THE WOODS HOLE OCEANOGRAPHIC INSTITUTION

REPORT FOR THE YEAR
1941

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I. TRUSTEES

To serve until 1945

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MARION EPPLEY, The Eppley Laboratory, Inc., Newport, R.I.
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T. H. MORGAN, California Institute of Technology, Pasadena, Calif.
THE DIRECTOR (Admiral L. O. Colbert), U. S. Coast & Geodetic Survey, for the time being, Washington, D.C.
B. W. ST. CLAIR, 10 Arrow Street, Cambridge, Mass.

To serve until 1944

HENRY B. BIGELOW, Museum of Comparative Zoölogy, Cambridge, Mass.
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A. G. HUNTSMAN, University of Toronto, Toronto, Canada.
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To serve until 1943

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E. G. CONKLIN, Princeton University, Princeton, N.J.
ROSS G. HARRISON, Yale University, New Haven, Conn.
THE HYDROGRAPHER (Captain G. S. Bryan), U. S. Hydrographic Office, for the time being, Washington, D.C.
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To serve until 1942

CHARLES FRANCIS ADAMS, 15 State Street, Boston, Mass.
THOMAS BARBOUR, Museum of Comparative Zoölogy, Cambridge, Mass.
JOHN A. FLEMING, Carnegie Institution, Washington, D.C.
FRANK B. JEWETT, 195 Broadway, New York, N.Y.
ALBERT E. PARR, Bingham Oceanographic Foundation, New Haven, Conn.
ELIHU ROOT, JR., 31 Nassau Street, New York, N.Y.

Ex Officio

COLUMBUS O'D. ISELIN, Woods Hole Oceanographic Institution, Woods Hole, Mass.
LAWRASON RIGGS, 120 Broadway, New York, N.Y.

OFFICERS

HENRY B. BIGELOW, President of the Corporation, Museum of Comparative Zoölogy, Cambridge, Mass.
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II. MEMBERS OF THE CORPORATION

CHARLES FRANCIS ADAMS, 15 State Street, Boston, Mass.
THOMAS BARBOUR, Museum of Comparative Zoölogy, Cambridge, Mass.
HENRY B. BIGELOW, Museum of Comparative Zoölogy, Cambridge, Mass.
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ROSS G. HARRISON, Yale University, New Haven, Conn.
A. G. HUNTSMAN, University of Toronto, Toronto, Canada.
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FRANK R. LILLIE, 5801 Kenwood Avenue, Chicago, Ill.
ALFRED L. LOOMIS, Tuxedo Park, N.Y.
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III. REPORT OF THE TREASURER

To the Members and Trustees of the
Woods Hole Oceanographic Institution:

Gentlemen:

The accounts for the year 1941 have been audited by Messrs. Stagg, Mather & Hough, public accountants.

During the year bonds costing $217,031.75 were redeemed at a net profit of $18,410.92 (after adding the applicable reserve for amortization).

There was invested, during the year, in bonds $210,002.50 and in stocks $41,083.25.

Bonds in the Special Income Account were sold for $15,297.50 and these proceeds together with cash on hand in that account to the total, with said proceeds, of $20,871.01 were loaned to the general account and special dividends received during the year and credited to the general account were also retained in that account. So that there was due from the general account to the Special Income Account at the end of 1941 the sum of $24,656.01.

These borrowings by the general fund, as reported to the last meeting of the Trustees were made necessary by the unavoidable delay in the payment of our vouchers on Government projects. At the end of 1941 there was due from the Government $42,471.55 on these projects.

There was billed to the Government during the year $114,848.44 for disbursements incurred for the Government and $21,277.64 allowance for general overhead.

In addition to this a substantial part of our entire income is being used in the interests of the Government without reimbursement.

The entire appropriation of $4,800.00 for the reserve for periodic replacements was added to that fund, the actual transfer however having been made after the close of the year.

The total expenses of the Institution (not including disbursements for the Government and after applying the allowance from the Government for overhead) exceeded the budget by $5,737.32 but were under income by $6,939.19.

The gross income on the securities in the Endowment Fund excluding the special income (extra dividends) was about .0459 of the cost and about .0527 of the market value at the end of the year.

Summaries of the balance sheet and comparative income and expense statement for 1941 and 1940 are appended.

Respectfully submitted,

Lawrason Riggs
Treasurer

BALANCE SHEET

ENDOWMENT FUND ASSETS

	Quoted Market Value		
Endowment fund assets:			
Bonds (less reserve for amortization of bond premiums, $6,603.12)	$1,144,039.75	$1,216,959.88	
Stocks	$1,001,624.63	1,246,289.24	
Cash		8,381.86	$2,471,630.98
Reserve fund assets:			
Bonds	$ 8,852.50	8,627.50	
Stocks	$ 11,468.50	19,099.02	
Cash		2,164.98	29,891.50
			$2,501,522.48

PLANT ASSETS

Laboratory plant:		
Land	$ 27,072.32	
Buildings	323,213.12	
Laboratory equipment	21,361.93	
Crew room equipment	557.95	
Library	12,700.00	$ 384,905.32
Ship "Atlantis":		
Construction	$ 218,674.47	
Equipment	27,298.50	245,972.97
Ship "Anton Dohrn"		17,145.67
Small boat and equipment		6,570.55
		$ 654,594.51
Depreciation fund assets (for periodic replacements):		
Bonds (quoted market value $32,780.00)	$ 32,891.25	
Cash (including $4,800.00 due from current funds—Cash)	9,151.85	42,043.10
		$ 696,637.61

CURRENT ASSETS

Current funds—Cash	$ 3,665.61	
Less—Due to special income and depreciation funds	29,456.01	*$ 25,790.40*
Special income assets:		
Investments		
Bonds (quoted market value $7,700.00)	$ 7,700.00	
Stocks (quoted market value $1,902.13)	2,166.13	
Cash (including $24,656.01 due from current funds—Cash)	24,705.30	34,571.43
Accounts receivable:		
Project No. 1	$ 931.28	
Project No. 2	41,540.27	42,471.55
		$ 51,252.58
Total assets		$3,249,412.67

DECEMBER 31, 1941

ENDOWMENT FUNDS

Endowment fund—General		$2,000,000.00	
Endowment fund—For upkeep of plant		419,419.96	
		$2,419,419.96	
Add—Accumulated net gain on securities called or sold		52,211.02	$2,471,630.98
Reserve fund		$ 23,395.57	
Add—Accumulated reserve fund income		6,495.93	29,891.50
			$2,501,522.48

PLANT FUND

Plant fund—General			$ 607,642.13	
Plant fund reserve—Transferred in prior years from current surplus		$ 29,006.71		
Add—Appropriations from current funds:				
Library	$ 800.00			
Reconditioning the "Anton Dohrn"	17,145.67	17,945.67	46,952.38	$ 654,594.51
Reserve for periodic replacements				42,043.10
				$ 696,637.61

CURRENT LIABILITIES AND SURPLUS

Accounts payable			$ 6,929.20
Capital surplus:			
Balance at December 31, 1940		$ 37,384.19	
Add—Excess of income over expenses for the year ended December 31, 1941		6,939.19	44,323.38
			$ 51,252.58
Total funds, current liabilities and surplus			$3,249,412.67

STATEMENT OF INCOME FROM ENDOWMENT FUND INVESTMENTS AND FROM CURRENT ASSETS, AND EXPENSES (LESS ALLOWANCE FOR GENERAL OVERHEAD BY THE U. S. GOVERNMENT) APPLICABLE THERETO, INCLUDING EXPENDITURES FOR PERMANENT PLANT ADDITIONS

FOR THE YEARS ENDED DECEMBER 31, 1941, AND DECEMBER 31, 1940

		Year Ended December 31, 1941			*Year Ended December 31, 1940*		
Income:							
From endowment funds:							
Interest (including in 1941 special income of $825.61)		$54,384.34			$ 55,276.99		
Dividends (including in 1941 special income of $4,670.58)		64,260.93			60,258.14		
Net profit on bonds called, or sold during the year, special income		390.40	$119,035.67		—	$115,535.13	
Less—Custodian fees and expenses			1,559.16			1,551.38	
Total Income				$117,476.51			$113,983.75
Expenses:	*Budget 1941*						
Upkeep of plant:							
Upkeep of buildings and grounds	$ 6,600.00	$ 8,801.62			7,634.94		
Upkeep of "Atlantis"	7,200.00	9,298.14			10,118.80		
Upkeep of "Asterias"	200.00	550.53			182.03		
Upkeep of "Anton Dohrn"	—	4,225.93			—		
Insurance	5,665.00	7,311.29			5,889.89		
Depreciation	4,800.00	4,800.00			4,800.00		
	$ 24,465.00		$ 34,987.51			$ 28,625.66	
Operating expenses:							
Operation of "Atlantis"	$ 32,250.00	$28,675.41			$ 30,406.79		
Operation of "Asterias"	565.00	1,000.33			671.53		
Operation of "Anton Dohrn"	—	3,347.75			—		
Scientists' salaries	27,470.00	23,720.56			26,484.58		
Scientific supplies and equipment	4,500.00	7,145.91			4,950.69		
Traveling expenses	600.00	925.28			459.97		
Publications	3,000.00	1,667.59			2,714.71		
Administration	7,325.00	9,048.31			7,603.50		
Amortization of bond premiums	2,200.00	1,739.13			2,634.21		
Contribution to retirement fund	1,575.00	1,543.22			1,493.64		
Interest on bank loan	—	35.16			—		
Miscellaneous (staff meetings and "Anton Dohrn" expenses)	50.00	33.13			71.38		
	$ 79,535.00		$ 78,881.78			$ 77,491.00	
Total expenses	$104,000.00		$113,869.29			$106,116.66	
Expenditures for permanent plant additions:							
Additions to library	$ 800.00	$ 800.00			$ 600.00		
Reconditioning the "Anton Dohrn"	—	17,145.67			—		
	$ 800.00		$ 17,945.67			$ 600.00	
	$104,800.00		$131,814.96			$106,716.66	
Less—Allowance for general overhead, by the U. S. Government			21,277.64				
				$110,537.32			$106,716.66
Excess of income over expenses				$ 6,939.19			$ 7,267.09

IV. TWELFTH ANNUAL REPORT OF THE DIRECTOR FOR THE YEAR 1941

BY C. O'D. ISELIN

During the eleven months before this country declared war the efforts of our staff were directed more and more towards the solution of practical problems. At the request of the Bureau of Ships of the Navy Department we have accelerated the study of factors influencing the fouling of ships' bottoms. Under contract with the National Defense Research Committee we have considerably expanded both our equipment and personnel. Thus by the end of 1941 our regular program of research had been almost entirely superceded by a number of projects of importance to the war effort.

Since this development was progressive throughout the year and also involved the use of our boats, this report will have to be considerably curtailed, compared to those of previous years.

Equipment

During the spring it was decided to recondition the "Anton Dohrn" a 70 ft. power boat which had been turned over to the Institution in 1940 by the Carnegie Institution of Washington. The work was completed early in June and the total cost ran somewhat over $18,000.

We now have a heavily built boat with a cruising radius of 2,600 miles at 8½ knots, whose fuel costs are very moderate and which can be operated by a crew of 7. Experience during the summer indicated the need for rolling chocks and these were added in October. Up to the end of the year the "Anton Dohrn" was at sea a total of 98 days and has proved herself both able and economical.

The new machine shop in the basement was used hard throughout the year. Additional tools were purchased and finally it became evident in December that a larger room would have to be found. After some hesitation it was decided to convert the "Atlantis" crew room into a machine shop, but this change was not made until shortly after the end of the year.

Among items of new equipment bought during the year were a plankton sampler, two current meters, one core sampling device, one microscope, one refrigerator unit, a 1½ H.P. air compressor, and, for "Atlantis," a jib, jumbo and trysail and a sextant.

Accidents

The boatswain on the "Atlantis" strained his shoulder last winter as the result of a fall, but otherwise we came through the year without damage to the boats or injury to any of the crew.

Gifts and Loans

The Geological Society of America contributed $300 toward the purchase of a bottom sampler. The U. S. Fish and Wildlife Service loaned a meter wheel and the Pfaudler Company of Rochester, New York, loaned a 130-gallon glass-lined container for preparing standard sea water.

Library

This year our contribution to the library of the Marine Biological Laboratory was increased from $600 to $800. This sum was spent as follows: 40 current journals and monographs were subscribed to; 23 books were purchased; 3 back sets were completed and 2 partially completed; 131 volumes were bound. In addition, 72 current journals were received in exchange for our publications and 8 as gifts. Members of our staff donated to the library 98 additional journal numbers and reprints.

Personnel

One new staff appointment was made during the year by vote of the Executive Committee, namely, Dr. Fred B. Phleger, Jr., as Submarine Geologist.

Fellowship holders who worked at the laboratory during the summer were: Dr. Donald Dooley, Mr. Richard Lee, Dr. George Whiteley, Mr. J. William Zabor. In addition the following investigators received special grants: Dr. Fred B. Phleger, Jr., and Dr. Theodor Von Brand.

There were 7 visiting investigators who remained here for considerable periods: Dr. Laurence Irving, Dr. H. B. Moore, Dr. and Mrs. Earl H. Myers, Dr. C. M. Osborn, Mr. William Schallek and Dr. Pierre Scholander.

Including the people working on the government projects, the assistants to our staff members and the crews of the boats, there were at one time during the summer a total of 114 people connected in one way or another with the Institution.

There were no changes among the officers on "Atlantis." Edwin Athearn was appointed captain of the "Anton Dohrn" while Stanley Poole has served as mate and Nelson Bryant as engineer. William Butcher, Jr., was captain of the "Asterias" which was in use during the summer months for the usual trips near Woods Hole.

During the course of the year a number of men connected with the laboratory have been called for active duty as reserve officers in the armed forces: Dr. H. R. Seiwell as First Lieutenant in the Army, Mr.

F. L. Higginson as Lieutenant Junior Grade in the Navy, Mr. Jason Kobler and Mr. Gilbert Oakley as Ensigns in the Coast Guard.

Travel

Dr. H. R. Seiwell returned in June from a long visit to the Scripps Institution of Oceanography. Dr. Mary Sears left in August for 6 months in Peru where she studied the plankton of the Humboldt Current. Her trip was financed by a Faculty Fellowship from Wellesley College and by a grant from the Committee for Inter-American Artistic and Cultural Relations.

Publications

The following contributions were published during 1941:

No. 244. H. C. Stetson. Oceanography. Chapter in Geology, 1888–1938, Fiftieth Anniversary Volume. *Geol. Soc. Amer.*, pp. 43–69.

No. 253. Sidney C. T. Hsiao. Melanosis in the Common Cod, *Gadus callarias* L., Associated with Trematode Infection. *Biol. Bull.*, Vol. LXXX, No. 1, pp. 37–44.

No. 256. Floyd M. Soule. Oceanographic Conditions in the Grand Banks Region and the Labrador Sea in 1939. Excerpt from International Ice Observation and Ice Patrol Service in the North Atlantic Ocean. Season of 1939. *U. S. Coast Guard Bull.* No. 29, pp. 79–133. (Published in 1940.)

No. 264. H. R. Seiwell. Investigation of Internal Waves in the North Atlantic Ocean. Year Book, 1940, *Am. Philos. Soc.*, pp. 243–246.

No. 270. Theodor Von Brand and Norris W. Rakestraw. The Determination of Dissolved Organic Nitrogen in Sea Water. *Sears Found. Jour. Mar. Res.*, Vol. IV, No. 1, pp. 76–80.

No. 273. Charles W. Hock. Marine Chitin-Decomposing Bacteria. *Sears Found. Jour. Mar. Res.*, Vol. IV, No. 2, pp. 99–106.

No. 275. R. B. Montgomery and R. B. Sykes, Jr. Table for Density of Sea Water at 0°C. and Atmospheric Pressure for Values of Chlorinity between 18.00 and 20.99 according to Knudsen's Formula. *Sears Found. Jour. Mar. Res.*, Vol. IV, No. 1, pp. 28–31.

No. 276. H. R. Seiwell. Summary of Some Results of Internal-Wave Investigations in the North Atlantic. *Trans. Am. Geophys. Union,* Twenty-second Annual Meeting, pp. 494–498.

No. 277. R. B. Montgomery. Sea Level Difference Between Key West and Miami, Florida. *Sears Found. Jour. Mar. Res.*, Vol. IV, No. 1, pp. 32–37.

No. 281. Alfred C. Redfield. The Effect of the Circulation of Water on the Distribution of the Calanoid Community in the Gulf of Maine. *Biol. Bull.*, Vol. LXXX, No. 1, pp. 86–110.

No. 282. C. G. Lalicker and P. J. Bermúdez. Some Foraminifera of the Family Textulariidae Collected by the first "Atlantis" Expedition. *Torreia,* No. 8, pp. 1–20.

No. 284. George Wald. Vitamins A in Invertebrate Eyes. *Amer. Jour. Physiol.*, Vol. 133, No. 2, pp. P479–480.

No. 285. Hubert Lyman Clark. Reports on the Scientific Results of the "Atlantis" Expeditions to the West Indies, under the Joint Auspices of the University of Havana and Harvard University. The Echinoderms (Other than Holothurians). *Mem. Soc. Cub. Hist. Nat.,* Vol. XV, No. 1, pp. 1–154.

No. 287. Gordon A. Riley. Plankton Studies. IV. Georges Bank. *Bull. Bingham Oceanographic Coll.,* Vol. VII, Art. 4, pp. 1–73.

No. 288. R. B. Montgomery and Athelstan F. Spilhaus. Examples and Outline of Certain Modifications in Upper-Air Analysis. *Jour. Aeronautical Sciences,* Vol. 8, No. 7, pp. 1–19.

No. 289. W. J. Clench and C. G. Aguayo. Notes and Descriptions of New Deep-Water Mollusca Obtained by the Harvard-Havana Expedition off the Coast of Cuba. IV. *Mem. Soc. Cub. Hist. Nat.,* Vol. XV, No. 2, pp. 177–180.

No. 290. Athelstan F. Spilhaus. Fine Structure of the Edge of the Gulf Stream. *Trans. Am. Geophys. Union,* Twenty-second Annual Meeting, Part II, pp. 478–484.

No. 294. Alfred H. Woodcock. Surface Cooling and Streaming in Shallow Fresh and Salt Waters. *Sears Found. Jour. Mar. Res.,* Vol. IV, No. 2, pp. 153–161.

No. 295. Lester V. Whitney. The Angular Distribution of Characteristic Diffuse Light in Natural Waters. *Sears Found. Jour. Mar. Res.,* Vol. IV, No. 2, pp. 122–131.

No. 296. Clinton M. Osborn. Studies on the Growth of Integumentary Pigment in the Lower Vertebrates. *Biol. Bull.,* Vol. LXXXI, No. 3, pp. 341–351.

No. 299. Mary Sears. Notes on the Phytoplankton on Georges Bank in 1940. *Sears Found. Jour. Mar. Res.,* Vol. IV, No. 3, pp. 247–257.

No. 300. Talbot Howe Waterman. A Comparative Study of the Effects of Ions on Whole Nerve and Isolated Single Nerve Fiber Preparations of Crustacean Neuromuscular Systems. *Jour. Cell. and Comp. Physiol.* Vol. XVIII, No. 1, pp. 109–126.

No. 303. R. B. Montgomery. Transport of the Florida Current off Habana. *Sears Found. Jour. Mar. Res.,* Vol. IV, No. 3, pp. 198–220.

No. 306. George L. Clarke. Observations on Transparency in the Southwestern Section of the North Atlantic Ocean. *Sears Found. Jour. Mar. Res.,* Vol. IV, No. 3, pp. 221–230.

Field Work

Operations of "Atlantis" for the year 1941:

Cruise 110: Jan. 7-11; Collection of standard seawater south of Montauk Point.

Cruise 111: Jan. 15-March 10; Temperature survey of the Northern Equatorial Current, the Antilles Current and the Gulf Stream.

Cruise 112: March 20-April 4; Biological survey of Georges Bank.

Cruise 113: April 14-24; Biological survey of Georges Bank.

Cruise 114: May 6-15; Biological survey of Georges Bank.

Cruise 115: May 17-21; Off Highland Light.

Cruise 116: May 27-June 6; Biological survey of Georges Bank.

Cruise 117: June 14-22; South of Nomans Land.

Cruise 118: July 10-21; Geological survey of continental slope south of Georges Bank.

Cruise 119: August 5-September 6; Temperature survey of the eastern Gulf Stream area.

Cruise 120: September 13-17; South of Montauk Point.

Cruise 121: October 7-10; South of Montauk Point.

Cruise 122: October 14-16; South of Montauk Point.

Cruise 123: October 20-22; Off Highland Light.

Cruise 124: October 28-November 2; Temperature survey of Georges Bank.

Cruise 125: November 3-6; South of Nomans Land.

Cruise 126: November 17-19; South of Nomans Land.

Cruise 127: November 25-December 9; Temperature survey of Gulf Stream and Western Sargasso Sea.

Summary of observations:

Total miles sailed	16,678
Number of days at sea	211
Deep hydrographic stations	47
Shallow hydrographic stations	181
Plankton hauls	495
Bottom samples	50
Light stations occupied	36
Plankton recorder, miles towed	672

Operations of "Anton Dohrn" for the year 1941:

Cruise 1: July 17-23; South of Nomans Land.

Cruise 2: June 28-July 1; Temperature sections, south of Long Island.

Cruise 3: July 14-25; Temperature sections, New York to Cape Hatteras.

Cruise 4: August 2-4; Temperature observations in the Gulf of Maine.

Cruise 5: August 6-8; South of Nomans Land.

Cruise 6: August 14-18; Temperature sections in the Gulf of Maine.

Cruise 7: August 20-24; Temperature sections in the Gulf of Maine.

Cruise 8: August 25-September 1; South of Nomans Land.

Cruise 9: September 3-6; South of Nomans Land.

Cruise 10: September 8-9; South of Nomans Land.

Cruise 11: September 11-12; South of Nomans Land.

Cruise 12: September 13-17; South of Montauk Point.

Cruise 13: September 22-26; Temperature survey of the Gulf of Maine.

Cruise 14: October 6-20; Temperature sections between Montauk Point and Chesapeake Bay.

Cruise 15: October 29-November 1; Temperature sections in Gulf of Maine.

Special equipment was designed and built for subsurface collection

Cruise 16: November 18-19; Cape Cod Bay.

Cruise 17: November 21-23; Boston Harbor.

Cruise 18: December 15-16; New Bedford Harbor.

Scientific Program

In cooperation with Mr. Floyd M. Soule and Dr. Clifford A. Barnes of the U. S. Coast Guard, a batch of standard sea water has been prepared. With the occupation of Denmark the available stock of the Copenhagen standard soon became alarmingly low in this country and elsewhere. As a result of this work, oceanography is assured of a satisfactory standard for salinity determinations for the next five years or more.

Special equipment was designed and built for subsurface collection of relatively large quantities of water, which were obtained from depths of 400 to 800 meters in the slope water area near the edge of the Gulf Stream. The water was filtered and stored in large glass stoppered carboys for a period of about 9 months. Then the whole quantity was mixed in a glass-lined evaporating dish and sealed into pyrex glass tubes. Its chlorinity has been compared against Copenhagen standard water of the batch P_{15} and against sodium chloride, and the American standard is now ready for distribution. Further work on interpretation of its chlorinity in terms of pure silver is planned for the future.

Dr. Clarke, Dr. Riley, Dr. Sears, and Mr. Bumpus have continued in the study of factors influencing the productivity of Georges Bank. The *Atlantis* carried out 4 additional surveys of the area during the spring months. Unfortunately, the physical oceanographers have not been able to take as active a part in this investigation as was at first hoped. However, as our knowledge of the plankton population increases, it is becoming possible to answer questions concerning the dominant circulation from the biological material. Eventually it will be advisable to carry out a thorough physical program in this area, but meanwhile the biological studies are not being retarded.

Mr. Woodcock's studies of convectional circulation in the surface

layer of the sea have been continued whenever possible. But as the outbreak of war approached, it became clear that additional field observations for such investigations would probably become impossible. Through the cooperation of Professor Rossby and Dr. Church, at the University of Chicago, plans have been made to continue these studies in Lake Michigan. It is hoped that in this way a new and valuable connection between physical oceanography and meteorology will develop.

Dr. Ewing found time during the summer months to continue developing photographic equipment for the study of the bottom. With the assistance of Mr. Hagelbarger, two types of cameras were built and a number of excellent pictures secured.

V. STAFF

(As of December 31, 1941)

COLUMBUS O'D. ISELIN, Associate Professor of Physical Oceanography, Harvard University, and Assistant Curator of Oceanography Museum of Comparative Zoölogy; Director.

CORNELIA L. CAREY, Assistant Professor of Botany, Barnard College; Associate in Marine Bacteriology.

GEORGE L. CLARKE, Associate Professor in Biology, Harvard University; Marine Biologist.

WILLIAM MAURICE EWING, Associate Professor in Geophysics, Lehigh University; Associate in Submarine Geology.

BOSTWICK H. KETCHUM, Associate in Marine Biology.

RAYMOND B. MONTGOMERY, Lecturer on Maritime Meteorology and Oceanography, Assistant Professor of Meteorology, New York University; Physical Oceanographer.

ALBERT E. PARR, Director of Peabody Museum and Curator of the Bingham Oceanographic Collection, Yale University; Associate in Oceanography.

FRED B. PHLEGER, JR., Associate Professor of Geology, Amherst College; Submarine Geologist.

NORRIS W. RAKESTRAW, Associate Professor of Chemistry, Brown University; Chemical Oceanographer.

ALFRED C. REDFIELD, Professor of Physiology, Harvard University; Associate in Marine Biology.

CHARLES E. RENN, Tutor in Biology and Instructor in Sanitary Engineering, Harvard University; Associate in Marine Bacteriology.

GORDON A. RILEY, Marine Biologist, Yale University; Marine Physiologist.

C.-G. ROSSBY, Professor of Meteorology, Massachusetts Institute of Technology, and Assistant Chief, U. S. Weather Bureau, Washington, D.C.; Associate in Physical Oceanography.

MARY SEARS, Instructor in Zoölogy, Wellesley College; Planktonologist.

H. R. SEIWELL, Physical Oceanographer.

FLOYD M. SOULE, Principal Physical Oceanographer, U. S. Coast Guard; Associate in Physical Oceanography.

ATHELSTAN F. SPILHAUS, Associate Professor of Meteorology, Chairman of the Department of Meteorology, New York University; Physical Oceanographer.

HENRY C. STETSON, Research Associate in Paleontology, Museum of Comparative Zoölogy; Submarine Geologist.

SELMAN A. WAKSMAN, Microbiologist, New Jersey Agricultural Experiment Station; Marine Bacteriologist.

EDMOND E. WATSON, Assistant Professor of Physics, Queen's University; Physical Oceanographer.

DEAN F. BUMPUS, Biological Technician.

EUGENIA P. LAMBERT, Geological Technician.

ELIZABETH ORR, Chemical Technician.

HELEN F. PHILLIPS, Secretary to the Director.

CHARLES M. WEISS, Bacteriological Technician.
ALFRED H. WOODCOCK, Oceanographic Technician.

WILLIAM C. SCHROEDER, Business Manager.
ETHELYN T. BIRD, Secretary.
BARBARA FERGUSON, Assistant Secretary.
WILLIAM SCHROEDER, Superintendent of Buildings and Grounds.

APPENDIX

Reports of progress by investigators working at the Institution during 1941.

LIGHT PENETRATION AND QUANTITATIVE ZOÖPLANKTON STUDIES

GEORGE L. CLARKE

1. *Transparency measurements in the Southwestern Section of the North Atlantic Ocean.*

Twenty-seven series of light penetration measurements, made with Photronic cell photometers to depths as great as 133 meters, yielded a minimum average value for the extinction coefficient of k = 0.037 and a maximum depth for the Secchi Disc of D = 47 meters. The region south of Bermuda and north and west of the Antilles was found to contain the clearest ocean water known and to be relatively homogeneous in respect to transparency. Individual measurements suggest the possibility that important changes in the relative effects of scattering and absorption may occur in ocean waters.

2. *Investigation of the factors underlying the productivity of Georges Bank.*

The study, began the previous year, of the steps in the biological cycle which underlie the productivity of this important fishing area was continued and expanded. The data obtained on the seven cruises of the previous year were analyzed and charts showing quantitative distribution have been prepared. These reveal that the plankton of the Bank is sharply distinguishable from that in the surrounding waters. One species, *Sagitta elegans* is particularly characteristic of the Bank water. Other species, such as *Calanus finmarchicus,* serve by their presence to indicate the course of the current from the Gulf of Maine which flows around the outer margin of the Bank. The appearance of fish eggs, particularly those of the haddock, revealed the position of the spawning grounds and the subsequent drift to the south and west.

Four additional cruises were made to the Bank during the past spring. On these cruises a larger network of stations was occupied than heretofore. The material obtained is now in the process of analysis. The testing of two new methods for the further extension of quantitative work was undertaken. The first of these was the use of two Continuous Plankton Recorders loaned by Professor A. C. Hardy of the Department of Zoology and Oceanography, University College, Hull, England. These

instruments were towed for several hundred miles over the Bank and were found to provide very valuable additional information on the distribution of the larger elements of the plankton. The other new method was the use of a commercial dredge, adapted for operation from a single cable, for the collection of bottom organisms. Since this dredge, with its opening of 2 x 3 feet, was much larger than any employed by earlier workers, and since it bit well into the bottom even when hard, the sample of bottom material obtained was of adequate size (10 to 50 liters) for quantitative treatment. When tested on a preliminary survey of 90 stations in Menemsha Bight, the dredge gave a very satisfactory performance.

SUBMARINE GRAVITY MEASUREMENTS

MAURICE EWING

Professor Donald Dooley assisted with the calculations of the Browne correction to the results of the gravity measuring cruise of the *U.S.S. Barracuda.* At several stations this correction was large enough to merit consideration, but it does not change the general features of the gravity field in the region investigated.

THE RELATION OF THE OXYGEN CONSUMPTION OF MARINE ANIMALS TO TEMPERATURE AND SEASON

LAURENCE IRVING

We began last summer to examine how the metabolism of a few types of marine animals varies with the season. The observation of the metabolism of these animals required the construction of special respirometers which conveniently allow the accurate observation of oxygen consumption over long continued periods.

First we determined the oxygen consumption of a sand crab, *Emerita talpoida,* and of the cunner, *Tautagolabrus adspersus,* at the temperatures which they would endure. Having first determined the relationship between oxygen consumption and temperature during the summer, they were then examined during the winter. At Christmas time, while living in cold water, the oxygen consumption of the cunner at any temperature was higher than it had been at the same temperatures during the summer. In other words, in winter the intrinsic metabolism had increased in a manner which would partially offset the depressant effect of winter temperature. The seasonal change shown by the cunner was not large enough to rank as much of an adaptation of

the metabolic rate to winter conditions. It is perhaps pertinent that the cunner does not naturally remain in shore during low winter temperature, and if it did, its metabolism would be at a rather slow rate.

In late winter the sand crabs had moved off shore and were secured by dredging in 15 or 20 feet of water. The metabolic rate was considerably accelerated over the rates shown at corresponding temperatures in the summer, so that the depressant influence of cold upon metabolism was in part counteracted by an increased metabolic rate.

The metabolic rates of only a few marine animals are now known, and then over too short a range of season and size to indicate the metabolism of the species during its life cycle. We hope to establish the metabolism and temperature relations of the whole size range of a few local forms at different seasons. With this basis, we can compare like forms in contrasting environments. The relation of metabolic rate to temperature seems to be a good basis for measurement.

STUDIES OF REPRODUCTION AND FOOD SUPPLY OF FISH

RICHARD E. LEE

1. *The hypophysis and gonads of female swordfish in southern New England waters.*

An examination of the hypophyses of 36 swordfish, and the gonads of 13 of these specimens, has been carried out during the past two summers at Woods Hole. All fish whose gonads were received were females, in a sexually inactive condition, with no evidence of ovarian changes taking place throughout the summer. The hypophyses, on the other hand, show a marked change, in appearance of basophile cells containing large vacuoles in the "Übergangsteil" region of the gland, and an increase in the number of orange acidophile cells in the pars intermedia. These phenomena were observed during both summers that the glands were studied. Various dissimilar pituitary changes of other fishes have been correlated with their breeding season, but there is no evidence for such a relationship in the swordfish. Those fish observed have been sexually immature or inactive, in the waters off the southern New England coastline. The exact nature of the changes found in its hypophysis is still to be established.

2. *The quantitative study of bottom fauna.*

During the summer of 1941, a quantitative investigation was begun of the bottom dwelling invertebrate animals of Menemsha Bight, an

important flounder fishery in Vineyard Sound. The purposes of this study were: (1) to determine the animals present in the area; (2) to plot their relative numbers and distribution; and (3) to establish the amounts of volatile organic compounds contained in those animals which the fishes might use for food.

It was found that the Petersen grab was highly unsatisfactory for this work. Since its area was exceptionally small, the size of the sample it obtained seemed insufficient to give a valid representation of the bottom faunal type, and its digging action varied greatly on the various bottoms. Therefore, a new, larger, and heavier grab was purchased for the purposes of this work.

In the preliminary quantitative examination of the faunal aggregations in the region, it was found that small tube-dwelling annelids, and amphipods, were the most numerous organisms in those areas in the Bight where flounders are usually taken. In general, these regions are also richest numerically in other organisms (small molluscs, crustaceans, etc.) and in the total amounts of organic matter contained in the organisms available to the fish as food. Further quantitative studies are planned of the faunal variations in number and distribution over this fishing ground, in the hope that further information will be gained which will aid in explaining fluctuations of the flounder population.

STUDIES IN PHYSICAL OCEANOGRAPHY AND METEOROLOGY

R. B. MONTGOMERY

1. Studies of the kinematics and dynamics of the waters in the Straits of Florida were terminated with the publishing of a paper on the transport of the Florida Current.

2. The joint project with Professor Spilhaus on the preparation of mean isentropic charts of the ocean was shelved due to the pressure of more immediate work. A set of preliminary charts showing the contours of certain sigma-t surfaces in the Atlantic Ocean was however prepared for publication by Mr. M. J. Pollak.

3. Material from the literature and from preliminary investigation on the transfer of heat and water across the sea surface was gathered together into a set of mimeographed notes. In this connection Mr. Pollak computed tables for the pressure of aqueous vapor, to hundredths of a millibar, over water and over sea water for every tenth of a degree from 32.0° F. to 99.9° F., as well as a supplementary table for use in finding vapor pressure from psychrometer readings.

4. Notes for instruction in physical oceanography were elaborated, and the first part of these was put in mimeographed form with the assistance of Miss Martha L. Bennett.

5. Studies of boundary turbulence were resumed with the development of a generalization of Prandtl's assumption for mixing length. This work makes it appear that the value of the universal turbulence constant which has been used commonly in oceanography and meteorology is apparently too low, the new value being 0.45.

CORRELATION OF POPULATIONS OF FORAMINIFERA WITH ASSEMBLAGES OF TESTS FOUND IN MARINE SEDIMENTS

BY EARL H. MYERS

Studies of populations of foraminifera in the sea, the conditions under which they are produced, and their contribution to marine sediments were made from material and data collected in widely separated regions for the purpose of providing a better basis for interpreting assemblages of foraminifera found in geologic marine sediments.

The sequence of events in life cycles of species to be used as guides was determined from laboratory cultures. From this and statistical studies of populations living on the floor of the sea, the rate of reproduction and the probable rate at which the tests are contributed to the sediments were determined. When allowances were made for tests destroyed by organisms feeding upon the foraminifera or other destructive agencies it was possible to estimate the rate of sedimentation by comparing the annual rate at which the tests are contributed to the sediments with the number of tests in core samples.

Populations per unit area of sea bottom were determined from samples taken with a special suction grab. The presence or absence of juvenile stages in samples obtained with a new type of dredge that removes only surface sediments revealed periods of reproduction, and core samples taken with a Trask coring device were used to determine the vertical distribution of tests.

Where data concerning measurable ecological conditions in the sea were available, it was possible to make interesting deductions as to the probable influence of these factors upon the distribution of species and the total productivity of the region.

Several reports and papers resulting from this work are now available and others have been accepted for publication in the near future.

STUDIES ON THE PIGMENTATION AND COLOR CHANGES OF FLOUNDERS

CLINTON M. OSBORN

The summer months spent at the laboratory enabled me to finish one manuscript, contribution No. 296, entitled, "Studies on the growth of integumentary pigment in the lower vertebrates. I. The origin of artificially developed melanophores on the normally unpigmented ventral surface of the summer flounder (*Paralichthys dentatus*)." This paper appeared in the December issue of *Biological Bulletin*. The photographs and the first drafts of two other papers were completed (Cont. Nos. 298 and 302).

Experimental work included problems on: (1) the influence of light intensity on pigmentation; (2) the role of the internal environment (nervous and hormonal) of the fish in modifying pigmentation; and (3) factors influencing the type of pigment and the pigmentary pattern in regenerating scales.

Preliminary shots were taken to demonstrate by the use of colored moving pictures the color changes in flounders. This was done in collaboration with Dr. Louis J. Milne of the Marine Biological Laboratory.

REPORT ON CHEMICAL INVESTIGATIONS

NORRIS W. RAKESTRAW

Dr. Theodor Von Brand and Dr. J. William Zabor were collaborators in 1941. We continued the investigation of the decomposition and regeneration of nitrogenous organic matter, studying certain factors which influence the length of the cycle, and also the part played by gaseous and dissolved organic nitrogen. By endeavoring to carry on more than one stage of the nitrogen cycle at the same time conditions were brought about which probably begin to approximate those actually found in nature. We are still unable to obtain any conclusive evidence of fixation of gaseous nitrogen in sea water, or indeed that gaseous nitrogen plays any important part in the cycle. It seems clear, however, that under certain conditions dissolved organic nitrogen may enter into the cycle.

A long-range study of oxygen consumption was also completed, in which samples of sea water from different depths were stored at their temperatures *in situ*. From the oxygen consumption observed it is hoped that an approximate rate can be calculated for the process as it occurs in nature.

THE DISTRIBUTION OF OXYGEN IN THE ATLANTIC OCEAN

ALFRED C. REDFIELD

The oxygen and phosphate contents of the waters of the Atlantic Ocean have been studied with a view to determining the extent to which isentropic processes of transport may account for the observed distribution. A report has been completed which concludes that—.

1. A large part of the phosphate content and apparent oxygen utilization observed in the deeper layers of the north and south Atlantic may be attributed to characteristics acquired by the water when it was relatively near the sea surface in higher latitudes.

2. The distribution of surfaces of constant potential density permit the transport of water from the regions near the sea surface in which its characteristics are acquired to the depths at which maximum oxygen deficits and phosphate concentrations are observed.

3. In the tropical Atlantic a large part of the observed phosphate concentration and oxygen deficit must be attributed to the decomposition of organisms which have sunk locally from the sea surface to depths as great as 600-800 meters.

4. The principal sources of the products of organic decomposition observed in the deep waters of the Atlantic appear to be the unusually abundant flora and fauna found in the sub-surface waters of the northern and southern convergences and the equatorial current.

A report on the distribution of oxygen in the Gulf of Maine continues under preparation.

THE PHYTOPLANKTON OF GEORGES BANK

GORDON A. RILEY

The first year's work on the phytoplankton of Georges Bank had resulted in a general survey of the horizontal and vertical distribution, an analysis of the relations of the phytoplankton with simple environmental factors such as temperature, phosphate, and nitrate, and a rough estimate of the productivity of the Bank.

Although the productivity seemed the most important line for further study, it was considered advisable to postpone it until certain necessary prerequisites, chief of which was the current system of Georges Bank, had been investigated more adequately. Accordingly, attention was focussed during the second year on certain special aspects of phytoplankton physiology.

It was found that the time when the spring diatom flowering begins was determined largely by solar radiation and the rate of vertical turbulence. The flowering first began in stable or shallow waters, and the rate of its development was proportional to the reciprocal of the thickness of the mixed layer.

An experimental study was made of the growth of natural diatom populations on Georges Bank. The results indicate that many of the species pass through a growth cycle at the time of spring flowering similar to that observed in pure cultures of diatoms in the laboratory. Certain aspects of this cycle appear to be important ecologically—particularly the initial lag and the rapid increase of the growth rate afterward, the relationship of nutrients and light to the peak of the growth curve, the clumping and rapid sinking of cells immediately after the growth has reached its maximum, and the long persistence of part of the population in an inactive but viable condition.

Further material was gathered for a comparison of the quantities of zoöplankton and phytoplankton and the analysis of their relationships.

THE VERTICAL MIGRATION OF PLANKTON UNDER CONTROLLED ILLUMINATION

WILLIAM SCHALLEK

Many plankton organisms are known to rise toward the surface of the sea at night and sink downward during the day. Although this vertical migration has long been known in the field, it has never been reproduced in the laboratory. If this could be done, it would be possible to study the factors controlling this migration.

When the copepod *Acartia tonsa* was placed in tall glass cylinders exposed to window light, the normal vertical migration continued. Spectral energy distribution was found not to be a controlling factor, since incandescent or fluorescent lamps could be substituted for daylight without affecting the migration. Total light intensity and area of light source were similarly eliminated. But normal migration occurred only when the illumination was oblique to the axis of the cylinder. When the light was parallel to the axis of either a vertical or a horizontal tube, the animals reversed their normal behavior and swam toward the light. It appears that the normal behavior is due to a downward sinking in diffuse light, followed by an upward movement in the dark. In direct light, on the other hand, the animal swims toward the light. Such illumination is not likely to be encountered in nature. Further analysis of these relations is planned for the summer of 1942.

STUDIES ON FISHES

WILLIAM C. SCHROEDER

In collaboration with Dr. H. B. Bigelow, considerable progress was made on the account of the sharks to be included in *Fishes of the Western Atlantic*. In addition to utilizing the excellent collection in the Museum of Comparative Zoology, we were fortunate in obtaining the loan of a substantial amount of material from the United States National Museum, from Yale University, and from several other sources. Original drawings have been prepared for all but a few unobtainable species.

PLANKTON STUDIES

MARY SEARS

1. With the Faculty Fellowship from Wellesley College and a grant from the Committee for Inter-American Cultural and Artistic Relations, I was able to join Mr. William Vogt, the ornithologist of the Compañia Administradora del Guano of Peru, on the Chincha Islands to continue collaboration in his ecological studies of the guano birds (mentioned in the last report).

It so happens that Mr. Vogt's arrival in Peru (three years ago) coincided with one of the cataclysmic "crash" periods when there may be heavy rains, when the temperature of the coastal waters becomes abnormally high and the guano birds die of starvation. Since the birds feed almost exclusively on anchovies, it was at once apparent that it was important to consider the food supply in studying the birds. And this supply, in turn, would chiefly be limited by the food upon which these fish feed, the plankton.

I was primarily concerned in my four months' stay on the guano islands with the plankton, completing a survey of the area in the offing of Pisco Bay every two weeks. And on two occasions when a bigger and faster boat was available, our collections were supplemented by observations farther offshore—to a distance of nearly 150 miles on the second trip.

After the first month, we also undertook to study the anchovies (at the expense of a preliminary study of the plankton), because so little was actually known about them. Despite the short period of our study, we were enabled to get some evidence on three or four questions which have a direct bearing on the guano bird population. For example, there was a rumor that the fish feed only on zoöplankton and are unavailable to the birds because they tend to follow it to deeper water during the daylight

hours. Were this true, the "guanays" would always starve as they never feed at night. Actually, so far as I am aware, nobody in Peru had ever examined the stomach contents of these fish. I think it is safe to say after a preliminary examination of nearly 3500 fish that most of their food may be classified as phytoplankton (which is apparently quite different from Fage's (1911) findings on the common anchovy in the Mediterranean). We also made length-frequency measurements, but as yet these have not been completely analysed. Although the scales appear to be very difficult to read, it may be that we will get some corroborative evidence from their study. Probably both these analyses are made complicated by the fact that the spawning period appears to be prolonged to judge from the condition of the gonads over the four month period and the times that eggs have been taken with the plankton.

After leaving the Chincha Islands, I made a supplementary trip to the Lobitos oil fields in northern Peru to collect more plankton. Here, at Capo Blanco, it is said, is the boundary between the warmer fresher water from the north and the colder salter water of the Humboldt current as it swings westward. This was an interesting region to me partly because it marks the usual northern limit of the guano birds and partly as a transitional area between the plankton collected off Pisco and that collected by Dr. Murphy off the coast of Colombia last winter (see below). Curiously enough, I seem to have picked the one period when the warm water had receded to the north and when the birds, fish, and plankton proved to be relatively scarce.

2. The zoöplankton collected by Dr. Robert Cushman Murphy of the American Museum on the "Askoy" Expedition to the west coast of Colombia during the early part of 1941 has been received for study.

3. The collection of zoöplankton samples on the profile from Montauk Point (or Martha's Vineyard) to Station B in the Sargasso Sea has been temporarily discontinued on account of world conditions.

4. The report on the phytoplankton on George's Bank during the spring of 1940 was published in December.

PHYSICAL OCEANOGRAPHY OF THE GRAND BANKS REGION AND LABRADOR SEA

FLOYD M. SOULE

Manuscript for the section on oceanography of the U. S. Coast Guard Bulletin No. 30 (season of 1940) was completed in March. For each survey during the 7-year period 1934-40, this work included an examination of the temperature-salinity correlations for the three types of water

found in the Ice Patrol area—Labrador Current water, mixed water, and Atlantic Current water. A new criterion of the boundary between the Atlantic Current and mixed water or Labrador Current water was selected as the condition where a salinity of 34.95 °/$_{oo}$ corresponds to a temperature of 6°C. The boundary was then determined for each survey made during the 7-year period. Fluctuations in the position of the boundary were considered by studying an area enclosed by arbitrarily fixed lines on three sides and the current boundary on the fourth side. An attempt was made to separate, quantitatively, boundary fluctuations caused by the Labrador Current from those arising from causes affecting the Gulf Stream system. The volume of flow, the mean temperature, and the heat transfer of the Labrador Current at South Wolf Island were computed from observations made during 1940 and compared with the results of eight previous occupations of this section. Examination of these results points to a possible connection between low values of mean temperature and heat transfer at this section, and small numbers of bergs reaching the Grand Banks.

The months from April to July were spent on the oceanographic vessel of the International Ice Patrol Force, the U.S.C.G.C. *General Greene,* during which time three current surveys of the Grand Banks region were made. The resulting dynamic topographic charts were referred to the 1000-deciber surface and were based on 195 oceanographic stations. A short post-season cruise was made in the southern part of the Labrador Sea where 12 oceanographic stations with closely spaced observational levels, from the surface to a depth of 150 meters, were occupied in the immediate vicinity of an iceberg off the Strait of Belle Isle. An additional 24 stations were occupied, from the surface to as near bottom as was practicable, along a section from South Wolf Island to Cape Farewell, Greenland. Throughout the season and post-season cruises a program of bathythermograph observations supplemented the usual reversing thermometer observations of temperature, with Mr. Gilbert Oakley of the Woods Hole Oceanographic Institution as observer.

After the return of the *General Greene* to Woods Hole in August, the remainder of the year was devoted to the preparation of a batch of standard sea water, to analysis of data collected during the year, and to preparing for publication the oceanographic section of U. S. Coast Guard Bulletin No. 31 describing the results of the 1941 Ice Patrol Season.

STUDIES IN SUBMARINE GEOLOGY

H. C. STETSON AND FRED B. PHLEGER, JR.

Several cores, deep water bottom samples and plankton tows were taken from the edge and south of Georges Bank during the summer of 1941. For the cores, the new Hvorslev free fall coring tube was used. The Foraminifera have been separated from the sediments and preliminary examination has been made of this material. Tows for living pelagic Foraminifera were successful down to a depth of 1000 meters, and techniques for handling and identifying them have been perfected.

Quantitative studies by Phleger of Foraminifera from the 1939 and 1940 submarine cores have been completed and the report on this material is in press. Several ecologic depth zones were established for the continental slope on the basis of the foraminiferal faunas. A thorough analysis of the faunas from all the submarine tows, taken from the sides of the canyons, is nearly completed. These results are giving important information on the environment of deposition of the sediments composing the canyon walls.

A catalogue of Recent Foraminifera has been started, and each species will be analyzed according to depth, temperature, and geographic distribution.

Field work on the east coast continental slope and shelf was finished in the summer of 1941 when all the unexplored areas were finally covered. The report by Stetson on the geology of this area and on the east coast canyons was nearly completed by the first of the year.

INVESTIGATIONS UPON THE DISSOLVED ORGANIC NITROGEN

THEODOR VON BRAND

Krogh's method, with the modifications worked out last year, was applied to several decomposition experiments in an effort to learn whether the dissolved organic nitrogen is actively involved in the nitrogen cycle. The results seem to indicate that this may be the case to some extent but further work seems advisable before a more definite statement can be made. The same method was also applied to samples secured by the "Atlantis" at several stations. There was some indication of stratification. Since, however, the danger of contamination is great, further experiments on safer sampling procedures seem indicated.

HEATING BY CONDENSATION

E. E. WATSON

The lightening of the water on Georges Bank at certain times may be due to the heat of vaporization released when water vapor condenses directly on the sea surface rather than in the air as fog. The condition for this is that the surface temperature shall be below the dew point of the air.

Preliminary experiments to observe this effect were carried out on the cold surface waters at St. Andrews, N.B. A shallow tank of sea water, open to the air but shaded from the sun, was floated on the sea surface. Only in calm weather could one be sure that waves would not splash into the tank. As a result the water in the tank was still and its surface usually warmed up rapidly above the dew point, even though it was floating in cold water. Out of many series of observations only one was favorable to condensation and in this case alone the salinity of the water was decreased. Further measurements are desirable for complete proof but it seems to be fairly certain that we must take account of this mechanism of heat absorption by cold surface water.

CRUSTACEAN PLANKTON OF GEORGES BANK

GEORGE C. WHITELEY, JR.

The examination, begun in 1939, of meter stramin-net bottom collections made during the winter and spring cruises of the "Atlantis" in 1939-41 was continued during the past summer.

Identification and enumeration of the fauna in these collections is now nearing completion. Analysis of the distribution of the organisms has been continued.

Our chief interest in the bottom fauna of Georges Bank is to interpret its importance in the food-chain of the haddock. Out of the 18 Amphipod species found in the collection, *Monoculodes edwardsi* Holmes occurred consistently in numbers presumably significant. *Thysanoessa inermis* Krøyer was the schizopod of first importance and *Crago septemspinosus* Say the most numerous Decapod.