The Origins and Early History of the Steamer *Albatross*, 1880–1887

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Spencer Fullerton Baird (Fig. 1), a noted systematic zoologist and builder of scientific institutions in 19th century America, persuaded the U.S. Congress to establish the United States Commission of Fish and Fisheries[1] in March 1871. At that time, Baird was Assistant Secretary of the Smithsonian Institution. Following the death of Joseph Henry in 1878, he became head of the institution, a position he held until his own demise in 1887. In addition to his many duties as a Smithsonian official, including his prominent role in developing the Smithsonian's Federally funded National Museum as the repository for governmental scientific collections, Baird directed the Fish Commission from 1871 until 1887.

The Fish Commission's original mission was to determine the reasons and remedies for the apparent decline of American fisheries off southern New England as well as other parts of the United States. In 1872, Congress further directed the Commission to begin a large fish hatching program aimed at increasing the supply of American food fish.

Five years later, Baird served as the government's chief scientific witness during an international arbitration held at Halifax, Nova Scotia, Can., to determine how much the United States owed for the rights granted in the 1871 Treaty of Washington to fish in the territorial waters of Canada and Newfoundland. From the U.S. point of view, the $5.5 million award that the Halifax tribunal granted to Canada and Newfoundland was shockingly unjust and suggested that the fishing treaty should not be renewed when it expired in 1885. Another reaction was Spencer Baird's decision to initiate a Fish Commission program that gave direct aid to the nation's commercial fisheries, including efforts to locate new fishing grounds that were as far removed from British North America as possible (Goode, 1883:177–178; Allard, 1978:180–238).

While pursuing these utilitarian programs, Baird's Commission devoted each summer to basic biological and physical investigations of the northwest Atlantic. Initially, Baird's pioneering surveys concentrated on the coastal waters of New England. The village of Woods Hole, Mass., was the base for this work in 1871 and 1875 and in the years following 1881. But, during the first decade of the Commission's work, as Baird extended his investigation to cover most of New England's continental shelf, he established his laboratory at a number of other locations in the region, ranging from Noank, Conn., to Eastport, Maine.

Baird repeatedly argued that the basic knowledge accumulated through his investigations was essential for the solution of practical fishery problems (Allard, 1978:164–179). But some contemporary observers argued that scientific work, including the gathering of massive collections of specimens for Baird's National Museum in Washington, received undue emphasis by the Fish Commission (U.S. Congress, 1889:544–545, 655–656).

The objectives of the Fish Commission lay behind Spencer Baird's 1880 request to Congress for the ship that became known as *Albatross* (Fig. 2). American officials, still smarting from the Halifax award of 1877, recognized the importance of locating new banks and improving the productivity of existing grounds used by American fishermen. It is not surprising, therefore, that, in his initial lobbying with Congress, Baird stressed the need for a ship that could undertake exploratory fishing (USFC, 1884:xxiv).

In addition, Baird very much had in mind the value of the *Albatross* in exploring the deep waters of the Northwest Atlantic where an exciting new frontier of scientific discovery beckoned (Fig. 3). Of initial interest was a region of relatively warm water on the edge

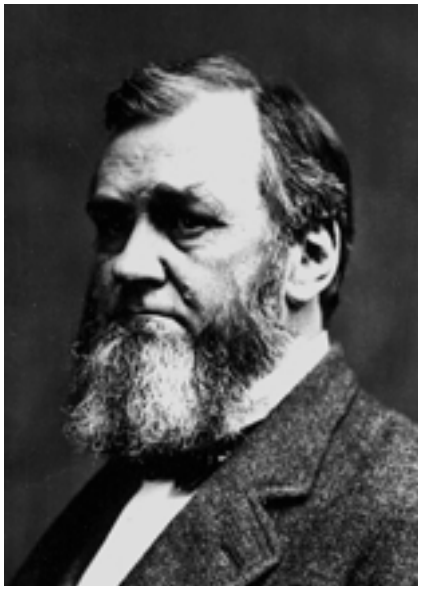

Figure 1.—Spencer F. Baird, founder and first Commissioner of the U.S. Commission of Fish and Fisheries and second Secretary of the Smithsonian Institution.

[1] Often referred to as the U.S. Fish Commission or just Fish Commission. For general accounts of Baird and the Fish Commission see Allard (1978), Dall (1915), Galtsoff (1962), and Rivinus and Youseff (1992).

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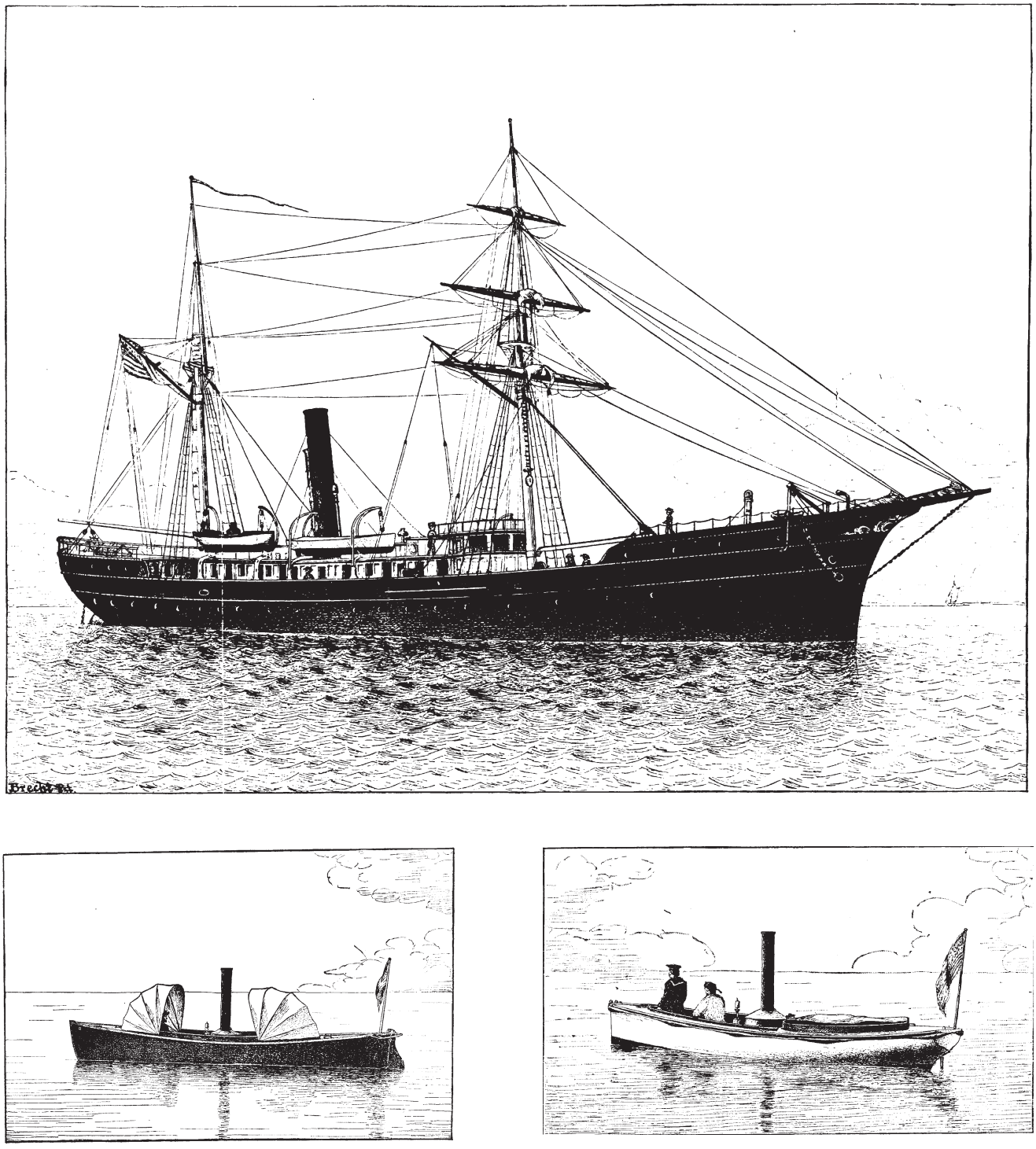

Figure 2.—A. The fisheries and oceanographic research steamer *Albatross*. B. The 25-foot Herreshoff steam gig. C. The 26.5-foot Herreshoff steam cutter. The *Albatross* also carried a 28-foot seine boat; a 26-foot whale boat; and an 18-foot, 2-inch dinghy.

of the Continental Shelf that the Fish Commission called the Gulf Stream Slope. The abyssal waters extending seaward of this area soon became another scientific target of the Fish Commission. Baird's new interests reflected the growing conviction by European and American scientists that the deep oceans contained an abundance of life.

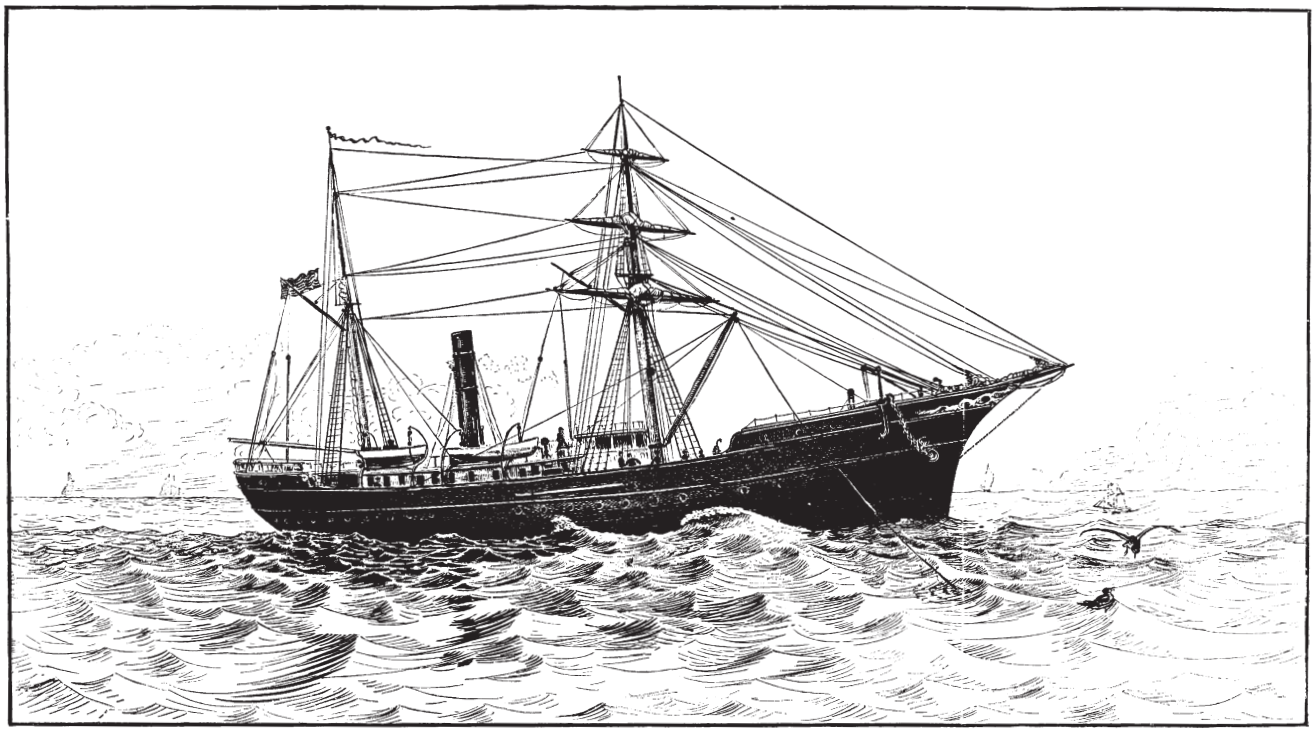

Figure 3.—The *Albatross* dredging.

Contributing to this belief was the material gathered during the round-the-world cruise of the British HMS *Challenger* in 1872–76.

During 1877–79, Alexander Agassiz made two cruises to the Caribbean and in 1880 one to Mid Atlantic and New England waters in the U.S. Coast Survey steamer *Blake*. Agassiz (1888) returned with valuable collections, some from as deep as 2,400 fathoms. During the same period, the *Speedwell*, a U.S. Naval ship assigned to Baird's Fish Commission, and the *Fish Hawk* (Fig. 4), a Commission hatchery vessel that could dredge in mid-depth waters, took rich hauls in the northwest Atlantic.

The excitement created by the fauna collected in 1877 from 144 fathoms by the *Speedwell*, at a point about 40 miles east of Cape Ann, Mass., was suggested by one of Baird's principal scientific assistants, George Brown Goode (Fig. 5). Goode exclaimed that "it seems incredible that American naturalists should not then have known that a few miles away there was a fauna as unlike that of our coast as could be found in the Indian Ocean or the seas of China[2]." Addison E. Verrill (Fig. 6), the Fish Commission's senior scientist, was equally impressed by the *Fish Hawk*'s collecting activity in 1880 in waters 100–500 fathoms deep and about 100 miles off Martha's Vineyard and Block Island. Verrill (1884:391) asserted that this area was "the richest and most remarkable ground ever discovered on our coast."

In 1881–82, Spencer Baird continued to use the *Fish Hawk* to dredge in waters as deep as 780 fathoms, primarily along the Gulf Stream Slope (Smith, 1888:915–932; Linton, 1915:741–744). But as soon as the *Fish Hawk*'s initial deep-sea work was completed in the fall of 1880, Baird decided to seek a far more capable research vessel. By December 1880 the Fish Commissioner could share his plans with Addison Verrill. Baird told his chief scientist that his new ship would have excellent laboratory spaces and scientific equipment, including "powerful hoisting engines" capable of working in waters as deep as 4,000 fathoms (Fig. 7). The Fish Commissioner specifically associated the *Albatross* with the exploration of the Gulf Stream Slope. As her later history revealed, however, the *Albatross* was equally capable of extended operations in any oceanic environment[3].

In his December 1880 letter to Verrill, the Fish Commissioner expressed pessimism that Congress would approve his proposal. Yet, despite his initial doubts, Baird mounted a skillful lobbying campaign that resulted in an 1881 Congressional appropriation for $103,000. By October 1881, Baird received the vessel's final plans from Charles W. Copeland, the New York City marine architect who had previously designed the Fish Commission's *Fish Hawk*. Bids

[2] Goode is quoted in Osborn (1901:22). For general background on deep-sea exploration in the 19th century, see Goode and Bean (1895:I, iii–viii) and Smith (1888:873–1017).

[3] Baird to Verrill, 7 Dec. 1880, USFC Letters Sent, Record Group 22, U.S. Natl. Archiv. A valuable overall source on the *Albatross* is Hedgpeth (1945) which includes a useful chronology prepared by Waldo L. Schmitt.

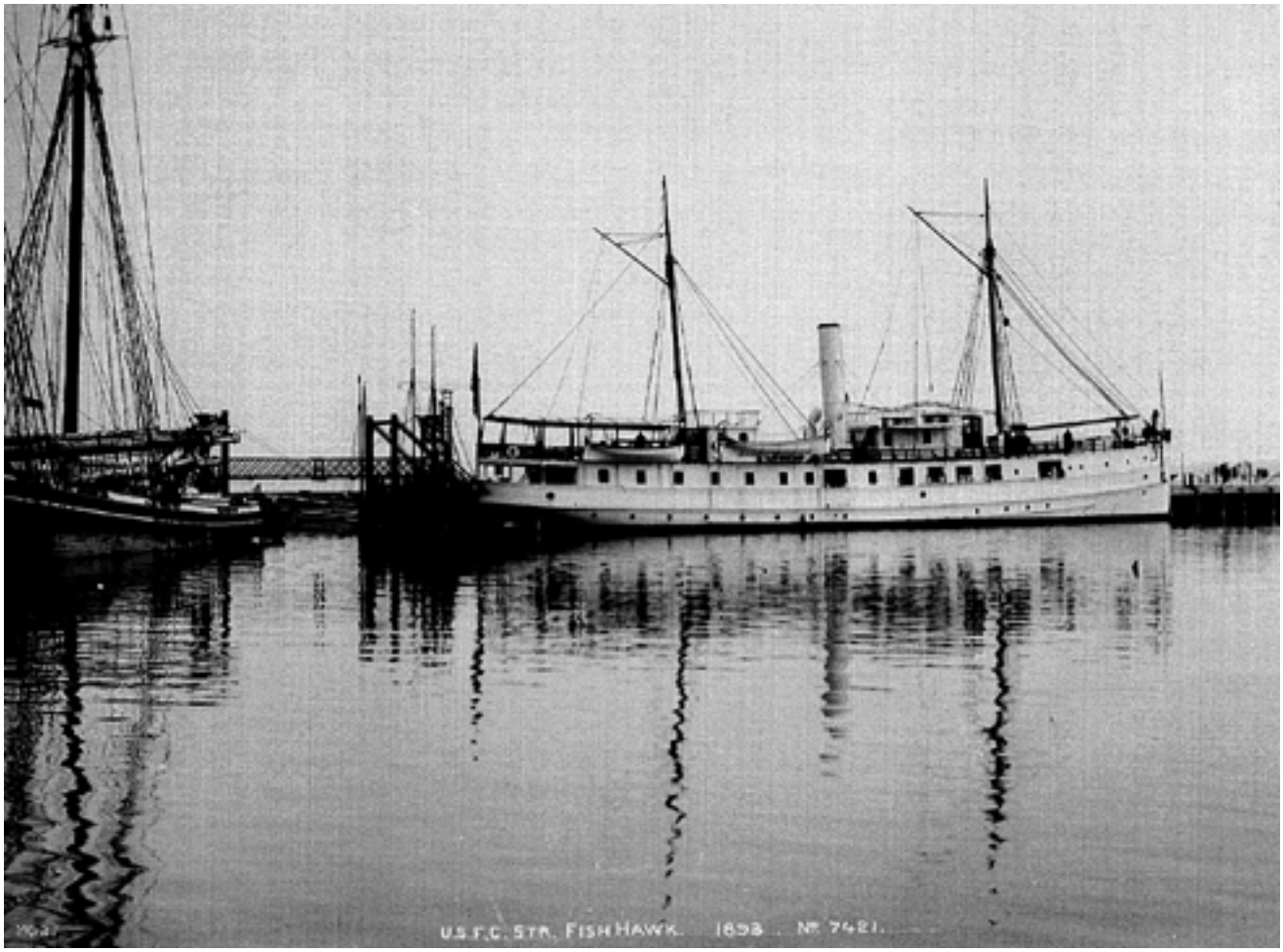

Figure 4.—The *Fish Hawk*.

Figure 5.—George Brown Goode, an assistant to Baird.

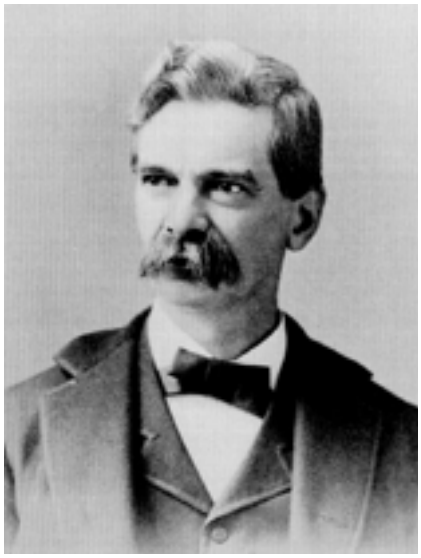

Figure 6.—Addison E. Verrill, a professor at Yale University.

then were requested from American shipbuilders. To Baird's profound disappointment, however, the lowest proposal received was for $129,500 (USFC, 1884:xxiv; Baird[4]).

Rejecting the option of using available funds to build a smaller vessel, the Fish Commissioner returned to Congress with a request for a supplemental appropriation. Pulling out all the stops, Baird listed six major contributions that *Albatross* could make to the nation:

1) Exploration and study of known fishing areas.
2) Location of new fishing grounds in the Atlantic, the Gulf of Mexico, and off the Pacific coast.

[4] Baird to Charles W. Copeland, 22 Oct. 1881, USFC Letters Sent, Record Group 22, U.S. Natl. Archiv.

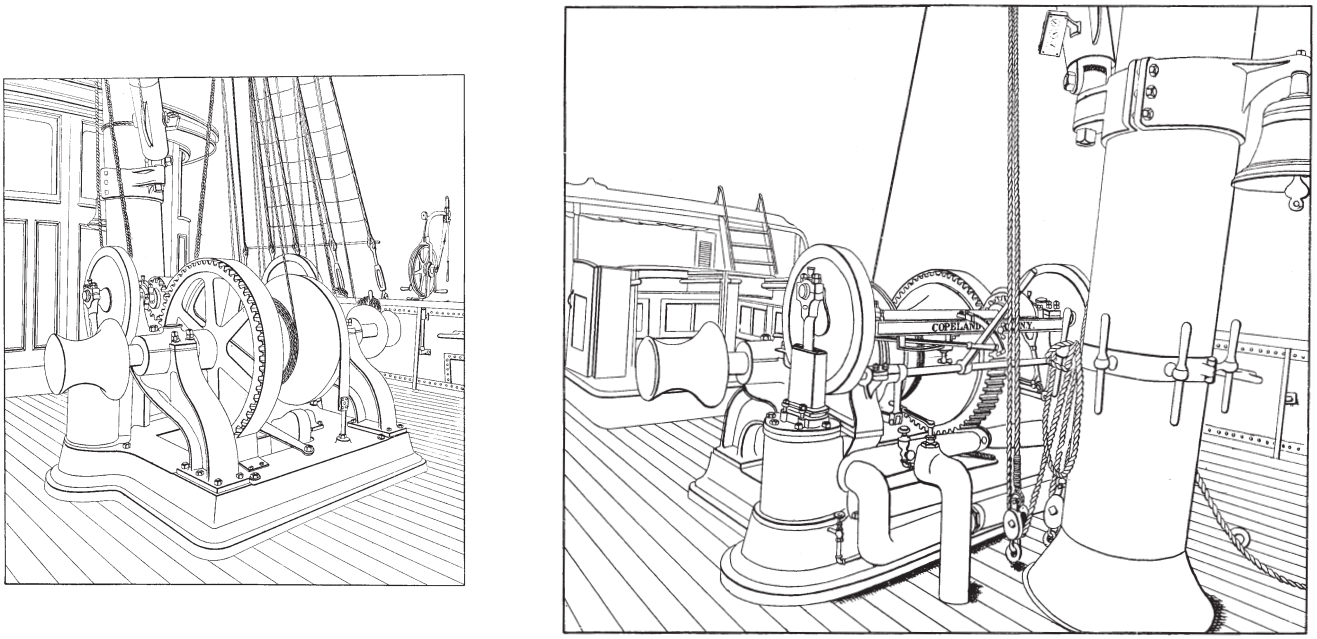

Figure 7.—The *Albatross* dredging engine views.

3) Major economic benefits would accrue to the nation's seafaring industry by increasing the yield of American fisheries.
4) The development of U.S. fisheries could make use of the British North American inshore fisheries unnecessary.
5) *Albatross* was a national security asset since, in case of need, she could be taken over by the Navy for use as a warship. In fact, this did occur during the Spanish American War and World War I.
6) And finally, Baird acknowledged his basic scientific interest when he stated: "As incidental to the economical inquiry, but of very great interest to the naturalist," the ship will collect "objects of natural history in large quantity otherwise unobtainable" (USFC, 1884a:xxv–xxxi).

In 1882 Congress once again granted Baird's request. In that year the Fish Commissioner not only received $42,000 in new funds for the ship, he also secured a $45,000 appropriation for the vessel's equipment. In all, a sum of $190,000 now was in hand to construct the *Albatross* (USFC, 1884b:xxvi–xxvii). Bearing in mind what this amount is worth in modern dollars, not to mention the great difficulty the U.S. Navy encountered during the early 1880's in obtaining appropriations for any new warship construction, one must be impressed by Baird's political skill in securing funding for the *Albatross*.

The Pusey and Jones Shipyard in Wilmington, Del., which previously built Baird's *Fish Hawk*, received the *Albatross* contract on 28 March 1882. Charles Copeland supervised the yard's work. He was assisted by Lieutenant Commander Zera L. Tanner, U.S. Navy, the prospective commander of the ship's Naval crew. That officer had considerable experience with marine exploration as the first commander of the *Fish Hawk* and through an earlier assignment with the Navy's Hydrographic Office.

Tanner was primarily responsible for selecting and installing—and in some cases personally designing—the trawl nets, rake and grapnel dredges, tangles, surface nets, and other collecting devices, as well as the ship's thermometers, salinometers, and sounding equipment (Fig. 8, 9) (Tanner, 1885; USFC, 1884b). According to Baird's associate, George Brown Goode (Goode and Bean, 1895: I,vi), the trawl nets carried by the *Albatross* were of particular importance since they represented a major advance in the ability to collect deep-sea specimens, a task previously undertaken with metal dredges.

Commissioned on 11 November 1882, the *Albatross* had her trial run from 30 December 1882 to 1 January 1883. She was the first large vessel specifically designed as a research vessel to be built anywhere in the world (Coker, 1949:43; Cotter, 1967:301). Writing in 1888, Alexander Agassiz (I, 51) noted another superlative of the ship. Pointing out that the vessel allowed the Fish Commission's exploration to extend "to the deepest waters along the American coast," Agassiz concluded that the *Albatross* was "the best equipped dredger for deep-sea work in existence."

The *Albatross* had an overall length of 234 feet, a maximum beam of 27.5 feet, and a displacement of 1,074 tons (Fig. 10). Her crew, minus the ship's scientific staff, numbered about 60 officers and men provided by the U.S. Navy. Constructed of wrought iron, the *Albatross* had twin screws and a maximum speed of 10 knots (Fig. 11). At her economical cruising speed of 8 knots, her maximum steaming radius was 3,200 miles. As was typical of oceanic ships

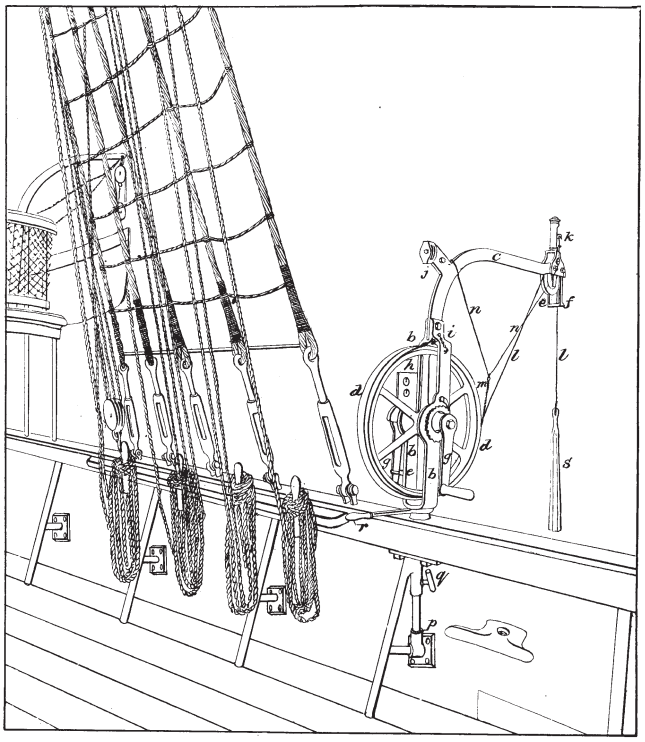

Figure 8.—The Tanner sounding machine.

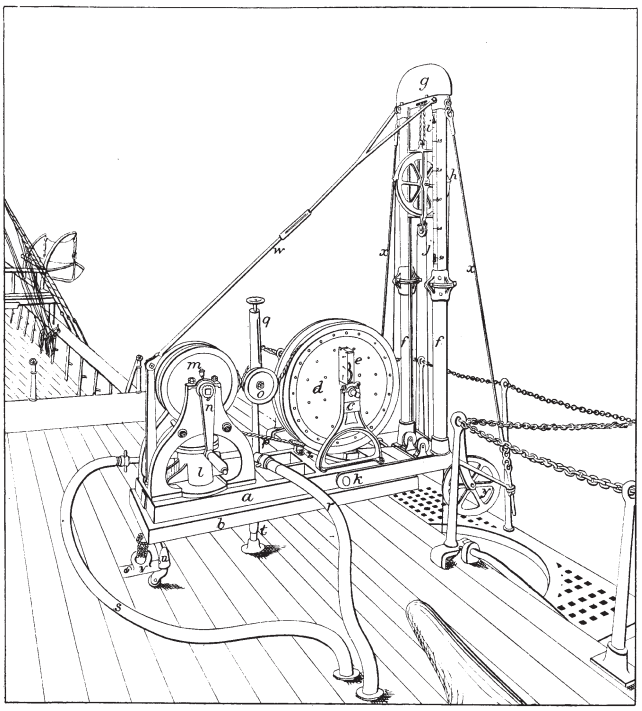

Figure 9.—Sigsbee's machine for sounding with wire, rigged for reeling in.

in an era when steam plants were still highly inefficient, she carried an auxiliary set of sails. The ship's deck logs show that sails were used frequently in the 1880's. In addition to her brigantine rig, a freshwater distilling plant allowed for prolonged maritime operations.

The *Albatross* had two relatively commodious laboratories (Fig. 12a, b, c), one on the main and the other on the berthing deck. She also had a pair of powerful dredging engines carrying 4,500 fathoms of 3/8-inch steel rope. Finally, her sponsors claimed that the ship was the first U.S. government vessel to be fully electrified (Fig. 13). This feature, as Lieutenant Commander Tanner pointed out, was especially important during prolonged deep-water dredging since these operations often could not be completed during daylight hours (Tanner, 1885:31–33; Tanner, 1895:107–124; Hedgpeth, 1945:6–8). Views of the cabin, chart room, pilot house, ward room, and berth deck are shown in Figures 14–18.

The *Albatross* began her distinguished career as a scientific vessel of the U.S. government—a history that would extend over the next 38 years—on 22 March 1883 when she established her first dredging station in 519 fathoms of water off the Mid Atlantic coast (Smith, 1889:934). As we know, many of the world's productive commercial fisheries are typically found in relatively shoal waters, rather than in the open ocean where this station was located. But, as previously noted, Baird made no secret of his desire to undertake a scientific survey of the ocean. He repeatedly argued that this knowledge was needed for its own sake, as well as for the understanding of commercial fishery issues. In addition to biological investigations, Baird recognized the importance of physical oceanography for both his applied and basic research programs. Hence, from the start, the *Albatross* took frequent soundings, tidal observations, bottom samples, temperature readings, and specific gravity and salinity measurements of the waters in which she operated (Schroeder, 1922: 160–161)

The *Albatross*'s primary mission during her first regular cruise in April 1883 was to study the movements of Atlantic mackerel, *Scomber scombrus*; Atlantic menhaden, *Brevoortia tyrannus*; bluefish, *Pomatomus saltatrix*; American shad, *Alosa sapidissima*; and other pelagic species during their spring migration northward of Cape Hatteras. At this time, the mackerel fishery had special importance[5] because of its great economic value and due to the fact that the mackerel was the major species caught by Americans in British North American waters under the controversial fishing treaty of 1871. But the mackerel was notorious, as Sabine (1853:184) commented, for being a "capricious and sportive fish, and continually changing its haunts and habits." Hence, any assistance that the *Albatross* could offer in locating schools of mackerel, particularly in U.S. or international waters, would be of value to American fishermen. The ship resumed her study of pelagic species in the fall of 1883 by attempting to track their southward mi-

[5] For the importance of the mackerel fishery see USFC (1884:xxv–xxxi).

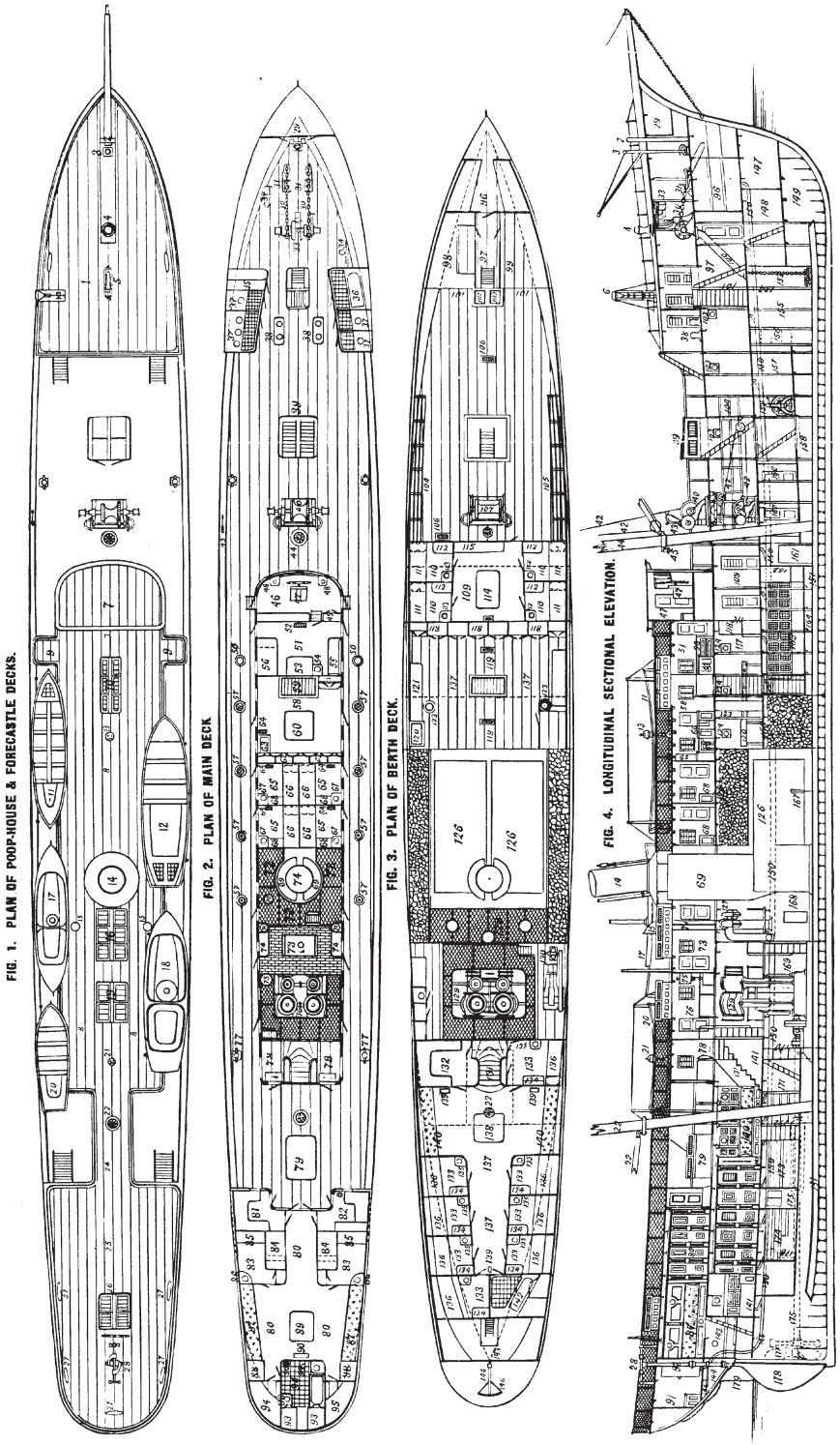

Figure 10.—Plans of the *Albatross*.

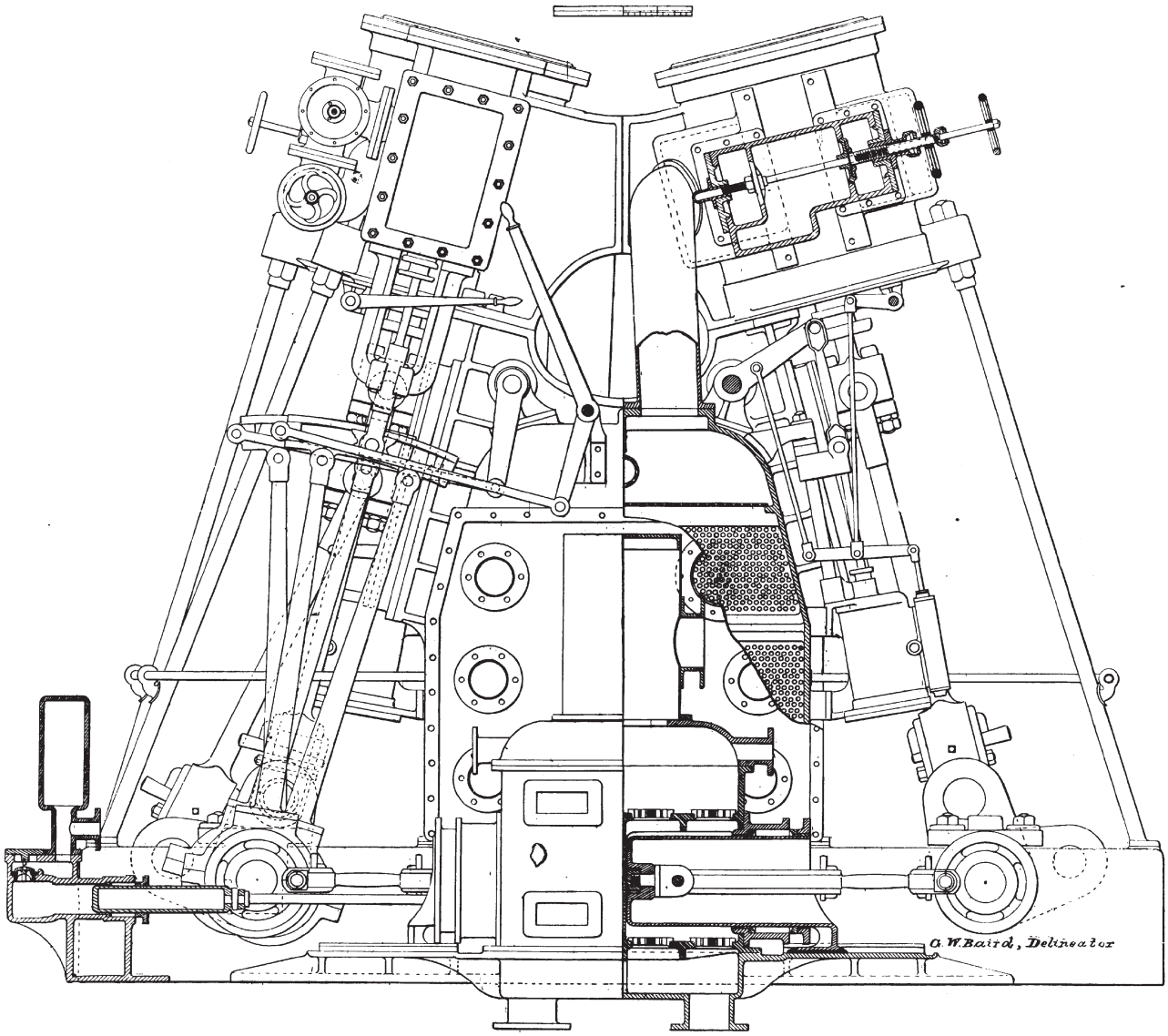

Figure 11.—Compound twin-screw engines of the *Albatross*.

gration from New England to the point where they disappeared for the winter in the deep waters off Cape Hatteras (Tanner, 1885:119–120, 154–165).

Another applied program of the ship was its effort to rediscover the tilefish, *Lopholatilus chamaeleonticeps*. In 1879, this previously unknown species was discovered by a Gloucester fishing captain in relatively warm New England waters 60–150 fathoms deep along the inside edge of the Gulf Stream Slope. Baird[6] once expressed private reservations about the taste of the tilefish, but, nevertheless, he and his Fish Commission colleagues touted it as a valuable food species comparable in quality to the Atlantic cod, *Gadus morhua*. Baird also asserted that the appearance of the tilefish demonstrated the value of exploratory fishing.

However, during the spring of 1882 there was a massive die-off of this species, apparently due to the intrusion of cold water into its grounds as the Gulf Stream slightly shifted its course. It was not until the early 1890's that the tilefish reappeared (Bumpus, 1899). Fortuitously, the tilefish grounds were in the Gulf Stream Slope region that was of so much basic scientific interest to Baird and his associates. After 1882 Baird could state that, in addition to his scientific agenda, the Fish Commission's investigations of that area were an attempt to relocate a valuable commercial species or at least to understand the reasons for the tilefish's disappearance (Bumpus, 1899:321–333; Herdman, 1923:178–181).

During the summer of 1883, the *Albatross* moved her base to Woods Hole. The ship's deployments from that port

[6] Baird to E. G. Blackford, 1 Sept. 1881, USFC Letters Sent, Record Group 22, U.S. Natl. Archiv.

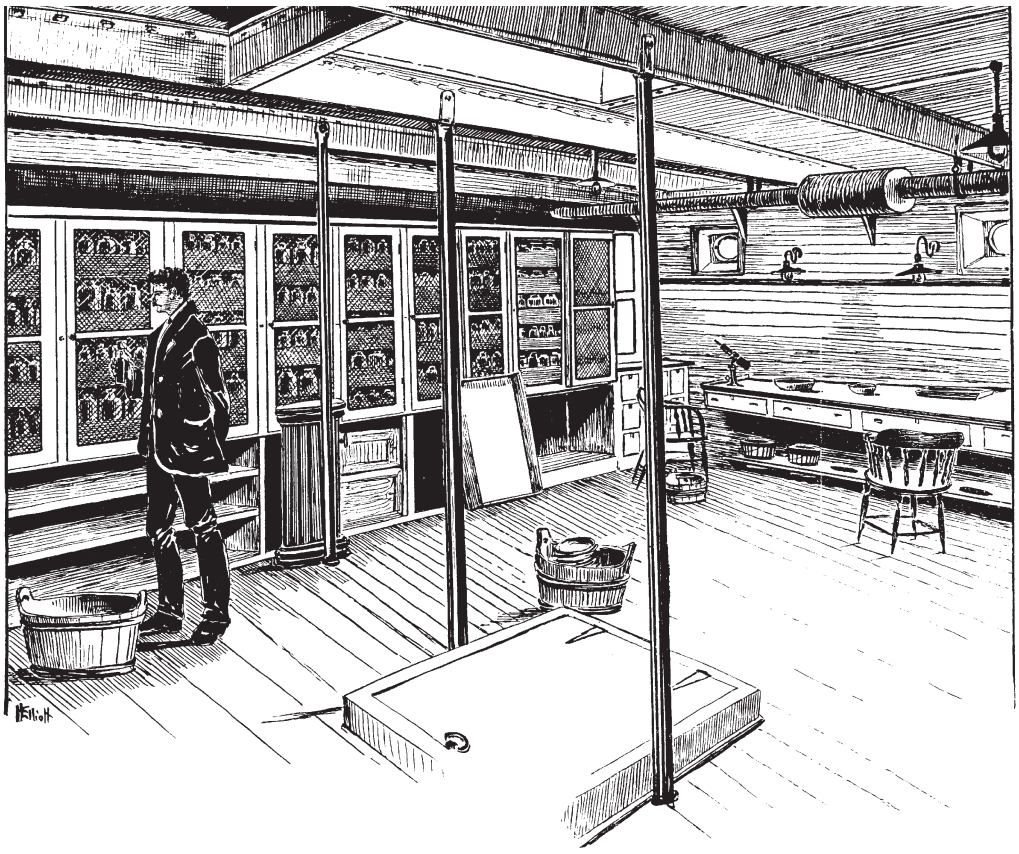

Figure 12a.—Lower laboratory, looking from aft forward.

revealed the fascination that the Gulf Stream Slope and the adjacent oceanic abyss held for the Fish Commission's scientists. In July, during the *Albatross*'s first cruise of the summer, the investigators on board included Edwin Linton, a young specialist in marine parasites. Linton gave a dramatic description of a night scene on the stern of the *Albatross* as the first trawl, which had been in the water for 6 hours, was hauled in from a depth of 1,400 fathoms under the illumination of the ship's electric lights.

None of the scientists present had seen deep-sea fauna, and they strained their eyes to detect the moment when the *Albatross*'s trawl broke the ocean's surface. Looking back many years after this event, Linton (1915:745–746) waxed poetic by suggesting that the surrounding darkness of that evening symbolized the profound ignorance of oceanic fauna that the light of science was seeking to dispel. Linton acknowledged that the net held only a relatively few forms. But, the naturalists present were profoundly impressed by the novelty of each species brought on board.

During this cruise the *Albatross* also established her deepest dredging station in the Atlantic phase of her career. The ship's record of 2,949 fathoms was set on 2 October 1883, several hundred miles off the Mid Atlantic coast in lat. 37°12′′N, long. 69°39′W. (Smith, 1889:936).

In 1883, the senior scientist at the Commission's summer laboratory in Woods Hole continued to be Addison Verrill. Other investigators included Verrill's brother-in-law Sydney I. Smith, a specialist in crustaceans and Verrill's fellow professor at Yale. Richard Rathbun, the chief curator for marine invertebrates at the National Museum, assisted Verrill in directing the Fish Commission's laboratory. The Fish Commission's embryologist, John Ryder, and Theodore Gill, a Washington-based ichthyologist, also were on hand. The permanent naturalist on board the *Albatross* was James E. Benedict. During the ship's research cruises, he typically was joined by other younger men including Edwin Linton, Sanderson Smith, Peter Parker, and Willard Nye.

The more senior members of the scientific corps tended to stay ashore at the Fish Commission's laboratory instead of going to sea with *Albatross*. But the specimens on which they based their work were collected by that ship and other Fish Commission vessels. Master sets of these governmental collections were destined for the Smithsonian's National Museum after being scientifically worked up by their assigned investigators. In addition, hundreds of duplicates were donated to American schools and museums in order to promote the study of marine biology, or they were traded with other museums[7] for desired scientific materials (Hedgpeth, 1945:16–17; Allard, 1978:329–338).

[7] For examples of Baird's extensive trading activities with other museums, see Baird to C. Lutken (Royal Zoological Museum, Copenhagen), 14 Feb. 1887; and Baird to E. Frey (Swiss Minister to the United States), 8 Mar. 1887, both in USFC Letters Sent, Record Group 22, U.S. Natl. Archiv.

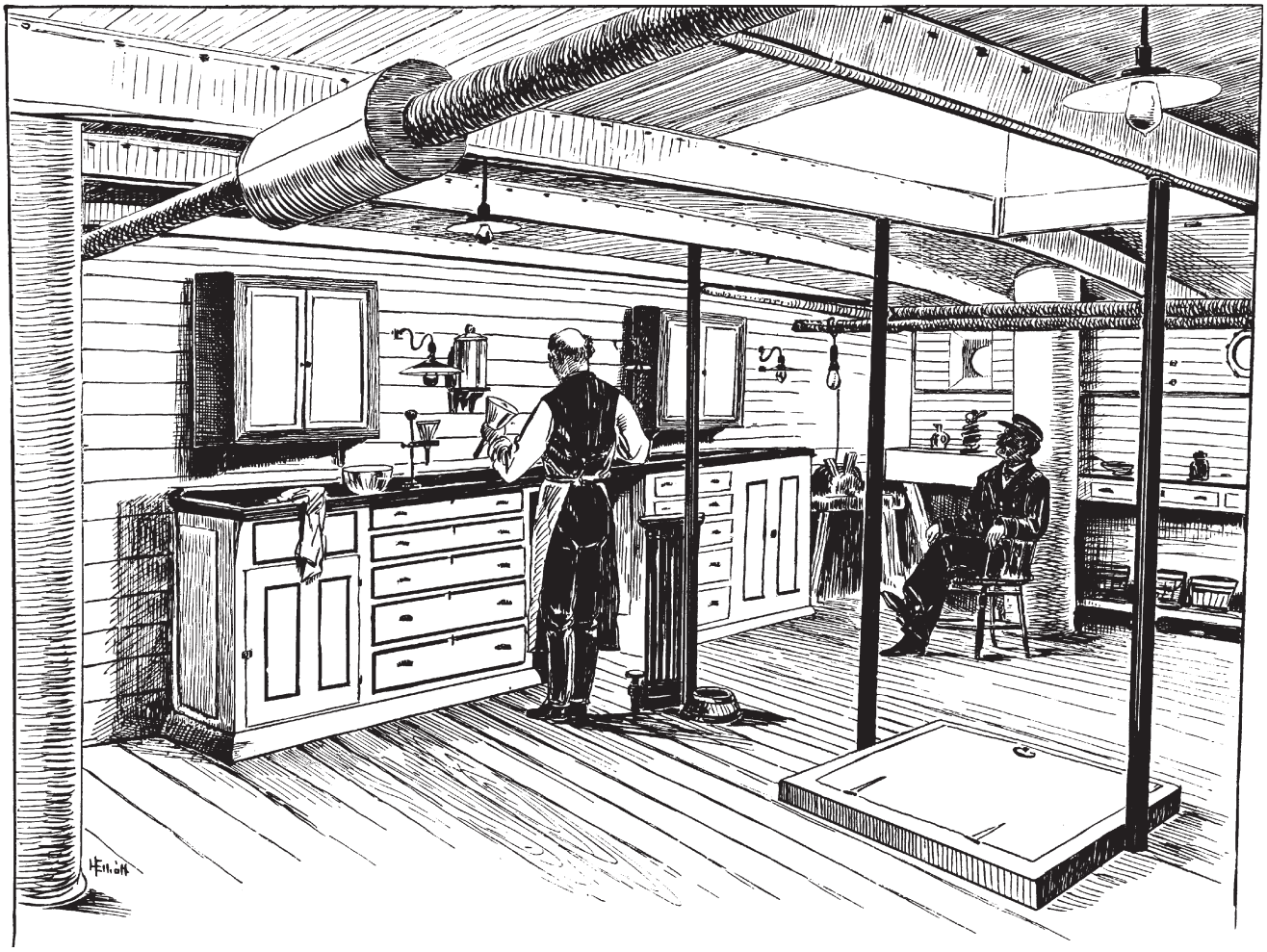

Figure 12b.—Lower laboratory, looking from forward aft.

The ship's association with Woods Hole was a consequence of Baird's decision in 1881 to locate his permanent field laboratory at that location. There were several reasons for Baird's choice. A base in southern New England was desirable because of its proximity to major fishing grounds. Baird also chose Woods Hole due to its relatively deep Great Harbor anchorage, the purity of the water in the Vineyard Sound–Buzzards Bay region, and the diversity of the fauna and flora that scientists could collect from the immediate region (Allard, 1978:329–338).

The Fish Commission's development of the Woods Hole station demonstrated once again Baird's ability to persuade Congress to fund major scientific initiatives. Overcoming the low priority that the Secretary of War assigned to the harbor improvements associated with his project, Baird obtained a March 1882 appropriation of $52,000 for the construction of piers, breakwaters, and other civil works needed for the Fish Commission's ships and for the operation of its hatchery and research programs. Between 1883 and 1885 he received additional appropriated funds in the amount of $65,000 earmarked for the construction of two buildings at Woods Hole. One contained biological and chemical laboratories and a fish hatchery, while the other structure was the residence and mess for his scientific corps (Fig. 19). Before these facilities were completed in 1884–85, the Fish Commission operated from a converted U.S. Lighthouse Board building on the shore of Woods Hole's Little Harbor that had been used since the Fish Commission began its work in 1871[8].

During the winter and spring of 1884, Baird loaned the *Albatross* to the U.S. Navy to undertake hydrographic surveys in the Caribbean Sea. These investigations confirmed the existence of a suspected underwater ridge stretching between St. Croix in the Virgin Islands and Puerto Rico, and located an extensive shoal (promptly named the Albatross Bank) east of Jamaica (U.S. Navy,

[8] The Secretary of War's position is indicated in Baird to Congressman S. J. R. McMillan, 8 Jan. 1883, USFC Letters Sent, Record Group 22, U.S. Natl. Archiv. For the development of the Woods Hole station see Allard (1978:321–323).

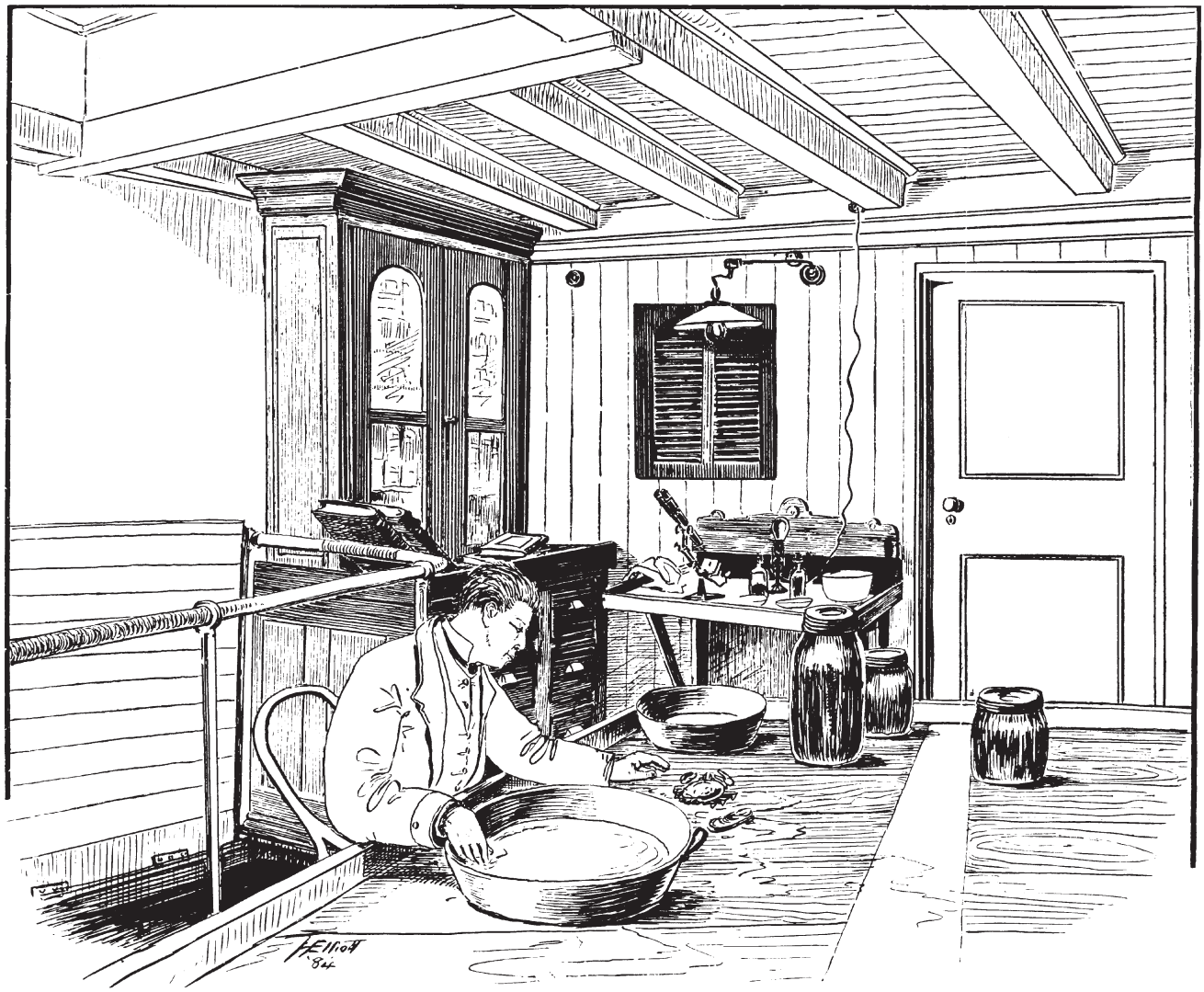

Figure 12c.–The upper laboratory.

1884:146–147). Equally important, according to the ship's navigator, these investigations proved the "non-existence" of a number of shoals reported by other mariners in this area (Smith, 1889:937). During the cruise, the ship's crew also had the secondary mission of collecting biological specimens. Then, from late July to early October of 1884, the ship proceeded to her summer base at Woods Hole. While en route to that location, the ship once again sought to trace the movements of pelagic species between Cape Hatteras and the Gulf of Maine.

But the focus of the *Albatross*'s summer activities was in the deep waters of the northwest Atlantic. Here, collections and data were obtained from waters as deep as 2,600 fathoms off the coasts of New England, Long Island, and New Jersey. Although Baird continued to observe that one of his purposes was to search for the tilefish along the Gulf Stream Slope, the fundamental contribution made by these oceanic operations was the illumination of the biological and physical characteristics of the deep-ocean environment (Tanner, 1886:78–79; USFC, 1886:xviii;xx)[9].

By this time, work was underway on two important research projects that used many of the materials gathered by the *Albatross*. One was the effort by Addison Verrill and his associates to study deep-sea invertebrates. Eventually this group published more than 100 papers, most of which appeared after Verrill ended his connection with the Fish Commission following Baird's

[9] Another basic source for the *Albatross*'s operations is the ship's deck log, 1 Jan. 1884 through Dec. 1887 (the author has not located earlier deck logs) held in Record Group 24, U.S. National Archives. Record Unit 7184 in the Smithsonian Institution Archives contains some of the ship's scientific logs for the 1880's. Periodic reports to Baird in 1883 and 1885, from James E. Benedict, the ship's resident naturalist, are in the Smithsonian's Record Unit 7438.

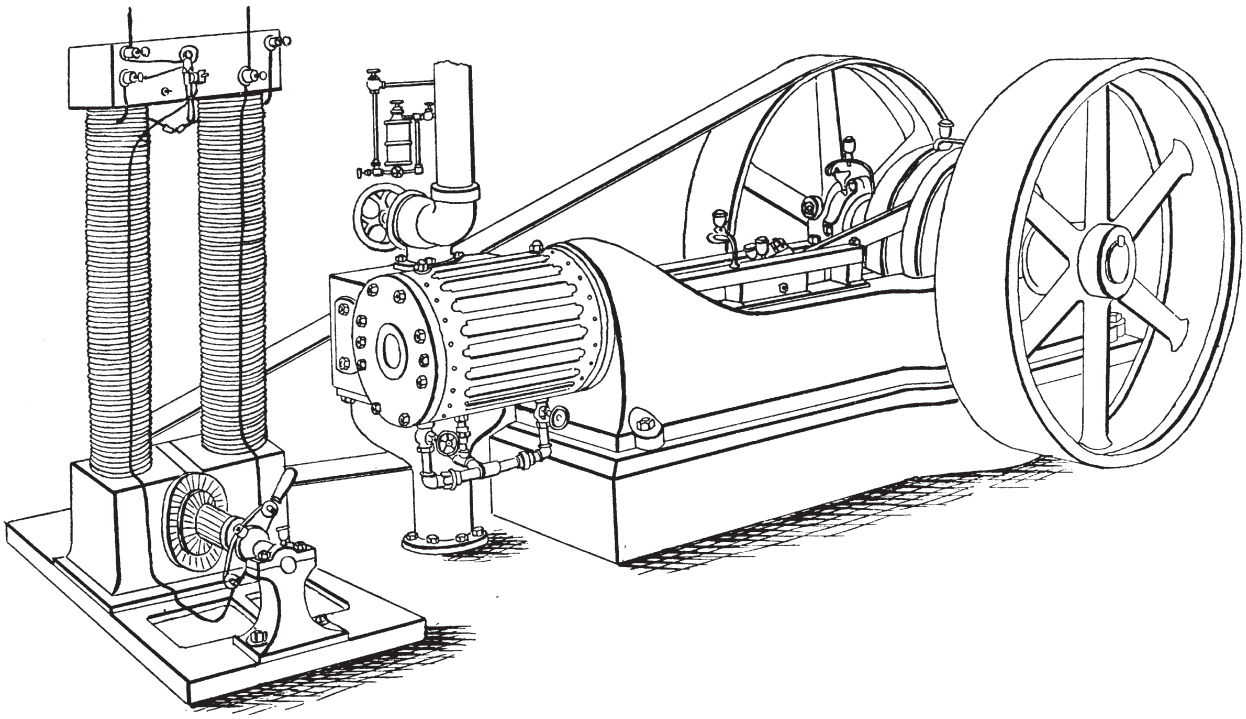

Figure 13.—The Edison dynamo and Armington & Sims engine.

death in 1887 (Schopf, 1968:F5–F10; Allard, 1978:337–338). The second undertaking was a two-volume work entitled "Oceanic Ichthyology," published by the Fish Commission and authored by George Brown Goode and Tarleton H. Bean (1895), two of Baird's associates at the National Museum.

Goode and Bean acknowledged the utility of the deep-sea specimens that Alexander Agassiz assigned to them after collecting these materials during the *Blake*'s 1880 cruise north of Cape Hatteras (Agassiz, 1888:I, xx). But they noted that their work rested primarily on specimens collected by the *Albatross*, supplemented by those from other Fish Commission ships and by Gloucester fishermen.

It is of interest that Goode and Bean (1895) questioned the scientific importance often ascribed to the famed cruise of the *Challenger* in 1872–76 (Allard, 1978:338–339). In the front matter to "Oceanic Ichthyology" they claimed that the 47 new genera and 147 new species of deep-water fishes described in their work were more numerous than all of the oceanic fishes collected by the *Challenger* during that ship's entire world cruise (Goode and Bean, 1895:I, v–vi).

Tensions between naval crews and ocean scientists that so often appear in the annals of oceanic exploration (the United States Exploring Expedition of 1839–42, commanded by the naval officer Charles Wilkes (Stanton, 1975), comes to mind[10]) seem to have been largely absent from the *Albatross*. Much of the credit for this happy situation needs to go to Lieutenant Commander Zera L. Tanner, who remained in command of the ship from 1882 to 1894. He was admired by the Fish Commission's staff as a bluff, ruddy-faced skipper who ran a taut but fair ship (Linton, 1915:749; Young, 1922:364–365). Tanner's fellow naval officer, Seaton Schroeder, the *Albatross*'s executive officer and navigator from 1882 to 1885, also commented on his captain's character by describing him as a "consummate seaman" with "a remarkable insight and balanced judgment regarding both men and things, coupled with an iron nerve and decisiveness" (Schroeder, 1922:160).

Tanner's marine skills were especially required when the ship deployed its large trawl nets in deep waters. During these operations, a constant strain needed to be maintained in order to prevent the trawl's steel cable from parting during the four or more hours required to complete a deep-water operation (Washburn, 1886:20–21). One *Albatross* scientist later claimed that Tanner never severed a dredge line (Townsend, 1924:620). But this is an exaggeration since, on at least one occasion in August 1885, the cable did part, resulting in the loss of more than 3,000 fathoms of wire rope plus the entire beam-trawl assemblage. On other occasions, trawl nets came up empty due to the failure of *Albatross*'s crew to place these devices on the ocean floor[11].

[10] Another example of commanding officer-scientist acrimony was the conflict in 1902 between a later commander of the *Albatross* (Chauncy Thomas, Jr.) and the naturalist Charles Henry Gilbert, as reviewed by Dunn, 1996.

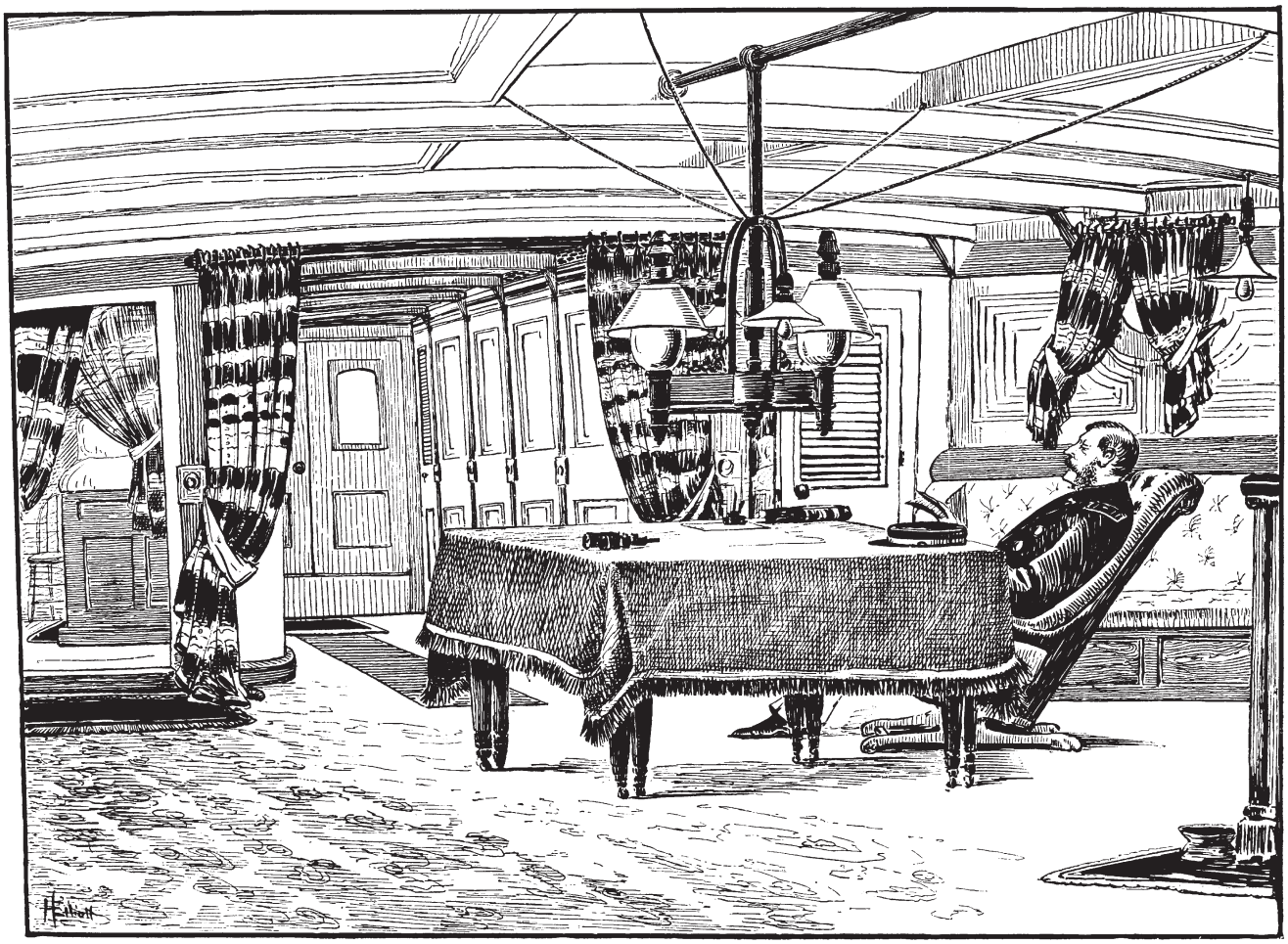

Figure 14.—The cabin.

Nevertheless, there is no doubt that the captain and his crew had notable operational skills. Tanner, himself, generously gave much credit for this situation to the vessel herself. He once described *Albatross* as having special strength and sea-worthiness; the ability to "lay-to" in heavy seas, while recovering its scientific gear, without shipping water over the bow or stern; and having an "easy motion under all circumstances [that] was necessary to the safety of the steel-wire dredge rope" (Tanner, 1895:117; Schroeder, 1922:165–166) (Fig. 20).

At the same time, it must be acknowledged that the *Albatross* had one major operational problem. Almost from the time of the ship's commissioning, it became clear that the ship's boilers were faulty. By 1884, the ship's engineer, Passed Assistant Engineer George W. Baird, U.S. Navy, reported that metal fatigue was the culprit for the many boiler leaks that required the crew to make almost constant repairs[12].

The *Albatross* began her third year of operation in January 1885 when she sailed from the Washington Navy Yard for a winter cruise in the Caribbean Sea. As was typical, Baird's letter of instruction to Tanner directed that he combine practical with scientific work[13]. Initially the ship collected specimens and hydrographic data off Cuba, Mexico's Yucatan Peninsula, and the U.S. Gulf coast. Then, the ship proceeded to an International Exposition in New Orleans, La., where many visitors came on board. Additionally, in another effort by the Fish Commission to expand American fisheries, the *Albatross* surveyed known fishing grounds and located a productive, new red snapper bank near Cape San Blas on the west coast of Florida (Tanner, 1887:3–26; USFC, 1887:xxvi–xxviii; Schroeder, 1922:166–167).

[11] *Albatross* Deck Logs, 30 Aug. 1885 and 22 Aug. 1886, Record Group 24, U.S. Natl. Archiv.

[12] Tanner's annual reports (USFC, 1884–87) often included separate accounts by Engineer Baird. There was no family relationship between this naval officer and Spencer Baird, according to Linton (1927:10).

[13] Baird to Tanner, 9 Dec. 1884, USFC Letters Sent, Record Group 22, U.S. Natl. Archiv.

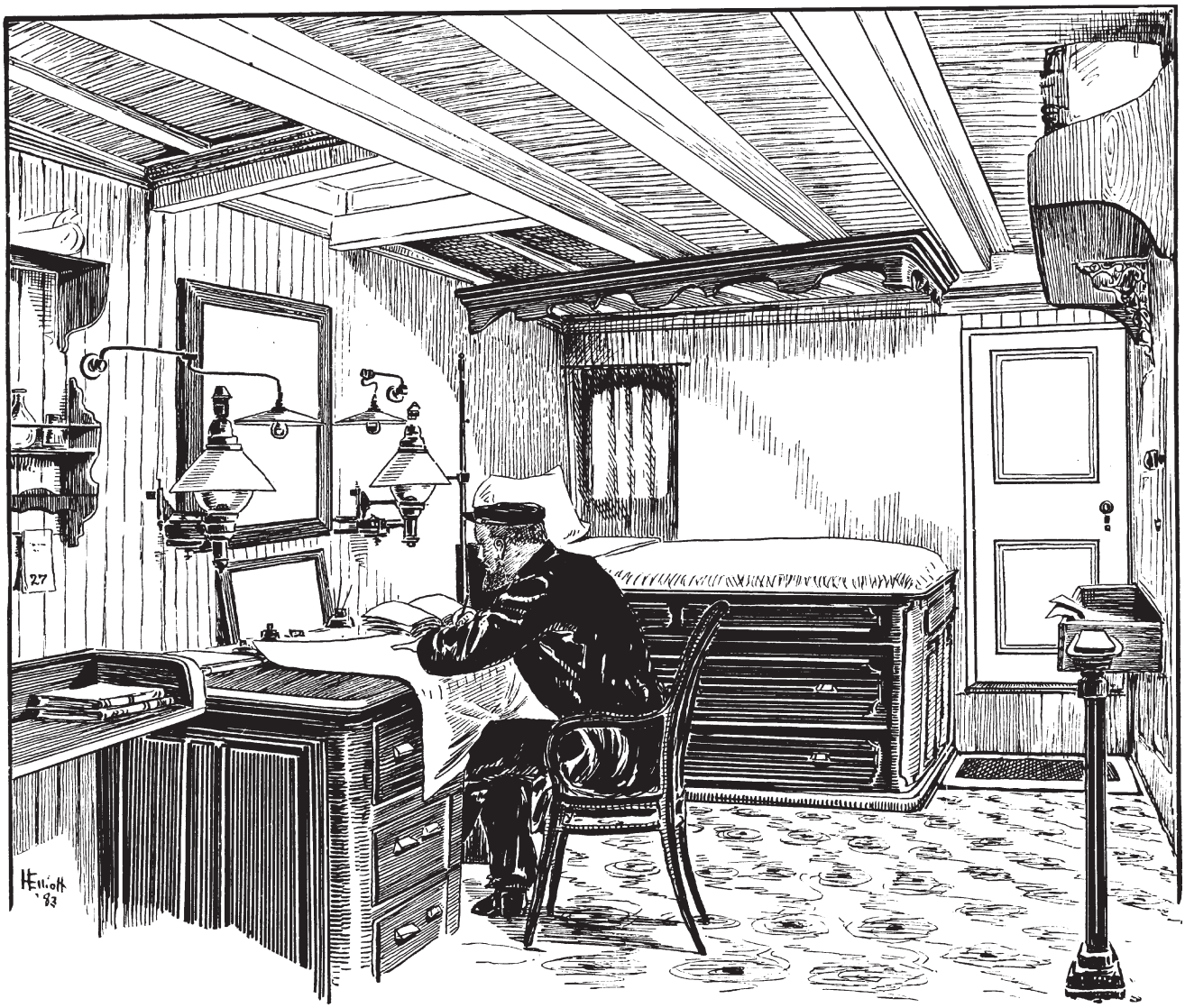

Figure 15.—The chart room.

Following a now-familiar pattern, the *Albatross* deployed for the summer of 1885 in northern waters, using Woods Hole as her base. Initially the ship cruised in the Grand Banks region collecting hydrographic data for a new contour map of those highly productive fishing banks. Joseph W. Collins, the Commission's commercial fishing expert, personally directed this work. Later, the vessel operated in deep oceanic waters off the Continental Shelf.

Fish Commission spokesmen continued to state that the *Albatross* was searching for the tilefish, but this was not Baird's only motivation. During one of her cruises out of Woods Hole, the ship logged 11 deep-water stations with an average depth of 1,923 fathoms, yielding numerous bottom specimens. As was typical in *Albatross* operations during this period, plankton also was collected by surface nets, continual hydrographic observations were made, and readings were obtained of the ocean's specific gravity, salinity, and temperature. In addition to the scientists named previously, the Fish Commission's investigators during the summer of 1885 included Leslie A. Lee, a naturalist from Bowdoin College, and William Libbey, Jr., a Princeton physical oceanographer (Tanner, 1887: 27–62; NCAB, 1931:140–141; Deck Log[14]).

On her return to Washington, D.C., in October 1885, the *Albatross* undertook a limited investigation of the Gulf Stream region off the Delaware and

[14] *Albatross* Deck Log, June–Oct. 1885, Record Group 24, U.S. Natl. Archiv.

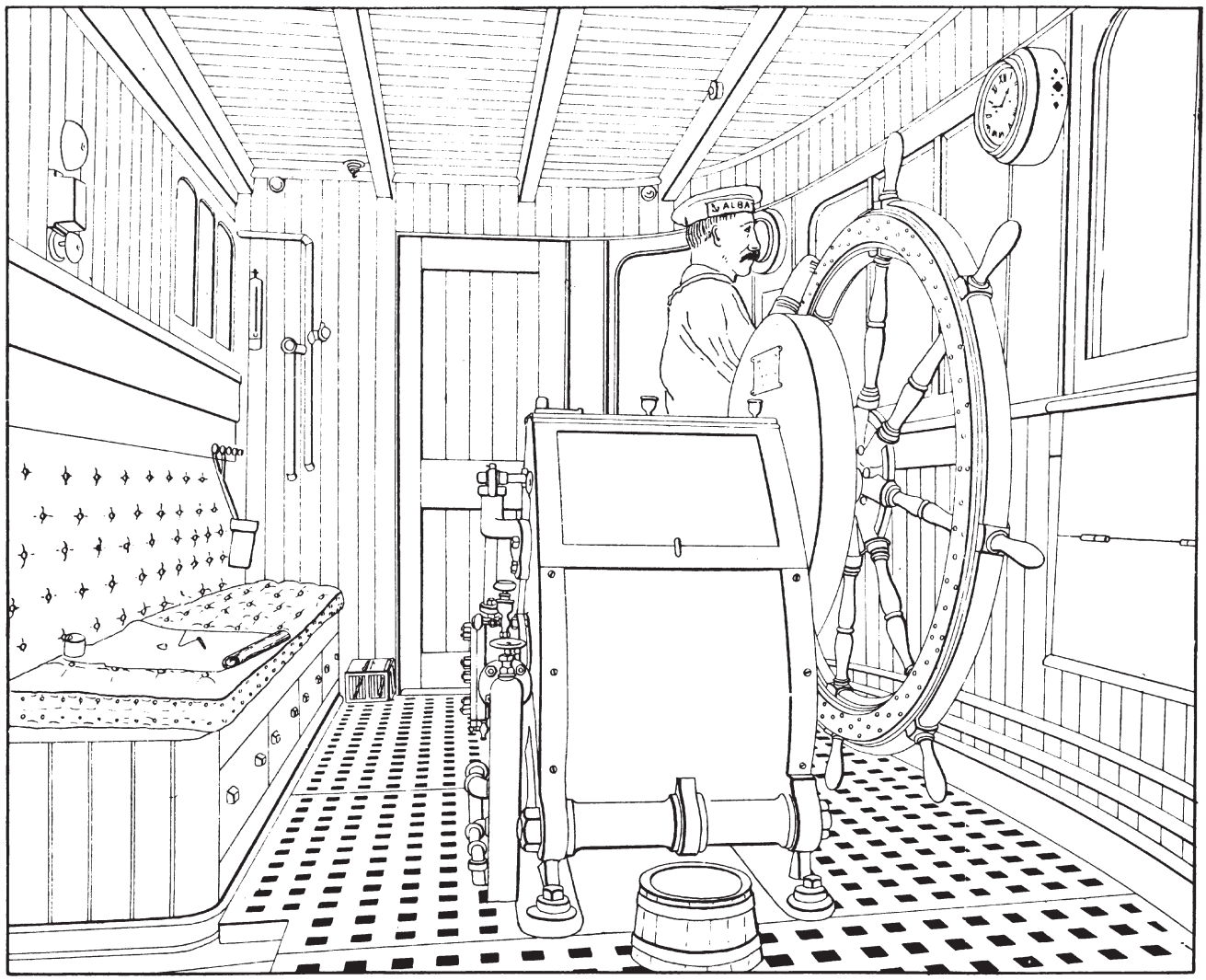

Figure 16.—Interior of the pilot house, steam steering room.

Chesapeake Capes and Cape Hatteras[15]. Aside from its scientific purpose, this activity probably was associated with Baird's interest in the spring and fall migrations of coastal pelagic species. Nevertheless, a later Congressional investigation of the Fish Commission alleged that Spencer Baird never "thoroughly planned" an inquiry into this subject (U.S. Congress, 1891:70–71).

The ship's 1886 winter cruise was funded jointly by the Navy and the Fish Commission. The *Albatross* cruised mainly in the Bahamas area to collect hydrographic data. Baird also directed the ship's crew to determine if the Bahamas were the winter home for the pelagic fish species that appeared each spring off the Mid Atlantic coast, but no evidence to support that theory was found. However, useful data were collected for the Commission on the sponge fisheries off Nassau. Productive hauls of biological specimens also were taken from the Straits of Florida and in the Gulf Stream south of Cape Hatteras (Tanner, 1888:605–606; USFC, 1892:x–xi).

In the summer of 1886, the ship returned to New England. After a cruise to the Gulf Stream Slope in July, Baird assigned the *Albatross* to investigate possible uncharted shoals near the cod and halibut banks off Nova Scotia and Newfoundland. Those banks were not confirmed. In September and October 1886, the *Albatross* deployed from Woods Hole to once again explore the deep waters stretching seaward of the Continental Shelf. Research stations were established in waters as deep as 1,867 fathoms where Zera Tanner reported that a "vast amount of material" was collected. The ship returned to the Wash-

[15] *Albatross* Deck Log, Oct. 1885, Record Group 24, U.S. Natl. Archiv.

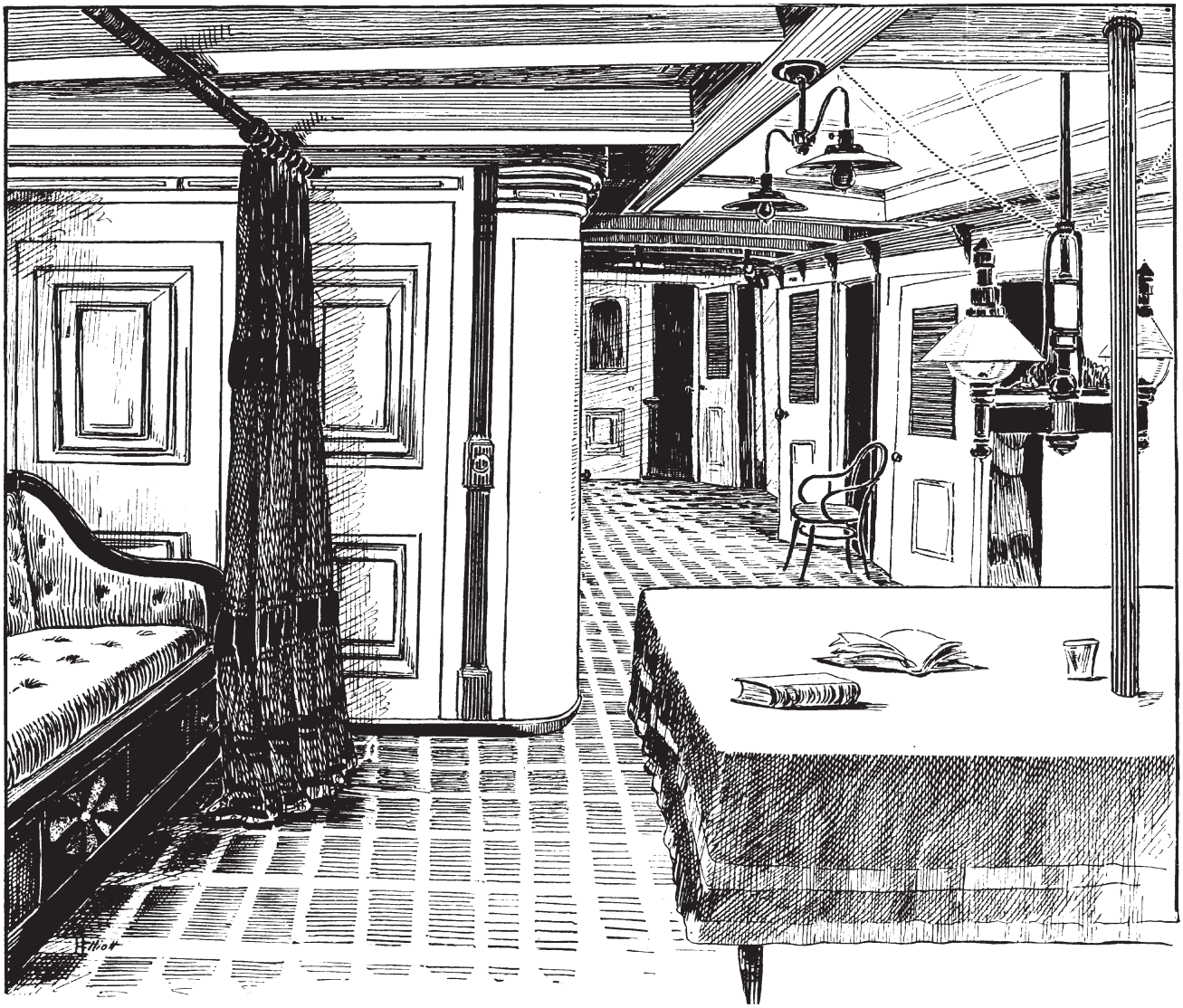

Figure 17.—The ward room.

ington Navy Yard in late October (Tanner, 1888:622–623, 668; USFC, 1892: xi–xii).

Another event in 1886 had a major impact on the future of the *Albatross*. In obtaining Congressional approval for the *Albatross* 5 years earlier, Spencer Baird specified that his ship could be useful in expanding American fisheries in the Pacific, as well as in the Atlantic and Gulf of Mexico. Following up on this suggestion, the Commissioner requested funds for the ship's transfer to the U.S. west coast, especially to study the area from "California northward to Alaska," where Baird noted that the fisheries were almost "totally undeveloped." Congress approved this proposal in August 1886. At the same time, Congressional funds were provided for the replacement of the defective boilers that had plagued Commander Tanner and his crew since 1883 (U.S. Congress, 1887:2, 23).

The *Albatross* remained in a prolonged repair status throughout the first 9 months of 1887 in preparation for her cruise to the Pacific. The ship was at the Washington Navy Yard until May when she shifted to the Columbian Iron Works in Baltimore for the boiler work. The ship's naval engineer, George W. Baird, personally designed the replacement boilers and supervised their installation.

The challenges so often involved in ship maintenance are revealed in Engineer Baird's official report. He was deeply frustrated when the Columbian Iron Works took twice as long as originally estimated to complete its job. The engineer's anxiety was heightened by the tense labor relations at the shipyard. The unionized Columbian Iron Works workers, resentful that naval crew members undertook some of the work associated with the installation of the new boilers, constantly threatened to strike. Nevertheless, a work stoppage

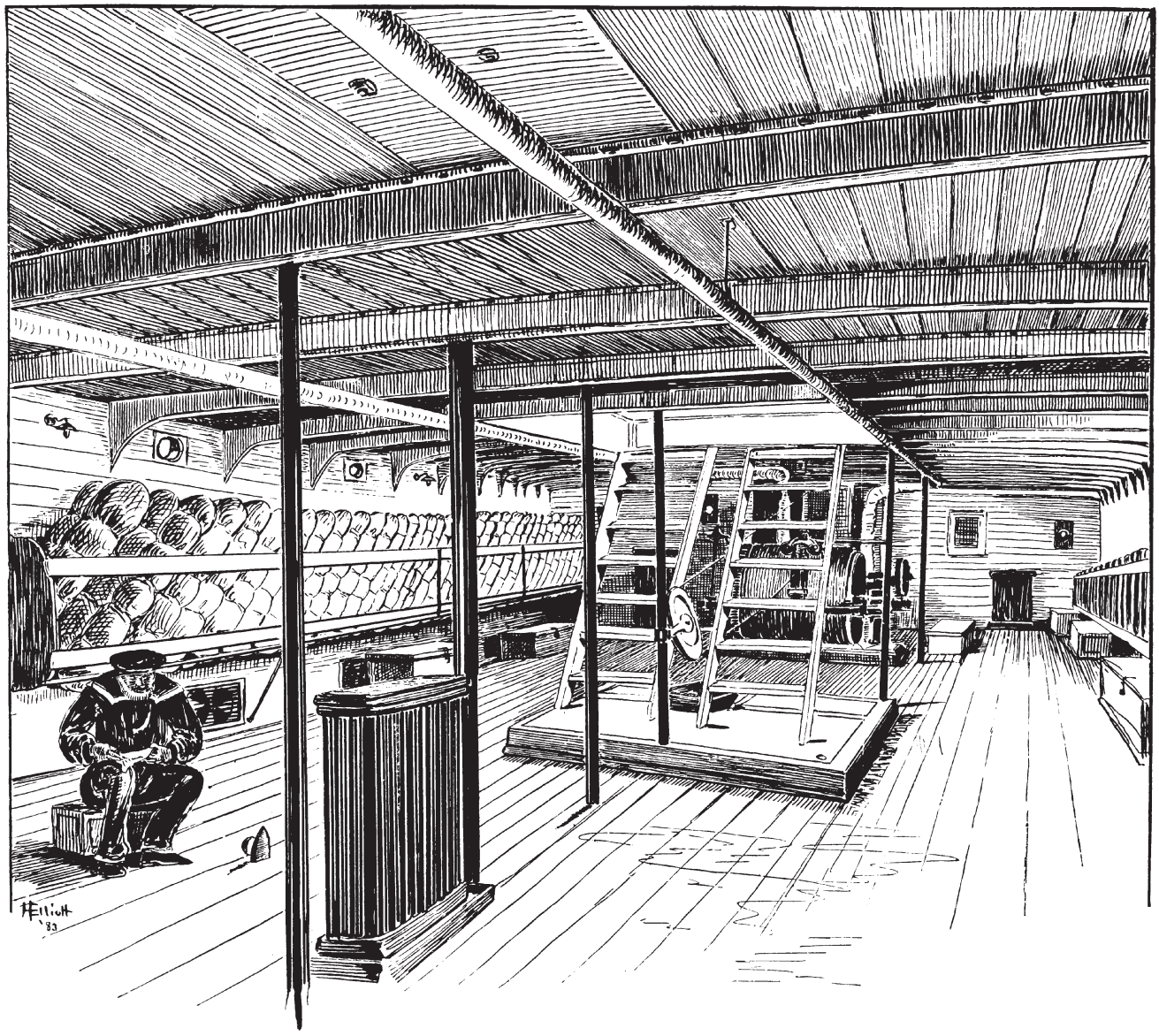

Figure 18.—The berth deck, looking from forward aft.

was avoided, and to Engineer Baird's intense relief, in September 1887 the boilers were finally in place and tested[16].

One month earlier, Spencer Baird had died in Woods Hole, and in November 1887, the *Albatross* took her own departure from the Atlantic. In a 7-month, 16,000-mile voyage, she sailed from Norfolk, Va., cruised down the South American east coast, transited the Straits of Magellan, shaped a northerly course for the Galapagos Islands, and finally reached her destination in San Francisco, Calif., on 11 May 1888.

It is fitting that, during her long transoceanic voyage, this pioneering research vessel carried a scientific party led by Leslie A. Lee, who, with his associates, established more that 125 dredging and hydrographic stations (Hedgpeth, 1945:18). This work was a preamble to the distinguished scientific contributions made by the ship in the Pacific Ocean for the next 30 years.

After being taken over by the Navy during the Spanish American War and again in World War I, the *Albatross* once again served as a research vessel in the Caribbean and Atlantic until finally decommissioned in 1921; Mooney (1991:135–138) provides an overall history of the *Albatross*.

[16] Engineer Baird's account is in Tanner (1890:418–435); see also USFC (1889:lii–liv).

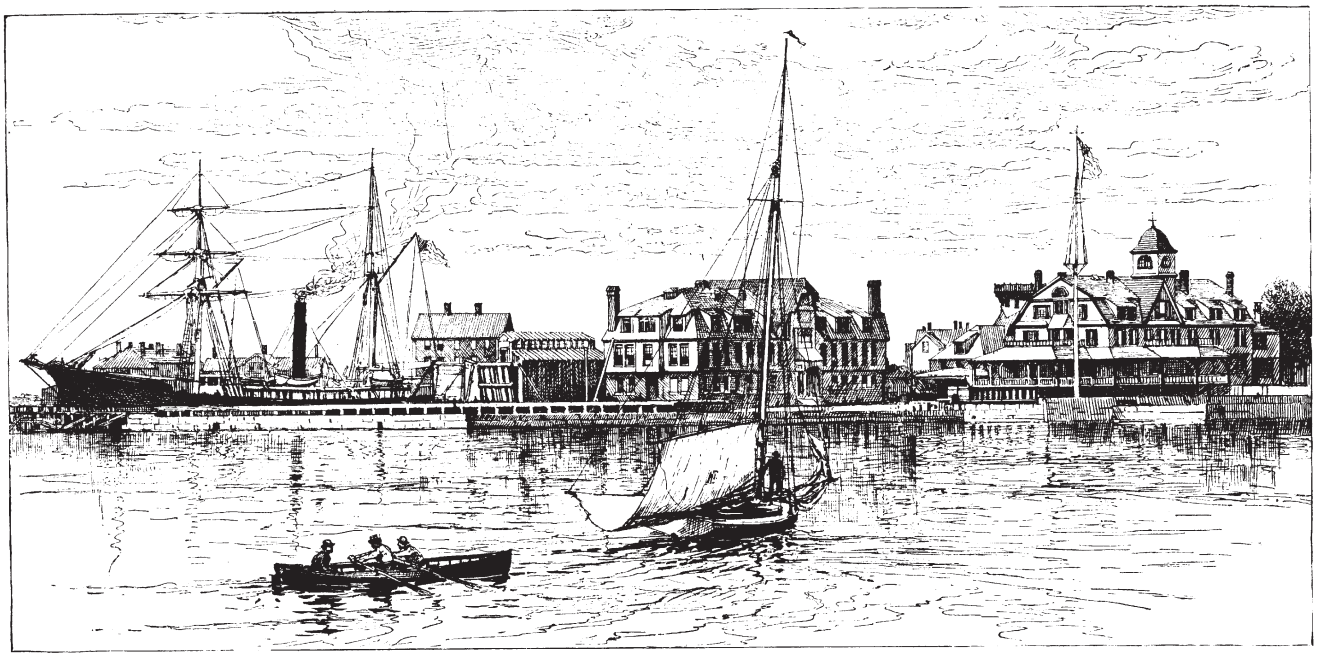

Figure 19.—The Woods Hole station of the U.S. Fish Commission, ca. 1886. At left is the *Albatross*, center is the laboratory building, and the residence is on the right.

Three general points may be made in taking stock of the early years of the *Albatross*'s history. First, the story underscores Spencer Baird's importance as a builder of institutions that promoted the study of science in 19th century America. In forming the U.S. Fish Commission, Baird recognized that research in the earth's little-explored oceans had great scientific value (USFC, 1873). He also knew that this type of activity required more than interested individual researchers; it also demanded the resources that only a relatively large organization could provide.

In modern terms, one could say that a "big science" approach was essential. The Commissioner's pronounced political skills made it possible for him to obtain the authority and funds, as well as the involvement of the U.S. Navy and other government agencies, that allowed the Fish Commission to become one of the world's leading research institutions in the ocean sciences. His ability to build the *Albatross*, widely recognized as the world's first large purpose- built research vessel, was of particular importance as marine scientists shifted their attention to deep oceanic waters (Allard, 1978:348–350, 353–355).

Secondly, the *Albatross*'s early history reflects the scientific distinction of the Baird program. There is little doubt that he viewed the Fish Commission's basic scientific survey of the Northwest Atlantic as having primary importance (U.S. Congress, 1891:66–67; Rathbun, 1892:680). It is equally clear that his simultaneous investigation of the biology, physics, and chemistry of the seas revealed a sophisticated approach to ocean science. In fact, the validity of his agenda continues to be recognized by modern scientists. For example, John Hobbie, the current Co-Director of the Marine Biological Laboratory's Ecosystems Center in Woods Hole, has stated that Baird was one of the pioneers in ecology who created "new approaches to questions of interactions of organisms and their physical, chemical, and biological environment." Hobbie concluded that Baird set modern fisheries research "off in an holistic, ecological direction" (Galtsoff, 1962:11; Allard, 1990:269).

Baird's pursuit of applied projects in support of American fisheries, such as his search for new fishing grounds, also revealed the Fish Commissioner's willingness to intermix practical programs with abstract science. This approach reminds one of David Starr Jordan's observation that Spencer Baird had a "theory of utility in science" in which "knowledge loses nothing through acquiring human values, and research takes on a certain dignity by serving at once intellectual demands and human necessities" (Jordan, 1922:I, p. 287).

Thirdly, the activities of the *Albatross* are an essential component of the pioneering survey of the northwest Atlantic that was undertaken by the U.S. Fish Commission between 1871 and 1887 (Allard, 1997). The relative intensity and sustained nature of this work are worth particular notice since, as Robert Cowen (1960:46) once observed, most oceanographic work in the 19th Century was based on "scattered soundings, samplings, and dredgings" that revealed only the "gross characteristics" of maritime areas. The validity of Cowen's observation is revealed in Table 1 which shows the limited number of research stations established by other expeditions of this period, including

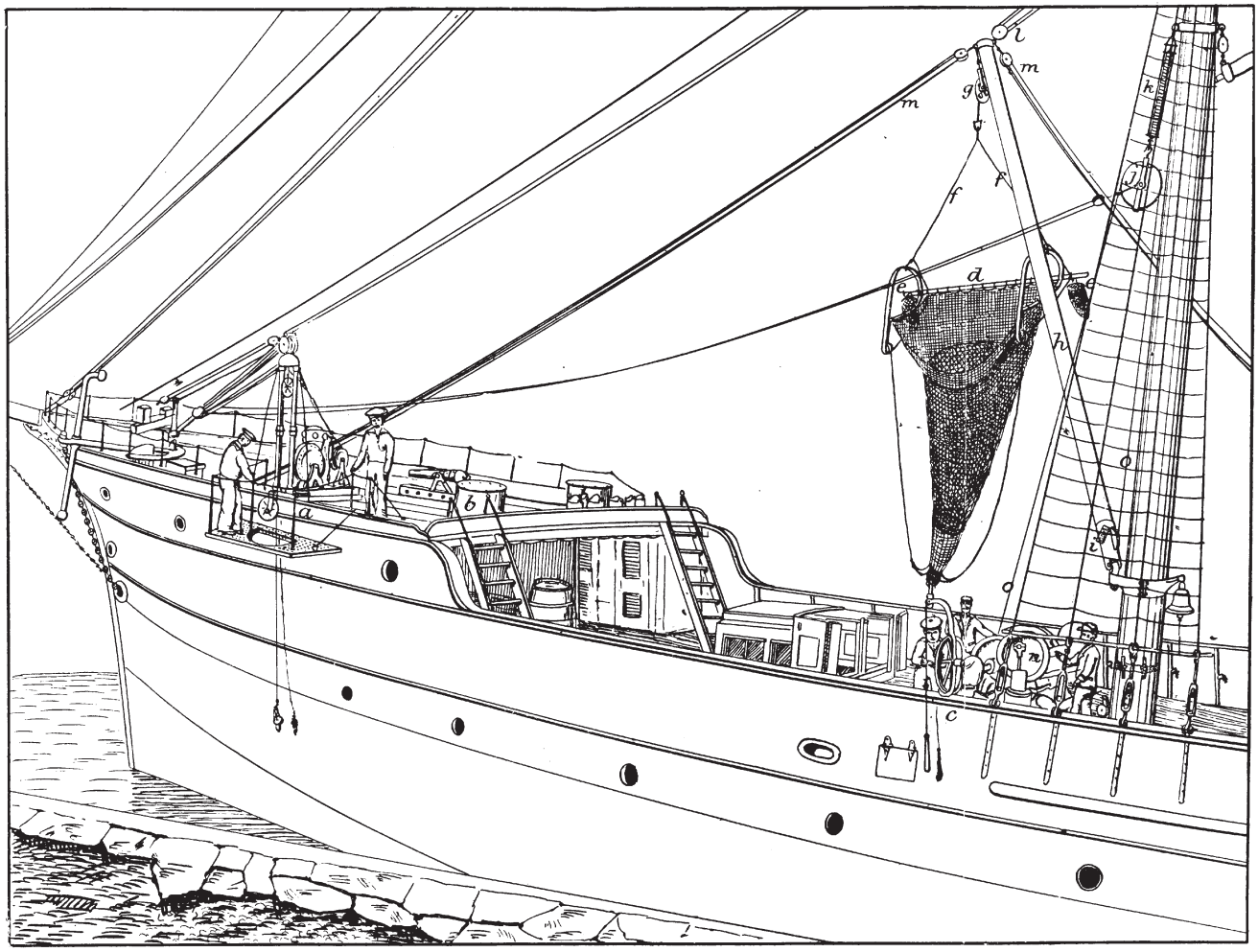

Figure 20.—The bow of the *Albatross*, showing the location of the dredging boom and sounding machine.

the relatively small number of Atlantic stations logged by the HMS *Challenger* during her circumnavigation of the world during 1872–76.

Yet, in comparison to the activity of the *Challenger*, as well as to the cruises made by Louis and Alexander Agassiz in U.S. Coast Survey ships and various contemporary expeditions in European waters, Table 1 demonstrates that the U.S. Fish Commission undertook a sustained program over a period of 17 years featuring more than 2,000 dredging stations concentrated in the northwest Atlantic.

During the 1870's, those investigations focused on the coastal shelf of New England. When the *Fish Hawk* became available in 1880, that ship investigated mid-water depths especial-

Table 1.—Dredging stations, 1871–87 (Source: Smith, 1889).

	Number of stations	
Agency, vessel, and cruise	North of Cape Hatteras	South of Cape Hatteras
U.S. Fish Commission, 1871–87		
Various ships assigned, 1871–79	1,075	
Fish Hawk, 1880–82	385	
Fish Hawk, 1883-87	96	
Albatross, 1883-87	518	230
Total	2,074	230
Agassiz-associated U.S. Coast Survey Ships, 1867–72, 1877–80		
L.F. Pourtales cruises, 1867–72		258
A. Agassiz in *Blake*, 1877–80	48	288
Total	48	546
Other Operations, 1867–83		
Lightning and *Porcupine*, 1867–70	194 stations north of the U.K.	
Challenger, 1872–76	About 180 in N. and S. Atlantic	
Swedish Arctic Expeditions, 1875-79	190 in Arctic Waters	
Le Travailleur, 1880–83	198 in Eastern Atlantic and Mediterranean	
Talisman, 1883	156 in Eastern Atlantic	

ly along the Gulf Stream Slope. The role of the *Albatross* after 1883 was to extend the Commission's survey into Atlantic abyssal waters in depths that approached 3,000 fathoms.

It should not be forgotten that the *Albatross*'s 748 biological dredging stations were in addition to the 1,088 hydrographic stations established by the ship between 1883 and the fall of 1887. Unlike her biological work, however, the ship's hydrographic activity was concentrated in waters south of Cape Hatteras (Smith, 1889; Hedgpeth, 1945:16–17).

The U.S. Fish Commission statistics in Table 1 support the validity of an 1891 assertion by the Johns Hopkins University biologist William Keith Brooks[17]. That scientist—a former student of Alexander Agassiz, a designated specialist for some of HMS *Challenger*'s collections, and the mentor of several prominent members of a new generation of American biologists—claimed that the Fish Commission's survey represented the first governmental effort anywhere in the world "to undertake the exhaustive scientific exploration of the ocean." Further, Brooks asserted, the Commission's "lead has been followed by most of the maritime nations of Europe." He added that "most of the machinery and apparatus which these foreign countries have employed has been modeled after that which has been devised and used by our Fish Commission" (U.S. Congress, 1891:544–545).

In summary, the *Albatross*'s work was the deep-sea component of the Fish Commission's historic survey of the northwest Atlantic between 1871 and 1887 that so impressed Professor Brooks. The ship's early years in the Atlantic demonstrated the major importance of the *Albatross* and should remind us of the U.S. Fish Commission's overall contributions to the annals of marine science during the era when it was directed by Spencer Fullerton Baird.

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[17] For information on Brooks, see Allen (1978: 36–50).

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