

# MAINE STATE LEGISLATURE

The following document is provided by the  
**LAW AND LEGISLATIVE DIGITAL LIBRARY**  
at the Maine State Law and Legislative Reference Library  
<http://legislature.maine.gov/lawlib>



Reproduced from scanned originals with text recognition applied  
(searchable text may contain some errors and/or omissions)

MAINE PUBLIC DOCUMENTS

1950-51

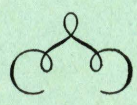
(in three volumes)

VOLUME II

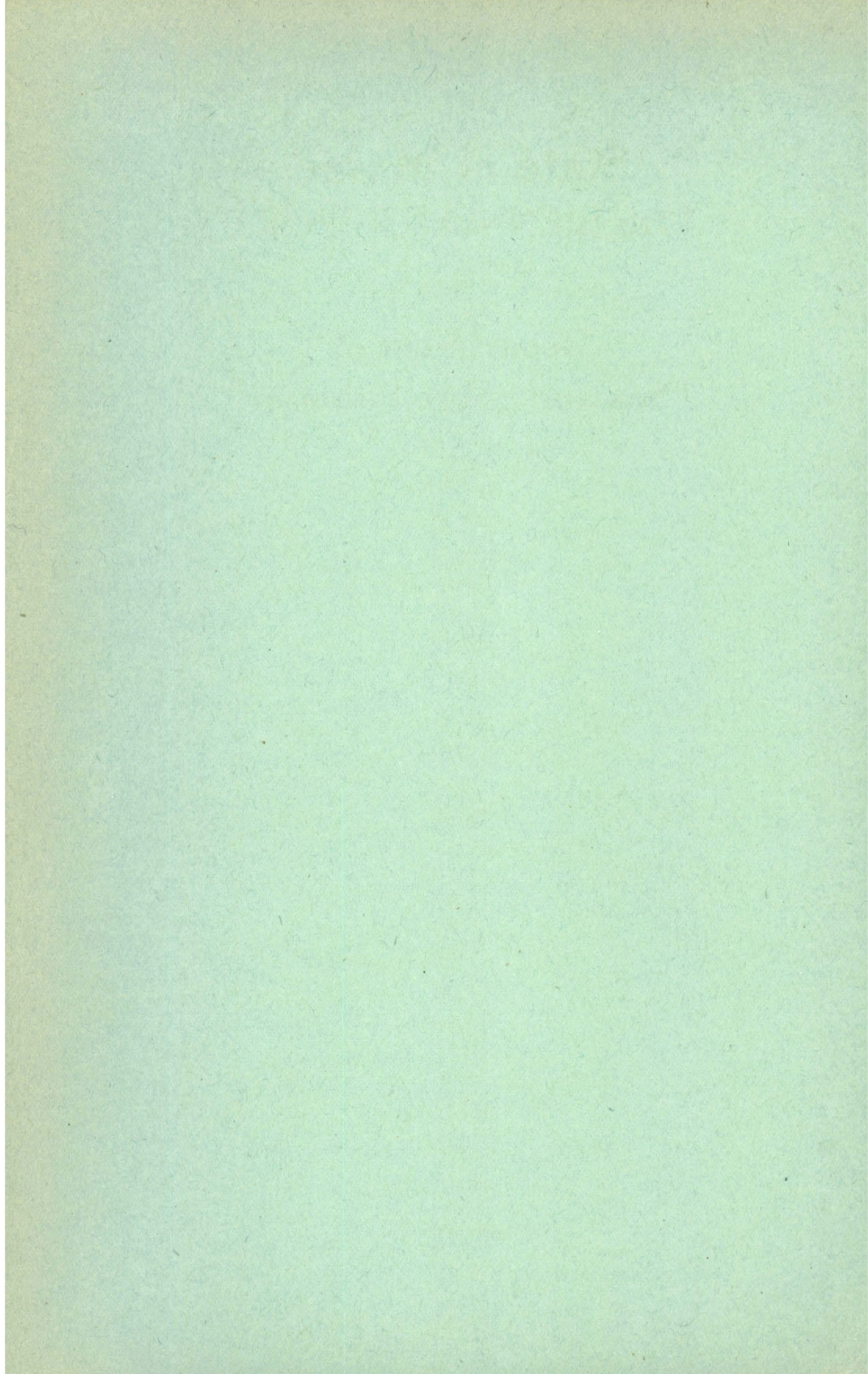
# State of Maine 17th BIENNIAL REPORT

---

## Department of Sea and Shore Fisheries



For Period  
July 1, 1950 to June 30, 1952  
Vickery-Hill Building  
Augusta, Maine

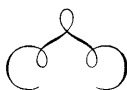


# State of Maine

## 17th BIENNIAL REPORT

---

### Department of Sea and Shore Fisheries



For Period  
July 1, 1950 to June 30, 1952  
Vickery-Hill Building  
Augusta, Maine

STATE OF MAINE

---

BIENNIAL REPORT OF  
DEPARTMENT OF SEA AND SHORE FISHERIES

Augusta, Maine

*To the Honorable Governor and Executive Council:*

Sirs:

I herewith transmit, in compliance with the law, the report of the Department of Sea and Shore Fisheries, for the two years ending June 30, 1952, together with statistics and other pertinent data.

ROBERT L. DOW,  
*Commissioner*

## COMMISSIONER'S REPORT

---

This report covers in summary all activities of the Department of Sea and Shore Fisheries for the biennium from July 1, 1950, through June 30, 1952, with additional information through the calendar year 1952.

The present Commissioner, who commenced his departmental employment in July 1946 and served for four years in charge of the Department's program for research and experimentation, was appointed to succeed Richard E. Reed as Commissioner in August 1952. Commissioner Reed had resigned to take the position of Executive Secretary of the Maine Sardine Industry. Dana E. Wallace, the Department's shellfish specialist since 1946, has been promoted to head the research program. Ronald W. Green, formerly skipper of the State boat *Explorer* and in charge of all floating equipment for the Department, has been promoted to Chief Warden.

Included in this report is detailed information on departmental expenditures and income, licenses, violations, fisheries statistics and the general program of the Department in law enforcement and research.

A report by Wayne Buxton of the Maine Development Commission covers the joint promotional activities of the Department and the Maine Development Commission in the promotion, advertising and merchandising of Maine seafoods and seafood products.

The departmental publications listed in this report are supplemented by progress reports covering research projects recently concluded or still in progress.

ROBERT L. DOW,  
*Commissioner*

## EXPENDITURES

Operating costs during the first fiscal year of the biennium increased \$12,090 over the corresponding period of the previous biennium. These increased expenditures were caused by increased warden service and administrative costs together with an approximate \$7,000 expansion of our research program.

During the second year of the biennium, expenditures decreased \$7,438.37 although operational expenses for warden service increased more than \$11,000 for the year. In like manner, expenses to operate the station at Boothbay Harbor were increased \$4,000 for the same period. Research expenditures decreased approximately \$4,000 and costs of operating our bacterial program were about \$4,000 less than during the previous year. A decrease in the available supply of egg lobsters for purchase by the Department resulted in an appreciable drop in the cost of carrying on that propagation program.

### Department of Sea and Shore Fisheries

#### *Expenditures*

	July 1, 1951 to June 30, 1952	July 1, 1950 to June 30, 1951
Administration . . . . .	\$ 24,223.18	\$ 24,165.10
Statistical . . . . .	4,773.46	4,465.27
Warden Service . . . . .	117,429.58	106,180.91
Patrol Boats . . . . .	10,297.92	10,507.67
Propagation of Shellfish . . . . .	2,293.35	14,667.67
Pemaquid Lobster Pound . . . . .	—	396.64
Operation of Research Station . . . . .	15,694.91	11,592.82
Research . . . . .	18,840.28	22,963.51
Survey of Closed Clam Areas . . . . .	8,946.17	12,333.55
Quahog Research Project . . . . .	2,006.00	3,200.75
Restoration & Development of Shellfish Resources . . . . .	6,793.51	8,262.84
Total . . . . .	\$211,298.36	\$218,736.73



# DEPARTMENT OF SEA AND SHORE FISHERIES

## (Organization and Major Duties and Functions)

By ROBERT L. DOW

The Department of Sea and Shore Fisheries, as provided by law, consists of a Commissioner and sufficient personnel to carry on the work of the Department and to enforce those laws which come within its province.

For operational purposes, the business of the Department has been divided into three divisions: (1) Law Enforcement; (2) Research; and (3) Development. The duties of the first two divisions are carried on by personnel of this Department. The activities of the Development division are carried on in part by personnel of this Department assigned on a part-time basis and in part by the Maine Development Commission. Detailed information on this work is furnished by the report of the major duties of the Maine Development Commission.

### ADMINISTRATION

The principal (not in their order of importance) administrative duties carried on by this Department are:

1. issuing licenses
2. processing accounts and maintaining current records
3. preparing, editing and reviewing reports, bulletins and other departmental publications
4. speaking engagements
5. preparing budgets and requisitions and selling authorized materials
6. collecting, compiling, collating and editing fisheries statistics
7. maintaining a current public and industrial information service
8. coordinating divisional activities

### LAW ENFORCEMENT

Laws which regulate the taking, transportation, and sale of marine fish and shellfish are enforced by the Sea and Shore Fisheries wardens; while those laws which govern the processing, canning, and packing of marine fish and shellfish, insofar as quality, condition and sanitation are concerned, come under the jurisdiction of the Department of Agriculture.

Fisheries laws enforced by the Department of Sea and Shore Fisheries, in general, fall into three major classifications—conservation, sanitary and economic. The majority of these laws have the intent of conservation in that conservation practices are put into effect by restricting the type or size of gear, areas which may be fished, the size of individual fish or shellfish which may be legally taken, and seasons of the year when fishing operations may be carried on.

Sanitary laws are those which close certain shellfish producing areas affected by insanitary conditions or which prohibit the contamination of inshore areas by the disposal of fish waste.

There are a few fisheries regulations that, by inference, are more economic than conservation in nature although, in the most general terms, even these possess some conservation implications. These laws restrict the use to which certain fish and shellfish species may be lawfully put.

## RESEARCH

No continuous marine fisheries research program existed in Maine before 1946. In that year, a small beginning was made and, under authority of the Ninety-third Legislature, certain funds were made available for the establishment of a continuing program. Subsequent legislative action expanded these research activities to the point that, at present, the following are provided by law:

1. a continuous research, development and propagation program
2. scientific work on projects to be designated by the Commissioner
3. restoration, development and conservation of clams, quahogs, mussels and marine worms
4. continuous bacteriological and sanitary surveys of closed clam areas
5. mussel control
6. the establishment of experimental areas

Research personnel in the Department have duties in three general categories. They do research, they serve as consultants to the fishing industry, and they carry on special investigative projects. Research activities carried on by the Department fall into the two general classifications of applied and basic research.

It has been the operating practice of the Department, insofar as possible, to assist the industry on short-term problems, the solution, or partial solution, of which would be of practical value to the industry. At the same time, continuous research and experimentation to provide

information on better management of the several fisheries has been carried on.

Since basic research is essential to the development of an applied research program, it has been necessary for the Department, through its own efforts or through cooperation with Federal or other state fisheries research agencies, to maintain continuous basic research. A great deal of this basic information has been obtained through the use of the Department's coastal warden force as well as through certain segments of the industry, interested individuals, and local communities. At times, the Department may work directly with the fishing industry on specific problems. Perhaps one of the most important efforts of the Department in being of service to the fishing industry has been through the close liaison that has been established with other comparable fisheries organizations and agencies.

The Department is frequently called upon to furnish advice and recommendations on fisheries problems to coastal communities, to individuals engaged in some phase of the fishing industry, and to the industry as a whole. One of the Department's most important research duties is that of furnishing information to the legislature on the many problems of the state's commercial fisheries.

Special projects have been set up from time to time with coastal communities, with individuals, or with firms engaged in the processing of seafood products. Shellfish experimental programs have been established in several coastal areas through the assistance and cooperation of town officials and commercial fishermen. Special research projects with the Department have been contracted by firms engaged in processing of seafoods and the cost of the work has been borne, in considerable part, by private industry.

Some special projects—the investigation of mussel control on clam producing areas, and a continuous bacterial survey of closed clam areas—have been established by legislative action.

During the period since 1946, investigations on basic problems of mutual interest to this Department, as well as to those other departments and agencies listed below, have been carried on:

- U. S. Fish and Wildlife Service
- U. S. Geological Survey
- Maine Department of Health and Welfare
- Maine Department of Agriculture
- Maine Forest Service
- Maine Geological Survey
- Massachusetts Division of Marine Fisheries

## DEVELOPMENT

Through the Maine Development Commission, with the guidance, advice and assistance of this Department, money made available for the promotion and development of Maine seafood products is used in the state's fisheries development program. With the planning, designing and constructing of exhibits, the keeping of records, and preparing material for publication, these duties require the equivalent of more than one full-time employee.

**PUBLICATIONS OF THE  
DEPARTMENT OF SEA AND SHORE FISHERIES**

**Clams**

See SHELLFISH

**Fisheries Circulars**

- #1—SOME OBSERVATIONS ON THE WEIGHT AND NUMBERS OF EGGS OF FEMALE LOBSTERS, Clyde C. Taylor, October 1947.
- #2—THE SCHOODIC LOBSTER PLANTING EXPERIMENTS, Clyde C. Taylor and Frederick T. Baird, Jr., January 1948.
- #3—A METHOD OF INFERRING THE ANNUAL GROWTH INCREMENT OF LOBSTERS FROM LENGTH-FREQUENCY MEASUREMENTS, Clyde C. Taylor, Reprinted May 1951.
- #4—SHELL DISEASE AS A MORTALITY FACTOR IN THE LOBSTER (*Homarus americanus*), Clyde C. Taylor, September 1948.
- #5—THE SCHOODIC LOBSTER PLANTING EXPERIMENTS, Supplement 1, Clyde C. Taylor, April 1949.
- #6—(Part II of RESEARCH BULLETIN #2) A DEVICE FOR DETERMINING LOBSTER WEIGHTS, Clyde C. Taylor, March 1950.
- #7—WHAT MAKES A LOBSTER SHED?, J. Kenneth Donahue, May 1951.
- #8—I. THE DISTRIBUTION OF THE GREEN CRAB, *CARCINIDES MAENAS* (L.) IN THE NORTHWESTERN ATLANTIC, Leslie W. Scattergood. II. OBSERVATIONS ON GREEN CRABS (*C. maenas*) IN MAINE, Robert L. Dow and Dana E. Wallace, October 1952.

**Herring**

RESEARCH BULLETIN #5—A STATISTICAL SUMMARY OF THE MAINE HERRING FISHERY IN 1948 AND 1949, Leslie W. Scattergood and Parker S. Trefethen, June 1952.

RESEARCH BULLETIN #6—UNITED STATES IMPORTS AND EXPORTS OF HERRING AND SARDINES IN RECENT YEARS, Leslie W. Scattergood, October 1952.

TECHNICAL BULLETIN #2—CONVERSIONS OF THE STANDARD, FORK, AND TOTAL LENGTHS OF THE MAINE HERRING, Leslie W. Scattergood, November 1952.

### **Laws and Regulations**

MAINE SEA AND SHORE FISHERIES LAWS AND REGULATIONS, Department of Sea and Shore Fisheries, Revised to July 1, 1951.

THE TAKING OF SHELLFISH AND MARINE WORMS IN VARIOUS MAINE TOWNS AS REGULATED BY PUBLIC LAWS, PRIVATE AND SPECIAL LAWS, RULES AND REGULATIONS AND MUNICIPAL ORDINANCES, Department of Sea and Shore Fisheries, Revised to November 1, 1951.

### **Lobsters**

FISHERIES CIRCULAR #1—SOME OBSERVATIONS ON THE WEIGHT AND NUMBERS OF EGGS OF FEMALE LOBSTERS, Clyde C. Taylor, October 1947.

FISHERIES CIRCULAR #2—THE SCHOODIC LOBSTER PLANTING EXPERIMENTS, Clyde C. Taylor and Frederick T. Baird, Jr., January 1948.

FISHERIES CIRCULAR #3—A METHOD OF INFERRING THE ANNUAL GROWTH INCREMENT OF LOBSTERS FROM LENGTH-FREQUENCY MEASUREMENTS, Clyde C. Taylor, Reprinted May 1951.

FISHERIES CIRCULAR #4—SHELL DISEASE AS A MORTALITY FACTOR IN THE LOBSTER (*Homarus americanus*), Clyde C. Taylor, September 1948.

FISHERIES CIRCULAR #5—THE SCHOODIC LOBSTER PLANTING EXPERIMENTS, Supplement 1, Clyde C. Taylor, April 1949.

FISHERIES CIRCULAR #6—(Part II of RESEARCH BULLETIN #2) A DEVICE FOR DETERMINING LOBSTER WEIGHTS, Clyde C. Taylor, March 1950.

FISHERIES CIRCULAR #7—WHAT MAKES A LOBSTER SHED?, J. Kenneth Donahue, May 1951.

HOW TO EAT A MAINE LOBSTER, Maine Development Commission & Department of Sea and Shore Fisheries, 1951.

HOW TO PREPARE MAINE LOBSTER, Maine Development Commission & Department of Sea and Shore Fisheries, December 1952.

MAINE LOBSTER RECIPES (27 NEW), Robert L. Perry, 1950 (out of print).

REPORTS ON: I. A STUDY OF ABNORMAL SHRINKAGE OF MAINE LOBSTERS ("RED TAIL") WITH OBSERVATIONS AND RECOMMENDATIONS, John S. Getchell.

II. A STUDY OF LOBSTER SHELL DISEASE WITH OBSERVATIONS AND RECOMMENDATIONS, Clyde C. Taylor, 1949.

RESEARCH BULLETIN #1—THE EFFECT OF SHELL DISEASE ON THE GILLS AND CHITIN OF THE LOBSTER (*Homarus americanus*), William H. Sawyer, Jr., and Clyde C. Taylor, 1949.

RESEARCH BULLETIN #2—I. LOBSTER PLUGS AND THEIR EFFECT ON THE MEAT OF THE LOBSTER'S CLAW, Frederick T. Baird, Jr.

RESEARCH BULLETIN #8—STUDIES ON ECDYSIS IN THE AMERICAN LOBSTER (*Homarus americanus*), J. Kenneth Donahue, December 1952.

STATISTICS ON MAINE LOBSTER INDUSTRY (ANALYSIS OF EQUIPMENT), Department of Sea and Shore Fisheries, 1946.

THE MAINE LOBSTER AS A PROMOTIONAL ASSET, Maine Development Commission & Department of Sea and Shore Fisheries, December 1952.

THE MAINE LOBSTER POT, Department of Sea and Shore Fisheries, 1948.

THE STORY OF THE MAINE LOBSTER (*Homarus americanus*), Robert L. Dow, Reprinted August 1950.

## **Marine Worms**

MARINE WORM REPORT, Department of Sea and Shore Fisheries, February 1951.

THE MAINE MARINE WORM BAIT INDUSTRY, Department of Sea and Shore Fisheries, Reprinted March 1949.

## **Predators**

FISHERIES CIRCULAR #8—I. THE DISTRIBUTION OF THE GREEN CRAB, *CARCINIDES MAENAS* (L) IN THE NORTHWESTERN ATLANTIC, Leslie W. Scattergood.

II. OBSERVATIONS ON GREEN CRABS (*C. maenas*) IN MAINE, Robert L. Dow and Dana E. Wallace, October 1952.

## **Quahogs**

See SHELLFISH

## **Recipes**

ADDITIONAL SEAFOOD RECIPES, Especially for use in School Lunch Programs, Department of Sea and Shore Fisheries, 1949.

HOW TO PREPARE MAINE LOBSTER, Maine Development Commission & Department of Sea and Shore Fisheries, December 1952.

MAINE LOBSTER RECIPES (27 NEW), Robert L. Perry, 1950 (out of print).

THE STATE OF MAINE'S BEST SEAFOOD RECIPES, Maine Development Commission & Department of Sea and Shore Fisheries, 1945 (out of print).

## **Research Bulletins**

#1—THE EFFECT OF SHELL DISEASE ON THE GILLS AND CHITIN OF THE LOBSTER (*Homarus americanus*), William H. Sawyer, Jr., and Clyde C. Taylor, 1949.

#2—Part I. LOBSTER PLUGS AND THEIR EFFECT ON THE MEAT OF THE LOBSTER'S CLAW, Frederick T. Baird, Jr., March 1950 (Part II is FISHERIES CIRCULAR #6).



- #3—AN INVESTIGATION OF FRESH CLAM (*Mya arenaria*) MEATS WITH RESPECT TO CRITERIA OF ADULTERATION, Donald M. Harriman, April 1950.
- #4—A METHOD OF REDUCING WINTER MORTALITIES OF QUAHOGS (*Venus mercenaria*) IN MAINE WATERS, Robert L. Dow and Dana E. Wallace, September 1951.
- #5—A STATISTICAL SUMMARY OF THE MAINE HERRING FISHERY IN 1948 and 1949, Leslie W. Scattergood and Parker S. Trefethen, June 1952.
- #6—UNITED STATES IMPORTS AND EXPORTS OF HERRING AND SARDINES IN RECENT YEARS, Leslie W. Scattergood, October 1952.
- #8—STUDIES ON ECDYSIS IN THE AMERICAN LOBSTER (*Homarus americanus*), J. Kenneth Donahue, December 1952.

### Sea Moss

MAP OF SEA MOSS AREAS, Survey made in 1947 by Department of Sea and Shore Fisheries warden force.

THE MAINE SEA MOSS INDUSTRY, Department of Sea and Shore Fisheries, Reprinted 1948.

### Shellfish

HOW TO PREPARE A MAINE CLAMBAKE, Robert L. Perry, 1950.

REPORT ON THE DEPARTMENT OF SEA AND SHORE FISHERIES SHELLFISH PROGRAM, Robert L. Dow and Dana E. Wallace, January 1951.

RESEARCH BULLETIN #3—AN INVESTIGATION OF FRESH CLAM (*Mya arenaria*) MEATS WITH RESPECT TO CRITERIA OF ADULTERATION, Donald M. Harriman, April 1950.

RESEARCH BULLETIN #4—A METHOD OF REDUCING WINTER MORTALITIES OF QUAHOGS (*Venus mercenaria*) IN MAINE WATERS, Robert L. Dow and Dana E. Wallace, September 1951.

TECHNICAL BULLETIN #1—SHELLFISH SURVEY METHODS, Robert L. Dow, November 1952.

THE STORY OF THE MAINE CLAM (*Mya arenaria*), Robert L. Dow and Dana E. Wallace, Revised January 1950.

Also see LAWS AND REGULATIONS

### **Sport Fishing**

General information on STRIPED BASS, Letter written by Bob Elliot of the Maine Development Commission, February 1950.

MAINE SALT WATER SPORT FISHING, Maine Development Commission, Revised December 1952.

STATE OF MAINE STRIPED BASS SURVEY, Sumner A. Towne, 1940 (out of print).

### **Technical Bulletins**

#1—SHELLFISH SURVEY METHODS, Robert L. Dow, November 1952.

#2—CONVERSIONS OF THE STANDARD, FORK, AND TOTAL LENGTHS OF THE MAINE HERRING, Leslie W. Scattergood, November 1952.

### **Tuna**

CANNING ATLANTIC TUNA, Tuna Bulletin #1, Department of Sea and Shore Fisheries, January 1948.

### **Miscellaneous**

COMMERCIAL FISHERIES OF MAINE, Robert L. Dow, Revised March 1950.

INSTRUCTION IN ARTS AND SCIENCES PERTAINING TO MAINE COASTAL INDUSTRIES, Department of Sea and Shore Fisheries.

MAINE LANDINGS, compiled by the Fish and Wildlife Service, Washington, D. C. Distributed monthly.

16TH BIENNIAL REPORT, DEPARTMENT OF SEA AND SHORE FISHERIES, Richard E. Reed, July 1, 1948-June 30, 1950 (with additional information to December 30, 1950) (out of print).

SOME FACTS ON THE NUTRITIONAL AND ECONOMIC VALUE OF MAINE SEAFOODS, Robert L. Perry, 1949.

**Annually Revised Lists of Dealers, Packers and Processors of  
Various Maine Seafoods and other Marine Products are  
also Available**

Alewife Processors

Clam Dealers from whom a supply may be obtained

Crabmeat Processors

Eel Fishermen

Fish Dealers

Fisheries By-Products and Marine Specialties Manufacturers

Herring Carriers (Measured)

Lobster Dealers (Wholesale) owning or renting pounds

Lobster Dealers (Wholesale) who make shipments to commercial  
houses and individuals

Marine Worm Dealers and Shippers

Marine Worms, out-of-state buyers of

Salt Fish Producers

Sardine Packers

Shellfish Packers

Shrimp, fresh & quick-frozen

Smoked Herring and Bloaters

## MAINE'S FISHING INDUSTRY IN 1952

By ROBERT L. DOW

Maine commercial fishermen established a new all-time record of more than eighteen million dollars for the value of their catch in 1952. This total exceeds the previous record set in 1948 by two million dollars, an increase of nearly 13 per cent.

Conditions, however, are not quite as encouraging as they might appear to be, since operational costs for almost all fishing activities have also been at record highs.

Total landings for the year were some seventy million pounds under the record set in 1950 when more than three hundred and fifty million pounds of fish and shellfish were landed at Maine ports. The 1952 production of 280 million pounds was still fifty million pounds above the ten-year average.

The drop in production from the record year of 1950 can be attributed primarily to declines in redfish production of nearly twenty million pounds and in herring production of thirty-five million pounds. Additional declines were registered in several of the groundfish species.

Two species, redfish and herring, normally make up 75 per cent or more of the volume of Maine's total fish and shellfish production and nearly 30 per cent of the catch value.

Redfish landings of sixty million pounds brought fishermen nearly two and three-quarter million dollars in 1952.

Herring landings were up ninety million pounds from the 1951 catch of approximately sixty million pounds. The 1952 catch was worth nearly one and three-quarter million dollars.

In addition to total dollar return, several other records were established during the year.

The Maine lobster, always the mainstay of Maine's commercial fisheries and in many respects of the entire New England fisheries, set a new record for the value of the catch in 1952. This record of nine million dollars exceeded the previous record set in 1945 by more than one million dollars. A considerable amount of the increase in lobster value can be traced to increased demand stimulated by the carefully planned lobster promotion program carried on during the year by the Department of Sea and Shore Fisheries and the Maine Development Commission. One very tangible result of this program has been a twenty-five per cent expansion of lobster consumption in certain mid-western markets and the opening and development of market outlets in the southwest.

Production of lobsters during 1952 was only one-quarter million pounds under the 1951 record of 20,759,471 pounds. The 1952 catch was the second largest since 1892.

It is noteworthy that the lobsters caught during August 1952 amounted to 4,719,654 pounds, the highest monthly catch on record, valued at \$2,055,816. The value of this single month's catch exceeded the annual value of the lobster catch for every year prior to 1943.

The total poundage for the same month, nearly five million pounds, was only a few hundred thousand pounds under the average annual catch during the 1930's.

Clam production, Maine's second most important shellfishery, was up about one-quarter million pounds and nearly one-half million dollars as compared with 1951 figures. The volume yield of this fishery appears to have levelled off at some over five million pounds annual catch, approximating the pre-World War II level.

The quahog or hard-shell clam fishery of Casco Bay, assisted by the cooperative management program maintained by the Department of Sea and Shore Fisheries and the several towns concerned, has remained for the last four years at the same high level of production, despite a generally diminishing supply during the period.

Among the other major species, sea scallop production of one and one-half million pounds during 1952 was the highest since 1912 and the value of the catch, \$663,000, was by far the highest on record. Although the inshore catch is reported to have been considerably less than during the two previous fishing seasons, good market conditions stimulated offshore dragging to make up more than the difference.

The importance of Maine's commercial fishing industry has greatly increased during the past several years. In 1944, Maine ranked sixth among the fifteen Atlantic coastal states in the value of its marine fisheries and produced 7.4 per cent of the total fisheries income for the Atlantic coast. By 1949, Maine ranked third in its comparative position and produced nearly 12 per cent of the total fisheries income for the Atlantic coast. Although fisheries information for the other states is not available beyond 1950, it is very likely that in 1952 Maine went into second position since, during the last several years, it has been very close to second-ranking Virginia in the value of its commercial fisheries.

## LAW ENFORCEMENT

RONALD GREEN, *Chief Warden*

As of June 30, 1952, the staff of this division consisted of nineteen district wardens, five supervisors, an administrative clerk and a chief warden.

There have been three vacancies since the last biennial report; one retired and two resigned. The warden supervisors were assigned a small patrol within their district. Patrols were rearranged and, by doing such, it was possible to fill the three vacancies with two men and at the same time increase the efficiency in all districts. We believe that this policy of having a smaller force of better paid, vigorous men with larger districts and responsibilities is working out well.

A breakdown of expenses of operating the warden service for the fiscal years 1950-51, 1951-52 is given as follows:

### 1950-51

Reimbursed expenses, auto travel, etc. . . . .	\$ 24,870.89
Salaries . . . . .	76,324.99
Clothing . . . . .	3,086.67
Miscellaneous equipment and supplies . . . . .	546.69
Transportation equipment . . . . .	292.29
Disability compensation . . . . .	147.00
Telephone services . . . . .	222.58
Maintenance of prisoners . . . . .	519.85
Other miscellaneous expenses . . . . .	169.95
	<hr/>
	\$106,180.91

### 1951-52

Reimbursed expenses, auto travel, etc. . . . .	\$ 27,116.62
Salaries . . . . .	87,096.21
Clothing . . . . .	1,408.01
Miscellaneous equipment and supplies . . . . .	660.64
Transportation equipment . . . . .	196.13
Disability compensation . . . . .	361.98
Telephone services . . . . .	373.25
Maintenance of prisoners . . . . .	116.55
Other miscellaneous expenses . . . . .	100.19
	<hr/>
	\$117,429.58

All new wardens are selected through competitive examinations. Before being assigned a patrol he receives training, not only in law enforcement but also trained to be familiar with the problems of those active in the fishing industry. Promotions to supervisors are also made through competitive examinations and we find that the maintenance of district supervisors is an excellent system that simplifies the field work of a complicated legal fisheries set up.

The entire coast is divided into five districts with a supervisor in charge of each. Changes in the fishing activities make it necessary from time to time to rearrange district wardens to more strategic locations. Rearrangements and transfers have been made and more will be necessary to give the industry maximum coverage at a minimum cost.

Full wardens meetings are held at least twice a year for the purpose of discussing department policy and mutual problems and the supervisors meet with the Commissioner and Chief Warden at least once a month. After the latter meetings, the supervisors call their district men together to discuss new developments and further orders.

All men are required to file comprehensive weekly reports of their activities and observations and a digest of these reports is prepared once a week for distribution to the entire force.

During the present National Emergency our wardens have been placed at the disposal of the State Director of Civil Defense and are receiving regular training along those lines. They are also made available to the State Police and Department of Inland Fisheries and Game for help and cooperation whenever needed.

Although law enforcement is the basic duty of all wardens they are also required to gather statistics and information, to consult with the industry on departmental matters, to help the fishermen and dealers whenever possible, to work on propagation and conservation projects and serve as all around representatives of the department in the field.

During the biennium a new schedule of pay was established for the division which is equal to the Inland Fish and Game law enforcement officers. The present scale for district wardens is \$48 to \$60 a week while supervisors receive \$60 to \$75 weekly. Each officer receives mileage on his car and expenses while on duty in the field.

Members of the force receive regular issues of uniforms, including Eisenhower jacket, shirt, pants, winter coat, ties, raincoat, boots, pacs, hat and incidentals. The method of wearing and caring for the uniform is strictly regulated.

During the biennium we have obtained more boats for the wardens. Two more will be made available in the Spring of 1953. More equip-

ment is needed and at this time our greatest need is portable two-way radios. The program now under way calls for three portable radios in 1953 and we are in hopes to add three sets each year until all who need them are equipped.

### CIVIL SERVICE COMMISSION

The Civil Service Commission set up by the 1947 Legislature is working out well and has resulted in better trained, better disciplined force. The morale, unity and efficiency of the men have been greatly increased. In 1953 we are in hopes that Legislature will put our wardens on a retirement basis equal to that now available to State Police officers, Inland Fish and Game wardens and State Prison guards.

### WARDEN SCHOOL

In 1953 we hope to hold a school for wardens at which they will be given instructions in new regulations, law enforcement, court procedure, propagation, conservation, and discuss the many problems of those active in the fishing industry. Men well informed will be a more efficient crew.

### VIOLATIONS

The over-all number of violations remains about the same as the last biennial. A full breakdown may be found on another page of this report. Possession of illegal clams and lobsters, digging clams in closed areas and illegal fishing were the leading offenses.

The 1951 Legislature did much to modernize and clarify the fishing laws; however, there is still work to be done and we hope to make more progress in 1953.

We have had less trouble with clam bootleggers but the short clam problem is still serious. The digging of clams under two inches in length is definitely harmful to conservation and can be stamped out only through strict enforcement and a continuous campaign of public relations and education.

Cases of molesting gear continue to be a problem but, with our increase in floating equipment and with portable radios, we'll be better prepared to give the fishermen more protection.

The force seized many thousands of short lobsters from Canadian shipments and released them in Maine waters and also released thousands of pounds of seed lobsters which were purchased from the pounds by the department.



## PATROL BOATS

The department has a combination patrol-research boat, three off-shore patrol boats, one harbor and bay patrol boat and two large out-board patrol craft that will be available in the spring of 1953.

The 28-foot cabin boat *Hel-Cat* is based at Jonesport and is used to cover the area from Calais to Schoodic Point.

The 26-foot *Little Explorer* which was recently damaged by fire will be rebuilt, repowered and will be based at Southwest Harbor and will be used to cover the area from Schoodic Point to Stonington.

The 34-foot *Guardian* is based at Rockland and is used to cover the area from Stonington to Monhegan.

In April 1952 we purchased a 26-foot Chris-Craft runabout for \$900.00. The boat and engine is in A-1 condition and it makes an ideal patrol boat for bays, rivers and harbors. This boat will be based at Boothbay Harbor and will be used to cover the area from New Harbor to Casco Bay.

The two 16-foot boats with 25 H.P. outboard motors will be used to cover the areas from Bailey Island to the New Hampshire line. One based at Portland will be used for patrol work from Bailey Island to Cape Elizabeth; the other, based at Kennebunkport, from Cape Elizabeth to Kittery.

Also available are three 12-foot outboard boats and trailers. These will be located at Harpswell, Friendship and Ellsworth and will be used in places not covered by larger boats.

The 42-foot combination research-patrol boat *Explorer* which is well equipped with diesel power, radio telephone, depth recorder, experimental fishing gear, etc., is based at Boothbay Harbor, under Captain Thurlow Farmer, and is used jointly by the wardens and research staff.

### Prosecutions of Violations of Sea and Shore Fisheries Laws

	July 1, 1951 to June 30, 1952	July 1, 1950 to June 30, 1951
Illegal possession of lobsters . . . . .	62	56
Lobstering without a license . . . . .	16	18
Illegal possession of clams . . . . .	47	64
Digging clams without license . . . . .	17	20
Digging clams in Closed Areas . . . . .	14	43
Non-resident digging of clams and quahogs without municipal license . . . . .	32	2

Non-resident digging of marine worms without municipal license . . . . .	12	44
Digging marine worms without license . . . . .	8	0
Lobster traps not properly marked . . . . .	2	0
Illegal serving of lobsters and lobster meat . . . . .	1	0
Larceny of lobsters . . . . .	4	0
Illegal transportation of lobsters . . . . .	3	0
Illegal sale of clams . . . . .	15	14
Illegal transportation of clams . . . . .	3	2
Illegal canning of clams . . . . .	1	0
Dumping . . . . .	6	6
Molesting Gear . . . . .	6	6
Illegal operation of fish weir . . . . .	2	0
Illegal use of otter trawl . . . . .	2	0
Setting seine within 2000 ft. of weir . . . . .	1	0
Illegal possession of smelts . . . . .	4	2
Illegal possession of sea moss . . . . .	3	0
Illegal fishing . . . . .	0	11
Illegal possession of scallops . . . . .	0	3
Serving clams without a license . . . . .	0	1
Smothered fish cast on shore . . . . .	0	2
	<hr/>	<hr/>
Total . . . . .	261	294

## DEVELOPMENT AND PROMOTION

WAYNE BUXTON

*Maine Development Commission*

In the past two years the marketing, promotion and publicity program of the Department has made definite strides in assisting Maine seafood producers in merchandising their products.

Through such media as television, radio, newspapers, and merchandising displays, Maine seafoods and products of the sea have been kept before consumers throughout the nation.

The present program was opened within the state. After an exhaustive survey of retail and wholesale outlets it was found that there was a great need for colorful display signs to attract the consumer eye to Maine seafood products. With the cooperation of the Maine Development Commission a series of display banners featuring eleven major Maine seafoods were printed and the industry was advised that they were available. The demand for these colorful displays was so great that the first printing was exhausted within a few days and more were ordered to meet the demand. The most popular of the display banners reading *Featuring Maine Lobsters* is highly regarded by Maine lobster dealers who distributed more than ten thousand to their retailers in Maine and throughout the nation.

Special attention has been given to food writers with syndicated columns in prominent metropolitan newspapers and magazines. By planning trips for them along the Maine coast, thousands of lines of publicity on Maine seafoods and their preparation were placed in newspapers throughout the country. By the same process about a dozen television films were made in Maine shown over the metropolitan TV stations. The most prominent of these was called "The Story of the Maine Lobster" and has been shown over fifty-one television stations. The film was sponsored by the American Association of Manufacturers.

To aid further in the promotion of Maine seafood products many of the booklets and publications distributed by the Department and the Development Commission have been redesigned and full color photographs taken for the cover material. A special lobster recipe folder has been completed and is ready for distribution. The "Best Seafood Recipes" booklet is being republished in more compact form with a sparkling color cover showing many species of Maine fish and shellfish. This booklet is considered to be one of the best of its type and is in constant demand. The popular "How To Eat A Maine Lob-

ster" has been revised. The Department felt that the revision of these publications was necessary to keep abreast of changing economic conditions and to meet competition of certain imported seafoods.

To meet the demand for sport fishing information the Department and the Development Commission have published a comprehensive salt water sport fishing guide. With this booklet anglers coming to the Maine coast will have complete information on where, when and how to catch the more popular species of salt water fish. The booklet lists locations of available charter boats, the time and location of fishing, tackle, bait and lures to be used. A detailed map of the coast completes the guide.

In its marketing research the Department has found that by promoting lobsters all other species of seafood benefit accordingly. In the past two years the Department has assisted in promoting a lobster festival week in South Bend, Indiana. There in the Clark Restaurants the sale of Maine lobsters, through a high pressure promotional program, has more than doubled the sale of all seafoods. Special promotions of this type are attracting new consumers for Maine seafood products.

Following along on this promotional theme of finding new customers for Maine seafoods, the Department and the Development Commission have put on similar events in Houston, Texas, New York, Florida, Chicago and many other points. To aid in this promotion the Department has constructed in its laboratory at Boothbay Harbor a portable artificial salt water display tank. This tank is being used to show consumers throughout the country what a live and swimming Maine lobster looks like. Lobsters can be shipped to any point in the country and when placed in the tank will live for an indefinite time. With this promotional aid a restaurant or market operator can display and sell this fine Maine product at its best. To assist the retailer with this sales program the Department has published a booklet outlining the various steps to be taken to catch the consumer eye. This material includes directions for the proper placing of news stories and advertising—possible window displays—store or restaurant decoration for the event—the use of Department booklets and recipe books during the promotion. With these promotional events the Department and Development Commission assist in every manner possible.

Now that the Department has developed a working promotional and marketing program it is in a position to aid the industry should any seasonal over-supply of seafood or seafood products occur. As has been pointed out, all of the promotional and merchandising material will be made available on request.

Participation by the Department at national events such as the Boston and New York Sportsman's Shows, the Eastern States Exposition, the annual convention of the National Fisheries Institute, rod and reel fishing tournaments, lobster festivals, cooking schools and the International Regatta has brought a great deal of publicity to Maine seafood products and coastal activities.

In view of the increasing competition from imported crawfish the Department plans additional national promotion of lobsters. In 1952 more than 20 million pounds of frozen crawfish were shipped into this country from South Africa, Australia, Mexico and South America. While this product does not compare in any manner with that of Maine it has been found by Maine dealers that it is affecting the lobster meat business because of the price differential. To combat this the Department, in cooperation with the Development Commission, plans to participate in the National Restaurant Show and other similar expositions. The show display will feature the live lobster display tank, prepared lobster dishes as well as lobster recipes. Small cups of lobster meat will be distributed to interested show visitors. A complete list of Maine lobster dealers will be available to potential customers. In this way the Department plans to show the taste and quality difference between the imported and Maine product as well as increase present sales.

On the educational side the Department is expanding its library of films on the Maine Fishing industry which are loaned to schools, clubs and other organizations. Booklets which cover all phases of the industry are available on request.

The Department feels that all these activities are vital to the welfare of the industry and will continue to expand them to the extent of funds available.

## RESEARCH AND EXPERIMENTATION

DANA E. WALLACE

### Work with the Towns in Transplanting Quahogs

The successful transplanting of quahogs from areas of heavy concentration to commercially depleted flats has continued. A method of reducing winter mortalities of quahogs (*Venus mercenaria*) in Maine waters is reported in Research Bulletin No. 4, 1951. When left in overcrowded beds, growth rates are slow and mortalities high, but when transplanted and spread out in adjacent areas survivals have generally been better than 90% and growth rates relatively good. The growth of shellfish varies from area to area but in general in Casco Bay transplanted quahogs measuring approximately 1½ inches have grown to the legal size of two inches in one growing season. Transplanted small quahogs have produced even more spectacular results and larger quahogs show somewhat smaller growth increases.

It is estimated that the diggers in Maquoit Bay flats of Brunswick realized better than \$23,000 in 1951-52 from the growth and survivals of transplanted quahogs over and above their income if no cooperative transplanting activities had been carried on.

The Department has worked with the diggers, dealers, and town officials in the towns of Brunswick, West Bath, and Harpswell in forming conservation committees. Closure or rotation of flats has been carried on in cooperation with these town groups, and public hearings and meetings have been held to work out methods of practical management of the town's shellfish resources.

In the last two years, three conservation areas have been opened in Brunswick, and 348 bushels of quahogs transplanted from the seed bed of Bunganuc Creek in Maquoit Bay.

In West Bath one area has been opened, and eight closed with the diggers giving their services and equipment in moving 925 bushels of quahogs from Bridgham's Cove to three of these areas.

In Harpswell one area was opened and six areas closed, with the diggers voluntarily relaying 372 bushels to these areas from seed concentrations in Orr's Cove.

A new quahog spreader was designed and built by Department personnel which aided greatly in a more even distribution of seed quahogs in the planted areas.

This past year experiments have been carried out that may lead to efficient and economical gathering, moving, and planting of seed quahogs. Preliminary experiments proved that a hand-operated suction pump would gather seed quahogs from the 200-250 square foot concen-

trations in Bridgham's Cove, West Bath. Ronald Green did further testing with a powered suction arrangement and was later able to borrow a Yeoman herring sucker type pump from Mr. Jacobson of Eastport. This suction equipment was placed on a barge borrowed from the Federal Clam Investigtion at Boothbay Harbor, rigged and operated by Thurlow Farmer and Clifford Huskins. Other department personnel aided in handling this equipment at West Bath and it was found that this pump would pick up seed quahogs with only a small percentage of breakage.

The Blount Shellfish Company of Warren, Rhode Island, contributed twenty man days of labor in operating the barge, aided in designing an effective drag for the suction end of the hose, and built the vacuum cleaner type attachment that proved very efficient. This company likewise made an additional contribution of \$400 towards the purchasing of equipment.

It is hoped that it will be possible in 1953 to improve the efficiency of this seed quahog digging equipment with a self-propelled shallow draught boat and dig, transport, and spread several hundred bushels of seed quahogs per day at a low cost per bushel. '

The conservation committee at West Bath used money collected from town licenses to pay for the transporting and transplanting of the 161 bushels dug while we were experimenting with the suction equipment.

When our equipment is ready for full scale transplanting operations, we will make cooperative arrangements with the towns where it can be used to good advantage.

### **Laboratory Rearing of Quahogs**

Population surveys and other information gathered about our Casco Bay Quahog Fishery indicates that our industry for the most part is being maintained by heavy, but infrequent natural sets. We are concerned about these sporadic natural surviving sets.

In 1948 Dr. Victor L. Loosanoff and his colleagues of the Fish and Wildlife Service Laboratory at Milford, Connecticut, demonstrated that it was possible to raise *Venus* seed in their laboratory.

They continued this laboratory rearing and in 1950 believed that it might be possible to raise quahog seed in the laboratory on a commercial scale. We considered that if culturing could be economically carried on, selected areas along our coast might be stocked and if growth and survivals warranted, a commercial fishery might be established or maintained in places where natural sets were lacking or infrequent.

The Campbell Soup Company of Camden, New Jersey, were likewise interested in investigating the commercial aspects of the laboratory culture of quahogs and their growths and survival in the flats.

In January of 1951 a cooperative arrangement was made with the Campbell Soup Company and they made \$2,500 available to us to assist in the cost of the project.

Biologist John Hurst, Jr., was hired to carry on the experimental investigation and was invited by Doctor Loosanoff to come to Milford, Connecticut, and learn the technique of spawning, raising, and culturing *Venus* larvae.

In a six weeks' training period at the Fish and Wildlife Service Laboratory, Mr. Hurst was repeatedly successful in the laboratory raising of quahog seed. Upon the completion of the laboratory facilities at Boothbay Harbor late in May, 1951, work was started in Maine.

Numerous experiments were carried out during the 1951 season, but it was impossible to successfully raise any quahog larva to the setting stage. The results of 1952 were nearly similar; it was possible to carry only one culture of 250 larvae to the setting size. This was done by using Middle Bay, Brunswick, water and culturing techniques developed in England; however, all additional attempts failed.

There are many different theories for our inability to raise quahog seed at Boothbay Harbor. These theories include toxicity of metals which came into contact with the water used in the laboratory, the salinity and biological differences which make the water at Boothbay Harbor different from that at Milford, Connecticut.

Because of the many unknown factors or elements in the laboratory culturing of quahogs and the undeterminable cost and results obtained from continuing such a project, this investigation has been discontinued.

### **Clam Farming**

Falling clam production since the recent peak of 1948 has leveled off and the figures for 1952 show a small increase in the number of clams taken from Maine flats. This upswing in production is further reflected in the records of the Department showing 398 more diggers in 1952 than in 1951.

The number of diggers holding Commercial Shellfish Licenses in the last five years is as follows: 1948—3356; 1949—2876; 1950—2305; 1951—2020; 1952—2418.

As part of our work since 1947 to develop management methods to better use our resources, we have experimented with the transplanting of seed clams dug by hand in many different areas along the coast.



The results of this transplanting has well demonstrated that it is economically unfeasible to relay seed clams that must be dug by hand because of the high cost of labor and the generally poor survivals of relayed stocks.

A hydraulic clam dredge was developed to take advantage of large numbers of seed clams available on Western Beach, Scarborough, and improved by the combined efforts of the Sea and Shore Fisheries Department and the Federal Clam Investigation. By using a jet type dredge tiny seed clams were gathered and cooperative experimental clam farms established in Jonesport, Southport, Georgetown, Wells, and Scarborough.

In all farms except Georgetown predators drastically reduced the transplanted clam population in a few months, or in several instances in a few weeks. Green crabs were observed to be the most destructive; for example, in Southport nearly a half million clams ranging in size from  $\frac{1}{2}$  to 1 inch were devoured by *Carcinides maenas* in three weeks. Experimental work aimed at learning more about green crabs and their control is being continued by the Fish and Wildlife Service at Boothbay Harbor. A discussion of green crabs along our Maine coast is presented in Fisheries Circular No. 8, 1952.

### **Management Studies of Natural Clam Production**

It appears very necessary to learn how to make the best possible use of natural production in the flats, by the management of the fishery in our clam-producing towns; since prospects for commercial scale clam farming are not good at the present time, because of the great destruction of transplanted clams by green crabs and other predators.

Included in the basic information that must be gathered and applied to the management of any town's industry is: The growth of the clams in their flats, the number that die from natural causes each year, the number of small clams that are killed when the legal size clams are dug at different seasons of the year, the digging efficiency of the diggers, and the frequency or rate that the flats are turned over. Shellfish survey methods are discussed in Technical Bulletin No. 1, 1952.

This type of information is being gathered by the Fisheries Research Board of Canada, the Federal Fish and Wildlife Service, and our Department.

### **Clam Meat Solids**

The percentage of total meat solids, or dry matter obtained when drained clam meats are dried in an oven, has been considered, by some, to be a criterion of fresh water adulteration.

The inadequacy of setting a definite percentage figure or using this method to determine the adulteration of clams by water was reported in Research Bulletin No. 3, 1950.

In the 1952-53 winter season, additional information will be gathered along the entire Maine coast and a program of monthly sampling initiated in several areas to follow seasonal and yearly changes in meat solids.

### **Geological-Biological Investigations**

The geological-biological investigations undertaken cooperatively in 1948 by the Department of Sea and Shore Fisheries and the Maine Geological Survey, under the direction of Dr. Joseph M. Trefethen, are continuing with graduate student geologists and biologists carrying on the field work in the summer months. This type of study was pioneered to give us information about our clam flats and to aid us in understanding the effects of geological factors and changes upon clam productivity. We hope to measure factors of the physical, geological environment, and determine associations with the setting, survival and growth of both soft shell clams, *Mya*, and our quahogs, *Venus*.

In the summer of 1951, the quahog producing area of Maquoit Bay, adjacent to Bunganuc Creek, was mapped and detailed. Geological and biological information was gathered by graduate student geologist, Robert M. Zink of the University of Maine, and Anthony Ganaros, teaching fellow at Bowdoin College.

In the summer of 1952, Stover's Cove in South Harpswell was likewise studied, with Anthony Ganaros gathering the biological data, and Glenn Frank, University of Maine, working as the geologist.

Stover's Cove is the first area where a detailed investigation has been repeated and reports are currently being written comparing the geology and biology in the area in 1952 with the 1948 findings.

In addition to the work being undertaken by the Maine Geological Survey and the Department of Sea and Shore Fisheries, Dr. William Bradley, Chief Geologist of the U. S. Geological Survey, has spent four field seasons on the Maine coast and plans to continue this work during 1953. Dr. Bradley's work is being supplemented on the biological side by the Clam Investigation of the U. S. Fish and Wildlife Service as well as the geological-biological work of the Maine Geological Survey and this Department.

## STUDIES ON THE QUAHOG, *VENUS mercenaria*

DR. ALTON H. GUSTAFSON, *Chairman*

*Department of Biology, Bowdoin College*

Investigations on the growth of the quahog were initiated at seven stations in the several towns within the area of major commercial production. Seed specimens were gathered from beds of extremely heavy concentration discovered in earlier surveys. They were measured, marked for identification, and planted in surveyed plots in areas legally closed to diggers. Seed of several ages and sizes were planted in soils of different types, in varying concentrations per square foot, and at selected tide levels. Upwards of 11,000 specimens were placed under observation.

Beds planted at Avery's Cove, Harpswell, and at Simmon's reservation, Freeport, were arranged so a portion of the crop could be removed each month in order to obtain data on mortalities, concentrations, and the seasonal factors which might be involved. After the data were taken the crop was replanted immediately for further observation at a later date. These beds have already yielded interesting and significant data.

Beds planted at Diamond Cove, Cundy's Harbor; Dam Cove, Back Cove, and Berry's Mills in West Bath; Mere Point Bay, Brunswick; as well as Avery's Cove, Harpswell, and Simmon's reservation, Freeport, will be removed after a year of growth and should furnish data of value.

The object of the investigations is to determine growth rates under known conditions for comparison with populations growing under random natural conditions and to analyze for the factors responsible for promoting or retarding growth. Relatively little is known about these phenomena in general and under the conditions prevailing in Maine in particular. The information acquired should be of considerable scientific value as well as of practical importance in managing and developing a valuable natural resource.

Surveys were made of the heavy set of young quahogs produced in the summer of 1952 throughout the region between the Harraseeket and the New Meadows rivers. This set, the first discovered at such an early stage, creates an opportunity to follow a natural set over a period of years.

## SOME OBSERVATIONS ON THE DISPERSION OF THE MARINE WORMS NEREIS AND GLYCERA

DR. A. H. GUSTAFSON, *Chairman*

*Department of Biology, Bowdoin College*

*Nereis*\* *virens* Sars, the clam worm or sandworm, and *Glycera di-branchiata* Ehlers, the bloodworm, have been known as components of the intertidal fauna of Maine since 1871<sup>10</sup> and 1873<sup>11</sup> respectively. Both are members of the phylum Annelida, the class Polychaeta, and the order Errantia. *Nereis*, with numerous species and a world wide distribution, is a member of the family Nereidae and *Glycera*, with several species and a wide distribution, is a member of the family Glyceridae.

Both species have come to be of commercial importance in the last two decades as bait for fishermen. They are dug extensively from the sand and mud-flats which is their natural habitat and are surely among the most abundant animals along the coast of Maine. The annual commercial catch of the two species has exceeded 350,000 pounds with a value of more than \$250,000 in recent years. An interesting account of the industry as well as of the habits of the worms is given by Sandrof.<sup>9</sup>

An examination of the published material on the habits, life histories, reproduction, development, and ecological relationships of the two genera makes clear that all too little is known about *Glycera*. *Nereis* is much better known, but, surprisingly enough in a genus so widely used in experimental work, observations of the habits, natural history, and ecology are rather scanty. Even the reproductive habits which have been studied by numerous investigators are known in detail for relatively few species. There are many interesting variations among the several species in almost all respects. It is, therefore, unsafe to assume that any particular species will conform to such generalization as may be made about the genus as a whole with respect to habits, behavior, or reproduction. Further observations on both genera would be of scientific interest and doubtless of value also to those engaged in utilizing and developing a fruitful natural resource. Among the points of interest about which further information would be desirable is the means by which the worms become dispersed from one area to another.

\**Nereis* has been transferred to *Neanthes* but the well-known name is retained in this paper.

### *Nereis virens*

This species is found in Europe as well as along the Atlantic Coast from Labrador to Long Island. The methods of dispersal must be quite effective along the Maine coast for the species is found almost everywhere in the intertidal zone although some areas exhibit notable concentrations and are therefore of particular interest commercially. Most of our knowledge of the distribution has been gathered from the commercial operations. Since the diggers confine their attention to the area between the low and high water marks and since few dredging operations for scientific purposes have been carried out along the Maine coast, we have little reliable information concerning the abundance of the worms below the low water mark. That some are found in the area continually covered by water seems certain but their abundance is unknown.

The name of the order, Errantia, to which this species belongs, suggests the motility which is common to several of the genera of the order including *Nereis*. Most species of the genus habitually spend their daylight hours, at least, burrowing in the sand or mud of the intertidal zone. A typical statement of this general situation is found in Buchsbaum<sup>1</sup> "Although well equipped for swimming, the nereis spends most of the time in its burrow in the sand, with only the head occasionally protruding above the surface." As a rule when feeding they partly protrude from the tubes they construct. Copeland and Wieman<sup>3</sup> after observing the feeding habits of *N. virens* under both experimental and natural conditions conclude that "In no case was a worm observed to leave the burrow entirely and move about freely in the water."

Nevertheless, there are many observations which show clearly that *Nereis* does move about on occasions other than swarming time. McMurrick<sup>8</sup> refers to *Nereis* as "becoming in some species at least, free-swimming at night." Crowder<sup>4</sup> mentions *N. virens* as burrowing in the daytime but as an active swimmer at night in the following quotation. "Leaving her burrow she will wander for hours and being a fairly fast swimmer, as well as an exceedingly graceful one, the distance she covers is not inconsiderable. In the tanks of this laboratory these worms invariably find their way back to their nests but it is quite certain that with the larger freedom of their natural habitat they do not return to their original homes: therefore, it would seem that *Nereis* is practically put to the necessity of constructing a new shelter at the end of every jaunt." Several notes in the possession of the Maine Department of Sea and Shore Fisheries written by fishermen and coastal

wardens testify to the swimming activities of *Nereis* both in the daytime and at night. Most of these observations are associated with swarming to which reference is made later but it is apparently not uncommon for coastal observers to see the worms swimming either singly or in small groups on other occasions. The nocturnal swimming is doubtless quite effective in bringing about dispersal.

The prevailing opinion of most observers is that, as a rule, the worms spend most of their daylight hours buried in the mud. A notable exception to this generalization was observed in an area of mud-flats covering a number of acres located between White's Island and Mere Point, Brunswick, Maine, throughout the summer of 1952. In mid-June thousands of specimens of *N. virens* were observed lying fully exposed on the mud-flats in broad daylight. Some were stationary but large numbers were crawling over the flats for distances of from a few inches to as much as twelve feet before burrowing under. The surface of the mud was literally covered with the tracks. Each incoming tide caused the worms to burrow except for a few specimens tumbled about by the advancing waters. The tidal wash obliterated the tracks but at the next exposure of the flats the mud surface was again covered with abundant evidences of the activity of the worms. The area was visited at least once a week until mid-September and occasionally until late October. By early October most of the worms had burrowed under the mud but a few specimens were seen crawling on the surface and a greatly diminished number of tracks showed that some activity continued. Interestingly enough no worms of commercial size were found here at any time either on the surface or when sought by rather extensive digging. The specimens were all very thin and small ranging in size from two to eight centimeters (.79 in. to 3.15 in.) in length when measured after preservation in 5% form-sea-water. Similar observations were made later in a number of small coves in the Brunswick area although in no case were the worms as abundant as in the original site. Daylight crawling is probably not a very effective factor in dispersal although tidal action on the worms at the surface cannot be completely discounted.

Observations on the swarming, spawning, reproductive, and developmental stages of the polychaete worms have been extensive and have attracted considerable attention. There are many interesting variations among the several species with respect to the details of the structures and processes involved in these phenomena. Important differences are shown in the relationships to the lunar cycle, the season of the year, the time of day, and the duration of the activities associated with reproduction and development. Perhaps the most celebrated

cycle is that of the palola worm, *Eunice*, which is closely related to *Nereis*. In any case, both the general patterns which emerge and the details characteristic of any species are of interest to the problem of dispersion. As Crowther says<sup>5</sup>, "To insure the certainty of survival of the greater number of young, it is necessary that the eggs be dispersed over the widest range possible; and to accomplish this the female must make more extended journeys than is her wont."

In *Nereis virens* extensive bodily changes occur as sexual maturity is attained. The body becomes divided into two distinct parts. The anterior portion shows some modifications but these are of no particular importance as far as reproductive activities are concerned. The longer posterior portion becomes tremendously swollen as the enlarged sexual organs bearing the maturing sexual cells or gametes continue to develop. This portion of the body becomes darker and opaque in contrast to the almost transparent and colorless anterior region and the parapodia and setae of the posterior portion become enlarged and modified. When in this condition the worms are said to be in the epitokous or heteroneis stage. Males and females are readily distinguishable at this time. Glidden<sup>7</sup> states that the worms are sexually mature in Maine from March to June but the sexual period certainly extends into August in some parts of the state.

When the heteroneis stage is fully developed the males leave their burrows, rise to the surface, swim rapidly about, and gather in huge concentrations. This phenomenon is known as swarming. The sexual products are exuded from the posterior portion of the body into the water. The females soon appear swimming madly about among the males and discharge the eggs from their swollen bodies which at this stage are soft and rupture easily. Swarming and spawning is reputed to take place chiefly at night.

Fishermen and wardens have observed these phenomena over a period of several years at various places along the Maine coast although the most extended observations have been made near Owl's Head in Rockland. Here the activities have been noticed from June through August in broad daylight. The worms migrate by the thousands to the spawning areas which may cover several acres. The activity is so intense that the worms have been mistaken for schools of herring. The mass of spawning individuals may be displaced by winds, tides, and currents.

Most of the worms exhaust themselves in the discharge of the sexual cells and soon die. Their spent bodies are consumed by hordes of other organisms such as fish, birds, or crustaceans although many are cast up on the shores in the tidal debris. Crowther<sup>4, 5</sup> states that all

the males die but that some of the females, at least, burrow into the mud, presumably to pass through another cycle of development.

It is interesting to note that in none of the published accounts is there any exact statement of where the worms come from or how far they travel during the swarming and spawning periods. Nor is there any certainty as to how far any survivors may have been displaced from their point of origin. They do swim actively and are carried by winds, tides, and currents so there can be no doubt that the reproductive habits are highly important in dispersing the worms over wide areas.

Once the eggs and sperm are liberated in the open water they unite. The fertilized eggs begin development immediately and soon enter the trochophore stage in which the young larvae possess cilia by means of which they may swim. After a few hours or days in this stage development proceeds rapidly but the young are still carried about by the waters for a period of days or even weeks depending on temperature, currents, and other factors. Eventually the larvae settle to the bottom and take up the normal burrowing type of existence. It seems obvious that the young may be carried long distances as they develop but there is no exact data to confirm this supposition.

Neither the time required to reach sexual maturity nor the life span of *Nereis virens* are known with certainty. Copeland<sup>2</sup> kept isolated specimens living under laboratory conditions for at least three years. The size attained by many specimens suggests that some individuals must live longer than a single season. Dales<sup>6</sup> concluded that in *Nereis diversicolor* the life span does not normally exceed eighteen months and includes but one breeding season. Additional information concerning the time required to reach sexual maturity and the longevity would be useful in an analysis of all the factors conditioning distribution and dispersal.

#### *Glycera dibranchiata*

Less attention has been paid to *Glycera* than to *Nereis* and comparatively little is known about its habits. It is a mud-dweller usually found nearer the surface closer to high tide level, and more likely to be found in tidal estuaries than is *Nereis*. There seem to be no published references to nocturnal swimming.

It undergoes a sexual metamorphosis similar to that of *Nereis* but epitokous individuals are not found in great numbers. Apparently it does not participate in group swarming to the extent characteristic of *Nereis*. Sexually mature individuals discharge their gametes in the water and fertilization and development proceed much as in other



polychaetes. There is a trochophore larval stage and a period of pelagic existence and development before the young settle to the bottom to take up a burrowing type of existence. Additional information is much needed for this species.

### Conclusions

In *Nereis* the daylight crawling on exposed intertidal areas, the nocturnal swimming, the swarming and spawning, and particularly the pelagic development of considerable duration all indicate a considerable movement of any given population. These factors seem to be quite adequate to account for fluctuations in the populations and to account for the distribution and dispersal of the species. In *Glycera*, as far as is known, dispersal is accomplished largely by the breeding habits.

### Bibliography

- <sup>1</sup>Buchsbaum, Ralph M. 1938. Animals without backbones. University of Chicago Press.
- <sup>2</sup>Copeland, Manton. 1935. Keeping *Nereis* for physiological study.
- <sup>3</sup>....., and H. L. Wieman. 1924. The chemical sense and feeding behavior of *Nereis virens*. Sars. Biol. Bull. 47: 231-238.
- <sup>4</sup>Crowder, William. 1923. Dwellers of the sea and shore. Macmillan.
- <sup>5</sup>..... 1928. A naturalist at the seashore. Century Co.
- <sup>6</sup>Dales, R. Phillips. 1951. An annual history of a population of *Nereis diversicolor* O. F. Muller. Biol. Bull. 101: 131-137.
- <sup>7</sup>Glidden, Phillip E. 1951. Three commercially important polychaete marine worms from Maine. Unpublished.
- <sup>8</sup>McMurrick, James P. 1894. A textbook of invertebrate morphology. Henry Holt.
- <sup>9</sup>Sandrof, Samuel. 1946. The worm turns. Nat. Geog. 89: 775-786.
- <sup>10</sup>Verrill, A. E. 1871. Marine fauna of Eastport, Maine. Bull. Essex Inst. 3: 1-6.
- <sup>11</sup>..... 1874. Results of recent dredging expeditions on the coast of New England. Amer. Jour. Sci. 131-135.

## STATION ACTIVITIES

PHILLIP L. GOGGINS, *Superintendent*

Since the 1949-1950 biennial report the Department has made many needed improvements on the buildings and grounds of the Fisheries Research Station.

The parking areas and driveways belonging to both the Sea and Shore Fisheries and the U. S. Fish and Wildlife Service have been surfaced with blacktop, and a drainage system has been installed. A picnic area for the benefit of our many visitors has been established; and tables, benches, and trash cans have been provided for their use. The fact that these tables were in constant use from the day they were set up proves how badly they were needed.

In October, 1951, the Department of Sea and Shore Fisheries, in a cooperative project with the U. S. Fish and Wildlife Service, completed the laying of a one-half mile pipe line across Orne's Cove to McKown Point. This line connected with the water system of the town of Boothbay Harbor and provides year-round water service not only to the Research Station and to the Fish and Wildlife Service Building, but also to two government-owned houses. The presence of year-round water makes for more efficient operation of the station and provides more adequate fire protection.

In April, 1951, a fire of electrical origin started in the boiler-room, causing considerable damage. The boiler-room belongs to the U. S. Department of the Interior but houses much equipment belonging to the Department of Sea and Shore Fisheries. The U. S. Fish and Wildlife Service rebuilt the boiler-room using fireproof material. The State of Maine replaced the equipment lost in the fire. As a result of this fire the following steps have been taken to prevent its recurrence:

1. A fireproof building to house the boiler and heavy electrical equipment has been constructed.
2. An auxiliary portable fire pump and hose have been purchased.
3. Year-round water has been installed.
4. A fire-alarm has been purchased, and will be installed before the end of the calendar year 1952.

There was one beneficial result of this fire. The power bills had been running about \$110 monthly, which seemed unreasonably high. At our insistence, the local branch of the Central Maine Power and Light made a survey of our needs. Demand meters were installed, smaller motors used wherever feasible, and new rates established. As a result, power bills have been cut in half, with no cut in electrical service.

Inside the Research Station two new laboratories have been built. The first is a warm water controlled-temperature laboratory constructed for the rearing of quahogs in a project sponsored jointly by the Campbell Soup Company and the Department of Sea and Shore Fisheries. The second laboratory, just completed, has been remodeled from an older one, and is now a temperature- and moisture-controlled room. This is for the purpose of housing our delicate electrical measuring instruments and analytical balances.

These new laboratories are heated by steam radiators, newly installed. At the time of installation, many of the old steam pipes were insulated, and several other new radiators added to the existing system, in an effort to improve heating by providing a more even distribution of heat. Additional office space has been made available by utilizing the second floor space, which has also been provided with radiators. At the present time, storm windows are being installed, and are already in use on the second floor and in the back laboratories.

We have purchased additional laboratory equipment which will aid us in making finer oceanographical and hydrographical studies.

The Marine Aquarium has developed into one of the major tourist attractions in the State of Maine. Approximately 500 people visited the aquarium daily during the summer season of 1952. A regular member of the station staff was the attendant during the summer of 1951 and a University of Maine student, during the summer of 1952. The visitors showed a considerable increase in interest in everything pertaining to the sea, especially during this last season.

Our facilities have been made available to several writers and photographers representing magazines of national circulation. We have also furnished other marine biological laboratories with live specimens for research. The seals which attracted so much attention last summer were donated to the Lincoln Park Zoo in Chicago.

Our aquarium attendant, while collecting specimens, reported several unusual ones to Mr. Leslie Scattergood, Fisheries Research Biologist, who was stationed here. Mr. Scattergood has been reporting the appearance of these unusual specimens in his "Notes on fishes of the Gulf of Maine," which appear under "Ichthyological Notes," in *Copeia*.

The station staff constructed a refrigerated and recirculated artificial salt water aquarium. The commercial practicality of holding lobsters in such an aquarium, using artificial sea-salt mixtures, was tested in October, 1952. The results were good. The percentage loss by weight of lobsters was small, and much interest was shown in the experiment

by both lobster dealers and retailers. This tank was shown originally at the Lobster Festival at Rockland, earlier in the summer, where it first aroused interest.

All Sea and Shore Fisheries exhibits which are sent to various shows around the country are now built at the Research Station. During 1951 there was a man whose job was to design these shows, paint them, and supervise their construction. However, during the past year, the entire job has fallen on the station crew, who have done a good job, and have sent package shows as far away as Texas, Illinois, and Indiana.

## CLOSED CLAM FLAT POLLUTION SURVEY

PHILLIP L. GOGGINS

Since the beginning of the Closed Clam Areas Survey, initiated by the Department of Sea and Shore Fisheries in 1949, twenty-nine of the fifty-three closed areas have been surveyed. They are as follows: Kittery, Ogunquit, Wells, Kennebunk River, Cape Porpoise, Jones Creek in Scarborough, Nonesuch River in Scarborough, Portland, Falmouth Shore, Yarmouth, Freeport, Kennebec River, Sebasco, Wasscasset, Boothbay Harbor, East Boothbay Harbor, Damariscotta, Waldoboro, St. Georges River at Thomaston, Rockland Harbor, Rockport, Belfast, Searsport, Penobscot River, Bar Harbor, Milbridge, Jonesport, Machiasport, and Dennys River.

The above areas were selected for surveying after being classified as hopeful when previous bacterial and sanitary surveys indicated either incomplete sampling of the areas or seasonal pollution loads due to increased summer population. In the Freeport area, the town installed a sewage disposal plant thereby improving the water over the clam flats to such an extent that the whole area has been opened to year round digging.

Parts of eight closed areas have been opened for winter digging. New closure lines have been established for six. Two have been opened completely to year round digging, Freeport and the Jones Creek area in the town of Scarborough. The value of clams harvested from flats opened under the Pollution Survey Program is approximately \$90,639.

At the present time we have eight closed areas in which a yearly survey must be conducted with the object of opening them for winter digging wherever possible.

On the basis of the bacterial survey work done by the Department of Sea and Shore Fisheries and the Sanitary Survey, conducted by the Sanitary Water Board, we feel that we cannot expect any worth-while results using bacterial survey methods alone, except in those eight areas already mentioned. Additional work which we hope will open more closed areas has been outlined for the coming two years.

The answer to the sewage pollution problem is to treat the sewage before disposing of it. This generally requires the installation of an expensive sewage treatment plant. One phase of our outlined program is to select those towns which have valuable clam flats in closed areas and local sources of pollution, and to work with the town officials assisting them in every way possible to solve their pollution problems. We hope that in this way more towns will see the practicality of follow-

ing the examples Freeport and Ogunquit set when they solved their own local pollution problems by installing sewage disposal plants.

The Department of Sea and Shore Fisheries uses the regulations established by the U. S. Public Health Service in conducting the Pollution Survey. Some of these regulations do not take into consideration the complicated hydrographical patterns existing along our broken coastline. For example, one regulation requires the closing of all clam flats located within 1000 feet of an open sewer. In some of our estuaries we have found clean waters within 100 feet of an open sewer. Apparently due to the current patterns the pollution is carried directly away without contaminating the adjacent area. Therefore another phase of investigation will be to establish the current patterns in these areas. In this way we may be able to convince the U. S. P. H. S. that it would be safe to relax the 1000-foot regulation in certain cases.

The third part of our planned program concerns the clam itself. In many of our estuaries we have a condition in which fresh, highly-polluted water flows over the flats as the tide approaches ebb. However, at the half and flood tides these polluted waters are diluted by clean sea water to a point where the waters are clean. We have evidence that the clam does not siphon when the water reaches a certain degree of freshness, but does siphon in the sea water. We plan to establish the point of freshness at which clams cease to siphon. If we can establish that the clam does not siphon in the polluted fresh water, we would have a strong talking point when trying to persuade the U. S. P. H. S. to relax regulations in certain areas.

## PROGRESS OF BIOLOGICAL AND TECHNOLOGICAL INVESTIGATIONS

FRED T. BAIRD, JR., *Chief Biologist*

DONALD M. HARRIMAN, *Biologist*

The staff of the Fisheries Research Station has suffered no serious changes since the publication of the 16th Biennial Report. Louis Taxiarchis who was serving as a Biologist at that time was called to military duty in the summer of 1950 but was replaced by Mr. John Hurst, Jr., who has been stationed at the Research Station while doing studies on the possibility of artificial propagation of quahogs. Dr. Kenneth Donahue has continued his experiments in the field of lobster shedding at Utica College, and John Getchell of the Maine Agricultural Experiment Station has been working with the use of artificial sea water in holding lobsters. Both of these studies are carried on by the above mentioned people with close cooperation and support by the Department. There has been close cooperation and support by the U. S. Fish and Wildlife Service Clam Investigation group and this Department and a high degree of cooperation on joint problems. In the absence of Mr. Leslie Scattergood the Department of Sea and Shore Fisheries has assumed administrative control of the Herring Investigations.

### Facilities and Equipment

Changes in Research facilities discussed in earlier pages are believed sufficient to present needs. New equipment has been added as its need was felt and we now have for use such devices as a thermarine recorder for measuring ocean temperature profiles of 200 feet, and a lumetron used in measuring such things as trace elements, metals, oxygen, etc., in sea water and other mediums. New office facilities have been made available at the Research Station in order to reduce congestion and create better working conditions for research personnel.

The motor vessel, *Explorer*, is now stationed at Boothbay Harbor; this has made for quicker and more efficient use of said vessel by the Research group.

### Lobster Measuring Program

On October 1, 1952 the Department of Sea and Shore Fisheries will have at hand three years of lobster measurements, taken by each warden in his respective area during each month of the year and based on the average landings for that area for the month in question. This

data should give some very excellent results. The results to October, 1951 are already figured and a report covering the three years of measurements should soon be forthcoming for the use of the industry and other interested parties. Added to this report are figures gathered by Sea and Shore and U. S. Fish and Wildlife Biologists since 1939. This report will deal with the percentages of all lobsters caught in Maine by size and weight, and the variations by size and weight both by seasons and by area. It should be of untold value to any further group discussions of any proposed legislative action concerning lobsters, as well as being a documented account of the size frequency distribution of Maine's commercial lobster landings.

### **Treated Traps**

A study of treatments to prevent damage by marine borers in lobster traps has been completed and the results of this treatment, its cost and effectiveness plus its effect on the fishability of the trap will soon be published. All treatments were quite effective for extended periods of time though some seemed to reduce the fishability of the trap.

### **Scallop Survey**

During the last biennium the scallop program has progressed favorably and much pertinent data has been gained concerning the life history and habits of this species. A full progress report of the scallop survey will soon be published which will contain such data as migration of scallops, meat yield, size frequency distributions, age and growth rates, etc.

Exploratory dragging for scallop beds has so far failed to turn up any beds of commercial proportions, but should be continued when and if fishermen of any area feel there are or may be scallops in said area.

To date no results have been forthcoming on the spawning attempts at Boothbay Harbor in either rearing or spawning, however, during the last two years, through the original observations of a scallop fisherman we have found extensive natural sets of young scallops of a size that is so small that microscopic examination is necessary to recognize them.

### **The Smelt Fishery**

A continuing long range smelt investigation has been carried forward through the last two years, though the program has been somewhat reduced due to the lack of personnel. Heavy emphasis has been placed on the effectiveness and results of spawning and present indica-



tions are that one of the greatest existing factors controlling smelt populations may be the extent and availability of sufficient spawning area. Size and age determinations are being continued so that any failure of year classes may be plotted against other conditions in hope that the cause may be found. Catch statistics are gathered each year from the commercial fishermen and where possible some checks of the landings of sport fishermen are made. Any further work with the smelt fishery or any recommendations based on the results to date must be tailored to best fit the conditions of a fishery which exists almost equally as a commercial and sport fishery.

### **Atlantic Salmon Restoration**

The Department has continued its close cooperation and support of the Sea Run Salmon Commission and has carried out certain phases of the investigation of that commission. We have aided in most fish planting, and thermal studies of the Sheepscot River, and extensive checks have been made by our personnel on reports of the presence of salmon or catching of same and this data is turned over to the Salmon Commission.

The silver salmon which we brought to Boothbay Harbor in May of 1950 are now maturing and we hope before the publication of the biennial report to be able to announce the successful completion of this attempt to hold salmon through all their cycles and to bring them to successful reproduction.

### **General Activities**

The services of the Research Station and personnel have constantly been available to the fishery industry for any problem which might arise. Surveys and recommendations have been made for towns interested in the establishment of alewife runs. A continuing watch has been kept of existing shad fisheries and runs, and an ever present attempt is being made with such personnel and equipment as is available to establish new fisheries and maintain at their highest level, those which already exist.

### **Lobster Pound Studies**

During the last two years considerable time has been spent in studying lobster pounds and the factors leading to losses in them. The seriousness of the bacterial blood disease, Gaffkya, has declined until in 1952 only a few reports of the disease could be confirmed.

While the Gaffkya organism has ceased to be serious in most pounds, the same physical and hydrographic factors which were associated

with it occur with much of the unexplained mortality occurring at present. Further study has strengthened the hypothesis that stratification and stagnation characteristically yield high mortalities. One pound keeper has installed an air release to provide circulation and reports that his lobsters appear more comfortable. While the operation of this air release raised the oxygen content of the pound only a little it resulted in a homogenous distribution. Oxygen is carried by convection as fast as it dissolves at the surface rather than by the slow process of diffusion. This increases the supply available to the lobsters. The operator of this pound may try using enough air releases to provide oxygen directly to the water, an application which was not originally planned. Further work upon pound circulation with him and with other operators is anticipated.

### **Bait Studies**

The search for a cheap, long lasting substitute for redfish cuttings and herring, to be used as lobster bait when they are not readily available is a perennial problem. Requests for information or proffered ideas for the solution occur quite regularly.

In the spring of 1952 two small experiments were undertaken with the cooperation of Mr. Leonard Waite of Newagen who kept data on the yield of mussels compared with that of redfish. Raw mussels were very disappointing, whether crushed or whole. Steamed mussels compared favorably with redfish but unless a commercial scale operator develops a cheap system of separating mussel meats the time involved in gathering and preparing the baits is prohibitive. Further work will be done on this problem as it appears advisable.

### **Lobster Traps**

From time to time individuals interested in the fabrication of lobster traps contact the Department with one or more samples. Some wire traps coated with rubber or plastic have been promising, but as yet none are in commercial production. The Department has acted as a clearing house, leaving these traps with interested fishermen and transmitting the fishing results to the manufacturer.

### **Display Aquaria**

The development of artificial sea water and recommendations for its use have been in progress since 1950. Mr. John Getchell of the Maine Agriculture Experiment Station, University of Maine, has worked under contract with this department on a series of tests using commercial quantities of lobsters in natural and artificial sea water

under refrigeration. Another phase of the program has been carried out at Boothbay Harbor where tests were run comparing the viability of lobsters held in several unrefrigerated sea salt solutions in the presence of metal plates. This has given a comparison of solutions under adverse conditions and has indicated certain metals which may be commercially used in tanks.

### **Shedding and Shell Hardening**

A program of research and basic physiological processes has been carried out with the assistance of Dr. J. Kenneth Donahue, Chairman of the Department of Biology, Utica College, Syracuse University. Dr. Donahue has been studying physiology of molting and the attendant variations in calcium metabolism. In the summers of 1951 and 1952 Dr. Donahue was unable to come to Boothbay Harbor to work, but under his direction specimens from a series of experiments done at Boothbay Harbor were sent to Utica for processing. A brief progress report of this work was published as the report, *What Makes a Lobster Shed*. The aim of this series of experiments was to develop a method of either delaying the molt or accelerating post molt hardening in order to provide a more vigorous lobster for shipment during the summer months. Dr. Donahue expects to be able to carry out further research at this station in 1953.

In addition to Dr. Donahue's study, work is planned on a series of experiments in which lobsters will be exposed to artificially high calcium levels, both in water and in feed, in an attempt to determine if the hardening process may thus be aided.

Supplemental to the research on physiology and pathology, attention is being given to studies on the natural history of the lobster about which little is known. In addition to studies of size frequency tabulations which have been provided by coastal wardens for over three years there is a program of measurement and tagging on Monhegan Island. Monhegan is an ideal location for carrying out such work since it has an isolated fishery, a closed season, and practically all lobsters are handled by two dealers. This has provided an opportunity to collect data on migration, fishing mortality, and changes in size frequency while being fished, which may eventually be used in calculations of natural mortality and changes in catchability of lobsters through the size range. This data is of great value in assessing the virtues of conservation measures such as size limits, closed season, etc.

In addition to the program of research the personnel of this station have been available to advise commercial operators when serious mortalities occur. In several instances advice has resulted in an appreciable saving of lobsters and money.

**DEPARTMENT PERSONNEL AS OF DECEMBER 31, 1952**

**Administrative**

	<i>Telephone</i>
<b>Robert L. Dow, Commissioner</b> , Box 174, Augusta . . . . .	2-2959
Ronald W. Green, Chief Warden, Box 283, Rockland . . . . .	757-R
Dana E. Wallace, Research & Experimentation, 37 Water St., Hallowell . . . . .	3-9269, Augusta
Louis R. Cates, Statistician, 153 Camden Street, Rockland . . . . .	562-W
Phillip L. Googins, Supt., Fisheries Research Station, Boothbay Harbor . . . . .	260
Frederick Baird, Jr., Marine Biologist, Edgecomb . . . . .	133-13K, Wiscasset
Thurlow A. Farmer, Boat Captain, East Boothbay . . . . .	304-M
Donald M. Harriman, Marine Biologist, Boothbay Harbor . . . . .	264-M4
Germaine M. Fortier, Secretary, Augusta House, Augusta . . . . .	3-3821

**COASTAL WARDENS**

**First District**

<b>Dwight W. Underwood, Supervisor</b> , 70 Middle St., Saco . . . . .	4-8893, Biddeford
Harold L. Ricker, 34 Fessenden Street, Portland . . . . .	4-7510
Elmore L. Wallace, Box 263, Pearl St. Sta., Portland (46 Reed St.) . . . . .	4-5887
John F. Anderson, P.O. 383, Kennebunkport (Boothbay Rd., Kennebunk) . . . . .	7-2101, K'port
Clinton A. Bishop, Long Sands Road, York Village . . . . .	416-W, York

**Second District**

<b>Warren A. Hume, Supervisor</b> , 19 Union Street, Boothbay Harbor . . . . .	440
James W. Thurston, Orr's Island . . . . .	58, Harpswell
Daniel H. Davis, Boothbay Harbor (Middle Road) . . . . .	472-M
Swansea G. Burns, 796 Middle Street, Bath . . . . .	1846-M

**Third District**

<b>Frank G. Hallowell, Supervisor</b> , 124 Main Street, Thomaston . . . . .	143
Fred A. McGlauffin, Friendship . . . . .	167-4, Waldoboro
Clayton Simmons, 14 Laurel Street, Rockland . . . . .	9-M
Paul J. Kvorjak, Jr., 32 Knox Street, Thomaston . . . . .	354
Malcolm McIntosh, Bristol . . . . .	4799, New Harbor

**Fourth District**

<b>Owen A. Richardson, Supervisor</b> , 164 Franklin Street, Ellsworth . . . . .	384-R
Ralph M. Pinkham, 57 Pine Street, Ellsworth . . . . .	322-W
Roy D. Stewart, Birch Harbor . . . . .	88-12, Winter Hbr.
Chester E. Brown, Box 596, Southwest Harbor . . . . .	510

**Fifth District**

<b>Ernest V. Woodward, Supervisor</b> , Jonesport . . . . .	12-13K
Daniel J. Johnson, Lubec . . . . .	296
Bertram E. Davis, South Addison . . . . .	39-12, Columbia
Herbert F. Morang, Sr., Jonesport . . . . .	56-2