

THE ROLE OF THE MARINE RESEARCH COMMITTEE AND CalCOFI

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I feel quite honored to be on a panel with Frances N. Clark and Richard S. Croker. Clark hired me, and at that time she was director of the California State Fisheries Laboratory, and on a pedestal much higher than I could reach. And Croker was the chief of the then Marine Fisheries Branch, a very important job indeed. So, as you can see, I feel a little bit out of place here, but I acknowledge that I am a second stringer. Actually, they intended this speaker to be Phil Roedel, and that would have been much more appropriate. I am like the baseball player who was inserted in the eighth inning and then was pinch hit for in the ninth. So that's a good analogy for my relationship with CalCOFI.

My talk is titled "The Role of the Marine Research Committee and CalCOFI," and results from a lot of library research that I hope will make sense to you and will fit in with this symposium. The Marine Research Committee (MRC) was established by an act of the legislature in 1947. Croker generally covered the reasons and some of the behind-the-scenes occurrences that led to its establishment. The statute described it as consisting of nine members, three of whom were *ex officio* members with the same rights and powers as the other members. The three were the president of the Fish and Game Commission, the executive secretary of the then Division of Fish and Game and later the director of the Department of Fish and Game (DFG), and one employee of DFG designated by the Fish and Game Commission. This member was, from the very start, Dick Croker. Of the other six members, at least five were to be experienced in and actively engaged in the canning or reduction of California sardines.

Members served without compensation. An added tax of fifty cents per ton or a fraction of each ton of sardines purchased, received, or taken was levied against the industry. That money was put into the Fish and Game Preservation Fund and dispersed by the majority of the Marine Research Committee solely to finance research in developing the commercial fisheries of the Pacific Ocean and developing marine products susceptible to being made available to Californians.

In 1953, this law was changed. The tax was increased to a dollar a ton for sardines and, in addition, the dollar a ton was levied on Pacific mackerel, jack mackerel, squid, Pacific herring, and anchovies. Beginning in 1956 the membership of the committee was changed. The three *ex officio* members representing

the Fish and Game Commission and the Department of Fish and Game were replaced. The six members representing the industry remained, but one member from the public at large, one from organized labor, and one to represent organized sportsmen were added.

The first meeting of MRC was held on April 28, 1948, at the California Academy of Sciences (CAS) in San Francisco. At that meeting, Julian Burnette, an old reductionist, was elected chairman of MRC, a position he held until February of 1967, when he was replaced by Charles R. Carry. Julian was the only member who served during the entire thirty-one-year life of MRC. Mr. Carry continued as chairman until its final meeting, which was held June 29, 1978, in Long Beach. Incidentally, Dick Croker was elected secretary at that first meeting in 1948, and he held that position until 1962 when he retired. He was followed by Phil Roedel, Doyle Gates, Laura Richardson, and Herb Frey.

During the thirty-one years that the MRC was in existence, revenues collected under the special tax totaled only \$3,350,000. Of this, approximately \$923,000 came from sardines, \$977,000 from the mackerels, \$1,200,000 from anchovies, \$231,000 from herring, and \$215,000 from the squid fishery. The largest budget ever adopted by MRC was \$185,000 in 1970-71, and more than half of this was from carry-over funds that hadn't been expended earlier. This, incidentally, was during the time the anchovy fishery was growing at a pretty good rate.

Of course, this money represents only a small part of the total picture. It has been estimated by many that the "seed money" provided by MRC was important in stimulating revenues that in recent years have greatly increased. The CalCOFI program has been over \$4,000,000 a year. That \$4,000,000 per year from other sources was all spent on things over which MRC exercised some purview.

In the early years, the MRC funds ranged from about \$65,000 to \$180,000; they played a very important part in keeping the cooperative sardine program going. They assisted the U.S. Bureau of Commercial Fisheries (BCF) through some tough years with its boat schedules, and provided assistance for boat crews for the DFG. The majority of MRC's monies in the first five years went to those kinds of programs.

From 1950 through 1960, Scripps Institution of Oceanography (SIO) used from \$30,000 to \$70,000 per year, to assist with research. It's obvious that although the budget of MRC was rather small, it helped

the research organizations over some tough financial times in the early years. In the later years, MRC served as a rather small tail wagging a rather large dog, which the CalCOFI program has become.

Also, this influential group of men, particularly the industry representatives, played a large part in encouraging the University of California to fund SIO for its CalCOFI part of the program. MRC members could talk to the president of the University of California, and also they played a large part in the founding of the Institute of Marine Resources (IMR). Whereas in 1949-50, MRC funding was \$97,500, the three major agencies by that time were expending about \$600,000 a year on the cooperative sardine fishery investigation. Ten years later, in July of 1960, MRC was supplying about \$60,000 to Scripps, Fish and Game, and BCF, and their budgets for the program totaled \$950,000. As pointed out earlier, the CalCOFI program is today about \$4,000,000 per year.

Through the forties and fifties, the major differences among scientists working on sardines hindered the implementation of management measures. Although I don't pretend to understand the total picture, the basic difference between BCF and DFG scientists was that BCF held that year-class size was independent of spawning-stock size. This basic disagreement was later softened when different leadership, upon further examination of the data, reached a decision more compatible with the DFG's views.

The matter was finally put to rest by Garth Murphy in his 1966 thesis on sardine population biology. He stated: "Thus, the long series of poor year classes (1949-1963) at small stock sizes in the face of varying oceanic climate suggests that Marr's conclusion that year-class size is independent of stock size is untenable." Further, "it seems clear that the population was overfished in an economic sense, and overfished in the biological sense, too, in that the heavy mortality induced by the fishery removed the 'cushion' against poor spawning success provided by older fish."

The net effect of this disagreement between major agencies over the relation of spawning-stock size and year-class size, in my view, continued overfishing of sardines until they were driven to the critically low point where the population is today. The first legislation restricting the size of the sardine catch was passed in 1969. MRC at last passed a motion recommending a complete moratorium on the take of sardines at their September 1967 meeting. This legislation was strengthened in 1974 by further restricting the uses of incidentally caught sardines.

Now, back to the beginnings. On May 19, 1948, the MRC met in La Jolla. At that time, Robert C. Miller was chairman of the Technical Committee (he is the

one Dick Croker referred to as having a very large part in holding this thing together in the early years). Bob outlined the following lines of research to be pursued by the then California Cooperative Sardine Research Program: (1) physical-chemical conditions in the sea; (2) organic productivity of the sea; (3) spawning survival and recruitment of sardines; (4) availability of the stock to fishermen, that is, the behavior of the fish as it affects catch, abundance, distribution, and migration; (5) fishing methods in relation to availability; and (6) dynamics of the sardine population and fishery.

This forerunner of the later CalCOFI program was made up of representatives from SIO, CAS, BCF, and DFG. The California Cooperative Sardine Research Program was renamed the California Cooperative Oceanic Fisheries Investigations (CalCOFI) in June of 1953 to recognize the expansion of the sardine program to include work on other species. In 1952, the Hopkins Marine Station of Stanford University (HMS) joined the program. In 1965 or '66, San Diego State College was included. In 1974, HMS dropped out of the MRC part of the program, and its work in Monterey Bay was taken over by Moss Landing Marine Laboratories. From 1974 through 1977, MRC funded phytoplankton studies by UC Santa Cruz in Monterey Bay. These, then, have been the agencies that benefited from MRC's funds over the years.

Informal cooperative scientific studies between CalCOFI and Mexican scientists were begun in the fall of 1971 and continue to this day.

Much of the future course of CalCOFI was determined in the late 1950s. At the May 3, 1957, MRC meeting a special technical committee was appointed by the chairman to examine the objectives of CalCOFI, to define the problems involved in attaining these objectives, to assess progress on the solution of problems, and to assign priorities to the remaining problems. This committee was affectionately known as the Three John Committee and was made up of John Isaacs of SIO, John Marr of BCF, and John Radovich of DFG. Elton Sette was named as an independent scientist to serve as special advisor to the chairman of MRC and to attend all meetings of the special technical committee to offer his advice and comments whenever he considered it necessary to expedite progress or agreement. Jack Marr was the chairman of this committee.

At the December meeting of MRC, the special technical committee presented its report, which noted that the research program of CalCOFI, conducted by the five agencies under MRC, had made real contributions toward understanding the fisheries but lacked effective coordination. To remedy these shortcom-

ings, the committee recommended that control of the program be vested in a four-person committee. There would be one member each from DFG, from BCF, and from SIO. Each committee member would be the person actively directing his agency's share of the CalCOFI program. The fourth member and chairman would be a full-time scientific advisor hired by the MRC for this purpose. MRC and the three major agencies endorsed the plan, and thus was born the CalCOFI Committee.

The high priorities proposed by the Three John Committee were (1) to further describe and investigate the causes of the sardine's catastrophic decline; (2) to determine the population subgroups and their rate of intermixing; (3) to further study the dynamics to determine the vital statistics of the sardine population; that is, to derive an independent measure of recruitment and appraise the best methods for determining the size of the spawning stock to a degree of accuracy consistent with other associated measures; and (4) to complete descriptive oceanographic studies of the general circulation and of seasonal and other changes.

An early objective of the California Cooperative Sardine Investigation, the forerunner of CalCOFI, was to seek out the underlying principles that governed the Pacific sardine's behavior, availability, and total abundance. By 1960 the CalCOFI Committee formulated slightly different objectives: to acquire knowledge and understanding of the factors governing the abundance, distribution, and variation of the pelagic marine fishes, emphasizing the oceanographic and biological factors affecting the sardine and its ecological associates in the California Current system. The ultimate aim of the investigation was to obtain an understanding sufficient to predict, thus permitting efficient use of the species and perhaps manipulation of the population. These restated objectives formalized some aspects of the research that had long been recognized: (1) that no pelagic fish such as the sardine can be studied in nature as a creature isolated from its natural associates, (2) that such research is ultimately responsible to the needs of society, and (3) that the ultimate goal of this responsibility is attaining sufficient understanding to guide society in using the resource. Quite a change from earlier objectives.

After a year of search, Garth Murphy was selected as coordinator in November 1958. His chief responsibilities were to coordinate the agency programs through the CalCOFI Committee and to look into the sardine problem. His studies on sardine population dynamics culminated in a 1965 Ph.D. dissertation entitled "Population Biology of the Pacific Sardine (*Sardinops caerulea*)." This study showed that the maximum sustainable yield of the pre-1949 sardine

population was 471,000 tons for a spawning population size of about 1,000,000 tons. During this period the catch averaged 570,000 tons. In addition, the heavy fishing left too few older individuals to cushion the population against reproductive failure. The maximum sustainable yield of the 1960s population was 57,000 tons for a population of 178,000 tons.

During his work with CalCOFI, Murphy received data indicating that the rise of the anchovy was apparently in response to an environmental void created by the decline of the sardine. Murphy states, "If this is so, the validity of a sustainable yield of sardines can be questioned, for the reduced sardine population required to generate the yield would also release resources to the anchovies. The subsequent increase of the anchovy would surely alter the parameters of the sardine population in such a way as to reduce the maximum sustainable yield. As a converse, the present situation is not likely to alter rapidly, even if sardine fishing is stopped, unless man or nature acts to reduce the anchovy population somewhat. It appears that judicious use of all ecologically similar species within the trophic level offers the only hope of sustained yield."

As a result of Murphy's work, and that of many others in CalCOFI's other agencies, the CalCOFI Committee proposed the famous anchovy experiment in March of 1964. At that time, the CalCOFI Committee was made up of Garth Murphy, coordinator; John Isaacs from SIO; E.H. Ahlstrom from BCF, who replaced Marr in 1959; and Baxter, from DFG, who replaced Radovich in 1963.

This proposal was developed considering the following three factors: (1) the basis for the suggested experiment, although the most complete ever achieved, still is not precise enough to foresee exactly how many anchovies and sardines should ultimately be taken; (2) a careful stepwise approach, such as was used in South Africa, is the only defensible experiment; and (3) there are time lags in response of sardine and anchovy populations to new factors. Their life histories suggest that at least three years would be required for population responses to be detected, even in a regime of favorable environment, and there are also time lags in scientific analysis, especially when dealing with new problems. Thus it is necessary to carry out measurements that can follow events closely and that will yield results that are readily interpreted.

With these three factors in mind, the approach was divided into three phases. The CalCOFI Committee believed three years was the minimum for each phase. In phase I, the objective was to initiate a conservative fishery on anchovies and reduce sardine fishing just enough to produce an observable change in the system

and just enough to improve our preliminary appraisals of the magnitude of the anchovy resource. During this phase, a limit of 200,000 tons should be placed on the anchovy fishery, and the sardine fishery should be limited to 10,000 tons. Percentages were also established for north and south of the Baja California border.

The amounts to be removed during phase II, and the areal distribution of the limits of these *species* must await the results of phase I. We hazarded a guess at that time that during phase II the anchovy quota might be raised about fifty percent, providing the results of phase I are not widely different from preliminary expectations.

Phase III, we felt, couldn't be specified at all beyond indicating its objective, which was to restore the predecline balance between sardines and anchovies and maximize the harvest consistent with all uses—food, recreation, and so forth.

Although the great experiment really has never come off, as a result of CalCOFI's and MRC's active participation in the program, the Fish and Game Commission took a big step in 1964. They changed their policy on allowing the reduction of anchovies, which had been banned since about 1920, and permitted a quota of 75,000 tons. Because of many restrictions and small fishing zones, it was almost impossible for the fishery to really develop.

A fishery has continued since, with catches of up to 165,000 tons. Opposition by sportsmen and even other commercial groups was so great over the years that the fishery has never operated as the "experiment" that the proposal called for.

Anyway, shortly after receiving his Ph.D. in late 1965, Murphy left CalCOFI and took a position at the University of Hawaii. In fact, I am told he is the only person known who went from a graduate student to a full professor and took a cut in pay! Phil Roedel, who really should be up here instead of me, succeeded Dick Croker as secretary of MRC and was named the acting coordinator after Murphy left, a position he held until the mid-seventies. Then Marston Sargent came on and served as the MRC coordinator from mid-1971 until his retirement in 1974. Thereafter, I guess a number of people have served as coordinator—Herb Frey, I know, for a number of years, then George Hemingway, and now Reuben Lasker.

I was asked to speak on the role of MRC and Cal-

COFI, and what I have discussed is a combination of their roles and a history of their activities. The Marine Research Committee was established at a time when the sardine fishery was showing very strong signs of overfishing. California Fish and Game was urging curtailment of the catch, and had been for a number of years. Others were questioning that fishing was the cause of the failure of the sardine fishery. The industry agreed to tax itself to fund needed studies. What started as a delaying tactic to avoid management resulted in a research program that has provided much better understanding of the California Current system, and technological development that otherwise might not have been possible.

Of course, we lost the sardine, and I leave it to you to decide whether it was all worth it. CalCOFI continues today even without MRC. Would it have gotten started and prospered as it has without the small start MRC provided, without the coordination made possible by MRC, without the political clout that MRC and its members exerted, which resulted in added funding from other sources for furthering the CalCOFI research program? Again, you decide. Thank you.

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Lasker: Jack, I wonder if you would consider today's very large anchovy fishery as the experiment you were talking about, considering that a total of 300,000 tons of anchovy is now being taken from both sides of the border.

Baxter: I considered that, and I conveniently left it out, but, yes, I agree. Of course, it hasn't gone on for three years. We haven't monitored as closely, I think, as our original experiment envisioned. But even with the drop in anchovy biomass on our side of the border in recent years, the sardine has failed to reestablish itself. It makes me wonder, too, but I still think it was worth the try.

Question: Jack, may I answer Lasker's question? The reason we can't really come off with the experiment is that there are not enough sardines left. Remember that we were going to cut the harvest of the sardines to 10,000 tons. At this time I don't think there are 10,000 tons or close to 10,000 tons of spawning biomass left.

Comment: It's too small to measure by our present methods anyway.