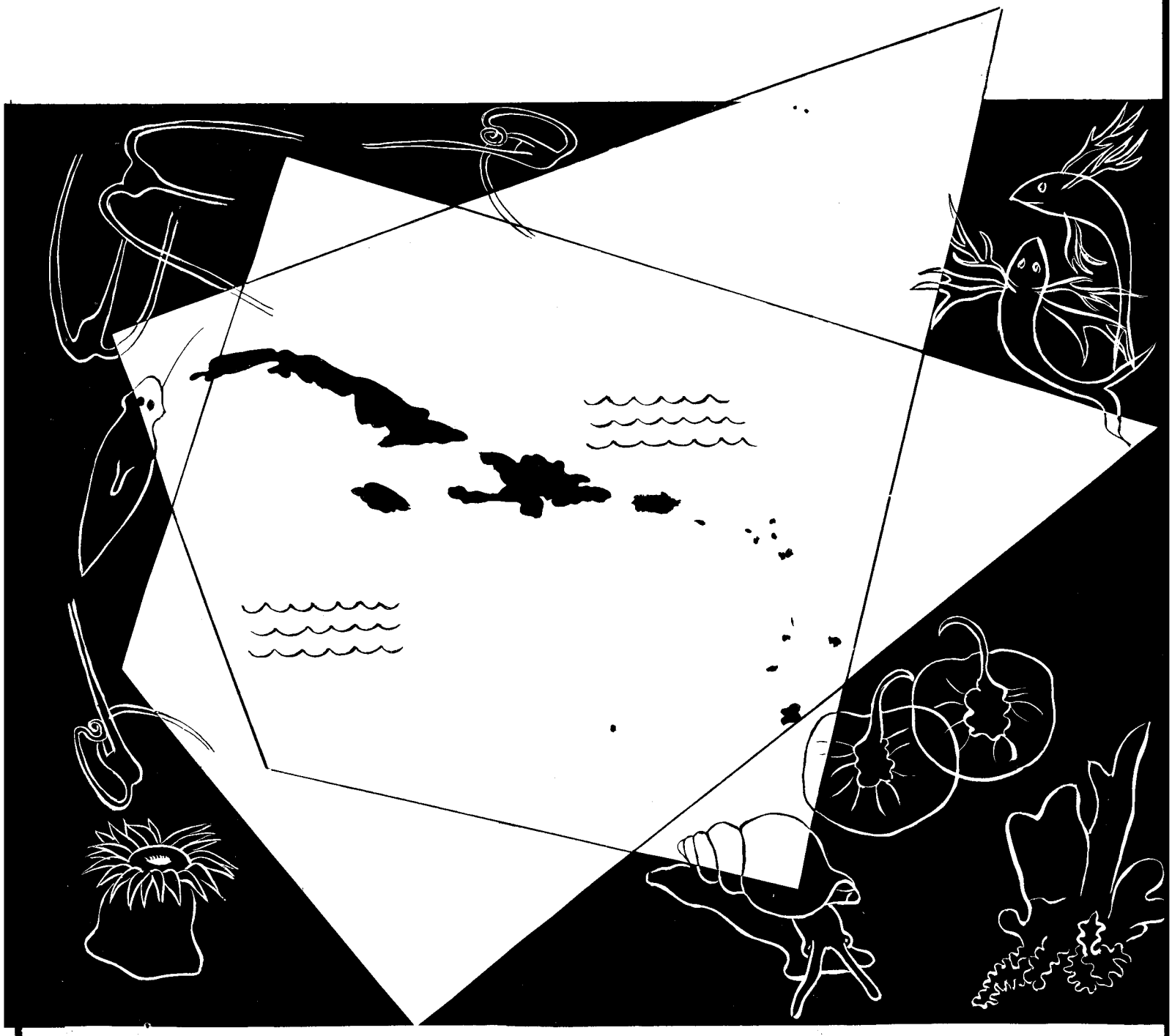
Ray Waldner

ASSOCIATION OF ISLAND MARINE LABORATORIES

Third Meeting



UNIVERSITY COLLEGE OF THE WEST INDIES

JAMAICA, B. W. I.

April 12 - 14, 1960

ASSOCIATION OF ISLAND MARINE LABORATORIES

THIRD MEETING

University College of the West Indies
Mona, St. Andrew, Jamaica, B. W. I.

The Port Royal marine laboratory of the University College of the West Indies in Jamaica was host to the Association of Island Marine Laboratories April 12th. to the 14th. 1960, when representatives of marine laboratories of the Southwest North Atlantic, West Gulf of Mexico and Caribbean Area assembled for this year's meeting. The meetings enjoyed the sponsorship of the Administration of the University College of the West Indies. Official representatives, accompanying participants from laboratory members, and guests from other laboratories were as follows:

BERMUDA BIOLOGICAL STATION, St. George's West, Bermuda B. W. I., Dr. William H. Sutcliffe, Jr., Director and Dr. David W. Menzel, Assistant to the Director.

INSTITUTE OF MARINE BIOLOGY, University of Puerto Rico, Mayaguez, Puerto Rico, Dr. Juan A. Rivero, Director and Juan Gerardo González, Research Assistant.

UNIVERSITY COLLEGE OF THE WEST INDIES, Mona, St. Andrew, Jamaica, B. W. I., Dr. David M. Steven, Professor of Zoology and Director of the marine laboratory at Port Royal; Dr. Ivan M. Goodbody from the Zoology Department; Mr. Garth Underwood, Senior Lecturer in the Department of Zoology; Dr. June New, Lecturer in the Department of Botany; Dr. Thomas F. Goreau, Senior Lecturer in Physiology; Mr. George Hechtel, Demonstrator in the Department of Zoology; Mr. D. Kettle, Principal Scientific Officer of the Jamaican Government's research project on sandflies.

LERNER MARINE LABORATORY, 1112 Dupont Building, Miami 32, Florida, Dr. Henry Kritsler, Director.

ESTACION DE INVESTIGACIONES MARINAS DE ISLA MARGARITA, Fundación La Salle de Ciencias Naturales, Apartado 681, Caracas, Venezuela, Dr. Robert Menzies, Director and Donald J. Robinson, Research Assistant in marine biology.

Attending by invitation, were: Dr. Jorge Carranza, Director of the marine station of the Instituto de Veracruz, Mexico, who gave an account of their activities at the newly established marine laboratory and their plans for the future; and Dr. John E. Randall from St. John, Virgin Islands who gave two papers on recent work he has conducted there. Dr. V. A. Zans, Director Geological Survey, Jamaica, who presented a paper on Jamaican coral reefs. Also, he was most kind in showing the visitors the Geological Survey Department of Jamaica.

All participants were greatly pleased with the success of the meetings. This was in good part attributable to the exhaustive cooperation of the following persons and organizations: Dr. David M. Steven, Professor of Zoology and director of the Port Royal Marine Laboratory, who, in spite of being extremely busy at his office, was highly efficient in respect to reservations of the conferees; he and Mrs. Steven, graciously extended a warm welcome and entertainment at their home. Dr. Hugh Springer, Acting Principal of the University College of the West Indies, and the Administration of the University whose generosity made the meetings possible. Dr. Thomas F. Goreau, besides lodging one of the participants at his home, contributed with transportation in campus and to distant points in Jamaica, a task he shared with Dr. Ivan Goodbody and Dr. Garth Underwood who were most cooperative. Mrs. M. Cooper of the Senior Common Room and Miss C. Stultz, Secretary of the Zoology Department were helpful in many ways.

All conferees were more than grateful for the warm hospitality and hearty welcome given to them. They will always remember with gratitude the cordial reception given in the Senior Common Room by the Administration of the University College. Thus, once more, all derived high satisfaction in discussion of problems in their respective fields and in establishing new personal relations.

PROGRAM

TUESDAY, 12 APRIL

All sessions were held in the lecture theatre of the Department of Physiology

Morning Session, 9:00 A. M.

Chairman : Professor David M. Steven

Address of welcome by the Acting Principal of the University College of the West Indies, Dr. Hugh Springer.

Reply by the President of the Association of Island Marine Laboratories, Dr. Juan A. Rivero.

Presentation of Papers

GOODBODY, IVAN M., The development of a sessile marine community. (Abstract appended)

MENZEL, DAVID, The relation between dissolved nutrients and primary production in the Sargasso Sea. (Abstract appended)

GOREAU, THOMAS F., E. L. Más, V. Torres Llauger, and E. R. Ramos Seda, On the community structure, standing crop and oxygen balance of the lagoon at Cayo Turrumote. (Abstract appended)

Afternoon Session, 2:30 P. M. to 4:30 P. M.

Chairman: Dr. Thomas F. Goreau

GONZALEZ, JUAN GERARDO, Ecology of the microscopic Thalassia community. (Abstract appended)

KRITZLER, HENRY, Conditioning experiments in sharks. (Abstract appended)

GOODBODY, IVAN M., The feeding mechanism of Mellita sexiesperforata. (Abstract appended)

NEW, JUNE, Variation in Caulerpa racemosa. (Abstract appended)

HECHTEL , G., Studies on the sponge fauna of Port Royal area. (Abstract appended)

WEDNESDAY, 13 APRIL

Morning Session, 8:30 A. M.

Chairman: Dr. Juan A. Rivero

ZANS, V. A., Structural features of recent coral reefs. (Abstract appended)

GOREAU, THOMAS F., On the physiological ecology of the coral Meandrina braziliensis (Milne-Edwards and Haime) in Jamaica. (Abstract appended)

RANDALL, JOHN E., A technique in fish photography.

MENZIES, ROBERT and C. Beckman, The relationship of reproductive temperature and geographic range of the wood borer, Limnoria tripunctata.

RANDALL, JOHN E., Grazing effect of parrotfishes (Sparrisoma spp.) on sea grasses (Cymodocea and Thalassia) in the Virgin Islands.

Afternoon, 2:30 P. M. to 5:00 P. M.

Excursion to the marine laboratory of the University College of the West Indies at Port Royal.

Evening, 8:00 P. M. to 11:00 P. M.

(Business Meeting)

THURSDAY, 14 APRIL

Morning Session, 8:30 A. M.

Chairman: Dr. William H. Sutcliffe, Jr.

COKER, R. E. and Juan Gerardo González, Some observations of copepod populations of bays on the southwest coast of Puerto Rico. (Abstract appended)

ROBINSON, DONALD, Recent collection and study of abyssal isopod crustacea. (Abstract appended)

CARRANZA, JORGE, The marine laboratory at Veracruz, Mexico. (Abstract appended)

KETTLE, D., Biting habits of Jamaican sandflies. (Abstract appended)

UNDERWOOD, G., Dispersal and differentiation of terrestrial faunas in the Caribbean. (Abstract appended)

Afternoon, 2:30 P. M. to 5:00 P. M.

Visits to the Institute of Jamaica, and Hope Gardens.

Evening, 6:30 P. M. to 11:00 P. M.

At 6:30 P. M. Drs. John E. Randall, Thomas F. Goreau, and D. M. Owen were very kind in showing films of underwater and other researches they are carrying on.

At 8:30, following the showing of films, the U.C.W.I. gave a complementary dinner in the Senior Common Room.

Although this was the last day of meetings, those who stayed enjoyed the cordial invitation of Drs. David M. Steven, Thomas Goreau, and Garth Underwood to take educative trips to the North Coast and the Blue Mountains. All who went were excited with these pleasing trips.

THE DEVELOPMENT OF A SESSILE MARINE COMMUNITY

By

Ivan M. Goodbody
University College of the West Indies
Mona, St. Andrew, Jamaica, B. W. I.

At Port Royal, Jamaica, panels of "Tuffnol" have been immersed in the sea continuously from August 1957 to April 1960 and a photographic record has been kept showing the development and changes in the sessile community through all stages from primary colonization to a climax community. Balanoids, serpulids, didemnid ascidians and the solitary ascidian, Ascidia nigra, are the principal primary colonizers. Actinians, ophiurans, sponges and pyurid and styelid ascidians appear after 3 to 4 months and dominate the panel after 12 months. Ascidia nigra has died off by 20 months and the climax community is dominated by actinians and sponges with some ophiurans.

Cleaned panels immersed in close proximity to a climax sponge-actinian community did not develop a normal primary community. Other panels 15 feet away during the same period developed a normal balanoid-didemnid community. It is suggested that the sponges either inhibit settlement of other organisms in their vicinity or prevent them from developing when they have settled. Further work on this is in progress.

(Author's Abstract)

THE RELATION BETWEEN DISSOLVED NUTRIENTS AND PRIMARY PRODUCTION IN THE SARGASSO SEA

By

David Menzel

Bermuda Biological Station
St. George's West, Bermuda, B. W. I.

During the past three years an intensive study of primary production and nitrogen and phosphorus cycles has been carried out in the Sargasso Sea off Bermuda. Unlike the situation in temperate seas, the instantaneous concentration of these nutrients appear to have no relation to the rate of plant growth. This fact may be explained in one of two ways: (1) the rate of recycling determines the availability of nitrogen and phosphorus in semi-tropical waters - this may never be reflected by changes in their concentration in situ since they may be utilized by the plants as rapidly as they are made available; or (2) nitrogen and/or phosphorus are not limiting to plant growth.

This latter possibility was tested by the method of direct enrichment of sea water with complete culture media, followed by the systematic elimination of one element at a time from the media. Preliminary experiments indicated that one or another of the trace metals was critical to plant reproduction. This was subsequently found to be iron.

The hypothesis that iron limits plant production in tropical waters in general was substantiated by further enrichment experiments conducted on board the R. V. "Crawford" in sections from Bermuda to the West Indies.

(Author's Abstract)

ON THE COMMUNITY STRUCTURE, STANDING CROP AND OXYGEN BALANCE OF THE LAGOON AT CAYO TURRUMOTE

By

Thomas F. Goreau
University College of the West Indies
Mona, St. Andrew, Jamaica, B. W. I.

Elba L. Mas
Department of Biology
University of Puerto Rico
Río Piedras, Puerto Rico

V. Torres Llauger
Agricultural and Mechanical College
Mayaguez, Puerto Rico

Edgard Ramos Seda
Agricultural and Mechanical College
Mayaguez, Puerto Rico

A study of the lagoon communities, standing crop and oxygen exchange was carried out on Cayo Turrumote, a coral cay situated 6 miles south of La Parguera, P. R. The island is ca. 450 metres long and 100 metres wide, the major axis running S.E. by N.W. The centre is occupied by a shallow lagoon which is almost completely surrounded by a coral reef. Water from the outside comes into the lagoon over the shallow eastern coral rampart and is discharged over the reefs on the western "tail" of the island. Circulation depends mostly on the wind impulse and less on tides. Turbulent mixing of water in the lagoon appears to be complete except for a narrow inshore belt on the S.W. margin of the lagoon where the water temperature may rise above 34°C during mid afternoon.

About two-thirds of the total lagoon area is covered by a dense growth of coral, anemones, algae and zoanthids. These communities are raised approximately 50 cm off the sandy bottom of the lagoon, and their depth varies between 0.3 and 1.5 metres. The sandy patches are usually deeper, and have a scattered coral and gorgonian fauna. The southern side of the lagoon is guarded by a long shingle rampart which has been colonised in parts by Laguncularia, Avicennia, Rhizophora, Sesuvium and Portulaca. The shallow reefs enclosing the lagoon are predominantly built up of Acropora palmata and Millepora complanata which are awash at low tide. The major lagoon sand producers appear to be Halimeda and corals.

The dominant faunal and floral components of the lagoon communities were sampled to establish total biomass as gm C/m^2, total protein as gm N/m^2 and total chlorophyll a in gm/m^2. The diurnal oxygen exchanges were observed at 3 hourly

intervals between 1 and 3 August 1959 at two stations within the lagoon and one outside on the eastern, windward, end of the island. The total oxygen balance was calculated in terms of the rate of change of O_2 per cm of reef per sec. with respect to the O_2 concentration on the outside. In the daytime, the lagoon organisms produced O_2 by photosynthesis; at night, O_2 was consumed by respiration. The total balance was in favour of consumption, i.e. the lagoon communities appeared to utilise approximately 50% more O_2 than they produced. This implies that the large standing crop of the lagoon can maintain itself only at the expense of suitable food brought in from the outside. We consider it probable that the plankton coming into the lagoon supplies only a part of the deficit. An additional source of food to the lagoon may be the huge schools of Jenkinsia lamprotaenia, a small clupeoid fish which congregates in enormous numbers in the lagoon between June and November. The biomass of these fish is unknown, but their presence attracts flocks of pelicans and terns, as well as large schools of jacks. The sea anemone Stoichactis helianthus, one of the most important sessile faunal components of this lagoon, was observed to capture large numbers of Jenkinsia with its tentacles. It appears probable that Jenkinsia, a plankton feeding fish, serves to concentrate the productivity of a large volume of seawater into the relatively small volume of Turrumote lagoon, thus making possible the maintenance of a predominantly consumer type of bio-economy.

(T. F. G.)

ECOLOGY OF THE MICROSCOPIC THALASSIA COMMUNITY *

By

Juan Gerardo González
Institute of Marine Biology
University of Puerto Rico

Thalassia, the turtle grass, is a common feature of the shallow embayments and channels of La Parguera, Puerto Rico. Observations are being made in the Canal de Magueyes.

Organisms that live associated with the meshes formed by tangled algae and decomposing Thalassia leaves show very interesting adaptations. Among these we find size, modifications of the appendages, and slow rhythmic movements while swimming. Apparently larger animals cannot thrive well among the intricate meshes of algae and Thalassia leaves.

It is thought that further studies of the microorganisms found associated with the turtle grass will reveal interesting adaptations to this sort of environment.

(Author's Abstract)

* Dr. Thomas E. Bowman, Associate Curator of Marine Invertebrates, of the U. S. National Museum, is very interested in this problem and has a colaborated in its study.

CONDITIONING EXPERIMENTS IN SHARKS

By

Henry Kritzler and Langley Wood
Lerner Marine Laboratory
Bimini, Bahamas

A facility for the study of orientation, behavior, and sensory physiology of sharks and other large fishes, newly established at the Lerner Marine Laboratory, was described.

In a study being conducted by the authors, bull sharks, Carcharhinus leucas, were conditioned to associate food with water - borne noises emitted by an auto horn and by lengths of pipe struck with a hammer. The former was characterized by a high intensity peak at 610 cps and lower amplitudes between 100 and 10,000 cps. Peak intensities of the latter occurred at 1700 and 2160 cps. An instrumental conditioned response consisting of grasping with the jaws a floating wooden bar was then elicited as a means of unequivocally demonstrating reception of the stimulus. While this phase of the study was in progress, a spontaneous response consisting of positive orientation and rapid swimming toward the source of sound before approaching the target was noticed. Instrumental conditioning was abandoned when it was concluded that this orientation response constituted sufficient evidence of reception of oscillator signals of varying frequency, intensity and duration.

(Author's Abstract)

THE FEEDING MECHANISM IN MELLITA SEXIESPERFORATA

By

Ivan M. Goodbody
University College of the West Indies
Mona, St. Andrew, B. W. I.

On the aboral surface of Mellita sexiesperforata there are two types of spine: club-shaped spines and miliary spines, both of them densely ciliated on the stem. On the oral surface there are stout ambulatory spines in the inter-ambulacral areas and smaller thinner spines in the ambulacral areas: only the latter have cilia. Also on the oral surface there are broad food tracts leading from the margins of the lunules to the ambulacral or food grooves. A feeding animal ploughing through the sand pushes sand on to the aboral surface where it is sorted by the club-shaped spines. Large particles are carried backwards off the animal, small particles and detritus fall between the spines. Ciliary currents around the bases of the spines carry the fine particles towards the margins or to the lunules where they pass around to the oral surface. On the oral surface they are carried along the food tracts and into the food grooves by more ciliary currents: in the ambulacral grooves the food mass is carried to the mouth by podia. A thin secretion of mucus is probably produced by the miliary spines which sticks food particles together very loosely when in the ambulacral grooves. Podia are not used for locomotion but assist in food gathering. During defecation the feeding mechanism is stopped.

(Author's Abstract)

VARIATION IN CAULERPA RACEMOSA (Forsk) W - v B

By

June New

University College of the West Indies

Mona, St. Andrew, Jamaica, B. W. I.

There is a large amount of variation in this species and I have made some attempts to determine how much of this variation is genetically, how much is environmentally produced, and how much is an effect of age.

1) Genetical variation. An extensive population study of Jamaican material has shown that only 2 varieties (var. occidentalis (J. Ag.) Borgs. and var clavifera (Turner) W-v B.) can be said with certainty to have a genetic basis. They are frequently found growing together in the same habitat, they are never united on one plant, and they both retain their characteristics when transplanted to different habitats.

2) Effect of reduced light intensity. When var. occidentalis is transplanted to conditions where the L. I. is reduced to 1/5 daylight, the new shoots have far fewer ramuli per cm. and the ramuli are almost cylindrical and distichously arranged. This exactly fits the description of var. Lamourouxii (Turner) W-v B. which is found in deep water. When the light intensity is reduced to 1/10 daylight, the ramuli proliferate. At light intensities of 1/4 and 1/2 daylight there is no marked effect on the form, though the shoots may be longer than normal.

3) Juvenile forms. From observations of recolonization over a period of 4 months there is strong evidence that C. fastigiata (Mont.) and C. peltata (Turn.) Lam. are juvenile forms of C. racemosa.

(Author's Abstract)

STUDIES ON THE SPONGE FAUNA OF PORT ROYAL AREA

By

G. Hechtel

University College of the West Indies

Mona, St. Andrew, Jamaica, B. W. I.

Caribbean sponges require further study. A taxonomic and ecological survey of Jamaican sponges is now being carried out. Each of several habitats near Port Royal has a distinct sponge fauna. Coral reefs, harbor installations, mangroves and even turtle grass leaves serve as substrata for sponges. The taxonomy of the local faunas and general problems of sponge systematics were discussed.

(Author's Abstract)

THE DISTRIBUTION AND STRUCTURAL FEATURES OF RECENT CORAL REEFS OF JAMAICA

By

V. A. Zans *
University College of the West Indies
Mona, St. Andrew, Jamaica, B. W. I.

The recent coral reefs of Jamaica may be classified into two broad groups:

1. The more or less continous, linear fringing reefs or small barriers separated from the coast by a rather narrow moat or lagoon rarely exceeding a few hundred yards in width. This type is developed mainly along the north coast of the Island, though it is also found along certain sections of the southwestern and south-eastern coasts. These reefs vary widely in their morphology and structure and a number of sub-types can be distinguished.

2. Irregular, arcuate, semi-circular or circular patchy reefs, characteristic of the sub-marine bank extending several miles off the south coast of the Island. Off Port Royal and in the Portland Bight these patchy structures are encountered in various successive stages of their development and are usually associated with cays or small coralline islands rising several feet above the main sea level. An advanced stage of this type of reef development is a miniature atoll, morphologically closely resembling the oceanic atolls but much smaller in size and encircling only a very shallow lagoon or a lowlying circular mangrove cay (Salt Island, Pigeon Island).

The principal morphological and environmental zones typical of these reefs are given in the following paragraph. (The distribution of these reefs is shown on the recently published Geological Map of Jamaica (scale 1:250,000).

1. Moat or Lagoon, separating the reef barrier from the coast; 2. Reef Flat, the oldest and most mature landward part of the reef on the lee of the reef crest rising close to the low tide level. The reef crest is usually indicated by "negro heads" or boulder ramparts; 3. Reef Crown or A. palmata - zone, the most rugged cavernous labyrinthic region of the reef extending from the reef crest seawards to a depth of about 24 feet; 4. Outer Slope, characterised by buttress-chute development on steep declivities, the buttresses being built up mainly by Montastrea annularis, Agaricia spp. and other massive corals; 5. Talus or Detritus Belt, consisting of fan-shaped detrital deposits spreading outwards from the mouths of

the principal chutes and often merging laterally into a continous apron of detritus sloping seaward and away from the reef. The detritus belt is practically free from coral growth and lies usually below a depth of 40 feet, or sometimes as deep as 50 to 60 feet; 6. The Fore-reef and the Sea Floor outside the Reef, a rather scattered irregular development of coral growth beyond the talus belt, forming tongue-like patches mainly of A. cervicornis at depths exceeding 50 to 60 ft. The rather delicate branching A. cervicornis together with Madracis asperula appears to be the vanguard of the continous closed coral growth in Jamaican coastal waters.

* Director Geological Survey Department, Jamaica, B. W. I.

(Author's Abstract)

ON THE PHYSIOLOGICAL ECOLOGY OF THE CORAL MEANDRINA BRASILIENSIS (Milne-Edwards and Haime) IN JAMAICA

By

Thomas F. Goreau
University College of the West Indies
Mona, St. Andrew, Jamaica, B. W. I.

and

New York Zoological Society

Meandrina braziliensis (E. & H.) is one of the few corals of the Brazilian reef tract which is also found in the Caribbean coral sea. Although this coral may be classified as a reef builder since it contains zooxanthellae, in its habitat it does not generally associate with other true reef building corals, as it prefers silty or muddy bottom in more or less sheltered places where it does not compete for space and light with other hermatypic scleractinia.

In Jamaica, the first specimens were dredged from 10 fathoms on the broad shelf area south of Black River in 1957 by H. M. S. Vidal and positively identified by the writer. More recently, it has been found during free diving operations in the area south of Maiden Cay at about 75 feet depth, and near Cow Bay, Southern St. Thomas Parish, at between 50 and 150 feet depth, where it is the only coral, occurring in large numbers. The present study on M. braziliensis was conducted entirely at Cow Bay. Here the sea bottom slopes away rapidly from just below sea level to a depth of about 100 fathoms at an average angle of about 30°. This slope represents the outer edge of a large alluvial fan deposited at the angle of repose of the coarse gravel brought to the sea by the Yallahs River one mile to the East. Except for depth and light intensity, this steep slope is a continuous and uniform environment below a depth of about 25 feet where wave action ceases to be a factor. We have now investigated this slope with aqua-lungs to a depth of about 220 feet. M. braziliensis is confined to a zone lying between the 50 and 150 feet contours, the largest numbers occurring at a depth of about 100 feet. Smaller individuals are invariably attached by a slender pedicel to rounded gravel stones. Larger ones are sometimes attached, but often are also found free, floating as it were, in the organic ooze which coats the surface of the alluvial gravel to a depth of about 1.5 inches. Colonies ranging in dry weight between 0.5 and 65 grams have so far been collected. The colour of the specimens is nearly always light yellowish brown, the chlorophyll content varying from about 3 to 13 μg Chl a/mg N. The chlorophyll a content of a series of specimens collected between

110 and 130 feet was significantly higher than that of specimens collected from between 65 and 75 feet. This chlorophyll must be derived mostly from zooxanthellae since boring algae are almost completely absent.

In the upper part of its range, down to about 75 feet, M. braziliensis is associated with a large Halimeda sp. , but at depths below this, there are only isolated patches of filamentous algae, worms, bivalves of the genus Spondylus, sponges and whip gorgonia. Elsewhere, M. braziliensis is sometimes found in beds of deep Thalassia and/ or Cymodocea.

We have investigated the respiration rate and photosynthesis in a number of individuals of M. braziliensis. These experiments were carried out at a depth of about 110 feet which is very near the zone on which the largest number are found. In total darkness, respiration was about 1.2 μl O_2/mg N/hr. In the light, this was reduced to 1.0 μl O_2/mg. N/hr. Thus, at the prevailing light intensities, the zooxanthellae must have produced only about 0.2 μl O_2/ mg N/hr, and it is apparent that under these conditions there is much more O_2 consumed by respiration than is produced by photosynthesis. This implies that M. braziliensis can live below the depth of compensation of its zooxanthellae, and that these commensal algae must therefore lead a partially heterotrophic existence in the tissues of the scleractinian host.

The total nitrogen, i.e. protein, was directly and linearly related to the total dry weight, i. e. size, of the colonies. The slope of the regression line was about 0.8. Since nearly all tissue in the scleractinian corals is located outside the skeletal mass, the total amount must bear some relationship to the surface area. Our data shows that the surface area of M. braziliensis varies in direct proportion to the skeletal mass. A similar relationship has been found in the coral Manicina areolata. The great increase in surface area in relation to size and mass in M. braziliensis appears to be an adaptation for life on muddy unstable substrates where there is a premium on the ability of the coral to clear itself of sediment, and to prevent itself from sinking into the mud. This is achieved by keeping the dead mass of the skeleton relatively constant in relation to the area covered by living tissue this being brought about by the ever increasing complexity of the surface convolutions which gradually change the appearance of the coral from a simple cup shape when young to one resembling a brain when older.

From its distribution, it is evident that M. braziliensis has been able to escape the isolating tendency of the Amazon and Orinoco Rivers. This may be due to its preference for deeper water and muddy bottom. The fresh water outflow of these large rivers is believed to have isolated the reefs of northern Brazil from the rest of the Western Atlantic coral populations since at least Pliocene time, this resulting in the formation of a distinct local coral fauna which contains mostly species not found in the Caribbean reefs, but which are nevertheless closely related generically.

(Author's Abstract)

THE RELATIONSHIP OF REPRODUCTIVE TEMPERATURE AND GEOGRAPHIC RANGE OF THE WOOD BORER LIMNORIA TRIPUNCTATA

By

Carolyn Beckman and Robert Menzies
(Presented by Robert Menzies)
Laboratorio de Investigaciones Marinas
Fundación La Salle, Caracas, Venezuela

The growth and development of populations of Limnoria tripunctata Menzies, cultured under reasonably controlled laboratory conditions were found to coincide very well with the known geographic distribution of the species. Field data showed that when environmental temperatures favorable for population growth persisted for at least 4 consecutive months of the year the species was present. The optimum temperature for growth or survival was less important than simply tollerable temperatures required for positive growth of populations.

(Author's Abstract)

GRAZING EFFECT OF PARROTFISHES (SPARRISOMA SPP.) ON SEA GRASSES (CYMODOCEA AND THALASSIA) IN THE VIRGIN ISLANDS

By

John E. Randall
V. I. National Park, Cruz, Bay, St. John
U. S. Virgin Islands

Marine Laboratory, University of Miami (stationed at St. John, Virgin Islands)

Since November, 1958, the Marine Laboratory of the University of Miami has been conducting a marine biological survey of St. John, Virgin Islands. Among the projects being carried out is the charting of the major marine environments from the shore to the 10 fathom curve. The charting has been facilitated by the use of serial photographs. One rather persistent bottom feature, a band of sand between inshore coral and rock areas and offshore beds of turtle grass (Thalassia) and manatee grass (Cymodocea), shows on the photographs as a pale line. This line has served to delimit coral areas from sea grass which, if contiguous, would be difficult to distinguish on black-and-white photographs.

Initially, it was presumed that the sea grasses did not grow across this sand zone to the coral because of physical reasons. It was thought that the sand region would be sloping and that the sediment contained therein would be of coarser, shifting material, as a result of wave action on fringing reef. Later it was noticed that the band of sand occurred in well protected bays as well as off exposed promontories where wave action is heavier (surf, however, is not strong anywhere on St. John except during rare storms because of protection afforded by other Virgin Islands nearby). When the sand band was examined at various localities, it was found that there usually was no significant slope. Furthermore, samples of sand taken across the zone from coral to grass failed to demonstrate any difference in particle size.

The sand band shows no evidence of being an erosion effect. When a grass bed is eroded by strong current or wave action, the demarkation between grass and sand is abrupt, frequently with the level of the grass higher than the sand and with roots exposed. The sand band generally exhibits a zone of transition of several feet of sparse growth of sea grass.

A possibility that the sea grass might be grazed by certain reef fishes was investigated. Reef fishes are tied to coral and rock for shelter from predaceous

forms like the barracuda and amberjack. If they were to feed on sea grass, they would not leave their hiding places in the reef very far; thus their grazing effect would be concentrated in a region close to the reef.

Knowledge of the food habits of Virgin Islands fishes from stomach content analyses did not show much promise of success. Only the halfbeak Hemiramphus brasiliensis was noted to feed on sea grass. This surface-dwelling species was observed to ingest detached floating fragments of Cymodocea. The gut contents of parrotfishes, however, was never carefully analyzed. Plant material taken in by these fishes is ground in their pharyngeal mill with bits of dead coral and sediment to the extent that identification is difficult.

Two square feet of sea grass was dug with a shovel from a mixed bed of Cymodocea and Thalassia and carried to the edge of a reef located at a depth of 40 feet. Before the transplantation was completed, at least six adult parrotfishes (mostly Sparisoma rubripinne) began feeding on it. Twenty-four hours later two parrotfishes were seen nibbling the last vestiges of blades of Thalassia.

Some time ago a corridor of grass one foot wide was transplanted across the band where the width was 20 feet. After two days the grass was eaten 5 1/2 feet away from the reef. This experiment is continuing.

Recently an artificial reef of concrete block was constructed in a luxuriant bed of sea grass off Lameshur Bay, St. John. It is expected that the grazing effect of parrotfishes that should ultimately colonize this reef will result in removal of sea grass and creation of a band of sand around the reef.

(Author's Abstract)

SOME OBSERVATIONS OF COPEPOD POPULATIONS OF BAYS ON THE SOUTHWEST COAST OF PUERTO RICO

By
R. E. Coker and Juan Gerardo González
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Bi-monthly collections of plankton and certain hydrographic conditions were made at six stations in the region of La Parguera, Puerto Rico, beginning November, 1958.

Surface and deep hauls were taken at Bahía Fosforescente, Montalva Bay, Offshore (in deeper parts of the reef area, about a mile southward of the two bays) and Monsio José Bay, and surface or oblique hauls in the shallower Posa de Don Eulalio and Canal de Magueyes. The first three stations are referred to here in as the "eastern stations" and the others as the "western stations".

Counts for copepods and groups of other zooplankters were expressed as percentages.

With respect to the eastern stations, copepods were regularly predominant among multicellular zooplankters. As might have been expected, diversity of copepod species and multicellular zooplankters in general was greatest at the offshore station and least in the Fosforescente. In the last mentioned bay, only four species of copepods amounted, to as much as one percent (by number) of the total zooplankton count: Oithona minuta, Acartia tonsa, Paracalanus crassirostris, and O. simplex in that order.

At the other stations, about twice as many species of copepods appeared in the counts to the extent of as much as one percent or more (eight in Montalva, seven offshore) of the zooplankters. At all stations, a substantial number of species was encountered in small numbers, although only a few made up the bulk of the copepod populations of daytime collections in the open waters. It was the smaller species that predominated in Fosforescente.

No work has been conducted with copepods from bottom sediments or extreme littoral habitats. Collections considered here are from daytime hauls. However, when night collections were subjected to counts, these revealed little differences from the day collections, except for two copepods, Pseudodiaptomus sp. and Longipedia sp., which seem to come out at night from the Thalassia or the bottom near the shore.

Seasonal cycles of abundance were not apparent, except, as it seemed, for two species, Oithona simplex, common at all stations, but least so in Fosforescente, and Euterpina acutifrons, never abundant anywhere but fifth in rank in the bays and sixth offshore. It seems quite possible, however, that the cycles in these cases may be attributable to causes other than physiological cycles. It may be said that the population showed a notable degree of stability throughout the year, with four species constituting the bulk of the population at practically all times.

The small sizes of three copepods is notworthy. This condition of dominance by a few species could be attributable, either to two alternate assumptions - perhaps, it would be better said, by two complementary assumptions: one is that the bay offers highly favorable conditions for survival and multiplication of just four species; the other is that these copepods find ordinarily favorable conditions in the bay, but thrive greatly because conditions in the bay are unfavorable to other common species of the region.

Just the same four species of copepods dominated in both Monsio José and Fosforescente. Both bays seem to act "selectively" on the many available species between the bays.

Montalva and Don Eulalio both fairly open to the outside or reef are (Don Eulalio less so), gave, not surprisingly,about the same picture, particularly as to O. minuta, O. nana, A. tonsa and P. crassirostris.

Western stations showed lesser number of Euterpina and greater diversity of other harpacticoids. By species, the numbers were quite small, but the total of harpacticoids counted in collections from Don Eulalio amounted to a little more than three and a half per cent.

Although with respect to O. simplex and E. acutifrons statistical analysis of variance for the three eastern stations, seemed to yield significant evidence of seasonal cycle; it may, however, be said that for no species of copepods has there yet been established a seasonal cycle of abundance or of reproduction that is generally applicable for the five stations in close geographic proximity.

A SURVEY OF THE ABYSSAL ISOPODS OF THE CARIBBEAN AREA

By

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For a definition of the abyss it is necessary to review several meanings given over the years. When man first began to probe the oceans, his ability to reach depths below 200 meters was very limited and because of this, the abyss was set at 200 meters and deeper. In more recent times - within the last decade - the Russians, working principally in the Artic Ocean, set the abyss at below 600 meters. Their definition is based primarily on temperature and because they were able to demonstrate constants of temperature and fauna beginning at 600 meters; this became the upper limit of the abyss. In other regions of the world, marine investigators have set the abyss at around 2000 meters and deeper; Hedgepeth, an American, considers it to be below 4000 meters. For our concern the abyss is set at 2000 meters and deeper.

The data for this paper is based on samples collected by R/V Vema of Columbia University's Lamont Observatory, and evaluated by Dr. Robert Menzies.

It is obvious from the few samples that the Caribbean abyss contains a diversified isopod fauna. The relatively enormous number of new species implies that our knowledge is very incomplete and suggest that future efforts will be rewarded by additional exciting discoveries. The collections suggest that the Caribbean abyss possesses a significantly high degree of endemism and this bears significantly on the geologic and oceanographic history of the area.

(Author's Abstract)

THE MARINE LABORATORY AT VERACRUZ, MEXICO

By

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The Station of Marine Biology of Veracruz was organized in 1958 as a part of the Veracruz Institute of Technology, which is a federal technical school. It is lodged at present at the main campus of the Institute but soon will move into a building located by the sea and close to the fish - landing docks.

This is the only laboratory of its kind operating in Mexico on either coasts. The new building of the Laboratory is located within the city limits of Veracruz. It is surrounded by the sea on two sides, one of them being open waters and the other the protected harbor. Surrounding the bay of Veracruz there are about seven coral reefs, with islands in four of them. The main habitats in the neighborhood of the laboratory are Thalassia beds, sand beaches, coral reefs and mud flats. About 8 miles south of the City there is a large brackish water lagoon and 40 miles to the southeast we find one of the most interesting and productive costal lakes of the Mexican Coast of the Gulf of Mexico.

The Station engages in teaching and research but also acts as a consultant to the Fishing Industry. In regard to teaching, the laboratory is preparing at present the type of personnel needed most by the Fishing Industry, namely, Fishery Technicians and Captains of fishing boats. The Fishery Technicians undertake three years of practical and theoretical training and after that time they should be fitted to run the operations of a canning, freezing, or fish meal plant, administrate a fishing fleet, direct the operations of a fishing cooperative, etc. He will not be fitted to do research but will be an excellent research assistant.

As to the operations of the laboratory progress it will offer graduate courses in the fields of Marine Sciences. The main research proyects of the Station at present are:

1. Biology and Taxonomy of the snooks of the gemus Centropomus.

2. Studies on the oysters of Alvarado Lake, whose beds have been completely depleted from a former production of more than 500,000 kilograms in 1954 to 0 in 1959.
3. Research on the Biology, location and fishery of the yellowfin tuna of the Gulf of Mexico.
4. Studies on the white and brown shrimp fishery of the Gulf of Mexico.

In close cooperation with the Fishing Industry and other government agencies the Station of Marine Biology at Veracruz is experimenting and encouraging the development of new fisheries and the introduction of more productive fishing methods. The scientific personnel is formed by five Biologists and one Assistant Biologist, besides a Chemist in charge of teaching one of the courses for the Fishery Techinicians.

A 33 feet schooner completely built and equipped at the shops of the Veracruz Institute of Technology will be launched shortly and will be used for oceanographic work and general fishery activities.

THE BITING HABITS OF JAMAICAN SANDFLIES

By

D. Kettle*

Of the eleven species of sandflies found on Jamaica, three (C. furens, C. barbosai and L. bequaerti bite man abundantly. An essential prerequisite of detailed field studies is a sound quantitative method of estimating population densities. After considering the advantages and disadvantages of both light and sticky traps it was decided to concentrate on standardising biting rates. These are effected by many factors:

(1) individual 'bait';
(2) limb offered;
(3) position on site;
(4) time of day;
(5) meteorological conditions.

All three species agreed in which two of the five 'baits' they disliked, but shewed different specific preferences. This was complicated by C. barbosai and C. furens selecting paler skins as the light faded at sunset. Most of the time C. barbosai bit arms and legs impartially, while C. furens and L. bequaerti were always more abundant on the legs. With L. bequaerti this was very marked, the leg catch being four times that on the arm. C. barbosai alone shewed a definite preference among the four positions on the site. At one position it was nearly twice as numerous as elsewhere.

The bulk of the meteorological data has not yet been analysed, except for one series of observations on C. furens. Wind proved to be the dominant factor, with a limiting value for sandfly activity at 4 m. p. h. Below this speed the biting rate increased four fold for each m. p. h. decrease.

Correction factors calculated from one series of trials were found to be valid for another series. This gives substance to the hope that it will be possible to reduce all biting rates to a common standard in the same way as gas volumes are expressed at n. t. p.

(Author's Abstract)

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DISPERSAL AND DIFFERENTIATIATION OF TERRESTRIAL FAUNAS IN THE CARIBBEAN

By

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The important sources of the fauna of the islands are Central America and South America. Central American influence is marked in the Greater Antilles and falls off towards the east. There is evidence that Cuba and Jamaica represent separate ports of entry into the Greater Antilles; some elements have progressed no further than these islands. Central America has a surprisingly distinctive fauna, especially of reptiles; perhaps due to its position as a tropical peninsula of North America during much of the Tertiary. South American influence is marked in the Lesser Antilles, falling off in the Greater Antilles. There is no real evidence, geological or biological, of land bridges across the deep water channels. Cuba has an endemic gecko belonging to an otherwise African genus (Tarentola). The West African form of the ridley turtle (Lepidochelys divacea) has been reported in Cuba and may occur in other islands.

Within the Caribbean there are no two islands separated by a passage deeper than 40 fathoms which do not show differentiation of their terrestrial faunas. St. Lucia is the smallest island in which geographic differentiation (in relation to ecological conditions) has been observed (lizards). Guadeloupe is the smallest island which shows endemic development of sympatric species. The Greater Antilles show a wealth of diversification at the species level. Cuba and Hispaniola show higher level differentiation with the production of distinct new adaptive types. Hispaniola, geologically old (Jurassic) and topographically diverse, shows the richest endemic differentiation and may represent a secondary source of stocks of the other islands.

(Author's Abstract)

Official representatives and accompanying participants to the Third Meeting of the Association of Island Marine Laboratories.