

**STATUS OF THE
JACK MACKEREL RESOURCE
AND ITS MANAGEMENT**



by

Eric H. Knaggs

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ABSTRACT

The jack mackerel, *Trachurus symmetricus*, resource off the west coast of North America is known to be large and widely distributed. The spawning biomass is estimated to be 2.1 to 4.8 million tons based upon abundance of jack mackerel eggs collected at sea. The distribution extends from the Gulf of Alaska to the Gulf of Tehuantepec, off the coast of southern Mexico, and as far as 1,500 miles seaward. Within this range lies an area of maximum density which extends from Point Conception to central Baja California.

Jack mackerel biological data has not been processed very rapidly due to higher priorities for analysis of sardine and Pacific mackerel data, and the apparent healthy condition of this resource. The California Department of Fish and Game initiated several projects in 1972 to resolve unanswered biological questions.

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HISTORY OF THE FISHERY

Jack mackerel, *Trachurus symmetricus* (Ayres), were reported in the commercial fish catch as early as 1888, but were of minor commercial importance until 1947. Most of the jack mackerel catch between 1926 and 1946 was absorbed by fresh fish markets and consisted primarily of fish taken from mixed sardine, *Sardinops sagax caeruleus*, and Pacific mackerel, *Seomber japonicus*, schools. During these years it was referred to as "horse mackerel" and had relatively little market appeal.

During 1947, the industry, after being hit hard by poor sardine landings, turned to jack mackerel as a substitute sardine and landed approximately 64,500 short tons. Jack mackerel have been a major contributor to California's commercial landings ever since, averaging 34,000 short tons annually.

Commercial Fishery

Jack mackerel are caught on southern California fishing grounds throughout the year by purse seine vessels. In the early days of the cannery fishery, shortly after 1947, the monthly catches were simply related to the activity of the fleet searching for sardines and Pacific mackerel. As a result, fleet activity was low during the winter and spring months, reflecting the closed sardine season and spring scarcity of Pacific mackerel. Current monthly landings do not reflect the clear seasonal pattern evidenced in the early days of the fishery (Blunt, 1969).

The southern California wetfish fleet catches jack mackerel from Point Conception to San Diego, and offshore as far as Tanner and Cortes Banks.

Offshore distribution of jack mackerel catches over the years has been related to Pacific mackerel and sardine fishing. During periods of low sardine and Pacific mackerel catches, the jack mackerel catch was more seaward. In recent years, with both sardine and Pacific mackerel catches being under limits or a moratorium, Tanner and Cortes Banks produced approximately 50% of the jack mackerel catches.

Commercial age and length sampling methods have varied considerably since 1947 when routine sampling of the cannery catch commenced. These methods have not always been precise and systematic, so a new sample plan was formulated in 1967, and is used at the present time. Fundamentally, the sampling is conducted with probability of sampling proportional to estimated weight of a boat load, and with equal probability for sampling a particular fish within a catch.

Jack mackerel are measured to the closest millimeter fork length and weighed to the nearest gram. Fish below 200 mm fork length are not sexed due to the unreliability of determinations on shorter individuals. All identification and examination of ovaries is done externally.

Fish caught commercially off southern California and Ensenada are generally between 50 and 450 mm fork length. These fish are less than 10 years of age. In recent years, the catch has consisted primarily of 0, 1, 2, and 3 year old fish.

Examination of age composition data has shown that dominant year classes are evident in the fishery. The 1947 and 1952 year classes

each contributed over 100,000,000 lbs in total landings.

Recreational Fishery

When large jack mackerel are locally abundant, they are much sought by southern California sportsmen. These fish are caught at or near the water's surface, usually on a small hook attached to a light monofilament line. About the only bait that appears to be dependable is live anchovies. Best fishing occurs from July through September, but may begin as early as May. Sportfishermen have caught as many as 196,000 large jack mackerel from southern California partyboats during a single season. Off northern California, large jack mackerel are considered a nuisance when they take anchovies trolled for salmon (Frey, 1971).

Jack mackerel also are used by recreational fishermen as live bait for the larger and more desirable yellowtail, *Seriola dorsalis*.

In 1935, the California Legislature enacted a bill requiring written catch logs from all partyboat operators. Since 1935, except for 5 years during World War II, partyboat catch logs have been collected on a routine basis.

These records show (1) each day's fishing, (2) area fished, (3) number of persons fishing, (4) an accurate count of the number of fish taken, by species, and their approximate weight, and (5) the numbers of hours of actual fishing, not counting travel time.

Sampling for age composition is not done on a regular basis within the sports fishery.

BIOLOGICAL KNOWLEDGE

Geographic Range

The jack mackerel population represents a renewable resource of considerable range and magnitude. The distribution extends from the Gulf of Alaska to the Gulf of Tehuantepec, off the coast of southern Mexico, and as far as 1,500 miles seaward. Within this range lies an area of maximum density which extends from Point Conception to central Baja California.

Status of Populations and Subpopulations

An average biomass of 350,000 tons in the California Cooperative Oceanic Fisheries Investigations (CalCOFI) survey area was estimated during the years 1955-57 (MacGregor, 1964). This estimate was based on egg and larva surveys which did not cover the total jack mackerel spawning range, and included only spawning fish. Consequently, it is probably a low estimate with respect to the total population.

Elbert H. Ahlstrom (1968) estimated the jack mackerel resource off California and Baja California to range from 1.4 to 2.4 million tons. The total resource in the eastern Pacific was estimated at between 2.1 and 4.8 million tons (based on a rough estimate of the total population as 1 1/2 to 2 times that in the CalCOFI area).

In 1972, the total population off southern California available to roundhaul fishermen was estimated to range from .7 to 1.5 million tons.

These estimates represent a resource of considerable magnitude.

Migrations

Jack mackerel occurrence in the Gulf of Alaska appears to be related to warming surface waters with the progression of summer.

The distance traveled by some fish approximates 800 miles at a rate of 13 to 14 miles per day (Blunt, 1969).

It has been hypothesized that juvenile fish from distant offshore spawning stocks move inshore to grow and develop and then gradually move seaward again as they become older and larger.

Tagging studies have shown considerable movement of jack mackerel exists within the California bight area.

Reproduction

Jack mackerel are heterosexual and exhibit sexual dichromatism during the spawning season.

About 66% of the 1 year old female jack mackerel are sexually mature. All female jack mackerel are sexually mature at 3 years of age.

Jack mackerel eggs and larvae are among the more abundant fish zooplankton in CalCOFI plankton collections. The center of abundance of the spawning population is off southern California and Baja California between Point Conception and Cape San Quintin. Larvae have been taken up to 400 miles off the coast of southern California.

Spawning off California and Baja California extends from January to November. Peak spawning occurs from March to July, when 95% of the larvae are taken. A single female will normally spawn more than once during a season and the eggs, which are about 0.98 mm in diameter, float free in the upper layers of the ocean. The eggs hatch in 4 to 5 days.

Growth

The weight-length relationship derived from our samples is:
 $W = 0.0000042175 L^{3.16521}$. This curve is based on a sample of 459 fish.

Mortality

No mortality data are available.

REGULATION AND MANAGEMENT

California has regulations pertaining to fishing gear and craft, as well as restrictions on commercial fishing in several areas. These regulations were not passed specifically to control the jack mackerel fishery and probably have little if any effect on it. There are no closed seasons or other restrictions on the jack mackerel fishery. California law prohibits the use of these fish for reduction except that fish offal may be reduced.

Estimates of the jack mackerel resource represent a renewable stock of fish with a considerable range and magnitude. Until certain biological questions concerning jack mackerel are answered, and due to the apparent healthy condition of this resource; no recommendations should be made to restrict the use of the jack mackerel resource for both sport and commercial utilization.

DISCUSSION

Jack mackerel biological data have not been processed very rapidly due to higher priorities for analysis of sardine and Pacific mackerel data. Even in some cases, the biological knowledge which has been obtained is not appropriate for primary scientific publication.

The California Department of Fish and Game initiated several projects in 1972 dealing with fecundity, migrations, maturation and growth, age composition of the catch, and population size to resolve these unanswered biological questions.

Research Needs

To facilitate and stimulate research, problem areas which need to be answered are outlined below:

- a. Stock identification and estimates: Need to determine whether jack mackerel stock is made up of one or more genetic sub-populations and what is the distribution, abundance and migration patterns of each.
- b. Differential distributions and habits of age groups: Older fish distributed offshore--fishery depends on younger age groups, which are available inshore, but what portion of the total are available to the fishery has yet to be determined. How much is the varying abundance of young fish dependent on year class strengths?
- c. Analysis and publication of age composition data collected from jack mackerel fishery since 1947 (in progress but not yet available).
- d. Processing and related problems, especially with regard to the utilization of older size groups of fish.
- e. The decrease in numbers of larger, older fish in commercial landings during recent years is cause for concern. Does this represent a decline in the actual size of the breeding that supports the southern California fishery?

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