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Economic Impact of the Commercial Fisheries on Local County Economies from Catch in the Cordell Bank National Marine Sanctuary 2010, 2011 and 2012

U.S. Department of Commerce
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A fishing vessel in the Cordell Bank National Marine Sanctuary. (photo: Cordell Bank National Marine Sanctuary)

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Abstract

This report estimates the economic impact of commercial fishing within the Cordell Bank National Marine Sanctuary (CBNMS) according to the California Ocean Fish Harvester Economic Model. The methodology applies county multipliers to estimates of harvest revenue from the CBNMS in order to calculate output, income, value added and employment. This report also describes a profile of the commercial fish industry in the CBNMS. In addition, this report explores special issues related to trends in groundfish and "Longlines" catch. Special issues represent specific requests from sanctuary management for queries of the data.

The three-year average for 2010 to 2012 finds that landings of commercial fishing catch from CBNMS generated $992,875 in harvest revenue, $1,669,133 in output, $1,040,106 in value added, $929,023 in total income and 48 full- and part-time jobs across seven counties. During the study period harvest revenue demonstrated a consistent decline, ranging from $1,444,174 in 2010 to $757,258 in 2012. The top five species/species groups caught in CBNMS were *Dungeness Crab*, *Salmon*, *Dover Sole-Thorneyheads-Sablefish Trawl*, *Sablefish Non-Trawl*, and *Other Flatfish*. These top five species/species group accounted for over 95% of all CBNMS landings in 2012. In 2012, the gear types associated with highest percent of total value include "Pots & Traps," "Troll," "Trawl," "Longlines" and "Other Seine – Dip Net." The top four ports where catch from the CBNMS was landed are Bodega Bay, Fort Bragg, Princeton-Half Moon and San Francisco. None of these four ports was highly dependent on the sanctuary for their total port landings. CBNMS accounted for a high of 3.30% of total value at Bodega Bay and a low of .45% at Princeton-Half Moon.

Key Words

Economic impact, income, jobs, commercial fishing, harvest revenue, California, output, multiplier, groundfish, longlines

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Introduction

This report is part of the Socioeconomic Research and Monitoring Program for the Cordell Bank National Marine Sanctuary (CBNMS). Socioeconomic priorities were established for all West Coast Region (WCR) sanctuaries in the *Office of National Marine Sanctuaries West Coast Region Socioeconomic Plan FY2013 – FY2014* (Office of National Marine Sanctuaries 2012). This report also supports a "*National*" Office of National Marine Sanctuaries (ONMS) priority to document the connection between national marine sanctuary resource uses and local, regional and national economies.

This report addresses the commercial fisheries in the CBNMS. California Fishery Information System (CFIS) from the California Department of Fish and Wildlife (CDFW) provides data for estimates of how much California commercial catch landed at California ports comes from the CBNMS. Data presented here is from years 2000 through 2012. For estimating economic impacts on local county economies, the California Ocean Fish Harvester Economic (COFHE) Model was used (Hackett et al. 2009).

Economic impact here is limited to the impacts of commercial fishing operations and the multiplier impacts from the spending in conducting their fishing operations. The estimates underestimate the total economic impact because the COFHE Model used here did not include the processing, wholesaling, retail and restaurant market channels and market markups of the fish landed in each county. Only the costs of production from commercial fishing operations was included and the associated indirect and induced economic impacts (i.e. the ripple or multiplier impacts) of this spending. Although information on market channels and market-markups are presented in Hackett et al (2009), the information was not available at the county level to include in the COFHE Model.

The economic impacts estimated here relative to the "full" economic impacts will vary greatly by fishery and county of landings. For fisheries characterized by little processing, wholesaling, local retail sales and local restaurant sales, the differences will be small. In these cases, most of the landings are exported out of the county with little added value locally. Estimating the market channels and market mark-ups by county should be a high priority for the next version of the COFHE Model. In the peer review of this document, one of the authors in Hackett et al (2009) argued that the COFHE Model was designed to estimate the impacts of management strategies and regulations and the effects on processing, wholesaling, retail and restaurant markets would be minimal since these sectors can easily substitute lost catch from other places and therefore there would be little, if any, impacts on local economies. The reviewer also admitted that this might be less true for some processors.

In Leeworthy et al, 2005, the Fishery Economic Assessment Model (FEAM) developed by the Pacific Fishery Management Council (PFMC 1999) was used to estimate the potential economic impacts of the network of marine reserves (no-take areas) in the Channel Islands National Marine Sanctuary (CINMS). FEAM multipliers were very similar to the COFHE Model's in that the IMPLAN input-output model was used to derive multipliers defined in terms of income to harvest revenues. The FEAM multipliers were only done for income in each county by

species/species groups instead of OCs as in the COFHE Model and the FEAM multipliers included all market channels (e.g. processing, wholesaling, retailing and restaurant sales). In 1998, the CINMS multipliers for income to harvest revenue (ratio of income generated at all market levels divided by harvest revenue) ranged from 1.2 for most *Finfish* to 4.5 for *Market Squid*, while for *Crab* it was 2.8. The overall average was about 3.1, which was heavily influenced by *Market Squid* which accounted for 59% of CINMS harvest revenue. In comparison, the COFHE Model income multipliers for CINMS averaged about 1.00 for years 2010 through 2012. So the total economic impact could be three times higher than was estimated here using the COFHE Model for the CINMS. We don't have the FEAM multipliers for the other ONMS sites in California, but given the dominance of *Market Squid* and *Dungeness crab* in MBNMS, the total economic impact for MBNMS could also be about three times higher than estimated here. For CBNMS and GFNMS, which are more dominated by *Finfish* catch, the multipliers for total economic impact are likely lower, probably less than 2.0, so the estimates of total economic impact for these sanctuaries could be double that estimated here for total income generated.

Chapter 1 provides the results of applying the COFHE Model to landings from the CBNMS. Harvest revenue (what the fishermen receive when they land their catch at various California ports) is converted to estimates of total output, value added, income and employment (measured in number of full and part-time jobs) using the multipliers in the COFHE Model for each county. Results are presented for years 2010, 2011, 2012 and the three-year average. Details of the COFHE Model are presented in a separate technical appendix report (Leeworthy et al. 2013).

Chapter 2 provides a profile of commercial fisheries in CBNMS. Profile elements include: distribution of catch (pounds and value or harvest revenue converted to 2013 dollars using the consumer price index) for year 2012 by species/species groups; trends in catch for the top five species/species groups for years 2000 through 2012; catch by gear type for years 2010, 2011 and 2012; port dependence on catch from CBNMS (i.e. the percent of total harvested fish landings at the port from CBNMS); and fishing vessel dependence on their catch from the CBNMS (i.e. catch from the CBNMS catch as a percent of total fishing revenues from all California waters).

Chapter 3 is devoted to "Special Issues." Sanctuary management submitted several requests for special views of the commercial fishing catch from the CBNMS to support management efforts. Here, CBNMS management requested special tabulations for the species group groundfish and gear type "Longlines."

Chapter 1: Economic Impacts of the Commercial Fishing Catch in the CBNMS

To obtain estimates of the commercial catch from CBNMS the first step is to define the "best" spatial area from the CDFW-CFIS that "best" approximates the area within the CBNMS. CDFW-CFIS maintains commercial landings by where the fish is caught and where it is landed. 10-minute by 10-minute blocks (100 nautical square mile cells) describe where the fish is caught. Latitude and longitude coordinates define these blocks. Figure 1.1 shows the overlay of CBNMS boundaries on the CDFW-CFIS blocks. Each block has a three digit database code. Table 1.1 shows the five blocks included in our definition of CBNMS.

Figure 1.1. Definition of CBNMS using CDFW-CFIS Blocks

Table 1.1. Definition of the CBNMS using CDFW-CFIS Blocks

Sanctuary/Full or Partial Blocks	CDFW-CFIS 10-minute by 10-minute Blocks[1]
CBNMS (5)	
Full Blocks (2)	440, 441
Partial Blocks (3)	432, 442, 451

For where the catch is landed, catch is reported by port where landed. CDFW-CFIS also provides documentation for county location of each port, so landings can be summarized by port and county where landed. This is important for economic impact analysis since the multipliers in the COFHE Model are county multipliers.

Operational Categories

The COFHE Model is based on organizing the fisheries into 20 operational categories (OCs). OCs are either based on gear types or a combination of gear types and species. Each OC has a different production function (i.e. production input combinations such as gear, labor, fuel, bait, ice, etc.). Some OCs, such as "Salmon & Dungeness crab" and "Dungeness crab," are differentiated by vessel size (length). Table 1.2 lists the 20 OCs in the COFHE Model. Details on the harvest revenue by OC and the associated multipliers by county for translating harvest revenue into estimates of output, value added, income and employment by county are in the technical appendix report (Leeworthy et al. 2013). However, not all catch is included in the 20 OCs. Thus, economic impacts are slightly under estimated. In 2012, 0.11% was not included. In addition, small amounts of catch from CBNMS were landed at far distant ports. These amounts were also excluded from this analysis.

Table 1.2. Operational Categories for the COFHE Model

Number	Operational Category
1	Trawl - Northern California
2	Trawl - Southern California
3	CPS Seine
4	Herring Gillnet
5	Other Gillnet
6	Salmon
7	Salmon & Albacore
8	Salmon & Dungeness Crab - Small Vessels
9	Salmon & Dungeness Crab - Mid to Large Vessels
10	Dungeness Crab - Small Vessels
11	Dungeness Crab - Mid to Large Vessels
12	Longline
13	Harpoon - Spear
14	Hook & Line
15	Hook & Line - Live
16	Lobster & Crab
17	Nearshore & Groundfish Trap
18	Prawn Trap
19	Sea Urchin
20	Tuna - Other Seine

Source: Hackett et al, 2009.

Definitions of Terms (Adapted from Hackett et al. 2009)

Harvest Revenue: What fishermen receive when they land their catch at various CA ports.

Output: Total industry production, equal to shipments plus net additions to inventory.

Value Added: The value added during production to all purchased intermediate goods and services. This is equal to employee compensation plus proprietor's income plus other property income plus indirect business taxes.

Total Income: Sum of employee compensation, proprietor's income, corporate income, rental income, interest and corporate transfer payments.

Employment: Full- and part-time jobs.

Results

The COFHE Model was used to estimate the economic impact by county of harvest revenue from the CBNMS for years 2010, 2011, 2012 and the three-year average. This was done due to volatile fluctuation in some influential fisheries from year to year (see trends of top five species/species groups in Chapter 2).

Catch from the CBNMS was landed at 29 ports in seven counties in years 2010 to 2012 (Tables 1.3, 1.4, 1.5 and 1.6). All indicators for economic impact on local county economies show a steady decline over the study period. In 2010, about $1.44 million was harvested by the 20 OCs from CBNMS, which generated more than $2.44 million in total output, $1.59 million in value added, $1.43 million in income and 62 full- and part-time jobs in the seven counties (Table 1.3).

Table 1.3. Economic Impact on Local County Economies from Commercial Fishing in the CBNMS, 2010 (2013 $)

County	Harvest Revenue	Output	Value Added	Total Income	Employment[1]
Alameda	3,876	6,884	4,153	3,694	0.08
Contra Costa	0	0	0	0	0.00
Marin	1,046	1,594	753	623	0.05
Mendocino	2,955	4,463	2,360	2,054	0.18
San Francisco	449,861	720,644	498,927	452,722	8.85
San Mateo	42,943	69,735	55,808	52,579	0.58
Sonoma	943,493	1,646,551	1,031,855	919,971	51.79
Total	*1,444,174*	*2,449,871*	*1,593,857*	*1,431,643*	*62*

1. Number of full- and part-time jobs.

In 2011, harvest revenue decreased to just over $777 thousand in the 20 OCs from CBNMS. This generated almost $1.3 million in output, over $780 thousand in value added, $695 thousand in income and 45 full- and part-time jobs (Table 1.4).

Table 1.4. Economic Impact on Local County Economies from Commercial Fishing in the CBNMS, 2011 (2013 $)

County	Harvest Revenue	Output	Value Added	Total Income	Employment[1]
Alameda	9,623	15,028	1,148	913	0.73
Contra Costa	23,233	38,645	14,605	11,518	10.16
Marin	2,985	4,453	1,674	1,291	1.23
Mendocino	163,858	249,455	162,263	146,613	5.51
San Francisco	100,029	161,691	96,558	85,156	4.16
San Mateo	64,474	104,534	70,913	64,989	2.82
Sonoma	412,992	724,377	433,630	384,594	20.32
Total	*777,194*	*1,298,182*	*780,793*	*695,075*	*45*

1. Number of full- and part-time jobs.

In 2012, harvest revenue from the 20 OCs in CBNMS decreased again. Harvest revenue was over $757 thousand, which generated almost $1.26 million in output, over $745 thousand in value added, $660 thousand in income and 36 fell- and part-time jobs in the seven counties (Table 1.5).

Table 1.5. Economic Impact on Local County Economies from Commercial Fishing in the CBNMS, 2012 (2013 $)

County	Harvest Revenue	Output	Value Added	Total Income	Employment[1]
Alameda	2,690	4,667	2,015	1,663	0.48
Contra Costa	6,028	9,906	5,374	4,633	1.05
Marin	18,689	28,358	12,936	10,789	2.45
Mendocino	107,713	161,343	96,325	85,027	4.76
San Francisco	158,801	254,695	160,904	143,905	5.94
San Mateo	70,392	114,317	75,776	68,842	2.27
Sonoma	392,945	686,057	392,501	345,491	19.42
Total[2]	*757,258*	*1,259,344*	*745,832*	*660,350*	*36*

1. Number of full- and part-time jobs.
2. $840 not included from Sonoma because it did not map into one of the 20 OCs in the COFHE Model

The three-year average was almost $993 thousand in harvest revenue, over $1.66 million in output, $1.04 million in value added, $929 thousand in total income and 48 full- and part-time jobs (Table 1.6).

Table 1.6. Economic Impact on Local County Economies from Commercial Fishing in the CBNMS, 3-year Average 2010, 2011 and 2012 (2013 $)

County	Harvest Revenue	Output	Value Added	Total Income	Employment[1]
Alameda	5,396	8,860	2,439	2,090	0.43
Contra Costa	9,754	16,184	6,660	5,384	3.74
Marin	7,573	11,468	5,121	4,234	1.24
Mendocino	91,509	138,420	86,983	77,898	3.48
San Francisco	236,230	379,010	252,130	227,261	6.32
San Mateo	59,270	96,195	67,499	62,137	1.89
Sonoma	583,143	1,018,995	619,329	550,019	30.51
Total	*992,875*	*1,669,133*	*1,040,160*	*929,023*	*48*

1. Number of full- and part-time jobs.

Most of the economic impact is concentrated in San Francisco and Sonoma counties. For the three-year average, Sonoma County accounted for over 58% of harvest revenue, 61% of output, 59% of value added, 59% of income and 64% of employment. San Francisco County accounted for 23% of harvest revenue, 22% of output, 24% of value added, 24% of income and 13% of employment. Combined the two counties accounted for 96% of harvest revenue, output and value added; 95% of income and 98% of employment.

In 2010, the commercial fisheries directly (and indirectly through the multiplier process) accounted for 0.0007% of total income by place of work and 0.0005% of the total income by place of residence in the seven-county study area. In 2011, the commercial fisheries accounted for 0.0003% of total income by place of work and 0.00024% of total income by place of residence. In terms of employment, the commercial fisheries accounted for 0.0027% of all jobs in 2010 in the seven-county study area and 0.0019% in 2011. For 2012, county estimates of income by place of work and residence are not available to make comparisons. Usually, county estimates of income are lagged by about 18 months (U.S. Department of Commerce, Bureau of Economic Analysis 2013).

By county the percent of income by place of residence from commercial fishing in the CBNMS ranged from a high of .0046% in Mendocino County in 2011 to a low of 0% in Contra Costa County in 2010. Commercial fishing as a percent of total income by place of work ranged from a high of .0086% in Mendocino (2011) county to a low of 0% in Contra Costa County in 2010. Employment accounted for from commercial fishing in the CBNMS ranged from a high of .02% in Sonoma County in 2010 to a low of 0% in Contra Costa in 2010 (Table 1.7).

Table 1.7. Local/Regional Depedence on the CBNMS Fishing Industry, 2010 and 2011

County	Commercial Fishing Income	Commercial Fishing Employment	Income by Place of Residence ($000)	Income by Place of Work ($000)	Total Employment
2010					
Alameda	$3,694	0.08	$72,024,822	$55,762,084	676,047
%			0.000005%	0.000007%	0.000012%
Contra Costa	$0	0.00	$57,700,398	$29,351,680	465,486
%			0.00%	0.00%	0.00%
Marin	$623	0.05	$20,854,466	$9,895,696	122,558
%			0.000003%	0.000006%	0.000040%
Mendocino	$2,054	0.18	$3,049,993	$1,644,157	38,461
%			0.000067%	0.000125%	0.000475%
San Francisco	$452,722	8.85	$55,850,894	$62,256,151	413,291
%			0.000811%	0.000727%	0.002141%
San Mateo	$52,579	0.58	$47,946,507	$35,037,442	342,370
%			0.000110%	0.000150%	0.000169%
Sonoma	$919,971	51.79	$20,975,353	$12,387,049	229,466
%			0.004386%	0.007427%	0.022570%
Total	*$1,431,643*	*61.5*	*$278,402,433*	*$206,334,259*	*2,287,679*
% of Total from Commercial Fishing			*0.00051%*	*0.00069%*	*0.00269%*
2011					
Alameda	$913	0.73	$75,908,145	$57,401,672	686,091
%			0.000001%	0.000002%	0.000106%
Contra Costa	$11,518	10.16	$60,778,675	$30,600,694	473,938
%			0.000019%	0.000038%	0.002144%
Marin	$1,291	1.23	$21,871,623	$10,249,177	126,292
%			0.000006%	0.000013%	0.000973%
Mendocino	$146,613	5.51	$3,170,419	$1,686,462	38,077
%			0.004624%	0.008694%	0.014469%
San Francisco	$85,156	4.16	$60,432,766	$67,017,958	425,479
%			0.000141%	0.000127%	0.000979%
San Mateo	$64,989	2.82	$50,596,839	$36,930,765	353,431
%			0.000128%	0.000176%	0.000797%
Sonoma	$384,594	20.32	$22,126,957	$12,840,293	231,203
%			0.001738%	0.002995%	0.008790%
Total	*$695,075*	*45*	*$294,885,424*	*$216,727,021*	*2,334,511*
% of Total from Commercial Fishing			*0.00024%*	*0.00032%*	*0.00192%*

Source: U.S. Department of Commerce, Bureau of Economic Analysis (BEA) and U.S. Department of Labor, Bureau of Labor Statistics (BLS).

Chapter 2: Profiles of the Commercial Fisheries in the CBNMS

In addition to where catch is caught and landed, CDFW-CFIS database includes vessel and fisherman identification codes for who caught the fish and gear types for how the catch was made.

Catch by Species/Species Groups

Species are identified by three-digit codes. We have combined species into species/species groups. For CBNMS, we originally defined 24 species/species groups, including an *All Other* group. After processing the data, we discovered that some predetermined groups were not significant and placed them in the *All Other* group. In addition, we pulled out species/species groups originally in *All Other* if harvest revenue for the species/species group exceeded $1,000. Ultimately, there are 15 species/species groups, including the *All Other* group, for our analysis in 2012. *All Other* accounted for 0.12% of 2012 harvest revenue in CBNMS (Table 2.1).

Table 2.1. Pounds and Value of Landings from the CBNMS by Species/Species Groups, 2012 (2013 $)

Species/Species Groups	Pounds	Value	Percent of Total Value
Dungeness Crab	114,708	$393,576	51.92%
Salmon	30,017	$196,531	25.92%
Dover Sole-Thornyheads-Sablefish Trawl	14,995	$73,366	9.68%
Sablefish Non-trawl	12,664	$42,928	5.66%
Other Flatfish	13,921	$15,893	2.10%
Shelf Rockfish	22,010	$15,549	2.05%
Coonstriped Shrimp[2]	854	$4,769	0.63%
Rock Crab, Unspecified[2]	1,261	$3,836	0.51%
Deeper Nearshore Rockfish	557	$2,668	0.35%
Tuna	950	$2,303	0.30%
Herring	16,137	$1,636	0.22%
Sanddab	2,932	$1,486	0.20%
Lingcod	1,120	$1,320	0.17%
Slope Rockfish[2]	1,412	$1,288	0.17%
All Other[1]	1,266	$929	0.12%
Total	*234,804*	*$758,078*	*100.00%*

1. Species Groups *CA Halibut , Sharks-Rays not White Shark or Big Skate ,* and *Shallow Nearshore Rockfish* were added to *All Other* for having a value less than $1,000.
2. Species Groups originally in *All Other* that were broken out because their value exceeded $1,000.
Source: California Fishing Information System, California Department of Fish and Wildlife.

In 2012, *Dungeness crab* was the principal species by pounds (114,708) and value ($393,576); representing almost 52% of total value for harvest revenue from the CBNMS. The secondary species was *Salmon*, which represented almost 26% of total value for harvest revenue from the CBNMS. In 2012, over 30 thousand pounds of *Salmon* were harvested at a value of $196 thousand. Other prevalent species include *Dover Sole-Thornyheads-Sablefish Trawl* at $73,366 (9.68%), *Sablefish Non-Trawl* at $42,928 (5.66%), and *Other Flatfish* at $15,893(2.10%). Combined, these top five species accounted for over 95% of total value from CBNMS landings.

Catch by Gear Type and Number of Vessels by Gear Type

The CDFW-CFIS database contains 65 different gear codes. We combined gears into 12 gear types, plus an "All Other" category. If gear code was missing (not recorded) we classified this as "Unspecified." For 2010 to 2012, no landings in CBNMS were recoded as "All Other" or "Unspecified" (Table 2.2).

Throughout the study period, the majority of CBNMS harvest revenue came from "Pots and Traps" for *Dungeness crab.* Although "Pots and Traps" consistently dominates as a percent of total value, the absolute value declines steadily from 2010 to 2012. Conversely, "Troll" has experienced an increase in percent of total value, from 0% in 2010 to almost 26% in 2012. Other gear types vary in percent of total value over the time period. "Longlines" contributed between 4.33% and 14.67% of total value from 2010 to 2012. "Hook and Line" accounted for 2.84% to 7.13% in the same period. From 2011 to 2012, "Other Seine – Dip Net" contributed between 5.31% and 3.78%, while "Set Gill Nets" accounted for 0.22% to 0.26%. In 2012, "Trawl" accounted for 9.68%. "Purse Seine" contributed 2.97% in 2010. However, no landings from CBNMS have been recorded with this gear type since 2010 (Table 2.2).

Over the study period, the number of vessels landing catch from the CBNMS steadily increased. In 2010 there were 35 vessels operating in CBNMS, 57 in 2011, and 76 in 2012. While "Pots and Traps" account for the majority of harvest revenue, the number of vessels using this gear type decreased over the study period. On the other hand trolling and "Hook and Line" vessels steadily increased. Of the 35 vessels operating in CBNMS in 2010, 30 used "Pots & Traps" and three used "Longlines." Of the 57 vessels operating in CBNMS in 2011, 30 used "Troll," 20 used "Pots & Traps," five used "Hook & Line" and three used "Longlines." Of the 76 vessels operating in the CBNMS in 2012, 44 used "Troll," 22 used "Pots & Traps," seven used "Hook & Line" and four used "Longlines." Number of vessels per gear type is only reported here for those gear types with at least three vessels operating in a given year.

Table 2.2. Pounds and Value by Gear Type in CBNMS, 2010 to 2012 (2013 $)

Year/Gear type	Vessels	Value	Percent of Total Value
2010			
Troll	0	0	0.00%
Pots & Traps	30	510,482	66.85%
Longlines	3	29,399	7.68%
Hook & Line	1	22,993	5.82%
Hooka - Diving	0	0	0.00%
Set Gill Nets	0	0	0.00%
Trawl	1	527,071	16.68%
Purse Seine	1	82,196	2.97%
Other Seine - Dip Net	0	0	0.00%
Drift Gill Net	0	0	0.00%
Harpoon / Spear	0	0	0.00%
Unspecified	0	0	0.00%
All Other	0	0	0.00%
Total	*35*	*1,172,141*	*100.00%*
2011			
Troll	30	10,281	8.95%
Pots & Traps	20	172,656	56.67%
Longlines	3	18,488	14.67%
Hook & Line	5	12,791	7.13%
Hooka - Diving	0	0	0.00%
Set Gill Nets	1	448	0.26%
Trawl	2	65,581	7.00%
Purse Seine	0	0	0.00%
Other Seine - Dip Net	1	43,148	5.31%
Drift Gill Net	0	0	0.00%
Harpoon / Spear	0	0	0.00%
Unspecified	0	0	0.00%
All Other	0	0	0.00%
Total	*57*	*323,393*	*100.00%*

Source: California Fishing Information System, California Department of Fish and Wildlife.

Table 2.2. Pounds and Value by Gear Type in CBNMS, 2010 to 2012 (2013 $) (continued)

Year/Gear type	Vessels	Value	Percent of Total Value
2012			
Troll	44	30,132	25.99%
Pots & Traps	22	117,406	53.17%
Longlines	4	11,694	4.33%
Hook & Line	7	5,870	2.84%
Hooka - Diving	0	0	0.00%
Set Gill Nets	1	16,137	0.22%
Trawl	1	14,995	9.68%
Purse Seine	0	0	0.00%
Other Seine - Dip Net	1	38,570	3.78%
Drift Gill Net	0	0	0.00%
Harpoon / Spear	0	0	0.00%
Unspecified	0	0	0.00%
All Other	0	0	0.00%
Total	*76*	*234,804*	*100.00%*

Source: California Fishing Information System, California Department of Fish and Wildlife.

Harvest Revenue Distribution by Number of Vessels

In the commercial fisheries, it is often maintained that 20% of the fishermen catch 80% of the fish i.e. the "20-80" rule. For 2012, we developed a summary view of the distribution of total harvest revenue. In CBNMS 18 of the 76 vessels (23.4%) accounted for 77.95% of the total value of catch, which closely follows the "20-80" rule.

Thus, the distribution of harvest revenue by vessel is skewed. Three vessels (3.9%) account over a third of all harvest revenue, receiving at least $60,000 each. Six vessels (7.8%) account for over half of the total harvest revenue, receiving at least $30,000 each. Alternatively, 45 vessels (58.5%) account for less than 10% of harvest revenue, receiving less than $5,000 each (Table 2.3).

Table 2.3. Vessel Distribution of Harvest Revenue from CBNMS, 2012 (2013 $)

Distribution Range	Number of Vessels	Percent of Vessels	Percent of Harvest Revenue
Greater than $0	76	100.00%	100.00%
Greater than $60,000	3	3.90%	33.80%
Greater than $30,000	6	7.80%	50.62%
Greater than $10,000	18	23.40%	77.95%
Greater than $5,000	31	40.30%	90.83%
Less than $5,000	45	58.50%	9.17%
Less than $1,000	20	26.00%	1.41%

Mean=$9,975; Median=$2,832; Minimum=$203; Maximum=$99,278; sum=$758,078
Source: California Fishing Information System, California Department of Fish and Wildlife.

Vessel Dependence on the CBNMS for Their Total California Fishing Revenues

Another way to analyze harvest revenue distribution is how dependent a vessel is on the CBNMS for their total fishing revenues. We calculated the percent of a vessel's harvest revenue from their CBNMS catch as a percent of all of their catch from all of California. Table 2.4 shows the distribution for year 2012. For all 76 vessels operating in CBNMS in 2012, the total harvest revenue caught in CBNMS was $758,078, which is less than 9% of their aggregate harvest revenue in all California waters. Those vessels in the lower range of harvest revenue distribution, less than $5,000 in harvest revenue, depend on CBNMS for only a small portion of their total revenue (3.34%). Relative to the lower end of the distribution, those vessels on the higher end, receiving greater than $5,000 in harvest revenue, are more dependent on the sanctuary. However, even the most dependent vessels, those receiving $90,000 or more, only attribute about 13.31% of their total revenue to CBNMS (Table 2.4).

Table 2.4. Vessel Dependence on Harvest Revenue from the CBNMS, 2012 (2013 $)

Number of Vessels	Percent of Vessels	Revenue from CBNMS	Percent Distribution of CBNMS Revenue	Total Harvest Revenue from All of CA	Percent of All CA Revenue From CBNMS
3	3.90%	$256,224	33.80%	$2,138,276	11.98%
6	7.80%	$383,744	50.62%	$2,883,040	13.31%
18	23.40%	$590,880	77.95%	$4,996,675	11.83%
31	40.30%	$688,578	90.83%	$6,484,564	10.62%
45	58.50%	$69,500	9.17%	$2,079,729	3.34%
20	26.00%	$10,651	1.41%	$343,278	3.10%
76	100.00%	$758,078	100.00%	$8,564,293	8.85%

Source: California Fishing Information System, California Department of Fish and Wildlife.

Port Dependence on Catch from the CBNMS

Another indicator of economic dependence is port dependence, measured as the percent of total port landings from CBNMS. We calculated the percent of pounds and value by species/species groups for the top four ports where catch from the CBNMS was landed: Bodega Bay, Fort Bragg, Princeton-Half Moon, and San Francisco. Harvest revenue from CBNMS at these four ports totaled $730,671 or 96.4% of total harvest revenue from CBNMS at all California ports in 2012. None of the four ports was highly dependent on the CBNMS in terms of pounds or value. Bodega Bay depended on the CBNMS for 3.30% of total landings. San Francisco depended on CBNMS for 1.08% of total landings. Fort Bragg depended on CBNMS for 0.73% of total revenue. Finally, Princeton-Half Moon depended on CBNMS for 0.45% of total revenue. While overall dependence was low, at some ports landings of specific species were highly dependent on sanctuary resources. For example, at San Francisco, 41.13% of *Dover Sole-Thornyheads-Sablefish Trawl* by value was caught in the CBNMS. In addition, at Princeton-Half Moon, 21.48% of *Other Flatfish* and 15.06% of *Shelf Rockfish* by value were caught in the CBNMS (Table 2.5).

Table 2.5. Landings by Port and Species/Species Groups from Catch in the CBNMS, 2012 (2013 $)

Port/Species/Species Group	Catch from CBNMS		Total Port Landings		Percent of Total Port Landings from CBNMS	
	Pounds	Value	Pounds	Value	Pounds	Value
Bodega Bay						
Shelf Rockfish	648	$1,498	3,991	$20,772	16.24%	7.21%
Sablefish Non-Trawl	3,853	$15,852	89,263	$287,936	4.32%	5.51%
Tuna	652	$1,245	17,153	$30,871	3.80%	4.03%
Dungeness Crab	90,031	$291,569	2,683,738	$8,618,000	3.35%	3.38%
Salmon	11,501	$76,800	574,531	$2,816,346	2.00%	2.73%
CA Halibut	9	$61	872	$4,021	0.99%	1.52%
Lingcod	7	$18	704	$2,168	0.94%	0.83%
Deeper Nearshore Rockfish	0	$0	578	$2,082	0.00%	0.00%
Hagfish	0	$0	90,805	$69,051	0.00%	0.00%
Other Flatfish	0	$0	10	$20	0.00%	0.00%
Red Urchin	0	$0	44,264	$31,440	0.00%	0.00%
Shallow Nearshore Rockfish	0	$0	2,945	$18,674	0.00%	0.00%
Swordfish	0	$0	2,011	$9,175	0.00%	0.00%
All Other	1,738	$6,721	10,552	$38,113	16.47%	17.63%
Total	*108,439*	*$393,764*	*3,521,417*	*$11,948,668*	*3.08%*	*3.30%*
Fort Bragg						
Salmon	6,820	$44,479	581,881	$2,728,751	1.17%	1.63%
Dungeness Crab	15,721	$63,234	1,867,698	$6,687,459	0.84%	0.95%
Deeper Nearshore Rockfish	0	$0	2,320	$9,065	0.00%	0.00%
Dover Sole Non-Trawl	0	$0	1,198	$4,767	0.00%	0.00%
Dover Sole-Thorneyheads-Sablefish Trawl	0	$0	1,665,890	$1,234,325	0.00%	0.00%
Lingcod	0	$0	27,155	$35,942	0.00%	0.00%
Other Flatfish	0	$0	226,989	$199,614	0.00%	0.00%
Red Urchin	0	$0	2,218,597	$1,852,804	0.00%	0.00%
Sablefish Non-Trawl	0	$0	426,855	$1,334,378	0.00%	0.00%
Shallow Nearshore Rockfish	0	$0	7,100	$42,232	0.00%	0.00%
Sharks-Rays not White Shark or Big Skate	0	$0	110,460	$36,210	0.00%	0.00%
Shelf Rockfish	0	$0	427,301	$318,538	0.00%	0.00%
Swordfish	0	$0	24,922	$101,102	0.00%	0.00%
Tuna	0	$0	34,506	$62,852	0.00%	0.00%
All Other	0	$0	172,527	$139,570	0.00%	0.00%
Total	*22,541*	*$107,713*	*7,795,397*	*$14,787,608*	*0.29%*	*0.73%*

Table 2.5 Continued. Landings by Port and Species/Species Group from Catch in the CBNMS, 2012 (2013 $)

	Catch from CBNMS		Total Port Landings		Percent of Total Port Landings from CBNMS	
Port/Species/Species Group	Pounds	Value	Pounds	Value	Pounds	Value
Princeton-Half Moon						
Other Flatfish	13,921	$15,893	73,741	$73,985	18.88%	21.48%
Shelf Rockfish	19,589	$9,923	92,084	$65,898	21.27%	15.06%
Sharks-Rays not White Shark or Big Skate	784	$159	10,982	$2,948	7.14%	5.39%
Lingcod	1,050	$1,065	6,275	$20,932	16.73%	5.09%
Salmon	3,273	$23,826	282,011	$1,704,353	1.16%	1.40%
Sablefish Non-Trawl	213	$528	90,295	$142,485	0.24%	0.37%
Dungeness Crab	4,447	$17,377	2,341,359	$7,615,840	0.19%	0.23%
CA Halibut	0	$0	47,291	$229,355	0.00%	0.00%
Coastal Pelagic	0	$0	1,634	$1,483	0.00%	0.00%
Deeper Nearshore Rockfish	0	$0	6,167	$35,058	0.00%	0.00%
Dover Sole Non-Trawl	0	$0	268	$112	0.00%	0.00%
Dover Sole-Thorneyheads-Sablefish Trawl	0	$0	209	$42	0.00%	0.00%
Hagfish	0	$0	12	$117	0.00%	0.00%
Market Squid	0	$0	16,709,087	$5,086,410	0.00%	0.00%
Shallow Nearshore Rockfish	0	$0	665	$5,131	0.00%	0.00%
Smelts	0	$0	199	$64	0.00%	0.00%
Spot Prawn	0	$0	36,492	$459,289	0.00%	0.00%
Surfperch	0	$0	2	$2	0.00%	0.00%
Tuna	0	$0	54,699	$129,041	0.00%	0.00%
All Other	3,221	$1,622	71,898	$72,460	4.48%	2.24%
Total	*46,498*	*$70,393*	*19,825,368*	*$15,645,005*	*0.23%*	*0.45%*
San Francisco						
Dover Sole-Thorneyheads-Sablefish Trawl	14,995	$73,366	189,386	$178,395	7.92%	41.13%
Sablefish Non-Trawl	7,102	$20,101	67,642	$255,904	10.50%	7.85%
Salmon	7,044	$41,870	275,155	$1,486,615	2.56%	2.82%
Herring	16,137	$1,636	3,268,606	$399,465	0.49%	0.41%
Dungeness Crab	4,140	$20,180	3,065,851	$9,879,750	0.14%	0.20%
CA Halibut	46	$282	111,405	$556,202	0.04%	0.05%
Deeper Nearshore Rockfish	0	$0	2,882	$19,636	0.00%	0.00%
Lingcod	0	$0	3,726	$6,329	0.00%	0.00%
Other Flatfish	0	$0	71,744	$105,361	0.00%	0.00%
Shallow Nearshore Rockfish	0	$0	630	$4,360	0.00%	0.00%
Sharks-Rays not White Shark or Big Skate	0	$0	21,884	$13,658	0.00%	0.00%
Shelf Rockfish	0	$0	67,202	$66,735	0.00%	0.00%
Smelts	0	$0	794	$3,184	0.00%	0.00%
Spot Prawn	0	$0	672	$9,539	0.00%	0.00%
Surfperch	0	$0	966	$4,096	0.00%	0.00%
Swordfish	0	$0	412,079	$1,277,041	0.00%	0.00%
Tuna	0	$0	77,493	$185,468	0.00%	0.00%
All Other	1,514	$1,366	124,465	$267,507	1.22%	0.51%
Total	*50,978*	*$158,802*	*7,762,583*	*$14,719,243*	*0.66%*	*1.08%*

Source: California Fishing Information System, California Department of Fish and Wildlife.

Trends in Catch for the Top Five Species/Species Groups

In CBNMS, the top five species/species groups by value were *Dungeness Crab, Salmon, Dover Sole-Thornyheads-Sablefish Trawl, Sablefish Non-Trawl,* and *Other Flatfish.*

Dungeness crab. In 2012, *Dungeness crab* was the primary species with respect to harvest revenue. Landings of the species by value have varied, reaching a low of $63,045 in 2003. Following a spike in 2005, the fishery most recently had a significant peak in 2010 at $957,061. The cyclical dynamic of the *Dungeness crab* fishery shows trends of high landing years followed by low landing years due to the Pacific Decadal Oscillation (PDO) and a three-year lag time for larval maturation (California Department of Fish and Wildlife [CDFW] 2013 2-7).

Table 2.6. Trends in *Dungeness Crab* Caught in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	34,321	$124,607
2001	16,003	$72,583
2002	73,384	$190,525
2003	27,549	$63,045
2004	132,197	$292,355
2005	179,984	$375,339
2006	142,862	$329,749
2007	50,794	$169,590
2008	125,413	$434,638
2009	102,562	$321,942
2010	504,490	$957,061
2011	167,562	$425,444
2012	114,708	$393,576

Source: California Fishing Information System, California Department of Fish and Wildlife.

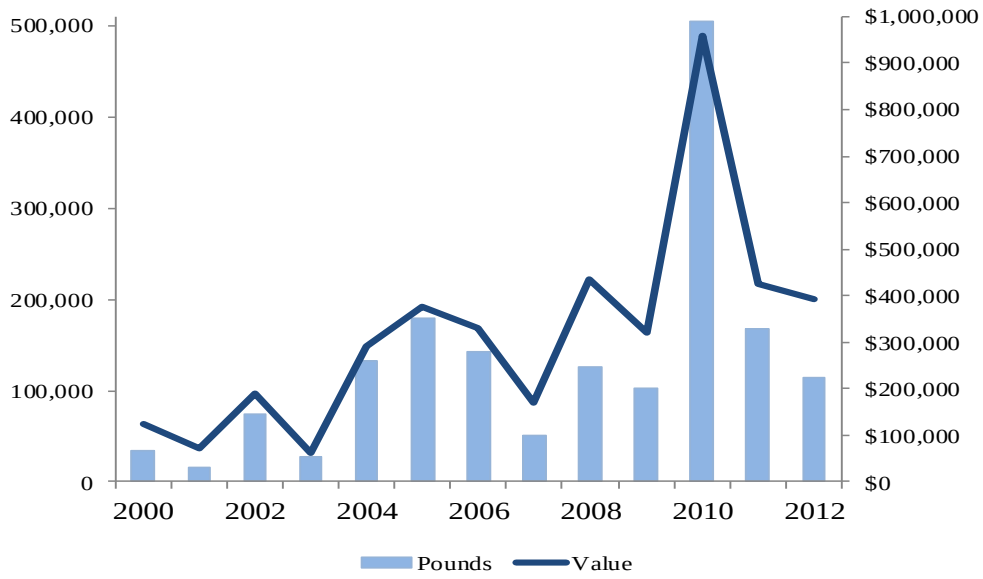

Figure 2.1 Trends in *Dungeness Crab* Caught in the CBNMS, 2000 to 2012 (2013 $)

Salmon. In 2012, Salmon was the second most valuable species caught in the CBNMS with $196 thousand in harvest revenue. Prior to closure of the fishery in 2008, catch peaked at just over 185 thousand pounds in 2003 and value peaked in 2007 at over $719 thousand. In 2008, the Pacific *Salmon* fishery was closed in order to meet conservation goals for the Sacramento River fall Chinook (SRFC) (Sweetnam 2008 27). The fishery was reopened in 2010. After the fishery reopened, catch was extremely restricted and consequently no *Salmon* was landed from the CBNMS until 2011. In 2006, the price per pound of *Salmon* nearly doubled as a result of increased costs to the fisher and lower than average landings (CDFW 2013 5-5).

Table 2.7. Trends in *Salmon* Caught in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	29,763	$112,637
2001	56,015	$172,244
2002	90,440	$178,724
2003	185,239	$413,626
2004	132,446	$508,889
2005	61,360	$255,234
2006	35,364	$213,211
2007	136,993	$719,641
2008	0	$0
2009	0	$0
2010	0	$0
2011	10,084	$68,461
2012	30,017	$196,531

Source: California Fishing Information System, California Department of Fish and Wildlife.

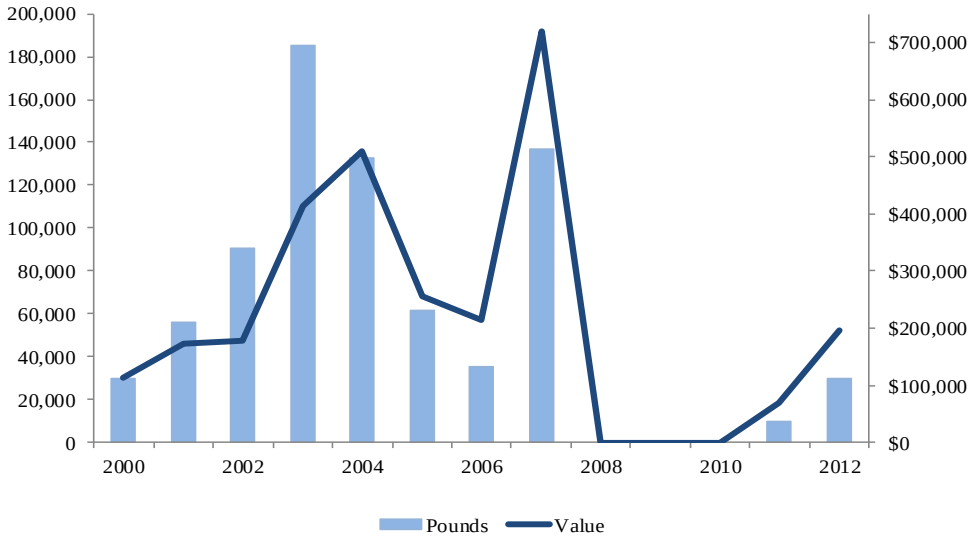

Figure 2.2. Trends in *Salmon* Caught in the CBNMS, 2000 to 2012 (2013 $)

Dover Sole-Thornyheads-Sablefish Trawl. In 2012, *Dover Sole-Thornyheads-Sablefish Trawl*¸ was the third most valuable species group with a peak catch of over $289 thousand in 2009. Excluding years with no catch, the low was $7,632 in 2002. For five years in the study period; 2000, 2003, 2004, 2005 and 2006, there was no *Dover Sole-Thornyhead-Sablefish Trawl* catch landed from CBNMS. Several trawl fishery management decisions can explain at least some of the low landings in the first half of the study period. In late 2002, implementation of a Trawl Rockfish Conservation Area restricted gear and catch in CBNMS (Pacific Fishery Management Council [PFMC] 2011 83). In addition, following the groundfish disaster in 2000, a federal and industry funded groundfish trawl vessel buyback program in 2003 greatly reduced the number of vessels and amount of catch (The Research Group 2006 IV-9). In order to offset increased restrictions on *Petrale sole* in 2009 and 2010, the council increased trip limits for species such as *Dover Sole-Thornyheads-Sablefish* (Sweetnam 2011 24).

Table 2.8. Trends in *Dover Sole-Thornyheads-Sablefish Trawl* Caught in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	0	$0
2001	75	$59
2002	11,766	$7,632
2003	0	$0
2004	0	$0
2005	0	$0
2006	0	$0
2007	52,034	$31,089
2008	393,137	$243,867
2009	480,831	$289,537
2010	352,136	$150,159
2011	61,496	$53,003
2012	14,995	$73,366

Source: California Fishing Information System, California Department of Fish and Wildlife

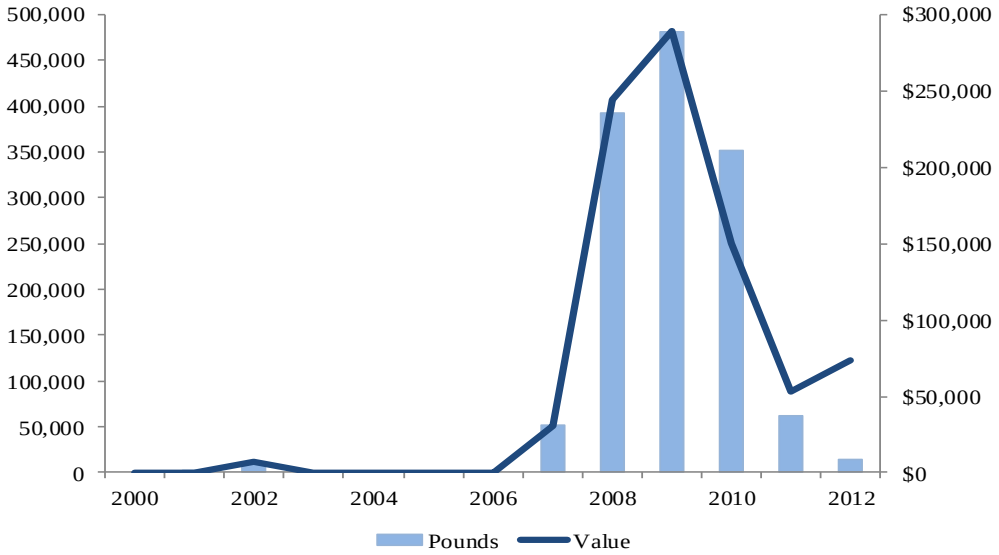

Figure 2.3. Trends in *Dover Sole-Thornyheads-Sablefish Trawl* Caught in the CBNMS, 2000 to 2012 (2013 $)

Sablefish Non-Trawl. The fourth most valuable species caught in CBNMS in 2012 was *Sablefish Non-Trawl*. Catch was varied over the study period. Following minimal catch through 2006, there was a considerable upward trend from 2007 to 2011. Catch peaked in 2011 with a value of $183,427. Declines in *Sablefish Non-Trawl* value are observed from 2000 to 2002, 2011 to 2012 and zero catch in 2004. In 2011, implementation of the West Coast Individual Fishery Quota (IFQ) program began and many vessels traded permits and switched gear for higher value quotas in *Sablefish Non-Trawl* fishery (CDFW 2013 17-1).

Table 2.9. Trends in *Sablefish Non-Trawl* Caught in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	20,586	$40,217
2001	1,063	$2,285
2002	477	$549
2003	7,284	$13,934
2004	0	$0
2005	79	$273
2006	752	$1,157
2007	1,350	$1,780
2008	10,322	$33,230
2009	20,887	$65,449
2010	27,857	$100,502
2011	36,344	$183,427
2012	12,664	$42,928

Source: California Fishing Information System, California Department of Fish and Wildlife.

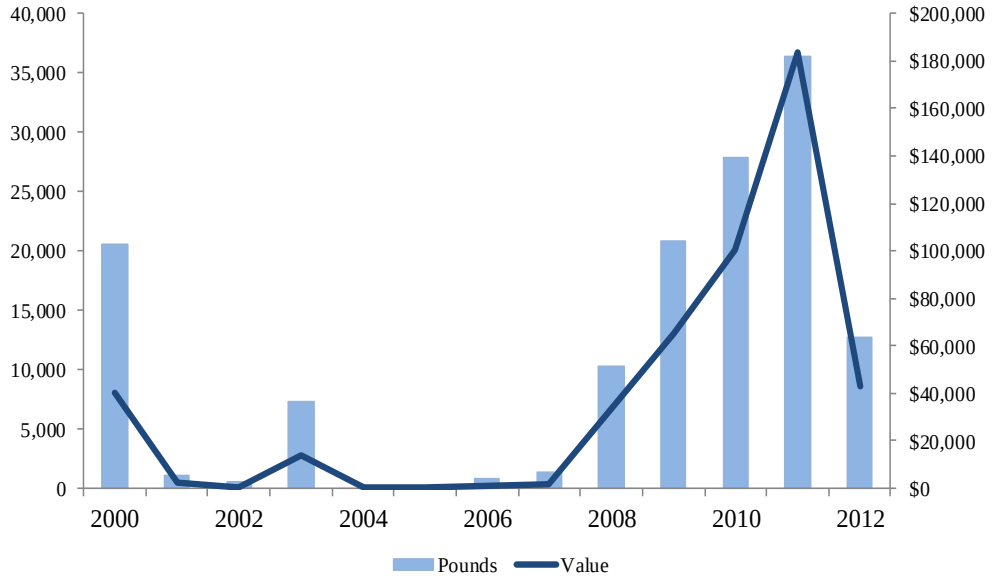

Figure 2.4. Trends in *Sablefish Non-Trawl* Caught in the CBNMS, 2000 to 2012 (2013 $)

Other Flatfish. In 2012, *Other Flatfish* rounds out the top species groups as the fifth most valuable. Landings of *Other Flatfish* by pound peaked in 2008 at almost 162 thousand pounds. Harvest revenue of *Other Flatfish* peaked in 2007 at almost $160 thousand. Following a period of no catch from 2003 to 2006, value spiked in 2007 and has been on the decline through 2012. At least some of this decline has been attributed to increased restrictions on *Petrale Sole*, which are commonly caught with other groundfish (CDFW 2013 17-1).

Table 2.10. Trends in *Other Flatfish* Caught in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	982	$1,838
2001	1,678	$1,777
2002	17,859	$21,488
2003	0	$0
2004	0	$0
2005	0	$0
2006	0	$0
2007	158,972	$159,816
2008	161,935	$128,444
2009	74,847	$53,421
2010	73,221	$63,179
2011	29,122	$35,369
2012	13,921	$15,893

Source: California Fishing Information System, California Department of Fish and

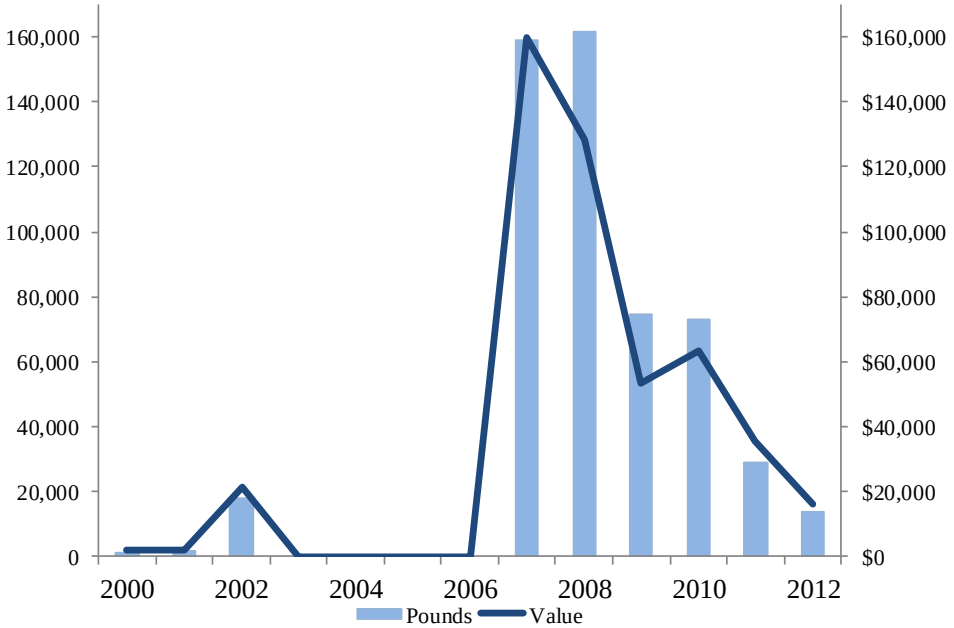

Figure 2.5. Trends in *Other Flatfish* Caught in the CBNMS, 2000 to 2012 (2013$)

Chapter 3: Special Issues

In this chapter, we address special requests made by CBNMS management for special queries of the data. The first request was for the groundfish fishery. Here all the topics addressed in Chapters 2 are addressed for groundfish. The second request was for "Longlines" gear type. Again, all topics addressed in Chapter 2 are addressed for "Longlines."

Profiles of the Groundfish Commercial Fishery in the CBNMS

In addition to where catch is caught and landed, the CDFW-CFIS database includes vessel and fisherman identification codes for who caught the fish and gear types for how the catch was made. CBNMS management requested analysis of this data for the groundfish industry. A description of species/species groups included as groundfish for this analysis is available in the separate technical appendix report (Leeworthy et al. 2013).

Groundfish Catch by Gear Type. Gear types are identified by three-digit codes. For CBNMS, we originally defined 13 gear types, including an "All Other" group. After processing the data, we found that only five gear types, including "Gear Unspecified," are involved in the groundfish fishery. In 2012, "Gear Unspecified" accounted for 18.45% of total value (Table 3.1).

Table 3.1. Pounds and Value of Groundfish Landings from the CBNMS by Gear Type, 2012 (2013 $)

Gear Type	Pounds	Value	Percent of Total Value
Trawl	14,995	$73,366	47.26%
Longlines	11,694	$32,851	21.16%
Hook & Line	5,002	$19,525	12.58%
Pots & Traps	583	$857	0.55%
Gear Unspecified	38,448	$28,637	18.45%
Total	*70,722*	*$155,236*	*100.00%*

Source: California Fishing Information System, California Department of Fish and Wildlife.

In 2012, "Trawl" was the predominant gear type for groundfish catch. "Trawl" accounted for $73,666 or 47.26% of total value of groundfish caught in CBNMS in 2012. "Longlines" was the secondary gear type with 21.16% of total value. "Hook and Line" accounted for 12.58% of total value, while "Pots and Traps" accounted for just over half a percent of total value.

Groundfish Catch by Number of Vessels and Gear Type. In 2012, groundfish catch accounted over 20% of total catch from the CBNMS. Dominant gear types involved in groundfish catch over the 2010 to 2012 period include "Trawl," "Hook & Line," and "Longlines." "Trawl" was number one by value in 2010 and 2012, accounting for $239,924 and $73,666 respectively. In 2011, "Longlines" accounted for the largest value at over $114 thousand. "Hook & Line" decreased steadily from over $84 thousand in 2010 to $19,525 in 2012. Conversely, "Gear Unspecified" increased steadily over the time period from just over 11% of total value in 2010 to over 18% in 2012 (Table 3.2).

In 2010, there were seven vessels landing groundfish. The number of vessels doubled in 2011 to 14. In 2012 the number of vessels decreased slightly to 12. However, in 2012, the number of "Trawl" vessels increased rapidly to 11.

Table 3.2. Pounds and Value of Groundfish Landings from the CBNMS by Gear Type and Year (2013 $)

Year/Gear Type	Pounds	Value
2010		
Trawl	518,827	$239,924
Longlines	3,945	$13,524
Hook & Line	22,993	$84,029
Pots & Traps	1,535	$4,535
Gear Unspecified	81,260	$42,639
All Gears	*628,560*	*$384,651*
2011		
Trawl	63,709	$53,918
Longlines	18,488	$114,030
Hook & Line	12,749	$55,206
Pots & Traps	5,094	$14,975
Gear Unspecified	43,477	$44,343
All Gears	*143,517*	*$282,473*
2012		
Trawl	14,995	$73,366
Longlines	11,694	$32,851
Hook & Line	5,002	$19,525
Pots & Traps	583	$857
Gear Unspecified	38,448	$28,637
All Gears	*70,723*	*$155,236*

Source: California Fishing Information System, California Department of Fish and Wildlife.

Groundfish Catch by Port and Gear Type. Groundfish landings by port varied considerably over the study period. In 2010, the top three ports included San Francisco at $243,192, Bodega Bay at almost $96 thousand and Princeton-Half Moon at $42,639. In 2011, the top three ports included Fort Bragg with just over $163 thousand, Bodega Bay with almost $47 thousand and Princeton-Half Moon with over $44 thousand. In 2012, the top three ports included San Francisco at over $95 thousand, Princeton-Half Moon at over $29 thousand and Bodega Bay at over $17 thousand (Table 3.3). Greater detail on port landings by gear type is available in Table 3.4.

Table 3.3. Pounds and Value of Groundfish Landings from the CBNMS by Port and Year, 2010 to 2012 (2013 $)

Year/Port	Pounds	Value
2010		
Port (All) (All Gear)	*547,300*	*$342,012*
San Francisco	519,769	$243,192
Bodega Bay	26,147	$95,864
Fort Bragg	1,384	$2,955
Port (All) (Gear Unspecified)	*81,260*	*$42,639*
Princeton-Half Moon	81,260	$42,639
2011		
Port (All) (All Gear)	*100,040*	*$238,129*
Fort Bragg	80,967	$163,119
Bodega Bay	12,645	$46,754
Richmond	5,086	$23,233
Bolinas	602	$2,750
Berkeley	656	$1,664
San Francisco	70	$538
Pinceton-Half Moon	14	$71
Port (All) (Gear Unspecified)	*43,477*	*$44,343*
Princeton-Half Moon	43,477	$44,343
2012		
Port (All) (All Gear)	*32,274*	*$126,599*
San Francisco	23,657	$95,116
Bodega Bay	4,501	$17,350
Bolinas	1,870	$6,452
Richmond	1,390	$4,056
Berkeley	531	$2,487
China Camp	117	$612
Princeton-Half Moon	208	$527
Port (All) (Gear Unspecified)	*38,448*	*$28,637*
Princeton-Half Moon	38,433	$28,558
Bodega Bay	15	$79

Source: California Fishing Information System, California Department of Fish and Wildlife.

Table 3.4. Pounds and Value of Groundfish Landings from the CBNMS by Year, Port and Gear Type, 2010 to 2012 (2013 $)

Year/Port/Gear	Pounds	Value
2010		
Fort Bragg	*1,384*	*$2,955*
Longlines	791	$1,689
Pots & Traps	593	$1,266
San Francisco	*519,769*	*$243,192*
Trawl	518,827	$239,924
Pots & Traps	942	$3,268
Bodega Bay	*26,147*	*$95,864*
Hook & Line	22,993	$84,029
Longlines	3,154	$11,835
2011		
Fort Bragg	*80,967*	*$163,119*
Longlines	17,258	$103,202
Trawl	63,709	$53,918
San Francisco	*70*	*538*
Hook & Line	70	$538
Bodega Bay	*12,645*	*$46,754*
Hook & Line	6,321	$29,950
Pots & Traps	5,094	$14,975
Longlines	1,230	$4,829
Richmond	*5,086*	*$23,233*
Hook & Line	5,086	$23,233
Princeton-Half Moon	*14*	*$71*
Hook & Line	14	$71
Berkeley	*656*	*$1,664*
Hook & Line	656	$1,664
Bolinas	*602*	*$2,750*
Hook & Line	602	$2,750
2012		
San Francisco	*23,657*	*$95,116*
Trawl	14,995	$73,366
Longlines	8,616	$21,467
Hook & Line	46	$282
Princeton-Half Moon	*208*	*$527*
Longlines	208	$527
China Camp	*117*	*$612*
Hook & Line	117	$612
Berkeley	*531*	*$2,487*
Hook & Line	531	$2,487
Bodega Bay	*4,501*	*$17,350*
Longlines	1,159	$3,912
Pots & Traps	583	$857
Richmond	*1,390*	*$40,556*
Hook & Line	941	$2,147
Longlines	449	$1,910
Bolinas	*1,870*	*$6,452*
Longlines	1,262	$5,034

Source: California Fishing Information System, California Department of Fish and Wildlife.

Trends in Groundfish Catch for Top Four Gear Types. In the CBNMS, the top five gear types for groundfish catch were "Trawl," "Longlines," "Hook & Line" and "Pots & Traps." Other gear types include "Troll" and "Set Gill Nets." However, there were no landings recorded for these gear types from the CBNMS in 2012.

Trawl. In 2012, "Trawl" was the top gear type by harvest revenue. From 2000 to 2002 "Trawl" for pounds and value of groundfish by "Trawl" increased. In the subsequent period, pounds and value fell to zero in 2003 and 2005 to 2006. In 2007, the use of "Trawl" for groundfish catch rebounded to over five times 2002 levels. The "Trawl" groundfish fishery has been the subject of many management activities to address overfishing. In 2003 a trawl vessel buyback program was implemented, depth-based Trawl Rockfish Conservation Areas began at the same time and a new tradable quota system was introduced in 2011 (CDFW 2013 17.1-17.2; ONMS 2009 18-19).

Table 3.5 Trends in Groundfish Caught by "Trawl" in the CBNMS, 2000 to 2010 (2013 $)

Year	Pounds	Value
2000	965	$1,507
2001	2,398	$2,656
2002	31,847	$30,566
2003	0	$0
2004	66	$264
2005	0	$0
2006	0	$0
2007	169,017	$157,874
2008	445,460	$290,110
2009	551,169	$333,632
2010	518,827	$239,924
2011	63,709	$53,918
2012	14,995	$73,366

Source: California Fishing Information System, California Department of Fish and Wildlife.

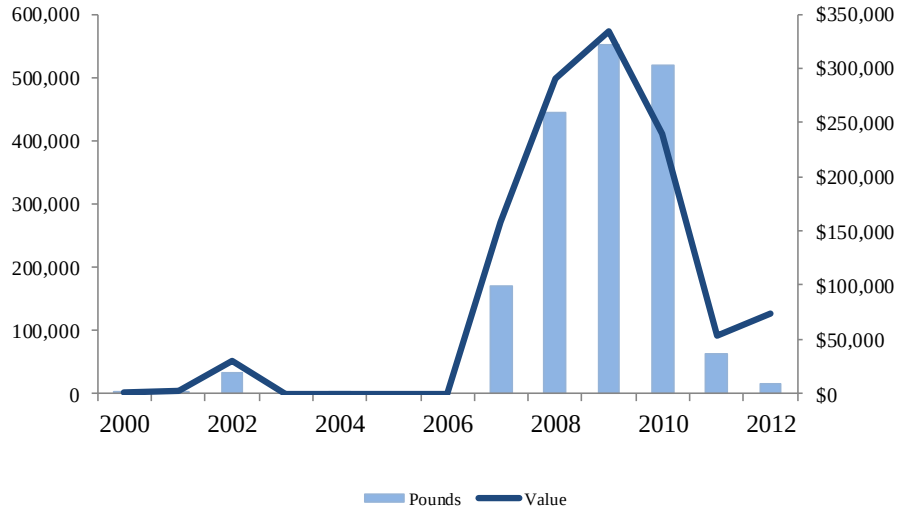

Figure 3.1. Trends in Groundfish Caught by "Trawl" in the CBNMS, 2000 to 2010 (2013 $)

Longline. In 2012, "Longlines" was the second largest gear type in terms of value. The extent of "Longlines" use in the groundfish fishery has varied over the study period. A high of over 36 thousand pounds was landed in 2000, and a low of 300 pounds landed in 2005. Increasing per pound prices drove groundfish catch from "Longlines" to a high value of over $114 thousand in 2001. In 2002, both pounds and price per pound fell, reaching a low of $352 occurred in 2002.

Table 3.4. Trends in Groundfish Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	36,447	$81,496
2001	10,947	$16,826
2002	325	$352
2003	15,193	$42,932
2004	568	$2,739
2005	300	$1,251
2006	3,488	$6,563
2007	4,958	$10,724
2008	21,549	$58,087
2009	19,783	$63,781
2010	3,945	$13,524
2011	18,488	$114,030
2012	11,694	$32,851

Source: California Fishing Information System, California Department of Fish and Wildlife.

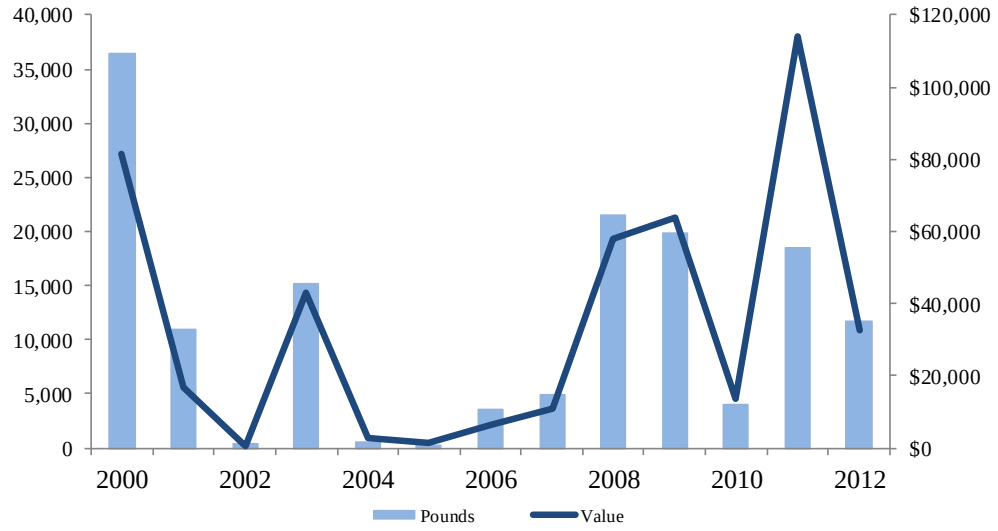

Figure 3.2. Trends in Groundfish Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

Hook and Line. In 2012, "Hook & Line" represents the third most valuable gear type in the groundfish fishery. Again, this gear type shows variability in both pounds and value over the study period. Ranging from a low of $447 in 2009 to a high of $84 thousand the following year, value decreased steadily from 2000 to 2003 and 2010 to 2012. Following the crash in 2009, the price per pound of groundfish caught by "Hook & Line" had nearly doubled in 2011. This trend is consistent with state-wide trends in the same time period (CDFW 2013 17-5).

Table 3.5. Trends in Groundfish Caught by "Hook & Line" in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	31,495	$55,875
2001	17,568	$27,990
2002	8,301	$19,879
2003	732	$2,994
2004	5,281	$10,295
2005	5,580	$14,815
2006	4,243	$8,593
2007	3,226	$9,236
2008	1,214	$6,121
2009	103	$447
2010	22,993	$84,029
2011	12,749	$55,206
2012	5,002	$19,525

Source: California Fishing Information System, California Department of Fish and Wildlife.

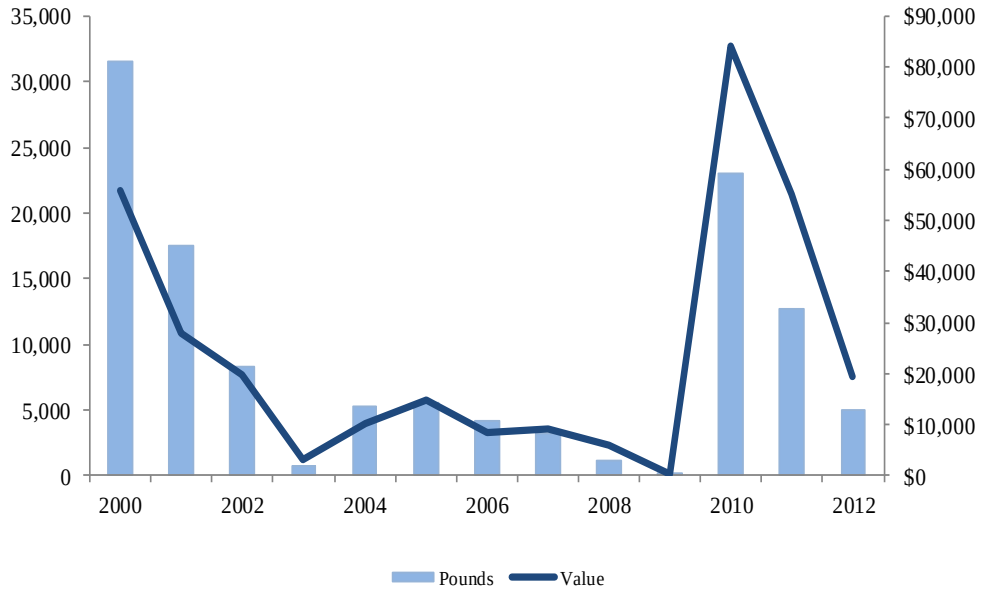

Figure 3.3. Trends in Groundfish Caught by "Hook & Line" in the CBNMS, 2000 to 2012 (2013 $)

Pots and Traps. "Pot & Traps" was the final top gear type for groundfish landings caught in the CBNMS. For the period 2000 to 2007, "Pots & Traps" was a minor gear type for groundfish in CBNMS, accounting for less than 200 pounds and just over $500 dollars in total for all seven years. In 2008, the gear type accounted for a high of over $16 thousand. Following a crash in 2009, value associated with the gear type increased until 2011. Overall, catch of groundfish with this gear type was highly variable with no catch recorded for the years 2000, 2002, 2004, 2005, 2006, 2007 and 2009.

Table 3.6. Trends in Groundfish Caught by "Pots & Traps" in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	0	$0
2001	163	$334
2002	0	$0
2003	38	$170
2004	0	$0
2005	0	$0
2006	0	$0
2007	0	$0
2008	16,951	$16,238
2009	0	$0
2010	1,535	$4,535
2011	5,094	$14,975
2012	583	$857

Source: California Fishing Information System, California Department of Fish and Wildlife.

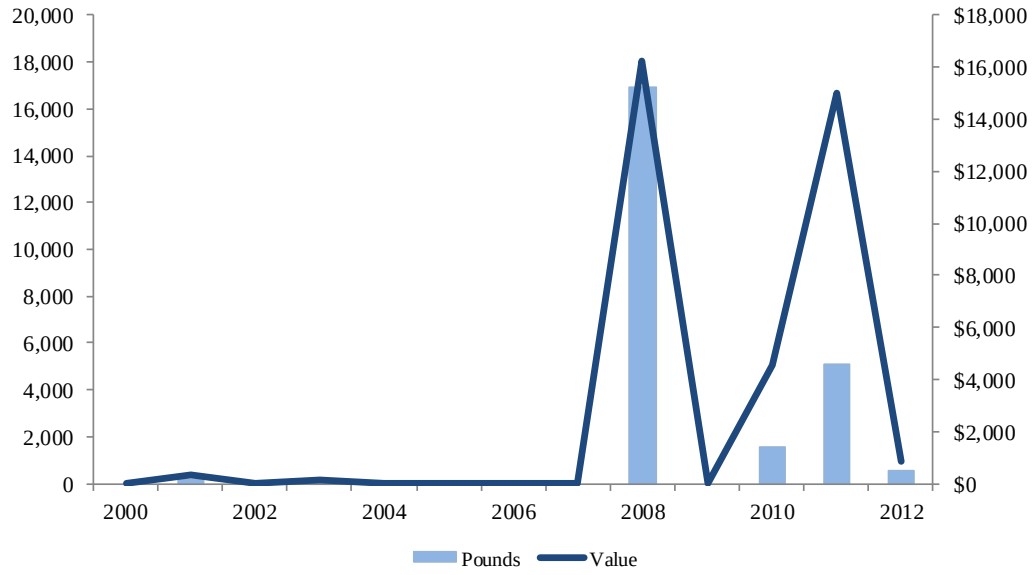

Figure 3.4. Trends in Groundfish Caught by "Pots & Traps" in the CBNMS, 2000 to 2012 (2013 $)

Profiles of the Longline Commercial Fishery in the CBNMS

In addition to where species/species groups are caught and landed, the CDFW-CFIS database includes vessel and fisherman identification codes for who caught the fish and gear types for how the catch was made. CBNMS management requested analysis of this data for the use of "Longlines" gear type within the sanctuary.

"Longlines" Catch by Species/Species Group. Species are identified by three-digit codes. We have combined species into species/species groups. For CBNMS, we originally defined 24 species/species groups, including an *All Other* group. After processing the data for "Longlines" catch, we discovered that some predetermined groups did not show up in 2012. For the year 2012, the only two species groups with harvest revenue in excess of $1,000 are *Sablefish Non-Trawl* and *Shelf Rockfish. All Other* accounted for 4.16% of 2012 "Longlines" harvest revenue in CBNMS.

In 2012, *Sablefish Non-Trawl* was the dominant species in terms of pounds (9,434) and value ($29,781); representing over 90% of total value for "Longlines" harvest revenue from CBNMS. The second predominant species was *Shelf Rockfish*, representing over 5% of total value for "Longlines" harvest revenue from CBNMS. In 2012, 746 pounds of *Shelf Rockfish* were harvested at a value of $1,704 (Table 3.9).

Table 3.7. Pounds and Value of "Longlines" Landings from the CBNMS by Species/Species Groups, 2012 (2013 $)

Species/Species Groups	Pounds	Value	Percent of Total Value
Sablefish Non-Trawl	9,434	$29,781	90.65%
Shelf Rockfish	746	$1,704	5.19%
All Other	1,514	$1,366	4.16%
Total	*11,694*	*$32,851*	*100.00%*

Source: California Fishing Information System, California Department of Fish and Wildlife.

Port Dependence on "Longlines" Catch from the CBNMS. Another way of looking at economic dependence on "Longlines" is port dependence measured as the percent of total port landings from CBNMS. We calculated the percent of pounds and value by species/species groups for the top five ports where "Longlines" catch from the CBNMS was landed: San Francisco, Bolinas, Bodega Bay, Richmond, and Princeton-Half Moon. "Longlines" harvest revenue from CBNMS at these five ports totaled $32,851 or 100% of total "Longlines" harvest revenue from CBNMS at all ports in 2012.

In 2012, both Bolinas and Richmond demonstrate dependency on the CBNMS for "Longlines" catch in terms of both pounds and value. Bolinas depended on CBNMS for over 87% of total value from "Longlines" catch, including 100% of *Sablefish Non-Trawl* and *Shelf Rockfish* from "Longline." Richmond depended on CBNMS for 100% of total "Longlines" catch. However, the total "Longlines" catch from these two ports totaled just $7,000 or 20% of total value from "Longlines" catch in the CBNMS for 2012. Princeton-Half Moon (0.36%) was least dependent on the CBNMS for total value from "Longlines." San Francisco depended on the sanctuary for 1.31% of its total value from "Longlines" catch in 2012. Bodega Bay depended on the CBNMS for 1.74% of its total value from "Longlines" catch in 2012 (Table 3.10).

Table 3.8. Landings by Port and Species/Species Groups from Catch by "Longlines" in the CBNMS, 2012 (2013 $)

	Catch from CBNMS		Total Port Landings		Percent of Total Port Landings from CBNMS	
Port/Species/Species Group	Pounds	Value	Pounds	Value	Pounds	Value
San Francisco						
Sablefish Non-Trawl	7,102	$20,101	44,650	$162,937	15.91%	12.34%
Lingcod	0	$0	527	$1,704	0.00%	0.00%
Smelts	0	$0	770	$3,123	0.00%	0.00%
Sharks- Rays not White Sharks or Big Skate	0	$0	8,555	$7,018	0.00%	0.00%
Swordfish	0	$0	384,311	$1,174,059	0.00%	0.00%
Salmon	0	$0	38	$85	0.00%	0.00%
Shallow Nearshore Rockfish	0	$0	157	$1,187	0.00%	0.00%
Deeper Nearshore Rockfish	0	$0	1,983	$14,139	0.00%	0.00%
Shelf Rockfish	0	$0	602	$3,926	0.00%	0.00%
Other Flatfish	0	$0	283	$720	0.00%	0.00%
Tuna	0	$0	66,782	$166,121	0.00%	0.00%
All Other	1,514	$1,366	64,423	$99,097	2.35%	1.38%
Total	*8,616*	*$21,467*	*573,081*	*$1,634,116*	*1.50%*	*1.31%*
Bolinas						
Sablefish Non-Trawl	1,058	$4,559	1,058	$4,559	100.00%	100.00%
Shelf Rockfish	204	$475	204	$475	100.00%	100.00%
Salmon	0	$0	122	$727	0.00%	0.00%
Total	*1,262*	*$5,034*	*1,384*	*$5,762*	*91.18%*	*87.38%*
Bodega Bay						
Shelf Rockfish	531	$1,206	1,291	$2,603	41.12%	46.34%
Sablefish Non-Trawl	628	$2,706	65,003	$213,839	0.97%	1.27%
Salmon	0	$0	200	$203	0.00%	0.00%
Shallow Nearshore Rockfish	0	$0	38	$425	0.00%	0.00%
Lingcod	0	$0	12	$61	0.00%	0.00%
All Other	0	$0	2,286	$7,748	0.00%	0.00%
Total	*1,159*	*$3,912*	*68,831*	*$224,879*	*1.68%*	*1.74%*
Richmond						
Sablefish Non-Trawl	438	$1,887	438	$1,887	100.00%	100.00%
Shelf Rockfish	11	$22	11	$22	100.00%	100.00%
Total	*449*	*$1,910*	*449*	*$1,910*	*100.00%*	*100.00%*
Princeton-Half Moon						
Sablefish Non-Trawl	208	$527	31,579	$92,327	0.66%	0.57%
Shallow Nearshore Rockfish	0	$0	561	$4,426	0.00%	0.00%
Deeper Nearshore Rockfish	0	$0	2,132	$14,023	0.00%	0.00%
Shelf Rockfish	0	$0	2,317	$13,735	0.00%	0.00%
Other Flatfish	0	$0	39	$119	0.00%	0.00%
Tuna	0	$0	3,062	$10,647	0.00%	0.00%
Sharks- Rays not White Sharks or Big Skate	0	$0	2,172	$629	0.00%	0.00%
Lingcod	0	$0	1,665	$5,064	0.00%	0.00%
All Other	0	$0	3,253	$6,110	0.00%	0.00%
Total	*208*	*$527*	*46,781*	*$147,079*	*0.44%*	*0.36%*

Source: California Fishing Information System, California Department of Fish and Wildlife.

Trends in "Longlines" Catch for Top Three Species/Species Groups. The top three species/species groups for "Longlines" catch in CBNMS include *Sablefish Non-Trawl*, *Shelf Rockfish*, and *All Other*. Other species groups include *Swordfish* and *Deeper Nearshore Rockfish*, however there were no landings of these species by "Longlines" in CBNMS for 2012.

Sablefish Non-Trawl. Throughout the study period, *Sablefish Non-Trawl* catch by "Longlines" has been highly variable. "Longlines" catch of the species in CBNMS peaked at a high value of over $112 thousand and reached lows of $0 for 2004, 2005 and 2012. High value in 2011 is consistent with state wide trends as fishers traded their quotas from other overfished stocks to participate in fixed gear *Sablefish* fishery with higher per pound prices (CDFW 2013 17-5).

Table 3.9. Trends in *Sablefish Non-Trawl* Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	20,586	$40,217
2001	900	$1,951
2002	273	$285
2003	6,467	$12,856
2004	0	$0
2005	0	$0
2006	742	$1,114
2007	569	$927
2008	10,011	$32,473
2009	19,182	$62,455
2010	3,785	$13,182
2011	16,543	$112,024
2012	0	0

Source: California Fishing Information System, California Department of Fish and Wildlife.

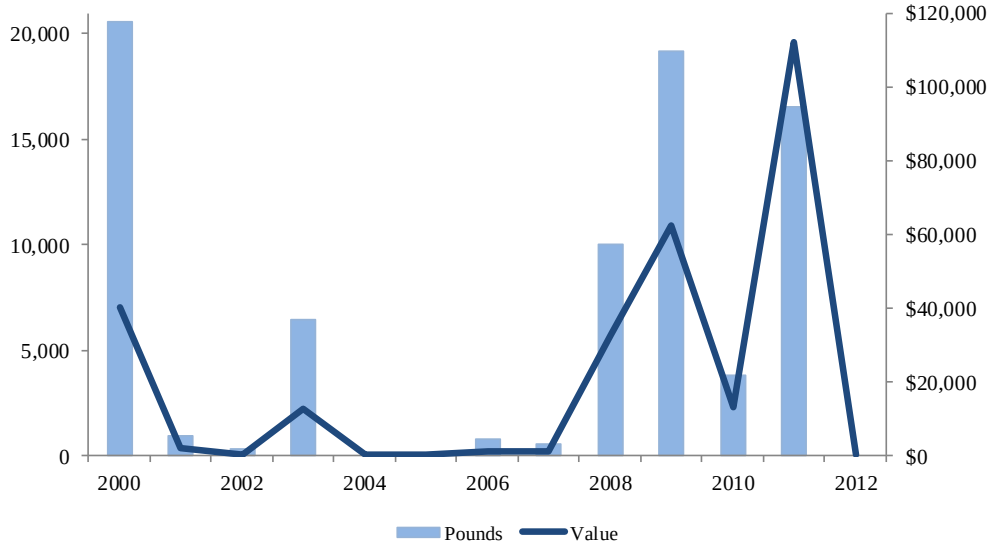

Figure 3.5. Trends in *Sablefish Non-Trawl* Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

Shelf Rockfish. The second most valuable species group caught by "Longlines" in CBNMS was *Shelf Rockfish.* This species group is of particular concern to CBNMS managers and was the impetus for depth-based area closures known as Rockfish Conservation Areas (ONMS 2009 18-89). Figure 3.6 demonstrates a color-coded timeline of management measures. The orange bars represent introduction of relevant management measure. The green bars from 2004 to 2008 represent initial implementation of Rockfish Conservation Areas. The yellow bars from 2010 to 2012 represent implementation of a Yelloweye Conservation Area.

Table 3.10. Trends in *Shelf Rockfish* Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	10,393	$17,108
2001	7,650	$11,549
2002	52	$67
2003	878	$1,460
2004	108	$614
2005	0	$0
2006	2,439	$3,764
2007	4,335	$9,686
2008	11,306	$25,029
2009	579	$1,257
2010	160	$342
2011	37	$40
2012	746	$1,704

Source: California Fishing Information System, California Department of Fish and Wildlife.

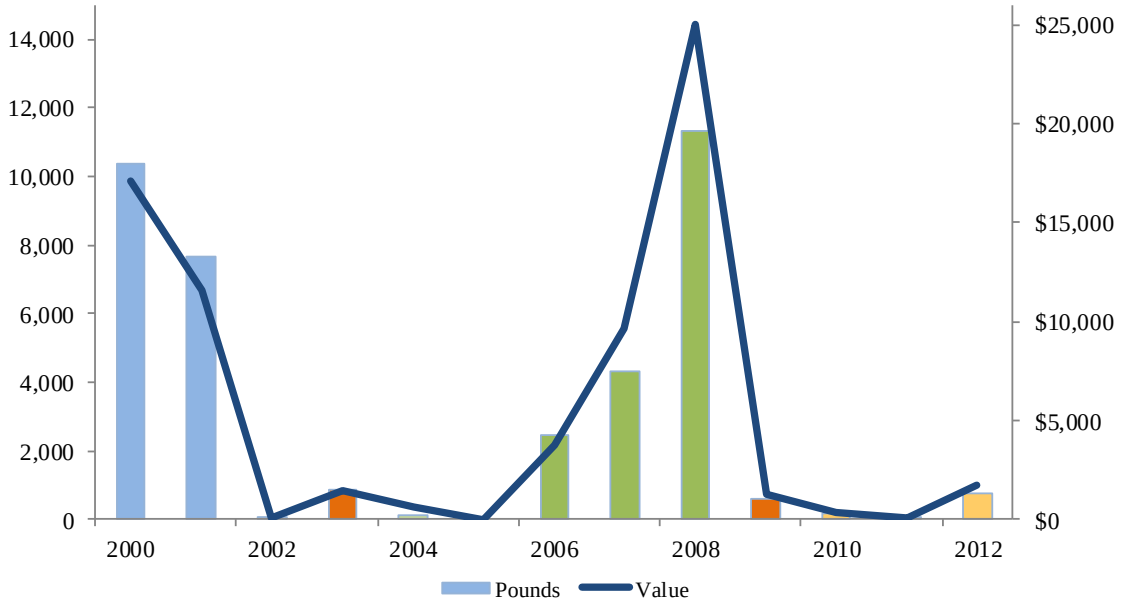

Figure 3.6. Trends in *Shelf Rockfish* Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

All Other. The third most valuable species group in the CBNMS for "Longlines" is *All Other*. *All Other* ranges from a high value of almost $28 thousand in 2003 to a low value of $0 in 2005. Following a spike in catch in 2003, the "Longlines" catch of *All Other* from 2005 to 2009 was limited. In 2011, values exceed $1,000 for the first time since 2003. In 2012, there was a slight decrease, however value maintained above $1,000.

Table 3.11. Trends in *All Other* Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

Year	Pounds	Value
2000	4,310	$17,649
2001	2,333	$3,199
2002	135	$175
2003	7,727	$27,956
2004	124	$956
2005	0	$0
2006	29	$144
2007	54	$112
2008	79	$171
2009	22	$69
2010	238	$178
2011	1,902	$1,963
2012	1,514	$1,366

Source: California Fishing Information System, California Department of Fish and

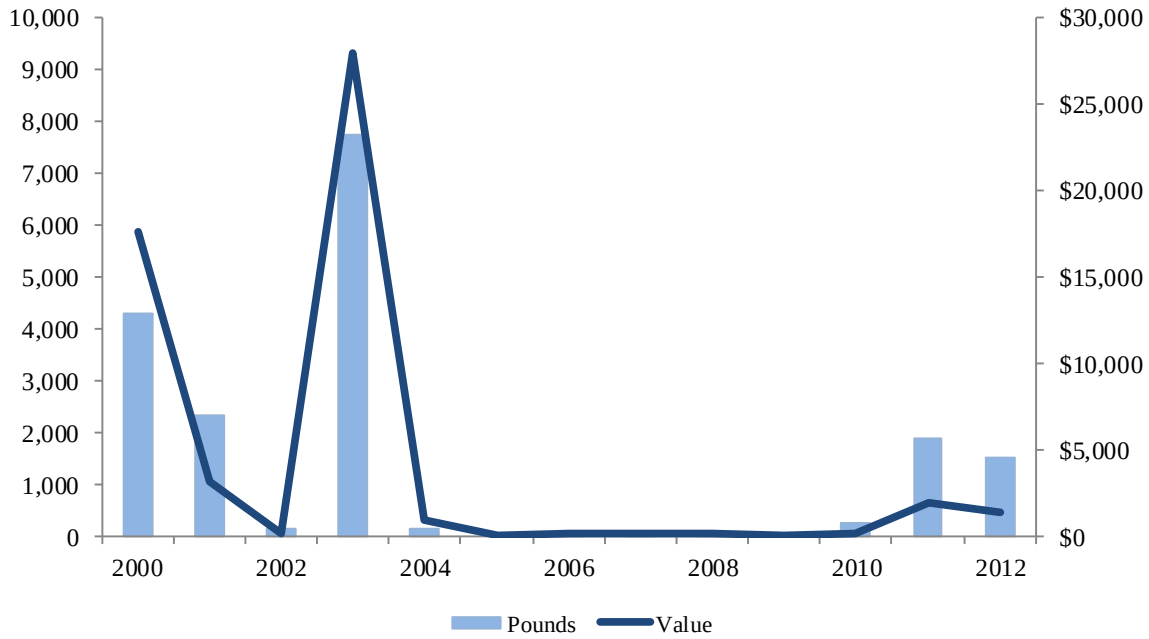

Figure 3.7. Trends in *All Other* Caught by "Longlines" in the CBNMS, 2000 to 2012 (2013 $)

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