

A STATUS REPORT ON THE  
JACK MACKEREL TAGGING PROGRAM 1/

by

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ABSTRACT

Methods and materials used to tag and recapture jack mackerel, *Trachurus symmetricus*, off the coast of southern California and Baja California, Mexico, are described. Tagging, recapture, and movement data resulting from this program are reported. Analysis of this preliminary data indicates a seasonal inshore-offshore movement pattern for this species within the range of the California fishery.

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### INTRODUCTION

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. Adults are distributed from Cape San Lucas to the Gulf of Alaska, and range hundreds of miles offshore.

The California fishery is operating on the fringe of this large population. Landings in California since 1947 have fluctuated from a high of 73,000 tons in 1952 to 8,700 tons in 1954. Part of this fluctuation is due to varying amounts of fishing effort directed towards other species, and to reduction in size of the fleet over the years; however, some variability in landings is due to differences in availability of jack mackerel from year to year.

The reasons for these differences in availability are poorly understood. The offshore spawning population seems to be relatively stable, but nothing is known of the relationship between this offshore population and those fish within range of the California fishery. The purse seine fleet seldom takes jack mackerel older than 6 years of age, though 20 to 30 year old fish turn up in the sport catch. Most catches consist of fish 3 years old or younger.

Because knowledge of jack mackerel migratory behavior is so meager many questions remain unanswered. Is the jack mackerel resource made up of one large interbreeding population or is it composed of a number of discreet subpopulations? Will stocks fished heavily in one area be replaced by fish moving in from other areas? The initiation of a comprehensive tagging program by the Department of Fish and Game, with funds

supplied by the Marine Research Committee, has been the first step in gaining a better understanding of jack mackerel behavior, movements, and racial structure. This program was instituted so that the fishery may develop to its full potential under sound management.

## METHODS

### Tagging

The tagging program was initiated July 1, 1971. Preliminary research indicated that the Floy anchor tag (Dell, 1968) had qualities that made it quite suitable for use on jack mackerel. The tag could be applied quickly and in large numbers by means of a cartridge fed tagging gun. Testing by Carline (1972) had indicated that tagging mortality and shedding were minimal on fish similar in size to the jack mackerel. The external vinyl shaft of the tag had been demonstrated to be long enough (3 inches) to be easily seen by cannery personnel or fishermen handling the fish individually.

Experiments were conducted at Marineland of the Pacific, Undersea Gardens in Marina del Rey, and aboard the R/V ALASKA to estimate netting, handling, and tagging mortality rates and to find methods for reducing this mortality. Results of these experiments indicated that netting and handling mortality were more significant than tagging mortality. Jack mackerel that were netted and handled many times, resulting in heavy scale and slime loss, suffered mortality rates as high as 90% following apparent bacterial invasion. When netting operations were kept to an absolute minimum and water soaked cotton gloves were used to handle the fish, mortality rates dropped below 20%.

Another form of mortality, though not very measureable, was that due to the accumulation of predators, particularly the California sea

lion, *Zalophus californianus*, and the blue shark, *Prionace glauca*, around the tagging operation. It was not uncommon, when working off commercial fishing boats at night, to encounter five or six sea lions while releasing tagged fish. Limitations on operation time aboard these vessels makes such mortality unavoidable.

The small wound created by inserting the tag does not appear to cause any great harm to the fish. Examination of recaptured fish with tags still attached revealed that in the great majority of cases sufficient scar tissue had formed around the tag to prohibit tag vibration from increasing the size of the wound. No attachment of tissue to any portion of the tag was ever noted, not even on fish that had been at liberty for nearly 1 year. This observation indicates the wound remains a possible site for bacterial or parasitic invasion. A small number of tags that had been out for 3 months or more had considerable algal growth on the exposed portion of the tag; however, this additional material does not seem to adversely affect tag retention nor increase the diameter of the insertion site.

Of the 13,067 jack mackerel tagged during the first 2 years of the program, approximately 40% were released from commercial purse seiners, 20% from local bait receivers supplied by lampara boats, and 40% from sportfishing vessels or Department research vessels. The fish tagged aboard the latter two groups of vessels were captured by hook and line.

Aboard commercial purse seiners a 2½ ft. X 2½ ft. X 3 ft. plywood receiver was utilized to retain jack mackerel during tagging operations. The receiver was supplied with continuous water flow from the vessel's pumps, and was as far removed from the fishing operation as possible. As many as 500 jack mackerel could be brailled into this receiver from

the vessel's nets after the net had been pursed and drawn close. Fish were withdrawn from the receiver, tagged, and released during the 1 to 2 hours the fishermen required to transfer their catch from the net to the hold and then restack the net.

Tagging operations from bait receivers required less preparation. The available jack mackerel were crowded in the receiver, scooped into buckets, tagged, and released. The lampara bait fishermen, who supplied these fish, and the commercial fishermen from the previously mentioned purse seine vessels were financially compensated for all fish provided.

Fish procured by hook and line were either immediately tagged and released, or retained in a bait tank to tag and release at a later time. Hook and line collection avoids net abrasion but has a major disadvantage in that the soft mouth parts of the jack mackerel are easily torn during removal of the hook.

#### Returns

Tag recoveries come primarily from cannery personnel, although a few have been returned by sportfishermen. Cannery workers handle each jack mackerel that is being packed for human consumption. Consequently, nearly one-half of the jack mackerel landed since the inception of this program have been handled individually. The remaining tonnage of jack mackerel, from which we have received no tag returns, is converted into pet food. An experiment is presently underway to determine the percentage of tagged fish returned to the Department from those that enter the cannery for packing. Preliminary, but inconclusive data, indicate a 60% return. When a tag is recovered it must be traced through interviews to the vessel which caught the fish in order to determine the location of recapture. To induce cannery workers and sportfishermen to return tags or tagged jack mackerel,

posters offering a \$1.00 reward were placed in the vicinity of all canneries and sportfish landings throughout southern California and Baja California, Mexico.

## RESULTS

### Tagging

A total of 13,067 tagged jack mackerel had been released by July 1, 1973 (Table 1). Generally, those released at Cortes Bank and San Clemente Island were tagged from commercial purse seine vessels and those tagged and released in San Diego Bay and Santa Monica Bay were supplied by lampara boat bait fishermen. At the remaining locations the most frequently used method of procurement was hook and line.

TABLE 1. Locations of tag releases and returns.

<u>Location</u>	<u>Number Tagged</u>	<u>Number of Returns</u>
Ventura	3	-
Santa Cruz Island	33	-
Santa Monica Bay	693	4
Horseshoe Kelp	70	3
Santa Barbara Island	5	7
Santa Catalina Island	1964	38
San Clemente Island	2614	29
Cortes or Tanner Bank	3908	31
Newport Beach	228	1
Dana Point	99	-
La Jolla	621	1
San Diego Bay	2530	2
Baja California	299	1
Questionable	-	18
<b>TOTALS</b>	<b>13067</b>	<b>135</b>

### Returns

There has been a tag return rate of over 1% for the first 2 years of the program. Considering the fact that less than 50% of the fish landed by commercial boats are handled individually, we feel that this figure represents a reasonable return. The figure is somewhat inflated since following a tagging operation aboard a purse seiner there is usually a substantive return of tags that have been at liberty a week or less. This situation results from an accumulation of fishing boats in the same area for as long as the good weather holds out and the fish schools remain. About 17% of the tag returns have fallen into this category.

The average tagged fish was at liberty 2 months before recapture and the extremes range from 1 day (minimum) to 373 days (maximum). A total of three fish has been recaptured after being at liberty for approximately 1 year.

### Movement

Recaptures indicate a considerable amount of movement within the fishery (Figure 1). Those fish that have demonstrated substantial

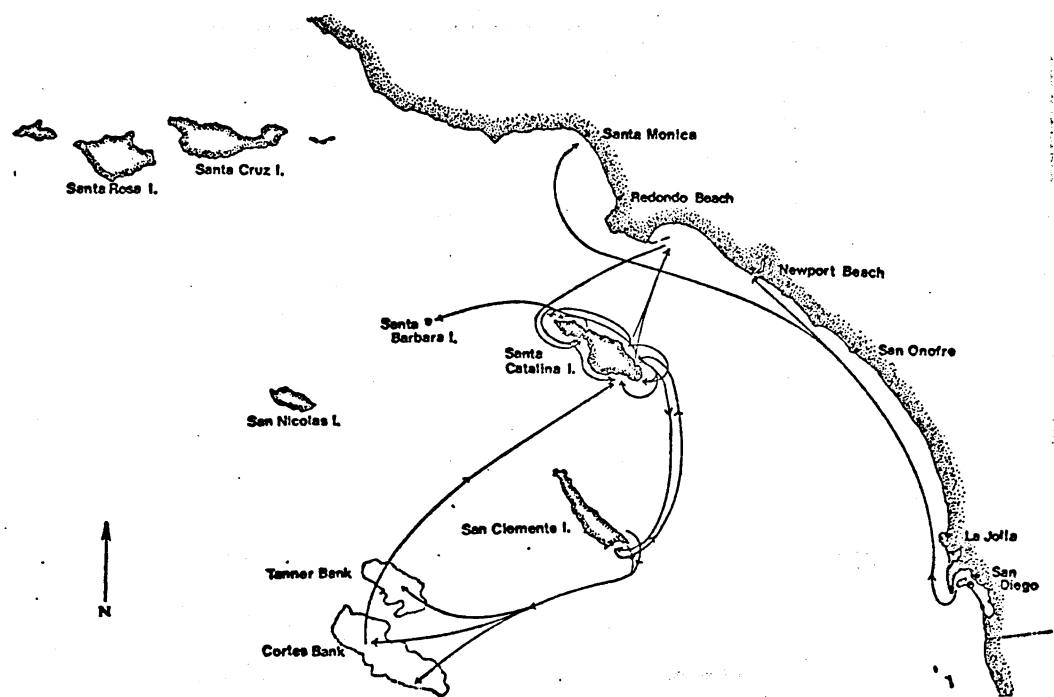


Figure 1. Movements of jack mackerel as indicated by tag recoveries.

movement (Table 2) averaged 71 days at liberty. The greatest movement noted was from San Diego Bay to Santa Monica Bay over a 212 day period. The number of questionable recaptures (Table 1) results from an occasional inability to pinpoint the location of recapture. If a number of boats from different fishing grounds unload at about the same time, the recapture location is in doubt.

TABLE 2. Substantial movement of tagged jack mackerel.

Recapture Date	Number of returns	Days at liberty	Point of release	Point of recapture
Nov. 16, 1971	3	19,28,30	Catalina Island	Horseshoe Kelp
Nov. 22, 1971	1	37	Catalina Island	Horseshoe Kelp
Dec. 10, 1971	1	43	Catalina Island	Horseshoe Kelp
Dec. 16, 1971	1	63	Horseshoe Kelp	Catalina Island
Jan. 3, 1972	1	67	Catalina Island	San Clemente Island
Jan. 10, 1972	1	74	Catalina Island	San Clemente Island
Jan. 21, 1972	7	97,85,90, 91,92,95,95	Catalina Island	Santa Barbara Island
Feb. 8, 1972	1	113	Catalina Island	Horseshoe Kelp
July 10, 1972	2	10,11	San Clemente Island	Cortes Bank
Aug. 6, 1972	1	46	San Clemente Island	Tanner Bank
Aug. 8, 1972	1	48	San Clemente Island	Cortes Bank
Aug. 10, 1972	1	41	San Clemente Island	Cortes Bank
Aug. 20, 1972	1	51	San Clemente Island	Cortes Bank
Sept. 14, 1972	1	68	San Clemente Island	Cortes Bank
Sept. 16, 1972	2	76,76	San Clemente Island	Cortes Bank
Oct. 9, 1972	1	102	San Clemente Island	Catalina Island
Dec. 9, 1972	1	66	San Diego Bay	Newport Beach
Jan. 9, 1973	1	184	Cortes Bank	Catalina Island
May 6, 1973	1	212	San Diego Bay	Santa Monica Bay

### CONCLUSIONS

Although all of these data are preliminary and incomplete, they seem to suggest a seasonal inshore-offshore movement pattern. Fish tagged at



Cortes Bank during the summer have been recaptured there approximately a year later and a single fish was recovered after 184 days liberty at Catalina Island. Fish tagged at Catalina Island in the fall moved to Santa Barbara Island and San Clemente Island during the winter, and a single fish tagged at Catalina Island that same fall was recaptured nearly 1 year later back at Catalina Island. A number of fish tagged at San Clemente Island during the first part of summer have been recovered from Cortes Bank during the latter part of the summer and one of their number was returned from Catalina Island in the fall. Combine these movements with commercial jack mackerel landings since 1965, which show an increase in availability of jack mackerel offshore at Cortes Bank during the spring and summer months and inshore at Catalina Island, Santa Barbara Island, and Horseshoe Kelp during the fall and winter months, and a pattern begins to emerge.

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