

Dr. Frances Clark: A California Pioneer in Marine Conservation

Wesley Marx

She specialized in small marine fish with unique reputations. Outfitted in rubber boots, slacks, a shirt with rolled up sleeves and a beret, she would tag sardines in Newport Bay. On moonlit nights, she would greet spawning grunion on sandy beaches. At dawn, she would greet fishermen at San Pedro and sift through their catch for egg-bearing sardines and smelt. Because of her penchant for small fish, she would become a principal player in one of California's major marine conservation struggles.

Her name was Dr. Frances Clark. In the words of one scientific colleague, she "was the first woman fishery researcher to receive worldwide respect and acclaim." As a child, Dr. Clark was more accustomed to rolling prairies than to tide-driven seas. She was born on a farm in eastern Nebraska in 1894. She and her older sister Laura would walk a mile to attend a one-room school. To attend intermediate school, they graduated to a horse and buggy.

In 1910, in a move that would set this child of the prairies on a path towards the small fish of the sea, her parents decided to retire in San Jose, California. She tried teaching as a career but found this was an occupation "she disliked intensely" according to her sister. She decided to attend Stanford University in nearby Palo Alto. The university had an outstanding zoology department that benefited from a premier fish collection established by the university president, David Starr Jordan. Here Clark was introduced to the amazing biological diversity of the nearby Pacific Ocean. After graduating in 1918 with a BA in zoology, Clark became a research assistant to Professor Charles Henry Gilbert who, in Clark's words, "was the man who determined, in general, that Pacific Coast salmon return to spawn in the streams in which they hatched." This was work that Clark very much enjoyed doing. "Dr. Gilbert was a careful and meticulous worker," recalled her sister, another Stanford graduate, "and probably very much influenced her own tendency to be very sure of all of her facts before making either verbal or printed statements. She was always a neat and orderly person, again something that fitted into Dr. Gilbert's way of doing things."

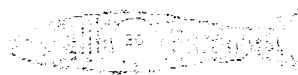
In 1921, Clark landed a position with the new State Fisheries Laboratory in Terminal Island estab-

lished by the California Fish and Game Commission. Its mission: to study the life history and changing abundance of marine fish stocks so measures could be adopted to prevent overfishing. California was the first state to establish such a research laboratory. This was a far-sighted move in its time. The commercial fishing industry regarded most, if not all, marine fish stocks as virtually inexhaustible. Sport fishermen, on the other hand, were anxious to protect game fish from market exploitation. Sport fishermen had supported the creation of the Commission.

Clark started a library that would allow researchers like herself access to marine research reports from around the world. The lab director, William Thompson, also encouraged his new recruit to study the grunion. While of modest commercial importance, the grunion was very vulnerable to exploitation. At the time, you could take a net or shovel down to the beach and catch grunion by the hundreds as they came ashore during high tides to spawn and bury their eggs in the sand.

Clark did a very thorough study. Indeed her research served as the basis of a dissertation that earned her a PHD from the University of Michigan under the guidance of Carl Hubbs. (As students at Stanford, Clark had introduced Hubbs to her sister Laura. The two would later marry.) In 1925, the creation of an artificial recreation beach, Cabrillo Beach in San Pedro, allowed Clark to answer a nagging question: did grunion, like salmon, return to the same spawning grounds year after year? When opportunistic grunion spawned on the new beach, Clark had her answer. Her dedicated work laid the basis for protective measures: capture by hand only and a closed season during the first grunion runs in the spring. Because of such long-standing measures, we continue to enjoy grunion runs.

Clark's ability to link research with protective measures attracted a devoted following. Recalled Patricia Powell, who would manage the library started by Clark, "Young biologists wanted to work under her and be trained by her, which is a very great compliment to a wonderful lady." The State Laboratory would become a "prep school" for biologists who would move on to staff federal and state agencies. Clark referred to her apprentices as "my boys".



Their nickname for her was "Clarkey".

In November, with a full moon indicating the occurrence of extreme low tides, Clarkey and her boys would be digging trenches into the exposed sands of Pismo Beach. They were conducting the annual Pismo clam census. The clam beds in Long Beach had already been depleted and the state biologists did not want this fate to overtake Pismo Beach. Besides catch and size limits, the biologists encouraged the California Legislature to set aside a no-take clam refuge to enhance reproductive success. However, illegal poaching and lack of public support could undercut such measures. Clark called for "the creation of a community attitude favoring law enforcement. In past years, one of the greatest handicaps to the enforcement of the Pismo clam measures has been the reluctance of the judges to make convictions when violators of these laws were brought up for trial."

As her reputation grew, Clark found herself studying another small fish with much greater commercial importance. By the 1930s, the Pacific sardine fishery in California was the nation's largest commercial fishery. In the 1936-37 season, enterprising fishermen harvested an incredible 700,000 tons. Much of the catch was reduced to fishmeal to feed chickens. The State Laboratory on Terminal Island was ringed by the canneries, smokestacks and boat repair yards of a major industry that defied the hard times of the Great Depression.

Early on, Clark's mentor, Thompson, had warned that catching a high volume of sardines to produce fishmeal could ultimately deplete the stocks. Now Clark saw clear danger signals. The fishermen were expending more effort and ranging further from port to net sardines that were becoming smaller in size and younger in age. In 1937, she warned, "The future of the California sardine fishery remains in doubt. Present indications are that the demand exceeds the supply." She urged that the annual catch

be cut in half. She posed another management alternative: restrict use of sardines to direct human consumption, i.e. no reduction to fishmeal. World War II and the need for protein to nourish our sailors and soldiers put this recommendation on hold.

With the war over and hard-pressed Monterey canneries importing sardines by barge and truck from San Pedro, Dr. Clark renewed her call for a catch cutback. She noted, "Again and again, the California Division of Fish and Game has warned the sardine industry that no fish population can withstand the vast exploitation experienced by the sardine in the last ten years. The industry is loathe to face this fact, and when any lack of fish arises, it marshals all possible explanations which will point the finger of guilt from man." However, the California Legislature preferred to heed the sardine processors. The processors, with some support from federal fishery researchers, argued that natural causes such as climate change determined the sardine's relative abundance. "The sardine processors were certainly far from polite in the things they said to us, and they brought pressure on the federal government to have somebody come

and really learn something about sardines!" Dr. Clark would later recall. Clark's mentor, Thompson, had recognized that natural fluctuations, such as sea temperatures, could play a role in the changing abundance of sardines. However, the State Laboratory never received funding to launch broad oceanographic studies. Anxious to avoid catch quotas, the processors decided the time was now ripe for such an investigation.

The processors lobbied to create an enlarged sardine investigation, to be conducted by Fish and Game, by the federal fishery agency (then the United States Fish and Wildlife Service) and by academic institutions, primarily Scripps Institution of Oceanography. This project would become known as the



*Frances Clark and John Johnson tagging sardines on Monterey Bay, 1936.
Photo by J.B. Phillips*

California Cooperative Fisheries Investigation (CalCOFI). Dr. Clark, by now director of the State Fisheries Laboratory, accepted this arrangement with some trepidation, realizing that its practical effect could be to delay even more restrictions on the sardine catch. Her concern would be more than justified.

Initially, state biologists resented intrusion of federal biologists on their research turf but Clark was willing to foster a better working relationship. During CalCOFI conferences she would awake at six in the morning to lead bird watching outings. "She helped introduce me to birds, trees, wild flowers and many other interesting aspects of nature," recalled Powell. Conference speakers would face spirited, sometimes discomfiting, questions from an eclectic mix of biologists and oceanographers. One oceanographer, Joseph Reid, recalled how some persons were "grinning like apes at my discomfiture. Then, as I left the stage, Frances would look at me with her kind, sweet smile and pat me on the back."

At times, Clark's goodwill would be sorely tested. One day, Clark read a headline in the Los Angeles Time that heralded "The Biggest Fish Hunt in History." The article went on to describe the sardine investigation as largely the work of Scripps researchers. The Scripps associate director was described as the "admiral" of the survey fleet. The cooperative role of the State Fisheries Laboratory, the original pioneer of sardine studies, was barely acknowledged. Shortly thereafter, Clark learned that Scientific Monthly (now call Scientific American) had contacted Scripps researchers to do an extensive article on the sardine investigation. Frustrated at being reduced by the media to a bit player in the sardine saga, Clark wrote a letter to her brother-in-law, Carl Hubbs, now on the faculty at Scripps. "Scripps is doing the new and spectacular and appears to get a lot of praise and glory. California Fish and Game (and Fish and Wildlife to some extent) is doing the routine drudgery without much glory...I do not think that anything can be done about this situation and we should be big enough to overlook it. We are human, however, and it tends to keep us on edge."

There would be more frustration. Clark was asked to review and comment on the manuscript for Scientific Monthly and she did so. However, when she read the article in print, she noticed that a paragraph had been added. The paragraph claimed that overfishing was not a cause of the sardine decline. If she had seen this paragraph beforehand, Clark would have vigorously protested because her agency was still trying to persuade state legislators to enact catch

restrictions.

CalCOFI, which continues to this day, has proven to be a scientific success. In seeking to understand the California Current system that sustains sardine and other pelagic fish, CalCOFI has generated a wealth of physical and biological data. This data is now being used in research into climate change and the potential impacts of global warming. However, not till 1966, 18 years after its inception, did CalCOFI come up with its answer to the sardine's continuing decline: overfishing coupled with an environmental regime unfavorable to sardine reproduction. Dr. Clark's prescient call to limit the catch was in large part vindicated. By now there were few sardines left. A total ban, not just a catch limit, was needed to insure any chance of recovery.

The California Legislature's willingness to substitute studies for timely action would not be lost on dam builders, ocean sewage dischargers, coastal developers and other change agents in the hectic postwar growth period. The state's foresight in establishing the State Fisheries Laboratory would be compromised time after time by appeals for more studies...and more policy paralysis.

As director of the State Fisheries Laboratory for 17 years, Clark expanded research efforts into newer areas, including pollution and habitat loss. She would author or co-author over 50 scientific papers on marine animals as varied as giant squid, pismo clams, and blenny eels. She continued to train new researchers attracted by her worldwide reputation. In 1953, she visited Peru to help train fishery researchers there. She saw some familiar faces. Fishmeal producers from California were moving their idled equipment to Peru. In a repeat of the California experience, Peru would later ignore warnings by its scientists and allow overfishing to deplete its anchoveta stocks. In 1957, Clark retired from Fish and Game. At a special recognition dinner in San Diego, she received a gold pendant from the American Institute of Fishery Research Biologists to honor her scientific accomplishments. She moved to La Jolla, where Carl and Laura Hubbs lived. From her seaside cottage, she could see terns and pelicans pursue schools of small fish.

In 1981, she returned to CalCOFI to recall her pioneer days in fishery investigations. One person wondered if she had faced discrimination as a woman. "My personal experience is not that people didn't 'want' to employ women, they just never 'thought' of doing so," responded Dr. Clark. In 1987, a few months after her 92nd birthday, she died. "Although small in physical size, she stood out among

her colleagues because of her achievements in the fields of science and conservation," observed Richard Croker, a fellow biologist with the Department of Fish and Game. The following year, the person who walked with Clark to the one-room school in the prairies, her sister Laura, passed away.

By the time of her death, the sardine was showing belated signs of recovery some four decades after her prescient warnings. Today, commercial fishing has resumed under measures that would please Clark. An annual quota is set based on the relative abundance of sardines. Federal and state biologists collaborate in working up these assessments. Besides catch data, they use fishery-independent data, such as pelagic egg surveys. The catch quota is supposed to include a reserve to insure that enough sardines are left as forage for seabirds, tuna and other marine animals higher in the food chain. Because there are few canneries left to can sardines, a portion of the California catch is exported to Australia as feed for

wild-caught tuna placed in grow-out pens.

There is, as always, unfinished business. "Clarkey and her boys" were able to determine that the Pacific sardine ranges from Baja California north to British Columbia. Trans-border agreements on catch quotas with Canada and Mexico will be needed to sustain the current sardine recovery.

Wesley Marx has written numerous articles and six books on environmental subjects. Hartley & Marks has just published an updated edition of his award-winning book, The Frail Ocean. Portions of this article appeared in Tidelines published by Friends of Cabrillo Marine Aquarium in San Pedro. The writer expresses his appreciation to Scripps Institution of Oceanography Archives for access to the Carl Hubbs Papers. wmarx@primenet.com



Frances Clark with her Department of Fish and Game colleagues, 1940.