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**STATUS OF THE SPAWNING BIOMASS
OF THE PACIFIC SARDINE, 1980-81**

by

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MARINE RESOURCES

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ABSTRACT

State law requires that the population of Pacific sardines, *Sardinops sagax caeruleus*, must reach a minimum spawning biomass of 20,000 short tons before initiation of a fishery. Data from ichthyoplankton surveys, the anchovy live bait fishery, sea survey cruises, and the mackerel purse seine fishery are analyzed for evidence of an increase in population size. Presently, the spawning biomass of the northern stock of sardines remains far below 20,000 tons.

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THE PACIFIC SARDINE, 1980-81

RECOMMENDATIONS

As of January 1981, the spawning population of the northern stock of Pacific sardines, *Sardinops sagax caeruleus*, remains below the 20,000 short tons required to initiate a harvest. The Department recommends that restrictions concerning incidental catches remain in force and that no fishery be initiated during 1981.

INTRODUCTION

This is the seventh in a series of annual reports concerning the status of the sardine spawning biomass. It is similar to previous reports in that rather than attempting to directly calculate biomasses, the author discusses four independent sources of data as they may relate to possible increases or decreases in biomass.

ICHTHYOPLANKTON DATA

Published estimates of sardine spawning biomass from egg and larval data are not available since 1969, although ichthyoplankton surveys have been conducted in 1972, 1975, 1978, 1979, and 1980. The 1979 and 1980 surveys were modified, partial surveys designed to estimate only northern anchovy, *Engraulis mordax*, biomass. The relatively few sardine eggs and larvae collected during these years (Paul Smith, National Marine Fisheries Service, La Jolla, pers. commun.) confirm that biomass levels have remained low.

LIVE BAIT FISHERY DATA

Klingbeil (1976) briefly describes the nature of historical data collection from the southern California live bait fishery. This fishery operates primarily in nearshore waters from San Diego to Morro Bay, and

sardines are often caught incidental to fishing for northern anchovies. Fishermen submit monthly logs to the Department on which they indicate the frequency of occurrence of incidental catches of sardines.

Although the occurrence of sardines in live bait catches was widespread during 1980 (reported at San Diego, Dana Point, Newport Beach, Long Beach, Redondo Beach, Port Hueneme, Oxnard and Avila), the frequency of occurrence was very low at all ports except San Diego. Sardines were reported on less than 2 percent of the days fished north of San Diego.

At San Diego, fishermen reported catching sardines incidental to anchovies on 46% of the days fished during 1980. During the period of late May to early September the catch of sardines was almost a daily occurrence and fishermen estimated that sardines frequently accounted for 1-2 percent of the catch. These catches included both juvenile and adult sardines.

Both the frequency of occurrence and the quantities of sardines reported at San Diego are unusual, but the events seem too localized to suggest any large scale resurgence of the northern stock of Pacific sardines.

SEA SURVEY CRUISES

The Department has conducted four intensive, nearshore, mid-water trawl surveys in recent years (1976, 1977, 1979, and 1980) to assess the young-of-the-year of anchovy; sardine; Pacific mackerel, *Scomber japonicus*; and jack mackerel, *Trachurus symmetricus*. During the 1976, 1977, and 1979 cruises, juvenile sardines were sampled in 2.8, 2.5 and 2.3 percent of mid-water trawls, respectively. In actual numbers, only eight sardines were taken in seven of the 283 trawls conducted in these years. In 1980 the young fish survey completed 147 mid-water trawls off northern Baja California and southern California, and no sardines were taken. These data suggest a continuing low level of recruitment.

MACKEREL FISHERY DATA

Sardines are known to school with jack mackerel, and historically have been observed in jack mackerel landings, primarily as adult fish (2-years old and older).

During 1980, the frequency of occurrence and the quantity of sardines landed incidentally with mackerel increased for the second straight year. In 1977 and 1978 sardines were seldom observed in mackerel landings; total landings for the two years are estimated at less than 5 short tons (Addenda 1 & 2). In 1979, sardines were observed in all but three months, and estimated landings increased substantially (Addendum 3). The 1980 estimated landings more than doubled the previous years estimate (Addendum 4).

SUMMARY AND CONCLUSIONS

Ichthyoplankton and sea survey cruise data suggest a continuing depression of northern stocks of Pacific sardine, while incidental catches of sardines in the mackerel and live bait fisheries suggest minor increases in relative abundance.

None of the information suggests a resurgence of sardines is imminent. Restrictions concerning the intentional and incidental take of sardines should remain in effect.

REFERENCES

- Klingbeil, Richard A. 1976. Status of the spawning biomass of Pacific sardine, 1975-76. Calif. Dept. Fish and Game, Mar. Resour. Adm. Rept. 76-4:1-9.

ADDENDUM 1. Estimated Species Composition by Weight (short tons) of Southern California "Mackerel" Landings, 1977^{1/}

Month	Total tonnage landed	Proportion of tonnage sampled for species composition ^{2/}	Estimated landings ^{3/}		
			Jack mackerel	Pacific mackerel	Pacific sardines
January	4,590.2	0.52	4,291.8	298.4	Trace
February	2,705.8	0.65	2,619.2	86.6	Trace
March	4,615.6	0.45	4,191.0	424.6	-
April	7,996.5	0.63	7,652.7	343.3	0.5
May	3,763.8	0.55	3,421.3	342.5	-
June	7,857.5	0.55	6,666.2	1,191.3	-
July	7,423.2	0.69	6,541.4	881.8	-
August	2,649.8	0.90	2,302.2	344.5	3.1
September	1,504.9	0.80	1,290.1	214.8	-
October	2,255.7	0.62	2,029.0	226.7	-
November	6,648.9	0.62	5,399.5	1,249.4	-
December	3,446.4	0.63	3,120.7	325.7	-
Totals	55,458.3		49,525.1	5,929.6	3.6

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

^{2/} From January through May sampling for species composition consisted solely of "eyeball" estimates made by port samplers during the off-loading process. From June through December, the majority of sampling consisted of taking "bucket" subsamples during the off-loading process.

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

ADDENDUM 2. Estimated Species Composition by Weight (short tons) of Southern California "Mackerel" Landings, 1978 ^{1/}

Month	Total tonnage landed	Proportion of tonnage sampled for species composition ^{2/}	Estimated landings ^{3/}		
			Jack mackerel	Pacific mackerel	Pacific sardines
January	3,703.6	0.72	1,442.6	2,261.0	-
February	3,078.7	0.79	1,284.8	1,793.9	-
March	3,993.5	0.65	3,246.1	747.4	-
April	2,318.9	0.61	1,962.5	355.3	1.1
May	385.8	0.32	328.8	57.0	-
June	449.2	0.36	325.2	124.0	Trace
July	7,295.1	0.74	5,633.4 ^{4/}	1,661.7	-
August	8,275.6	0.57	6,354.2 ^{4/}	1,921.4	-
September	5,146.2	0.71	4,307.3 ^{4/}	838.9	-
October	5,637.4	0.53	4,818.9 ^{4/}	818.5	-
November	4,079.6	0.48	3,392.0 ^{4/}	687.6	-
December	1,978.4	0.59	881.0	1,097.4	-
Totals	46,342.0		33,976.8	12,364.1	1.1

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

^{2/} The large majority of sampling consisted of taking an approximate 30-pound "bucket" sample for each 5-ton increment during the off-loading process. A small part of the tonnage sampled includes "eyeball" estimates of species composition.

^{3/} Estimated landings result from applying simple proportions of the species composition of sampled landings to the total tonnage landed. For San Pedro and Port Hueneme, monthly proportions were used to estimate species composition. At Terminal Island canneries, species composition was usually calculated at weekly or biweekly intervals, depending on the quantity of fish landed and the pattern of fishing activity and then summed to give monthly estimates.

^{4/} These estimates include 560, 839, 112, 671, and 486 tons of reported "jack mackerel" landed at Port Hueneme for the months July through November, respectively. No sampling for species composition was conducted for these landings.

ADDENDUM 3. Estimated Species Composition by Weight (short tons) of Southern California "Mackerel" Landings, 1979 ^{1/}

Month	Total tonnage landed	Proportion of tonnage sampled for species composition ^{2/}	Estimated landings ^{3/}		
			Jack mackerel	Pacific mackerel	Pacific sardines
January	2,358.1	0.55	455.0	1,903.0	Trace
February	1,201.4	0.53	397.7	803.7	Trace
March	3,202.5	0.76	608.5	2,594.0	Trace
April	4,535.9	0.66	1,477.6	3,057.2	1.1
May	4,443.2	0.61	1,423.1	3,020.1	Trace
June	2,151.3	0.44	444.7	1,706.5	0.1
July	10,065.0	0.61	5,205.1	4,844.4	15.4
August	1,762.6	0.54	1,613.2	149.4	Trace
September	555.4	0.58	378.8	176.6	-
October	3,948.1	0.61	904.1	3,044.0	Trace
November	6,944.0	0.46	3,029.7	3,914.3	-
December	5,892.5	0.38	1,714.0	4,178.5	-
Totals	47,060.0		17,651.6	29,391.8	16.6

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

^{2/} The majority of sampling consisted of taking "bucket" samples during the off-loading process. A portion of the tonnage sampled 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 landed.

ADDENDUM 4. Estimated Species Composition by Weight (short tons) of Southern California "Mackerel" Landings, 1980 ^{1/}

Month	Total tonnage landed	Proportion of tonnage sampled for species composition ^{2/}	Estimated landings ^{3/}		
			Jack mackerel	Pacific mackerel	Pacific sardines
January	7,799.7	0.66	2,643.1	5,156.6	-
February	2,570.8	0.53	809.8	1,761.0	-
March	1,910.9	0.39	468.2	1,442.7	Trace
April	3,328.8	0.47	842.2	2,486.6	Trace
May	4,573.3	0.58	1,273.7	3,295.8	3.8
June	747.1	0.08	612.1	135.0	Trace
July	10,678.4	0.62	3,327.4	7,336.1	14.9
August	7,050.7	0.75	1,900.2	5,147.7	2.8
September	5,522.5	0.68	2,201.6	3,305.7	15.2
October	4,278.6	0.59	3,430.5	847.2	0.9
November	1,846.7	0.35	1,466.3	380.4	Trace
December ^{4/}	4,303.9	0.62	3,249.4	1,054.5	Trace
Totals	54,611.4		22,224.5	32,349.3	37.6

^{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 sampled 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 landed.

^{4/} Preliminary.