

# Red Snapper Projections V – Addendum

10 April 2009

## 1 Description of Addendum

This addendum provides one additional projection scenario to those described in the document titled, “Red Snapper Projections V.” That earlier document included a projection labeled Scenario D5, a discard-only projection with  $F = F_{40\%}$ , which used regression-estimated 2008 MRFSS landings. The additional projection of this addendum is identical to Scenario D5, except that it uses the preliminary estimate of 2008 recreational landings from MRFSS, rather than the regression-estimated value. This new projection is labeled:

- Scenario D5-alt:  $F = F_{40\%}$

The discard-only projections differ from the harvest projections in two main ways: first, dive fishing was not included, and second, all fish caught were assumed released and were subjected to the release mortality rates used in the assessment (0.9 in the commercial sector and 0.4 in the headboat and recreational sectors). Thus, not all of the applied fishing rate contributes to mortality; tables of results report both the applied rate (e.g.,  $F_{\text{current}}$  or  $F_{40\%}$ ) and the rate that actually contributes to mortality (labeled as  $F_{\text{mort}}$ ). When interpreting the discard-only projections, one should bear in mind that the distribution of full  $F$  among the various fisheries is different from that in the assessment, which leads to inconsistency between projections and benchmarks (e.g., fishing at  $F_{40\%}$  leads to an equilibrium stock size other than  $SSB_{F_{40\%}}$ ).

The period between the end of the assessment (2006) and the start of new management (2010) was projected using values of  $F_{2007}$ ,  $F_{2008}$ , and  $F_{2009}$ . The 2007 and 2008 values of  $F$  were those that, in the deterministic projections, provided the 2007 and 2008 estimates of landings. The 2009 value of  $F$  was assumed to be  $F_{\text{current}}$ , defined as the geometric mean of  $F$  from 2004–2008.

## 2 Results of Scenario D5-alt

Results are shown in Table 4.1.

## 3 Comments on Projections

Projections should be interpreted in light of the model assumptions and key aspects of the data. Some major considerations are the following:

- Initial abundance at age of the projections were based on estimates from the last year of the assessment. If those estimates are inaccurate, rebuilding will likely be affected.
- Fisheries were assumed to continue fishing at their estimated current proportions of total effort, using the estimated current selectivity patterns. New management regulations that alter those proportions or selectivities would likely affect rebuilding.

- The projections assumed no change in the selectivity applied to discards. As recovery generally begins with the smallest size classes, management action may be needed to meet that assumption.
- The projections assumed that the estimated spawner-recruit relationship applies in the future and that past residuals represent future uncertainty in recruitment. If changes in environmental or ecological conditions affect recruitment or life-history characteristics, rebuilding may be affected.
- The projections used a spawner-recruit relationship with steepness of  $h = 0.95$ , the value estimated in the assessment but with considerable uncertainty. Such a high value implies that the stock, at its currently low abundance, spawns nearly as many recruits as it would at high abundance. That is, productivity is nearly independent of spawning biomass. If productivity depends on spawning biomass, stock recovery would take longer than projected.
- The preliminary estimates of 2008 MRFSS landings, as used in this addendum, were much higher than in recent years. These preliminary high values, if real, could reflect recruitment to the fishery of a strong year-class. The projection model, however, would be unaware of such a year-class, and instead interprets the high landings to be a consequence of high  $F$ . If a strong year-class is indeed pulsing through the population, and if it is protected by management regulations, stock recovery could occur more quickly than projected.
- Discard-only projections tacitly assumed that any individual fish would be caught only once per year. To the extent that this assumption is violated, discard-only projections may overestimate the velocity of recovery.
- Discard-only projections allocated sources of mortality in different proportions than those used in computing reference points. Thus discard-only projections are not consistent with reference points, in the sense that fishing at  $F_{40\%}$  may lead to an equilibrium stock size other than  $SSB_{F_{40\%}}$ .

## 4 Tables

Table 4.1. Red snapper: Projection results under scenario D5-alt—fishing mortality rate  $F = F_{40\%}$ . This scenario differs from D5 by using preliminary estimates of 2008 recreational landings from MRFSS.  $F$  = fishing rate (per year),  $F_{mort}$  = fishing rate (per year) as the portion of  $F$  that leads to (discard) mortality,  $Pr(recover)$  = proportion of replicates reaching  $SSB_{F_{40\%}}$ ,  $SSB$  = mid-year spawning biomass (mt),  $R$  = recruits (1000 fish),  $L$  = landings (1000 lb whole weight or fish),  $Sum L$  = cumulative landings (1000 lb), and  $D$  = discard mortalities (1000 lb or fish). For reference, estimated proxy reference points are  $F_{40\%} = 0.104$ ,  $SSB_{F_{40\%}} = 8102.5$  mt,  $R_{F_{40\%}} = 692,864$  fish,  $Y_{F_{40\%}} = 2,303,676$  lb, and  $D_{F_{40\%}} = 72,717$  lb.

Year	F	Fmort	Pr(recover)	SSB(mt)	R(1000)	L(1000 lb)	Sum L(1000 lb)	L(1000)	D(1000 lb)	D(1000)
2007	0.930	0.930	0.00	203	286	454	454	95	153	99
2008	4.980	4.980	0.00	205	321	1000	1454	218	383	304
2009	1.291	1.291	0.00	14	322	75	1529	29	89	91
2010	0.104	0.075	0.00	58	37	0	1529	0	23	11
2011	0.104	0.075	0.00	175	136	0	1529	0	36	12
2012	0.104	0.075	0.00	278	295	0	1529	0	52	17
2013	0.104	0.075	0.00	421	377	0	1529	0	83	26
2014	0.104	0.075	0.00	630	449	0	1529	0	123	36
2015	0.104	0.075	0.00	910	512	0	1529	0	174	46
2016	0.104	0.075	0.00	1262	561	0	1529	0	235	56
2017	0.104	0.075	0.00	1678	597	0	1529	0	306	66
2018	0.104	0.075	0.00	2146	622	0	1529	0	385	76
2019	0.104	0.075	0.00	2654	640	0	1529	0	469	84
2020	0.104	0.075	0.00	3187	653	0	1529	0	557	92
2021	0.104	0.075	0.00	3730	662	0	1529	0	646	100
2022	0.104	0.075	0.01	4274	670	0	1529	0	735	106
2023	0.104	0.075	0.01	4807	675	0	1529	0	822	112
2024	0.104	0.075	0.03	5322	679	0	1529	0	907	118
2025	0.104	0.075	0.06	5815	682	0	1529	0	987	123
2026	0.104	0.075	0.10	6281	685	0	1529	0	1063	127
2027	0.104	0.075	0.16	6718	687	0	1529	0	1134	131
2028	0.104	0.075	0.22	7126	689	0	1529	0	1201	135
2029	0.104	0.075	0.32	7503	690	0	1529	0	1262	138
2030	0.104	0.075	0.40	7851	691	0	1529	0	1319	141
2031	0.104	0.075	0.49	8171	692	0	1529	0	1371	144
2032	0.104	0.075	0.58	8463	693	0	1529	0	1418	146
2033	0.104	0.075	0.65	8730	694	0	1529	0	1462	148
2034	0.104	0.075	0.72	8973	694	0	1529	0	1501	150
2035	0.104	0.075	0.76	9194	695	0	1529	0	1537	152
2036	0.104	0.075	0.82	9394	695	0	1529	0	1570	154
2037	0.104	0.075	0.85	9575	696	0	1529	0	1599	155
2038	0.104	0.075	0.88	9739	696	0	1529	0	1626	156
2039	0.104	0.075	0.90	9887	696	0	1529	0	1650	158
2040	0.104	0.075	0.91	10,021	697	0	1529	0	1672	159
2041	0.104	0.075	0.92	10,142	697	0	1529	0	1692	160
2042	0.104	0.075	0.94	10,251	697	0	1529	0	1709	160
2043	0.104	0.075	0.95	10,350	697	0	1529	0	1725	161
2044	0.104	0.075	0.96	10,439	697	0	1529	0	1740	162
2045	0.104	0.075	0.97	10,519	698	0	1529	0	1753	162
2046	0.104	0.075	0.97	10,591	698	0	1529	0	1765	163
2047	0.104	0.075	0.97	10,656	698	0	1529	0	1775	163
2048	0.104	0.075	0.97	10,714	698	0	1529	0	1785	164
2049	0.104	0.075	0.98	10,767	698	0	1529	0	1793	164
2050	0.104	0.075	0.98	10,815	698	0	1529	0	1801	165