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**GULF STATES MARINE
FISHERIES COMMISSION**

**SEVENTEENTH ANNUAL REPORT
1965-1966**

To The

CONGRESS OF THE UNITED STATES

And To The

GOVERNORS AND LEGISLATORS

Of

**ALABAMA
FLORIDA
LOUISIANA
MISSISSIPPI
TEXAS**

IN MEMORIAM
W. DUDLEY GUNN
COMMISSION DIRECTOR
1949-1966

IN MEMORIAM
SPENCER G. TODD
COMMISSIONER
1964-1966

SEVENTEENTH ANNUAL REPORT (1965-1966)
OF THE
GULF STATES MARINE FISHERIES COMMISSION

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Of

**ALABAMA
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TEXAS**

Presented in compliance with the terms of the Compact and the state enabling acts creating such commission and Public Law 66-81st Congress assenting thereto.

**GULF STATES MARINE FISHERIES COMMISSION
Room 225 — 400 Royal Street
New Orleans, Louisiana 70130**

GULF STATES MARINE FISHERIES COMMISSION

ROSTER — OCTOBER 1966

James H. Summersgill
Chairman

Vernon K. Shriner
Vice-Chairman

Joseph V. Colson, Director

* COMMISSIONERS

Alabama

Claude D. Kelley, Director
Alabama Department of Conservation
Montgomery, Alabama

L. W. Brannan, Jr., Senator
State of Alabama
Foley, Alabama

Vernon K. Shriner
Montgomery, Alabama

Florida

W. Randolph Hodges, Director
Florida Board of Conservation
Tallahassee, Florida

J. Lorenzo Walker, Representative
State of Florida
Naples, Florida

Walter O. Sheppard
Fort Myers, Florida

Louisiana

Dr. Leslie L. Glasgow, Director
Louisiana Wild Life and Fisheries Commission
New Orleans, Louisiana

Richard P. Guidry, Representative
State of Louisiana
Galliano, Louisiana

James H. Summersgill
Golden Meadow, Louisiana

Mississippi

Charles Weems, Chairman
Mississippi Marine Conservation Commission
Biloxi, Mississippi

Ted Millette, Representative
State of Mississippi
Pascagoula, Mississippi

(Open)

Texas

J. R. Singleton, Executive Director
Texas Parks & Wildlife Department
Austin, Texas

Richard H. Cory, Representative
State of Texas
Victoria, Texas

Virgil Versaggi
Brownsville, Texas

* Order of listing - Administrator - Legislator - Governor's Appointee

SUCCESSIONS ON THE COMMISSION DURING THE YEAR

Dr. Leslie L. Glasgow	vice	Joe D. Hair, Jr.
J. R. Singleton	vice	J. Weldon Watson
Richard P. Guidry	vice	Spencer G. Todd
(Open)	vice	Joseph V. Colson

COMMISSION OFFICERS ELECTED OCTOBER 21, 1966 FOR YEAR 1966-67

Chairman: James H. Summersgill, succeeding
Walter O. Sheppard

Vice-Chairman: Vernon K. Shriner, succeeding
James H. Summersgill

Director: Joseph V. Colson, succeeding W. Dudley Gunn

STANDING COMMITTEES

ROSTER — OCTOBER 1966

Committee to Correlate Fishery Laws	(Committee 1)
Committee To Correlate Research And Exploratory Data	(Committee 2)
Shellfish Committee	(Committee 3)
Estuarine Technical Coordinating Committee	(Committee 4)
Committee Membership	
Wm. F. Anderson	(3)
Alabama Department of Conservation Dauphin Island, Alabama	
Charles R. Chapman	(4)
Bureau of Commercial Fisheries Galveston, Texas	
William J. Demoran	(2)
Mississippi Marine Conservation Commission Biloxi, Mississippi	
Johnie H. Crance	(4)
Alabama Marine Resources Laboratory Dauphin Island, Alabama	
Theodore B. Ford	(4)
Louisiana Wild Life and Fisheries Commission New Orleans, Louisiana	
Gordon Gunter	(3-4)
Gulf Coast Research Laboratory Ocean Springs, Mississippi	
Walter A. Gresh	(4)
Bureau of Sport Fisheries and Wildlife Atlanta, Georgia	
Robert M. Ingle	(2-3-4)
Florida Board of Conservation Tallahassee, Florida	
Joseph C. Jacobs	(1)
Assistant Attorney General Tallahassee, Florida	
Terrance R. Leary	(2-3-4)
Texas Parks and Wildlife Department Austin, Texas	

- Billy Joe Grantham (4)
Mississippi Game and Fish Commission
Jackson, Mississippi
- Lyle S. St. Amant (2-3-4)
Louisiana Wild Life and Fisheries Commission
New Orleans, Louisiana
- Paul E. Thompson (4)
Bureau of Sport Fisheries and Wildlife
Washington, D. C.
- James E. Sykes (4)
Bureau of Commercial Fisheries
St. Petersburg Beach, Florida
- H. Eugene Wallace (4)
Florida Game and Fresh Water Fish Commission
Tallahassee, Florida

ACKNOWLEDGEMENT

In submitting this seventeenth annual report the Commissioners wish to express their most sincere gratitude for the splendid cooperation of the members of the Congress and the Governors and Legislators of the compacted States. The Commission fully appreciates that such measure of success as has been attained in the past seventeen years could not have been possible without such valued assistance. This acknowledgement is also extended to the directorates and staffs of federal, state and interstate agencies and to representatives of all organizations and individuals who have contributed toward the realization of the objectives of the Gulf States Marine Fisheries Commission.

Respectfully submitted,
James H. Summersgill, Chairman
Vernon K. Shriner, Vice-Chairman
Joseph V. Colson, Director

COMMISSION ACTIVITIES

OCTOBER 1965 — OCTOBER 1966

The Gulf States Marine Fisheries Commission is an interstate compact of the States of Alabama, Florida, Louisiana, Mississippi and Texas, the compact having been signed in July 1949. Briefly, the purpose of the compact is to promote a proper utilization of the fisheries common to the seaboard of the Gulf Coast States, by the development of a joint program for the promotion and protection of these fisheries, and the prevention of their physical waste from any cause.

The Commission met twice in regular session during the past year. The usual spring meeting was held at Biloxi, Mississippi, March 17-18. A resolution was passed at this meeting requesting the Estuarine Technical Coordinating Committee to consider the development of an estuarine atlas and commend the Committee for its past endeavors. During the discussion of the estuarine Atlas by the Estuarine Technical Coordinating Committee, it was brought out that there was strong regional, as well as national interest in this cooperative project and the possibility of it being wholly or partially financed with PL 88-309 funds, (The Commercial Fisheries Research & Development Act of 1964). Apportionment of these funds for 1967 fiscal year, which began July 1, 1966, gives Florida, Louisiana and Texas \$246,000 each; Alabama \$43,500 and Mississippi \$121,000.

Also of importance was a resolution passed at the March meeting requesting the Bureau of Commercial Fisheries to extend its good efforts in exploration of technological research to those species of Gulf fishes considered most desirable for the manufacture of fish protein concentrate, and praised the Bureau for prior accomplishments in these two areas.

A motion was passed at the Biloxi meeting requesting the Estuarine Technical Coordinating Committee to coordinate the production of an estuarine film with the member states and the U. S. Fish and Wildlife Service.

The seventeenth annual meeting of the Commission was held in New Orleans, Louisiana on October 20-21, 1966. Due to the untimely death of its beloved director, it was necessary to sched-

ule a meeting on October 19 to discuss the appointment of his successor. Also preceding the October meeting, the Estuarine Technical Coordinating Committee met to discuss the developments in the production of the estuarine film mentioned earlier.

The Commission also published, through the efforts of its Shrimp Biological Committee, Informational Series No. 3 on THE SHRIMP FISHERY OF THE GULF OF MEXICO (Rio Grande River to Key West, Florida). This information is an important contribution to the knowledge of shrimp biology and the management of the shrimp industry. As stated in the Bulletin, the summary is not intended to be an extensive technical discussion of shrimp biology, but rather a statement of biological information immediately usable by fishery administrators and industry for understanding and managing shrimp production.

The pages to follow present in summary certain research activities being progressed by those agencies most closely associated with the Commission: The Alabama Department of Conservation, the Florida Board of Conservation, the Louisiana Wild Life and Fisheries Commission, the Mississippi Marine Conservation Commission, the Texas Parks and Wildlife Department, the U. S. Bureau of Sport Fisheries and Wildlife and the U. S. Bureau of Commercial Fisheries.

Continuing the plan of rotating regular meetings among the member states, the interested public is cordially invited to attend the following scheduled meetings in 1967:

Brownsville, Texas March 16-17

Montgomery, Alabama October 19-20

STATE ACTIVITIES

OCTOBER 1965 — OCTOBER 1966

ALABAMA



The Capitol
at
Montgomery

ALABAMA DEPARTMENT OF CONSERVATION

Laboratory Activities: The incorporation of the Federal Aid to Commercial Fisheries Act, PL 88-309 and its availability as a source of funding for the development of commercial fisheries increased the laboratory program of the Seafoods Division as well as funding certain phases of the shell and oyster planting program. At the present time, we have five active laboratory projects underway. The PL 88-309 projects are: the Cooperative Estuarine Survey, Oyster Raft Investigations, Oyster Pond Construction, and the State financed program consists of Artificial Reef Investigations, and the Population and Ecology Studies of the Mississippi Sound and Mobile Bay Area. In addition to these projects, the laboratory is assisting the U. S. Public Health Service in the collection and sampling of monitoring stations for the determination of pesticide residue, and periodic sampling of the primary oyster reefs for the determination of growth rate and commercial size density determinations.

The laboratory has employed a new director in charge of all laboratory operations, both contract and State operations. Employment and recruitment of personnel is continuing insofar as funding and availability of personnel will permit.

Oyster Production: The reporting period included one of the largest harvests of commercial oysters that has been on record for many years. An excellent crop, together with a high market demand brought production to a 300 per cent increase over the past years. For the first time in many years the main producing reefs were in a condition to allow the removal of steam oysters, and the industry profited thereby. In addition to the above, the private oyster growers were able to obtain seed oysters in quantities that enabled them to enter into planting programs at a level that was not possible up to the present. Examinations of the reefs at this time lead us to believe that the population density and general condition of the reefs will allow the Department to repeat the operations for another year.

Shrimp Production: The shrimp landings into Alabama increased considerably over the past reporting period. The development of larger fleets and bigger vessels has enabled the local operators to take advantage of the good off-shore shrimping operations, and the landings have increased proportionately. Inshore shrimping has also been better than normal in that the price has remained high, and the supply, while not exceptionally large, has remained steady. At present the fall run of white shrimp is anticipated to be very good, and should this condition remain, the annual harvest should again establish a new record of production.

Reef Development: The Department of Conservation again increased their planting efforts in both the planting of shell and seed oysters. This year there was planted around 80,000 barrels of seed oysters, together with about 50,000 barrels of shop shell on the public reefs. In addition to this the Department contracted for the planting of 36,000 barrels of dead reef shell in the vicinity of the seed oyster areas. These should provide adequate seed oysters for further planting by both the private lease holders and the Department efforts towards the public reefs.

FLORIDA



The Capitol
at
Tallahassee

STATE BOARD OF CONSERVATION — MARINE LABORATORY
ST. PETERSBURG, FLORIDA

FISHERIES

Oysters: Work has continued on oyster nutrition and results using finely ground cornmeal have been extremely gratifying. Glycogen content was substantially increased, color was improved, and shell growth was noted.

Additional substances (mostly cereal grains) are also being tested. With a known nutritional factor, other variables may now be measured, and studies are planned to determine temperature and salinity effects and optima.

A study on the occurrence of the marine fungus *Dermocystidium marinum* in Florida west coast oysters is underway. Oyster

mortality from this fungus has seriously affected production in several areas.

Clams: Preliminary studies completed in Tampa Bay have shown a commercial clam potential. Because of the results from this study and the availability of federal funds under PL 88-309 a large scale study of the clam populations of Tampa Bay and other areas has been initiated.

Fish: The studies on age, growth, and reproduction in the red grouper, *Epinephelus morio* are continuing. Preliminary results show that the red grouper matures as a female in four to five years. Many of these females then become the functional males of the population at eight to fourteen years of age. No males have been found with a standard length of less than 20 inches.

In conjunction with the samples received from Project Hourglass, an ecological analysis of offshore bottom fishes along the lower west coast of Florida is underway. This project will provide indications of population size, growth rate, seasonality and spawning activity of many common bottom fishes.

Also in progress is a report taken from the available literature concerning the spawning times of Florida shore fishes. This will provide a handy reference for summary spawning data of many common species.

The Florida Board of Conservation fish reference collection is still being expanded and fishes are available for loan to any interested scientists. An annotated listing of the specimens in the collection is now available.

Larval Fish: A recent publication has linked the larval forms of the worm eel *Myrophis punctatus* to the adult. There are several other species of fish beside the eels which have a leptocephalid type of larva, and studies are in progress to link the larval with the adult forms. Manuscripts are currently being prepared on the tarpon, bonefish, and ladyfish.

Fisheries Technology: Experiments are being conducted to find multiple uses for sharks and shark products. Vitamin A from the livers is no longer in demand, but shark hides are still valuable. By finding other commercial uses (fishmeal, fresh meat, etc.) it is hoped that shark fishing may again become a profitable business.

Studies on the production of fishmeal from various fish sources, (scrap fish, waste from filleting operations, shark carcasses, and others) are also underway. If uses can be found for these waste products, this will reduce costs and increase profits for commercial interests.

Different types and methods of handling frozen lisa fillets are being tested with regard to their efficiency in inhibiting rancidity. Objective chemical tests and taste panel judgments are used to determine which methods are preferable.

Invertebrates: The reference invertebrate collection begun in January 1965 is still growing rapidly and now contains over 700 Florida species of mollusks, decapod crustaceans, and echinoderms.

The Hourglass program is the largest contributor to the collection. With this continuing systematic sampling, it is now possible to determine seasonal periodicity, depth ranges, spawning seasons, growth rates, and other biological patterns of many invertebrates. This processing and record keeping now dominates the activities of the invertebrate section.

An additional trawling and trapping cruise is made each month by the R/V Hernan Cortez for the purpose of determining if there is a commercial potential for the shovel-nosed (*scyllarid*) lobsters off the west coast of Florida. A much clearer picture of the life history of this lobster will also result from this study.

Spiny Lobsters: Spiny lobster studies dealing with larval and postlarval periodicity, habitat preferences, salinity tolerance, age, and growth rates are in progress at the Stuart and Key West field laboratories. Some additional larval examinations have been done recently in St. Petersburg.

Larval Crabs: Studies of the larval stages of the blue crab, stone crab, and related species is continuing. Attempts are being made to raise many of these larvae from the eggs and additional stages are being separated from plankton samples. Detailed information on spawning grounds, spawning periods, growth, migration and natural habitats will be available when this study is completed.

SEAWEEDES

Interest in commercial utilization of seaweeds prompted a preliminary survey of the west coast of Florida for concentrations of these plants. A preliminary report is being prepared.

Samples from the Hourglass cruises are being retained for study.

DRIFT BOTTLE STUDIES

A cooperative study by the Florida Board of Conservation and Woods Hole Oceanographic Institution is in progress. This study is using drift bottles and seabed drifters to obtain additional information on the speed and direction of seasonal currents in the Gulf of Mexico. Such information is necessary for the complete understanding of larval transport.

RED TIDE

Chemistry: Chemical studies to determine the concentrations of iron, phosphate, nitrite, silica, salinity, humic acid, carbohydrates, organic nitrogen, and amino acids in both fresh and salt waters are continuing. It is hoped that some of this information may be correlated with the occurrence of the Red Tide organism *Gymnodinium breve*. Such a correlation has been found with heavy rainfall, increased iron content in rivers, and increased fresh water runoff.

A comprehensive study of the nutritional, chemical, and physical factors influencing the growth and reproduction of *G. breve* in the laboratory has also been initiated.

Bioassay of Sea Water for Vitamins: Water samples are also being analyzed for the presence of certain vitamins (B₁₂, Thiamin, Biotin) in an effort to link the presence of these vitamins to blooms of the Red Tide. No such correlation has yet been found.

Dinoflagellates: Studies on the dinoflagellates occurring in conjunction with the Red Tide organism *G. breve* (also a dinoflagellate) are continuing. To date, over 120 species and 31 genera have been identified.

Diatoms: These important unicellular algae are a major contributor to the primary food chain. Studies are being conducted to determine the species present and to gather data on their abundance and seasonality. This information will be used to determine the possible role of diatoms in relation to outbreaks of Red Tide.

Artificial Cultivation of Phytoplankton: Many of the more

common phytoplankters are being cultivated in the laboratory to determine ease of maintenance and nutritional requirements.

RELATED RESPONSIBILITIES

Research Vessel Hernan Cortez: The primary sampling program of the R/V Hernan Cortez is called Project Hourglass, and has been designed to meet the scientific requirements of the Fisheries and Red Tide Divisions of the Marine Laboratory. This program consists of monthly samplings in an offshore area between Ft. Myers and St. Petersburg, out to a depth of 40 fathoms. The same stations are sampled each month and the catch is preserved and brought back to the laboratory for study.

This project is considered one of the most important programs now in progress and is supplying vast quantities of data on hundreds of different species. From these data we are gathering information on the growth rates, size ranges, spawning periods and areas of seasonal occurrence and abundance of a large number of species, many of which are commercially important, and more of which may become commercially important.

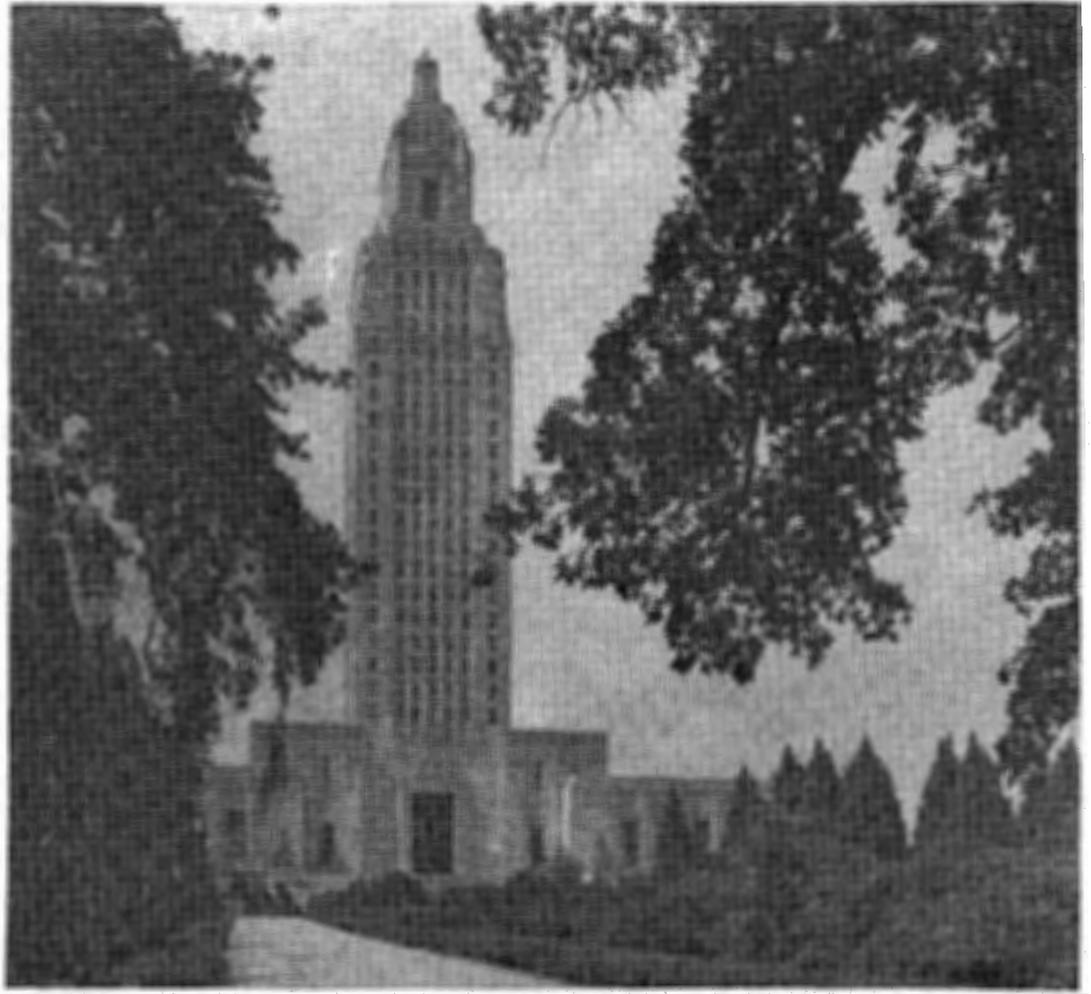
Additional cruises are made during the remainder of the month, involving trapping, trawling or other sampling as requested by laboratory project leaders.

Library: The Florida Board of Conservation Marine Laboratory library continues to expand and now has 762 books, 312 microfilms, 298 sets of microcards, 6,400 reprints, and a journal collection of several thousand serial publications.

Survey and Management: The normal work of reviewing coastal projects detrimental or beneficial to marine resources is continuing.

The publication of pamphlets and educational material concerning marine resources is being accelerated, and a wide variety are now available on request.

LOUISIANA



The Capitol
at
Baton Rouge

Primary repairs were completed during this year on the buildings and outside facilities such as the wharf and shrimp ponds that were still remaining following Hurricane Betsy. Planning has been completed for the replacement of three buildings completely lost during the storm and it is hoped that this work will get underway in early 1967. Additionally, it is proposed that the number of experimental research ponds for conducting experiments on shrimp and other marine animals will be initiated next year at the Marine Laboratory located on Grand Terre Island. This would permit an expansion of pond and shrimp investigations that have been conducted for the past two or three years.

SHRIMP STUDIES

Shrimp investigations since 1962 until this year were confined chiefly to the Greater Barataria Bay area. The enactment of Public Law 88-309 in the appropriation of matching funds for the states enabled the Commission to expand its investigations to a coastwide basis. There are now 6 three-man teams, headed by a biologist, working from the Mississippi line to the Texas line. This program is a part of the Cooperative Gulf of Mexico Estuarine Study with the States of Alabama, Mississippi, Louisiana, and, also, the Bureau of Commercial Fisheries Biological Laboratories in Galveston, Texas, and St. Petersburg Beach, Florida, participating in the program. Furthermore, this ambitious program is essentially being sponsored and coordinated through the Gulf States Marine Fisheries Commission's Estuarine Technical Coordinating Committee. Generally, shrimp production for both the brown and white species was a little less than that obtained in some prior years. However, the prices held good throughout the year and fishermen were able to compensate for the reduced catch by the increased price.

In November, approximately twelve thousand small white shrimp were stained with Trypan blue in the Caillou (Sister) Lake area of Terrebonne Parish below Houma, Louisiana. This marked recapture experiment was designed to determine the distribution and migration movements of undersized white shrimp and determine whether or not these animals re-entered the nursery areas following an overwintering period in the near offshore Gulf waters. The recaptures and recoveries were quite limited due principally, in our opinion, to the fact that our nursery areas are closed to fishing during the period that the white shrimp normally use these areas in the early Spring period. By the time the season for brown shrimp has opened for the inside waters, the white shrimp generally have moved offshore. Therefore, this is a difficult hypothesis to adequately test under present conditions.

HYDROGRAPHIC STUDIES

This has been a continuing program at the Marine Laboratory since 1958 and the cumulative data has been good. As a result of the expanded estuarine study, considerable hydrographical data will become available for the other five study areas of coastal Louisiana. Recording temperature, tide gages and

salinity meters were being installed in each area. This proposed long-term monitoring program should establish perimeters to assist with the interpretation of biological data obtained in the future.

OYSTER STUDIES

The basic applied research program on oysters has been re-established. It is proposed that the pond culture of oysters as a possible source of obtaining seed and for fattening purposes will be studied. Secondly, some consideration will be given to predator controlled methods on the oyster drill.

During the late Spring of 1966, more than 36,000 cubic yards of clam shell were planted for oyster cultch. Half of this volume was planted in the Bay Boudreaux area of the upper eastern Louisiana marshes, while the other half was planted around Snake Island in the Black Bay area east of the Mississippi River. Favorable catches of oyster spat occurred early and the seed outlook is promising. Both areas are tentatively scheduled to be opened in September, 1967.

Another segment of work initiated under Public Law 88-309 is the implementation of the Oyster Lease Monument Control Project. This provides for establishing highway-type concrete markers with brass discs at close intervals in the coastal marshes in oyster growing areas. This project should be extremely helpful in the future location of oyster leases and, particularly so, in congested areas where a large number of leases occur in close proximity to each other. The need for such a project has been recognized a long time in Louisiana and should be of considerable service to the oyster industry.

MISSISSIPPI



The Capitol
at
Jackson

GULF COAST RESEARCH LABORATORY

The 1965-1966 summer classes in marine zoology, botany and geology, and the National Science Foundation program for selected high school students was continued. The proximity of the nearby waters of Mississippi Sound and the Gulf to the classes enable the students to actually see that which they are studying. A Geology Institute for college professors was carried on under the joint sponsorship of Millsaps College and the Laboratory.

Approximately eleven acres of the old Coast Guard station at Point Cadet, Biloxi have been obtained and will be developed as an annex of the GCRL during the coming years.

A conference on oceanographic research was co-sponsored by the Laboratory at the American Embassy in Mexico City to acquaint Mexican scientists and government officials with the research conducted in the central and southern Gulf of Mexico.

The Laboratory is participating in the Pesticide Monitoring Project being conducted by the U. S. Fish and Wildlife Service through various coastal marine laboratories from Maine to Alaska, and is responsible for the collection and preliminary processing of organisms being monitored in our area. The results of these analyses will be used to gather a better idea of the amount of pesticides present in the marine environment and monthly and seasonal variations.

Extensions of the microcosm studies, particularly large scale field tests of phenomena observed in laboratory studies, along with the construction of estuarine ponds for larger studies is underway with funds provided by a Rockefeller Foundation Grant.

Population Studies of Exploited Crustaceans and Fishes in a Northern Gulf of Mexico Estuary with Special Reference to the Effects of Brood Success on Commercial Availability is in progress under Fisheries Research and Development Act of the Congress, Public Law 88-309, Project 2-25-R. Regular collection of data in Mississippi Sound and adjacent waters has been established.

Research projects also under Public Law 88-309 are a Study of Coliform Bacteria and *Escherichia coli* on Polluted and Unpolluted Oyster Bottoms of Mississippi and a Study of Depuration by Rebedding; and a Study of the Offshore Animals and Plankton of the Gulf of Mexico from Mississippi Sound Out to 50 Fathoms in depth.

MISSISSIPPI MARINE CONSERVATION COMMISSION

Plans were worked out by the commission to insure delivery of all shells owed the commission by the seafood packers and dealers; some dealers have been reluctant to turn over the 50 per cent of shells owed the state in past years. Extensive shell planting and seed oyster moving has been completed. 14,000 barrels of reef shell were planted. These shells were used primarily on new areas where oysters had not grown previously. Early checks on the shells that were planted this summer show some encouraging results. However, it is still too early to determine the success of the plantings, as this can be determined only after the fall set of young oysters.

TEXAS



The Capitol
at
Austin

PARKS AND WILDLIFE DEPARTMENT

HYDROGRAPHIC PROJECT

Hydrographic studies have been conducted continuously in all Texas Bays for the past eight years. Because of increasing emphasis on environmental conditions and the effects these conditions have on coastal fisheries, a separate hydrographic project was initiated in 1965. This project monitors tide, rainfall, runoff, salinity, turbidity, temperature, siltation and habitat modifications affecting nursery areas.

Tide gauge readings were available from only a few of the coastal bay areas: however, both the upper and lower Coast experienced high tides resulting from the autumnal equinox in September. Tides of two to three feet were present for a period of ten days in the Matagorda area. The Corpus Christi Bay area had tides of 1.86 feet above mean low tide in September and the Lower Laguna Madre had tides of 1.30 feet above mean low tide during the same period.

Rainfall varied with each area but generally increased from the lower to the upper Coast. Heavy rainfall was recorded at all coastal bay stations during the spring. Rainfall totals for March, April and May ranged from 21.39 inches in Galveston to 7.38 inches in the Lower Laguna Madre. The heaviest rainfall was during late May.

Flood waters from most rivers reached bay areas in May and some rivers were still at flood level during the first part of June. Turbidities increased throughout the area at this time.

The increased rainfall and heavy runoff during the spring months resulted in the lowest salinity readings, in most areas, since 1960. Upper Galveston Bay, Trinity, Clear Lake and adjacent small bays were virtually fresh during May when the highest salinity recorded in Trinity Bay was 4.1 ppt. Average salinities during the three month period of March through May ranged from 11.6 ppt in Galveston to 33.3 ppt in the Lower Laguna Madre. Matagorda Bay area salinities averaged 15.3 ppt, San Antonio Bay was 14.8 ppt, Aransas Bay was 19.2 ppt, the Corpus Christi Bay average was 28.6 ppt, the Upper Laguna Madre was 39.1 ppt, and the Lower Laguna Madre was 33.3 ppt. Salinity samples taken in the Gulf of Mexico during the period of heavy runoff averaged 25.00 ppt off Port Aransas and 30.03 off Port Mansfield.

Water temperatures followed normal seasonal trends. Temperature differences usually averaged from one to four degrees between the upper and lower Coast but at times the gradient was as much as ten degrees, depending on latitude and average depth of individual bay systems.

Nursery area surveys indicate approximately 364 acres were lost in the Aransas Bay area due to dredging operations. The Corpus Christi, Upper Laguna Madre and Lower Laguna Madre area combined had 113 acres of nursery grounds destroyed.

Silt monitoring stations showed some erosion of bay bottoms and in some areas rapid siltation. Vertical filling of 16.5 inches occurred near Padre Island in the Upper Laguna Madre, while the west shore of the Laguna Madre had negligible siltation.

SHRIMP PROJECT

The Shrimp project, now 8 years old, was begun to study the habitat, growth rates, migrations, sizes and seasonal abundances of commercial shrimps in Texas estuaries. Shrimp, for study,

are collected systematically with trawls and seines. The findings are used to manage the fishery.

Many important brown shrimp nursery areas on the upper coast were not fully used this spring, because salinities were greatly reduced by excessive fresh water influx. The young shrimp left the altered areas to enter saltier bay regions and began invading the Gulf in late May. The poor conditions of the upper coastal bays, which may have caused heavy shrimp mortalities, plus the below par abundance of shrimp in biological samples was indicative of a poor to mediocre brown shrimp season. However, another wave of small brown shrimp, detected in May, should contribute to the fished population. Commercial landings through July were below the 1965 level and most were caught south of Galveston.

Small white shrimp appeared in the samples late this year and were not abundant. Moderate catches were made early in the fall bay season in Matagorda Bay, but early catches, in general, were poor. Usually, prerecruitment waves of white shrimp enter the bays in September; hence bay shrimping should improve.

Shrimp research and management programs continued. The exchange of new findings and ideas between members of the Gulf States Marine Fisheries Commission has led to a better understanding of shrimp biology, the status of the fishery and management procedures.

CRAB PROJECT

Information of seasonal abundance, growth, movements, and environmental relationships was used to study trends in the blue crab, *Callinectes sapidus*, population while a survey of the commercial fishery was made to collect information on sizes caught, sex composition, catch per unit of effort, and market conditions.

Fall spawned crabs (8-18mm) were predominant in winter and spring catches, whereas, crab brood from the spring spawning were detected in July-August. The apparent abundance of juvenile crabs in Aransas Bay was at the highest level since sampling began in 1961 and the return of a commercial fishery to this area in the fall of 1966 is anticipated.

Growth studies in Galveston Bay indicated that most crabs will reach commercial size within one year after hatching. Limit-

ed growth occurred during winter, but low temperatures appeared to extend the time period between molts and had a greater effect on larger crabs.

Factors related to crab distribution within the bays were studied. Food availability, bottom type, size, sex and season were some of the factors related to congregation of crabs in certain areas. Studies to provide information of the effects of these factors on the success of reproduction and survival are being planned.

Tagging studies were continued in lower Galveston Bay and adjacent Gulf of Mexico waters. A new phase of study, aimed at determining the fate of spent female crabs was initiated in May.

Semi-monthly quantitative plankton samples taken in gulf passes to major bays were discontinued when analyses of data failed to reveal a clear relationship between the number of megalops entering the bay and the number of juvenile crabs present in nursery areas. Likewise, peaks of spawning could not be deduced from the data.

In 1965, crab landings (3.6 million pounds) increased 56% over 1964, but were one million pounds below the record year, 1962. Crab landings fluctuated with the availability of crabs to the fishery and market conditions.

FIN FISH PROJECT

Greater than normal rainfall and runoff kept salinities down over the entire coast throughout the year. Temperatures were moderate; no severe freezes were noted and no significant fish kills were noted from any causes; natural or man-made.

Juvenile fish samples indicated a generally successful redfish spawn with the first fingerlings appearing in December and continuing in all bay areas throughout the spring months. Flounder, trout and sheepshead spawns were successful, but the black drum spawn appeared to be poor in all areas.

Successful spawns and absence of catastrophic mortalities in recent years have resulted in an abundance of trout, redfish, flounder and sheepshead in most areas. While some sectional and seasonal variations were observed, no serious or permanent shortage of any of these species occurred. Numbers of black drum, however, decreased in some areas and generally declined, coastwide, in abundance.

In the fall of 1965, monthly sampling continued as in previous years but starting with the spring samples in 1966, adult sampling was condensed and intensified in an effort to obtain a more representative picture of the adult fish populations in each bay area.

Other work done under this project during the period included the survey of the Brown Cedar Cut area of Matagorda Bay area to determine the effects of pass opening and closing, the survey of the fish of the inshore waters of the Gulf of Mexico and an ecological survey of St. Charles Bay.

OYSTER PROJECT

Oyster stocks in Aransas, San Antonio, Matagorda and Galveston Bays were monitored through tray stations with emphasis on mortality rates among seed and market oysters. Reef sampling was discontinued in all areas except Galveston Bay.

The moderate to heavy mortalities among oyster stocks observed in most bay areas during 1965 were not repeated in spring and summer 1966. Both *Dermocystidium* and "Aransas Bay disease" appeared to be curtailed (at least temporarily) by low salinities resulting from spring flooding. Late summer mortalities, however, increased in Matagorda and Galveston Bays although these were due, in part, to predation by conchs (*Thais haemastoma*).

Flood waters killed oysters in Tres Palacios Bay and Trinity Bay, but damage to commercial oyster grounds was light. Private lease holders in Trinity Bay suffered heavy losses due to flood waters, and their major sources of transplanting stock, the upper Trinity Bay reefs, were destroyed.

The 1965-66 oyster harvest established a new record. As in past years, most of the oysters were harvested in Galveston Bay with limited production from East Matagorda Bay, upper Lavaca Bay, upper San Antonio Bay, and South Bay. Increased fishing pressure, rather than an increase in market oyster stock, was responsible for the high harvest in Galveston Bay.

GULF PROJECT

White Shrimp of 150-200 mm. were abundant in the shallow Gulf off Port Aransas and Port Mansfield in the late part of August and early September. In May, June and July, 1966 large white shrimp were ripe, but were not abundant.

Small brown shrimp were plentiful from the middle of May

through July. At the start of this period, browns of 60 to 100 mm. were taken in depths of less than 8 fathoms. Shrimp of 80-140 mm. were taken at depths of 8-14 fathoms. Toward the end of the period, most brown shrimp were 100 to 140 mm. long. The abundance was the same as in the previous years.

Fewer brown shrimp were caught off Port Mansfield and Port Isabel than in the waters north of this area but the size range was similar in both areas.

Most of the pink shrimp were caught in June. The size range was 80 to 160 mm.

Few commercial blue crabs were caught. Those taken in June and July were all females and over 80 per cent were in sponge. The Gulf blue crab was abundant throughout the year. Large numbers of box, shame-faced and speckled crabs were commonly caught in gill nets set over the inshore reefs off Port Mansfield.

The Atlantic croaker was the most abundant fish taken. Other common fish were the spot croaker, the two sand trout, the bumper and the Gulf whiff. Gill net sets produced a few shark and large hardhead catfish. Trotline sets were mainly unproductive except for small shark.

Bottom water temperature varied from a low of 14°C. in February off Port Aransas to 31°C. in August off Port Mansfield. Salinities varied from 29.0 to 36.0 ppt.

ESTUARINE ENGINEERING STUDY

Federal cooperation with the States in research, development, and conservation of fishery resources was provided by the Commercial Research and Development Act of 1964. A portion of the funds are provided for the study of Texas coastal resources.

The purpose of Project 2-12-R is to evaluate the effects of estuarine engineering projects. Research on various alterations, including channel dredging, spoil placement, bulkheading and levee construction, are needed so that recommendations can be made to minimize harmful effects and maintain suitable fisheries habitat.

Study was begun in March, 1966, to determine the effects of the Texas City Hurricane Protection Levee, an earthen sea wall designed to protect low elevation areas from tidal intrusion during storms. In 1964, preliminary work was completed on an extension of the levee across the mouth of Moses Lake, a shallow,

low salinity arm of Galveston Bay. Ultimately, the project will be completed by the construction of a navigation channel and hurricane lock. A project is proposed which would extend the levee across Jones Bay, an arm of West Bay. A survey of Jones Bay is being carried out in advance of construction so that conditions before, during, and after construction of the levee can be determined.

PRESTICIDE MONITORING PROJECT

This study was initiated to determine the source, amount, and areas of pesticide contamination within some Texas bays. The commercial oyster was used as the indicator organism. Whole oysters were prepared for analysis by electron capture gas liquid chromatography. Analyses were made in a cooperative study with the U. S. Bureau of Commercial Fisheries for the following chlorinated hydrocarbons: Aldrin, BHC, Dieldrin, DDD, DDE, DDT, Endrin, Heptachlor, Heptachlor epoxide, Lindane, and Methoxychlor.

The estimated crop land within each watershed being sampled was determined. Approximate pounds of each pesticide applied per year were determined to pinpoint areas of high application.

It was found that the lower Laguna Madre oysters contained more pesticides than other areas, and the watershed had the most pounds of pesticide applied per acre of cropland. Other areas of high application and contamination were upper San Antonio Bay and Tres Palacios Bay.

It appears that agricultural uses, rather than domestic uses from metropolitan areas, are the main source of pesticide pollution where sampled.

OTHER PROJECTS

Under the Federal Aid to Commercial Fisheries Research and Development Program, the department began construction of a 72 foot steel hull gulf research trawler. The vessel is equipped to trawl to 800 fathoms and will be used to monitor shrimp and fish stocks along the Texas Coast.

Also under the Federal program the department has contracted to purchase a 40 acre tract of land on Matagorda Bay for use as the site of a salt water pond experiment station. A series of ponds will provide controlled environment for fisheries research.



The Capitol
at
Washington, D. C.

U. S. FISH AND WILDLIFE SERVICE ACTIVITIES

OCTOBER 1965 – OCTOBER 1966

Bureau of Sport Fisheries and Wildlife

Primary activities of the Bureau of Sport Fisheries and Wildlife which are of interest to the Gulf States Marine Fisheries Commission include the status of the marine game fish research laboratory sites and activities conducted under the authority of the Fish and Wildlife Coordination Act.

Panama City, Florida, and Port Aransas, Texas, have been selected as the laboratory sites for marine game fish research. These laboratories are now being designed. Construction funds have been appropriated to cover site preparation which is expected to begin in early 1967. This will involve primarily installation of sea walls and filling.

Activities under the authority of the Fish and Wildlife Coordination Act have continued on public works projects and private Federally-licensed projects through the Regional Director's office, Atlanta, Georgia. Projects of interest include the Central and Southern Florida comprehensive water plan and the

comprehensive review report, Mississippi River and Tributaries project. The latter project was authorized by the 1965 Flood Control Act in which Congress did authorize construction of the structures necessary to divert fresh water from the Mississippi River below New Orleans into the coastal marshes.

Bureau of Commercial Fisheries

Bureau fishery research and services in the Gulf area are directed by the Regional Office at St. Petersburg Beach, Florida. These activities are aligned, insofar as facilities and funds will permit, with recommendations from the Gulf States Marine Fisheries Commission. The needs of the fishing industry in the Gulf are many and varied so that it is often not possible to attend to all aspects of these problems simultaneously. However, the outlook for obtaining more oceanographic information, especially in the western Gulf waters, has been improved by the start of a new program and the assignment of the well-founded oceanographic vessel Geronimo to the Galveston, Texas laboratory. Other general encouragement comes from progress being made on the construction of the new exploratory fishing vessel Oregon II at Ingalls Shipyard, Pascagoula, Mississippi, which will replace the veteran vessel Oregon based at the same city. A summary of all Bureau activities in this region for the year ending September 30, 1966, follows:

GULF OF MEXICO EXPLORATORY FISHING AND GEAR RESEARCH

PASCAGOULA, MISSISSIPPI

Since the transfer of the Oregon to St. Simons Island, Georgia, activities of the Gulf exploratory program have been limited mostly to analyzing data and preparing reports. Evaluation of the past 16 years of exploratory fishing data for scheduling Oregon II cruises was continued to fill in gaps in seasonal and geographic coverage. Evaluations of fish trawling effort have now been completed. A manuscript on estimates of the potential yield of fish and shellfish stocks in the Gulf was started. Calculations have been completed for most fish and shellfish categories and the total is in the neighborhood of 20 billion pounds. This estimate of Gulf stocks is about 15 times greater than present production.

Several briefs were completed on unutilized and underutilized fish resources in the Gulf. One such report on alternate resources was presented to the Gulf States Marine Fisheries Commission at the annual spring meeting. Thread herring are considered to be among the most important surface schooling species available. From Bureau shipboard and aerial observational data and from data yielded by commercial trials using conventional gear, the Gulf thread herring stocks alone are estimated at one million tons.

FAUNAL SURVEY

The shrimp resources atlas was completed to the point of final editing. This publication, to be the first in a series of resource atlases, summarizes commercial and exploratory data for the three major species of *Penaeus* in the Gulf of Mexico. Studies on the commercial royal red shrimp (*Hymenopenaeus robustus*) grounds of the Gulf are presently underway to provide a better understanding of the distribution and abundance of the species. Similar studies and evaluations are being made on the calico scallop (*Pecten gibbus*) grounds in the southeastern Atlantic.

Recent improvements in ADP make it possible to update data files with new cruise information within 10 days of their completion. This year, 15 exploratory cruises were incorporated into the data file, 8 by the R/V Oregon, and 7 by the R/V George M. Bowers. Studies by base personnel have placed an almost daily demand for data tabulations on the ADP center, creating a maximum level of activity throughout the year. Because of a growing demand for greater sophistication in the treatment of data, contacts have been established for providing statistical treatment of exploratory data outside the base center. The 9-digit bionumeric code in use at Pascagoula to catalog faunal species was presented at the AIBS meetings in Berkeley, California, in December. Although other codes have been theorized and proposed, the Pascagoula system is the only one in use in the taxonomic field.

A total of 10,426 specimens were shipped to cooperating institutions, museums, and individuals this year.

MENHADEN

Off-season explorations for menhaden and other clupeoid fishes were conducted for the third consecutive period in the

northeastern and eastern Gulf. Operational procedures were similar to previous years in that aerial observations were made along flight tracks between Panama City and the Florida Keys on a monthly basis. Sampling stations were occupied from Tampa Bay to Cape Sable in 2 to 32 fathoms.

Objectives of aerial operations were to search for visible fish schools, measure sea surface temperatures, and collect operational data pertinent to fishing and aerial spotting operations in the area during the off-season period. During the five flights completed, 375 fish schools were observed at 45 stations.

Objectives of the 4 sea operations with the George M. Bowers were to sample fish schools with monofilament gill nets and plankton nets. A total of 162 stations were occupied during the four cruises. Menhaden were caught along the coast from St. Petersburg Beach to below Cape Romano only in sets made in water depths of 5 fathoms or less. Other clupeoid fishes, e. g., thread herring, scaled sardines, and Spanish sardines, were also caught in this area in water depths of 10 fathoms or less. None of the sampling efforts in deeper waters yielded any clupeoids.

Flight and cruise reports were prepared and distributed after each activity and a summary report of the three years' work is in preparation.

GEAR RESEARCH AND DEVELOPMENT

The gear research and development station at Panama City was closed during the year and activities transferred to Pascagoula, Mississippi. This unit has been developing an electroshrimp trawling system. During the first half of the year, efforts were devoted to recording the reaction of shrimp to varying electrical voltages using underwater cameras. The individual response of nearly 1,000 shrimp was obtained on 16mm color motion picture film by SCUBA divers. Measurements of shrimp reaction made from the resultant movie footage provided data necessary for the design of the trawl's electrical system.

The design and fabrication of the individual components for the system were completed by engineering staff members during the second half of the year. The system is composed of four primary components. These are the power control panel aboard the vessel, an electrical cable which supplies power from the vessel to the trawl, an electronic pulse generator mounted on one of the trawl doors, and an electrode array.

At year's end, there was time for one brief fishing gear trial off the Mississippi coast. During the trial, two 40-foot trawls were dragged simultaneously. One trawl was equipped with the electro-trawling system and the other was equipped with only a single tickler chain. A daytime catch rate of better than 2:1 was achieved by the electrical trawl over the non-electric for the series of drags completed.

BIOLOGICAL LABORATORY GALVESTON, TEXAS

A Gulf oceanographic program was added last year to the four existing programs. This activity will give greater capability in offshore research and complement information being acquired in current programs.

SHRIMP BIOLOGY

In December 1965, the field phase of the synoptic study of the seasonal distribution and abundance of planktonic-stage penaeids, initiated 4 years ago, was terminated. Efforts have since been directed toward analysis of data and formulation of studies designed to answer more specific questions regarding the life histories of the brown, white, and pink shrimp.

Two papers on the seasonal distribution and abundance of larval shrimp, one on the pink shrimp in Florida waters and the other on *Penaeus* spp. in the northwestern Gulf, were prepared during the past year. Two topics of particular interest discussed were: (1) the apparent direction of larval transport from the Tortugas spawning grounds to the nursery areas, and (2) the possibility of larval and/or postlarval brown shrimp overwintering in offshore waters of the northwestern Gulf.

Both the white shrimp and the seabob were successfully reared to postlarvae from eggs spawned in the laboratory. In addition, mass culture techniques were developed which should permit large numbers of shrimp larvae to be grown for either detailed physiological studies or stocking of enclosed brackish-water ponds for future harvesting.

One year of study has been completed on the feasibility of growing shrimp in ponds under seminatural conditions. In the first experiment, brown shrimp, stocked at an average size of about 1/2 inch total length, grew to approximately 3 inches in 120 days. White shrimp, however, grew to an average length of

about 5 inches. In the second experiment, which is still in progress, 4,000 white shrimp spawned and reared to postlarvae in the laboratory have, during a 3-month period in one of our culture ponds, increased in size from 1/2 inch total length to about 4 inches.

In Florida Bay, differences have been observed between catches of juvenile pink shrimp, and associated benthic fauna in the various types of habitats being studied. In addition, a 1-year abundance estimate has been obtained for postlarval pink shrimp entering a part of the bay.

SHRIMP DYNAMICS

The structure of this program was altered during the past year to incorporate a former project, Commercial Catch Sampling, into another project entitled Population Studies. This change marks the end of studies designed to evaluate the accuracy of published shrimp landing data and an expansion of research involving the influences of commercial fishing on shrimp stocks. Work within the Population Studies Project includes investigations of the selectivity of shrimp nets, studies of the seasonal changes in the size composition of shrimp off the central Texas coast, and a detailed investigation of interactions between the Tortugas pink shrimp stock and the commercial fishery.

Improvements in both techniques and equipment have made it possible to conduct mark-recapture experiments involving large numbers of shrimp, thereby increasing the reliability of resulting estimates of shrimp growth and mortality. New equipment includes a large cooling unit to reduce the water temperature in holding tanks, automatic reloading syringes for injecting stain into shrimp, disposal containers for transporting marked shrimp to the sea floor, and light weight holding tanks. Two experiments, involving 7,000 and 12,000 stained shrimp were conducted during the year.

The Postlarval and Juvenile Shrimp Project has had considerable success in efforts to measure the abundance of brown shrimp at the postlarval and juvenile stages and has demonstrated that predictions of commercial harvests are possible. To date, predictions made on the basis of the abundance of postlarvae have been somewhat less reliable than those based on juvenile catches, but the postlarval method has greater potential

value because predictions can be made almost 2 months earlier. Emphasis is currently being placed on the development of methods to improve the postlarval index to abundance.

ESTUARINE

A major purpose of the Estuarine Program is to develop the basic facts needed to document the dependency of fishery resources on estuaries, the specific type of estuarine habitat that is the most productive, and the value of such areas in terms of their production of renewable fishery resources.

From a detailed analysis of the bottom sediments, organic distribution and habitats of Galveston Bay, the significant nursery grounds of many estuary-dependent species, including the commercially important white and brown shrimp, are being determined. Not unexpectedly, the peripheral edge of this estuary (exemplified by bordering marshes, small stream or bayou complexes, and protected shorelines) is utilized more extensively by the young of these animals than any other part of the estuary. Unfortunately, such valuable edges are being converted to residential and industrial sites at an alarming rate, causing serious losses of primary nursery habitat.

Technical assistance and participation in field studies with universities, private industry, and state and Federal agencies, is a part of the Bureau's activities. In cooperation with Texas A&M University, the fishery resources of the lower Trinity River Delta were surveyed before the area is inundated by a reservoir.

During the past year, plans were reviewed for 435 projects proposed for construction in the Texas estuaries, an increase of one-third over the previous year. Coordination was also initiated with the U. S. Army Corps of Engineers to advise on hurricane protection proposals for the Texas coast. Assistance was given in the development of a format for the Estuarine Atlas being considered by the Estuarine Technical Coordination Committee, Gulf States Marine Fisheries Commission.

EXPERIMENTAL BIOLOGY

The Experimental Biology Program continues the investigation of environmental factors on shrimp. Factors studied this year included temperature, salinity, and food.

Postlarval brown shrimp will burrow into a suitable substrate as temperature falls and emerge when the temperature

again rises. Postlarval white shrimp did not respond to decreasing temperature in this way. The burrowing response of brown shrimp may help explain the greater cold tolerance of this species as compared to white shrimp. In addition, it points out the requirement for certain bottom types during the time when the young shrimp may be exposed to sudden cold temperatures.

Both short-term survival and month-long growth experiments indicate that postlarval white shrimp tolerate warm temperatures (above 90°F.) better than do postlarval brown shrimp. These results aid us in explaining differences in distribution patterns of the two species.

The amount of food consumed by young shrimp differs both between individuals and between species. Such studies may enable us to understand how the species compete on the nursery grounds.

GULF OCEANOGRAPHY

The Gulf Oceanography Program has begun with a modest appropriation. The oceanographic vessel Geronimo has been recently transferred to the Galveston laboratory preparatory to getting this program on a field operating basis, but funding is still a problem. Two oceanographers were placed on the staff and were able to (1) analyze historical oceanographic data and (2) acquire some additional data near shore to fill some gaps in historical information.

In 1958, there was a distinct cooling off of the climate in the northern Gulf. This "deterioration" continued through 1965, during which time the mean annual temperatures were as much as 2.5°C. below normal. This cool period is the longest experienced in the northern Gulf since 1906 when a 9-year "cool spell" ended.

The Caribbean climate warmed at the same time that the Gulf coast cooled. This is not unusual, for the mean annual temperatures in Puerto Rico have been "mirror images" of those in New Orleans since 1900 (the year of first records on the island).

The cool temperatures extended to Key West in 1958 and 1964, but in the other years since 1958, the mean annual temperature there has been at or above normal. Thus, Key West is apparently in the transition zone between the climates of the northern Gulf and northern Caribbean.

The cool annual temperatures have resulted mainly from winters which were colder than usual. February of 1958, for example, had mean temperatures as much as 80°C. below normal (at Mobile).

The cooler air has corresponded with cooler waters in the western Atlantic Ocean since 1960 and, thus, cooler waters in the Gulf. The sea-atmosphere coupling of this system is not yet clear, but is seemingly associated with variations in the intensity of the Bermuda High Pressure System over the central Atlantic Ocean.

The waters which bathe the shrimping grounds of the Gulf, and which make up the significant water mass to depths of 200 meters, originate in the Atlantic Ocean to the east of the Virgin Islands. The water mass (called the Subtropical Underwater) comes into the Caribbean Sea over the Antilles Ridge and through the passage between Puerto Rico and Cuba. It is mixed during its time in the Caribbean Sea with warmer and less-saline waters. Thus, it enters the Gulf through the Yucatan Straits at depths of 150 to 200 meters, with a salinity of 36.7 parts per thousand and a temperature of 22°C.

As the Subtropical Underwater spreads through the Gulf, it is (1) mixed with shelf water and (2) modified by reactions between the sea and the atmosphere. The salinity and temperature are changed, the manner and extent depending on which of the two processes dominate during the period under consideration. Thus, the identification of Subtropical Underwater over the western and northern Gulf shelves is sometimes impossible by measuring only temperature and salinity. (It is hoped that the biologic constituents of the water can be learned so that they may be used to trace the water mass.)

The modifications of the Gulf waters by extreme weather conditions were analyzed from data collected before and after Hurricane Betsy. The investigations of the waters marked the first time in the history of oceanography that precise before-and-after hurricane data were available.

BIOLOGICAL LABORATORY
GULF BREEZE, FLORIDA

PESTICIDES RESEARCH

The evaluation of new pesticides and new formulations of those already in use continues to be a fundamental laboratory

project. Tests are conducted under controlled laboratory conditions and, consequently, indicate the relative toxicity of one pesticide to another rather than the actual effect that would take place under field conditions. During the year, approximately 225 tests were conducted. These established acutely toxic levels that would cause damage in 24 to 96 hours. Several chronic toxicity tests are underway in which fish and crabs are exposed to sublethal concentrations for periods of six to nine months to determine what effect this chronic type of pollution might have on economically important species.

Two major projects have been completed and the reports are being prepared for publication. In the first, an inventory of macroscopic animals and plants occurring in the Pensacola Estuary during a 2-year period was made. This establishes current population densities and seasonal variations that can be expected. In the second study, the population dynamics of two common species of fish in the estuary were evaluated over a 2-year period. In both cases, the objective was to document these aspects of the biota while Pensacola Bay is still relatively unpolluted. These data will serve as a foundation in later years for interpreting the importance of man-made changes in the estuarine environment.

The monitoring program initiated last year to determine existing levels of organochlorine pesticide pollution in shellfish populations continues to expand. There are now more than 150 stations on the Atlantic, Pacific, and Gulf coasts where shellfish are collected at 30-day intervals and sent to this laboratory for residue analysis; about 1,200 chromatographic analyses were completed. The program has already been useful in pin-pointing sources of pesticide pollution.

The monitoring program is being expanded now to identify areas in which organophosphorus pollution has affected fish populations. Samples for analysis are being received from eight cooperating agencies on the Atlantic and Gulf coasts.

Residues of DDT are essentially everywhere in the estuarine animals of the Gulf coast. A long-term study of the mechanisms by which this chemical gets into the food web has been started.

A second important aspect of the pesticide pollution problem concerns the subtle effects pesticides may have on animal behavior without causing obvious mortalities. There is concern, for example, that pesticides may alter an animal's reaction to

changes in salinity. Such a result could cause drastic changes in the migration patterns of shrimp, crabs, and menhaden, for example. Increased funds provided for the fiscal year beginning in July will permit initiation of research in this critical area.

There are so many areas urgently requiring research on the effects of pesticides on marine animals that the present laboratory facilities are no longer adequate. Consequently, a significant portion of the program now underway is by contract with research staffs at three universities.

The laboratory has continued its policy of making its research data available to other agencies as early as possible. All of the new data are distributed on a provisional basis at the end of each three months period. During the year, progress reports of our research were made by staff members at eight public meetings in the Gulf area. Eleven final project reports were published or approved for publication.

BIOLOGICAL LABORATORY
ST. PETERSBURG BEACH, FLORIDA

ESTUARINE ECOLOGY

Principal functions of this laboratory center around studies to maintain estuaries. In this respect, there is participation in the Estuarine Technical Coordinating Committee of the Gulf States Marine Fisheries Commission. The principal research areas are currently within the central Florida estuarine complex where biological, hydrological and sedimentological studies are pursued. Resulting data were used to demonstrate the magnitude of the loss of an estuarine fish nursery where conversion to a fresh-water lake is planned. The 11,000-acre area is exceptionally productive of commercial species which constitute Gulf fisheries. Its present and potential values were effectively placed on record with regulatory agencies.

The laboratory cooperated with members of Gulf States research units in planning a Gulf-wide estuarine inventory consisting of four parts; area description, hydrology, sedimentology, and biology. An inventory of the Florida estuaries was initiated in accordance with the generally accepted plan.

Standard codes for biological, physical and chemical data are not available for estuaries on a national scale, although some good systems have been developed independently at various

laboratories. This Bureau laboratory has been working with the National Oceanographic Data Center toward the perfection of an all-inclusive estuarine data system which will become available to interested agencies upon completion.

Research continued in the determination of methods useful in rehabilitating degraded coastal waters. Experiments in the laboratory sea-water system indicate that *Thalassia testudinum* is the most suitable type of vegetation for reestablishing bottom cover in local denuded areas. Erosion appears to detract from the success of transplantation in bay bottoms. Additional studies were begun in an attempt to provide anchoring methods and to protect transplants from that hazard. Oyster rafts were placed in dead-end canals between dredged real estate sites to determine whether or not they would prove suitable for shellfish cultivation.

RED TIDE

In the Bureau of Commercial Fisheries Red Tide Symposium of 1964, one of the eleven proposed research objectives was the isolation and characterization of toxin produced by *Gymnodinium breve*. The design for a toxin research program was completed, and a contract was awarded the University of South Florida. The first phase—that of culturing a stable supply of the organism—was brought to completion. The second phase of isolating toxin through gas chromatographic methods was initiated.

Staff work with National Oceanographic Data Center (NODC) resulted in an atlas of oceanographic properties in Tampa Bay and adjacent Gulf of Mexico waters. Vertical sections of the data, including *G. breve* counts, were plotted automatically by the NODC 564-670 CALCOMP plotter. The atlas is nearing publication and is expected to be useful to biologists and oceanographers, particularly those interested in physical and chemical components of eastern Gulf waters.

BIOLOGICAL LABORATORY BEAUFORT, NORTH CAROLINA

MENHADEN

The Gulf menhaden biological research program, which began in 1965, is aimed principally at assessing the species composition and biological characteristics of the commercial catch; determining the magnitude and extent of the fishery; and devel-

oping methods for estimating the relative abundance of juvenile menhaden for each year class.

Systematic sampling of the catch was conducted at several ports throughout the fishing season, and analyses of these data indicate that the bulk of the catch of menhaden in the Gulf of Mexico consists of only one species. Furthermore, scale samples collected from these fish indicate that 1- and 2-year-old fish make up the bulk of the catch.

Commercial fishing effort increased in 1966, both in the number as well as in the size of the fishing vessels. In spite of these additional vessels, the 1966 catch declined significantly compared with 1965. The increase in fishing effort was mainly in the earlier part of the season, but fell off rapidly in August as a number of vessels withdrew because of poor fishing.

Studies to estimate the relative abundance of juvenile menhaden have encountered considerably more difficulties than experienced with similar studies on the Atlantic coast. The young menhaden are very widely dispersed through the vast estuarine area of the Gulf, making adequate sampling difficult. The two methods of estimation currently used are surface trawl catches and estimates from aerial surveys.

Surface trawl data indicated that the 1965 year class of Gulf menhaden was considerably smaller than the abundant 1964 year class. However, estimates of abundance based on aerial surveys did not agree, so no definite conclusions could be reached. In view of the subsequent decline in the commercial catch in 1966, it appears that the trawl catch data were the more representative as to the actual abundance of the 1965 year class.

Preliminary catch data by surface trawl indicate that the 1966 year class is more abundant than 1965, but considerably less abundant than 1964. Aerial surveys will be conducted later in the year to obtain independent estimates of abundance. Effort on estimating juvenile abundance will be increased significantly in the coming year in order to improve the consistency and reliability of the estimates.

Biologists from the Beaufort laboratory participated in exploratory fishing cruises operated from the Pascagoula base to collect menhaden specimens and plankton samples.

TECHNOLOGICAL LABORATORY
PASCAGOULA, MISSISSIPPI

CHEMISTRY

This laboratory is designed as the national headquarters for study of the composition and nutritive value of fish and shellfish. During the year, special emphasis was placed on studies of amino acid and lipid content of ocean perch, Dungeness crab and croaker. The amino acid pattern was shown to be similar to that of other sources of protein and nutritionally well balanced. Seasonal variations in amount, but not kind, of amino acids present were evident in all of the species studies. A new method developed at the laboratory allows the identification of a large number of compounds present in marine oils that were not identifiable by other techniques. A study of the body oils of the Chesapeake Bay blue crab showed differences in amount and kind of fatty acids in the various oil components. The polyunsaturated character of the body oil was similar to that of other species of fish and shellfish. The new technique for trace mineral analysis—atomic absorption spectrophotometry—has proved an extremely useful and reliable one in the analysis of fish and shellfish. Methods were adapted which allow the determination of nine trace minerals essential to human and animal nutrition normally present in foods in extremely minute amounts. Microbiological procedures for the assay of the quantity of the water soluble vitamins present in fish and shellfish were developed. The completion of the aforementioned methods development studies ends the necessary technique studies and will allow the rapid characterization of the quantity of these components in the species presently under study. The next species to be considered are croaker and mullet.

A second canned shrimp symposium was held to present research finds to the industry. It showed that shrimp blanched in salt, packed at present fill-of-container weights in 75 grain salt brine had the best organoleptic characteristics over a 24-month storage period with the exception of the texture score. A suggestion of improvement in the texture of canned shrimp through the use of added polyphosphate proved helpful in this regard during the first half of an experiment designed to cover a year's period. Work was initiated concerning the effect of various product storage methods upon the connective tissue of

shrimp. In this effort to determine best means of retaining product quality, it was necessary to prepare a quantity of pure shrimp collagen for experimental purposes. Shrimp collagen proved to be quite different from that of other marine collagens, particularly in size and sensitivity of the molecule to outside influences.

A continuation of the study of the pesticide residue content of Gulf of Mexico fishery products showed a trend toward seasonal variation in quantity and type of residue present. There appeared to be an increase in the amount of DDT, DDE, and DDD during the early spring months, accompanied by the occasional appearance of small quantities of endrin, dieldrin, and heptachlor epoxide. It was determined, however, that the normal preparation of fishery products for market—i.e., filleting fish, heading shrimp, etc.—would decrease the pesticide residue levels present by at least a factor of two and at times by a factor as great as ten. Other studies indicated that certain of the residues were decreased during heat processing by a mechanism as yet unknown. Decreases can also be attained by such methods as are employed in oil polishing processes. Controlled laboratory studies on the effect of heat and of phase separation upon the reduction of pesticide residues are now underway.

MICROBIOLOGY

Results from the Atomic Energy Commission contract-financed survey of the Gulf of Mexico for the presence of *Clostridium botulinum* Type E revealed the presence of all known types (A-F) in the sampling area. The area concerned extended from Key West, Florida, to Brownsville, Texas. The sampling area did not extend beyond the 10-fathom curve. Attempts to utilize the fluorescent antibody-antigen technique for detection of Type E botulinum to large numbers of sample proved to be inadequate.

Prior to the completion of this work by the Bureau in the Gulf, a second joint venture was entered into, again with AEC, for a similar study to be conducted on the east coast (Staten Island, New York, to Key Largo, Florida). Sample collection and analysis are currently underway on this study.

Also completed during the past year was a study to determine the presence of coliforms, *E. coli*, coagulase-positive staphylococci, fecal streptococci, and *Salmonella* on precooked sea-

foods. Those products examined included shrimp, shrimp creole, and fish sticks and portions. In general, data collected during this investigation reflected a very good bacteriological record for these products.

Processing parameters for fish meal are being scrutinized with regard to heat effect on *Salmonella* survival. Also receiving attention are the problems of *Salmonella* survival, detection, enumeration, and thermal inactivation in fish solubles.

The microbiology program has been strengthened by the activation of a project dealing with marine microorganisms and the effects they produce on various fishery products. Many problems relating to product quality improvement may ultimately be solved.

SEAFOOD INSPECTION AND CERTIFICATION

Processing plants under the USDI voluntary inspection program produce a variety of inspected fishery products. Of the 12 plants under this program in the Gulf and South Atlantic Region, 10 are located in the States of Texas and Florida. Each plant is under the continuous surveillance of a resident inspector to assure production of high quality fishery products which merit the U. S. grade shields. These services are financed by the participating firms and include lot inspection when requested, as well as the continuing inspection. The Commodity Exchange in Chicago requires shrimp traded there to be U. S. grade and many states now have the same requirement for seafoods purchased for institutional use.

RIVER BASIN STUDIES

This program, closely coordinated with the activities of the Bureau of Sport Fisheries and Wildlife, is devoted to problems arising from man's alteration of the marine environment. During the past year, 84 reports were reviewed involving marine resources and several field surveys were made.

STATISTICS

The continuing Bureau program in cooperation with state agencies for collection of detailed shrimp statistics has been adequate to meet research and industry basic needs. Collection of the data on a daily basis permits dual utilization by issuing it in the Market News daily reports as well as having it avail-

able for monthly and annual summarizing. Information collected on specific areas from which shrimp catches were taken, and fishing effort expended, has provided state and Federal research agencies with the type of data essential to their scientific programs. Statistics personnel also assisted in a special survey of crew accommodations on selected Gulf fishing vessels. This provided background information for U. S. delegates at the International Labor Conference in Geneva, Switzerland, where a convention for minimum standards for accommodations on fishing vessels was being considered. An analysis of the Gulf statistics was also made to develop patterns of vessel operations in relation to changes which were being sought in the Gulf oil rig light and signal regulations.

The increased use of fishery statistics data in connection with both domestic and international issues requires more effort to better pin-point the areas of capture for major species other than shrimp.

MARKET NEWS

Monthly summaries issued by the New Orleans market news office were terminated at the end of 1965 as a cost reduction and manpower conservation measure; greater effort will now be expended in establishing a much earlier release date for annual summaries. There were no major changes in the format or content of the daily Fishery Products Reports which were mailed daily to over 1,200 subscribers. Comments from subscribers on the annual recircularization notice indicate that the daily reports are still vital to members of the fishing and allied industries in planning day-to-day and long-range operations.

MARKETING

Excellent results were achieved in increasing the use of fishery products in restaurant chains. Grouper, frozen mullet loins, soft clams, royal red shrimp, canned mullet, and calico scallops were introduced into four restaurant chains, with the smallest chain having more than 30 restaurants.

Special marketing and technical assistance was rendered a group of businessmen in Miami in establishing the first major fish canning plant in Florida. Initially, two products are to be canned—mullet and bonito. Future plans are to also can king mackerel and tuna. Experiments presently are being conducted

on the canning of thread herring for possible export. Although this plant is on the Florida east coast, substantial supplies of fish for canning will come from the Gulf.

In the 18-month period ending June 30, 1966, southeastern newspapers having a combined circulation of over 77 million devoted the equivalent of 280 full pages to seafoods using Bureau-produced materials. Bureau films and video tapes were shown 208 and 188 times respectively on television in the same area.

The cooperative market promotional program involving the Florida Board of Conservation, Southeastern Fisheries Association, and the Bureau has been effective in increasing outlets for several seafood products and is continuing.

FEDERAL AID TO STATES

Under the Commercial Fisheries Research and Development Act of 1964, the five Gulf States have obligated \$1,408,389 of available Federal funds for 18 projects to date. These projects include eight research projects consisting of studies on shrimp, oysters, clams, and environmental characteristics; five development projects including the planting of oyster cultch, marketing of seafoods, and the placing of oyster lease control structures; four construction projects providing for a coastal fisheries experiment station, research ponds, public landing facilities, and a research vessel; and one coordination project. Four states and the Bureau are participating in a cooperative Gulf of Mexico estuarine inventory. Also, as a joint effort, five of the Gulf States and the Bureau are producing a film on the value of Gulf of Mexico estuaries. Completion of this film is expected within a year. The Gulf States have now been able to employ and equip technical staffs for the research and development of their marine commercial fisheries resources at a level that was heretofore impossible. The total approved project costs to date, including state matching funds, for the respective Gulf State are as follows: Alabama \$109,720; Florida \$613,884; Louisiana \$725,085 (includes \$100,000 under Section 4(b) for commercial fishery disasters caused by Hurricane Betsy); Mississippi \$162,113, and Texas \$309,792. It is expected that all remaining allocations to the Gulf States now totalling \$501,511 will be obligated before July 30, 1967.

FINANCIAL ASSISTANCE

Vessel operators are continuing an active participation in the Bureau's financial assistance programs. To date, 390 applications requesting \$12,521,043 have been received from the fishing industry in the Gulf States for all three programs.

The vessel mortgage insurance program highlighted financial activities with 30 applications received requesting \$1,738,450 over the past 12 months. Mortgage insurance is designed primarily for financing new vessels, and it provides banks a safe means of making vessel loans with low interest rates and long maturities.

Over the past year, 22 fishery loan applications requesting \$739,328 were received. Such loans are granted to commercial fishermen for refinancing vessel debts, repairs and equipment, and purchasing new or used vessels. Applicants must prove that reasonable financing is not otherwise available.

Although 11 applications for vessel subsidies requesting \$762,500 have been processed, no subsidy contracts have been executed in the Gulf area. Shipyard bids have been too high, and the subsidies granted have been too low.

With the increasing interest rates and short supply of funds currently being experienced throughout the money market, it appears that industry will find these Federal programs increasingly useful in the future.

PEAT, MARWICK, MITCHELL & CO.

Certified Public Accountants

535 Gravier Street

New Orleans, La. 70130

ACCOUNTANTS' REPORT

Commissioners

Gulf States Marine Fisheries Commission:

We have examined the statement of income and expenses of Gulf States Marine Fisheries Commission for the year ended June 30, 1966 and related statement of resources as of that date. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying statements of income and expenses and resources present fairly the results of the financial transactions of Gulf States Marine Fisheries Commission for the year ended June 30, 1966 and its resources at that date, in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year. Also, in our opinion, the accompanying supplementary information to accounts is stated fairly in all material respects when considered in conjunction with the financial statements taken as a whole.

Peat, Marwick, Mitchell & Co.

New Orleans, Louisiana
July 1, 1966

GULF STATES MARINE FISHERIES COMMISSION

Statement of Income and Expenses

Year ended June 30, 1966

Income—member states' contributions:	
Alabama	\$ 3,500.00
Florida	4,500.00
Louisiana	6,000.00
Mississippi	1,500.00
Texas	6,000.00
Total income	<u>21,500.00</u>
Expenses:	
Salaries	\$14,000.00
Traveling	937.96
Office rent	1,080.00
Stationery, printing and supplies	385.10
Telephone and telegraph	418.40
Postage	210.10
Electricity	41.00
Equipment maintenance	62.06
Accounting	250.00
Insurance	269.78
Meeting expense	396.10
Publication expense	609.40
Payroll taxes	366.53
Depreciation	69.86
Sundry	54.13
Total expenses	<u>19,150.42</u>
Excess of income over expenses	<u>\$ 2,349.58</u>

Statement of Resources—June 30, 1966

Cash (note 1)	\$ 7,477.99
Traveling advance	250.00
Meter deposit	10.00
Prepaid insurance premiums	130.88
Equipment—at cost less allowance for depreciation, \$2,650.88 (note 2)	386.47
Resources (net)—note 3	<u>\$ 8,255.34</u>

For notes see accompanying supplementary information to accounts.

GULF STATES MARINE FISHERIES COMMISSION
Supplementary Information to Accounts
Year ended June 30, 1966

- (1) The changes in cash balances during the year are summarized as follows:

Cash receipts:	
Income (see accompanying statement)	\$21,500.00
Cash disbursements:	
Expenses (see accompanying statement)	\$19,150.42
Adjustments for expenses not representing cash outlay:	
Depreciation	(69.86)
Increase in prepaid insurance	<u>12.82</u>
Total cash disbursements	<u>19,093.38</u>
Excess of receipts over disbursements	2,406.62
Cash balance at beginning of year	5,071.37
Cash balance at end of year	<u>\$ 7,477.99</u>

- (2) The changes in investment in equipment during the year are summarized as follows:

	Cost	Allowance for depreciation	Net
Balances at beginning of year:			
Automobile	\$1,436.38	1,436.38	—
Furniture and fixtures	1,600.97	1,144.64	456.33
	<u>\$3,037.35</u>	<u>2,581.02</u>	<u>456.33</u>
Balances at end of year:			
Automobile	\$1,436.38	1,436.38	—
Furniture and fixtures	1,600.97	1,214.50	386.47
	<u>\$3,037.35</u>	<u>2,650.88</u>	<u>386.47</u>

- (3) The change in resources during the year is summarized as follows:

Resources of the Commission at beginning of year	\$5,905.76
Excess of income over expenses	2,349.58
Resources of the Commission at end of year	<u>\$8,255.34</u>

- (4) Fidelity bond insurance of \$10,000.00 each is carried on the chairman, vice-chairman and director of the Commission.

**GULF STATES MARINE FISHERIES COMMISSION
BUDGET
Fiscal Year 1966-67**

Salaries	\$14,000.00
Traveling	1,800.00
Office rent	1,200.00
Stationery, printing and supplies	450.00
Telephone and telegraph	550.00
Postage	250.00
Electricity	50.00
Equipment maintenance	75.00
Accounting	250.00
Insurance	275.00
Meeting expense	700.00
Publication expense	700.00
Payroll taxes	500.00
Depreciation	100.00
Sundry	100.00
	<hr/>
	\$21,000.00
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Approved October 21, 1966)

