

PACIFIC HAKE LENGTH FREQUENCIES
AT
CALIFORNIA PORTS, 1963-70



by

Tom Jow

MARINE RESOURCES
TECHNICAL REPORT NO. 2

1973

CALIFORNIA DEPARTMENT OF FISH AND GAME
MARINE RESOURCES TECHNICAL REPORTS

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ABSTRACT

Since 1966, enlargement of specialized United States and Soviet hake fisheries led to scientific meetings and fishing agreements with provisions for exchanges of biological data by statistical areas where the catch exceeds 100 metric tons. While California area landings have not approached the qualifying level for data exchange, measurement data are presented in this report to complement other data for the hake resource.

Hake in animal food samples were measured at Santa Barbara, Morro Bay, Fort Bragg, and Eureka. The majority of measurements were obtained at Santa Barbara where a declining trend in average sizes was noted for quarterly periods and for annual periods from 1966 to 1970.

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INTRODUCTION

Pacific hake, Merluccius productus, have been utilized in California at least since Lockington (1881) noted them in San Francisco markets in 1879. Between 1916, when records of commercial catch were inaugurated, and 1951 annual hake landings ranged from 500 to 254,331 pounds and averaged 60,872 pounds. Subsequent to the development of the animal food fishery in 1952 (Best, 1959) hake landings gradually increased to a peak of 1,376,217 pounds in 1956. They remained above a million pounds through 1959 and declined to 325,088 pounds in 1960. Beginning in 1961 hake landings for food were recorded separately from those destined for animal food. From 1961 to 1970 hake landings as a food fish ranged from 3,275 to 139,699 pounds and averaged 57,904 pounds. For the same period animal food landings of hake averaged 362,378 pounds with a range of 204,984 to 732,718 pounds (Table 1).

In 1966, a specialized United States fishery operating from Oregon to Vancouver Island, Canada took 3.7 million pounds of hake with midwater trawls. In 1967, 18.5 million pounds were taken by this fishery (Nelson, 1970). In 1966, Soviet trawlers started to fish off Washington and Oregon. Beginning in 1967 and continuing in 1968 these trawlers expanded fishing into California waters. Out of their total U.S. coastal catch of 367 and 229 million pounds caught in these two years, 76 and 9 million pounds, respectively, came from California waters.

The enlargement of the hake fishery by the United States and the Soviet Union led to meetings between scientists of the two countries and ultimately to annual exchanges of biological data.

It was agreed to exchange 500 fish samples of length, weight, sex, age, and maturity of hake by broad statistical areas where the catch exceeds 100 metric tons (220,460) for quarter-year periods. Hake landings from the California statistical area have not approached the qualifying level of 100 metric tons per quarter since the exchange of data began in 1967, and no special samples were obtained to meet the data exchange commitment. However, hake have been sampled for length composition in conjunction with sampling animal food landings (Best, 1959, 1964; Nitsos and Reed, 1965). Lengths of hake sampled through 1964 in California landings were summarized by Best and Nitsos (1966). Length data are presented in this report for the years 1963 to 1970. These data are of limited value alone but since available information suggests a homogeneous hake population between California and British Columbia (Alverson and Larkins, 1969), they will complement other data available for the hake resource of the Pacific coast.

METHODS

Hake in samples to determine the species composition of animal food were segregated from other fish. Total length measurements in centimeters for each hake, and total weight for all hake in the sample were obtained. The hake were neither sexed nor aged.

Measurements have been accumulated by quarter periods of each year, and by year in tables for each port where samples were obtained.

Hake measurements were made at Santa Barbara, Morro Bay, Fort Bragg, and Eureka. Trawl landings at these four ports originate from grounds adjacent to each port. Santa Barbara trawlers generally fish in the Santa Barbara Channel from Point Conception to Point Hueneme at depths to about 200 fathoms. Grounds between Point Conception to Cape San Martin with depths

to 200 fathoms are fished by Morro Bay trawlers. Activities of Fort Bragg trawlers are largely confined to the area between Point Arena and Cape Mendocino; fishing depths extend to about 450 fathoms. Eureka trawlers generally fish between Cape Mendocino and southern Oregon at depths to 450 fathoms. Hake are generally taken in the latter two areas in depths under 200 fathoms.

Hake are readily accepted by animal food buyers at Santa Barbara and Morro Bay; the reverse situation exists at Fort Bragg and Eureka where only limited amounts of hake are bought. Animal food samples were unavailable at the latter ports in 1962 and 1963 due to the temporary cessation of the use of whole fish for animal food.

RESULTS

Santa Barbara

Total lengths of 4,541 hake measured at Santa Barbara between 1963 and 1970 ranged from 11 to 84 cm. Samples for 1965 were unavailable. Annual average sizes ranged from 36.7 to 52.4 cm. A declining trend in annual average size occurred from 1966 through 1970; the average size declined from 52.4 to 36.7 cm TL (Table 2).

Average sizes of hake arranged by quarter year periods also show declines in average sizes from 1966 to 1970. Small fish under 35 cm TL were more prevalent in January to March and in October to December quarters (Tables 3.1, 3.4). During the intervening quarters (Tables 3.2, 3.3) adult fish over 40 cm TL were generally predominant in samples. Best and Nitsos (1966) noted at Santa Barbara in 1961 and 1962 that small hake (20 to 35 cm TL) predominated in samples taken between December and March.

Morro Bay

At Morro Bay, 1,008 hake measurements were obtained between 1963 and 1970. None were obtained in 1968 and fewer than 100 lengths were obtained in 1967, 1969, and 1970. Total length ranged from 16 to 76 cm. Annual average lengths ranged from 44.1 to 64.8 cm. Adults over 40 cm TL were well represented in samples (Table 4).

Few small fish under 35 cm TL occurred in samples; most of these were measured during the first and last quarters (Tables 5.1, 5.4). Only in 1963 did fish under 35 cm TL occur in second and fourth quarter samples (Tables 5.2, 5.3).

Fort Bragg

Only 127 hake were sampled from annual landings at Fort Bragg in 1967, 1968, and 1969. Sizes ranged from 24 to 76 cm and annual mean sizes ranged from 41.9 to 59.2. Samples were obtained only during the second, third, and fourth quarters. Most hake measured during the third, July to September quarter (Table 6).

Eureka

Only 75 hake measurements were obtained from 1964 to 1970 at Eureka; none were taken in 1969. Total lengths ranged from 29 to 72 cm. All but two fish had lengths between 40 and 72 cm. Samples were obtained during the second, third, and fourth annual quarters. Most measurements, 52 of 76, were obtained during the July to September quarter (Table 7).

REFERENCES

- Alverson, Dayton L. and Herbert A. Larkins. 1969. Status of knowledge of the Pacific hake resource. Calif. Mar. Res. Comm., Cal COFI Rept., 13:24-31.
- Best, E. A. 1959. Status of the animal food fishery in northern California, 1956 and 1957. Calif. Fish and Game, 45(1):5-18.
- _____. 1961. The California animal food fishery 1958-1960. Pac. Mar. Fish. Comm., Bull. 5:5-15.
- Best, E. A. and R. J. Nitsos. 1966. Length frequencies of Pacific hake (Merluccius productus) landed in California through 1964. Calif. Fish and Game, 52(1):49-53.
- Lockington, W. N. 1881. Report upon the food fishes of San Francisco. Report of the Commissioners of Fisheries of the State of California for the years 1878 and 1879. pp. 17-58.
- Nelson, Martin O. 1970. Pacific hake fishery in Washington and Oregon coastal waters. U.S. Fish Wildl. Serv., Circ. 332:43-52.
- Nitsos, R. J. and Paul H. Reed. 1965. The animal food fishery in California, 1961-1962. Calif. Fish and Game, 51(1):16-27.

Table 1. Annual Landings of Pacific Hake at California Ports, 1916-1968

<u>Year</u>	<u>Pounds Landed</u>	<u>Year</u>	<u>Pounds Landed</u>	<u>Estimated Pounds Landed as Animal Food</u>
1916	189,219	1943	10,505	
1917	254,331	1944	4,751	
1918	193,018	1945	2,415	
1919	133,181	1946	550	
1920	141,981	1947	876	
1921	90,218	1948	4,600	
1922	74,516	1949	1,535	
1923	78,969	1950	500	
1924	60,780	1951	24,972	
1925	22,017	1952	6,145	
1926	58,335	1953	107,926	
1927	84,553	1954	611,522	
1928	108,648	1955	956,545	
1929	145,669	1956	1,376,217	
1930	56,088	1957	1,150,006	
1931	12,501	1958	1,135,138	
1933	37,539	1960	325,088	
1934	56,901	1961	3,275	453,256
1935	73,843	1962	78,530	317,668
1936	50,791	1963	139,699	261,592
1937	63,454	1964	111,529	276,412
1938	36,428	1965	119,255	732,781
1939	13,661	1966	69,002	256,350
1940	18,049	1967	14,430	510,916
1941	15,044	1968	6,494	344,412
1942	41,981	1969	27,047	204,984
		1970	9,775	265,410

Table 2. Length Frequencies of Pacific Hake Sampled at Santa Barbara, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
11					1	1		
12					1	1		
13								
14	1					1		
15	1					3		
16	3							2
17						4	1	2
18						1		2
19							2	2
20					1	3	3	4
21						10	5	1
22						29	28	10
23	7			1		55	56	12
24	5				2	59	80	26
25	11				4	64	73	40
26	11				9	38	39	27
27	10			4	10	28	22	34
28	12	3		8	7	25	23	16
29	6			7	6	33	17	18
30	9	1		13	9	17	28	20
31	10	2		10	6	40	15	23
32	9			16	8	46	15	31
33	7	4		12	6	40	26	25
34	9	2		8	1	22	24	16
35	3	3		13	20	30	22	19
36	5	8		4	18	34	15	11
37	4	14		5	24	18	19	19
38	12	7		3	14	22	21	15
39	11	11		5	4	14	20	16
40	6	12		4	12	18	14	10
41	17	9		6	7	18	23	13
42	20	8		8	3	14	20	12
43	19	12		6	4	20	10	9
44	17	10		8	2	17	8	8
45	24	11		5	3	16	11	16
46	16	7		6	2	12	12	10
47	24	7		7	4	12	3	6
48	21	9		9	6	12	4	4
49	26	9		9	3	14	4	7
50	32	8		21	2	22	7	5
51	25	9		15	11	17	8	3
52	19	17		14	12	24	6	2
53	20	11		19	7	31	11	4
54	9	9		28	7	17	11	6
55	11	6		16	10	30	8	3
56	12	7		32	10	34	12	4
57	13			20	11	35	17	1
58	11	5		29	11	45	15	2
59	7	2		31	16	34	14	6
60	5	4		36	15	41	18	5
61	7			28	11	44	13	3
62	3			20	6	22	16	10
63	8	2		17	6	28	18	3
64	3	2		21	4	22	17	4
65	1			23	8	17	16	5
66	2	1		11	6	14	10	1
67	1	2		10	3	17	10	3
68	1	1		5	2	13	8	1
69	1	1		4	3	4	8	3
70	1			4	1	7	6	1
71		1		5	2	6	6	1
72	1				1	6	1	3
73		1		2	1	5	1	1
74	1				1	3		4
75				1			2	1
76					1		1	
77								1
78							1	1
79						1		
80					1			
81								
82								
83							1	
84								
TOTAL	530	238		589	366	1,330	925	572
AVERAGE LENGTH	44.7	46.5		52.4	46.2	42.9	39.3	36.7

Table 3.1 Length Frequencies of Pacific Hake Sampled at Santa Barbara
January-March, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
11						1		
12						1		
13								
14						1		
15								
16								
17							1	
18								
19							1	1
20							1	3
21						1		
22							14	9
23	7						33	12
24	5					1	36	21
25	11					1	37	35
26	11				1	6	10	24
27	10				1	10	5	19
28	9				2	15	3	10
29	5				3	11	4	13
30	7				6	4	2	10
31	10				4	5	1	11
32	8				2	1	3	14
33	6	1				2	10	10
34	5	1			1	2	5	8
35	2				2	1	11	10
36	1				1	5	5	7
37	1	4			1	1	9	13
38	1	5			2	4	14	10
39	2	2			1	3	11	11
40	1	2			2	2	4	7
41	2	3			1	1	9	11
42	3	3				1	9	10
43	2	4				1	1	7
44		2			1	3	2	8
45		1			1	3	5	13
46		3				1	2	6
47	1	1				1	1	3
48		2			1	1		3
49	1	3				1	1	5
50	2	2				2	4	4
51		3			1		4	1
52	1	3			1	1	1	1
53		1			1	6	3	3
54		3				2	4	4
55	2	2			3	4	4	3
56	1			1		2	6	1
57					3	5	10	1
58	2				2	8	4	1
59	1				2	6	6	4
60		1			2	9	12	5
61	2			2	3	8	5	2
62				2	3	3	10	6
63	2	1			2	6	11	3
64	1	1		1		6	5	4
65				2		5	10	4
66		1			2	3	4	1
67		1				4	4	3
68				1		2	1	1
69					1	1	6	3
70							5	1
71						1	4	
72					1	2		2
73		1				2		1
74						1		3
75							1	1
76							1	
77								1
78							1	1
79							1	
80								
81								
TOTAL	129	54		9	58	180	377	389
AVERAGE LENGTH	33.3	47.4		62.7	55.7	46.2	40.6	37.4

Table 3.2 Length Frequencies of Pacific Hake Sampled at Santa Barbara
April-June, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
14								
15								
16								
17								
18								
19							1	
20							1	
21								
22								
23				1			1	
24							7	2
25							10	1
26							10	3
27				1		1	6	6
28							8	2
29							4	1
30						1	9	7
31							4	12
32								14
33	1						5	12
34							3	8
35						1	1	5
36							4	
37							4	3
38							3	2
39							1	5
40						3	1	2
41	2					2	2	2
42	1					2	1	2
43	6					2	1	2
44	6			1		1		
45	8					1	1	3
46	7					1	1	2
47	12			2		1		2
48	9					1		1
49	8			1	1			2
50	9			1		4		
51	6			2		1	1	2
52	3					3	1	1
53	3			5		1		1
54	1			3		4	3	1
55	3			3		1	1	
56	2			7	1	2	1	2
57	2			6		4	1	
58	1			9	1	10	2	1
59	1			9		4	2	1
60				11	2	5	3	
61				12		12	4	1
62				9		4	3	3
63				8	2	11	1	
64				7	1	7	3	
65				10	4	3	5	1
66				8	1	6	3	
67				9	1	6	5	
68				2		8	1	
69	1			2	1	1	1	
70				3	1	6	1	
71				2	1	2	2	
72						2	1	1
73				2			1	
74								
75				1			1	
76								
77								
78								
79								
80								
81								
TOTAL	92			137	18	124	135	116
AVERAGE LENGTH	48.4			60.6	63.2	59.0	41.4	37.3

Table 3.3 Length Frequencies of Pacific Hake Sampled at Santa Barbara July-September, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
11					1			
12					1			
13								
14								
15								
16								
17								
18								
19								
20							1	
21							1	
22						1	1	
23								
24								
25					2			
26					2	1	2	
27					5		1	
28	3				2		5	
29	1				2	2	3	
30	2				3		5	
31				1	2	2	6	
32	1				6	1	5	
33					6	2	4	
34	2			2			9	
35	1			5	18	3	2	
36	3				17	2	2	
37	2			2	22	1		
38	6			1	14	2	1	
39	6			3	3		1	
40	4			3	10	2	3	
41	8			2	5	1	2	
42	11			4	3	1	1	
43	9			4	4	6	3	
44	9			5	1	4		
45	13			3	2	2	2	
46	6			3	2	4	1	
47	8			4	4	4		
48	10			4	5	7	2	
49	15			4	2	7	1	
50	19			16	1	12	2	
51	18			11	9	11		
52	12			9	11	15	2	
53	16			6	6	16	4	
54	5			16	7	11	3	
55	4			7	7	21	2	
56	7			16	8	27	3	
57	9			10	8	24	4	
58	8			15	8	19	6	
59	5			14	14	21	4	
60	2			13	10	19	3	
61	4			10	7	22	3	
62	1			7	1	6	2	
63	4			4	3	4	5	
64	1			6	3	7	6	
65	1			3	4	5	1	
66	1			1	2	4	1	
67				1	2	2	1	
68	1			1	1	1	5	
69					1	1	1	
70	1			1				
71				1		2		
72	1							
73						2		
74	1				1	1		
75								
76					1			
77								
78								
79								
80					1			
81								
TOTAL	241			218	260	308	122	
AVERAGE LENGTH	48.9			53.5	46.1	54.6	46.2	

Table 3.4 Length Frequencies of Pacific Hake Sampled at Santa Barbara
October-December, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
14	1							
15	1							
16	3					3		2
17						4		2
18						1		2
19								1
20					1	3		1
21						9	4	1
22						28	13	1
23						55	22	
24					2	58	37	3
25					2	63	26	4
26					6	31	17	
27				3	4	17	10	9
28		3		8	3	10	7	4
29				7	1	20	6	4
30		1		13		12	12	4
31		2		9		33	4	3
32				16		44	7	3
33			3	12		36	7	3
34	2	1		6		20	7	
35		3		8		25	8	4
36	1	8		4		27	4	4
37	1	10		3	1	16	6	3
38	1	5		2		16	3	3
39	3	9		2		11	7	
40	1	10		1		11	6	1
41	1	6		4	1	14	10	
42	5	5		4		10	9	
43	2	8		2		11	4	
44	2	8		2		9	6	
45	3	10		2		10	3	
46	3	4		3		6	9	2
47	3	6		1		6	2	1
48	2	7		5		3	2	
49	2	6		4		6	2	
50	2	6		4	1	4	1	1
51	1	6		2	1	5	3	
52	3	14		5		5	3	
53	1	10		8		8	4	
54	3	6		9		6	1	1
55	2	4		6		1	1	
56	2	7		8	1	3	2	1
57	2			4		2	2	
58		5		5		8	3	
59		2		8		3	2	1
60	3	3		12	1	8		
61	1			4	1	2	1	
62	2			2		9	1	1
63	2	1		5		7	1	
64	1	1		7		2	3	
65				8		4		
66	1			2	1	1	2	
67	1	1				5		
68		1		1	1	2	1	
69		1		2		1		
70						1		
71		1		2	1	1		
72						2		
73					1	1		
74						1		
75								1
76								
77								
78								
79						1		
80								
81								
TOTAL	68	184		225	30	718	291	67
AVERAGE LENGTH	46.4	46.2		45.9	37.6	34.3	33.6	32.2

Table 4. Length Frequencies of Pacific Hake Sampled at Morro Bay
1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
14								
15								
16	1							
17								
18								
19								
20								
21	1							
22	1							
23	1							
24	1		1					
25	1		1					
26	10	1						
27	3	2						
28	5	2						
29	9	4						
30	8	3	1		1			
31	10	1	1					
32	9		1		1			
33	1	1						
34	4	1				1		
35	3							
36	3		3					
37	3							
38	6	4	1		1			
39	6	2	1	1				
40	3	3	2					
41	4	3	10	2				
42	9	2	1	1	1			
43	5	1	2	1				
44	7		5	1				
45	3		8	2				
46	10	3	9			1		
47	9	2	9	1		1		
48	10	2	10			3		
49	11	3	9	2				
50	7	5	18	3		2		
51	5	2	12	2		4		
52	8	11	14	3		7		
53	8	13	15	5		3		
54	6	11	24	2		5		
55	5	11	25	1		8		
56	10	19	21	6		14		
57	9	12	17	6		10	1	
58	5	12	14	4			1	
59	5	9	15	7		9	1	
60	6	11	12	3		2		
61	2	14	8	11		3	1	
62	1	14	15	6		2		
63		10	7	6		1		
64	4	3	11	6		3	1	1
65	3	4	6	6		4		1
66		7	6	3		1		1
67	1	3	4	1				
68		4	3	2		1		1
69	1	1	1	2		3		1
70		2	2	3		2		1
71			1	1		2		
72		3	3	1				
73		1						
74		1		2				
75			1					
76								
77								
78								
79								
80								
81								
TOTAL	243	223	330	103	96		5	8
AVERAGE LENGTH	44.1	55.0	54.4	58.8	56.3		59.8	64.8

Table 5.1 Length Frequencies of Pacific Hake Sampled at Morro Bay
January-March, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
14								
15								
16								
17								
18								
19								
20								
21								
22								
23	1							
24	1							
25								
26	7	1						
27	2							
28	2							
29	2							
30	1		1		1			
31			1					
32			1		1			
33								
34	1	1			1			
35								
36			1					
37								
38			1		1			
39	1		1					
40	1							
41			6					
42	4				1			
43								
44	2							
45								
46		1	1					
47	1							
48	2	1						
49	1							
50		1						
51								
52	1	3						
53		3						
54								
55		1	1					
56		5	1					
57	1	1	3	1				
58	1	1	2					
59			2	1			1	
60		2			1			
61								
62		3	1					
63		2	1					
64			3			1		
65		1	3		1			
66			1					
67		1	1					
68			1					
69			1					
70		1	1					
71								
72			2					
73								
74								
75								
76			1					
77								
78								
79								
80								
81								
TOTAL	32	29	38	2	8		1	
AVERAGE LENGTH	36.1	55.2	54.9	58.0	45.5		59.0	

Table 5.2 Length Frequencies of Pacific Hake Sampled at Morro Bay
April-June, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29	1							
30	1							
31								
32	1							
33								
34								
35								
36			1					
37								
38								
39	2							
40	2							
41								
42								
43								
44								
45								
46	1		1					
47			1					
48								
49	2		2					
50		2	3					
51			5					
52		3	6					
53		7	6					
54		4	6					
55		4	9					
56	1	2	8		1			
57	3	2	5		1			
58		5	7					1
59		1	7		1			
60	2	2	5					
61		3	6	1	1			
62	1	2	11					
63		2	5					
64			7					1
65	1	1	3					1
66		1	3					1
67			2					
68		1	1		1			1
69					1			1
70		1	1		1			1
71			1		2			
72			1					
73		1						
74								
75								
76								
77								
78								
79								
80								
81								
TOTAL	18	45	113	1	9			7
AVERAGE LENGTH	48.2	57.9	58.0	61.0	64.7			65.7

Table 5.3 Length Frequencies of Pacific Hake Sampled at Morro Bay
July-September, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
14								
15								
16								
17								
18								
19								
20								
21								
22	1							
23								
24								
25								
26	1							
27								
28								
29	4							
30	3							
31	4							
32	4							
33								
34	2							
35	2							
36	2		1					
37	2							
38	5	3						
39	3	2						
40		3	2					
41	4	3	4	1				
42	5	2	1	1				
43	3	1	2	1				
44	5		5	1				
45	3		8	1				
46	7	2	7			1		
47	7	2	8			1		
48	6	1	10	1		3		
49	5	3	7					
50	3	2	15	2		2		
51	3	2	7	1		4		
52	4	5	8	3		7		
53	4	3	9	4		3		
54	3	7	17	2		5		
55	4	6	15			8		
56	4	12	12			13		
57	4	9	9	5		9	1	
58	2	6	5	3			1	1
59	3	8	6	7		8		
60	2	7	7	5		1		
61	2	11	2	9		2	1	
62		9	3	4		2		
63		6	1	6		1		
64	3	3	1	6		2	1	
65	2	2		5		3		
66		5	1	3		1		
67	1	2	1	1				
68		3	1	2				
69	1	1		1		2		
70				2		1		
71				1				
72		2						
73								
74		1		2				
75								
76								
77								
78								
79								
80								
81								
TOTAL	123	134	175	80	79		4	1
AVERAGE LENGTH	46.3	56.6	52.2	59.7	56.4		60.0	58.0

Table 5.4 Length Frequencies of Pacific Hake Sampled at Morro Bay
October-December, 1963-1970

Total Length Centimeters	1963	1964	1965	1966	1967	1968	1969	1970
14								
15								
16	1							
17								
18								
19								
20								
21	1							
22								
23								
24				1				
25	1			1				
26	2							
27	1	2						
28	3	2						
29	2	4						
30	3	3						
31	6	1						
32	4							
33	1	1						
34	1							
35	1							
36	1							
37	1							
38	1	1						
39					1			
40								
41					1			
42								
43	2				1			
44								
45					1			
46	2							
47	1							
48	2							
49	3							
50	4				2			
51	2				1			
52	3							
53	4				1			
54	3			1				
55	1				1			
56	5				2			
57	1				1			
58	2				1			
59	2				1			
60	2							
61					1			
62					2			
63								
64	1							
65					1			
66		1		1				
67								
68								
69					1			
70					1			
71								
72								
73								
74								
75								
76								
77								
78								
79								
80								
81								
TOTAL	70	15	4	20				
AVERAGE LENGTH	43.0	32.3	42.3	55.2				

Table 6. Length Frequencies of Pacific Hake Sampled at Fort Bragg
by Annual Quarter and by Year, 1967-1969

Total Length Centimeters	1967	1968				1969
	July-Sept.	April-June	July-Sept.	Oct.-Dec.	Total	July-Sept.
24			1		1	
25						
26						
27						
28			1		1	
29			1		1	
30						
31						
32						
33						
34						
35			1		1	
36			1		1	
37						
38			1		1	
39						
40						
41						
42						
43						
44						
45			3		3	
46						
47						
48	1		1		1	
49		1	1		2	
50	1		3		3	1
51	2		5		5	1
52			4		4	
53			2	2	4	1
54		1			1	
55	1		8		8	2
56		2	8		5	1
57		3	8		11	1
58		1	9		10	
59		1	8	1	8	
60			5		5	
61		1	3	1	3	2
62			3		3	
63	1	2	2		4	
64		1	3		4	
65	2		3		3	
66			1		1	
67			1		1	
68			1		1	
69	1		5		5	
70			1		1	
71						
72						
73			1		1	
74						
75			2		2	
76	1		1		1	
TOTAL	10	13	91	4	108	9
AVERAGE LENGTH	59.3	53.0	56.9	56.5	57.0	55.4

Table 7. Length Frequencies of Pacific Hake Sampled at Eureka
by Annual Quarter and by Year, 1964-1970

Total Length Centimeters	1964			1965			1966	1967	1968	1970
	July-Sept	Oct-Dec	Total	Apr-June	July-Sept	Total	Apr-June	July-Sept	Oct-Dec	Apr-June
29									1	
30									1	
31										
32										
33										
34										
35										
36										
37										
38										
39										
40	1		1		1	1				
41	2	1	3		2	2				
42	2		2		2	2				
43	1	1	2		1	1				
44		1	1							
45	1		1					1		
46					1	1				
47								1		
48								1	4	
49	1		1		1	1		3		
50								2	2	
51								4		1
52							1		2	
53										
54	1		1	1		1		1		
55	1		1	1		1		2		
56								1		
57	1		1	1		1		2		
58								4		
59										
60	1		1	1		1				
61	1		1	1		1				
62	1		1	1		1		1		
63										
64	1		1		1	1		1		
65	1		1		1	1				
66										
67										
68										
69	1		1	1		1				
70										
71										
72	1		1	1		1				
TOTAL	18	3	21	8	10	18	1	24	10	1
AVERAGE LENGTH	53.4	42.7	51.9	61.3	47.3	53.5	53.0	53.5	45.5	51.0