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2007 Darkblotched Rockfish Rebuilding Analysis

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Owen S. Hamel
Fishery Resource Analysis and Monitoring Division,
National Marine Fisheries Service
Northwest Fisheries Science Center
2727 Montlake Boulevard East
Seattle, Washington 98112

1. Introduction

The Pacific Fishery Management Council (PFMC) adopted Amendment 11 to its Groundfish Management Plan in 1998. This amendment established a definition for an overfished stock of 25% of the unfished spawning biomass ($0.25B_0$). Darkblotched rockfish (*Sebastes crameri)* was declared overfished in January 2001 based on the most recent stock assessment at that time (Rogers et al. 2000). Rebuilding analyses were first conducted in mid-year 2001 (Methot and Rogers 2001) and included a partial update of the 2000 stock assessment.

The stock assessment for darkblotched rockfish was updated in 2003 (Rogers 2003). Full assessments were conducted in 2005 (Rogers 2005) and 2007 (Hamel 2007), using stock-synthesis II (SS2). In 2005 the natural mortality rate used in the assessment was changed from the previously used value of 0.05 (based largely on Hoenig's method) to 0.07 (as a balance between Hoenig's method and Gunderson's method based on gonadosomatic index (GSI)). This latter value was used in the 2007 assessment as well. The largest change in assumptions between the 2005 and 2007 assessments was the value of stock-recruitment steepness. In 2005, steepness was estimated at 1.0, and was set at 0.95. In 2007, a great deal more age data was included in the assessment, largely as conditional age-at length compositions, and steepness was estimated (using the prior from Dorn's meta-analysis) at 0.6 and that value was then fixed in the assessment. The SPR chosen following the 2005 rebuilding analysis (0.607) corresponded to a T_{target} (median rebuilding year) of 2011, which was much earlier than for previous rebuilding analyses, due largely to the high value of steepness (and thus productivity at low stock sizes) assumed in the 2005 assessment.

2. Specifications

2.1 Selection of B_0

The unfished spawning stock biomass, B_0, is determined from the fitted stock-recruitment relationship in order to be consistent with the assumptions underlying the current stock assessment. This is in contrast to previous rebuilding analyses for darkblotched rockfish which used a range of estimated historical recruitments to estimate B_0. The MPD estimate of B_0 is 30,640 units of spawning output[1].

2.2 Generation of future recruitment

Future recruitments are generated using the Beverton-Holt spawner recruit relationship with steepness = 0.6 and $\sigma_r = 0.8$ as estimated within the assessment (Hamel 2007). This is in contrast to previous rebuilding analyses which resampled from a range of estimated historical recruitments. Again, this choice is consistent with the assumptions underlying the current stock assessment.

2.3 Mean generation time

The mean generation time is defined as the mean age weighted by net spawning output (see Figure 2 for a plot of net spawning output *versus* age). The best estimate of the mean generation time is 25 years (figure 1). This is one year longer than in the previous rebuilding analysis, likely due to new estimates of growth and therefore fecundity-at-age (Appendix 1).

[1] Spawning output is defined in units of 100 million eggs.

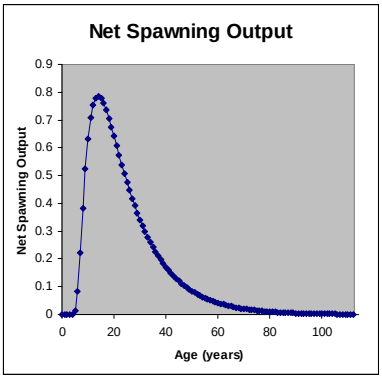

Figure 1: Relationship between net spawning output and age for darkblotched rockfish.

2.4 The harvest strategies

Table 1 summarizes those options considered in the rebuilding analyses. These include a 50% probability of rebuilding by T_{target} (2011; case 1; undefined); a no catch option (case 2); using the calculated SPR from the last rebuilding analysis (case 3); or the implied SPR in the current analysis from the 2007-8 OYs (290 and 330 mt; case 4); or using the ABC harvest rule (Case 5). These five cases were requested by the Council in a memorandum dated September 04, 2007. The other eight cases include four evenly spread intermediate values of T_{target} between $T_{F=0}$ (2018) up to either the current or newly calculated values of T_{max} (2033: cases 7,9,10,11 (2022, 2025, 2029, 2033); 2040: cases 8,10,12,13 (2023, 2029, 2035, 2040)) with one additional intermediate run (case 6: 2020).

Table 1: Harvest strategy options considered in this document ordered by SPR.

Case	Name	$T_{50\%}$	*2009 OY*	*SPR*	*2010 ABC*
1	**T_{target} = 2011 (Current)**	2011	NA	NA	NA
2	**F = 0**	2018	0	1.000	457
3	**SPR from 2005 rebuilding**	2030	300	0.607	445
4	**SPR from 2007-8 OYs**	2031	318	0.592	445
5	**ABC rule**	2052	437	0.500	440
6	T_{target} = 2020	2020	96	0.842	453
7	T_{target} = 2022	2022	160	0.756	451
8	T_{target} = 2023	2023	188	0.722	450
9	T_{target} = 2025	2025	229	0.677	448
10	T_{target} = 2029	2029	293	0.613	445
11	T_{target} = 2033	2033	341	0.572	444
12	T_{target} = 2035	2035	354	0.561	443
13	T_{target} = 2040	2040	385	0.537	442

2.5 Other specifications

The calculations of this document were performed using Version 2.11 of the rebuilding software developed by Punt (2007) and the results are based on 1,000 Monte Carlo replicates.

The definition of "recovery by year *y*" in this analysis is that the spawning output reaches $0.4B_0$ by year *y* (even if it subsequently drops below this level due to recruitment variability). Appendix 1 provides a comparison of life history inputs in this rebuilding analysis to those in the 2005 rebuilding model. The input to the rebuilding program is given as Appendix 2. The catch for 2007 and 2008 were set to 290 and 330 mt respectively (the Council-selected *OYs* for 2007-2008).

3. Results

3.1 Time-to-recovery

The median year for rebuilding to the target level in the absence of fishing since the year of overfished declaration, and with randomly drawn recruitment after that year, is termed T_{min}. Figure 2 shows the distribution for the number of years beyond 2001 that it would have taken to recover to $0.4B_0$ under those assumptions. The number of years to T_{min} (14 years) is greater than that value for T_{min} from the 2001, 2003 and 2005 rebuilding analyses (12, 10 and 8 years, respectively). If T_{max} is determined using the new information on the depletion level and the age-structure of the population in 2000, it is calculated to be 2040 which is greater than the value from the 2005 rebuilding analysis (2033), though less than that from the 2001 or 2003 analyses (2047 and 2044 respectively) (Table 2).

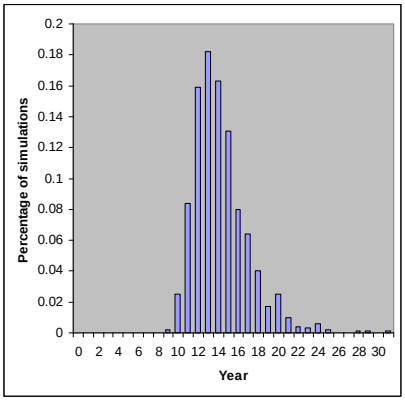

Figure 2: Time to recover to $0.4B_0$ in the absence of catches from 2001 on for the base-case analysis.

Table 2 gives summary statistics from the 2001, 2003 and 2005 rebuilding plans and the current analysis.

Table 2: Summary statistics.

Value	2001	2003	2005	2007
T_{min}	2014	2011	2009	2015
Mean generation time	33 years	33 years	24 years	25 years
T_{max}	2047	2044	2033	2040
P_{max}	80.0	>90.0	100	
T_{target}	2030	2019	2011	
SPR_{target}			60.7%	

3.2 OYs and fishing mortalities

Table 3 gives the probabilities of recovery at the established and new estimates of T_{max} (2033 and 2040) and at the mid point between the newly calculated $T_{F=0}$ and the established value of T_{max} (2025), and 10 year projected OY values based on the SPR for each of the 13 cases explored in this rebuilding analysis.

Table 3: Ten year OY/ABC projections.

Case	**1**	**2**		**3**		**4**		**5**	**6**		**7**		**8**		**9**		**10**		**11**		**12**		**13**	
RUN	**T_{target}**	**SPR'05**		**OY'7-8**		**F=0**		**ABC**	**2020**		**2022**		**2023**		**2025**		**2029**		**2033**		**2035**		**2040**	
SPR	NA	0.607		0.5917		1		0.5	0.842		0.756		0.722		0.677		0.613		0.572		0.561		0.537	
F	NA	0.0289		0.0306		0		0.0421	0.0091		0.0152		0.0180		0.0219		0.0282		0.0328		0.0342		0.0372	
T50%	2011	2030		2031		2018		2052	2020		2022		2023		2025		2029		2033		2035		2040	
P2025	NA	33.6		28.5		98.4		10.8	86.7		69.9		61.3		50.0		33.7		23.8		21.2		15.9	
P2033	NA	61.7		57.4		99.9		25.3	98.3		92.3		88.2		79.1		62.7		50.0		45.9		36.6	
P2040	NA	76.7		76.2		100		34.7	99.8		97.7		95.9		91.0		77.7		65.4		61.7		50.0	
10 Year projected **OYs** and ABCs at SPR rate above:																								
2009	NA	**300**	437	**318**	437	**0**	437	**437**	**96**	437	**159**	437	**188**	437	**229**	437	**293**	437	**341**	437	**354**	437	**385**	437
2010	NA	**306**	445	**323**	444	**0**	457	**440**	**99**	453	**165**	451	**193**	450	**235**	448	**299**	445	**346**	444	**360**	443	**390**	442
2011	NA	**312**	453	**329**	452	**0**	477	**443**	**103**	469	**170**	464	**199**	462	**240**	459	**305**	454	**351**	450	**364**	449	**394**	447
2012	NA	**317**	461	**334**	459	**0**	496	**445**	**106**	485	**174**	477	**204**	474	**246**	469	**310**	461	**356**	456	**369**	455	**398**	451
2013	NA	**322**	468	**339**	465	**0**	515	**448**	**110**	500	**179**	490	**209**	485	**251**	479	**315**	468	**361**	462	**373**	460	**402**	455
2014	NA	**327**	475	**344**	472	**0**	534	**451**	**113**	515	**183**	502	**214**	497	**256**	489	**320**	476	**365**	468	**378**	465	**406**	460
2015	NA	**332**	483	**349**	479	**0**	554	**454**	**116**	530	**188**	515	**219**	509	**262**	499	**325**	484	**370**	474	**383**	471	**410**	465
2016	NA	**337**	490	**354**	486	**0**	573	**457**	**119**	545	**193**	527	**224**	520	**267**	509	**331**	492	**375**	480	**387**	477	**414**	470
2017	NA	**344**	500	**360**	495	**0**	593	**462**	**123**	562	**198**	542	**229**	533	**273**	522	**338**	503	**381**	488	**393**	484	**420**	476
2018	NA	**350**	509	**366**	504	**0**	614	**468**	**127**	579	**203**	556	**235**	546	**279**	533	**344**	512	**387**	496	**399**	492	**426**	483

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Appendix 1: Comparison of life history inputs into 2005 rebuilding analysis to those in the 2007 rebuilding model.

Year of Analysis								
	2005				2007			
Age	M	Fecundity	Weight (kg)		M	Fecundity	Weight (kg)	
		10^7 eggs	Females	Males		10^7 eggs	Females	Males
0	0.07	0.00	0.01	0.01	0.07	0.00	0.01	0.01
1	0.07	0.00	0.06	0.06	0.07	0.00	0.05	0.05
2	0.07	0.00	0.16	0.16	0.07	0.00	0.14	0.14
3	0.07	0.00	0.31	0.30	0.07	0.00	0.26	0.27
4	0.07	0.00	0.45	0.44	0.07	0.00	0.41	0.39
5	0.07	0.04	0.59	0.55	0.07	0.02	0.54	0.51
6	0.07	0.07	0.63	0.59	0.07	0.13	0.66	0.60
7	0.07	0.44	0.81	0.71	0.07	0.36	0.77	0.68
8	0.07	0.78	0.91	0.77	0.07	0.67	0.86	0.74
9	0.07	1.13	1.00	0.82	0.07	0.98	0.95	0.78
10	0.07	1.44	1.08	0.86	0.07	1.28	1.02	0.82
11	0.07	1.71	1.14	0.89	0.07	1.53	1.09	0.85
12	0.07	1.94	1.20	0.91	0.07	1.75	1.14	0.88
13	0.07	2.14	1.24	0.93	0.07	1.93	1.19	0.90
14	0.07	2.30	1.28	0.94	0.07	2.09	1.22	0.91
15	0.07	2.44	1.31	0.95	0.07	2.22	1.26	0.92
16	0.07	2.55	1.34	0.96	0.07	2.33	1.28	0.93
17	0.07	2.64	1.36	0.96	0.07	2.42	1.30	0.94
18	0.07	2.72	1.37	0.97	0.07	2.49	1.32	0.94
19	0.07	2.78	1.39	0.97	0.07	2.55	1.33	0.94
20	0.07	2.83	1.40	0.97	0.07	2.60	1.34	0.95
21	0.07	2.87	1.41	0.97	0.07	2.64	1.35	0.95
22	0.07	2.90	1.41	0.98	0.07	2.68	1.36	0.95
23	0.07	2.93	1.42	0.98	0.07	2.70	1.36	0.95
24	0.07	2.95	1.42	0.98	0.07	2.72	1.37	0.95
25	0.07	2.97	1.43	0.98	0.07	2.74	1.37	0.95
26	0.07	2.98	1.43	0.98	0.07	2.76	1.38	0.95
27	0.07	2.99	1.43	0.98	0.07	2.77	1.38	0.95
28	0.07	3.00	1.44	0.98	0.07	2.78	1.38	0.95
29	0.07	3.01	1.44	0.98	0.07	2.78	1.38	0.95
30	0.07	3.01	1.44	0.98	0.07	2.79	1.38	0.96
31	0.07	3.02	1.44	0.98	0.07	2.80	1.38	0.96
32	0.07	3.02	1.44	0.98	0.07	2.80	1.39	0.96
33	0.07	3.02	1.44	0.98	0.07	2.80	1.39	0.96
34	0.07	3.03	1.44	0.98	0.07	2.81	1.39	0.96
35	0.07	3.03	1.44	0.98	0.07	2.81	1.39	0.96
36	0.07	3.03	1.44	0.98	0.07	2.81	1.39	0.96
37	0.07	3.03	1.44	0.98	0.07	2.81	1.39	0.96
38	0.07	3.03	1.44	0.98	0.07	2.81	1.39	0.96
39	0.07	3.03	1.44	0.98	0.07	2.81	1.39	0.96
40	0.07	3.03	1.44	0.98	0.07	2.81	1.39	0.96

Appendix 2: Input File (for SPR based on 2007-8 OYs)

#Title #runnumber: 5 dat.txt ctl.txt 2216.95 30640.5 6853.44
SS2_default_rebuild.dat
Number of sexes
2
Age range to consider (minimum age; maximum age)
0 45
Number of fleets
1
First year of projection (Yinit)
2007
First Year of rebuilding period (Ydecl)
2001
Is the maximum age a plus-group (1=Yes;2=No)
1
Generate future recruitments using historical recruitments (1) historical recruits/spawner (2) or a stock-recruitment (3)
3
Constant fishing mortality (1) or constant Catch (2) projections
1
Fishing mortality based on SPR (1) or actual rate (2)
1
Pre-specify the year of recovery (or -1) to ignore
-1
Fecundity-at-age
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 #runnumber: 5 dat.txt ctl.txt 2216.95 30640.5 6853.44
 0 0 3.63726e-007 3.70017e-005 0.00139436 0.0216256 0.129324 0.362901 0.669701 0.984996 1.27503 1.52954 1.74816 1.93372 2.08988 2.22041 2.32887 2.41853 2.49234 2.55289 2.60241 2.64281 2.67571 2.70246 2.72417 2.74177 2.75604 2.76759 2.77694 2.7845 2.79061 2.79554 2.79953 2.80276 2.80536 2.80746 2.80916 2.81053 2.81164 2.81254 2.81326 2.81384 2.81431 2.81469 2.815 2.81524 #female fecundity; weighted by N in year Y_init across morphs and areas
Age specific selectivity and weight adjusted for discard and discard mortality
 #wt and selex for gender,fleet: 1 1
 0.0125932 0.0511507 0.136097 0.264146 0.406618 0.540463 0.660554 0.766921 0.863341 0.94953 1.02461 1.08869 1.14263 1.18757 1.22476 1.25537 1.28047 1.30098 1.31769 1.33129 1.34234 1.3513 1.35857 1.36445 1.36921 1.37307 1.37618 1.3787 1.38073 1.38238 1.3837 1.38478 1.38564 1.38634 1.38691 1.38736 1.38773 1.38803 1.38827 1.38846 1.38862 1.38874 1.38885 1.38893 1.389 1.38905
 0 0.102449 0.110254 0.183894 0.392269 0.656592 0.84795 0.940347 0.976457 0.989957 0.995239 0.997482 0.998525 0.999053 0.999343 0.999513 0.999619 0.999687 0.999734 0.999766 0.99979 0.999807 0.99982 0.99983 0.999837 0.999843 0.999848 0.999851 0.999854 0.999856 0.999858 0.999859 0.999861 0.999862 0.999862 0.999863 0.999863 0.999864 0.999864 0.999864 0.999864 0.999865 0.999865 0.999865 0.999865 0.999865
 #wt and selex for gender,fleet: 2 1
 0.0125932 0.0511507 0.13924 0.265181 0.39452 0.506737 0.600349 0.675537 0.735829 0.784301 0.822967 0.85347 0.877291 0.895748 0.909964 0.920865 0.929198 0.935552 0.940389 0.944065 0.946857 0.948976 0.950582 0.951801 0.952724 0.953423 0.953953 0.954354 0.954658 0.954888 0.955062 0.955194 0.955294 0.95537 0.955427 0.955471 0.955503 0.955528 0.955547 0.955561 0.955572 0.95558 0.955586 0.955591 0.955595 0.955597
 0 0.102449 0.110976 0.184975 0.370547 0.592457 0.764326 0.867459 0.922361 0.951026 0.966494 0.975283 0.98055 0.983862 0.986029 0.987495 0.988512 0.989232 0.98975 0.990128 0.990405 0.99061 0.990763 0.990877 0.990963 0.991027 0.991076 0.991112 0.99114 0.99116 0.991176 0.991188 0.991197 0.991204 0.991209 0.991213 0.991216 0.991218 0.99122 0.991221 0.991222 0.991223 0.991223 0.991224 0.991224 0.991224
M and current age-structure in year Yinit: 2007
 # gender = 1
 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07
 1043.75 912.92 870.077 768.622 660.282 197.911 174.858 1382.51 1376.81 138.127 482.116 357.396 916.513 215.36 46.9688 97.4119 55.1145 45.785 15.4174 148.8 81.3436 26.8732 22.5589 14.277 11.5256 13.6436 31.1807 42.9175 23.5594 7.50042 5.88939 10.347 7.44613 9.96087 9.05 8.22554 7.46925 6.75631 6.10291 5.65187 5.21305 4.83732 4.34285 3.87281 3.35793 34.0867
 # gender = 2
 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07
 1043.75 912.92 870.077 768.614 660.263 197.969 175.083 1386.59 1383.35 138.98 485.933 361.427 931.622 220.778 48.7606 102.312 58.2569 48.5186 16.3718 158.313 86.6165 28.6743 24.1556 15.3231 12.3935 14.6945 33.5577 46.0612 25.1816 7.97811 6.23692 10.9136 7.82562 10.4375 9.454 8.56734 7.76521 7.01996 6.3436 5.8788 5.42275 5.02721 4.50627 4.02131 3.5074 35.5726
Age-structure at Ydecl= 2001
 273.29 2204.39 2236.23 229.299 820.385 621.541 1615.63 382.007 83.5159 173.371 98.1283 81.5313 27.4567 265.008 144.874 47.8622 40.1788 25.4283 20.5279 24.3004 55.5355 76.44 41.9615 13.3589 10.4896 18.4289 13.2623 17.7413 16.1189 14.6505 13.3035 12.0337 10.8699 10.0665 9.28496 8.61576 7.73505 6.89787 5.98081 5.08334 4.35876 3.84681 3.48011 3.19041 2.94181 37.8106
 273.29 2204.39 2236.23 229.285 820.262 622.536 1627.08 388.699 86.2178 181.325 103.382 86.1666 29.0894 281.376 153.979 50.9819 42.9523 27.2487 22.0402 26.1333 59.6821 81.9212 44.7869 14.1897 11.0929 19.4109 13.9188 18.5644 16.8152 15.2381 13.8115 12.486 11.283 10.4563 9.64512 8.94159 8.01503 7.15247 6.23842 5.35509 4.62674 4.08254 3.67219 3.34574 3.07076 39.118
Year for Tmin Age-structure (set to Ydecl by SS2)
2001
Number of simulations
1000
recruitment and biomass

Number of historical assessment years
81
Historical data
year recruitment spawner in B0 in R project in R/S project
1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953
1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980
1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
#years (with first value representing R0)
3295.04 3295.05 3295.04 3294.99 3294.95 3294.94 3294.93 3294.92 3294.89 3294.86 3294.84 3294.81 3294.74 3294.63 3294.51 3294.37 3294.21
3293.56 3292 3287.9 3285.15 3283.52 3280.87 3278.09 3274.82 3270.53 3267.54 3264.67 3261.77 3259.06 3255.55 3251.65 3248.29 3245.1 3241.72
3239.56 3236.04 3231.64 3229.72 3223.59 3128.4 3044.53 2968.98 2968.17 2969.4 2966.46 2959.7 2945.02 1978.21 2453.36 1239.82 1388.69
3786.08 5920.69 3626.2 1314.88 908.778 912.592 1163.37 1120.56 2728.75 4053.94 341.823 819.728 797.824 1140.17 438.837 1625.41 5747.55
1923.03 2270.86 575.815 5188.11 4728.45 546.581 569.543 1760.82 1902.68 2004.81 1958.23 2087.49 #recruits; first value is R0 (virgin)
30640.5 30640.8 30640.2 30637.6 30635 30634.4 30633.8 30633.3 30631.8 30630.4 30629 30627.7 30623.5 30617.4 30610.5 30602.7 30594.2
30557.8 30471.6 30246 30096.7 30008.6 29866.3 29718 29545.9 29321.6 29167.3 29020.4 28873.4 28736.9 28561.6 28368.9 28204.9 28050.4
27888.1 27785.3 27618.7 27413.4 27324.6 27043.7 23219.2 20513.1 18469.8 18449.6 18480.4 18407.1 18240.4 17885.7 17640.1 17553.2 17465.9
17665 17737.6 17275.6 17169.8 16635.7 15861.9 15172.2 14204.3 12966.4 12376 10815.9 9777.41 8917.34 7597.51 6644 6220.72 5507.92 5133.39
4787.36 4414.81 3906.42 3272.46 3175.89 3230.14 3566.52 4071.45 4659.96 5230.82 6012.66 6853.44 #spbio; first value is S0 (virgin)
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
in Bzero
0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0
in R project
0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0
in R/S project
Number of years with pre-specified catches
2
catches for years with pre-specified catches go next
2007 290
2008 330
Number of future recruitments to override
0
Process for overiding (-1 for average otherwise index in data list)
Which probability to product detailed results for (1=0.5; 2=0.6; etc.)
3
Steepness sigma-R Auto-correlation
0.6 0.8 0
Target SPR rate (FMSY Proxy); manually change to SPR_MSY if not using SPR_target
0.5
Target SPR information: Use (1=Yes) and power
0 20
Discount rate (for cumulative catch)
0.1
Truncate the series when 0.4B0 is reached (1=Yes)
0
Set F to FMSY once 0.4B0 is reached (1=Yes)
0
Percentage of FMSY which defines Ftarget
0.75
Maximum possible F for projection (-1 to set to FMSY)
-1
Conduct MacCall transition policy (1=Yes)
0
Defintion of recovery (1=now only;2=now or before)
2
Results for rec probs by Tmax (1) or 0.5 prob for various Ttargets (2) 0r sustainability (3) or 5 years (4)
4
Definition of the 40-10 rule
10 40
Produce the risk-reward plots (1=Yes)
0
Calculate coefficients of variation (1=Yes)
0
Number of replicates to use
10
Random number seed
-99004
Conduct projections for multiple starting values (0=No;else yes)
0
File with multiple parameter vectors
rebuild.ss2
Number of parameter vectors: value is placeholder only, user needs to change it
1

```
# User-specific projection (1=Yes); Output replaced (1->9)
1 6  0  0.1
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2009 3 0.607
-1 -1 -1
# Split of Fs
2007 1
-1  99
#Years for rebuild
2020 2022 2025 2029  2033
#Year for probability of recovery
2033
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
none
# Use bisection (0) or linear interpolation (1)
1
# Target Depletion
0.4
# Project with Historical recruitments when computing Tmin (1=Yes)
0
# CV of implementation error
0
```