Updated Rebuilding Analysis for Yelloweye Rockfish Based on Stock Assessment in 2006

March 2006

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Introduction

The yelloweye rockfish (*Sebastes ruberrimus*) stock off the United States Pacific coast was declared to be at an "overfished" state in 2002 based on the first two full stock assessments Wallace (2001) and Methot *et al*. (2002). Both assessments were length-based models and used an earlier version of the Stock Synthesis program (Methot 1990). Wallace (2001) conducted two area assessments by using data from California and Oregon. Methot *et al*. (2002) incorporated Washington catch and age data, and treated the stock as one single assemblage off the California, Oregon, and Washington (W-O-C) coast. Results from Methot *et al.* (2002) indicated that the stock was depleted at 24% of B_0 in 2002. A subsequent rebuilding analysis was conducted (Methot and Piner 2002) and the estimated rebuilding parameters were adopted by the Pacific Fishery Management Council in 2004 (PFMC 2004). The parameters in the 2004 rebuilding plan are as follows:

Year stock declared overfished:	2002
Year rebuilding plan adopted:	2004
B_0:	3,875 mt
B_{MSY}:	1,550 mt
$B_{CURRENT}$ (% OF B0):	24% in 2002
T_{MIN}:	2027
T_{MAX}:	2071
P_{MAX}:	80%
T_{TARGET}:	2058
Harvest control rule:	F = 0.0153

Based on the harvest control rule (F = 0.0153), the optimum yields (OY) for 2004, 2005, and 2006 were determined to be 22, 26, and 27 metric tons, respectively. In 2005, Wallace et al. (2005) updated stock assessment by Methot et al (2002) and subsequently Tsou and Wallace (2005) updated the rebuilding analysis by Methot and Piner (2002).

In 2006, The PFMC requested a full stock assessment for the yelloweye rockfish to incorporate new data sources and area-specific modeling in the assessment. The purpose of this document is to update rebuilding analysis based on this most recent stock assessment.

Highlights of 2006 assessment

The 2006 assessment for yelloweye rockfish (Wallace et al., 2006) revised the historical fishery catch data prior to 1983, re-evaluated all abundance indices, incorporated the

IPHC yelloweye catch trend index, and appended new age and size composition data. There are several features that influence the rebuilding analysis:

- There were four models constructed – one coastwide and three area-specific models. Though the stock assessment review panel (February 2006) adopted all four models, the assessment authors point out that relative to other area-specific models, the Washington model is much more uncertain. This uncertainty is associated with the lack of data that required additional model assumptions on growth, selectivity and fit to the indices.
- The assessment start year was moved back from 1953 to 1923 in the coastwide, California, and Oregon models.
- Selectivity functions were changed from double logistic to logistic functions.
- Natural mortality and recruitment steepness were revised. The values of these parameters used in three coastwide models are listed below. In this rebuilding analysis, we use the values in the 2006 assessment for coastwide and area-specific models.

Assessment year	Natural mortality	Recruitment Steepness	Sigma R
2002	0.045	0.437	0.4
2005	0.045	0.437	0.4
2006	0.036	0.450	0.5

- Yelloweye rockfish is further depleted (17.7% B_0 at year 2006) than it was estimated in the 2002 stock assessment (23.5% at year 2001) (Figure1).

Rebuilding Calculations

We followed the guidelines from the PFMC Statistic and Scientific Committee (SSC) Terms of Reference for Groundfish Rebuilding Analyses dated 20 April 2005 and used the SSC Default Rebuilding Analysis as implemented by Punt (December 2005, version 2.9).

Life History and Selectivity parameters

Life history parameters, age structures, and historical estimates of spawning output and recruitments are taken from Wallace *et al*. (2006). The age-specific selectivity patterns are from Wallace et al (2006), except for the coastwide rebuilding analysis in which we used averaged selectivity functions from seven fisheries, which was weighted by total catches of each fishery over the last five years.

Future Recruitment

To calculate recruitment during rebuilding period, four methods were considered: 1) random sampling of observed recruitment levels, 2) random sampling of observed recruits per spawner (R/S) levels, 3) using a Beverton-Holt stock-recruitment relationship, and 4) using a Ricker stock-recruitment relationship. We used the Beverton-Holt curve with a steepness of 0.45 and Sigma R = 0.5 because recruitments in 1993 -

2005 were estimated based on this relationship in the stock assessment (Figure 2). Also, this method will reproduce recruitment at current levels while the spawning biomass remains low and will predict smoother mean recruitment towards rebuilding.

Rebuilding Schedule

The combination of stock-recruitment steepness and Sigma R affects the calculation of rebuilding time and projected OY (Tables 1 - 4). In the absence of fishing from 2002, the minimum rebuild time T_{MIN} are estimated to be 2046, 2073, 2035, and 2026 for the coastwide, California, Oregon, and Washington models, respectively. The rebuilding trade-off between OY and P_{MAX} is summarized in Figure 3.

The SSC Requested Runs

A set of six rebuilding runs was requested in the SSC Terms of Reference for species currently managed under rebuilding plans. We conducted all six runs only for the coastwide model because there has not been an area-specific rebuilding plan adopted by the PFMC.

Run #	Prob (recovery)	By	Based on
#1 (default)	Estimated	Current T_{TARGET}	Current SPR
#2 (T_{TARGET} with 50% prob)	0.5	Current T_{TARGET}	Estimated SPR
#3 (#1 based on T_{MAX})	Estimated	Current T_{MAX}	Current SPR
#4 (#2 based on T_{MAX})	P_0	Current T_{MAX}	Estimated SPR
#5 (#3 with re-estimated T_{MAX})	Estimated	T_{MAX} (re-estimated)	Current SPR
#6 (#4 with re-estimated T_{MAX})	P_0	T_{MAX} (re-estimated)	Estimated SPR

The current SPR rate was estimated to be 0.696 by applying rebuilding program version 2.9 (Punt, December 2005) to the 2002 rebuilding data (Methot and Piner, 2002).

The results indicate that the yelloweye rockfish stock is behind in rebuilding schedule and will take longer time to rebuild than as indicated in the 2002 rebuilding analysis (Methot and Piner 2002). New T_{MIN} of 2046 and T_{MAX} of 2096 are 19 and 25 years longer than the T_{MIN} of 2027 and T_{MAX} of 2071 reported in the previous analysis. Probabilities of recovery by current T_{TARGET} (2058) and T_{MAX} (2071) based on current SPR are low (Table 6, SSC runs 1 and 3). To recover by current T_{TARGET} or T_{MAX} fishing mortality needs to be reduced to 0.0044 (Table 6, SSC run2) and 0.0061 (Table 6, SSC run 4), respectively. Probability of recovery by re-estimated T_{MAX} (2096) with current SPR is 0.63 (Table 6, SSC run 5). Based on SSC run 6 settings, where T_{MAX} and SPR rate

are re-estimated and P_o = 80%, OY is projected to be 12.6 mt in 2007 and the coastwide stock is estimated to rebuild in year 2096 (Table 2).

Literature Cited

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Table 1. Rebuilding parameters for coastwide, California, Oregon, and Washington models.

	Coastwide	California	Oregon	Washington
FMSY proxy	0.024	0.021	0.021	0.027
FMSY SPR / SPR(F=0)	0.5	0.5	0.5	0.5
Virgin SPR	52.195	52.189	53.349	44.960
Generation time	50	47	49	46
T_{MIN}	2046	2073	2035	2026
T_{MAX}	2096	2120	2084	2072
Virgin Spawning Output	6643	3421	2510	906
Target Spawning Output	2657	1368	1004	362
Current Spawning Output	1146	281	530	188
Spawning Output (ydecl = 2002)	1019	249	456	180
Natural mortality	0.036	0.036	0.036	0.040
Steepness	0.45	0.45	0.45	0.45
SigmaR	0.50	0.50	0.50	0.50

Table 2. Ten-year OY projections and depletion levels under different P_{MAX} for the coastwide model.

P_{MAX}	0.5		0.6		0.7		0.8		0.9		Yr=Tmid		F=0	
T_{MAX}	2096		2092		2087		2083		2078		2073		2048	
2007	14.8	18%	14.1	18%	13.4	18%	12.6	18%	11.4	18%	10.2	18%	0.0	18%
2008	15.1	18%	14.5	18%	13.7	19%	12.9	19%	11.7	19%	10.5	19%	0.0	19%
2009	15.4	19%	14.8	19%	14.0	19%	13.2	19%	12.0	19%	10.7	19%	0.0	19%
2010	15.7	19%	15.1	19%	14.3	19%	13.5	19%	12.3	20%	11.0	20%	0.0	20%
2011	16.0	20%	15.4	20%	14.6	20%	13.8	20%	12.6	20%	11.2	20%	0.0	21%
2012	16.3	20%	15.6	20%	14.9	20%	14.1	20%	12.8	20%	11.4	20%	0.0	21%
2013	16.6	21%	15.9	21%	15.1	21%	14.3	21%	13.0	21%	11.7	21%	0.0	22%
2014	16.8	21%	16.1	21%	15.4	21%	14.5	21%	13.2	21%	11.9	21%	0.0	22%
2015	17.0	21%	16.4	21%	15.6	21%	14.7	21%	13.5	22%	12.1	22%	0.0	23%
2016	17.3	21%	16.6	22%	15.8	22%	15.0	22%	13.7	22%	12.2	22%	0.0	23%

Table 3. Ten-year OY projections and depletion levels under different P_{MAX} for the California model.

P_{MAX}	0.5		0.6		0.7		0.8		0.9		Yr=Tmid		F=0	
T_{MAX}	2120		2116		2113		2108		2104		2098		2075	
2007	3.3	9%	3.1	9%	3.0	9%	2.7	9%	2.5	9%	2.1	9%	0.0	9%
2008	3.4	9%	3.2	9%	3.0	9%	2.8	9%	2.5	9%	2.2	9%	0.0	9%
2009	3.5	9%	3.3	9%	3.1	9%	2.9	9%	2.6	9%	2.2	9%	0.0	9%
2010	3.6	9%	3.4	9%	3.2	10%	2.9	10%	2.7	10%	2.3	10%	0.0	10%
2011	3.6	10%	3.4	10%	3.3	10%	3.0	10%	2.7	10%	2.4	10%	0.0	10%
2012	3.7	10%	3.5	10%	3.3	10%	3.1	10%	2.8	10%	2.4	10%	0.0	10%
2013	3.8	10%	3.6	10%	3.4	10%	3.1	10%	2.9	10%	2.5	10%	0.0	11%
2014	3.9	10%	3.7	10%	3.5	11%	3.2	11%	2.9	11%	2.5	11%	0.0	11%
2015	3.9	11%	3.7	11%	3.5	11%	3.3	11%	3.0	11%	2.6	11%	0.0	11%
2016	4.0	11%	3.8	11%	3.6	11%	3.3	11%	3.0	11%	2.6	11%	0.0	12%

Table 4. Ten-year OY projections and depletion levels under different P_{MAX} for the Oregon model.

P_{MAX}	0.5		0.6		0.7		0.8		0.9		Yr=Tmid		F=0	
T_{MAX}	2084		2080		2075		2070		2064		2061		2037	
2007	7.5	22%	7.2	22%	6.9	22%	6.4	22%	5.8	22%	5.5	22%	0.0	22%
2008	7.7	23%	7.3	23%	7.0	23%	6.6	23%	6.0	23%	5.6	23%	0.0	23%
2009	7.8	24%	7.5	24%	7.1	24%	6.7	24%	6.1	24%	5.7	24%	0.0	24%
2010	7.9	24%	7.6	24%	7.2	24%	6.8	24%	6.2	24%	5.8	24%	0.0	25%
2011	8.0	25%	7.7	25%	7.3	25%	6.9	25%	6.3	25%	5.9	25%	0.0	26%
2012	8.1	25%	7.8	25%	7.4	25%	7.0	25%	6.4	25%	6.0	25%	0.0	26%
2013	8.2	25%	7.9	25%	7.5	25%	7.1	26%	6.5	26%	6.1	26%	0.0	27%
2014	8.3	26%	7.9	26%	7.6	26%	7.1	26%	6.5	26%	6.1	26%	0.0	28%
2015	8.3	26%	8.0	26%	7.7	26%	7.2	26%	6.6	26%	6.2	27%	0.0	28%
2016	8.4	26%	8.1	26%	7.7	26%	7.3	27%	6.7	27%	6.3	27%	0.0	29%

Table 5. Ten-year OY projections and depletion levels under different P_{MAX} for the Washington model.

P_{MAX}	0.5		0.6		0.7		0.8		0.9		Yr=Tmid		F=0	
T_{MAX}	2072		2068		2064		2060		2055		2051		2031	
2007	3.0	21%	2.9	21%	2.8	21%	2.6	21%	2.4	21%	2.1	21%	0.0	21%
2008	3.1	22%	3.0	22%	2.9	22%	2.7	22%	2.4	22%	2.2	22%	0.0	22%
2009	3.2	23%	3.1	23%	3.0	23%	2.8	23%	2.5	23%	2.3	23%	0.0	23%
2010	3.3	24%	3.2	24%	3.1	24%	2.9	24%	2.6	24%	2.3	24%	0.0	24%
2011	3.4	24%	3.3	24%	3.1	24%	3.0	25%	2.7	25%	2.4	25%	0.0	26%
2012	3.5	25%	3.3	25%	3.2	25%	3.0	25%	2.8	25%	2.5	26%	0.0	27%
2013	3.6	26%	3.4	26%	3.3	26%	3.1	26%	2.8	26%	2.5	26%	0.0	28%
2014	3.6	26%	3.5	27%	3.4	27%	3.2	27%	2.9	27%	2.6	27%	0.0	29%
2015	3.7	27%	3.5	27%	3.4	27%	3.2	27%	2.9	28%	2.7	28%	0.0	30%
2016	3.8	27%	3.6	28%	3.5	28%	3.3	28%	3.0	28%	2.7	28%	0.0	31%

Table 6. Summary of the SSC requested runs with 10-year OY projections. Numbers in bold are re-estimated values.

	SSC run 1	SSC run 2	SSC run 3	SSC Run 4	SSC run 5	SSC Run 6
Prob(rebuild)	**0.005**	0.5	**0.042**	0.8	**0.63**	0.8
Rebuild by T_{TARGET}	2058	2058	--	--	--	--
Rebuild by T_{MAX}	--	--	2071	2071	**2096**	**2096**
SPR	0.696	**0.860**	0.696	**0.812**	0.696	**0.719**
F		**0.0044**		**0.0061**		**0.0101**
2007	14.0	5.5	14.0	7.7	14.0	12.6
2008	14.3	5.6	14.3	7.9	14.3	12.9
2009	14.6	5.8	14.6	8.1	14.6	13.2
2010	14.9	5.9	14.9	8.3	14.9	13.5
2011	15.2	6.1	15.2	8.5	15.2	13.8
2012	15.5	6.2	15.5	8.7	15.5	14.1
2013	15.8	6.4	15.8	8.9	15.8	14.3
2014	16.0	6.5	16.0	9.0	16.0	14.5
2015	16.2	6.6	16.2	9.2	16.2	14.7
2016	16.4	6.7	16.4	9.4	16.4	15.0

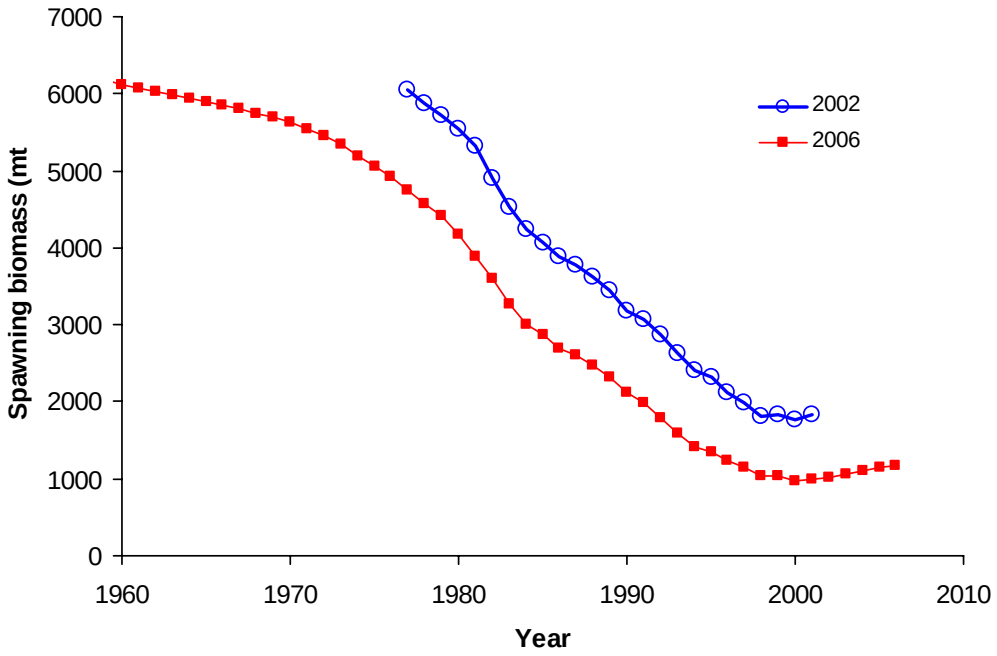
7000
6000
5000
4000
3000
2000
1000
0
Spawning biomass (mt
1960
1970
1980
1990
2000
2010
Year
2002
2006

Figure 1. Comparison of yelloweye rockfish spawning biomass estimated in 2002 and 2006 stock assessment

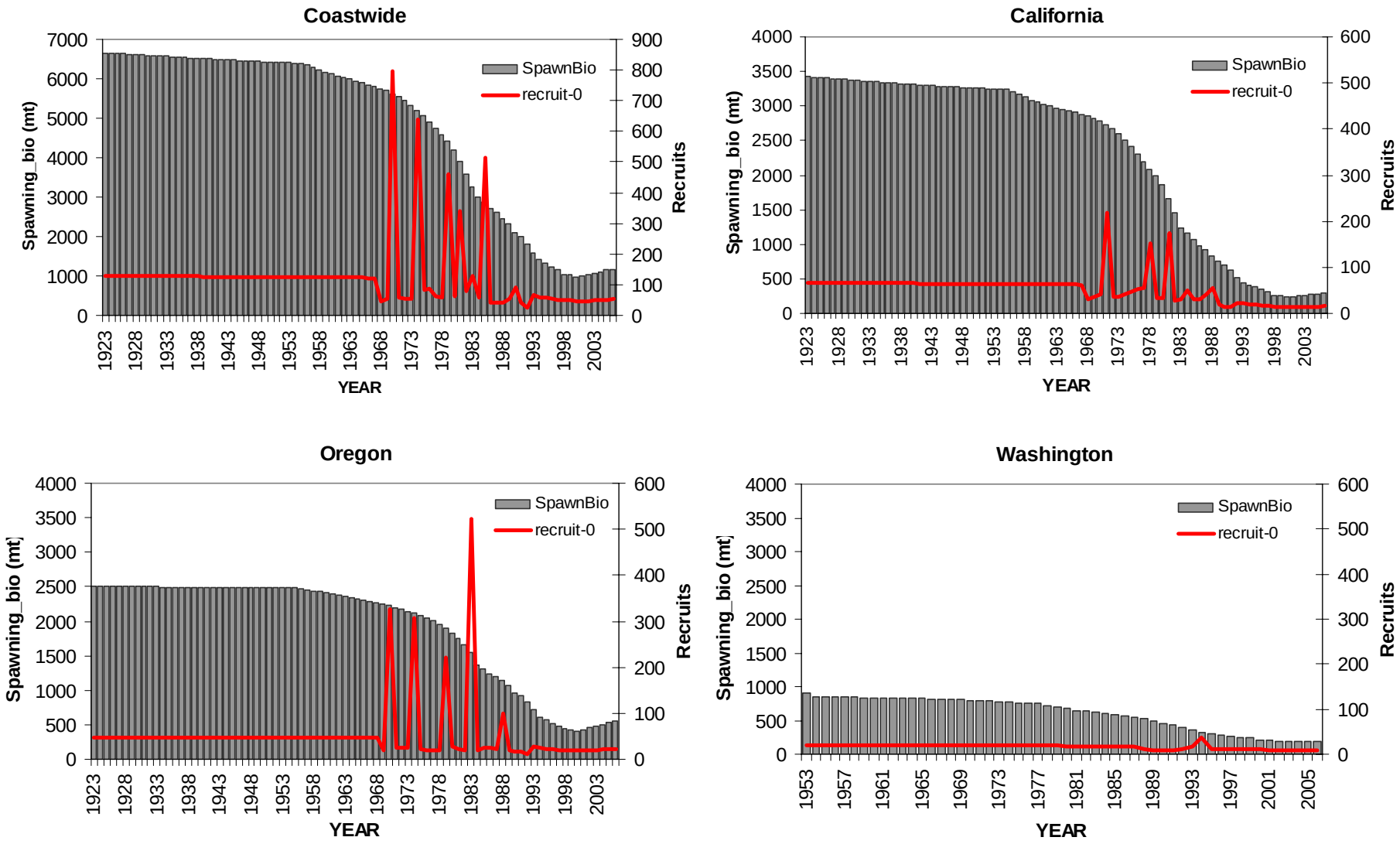

Figure 2. Spawning biomass and age-0 recruits in coastwide and area-specific models.

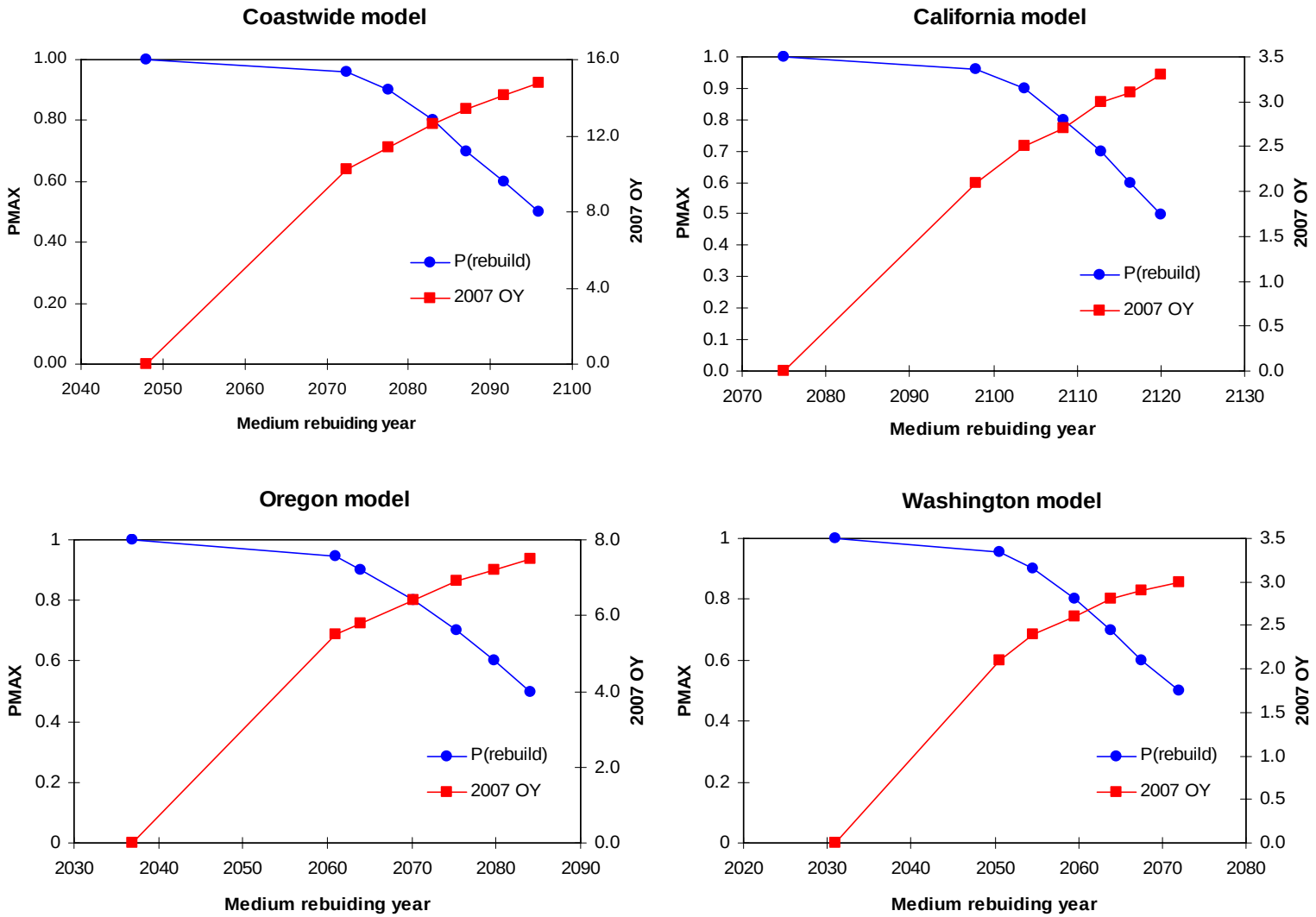

Figure 3. Trade-off between OY in 2007 and medium rebuilding time before T_{MAX}.

Appendix A. Input data for coastwide model

```
#Title
Yelloweye_CST_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
3
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# 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 (64 or 51: #of years beyond Tstart to Tmax 2071 or Ttarget 2058, from previous rebuilding plan)
-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      46      47      48      49      50      51      52
        53      54      55      56      57      58      59      60      61      62      63      64      65
        66      67      68      69      70
0.00001         0.00001         0.00001         0.00001         0.00002         0.00008         0.00037689
        0.00163636      0.00618861      0.0198959       0.0531941       0.118229        0.22283
        0.366512        0.541439        0.736379        0.940456        1.14517         1.34484
        1.5362  1.71769         1.88888         2.04994         2.20134         2.34371         2.47766
        2.60381         2.72269         2.83479         2.94056         3.04039         3.13462
        3.22358         3.30755         3.3868  3.46158         3.53213         3.59867         3.6614
        3.72052         3.77623         3.8287  3.8781  3.9246  3.96835         4.00951         4.04821
        4.08459         4.11879         4.15092         4.18111         4.20945         4.23607
        4.26106         4.28451         4.30651         4.32716         4.34653         4.3647  4.38173
        4.39771         4.41265         4.42667         4.4398  4.45211         4.46365         4.47446
        4.48459         4.49407         4.50296         4.51129
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=CA fleets
0.1309  0.1309  0.1309  0.1336  0.1641  0.2291  0.3132  0.4099  0.5169  0.6324  0.7551  0.8832  1.0156
        1.1507  1.2876  1.4250  1.5622  1.6982  1.8324  1.9641  2.0930  2.2186  2.3405  2.4586  2.5726
        2.6824  2.7879  2.8891  2.9860  3.0786  3.1669  3.2511  3.3312  3.4074  3.4796  3.5482  3.6131
        3.6746  3.7328  3.7878  3.8397  3.8887  3.9349  3.9785  4.0196  4.0583  4.0947  4.1290  4.1613
        4.1916  4.2201  4.2469  4.2721  4.2958  4.3180  4.3388  4.3584  4.3767  4.3940  4.4101  4.4253
        4.4395  4.4528  4.4653  4.4769  4.4879  4.4982  4.5078  4.5168  4.5252  4.5332
0.0252  0.0252  0.0252  0.0265  0.0425  0.0885  0.1705  0.2854  0.4174  0.5462  0.6577  0.7467  0.8141
        0.8635  0.8992  0.9249  0.9433  0.9566  0.9664  0.9735  0.9789  0.9829  0.9860  0.9884  0.9903
        0.9917  0.9929  0.9938  0.9946  0.9952  0.9958  0.9962  0.9966  0.9969  0.9972  0.9974  0.9976
```

0.9977 0.9979 0.9980 0.9981 0.9982 0.9983 0.9984 0.9985 0.9985 0.9986 0.9986 0.9987
0.9987 0.9988 0.9988 0.9988 0.9989 0.9989 0.9989 0.9989 0.9990 0.9990 0.9990 0.9990
0.9990 0.9990 0.9990 0.9991 0.9991 0.9991 0.9991 0.9991 0.9991 0.9991
wt and selex fleet 2=OR fleets
0.1309 0.1309 0.1309 0.1336 0.1641 0.2291 0.3132 0.4099 0.5169 0.6324 0.7551 0.8832 1.0156
1.1507 1.2876 1.4250 1.5622 1.6982 1.8324 1.9641 2.0930 2.2186 2.3405 2.4586 2.5726
2.6824 2.7879 2.8891 2.9860 3.0786 3.1669 3.2511 3.3312 3.4074 3.4796 3.5482 3.6131
3.6746 3.7328 3.7878 3.8397 3.8887 3.9349 3.9785 4.0196 4.0583 4.0947 4.1290 4.1613
4.1916 4.2201 4.2469 4.2721 4.2958 4.3180 4.3388 4.3584 4.3767 4.3940 4.4101 4.4253
4.4395 4.4528 4.4653 4.4769 4.4879 4.4982 4.5078 4.5168 4.5252 4.5332
0.0098 0.0098 0.0098 0.0105 0.0210 0.0575 0.1345 0.2536 0.3963 0.5377 0.6600 0.7563 0.8277
0.8787 0.9143 0.9389 0.9559 0.9678 0.9760 0.9819 0.9861 0.9892 0.9915 0.9932 0.9944
0.9954 0.9962 0.9968 0.9972 0.9976 0.9979 0.9982 0.9984 0.9986 0.9987 0.9988 0.9989
0.9990 0.9991 0.9992 0.9992 0.9993 0.9993 0.9993 0.9994 0.9994 0.9994 0.9995 0.9995
0.9995 0.9995 0.9995 0.9995 0.9996 0.9996 0.9996 0.9996 0.9996 0.9996 0.9996 0.9996
0.9996 0.9996 0.9996 0.9996 0.9996 0.9997 0.9997 0.9997 0.9997 0.9997
wt and selex fleet 3=WA fleets
0.1309 0.1309 0.1309 0.1336 0.1641 0.2291 0.3132 0.4099 0.5169 0.6324 0.7551 0.8832 1.0156
1.1507 1.2876 1.4250 1.5622 1.6982 1.8324 1.9641 2.0930 2.2186 2.3405 2.4586 2.5726
2.6824 2.7879 2.8891 2.9860 3.0786 3.1669 3.2511 3.3312 3.4074 3.4796 3.5482 3.6131
3.6746 3.7328 3.7878 3.8397 3.8887 3.9349 3.9785 4.0196 4.0583 4.0947 4.1290 4.1613
4.1916 4.2201 4.2469 4.2721 4.2958 4.3180 4.3388 4.3584 4.3767 4.3940 4.4101 4.4253
4.4395 4.4528 4.4653 4.4769 4.4879 4.4982 4.5078 4.5168 4.5252 4.5332
0.0123 0.0123 0.0123 0.0126 0.0160 0.0241 0.0367 0.0543 0.0776 0.1075 0.1443 0.1876 0.2367
0.2900 0.3454 0.4011 0.4551 0.5062 0.5534 0.5964 0.6351 0.6694 0.6998 0.7266 0.7501
0.7707 0.7888 0.8047 0.8187 0.8310 0.8418 0.8514 0.8599 0.8675 0.8742 0.8802 0.8856
0.8905 0.8948 0.8987 0.9023 0.9055 0.9084 0.9110 0.9134 0.9156 0.9176 0.9194 0.9211
0.9226 0.9240 0.9253 0.9265 0.9276 0.9286 0.9296 0.9304 0.9312 0.9320 0.9327 0.9333
0.9339 0.9344 0.9350 0.9354 0.9359 0.9363 0.9367 0.9370 0.9374 0.9377
M and initial age-structure for 2005
for both male and female
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036
51.6255 48.5266 45.4700 42.5004 40.5386 38.2789 38.4885
37.3432 38.4787 38.7310 39.3492 39.1482 39.8207
14.6943 22.8271 44.0905 24.0429 16.0633 13.5908
12.3064 129.6330 12.7506 23.1109 12.0458 43.5901
6.6227 42.8411 4.5909 4.4241 5.2766 4.4016 29.0624 2.1195 1.8523 1.7643
21.6986 1.3380 0.9875 2.4541 2.2532 2.0796 1.9284 1.7969 1.6805 1.5772 1.4854
1.4031 1.3289 1.2604 1.1975 1.1387 1.0816 1.0281 0.9778 0.9303 0.8854 0.8432 0.8037
0.7670 0.7329 0.7012 0.6717 0.6440 0.6180 0.5933 0.5699 0.5476 0.5264 0.5061 0.4867
12.8309
Initial age-structure female then male for Ydeclared=2002 (Tmin)
47.3655 45.1882 42.6739 42.9246 41.6864 43.0243 43.4054
44.2166 44.1111 44.9822 16.6355 25.8913 50.0887
27.3513 18.2953 15.4953 14.0437 148.0510 14.5722
26.4288 13.7825 49.8982 7.5842 49.0784 5.2609 5.0712 6.0499
5.0477 33.3347 2.4315 2.1252 2.0246 24.9025 1.5357 1.1335 2.8172 2.5868
2.3877 2.2142 2.0634 1.9297 1.8113 1.7060 1.6115 1.5263 1.4477 1.3754 1.3079 1.2424
1.1810 1.1232 1.0687 1.0171 0.9687 0.9234 0.8812 0.8420 0.8056 0.7717 0.7399 0.7100
0.6817 0.6548 0.6292 0.6048 0.5814 0.5591 0.5378 0.5173 0.4977 13.1895
Year for Tmin Age-structure

2002
Number of simulations
1000
recruitment and biomass
Number of historical assessment years
83
Historical data
year recruitment spawner in B0 in R project in R/S project

1923	127.281	6643.41	1	0	0
1924	127.281	6643.41	1	0	0
1925	127.281	6643.41	0	0	0
1926	127.222	6633.39	0	0	0
1927	127.163	6623.41	0	0	0
1928	127.105	6613.48	0	0	0
1929	127.047	6603.62	0	0	0
1930	126.989	6593.84	0	0	0
1931	126.932	6584.14	0	0	0
1932	126.875	6574.56	0	0	0
1933	126.818	6565.1	0	0	0
1934	126.763	6555.76	0	0	0
1935	126.708	6546.58	0	0	0
1936	126.654	6537.55	0	0	0
1937	126.601	6528.68	0	0	0
1938	126.549	6519.98	0	0	0
1939	126.497	6511.44	0	0	0
1940	126.447	6503.07	0	0	0
1941	126.397	6494.87	0	0	0
1942	126.349	6486.82	0	0	0
1943	126.301	6478.94	0	0	0
1944	126.254	6471.21	0	0	0
1945	126.208	6463.62	0	0	0
1946	126.163	6456.19	0	0	0
1947	126.118	6448.9	0	0	0
1948	126.075	6441.75	0	0	0
1949	126.032	6434.73	0	0	0
1950	125.99	6427.85	0	0	0
1951	125.948	6421.1	0	0	0
1952	125.908	6414.47	0	0	0
1953	125.868	6407.97	0	0	0
1954	125.828	6401.59	0	0	0
1955	125.79	6395.33	0	0	0
1956	125.49	6346.98	0	0	0
1957	125.144	6291.85	0	0	0
1958	124.802	6237.97	0	0	0
1959	124.406	6176.33	0	0	0
1960	124.052	6122.01	0	0	0
1961	123.726	6072.38	0	0	0
1962	123.44	6029.5	0	0	0
1963	123.159	5987.64	0	0	0
1964	122.83	5939.12	0	0	0
1965	122.552	5898.51	0	0	0
1966	122.229	5851.86	0	0	0
1967	121.878	5801.66	0	0	0
1968	44.6223	5751.12	0	1	0
1969	54.626	5700.33	0	1	0
1970	794.277	5620.62	0	1	0

1971 57.4323 5536.46 0 1 0
1972 53.1839 5454.66 0 1 0
1973 53.3088 5338.45 0 1 0
1974 637.256 5196.34 0 1 0
1975 83.934 5058.85 0 1 0
1976 87.4141 4917.57 0 1 0
1977 63.5935 4752.41 0 1 0
1978 57.0958 4579.12 0 1 0
1979 458.69 4411.06 0 1 0
1980 60.6498 4180.21 0 1 0
1981 339.435 3892.78 0 1 0
1982 79.3289 3594.84 0 1 0
1983 128.363 3265.23 0 1 0
1984 59.709 3006.81 0 1 0
1985 513.603 2864.65 0 1 0
1986 41.6036 2699.16 0 1 0
1987 39.6196 2604.61 0 1 0
1988 40.9073 2465.36 0 1 0
1989 54.2458 2316.87 0 1 0
1990 89.5403 2110.33 0 1 0
1991 42.3809 1993.85 0 1 0
1992 25.2998 1792.08 0 1 0
1993 64.3818 1582.76 0 0 0
1994 60.0054 1422.81 0 0 0
1995 57.5386 1337.55 0 0 0
1996 54.2349 1228.48 0 0 0
1997 51.7059 1148.68 0 0 0
1998 48.2626 1044.84 0 0 0
1999 47.8721 1033.4 0 0 0
2000 45.8841 976.155 0 0 0
2001 46.8447 1003.61 0 0 0
2002 47.3655 1018.65 0 0 0
2003 48.8742 1062.9 0 0 0
2004 50.3054 1105.8 0 0 0
2005 51.6255 1146.2 0 0 0
Number of years with pre-specified catches
2
catches for years with pre-specified catches
2005 26
2006 27
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; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
Steepness sigma-R Auto-correlation (Change sigmaR to 0.4 for final runs!!)
0.45 0.5 0
Target SPR rate (FMSY Proxy)
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
0.9
# 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)
1
# 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
20
# Random number seed
-89102
# Conduct projections for multiple starting values (0=No;else yes)
0
# File with multiple parameter vectors
MCMC.PRJ
# Number of parameter vectors
1
# User-specific projection (1=Yes); Output replaced (1->6)
0         6         0         0.5
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.591
-1        -1        -1
# Split of Fs (first year MUST be Yinit)
2005 0.3 0.3 0.4
2006 0.3 0.3 0.4
-1        1         1         1
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
HakWght.Csv
# Use bisection (0) or linear interpolation (1)
0
# Target Depletion
0.4
```

Appendix B. Input data for California model

```
#Title
Yelloweye_CA_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
2
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# 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      46      47      48      49      50      51      52
        53      54      55      56      57      58      59      60      61      62      63      64      65
        66      67      68      69      70
0.00    0.00    0.00    0.00006         0.0003  0.0014  0.0051  0.0176  0.0509  0.1207  0.2374  0.3984
        0.5909  0.7993  1.0102  1.2152  1.4096  1.5914  1.7604  1.9171  2.0624  2.1972  2.3224  2.4388
        2.5471  2.6481  2.7422  2.8300  2.9118  2.9881  3.0593  3.1257  3.1876  3.2453  3.2990  3.3491
        3.3957  3.4391  3.4794  3.5170  3.5520  3.5844  3.6146  3.6427  3.6688  3.6930  3.7155  3.7363
        3.7557  3.7737  3.7904  3.8059  3.8202  3.8335  3.8459  3.8573  3.8680  3.8778  3.8869  3.8954
        3.9032  3.9104  3.9171  3.9232  3.9289  3.9342  3.9391  3.9437  3.9479  3.9518  3.9554
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=CA recreation
0.1309  0.1320  0.1764  0.2644  0.3650  0.4736  0.5877  0.7100  0.8362  0.9658  1.0979  1.2314  1.3653
        1.4986  1.6302  1.7594  1.8855  2.0079  2.1261  2.2400  2.3492  2.4536  2.5531  2.6477  2.7374
        2.8224  2.9027  2.9784  3.0497  3.1168  3.1798  3.2390  3.2944  3.3462  3.3948  3.4401  3.4825
        3.5221  3.5589  3.5933  3.6254  3.6552  3.6830  3.7088  3.7329  3.7552  3.7760  3.7953  3.8132
        3.8299  3.8453  3.8597  3.8730  3.8854  3.8968  3.9075  3.9173  3.9265  3.9350  3.9428  3.9501
        3.9568  3.9629  3.9686  3.9739  3.9788  3.9833  3.9875  3.9914  3.9950  3.9983
0.0000  0.0357  0.0540  0.1143  0.2169  0.3533  0.5001  0.6321  0.7363  0.8125  0.8660  0.9031  0.9286
        0.9464  0.9589  0.9679  0.9744  0.9792  0.9829  0.9856  0.9878  0.9895  0.9908  0.9919  0.9927
        0.9935  0.9941  0.9946  0.9950  0.9954  0.9957  0.9959  0.9962  0.9964  0.9965  0.9967  0.9968
        0.9969  0.9970  0.9971  0.9972  0.9973  0.9974  0.9974  0.9975  0.9975  0.9976  0.9976  0.9977
        0.9977  0.9977  0.9977  0.9978  0.9978  0.9978  0.9978  0.9979  0.9979  0.9979  0.9979  0.9979
        0.9979  0.9979  0.9980  0.9980  0.9980  0.9980  0.9980  0.9980  0.9980  0.9980
# wt and selex fleet 2=CA commercial
```

0.1309 0.1323 0.1838 0.2783 0.3843 0.4952 0.6076 0.7265 0.8483 0.9736 1.1021 1.2330 1.3650
1.4970 1.6278 1.7565 1.8822 2.0045 2.1227 2.2365 2.3457 2.4502 2.5498 2.6445 2.7343
2.8193 2.8997 2.9755 3.0469 3.1141 3.1771 3.2363 3.2918 3.3437 3.3923 3.4377 3.4801
3.5197 3.5566 3.5910 3.6231 3.6529 3.6807 3.7066 3.7306 3.7530 3.7738 3.7931 3.8111
3.8277 3.8432 3.8576 3.8709 3.8833 3.8947 3.9054 3.9153 3.9244 3.9329 3.9408 3.9481
3.9547 3.9609 3.9666 3.9718 3.9767 3.9813 3.9855 3.9894 3.9930 3.9963
0.0000 0.0087 0.0161 0.0475 0.1220 0.2524 0.4206 0.5865 0.7190 0.8130 0.8755 0.9160 0.9421
0.9591 0.9704 0.9780 0.9832 0.9869 0.9896 0.9916 0.9930 0.9941 0.9950 0.9957 0.9962
0.9966 0.9970 0.9973 0.9975 0.9977 0.9979 0.9980 0.9981 0.9982 0.9983 0.9984 0.9985
0.9986 0.9986 0.9987 0.9987 0.9987 0.9988 0.9988 0.9988 0.9989 0.9989 0.9989 0.9989
0.9989 0.9989 0.9990 0.9990 0.9990 0.9990 0.9990 0.9990 0.9990 0.9990 0.9990 0.9990
0.9991 0.9991 0.9991 0.9991 0.9991 0.9991 0.9991 0.9991 0.9991 0.9991
M and initial age-structure for 2005
for both male and female
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036
14.8329 13.8524 12.9318 12.0221 11.3712 10.8050 10.8923
10.6878 11.6463 12.3016 12.3010 12.1624 11.5713
10.4492 6.0055 4.9790 5.9539 14.0654 8.5047 5.0151 4.2398 5.8357 2.9907
2.0763 11.5461 1.9081 1.6592 6.4867 2.0495 1.6458 1.2881 0.9644 0.7431 0.6702
3.5202 0.5999 0.4803 0.3651 0.6875 0.6381 0.5954 0.5581 0.5260 0.4975 0.4722 0.4496
0.4292 0.4105 0.3926 0.3758 0.3594 0.3427 0.3267 0.3114 0.2970 0.2834 0.2709 0.2594
0.2488 0.2389 0.2296 0.2208 0.2124 0.2044 0.1967 0.1894 0.1823 0.1755 0.1690 0.1627
4.3220
Initial age-structure female then male for Ydeclared=2002 (Tmin)
13.4058 12.6932 12.0832 12.2164 12.0314 13.1620 13.9523
13.9919 13.8641 13.2104 11.9420 6.8685 5.6973 6.8153 16.1045
9.7395 5.7440 4.8565 6.6851 3.4261 2.3787 13.2285 2.1862 1.9011 7.4324 2.3484
1.8858 1.4759 1.1051 0.8514 0.7679 4.0338 0.6874 0.5504 0.4184 0.7878 0.7312 0.6823
0.6395 0.6028 0.5702 0.5411 0.5152 0.4918 0.4704 0.4499 0.4306 0.4118 0.3927 0.3744
0.3569 0.3403 0.3248 0.3105 0.2973 0.2851 0.2737 0.2631 0.2530 0.2434 0.2342 0.2254
0.2170 0.2089 0.2011 0.1937 0.1865 0.1796 0.1729 0.1665 4.4338
Year for Tmin Age-structure
2002
Number of simulations
1000
recruitment and biomass
Number of historical assessment years
83
Historical data
year recruitment spawner in B0 in R project in R/S project
1923 65.704 3429.02 1 0 0
1924 65.4049 3413.41 1 0 0
1925 65.6123 3413.41 0 0 0
1926 65.5696 3406.18 0 0 0
1927 65.5269 3398.97 0 0 0
1928 65.4843 3391.78 0 0 0
1929 65.4417 3384.63 0 0 0
1930 65.3993 3377.52 0 0 0
1931 65.3571 3370.47 0 0 0
1932 65.3152 3363.5 0 0 0
1933 65.2737 3356.61 0 0 0

1934	65.2328	3349.83	0	0	0
1935	65.1924	3343.17	0	0	0
1936	65.1528	3336.64	0	0	0
1937	65.1139	3330.25	0	0	0
1938	65.0757	3323.99	0	0	0
1939	65.0383	3317.88	0	0	0
1940	65.0015	3311.89	0	0	0
1941	64.9656	3306.04	0	0	0
1942	64.9302	3300.31	0	0	0
1943	64.8956	3294.71	0	0	0
1944	64.8616	3289.22	0	0	0
1945	64.8283	3283.85	0	0	0
1946	64.7955	3278.58	0	0	0
1947	64.7633	3273.42	0	0	0
1948	64.7317	3268.37	0	0	0
1949	64.7007	3263.41	0	0	0
1950	64.6703	3258.56	0	0	0
1951	64.6403	3253.8	0	0	0
1952	64.6109	3249.13	0	0	0
1953	64.582	3244.55	0	0	0
1954	64.5536	3240.06	0	0	0
1955	64.5257	3235.66	0	0	0
1956	64.3242	3204.1	0	0	0
1957	64.0789	3166.23	0	0	0
1958	63.8396	3129.87	0	0	0
1959	63.5532	3087.11	0	0	0
1960	63.3128	3051.81	0	0	0
1961	63.103	3021.45	0	0	0
1962	62.9388	2997.96	0	0	0
1963	62.7821	2975.77	0	0	0
1964	62.5966	2949.79	0	0	0
1965	62.467	2931.82	0	0	0
1966	62.2935	2907.98	0	0	0
1967	62.0932	2880.78	0	0	0
1968	30.3249	2853.27	0	1	0
1969	36.4519	2825.59	0	1	0
1970	41.3152	2781.87	0	1	0
1971	218.362	2728.16	0	1	0
1972	37.0963	2678.42	0	1	0
1973	36.3038	2602.33	0	1	0
1974	41.1095	2502.85	0	1	0
1975	47.435	2407.19	0	1	0
1976	52.0892	2305.22	0	1	0
1977	55.7812	2194.07	0	1	0
1978	152.371	2089.3	0	1	0
1979	33.7009	1990.26	0	1	0
1980	33.3917	1859.12	0	1	0
1981	172.841	1661.94	0	1	0
1982	26.2746	1456.13	0	1	0
1983	31.6742	1230.91	0	1	0
1984	51.1318	1154.82	0	1	0
1985	30.4267	1065.9	0	1	0
1986	29.4327	972.492	0	1	0
1987	40.9978	913.922	0	1	0
1988	56.2407	833.007	0	1	0
1989	19.9289	760.843	0	1	0

1990 14.0639 702.201 0 1 0
1991 14.4547 631.309 0 1 0
1992 21.7774 520.784 0 1 0
1993 21.3551 439.811 0 0 0
1994 20.3219 412.711 0 0 0
1995 18.9849 378.741 0 0 0
1996 17.801 349.652 0 0 0
1997 15.9558 306.054 0 0 0
1998 13.9752 261.479 0 0 0
1999 13.6365 254.076 0 0 0
2000 12.9935 240.189 0 0 0
2001 13.1585 243.731 0 0 0
2002 13.4058 249.068 0 0 0
2003 13.9023 259.881 0 0 0
2004 14.3602 269.972 0 0 0
2005 14.8329 280.512 0 0 0
Number of years with pre-specified catches
2
catches for years with pre-specified catches
2005 8
2006 8
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; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
Steepness sigma-R Auto-correlation (Change sigmaR to 0.4 for final runs!!)
0.45 0.5 0
Target SPR rate (FMSY Proxy)
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
0.9
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)
1
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

```
20
# Random number seed
-89102
# Conduct projections for multiple starting values (0=No;else yes)
0
# File with multiple parameter vectors
MCMC.PRJ
# Number of parameter vectors
1
# User-specific projection (1=Yes); Output replaced (1->6)
0          6          0          0.5
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.717
-1         -1         -1
# Split of Fs (first year MUST be Yinit)
2005 0.8 0.2
2006 0.8 0.2
-1         1          1          1
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
HakWght.Csv
# Use bisection (0) or linear interpolation (1)
0
# Target Depletion
0.4
```

Appendix C. Input data for Oregon model

```
#Title
Yelloweye_OR_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
2
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# 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      46      47      48      49      50      51      52
        53      54      55      56      57      58      59      60      61      62      63      64      65
        66      67      68      69      70
0.00000         0.00000         0.00001         0.00001         0.00001         0.00001         0.00006
        0.00038         0.00201         0.00900         0.03218         0.08970         0.19769
        0.35888         0.56178         0.78864         1.02318         1.25403         1.47468
        1.68223         1.87588         2.05599         2.22337         2.37902         2.52390
        2.65887         2.78472         2.90214         3.01173         3.11402         3.20950
        3.29861         3.38175         3.45929         3.53158         3.59895         3.66171
        3.72015         3.77454         3.82514         3.87219         3.91593         3.95658
        3.99433         4.02939         4.06193         4.09213         4.12015         4.14614
        4.17024         4.19257         4.21328         4.23247         4.25024         4.26671
        4.28196         4.29609         4.30916         4.32127         4.33248         4.34286
        4.35241         4.36125         4.36943         4.37700         4.38401         4.39049
        4.39648         4.40202         4.40715         4.41189
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=CA recreation
0.1309  0.1309  0.1309  0.1309  0.1318  0.1854  0.2929  0.4043  0.5156  0.6313  0.7551  0.8882  1.0296
        1.1770  1.3284  1.4815  1.6345  1.7859  1.9346  2.0796  2.2202  2.3558  2.4862  2.6110  2.7301
        2.8434  2.9509  3.0527  3.1488  3.2395  3.3249  3.4051  3.4804  3.5511  3.6172  3.6790  3.7368
        3.7908  3.8411  3.8880  3.9317  3.9724  4.0103  4.0455  4.0783  4.1087  4.1369  4.1632  4.1875
        4.2101  4.2311  4.2505  4.2685  4.2852  4.3007  4.3150  4.3283  4.3406  4.3520  4.3625  4.3723
        4.3812  4.3895  4.3972  4.4043  4.4109  4.4170  4.4227  4.4279  4.4327  4.4371
0.0000  0.0118  0.0118  0.0118  0.0119  0.0231  0.0864  0.2411  0.4570  0.6560  0.7969  0.8832  0.9327
        0.9604  0.9760  0.9850  0.9903  0.9935  0.9955  0.9968  0.9976  0.9982  0.9986  0.9989  0.9991
        0.9993  0.9994  0.9995  0.9996  0.9996  0.9997  0.9997  0.9997  0.9998  0.9998  0.9998  0.9998
        0.9998  0.9998  0.9998  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999  0.9999
```

0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999
0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999
wt and selex fleet 2=CA commercial
0.1309 0.1309 0.1309 0.1309 0.1316 0.1784 0.2884 0.4204 0.5612 0.7012 0.8386 0.9753 1.1134
1.2539 1.3967 1.5411 1.6860 1.8303 1.9729 2.1128 2.2491 2.3812 2.5085 2.6309 2.7479
2.8594 2.9655 3.0660 3.1611 3.2509 3.3354 3.4150 3.4897 3.5598 3.6255 3.6870 3.7444
3.7981 3.8481 3.8948 3.9383 3.9788 4.0165 4.0516 4.0842 4.1145 4.1426 4.1687 4.1930
4.2155 4.2363 4.2557 4.2736 4.2903 4.3057 4.3200 4.3332 4.3455 4.3568 4.3673 4.3770
4.3860 4.3943 4.4019 4.4090 4.4156 4.4216 4.4272 4.4324 4.4372 4.4417
0.0000 0.0036 0.0036 0.0036 0.0037 0.0060 0.0184 0.0539 0.1299 0.2511 0.3977 0.5413 0.6628
0.7563 0.8246 0.8731 0.9071 0.9309 0.9478 0.9598 0.9685 0.9749 0.9797 0.9832 0.9860
0.9881 0.9898 0.9912 0.9922 0.9931 0.9938 0.9944 0.9949 0.9953 0.9957 0.9960 0.9963
0.9965 0.9967 0.9969 0.9970 0.9971 0.9972 0.9974 0.9974 0.9975 0.9976 0.9977 0.9977
0.9978 0.9978 0.9979 0.9979 0.9979 0.9980 0.9980 0.9980 0.9981 0.9981 0.9981 0.9981
0.9981 0.9982 0.9982 0.9982 0.9982 0.9982 0.9982 0.9982 0.9982 0.9982
M and initial age-structure for 2005
for both male and female
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036 0.036
0.036 0.036 0.036 0.036 0.036
21.9894 20.5636 19.1752 17.7679 16.4652 15.2328 15.2911
14.8226 15.3906 15.3280 15.9415 15.9114 16.8150
6.7280 8.4961 8.3043 8.5727 39.7469 7.9843 7.2014 5.9153 3.9757 84.1920
2.6733 2.3903 2.4198 16.7143 1.2385 1.0151 0.9076 0.8684 10.8216 0.7696
0.6936 0.6232 7.0388 0.3788 0.8131 0.7517 0.7001 0.6559 0.6175 0.5834 0.5529 0.5250
0.4993 0.4755 0.4535 0.4329 0.4137 0.3956 0.3779 0.3613 0.3455 0.3305 0.3164 0.3029
0.2902 0.2782 0.2669 0.2564 0.2465 0.2372 0.2284 0.2200 0.2120 0.2043 0.1969 0.1898
0.1830 4.9528
Initial age-structure female then male for Ydeclared=2002 (Tmin)
19.7969 18.3469 16.9736 17.0394 16.5228 17.1753 17.1459
17.8930 17.9239 18.9994 7.6187 9.6349 9.4263 9.7368 45.1619
9.0744 8.1859 6.7248 4.5201 95.7253 3.0396 2.7179 2.7515 19.0059 1.4083
1.1543 1.0320 0.9875 12.3058 0.8751 0.7888 0.7086 8.0042 0.4307 0.9247 0.8548
0.7961 0.7459 0.7022 0.6635 0.6287 0.5970 0.5678 0.5408 0.5157 0.4923 0.4704 0.4499
0.4298 0.4108 0.3929 0.3759 0.3598 0.3445 0.3300 0.3163 0.3035 0.2916 0.2803 0.2698
0.2597 0.2502 0.2411 0.2323 0.2239 0.2159 0.2081 0.2006 0.1935 0.1865 5.0515
Year for Tmin Age-structure
2002
Number of simulations
1000
recruitment and biomass
Number of historical assessment years
83
Historical data
year recruitment spawner in B0 in R project in R/S project
1923 47.1445 2515.11 1 0 0
1924 46.9689 2505.74 1 0 0
1925 47.0907 2505.74 0 0 0
1926 47.0854 2504.82 0 0 0
1927 47.0801 2503.89 0 0 0
1928 47.0748 2502.98 0 0 0
1929 47.0695 2502.07 0 0 0
1930 47.0644 2501.17 0 0 0

1931	47.0592	2500.28	0	0	0
1932	47.0541	2499.4	0	0	0
1933	47.0492	2498.53	0	0	0
1934	47.0442	2497.69	0	0	0
1935	47.0394	2496.86	0	0	0
1936	47.0348	2496.05	0	0	0
1937	47.0302	2495.26	0	0	0
1938	47.0258	2494.51	0	0	0
1939	47.0216	2493.78	0	0	0
1940	47.0176	2493.09	0	0	0
1941	47.0138	2492.43	0	0	0
1942	47.0101	2491.79	0	0	0
1943	47.0066	2491.19	0	0	0
1944	47.0032	2490.6	0	0	0
1945	46.9999	2490.04	0	0	0
1946	46.9968	2489.5	0	0	0
1947	46.9938	2488.98	0	0	0
1948	46.9908	2488.48	0	0	0
1949	46.988	2487.99	0	0	0
1950	46.9852	2487.51	0	0	0
1951	46.9826	2487.05	0	0	0
1952	46.9799	2486.6	0	0	0
1953	46.9774	2486.16	0	0	0
1954	46.9749	2485.74	0	0	0
1955	46.9725	2485.32	0	0	0
1956	46.8889	2471.03	0	0	0
1957	46.802	2456.28	0	0	0
1958	46.7123	2441.19	0	0	0
1959	46.6194	2425.68	0	0	0
1960	46.5238	2409.88	0	0	0
1961	46.4252	2393.73	0	0	0
1962	46.3242	2377.33	0	0	0
1963	46.2203	2360.62	0	0	0
1964	46.1142	2343.73	0	0	0
1965	46.0055	2326.59	0	0	0
1966	45.8948	2309.31	0	0	0
1967	45.7815	2291.8	0	0	0
1968	45.6663	2274.19	0	1	0
1969	19.4462	2256.38	0	1	0
1970	327.158	2225.66	0	1	0
1971	25.9613	2202.43	0	1	0
1972	25.6524	2176.91	0	1	0
1973	25.05	2144.21	0	1	0
1974	307.775	2110.63	0	1	0
1975	21.4547	2078.32	0	1	0
1976	19.3827	2046.63	0	1	0
1977	18.6466	2002.29	0	1	0
1978	19.4331	1952.81	0	1	0
1979	221.978	1902.86	0	1	0
1980	26.9285	1822.99	0	1	0
1981	22.0788	1753.85	0	1	0
1982	20.3212	1657.00	0	1	0
1983	523.067	1544.93	0	1	0
1984	20.1546	1358.73	0	1	0
1985	24.5851	1302.58	0	1	0
1986	24.8154	1235.07	0	1	0

1987 23.193 1196.04 0 1 0
1988 99.3495 1146.26 0 1 0
1989 18.8451 1077.39 0 1 0
1990 16.4023 950.896 0 1 0
1991 15.3674 913.641 0 1 0
1992 11.3309 829.403 0 1 0
1993 26.7272 718.584 0 0 0
1994 24.0959 608.913 0 0 0
1995 23.1138 571.285 0 0 0
1996 21.337 507.238 0 0 0
1997 20.5976 482.005 0 0 0
1998 19.1026 433.322 0 0 0
1999 18.9889 429.743 0 0 0
2000 18.2427 406.65 0 0 0
2001 19.0194 430.701 0 0 0
2002 19.7969 455.554 0 0 0
2003 20.6078 482.348 0 0 0
2004 21.3174 506.561 0 0 0
2005 21.9894 530.179 0 0 0
Number of years with pre-specified catches
2
catches for years with pre-specified catches (use W-O-C: 5.1:4:3.7 ratio to split the OY)
2005 8
2006 8
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; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
Steepness sigma-R Auto-correlation (Change sigmaR to 0.4 for final runs!!)
0.45 0.5 0
Target SPR rate (FMSY Proxy)
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
0.9
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)
1
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
20
# Random number seed
-89102
# Conduct projections for multiple starting values (0=No;else yes)
0
# File with multiple parameter vectors
MCMC.PRJ
# Number of parameter vectors
1
# User-specific projection (1=Yes); Output replaced (1->6)
0          6          0          0.5
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.717
-1         -1         -1
# Split of Fs (first year MUST be Yinit)
2005 0.8 0.2
2006 0.8 0.2
-1         1          1          1
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
HakWght.Csv
# Use bisection (0) or linear interpolation (1)
0
# Target Depletion
0.4
```

Appendix D. Input data for Washington model

```
#Title
Yelloweye_WA_06
# Number of sexes
1
# Age range to consider (minimum age; maximum age)
0 70
# Number of fleets
2
# First year of projection (Yinit, last year of assessment)
2005
# Year declared overfished (Ydecl, the first year of zero OY)
2002
# 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      46      47      48      49      50      51      52
       53      54      55      56      57      58      59      60      61      62      63      64      65
       66      67      68      69      70
0.00001         0.00001         0.00001         0.00001         0.00001         0.00001         0.00005
        0.00031         0.00172         0.00806         0.03102         0.09285         0.21444
        0.39745         0.62398         0.87036         1.11793         1.35575         1.57896
        1.78627         1.97815         2.15571         2.32025         2.47295         2.61486
        2.74690         2.86983         2.98432         3.09096         3.19027         3.28272
        3.36876         3.44879         3.52319         3.59233         3.65653         3.71612
        3.77140         3.82266         3.87017         3.91417         3.95492         3.99264
        4.02753         4.05980         4.08964         4.11722         4.14270         4.16624
        4.18799         4.20806         4.22659         4.24369         4.25948         4.27404
        4.28747         4.29986         4.31129         4.32182         4.33154         4.34050
        4.34861         4.35609         4.36299         4.36934         4.37519         4.38059
        4.38556         4.39014         4.39435         4.39824
# Age specific information (Females then males) weight  selectivity
# wt and selex fleet 1=WA recreation
0.1309  0.1309  0.1309  0.1309  0.1309  0.1731  0.2821  0.4184  0.5576  0.6893  0.8197  0.9549  1.0973
        1.2461  1.3995  1.5551  1.7109  1.8650  2.0162  2.1633  2.3057  2.4426  2.5738  2.6989  2.8178
        2.9305  3.0371  3.1376  3.2321  3.3209  3.4041  3.4820  3.5549  3.6228  3.6862  3.7453  3.8002
        3.8513  3.8987  3.9428  3.9836  4.0215  4.0566  4.0891  4.1192  4.1470  4.1728  4.1966  4.2186
        4.2389  4.2577  4.2751  4.2911  4.3058  4.3195  4.3321  4.3437  4.3544  4.3643  4.3734  4.3818
        4.3893  4.3963  4.4027  4.4086  4.4141  4.4191  4.4237  4.4280  4.4319  4.4356
0.0000  0.0009  0.0009  0.0009  0.0009  0.0017  0.0098  0.0502  0.1743  0.3836  0.5974  0.7561  0.8555
        0.9135  0.9466  0.9657  0.9771  0.9841  0.9885  0.9914  0.9933  0.9947  0.9957  0.9964  0.9969
        0.9974  0.9977  0.9979  0.9981  0.9983  0.9984  0.9985  0.9986  0.9987  0.9988  0.9988  0.9989
        0.9989  0.9990  0.9990  0.9990  0.9991  0.9991  0.9991  0.9991  0.9991  0.9992  0.9992  0.9992
```

0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9993 0.9993 0.9993 0.9993
0.9993 0.9993 0.9993 0.9993 0.9993 0.9993 0.9993 0.9993 0.9993 0.9993
wt and selex fleet 2=WA commercial (with line gear)
0.1309 0.1309 0.1309 0.1309 0.1309 0.1638 0.2636 0.3933 0.5459 0.7134 0.8864 1.0574 1.2232
1.3839 1.5405 1.6938 1.8442 1.9915 2.1352 2.2751 2.4105 2.5411 2.6665 2.7864 2.9008
3.0094 3.1123 3.2096 3.3013 3.3875 3.4685 3.5444 3.6155 3.6818 3.7438 3.8016 3.8554
3.9054 3.9519 3.9951 4.0352 4.0724 4.1069 4.1388 4.1684 4.1958 4.2211 4.2445 4.2662
4.2862 4.3047 4.3217 4.3375 4.3521 4.3655 4.3779 4.3893 4.3999 4.4096 4.4186 4.4269
4.4342 4.4410 4.4473 4.4531 4.4584 4.4633 4.4678 4.4720 4.4758 4.4794
0.0004 0.0004 0.0004 0.0004 0.0004 0.0006 0.0019 0.0056 0.0149 0.0355 0.0750 0.1391 0.2264
0.3273 0.4295 0.5237 0.6051 0.6728 0.7276 0.7716 0.8066 0.8345 0.8569 0.8749 0.8895
0.9015 0.9113 0.9195 0.9263 0.9320 0.9369 0.9410 0.9446 0.9476 0.9503 0.9526 0.9546
0.9564 0.9580 0.9594 0.9606 0.9617 0.9627 0.9636 0.9643 0.9650 0.9657 0.9663 0.9668
0.9672 0.9677 0.9681 0.9684 0.9687 0.9690 0.9693 0.9695 0.9697 0.9699 0.9701 0.9703
0.9705 0.9707 0.9708 0.9710 0.9711 0.9712 0.9713 0.9714 0.9715 0.9716
M and initial age-structure for 2005
for both male and female
0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
0.04 0.04 0.04 0.04 0.04
9.3089 8.8362 8.3557 7.9966 8.3428 8.2372 8.6273 8.4875 8.5030 8.4335 8.3180 22.7786
10.6208 6.1877 4.4632 3.7844 3.6566 4.1672 5.6961 4.6955 4.1456 3.6217 3.1537
2.7398 2.3882 2.1216 1.8910 1.6944 1.5278 1.3801 1.2532 1.1465 1.0550 0.9747 0.9023
0.8361 0.7743 0.7181 0.6679 0.6236 0.5845 0.5498 0.5187 0.4899 0.4637 0.4397 0.4175
0.3969 0.3775 0.3592 0.3421 0.3333 0.3177 0.3031 0.2893 0.2763 0.2640 0.2524 0.2414
0.2310 0.2212 0.2119 0.2030 0.1945 0.1864 0.1786 0.1712 0.1641 0.1572 0.1507 3.4918
Initial age-structure female then male for Ydeclared=2002 (Tmin)
9.0165 9.4071 9.2880 9.7281 9.5721 9.5986 9.5503 9.4814 26.2087 12.3455 7.2570
5.2706 4.4921 4.3576 4.9813 6.8255 5.6373 4.9845 4.3596 3.7997 3.3034 2.8811 2.5606
2.2831 2.0463 1.8456 1.6675 1.5144 1.3856 1.2752 1.1783 1.0909 1.0109 0.9363 0.8683
0.8076 0.7541 0.7069 0.6649 0.6273 0.5925 0.5608 0.5318 0.5050 0.4800 0.4565 0.4345
0.4137 0.4032 0.3843 0.3666 0.3499 0.3342 0.3194 0.3053 0.2921 0.2795 0.2676 0.2563
0.2455 0.2352 0.2254 0.2160 0.2071 0.1985 0.1902 0.1823 0.1748 0.1675 0.1606 3.7211
Year for Tmin Age-structure
2002
Number of simulations
1000
recruitment and biomass
Number of historical assessment years
53
Historical data
year recruitment spawner in B0 in R project in R/S project
1953 20.1555 906.199 1 0 0
1954 20.1555 842.582 1 0 0
1955 19.701 842.582 0 0 0
1956 19.6942 841.668 0 0 0
1957 19.6873 840.756 0 0 0
1958 19.6804 839.846 0 0 0
1959 19.6667 838.028 0 0 0
1960 19.653 836.217 0 0 0
1961 19.6393 834.418 0 0 0
1962 19.6257 832.634 0 0 0
1963 19.6122 830.87 0 0 0

1964 19.5778 826.383 0 0 0
1965 19.5433 821.925 0 0 0
1966 19.5087 817.494 0 0 0
1967 19.4741 813.081 0 0 0
1968 19.4393 808.681 0 0 0
1969 19.4043 804.294 0 0 0
1970 19.3693 799.925 0 0 0
1971 19.3186 793.665 0 0 0
1972 19.2715 787.905 0 0 0
1973 19.2175 781.377 0 0 0
1974 19.1489 773.179 0 0 0
1975 19.0715 764.063 0 0 0
1976 19.0049 756.332 0 0 0
1977 18.9102 745.513 0 0 0
1978 18.7153 723.881 0 0 0
1979 18.4986 700.77 0 0 0
1980 18.242 674.603 0 0 0
1981 17.9234 643.801 0 0 0
1982 17.8338 635.453 0 0 0
1983 17.7171 624.778 0 0 0
1984 17.5265 607.814 0 0 0
1985 17.3089 589.117 0 0 0
1986 16.9786 562.024 0 0 0
1987 17.9171 545.66 0 1 0
1988 11.4743 518.901 0 1 0
1989 8.89669 493.991 0 1 0
1990 8.23966 451.587 0 1 0
1991 8.81922 425.257 0 1 0
1992 11.2441 397.383 0 1 0
1993 17.9672 359.504 0 1 0
1994 36.2702 323.943 0 1 0
1995 12.5664 304.453 0 0 0
1996 12.1511 287.145 0 0 0
1997 11.7294 270.423 0 0 0
1998 11.2369 251.894 0 0 0
1999 10.9699 242.271 0 0 0
2000 10.0625 211.597 0 0 0
2001 9.79097 202.981 0 0 0
2002 9.01646 179.688 0 0 0
2003 9.05178 180.711 0 0 0
2004 9.19683 184.95 0 0 0
2005 9.3089 188.268 0 0 0
Number of years with pre-specified catches
2
catches for years with pre-specified catches
2005 10
2006 11
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; 3=0.7; 4=0.8; 5=0.9; 6=Ttarget of Tmin+0.75(Tmax-Tmin); 7="F=0"; 8="40-10" rule; 9=ABC rule)
4
Steepness sigma-R Auto-correlation (Change sigmaR to 0.4 for final runs!!)
0.45 0.5 0
Target SPR rate (FMSY Proxy)

```
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
0.9
# 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)
1
# 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
20
# Random number seed
-89102
# Conduct projections for multiple starting values (0=No;else yes)
0
# File with multiple parameter vectors
MCMC.PRJ
# Number of parameter vectors
1
# User-specific projection (1=Yes); Output replaced (1->6)
0         6         0         0.5
# Catches and Fs (Year; 1/2/3 (F or C or SPR); value); Final row is -1
2007 3 0.717
-1        -1        -1
# Split of Fs (first year MUST be Yinit)
2005 0.5 0.5
2006 0.5 0.5
-1        1         1         1
# Time varying weight-at-age (1=Yes;0=No)
0
# File with time series of weight-at-age data
HakWght.Csv
# Use bisection (0) or linear interpolation (1)
0
# Target Depletion
0.4
```