

Cowcod Rebuilding Review

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Objectives of Review

The primary objective of the Review was to provide a thorough examination of fishery-related cowcod removals that followed strict harvest restrictions that went into effect in 2000. Further, this examination is presented in the context of the yields (e.g., ABCs, OYs, etc.) recommended by the Pacific Fishery Management Council (PFMC). Indices of abundance were updated in cases where recent data were available; however, the time series will be made available as part of the oral presentation only, given these auxiliary data have not been evaluated in an inclusive (stock) framework and are best interpreted qualitatively at this time (see Appendix). That is, it is important to note that this Review did not include population modeling exercises and thus, should not be considered a formal stock assessment. In this regard, the Science and Statistical Committee (SSC) of the PFMC has recommended that cowcod be assessed formally again in 2004-05, with assessment-related duties assigned to researchers from the Southwest Fisheries Science Center in La Jolla, CA. Finally, in this Review, we focused on sample information associated with recognized data sources and arguably, have developed the most accurate time series of cowcod removals possible at this time.

Introduction

Cowcod (*Sebastes levis*) are distributed from Oregon to central Baja California, Mexico, are common off southern and central California, and are much less common off northern California and Oregon. This species generally inhabits a wide range of depths from 40 to 366 m (22-203 fm), with highest concentrations restricted to roughly 100 to 250 m (55-140 fm). Adults are usually associated with rocky outcrops. Larvae and juveniles are planktonic for up to three months and likely disperse long distances before settling to the bottom. The prolonged pelagic phase suggests a single biological population; however, the existence of multiple populations cannot be discounted definitively. Cowcod are long lived, slow growing, become sexually mature at a relatively old ages (12 y) and have a range of plausible natural mortality rates ($M=0.065-0.085y^{-1}$) that are relatively low for species of rockfish in general.

Management History

Prior to 2000, commercially harvested cowcod were managed under "other rockfish," with an ABC of 3,603 MT recommended for the combined statistical areas of Conception, Monterey and Eureka (PFMC, 1998). Recreational fishery regulations limited California anglers to 15 rockfish per day prior to 2000, with no 'sub-limit' restrictions for cowcod within the overall 15-rockfish limit. In 1999, the first assessment of cowcod indicated that the stock was overfished (Butler et al., 1999), which resulted in the adoption of specific management measures by the PFMC. In 2000, commercial fishers were limited to 1 cowcod per landing and bag limits for recreational fishers were 1 cowcod and 10 rockfish in the 'south' and 'north' management areas (see Table 1 for description of management areas). In addition, the PFMC created a Cowcod Conservation Area, where most bottom fishing was prohibited deeper than approximately 36 m (20 fm), see

Table 1. In 2001, cowcod became a ‘prohibited’ species for both recreational and commercial fishers.

The cowcod rebuilding analysis (Butler and Barnes, 2000) indicated that achieving B_{MSY} (i.e., $B_{40\%}$) for the south area could be achieved in 95 y, with initial total removals of 2.4 MT based on a fishing mortality rate (F) of 0.01. Ultimately, the PFMC adopted rebuilding plans for two geographic areas (‘north’ and ‘south’) that were partitioned at Point Conception, CA (Table 1). Catch limits for the south area were based on the rebuilding analysis and the OY was set at 2.4 MT, with an ABC of 5 MT that represented equilibrium-based yield estimates. Catch limits for the north area were set at 2.4 MT, with an ABC of 19 MT that was roughly equivalent to landings made in recent years.

Data Sources for Removals

Removals are defined here as landings (i.e., estimated through port sampling programs) and bycatch/discard (i.e., estimated via observer sampling programs); however, it is important to note that it was not possible to determine objective estimates of bycatch/discard for some fisheries. Henceforth, removal estimates are presented in the context of the naming convention above.

Commercial landings of cowcod were generated from the CalCOM data base (Pearson, 2003) in a similar fashion as was done in the previous assessment (Butler et al., 1999). Additionally, bycatch-related estimates of cowcod were generated from sample data associated with the spot prawn fishery off southern California (Reilly and Geibel, 2002a and 2002b) and various other commercial fisheries that exploit groundfish populations off the U.S. Pacific coast (see Table 4.4-1 in PFMC, 2003). Recreational landings of cowcod were estimated from the RecFIN data base (RecFIN, 2003), LA Times Newspaper (LA Times, 2003), and CPFV logbook data using similar methods as were used in the previous assessment (Butler et al., 1999).

It was possible to generate estimates of recreational fishery-related (Commercial Passenger Fishing Vessel, CPFV) discard from data collected through a recently implemented observer sampling program conducted collaboratively by the California Department of Fish and Game (CDFG) and Marine Recreational Fishery Statistics Survey (MRFSS). Also, note that no estimates of cowcod discard were currently available from the recently implemented observer sampling program for the groundfish trawl fishery off the U.S. Pacific coast, but given groundfish (including cowcod) trawl landings off southern California (the species primary concentration) have declined markedly since the late 1990s when further restrictions to quotas were established for this fishery, levels of discard were assumed negligible.

Results and Conclusions

Most importantly, this Review indicated that total removals of cowcod have declined in accordance with the new harvest stipulations enacted in 2000. Removal estimates of cowcod for both commercial and recreational fisheries are presented in Table 2. Total removals for the two management areas (north and south of Point Conception) were below the ABC/OY, with the exception of the south area in 2000. This was largely the result of additional removals (bycatch) by the spot prawn trawl fishery off southern California that were accounted for in this Review, but not in previous assessments of the population. Regardless, in statistical terms, the additional yield of 12% (i.e., 0.6 MT above the 5 MT OY) is within the bound of error associated with these estimates, given the substantial variability surrounding the recreational fishery statistics alone, which typically represented the majority of the total removals of cowcod, i.e., variance estimates associated with recreational fishery sample data were able to be derived.

The stringent harvest restrictions in place since 2000 appear to have been generally effective in constraining total removals of cowcod to levels that were within the rebuilding-based OYs. Additionally, it is expected that the population would be further protected as a result of establishment of the Rockfish Conservation Areas that were set aside beginning in 2003 (see Table 1); however, the potential reduction in removals due to these area closures was not considered in this Review. Finally, conclusions drawn here were based strictly on the assumption that the available sources of data were inclusive and did not include potentially influential biases, e.g., sample information was representative of the statistical populations of interest, unreported removals of cowcod were minimal, etc.).

References

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Table 1. Cowcod and shelf rockfish regulations (2000-02) and description of Cowcod Conservation Areas.

Year	Area ¹	Recreational fishery regulations				
		Cowcod stock ABC/OY (mt)	Cowcod bag limit	Rockfish bag limit	Gear restrictions	Shelf rockfish open season
2000	North	19 / <5	1 (2/boat)	10	1 line / 3 hooks	Jan-Feb + May-Dec
	South	5 / <5	1 (2/boat)	10	1 line / 3 hooks	Mar-Dec
2001	North	19 / 2.4	Prohibited	10	1 line / 2 hooks	Jan-Feb + Jul-Dec
	South	5 / 2.4	Prohibited	10	1 line / 2 hooks	Mar-Dec
2002	North	19 / 2.4	Prohibited	10	1 line / 2 hooks	Jan-Feb + Jul-Aug
	South	5 / 2.4	Prohibited	10	1 line / 2 hooks	Mar-Oct

Commercial fishery regulations								
Year	Area ¹	Cowcod landing limit	LE-FG shelf rockfish season	LE-FG shelf rockfish limit (lb)	LE-Trawl shelf rockfish season	LE-Trawl shelf rockfish limit (lb)	OA shelf rockfish season	OA shelf rockfish limit (lb)
2000	North	1 fish	Jan-Feb + May-Dec	500/mo + 1000/mo May-Jul	All year	500/mo + 1000/mo May-Jul	Jan-Feb + May-Dec	200/mo
	South	1 fish	Mar-Dec	500/mo + 1000/mo May-Jul	All year	500/mo + 1000/mo May-Jul	Mar-Dec	200/mo
2001	North	Prohibited	Jan-Feb + Jul-Sep	500/mo + 1000/mo Jul-Sep	All year	500/mo + 1000/mo May-Oct	Jan-Feb + Jul-Sep	200/mo
	South	Prohibited	Mar-Sep	500/mo + 1000/mo Jul-Sep	All year	500/mo + 1000/mo May-Oct	Mar-Sep	200/mo
2002	North	Prohibited	Jan-Feb	200/mo	Jan-Jun	500/mo + 1000/mo May-Jun	Jan-Feb	200/mo
	South	Prohibited	Mar-Jun	1000/mo	Jan-Jun	500/mo + 1000/mo May-Jun	Mar-Jun	500/mo

¹ Areas are defined as:

North: 2000 is 40°10' -36°; 2001 is 40°10' -34°27'; and 2002 is 40°10' -34°27'.

South: 2000 is south of 36°; 2001 is south of 34°27'; and 2002 is south of 34°27'.

Table 1. Continued.

Cowcod Conservation Areas have been in place since 2000.

The coordinates of the Cowcod Conservation Areas (CCAs) are:

(1) The Western CCA is an area south of Point Conception that is bound by straight lines connecting all of the following points in the order listed:

- 33°50' N. lat., 119°30' W. long.;
- 33°50' N. lat., 118°50' W. long.;
- 32°20' N. lat., 118°50' W. long.;
- 32°20' N. lat., 119°37' W. long.;
- 33°00' N. lat., 119°37' W. long.;
- 33°00' N. lat., 119°53' W. long.;
- 33°33' N. lat., 119°53' W. long.;
- 33°33' N. lat., 119°30' W. long.;

and connecting back to 33°50' N. lat., 119°30' W. long.

(2) The Eastern CCA is a smaller area west of San Diego that is bound by straight lines connecting all of the following points in the order listed:

- 32°42' N. lat., 118°02' W. long.;
- 32°42' N. lat., 117°50' W. long.;
- 32°36'42" N. lat., 117°50' W. long.;
- 32°30' N. lat., 117°53'30" W. long.;
- 32°30' N. lat., 118°02' W. long.;

and connecting back to 32°42' N. lat., 118°02' W. long.

Recreational and commercial fishing for groundfish is prohibited within the CCAs, except that recreational and commercial fishing for rockfish and lingcod is permitted in waters inside 20 fm (36.9 m). It is unlawful to take and retain, possess, or land groundfish inside the CCAs, except for rockfish and lingcod taken in waters inside the 20-fm (36.9 m) depth contour, when those waters are open to fishing. Commercial fishing vessels may transit through the Western CCA with their gear stowed and groundfish on board only in a corridor through the Western CCA bounded on the north by the latitude line at

33°00'30" N. lat., and bounded on the south by the latitude line at 32°59'30" N. lat.

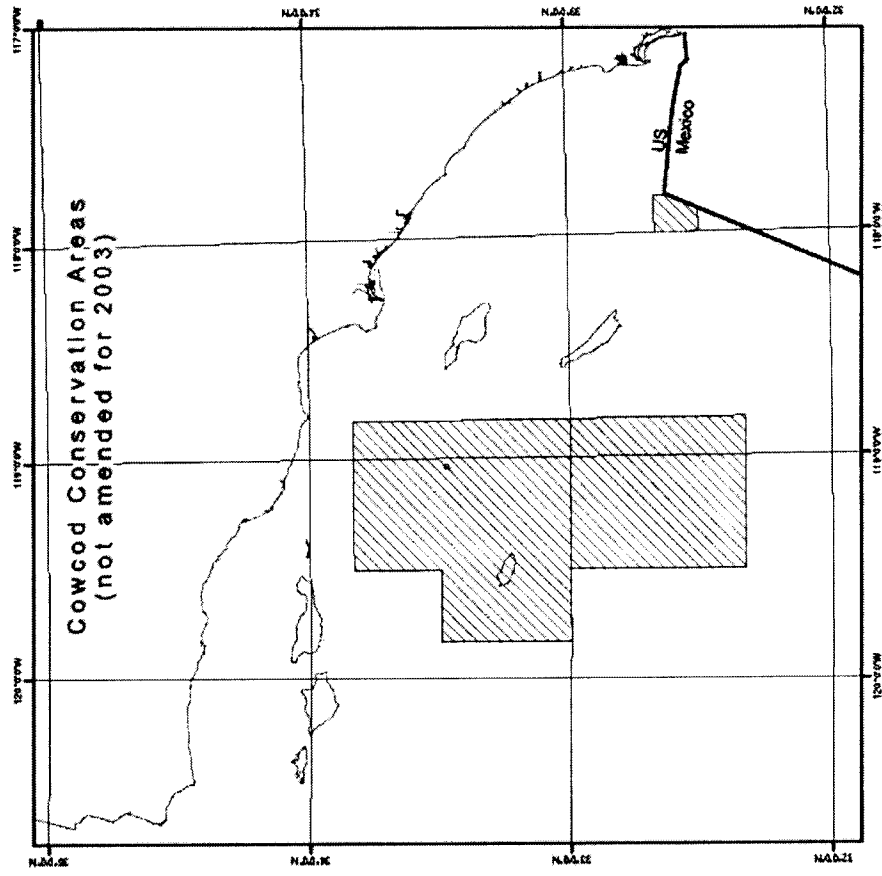


Table 2. Cowcod removals (mt) off the U.S. Pacific coast from 2000-02. See Data Sources for Removals for further details regarding the estimates.

Year	Area ¹	ABC/OY ²	Commercial ³	Recreational ⁴	Other ⁵	Total
2000	North	19 / <5	0.45	1.73	0.44	2.62
	South	5 / <5	0.29	4.49	0.82	5.60
2001	North	19 / 2.4	0.03	0.00	0.44	0.47
	South	5 / 2.4	0.00	0.00	0.82	0.82
2002	North	19 / 2.4	0.02	0.09	0.44	0.55
	South	5 / 2.4	0.03	0.49	0.82	1.34

¹Areas are defined as:

North: 2000 is 40°10'-36°; **2001** is 40°10'-34°27'; and **2002** is 40°10'-34°27'.

South: 2000 is south of 36°; **2001** is south of 34°27'; and **2002** is south of 34°27'.

²ABC/OY denotes Acceptable Biological Catch/Optimum Yield adopted by management (PFMC).

³Commercial removals reflect groundfish trawl landings only. No estimates of discard were available.

⁴Recreational removals reflect sport-related landings. Estimates of discard from the Commercial Passenger Fishing Vessel (CPFV) fleet were negligible and had no appreciable impact on magnitudes of removal estimates presented above.

⁵Other removals reflect estimates of bycatch from various commercial fisheries (see Data Sources for Removals).

Population Indices used in the 1999 Cowcod Stock Assessment

Appendix

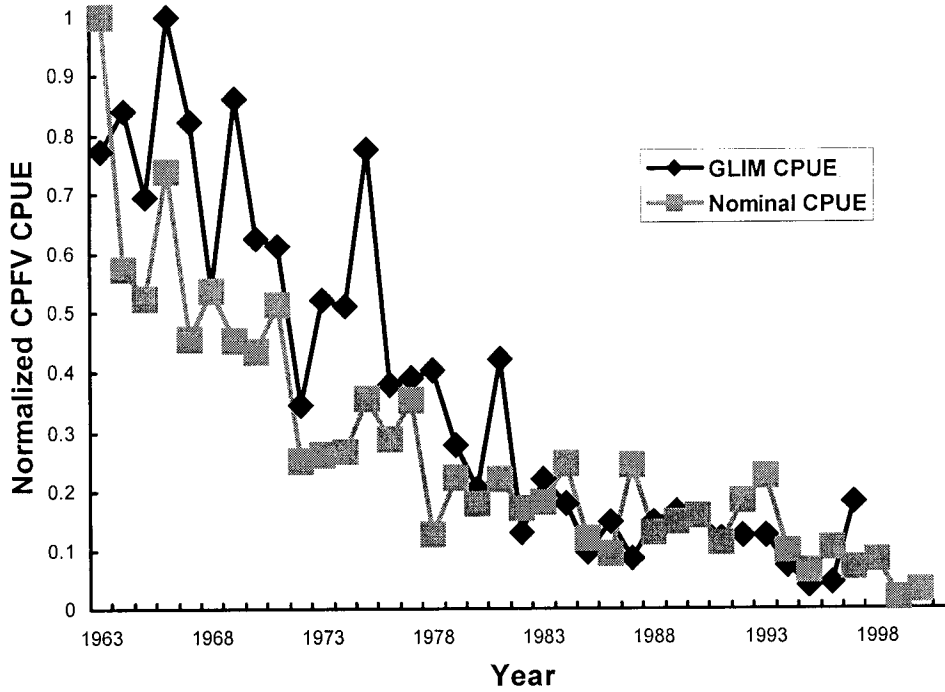


Figure A1. Catch per unit effort in Commercial Passenger Fishing Vessel (CPFV) Logbooks from 1964 to 2000. The GLIM CPUE is a General Linear Model of the catch per unit effort (CPUE) weighted by habitat area in fished CDFG blocks (See Butler et al. 1999 for details). The Nominal CPUE is the average number of fish per angler day for all blocks south of Pt. Conception and north of the Mexico-US border. Both series have been normalized for presentation purposes.

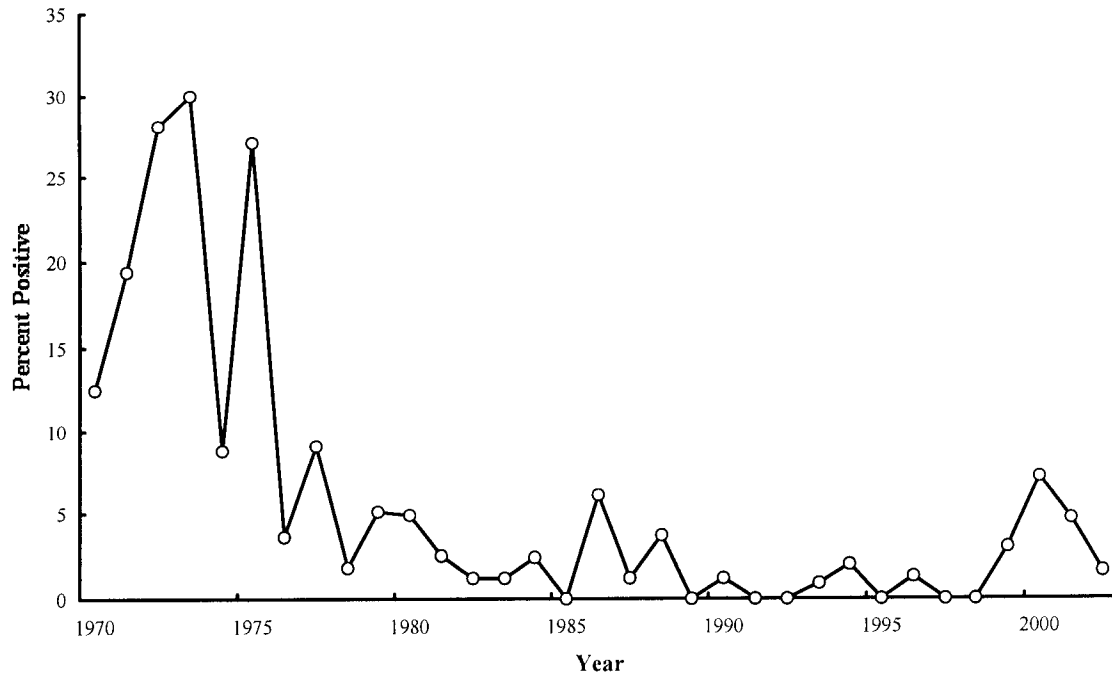


Figure A2. Proportion of otter trawl samples taken by Los Angeles and Orange County Sanitation Districts that included cowcod juveniles (Percent Positive) from 1970 to 2002.

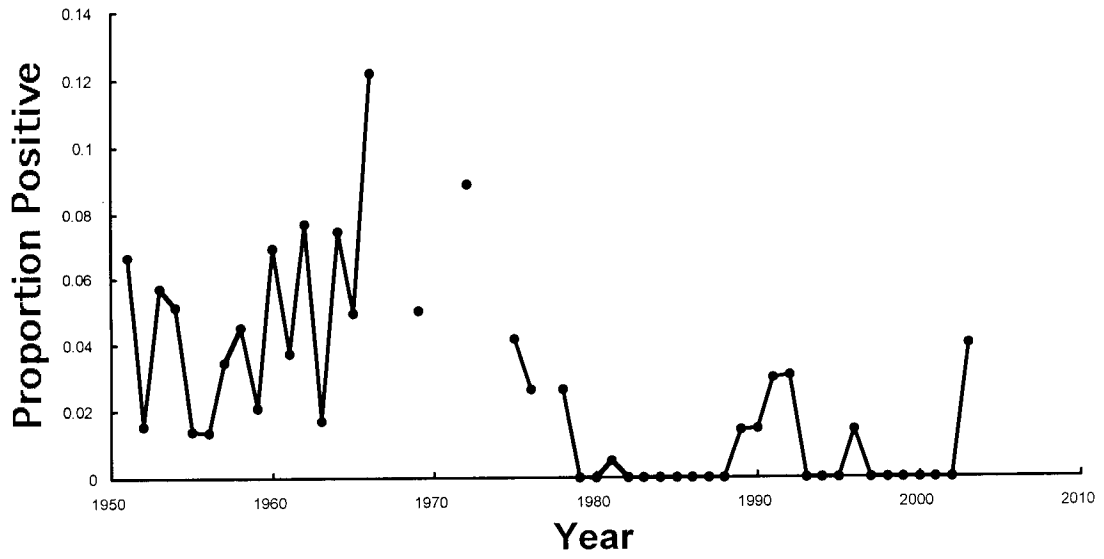


Figure A3. Proportion of CalCOFI plankton tow stations in the Southern California Bight that included cowcod larvae (Percent Positive) from 1951-2003.

SPECIES	AREA	YEAR	Sample Size (no. locations)	CPUE (no./angler day)	CV	EFFORT (Total)	REMARKS
Cowcod	North	2000	29	0.0000	na	?	
Cowcod	North	2001	60	0.0000	na	?	
Cowcod	North	2002	93	0.0021	0.56	?	Roughly, 1 fish (caught) per 476 angler-days of fishing
Cowcod	North	2003	8	0.0000	na	?	
Cowcod	South	1999	189	0.00005291	1.00	?	Roughly, 1 fish (caught) per 18,900 angler-days of fishing
Cowcod	South	2000	283	0.0000	na	?	
Cowcod	South	2001	125	0.0000	na	?	
Cowcod	South	2002	209	0.0000	na	?	
Cowcod	South	2003	190	0.0000	na	?	

Additional Notes:

- (1) Sample sizes reflect individual 'locations' within 'trips'
- (2) In total, 6 cowcod were caught (kept or returned) over the 3+-year survey
- (3) In terms of actual discards (i.e., 'returned' to the water), only 1 cowcod (from a single location within a single trip) was actually discarded over the 3+-year survey