William Francis Thompson (1888–1965) and the Dawn of Marine Fisheries Research in California

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Introduction

As concern increased in Canada over the consequences of World War I, the Province of British Columbia terminated fisheries research in 1917. William Francis Thompson (1888–1965), with the aid of Charles Henry Gilbert (1859–1928) and others, sought other work in fisheries.[1,2] With high recommendations from Gilbert, Thompson was hired to a temporary position in 1917 by the California Fish and Game Commission.[3,4] Thompson then became important in the burgeoning field of marine fisheries research in California. By the time Thompson left California some eight years later, he had established the commission's first marine fisheries laboratory and was instrumental in creating one of the finest state fisheries agencies in the nation (Bryant, 1921, 1924; Dunn, 2001a, b).

This article concerns Thompson's efforts to usher in marine fisheries research in California from 1917 to 1925. He initiated research programs first on the albacore tuna, *Thunnus alalunga,* and then on the Pacific sardine, *Sardinops sagax*. It was during his California period that Thompson developed his research approach of studying the fisheries directly, rather than studying the environment (Kendall and Duker, 1998). Thompson helped found and then directed the commission's first marine fisheries research laboratory. He was responsible for hiring a staff of scientists, many of whom subsequently became renowned for their work in fisheries research. This was also a period when Thompson became cognizant of the politics of the commercial fishing industry as well as the political aspects of working for a government organization. Thompson left the state agency in 1925 to become the Director of Investigations of the newly formed International Fisheries Commission (now the International Pacific Halibut Commission), which was charged with managing the Pacific halibut, *Hippoglossus stenolepis*.

This paper is based primarily on Thompson's published work and his personal papers in the archives of the University of Washington Libraries and the archives of the School of Aquatic and Fishery Sciences (U.W.), Seattle, Wash. Other sources consulted include the Stanford University Libraries, Stanford, Calif., and the files of the Inter-

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ABSTRACT—William Francis Thompson (1888–1965), an early fishery biologist, joined the California Fish and Game Commission in 1917 with a mandate to investigate the marine fisheries of the state. He initiated studies on the albacore tuna, Thunnus alalunga*, and the Pacific sardine,* Sardinops sagax*, as well as studies on other economically important marine organisms. Thompson built up a staff of fishery scientists, many of whom later attained considerable renown in their field, and he helped develop, and then direct, the commission's first marine fisheries laboratory. During his tenure in California, he developed a personal philosophy of research that he outlined in several publications. Thompson based his approach on the yield-based analysis of the fisheries as opposed to large-scale environmental studies. He left the state agency in 1925 to direct the newly formed International Fisheries Commission (now the International Pacific Halibut Commission). William Thompson became a major figure in fisheries research in the United States, and particularly in the Pacific Northwest and Alaska, during the first half of the 20th century.*

[1] Biographical data on Thompson are contained in an unpublished family memoir, "Thompson: a family history," compiled by his wife, Julia Bell (1884–1976), between ca 1925–1972: A copy of this mauscr. has been deposited in the W. F. Thompson papers, Archives, School of Aquatic and Fishery Sciences, University of Washington. Referred to here as J. B. Thompson, manuscr., unpaginated, but ca 372 p. (The volume and page numbers used here are those that I have added to my personal photocopy of this manuscr; the original is variously paginated.) Thompson registered for the military draft but was not called to duty because he was married with dependents (a wife and a young son). See Notice to Call and Appear for Physical Examination, Local Board for Division No. 1, County of Los Angeles, dated 11 August 1917; Certificate of Discharge from Military Service, Local Board for Division No. 1, County of Los Angeles, dated 22 October 1917. Archives, School of Aquatic and Fishery Sciences, Thompson papers, Box 9, Folder 2.

[2] Presumably John Babcock aided Thompson's entry into the commission.

[3] Carl Westerfield, Executive Officer, State of California, Fish and Game Commission to Thompson, dated San Francisco, 21 February 1917. "We are very desirous to obtain some one to take charge of investigation work in Southern California connected with the commercial fisheries there and hereby tender you this position, which will carry with it a salary of One Hundred Fifty ($150) Dollars per month. We do not at present know how long this work will be continued, but can guarantee that your employment will last at least a year." Archives, School of Aquatic and Fishery Sciences, Thompson papers, Box 9, Folder 2.

[4] Thompson to Fish and Game Commission, dated San Francisco, 21 February 1917. "In reply to your letter tendering me employment with the Fish and Game Commission, I would state that the conditions mentioned are perfectly satisfactory." Archives, School of Aquatic and Fishery Sciences, Thompson papers, Box 9, Folder 2.

national Pacific Halibut Commission, Seattle.

Thompson at the California Fish and Game Commission

Thompson was hired in 1917 by Norman Bishop Scofield (1869–1958), the Director of the recently formed Department of Commercial Fisheries in the California Fish and Game Commission (Clark, 1982; Smith, 1994).[5] Thompson began work on 1 June in Long Beach, California, with a mandate to investigate commercially important marine fishes (Scofield, 1918).[6, 7] The albacore tuna was the object of initial studies by Thompson (Scofield, 1917d). The oceanside residence used as his office was called initially the Long Beach Laboratory and later the California State Fisheries Laboratory. Thompson was in charge of the "Laboratory."[8]

The California tuna pack (mostly albacore) in 1916 was the largest on record. Nearly a half-million cans were processed, exceeding the sardine production by a factor of two. Some 397 fishing boats were employed in the tuna fishery, mainly off southern California. There were reports, however, that the abundance of albacore was less than it was the previous year (Scofield, 1917a, b).

In the early part of the 20th century certain prestigious scientists argued that because of their high fecundity it was impossible for many marine fishes to be overfished (Fig. 1–4).[9] Thompson knew better, based on his experience with the Pacific halibut. The potential problem of albacore overharvest was one of the first questions Thompson encountered in his new work (Thompson, 1919b). He understood, however, that "proof" of overharvest would have to be demonstrated again and again for each fishery (Thompson, 1922a).

Thompson began his work on the albacore. A fishery data collection method, called the "pink ticket" system, was established in 1915 by the state legislature (Anonymous, 1918a; Scofield, 1918).[10] These statistics provided the basis for assessing the status of the major commercial fishery stocks by the commission. Thompson began an analysis of albacore catch records, combined with data collected on size, etc.[11] Investigations of the albacore of various intensity continued through the eight years of Thompson's regime and thereafter.

Thompson never published a comprehensive report on his albacore investigation, but, in a 1924 progress report, he noted that while overharvest might have been occurring he found no evidence of depletion.[12] He advised caution, recommending that conservation was advisable. He further indicated that progress had been made in accumulating knowledge of the age and growth of this species and that albacore appeared to be sensitive to physical conditions.[13] Thompson indicated that his laboratory was studying the variability of the numerical strength of incoming age classes of albacore entering the fishery. Finally, he concluded that work was needed to determine the distribution and spawning areas of the albacore. He indicated that both of these investigations would be expensive, each requiring the use of a research vessel (Thompson, 1924c).

Thompson also began to hire scientific assistants to assist in his investigation of the albacore. Following a pattern that continued throughout his career, he hired talented biologists who subsequently became leading figures in fisheries science (Fig. 5–7). The first biologist hired by Thompson was Elmer Higgins (1892–1977). Other people

[5] Norman Scofield was considered by some California scientists of the era to be the "father" of marine fisheries research in California (Clark, 1982). He was a member of the first graduating class of Stanford University in 1895. Scofield earned an M.A. degree in zoology from that institution in 1897 while studying under Professor Charles H. Gilbert (Anonymous, 1919c; personal communication, 8 June 2001, from Mark R. Jennings, 33913 Sharon Avenue, Davis, Calif. 95616–9456). Norman Scofield directed marine research for the State of California for 42 years (Croker, 1959).

[6] Norman Scofield helped steer new legislation through the California legislature that levied a tax on all fish purchased by fish dealers. In addition to requiring a license for anyone catching or selling fish, the legislation assessed a "privilege tax" of 2 1/2 cents per hundred pounds of fish. This tax provided a continuing source of funding for the new Department of Commercial Fisheries (Scofield, 1917c; Thompson, 1924a; Clark, 1982).

[7] Stanford University during the early 20th century was the center of ichthyology and of the emerging field of fisheries biology in North America (e.g., Brittan, 1997). During this time, zoology professors from Stanford University were frequently hired to conduct research for the commission. For example, Pacific salmon, *Oncorhynchus* spp., studies were conducted in 1911 by Charles H. Gilbert (later conducted by John Otterbien Snyder, 1867–1943), clam studies (razor clams, *Siliqua alta,* and other spp.) were undertaken by Frank Walter Weymouth (1884–1963), native oyster, *Ostrea conchaphila*, research was pursued in 1920 by Harold Heath (1868–1951), and taxonomic work on various families of marine fishes was directed by Edwin C. Starks between about 1915 and 1920 (Bryant, 1921, 1924). Thompson also hired Stanford faculty to investigate fisheries problems. For example, he hired Weymouth to study Pismo clams, *Tivela stultorum,* during April–June 1919 (Thompson, 1919c). Weymouth became Thompson's Ph.D. advisor after Charles Gilbert's death in 1928 and Thompson completed his doctorate under Weymouth in 1930 (Anonymous, 1931). One of the first definitions of fishery biology was written by Elmer Higgins (1934).

[8] In 1918 the department acquired a vessel for marine research that was aptly named the *Albacore* (Anonymous, 1918b; Scofield, 1918).

[9] For a historical review of the "overfishing" controversy, see Smith (1994).

[10] The "pink-ticket" system required the fishermen to fill out a form listing the catch by species. The form consisted of three tickets, one for the fisherman, a pink copy for the commission, and a third copy for the dealer (Clark, 1982). Thompson described this data collection system "as one without parallel in any country, and it has already proved itself superior to any statistical system we are acquainted with" (Thompson, 1920b). For background information on the "pink-ticket system" and the law enabling the collection of commercial fisheries data, see Scofield (1918) and Thompson (1924a).

[11] In 1919 the commission announced plans for a new biological laboratory that was ultimately located in San Pedro, Calif. (Anonymous, 1919a; Scofield, 1921). Thompson undertook the planning of the new laboratory that was occupied in October 1921. He was appointed the laboratory director (Anonymous, 1919b; Thompson, 1921b). Thompson, with his wife Julia, also published in 1919 a pioneering study of the spawning behavior of the California grunion, *Leuresthes tenuis* (Thompson and Thompson, 1919). In his published papers, Thompson frequently acknowledged the help of his wife (e.g. Thompson, 1919b).

[12] "The report upon the albacore, which has been for some time in the final stages, has not been completed for publication, and it is not at present writing, known how soon the writer can resume work upon it" (Thompson, 1924c). This statement was likely written after he had accepted his new position with the International Fisheries Commission (see footnote 30).

[13] The albacore fishery collapsed in the 1930's, apparently because warmer ocean waters caused the albacore to migrate north to cooler waters. The prevalence of warmer waters off southern California lasted from about 1926 to 1941. For more on the history of the fishery and the biology of albacore tuna, see Clemens and Craig (1965).

Figure 1.—One day's catch of tuna and similar fish at the cannery of the International Packing Corporation at San Diego, California (n.d., but ca 1917–18). From Thompson (1919e).

Thompson hired early in his California tenure included Oscar Elton Sette (1900–1972), a student at Stanford University, who was stationed at San Pedro to collect measurements and other statistics on albacore. Later employees (mostly Stanford University graduates) who also became leaders in fisheries science and administration included Francis Naomi Clark (1894–1987); Harlan Banta Holmes (1898–1975); William Launce Scofield (1886–1966), a younger brother of Norman Scofield; and William Charles Herrington (1903–1989) (Thompson, 1921c, e).[14]

[14] Elmer Higgins, whose background was relatively unusual in that he was a graduate of the University of Southern California, moved from the state agency to the U.S. Bureau of Fisheries in 1924 where he served in various capacities, including director of the Key West Biological Station in Florida. Later he was assistant to the Director of the Bureau (Cattell, 1955).

Oscar Sette, who preferred to be address by his middle name, Elton, became a prominent figure in fisheries science in both the Atlantic and Pacific regions and he later became a leader in Federal studies on the Pacific sardine (Cattell, 1955; Powell, 1972; Kendall and Duker, 1998).

Frances Clark was the first female biologist to be employed by the California Fish and Game Commission. She spent most of her career with the state agency, rising to become Director of the State Fisheries Laboratory and a major figure in Pacific sardine research (Clark, 1982; Croker, 1987).

Harlan Holmes left the commission in 1922 to join the U.S. Bureau of Fisheries. He spent the remainder of his career with the Federal agency, stationed in the Pacific Northwest, and became a well-known figure in salmon research on the Columbia River (Cattell, 1955).

William Scofield spent 37 years with the California Department of Fish and Game. He became director of the California State Fisheries Laboratory in 1925, upon Thompson's departure from the state agency. He served as laboratory director for nearly 17 years and was particularly noted for his knowledge of the fishing industry (Roedel, 1967).

William Herrington left the state agency to join Thompson at the International Fisheries Commission where he stayed from 1927 to 1930. He then worked for the U.S. Bureau of Fisheries from 1930 to 1947 and later (from 1951 to 1966)

continued

Figure 2.—California sardine catches, 1917. Source: William F. Thompson papers, Archives, School of Aquatic and Fishery Sciences, University of Washington, Seattle.

Finding trained technical help was a continuing problem that worried Thompson. Many of his assistants were graduate students (mainly at Stanford University) who would work for some time before returning to school to continue their graduate work. The shortage of these kinds of people caused Thompson to hire undergraduate students, "no graduates being available" (Thompson, 1924b).

Thompson was able to identify those fishery resources most in need of scientific attention. He listed six kinds of commercial marine fishes and invertebrates being studied by his laboratory: albacore; Pacific sardine; California grunion, *Leuresthes tenuis*; clams (mainly the Pismo clam, *Tivela stultorum*); Pacific herring, *Clupea pallasi*; and California halibut, *Paralichthys californicus* (Thompson, 1924a). The species primarily in need of research, however, was the Pacific sardine (Thompson, 1919b, 1920a).

Based on his experience with the Pacific halibut in British Columbia, Thompson (1924a) emphasized the necessity of conservation, a theme he was to revisit in subsequent years:

> "The general and marked depletion of migratory fishes such as the salmon, together with that of our Pacific coast halibut, and the plain overfishing of various species in the waters of the North Sea, have been real object lessons to fishery men.
>
> Our program is, because of such reasons, based on the necessity of conservation and upon the need for governmental vigilance to permit the free expansion of the fisheries.
>
> It requires, because of its nature, the support of farseeing and unselfish men."

About this time, the harvest of the Pacific sardine in California coastal waters was beginning to increase dramatically, from about 27,500 tons[15] in 1916–17 to over 173,000 tons in 1924–25. Although this level of harvest was relatively small compared to later harvest (over 725,000 tons off California in 1936–37), some biologists were becoming fearful of depletion (Radovich, 1982).[16] Thompson

[14] (*continued*) was the U.S. State Department Fishery Attaché to Japan (Anonymous, 1971). See also the Thompson diary for 1924–25, black leather 3-ring binder, about 18 by 26-centimeters, listing Herrington as an employee. Only diary entries for 24 November 1924–February 1925 are present in the files of the International Pacific Halibut Commission.

[15] Harvests in that era were listed in U.S. tons (2,000 lb.), not metric tons.

[16] See the next page for Footnote 16.

Figure 3.—Sardines drying in the sun, Monterey, Calif., ca 1917. Source: William F. Thompson papers, Archives, School of Aquatic and Fishery Sciences, University of Washington, Seattle.

turned his attention to this burgeoning resource (Thompson, 1920a; Thompson and Higgins, 1920).

Thompson developed a research plan for the Pacific sardine. In an article targeted for a general audience, he outlined the questions that needed to be answered to determine the status of the sardine stocks and how the commission would answer those questions (Thompson, 1920a).[17,18] He indicated that his group would be collecting the appropriate data needed to assess the sardine populations.

Elmer Higgins was stationed in San Pedro, Calif., and Elton Sette was transferred from San Pedro to Monterey, Calif., to collect sardine catch data.

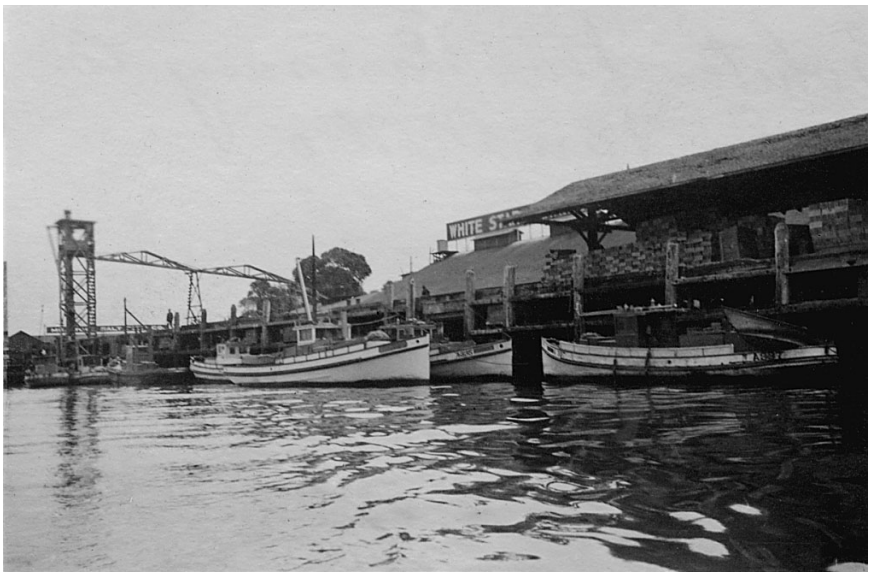

Figure 4.—White Star Canning Company, San Pedro, Calif., 1919. Source: William F. Thompson papers, Archives, School of Aquatic and Fishery Sciences, University of Washington, Seattle.

[16] The sardine fishery reached its apogee in 1936–37, only to collapse in the early 1950's (Radovich, 1982).

[17] Thompson's (1919b) article on the "proposed investigation of the sardine" centered on five questions: "1) Will depletion occur?; 2) Are there great natural fluctuations in abundance, or quality, other than those of depletion?; 3) Is it possible to foretell fluctuations?; 4) Do sardines migrate from one region to another?; and 5) If depletion should occur, what measures for protection should be adopted? He described the kinds of data needed to answer these questions, and for the sardine he wanted: 1) Commercial catch of sardines by vessel type, gear, and fishing area; 2) Composition in and variation of catch by size and age; 3) Spawning season and areas; 4) Yearly abundance of young sardines and knowledge of their early life history; and 5) Age and rate of growth as well as knowledge of the "racial" differences of stocks, if any (Thompson, 1919b).

[18] Thompson described his research plans in various issue of the commission's quarterly publication, but most often he directed his writing toward a lay audience (e.g. Thompson, 1920a, 1921a, b). He also published a more scholarly description of his methods of fisheries research (Thompson, 1919b).

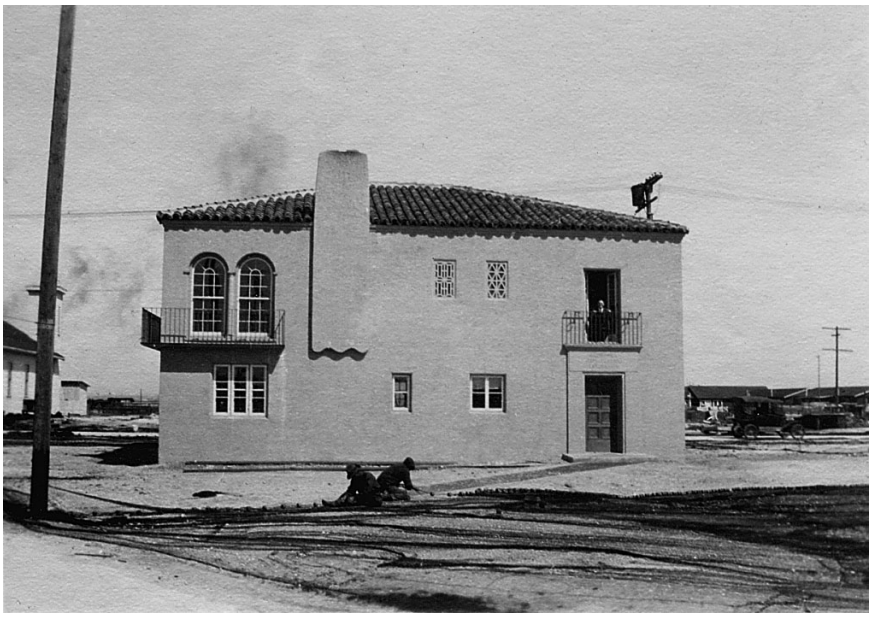

Figure 5.—California State Fisheries Laboratory, February 1922. Source: William F. Thompson papers, Archives, School of Aquatic and Fishery Sciences, University of Washington, Seattle.

Thompson, aided by various others, oversaw the fieldwork and conducted much of the data analysis from his base in San Pedro (Thompson, 1920c). Higgins (1920) analyzed daily catch data obtained from the "pink tickets" of sardines caught on about 110 boats fishing in the San Pedro district. Data on length, average weight, sex, and degree of maturity were taken daily as vessels unloaded their catch. Higgins confirmed Thompson's (1919d) previous observations that sardines spawned in the spring.

Sette (1920) reported that the fishery in the Monterey Bay district had increased in volume by a factor of eight over the catches just three years previously. He began his study in the summer of 1919 and the data collected in the Monterey area paralleled those collected by Higgins at San Pedro. Sette was granted laboratory space at the Hopkins Marine Station, a facility of Stanford University, where he began the analysis of catch data.[19]

Thompson (1921a) noted that in 1920 the sardine accounted for about 85 percent of the commercial harvest of fishes in California. In a portent of the future, he wrote "Will the sardine remain, or will it vanish at times as does its cousin the herring of the North Atlantic, and as the sardine itself probably does in British Columbia and Alaska?" That question would be answered in the 1950's as the sardine disappeared (Radovich, 1982).[20]

As he was to do later for the Pacific halibut, Thompson described the history of the sardine industry, tracing its origin in California to about 1890 (Thompson, 1921d). He considered the industry as a product of World War I, with growth of the fishery in California due to the cessation of foreign imports and, later, increased foreign demand.

In a summary of sardine research conducted by the state fisheries laboratory through 1924, Thompson stressed conservation and the avoidance of depletion of the sardine populations.[21] He also emphasized the applied nature of his research, noting "that a rigid adherence to a practical end was insisted upon from each of the assistants" (Thompson, 1924c).

A volume of the commission's *Fish Bulletin*, containing five papers devoted to the Laboratory's sardine research, was published in 1926, after Thompson left state employment. Thompson's final two papers concerning the sardine were published in that volume. The first report was a review and analysis of the sardine work completed during Thompson's tenure in California. With a thoroughness that was to characterize Thompson's work, this report reviewed the available knowledge on sardines. He analyzed the morphology of the sardine and compared it with its European counterpart, reviewed the commercial catch of sardines on the Pacific coast and compared it to the fluctuations in catches of the European sardines, analyzed the sardine catch off California, and reviewed the methods used to study the abundance of the species. He introduced "catch-per-unit-of-effort," defining catch as "the catch of a unit of gear, or equipment, fished with normal skill and without hindrances for a given time." Thompson further noted that this measurement was "capable of very considerable refinement." Among his conclusions, Thompson noted "that the discovery of overfishing must take many more years than were thought at first" (Thompson, 1926a).

In the second paper published in this volume, Thompson reviewed the difficult sampling problems inherent in data collection on sardines. He discussed the

[19] Thompson recorded in the Thompson family history a humorous episode in 1917 that apparently plagued his early scientific group as they began their statistical analysis of data. He wrote: *continued*

[19] (*continued*) "But unfortunately we had at that time no adding machines or calculators or tabulating systems, and were seemingly unable to convince the Sacramento authorities that they were needed. We received an answer to our request for an adding machine, an inquiry as to why a biologist needed such a machine! My wife and I, and later helpers, tried valiantly to add our figures mentally from tables copied in longhand; we ended with what seems to me a confused mess of personal notes and memoranda which made no sense at all as a report. We did not succeed in setting this in order because of deep involvement in sardine problems and my move in 1924 to Seattle to direct the new International Halibut Commission" (Thompson, J. B. manuscr. III: 72, see footnote 1).

[20] For a review of the early history of applied fisheries research as well as Thompson's role in it, see Kendall and Duker (1998).

[21] Emphasizing the goal of "conservation," Thompson (1924c) wrote "as is made very clear in the law under which we work and in our published papers, the conservation of our fisheries must be set above all else."

concept of "dominance" and the understanding of the catch, the significance, interpretation, and use of the mode, as well as the problem of statistical errors and the difficulties of sampling. Thompson noted the numerous uncertainties surrounding the sampling of the sardine catch. He acknowledged the need to "weight" each sample by the amount of the commercial catch it represented. Thompson felt that the time for, and knowledge of, such weighting had not yet arrived (Thompson, 1926b).

In the same volume, Sette presented the results of his studies of problems in sampling the sardine. He suggested that sampling the commercial catch twice a week was necessary to obtain a portrait of the year's catch (Sette, 1926). Higgins described the fluctuations in the sardine fishery at San Pedro. He noted the marked changes in sardine catches from year to year and he described the length variability of the samples. He found that there may be extended periods in which spawning is relatively unsuccessful. Higgins also found a good correlation between the sizes of sardines captured with the numbers of fish packed in oval tins. Such a correlation offered a method of estimating the catch during the fishing season (Higgins, 1926). William Scofield (1926) described the progression of size classes of sardines in Monterey and the fluctuations in abundance within and between years; he too found a correlation between the length composition of sardines and the numbers of fish packed in oval tins.

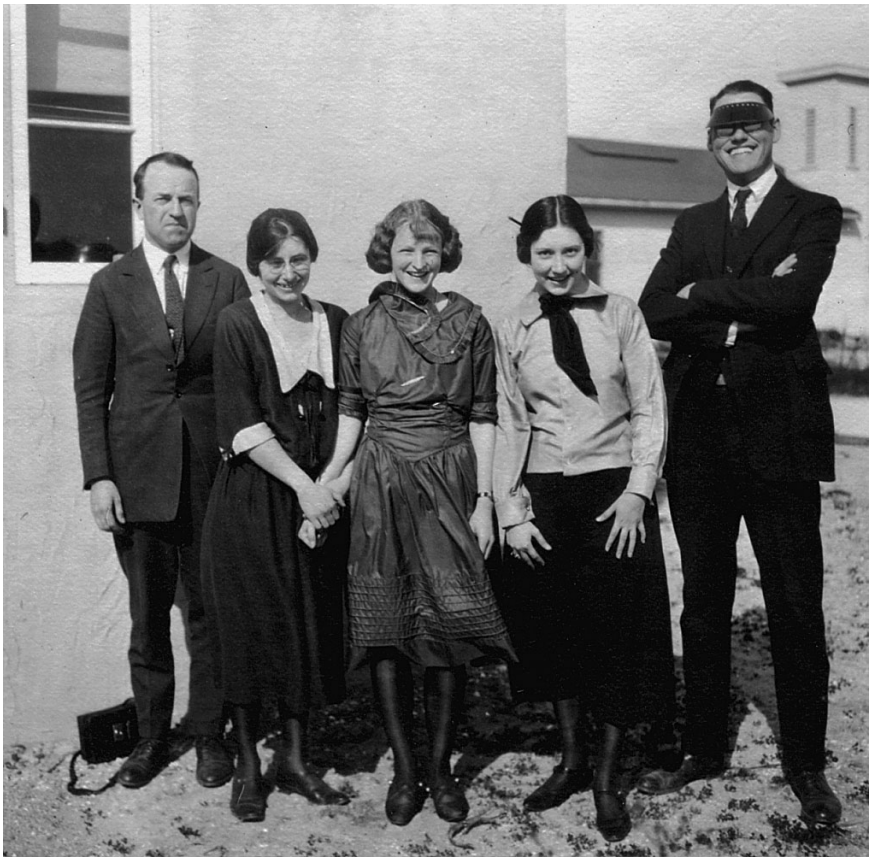

Figure 6.—Staff of the California State Fisheries Laboratory, April 1923. From left to right: Thompson, Frances N. Clark, Miss Anderson, Miss Stewart, and Elmer Higgins. Source: William F. Thompson papers, Archives, School of Aquatic and Fishery Sciences, University of Washington, Seattle.

The Development of Thompson's Philosophy of Fisheries Research

During his California days, Thompson was developing his own philosophy about marine fisheries research, and he saw the need to disseminate his thoughts to a general audience. His previous experience in British Columbia had taught him the benefits of communication with the fisherman and the processor. He published several general articles describing the work conducted by the state fisheries laboratory and the value of fishery research (Thompson, 1919a; 1920a,b; 1921a; 1924a). Reaching out to a wider audience became a Thomp-

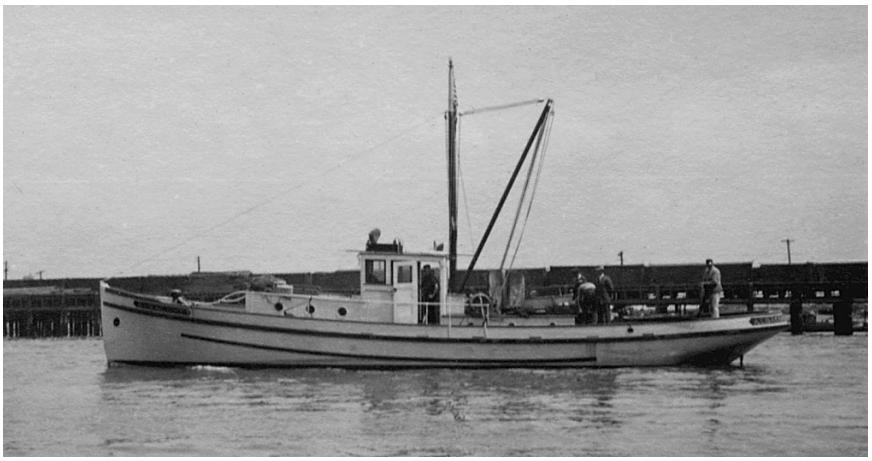

Figure 7.—California Fish and Game Commission research vessel *Albacore*, San Pedro, California, 1919. Source: William F. Thompson papers, Archives, School of Aquatic and Fishery Sciences, University of Washington, Seattle.

son trademark throughout his professional career.[22]

Thompson's philosophy of "pragmatic applied research" was elucidated in some of his publications (Thompson, 1919b; 1921d; 1922b; 1924a).

> "That the primary purpose of the investigations of the California Fish and Game Commission are conservation and adequate utilization has been stated many times. But such purposes have been repeatedly avowed by investigators, whose programs when adopted have betrayed a primary interest in natural history, and have shown little relationship to the problems to be solved. The scientific program of the Commission has, however, been planned very specifically to meet the problems which are involved in government control of the fisheries, and are adapted to meet the responsibilities of the state as legal guardian of those natural resources" (Thompson, 1920b).

He further defined his approach in a subsequent paper. Referring to the extensive research conducted in the North Sea by various countries and the limited resources of the state, Thompson (1922a) wrote:

> "It soon became evident that it was impossible for the State of California to undertake the many lines of general inquiry into the varying conditions of the sea and its life that had been investigated more or less by those European countries. That would have been tunneling the mountain by removing it in its entirety. It was necessary for the state to limit its efforts to those fields which had been shown to bear directly on the ascertainment of the condition of the fisheries, namely, the measurement of the variance in abundance of the fishes in the sea, the effects of fishing upon it and the biological criteria of overfishing. A careful perusal of much of the hydrographic and planktonic work demonstrated its remoteness from the work in hand despite its undoubtedly great ultimate value, and showed that most of the immediate questions could be solved to the required degree without their aid. There were necessary certain biological studies upon the fishes themselves, but above all a statistical study of the fisheries and the fish."

Thompson therefore advocated a rather narrow view of fishery research, focusing on the fishery rather than the environment. His belief was that stock abundance could most efficiently be determined from commercial fishery catch rates. He felt this method was a pragmatic and cost effective approach to fishery research that resulted in the information needed for rational management of a fishery.

Epilogue

The nation and the State of California underwent an economic recession in the aftermath of World War I (Abell et al., 1955). This caused a retrenchment in state funding of fisheries research in California and resulted in cuts in the budget for Thompson's laboratory. There was a movement by the state government in 1923 to delete funding for the California State Fisheries Laboratory.[23] The laboratory survived, but with a reduced scope of research.[24] Low pay for biologists, coupled with the political uncertainty, led several of Thompson's employees to leave state employment.[25] Thompson worried about the viability of fishery research in a political climate[26, 27, 28], and he also wondered about his future.[29]

[22] "It seems to me as though I must (original emphasis) popularize my work and place the facts in easily accessible articles. Indeed as I think it over, that seems the greatest single thing to be done, and the factor which seems least attended to." Thompson to J. B. Thompson, dated Stanford University 1 June 1915 (Thompson, J.B. [Editor]. MS. II:8–9, see footnote 1).

[23] In 1923, Thompson became heavily engaged in attempting to ensure the survival of his laboratory. He wrote letters seeking support from Gilbert, Jordan, and others (but he kept his supervisor, N. B. Scofield, advised of his actions). Many of those he sought assistance from wrote letters of support to the Governor of California, Friend William Richardson (1865–1943) (Anonymous, 1950). See numerous letters in Thompson papers, University of Washington Archives, Accession Number 2597-77-1, Box 12, Folders 10–12. Whether or not the letters were influential, the laboratory remained open. See memo to files (n.d., but 1923) from Thompson in the University of Washington Archives, Accession Number 2597-77-1, Box 12, Folder 11.

[24] Apparently due to budget restrictions, research in the 1924–1926 biennium was confined mainly to the sardine and northern anchovy, *Engraulis mordax*, instead of the 8–10 species studied in previous years (W. Scofield, 1927).

[25] Thompson (1924c) noted in the commission's Biennial Report for 1922–24 that, of the scientific assistants he had hired, "All of these assistants, with the exception of Mr. W. L. Scofield, have, however, now left the Commission, either for the service of the Federal Bureau of Fisheries or for work at universities. It has become very apparent that the retention of these assistants when fully trained will require a higher standard of salary and greater provision for permanency of employment that at present offers, since there is very obviously a shortage of such men in the United States." Some of those who left acquired prestigious positions. For example, Sette and Higgins each took jobs as division chiefs for the U.S. Bureau of Fisheries in Washington, D.C. (Anonymous, 1926).

[26] In one of his last reports for the commission, Thompson recommended that the state fisheries laboratory be removed from the uncertainties of state funding and politics. He recommended the establishment of a legal foundation "for the formal organization of the laboratory, the formation of a cooperative agreement with the U.S. Bureau of Fisheries, and the creation of an advisory committee or board to keep a general supervision of the scientific work" (Thompson, 1924c).

[27] During the period of financial hardship for the state fisheries laboratory, a cooperative agreement was reached between the commission and the U.S. Bureau of Fisheries. In the agreement, the Federal agency agreed to pay $2,000 per annum to help pay the salaries of two employees of the state fisheries laboratory. According to the agreement, one state employee was to work on fishery investigations and the other was to be assigned to pursue fishery statistics. Presumably Thompson negotiated the contract in that the letter of agreement between the two agencies was addressed to Thompson from Henry O'Malley, Commissioner of the U.S. Bureau of Fisheries (letter reproduced by Thompson, 1924c). O'Malley (1876–1936), who was a "Field Agent" for the Bureau in 1918–21 and headquartered in Seattle, was appointed director of the agency in 1922 and served in that capacity until 1933 (Anonymous, 1943).

[28] As an example of how the agreement with the Bureau of Fisheries worked, Thompson's diary for 1924–25 noted that Herrington's salary (n.d., but presumably for 1925) was to be $70 a month from the state and $80 per month from the U.S. Bureau of Fisheries. W. F. Thompson diary for 1924–25, files of the International Pacific Halibut Commission (see footnote 14).

[29] In 1923 Thompson wrote to Norman Scofield complaining about the lack of resources and the loss of his prized employees. Thompson to

continued

About this time Thompson was offered the position of Director of Investigations for the newly formed International Fisheries Commission established to regulate and restore the Pacific halibut fishery. Thompson accepted the job, moved to Seattle, Wash., and joined the new Commission in February 1925, thus ending the California phase of his career (Scofield, 1925; Thompson, 1926c).[30, 31] With the International Fisheries Commission he was to forge the next step of his career as a fishery scientist.

During his tenure in California, Thompson laid the foundations for a strong marine research program for the state agency. His emphasis was on the collection of "vital statistics" of the fishery (Thompson, 1919b). He published over 55 papers during this period, many of them rather general papers directed toward the lay public. Other articles he published were definitive studies that set the standard of the era. California became noted for the quality of its marine fisheries research and for Thompson's development of yield-based analysis for managing fisheries (Scheiber, 1994).

In particular, Thompson's approach to investigating the abundance of the sardine utilizing yield-based statistics was in stark contrast to the wide-scale environmental studies (or fisheries-oceanography) conducted later by the California Cooperative Fisheries Investigations (CalCOFI) to assess the abundance of the sardine (Scheiber, 1994; Kendall and Duker, 1998). Thompson continued this approach in his subsequent work at the International Fisheries Commission, and he strongly influenced later generations of fishery scientists.[32]

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[29] (*continued*) N. B. Scofield dated San Pedro, 9 August 1923 in Thompson papers, University of Washington Archives, Accession Number 2597-77-1, Box 12, Folder 11. He also sought the counsel of Gilbert concerning the political uncertainty in the state agency. Thompson to Gilbert, dated San Pedro, 21 June 1923, Thompson papers, University of Washington Archives, Accession Number 2597-77-1, Box 12, Folder 12.

[30] Among the commissioners who likely made the choice for the new director was John Babcock (Anonymous, 1924). Norman Scofield was one of the first biologists appointed to the Commission's "scientific advisory committee" (Anonymous, 1926). Thompson initially worked for the International Fisheries Commission while "on leave" from the California Fish and Game Commission. He returned to California at intervals to continue his work there (W. Scofield, 1927). Thompson's diary for 1924 briefly describes his trip from California to Seattle to interview for the position with the International Fisheries Commission. He was hired on 24 November 1924. William F. Thompson diary for 1924 (see footnote 14). Files, International Pacific Halibut Commission, Seattle, Wash.

[31] Norman Scofield (1925) announced Thompson's move to the new International Fisheries Commission: "Mr. Thompson proposes to adopt the same common-sense method of statistical observation which has been utilized in California and to interpret and support the statistical evidence by biological research."

[32] Thompson's approach to research was not without later criticism. A summary of some of the controversy about Thompson's research methods is given by Smith (1994).

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