REPORT OF THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL STATION, ST. PETERSBURG BEACH, FLORIDA

Fiscal Years 1962-64

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

Circular 239

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REPORT OF THE STATION CHIEF

James E. Sykes

PROGRAMS AND FINANCING

Administration and research at the Bureau of Commercial Fisheries Biological Station at St. Petersburg Beach, Fla., were removed from supervsion by the Bureau of Commercial Fisheries Biological Laboratory, Galveston, Tex., on January 1, 1962. Since this is the first Station report, it incorporates information for fiscal years 1962, 1963, and 1964.

When the Station became a separate research facility, funds were allotted for estuarine research under the title "East Gulf Estuarine Investigations." The purposes of this program are to study the biological, chemical, and physical complex of the estuary and to determine the effects of environmental factors on the production of commercially important species. Environmental studies are urgently needed to appraise the relation of manmade estuarine changes to biological production. An evaluation of the changes is best obtained from studies made before, during, and after major alterations. The investigations involve a thorough study of hydrology and bottom dwellers, planktonic organisms, and fishes; the program was designed to include projects concerned with water chemistry, faunal production, hydrology, plankton, bottom communities, water circulation dynamics, reefs, and biogeochemical alteration. All but the last three projects were staffed by late 1963. Studies of reefs and biogeochemical alterations were made as part of existing projects.

In fiscal year 1964 funds allotted to estuarine studies increased, and an additional appropriation was made for red-tide research. Red-tide funds were not used as in the past, when "crash" sampling accompanied each occurrence of a bloom of the causative organism, Gymnodinium breve. Rather, the plan for the first year was threefold: (1) To assemble the published and unpublished results of past red-tide research and evaluate those which appeared to be most pertinent and helpful in further research; (2) through use of automatic data processing equipment, to run multivariate analysis of G. breve counts recorded in data reports against associated hydrographic factors, to determine whether measurement of these factors is worth continuing and if formulas can be devised to predict red tide; and (3) to hold a symposium in 1964 of experts in red-tide research and related fields, who might suggest further studies.

ENVIRONMENT, FACILITIES, AND EQUIPMENT

St. Petersburg Beach is ideally located for diverse research in marine and estuarine biology. It is in west-central Florida, where a mixing of temperate, subtropical, and tropical species occurs. The Station lies on a narrow peninsula separating the Gulf of Mexico from Boca Ciega Bay, a small arm of Tampa Bay.

A two-story building and dockside garage incorporate some 7,000 square feet of space for biological and chemical laboratories, the library, a conference room, offices, and storage. An additional 1,800 square feet of space in the Don Ce-Sar Federal Building next door house a laboratory and specimen collections.

The center of investigation is Tampa Bay, one of the largest and most productive estuaries of the Gulf of Mexico. Sampling stations throughout the Bay cover some 350 square miles of water and extend 20 miles offshore into the Gulf. Red-tide and oceanographic cruises extend from immediately north of Tampa Bay southward for 100 miles to Boca Grande and to 20 miles offshore.

Laboratory and field equipment includes items necessary for estuarine and oceanographic investigation. A Beckman[1] DU spectrophotometer, Kjeldhal digesters, a pyroheliometer, and other standard instruments are used in chemical analyses. The Station's 43-foot, twin-diesel vessel, Kingfish, is equipped with a marine radio, radar, and sleeping facilities for five persons. Field equipment aboard the vessel includes electrodeless

[1] Trade names referred to in this publication do not imply endorsement of commercial products.

View showing one section of library.

induction salinometers, Whitney photometers, Nansen and Van Dorn collecting bottles, 10- and 16-foot trawls, deck and submersible plankton pumps, high-speed plankton samplers, portable temperature indicators, a Smith-McIntyre bottom sampler, and a Frolander bottom plankton sled. Four outboard motor boats are also used for inshore research.

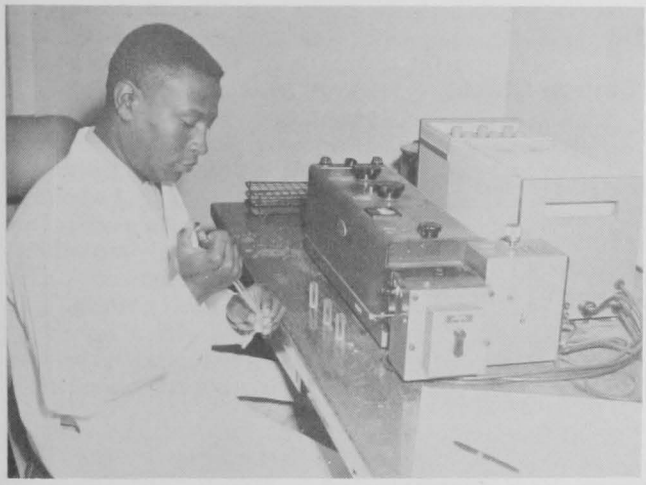
Station scientists are trained in such specialties as planktonology, vertebrate and invertebrate zoology, ichthyology, fish population dynamics, oceanography, and chemistry. The staff participates in plans and activities of the Marine Fisheries Commissions of Gulf and Atlantic States. The Station participates in a Work-Study Cooperative Student Plan with the University of South Florida. Florida State University and the University of Alabama are contracting research for the Station.

The location of the Station is such that contact can be readily maintained with faculties and libraries of several universities. Some of these are Florida State University, University of South Florida, University of Florida, University of Tampa, University of Miami, and Presbyterian College.

WORK CONFERENCES

Conferences are held between staff members of the Bureau Station and the Florida State Marine Laboratory. From these meetings, cooperative and complementary projects arise. During 1963 two cooperative studies were designed, both within the research obligations of the Station. One was the study of the biology and chemistry of an area surveyed by the State in 1958 prior to landfill engineering. The other was the compilation and documentation of red-tide and hydrographic data obtained jointly before, during, and after a red-tide outbreak in April 1963; a joint mimeographed report of the data was issued to red-tide researchers.

The Kingfish--a 43-foot, twin-diesel research vessel.



Dispensing water samples prior to reading light absorbancy with a Beckman DU spectrophotometer.

Other participation in work conferences included: Meeting with Public Health Service representatives on red tide and associated shellfish toxin; meeting with Florida Game and Fresh Water Fish Commission regarding a proposed barrier in Old Tampa Bay; participating in a meeting with the Committee on Scientific Exploration of the Atlantic Shelf; Bureau of Commercial Fisheries Regional Conference; Regional Estuarine Coordination Conference; and meeting of Biological Laboratory Directors, Bureau of Commercial Fisheries.

PUBLIC RELATIONS

The Station maintained an awareness of the need for contact with the public. It provided speakers for local Rotary and Optimist Clubs

and radio and television programs. Two staff members gave personal time to instruction of students at the St. Petersburg Science Center. Civic groups and scout troops toured the laboratory. Our chemists analyzed water samples obtained by the new St. Petersburg Beach Aquatarium during well-drilling operations.

PRESENTATIONS

Papers were presented at meetings of the Southern Division of the American Fisheries Society, Gulf and Caribbean Fisheries Institute (3), Atlantic Estuarine Research Society, and the Atlantic States Marine Fisheries Commission; one lecture was given to the biology class, University of South Florida, and three to graduate fishery students, University of Alabama.

TRAINING

One staff biologist spent 2 weeks in Washington at the U.S. National Museum consulting systematists and identifying the animals taken in bottom collections, and another attended a 1-week course in safety at Tampa.

WORK STUDY

An agreement was made between the Station and the University of South Florida for the establishment of a continuing laboratory position for one student each trimester. Students who prove themselves worthy may return to the laboratory for four periods during a 4-year curriculum. Careful selection of students interested in careers in marine biology and geology has resulted in an excellent program. Two students alternate in the position, which is assigned to the benthic research project.

PLANNING SESSION--ESTUARINE CONFERENCE

In 1963, Washington Office personnel, the Regional Director, and Laboratory Directors of Region 2 met to develop a coordinated program of estuarine research for the Atlantic Coast and Gulf of Mexico. Eugene P. Odum was engaged to consult with Regional and Central Office personnel in planning. The Conference resulted in a definition of estuarine problems facing the Bureau of Commercial Fisheries and methods of research by which program objectives could be achieved.

It was agreed that items needing early investigation were: Primary and potential secondary productivity; taxonomic diversity in relation to production; eco-system indices; the role of detritus, artificial reefs, and nursery grounds; and the role of biological structure. As a working document, an estuarine atlas was planned, to consist of charts with data on physical and biological features. A coordinated investigation of primary productivity was planned among Region 2 laboratories. It was generally agreed that we should consider the possibility that manmade changes might increase, as well as decrease, estuarine production and that assessments should be made of factors limiting production such as oxygen, food supply, etc. Research activities of the Station included several of those outlined at the Conference and have been modified to accommodate others recommended.

STAFF

James E. Sykes, Station Chief

Administration

Mary Jo Greer	Administrative Assistant
Dorothy M. Hartswick	Clerk-Stenographer
Norma R. Wiles	Clerk-Stenographer (Resigned Oct. 11, 1963)
Anne M. Cottrell	Clerk-Stenographer (Temporary)
Sara D. Nelson	Clerk-Stenographer (Temporary)

Library

Annemarie P. Rempel	Acting Librarian

Vessel

John D. McCormick	Master-Engineer, R/V Kingfish

Estuarine Program

John H. Finucane	Project Leader, Faunal Production
Gordon R. Rinckey	Fishery Biologist
John C. Thompson	Fishery Aid

John L. Taylor	Project Leader, Benthic Communities
Carl H. Saloman	Fishery Biologist
Eric M. Roth	Fishery Aid (Cooperative Work-Study Student, University of South Florida, terminated April 30, 1964)
Orlando Villot	Fishery Aid (Cooperative Work-Study Student, University of South Florida, terminated April 17, 1964)
John Jensen	Fishery Aid (Cooperative Work-Study Student, University of South Florida)
Billie Z. May	Project Leader, Chemical Environment
Lucius Johnson, Jr.	Physical Science Aid
David M. Jones	Physical Science Aid

Red-Tide Program

Alexander Dragovich	Project Leader, Plankton Ecology
John A. Kelly, Jr.	Fishery Biologist
Robert D. Kelly	Fishery Aid

Summer Employees

William F. Malzone	Fishery Aid
Randal C. Teague	Fishery Aid
Stephen C. Henry	Fishery Aid

ESTUARINE RESEARCH PROGRAM

James E. Sykes, Program Leader

Gulf of Mexico fisheries occupy a prominent position in the fishing industry of the United States. During the past 14 years, the catch of fish and shellfish in the Gulf has more than tripled. Recent annual catches have exceeded 1-1/3 billion pounds (about 27 percent of total U.S. landings), with an ex-vessel value of about $85 million. Studies have clearly illustrated the role of one major estuary in providing an environment for the early development of most species important in Gulf fisheries. Emphasis in the research is placed therefore on the relation of organisms to the biological, chemical, and physical environment of the estuary.

For documentation of that relation, we are studying species and numbers of animals in different habitats, particularly in areas where dredging or filling has been carried out or proposed. Of special importance have been definitive studies of biological and hydrologic conditions in existing areas between finger-fills. In addition to determining the effects of engineering changes in Tampa Bay, research began on methods of increasing estuarine productivity experimentally through revitalization of unproductive areas.

BENTHIC PROJECT

John L. Taylor, Project Leader

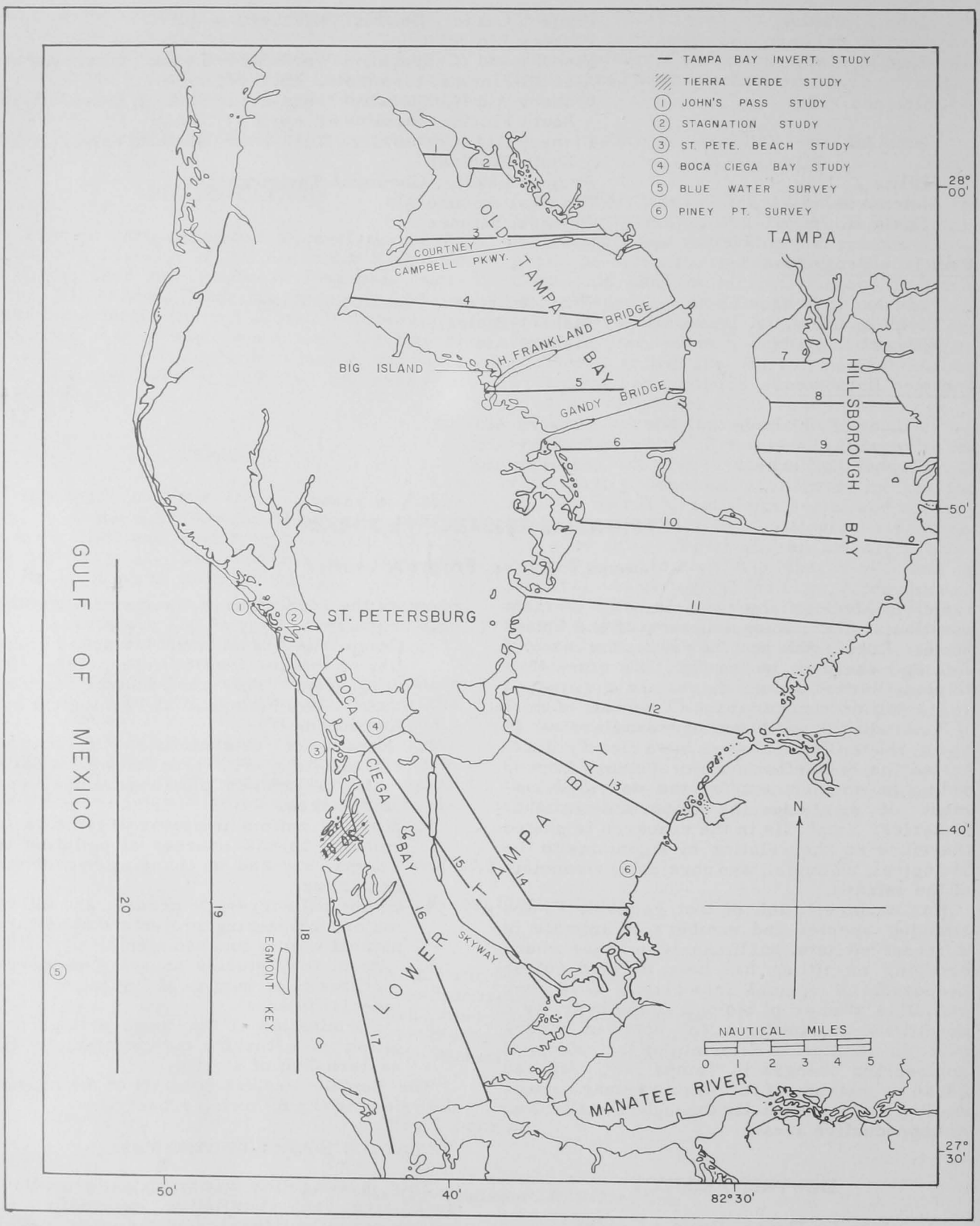
The Benthic Project was established in June 1963. Within the scope of the Estuarine Program, we are studying the conditions that promote the production of commercially valuable organisms. Aims of this project are:

1. Compilation of an annotated area checklist of marine invertebrates, algae, and seagrasses. This compendium includes quantitative biological and ecological information.
2. Quantitative determinations of bottom communities, with size and weight estimates of dominant plants and animals per unit of area.
3. Study of bottom indicator organisms in relation to the sources of pollution in Tampa Bay and to changing hydrologic conditions.
4. Biological surveys to precede and follow major engineering projects that disturb natural waters and sediments.
5. Life-history studies on selected invertebrates of particular biological or commercial interest.
6. Determination of the zoogeographic relation of estuarine bottom biota in the eastern Gulf of Mexico.

The Benthic Project consists of the phases described in the following subsections.

Tampa Bay Bottom Invertebrates

This investigation was undertaken to obtain qualitative and quantitative information on bottom organisms throughout the estuary. The sampling program represents the first comprehensive survey of the area and yields information on species, species abundance, sediments, and hydrology.



Benthic transects (shown with numbered lines) and study areas in Tampa Bay and the adjacent Gulf of Mexico.

Field work from July through November 1963 included net and dredge sampling at about 400 stations located at 1/2-mile intervals along 20 transects (see accompanying map). Transects were at regular intervals extending from 6 miles offshore to the head of the Bay and were at right angles to the main current flow.

Preliminary sorting of animals and plants into general taxonomic categories was nearly completed, and specific determinations were begun on Polychaeta, Crustacea, Mollusca, and a number of the less well represented phyla.

Sediment samples were analyzed for texture, total carbon, and total carbonate at the Sediment Research Laboratory of Florida State University.

The sediments are generally firm and consist of quartz sands on the smooth, shallow bottoms characteristic of the Bay. Shell fragments constitute a significant proportion of the sediments, particularly near the mouth of the Bay and in channels. Soft bottoms with a high percentage of silt are restricted to the upper portions of Old Tampa and Hillsborough Bays and deep channels dissecting landfills, which are rapidly becoming a major feature of the Bay. Areas with a high percentage of clay are sparingly distributed throughout the Bay as clay banks.

Salinity and pH determinations were completed for all stations.

Preliminary summary of numbers of bottom species identified to phylum

Coelenterata.....	7	Phoronida.....	1
Ctenophora.....	2	Ectoprocta.....	1
Rhynchocoela.....	2	Brachiopoda.....	1
Polychaeta.....	93	Echinodermata.....	15
Mollusca.....	108	Hemichordata.....	1
Arthropoda.....	60	Chordata.....	30
Sipunculida.....	1		

Boca Ciega Bay Stagnation

Boca Ciega Bay, a part of Tampa Bay, has been under intensive development since 1940, when dredge-and-fill operations began to increase rapidly. In 1955 the Florida Board of Conservation attempted to stem the destruction of the area by publicizing its ecological value. During the same year an ecological survey of the Bay revealed abundant flora and fauna.

In conjunction with Plankton and Faunal Projects, the area was resurveyed in November 1963. To substantiate earlier findings and to study further the effects of finger-fills, sampling of the area continued on a quarterly basis for 1 year. Twenty-eight stations were sampled during the first quarter and six during the remaining three quarters for 1 year. Collecting equipment used for the bottom invertebrate study was also used in this study, together with gear which was employed by the State Laboratory in the original survey of 1955.

Analyses have already shown pronounced changes in texture of bottom sediments after dredging. Canals between residential "fingers" less than 10 years old now have sediments consisting of 70 percent silt, whereas these bottoms originally were 80 to 90 percent sand. These fine sediments are heavily charged with hydrogen sulfide and are devoid of invertebrates that can be retained with a 25-mesh-per-inch screen.

Tierra Verde

Extensive and dense aggregations of marine grasses and algae and a diverse fauna characterize the shallow waters of lower Boca Ciega Bay. A portion of the grass-bed community has already been destroyed by real-estate development. During the winter of 1963-64, we were notified that a land development corporation intended to add 500 acres of land by extending its fill area. A protest from the Station was registered with State and County officials through the Regional Director. A survey began in March and was repeated during the summer of 1964 to supplement previous information showing the biological importance of the endangered area.

Ten biological samples and two sediment samples were taken from each of 45 stations arranged on a 1/4-mile grid system. At each station, a coring device was used to extract bottom samples, 6 inches long and 2-1/2 inches in diameter. The sampling design included

Sieving the contents of a bottom sample.

Sampling of beach sediments with a shallow-water coring device.

two cores at the center of each station and the remaining eight at points 100 feet from the center at intervals of 45 degrees.

Biological and sedimentological data are now being compiled, and we hope that forthcoming information coupled with evidence from pertinent studies in other estuarine situations may help to turn the tide of irresponsible obliteration of the nation's valuable submerged lands. Preliminary results regarding species abundance in Boca Ciega Bay are shown in the following table.

Early spring weight of faunal and floral groups in lower Boca Ciega Bay in pounds per acre

	(dry weight)
Algae (predominantly Rhodophyta)	195
Thalassia testudinum (turtle grass)	1,224
Caridean shrimp (grass shrimp)	1
Fish (juvenile)	3
Polychaetes, mollusks, and miscellaneous invertebrates	537
Total	1,960

Piney Point

From Interbay Peninsula to the Gulf, the southeastern shore of Tampa Bay is essentially pristine in spite of polluted waters flowing from Hillsborough Bay and its tributaries. At Piney Point, midway along this coastline, a deepwater port has been proposed, consisting of five berths and two deepwater channels in addition to extensive staging areas and other docking facilities. Construction permits for this project probably will be issued regardless of protests based on results of biological research.

A semiannual collecting program was begun at Piney Point to obtain biological information to support a formal protest of the port development project. In the event that the proposal is approved, sampling will be continued to show biological, hydrographic, and sedimentological changes following large-scale environmental alterations and concomitant pollution. Corers are used for this study at intertidal stations and nets and dredges for deeper, offshore stations.

Johns Pass

In the spring of 1964, maintenance dredging of Johns Pass and deposition of new spoil gave us an opportunity to begin studying colonization and succession on spoil banks exposed to open Gulf conditions. Biological field collections were begun and will continue quarterly for at least 1 year. Core samples are taken from both old and new spoil banks on north, south, east, and west exposures in the intertidal zone.

The first quarter's data indicate that the major faunistic difference between new and established spoil is the scarcity of numbers and species of mollusks in the new spoil.

Exposed Beach

To investigate the taxonomy and population dynamics of sand beach communities, monthly collections are made from the Gulf beach adjacent to the laboratory. Biological and sediment samples are taken in the intertidal zone with a corer. Biological specimens are sorted from each core, and sediment texture is analyzed.

On the basis of preliminary results from 5 months of collecting, the sand bug, Emerita talpoida, the coquina, Donax variabilis, and a polychaete, Spio setosa, were the dominant sand beach animals.

SCUBA diving over an estuarine grass bed.

FAUNAL PRODUCTION PROJECT

John H. Finucane, Project Leader

Hydrological and biological samples were taken at selected stations throughout the Tampa Bay estuarine system, and during 1964 additional sampling stations were established in Pine Island Sound and Charlotte Harbor.

During 1963 a series of plankton stations was occupied in the Gulf of Mexico from St. Petersburg south to Boca Grande. Fish eggs and larvae from these areas are being analyzed to determine the species, spawning times, and abundance of fish that live in the Florida west coast estuaries during part of their life cycle. A preliminary analysis of fish larvae was completed from plankton samples for the period August 1961 through 1962 from Tampa Bay and adjoining estuaries.

Fishes of the Tampa Bay Estuarine System

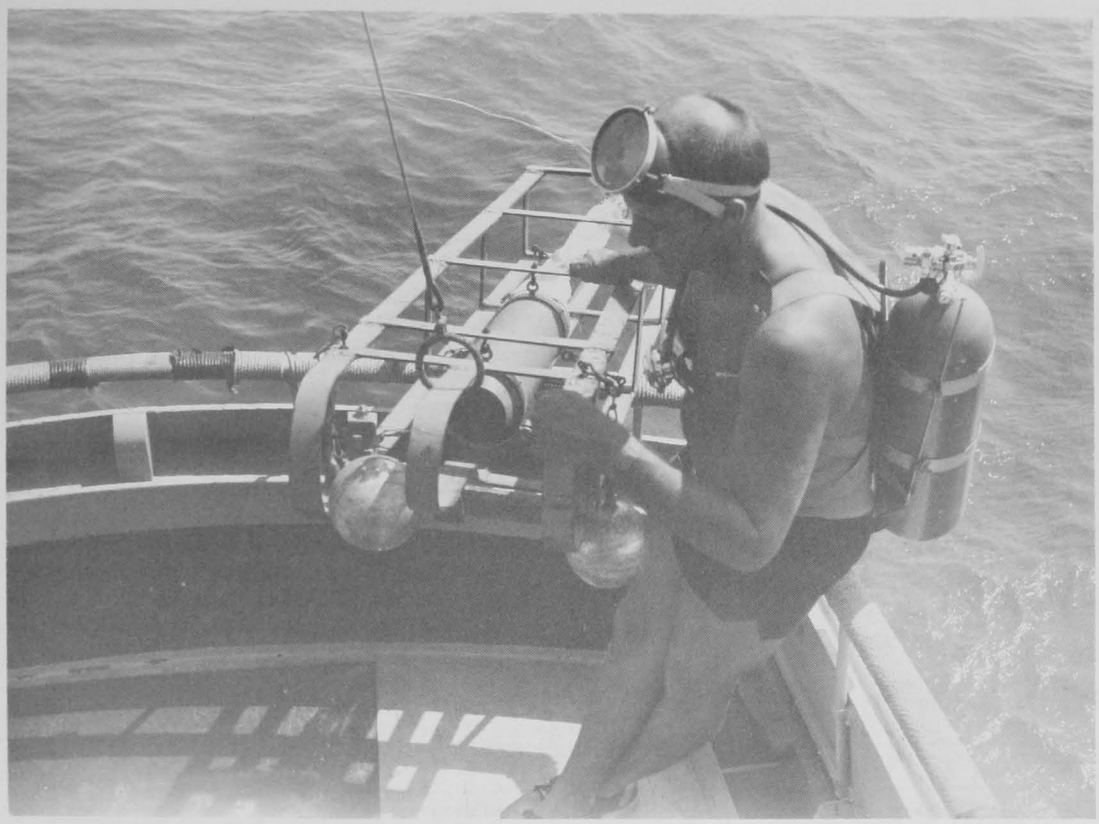
From August 1961 to June 1964, 57 families, including 116 genera and 147 species, of fish

were collected throughout Tampa Bay. The dominant families, in descending order of abundance, were: Clupeidae, Engraulidae, Cyprinodontidae, Gerridae, Pomadasyidae, Sciaenidae, Sparidae, Mugilidae, and Atherinidae. The principal species of fish caught in the Bay numbered 15; the bay anchovy and silver perch comprised 59 percent of the trawl catch, and the tidewater silversides, spot, and pinfish comprised 47 percent of the beach seine catch.

The greatest number of species was caught in the lower Bay, and the smallest number in Terra Ceia and Hillsborough Bays. Some species were found throughout Tampa Bay, but others showed a preference for specific areas. Our distribution data suggest that most fish species move throughout the Bay and are not generally restricted to any one area.

The seasonal occurrence of the dominant Bay species, with the possible exception of the resident cyprinodonts and silversides, is ascertained mainly by documentation of spawning migrations and of the entrance of young fish into the Bay nursery grounds. For example, striped mullet, spot, and pinfish leave Tampa Bay to spawn in the Gulf of Mexico during late fall and winter. After spawning, young of these species return to the Bay in the winter and spring. Additional larvae and juveniles of other species continue to enter the Bay throughout the summer and into fall, when the peak influx

Stations and subareas for sampling fish in Tampa Bay.



A SCUBA diver and Frolander bottom plankton sampler.

of these young fish occurs. Although a definite seasonal pattern exists for most species, our data indicate that young-of-year fish are never completely absent from the Bay.

Environmental Factors

Temperature.--Most of the major fish species in Tampa Bay were present over the entire temperature range of 50° to 95° F. The smallest number of fish was caught in the winter at beach seine stations when the temperature was below 59° F. At the deeper trawl stations, winter temperatures were more stable and higher than at the beach stations. Fish catches did not reflect the decline in temperature as much at these locations as in littoral areas. Some species were not able to tolerate rapid, short-term temperature reductions; fish kills resulted from low water temperatures during December 1962, when temperature as low as 49.3° F. was recorded in Old Tampa Bay. Members of 19 tropical and subtropical species were killed. The striped mojarra and crevalle jack (Caranx hippos) appeared to suffer the greatest mortality.

Salinity.--Most of the abundant Bay species were euryhaline and occupied waters ranging in salinity from 5 to 30 p.p.t. (parts per thousand). A few marine species such as pompano (Trachinotus carolinus), gag (Mycteroperca microlepis), and the northern sennet (Sphyraena borealis) were collected in areas having salinity greater than 30 p.p.t. Salinity alone was not generally limiting to the distribution of most fish species in Tampa Bay.

Hydrogen-ion and dissolved oxygen.--The influence of the observed oxygen and hydrogen-ion (pH) concentrations on fish in the Tampa Bay estuarine system was studied. Most species of fish caught in the Bay were found in waters of pH ranging from 7.0 to 8.4; only 28 percent of the species were taken in waters with a pH below 7.0. Dissolved-oxygen values were usually above 2 milliliters per liter during most of the year. Hillsborough Bay was the only area in which anerobic conditions were noted during the fall of 1962. No fish kills were observed at this time. Supersaturation of oxygen occurred in littoral zones during periods of intense mixing and accelerated photosynthetic activity of seagrasses and algae.

Tampa Bay as a Nursery

The importance of the Tampa Bay area as a nursery for commercially important animals is shown by the presence in the Bay of young of the year of 19 species of fish, crab, and shrimp. Eighteen species were caught in the

Fish species occuring in 1 percent or more of the beach seine and trawl collections

Species[1]	Common name	Beach seine	Trawl
Anchoa mitchilli	Bay anchovy	X	X
Menidia beryllina	Tidewater silverside	X	--
Leiostomus xanthurus	Spot	X	X
Lagodon rhomboides	Pinfish	X	X
Bairdiella chrysura	Silver perch	X	X
Eucinostomus gula	Silver jenny	X	X
Mugil cephalus	Striped mullet	X	--
Fundulus similis	Longnose killifish	X	--
Cyprinodon variegatus	Sheepshead killifish	X	--
Eucinostomus argenteus	Spotfin mojarra	X	--
Lucania parva	Rainwater killifish	X	--
Harengula pensacolae	Scaled sardine	X	--
Floridichthys carpio	Goldspotted killifish	X	--
Fundulus grandis	Gulf killifish	X	--
Membras martinica	Rough silverside	X	--

[1] Listed in order of greatest abundance for all collections.

Seasonal occurrence of dominant young-of-year fish in Tampa Bay, 1961-64

Winter and spring	Summer	Fall
Mugil cephalus (striped mullet)	Bairdiella chrysura (silver perch)	Anchoa mitchilli (bay anchovy)
Leiostomus xanthurus (spot)	Menidia beryllina (tidewater silversides)	Mugil trichodon (silver mullet)
Lagodon rhomboides (pinfish)	Cynoscion nebulosus (sand seatrout)	Chloroscombrus chrysurus (bumper)
Anchoa mitchilli (bay anchovy)	Cynoscion arenarius (spotted seatrout)	Menidia beryllina (tidewater silversides)
Bairdiella chrysura (silver perch)	Orthopristis chrysopterus (pigfish)	Sciaenops ocellata (redfish)
Menidia beryllina (tidewater silversides)	Diapterus plumieri (striped mojarra)	Bairdiella chrysura (silver perch)
		Cyprinodon variegatus (sheepshead minnow)
		Fundulus similis (longnose killifish)
		Fundulus grandis (Gulf killifish)

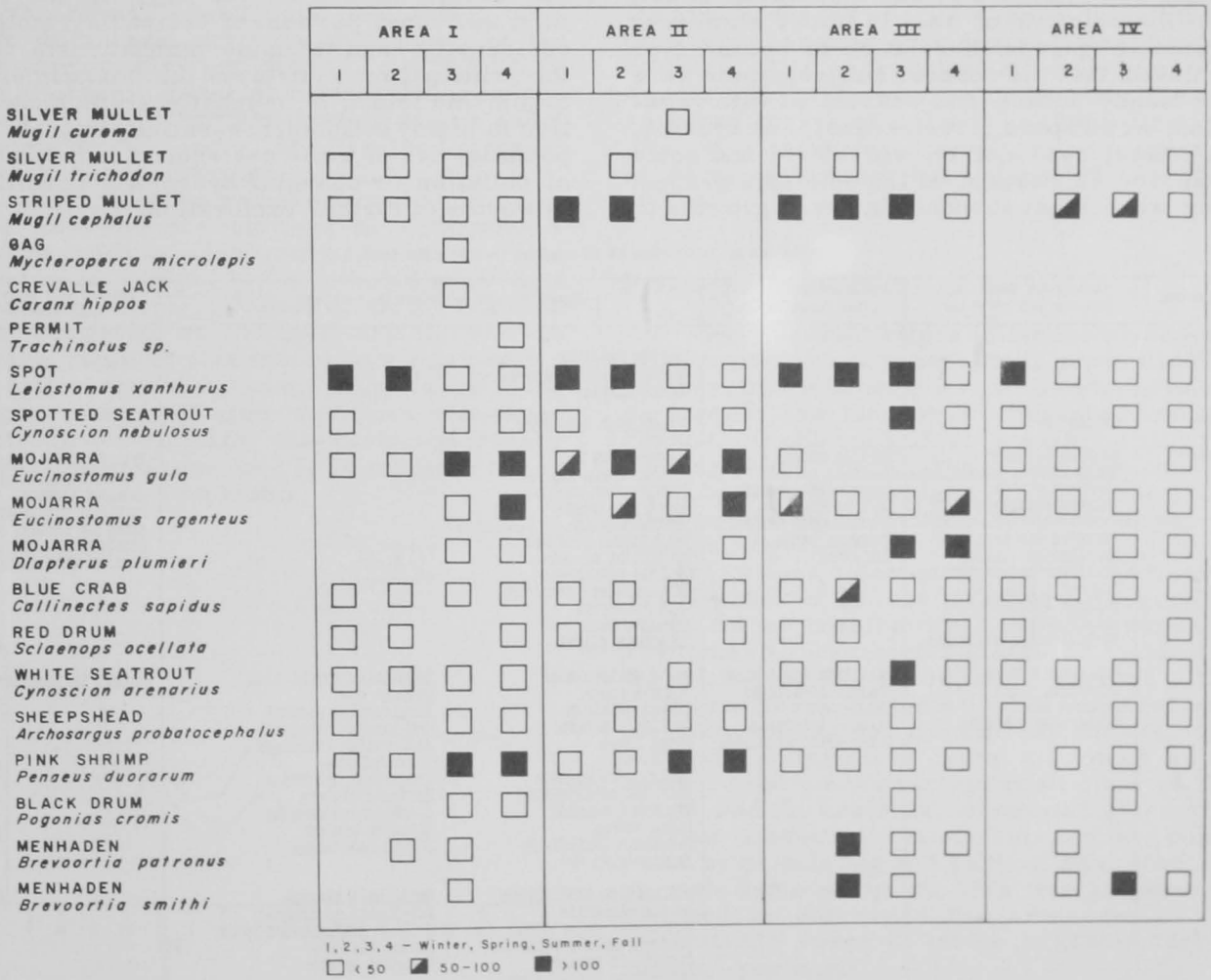
lower Bay (Area I), 13 in the central Bay (Area II), and 15 in both Old Tampa Bay (Area III) and Hillsborough Bay (Area IV). The highest catch per unit of effort for these species occurred in Old Tampa Bay and the lowest in Hillsborough Bay.

Commercially Important Crustaceans

Tampa Bay supports a bait shrimp and crab fishery. A preliminary ecological study of these crustaceans was completed in conjunction with the finfish investigations. From August 1961 through December 1963, 1,836 blue crabs (Callinectes sapidus) and 6,276 pink shrimp (Penaeus duorarum) were collected.

Sex distribution and life history stages were investigated in relation to Bay area and salinity. Adult male crabs occurred more frequently in the brackish waters of Old Tampa Bay during the winter, summer, and fall than in the spring. Adult females were taken only in Old Tampa Bay and Boca Ciega Bay during the spring and summer. No egg-bearing females were found in the Bay. Immature crabs preferred water of lower salinity than adults and were usually most abundant in upper Tampa Bay. Since adult females appear to leave the Bay during the winter and spring, spawning probably occurs in the Gulf of Mexico from spring through fall. Adult male crabs do not appear to migrate extensively but remain within the Bay throughout the year.

Pink shrimp reached peak abundance from July to October and were least plentiful in April and May, and though less numerous, shrimp caught during the spring were about twice the size of those taken in the summer and fall. A sharp decrease in size coincided with rising water temperature in the spring and early summer. At this time mature adults appeared to leave the Bay to spawn in the Gulf. Young pink shrimp began to enter the Bay again in June and remained through April of the following year. The continuous presence of small shrimp in the Bay throughout most of the year indicates an extended spawning period in this area.



Occurrence of immature species of commercially important fish and shellfish in Tampa Bay, by season and area.

Marco-Invertebrates
Alexander Dragovich and John A. Kelly, Jr.

This investigation began the first extensive survey of invertebrates in Tampa Bay. From August 1961 to September 1962, monthly biological and hydrological samples were collected concurrently from 42 locations in Tampa Bay and the adjacent shallow coastal waters. Stations were selected to include as many different habitats as possible. All biological specimens were collected with either a 10-foot shrimp try net or a beach seine and were preserved in 10 percent Formalin. Salinity and temperature determinations were also made along with collections of biological specimens.

Collections contained 78 genera, 82 species (4 subspecies), and 2 unclassified groups of invertebrates. Ninety-two percent of the invertebrates were bottom forms; the rest were pelagic and consisted of swimming (portunid) crabs, squid, and sea slugs.

The fauna in Tampa Bay is closely related to the Carolinian fauna of the North American Atlantic Coast. Seventy-two species were common to both Tampa Bay and the Atlantic Coast. The distribution of the 18 most numerous taxonomic groups in relation to bottom type disclosed that the densest congregations were over sandy bottom and associated with vegetation. Arthropods (crustaceans), sea urchins, sea hares, sea squirts, sea stars, and squid composed 72 percent of the dominant groups. They were most abundant in dense growths of turtle grass, eelgrass, and red algae. Sea squirts, crown conchs, blue crabs, and squid were found in large numbers over a muddy bottom. Sand dollars and sea stars were characteristic organisms on sandy bottom.

The species diversity in different areas of Tampa Bay and adjacent offshore waters displayed a distinguishable pattern. More species were collected in Tampa Bay and immediately offshore than in the brackish waters of Old Tampa and Hillsborough Bays, where entire groups of animals, such as sponges, starfish, sand dollars, and sea urchins, were absent. Echinoderms were well represented in Boca Ciega Bay, the lower portion of Tampa Bay, and in the offshore waters. Arthropods were the most widespread group of organisms. Commercially important crustaceans, pink shrimp and blue crab, were widely distributed and were numerically the most prominent arthropods. Most species of mollusks were also primarily confined to lower Tampa Bay and offshore waters. Squid was the most abundant mollusk found during this study and occurred with greatest frequency in brackish waters of Old Tampa Bay, Hillsborough Bay, and upper portions of Tampa Bay. Molgula occidentalis and Molgula manhattensis were the principal sea squirts and the most numerous organisms found. M. manhattensis is known to live in highly polluted, low-salinity waters. The potential use of these sea squirts as indicators of pollution or changing hydrologic conditions is worthy of further exploration.

Distribution of invertebrates by regions in Tampa Bay Area

Organism	Throughout Tampa Bay Estuary and offshore	Hillsborough Bay and Old Tampa Bay	Tampa Bay and adjacent Gulf waters		Exclusively adjacent Gulf waters
Porifera			Dysidea fragilis Halichondria bowerbanki Cliona celata		
Annulata	Nereis sp.		Siphonosoma cumanense		
Arthropoda	Penaeus duorarum Trachypenaeus constrictus Caridean shrimp Pagurus longicarpus Juvenile Portunidae Portunus gibbesii Callinectes sapidus Neopanope texana texana Neopanope packardii Menippe mercenaria Libinia dubia Metoporhaphis calcarata	Squilla empusa Upogebia affinis Persephona punctata Eurypanopeus sp. Eurypanopeus depressus Panopeus herbstii Uca rapax	Sicyonia typica Trachypenaeus similis Petrolisthes armatus Emerita talpoida Pagurus pollicaris floridanus Petrochirus diogenes Hypoconcha arcuata Limulus polyphemus Heterocrypta granulata Pitho anisodon Pilumnus sayi Podochela riisei		Petrolisthes galathinus Dromidia antillensis Calappa flammea Portunus spinimanus Arenaeus cribrarius Hexapanopeus angustifrons Hepatus epheliticus
Mollusca	Melongena corona Nassarius vibex Aplysia spp. Lolliguncula brevis	Polinices duplicatus Anadara transversa Macoma tenta Mulinia lateralis Crassostrea virginica	Bulla occidentalis Anachis avara Prunum apicinum Batillaria minima Murex pomum Echinochama cornuta Eupleura sulcidentata Terebra dislocata Oliva sayana Cerithium floridanum Vermicularia sp.	Bursatella leachi plei Octopus sp. Laevicardium mortoni Aequipecten irradians Aequipecten irradians concentricus Urosalpinx perrugata Martesia striata Brachidontes exustus Barbatia candida Chione cancellata	Chione intapurpurea
Echinodermata			Astropecten articulatus Luidia clathrata Echinaster spinulosus Ophiophragmus wurdemani Ophiothrix angulata Ophioderma brevispinum	Ophiolepis elegans Lytechinus variegatus Mellita quinquiesperforata Encope michelini Pentacta pygmea	
Urochordata	Styela plicata Molgula occidentalis Molgula manhattensis		Amaroucium pellucidum		

CHEMICAL ENVIRONMENT PROJECT

Billie Z. May, Project Leader

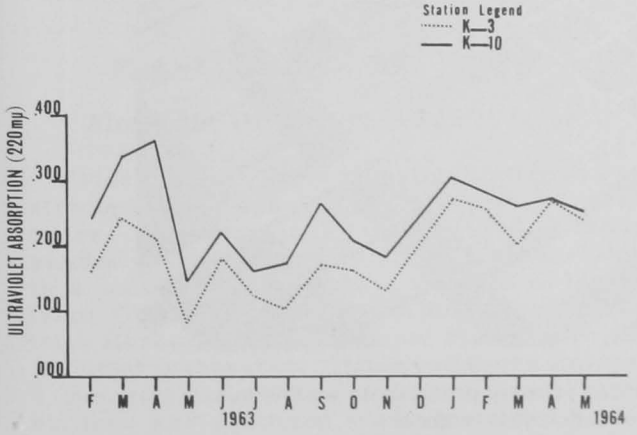
The chemistry laboratory routinely makes analyses for other Station projects, such as those for chlorophyll, inorganic phosphate, total phosphate, salinity, iron, oxygen, copper, total nitrogen, calcium, and pH. Research described in this report concerns primary productivity and ultraviolet absorption of sea water.

Ultraviolet Absorption

In addition to the inorganic macroconstituents and microconstituents, sea water contains measurable quantities of organic substances in solution or suspension. The knowledge concerning the amounts and types of these substances is scant.

If sea water is passed through activated charcoal, its ultraviolet absorption is decreased, and strongly colored material can be extracted from the carbon with solvents. At short wavelengths, natural sea water has twice the absorbancy of artificial sea water. This great difference suggests that much of the ultraviolet absorption results from the presence of organic material and that if the absorbancies of sea water are measured at a short wavelength, an index of dissolved organic material can be obtained.

Monthly samples were collected at 58 estuarine and offshore stations to determine a relative index of dissolved organic materials in water of Tampa Bay and the adjacent Gulf of Mexico. Water samples from all stations were collected at multiple depths, and an average value of absorbancy was obtained for the entire water column. Aliquots of these samples were filtered and then measured spectrophotometrically for their absorbancy at 220 millimicrons (mμ). (A millimicron is 1/25 millionth of an inch.)



Monthly change in absorbancy at 220 mμ wavelength at two stations in the Tampa Bay system.

A generally similar seasonal cycle was noticed at practically all stations in Tampa Bay, but the magnitude differed in various areas of the Bay. Amounts of dissolved organic material ranged from low at the mouth of the Bay to high farther up the Bay and off the mouths of rivers. Experimentation in the laboratory showed that the addition of as little as 2 mg. of ammonium humate to 1 liter of sea water increased its absorbancy from 0.240 to 0.340 mμ. Thus it is probable that dissolved humic acids and other soil components brought in by land drainage were a part of these dissolved organic materials. Absorbancy at two stations represented different areas of the Bay--station K-3, at the mouth of the Bay depicted absorbancy values for lower Tampa Bay, and station K-10, about 9 to 10 miles farther up the Bay, represented central Tampa Bay. The lowest level (0.076 mμ) of dissolved organics was observed at station K-3 during May 1963. This value was noted after an intensive April bloom of the Florida red-tide organism, Gymnodinium breve, in the lower and central portions of Tampa Bay. The marked reduction in levels of dissolved organics also occurred at all 18 Tampa Bay stations then being sampled, including a station 10 miles offshore. The second-lowest value came in August 1963. The similarity between the absorbancy curves of K-3 and K-10 was striking. The principal difference was in the magnitude of the values--which were higher at K-10 than at K-3.

Primary Productivity

Primary productivity is defined as the amount of organic carbon produced by phytoplankton photosynthesis beneath a square meter of water surface. It has long been established that the amount of chlorophyll in plankton indicates photosynthetic rate. The first productivity study by this Station began in September 1962. Data in this report include the 12-month period through August 1963.

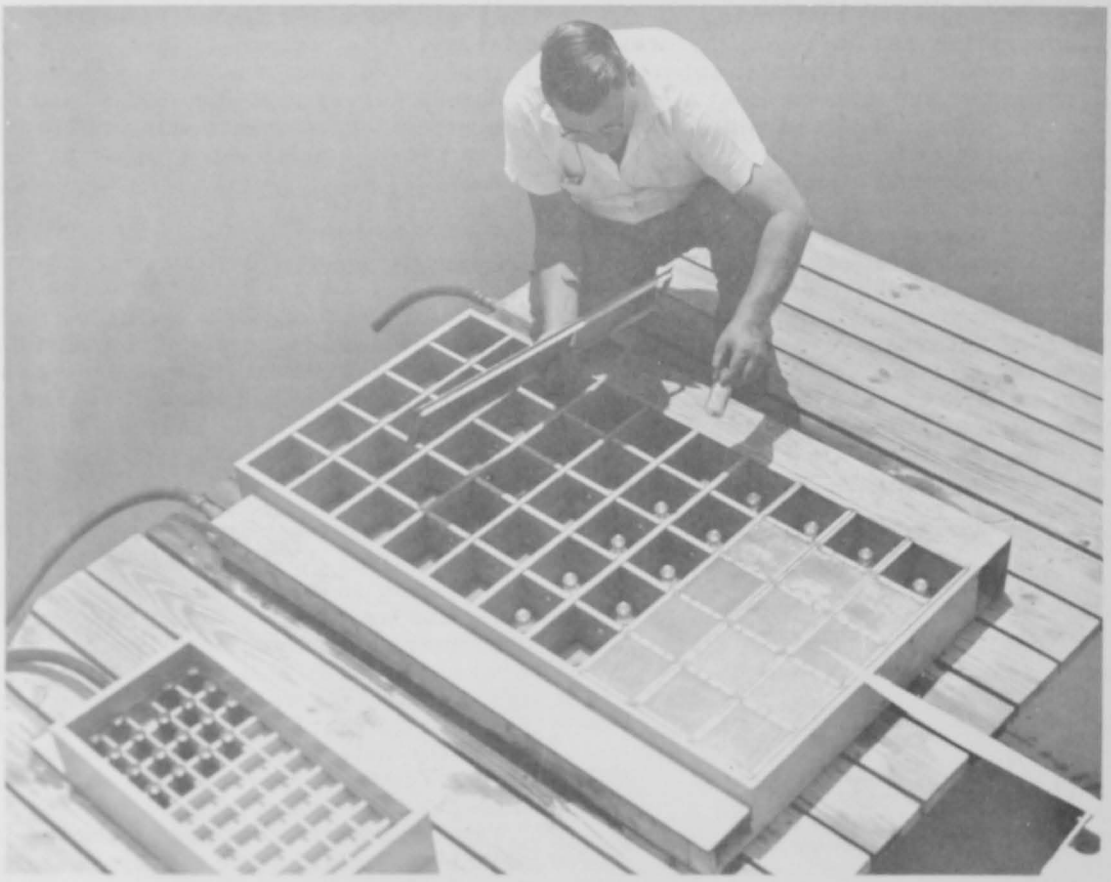
Ten stations selected throughout the Tampa Bay system to include as many hydrographic situations as possible were occupied monthly. A submarine photometer measured the depths to which 100, 50, 23, 10, and 1 percent of the light penetrated. Water samples were analyzed for chlorophyll, and organic carbon was consequently determined from a formula using solar radiation, extraction coefficient of the water, and the assimilation constant.

Total productivity at each station was computed by calculating and plotting the production at each depth sampled. This was graphically summed to determine the area beneath the productivity curve in terms of grams carbon per $m.^2$ per day.

The productivity value on the sampling date was applied to the entire month; extrapolation

Estimated production of organic matter in Tampa Bay, September 1962-August 1963

Year and month	Total carbon	Total dry organic matter	Dry organic matter per acre	Dry organic matter per acre
1962	Tons	Tons	Tons	Pounds
September	25,780	51,560	0.230	460
October	19,785	39,570	.177	354
November	16,487	32,974	.147	294
December	11,191	22,382	.100	200
1963				
January	17,387	34,774	.155	310
February	14,289	28,578	.128	256
March	16,088	32,176	.144	288
April	15,288	30,576	.136	272
May	18,286	36,572	.163	326
June	13,190	26,380	.118	236
July	22,883	45,766	.204	408
August	19,485	38,970	.174	348



Incubator box with attenuation screens, designed for primary productivity studies in a modified version of the light- and dark-bottle method.

of the average productivity value for the entire Bay (350 square miles) yielded the series of values shown in the accompanying table. Tons of dry organic matter were based on the estimate that the material was 50 percent carbon.

Addition of total monthly production values showed that an average of 1.88 tons of dry organic material were produced per acre per year in Tampa Bay. This production agrees closely with that found by extrapolating values for the light- and dark-bottle technique which yield an estimate of 2.0 tons of dry organic material per acre per year.

The values indicated maximum production during July, August, September, and October and minimum productivity in the spring. The maximum average production was recorded in Hillsborough Bay, which is adjacent to the river mouths and receives a large supply of nutrients, including phosphates and iron. The lowest mean productivity values were at the offshore stations in the Gulf.

RED-TIDE PROGRAM

James E. Sykes, Program Leader (Acting)

Sporadic concentrations of the red-tide organism, G. breve, are associated with fish mortality and human discomfort. Although outbreaks of red tide are observed in various parts of the Gulf of Mexico, they have been most frequent in the coastal waters of west Florida. Investigations in the past led to (1) identification of sets of hydrologic conditions under which the outbreaks occurred and (2) delineation of distribution of G. breve on the west coast of Florida. The principal aims of the present program are to conduct research leading to an understanding of the combination of hydrologic factors that are responsible for the blooms of G. breve and to propose and test methods which promise to reduce the lethal effect on marine animals.

A recent contract given to the University of Alabama resulted in an annotated bibliography of red-tide literature. The bibliography provides background information that is useful for designing effective studies. On the basis of this compilation, plans were made for a symposium of red-tide researchers for review and planning.

Estuarine and offshore plankton-succession studies began in January 1964 to detect geographic and seasonal changes in plankton populations.

PLANKTON ECOLOGY PROJECT

Alexander Dragovich, Project Leader

Prior to 1964, field investigations were restricted to Tampa Bay and offshore for 3-1/2 miles; however, in February 1964, offshore studies were revised to include observations in a belt 20 miles wide in the Gulf of Mexico from Clearwater to Pine Island Sound. Charlotte Harbor and seven major rivers were also included in this study. Sixteen offshore stations, 6 bay stations, 4 beach stations, and 10 river stations are occupied monthly so that simultaneous studies of phytoplankton and hydrology can be made in coastal and offshore waters of the west coast of Florida. The occurrence of the Florida red-tide organism is of major interest in this study. In an effort to determine its etiology, temperature, salinity, dissolved oxygen, phosphate-phosphorus, nitrogen, iron, water transparency, phytoplankton concentrations, plankton pigments, and their interrelationships are investigated. The influence of precipitation, land drainage, and wind upon hydrology and phytoplankton are also being studied.

Concentrations of Gymnodinium breve for the 5 months February through June were low, varying from 0 to 1,000 cells per liter in a total of 382 water samples. The highest incidence of "positive" samples (55.7 percent) and highest concentrations were in February. Incidence declined sharply from February to March and remained relatively low through June (range, 20.3 to 36.0 percent).

The areal distribution of G. breve showed maximum incidence in shallow coastal waters, 5 to 20 miles offshore. Except in April, when G. breve was present at one station in the lower portion of Charlotte Harbor and at a few beach stations, the organism was absent in all water samples from Tampa Bay and near the beach.

G. breve was present throughout the vertical water column. The greatest incidence (all data combined) was at depths of 8 and 10 fathoms.

Offshore Occurrence of G. breve in Relation to Temperature and Salinity

Most of the G. breve blooms during the past several years occurred at temperatures ranging from 57.2° to 78.6° F.; the most favorable salinities for proliferation probably lie somewhere between 21.0 and 37.0 p.p.t.; and the most likely area of occurrence is from the shore line to 10 miles offshore. The highest incidences and concentrations of G. breve were in February, during a period of reduced salinities (18.19 - 36.18 p.p.t.). The February occurrence of the red-tide organism was at a salinity range of 33.68 to 36.04 p.p.t. The mean water temperature of 59.2° F. during February was apparently too low for blooms. From

Red-tide laboratory showing G. breve samples being concentrated under fluorescent light.

Incidence of Gymnodinium breve by percentage of positive samples and counts per liter in the coastal waters from St. Petersburg Beach to Pine Island Sound, February-June 1964

Month	Bays	Beaches	5 miles offshore	10 miles offshore	15 miles offshore	20 miles offshore	Total	Cells per liter
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Number
February.....	0	0	50	92.3	80.2	60.0	55.7	0-1000
March.....	0	0	50	46.2	35.3	50.0	34.2	0- 800
April.....	8.3	75.0	20	38.5	47.0	52.6	36.0	0- 200
May.....	0	0	0	15.4	47.0	25.0	20.3	0-<100
June.....	0	0	10	15.4	82.4	30.0	30.1	0-<100

February to June the water temperature and salinity increased progressively. The incidence and concentrations of G. breve decreased and remained low. The distribution pattern of G. breve continues to indicate that it can survive in low concentrations in the offshore waters during periods when salinity is not optimal.

Associated Phytoplankton

From the standpoint of biological productivity, Tampa Bay, Charlotte Harbor, and the adjacent near-shore waters are, as expected, much more productive than waters farther offshore.

A preliminary analysis of phytoplankton associated with G. breve revealed over 100 taxonomic groups (only the most numerous organisms are mentioned here). Diatoms, dinoflagellates, tintinnids, and blue-green algae comprised the bulk of phytoplankton. Sceletonema costatum was the dominant diatom in Tampa Bay and Charlotte Harbor. Its offshore distribution was discontinuous and essentially limited to a distance of 15 miles. The intensity of S. costatum blooms decreased from the Bay to offshore waters. It flourished in the Bay from February through May. In June the blooms of this diatom were noted only near passes connecting the Bay with the Gulf and in the upper reaches of Hillsborough Bay. The

A portion of the collection of local plankton.

maximum count (8,250,000 chains of cells per liter) was recorded during February in central Tampa Bay. During the late winter and early spring, Asterionella japonica was also a very abundant diatom in the Bay and the near-shore waters. Melosira nummuloides, Rhizosolenia stolterforthii, Biddulphia regia, Biddulphia sinensis, Coscinodiscus centralis, Cosdinoscus spp., and Chaetoceros socialis were other principal diatoms that bloomed near shore. Prorocentrum micans, Prorocentrum spp., Ceratium furca, Gonyaulax spp. and Peridinium spp. occurred in large numbers in the bays and near shore.

In May, the entire upper portion of Hillsborough Bay was brownish with reddish patches. The most intense discoloration occurred in areas protected from wind. All samples from red water showed Ceratium furca in very high concentration. The density of cells in surface samples varied from 2,240,000 to 14,290,000 cells per liter and in samples near the bottom, from several cells to 580,000 cells per liter. No dead fish or any other organism were seen. Blue crabs and other small fish swam actively through the patches of red water without showing ill effects.

Subaliquoting plankton samples.

Several specimens of pinfish, 3.7-4.4 inches long, Paralichthys albigutta (Gulf flounder), 4.0-4.1 inches, and one Chaetodipterus faber (spadefish) were kept for 36 hours in an aerated 15-gallon tank containing high concentrations (14 million cells per liter) of C. furca. The fish remained active during the entire period. After the experiment, all C. furca were deliberately killed by adding Formalin. As the dead dinoflagellates settled to the bottom of the tank, the water regained its normal transparency.

Extensive surface concentrations of Skujaella thiebarti, a blue-green alga, were seen offshore during April, May, and June. This alga forms a fine, rusty-beige dust or film on the sea surface and is often mistaken by commercial airline pilots for Florida red tide. Dense concentrations of the organism sometimes cover several square miles.

1963 Red-Tide Outbreak

In April 1963 an outbreak of red tide occurred in Tampa Bay that was greater than any previously recorded there. A preliminary analysis of preserved phytoplankton collected prior to, during, and after the outbreak was made from eight locations in Tampa Bay and adjacent waters.

Incidence of Gymnodinium breve at various depths by percentage of samples for stations 5 to 20 miles offshore, February-June 1964

Depth	February	March	April	May	June	Total
Meters	Percent	Percent	Percent	Percent	Percent	Percent
1.....	81.2	25.0	26.7	62.5	25.0	32.9
5.....	75.0	51.2	43.8	18.8	37.5	46.2
10.....	64.0	71.4	28.6	28.6	35.7	45.7
15.....	77.8	11.1	66.7	55.6	66.7	51.1
20.....	60.0	40.0	60.0	40.0	40.7	60.0

Preserved plankton collections were examined from January through May 1963. A special filtering unit with a mesh opening of 0.0039 inches had been used to collect these plankters. Collection and examination of plankton in the living state began in April and included G. breve and other dinoflagellates. The principal phytoplankton components were diatoms, dinoflagellates, and tintinnids. Cyanophytes and silicoflagellates were of minor importance. Phytoplankton biomass was greater in the upper portions of Tampa Bay than in the lower parts of the estuary. The blooms of G. breve during April were coincidental with (1) the blooms of Ceratium furca, Prorocentrum micans, Gonyaulax diegensis, Rhizosolenia stolterfothii, and Tintinnidae and (2) the intrusion of offshore waters into Tampa Bay during a period of exceptionally low rainfall. These offshore waters contained G. breve. The change in planktonic successions cannot be accounted for by any of the observed hydrological factors alone. The reduced numbers in the plankton populations prior to the blooming periods provide sufficient evidence, however, that the phytoplankton remained at low levels because of physiological limitations.

Since flagellates require vitamins for their growth and our field data for a 5-month period do not explain the ecological situation prior to the April red-tide outbreak, an important factor (or factors) has been missed. The data suggest, however, that the ecological conditions preceding the April outbreak were ideal for formation and accumulation of vitamins in the upper portions of Tampa Bay. Diversified studies over several years might show a more definite relation between ecological conditions and phytoplankton populations.

Occurrence and Distribution of Zooplankton

During a 12-month period, September 1961 to August 1962, quantitative surface samples were collected from 14 stations in Tampa Bay and the adjacent Gulf of Mexico. This study was undertaken as a part of an ecological survey of Tampa Bay estuary. The primary purpose was to determine the seasonal variation and composition of macrozooplankton and its regional distribution in the estuary. Hydrographic data collected simultaneously were temperature, salinity, and total phosphate-phosphorus.

The zooplankton samples were collected by means of horizontal surface tows, with a no. 000, 19.68-inch nylon net. The usual volume of water strained was 9,240 gallons. The total numerical abundance per cubic meter of water was calculated for each taxonomic group.

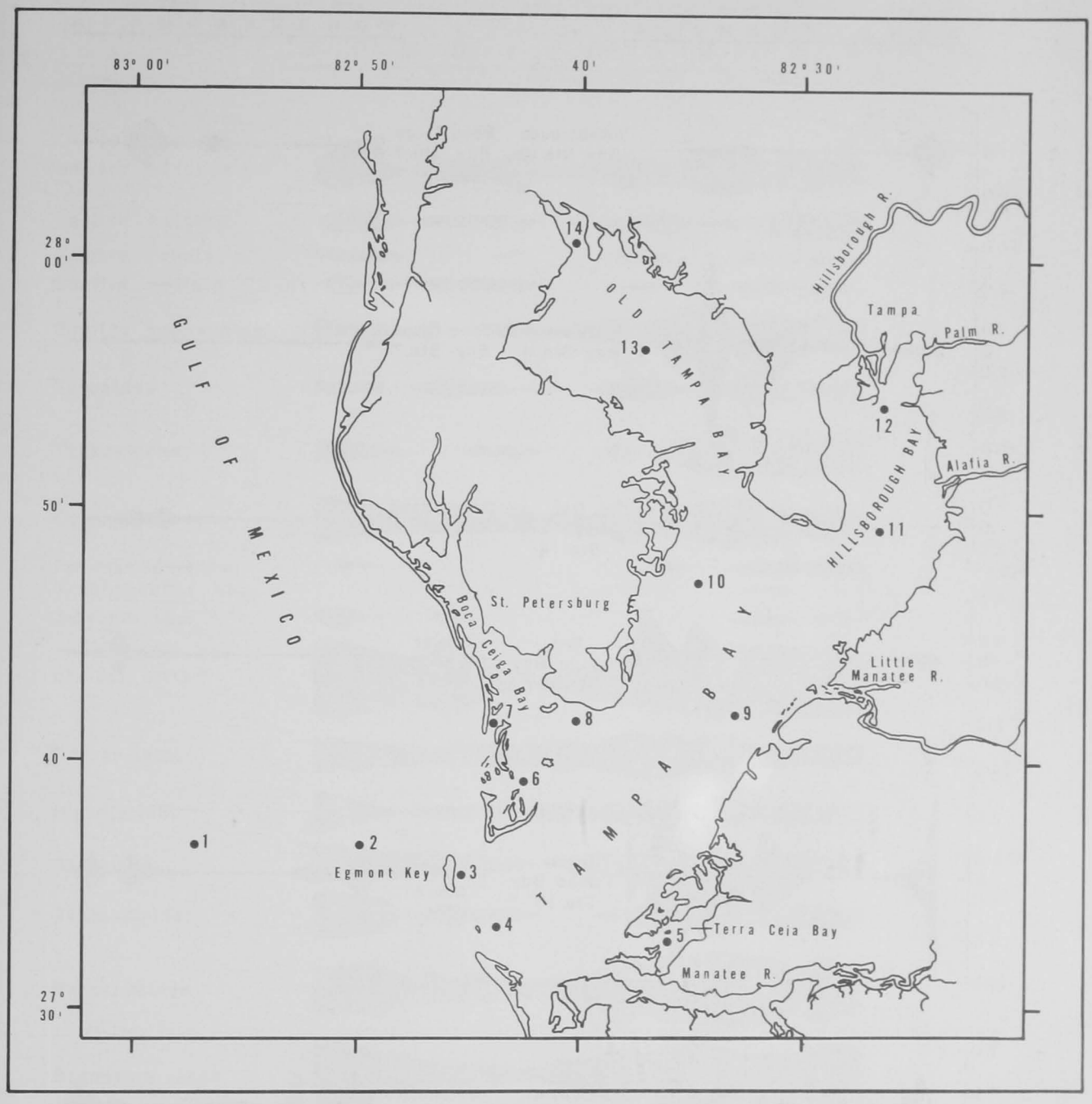
Zooplankton volumes.--The wet volumes of zooplankton in 263 tows varied from 0.3 to 5.6 cubic inches (average, 0.4 cubic inches). The highest values were in upper and central Tampa Bay. The most productive areas were in the lower portions of Hillsborough Bay, Old Tampa Bay, and upper Tampa Bay. The centrally located areas had larger standing crops of plankton than either the seaward stations or those near the fresh-water end of the estuary. The plankton showed wide variations in monthly abundance. The minimum plankton volumes were primarily observed during the winter; peaks occurred irregularly and appeared in the spring, summer, and fall.

Zooplankton constituents.--The planktonic organisms obtained during this study may be considered representative of the study area, considering the limitations of the sampling gear. The identified organisms comprised 95 taxa. Numerically and volumetrically, Lucifer faxoni (a small, transparent shrimp) was the most important organism in the collections. The high plankton volumes were due largely to L. faxoni in the samples. Taxonomically, chaetognaths, copepods, cladocerans, euphasids, L. faxoni, astigmateans, and appendicularids were the only genuine planktonic constituents in this study. Numerically, holoplankton (planktonic organisms that complete their life histories without ever leaving their planktonic life) accounted for 54 percent of the total zooplankters. If L. faxoni, copepods, and chaetognaths are excluded, holoplankton was responsible for 2 percent of the total number of plankters; hypoplankton (plankters being near the bottom) and meroplankton (temporary members of plankton community that spend only a part of their lives as plankton) represented 0.3 and 46 percent, respectively. Larval forms of bottom invertebrates were the principal organisms of meroplankton. The decapod early larval stages, and to a lesser degree the later larval stages, made up the bulk of the larval invertebrates.

Adults of many of these invertebrate larvae are either organisms of commercial importance or play an important role in the food chain. From the commercially important crustaceans, only larvae of pink shrimp were identified. The occurrence of these larval stages in Tampa Bay provides further evidence of the importance of the Bay as a nursery for pink shrimp.

The continuous presence of larval stages of crabs suggests that the adults spawn throughout the year and that the spawning is local. The commercially important common blue crab and the stone crab are numerous in the area.

Although fish eggs and larvae comprised about 2 percent of the total number of organisms collected, our information shows that Tampa Bay serves as a nursery area to many important fish species. Among the commercially important fish species, larvae of menhaden (Brevoortia spp.) and other clupeids

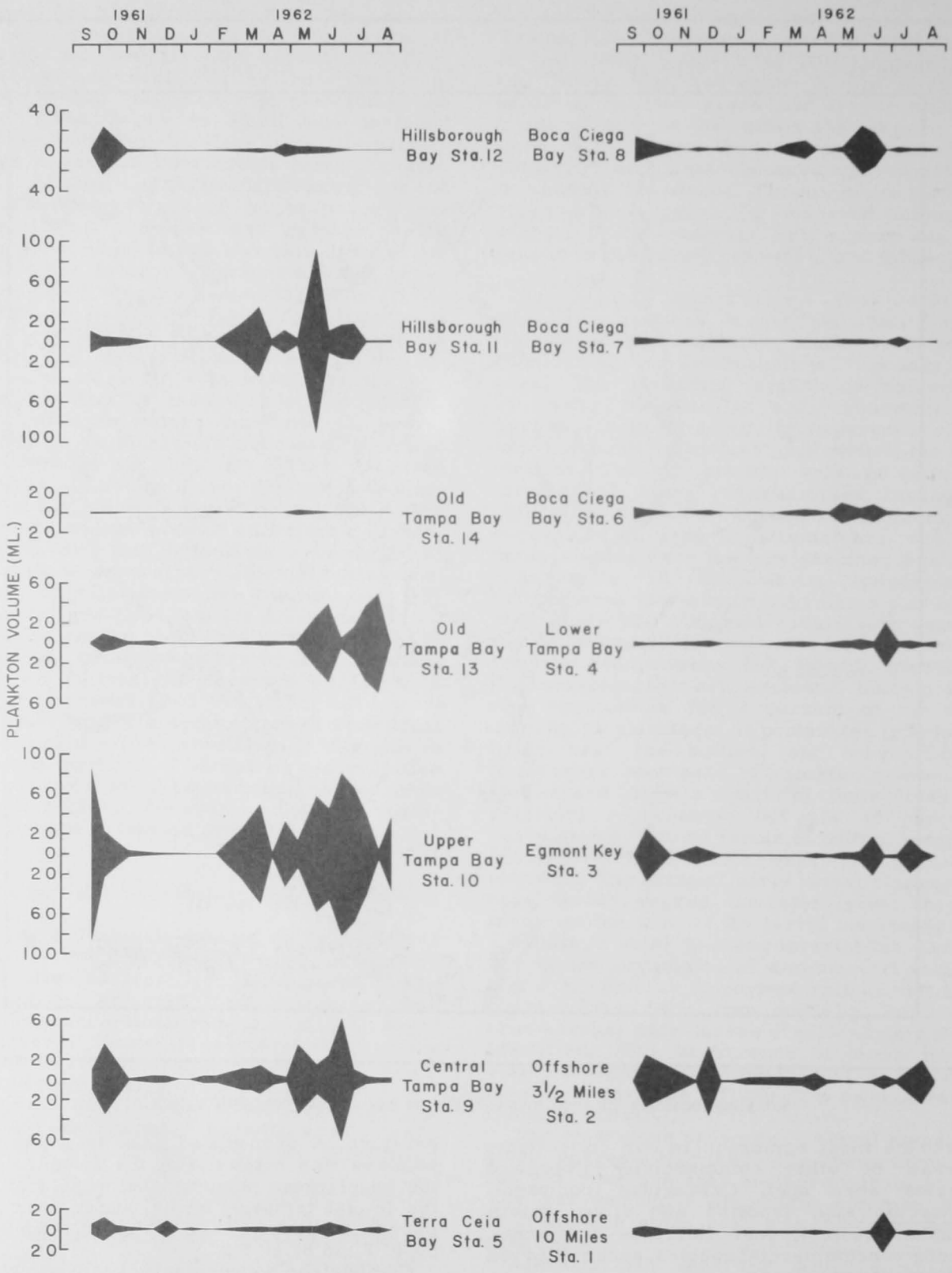


Sampling locations for zooplankton in Tampa Bay and adjacent Gulf waters.

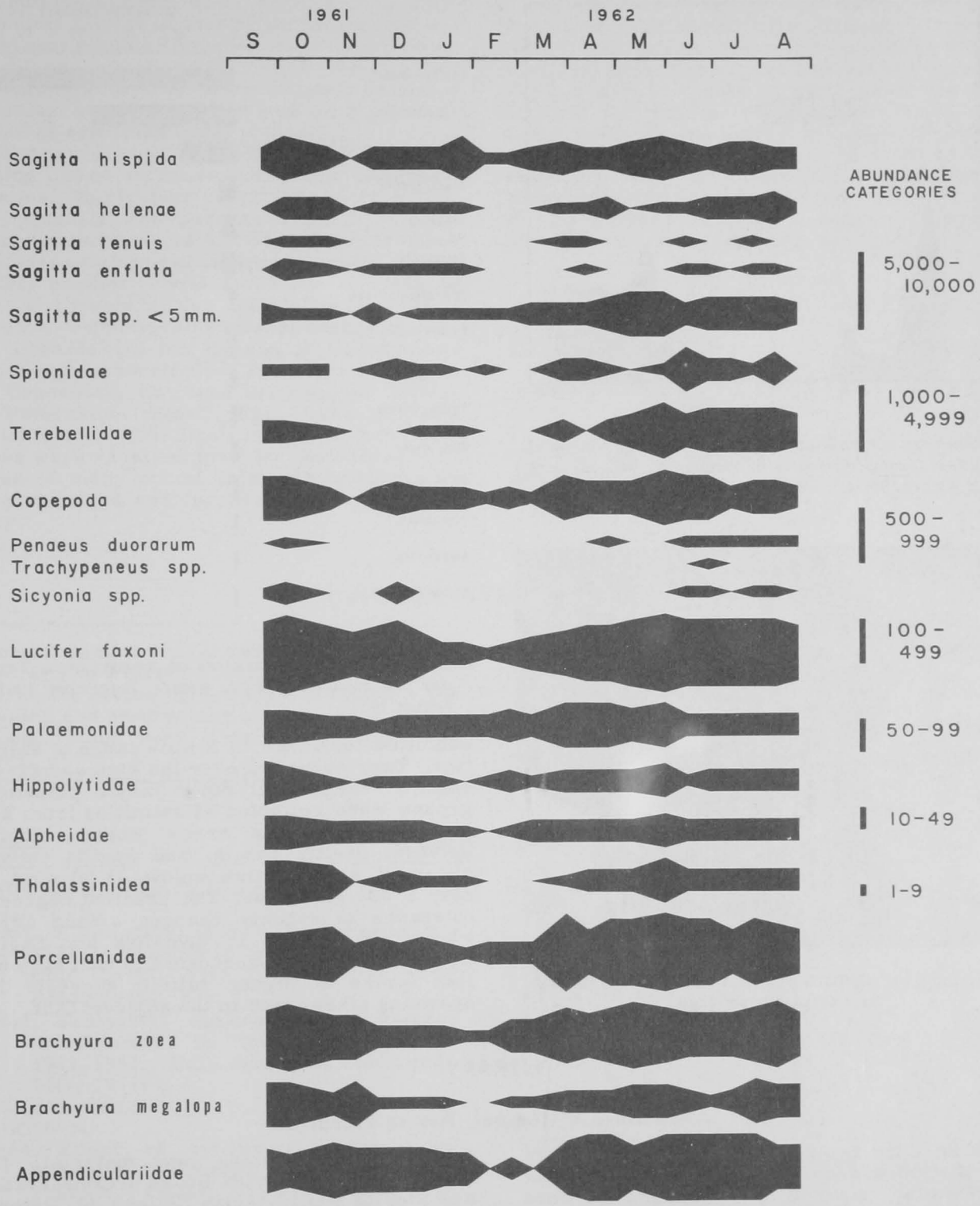
were the most numerous in our collections. Larvae of other commercially important species were spot, Carangidae (pompano), Cynoscion spp. (spotted and silver trout), Soleidae (soles), and Gerridae (mojarra). Among noncommercial species, anchovy larvae were most numerous.

Occurrence of zooplankton in relation to temperature and salinity.--Most planktonic organisms occurred with greater frequency at the higher temperatures. Data indicate that most plankters tolerated the maximum temperature. A pronounced drop in numbers and volumes was noted during the winter. None of the zooplankton occurred below 55.4° F., and the lowest temperatures at which many of the planktonic groups were observed ranged from 55.4° F. to 69.8° F.

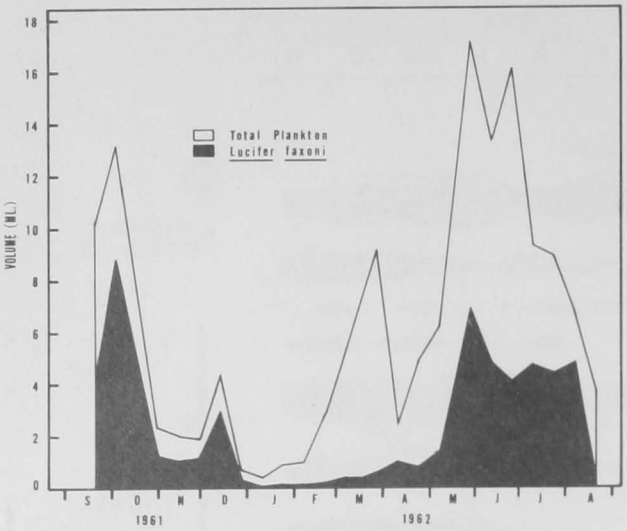
Comparison between salinity and occurrence of plankton suggests that most of the planktonic organisms prefer higher salinities. Salinity thus appears to be a limiting factor in the distribution of these marine forms of plankton. Copepods, Lucifer faxoni, some caridean shrimp, porcellanid crabs, and fish larvae



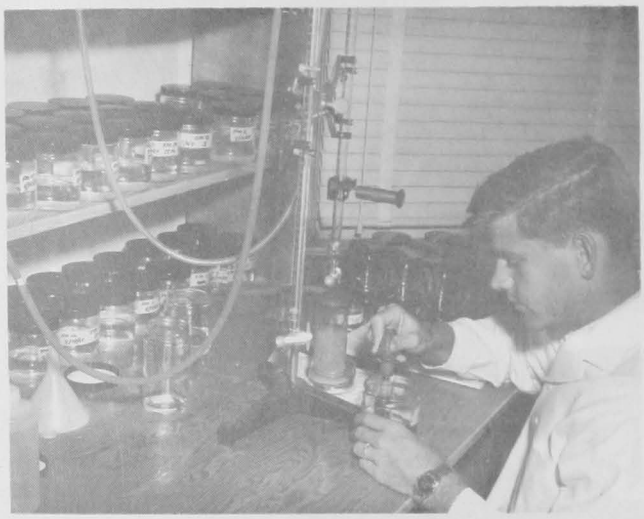
Monthly distribution of plankton volumes at various locations in Tampa Bay and adjacent Gulf waters. September 1961 to August 1962.



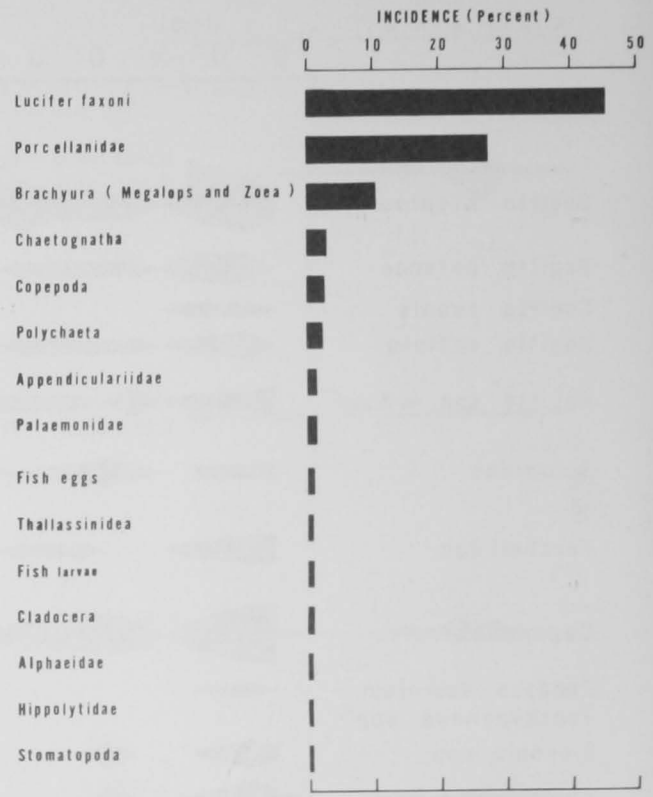
Relative abundance of the principal taxonomic groups of zooplankton in the surface waters of Tampa Bay and adjacent Gulf waters. Abundance is presented in terms of categories showing the mean number of specimens collected throughout the area of study. September 1961 to August 1962.



Monthly mean zooplankton volume and monthly volume of Lucifer faxoni, Bordaille in Tampa Bay and adjacent Gulf waters. September 1961 to August 1962.



Determining wet plankton volumes with a mercury immersion displacement gage.



Incidence of principal zooplankton constituents in Tampa Bay and adjacent offshore waters. September 1961 to August 1962.

exhibited tolerance to a wide range of salinities. They occurred over the entire observed salinity range. All other major planktonic groups were collected at salinities from 21.5 to 33.5 p.p.t. The arrow worms, Sagitta helenae, Sagitta tenuis, and Sagitta enflata, occurred at salinities below 33.00 p.p.t. in only a few instances. The greatest degree of tolerance to salinity changes among arrow worms was noted in juveniles and Sagitta hispida. The great abundance of fish eggs and fish larvae at higher salinity suggests that spawning takes place in the adjacent Gulf.

LIBRARY

Annemarie P. Rempel, Acting Librarian

Prior to the beginning of estuarine research this Station had no library, and all but a few publications required by staff members were received on loan from outside libraries. In July 1962 a room on the second floor of the building was designated for library use, and a librarian was employed. The librarian from the Bureau of Commercial Fisheries Biological Laboratory, Galveston, Tex., visited 3 days to discuss methods of cataloging, charging publications, and obtaining new material. The libraries of the Florida Board of Conservation and Florida Presbyterian College, St. Petersburg, Fla., were visited to obtain further ideas and advice. The Library of Congress cataloging system was adopted for bound volumes; other material is arranged alphabetically by series, agency, country, or state. Reprint and translation collections are filed by names of authors.

Acquisition lists are circulated to staff members. Copies of these lists are distributed to several outside libraries. New acquisitions are placed on a journal rack for review. Articles that seem to be immediately pertinent to research programs are marked for the attention of staff members.

Library material is now being received on a mailing list or exchange basis from 82 outside agencies. Thirty-four regularly issued scientific journals are purchased annually. The library contains about 5,300 publications which have been cataloged or entered into the records. Of this number, about 1,630 are volumes of books and journals. The remainder consists of reprints, reports, and miscellaneous items. The libraries of the Bureau of Commercial Fisheries Laboratories at Galveston, Tex., and Brunswick, Ga., and the Regional Office, St. Petersburg Beach, Fla., have supplied duplicate material. Back issues of scientific series were received from 60 agencies. Xerox copies of many out-of-print publications are being acquired and incorporated into the library.

During fiscal years 1963 and 1964, 225 items were borrowed under interlibrary loan, and 37 publications were lent to outside agencies and individuals. Use of outside libraries in this area by Station staff members decreased as Station reference material accumulated. The number of requests for information and assistance by area students and teachers, visiting scientists, local outside agencies interested in marine science, and the St. Petersburg Science Center increased considerably during fiscal year 1964.

Library Collection
(End of Fiscal Year 1964)

Type of publication	Number
Books	207
Journals	1,426
Institutional publications	3,245
Reprints and translations	436
Miscellaneous items	15
Total	5,329

VISITING INVESTIGATORS

Ronald Cowden and Conrad Bachman from the University of Florida School of Medicine spent time at the Station collecting and studying the spawning and embryology of amphioxus. Space and equipment were provided for their research.

Roy Mills from Purdue University was provided space, aquaria, and live invertebrates for photographing.

Earl Jertsen and Thomas Chapman from Marine Colloids, Inc., Rockland, Maine, were aided by Station scientists in locating marine plants suitable for reduction to commercial products.

PUBLICATIONS

DRAGOVICH, ALEXANDER, and JOHN A. KELLY, JR.
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