of the Acclimatization Society of Melbourne in 1878, and the gold medal of the Society of Acclimatization in France in 1879. The honors bestowed by these European organizations clearly show that artificial propagation of fish, including oceanic fishes, was considered to be practical and should be encouraged. These ideas greatly influenced the work of the Woods Hole station and its laboratory.

Numerous papers in the annual reports of the Commissioner of Fisheries describe many technical improvements in the method of hatching eggs. One of the earlier papers on oyster culture by Ryder (1887) summarizes the results of practical experiments, made at Woods Hole and in other parts of the Eastern Coast, in obtaining oyster spat.

Since 1873, Baird had suffered from irregular heart action. This did not prevent him from leading an extraordinarily active life and personally conducting many sea explorations around Woods Hole. The increased burden of work overtaxed his strength during the period of the station construction. His periods of sickness became more frequent, and in the summer of 1886 his doctors recommended that he reduce his work as much as possible. In July 1886, the Bairds, as usual, went to Woods Hole and here held the last four informal receptions in the Residence for the members of his staff. During the following winter his condition became worse and he was advised to take a complete rest for at least a year. Retirement to the Adirondack region in the State of New York somewhat improved his health, and in July 1887, he returned to the Woods Hole Laboratory.

The last days of Baird are described by Mayor J. W. Powell in his address at the memorial meeting of Scientific Societies of Washington in January 1888 (Dall, 1915). Three days before his death, Baird asked to be placed in a wheelchair and moved around the pier past the vessels and through the laboratory. For everyone he had a word of good cheer, though he knew it was the last. He died on August 19, 1887, and was buried at Oak Hill Cemetery in Washington, D. C. A granite boulder with a bronze tablet, in honor of the first United States Commissioner of Fisheries and founder of the Woods Hole Station, was placed at the station in 1902 by the American Fisheries Society; it remains in its original location.

At the time of Baird's death the scientific work of the Woods Hole Laboratory was already on a sound foundation. Research was conducted along several principal lines which can be grouped under the following general headings: taxonomy and distribution of fishes; composition of communities of bottom organisms; reproduction, embryology, and movements of principal food animals of the sea; fish culture as a means of maintaining the abundance of fish populations; parasites and diseases of fishes. The work was balanced

as far as possible with the available funds and personnel. The major part of the general program was carried out by independent investigators. Many distinguished scholars were attracted by the facilities of the laboratory, but even more by the scientific standing and dynamic personality of its director.

Baird's guiding spirit in the study of fisheries problems was not lost with his death. With modifications and changes his spirit has continued to the present time. He undoubtedly was the first fishery biologist in this country. His understanding of fishery problems is clearly expressed in the following excerpts from his paper read at the International Commission held at Halifax in 1877 (Baird, 1889).

"While it is probable that the supply of fish on the outer banks and in the deep sea, away from the immediate coast, is as great as that of former years, a lamentable falling off is to be appreciated in the capture of anadromous fish, such as the shad, salmon, and the alewife, as well as of many species belonging immediately to the coast, such as the striped bass, the scup, and other fish.

"Fortunately, it is believed they are capable of remedy by proper legislation and protection, artificial propagation, etc., and that we may look forward in the distant future to a very considerable return to the former very desirable state and condition of the fisheries. . . . . The status of fish in the sea is very largely determined by the question of temperature.

"The human race is more concerned in the movements and migrations of fish than in the question of their permanent abode. It is when they are aggregated in large bodies, and moving from place to place, either under the stimulus of search for food or other causes, that they furnish the best opportunity to man for their capture and utilization.

"That fish of many varieties have decreased greatly in abundance within the historic period in all parts of the world is well established, the reduction in some cases being truly enormous. This, however, applied only to certain varieties, especially of the anadromous fish, or those running up the rivers from the sea to spawn, and to the more inshore forms. The most indubitable cases of diminution are those of the shad, fresh-water herring, salmon, and striped bass. On the other hand, there is no reason to suppose that the cod, mackerel, bluefish, and the sea herring have been reduced essentially, if at all, in numbers, the stock of these fishes being from year to year about the same, and an apparent diminution in one region being balanced by a greater supply in another.

"The causes of this variation in abundance, so far as they can be detected, may be considered under two heads: first, the natural, or uncontrollable; and, second, the artificial, or those connected with the interference of man. Where the former alone are responsible there may be a hope of a return to original abundance; man's influence acts persistently and with increasing effect throughout long continued years."

II. The Next 64 Years (1887 to 1951)

In March 1888 a new institution was incorporated in Woods Hole under the name of the Marine Biological Laboratory (MBL). On July 17 of that same year, a modest shingled building was erected on a piece of land in close proximity to the U. S. Fisheries grounds. The new institution was established at Woods Hole by a group of university professors with very meagre financial assets. They met with cordial support from the Fisheries Laboratory. For many years the sea water for the new laboratory was supplied from the Fisheries pumping house and practical assistance was given in the use of wharves, floating equipment, and interchange of other services. Many of the MBL scientists who became leaders of American biology spent several summers working at the Fisheries Laboratory. The MBL rapidly outgrew the Fisheries Laboratory and became the leading marine research institute of the country, but the spirit of cooperation which prevailed throughout the history of Woods Hole has persisted and greatly contributed to its growth as the scientific center of marine research.

Shortly after the death of its first Commissioner, the U. S. Fish Commission was reorganized. As stated in the enabling act of Congress, passed and approved in 1871, "the Commissioner should be a civil officer of the Government, of proved scientific and practical acquaintance with the fishes of the coast, who should serve without additional compensation." The text was drawn jointly by Senator G. F. Edmunds and Baird, who insisted on the inclusion of the noncompensation clause with the idea that the phraseology of the bill would preclude the appointment of a mere political candidate and eliminate any suggestion that recommending the passage of the resolution was not voted by selfish consideration of the first Commissioner (Dall, 1915). The responsibilities of the Commissioner and the increased duties of organizing the laboratory and research program imposed a heavy financial burden on Baird. His request for an appropriation for furnishing adequate office space and living quarters for his personnel at Woods Hole was denied, and before the Government quarters were built he had to pay, out of his own money, the rentals for an office building and for housing facilities for his assistants. Shortly after his death, Congress corrected the oversight by an appropriation of $25,000 for the support of Baird's invalid widow and his daughter.

Baird was succeeded as Commissioner of Fisheries by George Brown Goode, his most competent assistant, an outstanding ichthyologist and Director of the National Museum. The appointment was a temporary one. In six months Goode (fig. 3) voluntarily resigned his Commissionership in order to devote all his time to the duties in the Museum. In January 1888, an act of Congress

established the U. S. Fish Commission as a separate bureau of the government and terminated its formal relationship with the Smithsonian Institution. The bill also authorized the President to appoint the Commissioner of Fish and Fisheries and also established the salary at $5,000 per year. The bill was approved on January 20, 1880, and Marshall McDonald was appointed Commissioner. He was a practical fish-culturist and inventor of important mechanical appliances for hatching fish eggs which were widely used in this country and in Europe. McDonald served as Commissioner until his death on September 1, 1895. The Fish Commission continued as an independent, government institution that was responsible directly to Congress until 1903, when it was included in the new Department of Commerce and Labor.

Baird's administration of the Fish Commission and of the Woods Hole station was essentially paternal. With the increased activity and greater complexity of administrative responsibility more formal organization became imperative. The duties were divided among several divisions each headed by an "Assistant in charge of the division". During the first year of McDonald's administration, Hugh M. Smith was appointed an Assistant in charge of the Division of Fisheries. The scope of work of this division covered "all matters specially pertaining to commercial fishing, including statistics". Smith also directed the work of the Washington office and supervised correspondence and preparation of special records. In 1885, R. Edward Earll directed the preparation of statistics. The fish culture activities remained under the direct supervision of McDonald until 1895. After his death, the Division of Propagation and Distribution of Food Fishes was established, with W. deRavenal as Assistant in charge.

In the years following Baird's death the major emphasis in the work of the Woods Hole Station was placed on fish culture and routine administration rather than on scientific investigations. Because of this trend the Woods Hole Station became the principal hatchery for artificial propagation of marine fish species. Administratively, the Station was under the Division of Propagation and Distribution of Fishes, and the Superintendent of the Station became responsible for the operation of the hatchery, maintenance of buildings and grounds, and expenditures of funds allocated to the institution. The Report of the Fish Commission shows that in the year of 1887, C. G. Atkins was Superintendent and William P. Seal was in charge of the aquaria. The scientific work was divided between J. N. Kidder, in charge of the physical and chemical laboratory, and A. E. Verrill, --assisted by Richard Rathbun--who was in charge of the biological laboratory. Among the 16 persons attending the summer session, 10 were engaged in research work, 4 can be listed as assistants to the investigators, 1 was an artist, and Vinal N. Edwards was the collector. The division of responsibilities as well as the titles of the positions occupied by various

persons was not definitely established. In 1888 John A. Ryder was in charge of the laboratory with 23 biologists in attendance. In the spring of the following year, H. V. Wilson was appointed "resident naturalist" and remained in this position until the summer of 1892. The number of investigators in this period varied between 12 and 16.

Henry Van Peters Wilson (fig. 23) was a man of dynamic personality. In a biographical sketch published by D. P. Costello (1961) Wilson is described as a small man, 5 feet 6-1/2 inches tall and never weighing more than 120 pounds, with piercing blue eyes. "He was not a man lightly to tolerate fools among his colleagues, assistants or students. He expected efficiency approaching perfectionin others as well as in himself, and worked with tireless energy to attempt to achieve this end." Unfortunately, the records of the Bureau of Fisheries contain no personal notes, letters, or other materials which would indicate his attitude toward his assistants and personnel of the Woods Hole Laboratory. During the first year at Woods Hole he devoted himself to the study of embryology of the sea bass. He described the development of the sea bass egg from fertilization to the free-swimming larva, about 160 hours old (Wilson, 1889). It is a classic contribution to fish embryology which has not lost its usefulness to the present day, and remains one of the chief reference books for students and researchers engaged in embryological investigations. Another valuable contribution by Wilson was the important discovery of regeneration of sponges from dissociated tissue cells. Wilson's interest in the structure, development, and taxonomy of sponges began in 1890. In 1891 he resigned from the Bureau of Fisheries and joined the faculty of the University of North Carolina at Chapel Hill, N. C., but he continued to work on the sponges collected during the Albatross expedition off the west coast of Mexico and those collected by the Fish Hawk in the vicinity of Puerto Rico. He induced the Bureau of Fisheries to establish a biological laboratory at Beaufort, N. C., where he completed his detailed study of the development of sponges from dissociated tissue cells. Wilson's report on sponges (Wilson, 1912) opened a new approach to the problem of regeneration and initiated many investigations conducted in American laboratories and abroad. Interest in the problem was revived in 1921-24 by experimental work conducted by P. S. Galtsoff, first at the Marine Biological Laboratory and later at the Bureau of Fisheries Laboratory at Woods Hole (Galtsoff, 1925).

At the time of H. V. Wilson's separation from the Bureau of Fisheries in 1891, the work of the Fishery Laboratory at Woods Hole assumed a distinct pattern. One of the biologists of the Bureau was assigned to Woods Hole "in charge of the Laboratory", or some outstanding zoologist outside of the Government service received a temporary appointment as "summer director". From time to time one or several biologists of the Bureau used the facilities of the Woods Hole Station for work on special problems related to

Figure 23.--H. V. Wilson, Professor at North Carolina University and Director of the U. S. Fisheries Laboratory at Woods Hole.

commercial fisheries. At the same time the facilities of the laboratory were made available without charge to professors of various colleges and their students or to other qualified investigators. With a few exceptions the Laboratory was open only during the summer and the major part of the Station's activities were concerned with hatching eggs of marine fishes. Vinal N. Edwards was employed as "permanent collector", helping the investigators by his knowledge of local fauna and assisting them in obtaining the needed material. During the years of 1893 to 1896, inclusive, the following persons, listed in chronological order, were in charge of the laboratory: James L. Kellogg, J. Percy Moore, serving two years, and James L. Peck. In 1898 H. C. Bumpus was appointed as "Director of the Laboratory", and remained in charge until 1901. The number of biologists

engaged in independent research work varied from year to year and attained the largest number of 61 in 1901. Also, that year, six laboratory assistants were employed to help the Director.

After the death of McDonald, the position of the Commissioner was occupied for two years (1896-97) by John J. Brice, retired Naval officer. The next Commissioner was George Meade Bowers. During the 13 years of his administration, from 1899 to 1912 inclusive, the activity of the Bureau of Fisheries greatly expanded in all branches, including the services rendered by the Woods Hole Laboratory. The policies with regard to the operation of the laboratory and its availability to independent investigators have not been formally established. Continuing the tradition initiated by Spencer F. Baird the Bureau of Fisheries allowed a number of investigators to work in the laboratories on various problems of their own choice. Sometimes this created difficulties for the Commissioner in justifying the request for funds made to the Appropriation Committee of Congress. To overcome this complication, Commissioner Bowers defined the Bureau's policy regarding this matter. In his report for the year 1909 he wrote (Bowers, 1911, p. 16-17): "The marine biological stations of the Bureau at Woods Hole, Massachusetts, and Beaufort, North Carolina, primarily established and maintained for study and experimentation in the interests of the fisheries and fish culture, have as usual been resorted to by competent investigators from all parts of the country. While the Bureau provides ample facilities for qualified students and does not attempt to dictate the scope and character of their researches, it is noteworthy that a large percentage of the men of science who avail themselves of the laboratory privileges are engaged in work having more or less direct relation to practical questions, and in the past year an unusual amount of attention was given on the commercial fisheries and the cultivation of marine creatures." As a matter of interdepartmental courtesy the facilities of the laboratory were available to the government scientists of the Department of Agriculture, Public Health Service, and other agencies.

Scientific accomplishments of the Woods Hole Laboratory made by its staff and by independent investigators have been published in many volumes of Government reports and scientific journals. A comprehensive review of these investigations is beyond the scope of the present historical sketch. It is sufficient, for the purposes of this report, to give a general outline of the research projects carried out in the laboratory and mention the more important contributions during the period.

Scientific problems of a general biological nature were studied by a number of eminent zoologists who were either guests of the Fishery Laboratory or were temporarily appointed by the Bureau to investigate a special research problem. The long list of scientists mentioned in the annual reports of the Commissioner

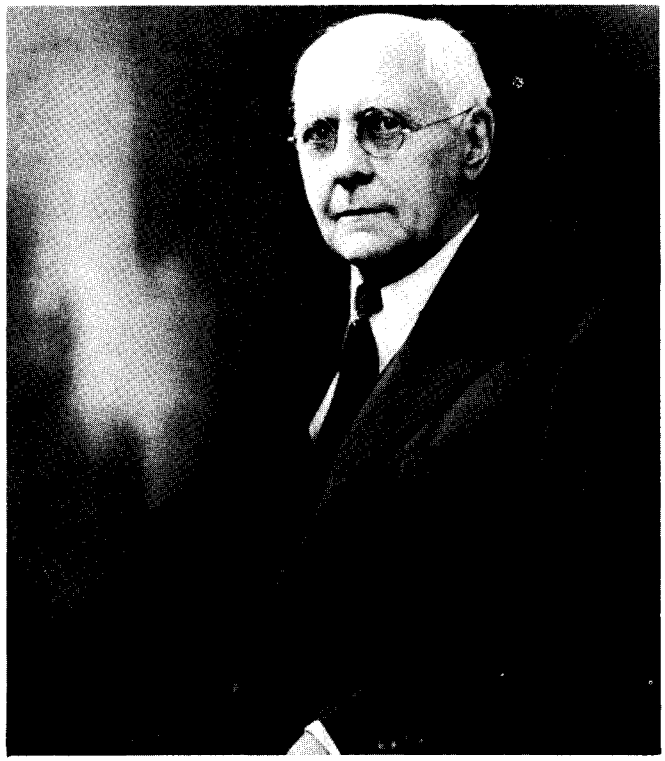

Figure 24.--Edwin Linton, Professor at Pennsylvania University. Was associated with the Fisheries Laboratory as an independent investigator from 1882 to 1941.

of Fisheries from 1884 to 1920 contains the names of persons who later attained great prominance and became leaders of American biology. For some of them the work at the Fisheries Laboratory was a starting point of their career. The following names, selected from the annual reports of the Bureau, are associated with the development of marine sciences at Woods Hole. The years after the names indicate the time they worked at the Fisheries Laboratory. W. K. Brooks (1888-90) biology of the oyster; Gary N. Calkins (1902) protozoologist, investigation of marine protozoa of Woods Hole region; Wesley R. Coe (1899, 1901) structure, biology, taxonomy of nemertines; Edwin G. Conklin (1890-94) embryologist, cell lineage and development of molluscan eggs; Charles B. Hargitt (1902-03) taxonomy and structure of coelenterates; Francis H. Herrick (1889-1895) biology of the American lobster; Edwin Linton (fig. 24) (1882-1941) parasitic worms in fishes; Jacques Loeb (1895) physiology of fertilization of marine eggs; T. H. Morgan (1889)

embryology of marine invertebrates and regeneration; Raymond Osburn (1904) taxonomy and distribution of Bryozoa; George H. Parker (1888-1903) fish behavior and physiology of hearing and lateral line; William A. Patten (1893-99) morphology of Limulus, ancestry of vertebrates; William M. Wheeler (1900-02) free-swimming copepods of the Woods Hole region; E. B. Wilson (1877-1886) embryology of mollusks, cell lineage; and many others.

The work of a few zoologists on the staff of the Woods Hole Station was concerned with practical fishery problems and various scientific pursuits. The authority of the biologist in charge, who sometimes was called "Director" or "Summer Director" of the Laboratory, was somewhat limited. Administrative responsibility for maintenance of the buildings, grounds, and small boats, as well as hatchery operations, were the duties of the Superintendent, who took orders directly from the Washington office.

From 1898 to 1901 the Laboratory was under the directorship of H. C. Bumpus. In addition to his other researches, Bumpus made observations on the reappearance of the tilefish, Lopholatilus chamaeleonticeps. In 1879, large schools of tilefish were discovered in the waters south of Nantucket Shoals. Three years later, multitudes of dead fish of this species were found on the surface throughout its entire area of its distribution north of Delaware Bay. This mass mortality attracted a great deal of public attention and was studied by the Fish Commission every year from 1882 to 1887. Not a single tilefish was found during this period. In 1898, however, the tilefish had become numerous again, and the Fish Commission schooner Grampus on three short trips caught several hundred fishes each weighing from 1/2 to 29 pounds. The mortality in 1879-80 was attributed to the influx of abnormally cold water, but this explanation has not been definitely substantiated.

During Bumpus' directorship, a new investigation of parasitic copepods infesting common food fishes was undertaken. Little was known at that time about this important group of Crustacea. Charles B. Wilson (fig. 25) was invited to undertake the study. He resolved to make it his life's work, and began a painstaking determination and description of parasitic species. Since the year 1899, his first summer at Woods Hole, C. B. Wilson continued his association with the Bureau of Fisheries working on copepod collections he made himself or those which were assembled for nearly 25 years by the U. S. S. Albatross. The importance of his undertaking was such that in 1901 the entire collection of parasitic copepods in the National Museum in Washington, D. C., was turned over to him, also the various stations and hatcheries of the Bureau of Fisheries were instructed to collect this material and forward it to him for identification. Being a man of broad scientific background, he was placed in charge of the economic survey of Lake Maxinkuckee, Indiana. Here he obtained the material for his monographic

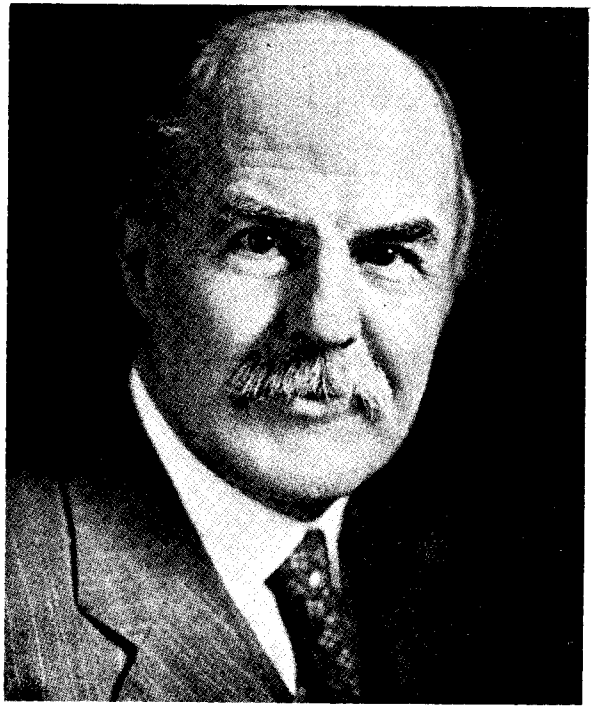

Figure 25.--Charles B. Wilson, Professor at State Teacher's College in Westfield, Mass. For many years studied parasitic and free-living copepods of the Woods Hole area and other parts of the United States. About 1930.

studies published as his doctoral thesis under the title "North American Parasitic Copepods. Part 9, The Lerneopodidae." He participated in economic surveys of Lake Maxinkuckee; the Mississippi River; and the Maumee, Kankakee, and Cumberland Rivers. Between 1913 and 1923 he was economic investigator for the Bureau of Fisheries at Fairport, Iowa, and in the summers of 1924-27 and 1931 he again worked at Woods Hole. Those who saw him every day in the laboratory remember him as very industrious, patient, and at the same time a cheerful man. During one summer he concentrated his efforts on the study of fresh-water copepods of numerous fresh-water ponds and lakes on Cape Cod, and was frequently seen rowing a small skiff towing a plankton net. Playing golf was his principal recreation, and he was a familiar figure on the Woods Hole golf course. He also liked bowling and watching baseball, but most of the time he was seen sitting at his laboratory desk patiently dissecting and mounting copepods with the aid of a binocular microscope. Among