STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME
MARINE RESEARCH COMMITTEE

CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS

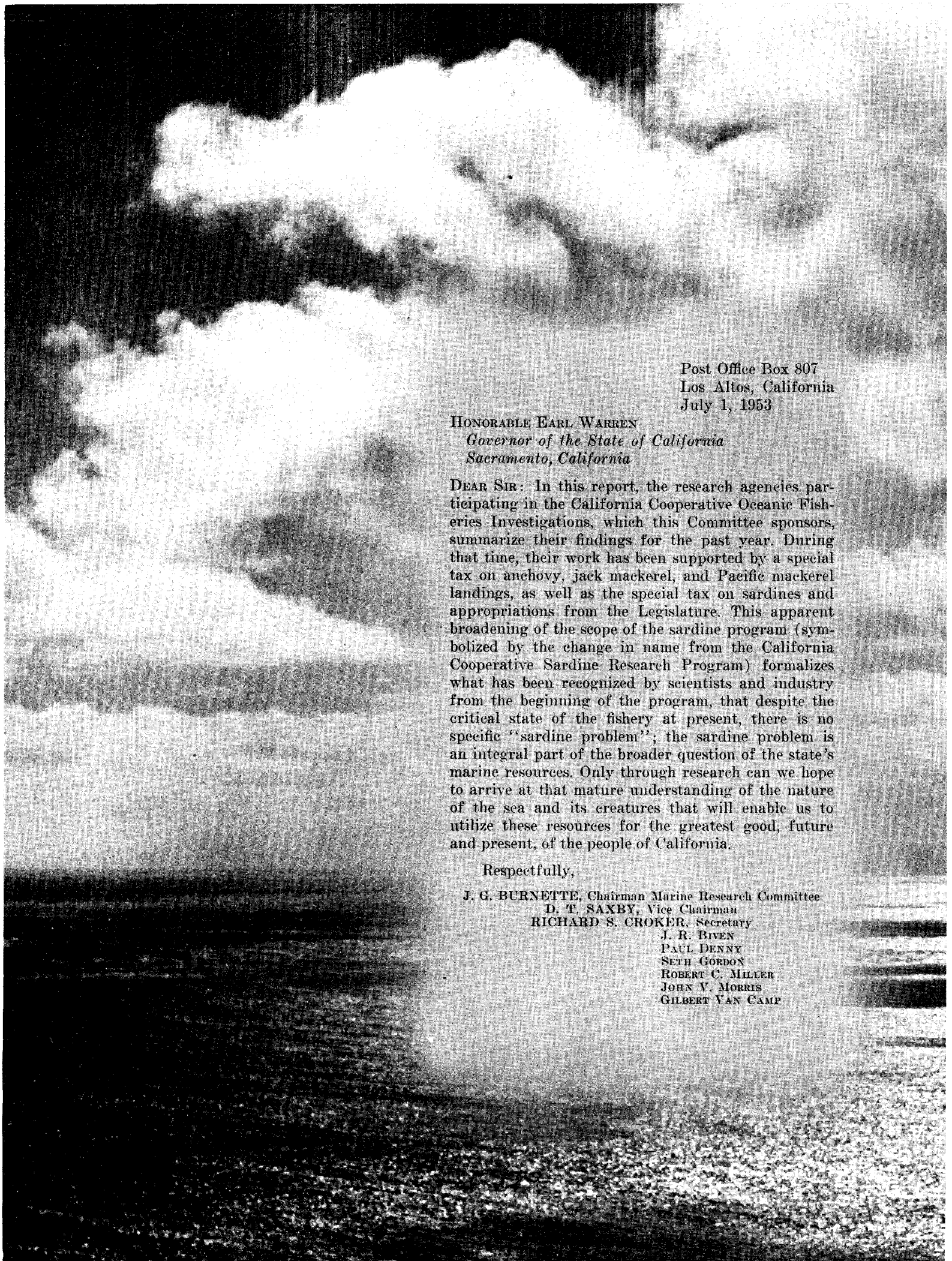
Progress Report

1 July 1952 to 30 June 1953

Cooperating Agencies:

CALIFORNIA ACADEMY OF SCIENCES
CALIFORNIA DEPARTMENT OF FISH AND GAME
STANFORD UNIVERSITY, HOPKINS MARINE STATION
U. S. FISH AND WILDLIFE SERVICE, SOUTH PACIFIC FISHERY INVESTIGATIONS
UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

1 July 1953



Post Office Box 807
Los Altos, California
July 1, 1953

HONORABLE EARL WARREN
Governor of the State of California
Sacramento, California

DEAR SIR: In this report, the research agencies participating in the California Cooperative Oceanic Fisheries Investigations, which this Committee sponsors, summarize their findings for the past year. During that time, their work has been supported by a special tax on anchovy, jack mackerel, and Pacific mackerel landings, as well as the special tax on sardines and appropriations from the Legislature. This apparent broadening of the scope of the sardine program (symbolized by the change in name from the California Cooperative Sardine Research Program) formalizes what has been recognized by scientists and industry from the beginning of the program, that despite the critical state of the fishery at present, there is no specific "sardine problem"; the sardine problem is an integral part of the broader question of the state's marine resources. Only through research can we hope to arrive at that mature understanding of the nature of the sea and its creatures that will enable us to utilize these resources for the greatest good, future and present, of the people of California.

Respectfully,

J. G. BURNETTE, Chairman Marine Research Committee
D. T. SAXBY, Vice Chairman
RICHARD S. CROKER, Secretary
J. R. BIVEN
PAUL DENNY
SETH GORDON
ROBERT C. MILLER
JOHN V. MORRIS
GILBERT VAN CAMP

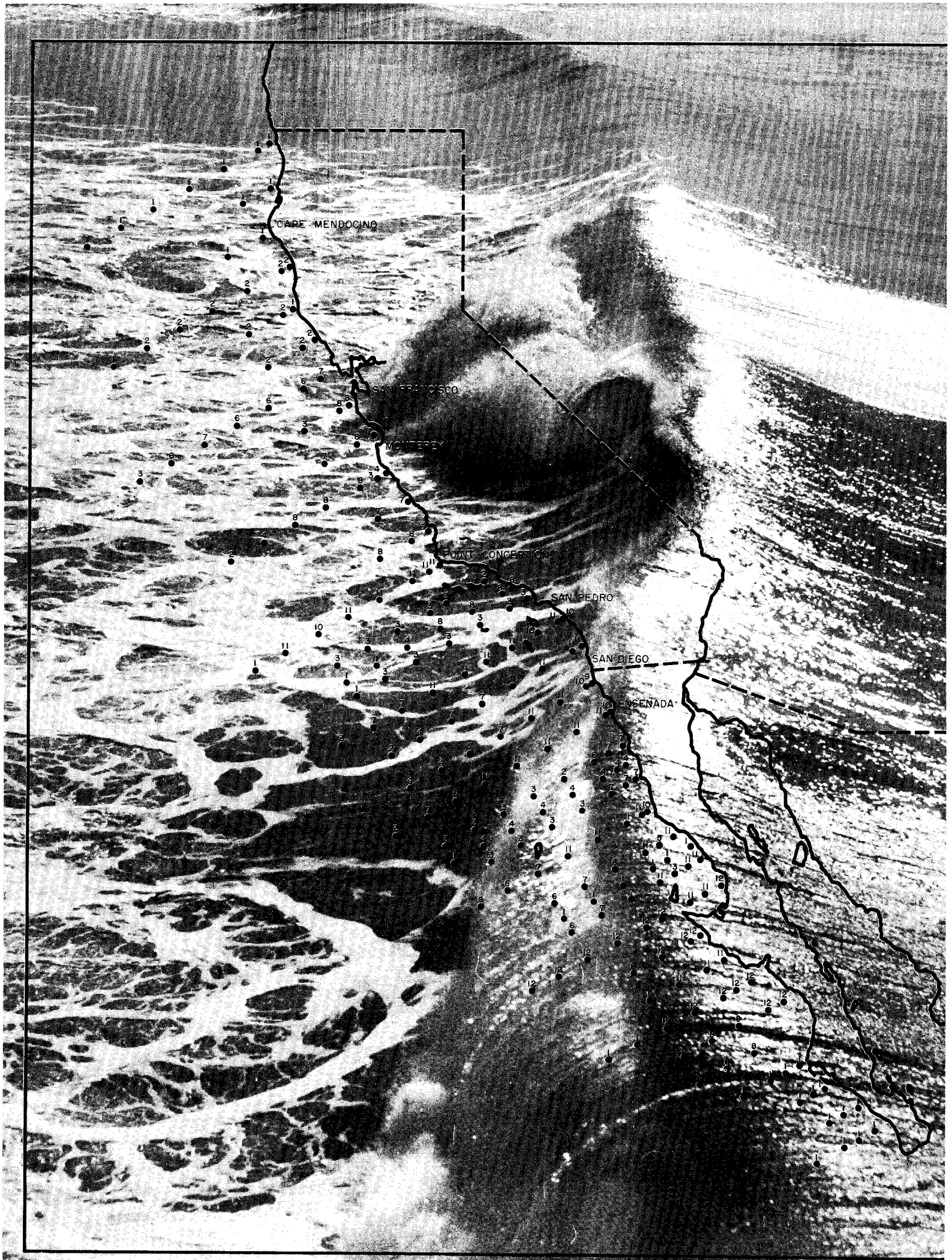
Abstract

THE SARDINE SITUATION, 1 July 1953

1. The bulk of the sardine population today is concentrated in the waters off Baja California, where it is largely unavailable to sardine fishermen of the United States.
2. There are fewer sardines in California waters than ever before.
3. There is little reason to hope that sardine fishing in the next two years will reach the level attained in the years of prosperity.
4. The most numerous year class present is that spawned in 1952, and evidence points to its being smaller than the 1948 year class.
5. Anchovy and jack mackerel populations appear to be satisfactorily abundant. Pacific mackerel catches, on the other hand, point toward a low abundance of these fish throughout California waters.
6. The research studies on which these conclusions are based are outlined in this report. We are able to give some clues as to the causes of the catastrophic decline in sardine landings, but are not able to isolate any single primary reason. As the studies progress, it begins to seem more and more probable that it is a combination of several factors that has brought the sardine catch to its low level and until we can identify and measure each of the most important factors, no complete explanation can be given for this or a similar crisis which may overtake any of our marine fisheries.

Contents

ILLUSTRATIONS

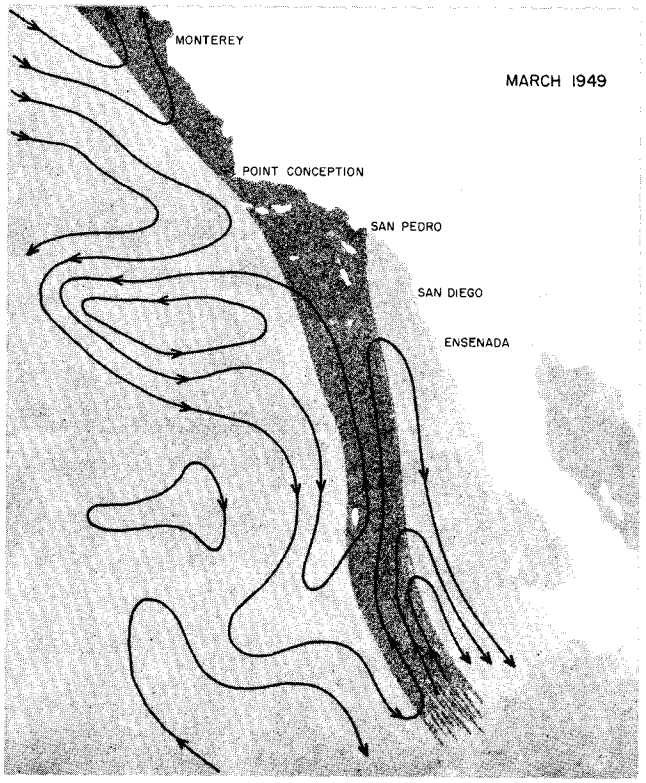

CAPE MENDOCINO
SAN FRANCISCO
MONTEREY
POINT CONCEPTION
SAN PEDRO
SAN DIEGO
ENSENADA

Introduction

The California Cooperative Sardine Research Program began its routine oceanographic cruises in 1949. Since then the program has expanded to include work on other food fishes and in June, 1953, this expansion was recognized by changing the name of the program to the California Cooperative Oceanic Fisheries Investigations. In the four years 1949 to 1953 sardine and Pacific mackerel fishing off California have grown progresssively worse, and the industry has turned to jack mackerel and anchovies as substitutes. In this progress report we have attempted to summarize the information collected during the four-year interval, to compare these data with facts known prior to 1949, to relate all to the sardine, and to explain as far as possible why the sardine supply has continued to decline on the California fishing grounds.

From the research standpoint, the year has been a productive one. Often a year's toilsome, expensive research eventuates in merely one more line of numbers in a table or one more point on a graph. It is only when a great deal of material has accumulated that we can set to work seeking out the relationships of the various individual projects and getting at the *whys* of the puzzles nature sets for us. But with each year's accretion of data, we move closer to the specific goal of our program, which is the ability to tell within reasonable limits where the sardines are, how many there are, and how large they are.

◀ FIGURE 1. During 1952, 1,252 hydrographic stations were occupied by vessels engaged in fisheries research cruises. The dots in the accompanying chart show the locations of these stations; the numbers tell how many times we visited each location during the year. At each station we collected information on the temperature, salinity, and other properties of the water. We collected samples of the plants and small animals living in the upper layers. When the program first began, we occupied stations from the mouth of the Columbia River to central Baja California. But as we have learned more about the area, the station pattern has steadily changed. Since we have discovered that most sardine spawning now occurs off Baja California, we have intensified our coverage of that region and have decreased the visits to the north. However, we run cruises up the coast often enough to feel sure that we will not overlook significant developments there. Representing though it does several thousands of man-hours spent at sea, this station chart still does not include all the sea-going work on the California Cooperative Oceanic Fisheries Investigations; several times each year we send out what are in effect miniature scientific "task forces" to investigate a single problem, such as current measurements in a limited area for a specific period of time, or the numbers of young sardines off the coast. Keeping our vessels at sea takes slightly more than half of all the money that is being spent on the research program, yet it remains the only method we know for gathering the sort of detailed factual information we need in the study of the environment and spawning of sardines and other fishes.



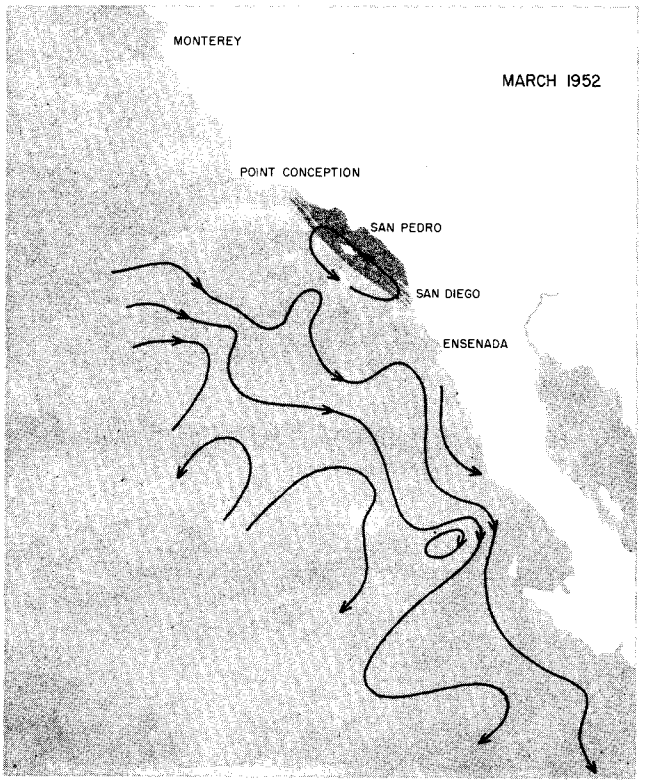


FIGURE 2. Here we show current patterns off the coast for comparable months in 1949 and 1952. Generally sardines are found in only a small part of the area we study. They seem to disperse well offshore in the spring to spawn but appear to spend the rest of the year inshore. But to understand the movement of the inshore waters, it is necessary to know a great deal about the offshore waters, for the circulation patterns of the latter determine the currents inshore. The years 1949 and 1952 ended with sardine seasons that were respectively fairly successful and the worst in history. Here we show current charts from the March cruises of each of those years. The arrows in these charts represent the direction of flow. The distances between the lines indicate the speed of flow; when the lines are close together, the currents are moving faster than when the lines are farther apart. The charts show that in 1949 the southward-flowing California Current meandered, that is, curved, much more than in 1952; that in the offshore area it was narrower and stronger in 1949 than in 1952; that the eddies, "whirlpools" set up by the action of the Current, were more pronounced in 1949 than in 1952. The charts also tell us that the Countercurrent, which here is heavily shaded, was stronger in 1949 than 1952. This is interesting, for it is very possible that the Countercurrent may immediately affect the sardine population in a number of ways.