

## 19 Petrale Sole, *Eopsetta jordani*



Petrале Sole, *Eopsetta jordani*. Photo credit: Department archives.

### History of the Fishery

Petrале sole (*Eopsetta jordani*) is a larger flatfish found throughout the state of California and it is among the most valuable commercial flatfish species. Because they are caught in deep, offshore waters, the fishery has remained almost entirely commercial. Historically, petrale sole landings have been documented in California as far back as the late 1800s, with official documentation beginning in 1916. In early records from 1916-1931, petrale sole was recorded as “sole” which was an aggregate category additionally composed of English sole, rex sole, Dover sole and, to a lesser extent, with rock sole, sand sole, and other various flatfish species. During this period, average “sole” landings averaged 8.0 million pounds (3629 metric tons) per year. The California Department of Fish and Wildlife (Department) estimated that petrale sole comprised approximately 20 percent or 1.6 million pounds (726 metric tons) per year of the entire “sole” landings. Trawl gear dominated the entire composition of flatfish landings during this time period, and the majority were landed from San Francisco north to the California/Oregon border.

Beginning in 1931, petrale sole was officially recorded under an individual market category so that more accurate accounting of total individual harvest was possible. Despite high landings throughout most of the mid 1900s with a peak of almost 5.1 million pounds (2310 metric tons) in 1948, the fishery has landed 2 million pounds (907 metric tons) or less each year since 1980 (Figure 19-1).

From 1990-2009, annual landings of petrale sole had an average ex-vessel value of \$1.2 million followed by an annual drop in 2010 and 2011 (due to regulation changes—see Management Considerations section below) to an ex-vessel value of \$557,350 and \$534,500, respectively (Figure 19-2).

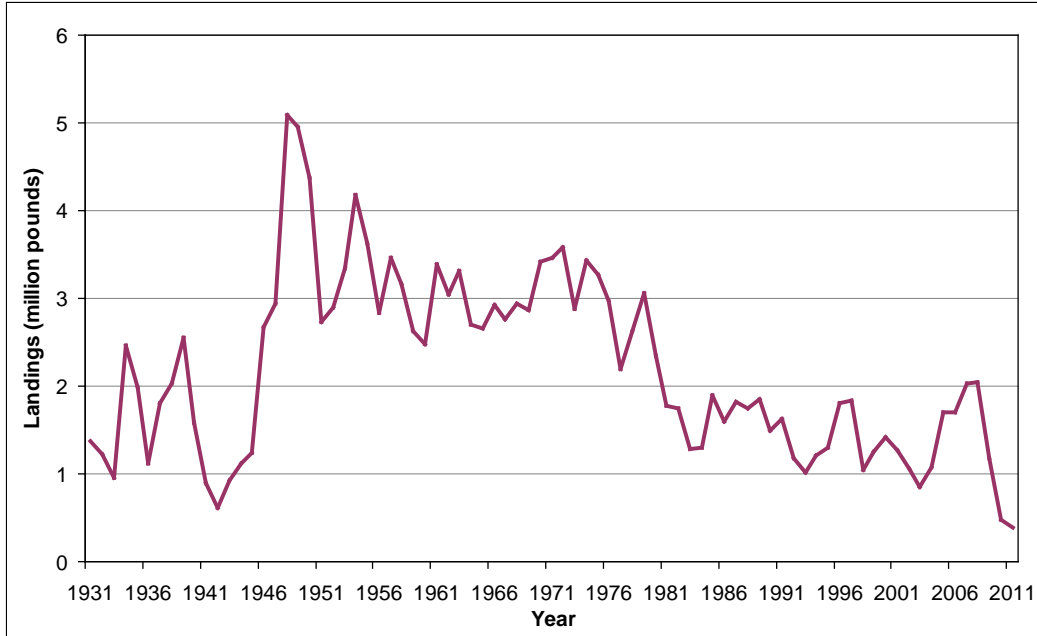


Figure 19-1. Petrale sole commercial landings, 1931-2011. Data source: Department catch bulletins (1931-1968) and Commercial Fisheries Information System (CFIS) data (1969-2011), all gear types combined. Data prior to 1931 are not available.

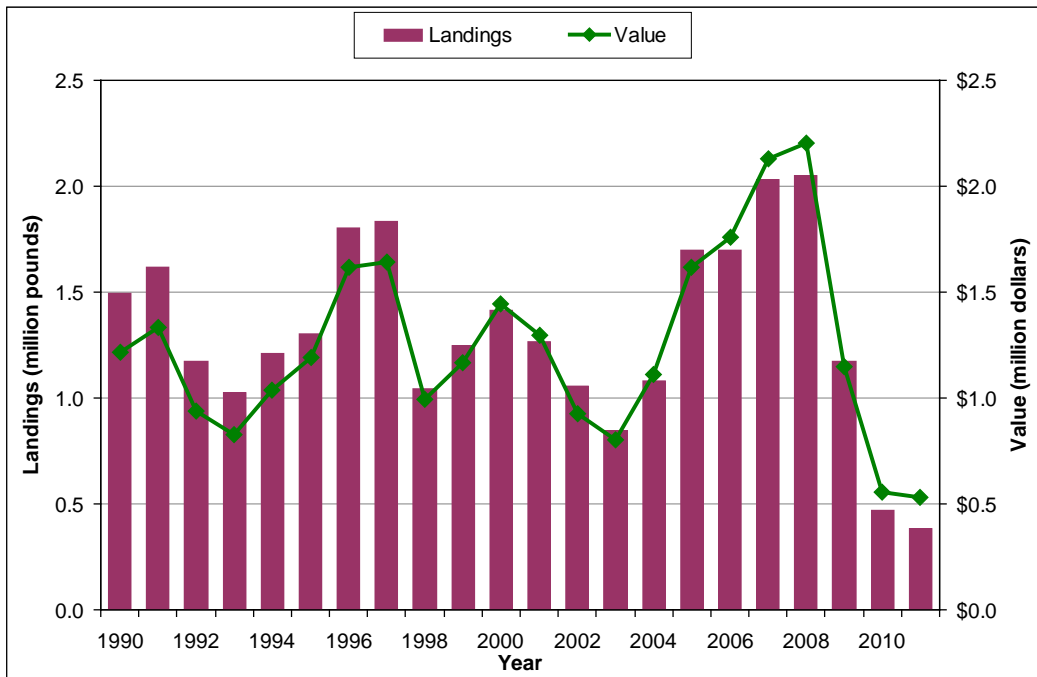


Figure 19-2. Petrale sole commercial landings and value, 1990-2011. Data source: CFIS data, all gear types combined.

Petrale sole is primarily trawl-caught, with 98 percent taken using trawl gear since 1990. From 1990-2011, a significant shift occurred in the composition of the trawl fleet which

affected the catch-per-unit-effort (CPUE). The CPUE, measured by average landings per trip, has significantly increased since 2004 (Figure 19-3) as a result of multiple factors. These factors included: federal government buy back programs, continued restrictions on the entire groundfish fishery, higher fuel expenses, and the development of the federal trawl Individual Fishing Quota (IFQ) program that was implemented via Amendment 20 of the Federal Groundfish Fishery Management Plan (Groundfish FMP) (see Groundfish Highlight section in this report). The result is a more efficient fleet that has fewer vessels landing the same if not slightly more pounds than previous years, except for 2010 and 2011 when fishing regulations were severely constrained due to stock decline (see Management Considerations section below).

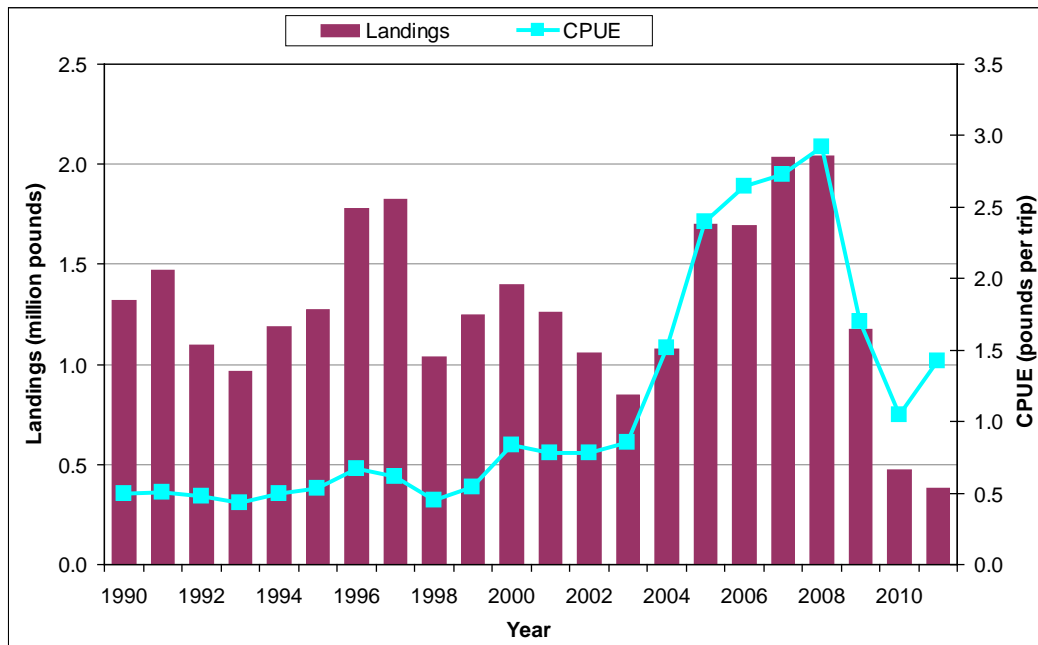


Figure 19-3. Petrale sole commercial trawl landings and CPUE, 1990-2011. Data source: CFIS data.

This fishery is characterized by strong winter and summer seasonality. During winter months, petrale sole aggregate in deep water for spawning and the trawl fleet harvests greater volume with less landings of associated groundfish species (such as chilipepper rockfish). Conversely, during spring and summer, petrale sole are found in shallower water. At this time they are spread out over the continental shelf where they are harvested with a large mixture of various rockfish species. Petrale sole are commonly caught with sablefish, Dover sole and other flatfishes throughout the year.

During the last decade, the majority of petrale sole were landed in the Eureka port complex, followed by the San Francisco and Fort Bragg port complexes (Figure 19-4). In Southern California, (south of Point Conception), petrale sole landings are minimal and do not amount to more than a few thousand pounds per year.

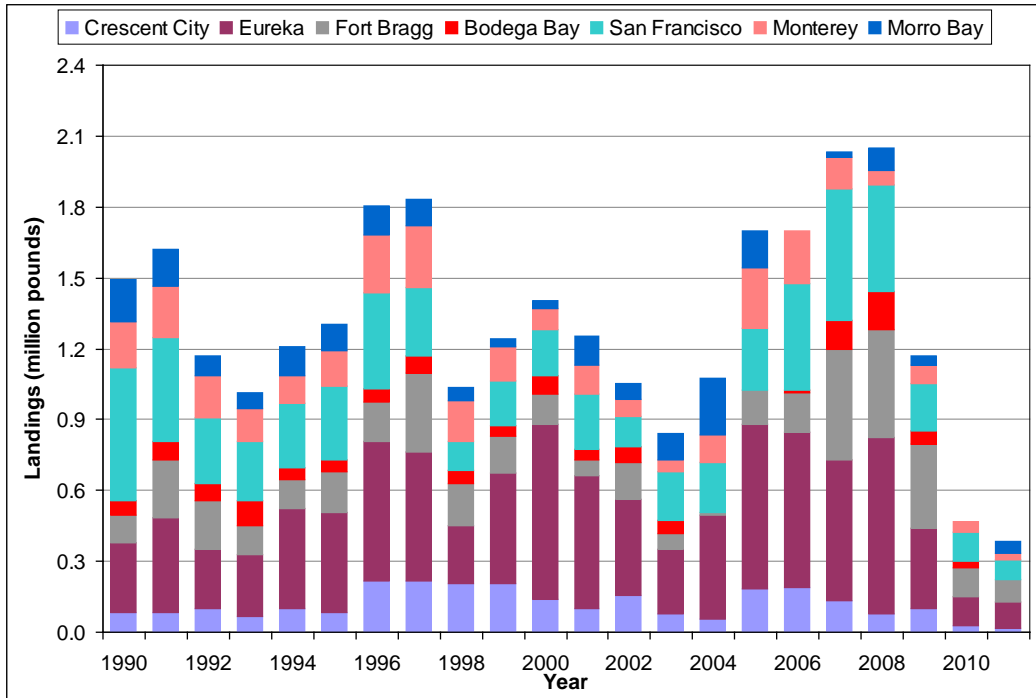


Figure 19-4. Petrale sole commercial landings by port, 1990-2011. Data source: CFIS data, all gear types combined.

Estimates of recreational catch were generated by the Marine Recreational Fisheries Statistics Survey (MRFSS) from 1981 to 1989 and from 1993 to 2003. From 2004 to the present, catch estimates are produced by the California Recreational Fisheries Survey (CRFS), which benefits from an improved sampling design. Both surveys rely on an angler-intercept method to determine species composition and catch rates, coupled with a telephone survey to estimate fishing effort. Though similar methodology in general was used for each, the two sampling designs are sufficiently different that catch estimates generated from MRFSS and CRFS are not considered comparable and will be provided in separate graphs and tables below.

Petrale sole is a very minor component of the recreational fishery. It is not a targeted species, but it is taken while fishing for other species such as rockfishes and other bottomfish. A review of the Marine Recreational Fisheries Statistical Survey (MRFSS) data (Figure 19-5) shows estimated annual recreational petrale sole catch averaged 3477 fish. Recent recreational data collected by the California Recreational Fisheries Survey (2004-2011) shows that since 2004 the petrale sole recreational catch averaged 685 fish annually (Figure 19-6). The recent decline in petrale sole catch is likely due to increased restrictions on recreational catch, including implementation of the Rockfish Conservation Areas that limit the depths at which recreational anglers can fish for bottomfish, including petrale sole. Depth restrictions vary by region, ranging from 20-60 fathoms (37-110 meters).

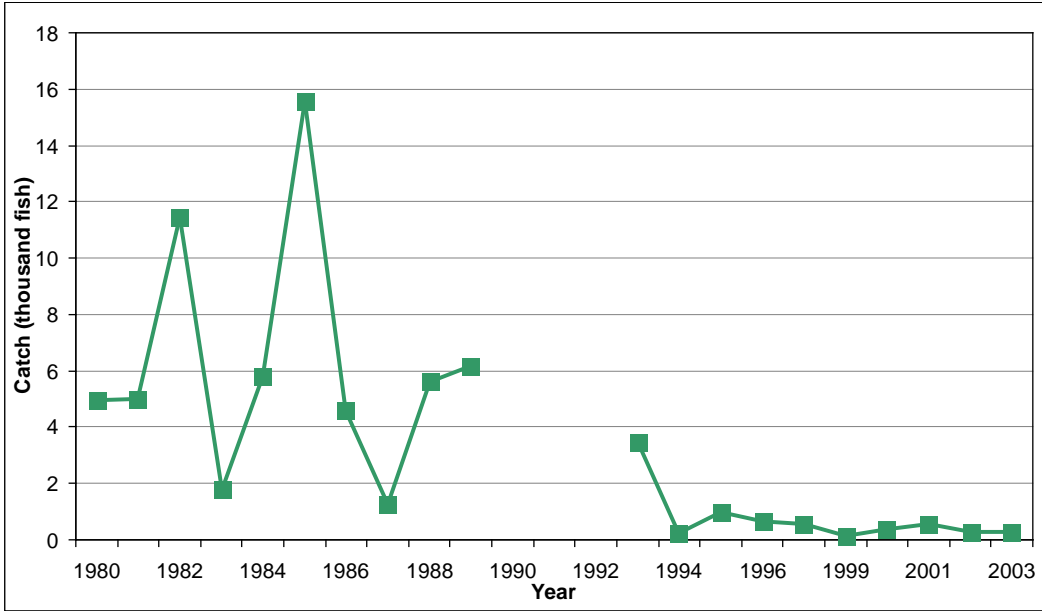


Figure 19-5. Petrale sole recreational catch, 1980-2003. Data source: MRFSS data, all fishing modes and gear types combined. Data for 1990-1992 are not available.

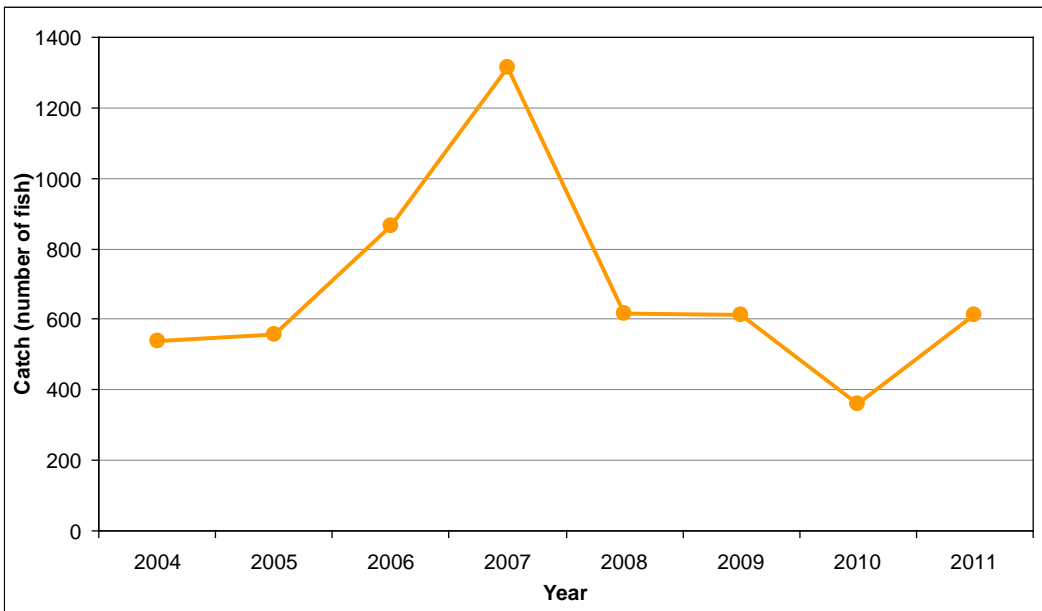


Figure 19-6. Petrale sole recreational catch, 2004-2011. Data source: CRFS data, all fishing modes and gear types combined.

### Status of the Biological Knowledge

Petrale sole, a right-eyed and large-mouthed flatfish, are distributed from the western Gulf of Alaska to northern Baja California, Mexico. Planktonic larvae are found in water depths up to 295 feet (90 meters), ranging in size from approximately 0.12-0.79 inches

(3-20 millimeters), and begin settling in spring and fall. Females grow larger than males, and growth and age at maturation can be variable with location and year. Females reach maturity between approximately 11-17 inches (28-44 centimeters) and males reach maturity between approximately 10-15 inches (26-39 centimeters), when both sexes range between 4-8 years of age. Petrale sole can reach a maximum length of 28 inches (70 centimeters) and can live up to 25 years. Petrale sole are found over sandy or muddy bottom and spawn in deep water ranging from 890-1500 feet (270-460 meters) during winter, and then they return to shallower water during summer. They have a diverse diet which begins, as larvae or juveniles, with a variety of invertebrates such as amphipods and shrimp, transitioning to larger invertebrates (crabs, octopi, squid) and fishes (anchovy, herring, small rockfish) as they grow into adults. In turn, they are preyed upon by larger fishes, marine mammals, and sharks.

### **Status of the Population**

Because of the economic and biological importance of petrale sole, periodic stock assessments are conducted by NOAA Fisheries Service scientists. In 2009, the Pacific Fishery Management Council (PFMC) adopted a new full stock assessment for one stock along the Pacific west coast of Washington, Oregon, and California. The outcome indicated the stock was at 11.6 percent of its unfished biomass, and was officially declared “overfished” (under NOAA Fisheries Service newly revised reference point for flatfish of 12.5 percent of unfished biomass). The most recent assessment (2010) included CPUE data from the winter trawl fisheries and accounted for a strong 2007 recruitment; a more optimistic stock status was the result at 18 percent of the unfished biomass.

### **Management Considerations**

Current management of petrale sole is largely driven by the stock status. As a result of the “overfished” status of the 2009 stock assessment, the Council recommended immediate action to decrease the fishing pressure on petrale sole in the 2010 season by limiting access to winter fishing grounds and reducing trip limits. The effect of reducing trip limits led to a 60 percent decrease in petrale sole landings and a 51 percent decrease in ex-vessel value from 2009 to 2010, a trend that continued into 2011 (Figure 19-2). To offset this lost opportunity, the PFMC also recommended increased trip limits for other healthy, actively managed groundfish species such as sablefish, longspine and shortspine thornyheads, slope rockfishes and Dover sole, in an attempt to balance some of the petrale sole losses. This restriction on petrale sole continued into 2011 based on the outcome of the results of the 2010 stock assessment. The fishery continues to be constrained to allow the stock to fully rebuild, although the 2010 assessment had an improved outlook. An additional benefit to the fishery was the implementation of the federal trawl fishery IFQ program which began in 2011. As anticipated from this program, establishing trawl allocation limits in combination with 100 percent observer coverage enabled all trawl-caught groundfish species to stay within established catch limits.

All groundfish stocks declared overfished are held to a standard of 10 years to rebuild and require strict management measures in both state and federal waters, including conservative annual catch limits, to achieving the rebuilding goal. Because petrale sole grow relatively quickly and reach maturity at a young age, the recommended management changes coupled with a more optimistic stock assessment outcome project petrale sole to be fully rebuilt by 2016, well within the 10 year goal.

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**Further Reading**

Allen L, Pondella II DJ, Horn MH. 2006. p 179-182. *The Ecology of Marine Fishes*. Berkeley (CA): University of California Press.

Haltuch MA, Hicks AC. 2009. Status of the U.S. petrale sole resource in 2008. 309 p. Available from: <http://www.pcouncil.org/groundfish/stock-assessments/>.

Haltuch MA, Hicks AC, See K. 2011. Status of the U.S. petrale sole resource in 2010. 389 p. Available from: <http://www.pcouncil.org/groundfish/stock-assessments/>.

Love MS. 2011. *Certainly more than you want to know about the fishes of the Pacific coast*. p 565-566. Santa Barbara (CA): Really Big Press.

<b>Petrale sole commercial landings, 1931-1989</b>					
<b>Year</b>	<b>Pounds</b>	<b>Year</b>	<b>Pounds</b>	<b>Year</b>	<b>Pounds</b>
1931	1,375,353	1951	2,726,304	1971	3,468,973
1932	1,227,223	1952	2,893,619	1972	3,575,245
1933	953,424	1953	3,350,163	1973	2,876,989
1934	2,456,989	1954	4,171,901	1974	3,430,685
1935	1,988,325	1955	3,619,530	1975	3,269,998
1936	1,126,527	1956	2,830,158	1976	2,977,557
1937	1,802,721	1957	3,456,709	1977	2,200,713
1938	2,026,166	1958	3,157,678	1978	2,634,039
1939	2,558,461	1959	2,632,451	1979	3,061,802
1940	1,575,489	1960	2,475,661	1980	2,350,504
1941	893,426	1961	3,390,739	1981	1,775,031
1942	611,580	1962	3,041,164	1982	1,745,597
1943	918,925	1963	3,317,948	1983	1,287,243

<b>Petrale sole commercial landings, 1931-1989</b>					
<b>Year</b>	<b>Pounds</b>	<b>Year</b>	<b>Pounds</b>	<b>Year</b>	<b>Pounds</b>
<b>1944</b>	1,123,986	<b>1964</b>	2,697,670	<b>1984</b>	1,301,895
<b>1945</b>	1,232,801	<b>1965</b>	2,662,257	<b>1985</b>	1,888,385
<b>1946</b>	2,666,285	<b>1966</b>	2,927,190	<b>1986</b>	1,600,379
<b>1947</b>	2,947,177	<b>1967</b>	2,768,537	<b>1987</b>	1,815,848
<b>1948</b>	5,089,684	<b>1968</b>	2,946,605	<b>1988</b>	1,752,935
<b>1949</b>	4,952,156	<b>1969</b>	2,866,769	<b>1989</b>	1,853,223
<b>1950</b>	4,366,598	<b>1970</b>	3,415,708		

Data source: Department catch bulletins (1931-1968), CFIS data (1969-1989), all gear types combined. Data prior to 1931 are not available.

<b>Petrale sole commercial landings and value, 1990-2011.</b>					
<b>Year</b>	<b>Pounds</b>	<b>Value</b>	<b>Year</b>	<b>Pounds</b>	<b>Value</b>
<b>1990</b>	1,495,649	\$1,215,895	<b>2001</b>	1,266,702	\$1,294,250
<b>1991</b>	1,620,124	\$1,331,758	<b>2002</b>	1,055,574	\$925,658
<b>1992</b>	1,172,949	\$936,961	<b>2003</b>	843,418	\$804,247
<b>1993</b>	1,021,859	\$825,470	<b>2004</b>	1,080,285	\$1,109,432
<b>1994</b>	1,211,845	\$1,037,028	<b>2005</b>	1,700,169	\$1,619,795
<b>1995</b>	1,305,154	\$1,192,797	<b>2006</b>	1,700,151	\$1,761,209
<b>1996</b>	1,803,639	\$1,614,530	<b>2007</b>	2,031,027	\$2,132,347
<b>1997</b>	1,836,090	\$1,639,034	<b>2008</b>	2,048,686	\$2,204,953
<b>1998</b>	1,042,122	\$995,772	<b>2009</b>	1,172,154	\$1,145,958
<b>1999</b>	1,247,391	\$1,164,994	<b>2010</b>	470,348	\$557,352
<b>2000</b>	1,411,037	\$1,444,220	<b>2011</b>	383,328	\$533,556

Data source: CFIS data, all gear types combined.

<b>Petrale sole commercial landings (pounds) by port area, 1990-2011.</b>									
<b>Year</b>	<b>Crescent City</b>	<b>Eureka</b>	<b>Fort Bragg</b>	<b>Bodega Bay</b>	<b>San Francisco</b>	<b>Monterey</b>	<b>Morro Bay</b>	<b>Southern California</b>	<b>Statewide total</b>
<b>1990</b>	86,167	291,535	117,610	62,963	563,663	190,991	179,857	2,864	1,495,649
<b>1991</b>	85,326	398,446	245,350	75,840	443,455	218,751	150,656	2,301	1,620,124
<b>1992</b>	97,810	252,299	208,754	72,089	277,634	178,513	83,750	2,101	1,172,949
<b>1993</b>	65,489	264,076	121,612	104,410	250,632	137,816	71,306	6,519	1,021,859
<b>1994</b>	98,528	423,903	120,831	52,820	272,832	116,334	121,987	4,609	1,211,845



**Petrale sole commercial landings (pounds) by port area, 1990-2011.**

<b>Year</b>	<b>Crescent City</b>	<b>Eureka</b>	<b>Fort Bragg</b>	<b>Bodega Bay</b>	<b>San Francisco</b>	<b>Monterey</b>	<b>Morro Bay</b>	<b>Southern California</b>	<b>Statewide total</b>
1995	84,544	419,402	175,326	50,959	309,244	152,124	112,177	1,377	1,305,154
1996	216,782	591,510	166,701	55,481	404,386	245,568	121,012	2,199	1,803,639
1997	218,789	546,344	330,459	75,689	290,202	258,513	111,854	4,240	1,836,090
1998	207,474	244,657	179,686	54,728	123,294	168,013	59,849	4,422	1,042,122
1999	208,254	463,631	156,631	46,129	188,514	145,379	35,715	3,139	1,247,391
2000	141,691	736,028	128,940	78,980	192,325	93,564	34,035	5,475	1,411,037
2001	99,575	562,685	67,508	45,649	230,384	124,921	124,508	11,472	1,266,702
2002	153,760	410,613	154,547	64,664	129,024	73,752	67,223	1,991	1,055,574
2003	79,696	273,679	63,382	58,027	202,828	53,381	110,958	1,466	843,418
2004	55,775	438,031	13,287	173	211,161	119,309	239,338	3,211	1,080,285
2005	182,862	699,371	141,168	834	264,692	251,406	159,745	90	1,700,169
2006	188,018	660,462	162,769	15,571	449,746	221,389	2,167	29	1,700,151
2007	132,879	598,832	464,265	123,532	558,127	130,455	22,837	99	2,031,027
2008	80,047	746,347	452,961	164,918	448,090	62,560	92,750	1,013	2,048,686
2009	101,806	339,322	356,219	52,424	203,350	76,354	42,651	27	1,172,154
2010	25,867	121,980	124,291	29,191	124,289	44,370	39	321	470,348
2011	15,067	112,842	96,139	882	79,383	30,045	48,525	205	383,088

Data source: CFIS data, all gear types combined.

<b>Petrale sole recreational catch, 1980-2003.</b>			
<b>Year</b>	<b>Number of fish</b>	<b>Year</b>	<b>Number of fish</b>
1980	4,970	1992	---
1981	4,988	1993	3,437
1982	11,455	1994	217
1983	1,766	1995	977
1984	5,794	1996	665
1985	15,560	1997	542
1986	4,582	1999	145
1987	1,245	2000	351
1988	5,609	2001	547
1989	6,161	2002	274
1990	---	2003	273
1991	---		

Data source: MRFSS data, all fishing modes and gear types combined. Data for 1990-1992 are not available.

<b>Petrale sole recreational catch, 2004-2011.</b>			
<b>Year</b>	<b>Number of fish</b>	<b>Year</b>	<b>Number of fish</b>
2004	538	2008	616
2005	558	2009	613
2006	867	2010	361
2007	1,315	2011	612

Data source: CRFS data, all fishing modes and gear types combined.