

Addendum to the 2007 Stock Assessment and Rebuilding Analysis for Cowcod, *Sebastes levis*

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Summary

The 2007 cowcod assessment and rebuilding analysis are updated with a revised biomass estimate from the 2002 submersible survey. An error in the calculation of mean size was recently corrected in the survey results, reducing the estimate of cowcod biomass in the survey area from 940 to 524 metric tons. The revised biomass estimate is more consistent with the trend in relative abundance observed in CPFV logbook data, reducing estimated depletion in 2007 to 3.8% of unfished biomass in the base model. Revised models for the low and high alternative states of nature estimate depletion at 3.4% and 16.3%, respectively. Results from the recent rebuilding analysis are only slightly changed, with a median rebuilding year of 2065 under the Amendment 16-4 harvest rate ($F_{90\%}$). The revised estimate of T_{\max} is 2098.

Introduction and Background

In the most recent assessment of cowcod, *Sebastes levis*, in the Southern California Bight, Dick et al. (2007) estimate spawning stock biomass in 2007 at approximately 4.6% of the theoretical unfished biomass. The uncertainty in this estimate was characterized by two alternative “low” and “high” models, which estimate 2007 depletion at 4.1% and 27.3%, respectively. In the subsequent rebuilding analysis (Dick and Ralston, 2007) the estimated median time to rebuild (T_{target}) under the current harvest rate ($F_{90\%}$) was delayed by 23 years relative to the T_{target} of 2039 specified in Amendment 16-4 to the Pacific Coast Groundfish Fishery Management Plan (FMP). This change is largely driven by revised estimates of stock productivity, historical commercial landings, and a structural flaw detected in the 2005 assessment (Dick et al., 2007).

One of the data sets included in the 2007 assessment was an estimate of cowcod biomass in 2002 based on a visual transect survey conducted from an occupied submersible (Yoklavich et al., in press). A formal review of this survey was conducted in 2004 with the assistance of the Center for Independent Experts (<http://www.rsmas.miami.edu/groups/cie/>) and the biomass estimate was included in the last two assessments as a relative index of abundance with an informative prior on the catchability parameter (Piner et al., 2005; Dick et al., 2007). In this way, estimated biomass from the survey area was adjusted to reflect the expected biomass in the entire Southern California Bight.

An error was recently discovered in the visual survey methodology, related to the calculation of mean weight (M. Yoklavich, pers. comm.). During the survey, cowcod at greater distances were easier to detect if they were large. Although the originally reported numbers and densities of cowcod remain unchanged, the total biomass estimate (940 metric tons) was based on estimates of mean weight that did not account for this effect. The survey investigators therefore adjusted their estimates of mean weight to include only cowcod sighted within 2.7 meters of the transect line. Within this distance they found no relationship between fish size and distance. Their revised estimate of cowcod biomass in the survey area is 524 metric tons, 56% of the previous estimate.

Effect on the 2007 Cowcod Stock Assessment

The three models presented in the 2007 cowcod assessment were fit using the revised biomass estimate from the visual survey (Table 1). While changes to unfished biomass are minor (<1%), female spawning biomass in 2007 is estimated at 94 metric tons, compared to 113 mt in the original 2007 assessment. This reduces depletion in 2007 from 4.6% to 3.8% in the base model. The revised range of plausible depletion levels in 2007 is between 3.4% and 16.3%, based on point estimates from the alternative low and high models, respectively.

One of the unresolved issues with the 2007 assessment was a conflict between the CPFV logbook index and the visual survey. The 2002 biomass estimated from the visual survey was considerably higher than the model-predicted biomass, which was influenced by the declining trend in the CPFV index. Therefore, the prior distribution for the visual survey’s catchability coefficient (expansion factor) was not consistent with the posterior mode. The revised biomass estimate reduces, but does not eliminate, this discrepancy between the two data sets (Table 1).

Effect on the 2007 Rebuilding Analysis

Table 2 summarizes changes to the results for rebuilding model runs requested by the PMFC. A complete revision of the rebuilding analysis is presented as a separate document.

Literature Cited

Dick, E.J., S. Ralston, and D. Pearson. 2007. Status of cowcod, *Sebastes levis*, in the Southern California Bight. Document submitted to the PFMC, August 22, 2007.

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Piner, K., E. J. Dick, and J. Field. 2006. 2005 Stock Status of Cowcod in the Southern California Bight and Future Prospects. In Volume 1: Status of the Pacific Coast Groundfish Fishery Through 2005, Stock Assessment and Fishery Evaluation: Stock Assessments and Rebuilding Analyses. Portland, OR: Pacific Fishery Management Council.

Yoklavich, M., M. Love, and K. Forney. In press. A fishery-independent assessment of cowcod (*Sebastes levis*) using direct observations from an occupied submersible. Canadian Journal of Fisheries and Aquatic Sciences.

Table 1. Comparison of results from the 2007 cowcod stock assessment, using original (940 mt) and revised (524 mt) estimates of cowcod biomass from the 2002 visual survey.

	Visual survey biomass = 940 mt			Visual survey biomass = 524 mt		
	h = 0.4 CPFV index & visual survey	h = 0.6 CPFV index & visual survey	h = 0.8 Visual survey only	h = 0.4 CPFV index & visual survey	h = 0.6 CPFV index & visual survey	h = 0.8 Visual survey only
Reference Points						
Unfished female spawning biomass (SB_0)	2785	2494	2496	2777	2488	2389
Unfished summary (age-1+) biomass	5923	5303	5308	5905	5291	5080
40% of SB_0 (proxy for SB_{MSY})	1114	997	998	1111	995	956
Female spawning biomass in 2007	115	113	681	94	94	389
SB in 2007 / unfished SB	4.1%	4.6%	27.3%	3.4%	3.8%	16.3%
Parameter Estimates						
Unfished recruitment (R_0)	123.1	110.2	110.3	122.7	109.9	105.6
Catchability for CPFV logbook index	0.000197	0.000208	n/a	0.000205	0.000216	n/a
Catchability for visual survey	3.06	3.19	0.75	2.22	2.30	0.75
Likelihood components						
Total negative log likelihood	17.22	17.91	n/a	15.90	16.54	n/a
CPFV logbook index	12.28	12.67	n/a	12.92	13.34	n/a
Visual survey	0.99	1.05	n/a	0.64	0.68	n/a
Prior on visual survey	3.95	4.19	n/a	2.35	2.51	n/a

Table 2. Revised summary of requested model runs, based on 2007 cowcod assessment with revised 2002 biomass estimate. Refer to Ralston and Dick (2007) for a description of model runs. Values in bold are fixed. Run D3 does not apply to cowcod because the median time to recovery exceeds the Amendment 16-4 value for T_{target} even in the absence of fishing.

	Run	C	D1	D2	D3*	D4
	SPR	1	0.900	0.790	n/a	0.5
	F	0	0.0038	0.0088	n/a	0.0295
	Median rebuilding year	2061	2065	2072	n/a	2201
Pr{above target}	by 2035 (old Tmin)	0.159	0.159	0.159	n/a	0.027
	by 2039 (old Ttarget)	0.216	0.216	0.216	n/a	0.062
	by 2060 (new Tmin)	0.467	0.467	0.402	n/a	0.159
	by 2074 (old Tmax)	0.662	0.598	0.533	n/a	0.216
	by 2098 (new Tmax)	0.784	0.724	0.662	n/a	0.338
Median Catch (metric tons)						
	2007	0.5	0.5	0.5	n/a	0.5
	2008	0.5	0.5	0.5	n/a	0.5
	2009	0	0.9	2.0	n/a	6.6
	2010	0	0.9	2.1	n/a	6.9
	2011	0	1.0	2.2	n/a	7.1
	2012	0	1.0	2.3	n/a	7.3
	2013	0	1.1	2.4	n/a	7.5
	2014	0	1.1	2.5	n/a	7.8
	2015	0	1.2	2.7	n/a	8.0
	2016	0	1.2	2.8	n/a	8.3
	2017	0	1.3	2.9	n/a	8.6
	2018	0	1.4	3.1	n/a	8.9