

Frederic Morton Chamberlain (1867–1921), Pioneer Fishery Biologist of the American West

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"The power to mark the facts coming, or rather brought, under one's attention and to deduce accurate conclusions, unbiased by personal prejudice, from these observations, is the power which makes one man's life success where a less fortunate brother's would be failure."—Frederic Morton Chamberlain¹

ABSTRACT

The life of Frederic Morton Chamberlain (1867–1921) was marked by his many contributions to fishery science. As an assistant with the old U.S. Bureau of Fisheries, he pioneered life history studies of salmon in California and Alaska, and assisted in the collection of hundreds of thousands of natural history specimens from the Pacific Ocean as resident naturalist on the U.S.S. *Albatross*. He was innovative in the use of field photography in fishery work, and the design and construction of capture nets and collecting gear. His detailed reports were important in documenting the conditions of the native ichthyofauna in Alaska, Arizona, and California at the turn of the century and have been heavily relied upon by subsequent investigators. His ability to design and conduct scientifically justifiable studies to solve fishery problems while under many kinds of hardships is a testament to his background and dedication to the field. He represents the prototype of the modern fishery biologist.

Frederic Morton Chamberlain (1867–1921; Fig. 1) was one of many young assistants hired by the old U.S. Fish Commission to collect specimens, gather field data, and compile catch statistics. Although many authors have acknowledged his contributions to various branches of zoology over the years (Rutter 1904a; Evermann and Goldsborough 1906; Clark 1907; Hanna 1921a; Bartsch 1927; Miller 1946, 1961), little is known of the life of this man who did so much to advance the frontiers of fishery science. In the following biography, I outline points of Chamberlain's life, with emphasis on his accomplishments as a pioneer fishery biologist of the American West. Such information not only provides examples of the kinds of hardships under which early fishery science was accomplished, but also serves as a reminder of the types of people who were intellectual ancestors of fishery biologists of the twentieth century.

Biography

Frederic Morton Chamberlain was born on 29 June 1867 near Glenn, in Lost Creek Township, Vigo County, Indiana. He was the youngest of three children of Horace (6/26/1821–4/27/1885) and Mary Elizabeth (Dickerson) Cham-

berlain (12/20/1831–7/11/1900), descendants of pioneer families who moved westward to Indiana in flatboats down the Ohio River (Gookins 1880; Gleason 1938). His paternal grandparents were Moody C. (11/3/1791–9/28/1862) and Betsey Johnson (Dole) Chamberlain (1795–7/14/1868), both licensed school teachers in Merrimack and Bedford, New Hampshire, after the War of 1812. After moving to Terre Haute, Indiana, in 1821, Moody Chamberlain was elected as an associate judge of the Circuit Court of Vigo County for two seven-year terms (1825–1839) (Gleason 1938). In the 1830s, Judge Chamberlain went into the grist mill and lumber business and subsequently purchased a 22.7-ha farm northeast of Terre Haute where grandchildren Volney C. Chamberlain (3/5/1855–8/31/1885), Imogen "Minnie" (Chamberlain) Moore (5/25/1861–7/9/1933) and Frederic were born, raised, and given their first academic lessons.

Frederic was educated in local schools, and as a young man assisted his father in farming, carpentry, and cabinet-making. In the fall of 1886, he entered Indiana State Normal (now Indiana State University) at Terre Haute, where he attended classes intermittently over the next nine years, health and finances permitting (Records of Indiana State University). While there, Chamberlain attracted the attention of Professor Barton Warren Evermann, who guided his academic career and encouraged him to major in zoology with an emphasis in ichthyology. Under Evermann's watchful eye, Chamberlain steadily matured and received a thorough training in not only physical and natural sciences, but also social sciences.

In the fall of 1893, he entered Indiana University (at

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Figure 1. Portrait of Frederic Morton Chamberlain taken about 1905 in Terre Haute, Indiana. Original courtesy of Dr. Fred Swalls.

Bloomington), where he continued studies in ichthyology under Professor Carl "H." Eigenmann (along with fellow classmate Chancey Juday) and received his first practical field experience at the University Biological Station at Turkey Lake. Although ill health forced him to give up his studies in the fall of 1893 (Anonymous 1893), he later re-entered Indiana State Normal for one semester in the fall of 1894 and graduated with his class on 28 June 1895. His senior paper "Shall Science Be Taught In The Elementary Schools?"¹ is an insightful work that reveals much about Chamberlain's philosophy and outlook on life. To him, natural sciences were of first rank as a disciplinary subject, allowing use of the scientific method to furnish a practical exercise of reasoning unequalled by all other subjects except mathematics. With such reasoning, all nature and the outdoors were of intense interest, just waiting to be studied by anyone willing to take the time. No matter whether it was geology, botany, ornithology, or ichthyology, Chamberlain felt all were worthy of observation and study. He was quite willing to communicate his knowledge to others so they could also indulge in the excitement of rational observation, thought, and reasoning provided by the impetus of the great outdoors.

In the spring of 1895, Chamberlain re-entered Indiana University, and was soon put to work as curator of the zoology museum, teaching at the biological station, and studying variation in sunfishes (Centrarchidae) (Anonymous 1895). After a full year of study, he graduated with an A.B. in zoology in June 1896. Immediately thereafter he was off to Wichita, Kansas, where he had been hired as an assistant science instructor at the local high school for a

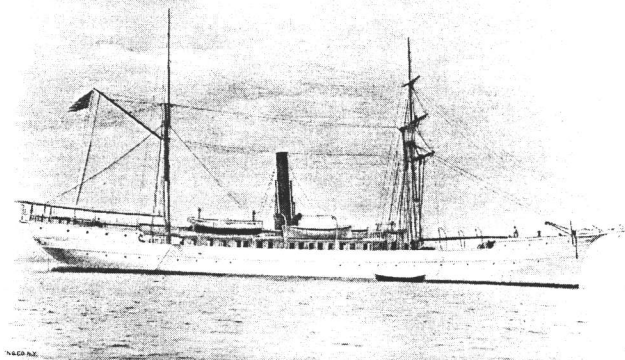


Figure 2. The Steamer U.S.S. *Albatross* as she looked in Chamberlain's day. Photo reproduced from Tanner (1897, plate 1).

then-princely sum of \$75 per month (Anonymous 1896; Records of Personnel Services, Wichita Public Schools).

However, public education was not to be Chamberlain's future calling in spite of his intense interest in this area, for Dr. Evermann (now an ichthyologist with the U.S. Fish Commission) offered him a chance to work with the Commission (which became the U.S. Bureau of Fisheries in 1903). Thus, after some preliminary paperwork in summer and autumn of 1896, Chamberlain was hired on 16 January 1897 as a scientific assistant at \$760 per year.² Shortly thereafter, Evermann put Chamberlain to work writing a chapter about frogs (*Rana* spp.) (Chamberlain 1898) for an upcoming manual on fish culture. Although he had previously written only two short notes (Chamberlain 1895, 1896) about water birds and the biological station at Turkey Lake (or Lake Wawasee), Kosciusko County, Indiana, Chamberlain was well up to the task as judged by the usefulness of his report some 88 years later (Jennings and Hayes 1985).

On 13 April 1897, Chamberlain was promoted to general assistant on the steamer U.S.S. *Albatross* (Fig. 2) upon the death of fellow employee N. B. Miller (Smith 1898). He was then detailed, with Barton Warren Evermann and Henry R. Center, to the Pearl River region, Mississippi. Their assignments were to examine fishery resources in the lower Mississippi River; determine the status of the catfish (*Ictalurus* spp.) industry of the Atchafalaya River, Louisiana; and ascertain the suitability of the Sabine and Neches rivers in eastern Texas for shad (*Alosa sapidissima*) introductions (Smith 1898).

For three and a half weeks, Chamberlain assisted in canvassing commercial fish firms and making extensive collections in the Atchafalaya River (Evermann 1899). The shiner *Notropis chamberlaini* (Jordan and Evermann 1898), presently known as *N. shumardi* (Gilbert and Bailey 1962), was named in his honor from 14 specimens that he collected during this trip (Evermann and Kendall 1898).

Upon their return, Chamberlain was detailed north with the *Albatross* to Alaskan waters and the Bering Sea to determine the status of salmon (*Oncorhynchus* spp.) fisheries and canneries. During the 8-month expedition, Chamberlain not only assisted Harry Clifford Fassett in making a photographic trip record (Fig. 3), he also helped in locating salmon spawning streams, finding illegal fish weirs, and collecting specimens (Moser 1899). The trip was definitely

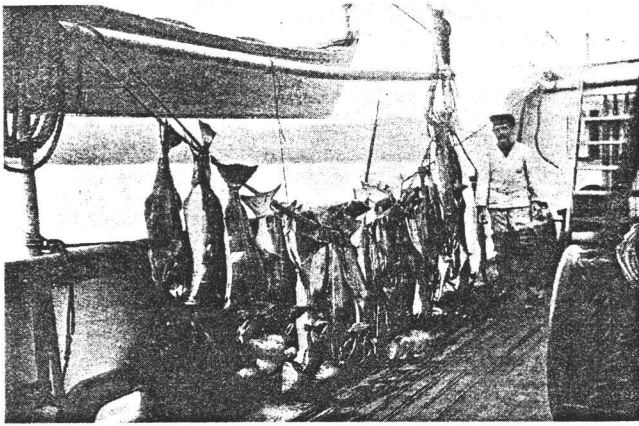


Figure 3. Frederic Morton Chamberlain standing next to a catch of Pacific halibut (*Hippoglossus stenolepis*) on the deck of the *Albatross*. Photo taken in 1897 near Killisnoo, Alaska. Reproduced from Moser (1899, p. 44).

not a pleasure cruise as judged from the physical hardships in having to hack their way through uncharted woods to observe stream conditions and climbing trees to take suitable photographs (Fig. 4). But Chamberlain persevered and learned much about the salmon and Pacific halibut (*Hippoglossus stenolepis*) fisheries of the area. This information would become extremely useful to him in his later years with the Bureau.

Upon his return to Washington, DC, in the spring of 1898, Chamberlain was assigned to the California Salmon Investigations with Cloudsley Louis Rutter and Norman Bishop Scofield, who was an employee of the California Fish Commission (Smith 1899, 1900; Anonymous 1939). Together they helped design and implement the first truly comprehensive study of the ecology of chinook salmon (*Oncorhynchus tshawytscha*), or for that matter of an anadromous fish species. Examination of Rutter's (1904a) report

reveals just how revolutionary this study was. With considerable foresight, these pioneer fishery biologists designed studies so they would not only be able to make accurate reports on migratory patterns and life history traits of indigenous salmonids, but also on food habits, predators, parasites, and growth of these fishes. All of this information was essential for proper management decisions. Additionally, they made surveys and collections of fishes inhabiting the Sacramento-San Joaquin River system and Lahontan basin (Smith 1900; Rutter 1904b, 1908). They also conducted experiments on effects of various chemicals and heavy metals on embryonic salmon³ (Rutter 1904a) as a result of Chamberlain's observations of Sacramento River fish kills below the confluence of Spring Creek (Smith 1902). All in all, it was a masterful piece of work.

During this period, Chamberlain further divided his time in California between the McCloud River Fish Hatchery at Baird, the Battle Creek Salmon Egg Collecting Station on the Tehama-Shasta county line, and the Sacramento River Fish Weir at Balls Ferry⁴ (Smith 1900). While at Baird, he managed to fight off bouts of malaria by "pouring in the quinine all day" and also set out a large garden to augment meager food supplies.⁴ Because of a variable work schedule, Chamberlain had a good deal of free time on his hands, which he used to advantage by reading, playing tennis, hunting game, and prospecting for gold. The latter activity apparently did not yield much return despite the best efforts of Chamberlain and fellow Fish Commission members (Robert Radcliff, Seymour S. Bass, and Giles H. Lambson) of the McCloud River Mining Company!⁵

In the spring of 1901, Chamberlain was again assigned with the *Albatross* to Alaska to conduct further salmon investigations. This time he went as the official photographer and spent much time "spoiling more plates" just to get a few good pictures.⁵ The cruise of 1901 proved as taxing as that of 1897, especially when cases of smallpox and tuberculosis broke out among the crew and the ship was quarantined for a few weeks in Port Discovery, Washington⁵ (Moser 1902). But once again, Chamberlain showed his mettle by being an indefatigable collector and photographer.

In the summer of 1902, Chamberlain assisted Charles Henry Gilbert, John Otterbein Synder, and Alvin Burton Alexander on the *Albatross* collecting expedition to the Hawaiian Islands. The cruise started rather ominously when a crewman was washed overboard the second day out from San Francisco, and Chamberlain lost six dredges in the first three weeks.⁶ Despite being seasick half the time and racked with malaria, Chamberlain helped collect thousands of specimens of deepwater fishes, invertebrates, and sea birds from Hawaii to the Laysan Islands for the U.S. National Museum and Stanford University (Jordan and Evermann 1905). Additionally, he kept the daily log, wrote up reports, built collecting gear, and took hundreds of photographs.⁶

By the spring of 1903, Chamberlain had become an established and highly competent assistant in the U.S. Bureau of Fisheries. On the cruise of the *Albatross* to Alaska that year, he was detailed to scout likely sites for a federal



Figure 4. Frederic Morton Chamberlain (arrow) "photographing under difficulties, near Loring," Alaska, 1897. Reproduced from Moser (1899, plate 2).

salmon hatchery and make field collections of indigenous fishes⁷ (Bowers 1905). Chamberlain's work in Alaska is not only noteworthy for large collections of fishes, but also for extensive notes and studies of life histories of trout (*Salmo* spp.), salmon, and charr (*Salvelinus* spp.)⁸ (Chamberlain 1907; Evermann and Goldsborough 1906), and pioneer sockeye salmon (*Oncorhynchus nerka*) marking experiments (Foerster 1968). Much of the work was conducted in remote areas that required great physical effort to reach. Additionally, he had to put up with inclement weather (signified in his diaries as "rain, rain, rain, RAIN!!!"), constant travel, poor lodging arrangements, hordes of mosquitoes (Culicidae), and occasionally drunken or sick assistants.⁷ Such comments as "Bunk in dance hall"; "Stiff poker game on board"; "Sleep on the grating of the [ship] *Novelty*"; "The ship *Macy* arrives at night [with] whores and whiskey. . . docks and the chinese take possession"; typify the rough frontier conditions of turn of the century gold-rush Alaska, with which Chamberlain had to deal.⁷ Even though Chamberlain reported being sick with colds and "the burn" (apparently a fever caused by the onset of tuberculosis) occasionally, he still kept busy with mundane hatchery operations, stocking fry, downstream migration studies, fishing, working up collections, botanizing, developing photographs, reading, writing letters, compiling reports, and even an occasional duck, goose, or small bird hunt!

When Cloudsley Louis Rutter died at the age of 36 on 29 November 1903, after a short bout of erysipelas (Anonymous 1903a,b), Chamberlain succeeded him as naturalist on the *Albatross* (Bowers 1905) and was also given the task of completing Rutter's unpublished report on fishes of the Sacramento-San Joaquin River basin (Rutter 1908). He signed the oath of office on 24 December 1903 and received a raise in salary to \$1800 per year.² For the next six years, Chamberlain was in charge of all natural history collections obtained by the *Albatross*, except when detailed to other projects for short periods.

In January 1904, Evermann assigned Chamberlain to Arizona to make a report on the fishery resources of that Territory (Evermann 1905). Only five years earlier, Dr. Philip H. Kirsch (a former Indiana State Fish Commissioner) volunteered to make a report on the fishery resources of Arizona, but he died on 8 September 1900 after surveying the San Pedro River (Smith 1900; unpublished records, National Archives). Therefore, Chamberlain was to continue Kirsch's survey and obtain as much information as possible about Arizona fishes during a brief three-month stay.

The Arizona excursion is an interesting account of ingenuity with Chamberlain's limited time, resources, and knowledge of the area. Traveling as light as possible, he set up a base of operations first at Yuma, and later at Tucson.⁹ Then, in a four-and-one-half-week flurry of activity, he traveled by train, stagecoach, auto, horseback, bicycle, and foot to reach springs, ciénegas, and streams of interest and make natural history collections and note opportunities for fisheries improvement.⁹ His work was described in an unpublished, 52-page, handwritten manuscript on file in the Smithsonian Institution Archives.¹⁰ Although Miller (1961) described the importance of this work in his classic paper "Man and the Changing Fish Fauna of the American Southwest," examination of the document and publications by subsequent authorities (Hastings and Turner 1965; Cooke

and Reeves 1976; Hendrickson and Minckley 1985) reveals just how perceptive Chamberlain was of changes occurring in desert rheocrenes of the American Southwest. Everywhere he traveled, he noted the failing of springs, drying of ciénegas, lowering of water tables, erosion of stream banks, and loss of fishery resources. His hypothesis that these changes were largely due to a combination of overgrazing, removal of tree cover, climatic change, groundwater pumping, and poor farming practices remains as valid today as it was in 1904. Furthermore, it has not been greatly modified despite increased amounts of available data (Leopold 1951; Miller 1961; Hastings and Turner 1965).

Chamberlain's comments on fishes of Arizona are noteworthy because they reveal much about the commercial value of the indigenous ichthyofauna (Miller 1961; Minckley 1973) and the composition of the fauna and flora of ciénega habitats before they became almost completely eliminated in the twentieth century (Hendrickson and Minckley 1985). Additionally, his extensive natural history collections provided material for later comparisons with specimens of introduced and native species taken in the past 50 years (Miller 1946, 1961; Minckley 1973).

On 28 April 1904, Chamberlain was sent to Alaska for a fourth season of field work in that region. He conducted downstream migrant studies on salmonids in the Naha River near Loring, and made further collections of native fishes.⁹ However, the trip was cut short in September as the *Albatross* was sent to the eastern South Pacific under the direction of Alexander Agassiz. For the next six months, Chamberlain assisted in making extensive natural history collections from Panamanian, Mexican, and Peruvian coastal waters, and seas around the Galapagos and Easter islands (Bowers 1906a). As he was in charge of all nets and temperature and water density data (Agassiz 1905), his work was of critical importance to the success of the expedition.

It was during the South Pacific Expedition of 1904–05 that Chamberlain first learned of his tuberculosis condition. On 11 November 1904 he became violently ill after breaking a bottle of formalin in the laboratory and breathing the fumes.⁹ Dr. Joseph Cheeseman Thompson, the surgeon of the *Albatross*, conducted a microscopy on a sample of Chamberlain's tissue and after some deliberation, diagnosed a latent case of tuberculosis. Although bedridden for much of a week, Chamberlain eventually recovered to resume his duties.⁹ From then on, he continued a long, and sometimes hopeful fight against the disease that would eventually cause his death (Hanna 1921a, b).

In June 1905, Chamberlain again traveled to Alaska on the *Albatross* to supervise construction of a salmon hatchery on McDonald Lake near the head of Yes Bay, and finish a final season of field work on the life history and young stages of Alaskan salmon (Bowers 1906b). His report (Chamberlain 1907) is noteworthy for its thoroughness and value to future fish culturalists and biologists (e.g., Hartman and Conkle 1960; Rounsefell 1962; Foerster 1968). Besides being a useful compendium of literature and field observations, the report also includes the first detailed keys and figures for juvenile and adult salmon, trout, and charr inhabiting coastal Alaska. As with his previous work in California, Chamberlain helped set standards for future investigations by clearly presenting the data necessary for sound management decisions. He also described the equipment used

(much of it designed in the field under his direction) to allow the collection of pertinent data.

Upon return to San Francisco in December 1905, Chamberlain worked up the season's field data and prepared to outfit for another year of *Albatross* expeditions. In April 1906, he assisted, with other members of the *Albatross* crew, victims of the San Francisco earthquake (Bowers 1906b). Fortunately, all the data and collections were either on board the ship, at Stanford University, or enroute to Washington, DC, and thus missed being lost in the destruction of the city.

In May 1906, Chamberlain sailed with the *Albatross* to the waters of the North Pacific and Japan. After six months of collecting and stops at various Far Eastern ports, the expedition sailed for home on 10 November 1906 (Bowers 1907).

During the spring and summer of 1907, Chamberlain worked on various reports and prepared for an extended cruise on the *Albatross* to the Philippine Archipelago and adjacent southern seas. On 16 October 1907, the *Albatross* left San Francisco and sailed west to Manila (via Hawaii, Midway, and Guam). For the next two years, Chamberlain, along with Lewis Radcliffe, Harry Clifford Fassett, Paul Bartsch, and Clarence M. Wells, actively engaged in natural history surveys under the direction of Hugh McCormick Smith, future Bureau of Fisheries commissioner (Fowler and Bean 1928). Results of their efforts are astonishing. Of fishes alone, there were more than 400,000 specimens presented to the U.S. National Museum. Mollusks numbered more than 89,000 lots (a lot embracing all specimens of one species obtained at one locality, which varies from a single individual to more than 10,000) (Bartsch 1941). Considerable numbers of birds, reptiles, amphibians, and immense groups of other invertebrates were also taken.

Bartsch (1941) provided an impressive account of the amount of work required to collect and process specimens during an "average" day. From daybreak to well after dusk, every member of the scientific staff was engaged in finding, gathering, and fixing specimens, taking copious field notes, and preparing to move to the next collecting site. Since the *Albatross* was rarely in port for extended periods, the ship was constantly on the move with only a couple of days spent at any of 577 established collecting stations (U.S. Bureau of Fisheries 1911). It is indeed unfortunate that a lack of funds precluded further publication of results after some 7,673 pages in U.S. National Museum Bulletin Number 100. Henry Weed Fowler's six unpublished manuscripts on fishes alone (on file in the Smithsonian Institution Archives) would have filled an additional 2,400 printed pages!

The Philippine expedition was Chamberlain's last cruise with the *Albatross*. On 23 August 1911, he resigned as naturalist to become agent, Alaskan salmon fisheries.² As agent he was responsible for gathering catch statistics and compiling reports for the entire salmon, halibut, and herring (*Clupea harengus*) fisheries in Alaskan waters. Additionally, he took notes on other exploited species such as trout, charr, eulachon (*Thaleichthys pacificus*), cod (*Gadus macrocephalus*), and whales (Cetacea) (Cobb and Chamberlain 1912; Evermann and Chamberlain 1912; Chamberlain and Bower 1913). Statistics of Chamberlain's reports provide important historical catch data for comparison with later studies (e.g., Cobb 1916, 1930; Rounsefell 1930).

In 1912, Chamberlain married Mary Mollie Bufink (12/8/1867–3/5/1957), a school teacher and principal he first met while attending Indiana University. They set up residence in Washington, DC, where Chamberlain was writing reports and attending classes at nearby George Washington School of Law (Records of George Washington University). However, things changed when Millard Caleb Marsh resigned as naturalist of the fur seal service and the Bureau needed a replacement to fill that position. Because of Chamberlain's long-time experience in commercial fisheries and his ability to conduct scientifically accurate studies, Evermann asked Chamberlain to take Marsh's place. Although Chamberlain did not want to give up his position as agent, he eventually consented and changed positions for the benefit of the Bureau.¹¹ It was to be a fateful decision.

The northern fur seal (*Callorhinus ursinus*) herd of the Pribilof Island had long been marked by controversy. Acquired by the United States from Russia with the purchase of Alaska in 1867, the herd had experienced a precipitous decline due to unrestricted hunting during the nineteenth century. During the 1880s and 1890s the U.S. Congress had commissioned several studies to determine the status of the fur seal industry in the North Pacific and the rookeries on the Pribilof Islands (Elliot 1882; Stanley-Brown 1894; Stejneger 1896). After much debate, it was finally decided in 1911 that a treaty would be signed between interested nations (Great Britain, Japan, Russia, and the United States) that would ban further pelagic sealing. From then on, the U.S. and Russian governments would take responsibility for conducting harvests on their respective seal islands. Profit from the sale of U.S. and Russian government seal skins in the London market would then be divided between the treaty nations (Bowers 1912).

This plan appeared suitable to all parties involved until a major disagreement between conservationists and preservationists ensued. To preservationists such as Henry Wood Elliot and William Temple Hornaday, fur seal populations were already at dangerously low levels and further killing would risk extinction. However, to conservationists such as George Archibald Clark, David Starr Jordan, and Barton Warren Evermann, culling of a portion of nonbreeding males would not endanger the species, and would provide the U.S. Treasury with added income, ensure employment of the resident Aleut population, and fulfill treaty obligations (U.S. Bureau of Fisheries 1912). To help solve the argument, Congress decided to fund more scientific investigations and defer a final decision until all necessary data on fur seal herds were collected and analyzed.

Chamberlain entered the fray during the winter of 1912. After being hired as naturalist of the fur seal service on 1 December 1912, he was detailed immediately by Evermann to begin outfitting an expedition to the Pribilofs to make pup counts in the rookeries of the scattered seal islands. As an added check (and for future reference), he was also to procure necessary equipment for motion and still pictures of the seal rookeries.¹²

Chamberlain and George Archibald Clark (of Stanford University), temporary Bureau of Fisheries employee, arrived at St. Paul Island on 10 July 1913. They immediately commenced counting pups on the island; however, the work was strenuous under inclement weather conditions, and after three days Chamberlain collapsed with an attack

of fever and "grip" (influenza)¹³ (Hanna 1921b). Clark reported to Commissioner Smith that Chamberlain was bedridden for two weeks, but "as of late he was feeling better."¹³ He filled in when he could, but most pup counts were conducted by Clark and Bureau of Fisheries assistants Philip Hatton, Alexander H. Proctor, and Donald Clark.

By August 1913, Chamberlain's condition had deteriorated to a point where he had to be moved to Seattle, Washington.¹⁴ Soon after, he was diagnosed as having an active case of tuberculosis and sent to Oakland, California, for further treatment.¹⁵

In the meantime, preservationists were able to push through congressional legislation banning all seal hunts for the next decade. With the ban also went the need for further appropriations in the fur seal service. Congressman Moss of Terre Haute was able to reinstate Chamberlain's position for another year, but was unable to do so in the Congressional Appropriation of 1915 due to a change in political administration.¹⁶ Evermann did his best to save Chamberlain's job through the Commissioner of Fisheries,¹¹ but it was of little use. By 1914, Chamberlain was seriously ill, and there was little that could be done for him in the days before antibiotics. He was unable to continue studies at the George Washington School of Law and was forced to retire from government service. He and his wife moved frequently over the next five years (Tucson, Arizona; Palo Alto, California; Colorado Springs, Colorado; and Oakland, California) for treatment of his condition. Unfortunately, he continued to have relapses and his health worsened. The end came on 17 August 1921 when he died of pulmonary tuberculosis at King's Daughters Home in Oakland.¹⁷ He was cremated and the ashes interred at the Oakland Crematory (Anonymous 1921).

Conclusion

The many contributions of Frederic Morton Chamberlain to fishery science cannot be underestimated and support my contention that he represents the prototype of the Twentieth Century fishery biologist. As one of a "new breed" of college-educated field assistants (something we take for granted today), he helped bring about a revolution in analysis and management of exploited, renewable natural resources by an ability to design and direct scientifically justifiable studies to solve fishery problems in the American West. Because of his thorough training and keen facilities of observation, his field notes and reports of fishery resources of central California, southern Arizona, and southwestern Alaska are of immense value, as indicated by extensive use by later investigators (Gilbert and Rich 1927; Miller 1961; Rounsefell 1962; Foerster 1968; Minckley 1973; Jennings and Hayes 1985). In addition, Chamberlain assisted in the innovative use of photography in fishery work in Alaska and California, and the construction of a wide variety of capture nets and collecting gear on the *Albatross*, not to mention his extensive natural history collections. Had he lived longer, he would have doubtless made further important contributions to the field of fishery science.

Contemporaries described Chamberlain as a "very keen, clear minded, capable man of excellent judgement and charming personality"¹⁸ (Hanna 1921b). Although somewhat pessimistic, his frankness, learned background, engaging conversations, and voluminous correspondence

Table 1. Organisms named in honor of Frederic Morton Chamberlain.

Original Description	Present-day Taxon
Mollusca:	
<i>Teredo</i> (<i>Unqoteredo</i>) <i>chamberlaini</i> Bartsch 1927	"same"
Pisces:	
<i>Cottus chamberlaini</i> Evermann and Goldsborough 1906	<i>Cottus cognatus</i> Richardson 1836
<i>Chasmistes chamberlaini</i> Rutter 1904b	<i>Catostomus</i> <i>tahoensis</i> Gill and Jordan, in Jordan 1878
<i>Notropis chamberlaini</i> Evermann, in Jordan and Evermann 1898	<i>Notropis shumardi</i> (Girard 1856)
Aves:	
<i>Laqopus rupestris chamberlaini</i> Clark 1907	"same"

(averaging some 200 letters per year) endeared him to many. Being somewhat delicate in health, it is amazing he was able to accomplish as much as he did throughout his active career. Fortunately, he was willing to put up with all kinds of physical hardships and inconveniences. Perhaps the greatest tributes to his dedication are organisms named in his honor (Table 1). Use of such scientific patronyms is most fitting for Frederic Morton Chamberlain, natural history collector of the highest caliber and pioneer fishery biologist of the American West.

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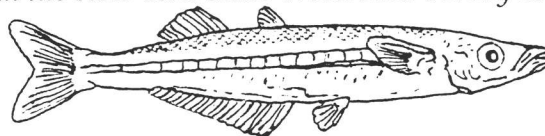
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