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The Resources Agency
DEPARTMENT OF FISH AND GAME

STATUS OF THE SPAWNING BIOMASS
OF THE PACIFIC SARDINE, 1983-84

by

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ABSTRACT

State law provides for the initiation of a fishery for Pacific sardines, *Sardinops sagax caeruleus*, when the spawning biomass of sardines reaches 20,000 short tons. Data from ichthyoplankton surveys, sea survey cruises, the mackerel fishery sampling program, and the live-bait fishery monitoring program are discussed with regard to an increase in population size. It appears that the spawning biomass of the northern stock of Pacific sardines remains below 20,000 tons. Legislation passed in 1983 which affects the incidental take and commercial use of sardines is also discussed.

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RECOMMENDATIONS

As of January, 1984, the spawning biomass of the northern stock of Pacific sardines, *Sardinops sagax caeruleus* remains below the 20,000 short tons required by law before a directed harvest may be initiated. The Department recommends that current restrictions concerning marketing and incidental catches be continued and that no directed fishing for sardines be initiated during 1984.

INTRODUCTION

This is the 10th in a series of reports concerning the status of the sardine spawning biomass. It is similar to previous reports in that no attempt is made to estimate the spawning biomass of Pacific sardines. Rather, several independent sources of information which reflect on the abundance of sardines in 1983 relative to their abundance in previous years are discussed.

ICHTHYOPLANKTON DATA

Klingbeil (1982) reported that the 1981 California Cooperative Oceanic Fisheries Investigations (CalCOFI) egg and larval survey showed a moderate increase in number and geographic range of positive stations for Pacific sardine eggs and indicated the best spawn since 1964 in the southern California bight. It has also been suggested (Klingbeil 1983) that if survival from the 1981 spawn was good, a moderate increase in the size of the spawning portion of the sardine resource might be expected to occur during 1983-84, when these fish produced in 1981 become mature. As yet, no egg and larval data are available to confirm any increase in production that might have resulted from such circumstances. The next CalCOFI survey, scheduled to take place in 1984, will provide additional information on the abundance of eggs and larvae and could be correlated with historical spawning biomass estimates (MacCall 1979; Murphy 1966), if necessary.

SEA SURVEY CRUISES

Each fall the Department conducts nearshore midwater-trawl surveys off California and Mexico to assess recruitment of Pacific sardine; northern anchovy, *Engraulis mordax*; Pacific mackerel, *Scomber japonicus*; and jack mackerel, *Trachurus symmetricus*. During the 1976, 1977, and 1979 cruises, Pacific sardines occurred in 2.8, 2.5, and 2.3% of the trawls, respectively. However, this represented only eight fish taken in 7 of 283 trawls over 3 yr. During comparable surveys in 1980 and 1981, no sardines were observed in 282 trawls.

Over the last 2 yr, the number of sardines occurring in the fall young-fish surveys has increased considerably. In the 1982 survey, which was conducted entirely off California in nearshore and offshore waters, 145 Pacific sardines were captured in 14 of 152 or 9% of the trawls. Young-of-the-year sardines (those less than 125 mm SL {5 in.} for the purpose of this report) were observed in 9 of 152 or 5% of the trawls. Although this catch rate was unprecedented in 20 yr of our midwater trawl operations, sardines were by far the most poorly represented of the four species surveyed.

During the 1983 fall survey, which was conducted in nearshore waters off California and Mexico, 1,600 sardines were captured in 37 of 133 or 28% of the trawls. This represents a substantial increase over previous years in both number of fish and number of trawls in which sardines were captured. Young-of-the-year fish (less than 5 in. in length) occurred in 25 of 133 or 19% of the trawls, and comprised the majority of the catch by number. During an additional survey conducted offshore in southern California waters in November of 1983, 230 sardines ranging in size from 40 to 233 mm SL (1.5 to 9.2 in.) were captured in 9 of 99 or 9% of the trawls. One catch of small sardines 40 to 70 mm SL (1.5 to 2.8 in.) made at Santa Catalina Island indicated a fall spawning. According to Ahlstrom (1967), sardine larval abundance in the 1950's that occurred during the second half of the year was restricted to waters off Baja California and

represented spawning of a southern population. A fall spawning might indicate the presence of a southern population of sardines that had moved north.

MACKEREL FISHERY

During 1983, an estimated 388 tons of sardines were landed with Pacific and jack, mackerel (Table 1). This represents a three-fold and twelve-fold increase over the incidental catches of sardines in 1982 and 1981, respectively. In dock-side interviews, fishermen described increasing occurrences of sardines mixed with mackerel; several instances of dumping pure schools of sardines or schools with a high percentage of sardines have been reported, but are unverified. Sardines were observed by Department personnel in mackerel landings during all months of the year, and landings of 10 tons or more occurred in all but 3 months of the year. The frequency of occurrence of observed mackerel landings which contained sardines climbed to 30% in 1983, almost double that of 1982. Length frequencies of sampled sardines showed a fairly distinct bimodal distribution. The smaller mode, ranging between 115 and 145 mm SL (4.5 and 5.7 in.) represents fish landed during July only, and most likely is 1982 year-class fish (fish produced from spawnings in 1982). The larger mode, ranging from 160 to 250 mm SL (6.3 to 9.8 in.), represents fish 2 yr old and older.

LIVE BAIT FISHERY

Information from the live-bait monitoring program has been used as a relative indication of abundance of sardines since 1975. Fishermen voluntarily submit monthly logs to the Department on which they indicate the occurrence by day of incidental species, including sardines. The percent occurrence by day may be used to assess the availability of sardines relative to previous years. In San Diego, sardines occurred in live bait hauls on approximately 3% of the days fished in 1979. This jumped to 48% in 1980, 31% in 1981, and 48% in 1982. In 1983, however, sardines were reported only in trace amounts during

April, June, and July, and on 84% of the days in August. At other ports, catches were widespread in trace amounts in 1978, but rarely reported in 1979. During the next 2 yr sardines were reported at increasing but low levels: they occurred in the catch on less than 2% of the days fished in 1980, and less than 10% of the days in 1981. In 1982, however, Dana Point and Newport Beach live bait fishermen reported sardines on 24% and 41% of the days fished, respectively. In 1983, Dana Point fishermen logged sardines on 59% of the days fished, but did not report from January through May. No 1983 logs are available from Newport Beach. Although the percent occurrence by day of sardines from live bait logs did not increase significantly from 1982 (24%) to 1983 (27%), reports of "firecracker" (juvenile) sardines in live bait catches were frequent.

LEGISLATION

As a result of concern about the increased availability and incidental take of sardines, two pieces of legislation were enacted in 1983. Assembly Bill 394, passed in April and enacted as urgency legislation, requires the Department to monitor the incidental catch of sardines and allows the percentage of sardines which may be taken incidentally to be increased or decreased in accordance with a specified formula. This is an attempt to lessen the impact of a presumed recovery of the sardine population on other fisheries.

The second bill, AB 457, goes into effect in January, 1984 for 1 yr. It allows the first 250 tons per year of incidentally landed sardines to be used for any purpose, not just for canning and reduction as required by previous regulations. After the first 250 tons are landed, the allowable uses of incidentally taken sardines are restricted to canning, reduction and live bait for the remainder of the calendar year. This bill allows fresh fish dealers without cannery or reduction facilities to utilize incidental catches of sardines

during a portion of the year. It also eliminates the need for market fishermen to dump loads containing sardines for a portion of the year, and legalizes the use of incidentally caught sardines as live bait.

DISCUSSION AND CONCLUSIONS

All sources of information pertaining to the relative abundance of Pacific sardines continue to indicate a moderate increase in the biomass has occurred. The 1981 CalCOFI egg and larval survey suggested a small increase in spawning biomass that year, and the 1981 yr class produced by that spawn primarily accounted for increases in occurrences of sardines in 1982 (Klingbeil 1983). Most 1981 yr class sardines should become mature by 1984 and, therefore, should be fully recruited to the spawning biomass in 1984. However, it is unlikely that this addition will increase the spawning biomass above 20,000 tons. The 1982 yr class of sardines has been sampled only scantily during the last year and is presumed to be very weak. The 1983 yr class fish seen this year will only reach 1 yr of age in 1984. Since sardines historically mature at 2 yr of age (Ahlstrom 1960), it is unlikely this year class will contribute to the spawning biomass before 1985.

While signs of an increased biomass of sardines are evident, we continue to believe that the spawning biomass is less than 20,000 tons. A full recovery of the Pacific sardine population will require that the current catch restrictions, including tolerance levels for incidental catches and some marketing restrictions, continue to be strictly observed while the resource remains at low biomass levels.

REFERENCES

- Ahlstrom, E. H. 1960. Synopsis on the biology of the Pacific sardine (*Sardinops caerulea*). Proc. World Sci. Meeting on the Biology of Sardines and Related Species. 35: 246-254.
- _____. 1967. Co-occurrences of sardine and anchovy larvae in the California Current Region off California and Baja California. Calif. Coop. Oceanic Fish. Invest. Rep. 11: 117-135.
- Klingbeil, Richard A. 1982. Status of the spawning biomass of the Pacific sardine, 1981-82. Calif. Dept. Fish and Game, Mar. Resour. Admin. Rep. 82-1: 1-5.
- _____. 1983. Status of the spawning biomass of the Pacific sardine, 1982-83. Calif. Dept. Fish and Game, Mar. Resour. Admin. Rep. 83-1: 1-5.
- MacCall, Alec D. 1979. Population estimates for the waning years of the Pacific sardine fishery, 1945-65. Calif. Coop. Oceanic Fish. Invest. Rep. 20: 72-82.
- Murphy, Garth I. 1966. Population biology of the Pacific sardine (*Sardinops caerulea*). Proc. Calif. Acad. Sci. 34(1): 1-84.

TABLE 1. Estimated Species Composition by Weight (Short Tons) of California "Mackerel" Landings, 1983 ^{1/}.

Month	Total tonnage landed	Proportion of tonnage sampled for species composition ^{2/}	Estimated landings ^{3/}		
			Jack mackerel	Pacific mackerel	Pacific sardines
January	2702.0.	0.45	1150.2	1519.9	31.9
February	995.4.	0.32	446.4	538.6	10.4
March	543.8.	0.60	376.3	166.0	1.5
April	7821.3.	0.58	4988.4	2713.9	119.0
May	9178.2.	0.61	4816.3	4259.4	102.5
June	7406.3	0.71	2228.1	5153.3	24.9
July	5714.8.	0.54	2564.8	3150.0	trace ^{5/}
August	6614.0	0.55	1184.5	5408.5	21.0
September	4565.2	0.62	455.7	4077.3	32.2
October	5778.9	0.60	173.9	5604.1	0.9
November ^{4/}	2964.1	0.62	771.6	2152.8	39.7
December ^{4/}	2258.9	0.79	1115.9	1138.6	4.4
Totals ^{4/}	56 542.9		20 272.1	35 882.4	388.4

^{1/} Includes landings at Terminal Island, San Pedro, Port Hueneme, and Monterey.

^{2/} The majority of sampling consisted of taking "bucket" samples during the off-loading process. A portion of the tonnage includes "eyeball" estimates of species composition.

^{3/} Estimated landings result from applying simple monthly proportions of the species composition of sampled landings to the total tonnage.

^{4/} Preliminary.

^{5/} Trace - sardines observed, but only in quantities estimated to be less than 0.5% by weight of a load.