Chapter 4
Post-War Reconnaissance of Japanese Fishery and Ocean Science and Its Contribution to the Development of U.S. Scientific Programs: 1947–1954

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Abstract This chapter examines the over-looked contribution of Japanese scientists to ocean science and the construction of recruitment fisheries oceanography, the study of the effects of climate and ocean variability on fish abundance. After World War II, the U.S. Fish and Wildlife Service worked with the Supreme Commander Allied Powers staff in Tokyo to find and translate scientific documents about tuna and oceanography, for use by Americans trying to start fisheries in former Japanese waters. Determining the migration patterns of the fish was essential to catching them, and the Japanese translations greatly influenced *"Progress in Pacific Oceanic Fishery Investigations, 1950-53."* The document pioneers the integration of fisheries, oceanography, and meteorology to better understand the dynamic structure of the equatorial Pacific Ocean, and the importance of upwelling and frontal structures as they relate to distribution and abundance of Pacific tunas. The science of finding the fish was a critical step in the global expansion of tuna fishing throughout the subsequent decades. While the paper acknowledged the Japanese contribution to the construction of the science, the publication also masked the importance of the contribution.

4.1 Expanding the Foundation Stories about Fisheries Science

> In the last half of the 19th-Century American economy was largely based upon the development of the Great Plains. The Pacific Ocean is the Great Plains of the last half of the 20th century. (Chapman 1949)

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S. Partelow et al. (eds.), *Ocean Governance*, MARE Publication Series 25,
https://doi.org/10.1007/978-3-031-20740-2_4

The short version of the foundation story of the development of fisheries science is that it built on natural history and zoological studies begun in Northern Europe and formally organized in 1902 under the direction of the International Society for the Exploration of the Seas (ICES), headquartered in Copenhagen. Its first theoretical paradigm was developed by Johan Hjort (1869–1948) in 1914, with an explanation of the natural variations in year-classes of fish (Hjort 1914). Hjort brought his ideas with him to Nova Scotia in 1914, where he met and influenced American oceanographer Henry Bryant Bigelow (1879–1967), the Harvard zoology professor and later the first director of Marine Biological Laboratory at Woods Hole (Schwach and Hubbard 2009). But how did Hjort's ideas spread to the Pacific Ocean?

A 1998 paper by two fishery scientists offered an idea: that Bigelow's two graduate students at Harvard were responsible for bringing his ideas to the Pacific. The two students, Oscar Elton Sette (1900–1972) and Lionel Walford (1905–1979), worked for the U.S. Fish and Wildlife Service while they were completing advanced degrees at Harvard under Bigelow. The federal agency transferred them to Stanford University in 1937 to lead an investigation into the collapse of the California sardine (*Sardina caerulea*) fishery. Sette wrote the first coordinated research plan for sardines in 1943, and his ideas were implemented with the creation of the California Cooperative Oceanic Fisheries Investigation (CalCOFI) after 1949. Arthur W. Kendall, Jr. and Gary J. Duker contend that the sardine plan was written to test Hjort's theories on recruitment (Kendall and Duker 1998).

Sette would not end his career with his work on sardines. In 1949 he was named director of the Pacific Oceanic Fisheries Investigation (POFI), headquartered in a new laboratory in Honolulu, with a mandate to find enough information about tuna to start an American fishery in the waters of the Mandated Islands, the former Japanese possessions now under American control. In addition to three research ships, POFI included a reconnaissance mission between the U.S. Fish and Wildlife and the Supreme Commander Allied Powers (SCAP) to find and translate Japanese documents about tunas and oceanography.

Sette published *"Progress in Pacific Oceanic Fishery Investigations, 1950-53,"* pioneering the integration of fisheries, oceanography, and meteorology to better understand the structure of the equatorial Pacific Ocean, its weather, and most importantly, the behavior of its tuna stocks (Sette 1954). This paper argues that Sette's contribution to ocean science has been systematically overlooked, as has the contribution of Japanese scientists after World War II, to the development of what is known as recruitment fisheries oceanography. Most simply, that is the study of the "effects of climate and ocean variability on fish abundance," (Wooster 1987). "Fisheries science" in this paper is used very broadly, to refer to scientists who are involved in studying fish and the catching of fish, and to the process of managing both fish and people.

Oceanography is by no means a unified science. There are four (or five) main divisions, with physical oceanography (waves, tides and energy); geological oceanography (sediments); chemical oceanography (the components of seawater): and biological oceanography (marine life). Actions by the Japanese and American governments led to the development of a new sub-field, integrating weather, currents, and fish survival.

While there has been much attention paid to the impact of the military on the development of oceanography more broadly, there is little attention to the impact of the military on the development of fisheries science. I have argued that after World War II, science became a tool of government; in particular, fisheries science became a tool of the State Department, used to structure post-war relations in terms beneficial to the U.S. But the military, with the assistance of federal scientists, was also used immediately after the war, to help create an American fishery far from the home waters, (Finley 2011).

The central conundrum for fisheries scientists is why fish populations fluctuate so much. The great seasonal herring (*Clupea harengus*) and cod (*Gadus morhua*) migrations in Northern Europe fluctuated wildly and a poor year threatened national economies. Naturalists in the 1880s at first thought that the stocks fluctuated when they took different migration routes. Johan Hjort, the Norwegian director of fisheries, was one of the first to move away from migration thinking to looking at fish as populations, then trying to understand the factors that influenced their behavior. The "critical period" for survival was during the egg and larvae stages; both life stages needed plentiful plankton as the eggs hatched and the larvae learned to swim. The key to understanding fish migration was to understand ocean currents, and what is more broadly called dynamic oceanography, the study of the ocean forces.

For generations, oceanographers had measured and mapped the oceans, such as in the volumes of the *Challenger* Expedition of 1872 to 1876. Baselines were established and changes were measured over time and interpreted. But with the turn of the twentieth century, this descriptive oceanography was being replaced by dynamic oceanography, grounded in mathematics, and trying to understand the large-scale interactions between the ocean and the atmospheric systems. The scientists who gathered in Copenhagen at the first ICES meetings increasingly were interested in a new strategy- repeated cruises, in the same area, at the same time of the year. Called intensive area studies, the objective was to create a web of hydrographic, biological and geologic data, which scientists hoped to integrate into a comprehensive analysis of fisheries problems (Brosco 1989). Such large-scale research projects needed interdisciplinary teams to delineate the patterns the data revealed (Hamblin 2014). While Hjort is credited with the theory, the research was a joint undertaking of a small group at the Directorate of Fisheries in Bergen, named the Bergen group, and in co-operation with the ICES scientists in Copenhagen, as well as state and university scientists from a variety of disciplines and member countries (Schwach 2013).

Such government-funded science was expensive, and it was paid for with the expectation that scientists would find new schools of fish for exploitation. As Norwegian historian of science Vera Schwach has noted, "the establishment of marine science as a multidisciplinary field occurred globally and was to a large extent materialized and financed within the framework of the economic utilization of fishes and fisheries management," (Schwach 2013).

Historians are now looking at how fisheries expanded globally, especially after World War II. Fishing has always been a strategy of empire, and it assumed new importance as military technologies were increasingly used by fishing boats, as were larger and more powerful engines that could fish bigger nets in deeper water. Governments played a central role in industrializing the fisheries, with the adoption of policies that encouraged investment in the development of fleets and processing facilities, as well as research into how to store and ship fish. Fishing was increasingly woven into government policies as the 1950s went on (Finley 2017).

There is an increasing body of scholarship exploring the development of marine resources in the Pacific. The patterns of development were more rapid than development in the Atlantic, where fisheries changed over centuries. Development in the Pacific was much faster and more international, with many nations using their fisheries to achieve economic and social objectives. While most of the scholarship on development in the Pacific deals with terrestrial matters, there is growing scholarship about the development of fisheries and whaling in the Pacific (Tsutsui 2013; Hee 2019; Arch 2018; Ogawa 2015).

It was not until the twentieth century that fishermen developed the skills and technologies to follow tuna throughout the oceans. Maritime countries had always taken some of the great fish as they migrated past, but they did not have the power to pursue the fish that never stop swimming, until the early 1900s (Joseph et al. 1988). Steam engines gave boats the power to chase the fish, and then to slow them down by throwing live bait into the water, attached to long slender bamboo poles; three men could work together to catch one of the giant fish; yellowfin could reach 400 pounds. The technique soon spread from the waters of Japan across the Pacific Ocean to Southern California, early in the 1900s. It was only a start for the fishers of the two nations to learn from each other and to transfer technologies. They also transferred science, sometimes involuntarily. And it was the start to a rivalry, over which nation would dominate the catch of the Pacific's great tuna runs.

There are approximately 58 species of tuna and related fish in the family, which also includes billfish, bonitos, swordfish, and mackerel. The largest species are marlins and bluefin tuna. Tuna are found in the tropical and temperate waters of the Pacific, the Atlantic, and the Indian oceans. They are unique among fish; while they are related to salmon, the two species are separated by approximately 100 million years of evolution (Dewar and Korsmeyer 2001). Biologists call tuna energy speculators, because they can invest large amounts of energy based on a payoff when they capture food. When they need it, tuna have the capacity for increased levels of oxygen uptake, delivery, utilization, and, consequently, work, allowing them to carry out many metabolic functions faster than other fish. Their circulatory system is designed to dissipate excess heat and they usually maintain a body temperature that is higher than the temperature of the water in which they swim. Tagging studies on tuna show they migrate thousands of miles across the open ocean. "These fish are alert and very difficult to catch," wrote the world's premier tuna biologist, Kamakichi Kishinouye (1923). The most important commercial species were skipjack (*Katsuwonus pelamis)*, yellowfin tuna (*Neothunnus macropterus)* and albacore (*Thunnus alalunga*).

It was well known by the 1930s that the Japanese were the world's best fishermen. The sea has always been of central importance to Japan, and fishing, whaling, and shipbuilding have played prominent roles in the development of the world's largest and most sophisticated fishing fleet. A series of subsidies began in 1923, encouraging the construction of refrigerators, refrigerated boats, and ice-making systems, allowing Japanese boats to carry their fish to other countries. During 1931–1938, when fishing was at its peak, Japan's aggregate annual production ranged from 3.5 million metric tons to 4.5 million metric tons. The U.S. catch, combined with Alaskan salmon, was less than 2.5 million metric tons a year (Espenshade 1949).

But while they were the best fishermen, the quality and depth of their scientific scholarship is only recently receiving attention. They were also skilled scientists, with a rich research tradition that had been well-funded by successive governments. The *Fukuoka Gyogyoshi*, or "Description of Fukuoka's Fisheries," identifying about 100 species of fish, was compiled in the 1870s. The Hydrographic Department of the Imperial Navy was established in 1871 to make charts of ocean currents, tides, and depths in the coastal regions (Kalland 1995). The government also set up an extensive series of fisheries experimental stations and meteorological observatories. The fisheries experiment stations studied sea conditions and broadcast weather reports to the fishing industry. The marine meteorological observatories were engaged in ocean meteorology. The Central Meteorological Observatory conducted surveys of sea currents using a series of instruments placed along the Japanese coast.

The Fisheries Society of Japan was created 1882 to give direction to the general fishery activity in the country. In 1885, the Fisheries Bureau was inaugurated within the Ministry of Agriculture and Commerce. In 1890, the Fisheries Bureau established the Fisheries School for the training of technicians, while the government created the Committee of Investigation for Fisheries and the Investigation Station of Fisheries (*Japan Times and Mail* 1939a, b). The Fisheries School was reorganized into the Imperial Institute of Fisheries, located outside Tokyo. The curriculum was divided into three general areas, fishing, fisheries technology, and pisciculture. Study in each area took 3 years, and included all aspects of fishing, from navigation to gear development, canning and salting technology, and a wide range of aquaculture efforts aimed at increasing the cultivation of fishes and seaweeds. It was a uniquely comprehensive education.

By 1937, Japan was the world's leading fishing nation. Its network of fisheries was spread throughout the Pacific, and into the Indian and Atlantic oceans. The objectives of the "aquatic products industry" were to guarantee fishermen a stable livelihood and to improve the health of the nation by providing a supply of fresh protein. The development of overseas fishing and the export of fisheries products were considered extremely important to the health of the Empire. The Japanese were proud of their fisheries development, and the research that furthered the country's accomplishments. "The perfect cooperation among the aquatic industrial experimental stations…is unheard of in other countries," wrote the *Japan Times & Mail* in 1939. While fishery institutes in other countries only concentrated on the deep-sea, Japan had a far more extensive and expansive scale of fishery education, drawing requests for information from scholars in other countries. The initial structure of the School of Fisheries at the University of Washington in 1919 was modeled on the Japanese model (Stickney 1989).

After World War I, Japan had acquired control over the Micronesian islands, the Marshall, Mariana, and Caroline Islands, also known as the Mandated Islands. By the 1930s they had developed a lucrative tuna fishery. With the end of World War II, the islands and their waters, were under the control of the Americans. The Japanese fishing industry, which had dominated fishing in the Pacific during the 1930s, was now strictly confined to its home waters, opening an opportunity for the U.S. to begin developing fisheries the Japanese had discovered.

The Americans starting planning for the occupation of Japan in 1942, with a research division in the State Department (Martin 1948). The Supreme Commander Allied Powers (SCAP) arrived in Japan with a series of policies designed to completely transform Japanese life. Nine sectors were organized to carry out the Occupation. Japan was to be demilitarized and disarmed. The economy was to be transformed, the large industrial and banking combines dissolved, and the educational system modernized. Society was to be transformed from feudal and authoritarian to democratic, labor unions encouraged, and women given the right to vote, hold property, enter higher education, and run for public office. Four million acres of land was bought and sold cheaply to farmers (Le Feber 1997).

Fisheries was managed by the Natural Resources Section, along with agriculture, forestry, and mining.[1] It was headed by Col. Hubert Schenck, a paleontologist from Stanford University. SCAP's initial fisheries policy, laid out on Feb. 18, 1946, included the goal of "ensuring the maximum production of seafood products consistent with security requirements," (Yamamoto 2000). At the same time, Japanese boats were greatly restricted to their home waters, in the interests of security.

The Americans turned out to be extremely interested in reforming Japanese fisheries and giving rights to poor fishermen through the Fisheries Rights Reform bill. An undated SCAP document records a long series of meetings and correspondence over the American legislation; it covers 17 pages, with SCAP continuously urging the government to move forward with the American plans.[2] The core of the plan was to establish a fishery coordination committee to make democratic and optimum use of fishery resources. Local and regional fishermen would control the sea off their prefecture, conserving their resources for themselves and their communities. It was an attempt to break the power of the Japanese fishing companies and the government ministries.

The fisheries division staff included John L. Kask, an Army captain and a fishery graduate from the University of Washington. He published an intensive study of the ownership of the four largest Japanese fishing companies in 1949, including the names of their shareholders (Kask 1947). He wrote two other leaflets, about the

[1] National Archives and Research Administration (NARA), RG 331, Box 8867. Supreme Commander for the Allied Powers, "Summation of Non-Military Activities in Japan and Korea, No. 1," (Tokyo: Supreme Commander for the Allied Powers 1945) 3.

[2] NARA RG 331, Box 8867, Japanese Reconnaissance Team, Pacific Oceanic Fisheries Survey, Nov. 22, 1948.

fishing gear used in Japan, and the Japanese system of education. He found there were fisheries schools in all of the prefectures, turning out expert fishermen, cannery operators, and technicians. There were two universities doing advanced work in fisheries and oceanography, in Tokyo and Hokkaido.

A further report, in October of 1948, detailed the history of oceanography in Japan, starting in 1902, when the first cross-line observation, measurements on a wide scale, was attempted. The report contained a summary of published research for 1946, including what scientists were working on selected projects in various prefectures. The fisheries literature was “extremely voluminous,” Kask wrote, and would need to be translated (Kask 1947). Japan supported 32 provincial fishery schools in 24 provinces, teaching everything from “how to row a boat and how to fish to meteorology and navigation.” There are also two fisheries colleges and 70 research and training vessels (this is before the war). There were 112 provincial research stations and a large Central Fisheries Research Station in Tokyo with five strategically situated branch stations throughout the country. Even school children learned about fish.

By contrast, the American funding for ocean science had been scant and intermittent. The U.S. Fish Commission was created in 1871, after the British demanded landing taxes for American mackerel sold in Nova Scotia. The British had landing bills; the Americans no catch numbers, and Congress was unhappy about the size of the British tax bill. The first director of the new institution was Spencer Fullerton Baird (1823–1887). Baird argued that in order to understand the fluctuations in the supply of commercially valuable fish, it was necessary to understand the ocean food chain. This justified the construction of the first American oceanographic fishing vessel, the *Albatross*, a 200-foot-long steamer launched in 1882, and the construction of the Woods Hole laboratory, to process the material collected at sea and to do more intense work on marine organisms (Allard 1978).

The Depression had led to steep cuts in the budget for the U.S. Fish and Wildlife Service, and the last research ships had been mothballed early in the 1930s. There were no federal and state funds for ocean research. One of the reasons the Scripps Institution of Oceanography hired Norwegian Harold Sverdrup in 1937 was the hope that he would lead a resurgence of American research ships back to the ocean (Rainger 2000).

The fluctuations in the California sardine fishery, and its eventual collapse, created the crisis that sent American scientists back to sea. Sardines had gone from a $60 million industry down to $15 million. Despite its slim budget and small staff, the agency sent its two top Atlantic scientists to its laboratory at Stanford, to head an investigation into why the fishery was collapsing. For both Elton Oscar Sette (he preferred to go by Elton) and Lionel Walford, who were both born in California, it was chance to take Hjort’s and Bigelow’s ideas, and the techniques of intensive area studies, to the Pacific Ocean and the sardine problem. Sverdrup was introducing the theories of dynamic oceanography, and the need to study all of the life stages of marine life, as well as the environment in which they lived. It was an exciting time for the development of ocean science (Powell 1972).

Sette was born in California in 1900. He was 18 when he was hired to survey albacore landings at San Pedro. He would do his undergraduate work at Stanford under noted educator and ichthyologist, David Starr Jordan (1831–1951). His first academic publication, about why sardines fluctuated, is marked by its use of statistical methods to conclude that samples may not be representative of the population as a whole. Hired by the old Bureau of Commercial Fisheries, Sette was promoted to the Chief of the North Atlantic Fishery Investigations in 1928. His office was at the Museum of Comparative Zoology at Harvard, and he spent the summers acting as director of the Bureau's station at Woods Hole.

For the sardine research, the California legislature appropriated $800,000 for the Scripps Intuition of Oceanography and levied a $200,000 special tax on sardine processors. Sette's sardine plan, published in 1943, became the blueprint for the California Cooperative Sardine Research Program, re-named the California Cooperative Oceanic Fisheries Investigations, or CalCOFI. It was necessary to study all of the life stages of the sardines, as well as to study the impact of fishing on the stocks.

California state biologists were originally uneasy about the additional federal presence, but Sette soon established good relationships with state biologists (Powell 1982). With the spread of the fishery into Oregon and Washington waters in the 1930s, research into sardines also expanded to other agencies, including federal and provincial scientists in British Columbia. Sette organized annual meetings to share data and information, calling it a "cooperative research program, in the best sense," (Sette 1943).

The creation of CalCOFI, and the prospect of pushing the American tuna fishery deeper into the Pacific, generated a lot of state and federal support. Congress in 1944 passed a resolution to expand American fisheries, to develop king crab in Alaska and a high-seas tuna fishery. American boats had fished their way south to the Galapagos in the 1930s, and as far east as Hawaii. But to develop a new fishery, there would have to be substantial federal support.

As early as 1943, the U.S. military had decided on a Pacific strategy that depended on the building of military bases, some of them in the Mandated Islands, the former Japanese territories which came under U.S. control in 1946. As the fighting in the Pacific intensified, military officials were interested in finding new food sources, especially fish that could be served fresh. The Office of Economic Warfare was responsible for procurement and production of all imported materials necessary to sustain the war effort and the civilian economy. One of the board's many goals was to use local foods to supplement canned rations in war zones. For a war zone in the middle of the Pacific Ocean, that meant finding fish to feed service men.

The food situation was critical; in November of 1943, the upper Solomon Islands were so recently secured from the Japanese there were no lines of supply. Rations were dry and in short supply. There were growing numbers of troops in the Pacific. Could fish be caught to feed them? Four scientists, including Wilbert McLeod Chapman, were hired to find out. Chapman had graduated from the School of Fisheries at the University of Washington with doctorate in ichthyology in 1937. When war broke out, he had been hired as Curator of Fisheries at the California

Academy of Sciences in San Francisco. His close friend, Milner Baily Schaefer, had also graduated from the University of Washington School of Fisheries, with a Bachelor of Science in 1935. Chapman had Schaefer seconded to the fisheries investigation, but Schaefer contracted rheumatic fever in New Caledonia and would spend most of the war in military hospitals.

Chapman's initial scouting trip stretched from a few days to 3 months and 20,000 miles of air travel. He would eventually spend 14 months in all working to start fisheries in the Gilbert, Ellice, and New Caledonian islands, and then to the Solomon Islands. He started fisheries at roughly 20 different military bases, primarily in the New Caledonia, the New Hebrides, and the Solomon Islands.[3] But while the projects could catch fish to feed soldiers, it did not find a home. It was originally a Navy project, but it was transferred to the Army, and Chapman's plan to establish fisheries "in the whole South Pacific area," disappeared "and I was never again able to find the slightest trace of it," according to his account of his wartime service.[4]

Chapman's wartime plan for the military might have disappeared but he certainly retained his own plan to establish American fisheries in the South Pacific. After his return to San Francisco, he immediately started an extensive letter-writing campaign to expand American tuna fisheries deeper into the Pacific. In letter after letter, to politicians and other academics, Chapman urged for the expansion of the American tuna industry into the Pacific and insisted that federal funding was essential to the expansion.[5] Throughout Chapman's extensive writing during this time, he frequently referred to the effort the Japanese put into research and science on oceanography and tuna, far more than the Americans were funding.

In December of 1946, he asked Schaefer, who had finally been released from a military hospital, to pull together some information about the potential for an American fishery in the islands. Americans could reap a "considerable harvest," from the adjacent seas, and there were possibilities "that lie in the exploitation of other parts of Oceania by American fishermen based on scientific study of the tunas and their habitats." Schaefer went on to say the Japanese are building "new large tuna vessels and motherships. They may be expected to expand their fisheries as rapidly as the occupation forces permit."[6]

Hawaii's delegate to Congress, Joseph R. Farrington, introduced a bill in January of 1946, seeking funds to provide for the exploration and development of high seas

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[3] University of Washington Special Collections (UWSC), Wilbert M. Chapman papers, Box 4, folder A, undated report.

[4] UWSC, Chapman papers, Box 4, Folder 1.

[5] The most complete account of Chapman's activities during this period comes from Harry Scheiber, "Origins of the Abstention Doctrine in Ocean Law: Japanese-U.S. Relations and the Pacific Fisheries, 1937–1958." *Ecology Law Quarterly* 16 (1989): 23–101; "Pacific Ocean Resources, Science, and Law of the Sea: Wilbert M. Chapman and the Pacific Fisheries, 1945–1970," *Ecology Law Quarterly* 13, no. 38 (1986), Arthur F. McEvoy and Harry N. Scheiber, "Scientists, Entrepreneurs, and the Policy Process: A Study of the Post-1945 California Sardine Depletion" *Journal of Economic History* 44, no. 2 (1984).

[6] NARA RG 331, Box 8867, Japanese Reconnaissance Team, Pacific Oceanic Fisheries Survey, Nov. 22, 1948.

fishing in the Territorial waters of the sub-tropical Pacific. The bill called for $350,000 to build the research lab in Honolulu, $700,000 for three vessels, and $350,000 as an operating budget. For a country that has stopped going to sea in the 1930s because at sea research was too expensive, it was a big step forward. Too big; critics protested that surely the fish resources of Hawai'i could never be big enough to warrant such an expenditure.

Chapman became one of the most enthusiastic proponents of Farrington's bill, speaking with the authority that came having spent 14 months in the Eastern Pacific. This was the start of his rise to a national political figure, one of the most influential scientists of his generation, appointed to a position at the State Department and deeply involved in the negotiations over several fisheries treaties, including the peace treaty with Japan.

Chapman was explicit that the objective of the bill was to provide the information needed "by American industry to risk capital in establishing fisheries in the area, particularly in the Mandated Islands."[7] The Japanese harvested more tuna from the waters of the Mandated Island than what Americans had caught in the entire Eastern Pacific, Chapman wrote, "and their fisheries there were new and still rapidly developing." The Americans developed a high-seas tuna fishery that was dependent on being able to harvest bait from near-shore waters, increasingly the waters off Mexico and Latin America. The Latin American countries were increasing the fees they charged to American boats to fish in their waters.

In his frequent publications, Chapman argued that while crops are produced from the top few inches of soil, the sea had resources throughout its water column. With the victory in the war, Chapman wrote that the nation had won "an empire of great riches, where the land is as nothing and the sea is everything—an empire in which the native people are small in numbers and restricted to small points in its vastness; an empire which no other nation save the Japanese covets and which no other nation save theirs and ours can cultivate and make produce," (Chapman 1949).

With Chapman's support, the Farrington Bill passed on a second attempt in 1949, inaugurating a new period in the development of federal fisheries science, the exploratory fishing programs. Four programs were established, the Gulf Exploratory Fishery Investigations, the Northwest Pacific Exploratory Investigations, and the North Atlantic Fishery Investigations. The lead program was POFI, and Sette was the logical scientist to direct the new laboratory and its large-scale research operation. He hired Schaefer to head the section on biology and oceanography. Schaefer was the chief scientist onboard the first POFI cruise, on a vessel called the *Oregon*, out of Honolulu. Assigned to run surveys on systematic legs, they found the ocean was so rough they sometimes could not cast live bait. Bait was scarce. Finding tuna was going to be more difficult than they thought.

While Sette was in charge of the POFI operation, Chapman was deeply involved in the reconnaissance mission. He had left the California Academy of Sciences in 1947 to take over as director of fisheries at the University of Washington. Three of

[7] UWSC, Papers of Edward Allen, Box 18, Folder "United Nations fisheries conference."

the scientists hired for the reconnaissance mission came from the University of Washington. The leader was Frederick "Fred" Cleaver, and included a chemistry student, David T. Miyauchi.

The most important component of the renaissance mission was a 26-year old Japanese American scientist, Bell M. Shimada (1922–1958). He was born in Seattle to immigrant parents. He showed an early aptitude for mathematics and entered the School of Fisheries at the University of Washington in 1939. With the declaration of war against Japan, he was one of thousands of Japanese people rounded up and sent to internment camps; he was sent to Minidoka in Idaho in 1941. He volunteered as an infantryman, then was selected for intelligence and Japanese language training. He was assigned to the Military Intelligence Service and embedded in the US Army Air Forces.

For the next 2 years, Shimada "hopscotched behind the Pacific frontline," as his official federal biography states. After the surrender of Japan, he moved to U.S. Army Air Forces headquarters in Tokyo, as part of the Occupation of Japan. His job was to collect and synthesize economic and infrastructure data on the effects of the strategic bombing of Japan. He was discharged from the military in February of 1946, but he stayed in Tokyo, in a civilian position as a fisheries biologist in the Natural Resources Section. He remained in Tokyo for another 9 months before returning to Seattle where he enrolled for the fall quarter at the School of Fisheries in 1947. He left Tokyo with two highly complementary letters, including one from the SCAP natural resources director, Schenck. Shimada did "superior work," Schenck wrote, completing several detailed studies of fisheries and helping the Occupation run more smoothly. His loss would be "keenly felt." A second letter, from Major John F. Janssen, wrote that Shimada's "innate ability, pleasing personality, loyalty and conscientiousness make you a valuable asset to any fisheries research."[8]

Despite the disruptions to his schoolwork, he was seventh his senior class the fall of 1947. He would graduate in December, cum laude, and stayed in on to work on a graduate degree.[9] By December of 1948, he had his Master of Science in Fisheries, and had been hired by Sette as part of the new POFI investigation. In November of 1948, he was back in Tokyo, "to gather information on the methods of fishing, methods of fish processing, methods of research, distribution, ecology, life history and other information relating to tuna."[10]

He would certainly have been welcomed back at SCAP. He kept a detailed journal of his activities in Tokyo, dealing with scientists he was meeting and copies of papers that he has acquired. He was busy from the start, finding out who to talk with, and making appointments, acquiring copies of papers that were microfilmed by an assistant. It was to be a 3-month assignment, but it stretched until June of 1949. His

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8 Papers of Bell Shimada, courtesy of the Shimada family.

9 UWSC, Chapman papers, 1852-1,2,3, Box 11, Folder 26.

10 NARA RG 331, Box 8867, Japanese Reconnaissance Team, Pacific Oceanic Fisheries Survey, Nov. 22, 1948.

journal was typed on loose-leaf lined paper and kept in a three-ring binder. Over the 9 months, he would list the documents he was seeking, and those he was able to find. In his 1951 publication of tuna, Shimada thanked the Natural Resource Section for its help, including William C. Herrington, Drs. K. Kuronuma and Y. Hiyami, as well as additional scientists (Shimada 1954).[11] It is the first publication of some Japanese scientific works in English.

Shimada kept notes of all conversations in his journal. A typical example is of his conversation with Dr. Kinosuke Kimura of the Central Experiment Station. He wrote that Kimura tagged 1700 skipjack in 3 years, of which three were recovered offshore and six were taken in the inshore fishery. Details of the tagging and the recovery were included, as was Kimura's belief that the hook tags adhered best to the fish. His recording to conversations indicates how little was known about tuna, and how all scraps of information had potential value to be passed on. Everywhere he went, he asked for copies of papers. One of the most significant that he acquired was a copy, written in English, by Kishinouye Kamakichi's 1923 publication, "Contributions to the comparative study of the so-called Scombroid Fishes."

Over the next months, he continued to visit science stations, recording details of fish landed in various ports. He was especially interested in talking with fishermen, such as the fleet at Omaezaki, in the Shizuoka Prefecture, said to be the best skipjack fishermen in Japan. They told him that some skipjack migrated through their waters, but others were resident, said to live along the underseas ridges. "Fishermen believe that skipjack which are too weak to continue their journey drop out of the schools and remain near these ridges to feed…" He also packed up specimens for shipment to the POFI office in Honolulu.

He also found and was involved in translating the minutes of a meeting Japanese scientists held in 1940, to discuss what they knew about the spawning grounds of tuna and skipjack. Published as a Special Scientific Report, Fisheries 18, it was edited by Shimada and W.G. Van Campen, another of the SCAP translators, in April of 1950. Ten scientists and industry representatives met to pool their knowledge about tuna and to craft a research response. Shinkishi Natai, director of the Palou Tropical Biological Station and an emeritus professor from Tokyo Imperial University, was recorded as saying that almost nothing was known about the spawning grounds of most fish, but especially skipjack, the species most important to the Japanese industry. Despite a decade of considering the problem with conferences every 3 or 4 years, they were no closer to a solution. "No new facts have yet been ascertained," Natai said. He hoped the group would come up with a "definite plan" of study (Shimada and Van Campen 1951).[12]

Back in Los Angeles, POFI held a conference in October of 1949, laying out the work that needed to be done to expand the fishery. Expectations were high. "The

[11] B. M. Shimada, "An annotated bibliography on the biology of Pacific tunas," U.S. Fish and Wildlife, Fishery Bulletin 56.

[12] U.S. Fish and Wildlife, Special Scientific Report, Fisheries No. 18, "Spawning grounds of tuna and skipjack," translated by B. M. Shimada and W. G. Van Campen, Pacific Oceanic Fisheries Investigations, April, 1950.

expedition is expected to locate new tuna banks that should produce from $80,000,000 to $100,000,000 worth of tuna each year," enthused *Tuna Fisherman* magazine, a new publication from San Diego, (*Tuna Fishing Magazine* 1948a, b).

The first task would be to finish the translations that had come in from Shimada and the rest of the SCAP staff in Japan. The material was of "great value," both for its information about the fish, but also about successful Japanese fisheries. POFI cruises would begin with basic studies of salinity, oxygen, and nutrients. One of the first objectives was to look at how to catch bait, the fishing system used by most American tuna boats. The area of operation was to be the Central Pacific Ocean, between the Hawaiian archipelago and the equator, where the Japanese had established a growing fishery for skipjack tuna. The fishery expanded to include larger boats to catch yellowfin and marlin.[13] But bait proved hard to find. "It may well be necessary to test and devise techniques new to American fishermen."[14]

Three exploratory vessels were assigned to the new laboratory, all named after early federal fisheries scientists The *R/V Hugh M. Smith* was a 128-foot ex-Navy auxiliary vessel, outfitted "to conduct oceanographic studies of all sorts as well as semi-commercial-scale tuna fishing by means of live bait, trolling, and long-line fishing," Sette and Schaefer wrote in a statement about the program. The *Henry O'Malley* was a sister ship to the *Hugh M. Smith* and was set up for live bait fishing and trolling on a commercial scale. The third vessel was the *John R. Manning*, a newly built 85-foot purse seiner, designed for experimental and exploratory fishing. Finding tuna in the Pacific was a tall order, even for three new research ships. As a fishing industry contribution to the conference put it, while the industry was interested in new opportunities, it was hard to find a great fish "about which we know less than we do about tunas."[15]

As Shimada continued with his research in Tokyo, the new laboratory opened in Honolulu. Sette transferred there, along with his secretary, Rae Shimojima, originally from Portland.[16] The data was beginning to come in from the first research cruises. Some of the first came from POFI's flagship, the *Hugh Smith,* and its young oceanographic officer from the University of California, Townsend Cromwell. He was setting longline gear while fishing for tuna at the equator, south of Hawaii in December of 1951. The gear drifted to the east, while the surface current drifted the ship to the west. None of the current theories about ocean circulation could account for the phenomenon. During the next five longline cruises, Cromwell found further evidence for an eastward subsurface current. The following August, he headed an investigation that made 12 direct current measurements near the equator. He had

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13 University of Washington Special Collections, Pacific Oceanic Fisheries Investigations, tuna industry conference, Oct. 7, 1949, Richard Van Cleve papers, 168-3-71-10, box 4, Folder, "Tuna meeting, 1949."

14 *Commercial Fisheries Review*, May Progress Report, 27.

15 UWSC, Papers of Richard Van Cleve, Pacific Oceanic Fisheries Investigations, tuna industry conference, Oct. 7, 1949, Box 4, Folder, "Tuna meeting, 1949."

16 https://fish.uw.edu/2019/02/centennial-story-69-bell-masayuki-shimada-bs-1947-ms-1948-phd-1956-ba-2008-honoris-causa/Accessed 05/06/2018

discovered what he suggested calling the Pacific Equatorial Undercurrent for this east-flowing subsurface current, (Knauss 1960).

Shimada left Tokyo in June of 1949 and began work for POFI out of Honolulu. Some of the first translations began to appear in the U.S. Fish and Wildlife literature, and in the trade press. *Pacific Fisherman* in June of 1948 heralded "SOME of the SECRETS of Japanese tuna fishing dug from archives."[17]

In June of 1948 Chapman was appointed as an assistant to the State Department, to deal with fisheries issues. He was extremely successful, overseeing the signing of the treaties to establish the International Conference of the North Atlantic Fisheries (ICNAF) and the Inter-American Tropical Tuna Commission (IATTC), both active today. He was also heavily involved the negotiations of the peace treaty with Japan, as well as the signing of the first fishery treaty among Japan, Canada, and the U.S.

The Inter-American Tropical Tuna Commission was established in La Jolla; its first director was Schaefer. Among his first acts was the hiring of several scientists from the POFI laboratory in Honolulu, including Cromwell and Shimada. The two were on their way to another expedition in Mexico when their plane plunged into a mountain in 1958, killing everyone onboard. The Pacific current Cromwell had described was re-named the Cromwell Current. The Shimada Sea Mount is located southwest of Baja, California. Both men have had research vessels named after them, as has, Sette; Wilbert Chapman was also honored by the naming of a research vessel.

The 1954 report lays out the integration of fisheries, oceanography, and meteorology to better understand the dynamic structure of the equatorial Pacific Ocean, and the importance of upwelling and frontal structures as they relate to distribution and abundance of Pacific tunas. The 80-page document contains 25 pages of footnotes, with a substantial number of entries by Japanese scholars and the scientists who helped with the translations. Sette, aided by the translations (not just from the Japanese but from German, British and Italian scholars), had been able to apply the theories of dynamic oceanography to find order in the data that had poured in from so many sources. It was a triumph of the dynamic oceanography approach (Hamblin 2014). As Sette wrote, the results of the 3 years of sea work "appear to have immediate practical fishery significance," (Sette 1954).

Sette's research showed why equatorial waters were more productive than waters to the north and south: the presence of a powerful equatorial circulation. The steady southeast trade winds brought nutrient-rich waters from ocean floor to the surface, where sunlight stimulated production of planktons, benefitting the entire food chain, and where tunas, "the final step in oceanic production line, concentrate here where there is good feeding much more of the time than elsewhere," (Sette 1954).

With the development of hydraulics after 1957, purse seining for tuna expanded rapidly, worldwide. There had been seining in the ocean during the 1920s and 1930s, but nets were made of cotton painted with tar; they were heavy and difficult to bring back onboard, requiring a tuna boat to have a large crew. Along with

[17] *Pacific Fisherman*, June, 1948, 37–8.

hydraulics came nylon nets, lighter, stronger, and requiring a far smaller crew. Another powerful innovation was rapid freezing technology. The surface and the inside of the tuna are frozen simultaneously, allowing ice crystals to freeze before they can clump with other ice crystals, damaging the cell walls of the fish. The technology allowed tuna to be caught, frozen at sea, and delivered anywhere in the world.

While the Americans were busy copying any papers on tuna, salmon, hatcheries, and ocean conditions, at the same time, SCAP disparaged Japanese science as being woefully behind American science. Fisheries research was not based on population studies. Too many of the research stations did technical research into how to catch fish, not biological studies. SCAP recommended "a carefully planned and coordinated research program in the natural resources field."[18]

SCAP brought three prominent American fishery scientists to Tokyo, to help Japan develop a "sound, modern fisheries research plan," according to the report, written by Willis H. Rich of Stanford University.[19] He found that research before the war was largely devoted to technology and biological studies, aimed at improving catch rates. The effort was on exploitation, with little focus on conservation and the methods of research and regulation that were "sound and effective." It was an article of faith that American fishery management was the best in the world, based on sound science. In fact, sardines and salmon were both being over-harvested, and studies at sea, which the Japanese had being doing for decades, were just getting started on the West Coast.

Yet the Americans touted their modern, science-based research. Chapman was certainly aware of how far ahead the Japanese were, and that the Soviets were rapidly escalating their fisheries and research in both the Atlantic and Pacific. "The old method of straight political regulation of fisheries in international waters is passé; the new method of regulation on straight biological grounds is not yet applicable because of our ignorance," he stated in one of his letters campaigning for the Farrington Bill.[20]

The first significant scholarship on these events comes from Berkeley law professor Harry Scheiber, who has written extensively about the development of ocean law, especially in the Pacific. Scheiber places Chapman at the center of his analysis, with the central political role he played in events between 1945 and 1952. He called Chapman "a brilliant scientific entrepreneur," who was at the center of the development of ocean law between 1945 and 1951.

Scheiber also identifies several other scientists that were catalysts of change within the science. Milner Schaefer "exemplified the possibilities that Chapman and the other heralded when they embarked on their campaign for the new oceanography in 1945," Scheiber wrote. He identifies other scientists, including Sette, but he gives more credit to Schaefer. As Scheiber tells his story, the quest was to mobilize

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[18] UWSC, Papers of Miller Freeman, Box 11, Folders 4, SCAP, Natural Resources Section, Preliminary Study of No. 42, Fisheries Research Program of Japan, Willis H. Rich.

[19] Ibid.

[20] UWSC, Richard Van Cleve papers, Box 2, Folder "Chapman, W. M., 1940–48."

the "intellectual resources of American scientists, the fishing industry, as well as the government, to develop American ocean fishing interests," and also "developing marine fisheries management on a global scale." Missing from Scheiber's account is the influence of the military in these efforts, and the science developed by the Japanese.

The short story of the development of fisheries science needs to be amended, to include the Japanese contributions to the construction of the science.

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