

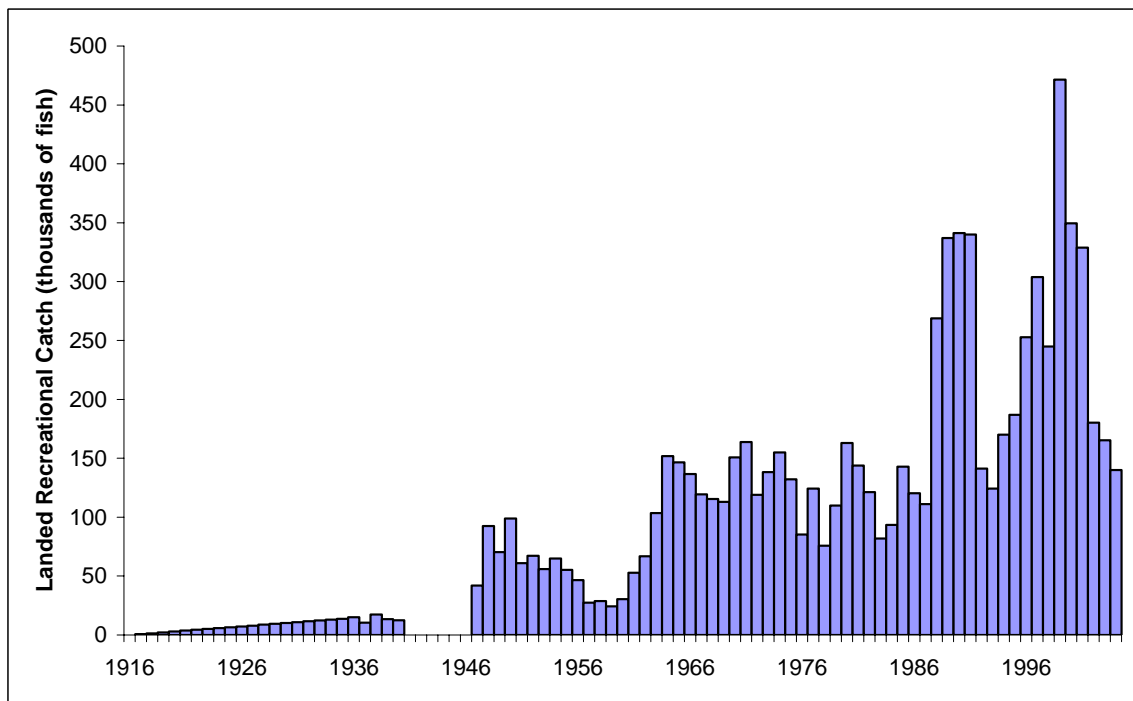
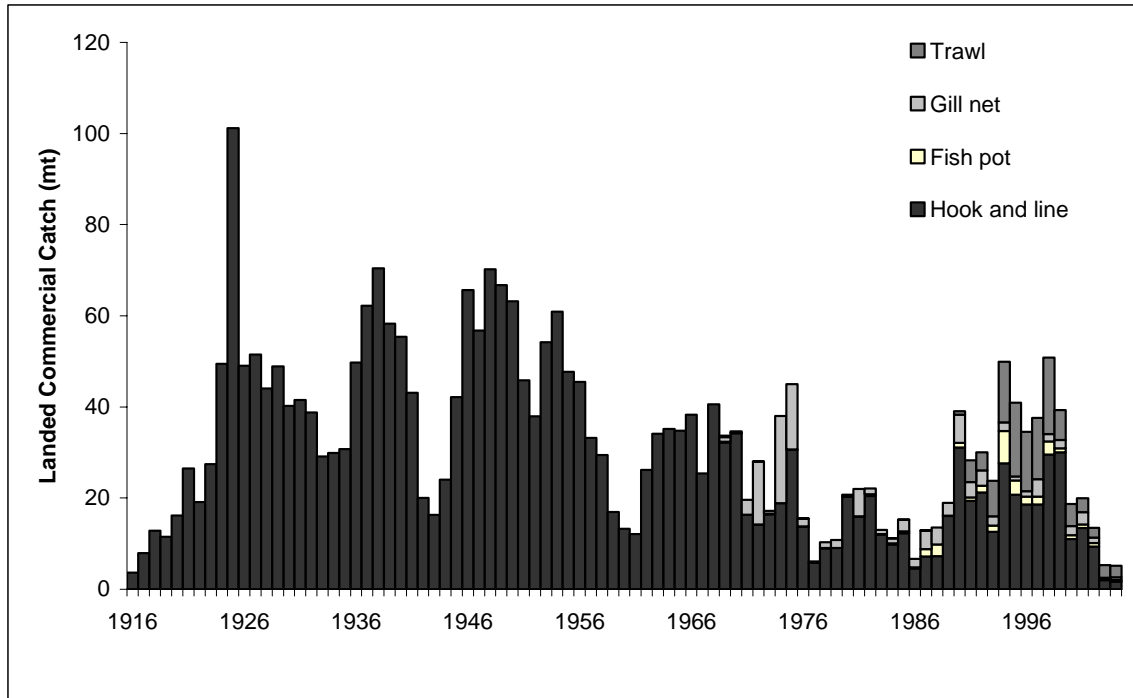
B. Executive Summary

Stock: This stock assessment pertains to the population of California scorpionfish (*Scorpaena guttata*) off southern California (Point Conception to the Mexico border). A single stock was assumed for the whole of southern California due to the consistency of results from initial sub-stock analysis and paucity of data for some regions.

Catches: The fisheries for California scorpionfish were divided into one recreational fishery and four commercial fisheries (hook and line, trawl, gillnet, and fish pot). Catches were obtained from published information for the period 1916-2004. Recreational catch in numbers was calculated based on the CPFV logbooks and scaling up based on a 80% assumed reporting rate and the ratio of CPFV catch to the total recreational catch estimated from the RecFIN data base. The catch in 1935 is assumed equal to the average of the catch for the years 1936-1940 and a linear trend is assumed to a catch of zero in 1916. Commercial catch in weight by method for 1969 to 2004 was taken from CFIS. Catch for 1928 to 1968 was taken from PFEL and catch from 1916 to 1927 was taken from CDFG Fish Bulletins. All catch before 1969 was assumed to be taken by hook and line. Catch from Mexican waters landed in Californian ports was excluded from the analysis. It was assumed that there is no discard mortality for this species.

Recent California Scorpionfish Landings

year	Hook and line (mt)	Fish pot (mt)	Gill net (mt)	Trawl (mt)	recreational (thousands of fish)
1990	31.1	1.0	6.2	0.8	341.1
1991	19.4	0.8	3.3	4.8	339.9
1992	21.2	1.5	3.4	3.9	141.1
1993	12.6	1.4	2.0	7.8	124.3
1994	27.6	7.1	1.9	13.3	170.0
1995	20.8	3.1	0.9	16.2	186.9
1996	18.6	1.8	1.2	13.0	252.9
1997	18.6	1.8	3.8	13.4	303.7
1998	29.5	2.9	1.6	16.7	244.8
1999	30.0	0.9	1.8	6.6	471.6
2000	11.0	0.8	2.0	4.8	349.6
2001	13.4	0.8	2.7	3.1	328.8
2002	9.3	0.8	1.2	2.2	180.2
2003	2.0	0.2	0.4	2.8	165.4
2004	1.6	0.4	0.6	2.5	140.1



Data and assessment: This is the first fishery evaluation for California scorpionfish. The statistical assessment model (SS2 version 1.18) was configured to estimate population characteristics for the period 1916-2004, with the initial state determined in an unexploited equilibrium. Data used in the model included commercial landings by method in weight, recreational landings in numbers of fish, a fishery dependent CPUE statistic determined from analysis of CPFV logbook trip data from 1980-1999, a fishery

independent index of abundance determined from trawl surveys carried out by the sanitation districts, and length-frequency data from the hook and line and trawl commercial fisheries, the recreational fishery, and the sanitation district trawl surveys. The model was sex-structured, used a Beverton-Holt stock-recruitment relationship with a steepness fixed at 0.7, estimated recruitment deviates for years 1966-2001, fixed M at 0.25 for both sexes, fixed the recruitment deviate standard deviation at 1.0, fixed the length at age coefficient of variation at 0.05 for both sexes, used sex specific growth curves and length-weight relationships from the literature, used maturity information from the literature, used fecundity information from available data, estimated logistic selectivity curves for the recreation and the hook and line and trawl commercial methods. The gillnet and fish pot selectivities were set equal to the hook and line selectivity. Two time blocks of selectivities were estimated to accommodate changes in management regulations: recreational 1916-1999 and 2000-2004; commercial 1916-1998 and 1999-2004. Iterative reweighting was used to determine the length-frequency sample size and the standard deviations of the two indices of abundance.

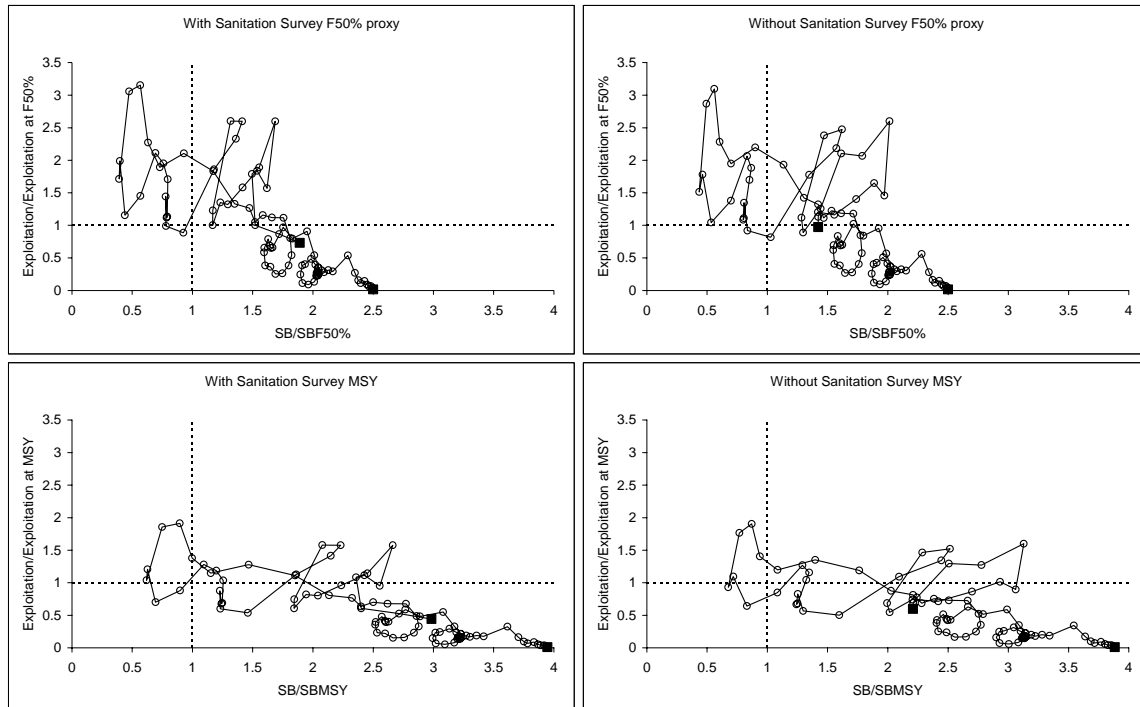
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Discards	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Landings (mt)	133	154	178	163	261	209	198	110	94	81	
ABC											
OY									84.9	84.9	
With sanitation survey											
SPR	0.482	0.455	0.435	0.471	0.383	0.418	0.420	0.530	0.587	0.656	
Exploitation rate	0.129	0.155	0.180	0.153	0.254	0.185	0.175	0.098	0.085	0.071	
Summary (age 2+) biomass	1444	1611	1687	1703	1688	1635	1743	1803	1848	1864	1866
Spawning stock biomass	530	580	629	663	691	636	612	623	704	774	816
(cv)	0.03	0.03	0.03	0.03	0.04	0.05	0.07	0.09	0.09	0.10	0.10
Recruitment	3025	2652	2223	3261	4660	3474	2103	1930	1968	1996	
Depletion level	0.518	0.567	0.615	0.648	0.675	0.622	0.598	0.608	0.688	0.756	0.798
(cv)										0.10	0.10
Without sanitation survey											
SPR	0.510	0.489	0.470	0.506	0.410	0.457	0.456	0.561	0.590	0.622	
Exploitation rate	0.114	0.138	0.163	0.144	0.256	0.204	0.207	0.124	0.111	0.096	
Summary (age 2+) biomass	1676	1801	1933	1894	1830	1646	1522	1405	1376	1358	1352
Spawning stock biomass	609	680	738	771	788	700	631	564	557	557	563
(cv)	0.05	0.04	0.05	0.05	0.06	0.08	0.09	0.10	0.10	0.09	0.09
Recruitment	3997	1984	1905	1915	1924	1893	1865	1831	1827	1827	
Depletion level	0.623	0.695	0.755	0.788	0.805	0.715	0.645	0.577	0.569	0.569	0.576
(cv)										0.08	0.07

Unresolved problems and major uncertainties: The current status is sensitive to the inclusion of the sanitation index in the stock assessment; removing the sanitation index reduces the current biomass level. To match information content in the data, annual recruitment deviates were not estimated after 1996 when the sanitation district trawl survey was excluded from the analysis. The STAR Panel and STAT Team gave relative

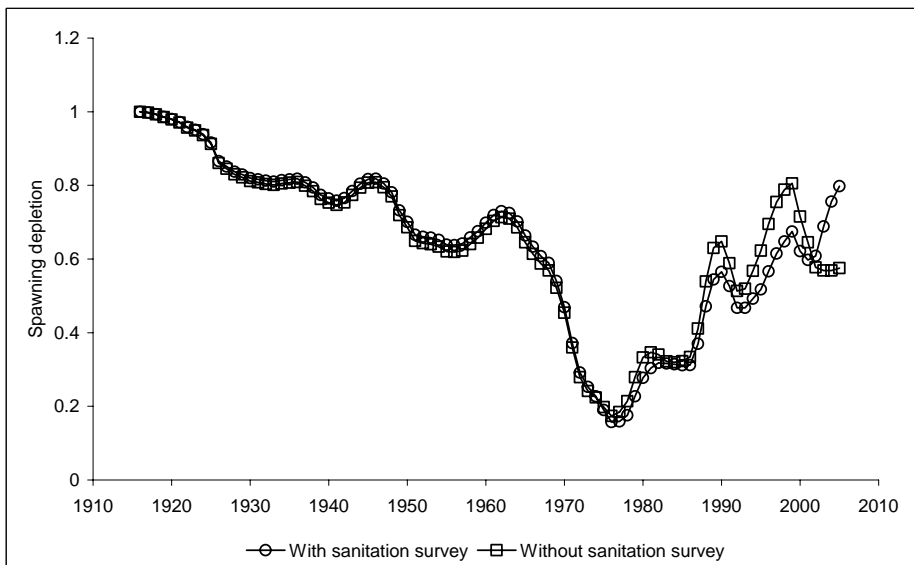
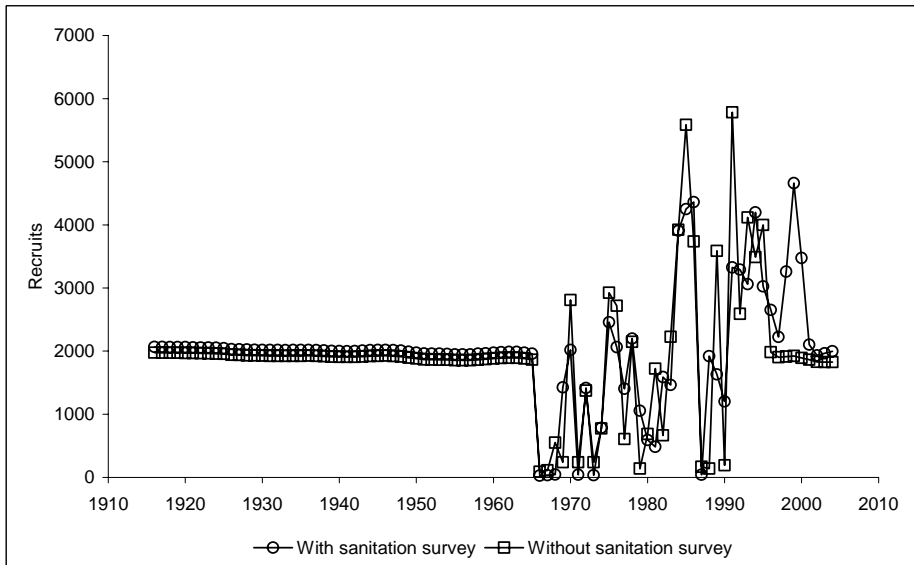
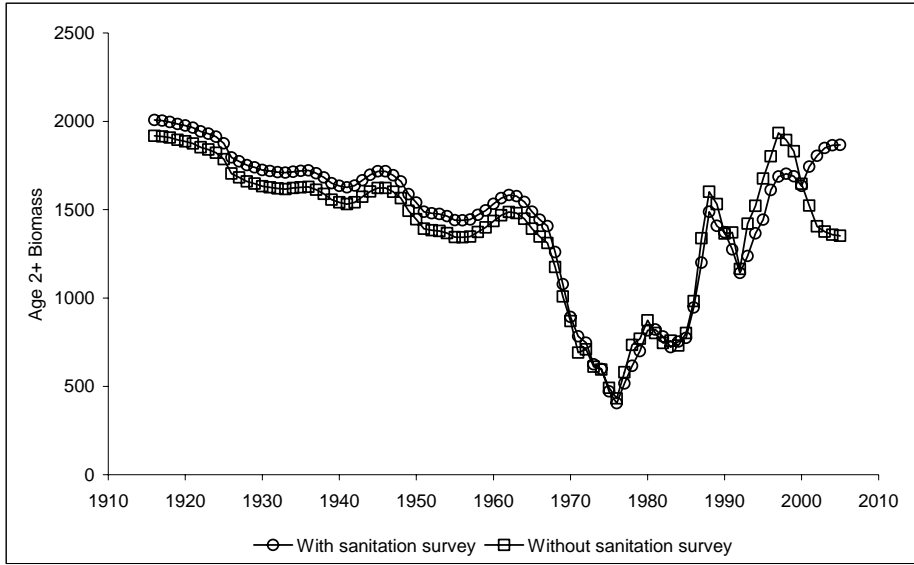
probabilities to models including and excluding the sanitation index of 74% and 26%, respectively. There is a large amount of variation in recruitment levels and recent recruitments are estimated to be substantially higher than average. Predictions of future biomass will be dependent on what recruitment level is assumed in the future. Projections presented in this report use average recruitment based on the Beverton-Holt stock-recruitment relationship.

Reference points: The following reference points were obtained from the two models considered.

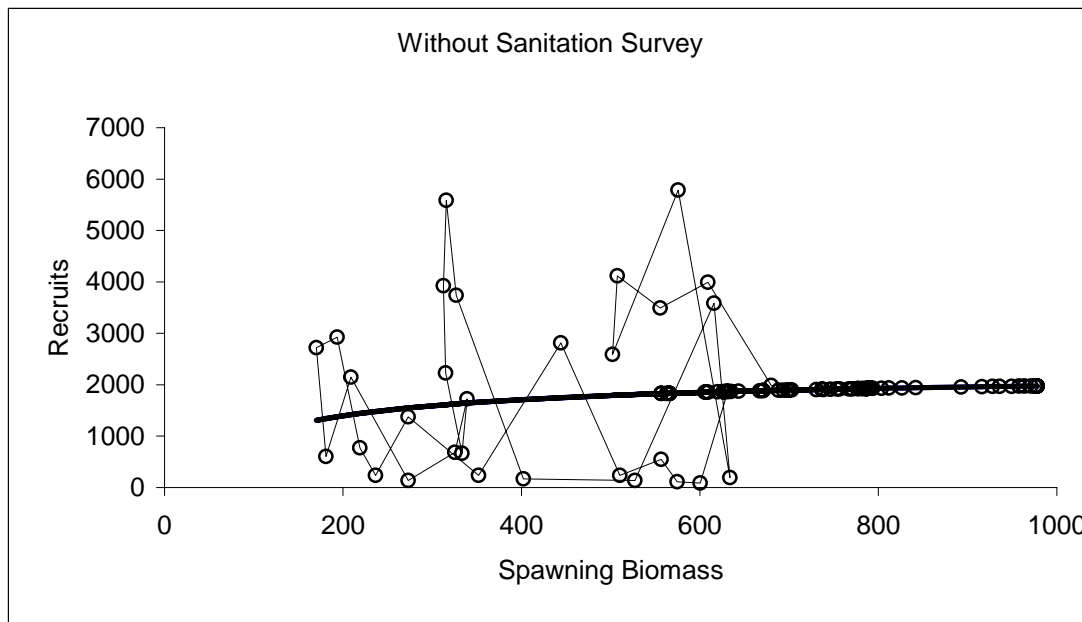
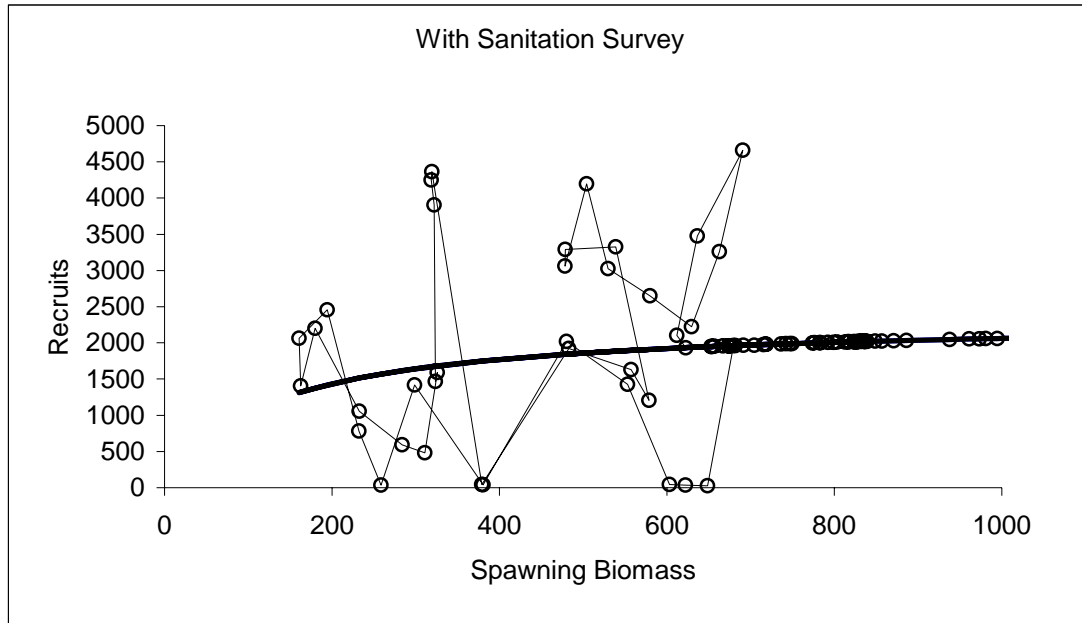
Biological Reference Points			
Quantity	Include sanitation index	Exclude sanitation index	
Unfished spawning biomass (SB_0)		1024	978
Unfished summary (age 2+) biomass (B_0)		2007	1918
Unfished recruitment (R_0 ; age 0)		2067	1975
$SB_{40\%}$ (MSY proxy stock size = $0.4 \times SB_0$)		409	391
Exploitation rate at $F_{50\%}$ proxy		0.098	0.098
SB_{MSY}/SB_0		0.253	0.257
MSY		127	121
Exploitation rate at MSY		0.161	0.160



Stock biomass: Biomass time series (summary biomass (age 2+), recruitment, and spawning depletion) for the two models are shown below.



Recruitment: In the assessment, recruitment was modeled using a Beverton-Holt stock-recruitment relationship, with steepness (h) fixed at a value of 0.7 and recruitment variability (σ_r) fixed at 1.0. Recruitment deviations were estimated for the period 1966-2001. The virgin recruitment parameter (R_0) was the key estimated parameter. The assessments showed evidence of several strong recruitments starting in 1984.



Exploitation status: Both assessments estimate the stock to be above the MSY proxy. In addition, recent exploitation rates have been below or near the F_{msy} proxy (see phase-plots under Reference Points above). Recent landings have been less than the calculated ABC, based on harvesting at a $F_{50\%}$ rate.

Management performance: This is the first stock assessment of California scorpionfish off southern California.

Prior to the adoption of the Pacific Coast Groundfish Fishery Management Plan (FMP) in 1982, California scorpionfish (*Scorpaena guttata*) was managed through a regulatory process that included the California Department of Fish and Game (CDFG) along with either the California State Legislature or the Fish and Game Commission (FGC) depending on the sector (recreation or commercial) and fishery. With implementation of the Pacific Coast Groundfish FMP, California scorpionfish came under the management authority of the Pacific Fishery Management Council (PFMC), being incorporated, along with all genera and species of the family Scorpaenidae, into a federal rockfish classification and managed as part of “Remaining Rockfish” under the larger heading of “Other Rockfish” (PFMC 2004; PFMC 2002, Tables 31-39). California scorpionfish continued to be managed through federal regulations for “Remaining Rockfish” from 1983-1996, although the larger heading “Other Rockfish” was discontinued in 1992 and replaced with “*Sebastes complex*” (PFMC 2002, Tables 40-47; March 1, 1999, 64 FR 9936).

Under the Pacific Coast Groundfish FMP, groundfish species and species groups were managed using estimates of Allowable Biological Catch (ABC) (early documentation refers to Maximum Sustainable Yield, but now referenced as ABC). The ABCs provided by the PFMC’s Groundfish Management Team (GMT) in the 1980’s were based on an analysis of commercial landings from the 1960’s and 1970’s. For this analysis, most of the rockfishes were lumped into one large group. This analysis indicated that the landings for rockfish in the Monterey-Conception area were at or near ABC levels (PFMC 1993). In the 1990’s, as bocaccio and other rockfish were assessed, the ABCs associated with these species were removed from this larger “*Sebastes complex*” group. Starting in 1992, some of the rockfish species and species groups began to be managed using harvest guidelines (in addition to ABCs) followed in 1999 by the use of Optimum Yields (OY).

To keep landings within these adopted harvest targets, the Pacific Coast Groundfish FMP provided the Council with a variety of management tools including area closures, season closures, gear restrictions, and, for the commercial sector, cumulative limits (generally for two-month periods). With the implementation of a federal groundfish restricted access program in 1994, allocations of total catch and cumulative limits began to be specifically set for open access (including most of California’s commercial fisheries that target California scorpionfish in Southern California) and limited entry fisheries (PFMC 2002; 2004).

During most of this time frame, management also centered on the commercial groundfish sector primarily because harvest from the recreational sector was considerably smaller than that from the commercial sector. This approach began to change in the later 1990’s as commercial landings decreased and recreational harvest became a greater proportion of the available harvest. For the “*Sebastes complex*”, an estimate of the recreational harvest began to be included in the ABC tables starting in 1997 (PFMC 2002, Tables 48).

Also beginning in 1997, the “Remaining Rockfish” group was separated into two groups: “Other Rockfish” which contained those species, like California scorpionfish, with no quantifiable assessment (and whose OY was calculated as 0.5 of the ABC); and “Remaining Rockfish” which contained species that had been assessed with less rigorous methods than a stock assessment (and whose OY was calculated as 0.75 of the ABC) (PFMC 2002, Tables 48-53; March 1, 1999, 64 FR 9935-9936). Therefore, beginning in 1997, California scorpionfish was managed as part of the *Sebastes* complex-south, “Other Rockfish” category. (*Sebastes* complex-south included the Eureka, Monterey, and Conception areas while *Sebastes* complex-north included the Vancouver and Columbia areas.)

The PFMC’s rockfish management structure changed significantly in 2000 with the replacement of the *Sebastes* complex –north and –south areas with Minor Rockfish North (now covering the Vancouver, Columbia, and Eureka areas) and Minor Rockfish South (now Monterey and Conception areas only). The OY for these two groups (which continued to be calculated as 0.50 of the ABC) was further divided (between north and south of 40°10’ N. Lat.) into nearshore, shelf, and slope rockfish categories with allocations set for Limited Entry and Open Access fisheries within each of these three categories (January 4, 2000, 65 FR 221; PFMC 2002, Tables 54-55). Species were parceled into these new categories depending on primary catch depths and geographical distribution. Because of its depth range and southern distribution, California scorpionfish was included within the Minor Rockfish South, “Other Rockfish” ABC and managed under the south of 40°10’ N. Lat. nearshore rockfish OY and trip limits (PFMC 2002, Table 29).

Along with the above changes, a North/South management line at 40°10’ N. Lat. was established in 2000 with separate management specifications adopted for the areas north and south of 40°10’ N. Lat. and with the southern area divided into two separate management areas at Point Lopez, 36°00’ N. Lat. This was followed in 2001 with the implementation of two distinct rockfish and lingcod management areas south of 40°10’ N. Lat. (along with separate management specifications): the northern rockfish and lingcod management area between 40°10’ N. Lat. and Point Conception (34°27’ N. Lat.); and the southern rockfish and lingcod management area between Point Conception and the U.S.-Mexico border. These were later revised starting in 2004 with the northern rockfish and lingcod management area redefined as ocean waters from the Oregon – California border (42°00’ N. Lat.) to 40°10’ N. Lat., the central rockfish and lingcod management area defined as ocean waters from 40°10’ N. Lat. to Point Conception, and the southern rockfish and management area continuing to be defined as ocean waters from Point Conception to the U.S.-Mexico border.

Cowcod Conservation Areas (CCAs) also were established in 2001 to reduce fishing effort for cowcod rockfish (PFMC 2002, Table 29). These areas were closed to all recreational and commercial fishing for groundfish except for recreational and

commercial fishing for minor nearshore rockfish¹ (including California scorpionfish) within waters less than 20 fathoms. In addition, Rockfish Conservation Areas (RCAs) were established in 2003 to allow for the closure of specific area and depth ranges along the West Coast for the purpose of reducing fishing effort for shelf and slope rockfish. The California Rockfish Conservation Area (CRCA) was defined as those ocean waters south 40°10' N. Lat. to the U.S.-Mexico border with different depth zones specified for the areas north and south of Pt. Reyes (37°59'44''N. Lat.).

During the late 1990's and early 2000's, major changes also occurred in the way that California managed its nearshore fishery. The Marine Life Management Act (MLMA), which was passed in 1998 by the California Legislature and enacted in 1999, required that the FGC adopt an FMP for nearshore finfish. It also gave authority to the FGC to regulate commercial and recreational nearshore fisheries through FMPs and provided broad authority to adopt regulations for the nearshore fishery during the time prior to adoption of the nearshore finfish FMP. Within this legislation, the Legislature also included commercial size limits for nine nearshore species including California scorpionfish (10-inch minimum size) and a requirement that commercial fishermen landing these nine nearshore species possess a nearshore permit.

Following adoption of the Nearshore FMP and accompanying regulations by the FGC in fall of 2002, the FGC adopted regulations in November 2002 which established a set of marine reserves around the Channel Islands in Southern California (which became effective April 2003) and adopted a nearshore restricted access program in December 2002 (which included the establishment of a Deeper Nearshore Permit) to be effective starting in the 2003 fishing year.

Although the Nearshore FMP provided for the management of the nearshore rockfish and California scorpionfish, management authority for these species continued to reside with the Council. Even so, for the 2003 and subsequent fishery seasons, the State provided recommendations to the Council specific to the nearshore species that followed the directives set out in the Nearshore FMP. These recommendations, which the Council incorporated into the 2003 management specifications, included a recalculated OY for Minor Rockfish South - Nearshore, division of the Minor Rockfish South - Nearshore into three groups (shallow nearshore rockfish; deeper nearshore rockfish; and California scorpionfish), and specific harvest targets and recreational and commercial allocations for each of these groups. This was followed in 2004 with the adoption of specific management measures for each of the three management areas: the California-Oregon border to 40°10' N. Lat.; 40°10' N. Lat. to Point Conception (34 ° 27' N. Lat.); and Point Conception to the U.S.-Mexico border.

Also, since the enactment of the MLMA, the Council and State in a coordinated effort developed and adopted various management specifications in 1999-2004 to keep harvest within the harvest targets, including seasonal and area closures (e.g. the CCAs; a closure of Cordell Banks to specific fishing), depth restrictions, minimum size limits, and bag

¹ This exception also included the two state managed groundfish species, cabezon and kelp greenling.

limits to regulate the recreational fishery and license and permit regulations, finfish trap permits, gear restrictions, seasonal and area closures (e.g. the RCAs and CCAs; a closure of Cordell Banks to specific fishing), depth restrictions, trip limits, and minimum size limits to regulate the commercial fishery.

Summary of Federal and California Regulations for California Scorpionfish for the Area South of Point Conception (34° 27' N. lat.) from 1999-2004.

Recreational	
1999	Fishing open January – December at all depths.
2000	10” minimum size limit. January-February closure for rockfishes including California scorpionfish.
2001	January – February, November - December fishing in waters < 20 fathoms; March-October fishing open at all depths.
2002	January – February, November – December closure for rockfishes including California scorpionfish; March-June fishing open at all depths; July – October fishing in waters <20 fathoms.
2003	Bag limit changed from 10 fish to 5 fish. January – February fishing only in waters < 20 fathoms; March – June fishing open at all depths; July – August fishing in waters < 20 fathoms; September - November fishing in waters < 30 fathoms; December closure for rockfishes including California scorpionfish.
2004	January – February, May - October closure for rockfishes including California scorpionfish; March – April, November – December open in waters < 60 fathoms.
Commercial	
1999	10” minimum size limit with exemption for fish taken in trawl nets and landed dead. Fishermen landing California scorpionfish required to possess a Nearshore Permit. <i>Sebastes</i> Complex -South (which includes California scorpionfish) open January – December. Limits under <i>Sebastes</i> Complex –South provided in Federal Register (FR) for all open access gear (revised at 64 FR 54786, October 8, 1999). A limit of 300 pounds of groundfish per trip also set for open access exempted trawl gear engaged in fishing for pink shrimp, spot and ridgeback prawns, California halibut, and sea cucumbers; all limits and closures adopted for open access gear also apply and are counted toward the groundfish limit (PFMC 2002).
2000	For area south of 36° N. Lat., closed January – February; in area between 40° N. Lat. and 36° N. Lat., closed March – April. Limits under Minor Rockfish South – Nearshore provided in Table 5 for all open access gear (revised at 65 FR 66655, November 7, 2000) (also provided in PFMC 2002, Table 29.d). A limit of 300 pounds of groundfish per trip also set for open access exempted

	<p>trawl gear engaged in fishing for spot and ridgeback prawns, California halibut, and sea cucumbers; all limits and closures adopted for open access gear (Table 29.d) also apply and are counted toward the groundfish limit; more specific limits set for exempted trawl gear engaged in fishing for pink shrimp (PFMC 2002).</p>
2001	<p>For area south of 34° 27', January – February fishing in waters < 20 fathoms; March – December open at all depths.</p> <p>Limits under Minor Rockfish South – Nearshore provided in Table 5 for all open access gear (revised at 66 FR 54721, October 5, 2001) (also provided in PFMC 2002, Table 29.h).</p> <p>A limit of 300 pounds of groundfish per trip also set for open access exempted trawl gear engaged in fishing for spot and ridgeback prawns, California halibut, and sea cucumbers; all limits and closures adopted for open access gear (Table 29.h) also apply and are counted toward the groundfish limit; more specific limits set for exempted trawl gear engaged in fishing for pink shrimp (PFMC 2002).</p>
2002	<p>For area south of 34° 27', closed January – February; March – June open at all depths; July – August open in waters < 20 fathoms; closed September – December.</p> <p>Limits under Minor Rockfish South – Nearshore provided in Table 5 for all open access gear (revised at 67 FR 70018, November 20, 2002).</p> <p>A limit of 300 pounds of groundfish per trip also set for open access exempted trawl gear engaged in fishing for spot and ridgeback prawns, California halibut, and sea cucumbers; all limits and closures adopted for open access gear (Table 5) also apply and are counted toward the groundfish limit; more specific limits set for exempted trawl gear engaged in fishing for pink shrimp (revised at 67 FR 10490, March 7, 2002).</p>
2003	<p>For California scorpionfish, closed January – April, September – December; open at all depths May – August.</p> <p>Limits under Minor Rockfish South – Nearshore, California scorpionfish provided in Table 5 (South) for all open access gears (revised at 68 FR 40187, July 7, 2003).</p> <p>Trip limits and RCAs for groundfish retained in the pink shrimp, ridgeback prawns, California halibut, and sea cucumber fisheries also provided in Table 5 (South).</p> <p>Fishermen using open access exempted trawl gear and taking nearshore species covered by the Nearshore Permit (including California scorpionfish) now required to have a Nearshore Fishery Bycatch Permit and now limited to 50 pounds per day of these select nearshore species. All limits and closures adopted for open access gear in Table (5) also apply.</p>
2004	<p>For California scorpionfish, closed January – February; open at all depths March – December.</p> <p>Limits under Minor Rockfish South – Nearshore, California scorpionfish provided in Table 5 (South) for all open access gears (revised at 69 FR 58916, October 6, 2004).</p> <p>Trip limits and RCAs for groundfish retained in the pink shrimp, ridgeback prawns, California halibut, and sea cucumber fisheries also provided in Table 5</p>

	<p>(South). Fishermen taking nearshore species covered by the Nearshore Permit (including California scorpionfish) under the Nearshore Fishery Bycatch Permit limited to 50 pounds per day of these select nearshore species. All limits and closures adopted for open access gear in Table (5) also apply.</p>
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ABCs, OYS, and Harvest Targets in Metric Tons for Nearshore Minor Rockfish South and California Scorpionfish for 1999-2006.

Species Group	1999			
	ABC	OY	Recreational ¹	Commercial ¹
<i>Sebastes</i> complex - south ²	4,731	2,705	-----	1,396
Other Rockfish	3,603	-----	-----	-----

Species Group	2000				2001				2002			
	ABC	OY	Recreational ¹	Commercial ¹	ABC	OY	Rec. ¹	Comm. ¹	ABC	OY	Rec. ¹	Comm. ¹
Minor Rockfish South ³	3,457	1,899	571	1,328	3,556	2,040	950	1,090	3,506	2,015	732	1,283
Other Rockfish	2,702	-----	-----	-----	2,702	-----	-----	-----	2,652	-----	-----	-----
Nearshore		680	379	301		662	550	112		662	532	130

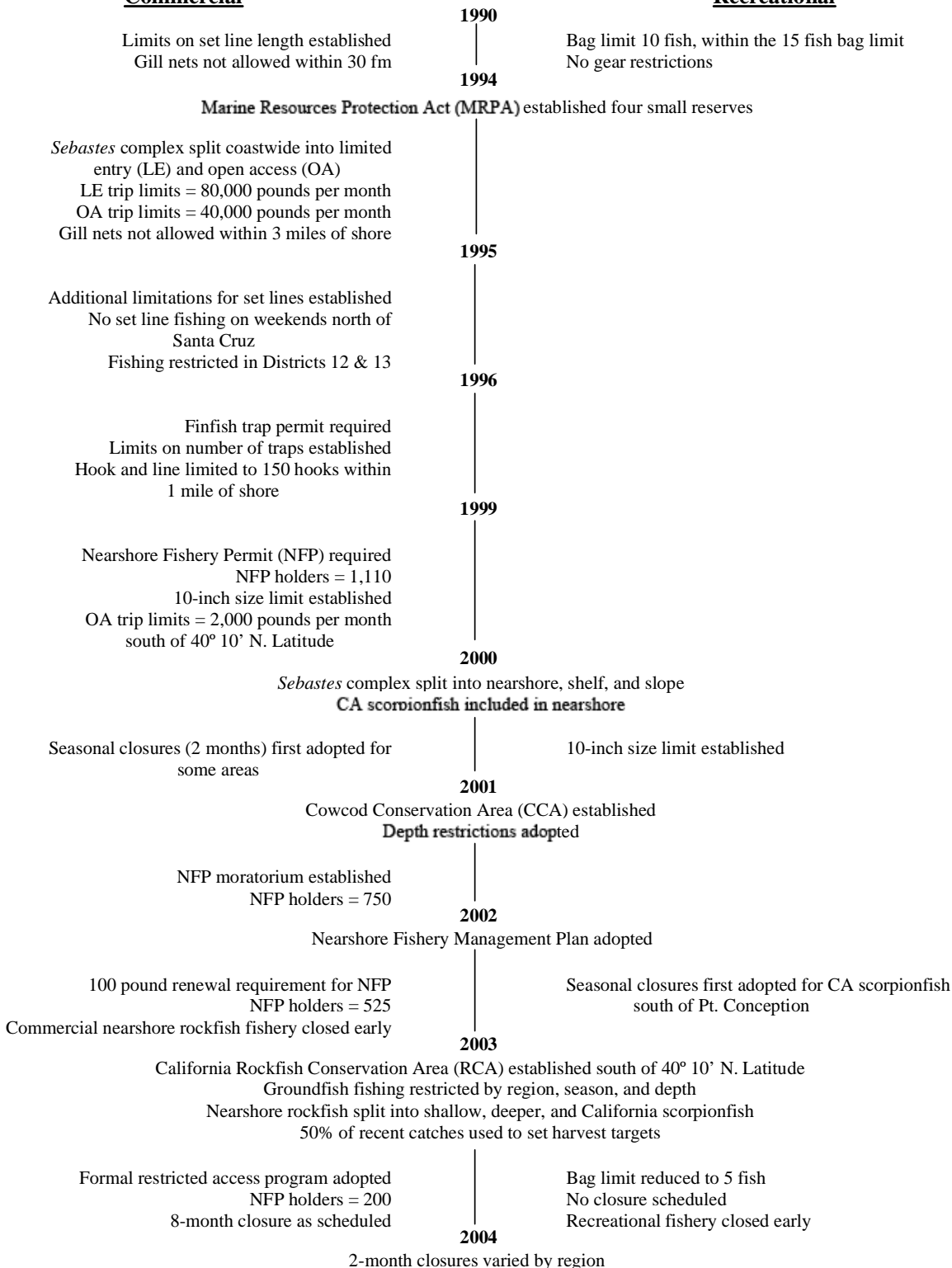
Species Group	2003				2004				2005/2006			
	ABC	OY	Recreational ¹	Commercial ¹	ABC	OY ⁴	Rec. ¹	Comm. ¹	ABC	OY ⁴	Rec. ¹	Comm. ¹
Minor Rockfish South ³	3,506	1,894	493	1,401	3,412	1,968	435	1,390	3,412	1,968	443	1,390
Other Rockfish	2,652	-----	-----	-----	2,558	-----	-----	-----	2,558	-----	-----	-----
Nearshore ^{4,5,6}		541	433	108		615	375	97		615	383	97
Shallow Nearshore		104.8	66	38.8		104.8	66	38.8		-----	-----	-----
Deeper Nearshore ⁶		351.1	303.1	48		282.3	245.1	37.2		-----	-----	-----
California Scorpionfish		84.9	63.9	21		84.9	63.9	21		-----	-----	-----

Note:

1. Unbolded recreational values are either recreational estimates or harvest targets; unbolded commercial values are harvest targets while bolded values are OYs.
2. *Sebastes* complex -south covers the Eureka, Monterey, and Conception areas.
3. Minor Rockfish South covers only the Monterey and Conception areas with the boundary between Minor Rockfish North and Minor Rockfish South at 40° 30' N. lat.
4. The Nearshore Minor Rockfish South OY of 615 mt for 2004-2006 is currently under review.
5. The Nearshore Minor Rockfish South northern boundary is 40°10' N. lat.
6. Starting in 2004, Nearshore and Deeper Nearshore Rockfish OYs and harvest targets do not include black rockfish.

Commercial

Recreational



Forecasts: The population assessments were projected forward under the default PFMC and California harvest policies (i.e. F50% with 40:10 and 60:20 reductions, respectively). All scenarios assume that catch in 2005 and 2006 is equal to the catch in 2004. Projections for the commercial fishery are based on landed weights, while recreational projections are based on catch in numbers of fish converted to weight, resulting in slightly different trajectories for the two sectors due to variations in recent recruitment. Different allocation of catch among fisheries than presented below will produce somewhat different biomass trajectories because of different selectivities for the two sectors. Note: exploitation rates are in terms of the oldest aged fish in the model (Age 25 plus group) and not summary biomass.

With Sanitation Survey

Year	40:10	Biomass Age 2+	Spawning Biomass	Depletion	Commercial catch (mt)	Commercial harvest rate	Sport Catch (mt)	Sport Harvest Rate
2005	NA	1866	816	0.80	5.2	0.005	78.9	0.121
2006	NA	1846	827	0.81	5.2	0.005	82.6	0.113
2007	1	1811	818	0.80	13.4	0.013	222.2	0.291
2008	1	1633	703	0.69	11.5	0.013	191.0	0.291
2009	1	1503	623	0.61	10.0	0.013	164.9	0.291
2010	1	1412	572	0.56	9.0	0.013	145.7	0.291
2011	1	1348	541	0.53	8.3	0.013	132.6	0.291
2012	1	1303	520	0.51	7.9	0.013	124.0	0.291
2013	1	1271	505	0.49	7.6	0.013	118.4	0.291
2014	1	1246	494	0.48	7.4	0.013	114.6	0.291
2015	1	1226	485	0.47	7.2	0.013	111.8	0.291
2016	1	1210	478	0.47	7.1	0.013	109.5	0.291
2017		1198	472	0.46				

Year	60:20	Biomass Age 2+	Spawning Biomass	Depletion	Commercial catch (mt)	Commercial harvest rate	Sport Catch (mt)	Sport Harvest Rate
2005	NA	1866	816	0.80	5.2	0.005	78.9	0.121
2006	NA	1846	827	0.81	5.2	0.005	82.6	0.113
2007	1.00	1811	818	0.80	13.4	0.013	222.2	0.291
2008	1.00	1633	703	0.69	11.5	0.013	191.0	0.291
2009	1.00	1503	623	0.61	10.0	0.013	164.9	0.291
2010	0.96	1412	572	0.56	8.7	0.013	140.4	0.280
2011	0.94	1354	544	0.53	7.8	0.012	125.2	0.272
2012	0.92	1315	528	0.52	7.3	0.012	116.4	0.267
2013	0.91	1289	517	0.51	7.1	0.012	111.1	0.264
2014	0.90	1269	510	0.50	6.9	0.012	107.6	0.261
2015	0.89	1254	504	0.49	6.7	0.012	105.0	0.259
2016	0.88	1243	499	0.49	6.6	0.012	103.0	0.257
2017		1234	495	0.48				

Without Sanitation Survey

Year	40:10	Biomass Age 2+	Spawning Biomass	Depletion	Commercial catch (mt)	Commercial harvest rate	Sport Catch (mt)	Sport Harvest Rate
2005	NA	1352	563	0.58	5.2	0.007	82.0	0.151

2006	NA	1343	566	0.58	5.2	0.007	82.8	0.152
2007	1	1335	566	0.58	8.8	0.013	141.7	0.261
2008	1	1268	526	0.54	8.1	0.013	128.4	0.261
2009	1	1223	499	0.51	7.5	0.013	118.8	0.261
2010	1	1192	481	0.49	7.2	0.013	112.4	0.261
2011	1	1170	470	0.48	7.0	0.013	108.1	0.261
2012	1	1154	462	0.47	6.8	0.013	105.5	0.261
2013	1	1142	456	0.47	6.7	0.013	103.7	0.261
2014	1	1132	451	0.46	6.7	0.013	102.3	0.261
2015	1	1123	447	0.46	6.6	0.013	101.3	0.261
2016	1	1117	443	0.45	6.5	0.013	100.4	0.261
2017		1111	441	0.45				

Year	60:20	Biomass Age 2+	Spawning Biomass	Depletion	Commercial catch (mt)	Commercial harvest rate	Sport Catch (mt)	Sport Harvest Rate
2005	NA	1352	563	0.58	5.2	0.007	82.0	0.151
2006	NA	1343	566	0.58	5.2	0.007	82.8	0.152
2007	0.98	1335	566	0.58	8.6	0.013	139.1	0.256
2008	0.94	1271	528	0.54	7.6	0.012	121.8	0.246
2009	0.92	1232	505	0.52	7.0	0.012	110.9	0.240
2010	0.90	1208	492	0.50	6.7	0.012	104.5	0.236
2011	0.89	1192	484	0.50	6.5	0.011	100.7	0.233
2012	0.89	1181	479	0.49	6.3	0.011	98.6	0.232
2013	0.88	1173	476	0.49	6.3	0.011	97.2	0.231
2014	0.88	1167	473	0.48	6.2	0.011	96.1	0.230
2015	0.88	1162	471	0.48	6.1	0.011	95.3	0.229
2016	0.87	1158	469	0.48	6.1	0.011	94.7	0.228
2017		1155	468	0.48				

Decision table: Uncertainty in the analysis is represented by including and excluding the sanitation districts trawl survey. Management action alternatives considered were: (1) harvesting using the 40:20 rule based on the assessment including the sanitation districts trawl survey; (2) harvesting using the 60:20 rule based on the assessment including the sanitation districts trawl survey; and (3) harvesting using catch in 2004. All scenarios assume that catch in 2005 and 2006 is equal to the catch in 2004. Projections for the commercial fishery are based on landed weights, while recreational projections are based on catch in numbers of fish. Results are presented below.

Management Action	Year	Recreational catch (thousands of fish)	Commercial catch (mt)	State of nature			
				With Sanitation		Without Sanitation	
				More likely ($p = 0.74$)		less likely ($p = 0.26$)	
				Spawning Biomass	Depletion	Spawning Biomass	Depletion
40-10	2005	140	5	816	0.80	563	0.58
	2006	140	5	827	0.81	566	0.58
	2007	361	13	818	0.80	566	0.58
	2008	308	11	703	0.69	478	0.49
	2009	267	10	623	0.61	425	0.43
	2010	240	9	572	0.56	397	0.41
	2011	222	8	541	0.53	385	0.39
	2012	211	8	520	0.51	380	0.39

	2013	203	8	505	0.49	379	0.39
	2014	198	7	494	0.48	378	0.39
	2015	194	7	485	0.47	378	0.39
	2016	191	7	478	0.47	379	0.39
	2017			472	0.46	380	0.39
60-20	2005	140	5	816	0.80	563	0.58
	2006	140	5	827	0.81	566	0.58
	2007	361	13	818	0.80	566	0.58
	2008	308	11	703	0.69	478	0.49
	2009	267	10	623	0.61	425	0.43
	2010	231	9	572	0.56	397	0.41
	2011	209	8	544	0.53	388	0.40
	2012	197	7	528	0.52	387	0.40
	2013	189	7	517	0.51	389	0.40
	2014	184	7	510	0.50	392	0.40
	2015	180	7	504	0.49	395	0.40
	2016	177	7	499	0.49	398	0.41
	2017			495	0.48	401	0.41
Current catch	2005	140	5	816	0.80	563	0.58
	2006	140	5	827	0.81	566	0.58
	2007	140	5	818	0.80	566	0.58
	2008	140	5	785	0.78	565	0.58
	2009	140	5	762	0.76	563	0.58
	2010	140	5	739	0.74	561	0.57
	2011	140	5	717	0.71	559	0.57
	2012	140	5	697	0.69	557	0.57
	2013	140	5	679	0.68	555	0.57
	2014	140	5	663	0.66	553	0.57
	2015	140	5	649	0.65	551	0.56
	2016	140	5	637	0.63	549	0.56
	2017			626	0.62	548	0.56

Regional management: The range of California scorpionfish is restricted to southern California. A substantial, but unknown, proportion of the stock is in Mexican waters. Initial analysis conducted on individual sub-stocks showed that similar results are obtained for the nearshore stocks along the U.S. mainland coast. This is corroborated by the similarity in the CPUE and sanitation abundances indices for the nearshore stocks. The sum of the individual sub-stock assessments was similar to the single southern California assessment. However, the individual sub-stock assessments indicated that the exploitation rates are lower in the offshore areas. Unfortunately, there is limited data for the offshore areas. Regional management would require obtaining length-frequency data by CDFG block to allow stock assessments by region. In addition, more information on the site fidelity of California scorpionfish from tagging data would be needed to determine the appropriateness of regional management.

Research and data needs: Differences in growth rates between the sexes may imply that the fisheries have different impacts on the sexes. Sex-specific sampling of the data (e.g. length-frequencies) would help refine the model and identify the different impacts on the sexes. There is only limited information on the stock structure and a large proportion of the stock resides in Mexican waters. Extensive tagging studies would help define the stock structure, evaluate the need for local scale assessments, and determine the impact of the Mexican component of the

stock. Catches from the Mexican fisheries would also be beneficial. The growth data are based on limited sampling and an updated aging study may improve the assessment.

C. Introduction

1. Description

California scorpionfish (*Scorpaena guttata*), also known locally as sculpin, is a generally benthic species found from central California to the Gulf of California between the inter-tidal and about 170 m (Eschmeyer et al., 1983; Love et al., 1987). It generally inhabits rocky reefs, but in certain areas and seasons it aggregates over sandy or muddy substrate (Frey, 1971; Love et al., 1987). Catch rate analysis and tagging studies show that most, but not all, California scorpionfish migrate to deeper water to spawn during May-September (Love et al., 1987). Tagging data suggest that they return to the same spawning site (Love et al. 1987), but information is not available on non-spawning season site fidelity. California scorpionfish are quite mobile and may not be permanently tied to a particular reef (Love et al. 1987). The species feeds on a wide variety of foods, including crabs, fishes, octopi, isopods and shrimp, but juvenile *Cancer* crabs are the most important prey (Limbaugh, 1955; Love et al., 1987).

2. Important life history characteristics

Love et al. (1987) provide a summary of the biology of California scorpionfish. California scorpionfish spawn from May through August, peaking in July (Love et al. 1987). The species is oviparous, producing floating, gelatinous egg masses in which the eggs are embedded in a single layer (Orton 1955). California scorpionfish utilize the “explosive breeding assemblage” reproductive mode in which fish migrate to, and aggregate at traditional spawning sites for brief periods (Love et al. 1987) and it is believed that spawning takes place just before, and perhaps after dawn, in the water column (Love et al. 1987). These spawning aggregations have been targeted by fishermen. Little is known about California scorpionfish larvae. Few larvae have been taken in ichthyoplankton surveys off southern California (Moser et al. 1993). Larvae are more abundant in surveys conducted off northern Baja California, Mexico (Moser et al. 1993). Few California scorpionfish are mature at 1 year of age, but over 50% are mature by age two and most are mature by age three (Love et al. 1987).

Males and females show different growth rates, with females growing to a larger size than males, and the sexes exhibit different length-weight relationships (Love et al. 1987).

Scorpionfish are very resistant to hooking mortality and have shown survival under extreme conditions. Therefore, for the purpose of this assessment, discard mortality is assumed to be negligible.

Like other species in the genus *Scorpaena*, California scorpionfish produce a toxin in their dorsal, anal, and pelvic spines, which produces intense, painful wounds (Love et al. 1987).