Progress in Exploratory Fishing and Gear Research in Region 2 Fiscal Year 1967

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U.S. FISH AND WILDLIFE SERVICE
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Fiscal Year 1967

By

JOHN R. THOMPSON
Assistant Base Director

Circular 267

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Cover photo.--*Oregon II* slides down the ways at the Ingalls Shipbuilding Corp., Pascagoula, Miss., February 4, 1967.

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By

JOHN R. THOMPSON, Assistant Base Director

Bureau of Commercial Fisheries Exploratory Fishing and
Gear Research Base, Pascagoula, Mississippi 39567

ABSTRACT

Accomplishments of the Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base in Pascagoula, Miss., and its Station in St. Simons Island, Ga., are documented for fiscal year 1967 (July 1, 1966-June 30, 1967). Area covered in the explorations is the tropical and subtropical western North Atlantic, including the Gulf of Mexico and Caribbean Sea.

INTRODUCTION

As the years pass, changes occur in technological research that must be reflected in the thinking and action of the research staff. The past year has been one of great change in the progress and thinking of the staff of the Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base at Pascagoula, Miss. This annual report deviates somewhat from previous reports to emphasize the changes that are occurring and have occurred.

Outstanding among the changes have been the launching of Oregon II, a vessel designed from the keel up for exploratory fishing and ultimately to be equipped with the latest electronic, laboratory, and fishing equipment; development of a concept of eventual "space monitoring" of the world ocean for fish schools and preliminary steps leading to its realization; and the preparatory steps toward computerization of operational data.

In all of this modernistic thinking and preliminary action, however, we have kept our feet planted firmly and have been cognizant of the meaning of the fisherman's old adage that "nets not in the water don't catch fish." Sea-going operations in the Gulf of Mexico have led to the successful development of an electric shrimp trawl, which allows daytime fishing for brown and pink shrimps and represents a significant breakthrough in use of electricity for harvesting in marine waters. A small "crash program" in the Gulf devoted to attracting schoolfish to lights and capturing them with purse seines has so far proved inconclusive.

On the east coast, the original Oregon spent over 200 days at sea while searching for new shrimp grounds, investigating the swordfish resource of the waters off the Southeastern States, providing direct aid to the North Carolina scallop fishermen, and looking at bottom-trawl fish stocks. The Oregon also made two cruises into the Caribbean and found excellent possibilities for a yelloweye snapper fishery over wide areas and encouraging signs of a large blackfin tuna resource.

All these activities are discussed in detail in the text that follows, with emphasis on our attempts to be forerunners in the technological revolution for fisheries.

FISHERIES LOOK TO SPACE

Why should fishery scientists be occupied with attempts to enter space? Isn't the world of water vast enough to contain our interests? Everyone has seen by now some of the beautiful photographs that pioneer spacemen have taken with rather simple equipment. Many of these photos show vast expanses of the world ocean and our continental shoreline--areas that we as fishery workers are interested in. For years we have been examining various portions of the oceans, with particular attention to areas contiguous to the coastlines, but our investigations have been carried out largely from vessels, which can cover only minute portions of the surface at any given time.

In recent years, industry and State and Bureau researchers have used low-flying aircraft to extend the limited range of view possible from vessels. Industry, especially in the menhaden and tuna fisheries, has cut down on expensive vessel search time by using aircraft as spotters. We have found it somewhat easier to gain a general impression of the magnitude of a stock of surface-schooling fishes from the air with visual estimates.

Still, visual records are subjective and momentary, and aircraft now in use do not cover a very large expanse at one time. Both industry and the Bureau need: (1) a more objective and permanent substitute for visual sightings, school counts, and estimates of school tonnages and (2) a means of viewing broad expanses at one time to be able to estimate the size of the stocks being fished in an entire fishery.

We thus come full circle to why we are interested in space. We believe that if our work with aircraft observation systems is successful, we can transfer techniques to suitably equipped space satellites. These satellites will be capable of recording schoolfish concentrations over large areas. The objective records resulting can--or will--be relayed to us nearly instantaneously for dispersal to the fishing industry for guidance in harvesting activities and to our scientists for aid in estimating such factors as standing crop.

It is not feasible, though, to leap from the oceans into space in one jump. As marine specialists and scientists, we must (1) feel our way through the intermediary stages, while (2) attempting to keep abreast of pertinent developments in space technology. For the latter purpose, we have established working relations with NASA (National Aeronautics and Space Administration); for the former, we are now in the preliminary stages of working with photographs taken with professional aerial cameras mounted in chartered aircraft, including high-altitude planes. At this stage of the Bureau's funding and staffing and because of current industry interest, we are restricting studies to the coastal schooling fishes of the eastern Gulf of Mexico. From this starting point we hope to expand to other species and to offshore areas.

First aims are to determine film types and camera requirements, in relation to flight

Figure 1.--Black and white photograph of fish schools taken originally with color film.

Figure 2.--Aircraft used in taking aerial photographs of fish schools in north Gulf.

speed, altitude, and atmospheric and sea conditions. Two aircraft were chartered, and they photographed schoolfish at altitudes from 1,500 to 10,000 feet in coastal waters from Mississippi Sound, off Mississippi and Louisiana, to Cape Sable, Fla.

During the year about 1,000 $9\frac{1}{2}$-inch-squai. aerial photographs were taken of schoolfish. We used four different types of films--black and white, color infrared aero, and two additional types of color films. School fish were successfully photographed with all films; however, the three color films produced better results than the black and white film. The false color distortions of the infrared aero color film produced excellent contrast, and, despite its infrared sensitivity in range, depth penetration was good.

The photographs indicate that the camera has recording sensitivities beyond the capabilities of the human eye. Enlargements of film segments show individual sea birds floating on the water. "Contrails" have been detected extending long distances behind moving fish schools. Oil slicks, photographed near fish schools, reveal certain species may be emitting oils which might be used for identifying species.

Through the facilities of NASA at Houston, Tex., we made isodensitracings of fish schools from several selected photographs. The results suggest that we will be able to make detailed assessments of schooling characteristics for species identification and measurement.

Sonar equipment is to be installed on two Bureau vessels that will work in coordination with aircraft to provide verifying data. Sonar configurations of fish schools, when compared with aerial photographs, will improve photo interpretation. Capture of the recorded fish schools by Bureau and chartered vessels will give accurate species identifications and tonnage figures, which will assist us in imagery interpretation. Applying the knowledge gained from photography, we hope to develop one or more remote sensing systems that can be adapted for use in high-altitude aircraft and eventually in satellites, to provide continuous recording, monitoring, and transmission of information to our investigators and the commercial fishing industry.

Figure 3.--Larger aircraft used mainly in taking aerial photographs of fish schools off Florida.

Figure 4.--Fish school showing "contrail." Black and white photograph made from infrared film.

FISHERY RESEARCH IN THE COMPUTER AGE

Seventeen years of data, over 30 vessel years, several thousand fishing stations, more than 3,000 species of shellfish and finfish, and all the ancillary data accompanying these add up to a complex problem in data retrieval. To handle this problem, we have been leaders in the development of a working bionumeric code, infinitely expandable, for recording and retrieving species data.

Our data center has been held to equipment absolutely necessary to meet our needs economically. To date it has consisted of a keypunch, electronic sorter, tabulator, and interpreter. In the natural evolution of systematization, we have outgrown this rudimentary setup and have received authorization to proceed to the next step--computerization--through rental of a 9200 series UNIVAC system, with peripheral IBM equipment.

With this system, we will be able to go beyond the simple retrieval and tabulation stages and enter into true data-use phases. We will be able to compute numbers (or weights) of animals caught per unit area, per unit time, or per gear type; examine the possibilities of correlations among the multiple physical and biological factors and the presence, availability, or absence of certain species; and set statistical limits to our interpretations.

Several basic zoogeographical studies were started or continued during the year on distributions of groups of fishes, mollusks, and crustaceans. The findings will add to the scanty knowledge available on offshore bottom-dwelling marine animals. Over 10,000 specimens, mostly fish and decapod crustaceans, were shipped to cooperating taxonomists in more than 60 institutions during the year. Identifications received from these cooperators help us immeasurably in keeping up with species records, whereas the results of the research by these people add to zoological knowledge.

In all these activities, data entered on and taken from the Automatic Data Processing System are the keys that open the doors to proper accessibility and interpretation of information.

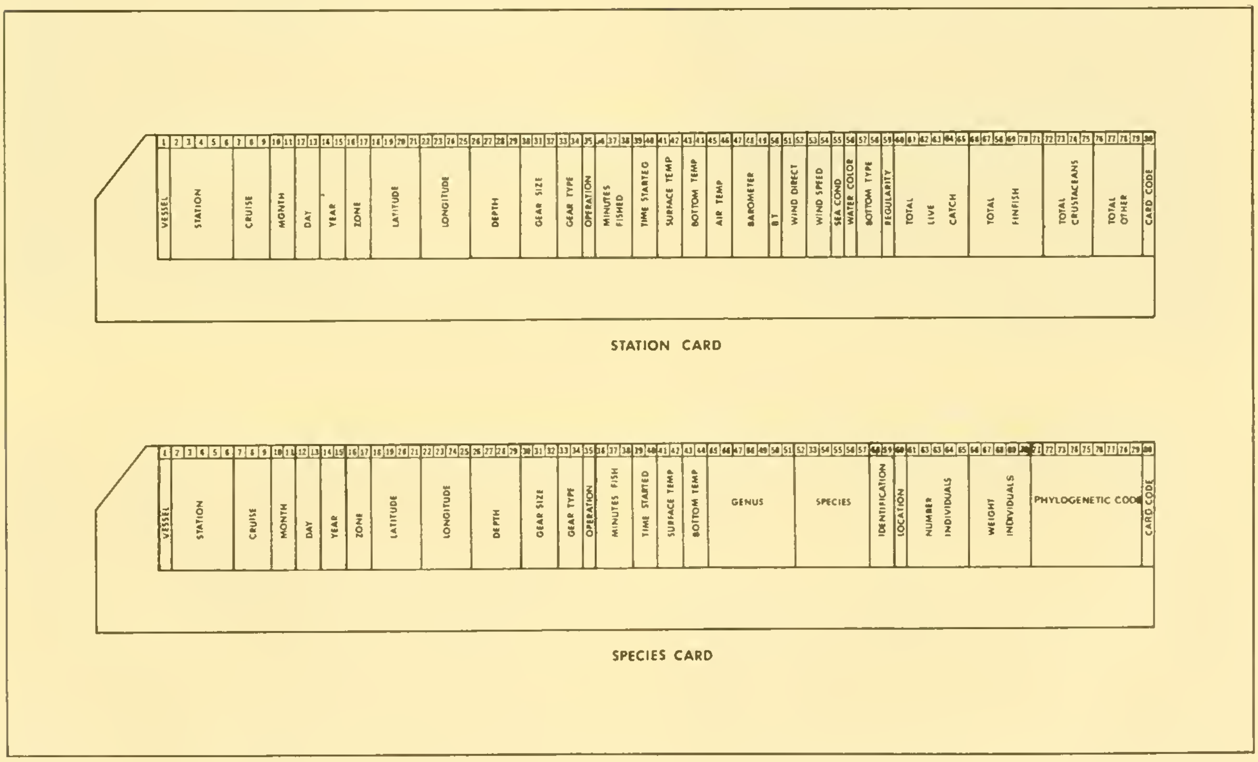

Figure 5.--Layout of 80-column card used in ADP of field data.

MEN STILL GO DOWN TO THE SEA

Since biblical days in Galilee, fishermen have used about the same gear--nets, hooks, and traps--with few basic changes. Most modern innovations within the industry involve auxiliary equipment such as diesel engines, radiotelephones, depth recorders, and navigational instruments. The power block and the advent of synthetic lines and webbing were perhaps the most significant breakthroughs in revolutionizing some aspects of fisheries in this generation. The trawl fishery, which takes a large percentage of the world catch, however, has changed little during the last two or three generations.

Electricity Enters the Ocean

For some years there has been an aura of excitement about using electricity in fishing. Many dollars and many hours have been spent in developing practical applications. In fresh water some of this effort has been successful. In the oceans, however, the salt in the water is a good electrolyte, so we must use considerably more power to be effective, even over short distances. A few breakthroughs have been achieved in marine fisheries. One menhaden firm used electricity to attract to the mouth of a pump the fish that had been "hardened" in a seine. Also a Scandinavian firm developed an electric shocker for longline hooks.

Previous annual reports and publications described our efforts to develop a practical electric shrimp trawl. Pulsed current was used to shock shrimp out of the bottom sediments, where they burrow in daytime, and into the path of the trawl. This gear makes possible daytime shrimping for brown and pink shrimps; whereas, till now shrimping has been strictly a nighttime endeavor.

Fishing trials with the electric shrimp trawl and development of practical system components were completed by the scheduled termination date of December 31, 1966. Three George M. Bowers cruises to the major shrimp grounds in the Gulf of Mexico proved that the system was effective for commercial shrimp harvesting.

After field tests to evaluate and correct deficiencies in the electric shrimp trawl system had been completed, the George M. Bowers was rigged with two standard 40-foot Gulf of Mexico shrimp trawls. The electric shrimp trawl system was installed on the starboard trawl, and a standard 3/8-inch galvanized tickler chain was attached to the port trawl. Except for these modifications, the two trawls were similar; so differences in the amount of shrimp caught in the two nets could be attributed largely to the electric system on the starboard trawl.

Both trawls were dragged simultaneously, day and night. Several 1-hour drags were made during daylight on each test area. Then, beginning immediately after sunset, additional 1-hour drags were made in the same area. This day-night procedure was repeated many times. The percentage effectiveness of the electric shrimp trawl system was determined by comparing the individual trawl catch rates for the night-time nonelectric trawl and the daytime electric trawl over 24-hour test cycles on each major shrimp ground.

Fishing trials were made within the major Gulf of Mexico shrimp grounds off Mississippi and Texas for brown shrimp and southern Florida (Tortugas area) for pink shrimp. When average catches (daytime electric trawl/nighttime nonelectric trawl) were compared, we found that off Mississippi and Texas the daytime electric trawl caught 109 and 95 percent of the nighttime nonelectric catch. On the Tortugas shrimp grounds, the catch rate was 50 percent. Since the Tortugas shrimp grounds is composed of calcareous sand mixed with shells, whereas the Mississippi and Texas grounds are soft mud, the adhesion-compactness characteristics may have been responsible for the reduced catch rate in the Tortugas area.

Although some unresolved questions remain, the catch rates of the electric trawl demonstrated that the system would be an effective and practical tool in harvesting shrimp in the northern Gulf. We are now applying for a public service patent on the electric trawl system. Several manufacturers are interested in reproducing the system or components, and the industry has shown avid interest in the system. Principal aim is to increase catch per unit of effort, thereby allowing for more efficient use of men and equipment.

Research of the St. Simons Island Station

The Oregon, operating out of St. Simons Island, Ga., made 10 cruises during the fiscal year. Five of these were directed toward seasonal assessment of swordfish, bottomfish, scallops, and offshore shrimp along the southeastern coast of the United States. Two cruises in the Caribbean Sea in cooperation with the United Nations' Special Fund Caribbean Fisheries Development Project investigated primarily snapper, shrimp, and tuna resources. The remaining three cruises were charters--two by the Bureau's Biological Laboratory at Brunswick, Ga., and one by Louisiana State University. During the latter cruise a specially installed 35,000-curie cobalt 60 irradiator was used in shrimp preservation studies.

Figure 6.--Broadbill swordfish captured on longline.

Results of cruises varied according to gear fished and area. Only light catches of shrimp were made during explorations off Florida and at widely scattered locations in the Caribbean. During scallop investigations off North Carolina, which were requested by the scallop industry, we found concentrations of large scallops near New River Inlet, N.C. Studies to determine the year-round availability of swordfish off Florida took only small catches. Trolling between longline sets off Florida and in the Caribbean confirmed earlier indications of a potential resource of blackfin tuna in the Caribbean and western Atlantic. This light-meat tuna is not now used by the U.S. fishing industry. Samples were sent to several of the larger tuna canning companies on the West Coast to prepare test packs, which proved to be excellent. Indications of a large potential resource for yelloweye or silk snapper, Caribbean red snapper, and blackfin snapper were obtained off Central America in the Caribbean. Handlines and handreels were used for sampling preliminary to work in the area with fish trawls. Promising concentrations of yelloweye were also found near the Virgin Islands.

Figure 7.--Worker obtaining a temperature record with a bathythermograph before a longline set.

Field Research in the Gulf of Mexico

In August 1966 participants at a Government-industry meeting in Pascagoula discussed the alarming decline in menhaden catches, especially on the east coast of the United States and means of maintaining a healthy industry in spite of the decline. Our Base was asked for advice on (1) use of alternate resources and (2) new advances in harvesting for greater industry economy. Stress during the meeting was placed on immediate relief to the fishery and use of present industry equipment.

Over the years, experiences aboard the exploratory fishing vessel Oregon in the Gulf and Caribbean had shown the existence in coastal areas of large stocks of anchovies and other small schooling fishes that could be attracted to lights at night. As a stop-gap measure we decided to study night-light attraction and purse seining to take anchovies for fish meal.

Sea trials with a 13,500-watt above-surface light bank and a 125-foot small-mesh purse began in September, with the George M. Bowers, in the coastal waters of the north central Gulf of Mexico.

Trials continued throughout the fiscal year, with emphasis on dark-of-the-moon periods. Several other attractors were acquired and used during the period, including 1,000-watt mercury vapor lamps and 12-volt direct current lamps used singly, alternately, and in combination. We found generally that the more light used, the more fish were attracted, but the lights varied in their abilities to "harden" the attracted fish into balls of milling fish.

The small-mesh purse seine, later lengthened to 250 feet, was very effective in capturing the assembled schools, especially with a single-boat pursing operation. In most instances, the entire assembled congregation would be captured.

The study will continue through September 1967 to provide full-year coverage. Results to date, however, do not show commercial promise, owing to relatively low numbers of fish assembled (less than 1,000 pounds per set). Anchovies of three species dominate most catches, with small thread herring, scaled sardines (razor bellies), harvestfish, bumpers, and cutlass fish also appearing often in the catches. On occasion, large predators would appear in the catches or slash through the milling school before capture. These predators include several species of jacks, Spanish mackerel, and leather jackets. If time permits, the fishery potential for predators in the "shadow area" just beyond the lighted zone will receive additional attention.

Along with the aforementioned commercial harvest attempts, we had a small-scale project aimed at a basic understanding of the whys and wherefores of schoolfish behavior as related to light attraction. Behavior studies of a preliminary nature were carried out at sea and in the laboratory.

Figure 8.--The start of retrieving a longline set. Man at rail holds grappling hook to catch line attached to buoy to start the haulback.

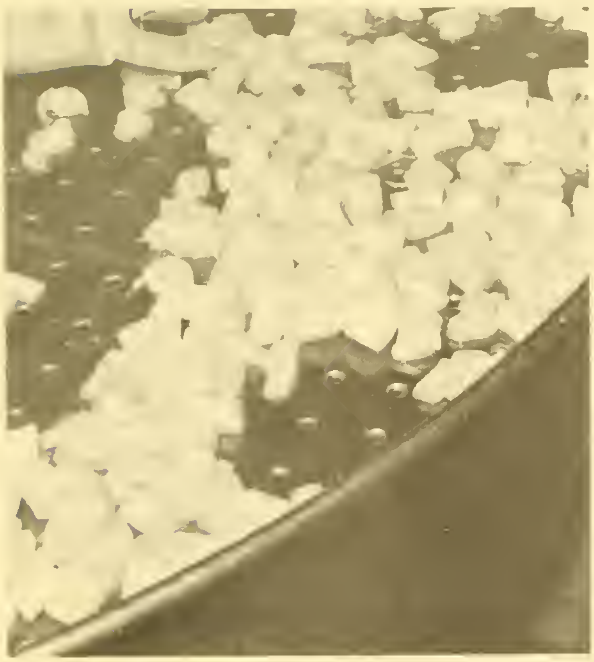

Figure 9.--Mechanically shucked and cleaned calico scallop meats from the North Carolina scallop grounds.

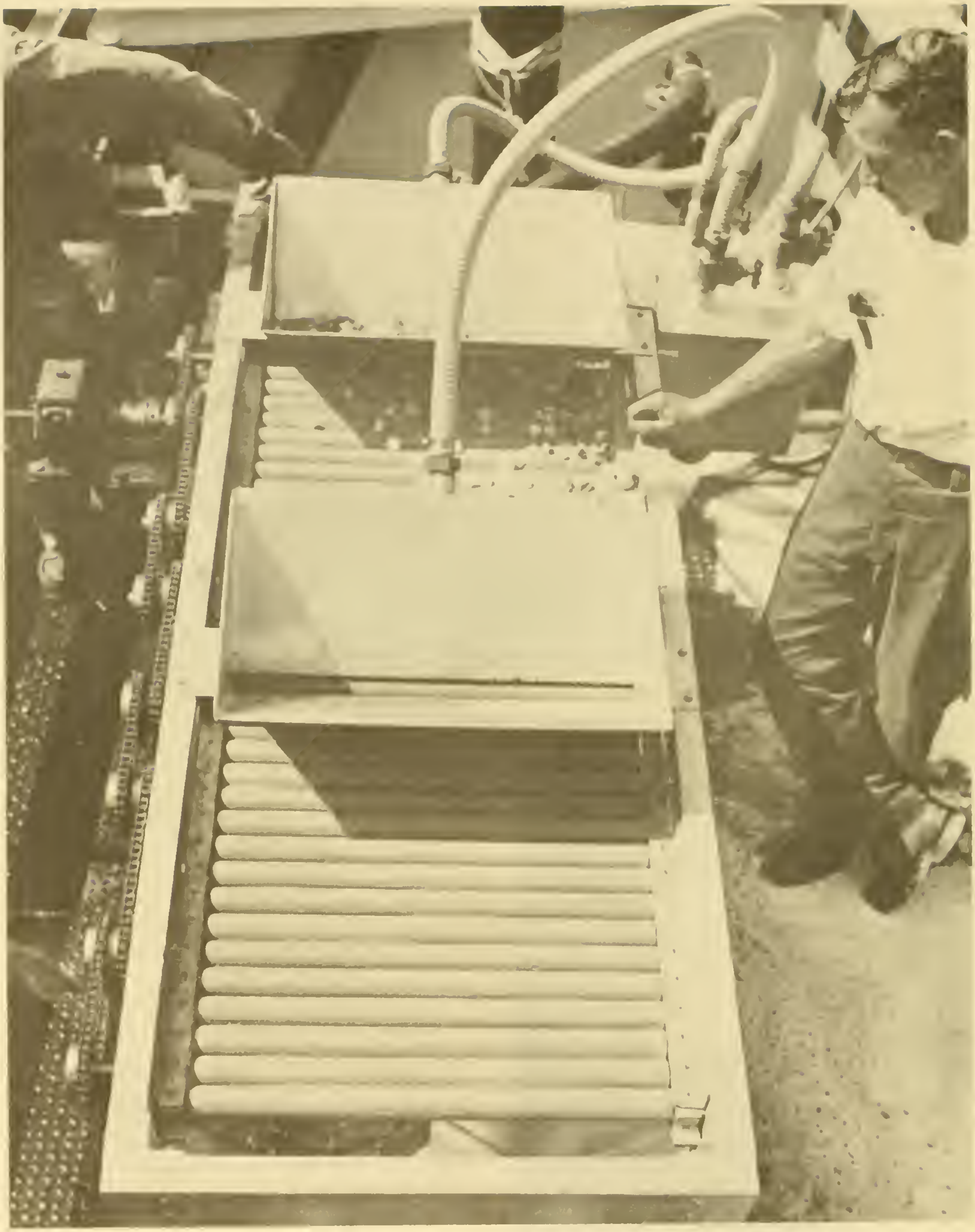

Figure 10.--Workers testing prototype calico scallop eviscerating machine.

Figure 11.--*George M. Bowers* with 13,500-watt light bank.

Figure 12.--Men setting the sampling purse seine around a night light.

Figure 13.--Partially completed shed holding 7,600-gallon experimental pool.

The light sources at sea were the same as those used for the commercial trials; however, a 5-foot diameter lift net was used in place of the purse seine. Some of the more significant preliminary findings were:

(1) Fish were attracted to all of the light sources used; however, the narrow-angle lights concentrated the fish into the requisite tight school, whereas the wide-angle lights did not.

(2) An initial period of attraction occurred shortly after dark, followed by a lessening of activity until shortly before dawn.

(3) Fish behavior in the light field varied greatly from night to night, and predators and currents played seemingly important roles. In fast-moving currents, the schools under the light were ragged; fish swam into the current with only the front edge of the school under the light.

Vertical schooling patterns were studied with a portable depth recorder, but we failed to detect consistent patterns.

For laboratory studies, a 7,600-gallon plastic-lined pool was constructed. Aside from a few survival and feeding tests, we accomplished little with the pool before the project leader left for graduate school. The equipment is being maintained for future use.

THE WORK GOES ON

Thus at sea, in the air, and in the laboratory work continues with the ultimate goal of a healthier domestic fishery industry.

We appear to be riding a wave of progressive optimism that marks the general tone of the industry in the Southeastern States, and we strive to lead the way twoard use in commercial fisheries of the latest in technological advancements combined with exploratory and gear research knowledge from continuing studies.

STAFF

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Martin R. Bartlett, Fishery Methods and Equipment Specialist--EOD 6/25/67

Faunal Survey Program (Pascagoula)

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Shelby B. Drummond, Fishery Biologist
Bruce W. Maghan, Fishery Biologist
Larry H. Ogren, Fishery Biologist--Transferred to Sandy Hook, N.J., 9/2/66
Judith C. Gatlin, ADP Technician
Bennie A. Rohr, Fishery Technician--Resigned 8/26/66, EOD (summer seasonal) 5/1/67
Leslie D. Osborne, Jr., Fishery Aid--Terminated 8/5/66
Luis R. Rivas, Fishery Biologist (summer seasonal)--Terminated 9/3/66, EOD (summer seasonal) 6/26/67
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Edith J. Seamen, Administrative Clerk
Suzanne W. Drummond, Administrative Clerk
Alice Colmer, Librarian
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Michael H. Quinn, Physical Science Technician
Donald A. Wickham, Fishery Biologist--EOD 7/13/66
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John D. Schlotman, Biological Aid
Douglas D. Hodge, Electronics Technician--Resigned 7/14/66
William F. Catranbone, Electronics Technician--EOD 8/4/66, Resigned 8/11/66
Joseph A. Benigno, Fishery Biologist--EOD 7/17/66

R/V George M. Bowers (Pascagoula)

J. B. Randall, Master--EOD 7/14/66
Anthony F. Veara, Chief Engineer
Laurence Vice, Skilled Fisherman
Julius W. Harper, Cook--EOD 3/13/67
John R. Anderson, Skilled Fisherman--EOD 3/13/67, Terminated 5/12/67
August A. Barich, Cook--Resigned 3/10/67

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Linda F. Arnold, Clerk-Stenographer--EOD 8/8/66
Linda L. Jackson, Clerk-Stenographer--EOD 8/30/66

R/V Oregon (St. Simons Island)

Milan Willis, Master--Resigned 10/1/66
Abraham J. Barrett, Master 10/1/66 (formerly First Officer)
Robert M. Mattos, Chief Engineer
Jake M. Marinovich, First Assistant Engineer
James M. Higgins, Second Assistant Engineer--EOD 3/6/67
Franklin P. Tippins, First Assistant Engineer--Resigned 3/10/67
Joseph Bowens, Skilled Fisherman--EOD 11/6/66, Terminated 4/10/67
Richard C. Finn, Ordinary Fisherman--EOD 4/17/67, Terminated 4/28/67
Robert B. Martin, Cook--EOD 5/1/67
Frederick Weems, Steward
Peter F. Rosetti, Skilled Fisherman
Edward A. Thompson, Skilled Fisherman
Harvey M. Bledsoe, First Officer 3/20/67, Acting Mate (EOD) 10/1/66 to 3/20/67
Ernest Williams, Skilled Fisherman

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