Figure 26.--Francis B. Sumner, Director of the Laboratory, 1904-1910. Photograph made in 1937.

his many contributions "The Copepods of the Woods Hole Region Massachusetts" (Wilson, 1932) is the most valuable book for students of marine copepods. His large library of copepod literature, probably the most complete in existence, he bequeathed to the National Museum. Until his retirement in 1932, C. B. Wilson was Professor of Biology at the State Normal School (later State Teacher's College), Westfield, Mass.

In 1902, H. M. Smith was the Director of the Laboratory. The following year he was appointed to the newly created administrative position of Deputy Commissioner of the Bureau. One of his actions was the appointment of Francis B. Sumner (fig. 26) as the Laboratory Director, who held this summer position until 1910. Sumner's reports (Sumner, 1904, 1905) indicate that in addition to the large laboratory room with nine tables, the Woods Hole station had 14 private rooms equipped for research. Certain parts of the hatchery plant and the aquarium were also available to the investigators. The permanent

collection of the library at that time comprised 16,000 titles; mostly reports of the U. S. and foreign governments and reprints donated by the authors. A large number of books were loaned by Brown University (650 volumes) and 100 volumes by the College of the City of New York for use during the summer. An author catalog of the library books was supplemented by a subject catalog that was commenced by Miss R. MacDonald, the librarian.

From 25 to 30 investigators worked at the Laboratory each summer. Sumner gives an interesting tabulation of the subjects of research which he more or less arbitrarily classified as follows:

Relations to stimuli, animal behavior, etc.	9
Faunal and floral distribution	7
Taxonomy	6
Embryology	3
Ecology (exclusive of distribution)	2
General physiology (exclusive of behavior)	2
Regeneration	2
Miscellaneous	6

Biological material for research was regularly supplied by dredgings of the Fish Hawk and Phalarope (fig. 27) and by selecting needed fish from several traps at Menemsha Bight, and Marthas Vineyard. Besides two steam launches, a catboat, an abundance of rowboats were available for short trips. A daily record was kept by Vinal N. Edwards of the species taken. One of the investigators for the Bureau was George Parker of Harvard University, who conducted a study of the lateral line physiology. He used for this purpose dogfishes, skates, killifish, scup, toadfish, and winter flounder. One of the conclusions reached was that the lateral line organs are stimulated by water vibrations of low frequency (six per second). Interesting observations were made by Lynds Jones on the food of marine birds. He counted the number of terns, Sterna hirundo and S. dougallii, nesting at Weepecket, Penikese, and Muskeget Islands near Woods Hole and calculated the number of fish they consumed. His results showed that in the course of one day 92,000 terns ate 736,000 small fish, Ammodytes americanus, and 184,000 fish of other species. The consumption of food fishes by terns appeared to be insignificant, and the birds were exonerated as an important destructive agency.

The principal feature of the work of the Woods Hole Laboratory undertaken by Sumner was the biological survey of the bottom animals and plants of Buzzards Bay and Vineyard Sound. The incentive for this project was Sumner's desire to use the Fish Hawk which, as he states, was customarily "parked" at Woods Hole during the summer. Having started on the project, he and his associates found themselves deeply involved in the work in which dredging was made at several

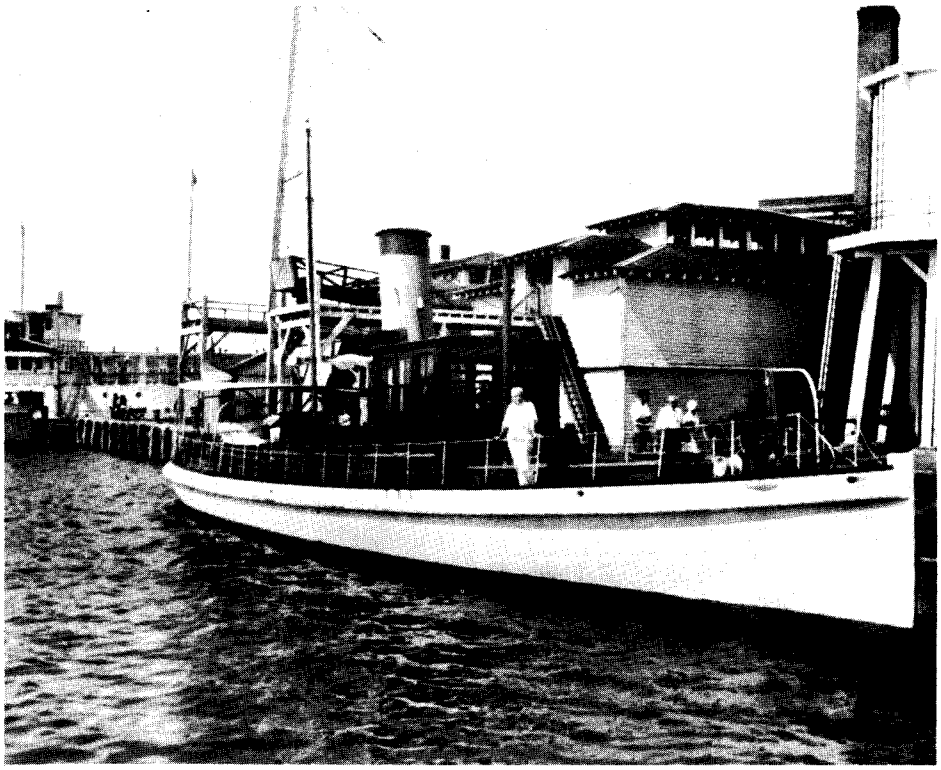

Figure 27.--Steamer Phalarope at the Fisheries dock, Woods Hole. The small vessel was used for daily collection of biological material in 1930's.

hundred stations. The distribution of about 250 species of animals and plants is shown on many maps accompanying the report of this survey. Osburn and Cole collaborated with Sumner in the study of animal populations; Bradley M. Davis, Professor of Botany at the University of Chicago and later at the University of Pennsylvania, studied the distribution of marine algae. Temperature and salinity of the water were recorded, and all collected material was carefully catalogued. The completed report on this monumental undertaking was published in two volumes of the Bulletin of the Bureau of Fisheries (Sumner, Osburn, and Cole, 1913a, 1913b; Davis, 1913a, 1913b). The survey contains valuable information on the distribution of various animals, and to this day remains the main source of information about marine life on the bottom of the principal bodies of water near Woods Hole.

Sumner introduced weekly meetings of a "research club" for general discussion of scientific problems of mutual interest. This practice has been continued by all his successors.

On Sunday, August 25, 1907, the Laboratory was visited by the members of the Seventh International Zoological Congress held in Washington. The group that accepted the Bureau of Fisheries invitation included 13 scientists from Russia, who were given overnight accommodations in the residence building of the Laboratory. The party was carried next day by the Fish Hawk to New Bedford, and one dredging was made en route as a demonstration of the American technique of oceanic research.

One of the Russian delegates was G. A. Koshewnikow, professor and Director of the Zoological Museum and Laboratory of the Imperial Moscow University. Upon his return he told the group of advanced students, which included the author of this paper, a glorifying account of the work of the Fisheries Laboratory. His talk about the research conducted at Woods Hole and the photographs of the Fisheries Laboratory made a deep impression on the minds of the young zoologists.

Sumner's acquaintance with Woods Hole covered a period of 14 years. His first visit was in 1897 when he was a graduate student at Columbia University. In his autobiography Sumner (1945a) refers to that period as the "Golden Age" of the Woods Hole colony, when the most insignificant beginner in biology came into intimate contact with men whom he had long heard cited as authorities by his professors at college. He describes the days when the MBL was housed in a few small buildings, when almost every point on the beach could be reached without "violating the 'trespass' warnings; the automobiles were scarce even in 1911 (fig. 28) the pleasure boats and yachts were seldom seen". In 1903 he received the summer appointment as Director of the Laboratory at the maximum salary of $100 per month. The Laboratory of the Bureau of Fisheries had at that time much better basic equipment, larger collecting boats, and more attractive living quarters than those available at the MBL. Although the MBL lacked funds for equipment and facilities, it already enjoyed a high scientific reputation for basic research. In addition to the survey of Buzzards Bay and Vineyard Sound, Sumner carried on a number of investigations, some of which were the continuation of the experimental embryology of fishes he started at Naples, Italy. One of them was an experimental study of selection in fishes, in which he attempted to demonstrate measurable differences between the survivors and nonsurvivors of killifish, Fundulus, that were transferred to fresh water. During his spare time he initiated the study of the differences induced in a population of white mice by low temperature, and their possible transmission by heredity. This work was a stepping stone to his fundamental research in genetics, distribution, and evolution of the subspecies of deer mice Peromyscus carried on in later years at Scripps Institution at La Jolla, Calif.

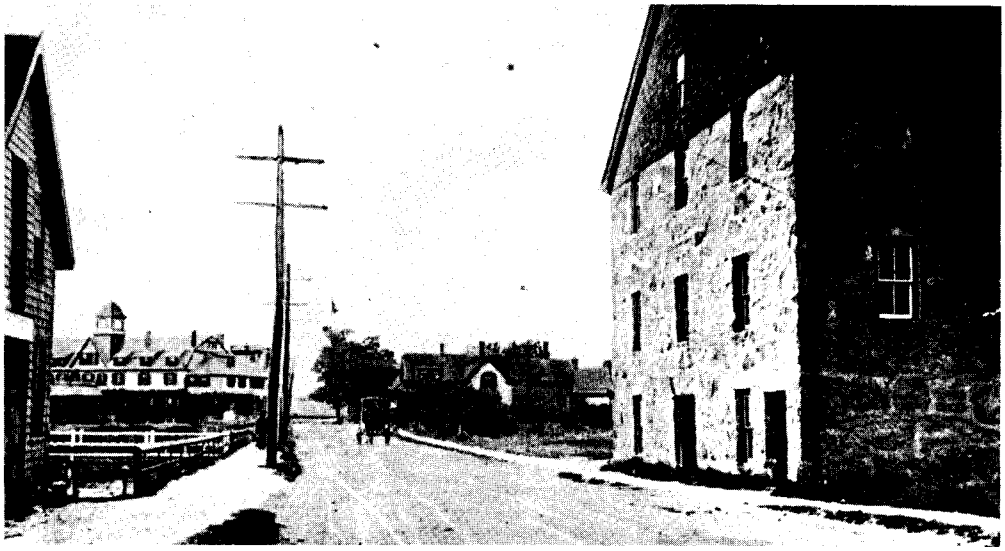

Figure 28.--Water Street of Woods Hole at the beginning of the 20th century. Former Candle House at right. Fisheries Residence at upper left.

In the fall of 1911 he accepted the position of "Naturalist of the Albatross". For the next two years he was engaged in a survey of San Francisco Bay, which was a cooperative study supported by the Bureau of Fisheries and the University of California. Upon completion of this work he joined the staff of Scripps Institution for Biological Research, as that institution was then known (later renamed Scripps Institution of Oceanography).

Sumner's contribution to the biology of fishes includes a valuable study of adaptive color changes in flatfishes. In later years, this work was continued and expanded by Mast who was a guest investigator at the Woods Hole and Beaufort Laboratories of the Bureau. Sumner's work on oxygen consumption and acclimatization of fishes greatly advanced our knowledge of the oxygen demand by various species and provided background information for devising bioassay tests that are now used to determine the toxicity of polluted

waters. The technique of maintaining living organisms in aquaria was benefited by his recommendation to de-aerate sea water, which sometimes becomes oversaturated with oxygen during pumping.

Sumner was deeply interested in the philosophy of science, particularly the relationship between religion and science and in the social responsibility of scientists (Sumner, 1937, 1939, 1940). One of his last papers entitled "A biologist reflects upon old age and death" (Sumner, 1945b) written when he reached "the biblical milestone of three-score years and ten", shows that the years did not diminish his reasoning power or his ability to present his ideas in a lucid and emphatic manner.

One of Sumner's remarks about the scientific method is of particular significance to those biologists who fail to recognize the true meaning of the so-called statistical probability. He states that "statistically speaking 'certainty of some differences' and a 'statistical significance too high to attribute to chance' creates no presumption in favor of the particular interpretation which the author gives to that difference". This pertinent remark by Sumner refers to his own experiments with white mice, made at the time when the application of statistical analyses to experimental data was at the early stages of development.

In 1913, H. M. Smith (fig. 29) was appointed Commissioner of the Bureau of Fisheries. During his administration, which terminated with his resignation in 1922, he retained his interest in the Woods Hole Laboratory. He spent many summers at the Laboratory, escaping from administrative burdens of the Washington office and continuing to work on fishes. He never ceased to be active in ichthyological and fisheries research, and his personal contact with the field employees frequently was helpful to them. In many respects Smith was a remarkable person. He began his work in the fishery service in 1886 under Spencer F. Baird, whom he always held in highest respect as a man and scientist. Upon graduation from medical school in 1888 he was appointed to the staff of the Medical School of Georgetown University, teaching anatomy, histology, pathology, and medicine. Increasing interest in ichthyology and fisheries work compelled him to stay in the fishery service. His medical training, however, remained very useful, especially after his resignation from the Government service in 1922. At that time he began a 12-year residence in Siam as Expert Advisor in Fisheries to the King of Siam. In his many trips to the interior of the country he came in close contact with the people in the dense jungles, and treated many of them suffering from various tropical diseases. A born naturalist, with a deep love for study of animal life, Smith loved to come to Woods Hole where he enjoyed informal meetings with many biologists, saw many old friends, and was visited by many zoologists coming to see him from Europe, Siam, Japan, and India.

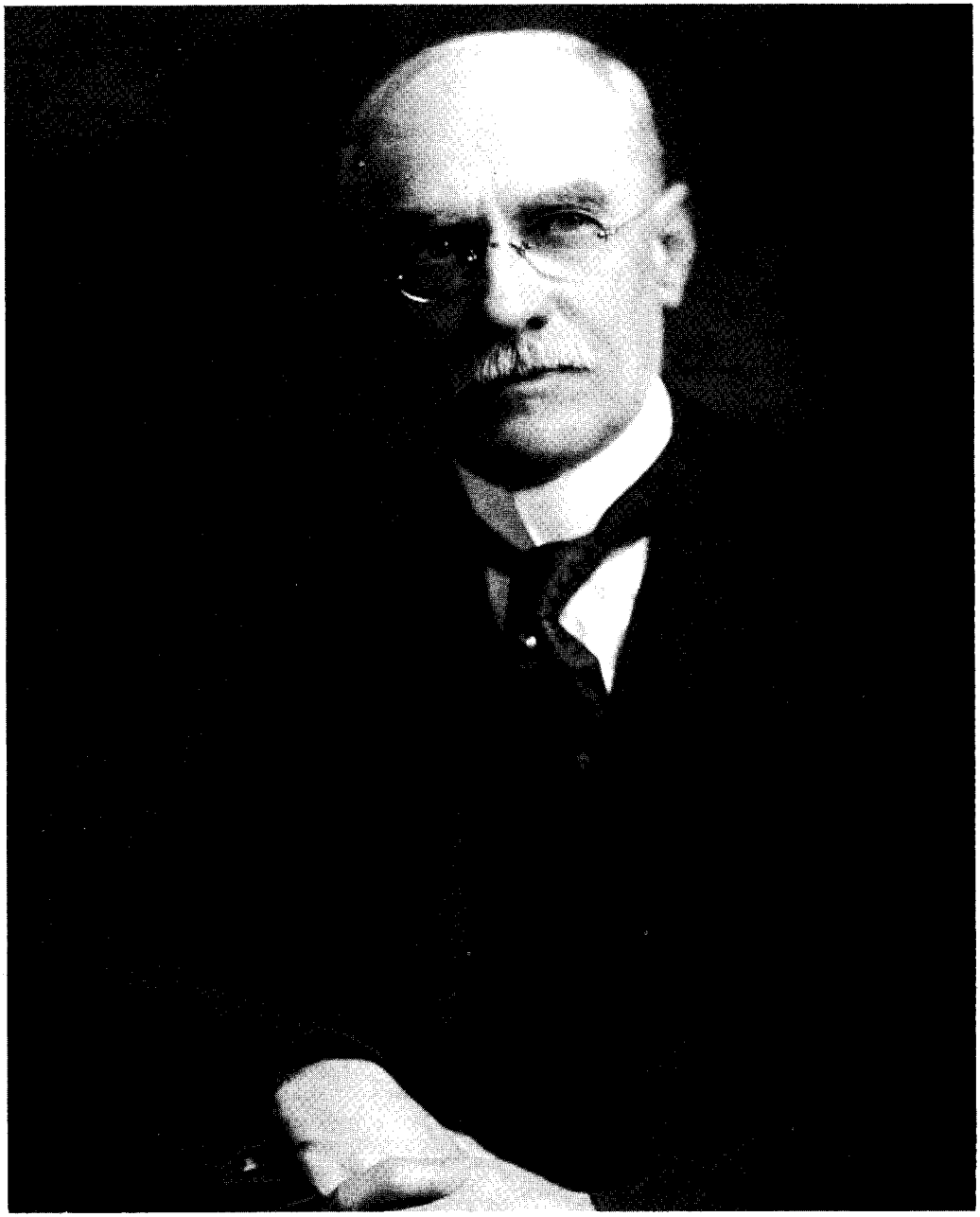

Figure 29.--Hugh M. Smith, ichthyologist, Commissioner of Fisheries, 1913-22. Courtesy of his daughter, Mrs. J. E. Claudy. About 1935.

Dr. and Mrs. Smith occupied a five-room apartment, the so-called Commissioner's quarters, on the second floor of the residence building and frequently held receptions for the scientists in the large sitting and dining rooms of the first floor. This practice, established by Baird and continued by Commissioner McDonald, became a regular feature during the ensuing years. It gave a chance to beginners in science to meet and talk to the men who had already achieved success and occupied positions of importance and influence. The affairs, as I remember them, were informal, simple, gay, but at the same time dignified. Of small stature, always neatly dressed and speaking with a soft voice, Smith at Woods Hole seemed to us a different man from the person we saw occasionally in his imposing office in Washington. He received visitors and employees sitting in a large black leather chair behind a highly polished mahogany desk. As an official of high rank, he seemed polite but reserved, almost to the point of being cold and forbidding. At Woods Hole he was a different man--a fellow zoologist, with an inner drive to see nature with his own eyes; a person who loved to go in a small boat to seine for fishes or to observe the birds, which he knew as well as fishes and snakes. It was an inspiring experience to accompany Smith on a collecting trip to Menemsha Bight at Marthas Vineyard Island. He loved to go collecting there, particularly in August when southeastern winds brought in a number of southern fishes not found around Woods Hole at the other times of the year. Dressed in an old blue sweater, weather-beaten hat, and in long rubber boots, and a notebook with pencil stuck into the right boot leg, he was ready for action (fig. 30). He showed us how to use the small hand seine most effectively. The material was sorted on the beach right after each haul. The needed specimens were preserved, and the rest thrown back into the water while they were still alive. Upon returning to the Laboratory, the entire afternoon was spent in studying, measuring, sometimes in dissecting, the morning's catch. Fine points of taxonomy or structural peculiarities of fish were often explained. All his associates in the Laboratory of Woods Hole soon recognized the high mental and spiritual qualities that inspired respect and admiration. This feeling is well expressed in a letter sent to Smith by one of his subordinates (the Superintendent of the Woods Hole Station) on the occasion of his resignation. One sentence of the message reads as follows: "Here your visits have been looked forward to with pleasure, I think, because the MAN was so much larger than the boss, this notwithstanding the fact that the boss is one of the greatest in his class".

As a Commissioner of Fisheries from 1913 to 1922, Smith on several occasions defined the role of the Woods Hole Laboratory as a research institution for the Bureau. In the annual report

Figure 30.--H. M. Smith (center) on collecting trip to Marthas Vineyard. Left to right: F. E. Chidester, P. S. Galtsoff, H. M. Smith, R. A. Goffin, C. J. Fish.

of the Commissioner for 1916 (Smith, 1917, p. 45) he wrote: "The Woods Hole, Massachusetts, Laboratory is intended to serve as a nucleus for investigations of more direct reference to the New England and Middle Atlantic fisheries as well as for more technical investigations of general application. In some respects this establishment is better adapted for technical studies than any other laboratory of the Bureau, and it is hoped to improve the facilities for biophysical and biochemical studies that form essential phases of certain fishery investigations. The lack of a permanent scientific staff for this station causes its scientific operations to be confined largely to the summer season, when temporary professional services are most readily available." Consequently, the months of June to the first half of September were the period of greatest scientific activities. Inasmuch as the new fiscal year in the Government service begins on July 1 and the passage of the appropriation bill is frequently delayed, it is impossible to operate the laboratories on the prorated allowance made by Congress until the passage of the regular appropriation. On several occasions the situation became acute; for instance, at the beginning of the fiscal year 1913 the difficulty is described as follows: "A number of investigators had already reached the laboratories before it became apparent that the appropriations would not be available. Some of these were employed at reduced salaries and others elected to carry on work under the authority possessed by the Bureau to afford facilities to properly qualified investigators." (Smith, 1914, p. 31). The policy with respect to permanent scientific personnel remained unchanged until the reorganization of the Bureau after World War II.

Smith's association with the Woods Hole scientific community was resumed upon his return from Siam in 1935, when he became Associate Curator in Zoology in the Smithsonian Institution. He acquired property at the corner of Millfield and Gardiner Streets in Woods Hole and established a summer home there. Even while working on his monumental monograph of the fresh-water fishes of Siam, he had not lost interest in the Woods Hole fauna, and he was frequently seen in the laboratory of the Bureau of Fisheries. The descriptions of *Leiostomus xanthurus* and *Alectis crinitus*, both species new to Massachusetts Bay, were his last contributions to the ichthyology of the Cape Cod area.

Biologists working at Woods Hole during the summer of 1935 recall the interesting evening lecture delivered by Smith at the MBL auditorium. He described the aquatic life of Siam he had observed during the 12 years of his explorations. He gave vivid accounts of his close encounters with many poisonous snakes and of the biology of the Siamese fighting fish. Snakes frequently invaded his bedroom at night and found shelter in the sleeves of his coat. He told about the 12-foot python that lived under the