require the application of a variety of scientific disciplines, and it is hoped that scientists other than meteorologists will be encouraged to tackle some of the challenging problems. There is need for both laboratory and field research. The tools that have been applied are in many instances inadequate. This applies particularly to the difficult problem of measuring cloud-physics parameters from aircraft. Not only is the subject of cloud physics an interesting scientific study but it bears directly on the increasingly pressing problem of the fresh-water supply of the world.

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Alvin Seale, Naturalist and Ichthyologist

Alvin Seale, adventurer, explorer, field naturalist, ichthyologist and aquarium expert, soldier of fortune, and one of the last of David Starr Jordan's personal disciples, died recently at his home in Corallitos, California, aged 87 years and 20 days.

This Indiana Quaker farm boy rode his bicycle across the country to enter Stanford in 1892. He was an outstanding zoology student and in the usual course of events should have graduated in 1896. But he was an unusual student, and his field trips often caused great gaps in classroom work. In 1896 Jordan selected Seale and Norman B. Scofield to go to the mouth of the Mackenzie River, British America, to see if there were salmon there. This was Seale's first trip to Alaska, Point Barrow, and the Arctic Ocean. His unpublished narrative of this trip is very interesting. Another year he collected sea birds on the Alaskan coast for the British Museum. Then he and his roommate joined the gold rush to the Klondike. His companion "struck it rich," but Seale was too busy studying animals in the wild to bother with panning gold. In his diary he says, "an exciting year."

He went back to Stanford in the fall of 1899, only to leave for Honolulu when appointed field naturalist for the Bishop Museum. In 1900 he made the first zoological survey of Guam, returning via Manila, Hong Kong, China, and Japan. From then until September 1903 he collected all over Polynesia. He explored the Society Islands, the Tuamotu Archipelago, and the Marquesas, Gambier, Austral, Cook, and Samoan islands. He visited, in turn, New Zealand, Australia, the New Hebrides, and the Solomon Islands, returning to Australia several times. These South Sea years were filled with many rare experiences. Just a few of them were related in his privately printed book, *Quest for the Golden Cloak.*

He returned again to Stanford in the fall of 1904 and graduated the following May, 13 years after matriculating. During those 13 years he had come to know more about Polynesia and about its fishes and fisheries than anyone else in the United States and had published a creditable number of important papers.

His next adventure stemmed from his being sent by Jordan to the Texas coast to collect cyprinodonts and carry them to Honolulu to combat the mosquito pest. One of them, *Gambusia patruelis,* was an eager destroyer of mosquito larvae. During the next two decades it was distributed to warm countries all round the globe and was of great help in fighting the mosquito plague.

In 1906 Seale was put in charge of the Anna Alexander Expedition to Alaska. Bears, moose, bighorn sheep, and other mammals were collected for the Alexander Museum of Vertebrate Zoology at the University of California.

In February 1907 President Theodore Roosevelt appointed Alvin Seale fishery expert for the Philippine Government. The next 10 years were spent in this attractive and stimulating position with the Philippine Bureau of Science. Some of the important things accomplished were the following: collecting, studying, and publishing on the little-known fishes of the islands, emphasizing those of economic importance; publishing the first study of the very important bangos fishpond industry; publishing the first study of the valuable pearl and pearl-shell industry, mapping the pearl oyster beds, and drawing up laws to regulate the industry; publishing the first studies of the island sponges, mapping the sponge reefs, and developing a profitable sponge industry; developing a pearl-button industry through studies of shells suitable for the purpose, and drawing up laws to regulate the industry; demonstrating the feasibility of canning the high-quality sardines so plentiful in the Philippines; publishing upon the wealth of other marine shells and developing methods of utilizing them commercially; publishing studies upon sea cucumbers and the trepang industry; publishing upon other marine resources and suggesting how to utilize them; and publishing on the fishes of Hong Kong and of Borneo. Seale brought carp from China and introduced them to the rivers of Mindanao; he brought black bass from the United States and planted them at Baguio, northern Luzon, at an altitude of 5000 feet; he brought mosquito fish from Honolulu to Manila and planted them in various parts of the Philippines;

Alvin Seale at his desk when he was superintendent of Steinhart Aquarium in San Francisco.

and he drew plans for an aquarium, supervised its construction, and made the Manila Aquarium the most outstanding one in the world for colorful tropical reef fish. During these years he visited Formosa and made several trips to Borneo, Hong Kong, China, and Japan.

In 1917 Seale resigned and went as ichthyologist to the Harvard Museum of Comparative Zoology. In 1920 he retired and settled on his ranch near Santa Cruz, California. In 1921 he was induced by B. W. Evermann to revise the plans for the Steinhart Aquarium in San Francisco, supervise its construction, and become its superintendent. This post he held for 20 years, resigning when he reached 70. In 1929 he revisited Samoa to collect fishes for the aquarium. In 1931 and 1932 he was put in charge of the scientific staff of the G. Allan Hancock Expedition to the Galapagos Islands. In 1935 and again in 1939 he made trips to the Hawaiian Islands to collect reef fishes for the Steinhart Aquarium. In 1938 he and his wife made a trip around the world. In 1941 they visited the Yukon, Fairbanks, Mt. McKinley, and Seward, Alaska.

Alone or in collaboration with others, Seale was the author of 162 books and pamphlets, some of them of much scientific importance.

Alvin Seale was more successful than anyone else I have ever met in transporting live fish from a cool climate to the tropics, or from high altitudes to sea level. Only those of us who have had experience in such difficult matters can appreciate his phenomenal skill in transporting live fish to alien habitats. He had none of the aids which now reduce the risks to almost nothing.

Alvin Seale was twice married. His first wife, Ethel Prouty, whom he married in 1908, died in 1936. In 1938 he married Jessie Frapwell, who survives him.

For many years the hobby of the Seales was collecting books on the South Seas. Ultimately this library of 1300 volumes contained practically all the rare chronicles of early voyages and expeditions. In 1936 Seale donated this valuable collection to the city library of Pacific Grove, California, as a memorial to his first wife.

Seale was a man of the highest character, smiling and gracious, who made friends wherever he went and held them for life. In the 55 years I knew him I never heard him say an unkind or slanderous thing about anyone. He exemplified the principles of his Quaker parents.

After his retirement, the Seales lived at their lovely home in Corallitos. Here a stream of friends from all over the United States and the countries of the Pacific came to see Alvin Seale. The hospitality of the Seales became legendary, and to be invited to one of their house parties was a great privilege.

I pay tribute to Alvin Seale not only as a scientist but also as a man who enriched the lives of his family, his friends, and his associates.

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