Cruises of the *Albatross* off San Diego and Other Parts of Southern California, 1889–1916

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Introduction

When the U.S. Fish Commission steamer *Albatross* was reassigned to the Pacific coast in 1888, a key mission was to study the aquatic life and hydrology of Pacific waters. Although it may be overly simplified to state that little was known of the scientific aspect of these aquatic resources, this was an accurate assessment. The Pacific coast had been explored for centuries, but not necessarily with fisheries science as a focus. The Spanish had the longest record of coastal exploration, but ship crews typically did not include artists, illustrators, or scientists until the eighteenth century. Even then, the term "scientific investigation" typically referred to depth soundings or botanical observations (Cutter, 1963). There were some observations of terrestrial animals and observations of the customs of Native Americans, but essentially these voyages concentrated on nonaquatic observations.

When early investigators noted aquatic animals, it was usually related to commercial value (Kelsey, 1984). British ships often carried along naturalists, but American vessels were largely concerned only with commercial products, such as sea otters, *Enhydra lutris*; northern fur seals, *Callorhinus ursinus*; and Pacific salmon, *Oncorhynchus* spp. Residents of California had localized knowledge of some fish species and certain invertebrates (e.g. abalone, *Haliotis* sp.; spiny lobster, *Panulirus interruptus*) but, when the *Albatross* arrived in 1888, a large gap remained in knowledge about aquatic resources of the Pacific coast. The contributions of the *Albatross* and its crew are particularly renown for investigations of fur seal and Pacific salmon fisheries in Alaska and the discoveries from several long trans-Pacific voyages. But investigations in waters of southern California, particularly near San Diego, also had significant impacts on scientific knowledge.

Early Investigations

The *Albatross* arrived in California in the spring of 1888 after a long voyage around Cape Horn. Stopping in San Diego Bay on the way northward, the crew went aboard a Chinese fishing junk that was anchored there (Fig. 1), but otherwise did no scientific studies, other than the typical soundings, weather, and temperature recordings that had been part of the sailing routine. This stop in San Diego Bay was brief; the ship sailed to San Clemente Island (Fig. 2), then northward to San Francisco, arriving in May 1888. But the *Albatross* would return to San Diego and other parts of southern California on numerous occasions over the next quarter century. In over one-third of the years that the *Albatross* cruised the Pacific, it conducted scientific investigations in and around San Diego Bay. The typical pattern for many years was to visit Alaska or the Pacific Northwest in summer months and southern California or Baja California in winter months.

Those investigations began in January 1889 when the *Albatross* traveled to the Santa Barbara Channel (Fig. 3). Sablefish, *Anoplopoma fimbria,* and several species of rockfish, *Sebastes* spp., were collected with trawls (longlines), and naturalists also went ashore on some of the Channel Islands. On Santa Rosa Island, they collected birds and an endemic fox, (the Santa Rosa gray fox, a subspecies of the gray fox, *Urocyon cinereorgenteus*), as well as some human skulls and skeletons—one of them in almost perfect condition (Tanner, 1892). Charles Gilbert reported "a great number of ancient human remains exposed on a strip of drifting sand 200 yards in width, extending from Carrington Point to the sea, a distance of about three-quarters of a mile," with numerous broken stone mortars (Tanner, 1892). Of particular note, however, was the almost total absence of life in the surface waters of a transect extending between one of the islands and the mainland. This was un-

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ABSTRACT—Between 1889 and 1916, the U. S. Fish Commission steamer Albatross *made numerous trips to waters off southern California, particularly in and near San Diego Bay. The typical pattern for many years was to conduct cruises in waters off the Pacific Northwest or Alaska in summer months and waters off southern California in winter months. The* Albatross *conducted the first depth soundings and benthic profiles for southern California waters and secured the first samples of many endemic marine animals of this region.* Albatross *collections formed the basis for numerous definitive monographs of invertebrates and vertebrates that were published in subsequent years. The* Albatross *anchored in San Diego Bay in 1894, conducting the first biological investigations of the bay, and returned to sample again in many subsequent years. The ship and its crew also examined Cortez and Tanner banks for exploitation potential and conducted the first biological investigations of southern California's tuna stocks in 1915 and 1916.*

Figure 1. —Members of the *Albatross* crew aboard a Chinese fishing junk anchored in San Diego Bay, spring, 1888. Photograph courtesy of the National Archives, College Park, Maryland.

explained by season or other factors, but the scientists concluded that the condition was likely a consequence of natural oil seepage (Tanner, 1892): "The presence of petroleum, which may be seen forming a thin film over the surface waters of the channel, may have something to do with it."

A. B. Alexander, the Fishery Expert on board, also noted "extensive 'slicks'" on the surface, caused by petroleum bubbling up through the water. "Oil is frequently reported by the fishermen and sea captains in this vicinity, sometimes in small patches and at others covering large areas." (Alexander, 1892). Alexander theorized that the presence of oil also may have affected the presence and movements of migratory fishes.

The scientists investigated the potential for oyster culture in Alamitos Bay and Newport Harbor, recording physiochemical conditions, then extended a transect west from Pt. Loma (the western border of San Diego Bay) and explored Cortez Bank—known to local residents but largely unexplored or exploited (Fig. 4). The *Albatross* produced the first accurate maps of the Bank, helped in large part by the presence of Bishop's Rock. The Rock was only 3–4 m deep, with waves often breaking overhead, so the ship could accurately orient and map the area around it. A number of fish species were captured, including two giant sea bass, *Stereolepsis gigas,* that weighed 70 and 86 kg (Alexander, 1892).

The investigators concluded that Cortez Bank's rich fauna was a promising offshore fishing ground on the California coast south of San Francisco (Tanner, 1892). It had heretofore remained unexploited because of the low demand for fish and the lack of appropriate fishing gear. At the time, fish brought only 3–4.5 cents per pound. Thus, the added expense of traveling to an offshore bank, however rich, was not justified economically. Add to this, California commercial fishermen did not have the more sophisticated gear used by those on the U.S. east coast, and certain types of gear were not cost effective to buy. As a consequence, although the *Albatross* scientists could recommend exploiting fishes at off-

Figure 2.—San Clemente Island, photographed by members of the *Albatross* crew on the ship's maiden voyage to the Pacific Coast, 1888. Photograph courtesy of the National Archives.

shore banks, there was little profit in doing so (Alexander, 1892).

During this same voyage in 1889, the *Albatross* mapped another unexplored bank—Tanner Bank—and visited several offshore islands, including San Clemente and San Nicholas. Scientists obtained information on fisheries and fish species from interviews of local residents. Although the scientists sometimes worked in near-gale conditions, they did encounter more human remains and stone implements on San Nicholas Island but rather barren biota. They noted a small, but active cottage industry for abalone shells (San Nicholas Island) that were shipped up and down the coast by Chinese harvesters (Alexander, 1892). There also were local fisheries for spiny lobsters that were collected with pots around offshore islands, then held until collected by a larger sloop that visited at regular intervals. Other local fisheries were exploiting "fat-heads" (California sheephead, *Semicossyphus pulcher*), "whitefish" (ocean whitefish, *Caulolatilus princeps*), and "red rock-cod" (likely the yelloweye rockfish, *Sebastes ruberrimus*, formerly known as the red snapper). The cruise concluded with measurements and biological samples along several transects off southern California, as far south as the Coronados Islands, and special studies of the biology of and fisheries for mackerel (chub mackerel, *Scomber japonicus*, formerly known as Pacific mackerel), Pacific bonito, *Sarda chiliensis*, and Pacific barracuda, *Sphyraena argentea*. On its way northward, the *Albatross* sampled along transects from Pt. Loma to Pt. Fermin, then between several offshore islands and the Santa Barbara Channel. Several commercially important species, such as "deep-water sole" (likely several species but definitely including rex sole, *Errex zachirus*), and the locally-known California halibut, *Paralichthys californicus*, were collected from previously unknown as well as exploited banks (Tanner, 1892).

Although the *Albatross* had stopped in San Diego Bay on several occasions to take on coal, it was not until 1894 that the ship conducted the first detailed scientific investigations of the bay and

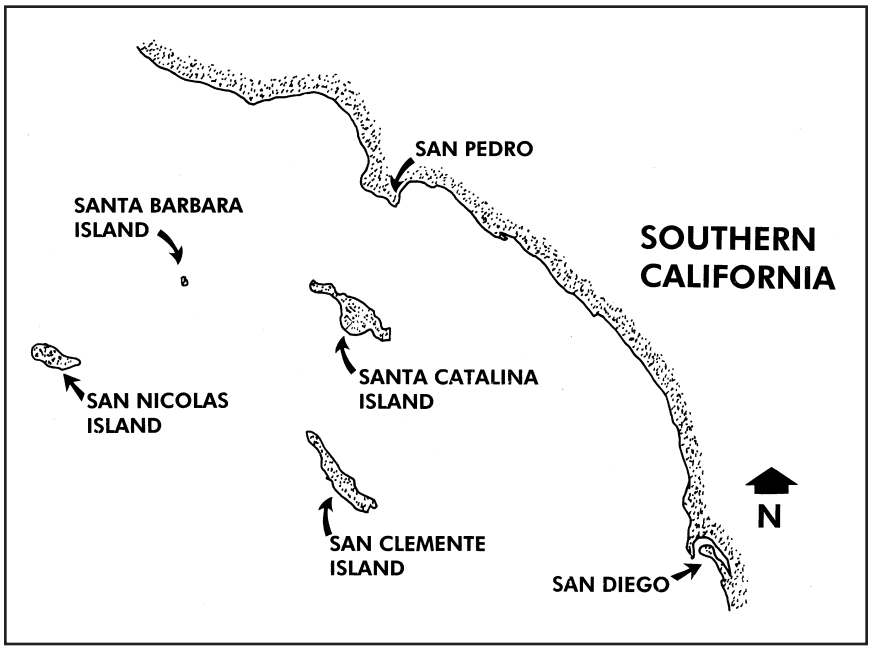

Figure 3.—The coast of southern California, including offshore islands.

its resources. The ship anchored in the bay for three months after "a boisterous trip." from the north in early January (Tanner, 1896).

One interesting observation was made en route. In February and March 1894, there were several reports in newspapers of coastal communities about extensive numbers of dead fish (Drake and Tanner, 1896). Although the *Albatross* itself did not investigate these mass mortalities, a member of the scientific staff, Assistant Fishery Expert N. B. Miller, traveled on a local steamer, the *Santa Rosa,* and, after interviewing local skippers, reported a string of dead fish from Santa Barbara southward to almost San Diego (there were no dead fish off Pt. Loma (San Diego) or False Bay (now known as Mission Bay). Extensive numbers of dead barracuda, flatfish, yellowtail, *Seriola lalandi*; Pacific sardines, *Sardinops sagax*; sea bass, Serranidae; northern anchovy, *Engraulis mordax;* and rockfish, *Sebastes* spp. were noted. In one half-mile stretch alone, near Redondo Beach, Miller counted 168 flatfish and 225 barracuda floating on the surface. He examined some of the dead fish washed ashore near Redondo Beach and found empty stomachs and ruptured air bladders. The gill rakers were covered with a yellow slime that emitted the telltale smell of petroleum. Despite these seemingly adverse influences on marketability, the dead fish were being actively gathered and sold to markets in Los Angeles. Others were served at local hotels and aboard coastal steamers (Drake and Tanner, 1896). Miller theorized that some type of seismic disturbance had released oil from the bottom, thus triggering the massive kill.

In 1896, the *Albatross* was back in southern California, spending the first 4 months of the year examining fishes and invertebrates. The ship's crew concentrated on the area near La Jolla, Pt. Loma, and San Diego Bay (Fig. 5), using the ship's five launches to conduct studies in San Diego Bay from 30 January to 12 April (Fig. 6). The *Albatross* itself served as a stationary laboratory (Fig. 7). A particular objective was to examine the bay as a candidate for oyster culture (Brice, 1898). Water temperatures in the bay during winter ranged from 11° to 19°C.

After completing the studies in San Diego Bay, the *Albatross* cruised southwest to the Coronado Islands, then north in April 1896 to Cortez and Tanner Banks, and on to Santa Catalina Island. Stormy weather restricted the investigations to just soundings and one trawl haul, but the ship's scientists concluded that the depth profiles at the two banks "promise considerable inducement for a local fishery whenever a demand shall have been established" (Brice, 1898). In Santa Barbara, the ship participated in the annual Flower Festival of Santa Barbara in mid April, then went south to become a star attraction in San Pedro's Fiesta de Los Angeles during 20–26 August 1896. Wherever the ship traveled, the crew kept steaming records of whales, kelp, and aquatic birds, as well as water temperatures, weather conditions, depth readings, and records of bottom characteristics. Some records, such as reports of "many puffins," while traveling between San Diego and Santa Barbara (Anonymous, 1898), are useful in considering distribution of such birds a century later.

Investigations in 1897 concentrated on Santa Catalina Island and the Santa Barbara Channel. The ship explored the shelf around Santa Catalina Island, using gillnets, dredges, handlines, seines, longlines, and beam trawls. The aquatic environment was investigated in detail from the intertidal zone down to a depth of about 80 m. Fishes collected were primarily smelt, Osmeridae; herring, *Clupea harengus*; and anchovies, but scientists also captured Pacific barracuda, Pacific bonito, albacore, *Thunnus alalunga*; yellowtail, and rockfish. There were few local fisheries around Santa Catalina Island, except for spiny lobsters and seasonal fisheries for sardines. An indication of how extensive these fish collections were is reflected in an annotated checklist prepared by Charles Gilbert: 63 species of fishes were captured around Santa Catalina Island and Monterey Bay in April 1897 alone (Gilbert, 1899). Many of these fishes were species of rockfish, but there were several species new to science and many others unknown to local commercial fishermen.

The ship returned to San Diego Bay in January 1898, then again visited Santa Catalina Island for a week in April. At the latter locale, the scientists

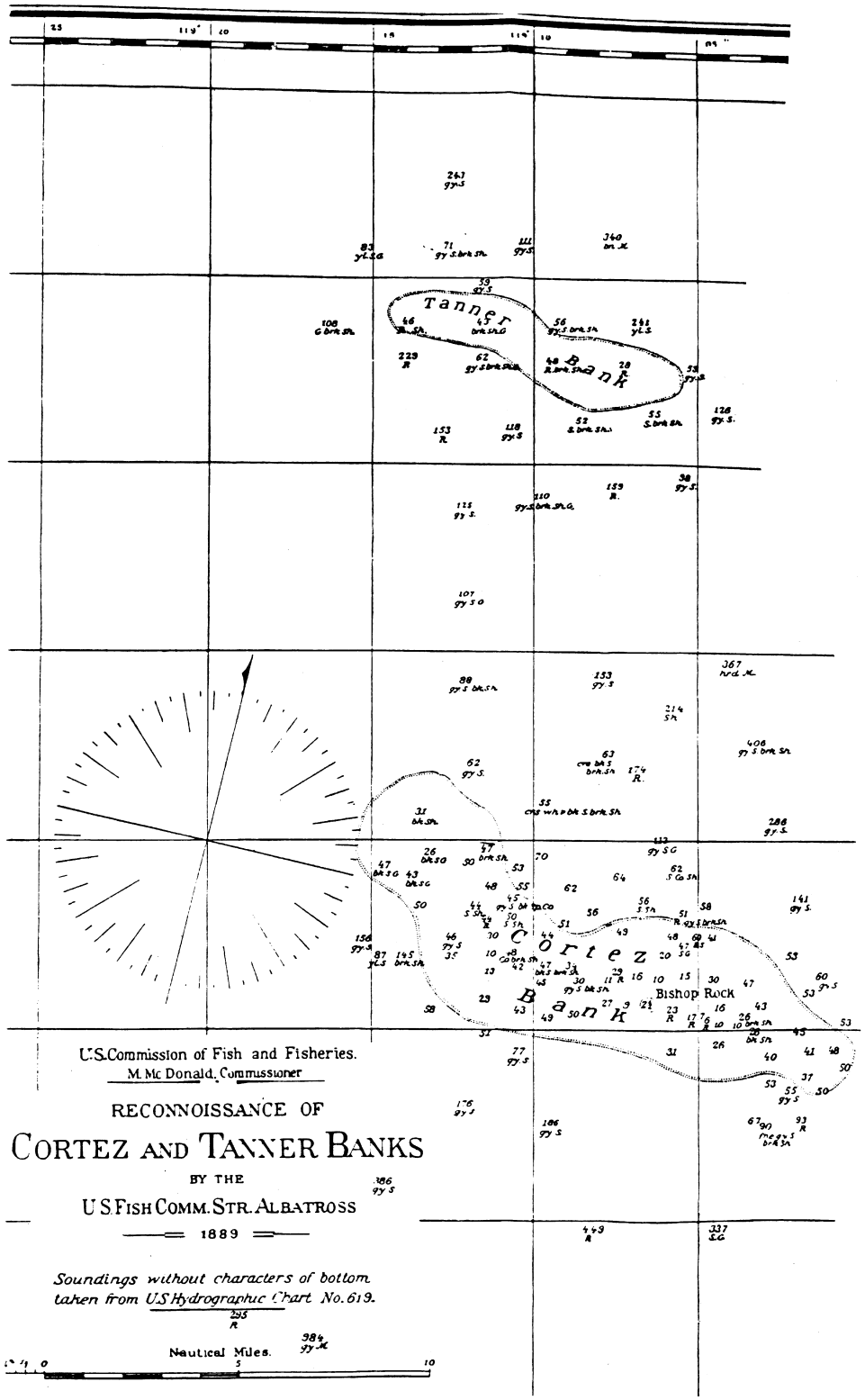

Figure 4. — The first published map of Cortez and Tanner banks (Tanner, 1892), using soundings by the *Albatross* in 1889.

again collected along the shelf, adding to the increasing knowledge of aquatic life and bottom topography near that large island. Moser (1899) reported that migratory species had yet to make their appearance at that time of year, but extensive sampling with seines, gill nets, trawls (long-lines), beam trawls, and hand lines at depths between a "few" meters and 238 m collected smelt (Osmeridae) and rockfish up to 3.6 kg in size. In addition, a few yellowtail also were taken, and the scientists compared the swimming behavior of yellowtail to that of pollock (*Pollachius virens*) of the Atlantic coast. The scientists encountered what local anglers and subsequent scientists would document in more detail—that species of rockfish were quite locale-restricted (Moser, 1899).

Later Investigations

Following its transfer to the U.S. Navy during the Spanish American War, the *Albatross* revisited San Diego Bay in 1903, along with Cortez Bank and Santa Catalina Island, as well as Monterey Bay as part of a cooperative cruise between the U.S. Fish Commission, Stanford University, and the University of California. Again, transects, benthic dredging, and surface and midwater sampling were underway almost continuously during the cruise, with a primary objective being exploration of new fishing banks. Many, small offshore banks were logged in the steaming records and mapped.

One of those new offshore banks was discovered and mapped during a cruise in 1904. In March and April, the *Albatross* sampled in the waters off Pt. Loma, La Jolla, the Coronado Islands, and Santa Barbara. A transect was extended 322 km westward from San Diego, out to the 3,660 m curve, and the crew mapped previously known banks or areas only locally known (Bowers, 1905b). One of those rocky shoals discovered was Cabral Bank, named after a local fisherman who served as a guide (Bowers, 1905a).

Tuna Investigations

The last major scientific effort by the *Albatross* in southern California waters was directed at tuna, Scombridae, populations. Beginning in 1907, when the operator of a local San Pedro sardine cannery, A. P. Halfhill, started experimental canning of albacore (Roedel, 1938), the southern California industry had grown steadily. Trial-and-error resulted in an effective technique for canning tuna in vegetable oil. Between 1909 and 1913, the pack of tuna rose from just 250 cases to 115,000 cases and the number of canneries rose to nine in San Pedro and San Diego (Smith, 1915). In 1916, 10.5 million kg of albacore were taken (Clemens and Craig, 1965). But there were concerns about the population numbers and the long-term prospects for expanding the fishery.

In 1914, the typical fishing method was hand lines and chumming with sardines and other small baitfishes. Rather than the later tuna clippers and purse seiners, tuna were taken by small boats powered by 8 hp motors and manned by crews of two to four. These boats did not venture far offshore, but the consensus was that catches of tuna could be considerably higher if the men had larger boats that could travel farther offshore and make longer trips (Smith, 1915). Three species of scombrids were captured in the fishery, but most effort was with albacore. However, there was little knowledge of the biology of albacore or why the species seemed so seasonal—even erratic—in its appearance along the southern California coast. For example, commercial harvesters noted that albacore were present in southern California waters in early spring, but the fish often disappeared from these

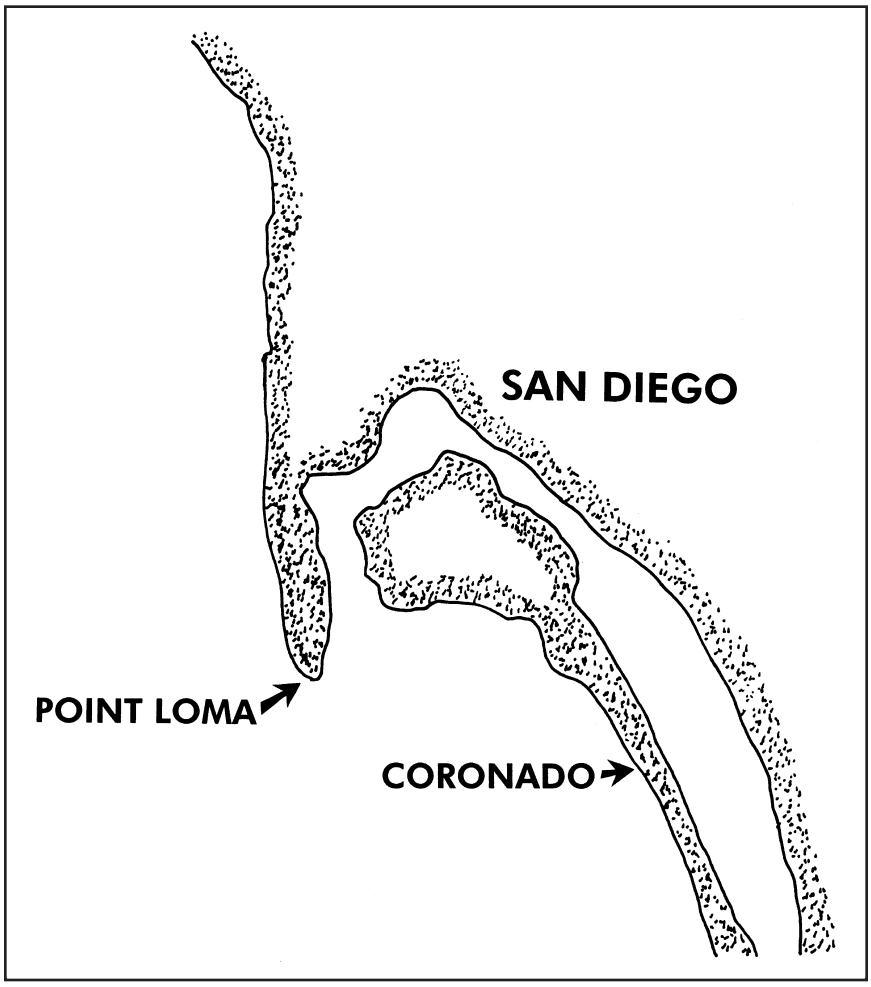

Figure 5.—San Diego Bay and surrounding waters.

Figure 6.—One of the launches from the *Albatross* loading sampling equipment from the larger vessel, 1888. Photograph courtesy of the National Archives.

waters close inshore between June and November (Smith, 1915). Before the industry could consider expanding, these life history questions needed to be resolved.

It was the *Albatross* that conducted the first studies on tuna populations. In 1915, using very limited funds, the scientists tagged and released some tuna. But the effort was minimal, and reports could only conclude that "unfortunately, the tuna can not be counted upon to appear in abundance with any regularity" (Smith, 1917). When politicians were urged to address the issue further, Congress appropriated $16,000 in 1916 to fund further investigations of tuna populations by the *Albatross*.

During April and May, 1916, the ship spent 3 weeks cruising along Baja California, traveling several hundred miles south and west to the Coronado Islands. The ship anchored in San Diego Bay for a brief period in mid May, then undertook a second cruise along Baja California. Despite taking two of "the best practical tuna fishermen of San Diego" along on this voyage, no tuna were encountered (Smith, 1917). In late May 1916, tuna started to appear off San Geronimo Island and the San Benito Islands, Mexico, but none were encountered for 240 km west of San Diego. In June, the *Albatross* started to encounter tuna off San Diego and San Pedro, but not in large numbers—certainly far from economically attractive levels—and possibly a reflection of relatively cool water temperatures.

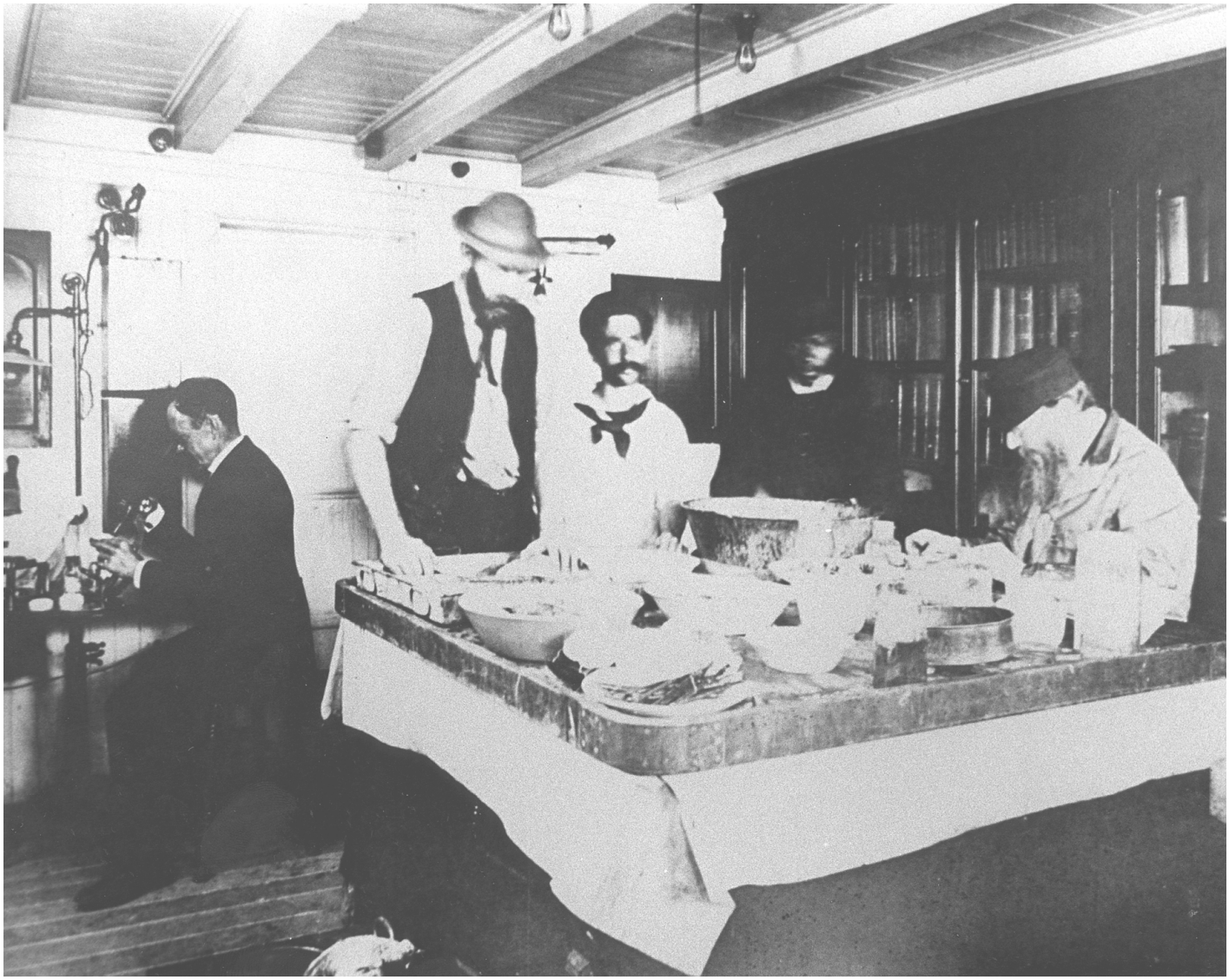

Figure 7.—The upper laboratory aboard the *Albatross*. Photograph courtesy of the National Archives.

Thompson (1917) concluded that the presence or absence of albacore was largely due to water temperatures—the first definitive evidence linking albacore and specific oceanic isotherms, based in large part on these tuna investigations by the *Albatross*. Later researchers improved knowledge of this relationship (e.g. Johnson, 1962) and developed predictive models of albacore distribution and abundance (Hester, 1961; Clemens, 1962; Rothschild and Yong, 1970).

The *Albatross* continued to study tuna until 23 November 1916, when the ship was ordered back to San Francisco. It was later put under U.S. Navy control for World War I and those scombrid investigations in 1915 and 1916 effectively marked the end of the *Albatross*'s scientific investigations along the southern California coast.

Summary

An examination of the role of the *Albatross* in aquatic investigations in and around San Diego and along the southern California coast reveals extensive hydrological records and numerous volumes of scientific discoveries that were still being published decades after their initial collection (e.g. Gilbert, 1891, 1896, 1915). It also should be noted that many of these contributions to science were not solely aquatic. Terrestrial animals were collected from many of the offshore islands, including lizards, and a new genus and species of insect that was collected on San Clemente Island in 1888 (Howard et al., 1890). The *Albatross* conducted the first scientific investigations of San Diego Bay and discovered and mapped several important offshore fishing banks. Finally, some of the earliest work on albacore along southern California—including the first tagging—was conducted by the *Albatross*, its scientists, and its crew.

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