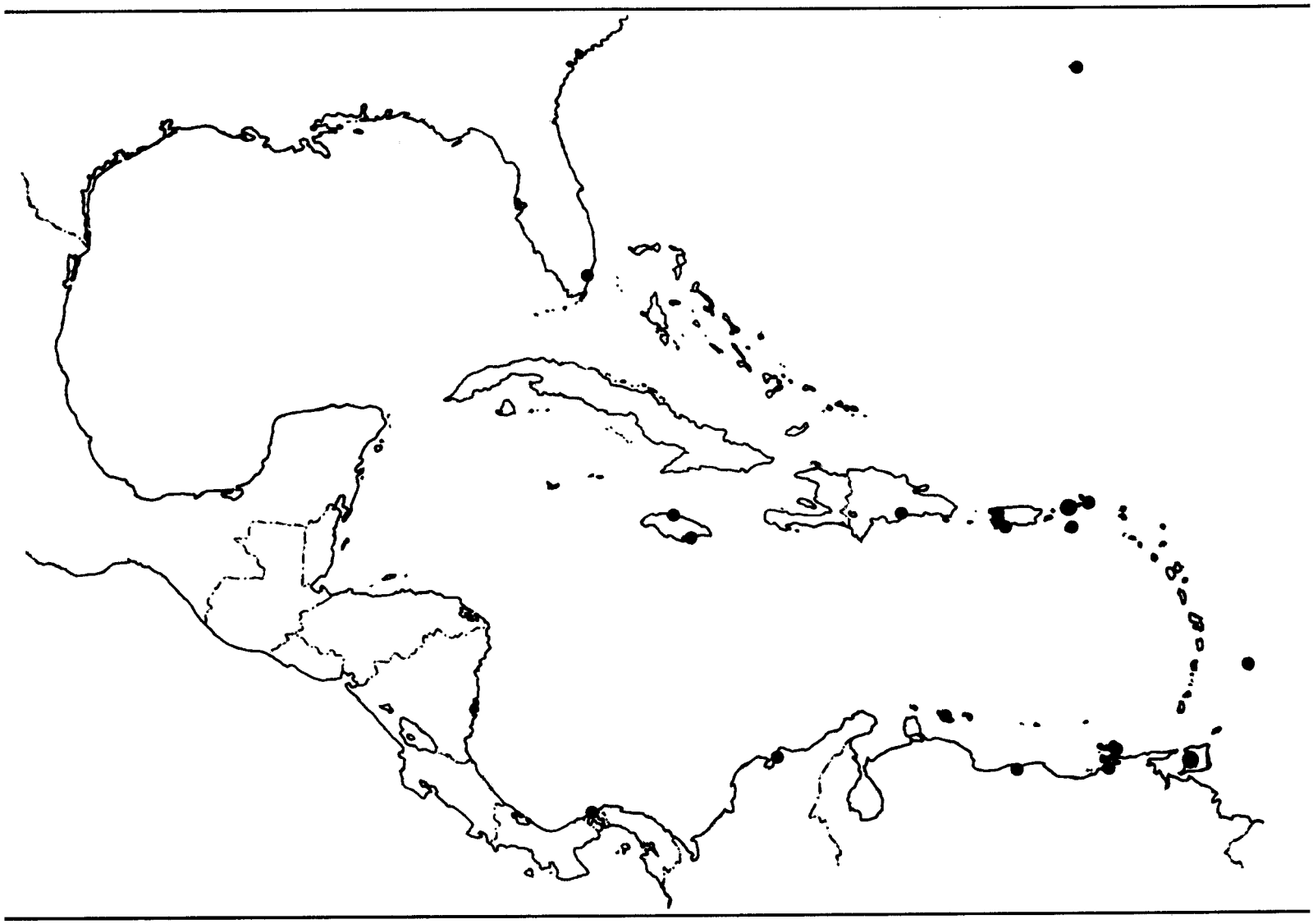
ASSOCIATION OF ISLAND MARINE LABORATORIES OF THE CARIBBEAN

SEVENTEENTH MEETING



ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE
UNIVERSITY OF MIAMI

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16-20 MAY 1983

ERNEST H. WILLIAMS — EDITOR

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INTRODUCTION

The seventeenth meeting of the Association of Island Marine Laboratories of the Caribbean was hosted by the Rosenstiel School of Marine and Atmospheric Science of the University of Miami, Florida, USA, 16 to 20 May 1983. The meeting began with opening remarks by Dr. William Fox and a welcoming address by Dr. Alan Berman. Sixty-one scientific presentations were arranged in 7 sessions over 3 days. Concurrent sessions were required 2 days. Members were treated to an afternoon at the Miami Seaquarium on the first day of the meeting and a reception and banquet at the F. G. Walton Smith Commons, RSMAS, in the evening. Mr. Warren Zeiller, General Manager of the Miami Seaquarium spoke on the "Future of Marine Aquaria and their Relation to Marine Science". After the close of the scientific sessions field trips were conducted by Jim Bohnsack to the Everglades National Park on 19 May and to Key West on 20 May.

The Executive Board meeting was conducted on the evening of 17 May by:

Alan Berman (President) (USA)	Francisco Geraldes (Dominican Rep.)
Meredith Jones (1st Vice Pres.)	Ivan Goodbody (PRL, Jamaica)
Doon Ramsaroop (2nd Vice Pres.)	Manuel Hernandez (DMS, Puerto Rico)
Bert Williams (Sec.-Tres.)	Heather Kaye (Barbados)
Charlene Long (1st M-a-L)	Jose Lopez (CEER, Puerto Rico)
Ray Hayes (2nd M-a-L)	Bill MacLean (St. Thomas)
Jim Parrish (3rd M-a-L)	John Ogden (St. Croix)
Arturo Acero (Colombia)	Doon Ramsaroop (Trinidad)
John Cubit (Panama)	Robbie Smith (Bermuda)
Norman Doorenbos (Virgin Gorda)	Jeromy Woodley (DBL, Jamaica)

Two new laboratories requested membership in the Association and letters of interest have been received from 7 other Caribbean laboratories. The Board decided the 2 laboratories were not sufficiently developed to fulfill the requirements of membership. The Board drafted letters encouraging the growth of these laboratories and requesting their applications for AIMLC membership in the future. The following labs offered to host Association meetings: (1) Institute of Marine Affairs, Trinadad, September 1984; (2) West Indies Laboratory, St. Croix, May 1986; (3) Bellairs Research Institute, Barbados, 1987. The Board approved the purchase of a microcomputer to aid with the business and record keeping of the Association. A plan for appointing "Local Representatives" to the AIMLC within each lab to increase business efficiency and communications was approved.

The General Business Meeting was held on the evening of 18 May with 107 members present. Bill Fox opened the meeting with Charlene Long's report on the History Committee and Doon Ramsaroop's Communication Committee report. John Ogden discussed the possibility of cooperation with UNESCO, and became head of a committee to explore this opportunity. New officers were elected:

President: Doon Ramsaroop	Members-at-Large:
First Vice President: Meredith Jones	(1) Ray Hayes
Second Vice President: John Ogden	(2) Avril Siung-Chang
Secretary-Tresurer: Bert Williams	(3) Alida Ortiz

The new president invited everyone to attend the next meeting in Trinidad and requested input for the new AIMLC Newsletter. Meredith Jones thanked all those who had made the meeting possible.

The meeting was the largest in the history of the Association. One hundred sixteen members were registered and many others attended the scientific sessions. The Association is very grateful to Dr. Alan Berman, Dr. William Fox, and other staff and students of the Rosenstiel School of Marine and Atmospheric Science, University of Miami, for making the seventeenth meeting of the AIMLC so successful and enjoyable.

Ernest H. Williams-Editor

Proc. Assoc. Is. Mar. Labs. Carib. (1983) 17: 1

A PECULIAR CASE OF IN FRAGANTI, MASS COMPETITIVE DISPLACEMENT BY A NON-AGRESSIVE (SENSU LANG) CORAL

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Although within-habitat competitive displacement has been demonstrated by experimental manipulation, seldom has this process been observed under natural conditions. Slow growing, long lived, sessil, colonial organisms, such as corals, allow observation of competitive interactions, including competitive displacement, in the field. Colonies of Porites porites, a non-agressive (sensu Lang) coral, was observed overgrowing living colonies of Montastrea annularis, Acropora palmata, A. cervicornis, Porites asteroides and the hydrocoral Millepora complanata at Cayo Pela, Culebra, east of Puerto Rico. Overgrowth did not seem to involve a modification the heirarchical competitive relations. Instead, unknown changes, possibily in the environmental patterns of this locality, were responsible for shifting the competitive relations. The possibility of having a situation similar to that reported by Bak et al. (1982) for another schleractinian coral (Madracis mirabilis), is discussed. The interaction, instead of occurring between isolated colonies, occurred on a massive scale. The Porites flat extended over the reef front, down to about 5 or 6 m, enclosing colonies of the mentioned, more aggressive species.

AUTOMATED MAPPING AND CLASSIFICATION OF CORAL REEFS USING LANDSTAT IMAGERY

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Landstat MSS (multispectral scanner) imagery was used in the discrimination and classification of coral reefs along the eastern coast of Puerto Rico and around the islands of Culebra, Vieques, St. Thomas, St. John, and St. Croix. An automated computer analysis, based on the unsupervised approach to classification, was used to generate a classified image depicting the distribution and areal extent of coral reefs and other shallow water marine communities. A number of spectrally distinct classes categorized submerged features present at various depths and/or bathymetric contours. Bathymetric contours were defined to a depth of 20 m. Coral reefs were adequately classified to a depth of 6 m which is the maximum water penetration depth of MSS 5. Highly reflective sandy areas were discriminated to a depth of 5 m. Deeper, less reflective bottom types such as seagrass beds remained unclassified. Caribbean coral reefs, which are relatively small when compared to Indo-Pacific coral reefs, were easily mapped and classified even at the present (79 m) coarse resolution of Landstat. Landstat, which covers a large area in 1 scene, provides a cost effective method of analysis when compared to aerial photography and other conventional data sources.

LUNAR CYCLES OF GAMETOGENESIS AND PLANULATION IN THE SCHLERACTINIAN CORAL FAVIA FRAGUM (ESPER)

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Corals exhibit different modes of reproduction: some spawn eggs and sperm into the seawater where development occurs, while others brood their larvae to the planula stage (planulation). Some brooding species have been found to planulate at regular intervals throughout much of the year, with a periodicity apparently related to the lunar cycle. There is little information on the correlation between gametogenesis and planulation in these species, nor on the embryogenic cycles during brooding. The small reef-flat coral Favia fragum releases planulae a few days before and after the new moon. An investigation of gametogenesis and planulation in this species at La Parguera, Puerto Rico was conducted. Colonies of Favia fragum were collected every 3-5 days. Some were observed in the laboratory for planulae release, while others were processed histologically to examine their gonadal tissues. Unlike previous studies, we found that F. fragum releases most of its planulae between 6 and 13 days after the new moon. Average planulation observed was about 10 planulae/cm^2 of coral surface area over the planulation period, with a maximum of 34 planulae/cm^2. Gametogenesis appears to also follow a lunar cycle. F. fragum is monecious with the spermaries and oocytes co-occurring on individual mesentaries. The most mature ova and spermaries were found at the end of the planulation cycle. Young embryos were first observed in the coelenteron of most of the polyps about 4-5 days after planulation. Shortly thereafter, we observed an increase in the number of immature ova and spermaries in the mesentaries. Gamete maturation is synchronous within a colony and closely synchronized within the population. After the eggs and sperm have reached maturity, their numbers decrease at the same time, indicating that self-fertilization may be taking place.

CIRCULATION OF FLUIDS IN THE GASTROVASCULAR CAVITY OF THE REEF CORAL ACROPORA CERVICORNIS

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Circulation of fluids in the gastrovascular system of A. cervicornis was determined by observing the movement of flourescein dye injected via a lateral polyp and viewed in the dark under ultra-violet light. Scanning electron microscopy and pentographic thin sections were used to describe the general morphology of the gastrovascular system. This consists of 2 functional units: an axial unit composed of the coelenteron of the axial polyps; and a peripheral unit composed of tubes oriented axially ramifying through the skeleton lying just beneath the outer ectoderm. These units are connected by radially oriented tubes including the coelenterons of the lateral polyps. The entire gastrovascular system is lined by flagellated endoderm cells. Flow in the axial unit is always proximal. Flow in the peripheral unit is both distal and proximal and the velocity is always less than the flow in the axial unit. Light does not appear to change the rate of flow. Rates of flow in the peripheral unit show a diel cycle, with increased flow rates occurring between 2100 and 0600 hrs.

EXPANSIVE SKELETOGENESIS IN TUBASTREA COCCINEA LESSON

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Tubastrea coccina, the orange-red, ahermatypic coral, illustrates expansive skeletogenesis. As observed, extrusion of mesenterial filaments, through the edge zone epithelia, may start extratentacular budding. The developmental sequence involves: activation of the basal epithelia cells to form blisters; formation of stomodea; organization of new mesentaries; formation of new skeletal elements such as schlerosepta and thecae. In response to increased food supply, parental polyps extruded mesentarial filaments. Near the coenestal region, these induced the basil epithelia of the edge zone, which represent the embryological animal pole of the polyp, to form a crown of 6 buds. The formation of a blister around each extruded mesentery evinces cell polarization. After retraction of parental mesenteries a yellow aperture, or stomodeum, was at the center of the blister. The new stomodeum is a tissue organizer; it bounds de nova organization of mesenteries, including directives. The bud-polyp develops body wall, oral disk and tentacles. Skeletal deposition follows with the formation of a new corallite. Budding is extratentacular. The simultaneous formation of 6 juvenile polyps implies that 6 mesenteries are bud inducers. Since extrusion of mesenteries through the oral disk and/or at the rest of the free wall does not produce bud-polyps, it is proposed that interaction of mesenterial filaments with the basal epithelial cells, at the edge zone, ellicits tissue budding; hence, expansive skeletogenesis. Porites asteroides, a colonial hermatypic coral also exhibits extratentacular budding. A larval polyp, 3 weeks old, formed simultaneously a basal crown of 5 buds after food supply and illumination were increased. In colonial clusters of T. coccines, the parental corallites are taller. Budding, besides asexual cloning, represents increase of tissue and skeletal mass. Bud-polyps are larger than larval ones and form larger corallites. From inception, bud-offsets fail to repeat the pattern of primary skeletogenesis of the larval corallites. Bud-offsets show accelerated skeletal development which by-passes formation of basal skeletal plates and confluent, lamelated thecea; these skeletal elements are characteristic of larval corallites. Bud-offsets are colonial units integrated within epithecal reach of the parental polyps. They share coenosarc, coenestum and nutritional resources. The larval corallite is a solitary coral representing the dispersal phase of sexual reproduction. It must fend by itself elsewhere.

A NEW LOOK AT BENTHIC COMMUNITY DYNAMICS IN A CORAL REEF-SEAGRASS COMMUNITY

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Preliminary sampling to asses invertebrate prey density in seagrass meadows contiguous to a patch reef showed significant differences between day and night abundance of the benthic, epibenthic and cryptic fauna. Only 1 taxon, the ophiuroid, had significantly higher numbers during the day. The taxa with significantly higher nighttime collections included Natantia, Mysidacea, Tanaidacea, Ostracoda, and Nematoda. While Polychaeta and Amphipoda were more numerous at night, the increase was not significant. Vertical migrations of benthic invertebrates into the water column are well documented. This present paper examines the possibility that migration from the reef community and sand flats might provide a means to maintain high prey populations in the seagrass meadows.

GROWTH AND FORM OF THE BUD SKELETON IN THE SCLERACTINIAN CORAL, CLADOCORA ARBUSCULA

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Colonial expansion on scleractinian corals is initiated by reorganization of soft tissue followed by skeletal production. Architectural principles of expansive skeletogenesis are shown by descriptive analysis of the corallum generated by the branching hermatype, Cladocora arbuscula. The site of protrusion by the directive mesentery beyond the parental thecal rim remains as a basal opening in the bud corallite, adjacent to the counter scleroseptum of that newly generated unit. The axial scleroseptum appears opposite this site as an outgrowth from the external surface of the parental theca. The primary 12 scleroseptal pattern is bilaterally symmetrical with respect to the axial-counter scleroseptal axis. Although derived from 6 radially symmetrical centers,These sclerosepta emerge as 4 bifurcated units flanking the singular axial scleroseptum and the trifurcated counter scleroseptal complex. Transformation of the primary scleroseptal pattern of the bud corallite into the definitive adult septal arrangement develops through confluence of additional sclerosepta to form secondary bifurcations. Bilateral symmetry is preserved through this elaboration. In the taxonomic adult corallite, scleroseptal elongation establishes an array of secondary bifurcations alternating with radially-expanded individual septa. Growth of the bud corallite is more rapid on the axial scleroseptal side, leading to an acute angular orientation with respect to the parental axis. Measurement of the angularity of the bud coarllite with reference to the parental axis averages 45 degrees, provided no crowding occurs within the corallum. Lateral fusion of branches does occur, but distal confluence is prevented by divergence of fused branches. Tiers of branches emerge from the parental corallite as it elongates, implying that events triggering the arborization may be environmentally or metabolically derived. Examination of sequential episodes of branching from 1 parental stem or fromneighboring stems does not reveal a spacial interval for branching. The ultimete shape of the branching scleractinian coral colony is established by a combination of deterministic and opportunistic processes. A precise genetic ground plan for colonial architecture is expressed during expansive skeletal growth, regulated by mesenterial soft tissues. However, the specific form of any colony is subject to extrinsic factors including metabolic stress upon the organism, spatial constraints to expansion and orientation toward sunlight.

INVENTORY OF REEF FISHES OF THE COLOMBIAN CARIBBEAN: PRILIMINARY RESULTS

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Since 1981, boney reef fishes have been intensively collected in the Colombian Caribbean, principally northeast of Santa Marta (Parque Tayrona) and southwest of Cartagena (Isla del Rosario and Islas de San Bernardo). The number of species known from these habitats have increased from 296 to 394. Families with the most significant increases (number of species known in 1981, number today) are: Ophichthidae (1, 7); Ophidiidae (0, 4); Bythitidae (0, 3); Sygnathidae (1, 9); Scorpaenidae (8, 14); Serranidae (26, 36); Sciaenidae (1, 4); Dactyloscopidae (0, 4); Blenniidae (3, 6); Tripterygiidae (0, 4); Gobiidae (16, 26); Gobiesocidae (3, 6).

SURVEY OF THE FISH COMMUNITIES OF RINCON AND CARRIZAL ON THE NORTHWEST COAST OF PUERTO RICO

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A survey of species and abundance of fishes from the Rincon and Carrizal areas was part of studies required for establishment of a 900 MW coal-powered plant on the northwest coast of Puerto Rico. Sampling was by 24 hr fish-trapping, day/night echosounding, spot-dive censusing, night light stations, and hook and line. A total of 123 species were identified at Rincon and 69 species at Carrizal. Diver observations identified the largest number of species with $_{2}64$ and 38 respectively. At Rincon, the average number of individuals/154 m^2 (radius of 7 m) were 325 $\pm$ 115; in sponge- gorgonian-hard coral flats (S G); 215 $\pm$ 56 individuals in rocky outcrops with hard coral (R O); and 104 $\pm$ 70 individuals in coralline algal flats with scattered corals (A F). the high variability within substrate type was caused by aggregated distribution patterns, heterogenous distribution of micro-habitats, and movements of pelagic fish aggregations. The greatest similarity in species composition, 67%, was found between S G and A F, and the least, 51%, between R O and A F. Observations in Carrizal were limited by poor visibility. However, 6 observations made during "good" visibility days noted 38 species. Pelagic-esturine populations (Harengula clupeola and Opisthonema oglinum) were most abundant. Demersal type species (Pomacentrus fuscus and Thallasoma bifasciatum) were most abundant on solid substrate. T. bifasciatum and P. partitus were the most abundant species observed at Rincon. Fish traps collected 34 species at Rincon and 22 at Carrizal. Catch per unit effort was higher at Rincon (average 4.7 ind/trap/24 hr) (Carizzal, 0.5); however, 65% of the total collection at Carrizal was commercial species (Lutjanus synagris). Seven "recreational" species accounted for 85% of the total at Rincon. Most species (24 at Carrizal and 23 at Rincon) collected at night-light stations were juveniles and post larval forms of pelagic, esturine, or reef fish. Echosounding transects related poorly to fish stock densities.

THE COMPARISON OF TWO SAMPLING TECHNIQUES IN A REEF FISH POPULATION STUDY

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The fish communities of 3 fringing reefs on the west coast of Barbados were examined using 2 different sampling techniques. Each station was defined by a 5 m^2 quadrat. A total of 120 of these quadrats were divided between 3 habitats on the 3 reefs that were chosen for analysis during the study. A 10 minute visual census was made at each site for the months of May, June, and July, 1982. The second technique involved the collection of cryptic residents within each quadrat by a single application of 200 ml of a 10% rotenone solution. Each site was enclosed by a fine mesh net to prevent encroachment of predators and escape of poisoned fish. The techniques sampled 2 very different segments of the reef fish comminity. Species diversity was measured using Brillouin's Species Diversity Index. Analysis of variance was used to test for significant differences between stations within reefs and between the reference reef (typical spur and groove reef) and 2 atypical reefs. Similarity indices were calculated based on species presence and absence within and between habitats and between reefs. Comparison of the results of these sampling methods leads to the conclusion that the estimation of reef fish populations can only be made by employing sampling procedures designed to identify both cryptic and mobile residents.

SOUND PRODUCTION AS A DETERMINANT OF FEMALE CHOICE DURING SPAWNING BY THE BICOLOR DAMSELFISH, POMACENTRUS PARTITUS POEY

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Experiments were conducted on the coral reef to determine if the courtship sounds of male bicolor damselfish (Pomacentrus partitus) influence conspecific females as to their choice of spawning partners. An acoustical range was erected on a sandy area, 3.5 m depth, a short distance from the reef line. Courtship sounds (chirps) were recorded prior to removal of nearby males. Tape-loops were then prepared, each having 3 sounds from a single male. A line of large conch shells (Strombus gigus) was positioned, 1.5 m apart, facing the reef line, with underwater loudspeakers behind them. Tape-loops from 2 sucessful males (i.e., having spawns in their shelters when captured) were selected for the experiments. Each loop differed as to the range of dominant frequencies that characterized their respective sounds, but all sounds had similar signal/noise ratios. These respective sounds were transmitted from different loudspeakers each day at the time of spawning on the 3 successive days of peak spawning in September 1982. Results showed that these sounds not only attracted ovulating females off the reef and onto the range, but also in 14 out of 17 cases, females moved rapidly to, and either entered or circled, the specific conch shell which was standing in front of the loudspeaker which was transmitting the sounds of the male having the lowest range of dominant frequencies within its power spectrum. These experiments constitute the first evidence in the field that sound-production directly influences female-choice in fishes. To understand more fully the specific acoustical factors that result in such preferential attraction of females, attempts were made to influence female-choice of spawning partners under the more controlled conditions of the laboratory. Several series of experiments have, thus far, shown that choice can indeed be influenced by courtship sounds in the laboratory setting.

REPRODUCTION STUDIES ON THE GENUS LIMIA (POECILIDAE) DOMINICAN FORAGE FISH

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Limia spp. are one of the most abundant fishes in Hispaniola. They range from mountain streams and estuarine zones to the inner salt lake, Lago Enriquillo, and calstic caves of the south coast. Their adaptation moved us to study their productive capabilities and adaptation from streams to lotic environments. L. perugiae in aquaria and L. melanonotata in earthen-ponds (400 m^2) were stocked at a density of 1 fish/0.18 m^2. Female production was 12 fry/3 mo. When the fish were dissected 60-70 fry per female were found. A high index of canibalism seems to exist.

ICHTHYOPLANKTON DISTRIBUTION AND ABUNDANCE OVER A 24-HOUR PERIOD AT THE WEST FLOWER GARDEN REEF, NORTHWEST GULF OF MEXICO

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Ichthyoplankton samples from discrete depth tows above and below the thermocline and from neuston tows at stations directly over the reef crest and both inshore and offshore from the reef were collected 6 times over 24 hours. Ichthyoplankton abundance varied with time, depth, and location. Myctophidae, Gonostomatidae, Bregmacerotidae, Bothidae, and Synotidae were most abundant. Of the reef fish known to occur at the Flower Garden Bank, only the groupers, Serranidae, were abundant in the ichthyoplankton.

ASPECTS OF CORAL SELECTION BY POMACENTRUS PARTITUS AND P. LEUCOSTICTUS (TELEOSTEI: POMACENTRIDAE)

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Habitat partitioning occurs among tropical western Atlantic damselfishes. The causes for this are not readily apparent but may involve competitive exclusion or different habitat preferences. In southwest Puerto Rico, threespot damselfish, Pomacentrus planifrons, are most abundant in patches of staghorn coral, Acropora cervicornis, beaugregaries, P. leucostictus, reach high population densities in star coral, Montastrea annularis. Both damselfish species show some degree of habitat overlap. Reefs, consisting of similar-sized units of the 2 coral species, were used to test if these damselfish prefer the same species of coral, in the absence of congener competition. The effect of prior habitat experience on coral selection was also examined. The damselfishes, each species collected from the each species of coral (4 categories; 12 fish/category), were introduced to the experimental reefs. Six times per day for 5 days, the coral species in which each fish spent the most time was determined. The cumulative data indicated that all categories preferred staghorn over star coral. The categories differed significantly in the total amount of time spent in association with each coral species, with those fish collected from staghorn spending significantly more time in association with this coral than those fish collected from star coral. Within each category, individual differences existed, with some fish showing a definite preference for staghorn, and others showing no significant preference. No fish showed a preference for star coral.

AN OVERVIEW OF VISUAL TECHNIQUES FOR CENSUSING REEF FISHES AND THEIR APPLICATIONS, WITH EMPHASIS ON A RANDOM POINT TECHNIQUE

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James A. Bohnsack, Coop. Inst. Mar. Atmosph. Sci., Miami, FL

A number of non-destructive visual techniques have been developed recently for the collection of quantitative data on reef fishes by divers working in shallow water. The techniques are usually designed to produce information about species diversity, community structure, relative abundance, or density of individuals. The data have been used to provide simple inventories of species present, to test various hypotheses from theoretical ecology and biology, and to provide independent estimates of abundance for stock assesment. Demand for these data has been growing with the advent of new marine sanctuaries and increased interest in the analysis of exploited reef resources. Visual census methods vary widely, from geographically unrestricted, timed swims to rigidly controlled transects. Each introduces a different bias in the data. Several methods are discussed in terms of the efficiency of data collection and the quality and quantity of data collected. A random point visual technique is presented which minimizes bias due to diver movement, is rapid, efficient, repeatable, and objective; and produces data on frequency occurrence, indices of abundance, fish size, density of individuals, and community composition. This technique has been used to characterize the fish fauna at a number of different reefs in Georgia, Florida, and Belize; to test hypotheses about competition for space and food resources in reef fish; to provide independent estimates of relative abundance for a sport fishery for yellowtail snappers; and to analyse the effects of spearfishing on community structure of reef fishes.

SEX CHANGE IN THE REDBAND PARROTFISH

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The redband parrotfish, Sparisoma aurofrenatum (Valenciennes) is a protogynous hermaphrodite and all males are derived from females through sex reversal. One male and approximately 5 females live in a territory defended primarily by the male. Field removal experiments and natural disappearance of territorial males resulted in take over of territories by non-territorial males within 24 hours. Data derived from the size and coloration of non-territorial males as well as histological analyses of their gonads, indicate that these males have recently completed sex reversal. Thus, territorial females must leave the social unit in order to change sex. Upon completion of sex reversal, a non-territorial male will take over an available territory when the opportunity arises. These males possess mature testes and are capable of spawning with females remaining in territories.

PRELIMINARY ASPECTS ON SEASONALITY OF LITTORAL MARINE ALGAE IN PUERTO RICO

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Rocky substrate, protected from heavy wave action by an offshore fringing coral reef in Fajardo and rocky shore exposed directly to wave action in Humacao were observed for species composition of the littoral algal communities. Tides on the south coast are diurnal, mean tide range is close to 1 ft. On the east coast, tide is mainly semi-diurnal, mean range about 1 ft in Fajardo. Hurricane season may bring high wave action and heavy rainfall. High waves may also occur between October and February due to swells generated by winter storms in the north Atlantic. During heavy seas, a considerable amount of sand is transported along the littoral zone causing abrasion and suffocation of algae in this region. Wave regime in this coast may determine the permanence of algal species and cause seasonal appearance of species of littoral algae. In Fajardo, 75 species of littoral algae (34% Chlorophyta, 26% Phaeophyta and 40% Rhodophyta) and in Humacao 48 species (29%, 27%, and 44%) have been identified. Monthly observations in these 2 stations will be continued and temperature, salinity, and wave action recorded. Colonization of natural and artificial substrates after heavy seas will be studied throughout the year.

POTENTIAL FOR APPLICATION OF MARINE BIOLOGICAL SOLAR ENERGY CONVERSION TECHNOLOGY IN THE CARIBBEAN

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Many strains of marine photosynthetic organisms collected from the Caribbean have application for food and energy production. The nitrogen fixing marine blue-green algae could provide total food requirements for fish, shrimp, and shellfish. This nitrogen fixing ability reduces the contamination of pathogenic species and reduces the need for fertilizer in aquaculture. Hydrogen producing blue-green algal strains provide a clean fuel which does not pollute the environment. Some marine photosynthetic bacteria produce hydrogen using organic and sulfide waste. Some of these algae and bacteria produce substances with medical, nutritional, or industrial chemical applications and all productions are pollution free. The Caribbean area receives high solar energy and has plenty of warm sea water. Marine solar energy conversion technology could be used in this area while keeping the environment clean.

ADHESION ENHANCING, HIGH MOLECULAR WEIGHT EXUDATES PRODUCED BY BACTERIA ISOLATED FROM ALUMINUM AND TITANIUM SURFACES EXPOSED TO COASTAL SEAWATER

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Adhesion enhancing, high molecular weight materials associated with aluminum and titanium surfaces exposed to flowing coastal seawater for 139 days have been isolated. The activity was purified by hydroxylapatite chromatography and subsequently employed to produce antibodies in the toad, Bufo marinus. The antibodies were immobilized on a solid support and employed to isolate adhesion active high molecular weight materials from the laboratory culture media of bacterial strains recovered from the respective metallic surfaces during the course of their exposure to seawater. The installation employed to expose the test surfaces to seawater was the CEER-OTEC facility off the southwest coast of Puerto Rico. The predominate bacterial strains associated with these surfaces were isolated and characterized. The strains associated with titanium were different than those associated with the aluminum surfaces. The relationship between the adhesion enhancing materials found on these surfaces and those materials produced by the bacteria present is discussed.

NUTRIENTS IN SEAGRASS BEDS IN MISKITO CAYS, NICARAGUA

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Seagrasses and associated sediments were quantitatively sampled in the Miskito Cays off Nicaragua from 5 stations along a transect that began in a shallow mangrove-surrounded lagoon and ended in the waters of the open shelf. The plant community in the 2 stations adjacent to the mangroves was dominated by monospecific stands of Thalassia testudinum with high biomass (ave. leaves = 145 g dry/m^2) whereas the shelf stations contained mixed stands of T. testudinum amd Syringodium filiforme with low biomass (ave. = 26 g dry/m^2). Plant detritus in this transect varies from 241 g dry/m^2 in the innermost station to 11 g dry/m^2 in the outer station. Interstitial sediment nutrients and related chemical parameters paralleled this gradient. The inner, lagoon stations were the most reducing habitats and contained the highest concentration of nitrogen, primarily as ammonium, and hydrogen sulfide and had the lowest pH values. I conclude that the plant detritus gradient, due to the subsidy from mangroves, was responsible for the observed changes in sediment chemistry and subsequently the plant community.

RESTORATION OF SEAGRASSES IN JAMAICA: PRELIMINARY SUMMARY OF JAMAICA'S MANAGEMENT OF SEAGRASS RESTORATION

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The first attempt to transfer seagrass restoration technology developed in the subtropical U.S.A. to a Caribbean nation began in the fall of 1982 at 20 sites around the coast of Jamaica. The goals of the program, sponsored by USAID, are to determine the feasibility of transplanting Thallasia testudinum, Halodule wrightii, and Syringodium filiforme to damaged nearshore ocean and bay bottom and ascertain the best and most cost-effective restoration technology to combat damage by industrial and urban pollution. The test sites included a variety of wave energy regimes, sediment types, turbidity levels, wate chemistry characteristics, and pollutants. Two methods for planting each species at each site were attempted fall and spring. Preliminary results after 3 and 5 months for the fall planting are discussed.

POPULATION VARIATION OF OSCILLATORIA (TRICHODESMIUM) SPP. IN THE NORTH EASTERN CARIBBEAN SEA

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Measurements of Ocillatoria (Trichodesmium) spp. standing crop were made weekly for 22 months at a station approximately 3 miles off the south coast of Puerto Rico. Population density varied from 0 cells/m^3 to 1.13 x 10^9 cells/m^3. Temperature, wind velocity, sea state and rain were measured to analyse possible effects on the population.

TEMPORAL AND SPATIAL VARIABILITY IN THE PHYTOPLANKTON COMMUNITY OFF THE SOUTHEASTERN COAST OF PUERTO RICO

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Phytoplankton biomass and species composition displayed day-night and seasonal variability during 3 cruises in 1980-1981 to a potential OTEC site off the southeastern coast of Puerto Rico. Less than 50% of the species counted were found in both day and night assemblages while approximately 40% of identified species were present seasonally. Day-night decreases in total pigment levels, increased night phaeopigment levels and the phaeopigment /chlorophyll ratio combined with a lower night biomass of diatom and dinoflagellate populations, suggests grazing may be responsible for the observed daily variation. However, high diversity coupled with a low day-night similarity index suggests that patchiness must also be considered to account for short-term variability in the phytoplankton assemblage.

COMBINED EFFECTS OF TEMPERATURE AND SALINITY ON RESPIRATORY BEHAVIOR OF MUREX POMUM

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The respiratory behavior of the marine gastropod, Murex pomum, was monitored for combinations of salinity and temperature, encompassing a salinity range of 25-40 ppt at 3 ppt intervals and temperatures of 20, 23, 27, 32, and 35 C. The limits cover roughly the extremes in salinity and temperature this animal is likely to encounter in its native Caribbean Province, extending from southeastern United States to northern Brazil. The animals were acclimated for 24 hrs. Respiratory performance was measured individually for 1 hr (30 combinations, 450 measurements). Regression analysis was performed utilizing 3 factors ((salinity (S), temperature (T), and their product (S x T)) as independent variables, accounting for variation in the dependent variable, respiration rate (RR). Regression resulted in the model: $RR = 0.0248 - 3.9278 \times 10^{-4} T - 2.3983 \times 10^{-4} s + 4.5080 \times 10^{-5} (T \times S)$. An r^2 value of 0.3662 suggests high predictibility of the model. Regression analysis utilizing the factor (S - T) as the single independent variable gave the model: $RR = 0.0158 + 3.4421 \times 10^{-5} (T \times S)$. The model has an r^2 value of 0.3650 indicating a similar strong agreement between actual and predicted respiration rates. Both of these models adequately account for the trends apparent in the data. The latter have been plotted in the traditional method and as response surfaces determined from the above models. These show 1) respiration rate means increasing simultaneously with increasing salinity and temperature, and 2) a slower rate of effect of salinity and of temperature at low temperature and salinity respectively. The results are discussed in terms of absolute and relative changes. No clear pattern of Q_{10} values emerged from the data.

THE DISTRIBUTION OF STRAINS IN A POPULATION OF THE MARINE DEMOSPONGE, VERONGIA LONGISSIMA

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Intraspecific acceptance and rejection of individuals of the marine demosponge, Verongia longissima, were observed to occur in reef communities on the west coast of Barbados. In situ grafting experiments have provided direct evidence of strain specificity in this sponge. The results show that all autografts (self grafts) accepted and there was both acceptance and rejection of allografts (same species grafts). Among the allografts, groups of individuals could be easily identified which consistantly accepted grafts from individuals within their group and always rejected all other individuals. These groups were designted as strains. Strain is defined here as an incompatibility with all other members of the species. Incompatibility is present in contact zones, creating a discrete border, or zone of non-coalescence separating the allogenic individuals. The strain distribution in this marine sponge was studied. A central individual was chosen and measurements of distance, direction and angle between this central individual and all of the other members of the population were recorded. A distribution map was formulated from which distances between all individuals within this sub-sample population were calculated. The mean distance between individuals of different strains is greater than the mean difference between individuals of the same strain. One possible explanation for this is that members of the same strain are products of asexual reproduction. However, given this species' method of asexual reproduction, the distance between individuals of the same strain appear too large to be consistant with the suggestion that they are asexual products. An alternative hypothesis is that individuals of the same strain are products of sexual reproduction, but have strain-specific microniche preferences which produce the short mean distances between individuals of the same strain.

INTRASPECIFIC PREDATION AND THE EVOLUTION OF PHOTOTAXIX IN AMPHIPODS

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Intraspecific predation or cannibalism has been reported in about 1,300 species, but has been viewed as an aberrant and occasional phenomenon. This is perhaps partly because the habit of many biologists of thinking that characteristics and behaviors exist to the extent that they are advantageous to the species, has proved difficult to break. One consequence of this is that the possible demographic and evolutionary implications of cannibalism has received little attention. In particular, no studies have investigated characteristics which may reduce the chance of being cannibalised, whilst enquiring whether such characteristics are heritable and consequently subject to evolutionary changes. Juveniles of estuarine amphipods Grammarus tigrinus and G. mucronatus were initially photoneutral and became photonegative 2 days after hatching; G. lawrencianus were photopositive on hatching and became photoneutral approximately 11 days later. The change in phototactic behaviour coincided with the age at which juveniles became markedly less vulnerable to cannibalism by adults. Moreover, a full-sib experimental analysis used to estimate the heritability of phototaxis in G. lawrencianus showed the presence of additive genetic variance for the trait. Juvenile phototaxis in these species seemed to be an evolutionary adaptation to minimize cannibalism by adults. Cannibalism may be an important agent of selection in the evolution of life histories.

MOBILE INVERTEBRATE EPIFAUNA FROM SEAGRASS BEDS ON THE NORTH COAST OF PUERTO RICO: DIEL VARIATION IN SPECIES COMPOSITION AND ABUNDANCE

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A monthly daynight sampling program has been conducted in mixed Thalassia-Syringodium meadows at Dorado, Puerto Rico, since February 1982. At 2 qualitatively similar replicate sites, 10 day and 10 night samples were taken at randomly selected locations; each sample was a 10 m rum with a 0.5 m wide pushnet (1 mm mesh). The small mesh was essential to adequately sample the numerically dominant species (small shrimp). The epifaunal invertebrate assemblage is highly dominated by decapod crustaceans, especially small caridean shrimp (several species), penaeid shrimps (especially Sicyonia spp.) and pagurid crabs. Gastropods are the second most abundant group; amphipods are poorly represented. At night, the total epifaunal abundance is significantly higher and more species are collected. Comparison of dominance-diversity curves for day and night samples show that day sampling gives a poor picture of the true epifaunal community. All the numerically important shrimp species are more "collectable" at night. Laboratory observations show the peneaids (Sicyonia parri, S. laevigata, Metapenaeopsis spp.) and carideans (Alpheus normanni, Processa riveroi and P. bermudensis) are nocturnal emerging from burrown or sediment at night. The caridean Hippolyte curacaoensis typically rests on Thallasia leaves and is thus susceptible to capture day and night. However, it is still collected in greater abundance at night, perhaps due to net avoidence during the day. Diel variaton in activity of other abundant carideans (Latreutes focorum, L. parvulus, Thor manningi, Periclemenes americanus) has not yet been sufficiently studied to determine if nocturnal activity or daytime net avoidence is responsible for their higher numbers in night samples. Night sampling is essential for best estimates of abundance of the numerically dominant peneaid and caridean shrimps for life history studies and production estimates.

TIME LAPSE MOVIES AND TIME BUDGETS OF CRABS

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Time lapse cinematography was used to record daily activity paterns and specific behaviors performed in a dense population of a small xanthid crab, Cataleptodius floridanus, on Glover's Reef atoll in Beliz. This crab's activities were filmed in the extreme low intertidal zone on Long Cay, Glover's Reef, where the population exceeds 100 individuals/m^2 in coral rubble. All day films taken at a rate of 1 frame/15 sec showed few or no C. floridanus individuals outside their burrows when the tide was high. Activity levels increased as the tide fell, and greatest activity occurred during low tides in the afternoon. The crabs were filmed at 2 frames/sec for 30 min during peak activity periods. Analysis of the time budgets of 21 C. floridanus filmed during one 30 min period shows that an average crab spent about: 68% of its time inside its burrow out of site; 23% feeding; 3% coming out; 2% going in; 2% performing burrow maintainence; and <1% in extended foraging bouts, stone rolling, agonistic encounters, and courtship. Entrances and exits from burrows were quick, averaging less than 7 sec each, but burrow tending bouts averaged 40 sec and feeding episodes averaged almost 70 sec (median 45 sec). Most of the crabs stayed within a few cm of their burrow entrances.

DRIBBLERS AND SWAMPERS: THE RELATIONSHIP BETWEEN REPRODUCTIVE PERIODICITY AND LARVAL RECRUITMENT IN THREE SPECIES OF SEA URCHINS FROM THE CARIBBEAN

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The timing of reproduction in benthic marine invertebrates with a complex life pattern is thought to be shaped by larval and juvenile survival. For example, larvae may be released to coincide with the spring plankton blooms on which they feed. Few ecological correlates have been determined for recruitment, the particularly crucial transition from larval to adult life. Larval abundance, substrate selection and post-settlement mortality together dictate patterns of recruitment. I have measured reproductive state, larval abundance and size distribution for 3 species of sea urchins (Lytechinus variegatus, Echinometra viridis and Tripneustes ventricosus) which occur subtidally off the southwest coast of Puerto Rico. Larvae of L. variegatus, the species with the least synchronous spawning pattern, are present at almost all sampling times. Larvae of the species with the most synchronous pattern, E. viridis, were only found on 1 date. The third species, T. ventricosus, was seldom represented in the larval collections. Seasonal recruitment patterns as interpreted by size distributions of adults exhibit a similar correlation. These preliminary observations are consistant with the premise that survival at recruitment could shape reproductive patterns. Studies of site- and season-specific post-settlement mortality are currently underway.

ON THE GENERAL ECOLOGY OF HOLOTHURIA GLABERRIMA SELENKA (ECHINODERMATA)

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Distribution and habitat preference, feeding, reproduction, and respiration of Holothuria glaberrima were examined in Barbadon for 1 year. Rocky areas with high surf action were preferred habitats because of substrates and food requirements. Feeding was non-selective, with particles, held in suspension by the wave action, being trapped on upturned oral tentacles. Digestion is derived from micro-floral and faunal sources. Gonad index values reached a peak during April and May. Temperature, salinity, and currents did not seem related to reproduction. An apparent substrate competitor, Echinometra lucunter which breeds in June and July, may or may not have an effect on H. glaberrima's choice of breeding season. In the laboratory, salinity changes produced no significant effect on respiration rates and H. glaberrima was found to be a conformer with respect to temperature and oxygen tension.

SPATIAL AND TEMPORAL DISTRIBUTIONS OF OCEANIC ZOOPLANKTON OFF PUERTO RICO

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Abundances of selected zooplankton categories were followed in the upper 100 m off the south coast of Puerto Rico during 1980. Spatial patterns of abundance encompassing scales of a few to hundreds of kms in addition to diel and bimonthly variations were examined. Spatial patterns larger than a few kms were not observed, indicating that island wake effects or other intermediate scale processes do not affect zooplankton abundance in this region. Significantly higher chlorophyll a concentrations and abundances of most zooplankton occurred in July. The coincidence of peak abundances with a seasonal decrease in surface salinities suggest the presence of true seasonality related to a large scale process.

A NEW DONDICE (OPISTHOBRANCHIA: FAVORINIDAE), AND ITS ASSOCIATION WITH CASSIOPEA IN SOUTHWEST PUERTO RICO

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Major diagnostic features of the species include 9 groups of cerata on either side; genital pores between the first and second groups of cerata; rhinopores with up to 11 annulations; masticatory process with about 54 denticles and about 20 radular teeth, with 7 denticles per side. From settlement to death, approximately 7 weeks, the nudibranch lives, feeds and reproduces on either of 2 species of Cassiopea. The principal host is C. xamachana, although C. frondosa can also be its host. The slug cryptically colored, feeds on the finer parts of the medusa's oral arms, on which it also lays its eggs. Like all other cnidarian-feeding eolids, Dondice n. sp. stored the nematocysts of its host in simple cnidosacs at the tips of its cerata, and the larger euryteles were selected in a ratio of 5 to 1. Dondice n. sp. has a life span of approximately 9 weeks. Newly laid eggs hatch in 2 to 6 days, and development is planktotrophic. Veligers apparently settle upon the schyphozoan, which possesses a host factor critical for metamorphosis. Adult nudibranchs are clearly host specific, and can distinguish between other cnidarians, plain sea water and water with Cassiopea, responding to some chemical stimulus coming from the jellyfish. Both slugs and their egg masses can be found year-round.

MACRO AND MICRO-ZOONATION OF COELOBITES (CRYPTIC ORGANISMS) IN CORAL RUBBLE OF THE FLORIDA REEF TRACT

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Coelobites, cavity-dwelling organisms, are the most abundant yet least understood element of coral reefs. A census of the coelobites within coral rubble from a series of stations across the northern Florida reef tract, revealed a distinct zonation of 80 species identified. Coelobites are most abundant in the marginal and lagoon reefs, but are poorly developed in the in-shore lagoon and the fore-reef areas. The biomass of coelobites is high in the shallow part (1-3 m) of the marginal reefs, but rapidly decreases toward the reef slopes. However, the maximum variety comes in the fore-reef at depths of about 20 to 30 m. On the underside of coral rubble, coelobites are most abundant on the peripheral areas, free from burial by bottom sediments; and are scarcer toward the central areas, often buried by interstitial sediments. There is a consistant but small-scale zonation of coelobites on individual pieces of coral rubble.

BIOLOGICAL DESCRIPTION OF DOMINICAN COASTAL ECOSYSTEMS, AN AERIAL SURVEY

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A description of the different ecosystems which occur along the Dominican coast is important for managing this island's resources. The occurrence and extent of rocky coasts, sandy and pebbled beaches, swamps, marshes, mangroves, grass beds, river deltas, and fringing, patch and barrier reefs is reported. The Dominican coast line has a total length of 1,575 kms. It was divided into 76 sections to determine the extent of mangroves and coral reefs from a false color map of 1:250,000 scale (error = 10.7%). The dominican Republic has 267.7 kms of mangroves (17% of the coast line). Coral reefs occupied 165.7 kms (10.5% of the coast line).

GEOLOGY INSIDE CORAL REEFS

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Most of the biomass and volume of coral reefs lie beneath their surfaces. The myriad of cavities and pores, profuse array of organisms that inhabit them, and sediments that ultimately accumulate in these voids are all integral elements of reef ecosystems. The cavities of reefs range from pores within the skeletons of reef builders or sediments (tens of um to a mm), through shelter cavities and borings (mm to dm) to caverns and larger voids between corals (dm to m). The total volume of all cavities in many reefs is probably 50% and for some it may exceed 75%. The most common coelobites are attached, encrusting and boring forms that line or penetrate the surfaces of the cavities. In addition, there are numerous vagile crustaceans as well as other nektonic and planktonic biota. In the few reefs that have been examined, coelobites are known to extend at least to a few m below the surface, and there is good reasen to expect much deeper penetration in high-relief structures. The extensive cavity systems of reefs are traps for mineral and organic matter produced on the living surfaces and within the cavities, as well as for suspended sediment from outside the reefs. Large voids near the surface collect the coarser-grained skeletal debris; smaller voids are often floored with finer, sand-sized detritus; and even the smallest pores are often choked with mud-sized sediment. The mineral fraction of these internal sediments adds to the volume of the reef; the organic fraction can be recycled as nutrients to the surface. Furhter elucidation of the nature of cavities, coelobites, and internal sediments in various reefs is one of the frontiers of geological and biological research.

INTERNAL WAVE VARIABILITY IN THE NORTHEAST CARIBBEAN SEA

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Serial observations of temperature, salinity and dissolved oxygen show the existance of a persistent internal wave field, with periods approximating those of the astronomical tides. In the northeastern Caribbean, the period of the tide varies between a semidiurnal and a diurnal tide during a single fortnightly period. Although no fortnightly duration data sets for internal waves have been collected, the 2 extremes can be seen in our data from off the southeast corner of Puerto Rico of 190.5 hrs for July 1981 and 192 hrs for January 1981. The first shows peaks in the Fourier spectrum at both the diurnal and semidiurnal tidal periods. The second shows no peak at the semidiurnal tidal period and a large peak at the diurnal period. Less than 20% of the variability is accounted for in short period, less than the semidiurnal tidal frequencies. Long period variations, greater than the inertial period, are also present. These vertical fluctuations in the thermocline are possibly due to turbulence generated by the interaction of the mean circulation with the Leeward Islands. A long period deepening of the mean depth of the picnocline was observed to occur in January 1981. This may have resulted from the advection of a mesoscale eddy through the area or it may have been due to the seasonal deepening of the themocline. A third observation of internal wave at the southwest corner of Puerto Rico, which produced a 15 hr record, shows a peak at the M_4 period and at the period of half the record length. This may have been due to a semidiurnal tidal frequency.

SEA LEVEL IS RISING - SO WHAT?

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Sea level is dynamic, and there is the possibility that man-induced CO_2 buildup is the atmosphere may be causing global warming, triggering a major eustatic rise in sea level. In focusing only on the scientific and socioeconomic implications of some future rise, we are missing what is of much greater significance to us as scientists who are attempting to understand the dynamics of biological, hydrodynamic and geological processes in the coastal zone. There are real trends and fluctuations in sea level that must be understood in any study of the coastal zone. South Florida and Bermuda are used as examples. Following the Wisconsin Ice Age, sea level rose at an average rate of 10-15 mm/yr from -120 to -30 m (between 16,000 and 10,000 years ago). The rate slowed to about 2.3 to 2.6 mm/yr between -15 m and -2 m (8,000 to 3,000 years ago). Since then relative sea level rise has averaged 0.4 mm/yr for Florida and 0.7 mm/yr for Bermuda. Tide guage records averaged over the last 48 years show that sea level rise has recently taken a dramatic increase to 2.3 mm/yr in South Florida and 2.6 m/yr for Bermuda. Actual mean annual sea level trends during this period have minor to major fluctuations in a 1 to several-year scale. Mean annual sea level commonly varies 4-10 cm between years and may deviate by as much as 20 cm over a few years. The 50-year averaged sea level rise may be a reflection of longer-term trends; the 5- to 10-year trends are not. Yet they are real, and can have very real effects on coastal dynamics. Fluctuations in mean monthly sea level can be even more dramatic, and, though patterns are generally predictable, timing and intensity are not. So what? Sea level is dynamic, and some aspects of its dynamics lie at the very core of much of the coastal dynamics we are trying so hard to unravel. Use it!

THE RELATIONSHIP BETWEEN COASTAL SEICHES IN PUERTO RICO AND TIDE-GENERATED INTERNAL SOLITARY WAVES

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Coastal seiches recorded at Magueyes Island, Puerto Rico, occur in distinct fortnightly groups with maximum seiche activity following new and full moon by 7 days. The size of the fortnightly groups depends upon the amplitude of the proceeding spring tide and upon the Caribbean surface water temperature. Sea surface radar images obtained by P. G. Black (NOAA/AOML) in the southeastern Caribbean Sea indicate packets of internal solitary waves moving northwestward toward Puerto Rico. It has been hypothesised that these waves are generated by tides in the southwestern Caribbean and that they are responsible for exciting coastal seiches along the south shelf of Puerto Rico. From 26 June to 1 July 1982, the period of maximum seiche activity, predicted to follow the perigean new moon of 21 June, sea levels were monitored at 2 coastal and 2 reef stations, currents were recorded at the shelf edge 10 km offshore, and expendable bathythermographs (XBT) were deployed every 20 min for 17 hrs at a deep water station 15 km offshore. The XBT series revealed 2 isolated solitary waves, each defined by a single cast and a zone of temperature inversion at about 600 m. The shelf edge currents were characterized by on-offshore oscillations closely matching in phase and amplitude those calculated from the sea level oscillations, assuming fundamental mode shelf seiches. The current records also revealed onshore surges, 2 of which followed by about 50 min the passage of the 2 solitary waves at the offshore station. Sea level oscillations occurred continuously during the study, reaching a maximum height of 23 cm on 28 June.

SUBMARINE OPTICS IN PUERTO RICO

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Light intensities underwater are measured with simple light meters or photometers. No specific effort has been made to measure complete light spectra synoptically on a quantitative level. Underwater light spectra have been measured using optical filters, 1 at a time, and measuring the photometer output with a sensative voltmeter. While this method is adequate in a lake or calm lagoon, in changeable coastal waters the results are unreliable. Seven cells, each with its own optical filter, covering the spectra, were placed in an enclosure. The cell outputs were measured with a voltmeter, 1 at a time via an 8 conductor cable. The results were virtually useless. It was obvious that the measurements had to be doon synoptically for quantitative results. The 7 outputs had to be "read" simultaneously. Seven people with 7 voltmeters was not the answer, so a digital system with an 8K memory was designed and built. Now, 1 spectrum can be taken and recorded in 200 millisec and a spectral profile about as fast as the photometer can be lowered. The spectral absorption curves for 5 stations, 1 from Phosphorescent Bay at La Parguera, will be presented. Although optical oceanography falls within the general discipline of physical oceanography, it cannot be isolated from marine biology, geology or chemistry. It is the organic and inorganic suspended material as well as the disolved chemicals that define the optical properties.

THE INFLUENCE OF DREDGING ON A CORAL REEF IN BONAIRE, NETHERLAND ANTILLES

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Mortality of hard corals was monitored photographically and sediment movement was determined on a fringing reef off the construction site of a large resort development project in Bonaire. This project included the excavation of a limestone terrace by means of blasting to create waterfront building sites and dredging to connect the resulting canal system to the open sea. Photoquadrats (3x3 m) were established at 35, 20, 10 and 5 m on 4 stations both off the dredging site and upcurrent and downcurrent. Sediment was collected in sediment traps at 10 m depth at the stations and at a control. The average sediment load of the water off the canal entrance (139.6 $g.m^{-2}.d^{-1}$) was significantly higher than at the control (25 $g.m^{-2}.d^{-1}$) and other stations. Sedimentation rates at the other stations were not significantly different from the control. The variation in the amount of sediment released was clearly correlated with construction activities. The sediment load reached a high of 2301.2 $g.m^{-2}.d^{-1}$ during pre-dredge filling operations, but remained at a much lower level after a turbidity screen had been placed before the canal entrance. The percentage cover by living hard corals was determined in each photograph using a point-intercept sampling method (100 points). The percentage cover by living corals decreased most in the 35 m quadrat off the canal entrance (73 to 32%) (September 1980-March 1983). The high mortality in the 35 m quadrat in comparison to the more shallow quadrats is accounted for by the relative high percentage by sediment-sensitive Agaricia lamarcki on the lower reef slope. There was increased mortality in in the first downcurrent quadrats, but the percentage cover by living corals remained almost constant in the second downcurrent and the upcurrent quadrats. The mortality observed is almost exclusively correlated with the high sedimentation caused by the pre-dredge filling. The turbidity screen (placed largely as a result of environmentalist lobby) prevented further mortality among reef corals.

CORAL RECOLONIZATION STUDIES IN BERMUDA

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The freighter, Mari Boeing grounded on Bermuda's northern reefs in December 1978. several thousand m^2 of shallow reef were severly damaged in the subsequent salvage operation. Initial observations established that large areas of the rock bottom were scraped clean of all marine life. A bloom of the calcareous red alga, Liagora farinosa, covered the damaged area until September 1979, after which only minute filamentous algae remained. Four permanent m^2 quadrats were set up in July 1980. Two were located in a totally destroyed area and 2 in a damaged area that included surviving hard corals. The sites were resurveyed in 1981 and 1982. Recolonization had begun by 1980 and the number of colonies has increased since then. Porites asteriodes accounts for 62% of the total number of colonies found in the quadrats. Other species found were Favia fragum, Diploria strigosa, D. labyrinthiformis, Siderastrea radians, and Montastrea cavernosa. No juvenile soft corals have been found in the quadrats. Larval settlement plates, 225 cm^2 grooved ceramic tiles, were deployed in 3 orientations on the site in May 1982. The plates were examined on a monthly basis and newly settled hard corals were observed in June, July, August and September, with a peak of about 100 colonies/m^2 in August. Plates kept on site from May to February 1983 indicated a low survival rate due to overgrowth from the encrusting algae species, Fosliella sp. and an unidentified membranous green alga (Ulvacae?). A single soft coral polyp was found on one of the long term plates.

DISTRIBUTION OF CIGUATOXIC FISHES IN THE CARIBBEAN AND ADJACENT SEAS

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Ciguatera (tropical fish poisoning) is a disease generated in humans from the ingestion of ciguatoxic fishes. Ciguatoxic fishes are those which occur in the tropical marine waters of the world and are associated with hermatypic coral reefs. The causitive organism which generates ciguatoxin(s) is believed to be one or more species of benthic dinoflagellate. Ciguatera is manefested in gastro-intestinal and neurological disturbances which may persist for months or many years. There is no cheap, simple way to identify a ciguatoxic fish; once a human has contracted the disease, medical treatment of the victim is purely symptomatic. Identification of ciguatoxic fishes is accomplished only by an expensive radioimmunoassay. It is proposed here that a simple effective, and practical method to control outbreaks of ciguatera in humans is to identify specifically which coral reefs are known to harbor ciguatoxic fishes. The present study, based on analysis of several hundred literature sources from scientific, medical, and public health literature, and on a limited amount of correspondence with knowledgeble persons in the Caribbean and adjacent regions, indicates that ciguatoxic fishes are apparently unknown from the Central American isthmus or the South American continent; They apparently occur only in south Florida and islands of the Caribbean, Bahamas, and (occasionally) Bermuda. Ciguatoxic fish are represented by only certain fish species, which may possibly be further separated from non-ciguatoxic specimens bases on their size. Additional information on all of the above aspects are needed before such a cheap, simple way do reduce ciguatera intoxications can be realized, concomitant with an increased need for fisheries development in the Caribbean and adjacent seas.

A PRELIMINARY REPORT ON THE ARTISANAL FISHERY OF THE LOWER OR GREAT MORASS, SAINT ELIZABETH, JAMAICA

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The Lower or Great Morass of Elizabeth Parish is the largest wetland area in Jamaica. It is known for a popular spiced crayfish (Macrobrachium) product. The extent and value of the scalefish fishery has not been described. One-man, dugout canoes are used by 300 fishermen to fish about 3,000 traps and about 14,000 shrimp pots and produce approximately 200 metric tons of fish and 120 of shrimp per year, or J$2 million (US$1 million) worth. The fish traps are the common marine Z-trap reduced in size by 25%. The few spearfishermen operating in this fishery land small quantities. The main fishes caught are African perch (Tilapia mossambica), sleepers and guavinas (Eleotridae) and gobies. The mudfish (Gobiomorus dormitor) and goby (Awaos spp.) may weigh up to 2 kg and are the most important non-cichlid fish catches. The silver croaker (Bairdiella chrysoura) is of modest value in the catch and represents a range extension from the Gulf of Mexico. The remaining fish catch is largely marine and estuarine. The fishery was examined because peat has been found in the Lower Morass and its removal may impact fishing activities.

A SURVEY OF BLACK CORAL ON THE NORTH COAST OF JAMAICA. SHOULD HARVEST BE ALLOWED?

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High demand for jewlery from the skeletons of antipatharian corals has prompted the Jamaican Government to consider controlled exploitation of this resource. The distribution and abundance of black coral on the Jamaican north coast was assessed to make recommendations of harvest feasibility. 113 survey dives were conducted along 245 km of coastline to assess the suitability of areas as harvestable sources of black coral. Time limitations dictated the use of visual survey techniques, and results extrapolated halfway between adjacent sites were quantified by comparison with accurate re-survey of some areas. The total estimated mass of the standing crop was 3,800 km^2, with a downward gradient from west to east. Abundance in terms of mass is transformable to numbers by relating data to the population structure. A fisheries model was constructed to examine harvesting feasibility. This model, adapted from Beverton and Holt Dynamic Pool Model, estimates the yield of a cohort over its lifespan by considering growth in weight minus losses to mortality. To apply the model, growth rate was estimated at 7-8 cm/yr, converted to increase of mass with time by length/mass determinations, and losses to mortality were estimated by examination of the structure of an unfished population. By applying mortality losses against gross production a plot of net yield is obtained. Fishing mortality can be applied to the model to evaluate harvesting strategies. To protect recruitment, a minimum harvestable age of 23 yrs was chosen, allowing time for reproduction. The model provides a maximum harvestible yield of 137 kg/annum.

ASSESSING EFFECTS OF SMALL-SCALE REEF FISHERIES; AN ISLAND EXAMPLE

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The effects of small-scale, multi-species, mult-gear fisheries on the communities of coral reef fishes have been notoriously hard to assess by conventional fishery methods. A recent study of a coastal reef fishery on the Big Island of Hawaii was conducted without benefit of any historical fishery data (Parrish 1981, Proc. Assoc. Is. Mar. Labs. Carib. 16:6). The minimum data necessary to assess the fishery quantitatively was taken in 2 yr by a small field team. Catch by all major gear types was estimated from repeated creel census and a systematic program of visual observations to estimate fishing effort. An extensive program of repeated underwater visual census of all habitat types in all seasons gave an independent estimate of the populations of most species taken by this diverse fishery. Comparison of annual catch rates to these standing stock sizes, together with estimates of generation time, indicated a number of species were considerably overfished locally. Seasonal sampling and gonad examination of several target species in the fishery indicated much of the catch was prereproductive. The study provides important information for management of mixed stocks in minimum time and without historical statistics. The methods appear to be widely applicable to small-scale reef fisheries.

DISTRIBUTION OF FISH AFFECTED WITH NEUROGENIC TUMORS ON FLORIDA REEFS

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Surveys of 14 Florida reefs revealed the presence of a widespread disease in the bicolor damselfish, Pomacentrus partitus. The malignant, neurogenic tumors are eventually fatal. The disease is largely species-specific and has been observed rarely in 3 other pomacentrids. The tumors first appear as small, hyperpigmented spots on scales and fins and eventually expand to form wide areas of rugose epithelium of varing pigmentation. In severe cases large, fibrous nodules may be visable erupting through the epidermis. Prevalence in adult P. partitus varied from 0.1 to 20%. Rates were low (<1%) in the lower and middle Florida Keys and high (2-20%) near the upper Keys. Within reefs having high percentages of diseased fish, affected individuals were found in areas where population densities were significantly higher than the mean densities for these reefs. This disease is only known in Florida. If surveys indicate it is restricted to Florida, then this distribution may have important implications in understanding the etiology of the disease.

EFFECT OF HURRICANE DAVID ON SHALLOW WATER GORGONIANS OF PUERTO RICO

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Gorgonians at 6 exposed sies ranging in depth from 6-17 m off the south coast of Puerto Rico were sampled before and after the passage of Hurricane David. The effects were highly site specific. In extreme cases colony mortality ranged from 0-100%. The number of species and H' diversity showed similar site specific variations. No change was detected in equitability (J' diversity, or the distribution of individual colonies among species) indicating that Hurricane David did not affect community structure measured in this respect. Species specific mortality was detected in only 1 site. Effects of Hurrican David were not associated with environmental gradients such as depth, degree of exposure, or distance from shore and therefore are unpredictable. Major physical disturbances play a complex role in this community.

ALGAL ZONATION ON A CARIBBEAN FRINGING REEF: EFFECTS OF RECENT SEA LEVEL CHANGES

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On the fringing reef platform at Galeta Point (Caribbean Panama) month to month variations in tidal level cause seasonal changes in the distribution and abundance of algae. This relationship suggests that longer-term changes in algal distribution would result from year-to-year fluctuations in Caribbean sea level. This hypothesis was tested by measuring past variation in the landward extent of a band of the algae Laurencia papillosa, which forms a distinct zone in photographic records. Aerial photographs taken between 1948 and 1982 show landward-seaward shifts of this zone that are strongly correlated with fluctuations in annual mean sea level: during periods of higher sea level, the L. papillosa band extended further landward. The distribution of this algae on the reef is apparently influenced by herbivory and competition as well as by the direct effects of physical factors. If global sea levels continue their upward trend, further landward expansion of the L. papillosa zone will probably depend on interactions with these other factors, which are also affected by rising sea level.

A COMPARISON OF THE BELLAIRS FRINGING REEF (BARBADOS) BEFORE AND AFTER HURRICAN ALLEN

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Hurricane Allen passed the extreme north tip of Barbados at 0000 GMT 4 August 1980. The proceeding major hurricane to affect the island was Janet in 1955. The point method of line transects was used to record the reef substrates (reef rock, coralline red algae, sand, the hydrozoan Millepora, a variety of corals, and coral rubble) along 6 transects on the northern fringing reef offshore from the Bellairs Research Institute. The reef was divided into 6 equal area ellipses for analysis. Scuba surveys conducted before (1974) and after (1981) the hurricane were compared and statistically tested using a chi-square test. As well as determining whether the changes in substrate cover were significant within an individual ellipse, the data for each substrate/species for the entire reef was tested. On a reefal scale, the changes before and after Hurricane Allen were significant for all substrates and species with the exception of Millepora spp. Among the corals, Porites porites had been most affected by the catastrophe: its coverage was reduced by 96%. Madracis mirabilis, another branching coral, by 90%. The other corals (Siderastrea siderea, P. astreoides, Montastrea annularis and Agaricia agaricites) by 75-25%. Onshore transport is indicated by the relatively high abundances of Acripora cervicornis (20%) and M. mirabilis (30%) in the rubble of the fringing reef (the former only grows seaward of the fringing reef). Offshore transport is suggested by the relatively poor representation of P. porites (32%) in the rubble. Shannon-Weaver diversity indices of the corals dropped from 1.34 to 1.06.

MASSIVE SAND EXTRACTION FROM COASTAL DUNES IN PUERTO RICO: PROBLEMS AND SOLUTIONS

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Massive sand extraction from north coast dunes in Puerto Rico (lat. 18°N long. 66°W) have reduced their natural capability for protection. A sand depletion of more than 85% has occurred in some dune sectors, averaging 42% of sand extracted from the original north coast dunes (Benedetty 1980). Unvegetated dune ridges have suffered significant lowering by damages from

offroad vehicles and wind deflation. On 11-13 October 1982, waves generated by a broad low pressure system in the central Atlantic Ocean battered the north coast of the island opening 23 gaps and causing complete distruction of many dune areas. Nichols (1983) calculated storm surge and runup regime generated by hurricanes to predict the height that waves of a given frequency of occurrence can reach at specific locations. Present condition of residual dunes was surveyed by elevation profiling and field observations. Actual residual dune height and widths are insufficient to protect the coast from wave runup of a 1 in 20-year hurricane. Since type and status of dunes varies widely with natural conditions and man-alterations, 3 management approaches are considered for dune protection and restoration: let the natural processes prevail in selected sectors; modify some; and rebuild extensive washovers.

RECENT MASS MORTALITY OF GORGONIANS IN TRINIDAD

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The low-salinity high-turbidity waters of Trinidad is a stressed environment with a benthic fauna dominated by octocorals. Widespread mortality of gorgonians, especially Gorgonia ventalina, was first observed in November 1981 along the north coast of Trinidad to a depth of 10 m. The exposed skeletons of dying colonies were eroded and provided substrates for numerous epibiotic species. Algal "tumors" on the gorgonians possibly associated with necrosis (tissue death) and physical damage by corallivorous molluscs were observed. Exposed skeletal areas common at the bases were rapidly colonized by epibiotic species, particularly the alga, Bryopsis, which eventually spread over the entire colony. Host-specific pathogenic microorganisms could be involved. Pollutants, possibly originating from as far away as the Orinoco River system in South America could have produced the observed impact, or scouring by sediment could have directly damaged and killed tissues particularly at the bases of colonies. A major change in the community structure of the benthic fauna along Trinidad's north coast has occurred and an opportunity to monitor subsequent changes exists.

FATE AND EFFECTS OF CHEMICALLY-DISPERSED OIL IN CORAL REEFS

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Exxon is funding an extensive research program, initiated in mid-1980, to obtain information on the fate and effects of chemically-dispersed oil in the marine environment. Of particular interest is a comparison of chemically-dispersed oil with untreated oil. Twenty worldwide projects conducted by marine laboratories or environmental contractors examined the effectiveness of newly developed dispersants to accelerate dispersion, evaporation and degradation; and acute and chronic effects of oil spills treated with chemicals. Two of these projects involve coral reefs. Laboratory and field investigations (1980-1982) by the Bermuda Biological Station for Research indicate corals exhibit only minor effects when exposed to chemically-dispersed oil for short periods. The corals did exhibit hydrocarbon uptake, but also a slow depuration rate. Environmental Science & Engineering, Inc., Gainesville, Fla., in a 2 year study in the Arabian Gulf, determined healthy reef corals can tolerate short (1-5 day) exposures to chemically-dispersed oil with little to no discernible effects. Some coral mortality is likely in prolonged uses of dispersants on oil slicks, particularly if the corals are already under stress, as occurs during winter when the water temperature is relatively low.

RESILIENCY OF REEF POPULATIONS AFTER A SPEARFISHING BAN AT LOE KEY NATIONAL MARINE SANCTUARY: PROGRESS REPORT

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Looe Key National Marine Sanctuary was established and a ban on spearfishing was initiated in 1980. Enforcement began in the summer of 1981. Visiual fish surveys conducted prior to sanctuary establishment demonstrated significantly smaller piscivorous predator populations, differences in prey species composition, and differences in predator composition compared to control reefs (Molasses and French Reefs) in the Key Largo Coral Reef Sanctuary which had been protected from spearfishing since 1960. Predator populations have increased at Looe Key Reef since the establishment of the sanctuary. In particular, the observed frequency of grey snapper, Lutjanus griseus, has increased dramatically although population levels remain well below those on the control reefs. Thalassoma bifasciatum, the most abundant prey species, showed a drop in abundance correlated with increaseed predator populations. T. bifasciatum population levels at Looe Key Reef prior to sanctuary establishment had been double those on control reefs. Continued monitoring is expected to demonstrate the sequence and magnitude of changes in reef fish community structure resulting from protection. Results will aid resource management by providing an increased understanding of the importance of piscivorous predation, human exploitation, and other processes involving reef fish dynamics.

PRELIMINARY OBSERVATIONS OF THE BEHAVIOR OF TRAPPED FISHES IN ANTILLIAN FISH TRAPS

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An intensive diving study of the behavior of fishes in umbaited Antillian fish traps was conducted over a 2 week period at an inshore station on the reef platform of Bermuda. Wire traps with straight funnels and of identical dimensions were made of 3 different hexagonal mesh sizes: 3.8 cm (1.5"), 5.1 cm (2"), and 7.6 cm (3"). The catch composition with respect to proximity of the trap to a reef was studied for each mesh size by setting the traps along transects spaced 3, 20, and 50 m from different patch reefs. Significant differences were found in the mean size of each species either between mesh sizes or in relation to distance from the reef. There were marked specific differences in the behavior of trapped fish, with several species (e.g. Lutjanus griseus and Haemulon sciurus) showing frequent movements in and out of traps. Conspecific attraction appeared to be important in determining the ingress of a number of species. The rate of ingress may be higher at night. The passage of a tropical storm during the study was associated with a considerable increase in the numbers of 2 species in the 3.8 and 5.1 cm mesh traps.

A PRELIMINARY REPORT ON THE EFFECTS OF POLLUTION ON FRINGING REEFS OF BARBADOS

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The structure of scleractinian coral communities was studied on the insular fringing reefs of the west coast of Barbados because of their suspected degree of exposure to pollutants. Species composition, zonation patterns and species diversity were qualitatively and quantitatively analyzed; and distributions of the sea urchin, Diadema antillarum Philipi, filamentous algae and substrate type was also analyzed. Temperature, irradiance, salinity, dissolved oxygen, silica, phosphate, nitrate, nitrite, ammonia,

chlorophyll (a), suspended matter, volatiles, sedimentation, current velocity and direction were monitored weekly for 1 year. An environmental gradient exists alnog the west coast of Barbados. The eutrophication of the coastal waters is a direct result of the urban population. The species diversity and the percentage cover of schleractinian corals and population density of D. antillarum were inversely correlated with the degree of pollution. Substrate cover by filamentous algae and macrophytes was directly correlated with environmental quality. The synergistic effect of pollution and wave action is primarily responsible for the deterioration of certain fringing reef systems.

EXPLANATION FOR THE SIZE DISTRIBUTION OF THE STONEY CORAL MONTASTREA ANNULARIS ALONG THE COASTS OF CURACAO AND BONAIRE (NETHERLANDS ANTILLES)

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The horizontal distribution of size in Montastrea annularis colonies was studied in the drop off zone (5-15 m depth) along the leeward reefs of Curacao and Bonaire. Three size classes (>100 cm, 50-100 cm, <50 cm) were distinguished, based on maximum diameter estimates of the group of largest M. annularis specimens in the community. The hypothesis was the size of the corallum is related to the quality and stability of the environment. The life history strategy of M. annularis and specific environmental factors, that vary along the coasts, are employed to explain the irregular size distribution. The factors considered are turbidity, light availability, pollution (oil, thermal, domestic), water motion, salinity and nutrient supply. These influence skeletal calcium carbonate deposition and bioerosion, growthform, reef morphology, sedimentation and extreme physical disturbances such as slumpings, occasional storms and coastal developments influence the physical stability of the coral head. The presence, in situ, of bioeroded dead M. annularis coral boulders with diamenters exceeding 100 cm among living colonies in the smaller size classes is evidence of the severe effects of bioerosion on the stability of the environment and thus, on the size composition.

BEACH TAR POLLUTION ON MAIDEN CAY, JAMAICA

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The location of Maiden Cay (3 km offshore) in the approaches to Kingston Harbour, and its close proximity to the major shipping channel made it an ideal location to monitor beach tar pollution. Approximately 250 ships/month enter Kingston Harbour. Tar on the cay arises from tankers discharging oil into Jamaican coastal waters after leaving port (Wade, Provan, Gillet 1980). The levels and rate of arrival of tar on Maiden Cay were investigated. The specific gravity (SG) of beach tar balls was directly related to the sand content ($r = 0.92$). Older tar balls tended to be heavily encrusted with sand and thus sank (SG = 1.3), and were repeatedly transported in both longitudinal and horizontal directions across the beach. Newly arrived beach tar had a lower specific gravity (SG = 0.9), floated and was used to determine the rate of tar arrival. The entire cay was swept clean of tar and debris and sampled by means of m-wide transects over 12 days. The transects were placed at different sites on the cay chosen for the nature of its tar (i.e. weight/SG). The mean weight of tar collected over the period was 100.7 g/m of which 14.5% was floating tar. From this we estimated that the mean rate of arrival of fresh tar was 1.4 g/m/d. The research is a portion of our contribution to the Caribbean wide monitoring program (CARIPOL).

THE PURPOSE OF HOFSTRA UNIVERSITY MARINE LABORATORY

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The Hofstra University Marine Laboratory was founded in 1982 to provide a field facility in the Caribbean for American and Canadian colleges and universities. Its purpose is educational, and designed to provide and opportunity for professors to bring classes to study the extraordinary biotic communities of tropical seas. There is no scientific or educational staff; the professor is director when on-site. The facility provides hotel, dive shop, a fleet of boats, and 3 laboratories, all with running seawater systems and full equipment for marine studies. Habitats within a short walk or boat ride from the laboratory include: grass beds, rocky and sandy shores, mangrove swamp, bank/barrier and fringing coral reefs. Considerable support is provided for the visiting professor, including a 60-page instructor's Guide, hundreds of labelled 2 x 2 slides to augment lectures, and several publications designed to prepare the professor for teaching in an unfamiliar environment. The publications will be displayed and a lecture on mangrove succession will demonstrate the type of slides available.

"CORAL REEFS, SEAGRASS BEDS AND MANGROVES: THEIR INTERACTION IN THE COASTAL ZONES OF THE CARIBBEAN"- REPORT OF A WORKSHOP

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In May 1982, under the sponsorship of UNESCO, IOCARIBE, and WIL, a workshop was convened in St. Croix to consider the major ecosystems of the Caribbean coastal zone and their interactions. Coastal zone scientists from 15 countries were invited by UNESCO and represented 2 major sources of expertise; ecosystem specialists and regional specialists. After 6 plenary lectures about the structure and function of each ecosystem, the workshop divided into smaller group sessions to consider the interaction of ecosystems. The groups recognized 6 potential categories of connections linking all 3 ecosystems; physical interactions, nutrients, dissolved organic matter, particulate organic matter, animal migrations, and human impacts. Some of these are much better known than others and, also, there are regional differences depending upon the structure of a particular coastal zone. Because of the importance of nutrient cycling as a major avenue of interaction of ecosystems, the workshop adopted the terms "oligotrophic" to refer to nutrient-poor systems such as coral reefs, least tolerant of nutrient enrichment, and "eutrophic" to refer to mangroves and some seagrass beds which are correlated with high nutrient input and accumulation. Each specialist then presented a brief report on the status of knowledge on his country's coastal zone, a statement of the capability of existing research and training facilities, and a list of the major coastal fisheries. The workshop recommended that UNESCO through IOCARIBE assign a high priority to assisting Caribbean nations in the inventory of their coastal zones, to establishing training programs within the countries to develop research capabilities, and to make available regionally useful technology such as remote sensing to assist in this task. The workshop also recommended the implementation of a specific pilot project to examine the interaction of the ecosystems of the Caribbean coastal zone long a gradient of development and/or disturbance. Finally, the development of a Caribbean Coastal System Management Handbook was urged. Any of these potential projects might provide a suitalbe point of focus for a joint effort of the AIMLC, representing the principal source of knowledge of the Caribbean coastal zone, UNESCO, and other agencies concerned with the problems of resources in the Caribbean.