

REVIEW OF THE PELAGIC WET FISHERIES During the 1959-60 Season

SARDINE

The enthusiasm generated by the 104,000 ton 1958-59 sardine fishing season was short lived, as a soft market kept the catch from reaching a higher value. The poor foreign market continued into 1959-60 and as the season unfolded, it became apparent that catch would be limited even further by the supply. At the

end of the 1959-60 season, the catch of sardines totaled only about 37,000 tons.

During the summer of 1959, before the season began, fish surveys off the California fishing grounds conducted by the California Department of Fish and Game and egg and larvae surveys conducted by the U. S. Bureau of Commercial Fisheries, revealed the

TABLE 1
SEASONAL CATCH IN TONS OF SARDINES ALONG THE PACIFIC COAST—EACH SEASON
INCLUDES JUNE THROUGH THE FOLLOWING MAY¹

Season	PACIFIC NORTHWEST				CALIFORNIA ²						Baja ³ California	Grand Total
	British Columbia	Wash- ington	Oregon	Total	NORTHERN CALIFORNIA				Southern California	Total California		
					Reduction Ships	San Francisco	Monterey	Total				
1916-17	---	---	---	---	---	---	7,710	7,710	19,820	27,530	---	27,530
1917-18	80	---	---	80	---	70	23,810	23,880	48,700	72,580	---	72,660
1918-19	3,640	---	---	3,640	---	450	35,750	36,200	39,340	75,540	---	79,180
1919-20	3,280	---	---	3,280	---	1,000	43,040	44,040	22,990	67,030	---	70,310
1920-21	4,400	---	---	4,400	---	230	24,960	25,190	13,260	38,450	---	42,850
1921-22	990	---	---	990	---	80	16,290	16,370	20,130	36,500	---	37,490
1922-23	1,020	---	---	1,020	---	110	29,210	29,320	35,790	65,110	---	66,130
1923-24	970	---	---	970	---	190	45,920	46,110	37,820	83,930	---	84,900
1924-25	1,370	---	---	1,370	---	560	67,310	67,870	105,150	173,020	---	174,390
1925-26	15,950	---	---	15,950	---	560	69,010	69,570	67,700	137,270	---	153,220
1926-27	48,500	---	---	48,500	---	3,520	81,860	85,380	66,830	152,210	---	200,710
1927-28	68,430	---	---	68,430	---	16,690	98,020	114,710	72,550	187,260	---	255,690
1928-29	80,510	---	---	80,510	---	13,520	120,290	133,810	120,670	254,480	---	334,990
1929-30	86,340	---	---	86,340	---	21,960	160,050	182,010	143,160	325,170	---	411,510
1930-31	75,070	---	---	75,070	10,960	25,970	109,620	146,550	38,570	185,120	---	260,190
1931-32	73,600	---	---	73,600	31,040	21,607	69,078	121,725	42,920	164,645	---	238,245
1932-33	44,350	---	---	44,350	58,790	18,634	89,599	167,023	83,667	250,690	---	295,040
1933-34	4,050	---	---	4,050	67,820	36,336	152,480	256,636	126,793	383,429	---	387,479
1934-35	43,000	---	---	43,000	112,040	68,477	230,854	411,371	183,683	595,054	---	638,054
1935-36	45,320	10	26,230	71,560	150,830	76,147	184,470	411,447	149,051	560,498	---	632,058
1936-37	44,450	6,560	14,200	65,210	235,610	141,099	206,706	583,415	142,709	726,124	---	791,334
1937-38	48,080	17,100	16,660	81,840	67,580	133,718	104,936	306,234	110,330	416,564	---	498,404
1938-39	51,770	26,480	17,020	95,270	43,890	201,200	180,994	426,084	149,203	575,287	---	670,557
1939-40	5,520	17,760	22,330	45,610	---	212,453	227,874	440,327	96,939	537,266	---	582,876
1940-41	28,770	810	3,160	32,740	---	118,092	165,698	283,790	176,794	460,584	---	493,324
1941-42	60,050	17,100	15,850	93,000	---	186,589	250,287	436,876	150,497	587,373	---	680,373
1942-43	65,880	580	1,950	68,410	---	115,884	184,399	300,283	204,378	504,661	---	573,071
1943-44	88,740	10,440	1,820	101,000	---	126,512	213,616	340,128	138,001	478,129	---	579,129
1944-45	59,120	20	---	59,140	---	136,598	237,246	373,844	181,061	554,905	---	614,045
1945-46	34,300	2,310	90	36,700	---	84,103	145,519	229,622	174,061	403,683	---	440,383
1946-47	3,990	6,140	3,960	14,090	---	2,869	31,391	34,260	199,542	233,802	---	247,892
1947-48	490	1,360	6,930	8,780	---	94	17,630	17,724	103,617	121,341	---	130,121
1948-49	---	50	5,320	5,370	---	112	47,862	47,974	135,752	183,726	---	189,096
1949-50	---	---	---	---	---	17,442	131,769	149,211	189,714	338,925	---	338,925
1950-51	---	---	---	---	---	12,727	33,699	46,426	306,662	353,088	---	353,088
1951-52	---	---	---	---	---	82	15,897	15,979	113,125	129,104	16,184	145,288
1952-53	---	---	---	---	---	---	49	49	5,662	5,711	9,162	14,873
1953-54	---	---	---	---	---	---	58	58	4,434	4,492	14,306	18,798
1954-55	---	---	---	---	---	---	856	856	67,609	68,465	12,440	80,905
1955-56	---	---	---	---	---	---	518	518	73,943	74,461	4,207	78,668
1956-57	---	---	---	---	---	---	63	63	33,580	33,643	13,655	47,298
1957-58	---	---	---	---	---	---	17	17	22,255	22,272	9,924	32,196
1958-59	---	---	---	---	---	---	24,701	24,701	79,270	103,971	22,334	126,305
1959-60 ⁴	---	---	---	---	---	---	16,109	16,109	21,146	37,255	21,424	58,679

¹ Data for British Columbia were supplied by the Canadian Bureau of Statistics and the province of British Columbia; those for Washington by the Washington Department of Fisheries, and for Oregon by the Fish Commission of Oregon. Tonnages delivered to the reduction ships and data for Baja California were compiled by the United States Fish and Wildlife Service from the books of the companies receiving fish. California landings were derived from the records of the California Department of Fish and Game.

² Prior to the 1931-32 season fish landed in Santa Barbara and San Luis Obispo Counties are included in Southern California. Beginning with the 1931-32 season fish landed north of Pt. Arguello are included in the Monterey landings and those south of Pt. Arguello are included in the Southern California landings.

³ The amount of sardines landed in Baja California prior to the 1951-52 season are not known. Beginning with 1951-52, the period of fishing approximates that of the rest of the Pacific Coast. Figures are preliminary.

⁴ Preliminary records.

presence of sardines in sufficient numbers to yield only a slightly smaller catch than that of the preceding season. This was with the assumption that the sardines would behave in the same manner as in 1958. In addition, the blood genetic studies of the U. S. Bureau of Commercial Fisheries showed that a "southern type" of sardine extended northward from Mexico into southern California during the summer.

Although the season officially opened August 1, for central California and September 1, for southern California, price negotiations prevented the fleet from fishing off central California during August and off southern California during September. After the price was finally settled at \$35 a ton, the central California fleet began fishing on September 1, and the southern California fishery began on October 4.

When the fleets finally ventured forth, sardines were somewhat scarce. This appears to have been the result of two things: sardines were not schooled densely, probably because the "southern type" present off southern California were spawning at that time; and the fish moved southward as winter arrived. By February the line separating the "northern type" from the "southern type" was about 150 miles south of the International Border.

The 1959-60 season resulted in landings of 16,110 tons off central California and 21,150 tons off southern California, for a total California catch of 37,260 tons. As in 1958-59, most of the catches in southern California were made north of San Pedro. The fishing fleet totaled 128 vessels, 38 from central California and 90 from southern California. Again two-year-olds (1957 class) dominated the catch. The 1956 class which made up the bulk of the 1958-59 season's landings did not appear outstanding, reaffirming the earlier conclusion that the 1956 class was not large but extremely available during 1958.

TABLE 2
COMMERCIAL LANDINGS AND LIVE BAIT CATCH OF ANCHOVIES
IN TONS IN CALIFORNIA, 1939-1959
(Live Bait Catch 1943-45 Not Recorded)

Year	Commercial Landings	Live Bait	Total	Percent Live bait
1939	1,074	1,503	2,577	58.3
1940	3,159	2,006	5,165	38.8
1941	2,052	1,582	3,634	43.5
1942	847	258	1,105	23.3
1943	785			
1944	1,946			
1945	808			
1946	961	2,748	3,709	74.1
1947	9,470	2,854	12,324	23.2
1948	5,418	3,725	9,143	40.7
1949	1,661	2,802	4,463	62.8
1950	2,439	3,824	6,263	61.1
1951	3,477	5,142	8,619	59.7
1952	27,892	6,810	34,702	19.6
1953	42,918	6,391	49,309	13.0
1954	21,205	6,686	27,891	24.0
1955	22,346	6,125	28,471	21.5
1956	28,460	6,332	34,792	18.2
1957	20,274	4,110	24,384	16.9
1958	5,801	4,236	10,037	42.2
1959	*3,587	4,737	8,324	56.9

* Preliminary estimate.

ANCHOVY

Commercial landings of anchovies in 1959 dropped to a total of only 3,600 tons from 5,800 tons landed in 1958. These were the poorest catches since 1951, despite a large anchovy population present off the California coast. The low catch reflects market conditions rather than availability of anchovies, since the anchovy catches are generally low when sardines are abundant and high when sardines are scarce. The scarcity of sardines in 1959, did not increase the demand for anchovies, however, because of the large inventories of sardines left over from the previous year.

The catch of anchovies for live bait was about 5,000 tons compared with approximately 4,000 tons in 1957 and 1958. The live bait fishery continued to be dependent on the very small "pinhead" (fish of the year) and one year old anchovies. This was no indication of scarcity, however, as large anchovies apparently moved offshore and deeper to "cool off" when the ocean warmed up. Egg and larvae surveys of the U.S. Bureau of Commercial Fisheries indicate that a large spawning population was present during 1958 and 1959. In addition, offshore sampling by the California Department of Fish and Game revealed the presence of large anchovies between 20 and 60 miles off the coast, and some large anchovies were killed during offshore seismic operations. Another piece of evidence

TABLE 3
CALIFORNIA SEASONAL CATCH IN TONS OF
PACIFIC AND JACK MACKEREL
(Each Season Includes May through the Following April)

Season	Pacific Mackerel	Jack Mackerel	Total	Percentage Pacific Mackerel
1926-27	1,797	183	1,980	90.8
1927-28	3,228	213	3,441	93.8
1928-29	19,703	278	19,981	98.6
1929-30	28,347	337	28,684	98.8
1930-31	6,403	155	6,558	97.6
1931-32	7,576	336	7,912	95.8
1932-33	5,425	233	5,658	95.9
1933-34	36,437	553	36,990	98.5
1934-35	56,732	827	57,559	98.6
1935-36	73,194	4,925	78,119	93.7
1936-37	50,373	2,879	53,252	94.6
1937-38	35,223	4,121	39,344	89.5
1938-39	38,032	1,948	39,980	95.1
1939-40	49,980	559	50,539	98.9
1940-41	53,777	875	54,652	98.4
1941-42	35,877	959	36,836	97.4
1942-43	24,110	4,897	29,007	83.1
1943-44	38,902	4,228	43,130	90.2
1944-45	40,393	6,871	47,264	85.5
1945-46	26,001	4,635	30,636	84.9
1946-47	29,448	15,573	45,021	65.4
1947-48	19,814	71,330	91,144	21.7
1948-49	19,101	27,845	46,946	40.7
1949-50	25,031	32,494	57,525	43.5
1950-51	16,945	68,187	85,132	19.9
1951-52	15,953	37,495	53,448	29.8
1952-53	10,109	75,750	85,859	11.8
1953-54	4,415	18,369	22,784	19.4
1954-55	13,605	9,417	23,022	59.1
1955-56	13,448	29,674	43,122	31.2
1956-57	28,592	48,173	76,765	37.2
1957-58	28,119	19,917	48,036	58.5
1958-59	12,388	11,352	23,740	52.2
1959-60*	20,641	33,280	53,921	38.3

* Preliminary estimate.

which indicates that the large anchovies moved offshore, comes from examination of stomachs of bluefin tuna caught in purse seines between Santa Catalina and San Clemente Islands. These stomachs were gorged with freshly ingested large (7 inch) anchovies.

Therefore it is apparent that the low commercial anchovy catch was due to a lack of demand, and the scarcity of "hook size" anchovies in live bait catches was a result of an offshore movement of the larger fish.

MACKEREL

Commercial landings of Pacific mackerel during the 1959-60 season rose to 21,000 tons from 12,000 tons in 1958-59, while the jack mackerel catch of 33,000 tons tripled that of the previous year.

The higher price paid for both species of mackerel in 1959 (\$50.00 per ton compared with \$35.00 per ton for sardines) reflected a better market, and undoubtedly contributed to the increased mackerel catches in 1959-60, augmented by the scarcity of sardines causing more fishing effort to be directed toward the higher priced mackerel.

Pacific mackerel less than one-year-old dominated the catch with fair numbers of one- and two-year-olds, also present.

TABLE 4

ANNUAL COMMERCIAL LANDINGS IN TONS OF THE PELAGIC WET FISH IN CALIFORNIA FROM 1926 THROUGH 1959

Year	Sardines	Anchovies	Pacific Mackerel	Jack Mackerel	Herring	Squid	Total
1926	143,371	30	1,805	118	227	1,568	147,119
1927	171,138	184	2,364	231	584	3,007	177,508
1928	210,135	179	17,626	269	570	676	229,455
1929	325,886	191	28,987	349	479	2,330	358,222
1930	251,031	160	8,266	184	359	5,485	265,485
1931	182,176	154	7,127	282	343	869	190,951
1932	211,305	150	6,237	268	383	2,115	220,458
1933	313,199	159	34,807	505	301	412	349,383
1934	559,966	129	56,924	791	401	765	618,976
1935	547,879	90	73,214	4,992	464	408	627,047
1936	731,772	98	50,271	2,300	420	473	785,334
1937	535,745	113	30,468	3,270	316	251	570,163
1938	511,695	368	39,924	2,067	252	800	555,106
1939	580,397	1,074	40,455	1,880	151	581	624,538
1940	452,987	3,159	60,252	716	227	900	518,241
1941	631,240	2,053	39,084	1,034	395	716	674,522
1942	484,874	847	26,277	2,674	95	476	515,239
1943	486,135	785	37,607	6,350	315	4,582	535,774
1944	573,604	1,946	41,828	6,388	211	5,468	629,445
1945	422,531	808	26,858	4,516	230	7,613	462,556
1946	255,380	961	26,938	7,547	241	19,012	310,079
1947	127,757	9,470	23,239	64,524	827	7,271	233,088
1948	181,018	5,418	19,693	36,449	4,001	9,628	256,207
1949	316,690	1,661	24,886	25,625	190	3,430	372,482
1950	357,261	2,439	16,325	66,628	713	2,998	446,364
1951	164,450	3,477	16,759	44,919	2,462	6,191	238,258
1952	7,165	27,891	10,302	73,261	4,748	1,836	125,203
1953	4,734	42,918	3,751	27,875	3,901	4,459	87,638
1954	68,252	21,205	12,696	8,667	456	4,078	115,354
1955	72,804	22,346	11,655	17,877	973	7,136	132,791
1956	34,777	28,460	25,006	37,881	868	9,742	136,734
1957	22,931	20,274	31,022	41,006	594	6,225	122,052
1958	103,723	5,801	13,824	11,033	1,200	3,729	139,310
1959*	37,183	3,587	18,801	18,754	864	9,826	89,015

* Preliminary estimate.

PUBLICATIONS

1 July 1959 - 30 June 1960

Ahlstrom, E. H., 1959. Vertical distribution of pelagic fish eggs and larvae off California and Baja California, *U.S. Fish and Wildlife Service, Fishery Bulletin 161*, 60: 107-146.

Vertical distribution of 46 kinds of pelagic fish larvae and 8 kinds of eggs are discussed. Most fish eggs and larvae were found to occur in the upper mixed layer and the upper part of the thermocline, between the surface and approximately 125 meters deep. All the more common kinds of larvae showed marked differences in vertical distribution from series to series. Information is given on differences between day and night catches.

Ahlstrom, E. H., 1959. Distribution and abundance of eggs of the Pacific sardine, 1952-1956. *U.S. Fish and Wildlife Service, Fishery Bulletin 165*, 60: 185-213.

During the period covered, a major change occurred in the distribution of sardine spawning. In 1952 and 1953 sardine spawning was mostly confined to the waters off central Baja California. In 1954, sardine spawning spread northward to waters off southern California, and this distribution has continued through 1955 and 1956. Estimates of total eggs spawned during these years ranged from 136×10^{12} to 436×10^{12} .

Ahlstrom, E. H., 1959. Sardine eggs and larvae and other fish larvae, Pacific Coast, 1957. *U.S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Report: Fisheries No. 328*, 57 pp.

Belser, W., 1959. Bioassay of organic micronutrients in the sea, *Proced. of the National Academy of Sciences*, 45(10).

Berner, L. D., 1959. The food of the larvae of the northern anchovy *Engraulis mordax*. *Inter-American Tropical Tuna Commission Bulletin*, 4(1).

Boyd, C. M., 1960. The larval stages of *Pleuroncodes planipes* Stimpson (Crustacea, Decapoda, Galatheidæ), *Biological Bull.*, 118(1): 17-30.

Claussen, L. G., 1959. A southern range extension of the American shad to Todos Santos Bay, Baja California, Mexico. *California Fish and Game*, 45(3): 217-218.

Contois, D. E., 1959. Kinetics of bacterial growth: relationship between population density and specific growth rate of continuous cultures. *Jour. of Gen. Microbiology*, 21(1): 40-50.

Daugherty, A., and R. S. Wolf, 1960. Age and length composition of the sardine catch off the Pacific Coast of the United States and Mexico in 1957-58. *Calif. Fish and Game*, 46(2): 189-193.

Farris, D. A., 1960. Failure of an anchovy to hatch with continued growth of the larva. *Limnology and Oceanography*, 5(1): 107.

Fink, B., 1959. Observation of porpoise predation on a school of Pacific sardines, *Calif. Fish and Game* 45(3): 216-217.

Hand, C. H., and L. D. Berner, 1959. Food of the Pacific sardine (*Sardinops caerulea*), *U.S. Fish and Wildlife Service, Fishery Bulletin 164*, 40: 175-184.

Hyatt, H., 1960. Age composition of the southern California catch of Pacific mackerel, *Pneumatophorus diego*, for the 1957-58 season. *Calif. Fish and Game*, 46(2): 183-188.

Johnson, M. W., 1960. Production and distribution of larvae of the spring lobster, *Panulirus interruptus* (Randall) with records on *P. gracilis*, *Bull. of the Scripps Inst. of Oceano. U.C.* 7(6): 413-462.

MacGregor, J. S., 1959. Relation between fish condition and population size in the sardine (*Sardinops caerulea*). *U.S. Fish and Wildlife Service, Fishery Bulletin 166*, 60: 215-230.

A high degree of inverse correlation was shown between condition factor and catch, and a high positive correlation between length and condition factor for the seasons 1941-2 through 1956-7.

McGowan, J. A., 1960. The relationship of the distribution of the planktonic worm, *Poecobius meseres* Heath, to the water masses of the North Pacific. *Deep Sea Research*, 6: 125-139.