and pathology in general have been stimulated and enriched as the result of their labors.

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THE UNITED STATES FISHERIES BIOLOGICAL STATION AT BEAUFORT, N. C., DURING 1914 AND 1915

THE laboratory of the U. S. Fisheries Biological Station at Beaufort, N. C., has been open for investigators each summer for the past seventeen years. Below is given a brief summary of the various activities of the station during the years 1914 and 1915.

The many improvements and repairs effected during the past two years have contributed materially to the appearance of the small island on which the station is located, and to the working efficiency of the laboratory. The grounds were graded and covered with a coat of black top soil in which grass was planted and grown with success. An additional breakwater was built, the terrapin pounds were enlarged, and a fish pool and tide pool were constructed. The cedar post foundation of the main building was replaced by brick piers, the old coal house was rebuilt into a boat house, connected with marine boat ways, and a new coal bin connected with the power house was constructed. About 338 square feet of concrete walks were laid. Porches were constructed across the ends and south side of the dormitory rooms. These added much to the appearance of the building and the comfortableness of the bed chambers. A library room and a small laboratory have been provided on the lower floor of the main building. The power house has been equipped with a salt-water pump of such ample dimensions that the 10,000-gallon salt-water tank can be filled in about one seventh of the time previously required, with a consequent saving in labor and fuel. A new projection and micro-photographic apparatus was added to the laboratory equipment.

Under the direction of the librarian of the central office of the Bureau the library has been systematically arranged and catalogued. The number of volumes has been increased by both purchase and voluntary contributions of publications on biological subjects from various authors and institutions.

Most of the investigators who were employed during the past two years had been with the laboratory before, and continued lines of work begun previously. Professor H. V. Wilson, of the University of North Carolina, was at the laboratory for a short time during both summers. He continued the study and identification of the Albatross-Philippine sponge collection. Nearly all the forms studied differ in more or less important respects from described forms and most of them will be published as new species or varieties.

Dr. S. O. Mast, of Johns Hopkins University, was with the laboratory during the summer of 1914 and continued his studies of the previous season on the changes in shades, color and patterns in fishes, with especial reference to the flounders, *Paralichthys* and *Ancylopsetta*. He also made some observations on the behavior of *Fundulus majalis* in tide pools.

Dr. Mast was unable to demonstrate that adaptation to background in the above-named flounders has any biological value. Experiments, however, indicate that there is in flounders a tendency to select bottoms which harmonize with their skin in color as well as in shade. It was also shown that flounders do not compare their skin with the bottom in the process of adaptation, but that this is regulated solely by the effect of light received by the eyes from above and by its reflection from the bottom. The results of Dr. Mast's work also indicate that the fusion rate of images on the retina for flounders and for man is the same.

With reference to the behavior of *Fundulus majalis*, Dr. Mast's observations indicate that this fish has a sense of direction probably somewhat similar to certain birds. It was noticed many times that when a school of these fish was left in a tide pool as the water fell they left the pool and crossed a sand bar, continuing their flops toward the sea until water was reached, and seldom making the mistake of coming out on the wrong side of the pool.

Dr. Albert Kuntz, of the St. Louis University School of Medicine, during the summer of 1914 continued for the third season his investigation of the breeding habits, embryology and larval development of the fishes of the vicinity. His observations for the season were based exclusively on living material on the eggs and larvæ of five species of teleosts, viz.; *Cyprinodon variegatus, Lucania parva, Kirtlandia vagrans, Gobiosoma bosci* and *Ctenogobius stigmaticus*. The eggs of each species were fertilized and hatched in the laboratory.

Drawings illustrating different stages of development were prepared by Mrs. Decker, an artist, employed for the station. The chief purpose of this work was to give descriptions, along with the illustrations, that would afford ready means of identifying the eggs and larvæ of the species studied.

Mr. H. F. Taylor, then of the Tarboro High School, Tarboro, N. C., now an assistant in the Bureau of Fisheries, devoted the season of 1914 almost exclusively to the study of the scales of the menhaden (*Brevoortia tyrannus*). The results of Mr. Taylor's work indicate that this fish lives to be five or six, or rarely seven years old, and that it spawns about the fifth year. The year groups have approximately the following lengths; first year, 9 cm.; second year, 15 cm.; third year, 18.5 cm.; fourth year, 20 cm.; fifth year, 22 cm.; sixth year, 24 cm.; seventh year, 26.5 cm. The indications also are that the spawning time is very protracted or that there is a secondary spawning time in addition to the regular November spawning.

Prof. W. P. Hay, of the Washington, D. C., high schools, continued his experiments of previous seasons in diamond-back terrapin culture, the study of the life history of the blue crab, and the report on the decapod crustaceans of the Beaufort region.

The present series of experiments in diamond-back terrapin culture were first undertaken at this station in 1909. Since that time nearly 6,000 young terrapins have been hatched in the ponds at the laboratory. The brood of 1914 numbered 1,631 on November 10, an increase of 207 over the total number of the 1913 brood. The 1915 brood numbered 2,035 on the same date of the present year. Nearly 2,000 young terrapins, representing the various broods, are retained at the station for experimental purposes. A marked improvement in the size and vigor of the broods from year to year is apparent, indicating that the adult breeding stock is adapting itself more and more to life in captivity. The various broods are divided into two or more lots each of which is handled differently in order to determine the best treatment of the animal in captivity. Some of the individuals of the broods of 1909, 1910 and 1911 have reached a marketable size, *e. g.*, six inches or more in length, measuring the lower shell. The broods of 1909 and 1910 both produced eggs for the first time during the summer of 1915. The young hatched from these eggs, while they are vigorous and healthy, are notably smaller than the average size of those hatched from eggs produced by the adult breeding stock. During the winter of 1914 and 1915, nearly the entire brood of 1914 and 83 of the brood of 1911 were kept in the hot house. Contrary to the custom of previous winters, some of them were fed on fresh instead of salted food in order to determine the advantage or disadvantage of either. Those fed on fresh food had attained greater growth by spring when all were placed outside in concrete inclosures, after which, as usual, all were fed on fresh fish. When measured in September, 1915, the difference in size between the two lots was not so apparent. The brood of 1915 is being kept in the hot house and the experiment of the previous winter with reference to fresh and salted food is being continued.

On the study of the life history and behavior of the blue crab, Mr. Hay reports that the data collected indicate that the intervals between moults and the amount of growth at moulting time is quite variable and is determined by the amount of the food supply. The crab probably attains sexual maturity at three years of age, when also it has usually attained its maximum normal growth and then ceases to moult.

The report on the decapod crustaceans of the Beaufort region, which was originally be-

gun by Dr. C. A. Shore and later continued by Mr. Hay, has been nearly completed and will probably go to press at an early date.

Dr. H. S. Davis, of the University of Florida, devoted the two seasons to the continuation and completion of investigations on the Myxosporidian parasites of fishes occurring in the Beaufort region. The parasites are common in nearly all the fishes of the region. There is in fact scarcely a species which is not infested by one or more species. The results of these investigations have been embodied in a paper on the Myxosporidia of the Beaufort Region, which is nearly ready for publication.

Dr. James J. Wolfe of Trinity College, Durham, N. C., during both seasons under consideration continued his experiments on the brown alga, *Padina,* and the examination of the *Diatomaceæ* of the Beaufort region. It is expected that a paper covering the results of the experiments on *Padina* will soon be published. Dr. Wolfe is preparing a rather extensive and profusely illustrated report on the diatoms. Many microphotographic plates, which were retouched by the artist, have already been prepared.

Dr. L. F. Shackell, of the St. Louis University School of Medicine, continued his experiments begun in 1912 on the preservation of wood against marine borers. During the past two seasons these studies were carried on in collaboration with the staff of the U. S. Forest Products Laboratory, Madison, Wisconsin. A special study was made of the toxicity of coal-tar creosote and its fractions for certain borers. During the season of 1914 the common ship worm, *Xylotrya,* was used in the experiments, and during 1915 the common wood-boring crustacean, *Limnoria,* was used in the same series of experiments. The results were about the same for each. The results of the 1914 experiments have already been recorded in the *Proceedings* of the American Wood Preservers' Association for 1915. During the summer of 1915 specimens of wood treated with various coal-tar creosote preparations were exposed to the water of the harbor. These specimens are, of course, to be carefully examined in order to determine the effectiveness of the different treatments.

Dr. William L. Dolley, Jr., of Randolph-Macon College, began in 1914 an investigation of the copepods of the Beaufort region. Collections were made and forms occurring most frequently were identified. Unfortunately Dr. Dolley's work was greatly interrupted by sickness. Dr. Dolley was unable to return for the continuation of this work during the summer of 1915.

Dr. C. H. Edmondson, now of the University of Oregon, formerly of the University of Iowa, continued during the summer of 1915 the collection and identification of the foraminifera of the Beaufort region. During the past season over two hundred species were collected and provisionally identified and taken to the university for further study.

Mr. Radcliffe, of the Bureau of Fisheries, Washington, D. C., was at the laboratory during the summer of 1914. He continued the work of the report on the sharks and skates of the Beaufort region and had charge of the work done by the *Fish Hawk* during its stay in the vicinity.

Professor O. W. Hyman, of the University of Tennessee, during the summer of 1915 made some investigations regarding the artificial propagation of the common clam, *Venus mercenaria.* It was, however, determined that the spawning season was nearly over, and that this work should be undertaken earlier in the season, *e. g.,* probably as early as April. Mr. Hyman also worked on the early larval forms of certain decapod crustaceans of the Beaufort region. Of ten forms the first zœas were secured, in six of them the second zœas and in three the third zœas were secured. The method of procedure in each case was to get a ripe female with eggs and keep her in the laboratory until the eggs hatched. Each stage of the zœa was described and drawn with camera lucida.

Mr. Arthur Jacot, of Cornell University, spent the season of 1915 at the laboratory making a study of the mullets of the vicinity with especial reference to their spawning habits and the young, or *Querimanna* stage. It had been noticed by the director that young of one inch and less in length could be obtained throughout the year. It had also been reliably reported by

fishermen that mullets with roe are occasionally taken during the spring of the year. These mullets were identified by the fishermen as the common jumping mullet, *Mugil cephalus,* which species is pretty definitely known to spawn in this vicinity during the fall of the year.

Mr. Jacot found that all of the young of one inch and less in length taken during the winter are *Mugil cephalus,* and all of those taken during the summer are *Mugil curema.* This is very interesting in view of the fact that the adults of the latter species are rare in the vicinity, while the young are quite abundant. The exact spawning grounds of the mullets is not known, neither has it been possible to obtain young much less than three fourths of an inch in length. For these reasons the probability of an early migration of the young presents itself, and the knowledge now gained may finally aid in locating their spawning grounds.

Mr. H. S. Willis, a medical student of the Johns Hopkins University, who was with the laboratory in 1915 was detailed as naturalist aboard the steamer *Fish Hawk.* Besides this he made some camera lucida drawings for Dr. Mast of scales of flounders that had been held on variously colored backgrounds for a long period of time. He also rendered considerable assistance to the director in the preparation of a report on the teleosts of the Beaufort region.

Mrs. Effie B. Decker, of Washington, D. C., an artist, was with the laboratory during both seasons. She made illustrations and retouched photographic plates for the various lines of work conducted by the station.

Besides the above-named individuals employed by the Bureau the following persons visited the station as independent workers: Mr. W. C. George, of the University of North Carolina, spent a portion of June and July, 1914, at the laboratory investigating the Ascidians. He followed out the egg development of *Stylea plicata,* and studied some of the phenomena of degeneration and regeneration of *Perophera.*

Dr. G. L. Kite, of the Henry Phipps Institute, Philadelphia, spent about six weeks at the laboratory during June and July, 1914, devoting his time to the study of certain phases of the embryology of the white sea urchin *Toxopneustes* and that of the worm *Thalassema* which inhabits the dead tests of the sand dollar. Professor Ulric Dahlgren, of Princeton University, spent several weeks at the station during July and August, 1914, for the purpose of collecting the young of *Astroscopus y-græcum,* of the electric organs of which he is making an exhaustive study. His efforts at that time were, however, unsuccessful, as no young were obtained. Mr. August Webber, of New York, N. Y., spent about two weeks at the laboratory during August, 1915, collecting birds for the Brooklyn Institute and bird stomachs for the U. S. Biological Survey.

The director devoted such time as could be spared from other duties mainly to the study of the breeding habits of fishes. During April, 1913, Mr. Radcliffe examined a few specimens of flounders, identified as *Paralichthys lethostigmus,* containing roe. During 1914 and 1915 the spawning habits of the flounders were further investigated with the view of taking up the artificial propagation of these fishes if possible. No flounders containing roe were taken during the spring, but during the fall of each of these years several specimens have been secured with well-developed roe. In every case these were large females, which are comparatively rare. No male with developed roe has yet been observed.

The spawning habits of the weak fish *Cynoscion regalis* and the pig fish *Orthopristis chrysopterus* were also investigated. The data collected indicate that these species run out to sea to deliver their spawn. Data were also collected on the spawning habits of *Bairdiella chrysura,* and a number of minnows. Several experiments were performed in the laboratory with the viviparous species *Gambusia affinis* and with *Cyprinodon variegatus.* Data collected indicate that several of the minnows have a protracted spawning season, producing eggs throughout the greater part of the summer.

It is believed that the following species were taken for the first time in this vicinity during the past two years: (*a*) *Urophycis floridanus,* (*b*) *Menidia beryllina,* (*c*) *Sphyræna barracuda,* (*d*) *Fundulus ocellaris,* (*e*) *Fundulus*

luciæ. The last-named species appears to have been taken only twice previously, once on the New Jersey coast and later on the lower Potomac. This species is fairly common in the Mullet Pond and very abundant in the very shallow and muddy ponds on the marshes to the westward of the entrance of the canal on Newport River.

On July 16, 1914, a first-class can buoy, painted with red and white spiral stripes, was planted on the black-fish grounds off Beaufort as an aid to fishermen desiring the use of the bank. The buoy is 21⅓ miles S. by W. ⅞ W. of the whistle buoy on Beaufort Bar; 23½ miles SW. ¼ W. of Lookout Light; and 26 miles SE. by E. ½ E. of New River Inlet. These grounds have been pretty carefully surveyed and charted by the *Fish Hawk*. This bank is about six miles in length and over one half mile wide at the broadest point. It has been possible to obtain an abundance of fish there at all times when the bank was visited by the *Fish Hawk*. So far but little use has been made of this source of food supply, but it is hoped that in the near future fishermen will avail themselves of the opportunity there presented.

SAMUEL F. HILDEBRAND

ALVIN DAVISON

DR. ALVIN DAVISON, professor of biology at Lafayette College, Easton, Pa., died on the thirty-first of July. Dr. Davison was best known, perhaps, as the author of seven widely-used text-books on biological subjects—on zoology, physiology, anatomy and hygiene. He was also well known as the original advocate of the movement to dispense with the public drinking cup, as a frequent contributor to scientific magazines, as an able and entertaining lecturer and as a competent expert witness in both civil and criminal trials.

Although an author and scientific man of high standing, Dr. Davison will longest be remembered as a teacher. In September, 1894, he founded the department of biology at Lafayette, and since that time this department has turned out large numbers of biological workers who quickly assumed positions of leadership in the biological field. A number of well-known teachers of biology in the colleges of the eastern United States, and numerous entomologists, bacteriologists and foresters connected with the state and federal governments received their training under Dr. Davison.

A noted health worker recently wrote to the widow of Dr. Davison:

> I know he has meant a great deal to many students, but I doubt if the work and life of any one with whom he came into contact was more profoundly influenced by him than was my own. Any good I may have ever accomplished in the social and health field will be in large measure due to the sense of direction imparted to me by your husband while I was in his classes.

A professor of biology in one of our eastern colleges wrote:

> But for your husband my college course would have been largely wasted; but for him I would not now be engaged in the useful work I am doing.

Scores of similar communications attest the great influence which this unusual teacher exerted upon his students.

By inclination and training Dr. Davison was unusually fitted to pursue research work in science. After graduating from college, he took up postgraduate work at Princeton University, and later on studied in Freiburg under Weissman and Weidersheim. Although very fond of research work, and, as his books and magazine articles reveal, although he did no little amount of it, he felt that he could do a greater work for science by opening the eyes of others and starting them on the way he was traveling. He with Ruskin deplored the fact that "hundreds of people can talk where one can think and thousands can think where one can see." His greatest work was teaching his pupils "to see."

At the time of his death Dr. Davison was forty-eight years of age. Up to within a few days of his death he was busily engaged in working upon the eighth volume of his series of biology text-books.

H. D. BAILEY

MUHLENBERG COLLEGE