14. CALIFORNIA HALIBUT

Overview of the Fishery

Commercial Halibut Fishery

California halibut, *Paralichthys californicus*, is an important flatfish species in both the commercial and recreational fisheries of central and southern California. The highest recorded commercial landing of halibut was 4.7 million lb in 1919, which was followed by a decline to 950,000 lb in 1932 (Figure 14.1 and Table 14.1). Since 1932, an average of 913,000 lb has been landed annually with five notable peaks in landings: 1936 (1.6 million lb), 1946 (2.5 million lb), 1964 (1.3 million lb), 1981 (1.3 million lb), and 1997 (1.3 million lb).

The decline in commercial California halibut landings after 1919 is attributed to increased fishing pressure during World War I and to subsequent overfishing. Fishing restraints during World War II may have allowed halibut stocks to increase, resulting in peak landings in the late 1940s, followed by low catches in the 1950s. Warm waters during El Niño years in the late 1950s were followed by increased landings through the mid-1960s. Thereafter, annual landings decreased again to a historical low of 257,000 lb in 1970; after 1970 landings gradually increased. Since 1980, landings have averaged a little more than 1 million lb annually.

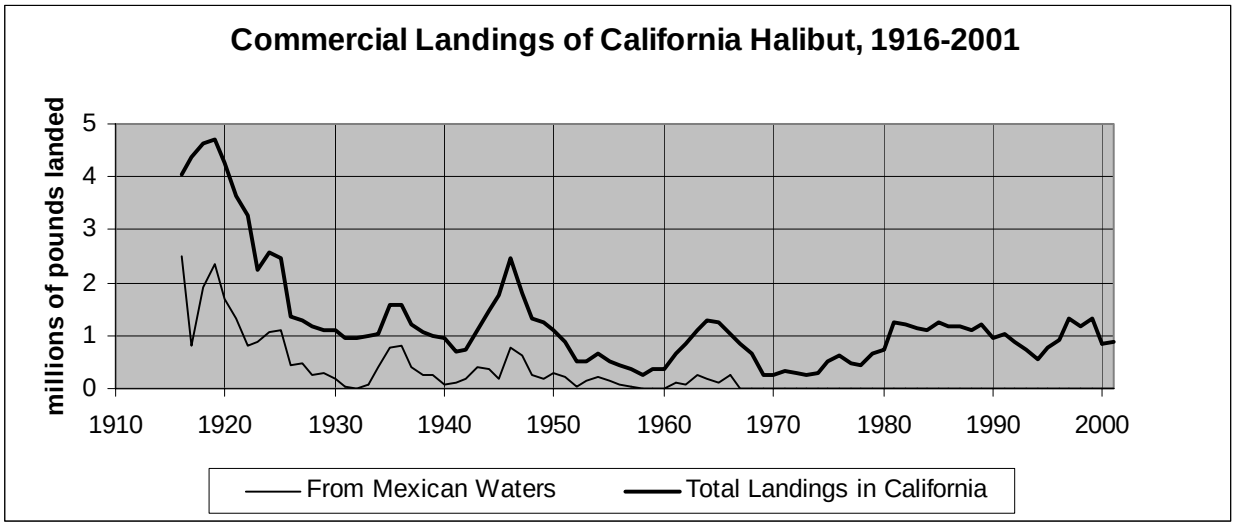

Figure 14.1. Annual commercial landings (pounds) of California halibut from 1916 to 2001. Data sources are the California Department of Fish and Game (DFG) Catch Bulletins (1916-1983) and the DFG commercial landing receipt database (1984-2001).

Although California halibut range from the Quillayute River, Washington to Almejas Bay, Baja California, Mexico, the commercial fishery is mostly concentrated from Bodega Bay in northern California to San Diego in southern California. The contribution of halibut from Mexican waters to California landings has varied but has generally been insignificant since 1967 (Figure 14.1 and Table 14.1). Historically, the fishery has been centered off southern California and Baja California, Mexico, but over the past twenty years, the greatest landings have oscillated between ports in southern

and central California. A majority of the halibut landings made in central California occurred in the San Francisco area. A limited amount of fishing occurs around the Channel Islands of southern California, which yields substantially larger halibut (average length 27 in.) than those caught in the nearshore mainland fishery (average length 24 in.).

Historically, California halibut have been commercially harvested by three principal gears: otter trawl, entangling nets (set gill net and set trammel net), and hook-and-line. The halibut trawl fishery evolved late in the nineteenth century in the San Francisco Bay area. Since then, the boats used to tow this gear across the ocean bottom have gone from sail-powered to steam-powered, to gasoline-powered, and finally to diesel-powered engines. Today, trawling for California halibut is permitted in federal waters (3 to 200 nautical miles (nm) offshore) using trawl nets with a minimum mesh size of 4.5 in. Trawling is prohibited within State waters (0 to 3 nm offshore), except in the designated "California halibut trawl grounds," which encompass the area between Point Arguello (Santa Barbara County) and Point Mugu (Ventura County) in waters beyond 1 nm from shore. Bottom trawls used in this area must have a minimum mesh size of 7.5 in., and trawling is closed from March 15 to June 15 to protect spawning adults.

A decade after the introduction of the trawl fishery to San Francisco Bay, set gill nets and trammel nets were used to fish for halibut coast-wide. Currently, the mesh size must be at least 8.5 in. to harvest California halibut. In southern California, gill and trammel nets are prohibited in State waters from Point Arguello to the U.S.-Mexico border, and in waters less than 70 fathoms (fm) or within 1 nm, whichever is less, around the Channel Islands.

North of Point Arguello, set gill nets and set trammel nets have been subject to many different area, depth, and seasonal closures over time. Beginning in September 2000, a series of closures were enacted to protect marine birds and mammals. Two emergency closures prohibited the use of gill and trammel nets in waters less than 60 fm between Point Reyes (Marin County) and Yankee Point (Monterey County), and between Point Sal (Santa Barbara County) and Point Arguello, then a third emergency closure prohibited use of the gear in waters less than 60 fm between Point Reyes and Point Arguello. Finally, in September 2002, the area covered by the third emergency closure was permanently closed.

Historically, commercial catches of California halibut by hook-and-line gear have been insignificant when compared to the total pounds landed annually by trawl and set net fisheries. However, over the last decade, hook-and-line catches of halibut have ranged from 11% to 23% of annual commercial landings, with the majority of those landings made in the San Francisco area.

Commercial fishing laws prohibit the sale of California halibut less than 22 in. long, unless the weight is at least 4 lb whole, 3.5 lb dressed with the head on, or 3 lb dressed with the head off. Four halibut less than the legal minimum size may be retained for personal use if taken incidentally with a gill, trammel or trawl net.

Recreational Halibut Fishery

California halibut are highly prized by recreational anglers and are primarily caught using hook-and-line. While California halibut can be caught from the shore, most are caught from boats.

The Marine Recreational Fisheries Statistics Survey (MRFSS), which has been conducted from 1980 to 1989 and 1993 to the present, estimates the recreational catch from shore, private or rental boats, and commercial passenger fishing vessels (CPFVs). The MRFSS estimates both the number and pounds of fish caught (Figure 14.2, Table 14.2 and Table 14.3). In the last two decades, about 90% of the recreational catch has been from boats, with most of that catch (77% to 79%) from private or rental boats (Table 14.2 and Table 14.3).

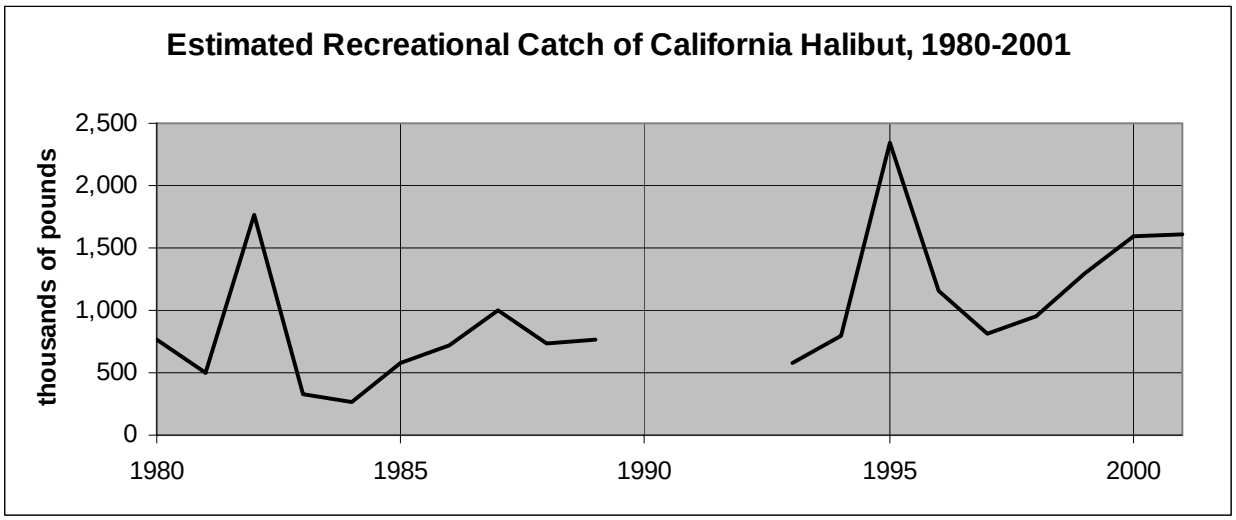

Figure 14.2. Estimated recreational catch (pounds) of California halibut from 1980 to 1989 and 1993 to 2001. Catch estimates do not include fish that were caught and released alive. Data source is the Marine Recreational Fisheries Statistics Survey (MRFSS).

The California Department of Fish and Game (DFG) did not keep records of recreational landings until 1936, when CPFV operators were required to submit logbooks reporting catches. No data were collected during World War II from 1941 to 1945. Although the CPFV catch was reported in pounds between 1936 and 1946, it was reported in pounds and number of fish in 1947, and only in number of fish after 1947 (Figure 14.3 and Table 14.4).

From 1947 through 1974, the catches reported by CPFV operators displayed trends similar to the commercial landings (Figure 14.3 and Table 14.4), with peaks in 1948 (143,000 halibut) and 1964 (141,000 halibut). While the commercial catch increased in the late 1970s and steadied in the 1980s, the CPFV catch remained low and variable with an average annual catch of 8,300 fish from 1971 to 1989. The CPFV catch rose to a 26-year high of 19,300 fish in 1995, and has averaged about 16,300 fish per year from 1995 to 2001. The CPFV catch, of course, represents only one component of the recreational fishery.

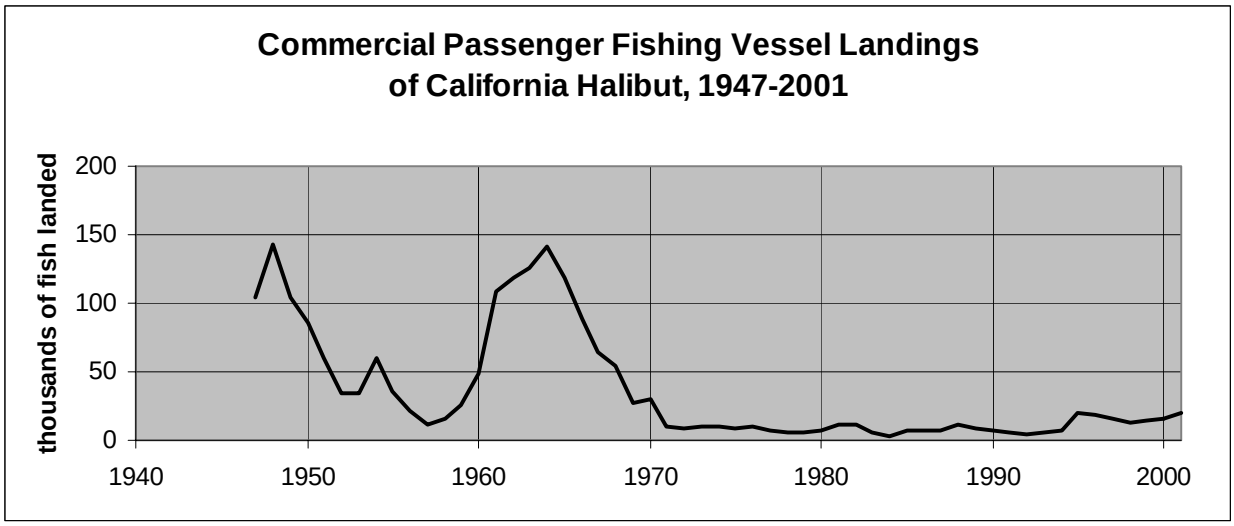

Figure 14.3. Recreational commercial passenger fishing vessel (CPFV) landings (number of fish) as reported on CPFV Logbooks for California halibut from 1947 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1947-1978) and DFG Annual Reports of Statewide Fish Landings By The Commercial Passenger Fishing Vessels (CPFV) Fleet (1979-2001).

More recently, the MRFSS estimated that the annual recreational catch of California halibut ranged from 268,700 to 2.3 million lb between 1980 and 2001 for both shore and boat fishing; there are no catch estimates for 1990 to 1992 (Figure 14.2 and Table 14.3). The MRFSS also estimated that recreational anglers have taken, on average, 976,000 lb of halibut annually since 1980 (excluding 1990 to 1992), slightly below the average annual figure reported for the commercial component of the fishery for the same period.

Recreational regulations require a minimum size limit of 22 in., in addition to a daily bag limit of five California halibut per day when fishing south of Point Sur (Monterey County), and only three California halibut per day when fishing north of Point Sur. South of Point Arena (Mendocino County) fillets must be a minimum of 16.75 in. long and bear the entire skin intact. In the recreational fishery, halibut can be taken by hand, or by using hook-and-line or spear-fishing gear.

Status of Biological Knowledge

Adult California halibut inhabit soft-bottom habitats in coastal waters generally less than 300 ft deep, with greatest abundance at depths of less than 100 ft. Adults spawn throughout the year with peak spawning in winter and spring. Free-drifting eggs and larvae have been found over the continental shelf, with greatest densities in water less than 250 ft deep and within 4 mi of shore. Halibut larvae appear to move inshore as they begin to change from larval to adult form. Early larval stages (about 0.1 to 0.3 in.) occur in midwater more than 1 mi offshore, whereas transforming larvae occur within 0.6 mi of shore and occupy the surface zone at night and the bottom during the day. Halibut have a relatively short free-drifting larval stage (less than 30 days), transforming and settling to the bottom at a small size (about 0.3 to 0.5 in.). Newly-settled and larger juvenile halibut are frequently taken in un-vegetated shallow-water embayments and infrequently on the open coast, suggesting that embayments are

important nursery habitats. However, settlement either in bays or along the open coast varies yearly and may reflect variability in nearshore currents which influence the onshore transport of larvae. The advantages of bays as nursery areas probably include a decrease in the risk of mortality of newly-settled juveniles and an increase in the growth rate of larger juveniles that feed upon the abundant small fishes in the bays. Juveniles emigrate from the bays to the coast at about one year of age and 6.9 to 8.7 in. in length.

The DFG has conducted extensive tag-and-release studies on California halibut over the past four decades. Tagging effort has ranged geographically from Sebastian Vizcaino Bay, Baja California, Mexico north to Tomales Bay, California (Marin County), although the primary effort has been centered between Oceanside (San Diego County) and Point Conception (Santa Barbara County) in southern California. Results showed that halibut do not tend to move extensively. Most sub-legal (less than 22 in.) halibut were recaptured within 2 mi of their release sites, while larger halibut appear to travel greater distances. The average distance traveled by halibut during the study was 8 mi. The results also indicate that halibut movement is parallel to the coastline, with significantly greater northward movements than southward movements. Tagged halibut recaptures south of the international boundary with Mexico may not have been reported, limiting our knowledge of southward movements.

California halibut may live to 30 years and reach 60 in. long. The maximum recorded weight is 72 lb. Male halibut mature at 2 to 3 years and 8 to 9 in., whereas females mature at 4 to 5 years and 15 to 17 in. Female halibut attain larger sizes at a given age than males and represent a greater fraction of the commercial landings (60% to 80%). Female halibut reach legal size (22 in.) at 5 to 6 years of age, about 1 year before males.

California halibut are ambush predators. Small juvenile halibut in bays primarily eat crustaceans, including copepods and amphipods, until they reach about 2.5 in. At 2.5 in., they are large enough to eat fish such as the gobies that are commonly found in bays. The percentage of fish in juvenile halibut diets increases as the halibut grows. On the coast, adult halibut feed primarily on Pacific sardine, northern anchovy, squid, and other nearshore fish species that swim in the water column.

Status of the Population

Abundance of larval California halibut in plankton surveys is correlated with commercial landings of halibut. This species appears to have a cycle of abundance approximately 20 years in length. However, the size of the halibut population may be limited by the amount of available nursery habitat, as juvenile halibut appear to be dependent on shallow water embayments as nursery areas. The overall decline in halibut landings corresponds to a decline in shallow water habitats in southern California associated with dredging and filling of bays and wetlands.

Recreational and commercial fishermen have held conflicting views of how to best utilize and preserve the halibut resource in southern California. In 1988, a differential minimum size limit of 22 in. for the recreational fishery and 26 in. for the commercial fishery was investigated as a possible management tool. This strategy would allow recreational anglers to harvest halibut between 22 and 26 in. long before fish had grown large enough to recruit to the commercial fishery. Yield-per-recruit (Y/R)

analysis (that is, an analysis of how size limits, and natural and fishing mortality will affect production or yield) indicated that:

- Differential size limits would provide an increased Y/R for the recreational fishery, whereas the commercial fishery would experience a loss
- Overall fishing effort was about twice the optimum level
- Y/R would probably increase with decreased fishing effort

The Y/R analysis indicated that allocation conflicts between the recreational and commercial components of the halibut fishery are not likely to be resolved by a management strategy that increases the minimum commercial size limit.

A virtual population analysis (a mathematical modeling technique used to estimate the number of fish in and the weight of each year-class of fish) conducted in the late 1980s estimated that the total biomass (total weight) of California halibut in California was 5.7 to 13.2 million lb, with annual recruitment of fish at 1 year of age estimated to be between 450,000 and 1 million fish. The number of juvenile halibut emigrating from southern California bays to the open coast (at 1 year of age) estimated from beam trawl surveys ranged between 250,000 and 400,000 in the late 1980s.

In the early 1990s, a swept-area trawl survey was conducted by DFG to better understand California halibut population dynamics. This fishery-independent survey produced a preliminary biomass (total weight) and population estimate (number of fish) for halibut in southern and central California. The survey results indicated a halibut biomass of 6.9 million lb for southern California and 2.3 million lb for central California, while the population estimate was 3.9 million halibut for southern California and 700,000 halibut for central California.

Management Considerations

California halibut is an ecologically and economically important nearshore finfish species that supports both commercial and recreational fisheries. Over the past century abundance appears to have been cyclic, which may be due to a number of fishery-dependent and fishery-independent factors. However, protection of bay and estuarine habitats, upon which juvenile halibut depend, is important to insure the health of this resource. California has lost more than 80% of its estuarine habitats over the past century. Management actions that should be considered include:

- Maintaining the current California halibut commercial and recreational regulations.
- Protecting nursery grounds of California halibut by prohibiting modifications to southern California embayments and estuaries unless mitigating actions are taken.
- Prohibiting dredging operations in embayments and estuaries during periods of peak abundance (March-May) of larval and newly-settled California halibut in southern California.

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Further Reading

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Table 14.1. Commercial landings (pounds) of California halibut, 1916-2001

Year	From California waters	From Mexican waters	Total California landings	Year	From California waters	From Mexican waters	Total California landings
1916 [1]	1,500,000	2,500,000	4,052,173	**1959**	345,286	8,956	354,242
1917 [1]	3,500,000	800,000	4,379,312	**1960**	366,191	10,072	376,263
1918	2,708,514	1,915,704	4,624,218	**1961**	545,472	109,082	654,554
1919	2,362,520	2,335,603	4,698,123	**1962**	776,077	87,009	863,086
1920	2,602,043	1,677,539	4,279,582	**1963**	855,092	265,277	1,120,369
1921	2,340,428	1,313,433	3,653,861	**1964**	1,092,068	184,037	1,276,105
1922	2,437,966	816,539	3,254,505	**1965**	1,128,348	115,370	1,243,718
1923	1,347,243	882,138	2,229,381	**1966**	749,555	261,857	1,011,412
1924	1,528,399	1,048,483	2,576,882	**1967**	824,919	13,139	838,058
1925	1,352,248	1,100,303	2,452,551	**1968**	659,425	12,229	671,654
1926	916,794	432,237	1,349,031	**1969**	272,331	1,946	274,277
1927	818,517	485,042	1,303,559	**1970**	256,898	546	257,444
1928	932,289	255,362	1,187,651	**1971**	336,416	455	336,871
1929	811,427	291,146	1,102,573	**1972**	309,003	242	309,245
1930	896,062	201,698	1,097,760	**1973**	272,466	1,060	273,526
1931	929,306	40,467	969,773	**1974**	306,290	189	306,479
1932	939,001	10,701	949,702	**1975**	507,785	1,128	508,913
1933	904,829	84,820	989,649	**1976**	627,574	796	628,400
1934	648,516	388,492	1,037,008	**1977**	463,760	4,102	467,862
1935	810,291	765,572	1,575,863	**1978**	432,884	8,244	441,440
1936	776,634	806,273	1,582,907	**1979**	658,892	6,399	665,546
1937	812,365	394,870	1,207,235	**1980**	724,590	2,120	726,852
1938	822,447	255,782	1,078,229	**1981**	1,259,029	3,236	1,262,265
1939	722,084	269,537	991,621	**1982**	1,211,232	1,324	1,214,375
1940	861,908	86,549	948,457	**1983**	1,130,543	38	1,130,581
1941	592,911	113,739	706,650	**1984**	1,105,273	------	1,107,019
1942	569,245	181,294	750,539	**1985**	1,255,599	204	1,255,966
1943	701,219	410,779	1,111,998	**1986**	1,183,482	205	1,184,296
1944	1,111,880	373,583	1,485,463	**1987**	1,185,139	2,609	1,188,596
1945	1,582,150	166,671	1,748,821	**1988**	1,106,877	------	1,107,207
1946	1,675,280	781,907	2,457,187	**1989**	1,217,868	76	1,219,321
1947	1,172,638	615,263	1,787,901	**1990**	938,572	------	938,572
1948	1,041,124	265,489	1,306,613	**1991**	1,040,855	------	1,040,864
1949	1,079,501	183,013	1,262,514	**1992**	885,073	57	885,130
1950	806,279	286,466	1,092,745	**1993**	725,535	980	726,525
1951	643,279	222,654	865,933	**1994**	533,917	780	535,018
1952	473,620	51,691	525,311	**1995**	770,065	94	771,628
1953	387,739	142,576	530,315	**1996**	914,034	60	914,236
1954	444,543	216,788	661,331	**1997**	1,324,987	106	1,325,175
1955	363,834	145,968	509,802	**1998**	1,187,115	351	1,187,549
1956	382,006	73,793	455,799	**1999**	1,313,286	------	1,313,495
1957	332,584	44,231	376,815	**2000**	847,946	------	847,949
1958	256,075	11,371	267,446	**2001**	891,475	------	894,002

------ Landings data not available.

1. Amounts caught from California and Mexican waters in 1916 and 1917 are estimates.
2. Data sources are DFG Catch Bulletins (1916-1983) and DFG commercial landing receipt database (1984-2001).
3. A small amount of the total commercial California halibut landings are from waters north of the State or from undesignated waters. These pounds are not reported separately in this table, but are included in the total.

Table 14.2. Estimated catch (number of fish) by recreational anglers of California halibut by fishing mode, 1980-2001

Year	Man-made structures	Beach and bank	Shore	Commercial passenger fishing vessels (CPFV)	Private or rental boats	Total
1980	17,959	2,558	------	12,064	94,071	126,652
1981	5,680	2,713	------	16,765	50,127	75,286
1982	6,519	176,969	------	16,683	72,301	272,473
1983	3,060	1,469	------	6,567	33,128	44,224
1984	3,936	2,281	------	2,960	30,745	39,922
1985	3,913	5,885	------	12,436	49,782	72,016
1986	------	------	8,132	11,410	106,173	125,715
1987	------	------	14,857	29,017	143,255	187,130
1988	------	------	23,567	18,665	63,284	105,517
1989	------	------	7,784	22,949	92,516	123,249
1990	------	------	------	------	------	------
1991	------	------	------	------	------	------
1992	------	------	------	------	------	------
1993	2,096	1,294	------	7,432	55,323	66,145
1994	1,618	2,046	------	13,833	86,072	103,569
1995	5,806	4,100	------	8,897	318,429	337,231
1996	9,315	986	------	13,645	122,975	146,921
1997	1,740	826	------	6,511	82,865	91,942
1998	2,155	------	------	7,445	96,620	106,220
1999	766	528	------	17,989	110,691	129,975
2000	1,768	5,822	------	22,709	136,116	166,415
2001	7,310	703	------	18,727	165,375	192,115

------ Estimates not available.

1. Data source: the Marine Recreational Fisheries Statistics Survey (MRFSS); data obtained from the Pacific States Marine Fisheries Commission website.
2. No estimates are available from 1990 through 1992 or for January and February of 1995. Estimates for 2001 are preliminary. Northern California CPFVs were not fully sampled because of refusals.
3. Catch estimates do not include fish that were caught and released alive; they only include fish that were harvested.
4. From 1986 to 1989, individual catch estimates were not made for the man-made structures mode or the beach and bank mode. Instead, a single estimate was made for these shore modes.

Table 14.3. Estimated catch (pounds) by recreational anglers of California halibut by fishing mode, 1980-2001

Year	Man-made structures	Beach and bank	Shore	Commercial passenger fishing vessels (CPFV)	Private or rental boats	Total
1980	57,447	7,487	------	107,828	598,290	771,052
1981	37,557	13,136	------	114,372	338,274	503,338
1982	16,336	1,230,207	------	87,060	429,499	1,763,103
1983	10,437	6,616	------	74,502	236,326	327,882
1984	10,506	11,330	------	45,026	201,923	268,786
1985	6,375	24,925	------	95,106	451,173	577,579
1986	------	------	26,263	72,251	615,017	713,531
1987	------	------	39,456	155,285	810,579	1,005,321
1988	------	------	169,234	98,551	463,378	731,163
1989	------	------	26,650	137,716	598,175	762,540
1990	------	------	------	------	------	------
1991	------	------	------	------	------	------
1992	------	------	------	------	------	------
1993	5,464	6,099	------	38,121	529,253	578,937
1994	5,362	14,139	------	101,669	669,912	791,083
1995	29,039	28,642	------	63,801	2,219,567	2,341,049
1996	56,641	5,466	------	109,940	984,657	1,156,703
1997	9,720	1,824	------	67,756	734,970	814,271
1998	14,495	------	------	68,122	863,242	945,859
1999	4,767	6,232	------	154,201	1,133,900	1,299,099
2000	10,351	63,032	------	241,398	1,276,052	1,590,833
2001	41,900	7,534	------	162,279	1,399,452	1,611,166

------ Estimates not available.

1. Data source: the Marine Recreational Fisheries Statistics Survey (MRFSS); data obtained from the Pacific States Marine Fisheries Commission website.
2. No estimates are available from 1990 through 1992 or for January and February of 1995. Estimates for 2001 are preliminary. Northern California CPFVs were not fully sampled because of refusals.
3. Catch estimates do not include fish that were caught and released alive; they only include fish that were harvested.
4. From 1986 to 1989, individual catch estimates were not made for the man-made structures mode or the beach and bank mode. Instead, a single estimate was made for these shore modes.

Table 14.4. Recreational commercial passenger fishing vessel (CPFV) landings (number of fish) as reported on CPFV Logbooks for California halibut, 1947-2001

Year	Number of fish	Year	Number of fish	Year	Number of fish	Year	Number of fish
1947	104,436	**1961**	108,011	**1975**	9,118	**1989**	9,116
1948	143,462	**1962**	118,966	**1976**	10,075	**1990**	6,658
1949	104,639	**1963**	125,669	**1977**	6,982	**1991**	5,984
1950	85,935	**1964**	141,465	**1978**	5,409	**1992**	4,341
1951	59,295	**1965**	118,213	**1979**	6,329	**1993**	5,335
1952	34,158	**1966**	88,726	**1980**	6,517	**1994**	7,549
1953	34,292	**1967**	63,582	**1981**	11,440	**1995**	19,345
1954	59,674	**1968**	54,663	**1982**	11,804	**1996**	19,092
1955	35,802	**1969**	27,634	**1983**	5,682	**1997**	15,846
1956	21,661	**1970**	29,968	**1984**	3,209	**1998**	12,191
1957	10,795	**1971**	10,598	**1985**	7,090	**1999**	14,339
1958	16,192	**1972**	8,140	**1986**	7,848	**2000**	15,865
1959	25,365	**1973**	9,622	**1987**	7,560	**2001**	20,637
1960	48,310	**1974**	10,292	**1988**	11,501		

------ Landings data not available.

1. Data sources: DFG Catch Bulletins (1947-1978) and DFG Annual Reports of Statewide Fish Landings By The Commercial Passenger Fishing Vessels (CPFV) Fleet (1979-2001).
2. Logbooks have been required for southern California, including fish taken in Mexican waters and landed in California, for the entire time period reported here. Logbooks were required for central and northern California from 1957 to present.
3. The data are number of fish reported on logbooks submitted to DFG.