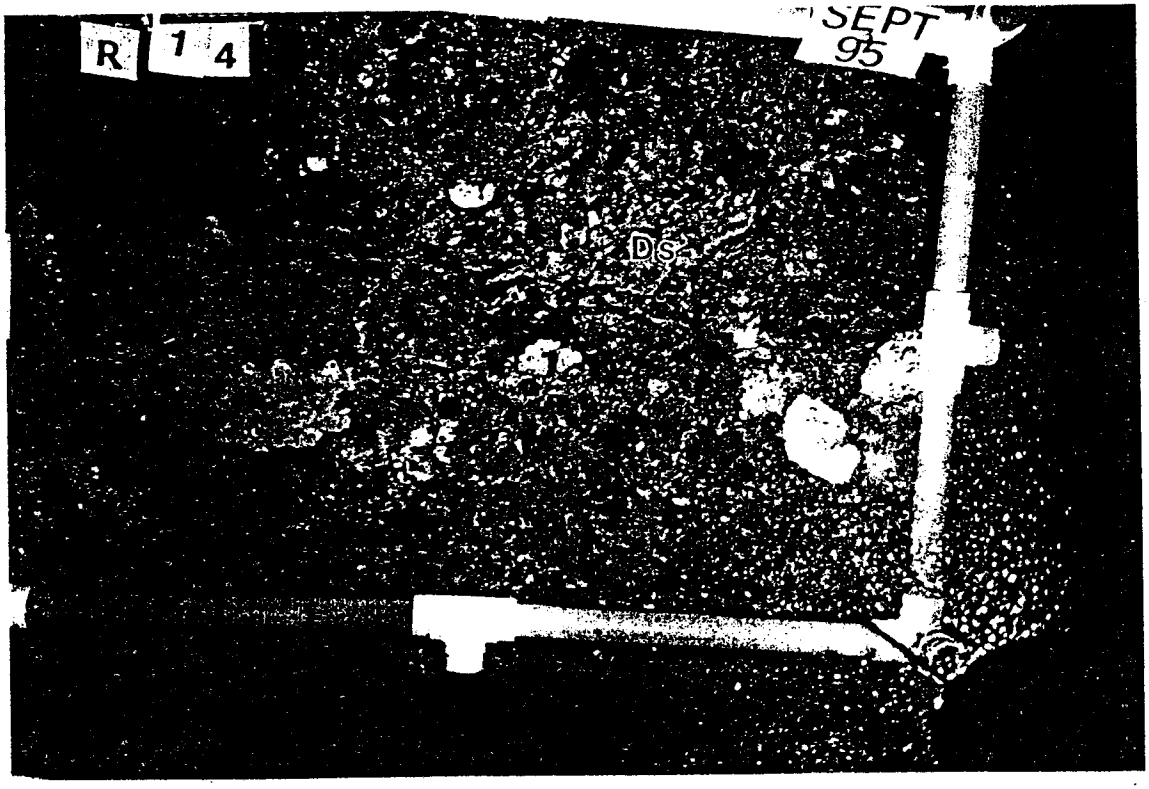
R 1 4
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R
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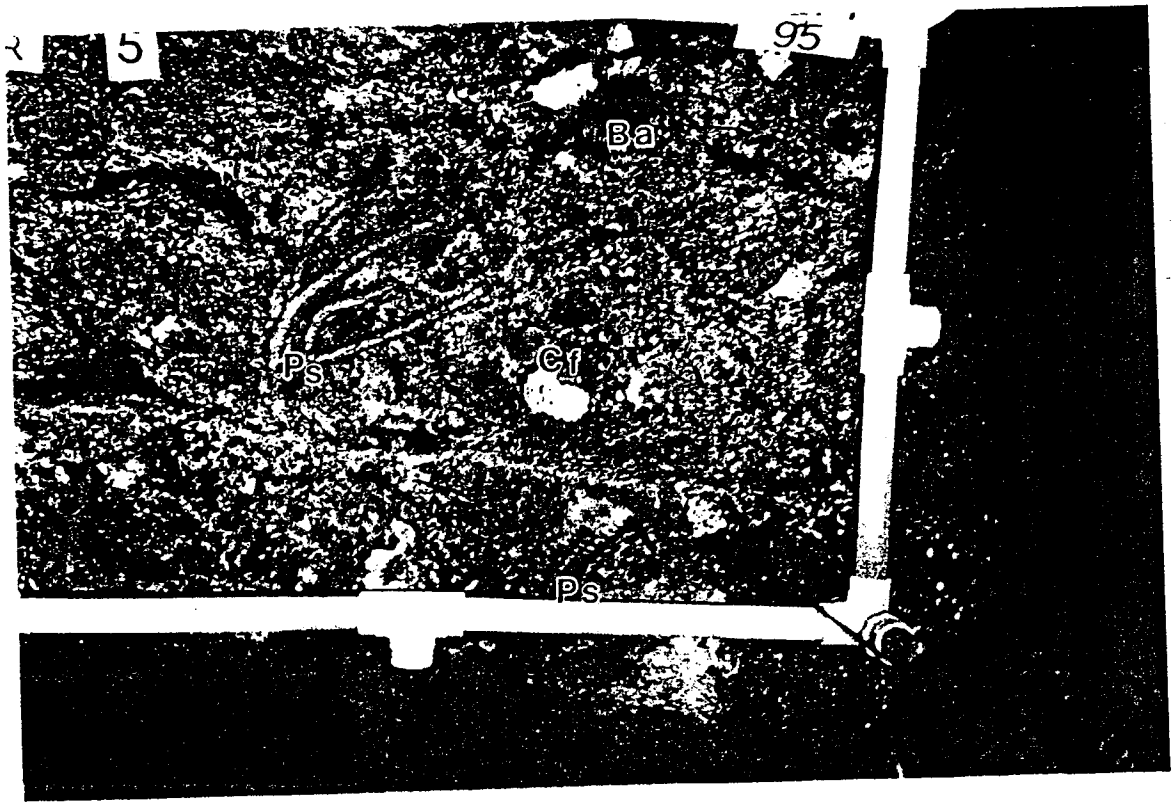
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Cf
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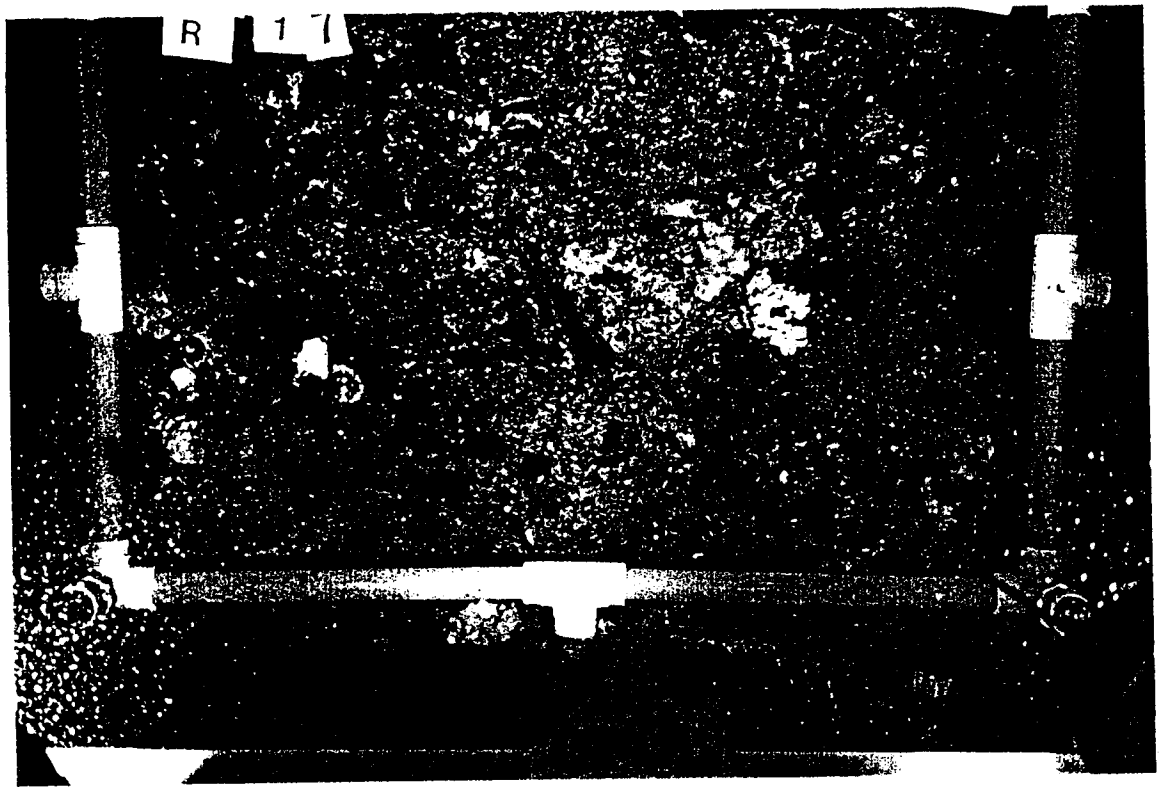
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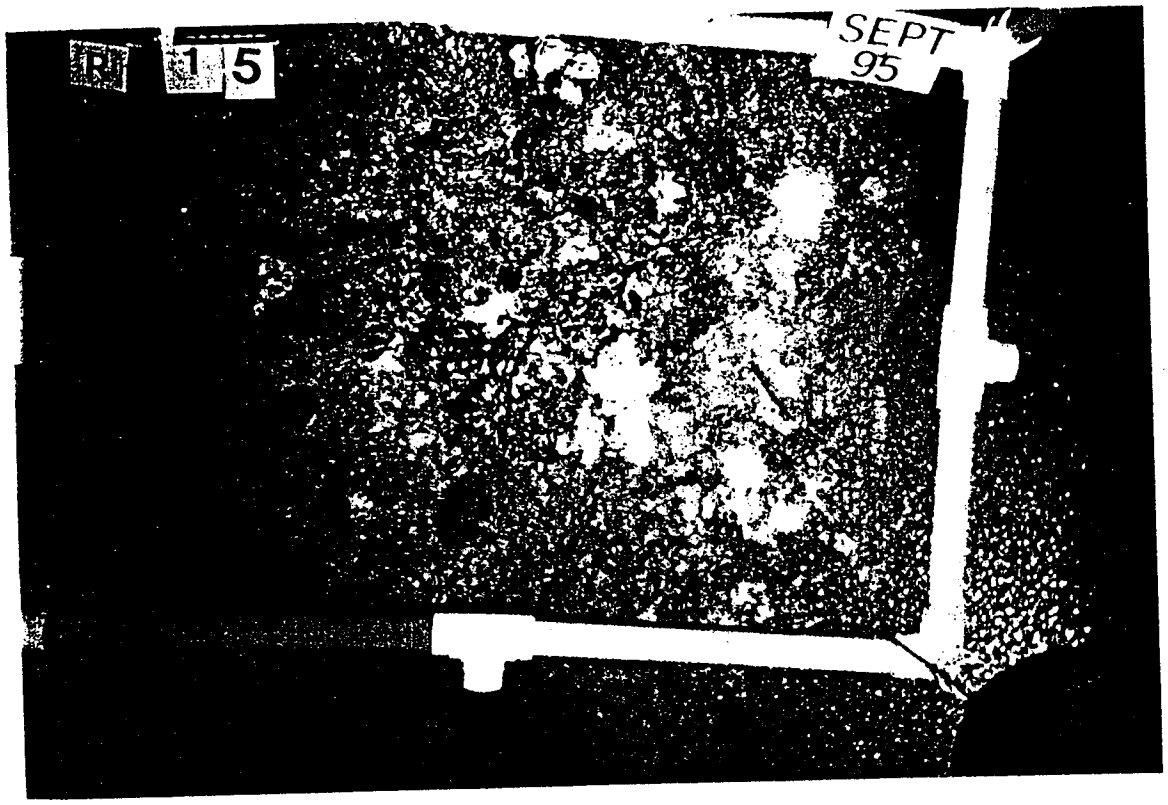
R 2 1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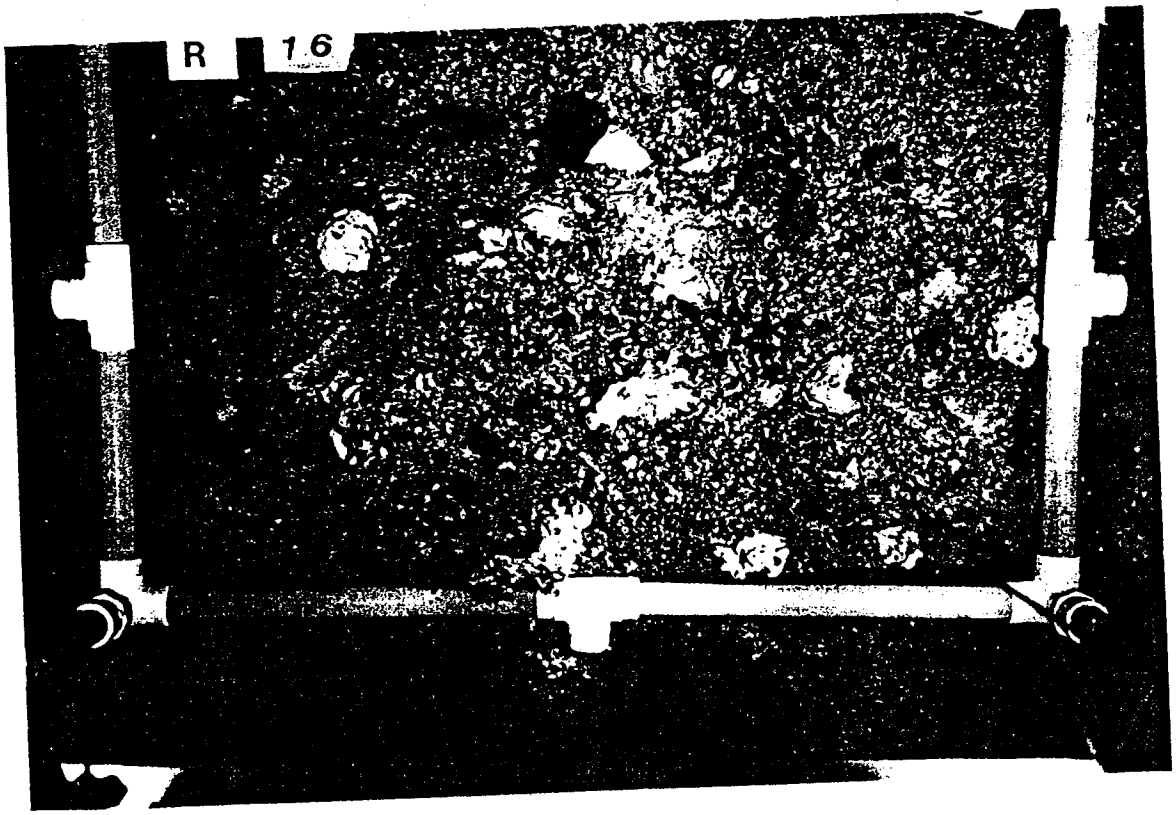
R 16


SEPT
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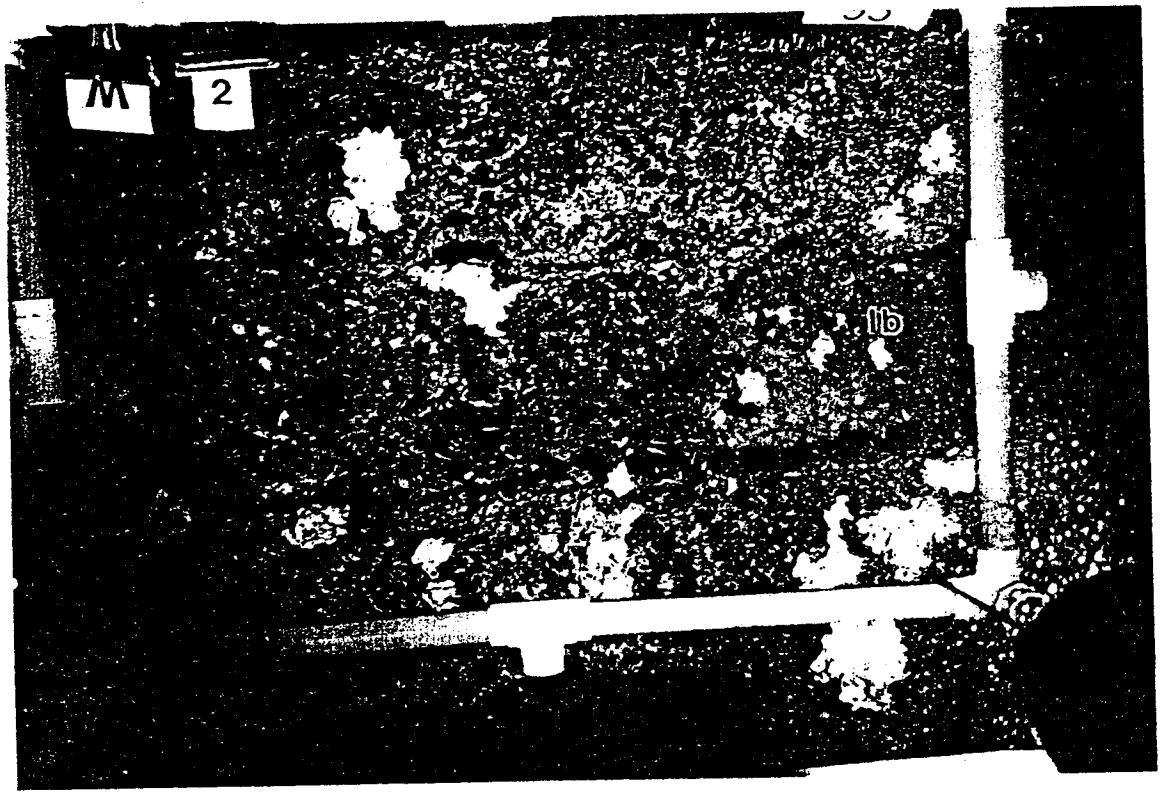
M
1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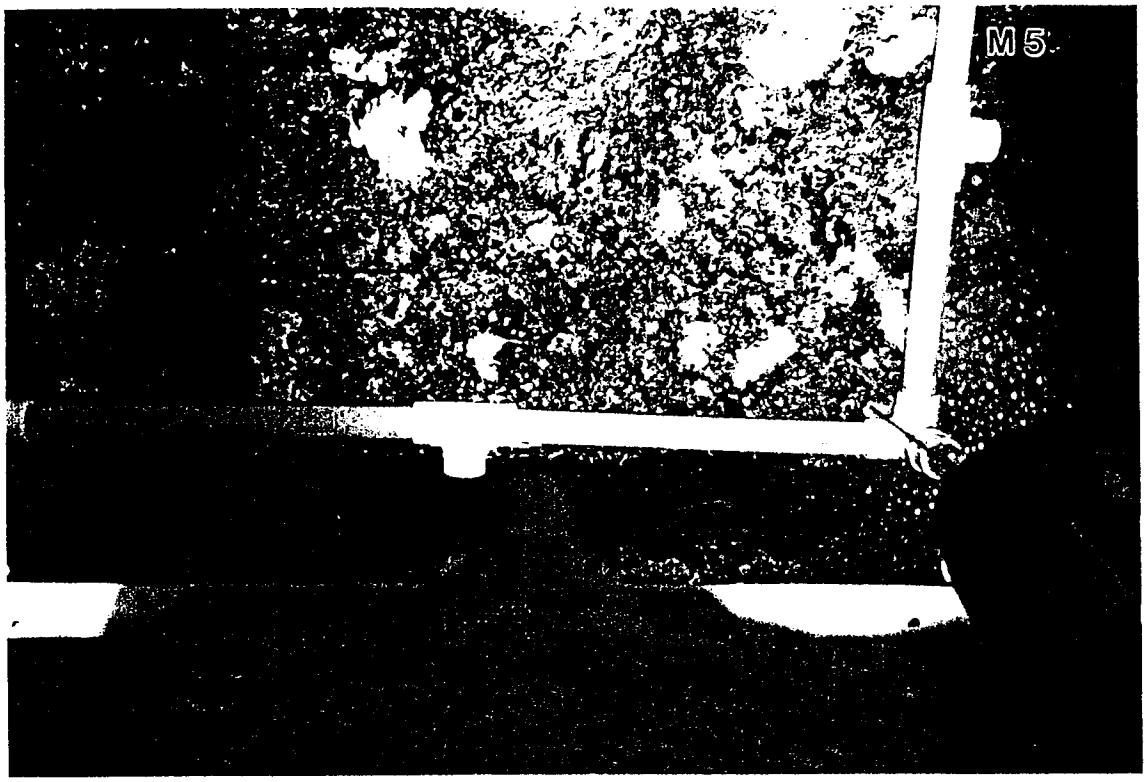
R
22


R 23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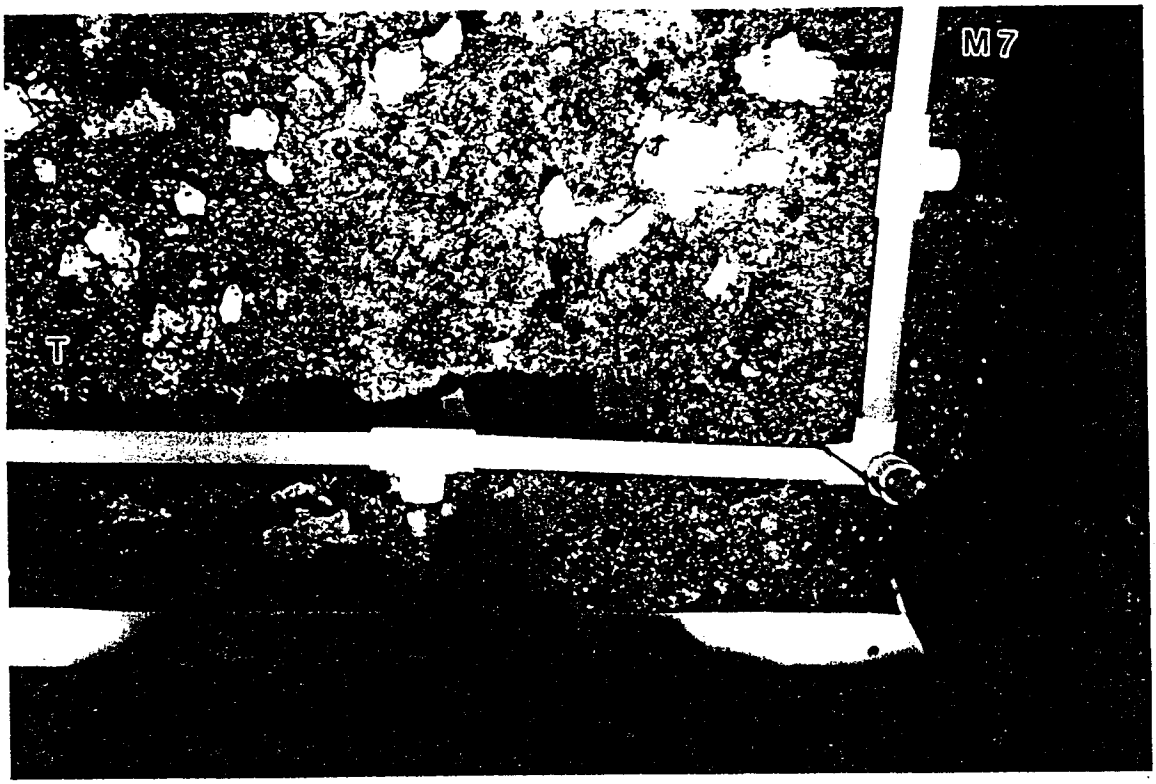
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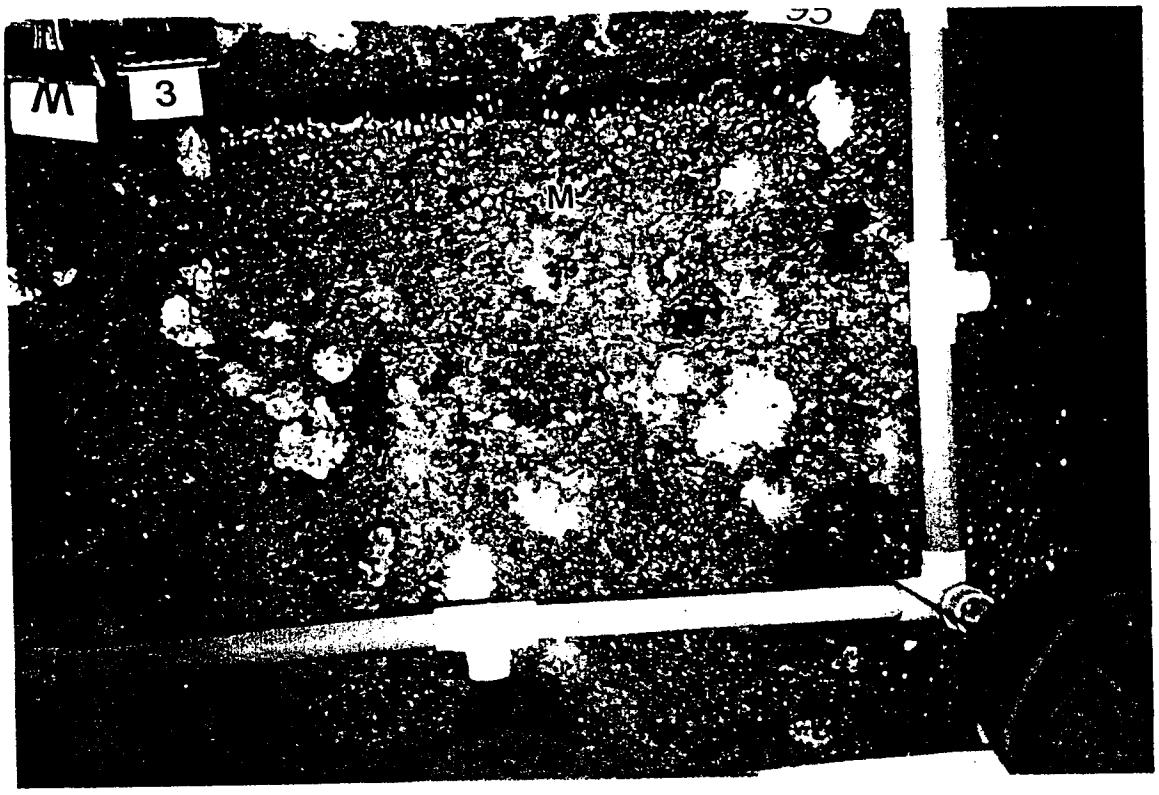
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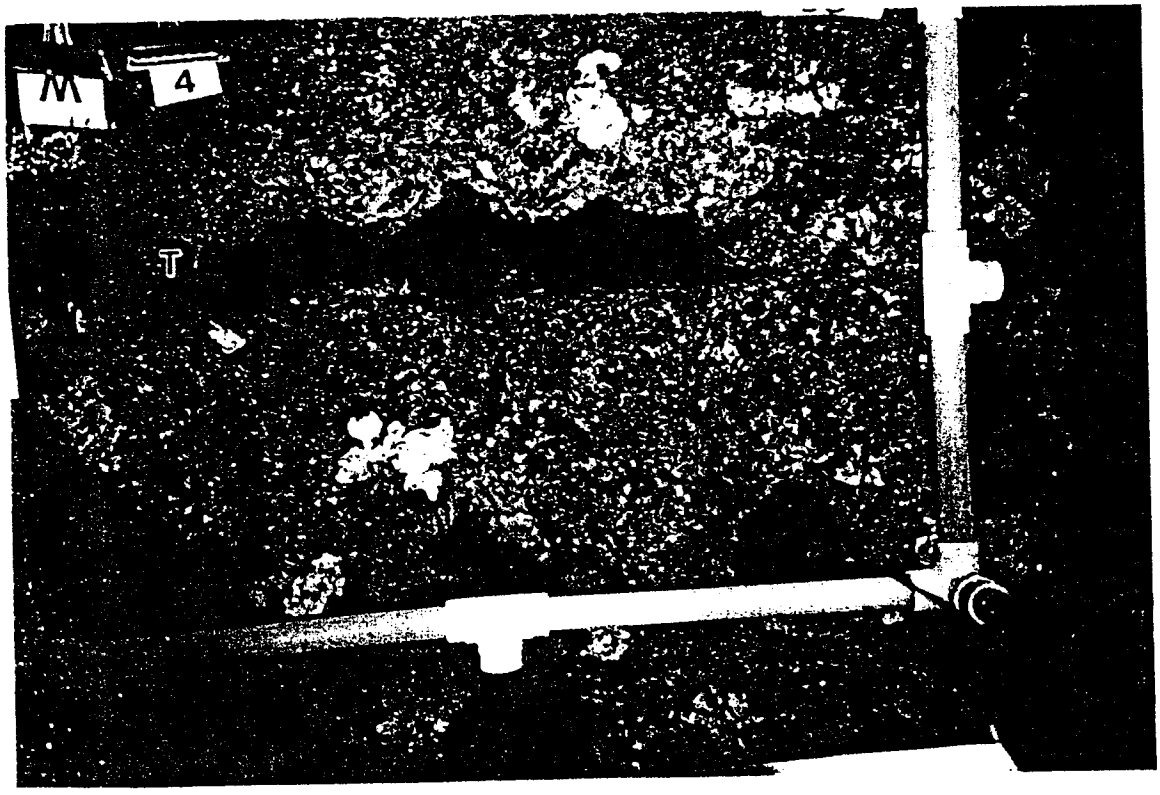
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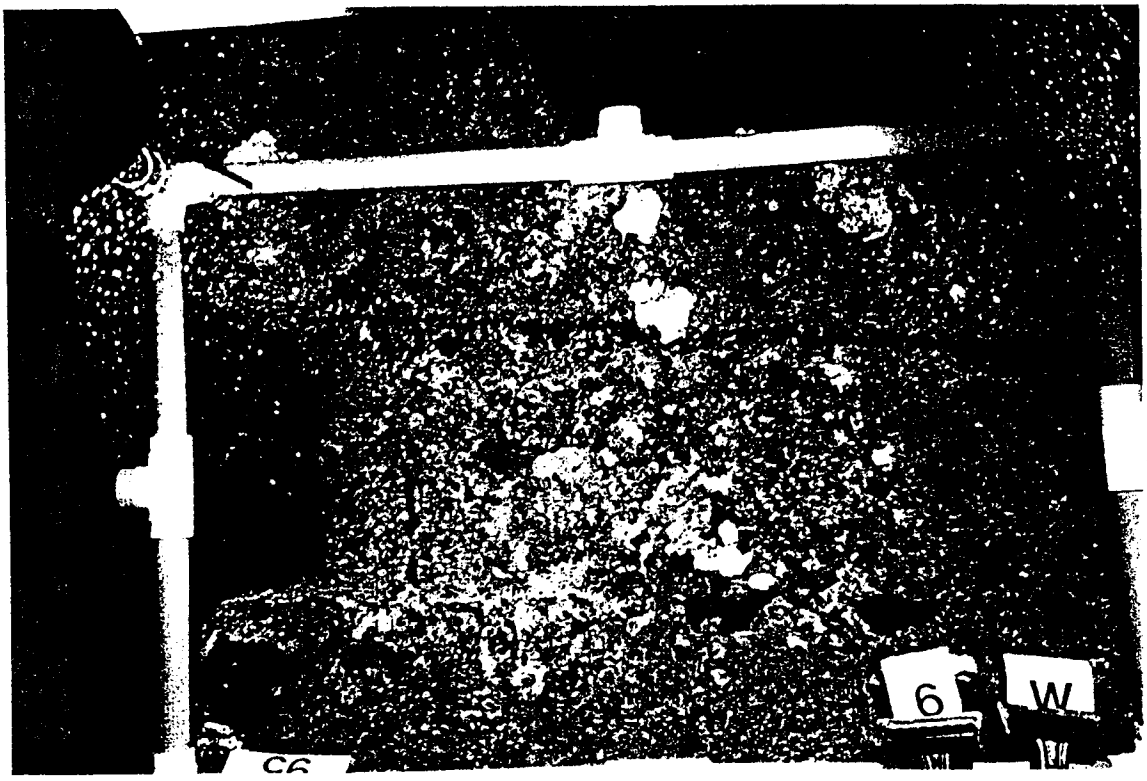
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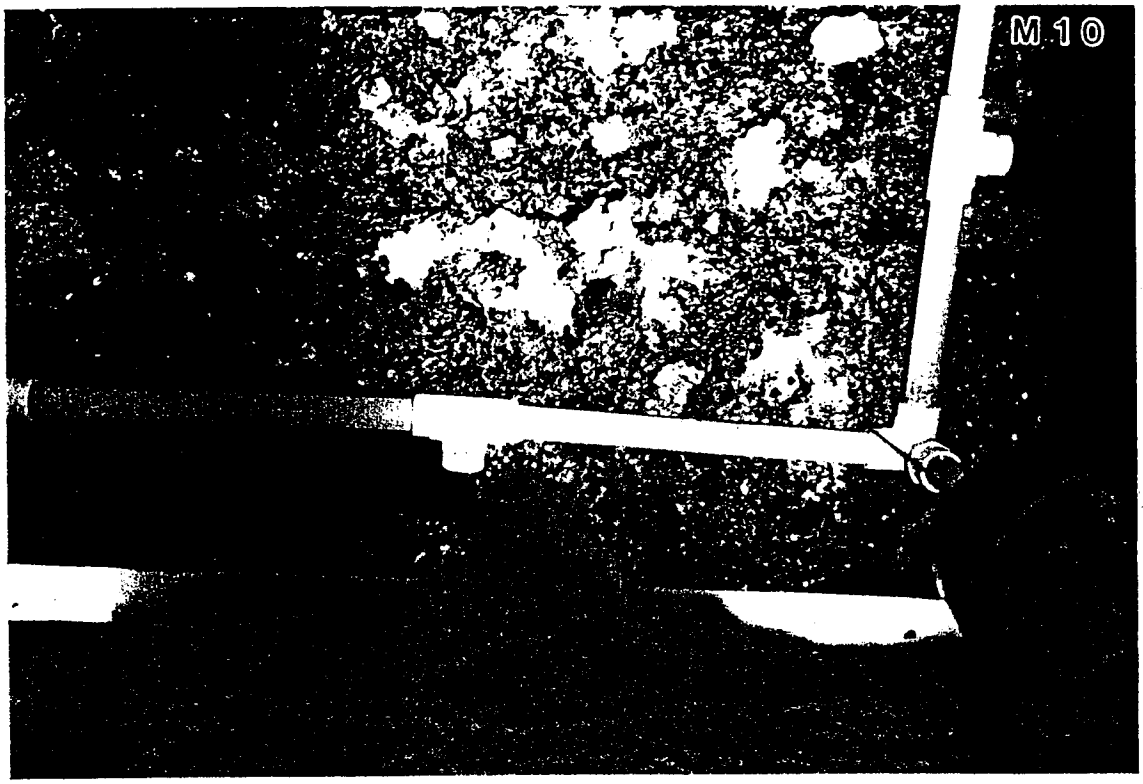
M8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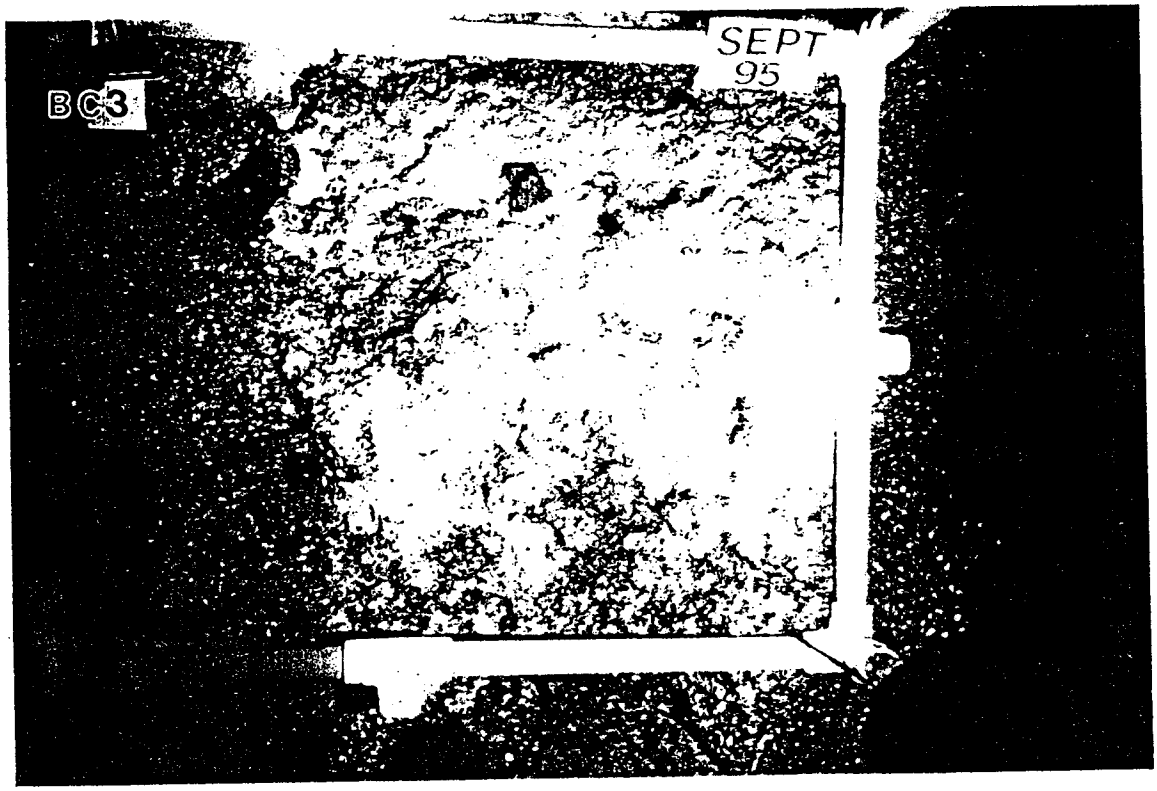
SEPT
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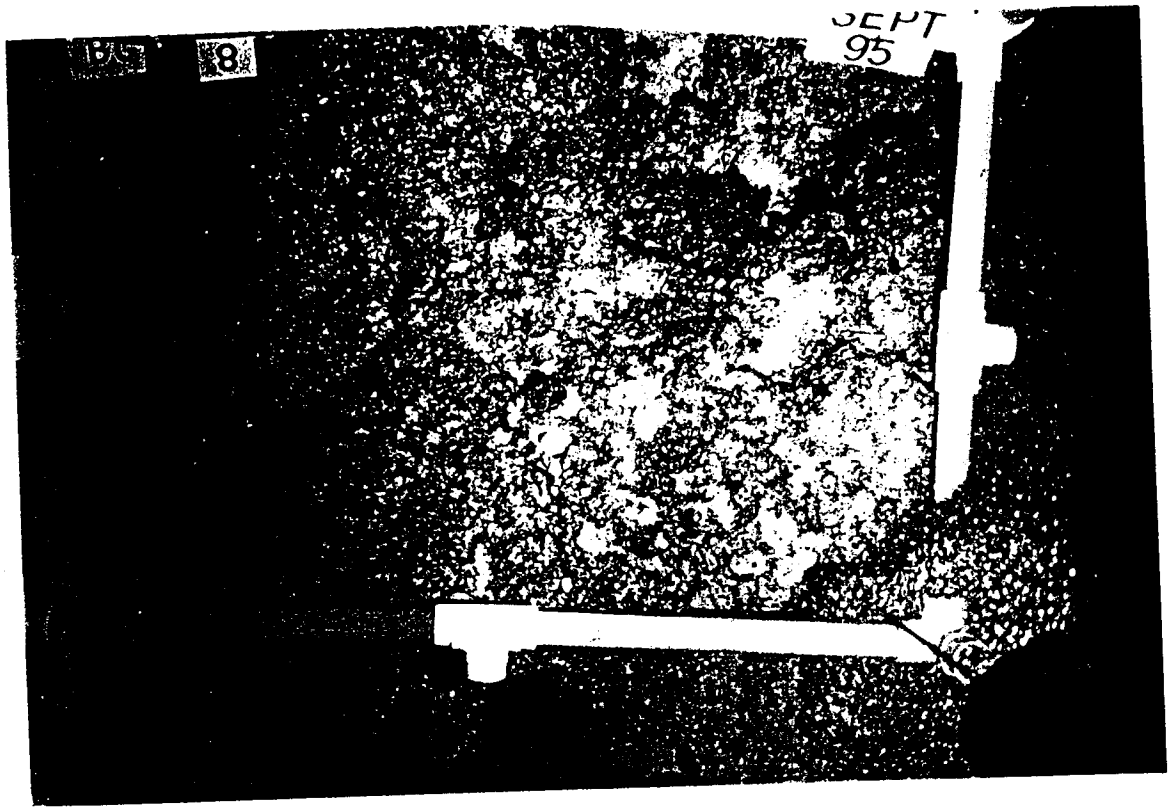
BC3


SEPT
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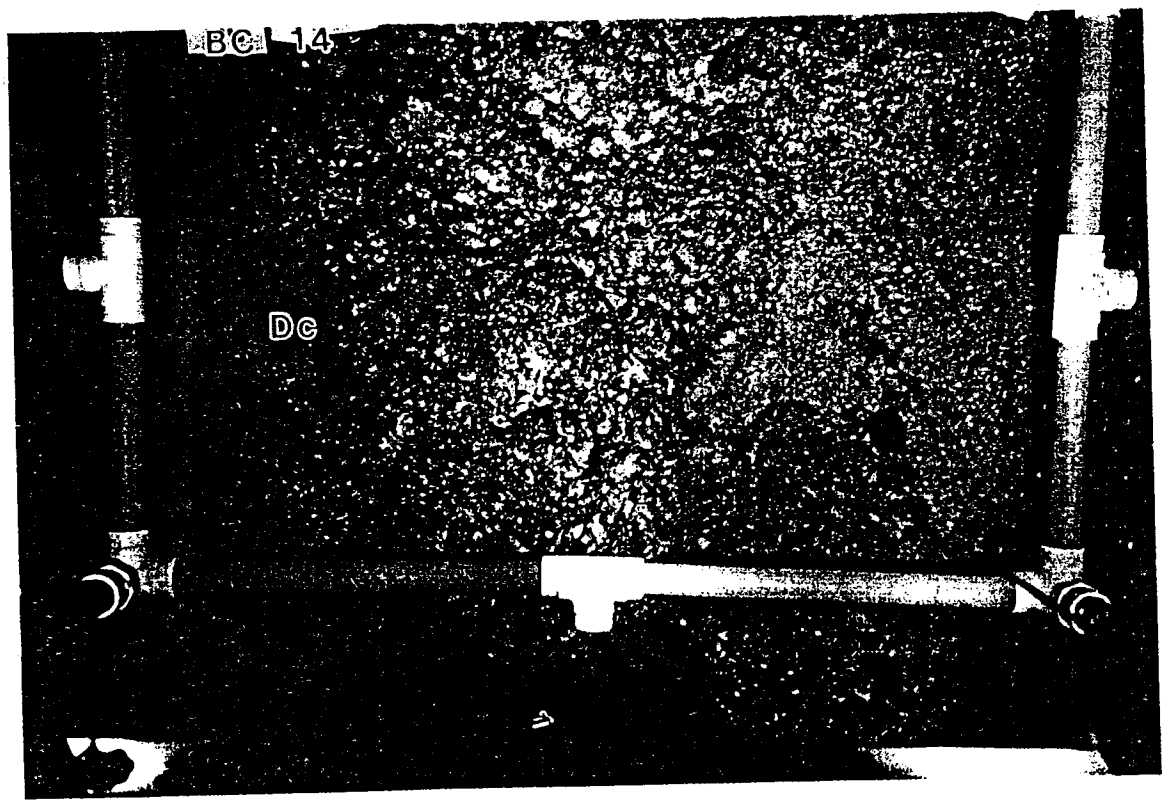
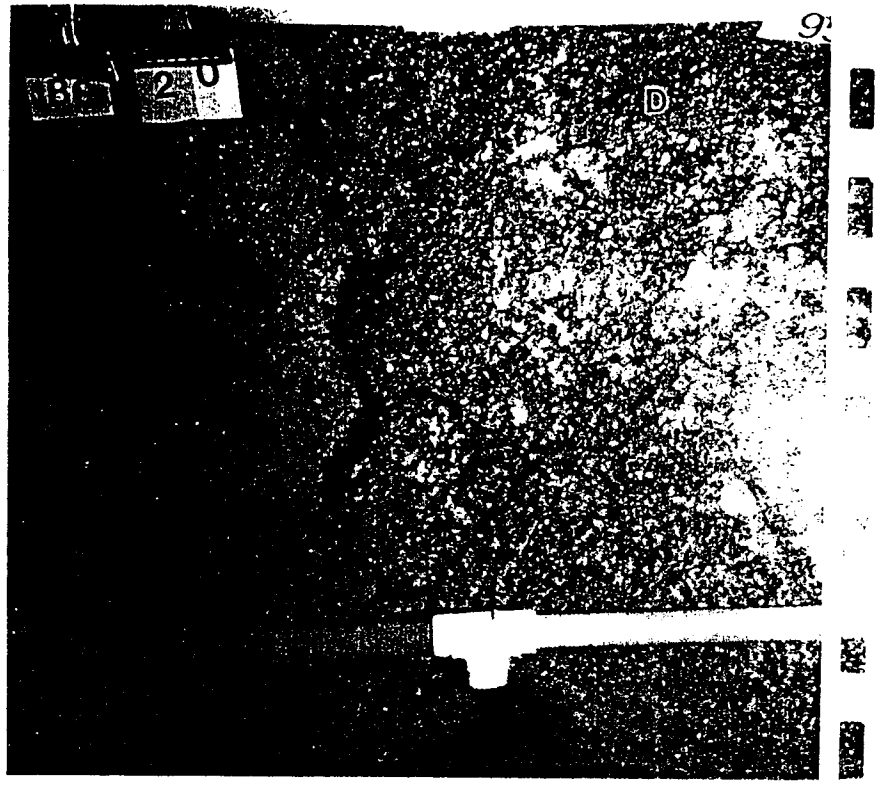
BC 8


BC 14
DC


D


Sc


BC
27


BC
30
Ba


BC
37