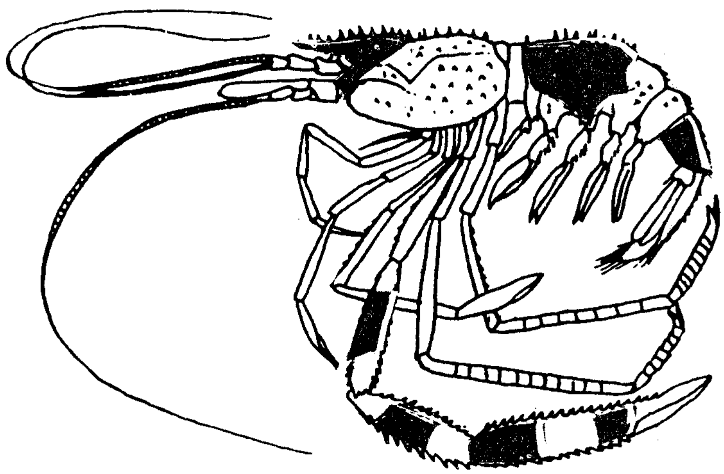
Kay Waldner

ASSOCIATION OF ISLAND MARINE LABORATORIES

OF

THE CARIBBEAN

Fifth Meeting



LERNER MARINE LABORATORY

BIMINI, BAHAMAS NOV. 6-8, 1963

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Lerner Marine Laboratory, Bimini, Bahamas; site of the Fifth Meeting of the Association of Island Marine Laboratories of the Caribbean.

ASSOCIATION OF ISLAND MARINE LABORATORIES OF THE CARIBBEAN

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For the period Nov. 6-8, 1963, the Lerner Marine Laboratory at Bimini, Bahamas, served as the host institution for the fifth meeting of the Association of Island Marine Laboratories. Listed below are the various member institutions that participated and also the representative members who attended the meetings:

BELLAIRS RESEARCH INSTITUTE OF McGILL UNIVERSITY, St. James, Barbados, B. W. I., John B. Lewis, Director.

BERMUDA BIOLOGICAL STATION, St. George's West, Bermuda, John R. Beers, Assistant Director and Fred T. Mackensie.

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INSTITUTE OF MARINE BIOLOGY, University of Puerto Rico, Mayagüez, Puerto Rico, John E. Randall, Director, Germaine Warmke, and Peter W. Glynn.

LERNER MARINE LABORATORY, Bimini, Bahamas (Mailing address: 1211 DuPont Building, Miami 32, Florida, U. S. A.), Robert F. Mathewson, Director and John M. Arnold, Research Fellow.

UNIVERSITY OF THE WEST INDIES, Mona, St. Andrew, Jamaica, W. I., Ivan M. Goodbody.

Representatives from the marine laboratories of the A. I. M. L. gathered for the presentation of papers at Bimini this year. In addition to the scheduled program numerous informal discussions developed involving an exchange of ideas based on current and planned research. Partly because of the success of the joint effort on productivity studies being carried out by certain laboratories, other cooperative research programs were considered. Among the studies that seem well suited for cooperative research in the Caribbean Province are a comparison of reproductive activities and growth rates among certain common invertebrate species.

Due to the proximity of Bimini to the continental United States it was convenient for some people from the mainland to attend the meetings.

The Association was pleased to have the following people from the Institute of Marine Science, University of Miami: Mr. William C. Cummings, Dr. Anthony J. Provenzano, Jr., and Mr. Sheldon Dobkins.

Dr. Samuel F. Clark, Chairman of the Department of Chemistry, and Dr. Carlos M. Vilar Alvarez, Chairman of the Department of Zoology, representing the newly established Florida Atlantic University, a state institution at Boca Ratón, attended the meetings. A message was read by Dr. Vilar Alvarez from Dr. K. Williams, President of F. A. U., and Dr. M. Sanders, Head of the Division of Biological Sciences, stating their regrets for not being able to attend the meetings and extending all members an invitation to visit and correspond with F. A. U. Information was presented about this University, which included such matters as its philosophy, academic planning, and the plans for development of the Departments of Chemistry and Zoology.

The Association was also honored by the presence of Dr. James E. Böhlke, Curator and Chairman of the Department of Ichthyology and Herpetology, Academy of Natural Sciences in Philadelphia, Dr. Raymond B. Manning, Associate Curator of Marine Invertebrates, United States National Museum, and Dr. Walter H. Hodge and Dr. Jack T. Spencer of the National Science Foundation.

Dr. Juan A. Rivero, Dean of Arts and Sciences of the College of Agriculture in Mayagüez, Puerto Rico, former Director of the Institute of Marine Biology and one of the founders of the A.I.M.L., attended by invitation.

All participants and conferees were greatly satisfied with the number and quality of papers presented and with all of the activities that took place during the meeting. Intermittent rain squalls interferred with field trips to distant regions, though a number of interesting habitats were visited in the environs of the Laboratory, viz. sandy and rocky shores, mangrove canals, sponge beds, and turtle grass meadows. All were grateful to Dr. and Mrs. Mathewson of the Lerner Marine Laboratory for the evening entertainment and the banquet the night of Nov. 7. Also appreciated was the active cooperation of Mrs. Lenore S. Tate, Secretary to the Director of the Bimini marine station.

Sincere thanks were expressed to Dr. Mathewson for showing the movies of the Lerner Laboratory and the march of the spiny lobster. Dr. Randall kindly showed his film on the Virgin Islands which included many aspects of the research work carried out in that region. Mr. Cummings of the Institute of Marine Science, University of Miami, presented some of his results on the production of sounds by marine organisms. He kindly demonstrated to all interested the operation of the submarine television and hydrophone equipment at the Lerner Marine Laboratory.

After the business meeting the following was announced to all participants:

1. The name of the Association of Island Marine Laboratories will henceforth be Association of Island Marine Laboratories of the Caribbean. This constitutes a change of Article 1, Section 1 of the Bylaws of the Association.

2. Article 5 of the Bylaws was changed to the following: These Bylaws may be amended, either by change or repeal of any provision or the adoption of new provisions, at any meeting of the Association by majority vote of institutional representatives (one per institution) present at a meeting.

3. The marine station of the Universidad de Oriente at Cumaná, Venezuela was admitted as a member institution of the Association.

4. The next meeting of the Association will be held at Margarita Island, Venezuela in early January, 1965. The meeting following this one will be held at the Bellairs Research Institute of McGill University at Barbados. The date for the latter will be determined at the next meeting.

Below are the abstracts of the papers in the order they were presented at the meeting. Following the abstracts is a financial statement covering the period, Feb., 1959 - Nov., 1963.

DIURNAL VARIATION OF AMMONIA IN THE SARGASSO SEA OFF BERMUDA

by
John R. Beers
Bermuda Biological Station
St. George's West, Bermuda, B. W. I.

The diurnal variation in ammonia concentration has been investigated at a location approximately 14 miles SE of Bermuda. Water samples were taken approximately every four hours for 48 hours at selected depths in the upper 500 meters. Highest levels of ammonia were measured in the surface water (average value 0.81 µgA NH_3-N/L) and at 25 m (average 0.83 µgA NH_3-N/L); lowest values were found at the base of the euphotic zone --- 100 m., average 0.32 µgA NH_3-N/L; 150 m., average 0.38 µgA NH_3-N/L. The mean ammonia concentration for each station integrated over the depth of the euphotic zone and from 200-500 m showed changes which can possibly be correlated with diurnal characteristics of the plankton populations.

(author's abstract)

A FATAL ATTACK BY THE SHARK *CARCHARHINUS GALAPAGENSIS* AT ST. THOMAS, *VIRGIN ISLANDS*

by
John E. Randall
Institute of Marine Biology
University of Puerto Rico
Mayagüez, P. R.

On April 20, 1963 a 10-foot shark attacked and killed Lt. John Gibson, USN who was swimming at the surface in Magens Bay, St. Thomas, Virgin Islands at about 1 p.m. without swim mask or flippers. The shark was caught the following day in the bay with the right hand and other remains of the man in its stomach. In various news releases the shark was reported as a blacktip, thresher, and hammerhead. The author flew to St. Thomas from Puerto Rico to examine the shark. It proved to be a ridge-back species of *Carcharhinus* that came close to the description of *C. springeri* in recent taxonomic reports of the genus in the western Atlantic, but showed enough differences to arouse suspicion. Ultimately, with the aid of a photograph, the jaws and teeth, several of the fins, and numerous measurements, the shark was identified as *C. galapagensis* by J.A.F. Garrick who is monographing the genus *Carcharhinus*.

This constitutes the first authenticated shark attack in the Virgin Islands and the first record of *galapagensis* from the western Atlantic.

(author's abstract)

HABITAT PREFERENCES IN ASCIDIANS

by
Ivan M. Goodbody
Department of Zoology
University of the West Indies
Jamaica, W. I.

Forty-five species of ascidians occur in the littoral and sub-littoral zone in the vicinity of Port Royal, Jamaica. Nineteen species are characteristic of the coral reef area, 16 species are characteristic of the harbour and lagoon area, 10 species are common to both. Within each area broad habitat differences may be defined but in any one habitat there may be a number of different species living side by side. This reaches its greatest development in the mangrove lagoons where seventeen species have been recorded from the sessile community growing on *Rhizophora* roots. Niche selection within such communities may involve a number of factors of which the following are probably important: food selecting ability, oxygen requirements, larval responses to illumination, current velocity and turbulence. Ecological separation of species is also achieved in seral succession: some species are characteristic of primary communities, others are characteristic of climax communities.

(author's abstract)

PHOTOGRAPHING LIVE MOLLUSKS FROM PUERTO RICO

by
Germaine L. Warmke
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University of Puerto Rico
Mayagüez, P. R.

Kodachrome slides of 35 species of live mollusks from Puerto Rico were shown. The purpose of exhibiting these was twofold: first, to illustrate some of the more interesting live mollusks recently found in Puerto Rico from shallow water and from dredgings up to 300 feet; secondly, to discuss the trials of photographing moving animals in contrast to dead shells.

Comments on the animals' activities and ecology were made.

A special effort is underway to collect and photograph the opisthobranchs, especially the nudibranchs. It is hoped to bring to light this hitherto little-known group of mollusks from Puerto Rico.

Among those species projected, for which photographs have rarely if ever been taken, are the following: Conus juliae Clench, Gaeotis nigrolineata Shuttleworth, Lobiger sowerbii Fisher, Micromelo undata Bruguière, Murex woodringi Clench & Perez Farfante, Natica canrena L., Oliva caribaeensis Dall & Simpson, Pecten ziczac L., Polinices hepaticus Röding, Spondylus americanus Hermann (mantle with iridescent eyes), and a new undescribed species of Typhis.

The camera used for all photos was an Exakta with a Makro-Kilar 1:2.8/90 mm. lens. The best results were obtained using the technique recommended by John Randall (Technique for fish photography, COPEIA, 1961, No. 2, pp. 241-242).

(author's abstract)

RECENT STUDIES AT THE ACOUSTIC-VIDEO SYSTEM; OCCURRENCE OF MARINE ANIMAL SOUNDS AT BIMINI

by
William C. Cummings
Institute of Marine Science
University of Miami
Miami, Florida

The Acoustic-Video System at the Lerner Marine Laboratory at Bimini was designed, installed and maintained by scientific personnel from The Marine Laboratory, Institute of Marine Science, University of Miami. This group, under the direction of Dr. John C. Steinberg, consists of biologists, physicists, and electronic engineers. Field equipment includes hydrophone arrays, a close circuit underwater television system, and a sound projector. These instruments are one mile offshore at a depth of 65 feet and they are connected by cable to recording equipment which is housed at the Lerner Marine Laboratory.

The chief objectives of the bio-acoustics phase of the underwater sound program are, (1) to maintain a system for the underwater observation of marine animals in the natural environment, (2) to study the occurrence of marine animal sounds and to determine which species produce them, (3) to study the biological significance of sound production by marine animals in their natural environment.

Over 40 categories of marine animal sounds have been recorded and studied. Many of these sounds occur in chorus at specific times of the day, month, or year. Analyses show their occurrence to be correlated with various solar and lunar phenomena. Some of the species responsible for the sounds are Strombus gigas, Balistes vetula, Halichoeres bivittatus, Caranx crysos, and Haemulon album. The specific sources of many of the biological sounds remain unidentified. Most sounds occur in the 50-2000 cps bandwidth. There is a considerable range in the frequency-time components and the level of the sounds being recorded. The frequency of occurrence of one category of biological sound may be increased by the playback of that sound into the water. Observations were made of the feeding, territorial, and schooling behaviour of fishes. The occurrence of biological sound is increased when lights are used during night-time observation. Twenty-four hour recordings have shown that long and frequent recording periods are necessary to obtain useful information about sound in the natural environment.

(author's abstract)

SPECIES COMPOSITION OF *PORITES FURCATA* REEFS IN PUERTO RICO WITH NOTES ON HABITAT NICHES

by
Peter W. Glynn
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University of Puerto Rico
Mayagüez, P. R.

Dense growths of *Porites furcata* are commonly present in the shallow waters on the leeward side of outer barrier and patch reefs. A typical *Porites* reef may be 2,000 square meters in area and vary in depth from several inches to about eight feet. Synecological studies on the community of organisms living in these reefs are now in progress, with particular emphasis on the composition and structure, the food interrelationships, and the movement of energy and materials through the complex. These investigations have been given financial support by the National Science Foundation for a three-year period, which was initiated in September, 1963.

To properly understand the structure and dynamics of any natural grouping of organisms it is first necessary to express qualitatively, the species composition and then quantitatively, the abundance and organic matter contents of the various populations. As a first step, the *Porites* reef-flat assemblage will be dissected and described in terms of its species composition, density, and biomass structure. Bimonthly, replicate quadrat sampling of the reef is planned in order to assess the variability within samples and between seasons.

Critical analyses of individual species populations have been undertaken in order to arrive at a level of synthesis of overall community interactions. Autecological studies are planned for the more abundant species, and these will include mainly such facets as a.) habitat niche, b.) patterns of movement, c.) physico-chemical tolerance limits, d.) feeding relations, e.) growth rates, f.) population structure and interactions, and g.) reproductive activity.

Succession and the rate of upgrowth of sessile organisms will be studied on artificial reef platforms placed into existing *Porites* reefs. Such surfaces will be constructed of concrete building blocks and set into the reef at different depths. Plastic screen cages will be used to determine the growth rates of motile animals, or of species that do not lend themselves well to length-frequency studies or to marking and tagging.

Numerous surveys of the macrobiota of *Porites* reefs in Puerto Rico have demonstrated a characteristic assemblage of species. Certain plants, such as *Thalassia testudinum* and *Ceramium nitens*, are frequently associated with *Porites*, usually living interspersed on the reef but not attached to the living coral. However, the arborescent growth form of *Porites*, together with its compact, finger-like branchlets, provides surfaces and spaces for most of the organisms living in this habitat. For example, tubes of Sabellastarte magnifica are attached along the lengths of the dead basal branches (with the crown of tentacles expanded in the water above) and Mithrax sculptus moves over the entire coral structure. Some of the typical species of the Porites furcata reef are tabulated below with notes on their usual spatial arrangement in the community.

TAXONOMIC GROUP	SPECIES	SPATIAL ARRANGEMENT IN PORITES FURCATA REEF
Chlorophyta	Caulerpa racemosa	Attached to Porites rubble or to dead basal branches of living Porites.
	Cladophoropsis membranacea	Attached to sand, Porites rubble or to dead basal branches of living Porites.
	Halimeda opuntia	Same as above.
	Valonia ventricosa	Attached to dead basal branches of living Porites.
Rhodophyta	Acanthophora spicifera	Attached to Porites rubble or to dead basal branches of living Porites.
	Ceramium nitens	Epiphytic on Halimeda opuntia.
	Laurencia obtusa	Attached to Porites rubble or to dead basal branches of living Porites.
	L. papillosa	Same as above.
Tracheophyta	Thalassia testudinum	Rhizomes embedded in sand or mud beneath Porites rubble.

Coelenterata	*Millepora alcicornis*	Attached to large, stable, dead colonies of *Porites*.
Porifera	*Cliona* spp.	Bores into dead basal branches of living *Porites*.
	Haliclona rubens	Attached along length of dead basal branches of living *Porites*.
	Pellina carbonaria	Same as above.
Annelida	*Sabellastarte magnifica*	Attached along length of dead basal branches of living *Porites*.
Arthropoda	*Clibanarius antillensis*	Motile over sand and mud, *Porites* rubble, and among dead basal branches of living *Porites*.
	C. tricolor	Same as above.
	Gonodactylus oerstedii	Motile in caves built in dead basal branches of living *Porites*.
	Mithrax sculptus	Motile over *Porites* rubble, and on dead and living branches of *Porites*.
	Petrolisthes galathinus	Motile over dead basal branches of living *Porites*.
Echinodermata	*Echinometra lucunter*	Motile in *Porites* rubble and among dead basal branches of living *Porites*.
	Microthele (=*Holothuria*) *parvula*	Motile, clings to dead basal branches of living *Porites*.
	Ophiocomella caribbaea	Motile in *Halimeda opuntia* and on dead basal branches of living *Porites*.

	Ophiothrix angulata	Motile in Porites rubble and among dead basal branches of living Porites.
Mollusca	Cerithium litteratum	Motile over Porites rubble and on dead basal branches of living Porites.
	Isognomon radiatus	Attached to dead basal branches of living Porites.

(author's abstract)

BERMUDA PLEISTOCENE EOLIANITES AND PALEOWINDS

by
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St. George's West, Bermuda, B. W. I.

The majority of the cross-stratified limestones of Bermuda appear to be stabilized dunes of Pleistocene age. The directional features of the dunes suggest that the paleowind pattern was similar to the present-day pattern around Bermuda.

Analysis of the attitude of more than 800 cross-strata at 129 localities suggests that the majority of the eolianites were formed by onshore winds at times of high sea level. The source of the sand was the nearby Pleistocene beaches.

(author's abstract)

STUDIES ON THE CHEMICAL COMPOSITION OF THE ZOOPLANKTON IN THE SARGASSO SEA OFF BERMUDA

by
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St. George's West, Bermuda, B. W. I.

In October, 1962 a one-year study was initiated of possible seasonal changes in the chemical composition of the major zooplankton groups represented in the standing crop from 500 meters to the surface at a site off Bermuda. Plankton tows were taken monthly. The fresh animals were sorted into major taxonomic groups - i.e., copepods, euphausid-mysid, other crustacea, chaetognaths, siphonophores, etc. - and the wet: dry weight relationship, total carbon, total nitrogen, total phosphorus, and carbohydrate content of each group determined. Data from these studies have indicated little seasonal change in the basic chemical composition of the animals. Whereas the N : P ratio varied considerably among the groups, it remained relatively constant in any one group throughout the year.

(author's abstract)

EFFECTS OF HURRICANE EDITH ON MARINE LIFE IN LA PARGUERA, PUERTO RICO

by
Peter W. Glynn
Luis R. Almodóvar
Juan G. González
(read by Peter W. Glynn)

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University of Puerto Rico
Mayagüez, P. R.

Observations were made of the effects on marine life of the cyclonic disturbance, Hurricane Edith, as it passed by the southwestern region of the Island on September 26-27, 1963. Previous studies, particularly at the coral reef, Cayo Laurel, made possible critical evaluation of the resulting damage.

As Hurricane Edith approached Mona Passage from the south, its center in one position was located at 17.8° N; 67.8° W --- approximately 50 miles WSW of La Parguera. The storm was classified as small and disorganized, with maximum wind velocities near the eye of 100 mph and marginal winds of 50-60 mph at a distance up to 50 miles from the center. Weather information was made available through the courtesy of R. L. Higgs, Isla Verde International Airport, San Juan, and D. C. McDowell, Institute of Tropical Meteorology, University of Puerto Rico.

Winds generated a sea that broke on the windward shore of outer reefs as 6 to 8 ft. combers. Three to 4 ft. waves moved seaward across the leeward sides of reefs and broke in the shallows on the reef flat. Normally, windward breakers range from 1 to 3 ft. in height while the lee of the reef is calm. Both the inshore and offshore sea level was elevated by 12 to 18 in. Precipitation amounted to 8.00 in., which fell mainly during the night of September 26-27. Annual rainfall is usually around 30 in., distributed rather irregularly throughout the year. Minimum surface salinity samples taken at the dock in the mangrove canal separating Magueyes Island from the mainland, and from nearby Cayo Májimo, were 27.16‰ and 31.40 ‰, respectively. A surface salinity of 33.84 ‰ was recorded at Cayo Turrumote, an outer coral reef. Previous studies of salinity conditions in this area demonstrated a range of 34.0-36.7 ‰ for the dock at Magueyes and 34.8-36 ‰ in open water between the reefs. No adverse effects on littoral organisms were noted by dilution from the rains.

Hundreds of individuals of the hermit crab *Coenobita clypeatus* climbed from the inundated floor of a small island on Cayo Laurel to cluster together in bushes and trees. Also, the entire population of the gastropod *Tectarius muricatus* was shifted higher on the shore for a horizontal distance of 3 to 4 ft.

After the storm passed the floor of the island was strewn with fragments of the corals Acropora palmata (up to 200 lb.), Porites furcata, and P. porites. In places the broken branches of Porites formed a layer 5 to 6 in. in thickness. Numerous large coral colonies were broken loose, rolled across the reef and then deposited in the lagoon. Some of these species were: Acropora palmata, Dendrogyra cylindrus, Diploria labyrinthiformis, Millepora alcicornis, and Montastrea annularis. Tracts of fallen and crushed P. furcata probably resulted from the movement of such large corals across the reef.

The following algae, growing attached to P. furcata or otherwise associated with this coral in the shallows of the reef flat, were broken loose by the action of strong currents that moved over the reef: Chlorophyta - Caulerpa racemosa, Cladophoropsis membranacea, Halimeda opuntia, Valonia ventricosa; Rhodophyta- Acanthophora spicifera, Amphiroa fragilissima, Ceramium nitens, Laurencia obtusa, L. papillosa. The following green algae, growing in shallow sandy patches among P. furcata, were uprooted or buried by the shifting sands and calcareous debris: Caulerpa racemosa, C. sertularioides, Halimeda monile, Penicillus capitatus. Filamentous algae growing attached to the substrate on the windward shore of the reef, such as Lyngbya majuscula (Cyanophyta), Cladophoropsis membranacea, and Ceramium nitens received the direct impact of large waves which uprooted and fragmented them. Two days after the storm large drifts of Sargassum natans and S. fluitans began to accumulate on the islands of reefs and on the shore at La Parguera. Evidently these algae drifted shoreward under the influence of the hurricane. Two weeks after the storm rocks and calcareous debris in the shallow water of the reef flat were dominated by the filamentous green alga, Bryopsis hydnoides. This alga was collected only once before in Puerto Rico, at Patillas near the outlet of a fresh-water stream.

Observations at Caballo Blanco, a cattle egret (Bubulcus ibis) rookery in front of the laboratory, showed that over 50% of the nestlings were drowned or knocked out of the nests.

(authors' abstract)

FEEDING AND DIGESTION IN THE TROPICAL SEA URCHIN DIADEMA

by
John B. Lewis
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Barbados, B. W. I.

The feeding behaviour, morphology and histology of the digestive tract are described, and an account is given of the digestive enzymes of the sea urchin Diadema.

Diadema feeds principally upon algae. It contains strong enzymes for digestion of carbohydrates and weak enzymes for proteins and fats.

(author's abstract)

LOW LIGHT INTENSITY INDUCING CAVE CHARACTERISTICS IN DIADEMA

by
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Although usually black-spined, the echinoid Diadema antillarum may have gray, banded, or white spines. One individual may possess pale or banded spines as well as black ones; in such cases the aberrant spines are often placed in concentric groups. Individuals with only black spines are found in shallow clear water without heavy surface. Specimens with gray, white or banded spines are found in deep water (below 8 m) or in shallow water if the water is turbid or if there is so much wave action that the urchins have to take shelter beneath rocks. Young specimens (5-15 mm) always have banded spines, even in shallow clear water.

Experiments were conducted, some by Miss Annemarie Elshove (Biol. Cand., Amsterdam University), to determine the effect of low light intensity on the pigmentation of spines and on preference for dark conditions such as one finds in caves.

Groups of 50 individuals of young Diadema (5-15 mm) were reared in an outdoor tank (normal light intensity) and three indoor tanks of 5-10%, 1%, and 0.1% light intensity. After three months all urchins in the outdoor tank had black spines, while those that had lived at low levels of light had spines colored as follows: 5-10% light intensity, 70% black spines, 17% banded, and 13% white; 1% light intensity, 55% banded, 45% white; 0.1% light intensity, 60% banded, 40% white.

Experiments were carried out on the preference by young Diadema for normal or 5% light intensity by placing individuals in a tank measuring 8 X 1 X 1 m which was half covered by a wooden lid. The light was of normal intensity under the uncovered half and 5% normal beneath the covered portion. Young, banded urchins, recently caught in shallow water, preferred the lighter part of the tank, 75 to 77% were found there and only 23 to 25% in the covered half. Some of these young urchins were raised in full light and some in almost complete darkness. The latter group showed increasing preference for the dark side of the tank when tested. After 16 weeks 72% were found in the dark half of the tank. The group reared under normal light conditions showed no significant change in its preference for either half of the tank over the 16 week period.

When white-spined adult individuals were tested, 72% preferred the half of the experimental tank with low light intensity. This initial preference diminished when the animals were placed in normal light, but did not vanish completely even after 16 weeks. On the other hand, when black-spined urchins were maintained under reduced light, 20% of the urchins chose the dark side at first, but after 16 weeks 70% were found there.

PREDATORS OF THE QUEEN CONCH (STROMBUS GIGAS)

by
John E. Randall
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University of Puerto Rico
Mayaguez, P. R.

Predators of the queen conch are known in the following classes of animals: Gastropoda, Cephalopoda, Crustacea, Pisces and Reptilia.

Two gastropods, Fasciolaria tulipa and Murex pomum, have been observed feeding on freshly dead Strombus gigas in the Virgin Islands; however, only the former appears to be an actual predator. The muricids had not drilled the shells of the conchs on which they were feeding, and it is assumed that some other organism, probably microscopic, had previously killed the conchs. The Florida horse conch (Pleuroploca gigantea), which does not occur in the West Indian region, is also known to prey upon the queen conch.

The cephalopod Octopus vulgaris was once observed at night wrapped around a 110 mm. S. gigas, as if trying to cut off the oxygen supply. It is also possible that it could secrete a toxin into the small volume of water in which the conch was contained (as described by MacGintitie and MacGintitie, 1949 for octopuses preying upon crabs). A mutton snapper (Lutjanus analis) was speared in the Virgin Islands which had eaten both an octopus and an adult queen conch (with no shell). Since the snapper does not have the dentition to crush a conch shell nor any known mechanism to kill it, the fish probably obtained the conch after the predatory octopus had killed it and had eaten the octopus as well.

Several species of hermit crabs have been found occupying conch shells, and there is good evidence that at least one of them, the large Petrochirus diogenes, obtains a meal at the same time that it is given the opportunity for a new home. On four occasions this hermit crab has been observed attacking live Strombus gigas and on four other occasions it was seen feeding on dead conchs. Another crustacean predator of the conch is the spiny lobster (Panulirus argus). It nibbles the shell, ostensibly with mandibles, in a very characteristic way to expose the soft parts.

The remains of conchs have been found in the stomachs of 12 species of fishes. Six of these, the mutton snapper (Lutjanus analis), the dog snapper (Lutjanus jocu), the yellowtail snapper (Ocyurus chrysurus), the Nassau grouper (Epinephelus striatus) the graysby (Petrometopon cruentatum), and the white grunt (Haemulon plumieri) had eaten conchs of such a large size that it does not seem possible that they killed the mollusks themselves. Probably they took advantage of the efforts of other predators or disease organisms. A bluestriped grunt (Haemulon sciurus) was found with just the proboscis of a conch in its stomach. The other fishes, the spotted eagle ray (Aetobatis narinari), the permit (Trachinotus falcatus), the hogfish (Lachnolaimus maximus), the queen triggerfish (Balistes vetula), and the porcupinefish (Diodon hystrix) appeared to have fed directly upon conchs which they crushed with their jaws or pharyngeal teeth. None of the conchs eaten by the latter group of fishes were adults.

Two other fish predators of Strombus gigas were reported to the author by other observers. Jacques Durocher at Haiti stated that he has seen the southern stingray (Dasyatis americana) tear the foot off of adult queen conch. Stewart Springer of the U. S. Fish and Wildlife Service has found queen conchs in the stomachs of tiger sharks in the Florida Keys.

Some adult male queen conchs lose their verge to an unknown predator, perhaps a fish or a crab. Of 79 dived from the Berry Islands in the Bahamas, 33 had lost at least part of the verge. Twenty-eight of these conchs were regenerating the verge.

The queen conch is an important food item to the loggerhead turtle (Caretta caretta). The loggerhead seems to be the only animal capable of crushing adult conch shells.

(author's abstract)

TECHNIQUES FOR THE IN VITRO CULTURE OF CEPHALOPOD EMBRYOS

by
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One of the factors that has limited the experimental approach to cephalopod embryology has been the inability to grow these embryos outside of their chorion. Adult *Loligo pealii* were stimulated by the presence of an egg mass to lay eggs and the embryos were allowed to develop to stages of organ anlagen formation. The outer tunics of the egg strings were stripped off and the individual embryos in their chorions were teased free or the egg jelly dissolved in sea water at pH 5. The chorion was torn open in sterile sea water and the embryos transferred through several changes of sterile sea water. The desired manipulations were performed and the embryos were placed in a medium of equal parts of adult squid blood, sterile sea water, and 1/10 to 1/100 of that volume of an antibiotic stock solution. The antibiotic stock solution was made up of 100,000 units of Potassium penicillin G, 100 mg. of streptomycin sulfate, 10 mg. of sulfadiazine, and 10 mg. of phenol red added to 20 ml. of deionized water. This stock solution was passed through a millipore filter (HA) to sterilize it and remove the excess sulfadiazine. The embryos were cultured in glass dishes which were made in a brass press from Pyrex or kimax glass rod. The cultures were incubated at 18°C (± 1°) and observations were made twice daily. Usually the medium was changed every other day.

These techniques seemed quite adequate for the culture of *Loligo pealii*. The rate of growth remained normal and the histological appearance was normal. Individual whole organs, isolated tissues, and dissociated-reaggregated cells grew well. Using modifications of these techniques it has been possible to grow cells and tissues of adult animals and maintain these tissue cultures for several weeks. A further and more elaborate report will follow.

(author's abstract)

A STUDY OF THE GROWTH AND OTHER ASPECTS OF THE BIOLOGY OF THE WEST INDIAN TOPSHELL (CITTARIUM PICA)

by
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The West Indian topshell, Cittarium pica (=Livona pica), lives in and slightly below the intertidal zone on a rocky shore. It is herbivorous, feeding mainly upon filamentous algae. Twenty-three genera of algae, not counting diatoms, were identified among the stomach contents of 40 specimens (25 to 77 mm) from the Virgin Islands and Puerto Rico by Luis R. Almodóvar. Nine of these genera were blue-green algae, and blue-greens accounted for about 30 percent of the total stomach material of these specimens. A considerable amount of sand, spicules and shell fragments was also ingested.

Growth was studied at St. John, Virgin Islands by painting groups of topshells of similar size with brightly colored acetone-based paint and notching the lips. One group averaging 1.5 mm in length (from spire to most distant edge of aperture) grew at a rate of 1.06 mm per month up to a size of 8.2 mm. A second group, started at a mean length of 5.8 mm, increased in length at an average rate of 1.81 mm per month over a period of 16 1/2 months. Two groups of larger shells, one averaging 34 and the other 45 mm, grew at a rate of 1.45 mm per month. From these data the time required for a 1 mm shell to attain the maximum size of about 100 mm is estimated at 5 1/2 years.

Movements of marked shells were not extensive. The longest movement of the group which averaged 5.8 mm when first marked was 45 feet. The longest movement for the larger marked shells was 150 feet.

A large influx of small shells (about 1 mm) was noted in January. This was easily followed as a mode on length frequency graphs of successive monthly collections until June. The progression of this mode matches the growth rate determined from the marking of small shells.

The gastropod Purpura patula, three fishes (Diodon hystrix, Halichoeres radiata, and Epinephelus adscensionis) and the oyster catcher (Haemotopus ostralegus) are predators of Cittarium pica (the one individual of E. adscensionis, however, probably did not obtain its meal directly, but more likely stole it from another fish capable of crushing the topshell).

The limpet Acmaea leucopleura lives attached to the underside of Cittarium pica, and the crab Pinnotheres barbatus is commensal in the mantle cavity. The empty topshells are often used by the land hermit crab Coenobita clypeatus.

(author's abstract)

AN AIML CO-OPERATIVE STUDY OF THE PLANKTON ECOLOGY AND RELATED HYDROGRAPHY OF TROPICAL AND SUB-TROPICAL WATERS

(Progress report November, 1962 - November, 1963)

by

John B. Lewis, Barbados
David M. Steven, Jamaica
John R. Beers, Bermuda

Routine productivity and hydrographic studies have continued on a monthly basis at the Bellairs Research Institute in Barbados and the Port Royal Marine Station of the Department of Zoology at the University of the West Indies in Jamaica. The Bermuda Biological Station has continued its biweekly observations at a site approximately 15 miles S.E. of the islands in the Sargasso Sea. The contract period with the Office of Naval Research for these studies has been extended an additional year in order that a full two years of data can be obtained from each cooperating institution.

Additional water samples, plankton tows, and sediment samples are now being taken in Barbados for the determination of the strontium content.

Special studies undertaken this year include that of the salinity reduction which appears in the late spring or early summer in the waters of Barbados. Mean integrated values for winter salinities in the upper 25 meters were generally between 35.6 - 35.8‰. This fell off to a low of 33.8‰ in mid-June of 1962 and approximately 34.2‰ in early August of 1963. The low salinity water is found to the northeast (windward side of island) as well as off the west coast (leeward side). The salinity changes cannot be correlated with periods of heavy rainfall and run-off in the Barbados area. A definite inverse correlation between salinity level and silicate-silicon content of the waters has been found.

Correction: Ivan M. Goodbody was listed as one of the co-authors of the progress report of the cooperative productivity study given at the Fourth Meeting of the Association of Island Marine Laboratories in Curaçao. Although Dr. Goodbody presented the findings from Jamaica, Dr. David M. Steven should have been listed as the co-author.

COMPARISON OF UPWELLING NEAR THE COAST OF VENEZUELA WITH UPWELLING NEAR THE EQUATOR AND WEST OF SOUTH AMERICA

by
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In the Caribbean Sea, especially near the coast of eastern Venezuela, we have detected a remarkable degree of upwelling. The author has already reported on this phenomenon which he explained as a wind effect.

In accordance with the direction of the trade wind (constantly with an easterly direction) the transport of water by wind is directed towards the north. Then, water with a low temperature flows towards the surface as a compensatory reaction.

Also, an eastward counter current is present in this region. These phenomena are similar to those near the equator and to the west of South America.

(author's abstract)

EXPLORACION PESQUERA E HIDROGRAFIA
RELACION ENTRE AMBOS ESQUEMAS

por
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En el estudio hidrográfico previo a la exploración pesquera de la zona denominada MACCTE en el mar oriental venezolano ha sido detectada una area de surgencia de agua. Las características hidrográficas de esta zona, la distribución de nutrientes y el caracter atípico de las poblaciones fitoplanctónicas contrastan con las de las áreas circundantes, típicamente tropicales y de baja productividad.

Asimismo es analizada la distribución de pigmentos fotosintetizadores y la productividad primaria correspondiente.

Se concluye que la zona MACCTE es apta para soportar una población de clupeidos permanente y considerable.

(author's abstract)

NUEVAS ESPECIES DE PECES PARA VENEZUELA; COMPARACION ENTRE LA FAUNA ICTIOLOGICA DE VENEZUELA Y LA DEL NORTE DEL CARIBE

por
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Hasta el presente, se encuentran citadas para Venezuela 420 especies de peces marinos, de las cuales 17 son de distribución cosmopolita cincuntropical y 328 se encuentran citadas para la región de Florida. De las 75 restantes solamente 6 pueden considerarse endémicas mientras las otras 69 han sido citadas de las costas de las Guayanas y del norte del Brasil.

Entre las nuevas citas de peces para Venezuela merecen destacarse las siguientes: Aplatophis chauliodus Böhlke, especie de la que se conocen muy pocos ejemplares, Melanorhynus microps (Poey), Atherinidae, también con escasas citas en la literatura, Uroconger syringinus Ginsburg y Mustelus norrisi Springer que es considerada endémica de Florida.

En conjunto, la fauna del norte y el sur del Caribe es bastante similar, aunque se pueden señalar algunas diferencias notables. De 21 especies de Clupeidae citadas de las costas de Florida, solamente siete se encuentran en las costas de Venezuela, mientras que 6 entre las especies citadas de este país no tienen representación en el norte del Caribe. La diferencia más notable la hallamos en la familia Sciaenidae de la que hay 23 especies en la región de la Florida de las que sólo seis se encuentran también en las costas de Venezuela, mientras que no menos de 20 especies de este país no han sido citadas de la región de Florida.

Dejando aparte la fauna abisal, cuya exploración en Venezuela apenas está iniciada, se puede considerar que las mayores diferencias entre ambos extremos del Caribe, se encuentran entre los peces pelágicos costaneros como los Clupeidae y Engraulidae, y bentónicos costeros como los Sciaenidae. Algunos grupos como los Blenniidae, Clinidae y Gobiidae no han sido suficientemente estudiados en Venezuela para poder apuntar sus relaciones con los de la parte norte.

Trinidad y el Golfo de Paria parecen constituir una barrera en la distribución de algunas especies y así Dasyatis geijskesi e Isopisthus parvipinnis sumamente comunes y abundantes al sur de Trinidad no se encuentran en la costa norte de Venezuela.

(author's abstract)

AN AERIAL RECONNAISSANCE OF THE BAHAMA ISLANDS

by
Robert F. Mathewson, Director
Lerner Marine Laboratory
Bimini, Bahamas

On October 25, 1963 an aerial reconnaissance of the major parts of the Bahamas was made. In a chartered amphibious aircraft a party of scientists from this laboratory, along with the Governor of the Bahamas, Sir Robert Stapleton and his scientific advisor, Mr. Oris Russell, spent a few days taking notes and photographs of this island complex. By flying low over critical areas and landing frequently we were able to gain a general impression of the land and shallow bank topography. Special attention was given to remote areas, from which such information would not be normally available.

A few photographic slides were culled from the more than 700 photographs taken and were presented to the members of the Association of Island Marine Laboratories at this meeting. The total complement of pictures will be used as reference material for the long range surface biological survey which will study the marine environment of the Bahamas and its associated biota, starting March 1964.

Information regarding this survey can he had by writing to R. F. Mathewson, Lerner Marine Laboratory, 1211 Dupont Building, Miami 32, Florida.

(author's abstract)

Financial Report

The Bylaws of the Association were submitted to the assembly during the Second Meeting of the Association in Bermuda on September 17-21, 1958. It was not until February 1959 that dues were received by the Secretary-Treasurer.

This report covers the period between Feb. 1959 to Nov. 1963.

Money received by the Association	$1,039.00
Expenditures	
printing of reports	220.50
group photographs at Curacao	9.50
bank service charge	7.50
secretarial services	50.00
postage, cables, stationery	136.47
Total expenditures	423.97
Balance	$615.03

Participants in Fifth Meeting of the Association of Island Marine Laboratories of the Caribbean at Bimini. Standing (left to right): Dr. John M. Arnold, Mrs. Arnold, Mrs. Mathewson, Dr. Ingvar Kristensen, Dr. Fred Mackensie, Mrs. G. L. Warmke, Dr. Raymond B. Manning, Dr. Carlos M. Vilar Alvarez, Mr. William C. Cummings, Dr. Fernando Cervigón, Dr. James Bohlke, Dr. Peter W. Glynn, Dr. John E. Randall, Dr. Anthony J. Provenzano, Jr., Dr. John R. Beers, Mrs. Lenore Tate, and Dr. Ivan M. Goodbody. Seated or kneeling (left to right): Dr. Walter H. Hodge, Dr. Juan A. Rivero, Dr. Samuel F. Clark, Dr. John B. Lewis, and Dr. Jack T. Spencer. In circular inset above: Dr. Robert F. Mathewson of the Lerner Marine Laboratory and newly elected president of the Association of Island Marine Laboratories of the Caribbean.