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*REPORT TO THE COMMITTEE  
ON COMMERCE  
UNITED STATES SENATE*

Information On  
The California Anchovy

National Oceanic and Atmospheric Administration  
Department of Commerce

*BY THE COMPTROLLER GENERAL  
OF THE UNITED STATES*

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DEC. 31, 1974

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COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

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The Honorable Warren G. Magnuson  
Chairman, Committee on Commerce  
United States Senate

*2300*

Dear Mr. Chairman:

In your March 4, 1974, letter, you requested that we gather information on:

- The abundance of the northern California anchovy resource.
- How much of this resource could be used in producing fishmeal without endangering the maximum sustainable yield of the resource and with the least interference with the sports fishing industry.
- The interest of fishmeal producers in increasing their production capacities if the annual limit on the anchovy catch were substantially increased.

You also requested that we report on the beneficial effects which could reasonably be expected from a substantial increase in the domestic production of fishmeal.

As your office requested, we have not asked the various Federal and State agencies concerned with the harvest and use of anchovies to review and comment on this report.

The most current estimate (1969) of the total northern California anchovy population was about 5.5 million tons. In 1974 the anchovy subpopulation off the coast of southern California was estimated to be between 2.5 and 3 million tons. The commercial harvest for the latest season, which ended in May 1974, was 121,000 tons, from which about 24,000 tons of fishmeal could have been produced.

Marine biologists generally agree that the anchovy could sustain an annual harvest of 50 percent of its population without endangering the maximum sustainable yield of the resource. National Marine Fisheries Service biologists believe that a substantially increased anchovy harvest would have

little impact on sports fishing; whereas, California Department of Fish and Game biologists believe that such an increase could have a serious impact. Fish and Game biologists endorse a policy of increasing the harvest in small increments and observing the effects of each increase on the anchovy population and sports fishing industry. Representatives of the sports-fishing industry oppose any increase in the harvest. They believe that the anchovy is the last forage for game fish in the California Current and that an increased harvest would ultimately decimate the species and destroy the sports fishing industry.

Fishmeal producers expressed considerable interest in expanding their production facilities--depending on the increase in the harvesting limit, the condition of the fishmeal market, and the potential return on investment.

Before 1973 the United States imported over 50 percent of its fishmeal supply. A substantial increase in our domestic supply of fishmeal could have a beneficial effect on our international balance of payments and reduce our dependence on foreign countries for fishmeal. Another benefit of an increased anchovy harvest, according to some biologists, would be the creation of a more favorable environment for the possible return of the Pacific sardine. The sardine is similar to the anchovy as forage for game fish but, unlike the anchovy, it is also valuable as a food for human consumption.

The appendix describes in more detail the availability of anchovy for the domestic production of fishmeal and the interests of fishermen, processors, and the sports fishing industry concerning increased use of anchovy for this purpose. In addition, the appendix summarizes the interests of East Germany, Poland, Mexico, and the Union of Soviet Socialist Republics in the anchovy off the California coast which increased in 1973 and 1974 and may further increase in future years.

We do not plan to distribute this report further unless you agree or publicly announce its contents.

Sincerely yours,



Comptroller General  
of the United States

**APPENDIX**

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ABBREVIATIONS

DFG	Department of Fish and Game
NMFS	National Marine Fisheries Service
SWFC	Southwest Fishery Center
U.S.S.R.	Union of Soviet Socialist Republics

POTENTIAL FOR GREATER USE  
OF THE CALIFORNIA ANCHOVY  
IN PRODUCING FISHMEAL

INTRODUCTION

The disappearance of the Peruvian anchoveta, which was the principal raw stock of fishmeal imported by the United States, resulted in a shortage of fishmeal in 1973. We reviewed the potential for expanding the use of the northern (California) anchovy in the production of fishmeal.

The northern anchovy

Northern (California) anchovy are ocean fish that swim in large schools and are generally found within 100 miles of shore. They inhabit the waters from Queen Charlotte Islands, British Columbia, to Cape San Lucas, Baja, California. Their life span is about 4 years and they grow to a length of about 7 inches. Each mature female lays 20,000 to 30,000 eggs a year, and about half of the anchovy spawned mature in a year.

In the United States anchovy that are harvested are used principally in the production of fishmeal. A small quantity of live anchovy is used for bait for sports fishermen.

Most of the anchovy harvested are processed in plants located in Terminal Island, California (Los Angeles harbor area). The catch and the fishing season are controlled by the California Fish and Game Commission, under authority granted by the California Legislature. Anchovy harvested in and outside of California's territorial waters are subject to the Commission's regulations when brought ashore in California. The Commission holds periodic public meetings throughout the State to obtain views of interested persons on Commission activities, including anchovy regulation.

Fishmeal

Fishmeal is a protein-rich flour which is the end product of cooking, drying, or milling whole fish or fish parts in a reduction plant. Most of the fishmeal produced in the world is used as an additive to poultry feed. Anchovy, menhaden, pilchard, mackerel, herring, hake, and waste from seafood processing plants are the principal raw stock used to produce

fishmeal. It takes about 5 tons of anchovy to make a ton of fishmeal.

The harvesting of fish is generally known as a fishery, and the reduction process is referred to as a reduction fishery.

Historically, the Peruvian anchoveta fishery provided about 40 percent of the world fishmeal supply and was a major source of the fishmeal used domestically. The source and consumption of fishmeal in the United States, in tons, follows.

<u>Calendar year</u>	<u>Domestic production</u>	<u>Imports</u>	<u>Total supply</u>	<u>Exports</u>	<u>Total domestic consumption</u>
1969	252,664	358,350	611,014	(a)	611,014
1970	269,197	251,492	520,689	4,724	515,965
1971	292,812	283,249	576,061	10,075	565,986
1972	285,506	391,955	677,461	10,351	667,110
1973	287,771	b/68,496	356,267	36,732	319,535

a/ Unknown.

b/ The drop in imports was caused by the disappearance of the Peruvian anchoveta.

According to the United Nations Food and Agriculture Organization, the disappearance of the Peruvian anchoveta was due to overfishing and a change in water temperature--an oceanic condition known as El Nino. The shortage of the anchoveta caused fishmeal prices to climb from \$175 a ton before September 1972 to about \$700 a ton in July 1973. The partial return of the anchoveta in 1974 decreased the price to about \$280 a ton in April 1974.

#### SCOPE OF REVIEW

We made our review at the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) headquarters, Washington, D.C.; its Southwest Fishery Center (SWFC), LaJolla, California; and Southwest regional office, Terminal Island, California; and at the State of California's Department of Fish and Game (DFG), Long Beach, California. We met with members of the California Fish and Game Commission, officials of the California Coastal Zone Conservation Commission, and California Water Resources Control Board officials. In addition, we interviewed officials

of seafood processing plants, commercial fishing interests, recreational fishing interests, poultry and nutritional experts, and poultry farmers to obtain their comments on the use of anchovy.

#### ABUNDANCE OF THE NORTHERN ANCHOVY

Biologists from SWFC have estimated that the anchovy population increased from about 640,000 tons in 1951 to a high of about 7.8 million tons in 1965 and decreased to about 5.1 million tons in 1966. Preliminary results of a 1969 survey showed a population of about 5.5 million tons. The biologists do not have a later estimate of the population. The total population consists of the northern, central, and southern subpopulations, as shown on the map on the following page.

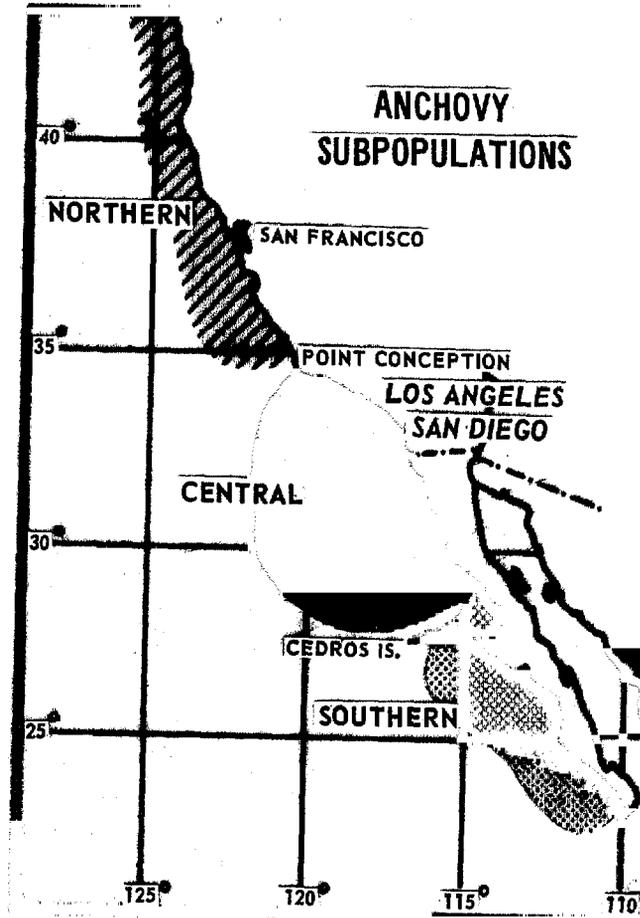
According to SWFC and DFG biologists, the central subpopulation, which is the largest of the three, has experienced almost all of the population changes over the years--increasing from 294,000 tons in 1951 to over 6 million tons in 1965 and decreasing to about 4 million tons in 1966. In 1974 DFG estimated that between 2.5 and 3 million tons of anchovy were in the central subpopulation. The southern and northern subpopulations have remained fairly constant.

#### Methods of estimating the population

Several well-known and widely accepted methods are available to estimate fish population sizes. These include estimates based on (1) data gathered from a fishery, (2) egg and larva surveys, (3) acoustical sea surveys, and (4) tagging studies. Only the egg and larva surveys and acoustical sea surveys have been used to estimate the size of the anchovy population.

SWFC uses the egg and larva survey method, which involves taking samples of eggs and larvae at various locations along the Pacific Coast up to 300 miles out to sea. The population is estimated by the number of adult anchovy required to produce the number of eggs and larvae estimated from the survey.

A disadvantage of the egg and larva survey is the great amount of time required for completion since it is necessary to identify and separate each egg and larva taken during the survey. Between 1951 and 1966 surveys were performed annually. Later, because of budget limits, they were performed at 3-year intervals--the last two in 1969 and 1972. As of July 1974 the results of the last two surveys had not been determined.



DFG initiated acoustical surveys in 1966. The surveys are made by operating sonar and echo-sounding equipment during daylight hours along transect lines spaced 5 to 20 miles apart and extending to a maximum of 100 miles off shore. A large midwater trawl is used at night along the same transect lines to identify the school concentrations that were detected acoustically. Population estimates are based on the density of anchovy schools found in the test area. The surveys are conducted each year in waters off northern Baja, California, and off southern and central California.

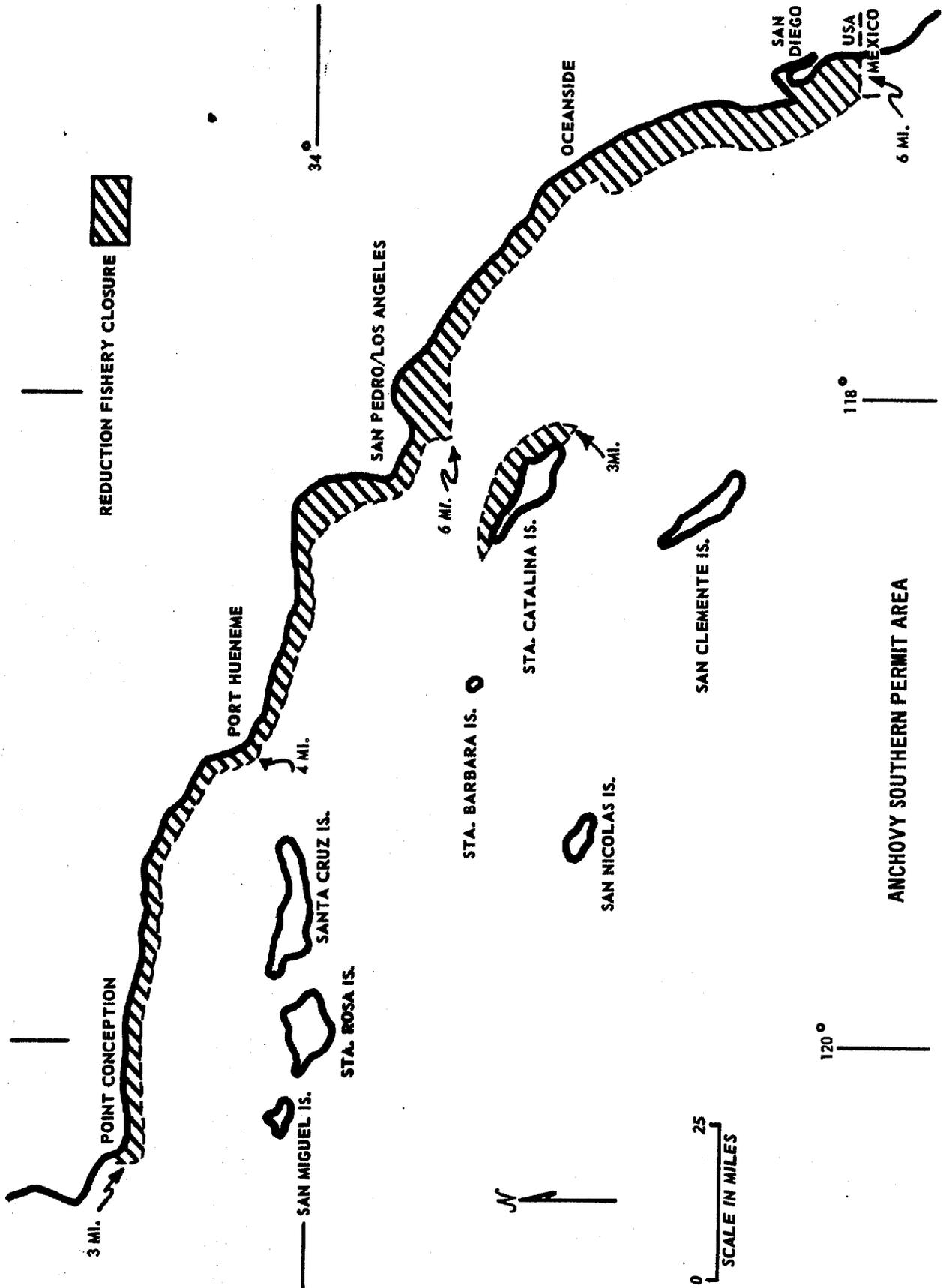
Representatives of the sports fishing industry question the validity of population estimates. They believe that the egg and larva surveys are not current and are made at intervals which are too far apart to be reliable. The representatives also question the reliability of the equipment and methods used in the acoustical sea surveys. They believe that the equipment has not been thoroughly tested and that the sample areas have been too small. These representatives said that they have made no studies of their own on the anchovy population.

#### USES OF THE NORTHERN ANCHOVY

Virtually every species of fish off the California coast and many birds and mammals feed on the northern anchovy. SWFC and DFG biologists, however, do not know the quantities of anchovy consumed or what percentage of each predator's diet is made up of anchovy. They believe that the anchovy is the major forage of most fish in the California Current. The sports fishing industry considers the anchovy the last species available as forage for game fish.

Commercial fishermen generally ignored the northern anchovy between 1916 and 1946. During those years the harvest averaged 561 tons a year, and the Pacific sardine was the main fish caught on the west coast--accounting for 25 percent of all fish caught in the United States. The sardine began to disappear during the late 1940s and its scarcity caused processors to harvest more anchovy.

From 1947 to 1957 the annual anchovy harvest averaged 17,000 tons. In 1958, due to a slight recovery of the sardine and a decline in demand for anchovy products, the catch again dropped and until 1966 the annual average harvest decreased to about 3,100 tons. The anchovy harvest increased to a high of about 120,000 tons for the reduction season ending in May 1974.



As shown by the map on page 13, about 80 percent of the 1973-74 season catch was in the San Pedro area.

According to the spokesman for the reduction fishing fleet in the Los Angeles harbor area, there were 31 anchovy boats located in San Pedro, 3 in Port Hueneme, and 16 in San Francisco in May 1974. The boats in San Francisco took less than 10 percent of the anchovy harvest. Most of the boats in the fleet are small (capacity between 75 and 120 tons), unrefrigerated, and have a limited range. They are used to fish for several species--principally tuna and mackerel. Anchovy are fished when other, more profitable species are not available.

The seafood processors generally place orders for the quantity of anchovy they can accept each day from the fishing fleet. The price of anchovy and the availability of other species determine how many boats fish for anchovy.

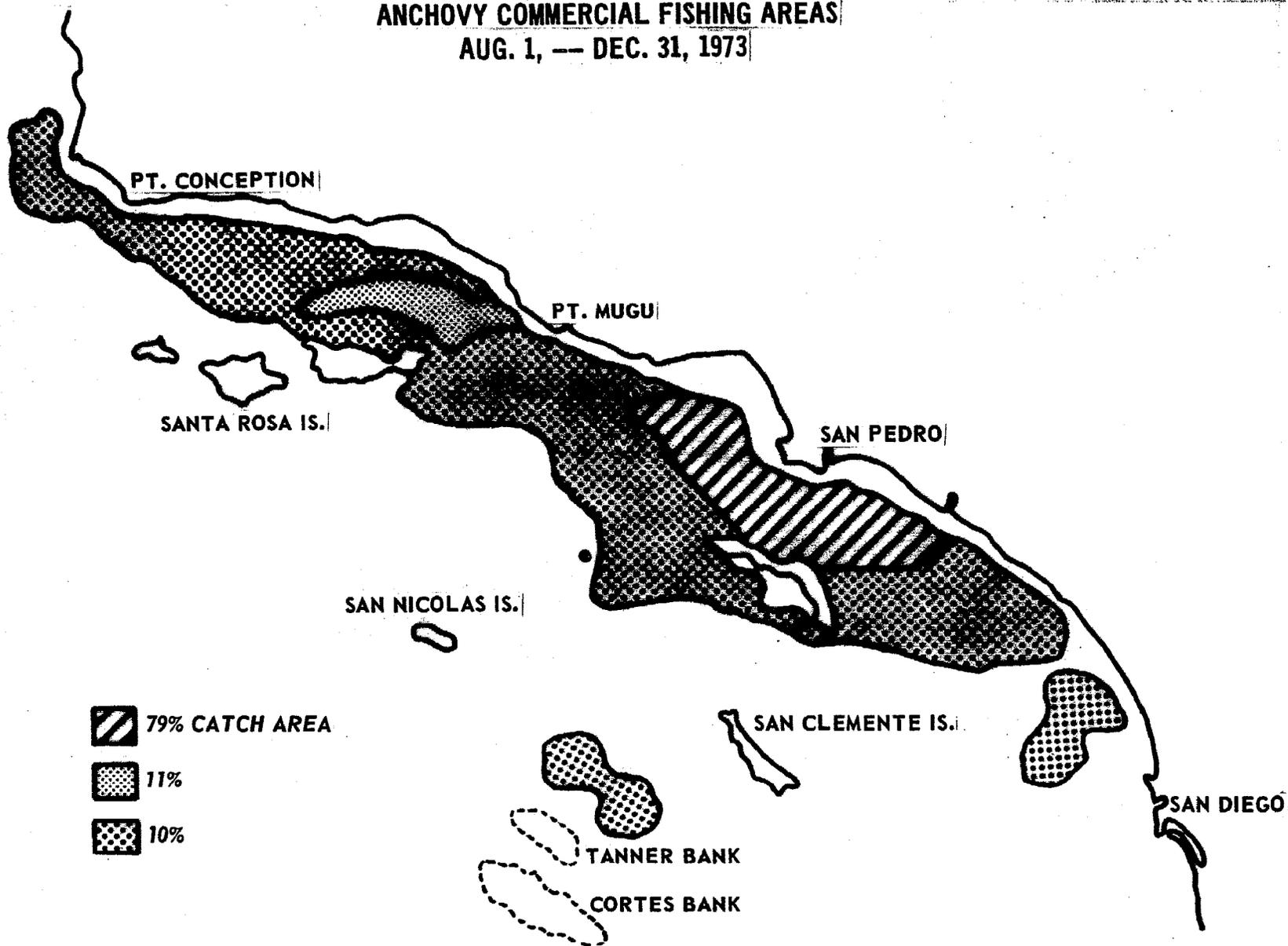
#### Live-bait fishery

The live-bait fishery, located primarily in southern California, also is in the central California area of Morro Bay and San Francisco. Anchovy has always been the major support of the live-bait fishery, but before the sardine population declined as much as 20 percent of the bait catch consisted of sardines. Anchovy now comprise about 99 percent of the catch.

In recent years the live-bait fishery has landed between 5,300 and 6,400 tons of bait each year. The boats used in the fishery are small, have a very short range, and generally fish within 3 miles of shore. These boats are located in the major sports fishing ports in California. Until May 1974 nine boats were used in the fishery. The locations and percentages of live bait taken in waters off California in 1973 are shown on the map on page 14.

The California DFG reported that during the summer months considerable difficulty is sometimes experienced in the Los Angeles harbor area in catching anchovy large enough to be used as bait by sports fishermen. The sports fishing industry insists that the reduction fishermen are not leaving any of the larger anchovy for live-bait fishing. However, the reduction fishermen claim that sufficient numbers of anchovy exist to meet bait needs but that during the summer months the anchovy do not stay close to shore. The reduction fishermen believe the problem could be solved if the live-bait fishermen would use more efficient nets and fish further out to sea.

**ANCHOVY COMMERCIAL FISHING AREAS**  
**AUG. 1, -- DEC. 31, 1973**



SWFC and DFG biologists associate this problem with a natural phenomenon. They claim that warm water conditions cause the larger anchovy to migrate out to sea while the smaller fish remain close to shore.

#### Maximum sustainable yield

Biologists at SWFC and DFG agree that the maximum sustainable yield of an anchovy fishery could be 50 percent of the total anchovy population. <sup>1/</sup> Because the anchovy has undergone some dramatic population changes over the years, it would probably be necessary to adjust annual catch in proportion to the annual population increase or decrease. Accurate and timely information regarding the population would be critical to managing the reduction fishery. These biologists generally agree that the DFG's acoustical sea surveys could provide the necessary accurate and timely information on population. However, they do not agree on the extent of the adverse effect on the sports fishing industry.

SWFC biologists believe the anchovy is an underutilized species that should be harvested at its maximum level. They also believe that a portion of the State-imposed limit should be allocated for live bait, thereby insuring an adequate supply. The SWFC biologists stated that under these conditions live bait would probably be harder to find, but additional live-bait storage facilities should guarantee a constant supply.

The SWFC biologists thought that removing half the anchovy stock would still leave an ample quantity of anchovy as forage for the various game fish in the California Current. They stated that these game fish are opportunists, that is, they will eat anything that is available. The biologists believe that, considering all the different forage fish, the effect of a larger reduction fishery on the food supply of the game fish would be minimal.

Although the DFG biologists agree that the maximum sustainable yield could be 50 percent, they believe that a harvest of this size would be inconsistent with their objectives of insuring that the anchovy can fulfill all its uses. For example, it is possible that a 50-percent harvest of the 2.5 to 3 million tons of anchovy in the central subpopulation could

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<sup>1/</sup> Maximum sustainable yield is the balance between catching fish of a particular species and leaving enough of the species to reproduce.

scatter the anchovy so badly that insufficient live bait would be available for the sports fishing industry. A reduced quantity of anchovy could also prove to be insufficient as a food source to attract the more valuable game fish into the area.

DFG, however, has endorsed a 1964 proposal made by California Cooperative Oceanic Fisheries Investigation to substantially increase the anchovy harvest. Personnel from the University of California's Scripps Institute of Oceanography, SWFC, and DFG formed the investigative group.

In the early 1950s this group began collecting data on the northern anchovy. In 1964 the group proposed that an experimental fishery be initiated in California to increase anchovy fishing while reducing sardine fishing. The experiment was to proceed in three phases. Phase 1 was for an annual anchovy harvest of 200,000 tons for 3 years and a restricted sardine harvest of 10,000 tons. Phase 2 called for adjusting quotas on the basis of findings during the initial phase. Phase 3 had the ultimate objective of restoring the balance between sardines and anchovy and maximizing the harvest of both species.

DFG believes that the 200,000-ton harvest is still valid and would not adversely affect the availability of live bait or the supply of forage for the game fish in the California Current. Because of the tremendous concern against an increase in the anchovy limit voiced by the sports fishing industry, DFG plans to recommend continuing the 115,000-ton limit. Upon request by the reduction industry, it would endorse a temporary increase, such as during the 1973-74 season, but would not recommend any increase beyond 200,000 tons until it could determine what effect this size harvest would have on the anchovy population.

Two members of the California Fish and Game Commission said they were concerned with preserving the anchovy for all its uses; i.e., forage for predators, live bait, and fishmeal reduction. They believe all of the uses are legitimate and must be considered when discussing an increase in the reduction fishery. They noted that, except for the 1973-74 reduction season, the current limit has never been reached. Consequently, the Commission does not plan to increase the current reduction limit. The Commissioners, however, indicated that they would consider temporary increases, as they did in the 1973-74 season, if requested by the reduction industry and circumstances warranted the increase.

A recent development which also affects fishmeal production is the advent of water pollution regulations. Officials from DFG and the California Water Resources Board, which is responsible for monitoring and controlling water pollution in California harbors, informed us that the seafood processors' canneries are under a cease-and-desist order to discontinue the discharge of effluent into Los Angeles harbor by 1976. To comply, the canneries can either purchase and install expensive antipollution equipment or hook up to the local sewer system. The officials believed the canneries will probably choose the latter method. A Board official told us that the sewer system could probably handle the extra wastes resulting from an increased reduction fishery but the cost would increase significantly as the quantity of wastes increases.

An official of the California Coastal Zone Conservation Commission, which regulates construction on or near the coastline, said that the Commission has stringent requirements but would consider any permit request, provided the water pollution requirements were met and no additional landfill would be needed.

A representative of one of the canneries told us his company could build a plant on the existing property that could process in a 24-hour operation up to 2,400 tons of fish a day. Although it would be very expensive, he believed the cannery could meet all the environmental requirements. Before deciding to build any size plant, his company would require some assurance that the anchovy catch limit would be permanently increased. Considering the current price of fishmeal, he believed a fairly large volume is necessary to make expansion economically feasible.

An official of another cannery stated that his firm was interested in expanding but doubted that it could substantially increase its reduction facilities because of the water pollution regulations governing the harbor. He stated that the technology exists to build nonpolluting reduction plants but the construction cost probably would be prohibitive. Even if the pollution problems could be overcome, he was still not sure that the California Coastal Zone Conservation Commission would issue construction permits.

#### Fishing fleet's capacity

According to a representative of the Fishermen's Cooperative Association, most of the anchovy fishing boats are between 30 and 50 years old, are small, and have a limited range. The present fishing fleet could harvest up to 3,000 tons of anchovy a day.

The representative stated that the fleet's primary targets are tuna and mackerel. Anchovy is harvested only when the more valuable species are unavailable. Before the current season,

the low price for anchovy and the low anchovy limit attracted very few fishermen. However, with increased volume, more boat owners would find the anchovy profitable even at lower prices and would enter the fishery.

#### Sports fishing industry views

Sports fishing industry representatives object to raising the anchovy catch limit because of the possibility that it would attract more fishermen and result in an "economic snowball" that would be difficult, if not impossible, to stop, should more stringent controls become necessary.

The sports fishing representatives also expressed concern that the newly developed technology--synthetic materials for net construction, power equipment to load the net, and airplane and electronic equipment for spotting anchovy schools--is so efficient that the present fleet could wipe out the anchovy in one or two seasons.

FOREIGN NATIONS' INTEREST IN THE ANCHOVY

The Union of Soviet Socialist Republics (U.S.S.R.), East Germany, Poland, and Mexico have, for some time, been interested in harvesting anchovy off the coast of California. In 1973 and 1974 there was increased interest by these nations as evidenced by the sighting of their vessels in the heavily populated anchovy areas.

According to an NMFS official, information on the extent of U.S.S.R., East German, and Polish interest in the anchovy is slight or nonexistent. Following is a summation of the limited information that we were able to obtain from NMFS and the Department of State on each of the four nations' anchovy activities in 1973 and 1974.

U.S.S.R.

During the United States-U.S.S.R. fishery talks in Moscow between January 29 and February 21, 1973, the Soviets indicated that they did not plan to fish for anchovy off the Pacific coast during the next 2 to 3 years. The U.S.S.R. is attempting to find alternate resources to offset declines in herring, but did not seem to consider anchovy as a substitute resource. The U.S.S.R. indicated that it would need to work out processing problems before initiating an anchovy fishery.

In the summer of 1973, a U.S.S.R. vessel was sighted off San Clemente Island, California, nesting with a refrigerated transport ship. No fishing activity was observed, although it was unofficially reported that the U.S.S.R. had been fishing for anchovy as part of its research effort. The U.S.S.R. research concept includes all aspects of fisheries, such as test fishing, processing, and distributing. During meetings in July and October 1973, U.S.S.R. fleet commanders and skippers either claimed to have no knowledge of U.S.S.R. anchovy fishing plans or indicated that there were no plans for anchovy fishing off California before 1975.

In June 1974 the same U.S.S.R. vessel that had been sighted in 1973 was sighted 100 miles west of Point Conception, California, and in August 1974 was still operating off the California coast. Also, during a 1974 U.S.S.R. research cruise, using another vessel, two midwater trawls for anchovy were made off Ensenada, Mexico. Anchovy were taken in both trawl attempts.

An NMFS official felt certain that the U.S.S.R. was aware of the anchovy resource and that their estimates of population size corresponded closely with those of the United States.

He also felt equally certain that some test fishing had been conducted. In his opinion, 1975 could be the start of U.S.S.R. anchovy fishing operations unless discussions at the Law of the Sea Conference, held in the summer of 1974, or bilateral agreements in late 1974 or early 1975 precluded such operations.

#### East Germany

An East German vessel fished off northern California in late 1973. In 1974 an East German vessel crossed southern California waters and was reported (and later sighted by a Coast Guard helicopter) off San Clemente Island. Although the vessel was not observed fishing, it could have made sample tows for anchovy. Subsequently the vessel was reportedly fishing off Ensenada, Mexico, but there was no confirmation that this actually occurred. In all likelihood, the East Germans are aware of the anchovy resource. It is possible that test fishing was conducted. The NMFS official believed that we will see more East German vessels next year off the Pacific coast, and the vessels might fish for anchovy.

#### Poland

Polish vessels fished off northern California and the Northwest States in late 1973. These vessels fished off California in 1974 and it was reported that six or seven Polish vessels, including a factory vessel which came from the east coast of the United States, were off the Pacific coast as late as August 1974. Polish vessels did cross southern California waters in 1974 and may have made sample tows for anchovy. As with the East Germans, it is probable that they are aware of the anchovy resource. Indications are that Poland will increase its efforts off the west coast and the possibility that they will fish for anchovy in the future is strong.

#### Mexico

Mexico has an active program for developing a fishmeal industry based on using the California anchovy. The Food and Agriculture Organization of the United Nations and Mexican Fisheries Development Project has advised the Mexican Government that the anchovy resource off Ensenada is capable of producing 500,000 tons of anchovy a year. The Organization reported that the then-existing reduction plant capacity was sufficient for an exploratory anchovy fishing program and that three additional plants could handle the estimated 500,000 tons a year. Mexico has concluded an agreement with the Food and Agriculture Organization for a scientific study of the anchovy

## APPENDIX

resource. The agreement, which will formally begin in November 1974, provides for six international and five Mexican scientists to participate.

In July 1974 the Mexican anchovy fleet consisted of five or six small, decrepit boats. There were, however, about 25 sardine vessels which could be used to fish for anchovy. Also, in July 1974, the Mexican Government had under contract with a Peruvian fishing company three anchovy seiners and an aircraft for exploratory work and had chartered a San Diego, California, anchovy vessel. It was reported that the Peruvian vessels, after a slow start, were making good catches. In addition, a recent fisheries loan made to Mexico by the Inter-American Development Bank provides for the construction of 30 sardine seiner vessels that could potentially engage in anchovy fishing.

A major U.S. fishmeal producer has presented a formal proposal to the Mexican Government for a joint venture to make use of the anchovy resource. The proposal outlines a 5-year plan that calls for constructing 5 vessels (500 tons each) and constructing a reduction plant that could be expanded each year, concurrent with completing each new vessel, to a total capacity of 400,000 tons a year. Information was not available on whether the Mexican Government will accept the proposal.

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All four foreign nations have shown interest in the central anchovy subpopulation which extends from Point Conception, California, to below Ensenada, Mexico. Since the central subpopulation extends well beyond the 12-mile limit, fishing by the four foreign nations in this area will be in direct competition to U.S. anchovy fishermen.

In view of the world need and demand for protein, other foreign nations may also become interested in the California anchovy because of the size of the resource and because the anchovy is a fish which travels in dense schools--an economical harvesting factor.

### BENEFITS OF INCREASED DOMESTIC FISHMEAL PRODUCTION

Fish processors and anchovy fishermen are interested in expanding their facilities to support a larger anchovy fishery if they can be assured of a substantial increase in the

could have produced an annual average of 14,660 tons of fishmeal compared to 20,000 tons, had the established limit been harvested. If the annual quota is increased to 200,000 tons, as recommended by the California Cooperative Oceanic Fisheries Investigation (p. 16), fishmeal production could have been increased to 40,000 tons annually. An annual production level of this size represents about a tenth of U.S. fishmeal imports in 1972. However, assuming that environmental regulations can be met and 1,200,000 tons of anchovy (one-half of the central subpopulation) are harvested annually, about 240,000 tons of fishmeal could be produced. Fishmeal production, at this level, would be about two-thirds of our average imports during 1969-72.

We believe several benefits would result from increasing the anchovy harvest. Assuming a price for fishmeal of \$280 per ton (closing price at the end of the 1974 season) and an annual production of 240,000 tons, there would be a favorable impact of over \$60 million a year on the U.S. international balance of payments. During 1969-72 about one-half of our domestic consumption of fishmeal was imported. An increased supply of domestic fishmeal would decrease our dependence on foreign countries for fishmeal.

In addition, there is a chance that the Pacific sardine might return if the anchovy were harvested substantially more than at present levels. This view is based on some biologists' conclusions that the Pacific sardine and anchovy not only occupy the same ocean areas but feed on the same food.