Status of Yelloweye rockfish off the U.S. West Coast in 2025

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U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest Fisheries Science Center

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Disclaimer

```
$SS_version
[1] "3.30.23.2;_safe;_compile_date:_Apr 17 2025;_Stock_Synthesis_by_Richard_Methot_(NOAA)

$SS_versionshort
[1] "3.30"

$SS_versionNumeric
[1] 3.3

$StartTime
[1] "StartTime: Wed May 14 00:13:02 2025"

$RunTime
[1] "0 hours, 22 minutes, 34 seconds."

$Files_used
[1] "Data_File: yelloweye_data.ss Control_File: yelloweye_control.ss"

$log_det_hessian
[1] 351.896

$Final_phase
[1] 8

$N_iterations
[1] 1392

$Nwarnings
[1] 7

$warnings
[1] "Note 1 Information: Max data length bin: 74  < max pop len bins: 88; so will accumul
[2] "Note 2 Suggestion:  recr_dist_method 3 is simpler and takes 1 parm for each settleme
[3] "Warning 1 : At least one block pattern ends in endyr. Check the output parameter val
[4] "Warning 2 : Minimum pop size bin:_8; is > L at Amin for sex: 1; Gpat: 1; L= 1.47471"
[5] "Warning 3 : Final gradient: 0.000865898 is larger than final_conv: 0.0001"
[6] "Note 3 Information:  N parameters that are on or within 1% of min-
max bound: 1; check results, variance may be suspect"
[7] " 3 warnings  and 3 notes "

$likelihoods_used
                                          values lambdas
TOTAL                                 7907.94000000      NA
```

```
Equil_catch                              0.00000000      NA
Survey                                   1.06399000      NA
Length_comp                           1384.50000000      NA
Age_comp                              6507.96000000      NA
Recruitment                             14.10160000    1.00
InitEQ_Regime                            0.00000000    1.00
Forecast_Recruitment                     0.00000000    1.00
Parm_priors                              0.00000000    1.00
Parm_softbounds                          0.00889951      NA
Parm_devs                                0.00000000    1.00
F_Ballpark                               0.30867200    1.00
F_Ballpark(info_only)_1999_estF_tgtF     0.10888800    0.09
Crash_Pen                                0.00000000    1.00

$likelihoods_laplace
                                    values lambdas
NoBias_corr_Recruitment(info_only)  -57.4556       1
Laplace_obj_fun(info_only)         7836.3900      NA

$likelihoods_by_fleet
              Label        ALL 1_CA_TWL 2_CA_NONTWL  3_CA_REC 4_ORWA_TWL
212 Init_equ_lambda         NA    1.000      1.0000   1.00000     1.0000
213   Init_equ_like    0.00000    0.000      0.0000   0.00000     0.0000
214     Surv_lambda         NA    0.000      0.0000   1.00000     0.0000
215       Surv_like    1.06399    0.000      0.0000  -4.40504     0.0000
216      Surv_N_use         NA    0.000      0.0000  15.00000     0.0000
217     Surv_N_skip         NA    0.000      0.0000   0.00000     0.0000
218   Length_lambda         NA    1.000      1.0000   1.00000     1.0000
219     Length_like 1384.50000  139.081     92.5693 264.93000    82.3613
220    Length_N_use         NA   38.000     44.0000  42.00000    29.0000
221   Length_N_skip         NA    0.000      0.0000   0.00000     0.0000
222      Age_lambda         NA    0.000      1.0000   1.00000     1.0000
223        Age_like 6507.96000    0.000    126.1870 334.84000  1602.3000
224       Age_N_use         NA    0.000     42.0000 102.00000   353.0000
225      Age_N_skip         NA    0.000     10.0000  16.00000    23.0000
    5_ORWA_NONTWL  6_OR_REC  7_WA_REC 8_CACPFV 9_OR_RECOB 10_TRI_ORWA
212        1.0000    1.0000   1.00000   1.0000     1.0000     1.00000
213        0.0000    0.0000   0.00000   0.0000     0.0000     0.00000
214        0.0000    1.0000   1.00000   1.0000     1.0000     1.00000
215        0.0000   25.9712  -4.72162  -6.9722    -4.5689    -1.28706
216        0.0000   36.0000  20.00000  11.0000    17.0000     9.00000
217        0.0000    0.0000   0.00000   0.0000     0.0000     0.00000
218        1.0000    1.0000   1.00000   1.0000     1.0000     1.00000
```

```
219       88.6431  180.1390 118.40900 163.2280    106.4650     26.64520
220       31.0000   43.0000  26.00000  32.0000     20.0000      7.00000
221        0.0000    0.0000   0.00000   0.0000      0.0000      0.00000
222        1.0000    1.0000   1.00000   0.0000      0.0000      0.00000
223      430.8030 1007.1400 807.99300   0.0000      0.0000      0.00000
224      266.0000  195.0000 177.00000   0.0000      0.0000      0.00000
225       23.0000   16.0000  20.00000   0.0000      0.0000      0.00000
    11_NWFSC_ORWA 12_IPHC_ORWA
212       1.00000      1.00000
213       0.00000      0.00000
214       1.00000      1.00000
215      -5.69629      2.74385
216      21.00000     21.00000
217       0.00000      0.00000
218       1.00000      1.00000
219      67.52970     54.50320
220      21.00000     21.00000
221       0.00000      0.00000
222       1.00000      1.00000
223    1370.05000    828.64700
224     382.00000    531.00000
225      21.00000     36.00000

$N_estimated_parameters
[1] 188

$table_of_phases

-99 -50  -6  -5  -4  -3  -2  -1   1   2   3   4   5   6   7   8
  1  10   2  31  11   1   1   9   2   2   3  20  10   2 136  13

$estimated_non_dev_parameters
                                         Value Phase   Min   Max      Init
L_at_Amin_Fem_GP_1                   1.4747100     2  0.01  35.0 1.4747100
L_at_Amax_Fem_GP_1                  61.3823000     2 40.00 120.0 61.3823000
VonBert_K_Fem_GP_1                   0.0759819     1  0.01   0.2 0.0759819
CV_young_Fem_GP_1                    0.1482920     3  0.01   0.5 0.1482920
CV_old_Fem_GP_1                      0.0642259     7  0.01   0.5 0.0642259
RecrDist_Area_2                      0.4602840     3 -4.00   4.0 0.4602840
SR_LN(R0)                            5.4351500     3  3.00  15.0 5.4351500
Q_extraSD_3_CA_REC(3)                0.1324150     5  0.00   5.0 0.1324150
Q_extraSD_6_OR_REC(6)                1.0445400     5  0.00   5.0 1.0445400
Q_extraSD_7_WA_REC(7)                0.4063890     5  0.00   5.0 0.4063890
```

```
Q_extraSD_8_CACPFV(8)                0.0794343      5  0.00    5.0  0.0794342
Q_extraSD_9_OR_RECOB(9)              0.1663750      5  0.00    5.0  0.1663750
Q_extraSD_10_TRI_ORWA(10)            0.1299870      5  0.00    5.0  0.1299870
Q_extraSD_12_IPHC_ORWA(12)           0.5510650      5  0.00    5.0  0.5510650
LnQ_base_6_OR_REC(6)_BLK2add_2005   -0.5979600      1 -4.00    4.0 -
0.5981050
Size_DblN_peak_1_CA_TWL(1)          43.9522000      4 20.00   60.0 43.9522000
Size_DblN_ascend_se_1_CA_TWL(1)      5.1261900      4 -1.00    9.0  5.1261900
Size_DblN_descend_se_1_CA_TWL(1)    18.2819000      5 -1.00   30.0 18.2818000
Size_DblN_peak_2_CA_NONTWL(2)       44.4293000      4 20.00   60.0 44.4293000
Size_DblN_ascend_se_2_CA_NONTWL(2)   5.1833000      4 -1.00    9.0  5.1833000
Size_DblN_descend_se_2_CA_NONTWL(2) 17.3737000      5 -1.00   30.0 17.3738000
Size_DblN_peak_3_CA_REC(3)          41.8052000      4 20.00   60.0 41.8052000
Size_DblN_ascend_se_3_CA_REC(3)      5.2204900      4 -1.00    9.0  5.2204900
Size_DblN_peak_4_ORWA_TWL(4)        41.8841000      4 20.00   60.0 41.8842000
Size_DblN_ascend_se_4_ORWA_TWL(4)    5.4868800      4 -1.00    9.0  5.4868800
Size_DblN_descend_se_4_ORWA_TWL(4)  18.1355000      5 -1.00   30.0 18.1352000
Size_DblN_peak_5_ORWA_NONTWL(5)     50.6925000      4 20.00   60.0 50.6925000
Size_DblN_ascend_se_5_ORWA_NONTWL(5)  5.4237700     4 -1.00    9.0  5.4237700
Size_DblN_peak_6_OR_REC(6)          36.8398000      4 20.00   60.0 36.8398000
Size_DblN_ascend_se_6_OR_REC(6)      4.1468000      4 -1.00    9.0  4.1468000
Size_DblN_peak_7_WA_REC(7)          42.7236000      6 20.00   60.0 42.7236000
Size_DblN_ascend_se_7_WA_REC(7)      4.3105600      6 -1.00    9.0  4.3105600
Size_DblN_peak_9_OR_RECOB(9)        35.0963000      4 20.00   60.0 35.0963000
Size_DblN_ascend_se_9_OR_RECOB(9)    4.6044200      4 -1.00    9.0  4.6044200
Size_DblN_peak_10_TRI_ORWA(10)      79.9714000      4 20.00   80.0 79.9714000
Size_DblN_ascend_se_10_TRI_ORWA(10)  7.0829600      4 -1.00    9.0  7.0829600
Size_DblN_peak_11_NWFSC_ORWA(11)    48.5565000      4 20.00   60.0 48.5565000
Size_DblN_ascend_se_11_NWFSC_ORWA(11) 6.2146900     4 -1.00    9.0  6.2146900
Size_DblN_peak_12_IPHC_ORWA(12)     53.9679000      4 20.00   60.0 53.9679000
Size_DblN_ascend_se_12_IPHC_ORWA(12)  4.1372900     4 -1.00    9.0  4.1372900
                                    Status    Parm_StDev          Gradient
L_at_Amin_Fem_GP_1                      OK    0.58067900 -0.0000258040000
L_at_Amax_Fem_GP_1                      OK    0.22502600 -0.0004515410000
VonBert_K_Fem_GP_1                      OK    0.00132433 -0.0002933460000
CV_young_Fem_GP_1                       OK    0.00679028 -0.0000216916000
CV_old_Fem_GP_1                         OK    0.00194060 -0.0000152147000
RecrDist_Area_2                         OK    0.02239730  0.0002962430000
SR_LN(R0)                               OK    0.06210570 -0.0008658900000
Q_extraSD_3_CA_REC(3)                   OK    0.08083150  0.0000053765900
Q_extraSD_6_OR_REC(6)                   OK    0.14915400 -0.0000020286800
Q_extraSD_7_WA_REC(7)                   OK    0.08029780  0.0000046156500
Q_extraSD_8_CACPFV(8)                   OK    0.07113640  0.0000116549000
```

```
Q_extraSD_9_OR_RECOB(9)                   OK     0.07950520  0.0000031767800
Q_extraSD_10_TRI_ORWA(10)                 OK     0.11924100  0.0000013354500
Q_extraSD_12_IPHC_ORWA(12)                OK     0.10640000  0.0000026669400
LnQ_base_6_OR_REC(6)_BLK2add_2005         OK 7821.22000000 -0.0000000593718
Size_DblN_peak_1_CA_TWL(1)                OK     3.29106000 -0.0000230546000
Size_DblN_ascend_se_1_CA_TWL(1)           OK     0.40203200  0.0000327405000
Size_DblN_descend_se_1_CA_TWL(1)          OK   151.72100000  0.0000001532420
Size_DblN_peak_2_CA_NONTWL(2)             OK     2.48446000 -0.0000142103000
Size_DblN_ascend_se_2_CA_NONTWL(2)        OK     0.28386700  0.0000265114000
Size_DblN_descend_se_2_CA_NONTWL(2)       OK   171.54800000  0.0000006927240
Size_DblN_peak_3_CA_REC(3)                OK     1.36029000 -0.0000459692000
Size_DblN_ascend_se_3_CA_REC(3)           OK     0.14357200  0.0000557261000
Size_DblN_peak_4_ORWA_TWL(4)              OK     2.98270000 -0.0000055137200
Size_DblN_ascend_se_4_ORWA_TWL(4)         OK     0.33837600  0.0000161098000
Size_DblN_descend_se_4_ORWA_TWL(4)        OK   154.57500000  0.0000002412800
Size_DblN_peak_5_ORWA_NONTWL(5)           OK     1.47962000 -0.0000057693700
Size_DblN_ascend_se_5_ORWA_NONTWL(5)      OK     0.14822000 -0.0000042702900
Size_DblN_peak_6_OR_REC(6)                OK     1.30948000 -0.0000217942000
Size_DblN_ascend_se_6_OR_REC(6)           OK     0.28575300  0.0000260836000
Size_DblN_peak_7_WA_REC(7)                OK     2.74742000 -0.0000198470000
Size_DblN_ascend_se_7_WA_REC(7)           OK     0.51791300  0.0000327997000
Size_DblN_peak_9_OR_RECOB(9)              OK     1.61130000 -0.0000187959000
Size_DblN_ascend_se_9_OR_RECOB(9)         OK     0.28983500  0.0000210250000
Size_DblN_peak_10_TRI_ORWA(10)            HI     0.90522700  0.0000018156800
Size_DblN_ascend_se_10_TRI_ORWA(10)       OK     0.26644100 -0.0000060550100
Size_DblN_peak_11_NWFSC_ORWA(11)          OK     5.44640000 -0.0000071116100
Size_DblN_ascend_se_11_NWFSC_ORWA(11)     OK     0.37941400  0.0000059259400
Size_DblN_peak_12_IPHC_ORWA(12)           OK     1.22122000 -0.0000106101000
Size_DblN_ascend_se_12_IPHC_ORWA(12)      OK     0.23465000  0.0000251788000
                                        Pr_type Prior Pr_SD Pr_Like Afterbound
L_at_Amin_Fem_GP_1                     No_prior    NA    NA      NA         OK
L_at_Amax_Fem_GP_1                     No_prior    NA    NA      NA         OK
VonBert_K_Fem_GP_1                     No_prior    NA    NA      NA         OK
CV_young_Fem_GP_1                      No_prior    NA    NA      NA         OK
CV_old_Fem_GP_1                        No_prior    NA    NA      NA         OK
RecrDist_Area_2                        No_prior    NA    NA      NA         OK
SR_LN(R0)                              No_prior    NA    NA      NA         OK
Q_extraSD_3_CA_REC(3)                  No_prior    NA    NA      NA         OK
Q_extraSD_6_OR_REC(6)                  No_prior    NA    NA      NA         OK
Q_extraSD_7_WA_REC(7)                  No_prior    NA    NA      NA         OK
Q_extraSD_8_CACPFV(8)                  No_prior    NA    NA      NA         OK
Q_extraSD_9_OR_RECOB(9)                No_prior    NA    NA      NA         OK
Q_extraSD_10_TRI_ORWA(10)              No_prior    NA    NA      NA         OK
```

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Q_extraSD_12_IPHC_ORWA(12)              No_prior    NA     NA       NA          OK
LnQ_base_6_OR_REC(6)_BLK2add_2005       No_prior    NA     NA       NA          OK
Size_DblN_peak_1_CA_TWL(1)              No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_1_CA_TWL(1)         No_prior    NA     NA       NA          OK
Size_DblN_descend_se_1_CA_TWL(1)        No_prior    NA     NA       NA          OK
Size_DblN_peak_2_CA_NONTWL(2)           No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_2_CA_NONTWL(2)      No_prior    NA     NA       NA          OK
Size_DblN_descend_se_2_CA_NONTWL(2)     No_prior    NA     NA       NA          OK
Size_DblN_peak_3_CA_REC(3)              No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_3_CA_REC(3)         No_prior    NA     NA       NA          OK
Size_DblN_peak_4_ORWA_TWL(4)            No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_4_ORWA_TWL(4)       No_prior    NA     NA       NA          OK
Size_DblN_descend_se_4_ORWA_TWL(4)      No_prior    NA     NA       NA          OK
Size_DblN_peak_5_ORWA_NONTWL(5)         No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_5_ORWA_NONTWL(5)    No_prior    NA     NA       NA          OK
Size_DblN_peak_6_OR_REC(6)              No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_6_OR_REC(6)         No_prior    NA     NA       NA          OK
Size_DblN_peak_7_WA_REC(7)              No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_7_WA_REC(7)         No_prior    NA     NA       NA          OK
Size_DblN_peak_9_OR_RECOB(9)            No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_9_OR_RECOB(9)       No_prior    NA     NA       NA          OK
Size_DblN_peak_10_TRI_ORWA(10)          No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_10_TRI_ORWA(10)     No_prior    NA     NA       NA          OK
Size_DblN_peak_11_NWFSC_ORWA(11)        No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_11_NWFSC_ORWA(11)   No_prior    NA     NA       NA          OK
Size_DblN_peak_12_IPHC_ORWA(12)         No_prior    NA     NA       NA          OK
Size_DblN_ascend_se_12_IPHC_ORWA(12)    No_prior    NA     NA       NA          OK

$maximum_gradient_component
[1] 0.000865898

$parameters_with_highest_gradients
                                     Value     Gradient
SR_LN(R0)                        5.4351500 -8.65890e-04
L_at_Amax_Fem_GP_1              61.3823000 -4.51541e-04
RecrDist_Area_2                  0.4602840  2.96243e-04
VonBert_K_Fem_GP_1               0.0759819 -2.93346e-04
Size_DblN_ascend_se_3_CA_REC(3)  5.2204900  5.57261e-05

$Length_Comp_Fit_Summary
     Data_type Fleet Recommend_var_adj #  N Npos min_Nsamp max_Nsamp
5980         4     1          0.507141 # 38   38  0.593431  16.13210
5981         4     2          0.408988 # 44   44  0.653378  50.21250
```

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5982          4     3           0.574349 # 42   42  2.838190  82.99970
5983          4     4           0.582423 # 29   29  1.266420  33.16560
5984          4     5           0.436315 # 31   31  0.922722 100.75400
5985          4     6           0.224649 # 43   43  0.820298 135.93700
5986          4     7           0.504250 # 26   26  1.138000  33.08200
5987          4     8           0.336157 # 32   32  1.887900  63.87120
5988          4     9           0.573264 # 20   20  1.226630  24.35200
5989          4    10           1.294940 #  7    7  1.680730   7.68335
5990          4    11           2.052860 # 21   21  4.191720  13.39460
5991          4    12           2.383500 # 21   21 14.212700  52.87600
     mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM err_method err_index
5980       9.93300        5.17974            NA          0        NA
5981      34.92250       10.02530            NA          0        NA
5982      45.84090       24.18310            NA          0        NA
5983      37.23070        9.49450            NA          0        NA
5984      79.26010       28.65790            NA          0        NA
5985      52.47780       18.91360            NA          0        NA
5986       7.25315        7.25315            NA          0        NA
5987      37.58630       20.78480            NA          0        NA
5988      25.59210       13.79260            NA          0        NA
5989      11.24710        5.09527            NA          0        NA
5990      16.07050        8.44147            NA          0        NA
5991      28.71880       25.47880            NA          0        NA
            par1 val1 par2 val2 mean_effN  HarMean Curr_Var_Adj     Fleet_name
5980 multinomial   NA   NA   NA   14.8142  5.03743     0.521468       1_CA_TWL
5981 multinomial   NA   NA   NA   81.5419 14.28290     0.287073    2_CA_NONTWL
5982 multinomial   NA   NA   NA   49.9643 26.32870     0.527545       3_CA_REC
5983 multinomial   NA   NA   NA   59.2346 21.68400     0.255018     4_ORWA_TWL
5984 multinomial   NA   NA   NA  124.5060 34.58240     0.361568 5_ORWA_NONTWL
5985 multinomial   NA   NA   NA   52.8324 11.78910     0.360412       6_OR_REC
5986 multinomial   NA   NA   NA   33.2542  3.65740     1.000000       7_WA_REC
5987 multinomial   NA   NA   NA   54.7718 12.63490     0.552988       8_CACPFV
5988 multinomial   NA   NA   NA   42.7617 14.67110     0.538939     9_OR_RECOB
5989 multinomial   NA   NA   NA   20.3055 14.56440     0.453028    10_TRI_ORWA
5990 multinomial   NA   NA   NA   38.0351 32.99050     0.525278 11_NWFSC_ORWA
5991 multinomial   NA   NA   NA   97.2455 68.45110     0.887182   12_IPHC_ORWA

$Age_Comp_Fit_Summary
     Data_type Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
8211         5     2          0.972139 #        52   42  1.000000    3.0000
8212         5     3          0.884301 #       118  102  1.000000    6.0000
8213         5     4          0.540419 #       376  353  1.000000   24.0000
8214         5     5          0.290144 #       289  266  0.220948   15.0245
```

```
8215          5     6           0.556567 #       211  195  1.000000   16.0000
8216          5     7           0.544856 #       197  177  1.000000   17.0000
8217          5    11           0.760806 #       403  382  1.000000   12.0000
8218          5    12           0.235905 #       567  531  0.086445   10.0276
     mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM err_method err_index
8211       1.38095        1.38095            NA          0        NA
8212       1.50000        1.50000            NA          0        NA
8213       4.20963        4.20963            NA          0        NA
8214       8.85714        1.95697            NA          0        NA
8215       4.09231        4.09231            NA          0        NA
8216       3.63277        3.63277            NA          0        NA
8217       2.27749        2.27749            NA          0        NA
8218      15.98310        1.38165            NA          0        NA
            par1 val1 par2 val2 mean_effN HarMean Curr_Var_Adj    Fleet_name
8211 multinomial   NA   NA   NA   1.65003 1.34248     1.000000   2_CA_NONTWL
8212 multinomial   NA   NA   NA   1.94201 1.32645     1.000000      3_CA_REC
8213 multinomial   NA   NA   NA   4.68598 2.27497     1.000000    4_ORWA_TWL
8214 multinomial   NA   NA   NA   8.44721 2.56985     0.220948 5_ORWA_NONTWL
8215 multinomial   NA   NA   NA   4.73032 2.27764     1.000000      6_OR_REC
8216 multinomial   NA   NA   NA   4.49136 1.97934     1.000000      7_WA_REC
8217 multinomial   NA   NA   NA   3.06105 1.73273     1.000000 11_NWFSC_ORWA
8218 multinomial   NA   NA   NA  10.09310 3.77048     0.086445  12_IPHC_ORWA

$SBzero
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$current_depletion
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$SPRratioLabel
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$sigma_R_in
[1] 0.5

$sigma_R_info
           period N_devs SD_of_devs Var_of_devs   mean_SE mean_SEsquared
1            Main     44  0.5718538   0.3270168 0.3497106      0.1272598
2      Early+Main    135  0.3669449   0.1346486 0.4319109      0.1927868
3 Early+Main+Late    136  0.3655846   0.1336521 0.4324116      0.1932075
  sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
1              0.6740004               1.1437077              1.348001
2              0.5722197               0.7338898              1.144439
```

```
3              0.5717163               0.7311691               1.143433
  alternative_sigma_R
1   0.674000435695887
2   0.572219681284994
3   0.571716330143147

$rmse_table
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1  main 44 0.565318         1.278340     0.482081
2 early 91 0.209602         0.175732     0.115969

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```

1 Introduction

Yelloweye Rockfish (*Sebastes ruberrimus*) are found from the Gulf of Alaska to northern Baja California in Mexico across the northeastern Pacific Ocean Love, Yoklavich, and Thorsteinson (2002). Their core distribution is from southeast Alaska to central California on the west coast of the United States (Love, Yoklavich, and Thorsteinson 2002). Yelloweye Rockfish in Puget Sound are considered isolated from the coastal waters population (**stewart_status_2009?**) and have been listed as threatened under the Endangered Species Act since 2010 (Drake J. S. and Williams 2010).

Yelloweye Rockfish are strongly associated with rocky bottom habtiat, particularly areas of high relief (Love, Yoklavich, and Thorsteinson 2002), and adults are considered to be solitary and sedentary after settlement DeMott (1983). However, new tagging studies suggest that adult Yelloweye Rockfish exhibit larger scale movement patterns more commonly than preivously considered Rasmuson LK and TK (2025).

There has been little advancement on information pertaining to the stock structure of Yelloweye Rockfish since the previous benchmark assessment. As noted in Gertseva and Cope (2017), there is evidence of genetic diferences between Canadian waters (Strait of Georgia) and West coast coastal populations of Yelloweye Rockfish but no evidence across coastal populations (Siegle and Yamanaka 2013). Gao and Wallace (2010) found that there was complete mixing of offspring from Oregon and Washington waters using otolith isotope analyses, indicating a single spawning stock in this portion of the Yelloweye Rockfish stock. Given the general perception of the sedentary nature of Yelloweye Rockfish adults and the moderate amount of mixing that occurs during the pelagic larval stage, the previous Yelloweye Rockfish assessment modeled the West coast population as a two-area assessment (California and a combined Oregon-Washington) with a common recruitment relationship (Gertseva and Cope 2017). This update assessment maintains this basic structure.

Map of scope of assessment - not needed for update

1.1 Life History

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

1.2 Ecosystem considerations

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

1.3 Fishery description

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

1.4 Management History

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

1.5 Management performance

Yelloweye Rockfish removals have been substantially reduced since its designation as overfished in 2002 through a variety of managment measures that eliminated retention in recreational fisheries, limited commercial retention, created broad spatial closures and implemented new gear restrictions that reduced trawling in rocky habitats. Many of these restrictions remain in effect, though as Yelloweye Rockfish stock has begun to rebuild, some managment measures have been modified or removed in recent years. These include some additional allocations to recreational fisheries that remain constrained by Yelloweye Rockfish estimated discard mortality, the recent removal of the Yelloweye Rockfish Conservation Areas (RCA) for the trawl sector off of California and Oregon, and eliminating some gear restrictions in the RCAs for the non-trawl sector.

Recent trends in total catch relative to managment guidelines is available in (Table **??**) and shows that total catch of Yelloweye Rockfish has remained below both the OFLs and ACLs in each year since the previous assessment. Catch in Table **??** combines the two areas in this model as catch limits for Yelloweye Rockfish are managed as a single coastwide unit and includes both landings and estimated discard mortality. As in the previous assessment, total catches for each fleet in this update include both landings and estimated dead discard mortality.

1.6 Fisheries off Canada and Alaska

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

2 Data

A summary of available data by type and fleet used in the yelloweye rockfish assessment is available in Figure 1. Data that have changed from the previous assessment are summarized below. No new data sources were considered in this update assessment.

Removals: - Post-2016 landings and discards were updated for all three states for the commercial and recreational fleets. - A new Oregon historical recreational catch reconstruction was incorporated, which covered 1979 - 2000. - A new Washington historical recreational catch reconstruction was provided by WDFW and included changes to data from 1990-2016.

Composition Data: - Length and age composition data were updated from 2017 - 2024 for all states for the commercial and recreational fleets. - Length and age composition data were also updated for two of the fishery-independent surveys, including the NWFSC Bottom Trawl survey and the IPHC Longline survey. - Some length and age composition data from the 2017 assessment had minor errors in how sample numbers were calculated, ageing error assignment, and doubled age samples and thus needed to be fixed. See Section 2.1.2 below.

Indices of Abundance: -Indices that were updated with more recent data and/or updated methodology include: -Oregon Onboard Observer (2001 - 2024) -Oregon ORBS Dockside (release only) (2004-2024) -NWFSC Bottom Trawl Survey -IPHC Longline Survey

Biological Data: - Length-weight relationship parameters were updated to include all the recent (2017 - 2024) fishery-independent data. - Ageing error matrices were unchanged but some Oregon recreation ages were assigned the wrong ageing error and were corrected based on ODFW recommendations.

2.1 Fishery-Dependent Data

Updated fishery-dependent data, including removals, length and age compositions, and indices of abundance, are detailed below.

2.1.1 Landings

A summary of total removals are provided in **Table 1** and Figure 2.

Recent commercial landings (2017-2024) were obtained from PacFIN for California, Oregon and Washington, and as with the previous assessment, for the period from 2016 through 2023, updated West Coast Groundfish Observer Program (WCGOP) discard estimates were added to PacFIN landings by calculating the proportion of observed area-specific fleet WCGOP discards expanded from the fleet-specific GEMM total recorded discards to obtain the total catch of yelloweye rockfish within commercial fleets.

Bycatch for the At-Sea Pacific Hake fleet (ASHOP) was updated from 2017 through 2024 and included in the trawl fleets for California and Oregon/Washington.

Recreational removals from RecFIN were updated for California, Oregon and Washington from 2017 - 2024. RecFIN removals include an estimate of discard mortality and represent total estimated removals. Updated historical recreational removals for Oregon from 1979 through 2000 were provided by Oregon Department of Fish and Wildlife (ODFW,(Whitman 2024)). Updated historical recreational removals for Washington (1967-1989) and Washington Department of Fish and Wildlife (WDFW) Ocean Sampling Program (OSP) estimates (1990-2001) were provided by WDFW (**Fabio/RecFin?** May pull). The historical recreational removals for 1971, 1974, and 1979 were not available and were treated as the average of the two preceding and two following years. Historical data were filtered to marine catch areas 1-4. For OSP catch estimates, data included marine catch areas 1-4, up to the Bonilla-Tatoosh line. WDFW also provided updated catch estimates for 2002-2004, which did not include discard mortality. To adjust for this, we multiplied the average mortality rate from the following 5 years (2005-2009) by the total discards to calculate total mortality for those years.

2.1.2 Fishery-Dependent Length and Age Compositions

Updated length composition data for commercial catches (trawl and non-trawl) were available from PacFIN (extracted April 4, 2025) and from WCGOP for all three states. These include the years 2017 - 2024 for PacFIN data and 2017 - 2023 for WCGOP data. Updated recreational length composition data were available from RecFIN (extracted April 4, 2025) for all three states, and include years 2017 - 2024. Additionally, updated length compositions from the California On-Board CPFV Observer Sampling Program and from the Ocean Recreational Fishery Survey (ORFS, previously the Oregon onboard recreational observer program), both of which measure fish discarded at sea, were also available up through 2024 on RecFIN.

New commercial age composition data was unavailable for California, but was available for both Oregon and Washington for 2017 - 2024 from PacFIN and WCGOP. New recreational age composition data was unavailable for California and Oregon, but was available for Washington for 2017 - 2024 from RecFIN (extracted May 13, 2025). These data were collected in the MRFSS and in the WDFW Ocean Sampling Program (OSP). There were also some historical updates to Oregon and Washington recreational age data provided by the state representatives.

In combining the new data with the 2017 assessment data, we applied some general processes and fixed minor data entry mistakes found in the old assessment data file. For length composition data, years with small samples sizes (N = 1) were excluded. Sampling statistics (number of samples and number of individual fish) for each fleet and year were used to create length frequency distributions. There were no changes in how commercial length sample numbers were calculated. However, all recent recreational fleet length data were missing the total number of trips information used to calculate the number of samples. Using data from the 2017 assessment, we built fleet-specific linear regressions to approximate the relationship of samples to the number of fish. Then, we applied that regression to the total number of fish for data between 2017 and 2024 to estimate the number of samples. A future benchmark assessment should investigate how to get the number of sampled trips from RecFIN to calculate the number of samples using the Stewart and Hamel (2014) method.

We also found that conditional-age-at-length (CAAL) data from the 2017 assessment had all sample sizes and ages doubled, potentially from when Yelloweye Rockfish was changed from a two-sex to single-sex model. To fix the CAAL data so it accurately represented the number of fish in each age class, we either rebuilt the entire fleet's CAAL dataframe using the most recently pulled information from PacFIN and RecFIN, or divided the number of samples and ages in each length bin by two.

How these problems were treated for each fleet specifically is detailed below, including other minor data changes. Otherwise, length and age composition data are unchanged from the previous assessment; please refer to the most recent benchmark assessment (Gertseva and Cope 2017) for additional information.

2.1.2.1 Fleet Specific Changes in the Compositional Data

Fleet 2. California Non-Trawl - For ages, all the CAAL and marginal-age-at-length (MAAL) data were recalculated using the most recent age data pulled from PacFIN and WCGOP, to account for age doubling in 2017.

Fleet 3. California Recreational - CAAL data for 1979-1984 were doubled, so the number of samples and ages in each length bin was divided by two. - CAAL data for 2009-2016 were doubled, but the raw data we received from RecFin were correct, without doubled ages, so this time series was replaced with newly pulled data. - We then re-built the MAAL data from the updated CAAL for both time periods because there were errors in previous data entry and sample number calculations.

Fleet 4. Oregon/Washington Trawl & Fleet 5. Oregon/Washington Non-Trawl - Both the OR/WA commercial fleets had all CAAL and MAAL data recalculated using the most recent age data pulled from PacFIN and WCGOP, to account for age doubling in 2017.

Fleet 6. Oregon Recreational - CAAL data was doubled so ages and sample numbers from 1979 - 2017 were divided by two. - We included 2015 unsexed ages. - We also reassigned the aging error for this fleet for the correct years. The ODFW data representative confirmed that all fish from 1979-2002 were aged by WDFW (ageing error 1), and fish from 2009-2016 were aged by the NWFSC (ageing error 2). No new ages since 2016 were provided. MAAL data were then recalculated from the updated CAAL so that the ageing error labels and number of samples matched.

Fleet 7. Washington Recreational - All age data from 1998 to 2024 were replaced with the most recent data provided in RecFIN, following the recommendation of the WDFW representative, due to resolved ages based on double readings in the age data. CAAL and MAAL were calculated using this data.

2.1.3 Indices of Abundance

Two fishery-dependent indices of abundance were updated with new data and up-to-date methodology. These are detailed below. Otherwise, indices of abundances are unchanged from the previous assessment; please refer to the most recent benchmark assessment (Gertseva and Cope 2017) for additional information.

2.1.3.1 Oregon Onboard Observer CPUE, 2001 – 2024

The Oregon Onboard Observer (now Ocean Recreational Fisheries Survey, or ORFS) index was updated from the previous yelloweye rockfish assessment and updated drift-level catch-per-unit-effort data was obtained from ODFW through the end of 2024. The database contains information on catch by species (number of retained and released fish), effort (angler hours), sample depth, and bag limits and other relevant regulations (Monk and Pearson 2013).

The unfiltered data set contained 18,410 drifts. Multiple standardized filters are applied to remove outliers and data unsuitable for an index. These filters are very similar to filters applied in 2017 and include drifts without data needed for CPUE information, long drifts (below 95th quantile), drifts in deeper waters (less than 64fm, 99th quantile), drifts that were targeting primarily mid-water species, and drifts outside of the legal fishing depth (with a five fm buffer). Additionally, years with extreme low sample sizes (<50) were excluded. Finally, drifts onboard charters from Port Orford were removed due to small sample size. The final filtered dataset included 6,839 trips with a 6.1% encounter rate for yelloweye rockfish.

Covariates evaluated included year, month, port, the open depths to fishing (all depths or inside 20/30/40fm), and a five fm-binned depth of drift covariate. This is in contrast to the 2017 index, which was only able to evaluate a year covariate. The covariates listed above are standard to evaluate for this index in other assessments. Negative binomial models were fit using sdmTMB (version 0.6.0) to the drift-level data (catch with a log offset for adjusted angler hours). A model without the open fishing depths or month was selected as the best fit model by AIC (**Table "model selection"**). Acceptable diagnostics for the model were achieved (Figure 3). The index of abundance in shown in Figure 4 and **Table XXXX**. A comparison to the ORFS index used in the previous assessment indicates that despite the change in modeling approach and the covariates included, most years overlap between the two indices and similar trends are observed ((**ORFS_comp?**)). The updated index has reduced within-year variance and a lack of extreme swings in the standardized index value (e.g. 2013).

2.1.3.2 Oregon ORBS Dockside (release only) CPUE, 2004-2024

The Ocean Recreational Boat Survey (ORBS) dockside index for Oregon was updated for this assessment. CPUE, expressed in terms of fish per angler-hour, was calculated by multiplying the number of anglers and the total trip time, minus the boat type-specific travel time. The database contains information on released fish by species (number of angler-reported released fish), effort (angler hours), sample location (port where data were collected), date, bag limits and other relevant regulations, boat type (charter or private), and trip type (e.g., bottom associated fish).

The unfiltered data set contained 504,128 trips from 2001 - 2024. Since the previous yelloweye assessment, multiple data filters have been standardized, which are very similar to the 2017 assessment, and are applied to ORBS trip-level data to remove outliers and data unsuitable for an index. For this index, the time period was restricted to years when retention of yelloweye rockfish was prohibited, which began on January 1, 2004. There were two differences in the filtering in this updated index. One, the previous index began in 2005, which was determined to be an error in the timing of the implementation of prohibited status for yelloweye. Given that prohibition was in effect on January 1, the year 2004 is included in this updated index. The second difference in filtering is the elimination of the Stephens-MacCall filter in the updated index. This filter has not been used for several assessment cycles, based on a recommendation from NWFSC staff (pers. comm. A. Whitman, ODFW). The final dataset included 133,039 trips (**TABLE "percent_pos.csv"**) from 2004 – 2024 with an overall encounter rate of 7.4%.

Covariates evaluated included year, month, port, the open depths to fishing (all depths or inside 20/30/40 fm), and boat type. These are the same covariates evaluated in the 2017 ORBS index, apart from the open depths of the fishery. The final model in 2017 included boat type, port and year. Negative binomial models were fit in sdmTMB (Version 0.6.0) to the trip-level data (catch with a log offset for adjusted angler hours). The final model selected includes year, month, port, boat type and open fishery depths, which was the best fit model by AIC in this series (**TABLE "model_selection.csv"**). Acceptable diagnostics for the model were achieved (Figure 6). The index of abundance in shown in Figure 7 and **Table XXXX**. ODFW no longer maintains the deltaGLM code that was used to develop the 2017 index and so the index was updated to use the currently accepted modeling approach for PFMC groundfish assessments (sdmTMB). To bridge this change, the 2017 model index structure was applied to the current dataset using sdmTMB and compared to the deltaGLM index used in the 2017 assessment and the current recommended updated index in Figure 8. There are some differences observed in 2005 – 2009 between the deltaGLM index and the two sdmTMB indices; however, this appears to be largely driven by the updated modeling approach.

2.2 Fishery-Independent Data

Two sources of fishery-independent data were updated. These include the NWFSC West Coast Bottom Trawl Survey and the IPHC Longline survey.

2.2.1 NWFSC West Coast Bottom Trawl Survey (WCGBTS)

The WCGBTS survey methods are most recently described in detail in Keller, Wallace, and Methot (2017). Geostatistical models of biomass density were fit to survey data from the WCGBTS using Template Model Builder (TMB) (Kristensen et al. 2016) via the Species Distribution Models with Template Model Builder (`sdmTMB`) R package (Anderson et al. 2024) as configured within the West Coast Groundfish Bottom Trawl Survey (WCGBTS) R package (Johnson et al. 2025). Code to reproduce the analysis is available online. These models can account for latent spatial factors with a constant spatial Gaussian random field and spatiotemporal deviations to evolve as a random walk Guassian random field (Thorson et al. 2015). Delta-gamma and delta-lognormal distributions were investigated. Results are only shown for the model that led to the best model diagnostics, e.g., similar distributions of theoretical normal quantiles and model quantiles (Figure 9), high precision, lack of extreme predictions, and low Akaike information criterion (AIC). Estimates of biomass from this best model were predicted using a grid based on available survey locations.

The final model used a delta model with a lognormal distribution for the catch-rate component. A logit-link was used for encounter probability and a log-link for positive catch rates. The response variable was catch (mt) with an offset of area (km^2) to account for differences in effort. Fixed effects were estimated for each year and pass. The index was estimated for the area north of $42°10'$ (Oregon and Washington) to be consistent with the previous assessment. The data were truncated to depths less than 325 m prior to modeling given that there were zero positive encounters in depths deeper than 325

m. The prediction grid was also truncated to only include available survey locations in depths between 55–325 m to limit extrapolating beyond the data and edge effects. Spatial variation was included in the encounter probability and the positive catch rate model. Spatial variation was approximated using 200 knots, where more knots led to non-estimable standard errors because the positive encounters are too sparse to support the dense spatiotemporal structure. Anisotropy was not estimated.

The biomass estimates produced for this assessment using sdmTMB are comparable to the biomass estimates produced in the previous benchmark assessment (Figure 10). The index is relatively flat with a peak in 2014, but variation is high throughout the time series (Figure 11).

2.2.2 IPHC Setline Survey

The IPHC has conducted an annual longline survey for Pacific halibut off the coast of Oregon and Washington (IPHC area "2A") since 1997 (no surveys were performed in 1998 or 2000). Beginning in 1999, this has been a fixed station design, with roughly 1,800 hooks deployed at each of 84 locations. Before 1999, station locations were not fixed, and, therefore, those years are not used in the index. Rockfish bycatch, mainly yelloweye, was recorded during this survey, although values for 1999 and 2001 are estimates based on subsampling the first 20 hooks of each 100-hook skate. The gear used to conduct this survey, while designed specifically to efficiently sample Pacific halibut, is similar to that used in some earlier line fisheries that targeted adult yelloweye rockfish. Some variability in exact sampling location is unavoidable, and leeway is given in the IPHC methods to center the set on the target coordinates but to allow wind and currents to dictate the actual direction in which the gear is deployed. This can result in different habitats accessed at each fixed location among years. The number of skates used can also differ from year to year; skates hauled (i.e., 100 hooks/skate) are thus used as the unit of effort for all years. This has been the standard effort used in past yelloweye rockfish stock assessments.

New to this assessment is the consideration of eight additional survey stations (1527 to 1534) conducted in a collaborative effort between IPHC and WDFW from 2007-2009 then from 2013-2019 and 2021-2023. These stations are arranged around IPHC station 1082 (one of the more notable stations to encounter yelloweye rockfish). Only the summer months are considered here to match the time of year sampled by the IPHC survey. Survey sets at the WDFW stations used 3 skates with 100 hooks each for most years, except for 2021 - 2023, where a total of 4 skates were used. Like the IPHC survey, effort was standardized to 100 hooks/skate. These stations were integrated into the IPHC stations when calculating the index of abundance. The full survey used in this assessment combined all stations in Oregon and Washington into a single index, fitting the area of the stock, instead of using state-specific indices. Data were first filtered to remove all depths with few or no encounters, and then we excluded stations that rarely encountered yelloweye (averaging less than one encounter a year). This left a total of 11 stations for analysis. Both filtering levels increased the percentage of encounters from an initial 11% to 80%.

A log-normal generalized linear model with a log link in the "sdmTMB" R package was used to standardize the CPUE. Model selection using the Akaike Information Criteria for small samples (AICc) was conducted to select which variables were included in the model. The final model included year, station, and depth as explanatory variables. Diagnostic tools to ensure the model fit was satisfactory included checking whether the hessian matrix is positive definite, the presence of extreme eigenvalues, and if the non-linear minimizer suggests convergence. These diagnostics were conducted with the "sanity( )" function in the sdmTMB package. The updated index is shown in Figure 12 and compared to the index used in the 2017 index in Figure 13.

2.2.3 Fishery-Independent Length and Age Compositions

Updated length and age composition data were available for the two updated fishery-independent surveys. Compositional data from 2017 through 2024 were updated for NWFSC West Coast Groundfish Bottom Trawl Survey were obtained using functions from the **{nwfscSurvey} R package**. The IPHC survey data were provided by WDFW.

A summary of sampling efforts (number of hauls and number of individual fish) in all surveys is provided in **Table X** and **Table X**. Updated year-specific length frequency distributions generated for each survey are shown in Figure 14 and Figure 15, respectively. Updated year-specific CAAL frequencies for each survey are shown in Figure 16 and Figure 17 for the WCGBTS and Figure 18 and Figure 19.

2.3 Biological Parameters and Data

The approach to natural mortality, maturity and fecundity were unchanged from the previous assessment (Gertseva and Cope 2017). Several biological parameters used in the assessment were estimated outside the model or obtained from literature. Their values were treated in the model as fixed, and therefore uncertainty reported for the stock assessment results does not include any uncertainty in these quantities (however, some were investigated via sensitivity analyses described later in this report). The parameters for the length-weight relationship were updated to include the most recent data from 2017 - 2024. The parameters derived from this analysis were as follows: = 7.183309 · 10-6, and = 3.244801 (Figure 20). Aging error matrices were unchanged but the designated matrix was corrected in some years for Oregon recreational ages. All fish from 1979-2002 were aged by WDFW (ageing error 1) and fish from 2009-2016 were aged by the NWFSC (ageing error 2).

3 Assessment model

3.1 History of modeling approaches

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

3.2 Responses to SSC Groundfish Subcommittee requests

To be completed after SSC GFSC review.

3.3 Model Structure and Assumptions

3.3.1 Model Changes from the Last Assessment

A list of changes that were made to the model compared to the previous assessment (Gertseva and Cope 2017) are listed below.

ADW - what do we need to update after new WA catches incorporated into base? Plus it seems like this section should go after the platform/structure section, and we need to double check we're limiting repetition with the model results section.

- Data
  - Detailed information on specific updates and changes to the data incldued in the model are included in Section 2 but are summarized below.
  - The landings time series was corrected and updated through the end of 2024 for California, Oregon and Washington.
  - Length and age compositions from all fishery removal and index fleets were updated through 2024.
  - Some indices of abundance were updated with recent data, where available, and re-analyzed using more up-to-date methods. Two fishery-dependent indices from Oregon were updated, along with the fishery-independent indices, the WCBTS and the IPHC setline survey.
- Biology

  - No changes were made to the biological parameterization of the model; however, the length-weight relationship was updated to include the most recent data. -No changes were made to the aging error matrices estimated for the previous assessment; however, the designated matrix for several years of Oregon recreational ages were corrected.
- Recruitment
  - The bias adjustment ramp was updated to end with the last year of removals (2024) and begin to ramp to zero two years prior (2022)
- Software and Workflow
  - Update SS3 3.30.23.2 - As seen in Figures Figure 21 and Figure 22, updating to the most recent version of the SS3 executable had no discernable impact on model results.
  - Use most up-to-date R packages to process input and output files for the assessment, including **nwfscDiag, r4ss, and pacfintools**.
  - Created a public github repository for Yelloweye Rockfish ("sebastes_ruberrimus_2025") to provide a transparent and reproducible system for processing the data and creating the model and assessment document

The iterative impact of the updated catch, composition and indices of abundance on the model are shown in Figure 23 and Figure 24. Overall, there was little impact on the model results when updating and extending the catch time series and when updating the indices of abundance. However, the addition of the new fishery length composition data decreased the spawning output (Figure 23). When the new age composition data were added, there was a slight increase in the scale of the population but was overall very similar to the model with the new length composition data (Figure 25 and Figure 26). There was very little impact on the model results when tuning the compositional data and updating the bias adjustment ramp (Figure 27 and Figure 28). The impact of the updated lenght-weight relationship is evalated as a sensitivity.

3.3.2 Modeling Platform and Structure

The assessment was updated to use the most recent version of Stock Synthesis 3 (Version 3.30.23.2 - available online). Bridging between SS versions is discussed in Section Section 3.3.1.

Briefly, the Yelloweye Rockfish model is a coastwide, single-sex two-area model. California is Area 1, and Oregon and Washington are combined into Area 2, due to differences in potential exploitation rates by area over time. Yelloweye Rockfish compositional data are primarily reported as both sexes combined, and therefore, the previous assessment used a single sex model to facilitate the use of all available data. Growth is assumed to be the same in both areas, though future benchmark assessments may want to re-evaluate this assumption if more spatially-explicit data become available. The modeling period starts in the first year of available catches from historical reconstructions (1889) and the stock is assumed to be at an unfished equilibrium prior to that time. No changes were made to the fleet structure of the model. Fishery removals were divided among seven area- and sector-specific fleets. Estimated discard mortality was added to landings and included in the model as fleet-specific total removals. Length compositions for discarded and retained fish were combined as well. Data weighting was done using the Francis method (Francis 2011) but the McAllister-Ianelli method was explored as a sensitivity. More detailed information on the model structure and justification is available in Gertseva and Cope (2017) and summarized in **?@tbl-table__config**. (ADW - DO WE NEED MORE DETAIL HERE?)

3.3.3 Model Parameters

** ADW - update the code here to be sure we're getting the proper base model. also do we need any more fig's from the base? **

The base model had r sum(mod_out$ parameters $Phase > 0)estimatedparameters(talliedbytypein@tbl-table_parcounts).Asingle-sexgrowthcurvewasestimated(@fig-growth).Naturalmortalitywasfixed,asin$ $recruitrelationshipwaskeptfixedat0.718,matchingthe2017assessment.Estimatingsteepnesswasevaluate$ RdevYrLast) were forced to sum to zero and the bias adjustment ranmp was updated (Figure 30).

Length, age, and age-at-length composition data weights were tuned using the Francis method (Francis 2011, **?@tbl-table__compweight**). All selectivity was assumed to be length-based and used a double-normal functional form. Selectivities for all fleets was estimated to be asymptotic (Figure 31), though selectivity for the California Onboard Observer CPUE was mirrored to the California recreational fleet. Selectivity was constant through time. Dome-shaped selectivity and various time blocks for specific fleets were explored in Gertseva and Cope (2017) but not re-evaluted in this update assessment.

Aging error matrices were estimated outside the assessment model and were unchanged from the previous assessment, with the exception of correcting the designated error matrix in some years for the Oregon recreational ages.

Additional standard error was estimated for all indices with the exception of the WCBTS.

3.3.4 Key Assumptions and Structural Choices

This section is not required for an update assessment; please refer to the most recent full assessment (Gertseva and Cope 2017) for additional information.

3.4 Base Model Results

3.4.1 Parameter Estimates

The list of the all the parameters used in the assessment model and their values (either fixed or estimated) is provided in **Table X**. The growth parameters estimated within the model are reasonable, commensurate with inspection of the raw data and consistent with what we know about the species. These parameters are relatively precisely estimated, in terms of the asymptotic standard error estimates. Figure 29 shows the estimated growth curve. Spawning output-at-length is shown in Figure 32. Spawning output in the assessment is expressed in millions of eggs.

Estimated stock-recruit function for the assessment model is shown in **?@fig-SR_curve**. Estimated recruitment deviations are shown Figure 34. Recruitment of yelloweye rockfish was estimated to be quite variable over time, and the estimated stock-recruit function predicts a relatively wide range of cohort sizes over the observed range of spawning biomass. The model output recruitment variance (RMSE = 0.48) is consistent with the fixed input recruitment variance (R = 0.5).

Length-based selectivity curves estimated in the assessment are shown for all fleets together in Figure 31. Estimated selectivity curves for the fishing fleets indicate that the recreational fleets access somewhat smaller fish than the commercial fisheries. This pattern is most pronounced in Oregon, and also as expected, since recent charter fishing selectivity has shifted shoreward where there is a higher density of smaller fish. Addition of the charter vessel length data did not appreciably change the estimate for the California recreational selectivity pattern and so the selectivity for the two series was not separated. All fleets for which curves were allowed to be dome-shaped (commercial trawl and non-trawl fleets) were estimated to be asymptotic. Estimated selectivity curves for the IPHC survey indicate a selection of the largest yelloweye available, and select the least amount of smaller yelloweye rockfish (Figure 35). The NWFSC trawl survey selected far more smaller yelloweye among all surveys (Figure 36). That the triennial survey selectivity was shifted to the largest fish but also selected some very small fish is likely an artifact of the very noisy composition data from that survey (Figure 37).

3.4.2 Fits to the Data

Model fits to the fishery CPUE and survey indices are presented in Figure 38 through Figure 45. The base model predicted a decreasing trend in the triennial survey between 1980 and 2004 (Figure 43) and a slightly increasing trend for the NWFSC trawl survey between 2003 and 2024 (Figure 44). The model predicted a relatively flat trend through the IPHC survey index despite the upward trend seen in the last three years as of this update (Figure 45). The triennial survey index indicated a population decrease in 1992 and lower estimates (compared with pre-1992) persisted through the end of the index time series. This decrease in the abundance index coincided with decrease in number of biological samples collected from this survey. No changes have been implemented to the triennial survey between 1989 and 1992. In 1995, the survey timing slightly shifted from early fall to mid-summer, approximately a month earlier that previous surveys. This shift in timing, however, seems unlikely to impact our understanding of yelloweye rockfish abundance trends during that period, given the sedentary life history of the species. Additionally, the change in the index trend was observed before the slight shift in survey timing. The California MRFSS recreational CPUE index tracked the decline in observations through the 1990s (Figure 38), and a slight increase in abundance was predicted in the Oregon MRFSS/ORBS recreational index during the 2000s (Figure 39). The Oregon recreational observer index showed a small and very uncertain increasing trend in the 2000s (Figure 42). The California CPFV charter series index indicated a relatively flat trajectory prior to 1992 with a drop in stock abundance from 1992 on (Figure 41). The model predicted a decreasing trend for the Washington Recreational index despite the relatively large variances on many of the observations, which does not match the relative stability of the index from 1982 to the early 2000s (Figure 40).

The model fitted length data aggregated across years reasonably well for all fleets (Figure 46). The model fits to length frequency distributions by fleet across years are shown in **add length comps by fleet/year - ADW - suggest these are all not needed, are there specific fleets we should highlight?**. Pearson residuals for the fits by fleet and year are shown in Figure 47 and Figure 48. The length data are very sparse in many years and the quality of fit varies among years and fleets, reflecting the differences in the quantity and quality of the data. However, neither length composition data nor the Pearson residuals, which reflect the noise in the data both within and among years, exhibit obvious patterns for any fleet. The data for fishing fleets are particularly poor after 2002 after retention of yelloweye rockfish was prohibited in most fleets and limited in trawl fleets. Input sample sizes for length composition data were tuned down using the Francis data weighting method **add weighting table**. Francis weighting fits to the mean lengths for each fleet by year (with 95% confidence intervals) are shown in **Figure X** through **Figure X** (**ADW note - we don't normally include these in the report - do we need them?**).

The fits to age data are shown in **Figure X** through **Figure X**, **ADW - I would**

suggest we don't include the ghost age comps and we don't normally include ALL of the CAAL - do we have a fleet where we can focus on this? with the "ghost" marginal age compositions shown to aid in visual interpretation of these fits. These "ghost" age compositions do not contribute to the likelihood and do not affect model fit in any way. Input sample sizes for conditional age-at-length composition data were also tuned down using Francis data weighting method. The Francis weighting index fit of the conditional age-at-length data for each fleet by year (with 95% confidence intervals) are shown in **Figure X** through **Figure X - ADW - again, these are probably not all necessary - let's focus on a specific fleet**.

3.4.3 Population Trajectory

The estimated time series of spawning output for the entire stock and by area are shown in Figure 49 and Figure 50, respectively. Spawning output relative to SB0 for the entire stock and by area are shown in **?@fig-status_combined** and **?@fig-status_area**. Total biomass, summary biomass and recruitment are shown in Figure 51, Figure 52 and Figure 53, respectively. Trends in total and summary biomass, absolute and relative spawning output track one another very closely. The spawning output of Yelloweye Rockfish started to decline in the 1940s during World War II, but are estimated to have been lightly exploited until the mid-1970s when catches increased and a rapid decline in biomass and spawning output began. The combined relative spawning output reached a minimum of 16% of unexploited levels in 2000 (Figure 49). Yelloweye Rockfish spawning output and relative status is estimated to have been gradually increasing since that time, in response to large reductions in harvest. However, the aggregate spawning output estimates do not convey the spatial heterogeneity included via the area-specific dynamics. Relative spawning output has differed between the two areas modelled in the assessment, with the California resource estimated to have a lower unfished equilibrium spawning output and estimated to be more depleted in 2025 than the Oregon and Washington resource (**?@fig-status_area**).

Recruitment appears to be relatively dynamic over time, with several elevated peaks over time estimated in the age-0 recruits (Figure 53). An initial peak in the mid-1940s is followed by a two periods of elevated recruitment in the 1970s and early 1980s and another period centered around the 2010s. This trend is consistent with the previous assessment, apart from the most recent elevated time period, which estimated a sole peak in 2001 and several other peaks of smaller magnitude starting in 2005. Recuits for this assessment appear to have extended and increased this more recent time period starting in 2005, with a peak in 2008 and 2013 and shifts the peak in 2001 to 2002. Recruitment in the late 2010s was estimated to be lower, but a more recent increase is seen starting in 2020.

3.5 Model Diagnostics

3.5.1 Convergence

3.5.2 Sensitivity Analyses

3.5.2.1 Sensitivity to assumptions about model structure

Sensitivity analysis to examine the impact of different assumptions about model structure on management quantities included a model with an estimated baseline Natural Mortality rate (M), one with estimated steepness (h) of the stock-recruit relationship, and one using the 2017 length-weight relationship.

The Natural Mortality rate (M) estimated by the first model was higher than that of the base model (~ 0.055 $year^{-}1$ compared to ~ 0.044 $year^{-}1$ from the base model). The second model estimated steepness at a higher value of ~ 0.905, which indicates recruitment is more dependent on spawning stock biomass, as opposed from the fixed value of 0.718 from the base model.

As shown in **Figure X** to **Figure X**, the base model is considerably sensitive to whether the Natural Mortality rate is estimated or fixed, with the alternative model estimating a higher spawning output compared to the base model. Similar outcomes are shown for the model with estimated steepness, which estimated a higher spawning output compared to the base model. Contrastingly, outputs of the model using the 2017 length-weight relationship showed the base model is not sensititive to this modelling choice, with very similar spawning outputs between the base and alternative model (**Figure X** to **Figure X**).

3.5.2.2 Sensitivity to data set choice and weighting schemes

3.5.3 Retrospective Analysis

3.5.4 Likelihood Profiles

3.6 Unresolved Problems and Major Uncertainties

4 Management

4.1 Reference Points

4.2 Harvest Projections and Decision Tables

ADW - Decision tables not required for draft assessment.

4.3 Evaluation of Scientific Uncertainty

4.4 Regional management considerations

4.5 Research and Data Needs

4.6 Acknowledgements

4.7 References

4.8 Tables

4.8.1 Data

Table 1: Time series of yelloweye rockfish catches by fleet used in the assessment. Trawl fleets include yelloweye bycatch in foreign POP and in at-sea Pacific hake fisheries. Years 1967 - 1974, 1979, and 2002 - 2004 do not include WA Sport Catch in MT as that information is not available.

Year	CA trawl (mt)	CA non-trawl (mt)	CA sport (mt)	OR-WA trawl (mt)	OR-WA non-trawl (mt)	OR sport (
-999	0.000	0.000	0.000	0.000	0.000	
1889	0.000	0.000	0.000	0.000	0.040	
1890	0.020	0.070	0.000	0.000	0.040	
1891	0.030	0.130	0.000	0.000	0.070	
1892	0.050	0.200	0.000	0.000	3.640	
1893	0.060	0.260	0.000	0.000	3.550	
1894	0.080	0.330	0.000	0.000	3.550	
1895	0.090	0.390	0.000	0.000	0.920	
1896	0.110	0.460	0.000	0.000	0.220	
1897	0.120	0.520	0.000	0.000	0.220	
1898	0.140	0.590	0.000	0.000	0.130	
1899	0.160	0.660	0.000	0.000	0.230	
1900	0.170	0.720	0.000	0.000	0.300	
1901	0.190	0.790	0.000	0.000	0.390	
1902	0.200	0.850	0.000	0.000	0.480	
1903	0.220	0.920	0.000	0.000	0.560	
1904	0.230	0.980	0.000	0.000	0.730	
1905	0.250	1.050	0.000	0.000	0.740	
1906	0.260	1.110	0.000	0.000	0.830	
1907	0.280	1.180	0.000	0.000	0.910	
1908	0.300	1.250	0.000	0.000	1.950	
1909	0.310	1.310	0.000	0.000	1.090	
1910	0.330	1.380	0.000	0.000	1.180	
1911	0.340	1.440	0.000	0.000	1.260	
1912	0.360	1.510	0.000	0.000	1.350	
1913	0.370	1.570	0.000	0.000	1.440	
1914	0.390	1.640	0.000	0.000	1.530	
1915	0.400	1.700	0.000	0.000	2.230	
1916	0.420	1.770	0.000	0.000	1.700	
1917	0.660	2.960	0.000	0.000	1.790	
1918	0.770	3.480	0.000	0.000	18.540	
1919	0.540	1.620	0.000	0.000	7.610	
1920	0.550	1.840	0.000	0.000	6.570	
1921	0.450	1.850	0.000	0.000	6.330	
1922	0.390	1.680	0.000	0.000	4.380	
1923	0.420	1.790	0.000	0.000	5.100	
1924	0.240	2.580	0.000	0.000	9.290	
1925	0.170	3.690	0.000	0.000	11.480	
1926	0.620	4.250	0.000	0.000	17.480	
1927	1.050	4.870	0.000	0.000	22.790	
1928	1.340	4.180	0.640	0.000	22.090	

1929	1.580	4.070	1.290	0.000	17.730	
1930	1.470	5.300	1.480	0.000	19.500	
1931	0.880	4.740	1.970	0.000	11.690	
1932	1.050	7.080	2.470	0.020	7.330	
1933	1.630	2.810	2.960	0.010	10.300	
1934	1.610	4.170	3.450	0.000	12.660	
1935	1.680	6.310	3.950	0.010	9.690	
1936	1.490	6.600	4.440	0.030	16.650	
1937	1.770	4.310	5.270	0.060	14.820	
1938	1.670	4.690	5.180	0.000	16.350	
1939	1.730	4.710	4.530	0.090	10.630	
1940	1.600	2.970	6.510	2.060	17.140	
1941	1.160	4.190	6.020	3.170	27.380	
1942	0.270	3.100	3.200	5.950	31.380	
1943	2.050	3.840	3.060	20.810	51.220	
1944	8.360	16.520	2.510	36.510	22.600	
1945	18.540	40.020	3.350	56.890	11.520	
1946	16.330	41.420	5.760	34.850	20.680	
1947	7.090	9.190	4.590	21.420	10.950	
1948	6.490	16.810	9.180	15.140	13.380	
1949	3.720	6.170	11.880	12.640	11.210	
1950	3.420	4.610	14.490	13.690	14.780	
1951	9.910	7.070	17.160	12.020	17.960	
1952	8.700	5.440	15.000	12.790	13.060	
1953	8.570	3.190	12.850	9.960	5.610	
1954	4.990	6.780	16.170	12.810	10.250	
1955	5.610	1.830	19.510	13.130	9.710	
1956	8.580	1.810	21.900	16.990	4.340	
1957	10.490	4.070	21.710	22.960	8.510	
1958	10.340	3.050	33.840	18.380	2.390	
1959	8.610	1.640	29.230	19.940	5.410	
1960	7.480	2.240	20.860	25.200	4.920	
1961	3.560	1.690	16.350	22.720	4.910	
1962	3.680	1.750	20.810	26.400	5.160	
1963	6.020	5.610	21.800	7.170	4.100	
1964	3.120	4.560	18.960	1.950	3.110	
1965	3.860	5.510	29.110	67.880	4.680	
1966	3.620	4.450	31.600	3.030	3.240	
1967	6.170	4.380	31.890	6.820	6.600	
1968	3.780	3.890	37.660	2.970	5.660	
1969	21.800	3.910	40.620	47.760	13.080	
1970	24.220	3.470	45.790	7.050	4.310	
1971	41.770	4.730	40.720	13.650	8.340	
1972	56.220	7.440	52.360	7.350	10.860	
1973	43.620	5.890	66.480	9.520	11.460	
1974	44.800	11.590	70.150	4.410	14.460	1
1975	50.310	9.930	71.130	5.360	7.650	
1976	45.270	13.390	80.630	6.910	10.150	1
1977	42.510	14.950	72.780	4.970	17.020	1
1978	123.440	30.760	67.890	23.640	24.100	2
1979	61.020	38.310	76.310	44.580	49.100	5
1980	15.480	26.580	72.510	83.950	24.960	4
1981	30.200	119.500	47.000	91.340	23.950	3
1982	199.930	15.590	102.000	156.080	31.450	6

1983	56.650	7.680	51.000	287.290	45.950	4
1984	44.030	4.420	77.000	113.980	39.390	4
1985	7.420	4.230	124.000	200.040	69.720	1
1986	9.890	23.430	65.000	92.920	66.150	9
1987	16.840	38.000	75.000	71.750	97.080	4
1988	30.570	34.950	58.000	130.640	47.450	1
1989	9.380	42.370	59.000	199.340	41.400	1
1990	10.080	70.260	46.250	81.070	68.950	1
1991	13.980	133.070	33.500	121.380	85.620	2
1992	15.830	96.850	20.750	135.660	89.870	2
1993	6.180	46.590	8.000	137.960	138.250	2
1994	4.700	49.780	14.000	86.000	79.290	1
1995	3.690	47.680	13.000	131.320	40.430	2
1996	16.320	56.180	12.000	83.880	93.250	
1997	6.200	57.060	15.000	80.130	115.540	1
1998	4.100	17.640	5.000	41.180	45.050	1
1999	8.660	13.730	13.000	18.940	102.000	1
2000	0.730	3.310	8.000	5.070	15.040	1
2001	0.620	3.900	5.000	1.630	26.310	
2002	0.360	0.030	2.000	1.590	4.150	
2003	0.130	0.050	4.000	0.550	2.240	
2004	0.020	0.750	1.000	0.500	2.380	
2005	0.020	0.730	1.000	1.240	1.660	
2006	0.004	0.200	1.000	1.420	2.160	
2007	0.000	0.930	4.000	0.090	3.680	
2008	0.017	0.640	1.000	0.160	3.430	
2009	0.022	0.190	5.000	0.090	2.180	
2010	0.060	0.040	1.000	0.080	0.860	
2011	0.000	0.200	2.000	0.060	1.210	
2012	0.003	0.880	2.000	0.060	1.910	
2013	0.009	0.560	1.000	0.110	2.940	
2014	0.055	0.020	1.000	0.030	2.160	
2015	0.003	0.400	2.000	0.030	3.150	
2016	0.003	0.000	1.000	0.070	2.590	
2017	0.011	1.229	4.524	0.244	6.974	
2018	0.001	0.000	4.994	0.541	6.379	
2019	0.039	0.000	6.160	0.589	7.429	
2020	0.128	0.000	1.946	0.321	7.515	
2021	0.117	2.432	3.956	0.391	7.972	
2022	0.095	5.603	3.801	0.764	15.552	
2023	0.087	1.826	9.588	0.400	20.635	
2024	0.191	0.000	4.649	0.440	3.086	

Table 2: Summary of sampling effort within triennial survey, with total and yelloweye positive hauls summarized by area.

	CA		OR-WA	
	Number of hauls	Number of positive hauls	Number of hauls	Number of positive hauls
1980	68	1	263	13
1983	96	1	416	26
1986	95	2	389	27

1989	147	7	300	30
1992	135	2	310	25
1995	123	1	241	7
1998	129	0	260	14
2001	129	0	246	15
2004	103	3	185	9

Table 3: Summary of sampling effort within NWFSC trawl survey, with total and yelloweye positive hauls summarized by area.

	CA		ORWA	
	Number of hauls	positive.Number of hauls	Number of hauls	positive.Number of hauls
2003	268	2	274	17
2004	247	1	223	7
2005	345	2	296	11
2006	346	1	293	12
2007	355	3	332	9
2008	382	2	298	13
2009	389	5	292	6
2010	413	1	300	14
2011	381	3	314	10
2012	389	2	306	12
2013	248	3	220	10
2014	0	0	311	19
2015	383	2	283	11
2016	383	5	309	20
2017	385	3	320	16
2018	396	5	305	19
2019	0	0	161	9
2021	382	4	302	16
2022	359	3	275	15
2023	365	4	296	10
2024	348	3	310	19

```
# Do we need this?
#| label: tbl-filtering-CA-MRFSS
#| echo: false
#| warning: false
#| tbl-cap: "Filtering levels and resultant data from the California MRFSS recreational i
```

```
# Do we need this?
#| label: tbl-model-selection-CA-MRFSS
#| echo: false
#| warning: false
#| tbl-cap: "Delta-GLM model selection for the California MRFSS recreational index. Gray
```

```
# Do we need this?
#| label: tbl-filtering-CA-CPFV
#| echo: false
#| warning: false
#| tbl-cap: "Filtering levels and resultant data from the California CPFV recreational in
```

```
# Do we need this?
#| label: tbl-model-selection-CA-MRFSS
#| echo: false
#| warning: false
#| tbl-cap: "Delta-GLM model selection for the California CPFV recreational index. Gray b
```

```
# Do we need this?
#| label: tbl-filtering-OR-onboard
#| echo: false
#| warning: false
#| tbl-cap: "Filtering levels and resultant data from the Oregon onboard recreational ind
```

```
# Do we need this?
#| label: tbl-filtering-OR-MRFSS
#| echo: false
#| warning: false
#| tbl-cap: "Filtering levels and resultant data from the Oregon MRFSS recreational index
```

```
# Do we need this?
#| label: tbl-filtering-OR-ORBS
#| echo: false
#| warning: false
#| tbl-cap: "Filtering levels and resultant data from the Oregon ORBS dockside index."
```

```
# Do we need this?
#| label: tbl-model-selection-ORBS
#| echo: false
#| warning: false
#| tbl-cap: "Delta-GLM model selection for the Oregon ORBS dockside index. Gray bar indic
```

```
# Do we need this?
#| label: tbl-filtering-WA-dockside
#| echo: false
#| warning: false
#| tbl-cap: "Filtering levels and resultant data from the Washington dockside recreationa
```

```
# Do we need this?
#| label: tbl-model-selection-WA-dockside
#| echo: false
#| warning: false
#| tbl-cap: "Delta-GLM model selection for the Washington dockside recreational index. Gr
```

4.8.2 Model results

Table 4: Specifications and structure of the model.

Section	Configuration
Maximum age	100
Sexes	Sexes combined
Population bins	8-88 cm by 2 cm bins
Summary biomass (mt) age	8+
Number of areas	2
Number of seasons	1
Number of growth patterns	1
Start year	1889
End year	2024
Data length bins	10-74 cm by 2 cm bins
Data age bins	0-65 by 1 year

Table 5: Estimated parameters in the model.

Type	Count
Growth mean	3
Growth variability	2
Stock-recruit	1
Rec. dev. time series	136
Rec. dev. forecast	12
Index	7
Index time-variation	1
Size selectivity	25

Table 6: Parameter estimates, estimation phase, parameter bounds, estimation status, estimated standard deviation (SD), prior information [distribution(mean, SD)] used in the base model.

Label	Value	Phase	Bounds	Status	SD	Prior
NatM_break_1_Fem_GP_1	0.0439	-1	(0.01, 0.15)	fixed		none
L_at_Amin_Fem_GP_1	1.47	2	(0.01, 35)	ok	0.581	none
L_at_Amax_Fem_GP_1	61.4	2	(40, 120)	ok	0.225	none
VonBert_K_Fem_GP_1	0.076	1	(0.01, 0.2)	ok	0.00132	none
CV_young_Fem_GP_1	0.148	3	(0.01, 0.5)	ok	0.00679	none
CV_old_Fem_GP_1	0.0642	7	(0.01, 0.5)	ok	0.00194	none
Wtlen_1_Fem_GP_1	7.18e-06	-50	(-3, 3)	fixed		none
Wtlen_2_Fem_GP_1	3.24	-50	(-3, 4)	fixed		none
Mat50%_Fem_GP_1	42.1	-50	(38, 45)	fixed		none
Mat_slope_Fem_GP_1	-0.402	-50	(-3, 3)	fixed		none
Eggs_scalar_Fem_GP_1	7.22e-08	-6	(-3, 3e+05)	fixed		none
Eggs_exp_len_Fem_GP_1	4.04	-6	(-3, 39000)	fixed		none
RecrDist_GP_1	1	-50	(0, 2)	fixed		none
RecrDist_Area_1	0	-50	(-4, 4)	fixed		none
RecrDist_Area_2	0.46	3	(-4, 4)	ok	0.0224	none
RecrDist_month_1	1	-50	(0, 2)	fixed		none
CohortGrowDev	1	-50	(0, 2)	fixed		none
FracFemale_GP_1	0.5	-99	(1e-06, 1)	fixed		none
SR_LN(R0)	5.44	3	(3, 15)	ok	0.0621	none
SR_BH_steep	0.718	-3	(0.2, 1)	fixed		none
SR_sigmaR	0.5	-2	(0, 5)	fixed		none
SR_regime	0	-50	(-5, 5)	fixed		none
SR_autocorr	0	-50	(-1, 2)	fixed		none
Early_RecrDev_1889	0.0197	7	(-5, 5)	dev	0.505	normal(0.00, 0.50)
Early_RecrDev_1890	0.0204	7	(-5, 5)	dev	0.505	normal(0.00, 0.50)
Early_RecrDev_1891	0.0211	7	(-5, 5)	dev	0.505	normal(0.00, 0.50)
Early_RecrDev_1892	0.0219	7	(-5, 5)	dev	0.505	normal(0.00, 0.50)
Early_RecrDev_1893	0.0226	7	(-5, 5)	dev	0.505	normal(0.00, 0.50)
Early_RecrDev_1894	0.0234	7	(-5, 5)	dev	0.505	normal(0.00, 0.50)
Early_RecrDev_1895	0.0242	7	(-5, 5)	dev	0.506	normal(0.00, 0.50)
Early_RecrDev_1896	0.0251	7	(-5, 5)	dev	0.506	normal(0.00, 0.50)
Early_RecrDev_1897	0.0259	7	(-5, 5)	dev	0.506	normal(0.00, 0.50)
Early_RecrDev_1898	0.0269	7	(-5, 5)	dev	0.506	normal(0.00, 0.50)

Early_RecrDev_1899	0.0278	7	(-5, 5)	dev	0.506	normal(0.00, 0.50)
Early_RecrDev_1900	0.0288	7	(-5, 5)	dev	0.507	normal(0.00, 0.50)
Early_RecrDev_1901	0.0298	7	(-5, 5)	dev	0.507	normal(0.00, 0.50)
Early_RecrDev_1902	0.0309	7	(-5, 5)	dev	0.507	normal(0.00, 0.50)
Early_RecrDev_1903	0.032	7	(-5, 5)	dev	0.507	normal(0.00, 0.50)
Early_RecrDev_1904	0.0332	7	(-5, 5)	dev	0.507	normal(0.00, 0.50)
Early_RecrDev_1905	0.0344	7	(-5, 5)	dev	0.508	normal(0.00, 0.50)
Early_RecrDev_1906	0.0357	7	(-5, 5)	dev	0.508	normal(0.00, 0.50)
Early_RecrDev_1907	0.0371	7	(-5, 5)	dev	0.508	normal(0.00, 0.50)
Early_RecrDev_1908	0.0387	7	(-5, 5)	dev	0.509	normal(0.00, 0.50)
Early_RecrDev_1909	0.0403	7	(-5, 5)	dev	0.509	normal(0.00, 0.50)
Early_RecrDev_1910	0.0421	7	(-5, 5)	dev	0.509	normal(0.00, 0.50)
Early_RecrDev_1911	0.0439	7	(-5, 5)	dev	0.51	normal(0.00, 0.50)
Early_RecrDev_1912	0.0459	7	(-5, 5)	dev	0.51	normal(0.00, 0.50)
Early_RecrDev_1913	0.0479	7	(-5, 5)	dev	0.51	normal(0.00, 0.50)
Early_RecrDev_1914	0.0498	7	(-5, 5)	dev	0.511	normal(0.00, 0.50)
Early_RecrDev_1915	0.0514	7	(-5, 5)	dev	0.511	normal(0.00, 0.50)
Early_RecrDev_1916	0.0526	7	(-5, 5)	dev	0.511	normal(0.00, 0.50)
Early_RecrDev_1917	0.0531	7	(-5, 5)	dev	0.511	normal(0.00, 0.50)
Early_RecrDev_1918	0.0524	7	(-5, 5)	dev	0.511	normal(0.00, 0.50)
Early_RecrDev_1919	0.0503	7	(-5, 5)	dev	0.51	normal(0.00, 0.50)
Early_RecrDev_1920	0.0464	7	(-5, 5)	dev	0.509	normal(0.00, 0.50)
Early_RecrDev_1921	0.0404	7	(-5, 5)	dev	0.507	normal(0.00, 0.50)
Early_RecrDev_1922	0.0322	7	(-5, 5)	dev	0.505	normal(0.00, 0.50)
Early_RecrDev_1923	0.0216	7	(-5, 5)	dev	0.502	normal(0.00, 0.50)
Early_RecrDev_1924	0.00893	7	(-5, 5)	dev	0.498	normal(0.00, 0.50)
Early_RecrDev_1925	-0.0055	7	(-5, 5)	dev	0.494	normal(0.00, 0.50)
Early_RecrDev_1926	-0.021	7	(-5, 5)	dev	0.491	normal(0.00, 0.50)
Early_RecrDev_1927	-0.0367	7	(-5, 5)	dev	0.487	normal(0.00, 0.50)
Early_RecrDev_1928	-0.0517	7	(-5, 5)	dev	0.483	normal(0.00, 0.50)
Early_RecrDev_1929	-0.0652	7	(-5, 5)	dev	0.48	normal(0.00, 0.50)
Early_RecrDev_1930	-0.0768	7	(-5, 5)	dev	0.477	normal(0.00, 0.50)
Early_RecrDev_1931	-0.0866	7	(-5, 5)	dev	0.475	normal(0.00, 0.50)
Early_RecrDev_1932	-0.0952	7	(-5, 5)	dev	0.472	normal(0.00, 0.50)
Early_RecrDev_1933	-0.104	7	(-5, 5)	dev	0.47	normal(0.00, 0.50)
Early_RecrDev_1934	-0.114	7	(-5, 5)	dev	0.468	normal(0.00, 0.50)
Early_RecrDev_1935	-0.127	7	(-5, 5)	dev	0.465	normal(0.00, 0.50)
Early_RecrDev_1936	-0.142	7	(-5, 5)	dev	0.462	normal(0.00, 0.50)

Early_RecrDev_1937	-0.158	7	(-5, 5)	dev	0.458	normal(0.00, 0.50)
Early_RecrDev_1938	-0.172	7	(-5, 5)	dev	0.455	normal(0.00, 0.50)
Early_RecrDev_1939	-0.184	7	(-5, 5)	dev	0.453	normal(0.00, 0.50)
Early_RecrDev_1940	-0.188	7	(-5, 5)	dev	0.452	normal(0.00, 0.50)
Early_RecrDev_1941	-0.184	7	(-5, 5)	dev	0.452	normal(0.00, 0.50)
Early_RecrDev_1942	-0.168	7	(-5, 5)	dev	0.454	normal(0.00, 0.50)
Early_RecrDev_1943	-0.137	7	(-5, 5)	dev	0.459	normal(0.00, 0.50)
Early_RecrDev_1944	-0.0854	7	(-5, 5)	dev	0.468	normal(0.00, 0.50)
Early_RecrDev_1945	-0.00578	7	(-5, 5)	dev	0.483	normal(0.00, 0.50)
Early_RecrDev_1946	0.105	7	(-5, 5)	dev	0.506	normal(0.00, 0.50)
Early_RecrDev_1947	0.237	7	(-5, 5)	dev	0.535	normal(0.00, 0.50)
Early_RecrDev_1948	0.349	7	(-5, 5)	dev	0.56	normal(0.00, 0.50)
Early_RecrDev_1949	0.355	7	(-5, 5)	dev	0.555	normal(0.00, 0.50)
Early_RecrDev_1950	0.224	7	(-5, 5)	dev	0.522	normal(0.00, 0.50)
Early_RecrDev_1951	0.0376	7	(-5, 5)	dev	0.483	normal(0.00, 0.50)
Early_RecrDev_1952	-0.138	7	(-5, 5)	dev	0.451	normal(0.00, 0.50)
Early_RecrDev_1953	-0.277	7	(-5, 5)	dev	0.428	normal(0.00, 0.50)
Early_RecrDev_1954	-0.372	7	(-5, 5)	dev	0.414	normal(0.00, 0.50)
Early_RecrDev_1955	-0.421	7	(-5, 5)	dev	0.407	normal(0.00, 0.50)
Early_RecrDev_1956	-0.425	7	(-5, 5)	dev	0.405	normal(0.00, 0.50)
Early_RecrDev_1957	-0.385	7	(-5, 5)	dev	0.408	normal(0.00, 0.50)
Early_RecrDev_1958	-0.305	7	(-5, 5)	dev	0.415	normal(0.00, 0.50)
Early_RecrDev_1959	-0.203	7	(-5, 5)	dev	0.421	normal(0.00, 0.50)
Early_RecrDev_1960	-0.15	7	(-5, 5)	dev	0.42	normal(0.00, 0.50)
Early_RecrDev_1961	-0.23	7	(-5, 5)	dev	0.413	normal(0.00, 0.50)
Early_RecrDev_1962	-0.39	7	(-5, 5)	dev	0.4	normal(0.00, 0.50)
Early_RecrDev_1963	-0.508	7	(-5, 5)	dev	0.391	normal(0.00, 0.50)
Early_RecrDev_1964	-0.502	7	(-5, 5)	dev	0.39	normal(0.00, 0.50)
Early_RecrDev_1965	-0.351	7	(-5, 5)	dev	0.397	normal(0.00, 0.50)
Early_RecrDev_1966	-0.164	7	(-5, 5)	dev	0.404	normal(0.00, 0.50)
Early_RecrDev_1967	-0.0525	7	(-5, 5)	dev	0.424	normal(0.00, 0.50)
Early_RecrDev_1968	0.131	7	(-5, 5)	dev	0.43	normal(0.00, 0.50)
Early_RecrDev_1969	0.223	7	(-5, 5)	dev	0.454	normal(0.00, 0.50)
Early_RecrDev_1970	0.414	7	(-5, 5)	dev	0.508	normal(0.00, 0.50)
Early_RecrDev_1971	0.895	7	(-5, 5)	dev	0.389	normal(0.00, 0.50)
Early_RecrDev_1972	0.281	7	(-5, 5)	dev	0.472	normal(0.00, 0.50)
Early_RecrDev_1973	-0.0147	7	(-5, 5)	dev	0.425	normal(0.00, 0.50)
Early_RecrDev_1974	0.0884	7	(-5, 5)	dev	0.429	normal(0.00, 0.50)

Early_RecrDev_1975	0.477	7	(-5, 5)	dev	0.372	normal(0.00, 0.50)
Early_RecrDev_1976	0.281	7	(-5, 5)	dev	0.421	normal(0.00, 0.50)
Early_RecrDev_1977	0.225	7	(-5, 5)	dev	0.367	normal(0.00, 0.50)
Early_RecrDev_1978	-0.108	7	(-5, 5)	dev	0.397	normal(0.00, 0.50)
Early_RecrDev_1979	0.144	7	(-5, 5)	dev	0.393	normal(0.00, 0.50)
Main_RecrDev_1980	0.358	7	(-5, 5)	dev	0.411	normal(0.00, 0.50)
Main_RecrDev_1981	0.425	7	(-5, 5)	dev	0.46	normal(0.00, 0.50)
Main_RecrDev_1982	0.505	7	(-5, 5)	dev	0.434	normal(0.00, 0.50)
Main_RecrDev_1983	0.175	7	(-5, 5)	dev	0.475	normal(0.00, 0.50)
Main_RecrDev_1984	0.415	7	(-5, 5)	dev	0.423	normal(0.00, 0.50)
Main_RecrDev_1985	0.241	7	(-5, 5)	dev	0.418	normal(0.00, 0.50)
Main_RecrDev_1986	-0.0942	7	(-5, 5)	dev	0.379	normal(0.00, 0.50)
Main_RecrDev_1987	-0.342	7	(-5, 5)	dev	0.343	normal(0.00, 0.50)
Main_RecrDev_1988	-0.627	7	(-5, 5)	dev	0.327	normal(0.00, 0.50)
Main_RecrDev_1989	-0.776	7	(-5, 5)	dev	0.311	normal(0.00, 0.50)
Main_RecrDev_1990	-0.856	7	(-5, 5)	dev	0.301	normal(0.00, 0.50)
Main_RecrDev_1991	-0.942	7	(-5, 5)	dev	0.305	normal(0.00, 0.50)
Main_RecrDev_1992	-0.773	7	(-5, 5)	dev	0.319	normal(0.00, 0.50)
Main_RecrDev_1993	-0.0887	7	(-5, 5)	dev	0.259	normal(0.00, 0.50)
Main_RecrDev_1994	-0.227	7	(-5, 5)	dev	0.279	normal(0.00, 0.50)
Main_RecrDev_1995	-0.931	7	(-5, 5)	dev	0.324	normal(0.00, 0.50)
Main_RecrDev_1996	-0.964	7	(-5, 5)	dev	0.311	normal(0.00, 0.50)
Main_RecrDev_1997	-0.756	7	(-5, 5)	dev	0.327	normal(0.00, 0.50)
Main_RecrDev_1998	-0.268	7	(-5, 5)	dev	0.336	normal(0.00, 0.50)
Main_RecrDev_1999	0.154	7	(-5, 5)	dev	0.291	normal(0.00, 0.50)
Main_RecrDev_2000	-0.413	7	(-5, 5)	dev	0.367	normal(0.00, 0.50)
Main_RecrDev_2001	-0.258	7	(-5, 5)	dev	0.368	normal(0.00, 0.50)
Main_RecrDev_2002	0.916	7	(-5, 5)	dev	0.194	normal(0.00, 0.50)
Main_RecrDev_2003	0.0491	7	(-5, 5)	dev	0.36	normal(0.00, 0.50)
Main_RecrDev_2004	-0.362	7	(-5, 5)	dev	0.363	normal(0.00, 0.50)
Main_RecrDev_2005	0.0358	7	(-5, 5)	dev	0.314	normal(0.00, 0.50)
Main_RecrDev_2006	0.537	7	(-5, 5)	dev	0.288	normal(0.00, 0.50)
Main_RecrDev_2007	0.568	7	(-5, 5)	dev	0.344	normal(0.00, 0.50)
Main_RecrDev_2008	1.05	7	(-5, 5)	dev	0.262	normal(0.00, 0.50)
Main_RecrDev_2009	0.807	7	(-5, 5)	dev	0.309	normal(0.00, 0.50)
Main_RecrDev_2010	0.753	7	(-5, 5)	dev	0.276	normal(0.00, 0.50)
Main_RecrDev_2011	0.492	7	(-5, 5)	dev	0.291	normal(0.00, 0.50)
Main_RecrDev_2012	0.371	7	(-5, 5)	dev	0.335	normal(0.00, 0.50)

Main_RecrDev_2013	1.18	7	(-5, 5)	dev	0.208	normal(0.00, 0.50)
Main_RecrDev_2014	0.451	7	(-5, 5)	dev	0.358	normal(0.00, 0.50)
Main_RecrDev_2015	0.711	7	(-5, 5)	dev	0.29	normal(0.00, 0.50)
Main_RecrDev_2016	0.328	7	(-5, 5)	dev	0.33	normal(0.00, 0.50)
Main_RecrDev_2017	-0.358	7	(-5, 5)	dev	0.395	normal(0.00, 0.50)
Main_RecrDev_2018	-0.412	7	(-5, 5)	dev	0.404	normal(0.00, 0.50)
Main_RecrDev_2019	-0.39	7	(-5, 5)	dev	0.417	normal(0.00, 0.50)
Main_RecrDev_2020	-0.413	7	(-5, 5)	dev	0.439	normal(0.00, 0.50)
Main_RecrDev_2021	-0.164	7	(-5, 5)	dev	0.465	normal(0.00, 0.50)
Main_RecrDev_2022	-0.0578	7	(-5, 5)	dev	0.486	normal(0.00, 0.50)
Main_RecrDev_2023	-0.0431	7	(-5, 5)	dev	0.49	normal(0.00, 0.50)
Late_RecrDev_2024	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2025	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2026	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2027	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2028	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2029	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2030	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2031	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2032	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2033	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2034	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2035	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
ForeRecr_2036	0	8	(-5, 5)	dev	0.5	normal(0.00, 0.50)
LnQ_base_3_CA_REC(3)	-9.16	-1	(-15, 15)	fixed		none
Q_extraSD_3_CA_REC(3)	0.132	5	(0, 5)	ok	0.0808	none
LnQ_base_6_OR_REC(6)	-10.8	-1	(-15, 15)	fixed		none
Q_extraSD_6_OR_REC(6)	1.04	5	(0, 5)	ok	0.149	none
LnQ_base_7_WA_REC(7)	-8.81	-1	(-20, 15)	fixed		none
Q_extraSD_7_WA_REC(7)	0.406	5	(0, 5)	ok	0.0803	none
LnQ_base_8_CACPFV(8)	-9.2	-1	(-15, 15)	fixed		none
Q_extraSD_8_CACPFV(8)	0.0794	5	(0, 5)	ok	0.0711	none
LnQ_base_9_OR_RECOB(9)	-11.3	-1	(-15, 15)	fixed		none
Q_extraSD_9_OR_RECOB(9)	0.166	5	(0, 5)	ok	0.0795	none
LnQ_base_10_TRI_ORWA(10)	-1.46	-1	(-15, 15)	fixed		none
Q_extraSD_10_TRI_ORWA(10)	0.13	5	(0, 5)	ok	0.119	none
LnQ_base_11_NWFSC_ORWA(11)	-0.85	-1	(-15, 15)	fixed		none
Q_extraSD_11_NWFSC_ORWA(11)	0	-5	(0, 5)	fixed		none

LnQ_base_12_IPHC_ORWA(12)	-0.544	-1	(-15, 15)	fixed		none
Q_extraSD_12_IPHC_ORWA(12)	0.551	5	(0, 5)	ok	0.106	none
LnQ_base_6_OR_REC(6)_BLK2add_2005	-0.598	1	(-4, 4)	ok	7820	none
Size_DblN_peak_1_CA_TWL(1)	44	4	(20, 60)	ok	3.29	none
Size_DblN_top_logit_1_CA_TWL(1)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_1_CA_TWL(1)	5.13	4	(-1, 9)	ok	0.402	none
Size_DblN_descend_se_1_CA_TWL(1)	18.3	5	(-1, 30)	ok	152	none
Size_DblN_start_logit_1_CA_TWL(1)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_1_CA_TWL(1)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_2_CA_NONTWL(2)	44.4	4	(20, 60)	ok	2.48	none
Size_DblN_top_logit_2_CA_NONTWL(2)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_2_CA_NONTWL(2)	5.18	4	(-1, 9)	ok	0.284	none
Size_DblN_descend_se_2_CA_NONTWL(2)	17.4	5	(-1, 30)	ok	172	none
Size_DblN_start_logit_2_CA_NONTWL(2)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_2_CA_NONTWL(2)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_3_CA_REC(3)	41.8	4	(20, 60)	ok	1.36	none
Size_DblN_top_logit_3_CA_REC(3)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_3_CA_REC(3)	5.22	4	(-1, 9)	ok	0.144	none
Size_DblN_descend_se_3_CA_REC(3)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_3_CA_REC(3)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_3_CA_REC(3)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_4_ORWA_TWL(4)	41.9	4	(20, 60)	ok	2.98	none
Size_DblN_top_logit_4_ORWA_TWL(4)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_4_ORWA_TWL(4)	5.49	4	(-1, 9)	ok	0.338	none
Size_DblN_descend_se_4_ORWA_TWL(4)	18.1	5	(-1, 30)	ok	155	none
Size_DblN_start_logit_4_ORWA_TWL(4)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_4_ORWA_TWL(4)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_5_ORWA_NONTWL(5)	50.7	4	(20, 60)	ok	1.48	none
Size_DblN_top_logit_5_ORWA_NONTWL(5)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_5_ORWA_NONTWL(5)	5.42	4	(-1, 9)	ok	0.148	none
Size_DblN_descend_se_5_ORWA_NONTWL(5)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_5_ORWA_NONTWL(5)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_5_ORWA_NONTWL(5)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_6_OR_REC(6)	36.8	4	(20, 60)	ok	1.31	none
Size_DblN_top_logit_6_OR_REC(6)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_6_OR_REC(6)	4.15	4	(-1, 9)	ok	0.286	none
Size_DblN_descend_se_6_OR_REC(6)	12	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_6_OR_REC(6)	-999	-4	(-1000, 9)	fixed		none

Size_DblN_end_logit_6_OR_REC(6)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_7_WA_REC(7)	42.7	6	(20, 60)	ok	2.75	none
Size_DblN_top_logit_7_WA_REC(7)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_7_WA_REC(7)	4.31	6	(-1, 9)	ok	0.518	none
Size_DblN_descend_se_7_WA_REC(7)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_7_WA_REC(7)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_7_WA_REC(7)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_9_OR_RECOB(9)	35.1	4	(20, 60)	ok	1.61	none
Size_DblN_top_logit_9_OR_RECOB(9)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_9_OR_RECOB(9)	4.6	4	(-1, 9)	ok	0.29	none
Size_DblN_descend_se_9_OR_RECOB(9)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_9_OR_RECOB(9)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_9_OR_RECOB(9)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_10_TRI_ORWA(10)	80	4	(20, 80)	HI	0.905	none
Size_DblN_top_logit_10_TRI_ORWA(10)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_10_TRI_ORWA(10)	7.08	4	(-1, 9)	ok	0.266	none
Size_DblN_descend_se_10_TRI_ORWA(10)	12	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_10_TRI_ORWA(10)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_10_TRI_ORWA(10)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_11_NWFSC_ORWA(11)	48.6	4	(20, 60)	ok	5.45	none
Size_DblN_top_logit_11_NWFSC_ORWA(11)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_11_NWFSC_ORWA(11)	6.21	4	(-1, 9)	ok	0.379	none
Size_DblN_descend_se_11_NWFSC_ORWA(11)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_11_NWFSC_ORWA(11)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_11_NWFSC_ORWA(11)	-999	-5	(-1000, 9)	fixed		none
Size_DblN_peak_12_IPHC_ORWA(12)	54	4	(20, 60)	ok	1.22	none
Size_DblN_top_logit_12_IPHC_ORWA(12)	-15	-5	(-15, 4)	fixed		none
Size_DblN_ascend_se_12_IPHC_ORWA(12)	4.14	4	(-1, 9)	ok	0.235	none
Size_DblN_descend_se_12_IPHC_ORWA(12)	20	-5	(-1, 30)	fixed		none
Size_DblN_start_logit_12_IPHC_ORWA(12)	-999	-4	(-1000, 9)	fixed		none
Size_DblN_end_logit_12_IPHC_ORWA(12)	-999	-5	(-1000, 9)	fixed		none

Table 7: Data weightings applied to compositions according to the `Francis` method. `Obs.` refers to the number of unique composition vectors included in the likelihood. `N input` and `N adj.` refer to the sample sizes of those vectors before and after being adjusted by the the weights. `CAAL` is conditional age-at-length data.

Type	Fleet	Francis	Obs.	Mean N input	Mean N adj.	Sum N adj.
Length	1_CA_TWL	0.521	38	9.9	5.2	196.8
Length	2_CA_NONTWL	0.287	44	34.9	10.0	441.1
Length	3_CA_REC	0.528	42	45.8	24.2	1015.7
Length	4_ORWA_TWL	0.255	29	37.2	9.5	275.3
Length	5_ORWA_NONTWL	0.362	31	79.3	28.7	888.4
Length	6_OR_REC	0.360	43	52.5	18.9	813.3
Length	7_WA_REC	1.000	26	7.3	7.3	188.6
Length	8_CACPFV	0.553	32	37.6	20.8	665.1
Length	9_OR_RECOB	0.539	20	25.6	13.8	275.9
Length	10_TRI_ORWA	0.453	7	11.2	5.1	35.7
Length	11_NWFSC_ORWA	0.525	21	16.1	8.4	177.3
Length	12_IPHC_ORWA	0.887	21	28.7	25.5	535.1
CAAL	2_CA_NONTWL	1.000	42	1.4	1.4	58.0
CAAL	3_CA_REC	1.000	102	1.5	1.5	153.0
CAAL	4_ORWA_TWL	1.000	353	4.2	4.2	1486.0
CAAL	5_ORWA_NONTWL	0.221	266	8.9	2.0	520.6
CAAL	6_OR_REC	1.000	195	4.1	4.1	798.0
CAAL	7_WA_REC	1.000	177	3.6	3.6	643.0
CAAL	11_NWFSC_ORWA	1.000	382	2.3	2.3	870.0
CAAL	12_IPHC_ORWA	0.086	531	16.0	1.4	733.7

Table 8: Time series of population estimates from the base model.

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploita-tion Rate
1889	9947	1129.70	9803	1.000	234	0	0.000	0.000
1890	9947	1129.70	9803	1.000	234	0	0.001	0.000
1891	9947	1129.68	9803	1.000	234	0	0.002	0.000
1892	9947	1129.66	9803	1.000	234	0	0.027	0.000
1893	9944	1129.19	9799	1.000	235	0	0.027	0.000
1894	9941	1128.74	9795	0.999	235	0	0.027	0.000
1895	9938	1128.28	9792	0.999	235	0	0.010	0.000
1896	9937	1128.13	9790	0.999	235	1	0.006	0.000
1897	9938	1128.05	9791	0.999	235	1	0.006	0.000
1898	9940	1127.97	9792	0.998	236	1	0.006	0.000
1899	9941	1127.91	9794	0.998	236	1	0.008	0.000
1900	9943	1127.85	9796	0.998	236	1	0.009	0.000
1901	9945	1127.81	9798	0.998	236	1	0.010	0.000
1902	9947	1127.80	9800	0.998	236	1	0.011	0.000
1903	9950	1127.82	9802	0.998	237	1	0.012	0.000
1904	9953	1127.89	9805	0.998	237	1	0.014	0.000
1905	9956	1127.99	9808	0.998	237	1	0.014	0.000
1906	9959	1128.14	9811	0.999	238	1	0.016	0.000

Table 8: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploita-tion Rate
1907	9962	1128.33	9814	0.999	238	1	0.017	0.000
1908	9966	1128.56	9818	0.999	238	2	0.025	0.000
1909	9969	1128.70	9820	0.999	239	2	0.019	0.000
1910	9973	1128.99	9824	0.999	239	2	0.020	0.000
1911	9977	1129.30	9828	1.000	240	2	0.021	0.000
1912	9981	1129.63	9832	1.000	240	2	0.023	0.000
1913	9986	1129.98	9836	1.000	241	2	0.024	0.000
1914	9990	1130.36	9841	1.001	241	2	0.025	0.000
1915	9995	1130.74	9845	1.001	241	2	0.030	0.000
1916	10000	1131.07	9849	1.001	242	2	0.027	0.000
1917	10005	1131.49	9854	1.002	242	4	0.038	0.000
1918	10009	1131.77	9858	1.002	242	4	0.148	0.000
1919	9996	1130.02	9845	1.000	241	2	0.066	0.000
1920	9996	1129.86	9845	1.000	240	2	0.061	0.000
1921	9998	1129.84	9847	1.000	239	2	0.059	0.000
1922	10001	1129.91	9849	1.000	237	2	0.044	0.000
1923	10006	1130.28	9854	1.001	234	2	0.050	0.000
1924	10010	1130.59	9859	1.001	231	3	0.082	0.000
1925	10010	1130.39	9859	1.001	228	4	0.103	0.000
1926	10006	1129.86	9856	1.000	225	5	0.146	0.000
1927	9996	1128.55	9847	0.999	221	6	0.185	0.001
1928	9979	1126.56	9831	0.997	217	6	0.183	0.001
1929	9962	1124.68	9816	0.996	214	7	0.163	0.001
1930	9948	1123.29	9804	0.994	212	8	0.182	0.001
1931	9931	1121.57	9788	0.993	209	8	0.130	0.001
1932	9920	1120.89	9780	0.992	207	11	0.122	0.001
1933	9910	1120.38	9772	0.992	205	7	0.120	0.001
1934	9898	1119.87	9762	0.991	203	9	0.147	0.001
1935	9880	1118.81	9746	0.990	200	12	0.146	0.001
1936	9861	1117.71	9729	0.989	197	13	0.193	0.001
1937	9833	1115.58	9702	0.987	194	11	0.176	0.001
1938	9805	1113.65	9676	0.986	191	12	0.186	0.001
1939	9773	1111.33	9646	0.984	188	11	0.148	0.001
1940	9746	1109.52	9620	0.982	187	11	0.203	0.001
1941	9708	1106.45	9583	0.979	188	11	0.271	0.001
1942	9656	1101.75	9533	0.975	191	7	0.278	0.001
1943	9600	1096.55	9479	0.971	196	9	0.460	0.001
1944	9506	1086.72	9386	0.962	206	27	0.526	0.003
1945	9406	1076.07	9287	0.953	223	62	0.727	0.007
1946	9261	1060.06	9142	0.938	248	64	0.675	0.007
1947	9127	1045.13	9007	0.925	283	21	0.366	0.002
1948	9061	1037.76	8937	0.919	316	32	0.407	0.004
1949	8988	1029.25	8858	0.911	317	22	0.323	0.002
1950	8933	1022.37	8796	0.905	278	23	0.358	0.003
1951	8877	1014.69	8729	0.898	230	34	0.431	0.004
1952	8814	1005.32	8654	0.890	193	29	0.384	0.003
1953	8767	996.97	8594	0.883	167	25	0.293	0.003
1954	8740	990.40	8559	0.877	152	28	0.364	0.003
1955	8707	982.70	8527	0.870	144	27	0.360	0.003
1956	8678	975.47	8514	0.863	144	32	0.383	0.004
1957	8648	968.37	8506	0.857	149	36	0.470	0.004
1958	8604	960.44	8483	0.850	161	47	0.456	0.006

Table 8: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploitation Rate
1959	8558	953.54	8452	0.844	178	39	0.452	0.005
1960	8513	948.15	8415	0.839	188	31	0.438	0.004
1961	8469	944.34	8375	0.836	173	22	0.370	0.003
1962	8433	942.70	8339	0.834	147	26	0.425	0.003
1963	8385	940.60	8289	0.833	131	33	0.324	0.004
1964	8348	940.05	8246	0.832	131	27	0.238	0.003
1965	8319	940.67	8213	0.833	153	38	0.720	0.005
1966	8208	931.46	8100	0.825	184	40	0.324	0.005
1967	8159	928.90	8054	0.822	205	42	0.412	0.005
1968	8094	924.00	7997	0.818	246	45	0.379	0.006
1969	8031	918.70	7939	0.813	269	66	0.802	0.008
1970	7893	904.03	7798	0.800	325	73	0.530	0.009
1971	7800	893.71	7693	0.791	525	87	0.660	0.011
1972	7682	879.98	7559	0.779	283	116	0.711	0.015
1973	7545	862.88	7404	0.764	210	116	0.801	0.016
1974	7409	844.20	7247	0.747	232	127	0.848	0.017
1975	7271	823.72	7085	0.729	341	131	0.787	0.019
1976	7151	804.04	6947	0.712	279	139	0.925	0.020
1977	7018	781.57	6798	0.692	262	130	0.979	0.019
1978	6895	759.46	6675	0.672	187	222	1.198	0.033
1979	6667	724.88	6506	0.642	239	176	1.434	0.027
1980	6422	688.59	6267	0.610	293	115	1.401	0.018
1981	6246	661.23	6077	0.585	312	197	1.500	0.032
1982	5990	626.65	5812	0.555	334	318	1.723	0.055
1983	5520	570.52	5363	0.505	236	115	1.775	0.022
1984	5128	523.04	4977	0.463	295	125	1.643	0.025
1985	4910	495.73	4760	0.439	245	136	1.767	0.028
1986	4605	459.46	4435	0.407	173	98	1.726	0.022
1987	4370	430.64	4189	0.381	133	130	1.721	0.031
1988	4151	403.85	3972	0.357	98	124	1.714	0.031
1989	3964	381.13	3797	0.337	83	111	1.805	0.029
1990	3718	352.43	3575	0.312	75	127	1.714	0.035
1991	3549	332.72	3413	0.295	68	181	1.836	0.053
1992	3248	301.04	3142	0.266	78	133	1.859	0.042
1993	2969	272.41	2890	0.241	151	61	1.850	0.021
1994	2704	245.14	2641	0.217	127	68	1.790	0.026
1995	2548	231.01	2495	0.204	61	64	1.820	0.026
1996	2378	216.64	2328	0.192	58	84	1.840	0.036
1997	2188	200.68	2137	0.178	69	78	1.874	0.037
1998	1973	181.86	1917	0.161	108	27	1.650	0.014
1999	1907	177.32	1843	0.157	164	35	1.744	0.019
2000	1800	168.24	1731	0.149	91	12	1.168	0.007
2001	1814	171.24	1758	0.152	107	10	1.116	0.005
2002	1830	173.72	1782	0.154	347	2	0.430	0.001
2003	1883	179.89	1827	0.159	148	4	0.423	0.002
2004	1937	186.11	1870	0.165	99	2	0.289	0.001
2005	2000	192.54	1916	0.170	149	2	0.307	0.001
2006	2067	198.82	1971	0.176	249	1	0.235	0.001
2007	2139	205.28	2044	0.182	260	5	0.398	0.002
2008	2213	211.19	2095	0.187	423	2	0.257	0.001
2009	2295	217.42	2154	0.192	337	5	0.338	0.002
2010	2382	223.59	2280	0.198	322	1	0.167	0.000

Table 8: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploitation Rate
2011	2485	230.50	2370	0.204	251	2	0.217	0.001
2012	2598	237.73	2447	0.210	224	3	0.286	0.001
2013	2722	245.33	2535	0.217	509	2	0.235	0.001
2014	2858	253.92	2654	0.225	248	1	0.197	0.000
2015	3007	263.55	2786	0.233	326	2	0.268	0.001
2016	3166	273.78	2970	0.242	228	1	0.192	0.000
2017	3338	285.38	3152	0.253	117	6	0.390	0.002
2018	3512	297.29	3331	0.263	114	5	0.349	0.001
2019	3695	310.98	3501	0.275	119	6	0.407	0.002
2020	3877	326.09	3664	0.289	119	2	0.297	0.001
2021	4065	343.67	3915	0.304	157	7	0.338	0.002
2022	4248	362.88	4108	0.321	179	9	0.483	0.002
2023	4412	382.50	4313	0.339	184	12	0.527	0.003
2024	4564	402.94	4488	0.357	195	5	0.221	0.001
2025	4732	426.87	4651	0.378	197	19	0.595	0.004
2026	4856	448.23	4769	0.397	200	19	0.588	0.004
2027	4971	469.51	4874	0.416	202	28	0.921	0.006
2028	5026	484.88	4916	0.429	203	28	0.915	0.006
2029	5072	498.65	4955	0.441	204	28	0.910	0.006
2030	5110	510.37	4990	0.452	205	28	0.905	0.006
2031	5142	519.89	5018	0.460	206	28	0.899	0.006
2032	5168	527.28	5043	0.467	206	28	0.894	0.006
2033	5190	532.81	5064	0.472	207	28	0.888	0.006
2034	5209	536.85	5082	0.475	207	28	0.884	0.006
2035	5226	539.78	5098	0.478	207	28	0.878	0.006
2036	5241	541.94	5112	0.480	207	28	0.872	0.006
1889	9947	1129.70	9803	1.000	234	0	0.000	0.000
1890	9947	1129.70	9803	1.000	234	0	0.001	0.000
1891	9947	1129.68	9803	1.000	234	0	0.002	0.000
1892	9947	1129.66	9803	1.000	234	4	0.027	0.000
1893	9944	1129.19	9799	1.000	235	4	0.027	0.000
1894	9941	1128.74	9795	0.999	235	4	0.027	0.000
1895	9938	1128.28	9792	0.999	235	1	0.010	0.000
1896	9937	1128.13	9790	0.999	235	0	0.006	0.000
1897	9938	1128.05	9791	0.999	235	0	0.006	0.000
1898	9940	1127.97	9792	0.998	236	0	0.006	0.000
1899	9941	1127.91	9794	0.998	236	0	0.008	0.000
1900	9943	1127.85	9796	0.998	236	0	0.009	0.000
1901	9945	1127.81	9798	0.998	236	0	0.010	0.000
1902	9947	1127.80	9800	0.998	236	0	0.011	0.000
1903	9950	1127.82	9802	0.998	237	1	0.012	0.000
1904	9953	1127.89	9805	0.998	237	1	0.014	0.000
1905	9956	1127.99	9808	0.998	237	1	0.014	0.000
1906	9959	1128.14	9811	0.999	238	1	0.016	0.000
1907	9962	1128.33	9814	0.999	238	1	0.017	0.000
1908	9966	1128.56	9818	0.999	238	2	0.025	0.000
1909	9969	1128.70	9820	0.999	239	1	0.019	0.000
1910	9973	1128.99	9824	0.999	239	1	0.020	0.000
1911	9977	1129.30	9828	1.000	240	1	0.021	0.000
1912	9981	1129.63	9832	1.000	240	1	0.023	0.000
1913	9986	1129.98	9836	1.000	241	1	0.024	0.000
1914	9990	1130.36	9841	1.001	241	2	0.025	0.000

Table 8: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploitation Rate
1915	9995	1130.74	9845	1.001	241	2	0.030	0.000
1916	10000	1131.07	9849	1.001	242	2	0.027	0.000
1917	10005	1131.49	9854	1.002	242	2	0.038	0.000
1918	10009	1131.77	9858	1.002	242	19	0.148	0.002
1919	9996	1130.02	9845	1.000	241	8	0.066	0.001
1920	9996	1129.86	9845	1.000	240	7	0.061	0.001
1921	9998	1129.84	9847	1.000	239	6	0.059	0.001
1922	10001	1129.91	9849	1.000	237	4	0.044	0.000
1923	10006	1130.28	9854	1.001	234	5	0.050	0.001
1924	10010	1130.59	9859	1.001	231	9	0.082	0.001
1925	10010	1130.39	9859	1.001	228	11	0.103	0.001
1926	10006	1129.86	9856	1.000	225	17	0.146	0.002
1927	9996	1128.55	9847	0.999	221	23	0.185	0.002
1928	9979	1126.56	9831	0.997	217	22	0.183	0.002
1929	9962	1124.68	9816	0.996	214	18	0.163	0.002
1930	9948	1123.29	9804	0.994	212	20	0.182	0.002
1931	9931	1121.57	9788	0.993	209	12	0.130	0.001
1932	9920	1120.89	9780	0.992	207	7	0.122	0.001
1933	9910	1120.38	9772	0.992	205	10	0.120	0.001
1934	9898	1119.87	9762	0.991	203	13	0.147	0.001
1935	9880	1118.81	9746	0.990	200	10	0.146	0.001
1936	9861	1117.71	9729	0.989	197	17	0.193	0.002
1937	9833	1115.58	9702	0.987	194	15	0.176	0.002
1938	9805	1113.65	9676	0.986	191	16	0.186	0.002
1939	9773	1111.33	9646	0.984	188	11	0.148	0.001
1940	9746	1109.52	9620	0.982	187	19	0.203	0.002
1941	9708	1106.45	9583	0.979	188	31	0.271	0.003
1942	9656	1101.75	9533	0.975	191	37	0.278	0.004
1943	9600	1096.55	9479	0.971	196	72	0.460	0.008
1944	9506	1086.72	9386	0.962	206	59	0.526	0.006
1945	9406	1076.07	9287	0.953	223	68	0.727	0.007
1946	9261	1060.06	9142	0.938	248	56	0.675	0.006
1947	9127	1045.13	9007	0.925	283	32	0.366	0.004
1948	9061	1037.76	8937	0.919	316	29	0.407	0.003
1949	8988	1029.25	8858	0.911	317	24	0.323	0.003
1950	8933	1022.37	8796	0.905	278	28	0.358	0.003
1951	8877	1014.69	8729	0.898	230	30	0.431	0.003
1952	8814	1005.32	8654	0.890	193	26	0.384	0.003
1953	8767	996.97	8594	0.883	167	16	0.293	0.002
1954	8740	990.40	8559	0.877	152	23	0.364	0.003
1955	8707	982.70	8527	0.870	144	23	0.360	0.003
1956	8678	975.47	8514	0.863	144	21	0.383	0.003
1957	8648	968.37	8506	0.857	149	31	0.470	0.004
1958	8604	960.44	8483	0.850	161	21	0.456	0.002
1959	8558	953.54	8452	0.844	178	25	0.452	0.003
1960	8513	948.15	8415	0.839	188	30	0.438	0.004
1961	8469	944.34	8375	0.836	173	28	0.370	0.003
1962	8433	942.70	8339	0.834	147	32	0.425	0.004
1963	8385	940.60	8289	0.833	131	11	0.324	0.001
1964	8348	940.05	8246	0.832	131	5	0.238	0.001
1965	8319	940.67	8213	0.833	153	73	0.720	0.009
1966	8208	931.46	8100	0.825	184	6	0.324	0.001

Table 8: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploita-tion Rate
1967	8159	928.90	8054	0.822	205	16	0.412	0.002
1968	8094	924.00	7997	0.818	246	9	0.379	0.001
1969	8031	918.70	7939	0.813	269	62	0.802	0.008
1970	7893	904.03	7798	0.800	325	13	0.530	0.002
1971	7800	893.71	7693	0.791	525	25	0.660	0.003
1972	7682	879.98	7559	0.779	283	22	0.711	0.003
1973	7545	862.88	7404	0.764	210	33	0.801	0.004
1974	7409	844.20	7247	0.747	232	36	0.848	0.005
1975	7271	823.72	7085	0.729	341	23	0.787	0.003
1976	7151	804.04	6947	0.712	279	41	0.925	0.006
1977	7018	781.57	6798	0.692	262	51	0.979	0.007
1978	6895	759.46	6675	0.672	187	77	1.198	0.011
1979	6667	724.88	6506	0.642	239	151	1.434	0.023
1980	6422	688.59	6267	0.610	293	152	1.401	0.024
1981	6246	661.23	6077	0.585	312	157	1.500	0.026
1982	5990	626.65	5812	0.555	334	259	1.723	0.045
1983	5520	570.52	5363	0.505	236	388	1.775	0.072
1984	5128	523.04	4977	0.463	295	210	1.643	0.042
1985	4910	495.73	4760	0.439	245	293	1.767	0.062
1986	4605	459.46	4435	0.407	173	265	1.726	0.060
1987	4370	430.64	4189	0.381	133	223	1.721	0.053
1988	4151	403.85	3972	0.357	98	199	1.714	0.050
1989	3964	381.13	3797	0.337	83	272	1.805	0.072
1990	3718	352.43	3575	0.312	75	176	1.714	0.049
1991	3549	332.72	3413	0.295	68	250	1.836	0.073
1992	3248	301.04	3142	0.266	78	267	1.859	0.085
1993	2969	272.41	2890	0.241	151	316	1.850	0.109
1994	2704	245.14	2641	0.217	127	189	1.790	0.072
1995	2548	231.01	2495	0.204	61	200	1.820	0.080
1996	2378	216.64	2328	0.192	58	194	1.840	0.083
1997	2188	200.68	2137	0.178	69	218	1.874	0.102
1998	1973	181.86	1917	0.161	108	113	1.650	0.059
1999	1907	177.32	1843	0.157	164	141	1.744	0.077
2000	1800	168.24	1731	0.149	91	40	1.168	0.023
2001	1814	171.24	1758	0.152	107	42	1.116	0.024
2002	1830	173.72	1782	0.154	347	11	0.430	0.006
2003	1883	179.89	1827	0.159	148	8	0.423	0.004
2004	1937	186.11	1870	0.165	99	7	0.289	0.004
2005	2000	192.54	1916	0.170	149	8	0.307	0.004
2006	2067	198.82	1971	0.176	249	7	0.235	0.003
2007	2139	205.28	2044	0.182	260	8	0.398	0.004
2008	2213	211.19	2095	0.187	423	7	0.257	0.003
2009	2295	217.42	2154	0.192	337	6	0.338	0.003
2010	2382	223.59	2280	0.198	322	5	0.167	0.002
2011	2485	230.50	2370	0.204	251	6	0.217	0.002
2012	2598	237.73	2447	0.210	224	8	0.286	0.003
2013	2722	245.33	2535	0.217	509	8	0.235	0.003
2014	2858	253.92	2654	0.225	248	7	0.197	0.003
2015	3007	263.55	2786	0.233	326	10	0.268	0.003
2016	3166	273.78	2970	0.242	228	8	0.192	0.003
2017	3338	285.38	3152	0.253	117	14	0.390	0.004
2018	3512	297.29	3331	0.263	114	14	0.349	0.004

Table 8: Time series of population estimates from the base model. *(continued)*

Year	Total Biomass (mt)	Spawning output	Total Biomass 8+ (mt)	Fraction Unfished	Age-0 Recruits (1,000s)	Total Mortality (mt)	(1-SPR)/(1-SPR_-50%)	Exploitation Rate
2019	3695	310.98	3501	0.275	119	17	0.407	0.005
2020	3877	326.09	3664	0.289	119	16	0.297	0.004
2021	4065	343.67	3915	0.304	157	14	0.338	0.004
2022	4248	362.88	4108	0.321	179	24	0.483	0.006
2023	4412	382.50	4313	0.339	184	28	0.527	0.006
2024	4564	402.94	4488	0.357	195	10	0.221	0.002
2025	4732	426.87	4651	0.378	197	30	0.595	0.006
2026	4856	448.23	4769	0.397	200	31	0.588	0.006
2027	4971	469.51	4874	0.416	202	73	0.921	0.015
2028	5026	484.88	4916	0.429	203	73	0.915	0.015
2029	5072	498.65	4955	0.441	204	73	0.910	0.015
2030	5110	510.37	4990	0.452	205	73	0.905	0.015
2031	5142	519.89	5018	0.460	206	72	0.899	0.014
2032	5168	527.28	5043	0.467	206	72	0.894	0.014
2033	5190	532.81	5064	0.472	207	71	0.888	0.014
2034	5209	536.85	5082	0.475	207	70	0.884	0.014
2035	5226	539.78	5098	0.478	207	69	0.878	0.014
2036	5241	541.94	5112	0.480	207	68	0.872	0.013

Label	Base	CA.REC.index	OR.REC.index	WA.REC.index	CA.CPFV.index	ORBS.index	AFSC.triennial.index	NWF tom.t dex
Diff. in likelihood from base model								
Total	0	4.24	-26.23	4.15	-160.13	-103.85	-25.46	-1461
Index	0	4.109	-26.403	3.972	6.761	3.485	1.172	5.527
Length comp	0	0.08	0.09	-2.33	-163.47	-99	-24.41	-83.5
Age comp	0	0.04	-0.72	2.46	-5.2	-8.42	-2.26	-1378
Recruitment	0	-0.042	0.843	-0.028	1.772	0.12	0.059	-4.75
Parm priors	0	0	0	0	0	0	0	0
Estimates of key parameters								
Recruitment unfished thousands	229.328	224.516	237.639	219.483	234.057	230.024	230.61	231.8
log(R0)	5.435	5.414	5.471	5.391	5.456	5.438	5.441	5.446
M Female	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
L at Amax Female	61.4	61.4	61.4	61.4	61.4	61.4	61.3	61.5
Estimates of derived quantities								
Unfished age 4+ bio 1000 mt	9.803	9.6	10.159	9.378	10.009	9.849	9.846	9.944
B0 trillions of eggs	1129.7	1106.36	1170.65	1080.56	1153.48	1135.74	1133.93	1143.
B2025 trillions of eggs	426.872	406.706	458.975	385.859	448.198	439.599	434.007	433.6
Fraction unfished 2025	0.378	0.368	0.392	0.357	0.389	0.387	0.383	0.379
Fishing intensity 2024	0.221	0.231	0.208	0.241	0.212	0.216	0.218	0.222

Label	Base	CA.REC.index	OR.REC.index	WA.REC.index	CA.CPFV.index	ORBS.index	AFSC.triennial.index	NWF tom.t dex
Diff. in likelihood from base model								
Total	0	4.24	-26.23	4.15	-160.13	-103.85	-25.46	-1461
Index	0	4.109	-26.403	3.972	6.761	3.485	1.172	5.527
Length comp	0	0.08	0.09	-2.33	-163.47	-99	-24.41	-83.5
Age comp	0	0.04	-0.72	2.46	-5.2	-8.42	-2.26	-1378
Recruitment	0	-0.042	0.843	-0.028	1.772	0.12	0.059	-4.75
Parm priors	0	0	0	0	0	0	0	0
Estimates of key parameters								
Recruitment unfished thousands	229.328	224.516	237.639	219.483	234.057	230.024	230.61	231.8
log(R0)	5.435	5.414	5.471	5.391	5.456	5.438	5.441	5.446
M Female	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
L at Amax Female	61.4	61.4	61.4	61.4	61.4	61.4	61.3	61.5
Estimates of derived quantities								
Unfished age 4+ bio 1000 mt	9.803	9.6	10.159	9.378	10.009	9.849	9.846	9.944
B0 trillions of eggs	1129.7	1106.36	1170.65	1080.56	1153.48	1135.74	1133.93	1143.
B2025 trillions of eggs	426.872	406.706	458.975	385.859	448.198	439.599	434.007	433.6
Fraction unfished 2025	0.378	0.368	0.392	0.357	0.389	0.387	0.383	0.379
Fishing intensity 2024	0.221	0.231	0.208	0.241	0.212	0.216	0.218	0.222

Table 11: Summary of reference points and management quantities, including estimates of the 95 percent confidence intervals. SO is spawning output, SPR is the spawning potential ratio, and MSY is maximum sustainable yield.

Reference Point	Estimate	Lower Interval	Upper Interval
Unfished Spawning output	1,129.7	992.2	1,267.2
Unfished Age 8+ Biomass (mt)	9,803	8,612	10,995
Unfished Recruitment (R0)	229	201	257
2025 Spawning output	427	339	515
2025 Fraction Unfished	0.378	0.327	0.429
Reference Points Based SO40%	—	—	—
Proxy Spawning output SO40%	452	397	507
SPR Resulting in SO40%	0.459	0.459	0.459
Exploitation Rate Resulting in SO40%	0.026	0.026	0.027
Yield with SPR Based On SO40% (mt)	115	101	130
Reference Points Based on SPR Proxy for MSY	—	—	—
Proxy Spawning output (SPR50)	503	442	565
SPR50	0.500	—	—
Exploitation Rate Corresponding to SPR50	0.023	0.023	0.023
Yield with SPR50 at SO SPR (mt)	111	97	124
Reference Points Based on Estimated MSY Values	—	—	—
Spawning output at MSY (SO MSY)	327	287	367
SPR MSY	0.359	0.358	0.361
Exploitation Rate Corresponding to SPR MSY	0.036	0.036	0.037
MSY (mt)	121	106	136

4.8.3 Management

Table 12: Potential OFLs (mt), ABCs (mt), ACLs (mt), the buffer between the OFL and ABC, estimated spawning output, and fraction of unfished spawning output with adopted OFLs and ACLs and assumed catch for the first two years of the projection period.

Year	Adopted OFL (mt)	Adopted ACL (mt)	Assumed Catch (mt)	OFL (mt)	Buffer	ABC (mt)	ACL (mt)	Spawning output	Fraction Unfished
2025	106	56	49	—	—	—	—	427	0.378
2026	108	57	50	—	—	—	—	448	0.397
2027	—	—	—	115	0.873	101	101	470	0.416
2028	—	—	—	117	0.864	101	101	485	0.429
2029	—	—	—	118	0.856	101	101	499	0.441
2030	—	—	—	119	0.848	101	101	510	0.452
2031	—	—	—	120	0.840	100	100	520	0.460
2032	—	—	—	120	0.832	100	100	527	0.467
2033	—	—	—	120	0.824	99	99	533	0.472
2034	—	—	—	120	0.817	98	98	537	0.475
2035	—	—	—	120	0.809	97	97	540	0.478
2036	—	—	—	121	0.801	97	97	542	0.480

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#   list(mod_low_B, mod_base_B, mod_high_B),
#   list(mod_low_C, mod_base_C, mod_high_C)
# )
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#Figures

#Figures

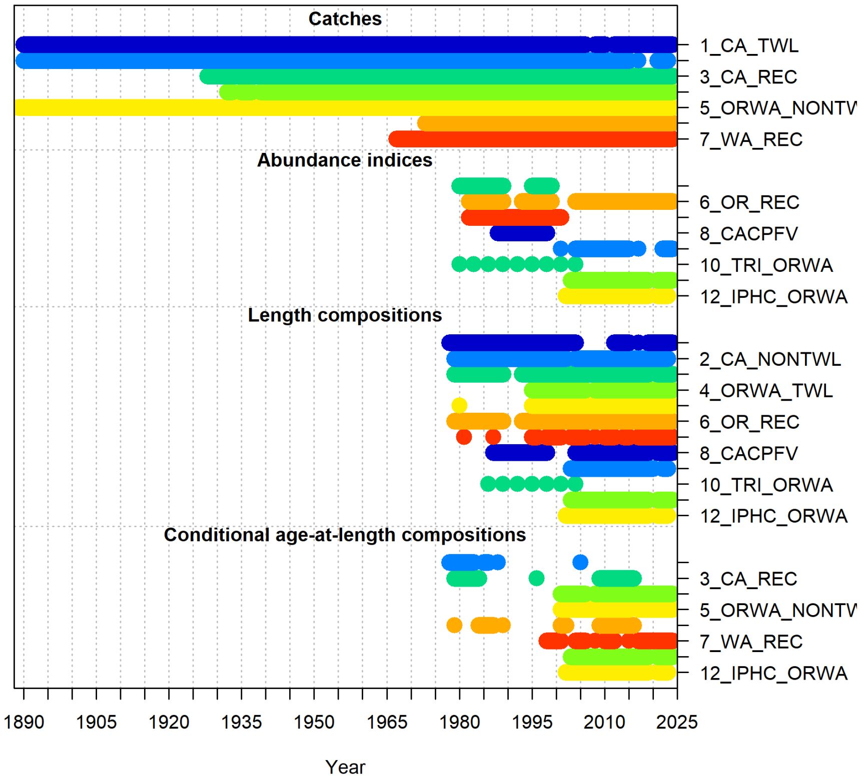

Figure 1: Summary of data sources used in the base model.

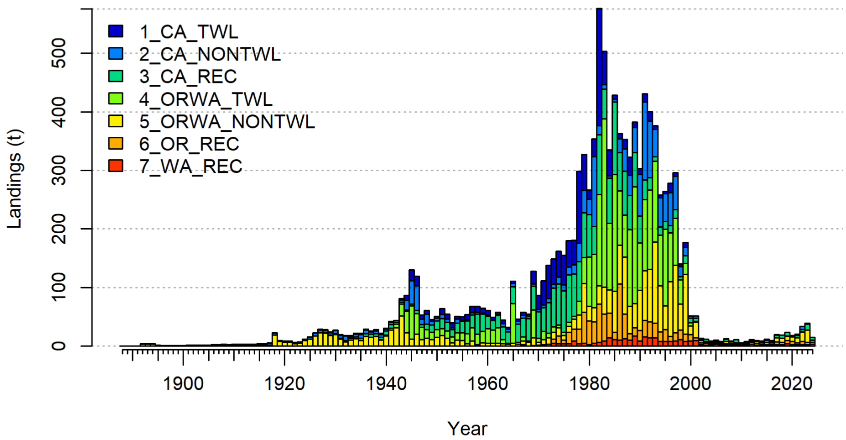

Figure 2: Landings (mt) by year and fleet.

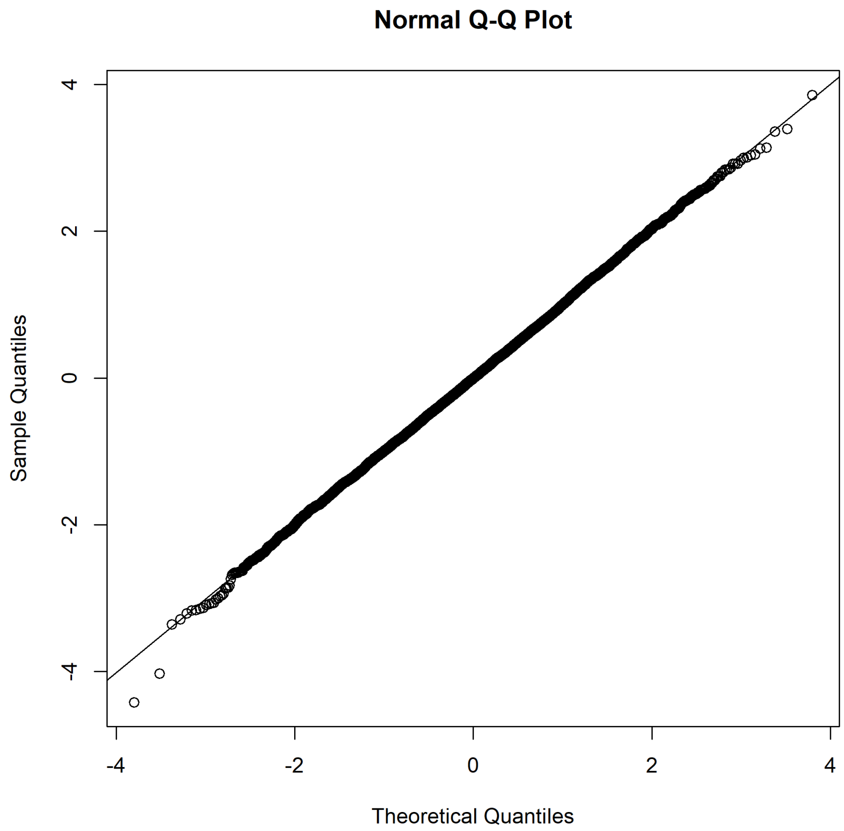

Figure 3: Quantile-quantile plot for the sdmTMB model fit for the Oregon Onboard Observer (ORFS) index.

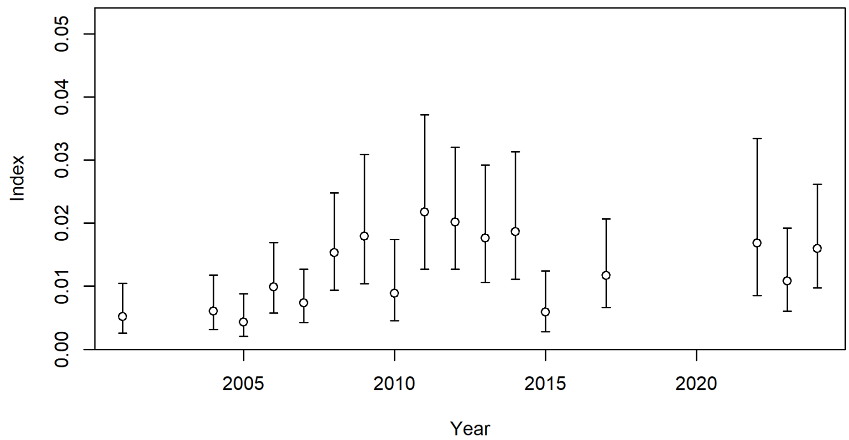

Figure 4: Annual relative index of abundance for the Oregon Onboard Observer (ORFS) index.

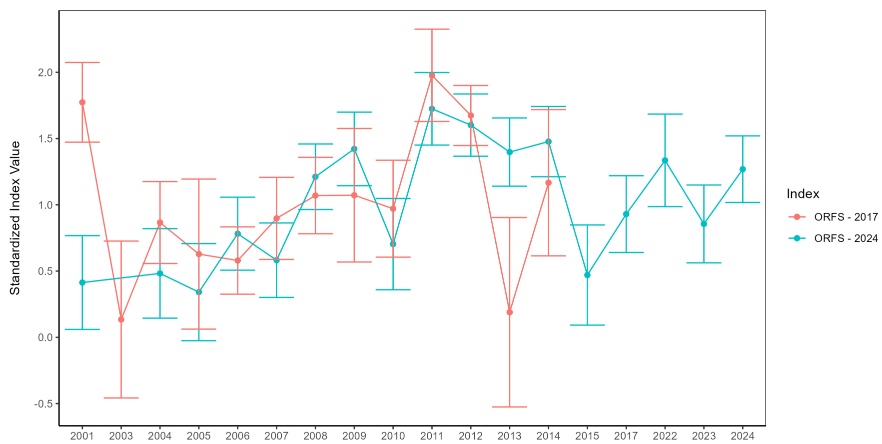

Figure 5: Comparison of Oregon Onboard Observer indices from the 2017 and the current assessment.

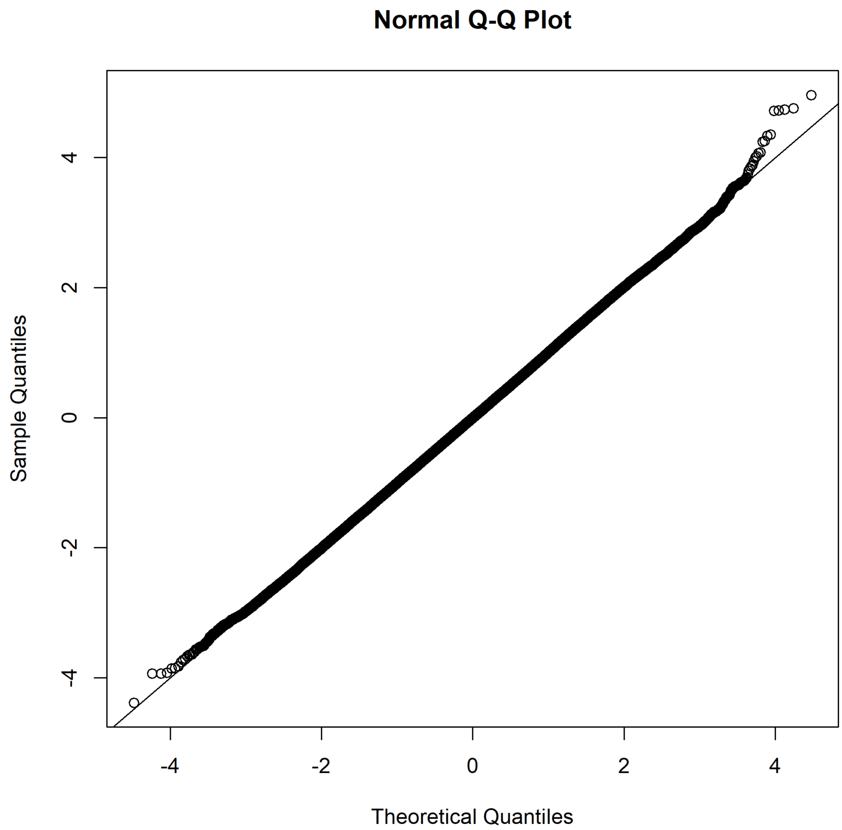

Figure 6: Quantile-quantile plot for the sdmTMB model fit for the updated portion of the Oregon recreational (ORBS) index.

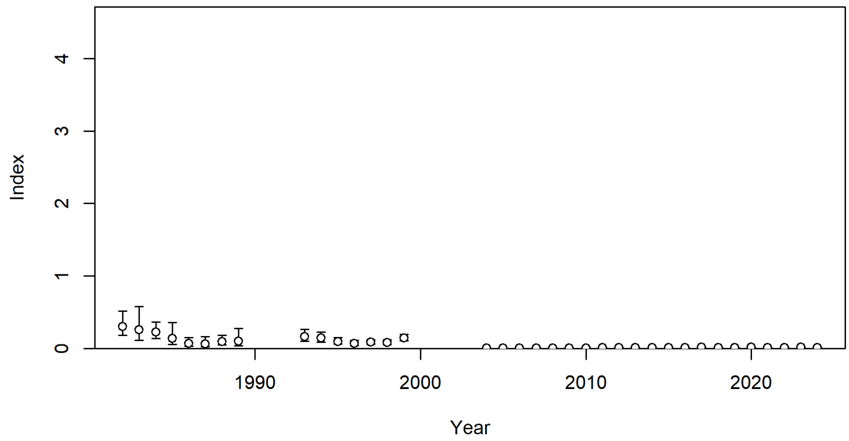

Figure 7: Annual relative index of abundance for the Oregon recreational index, including both MRFSS (1980 - 1999) and ORBS (2004 - 2024) indices.

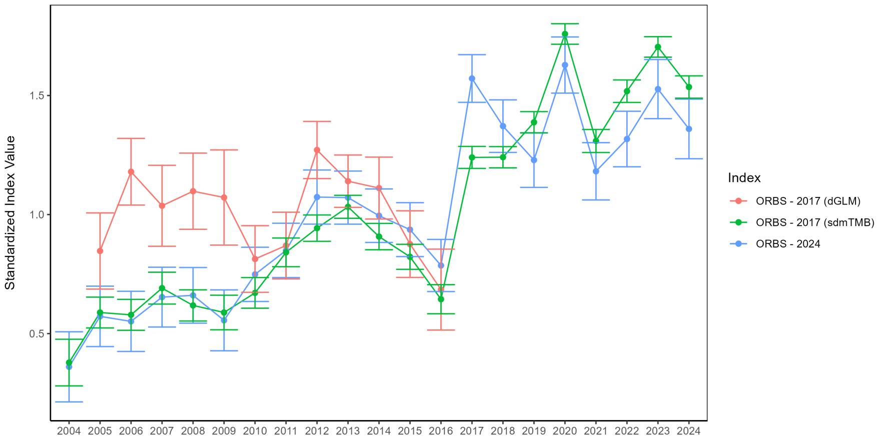

Figure 8: Comparison of the 2017 ORBS index (delta-GLM), the 2017 ORBS model (implemented in sdmTMB), and the current ORBS index (sdmTMB).

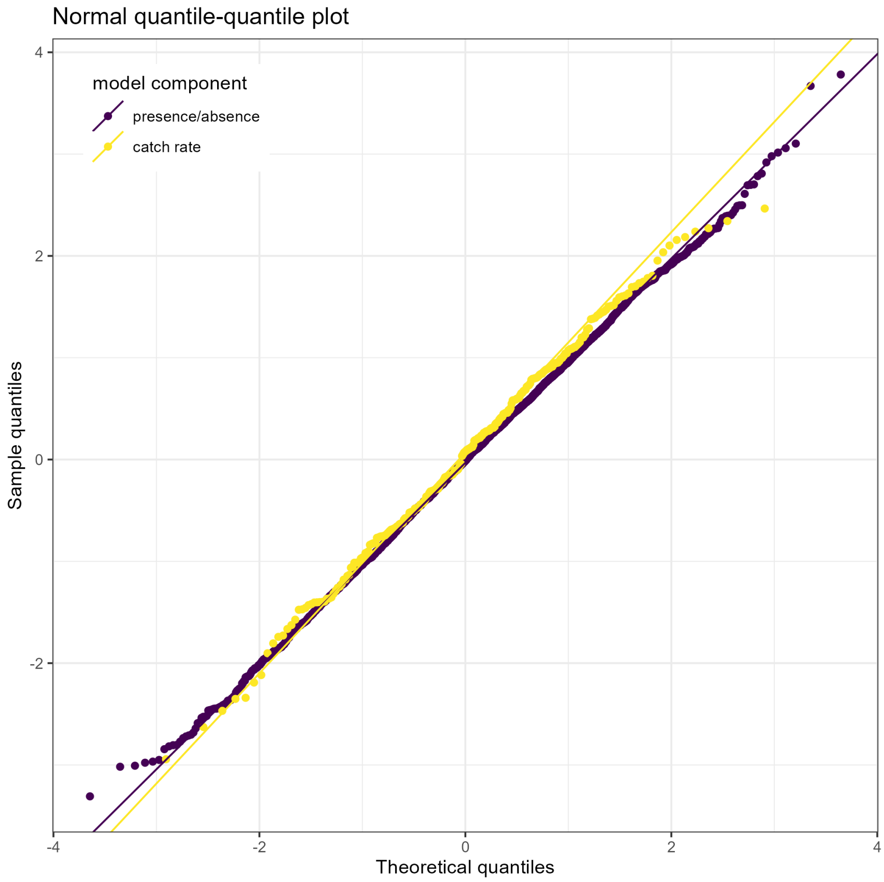

Figure 9: Quantile-quantile plot for the sdmTMB model fit for the NWFSC West Coast Groundfish Bottom Trawl Survey (WCGBTS) index.

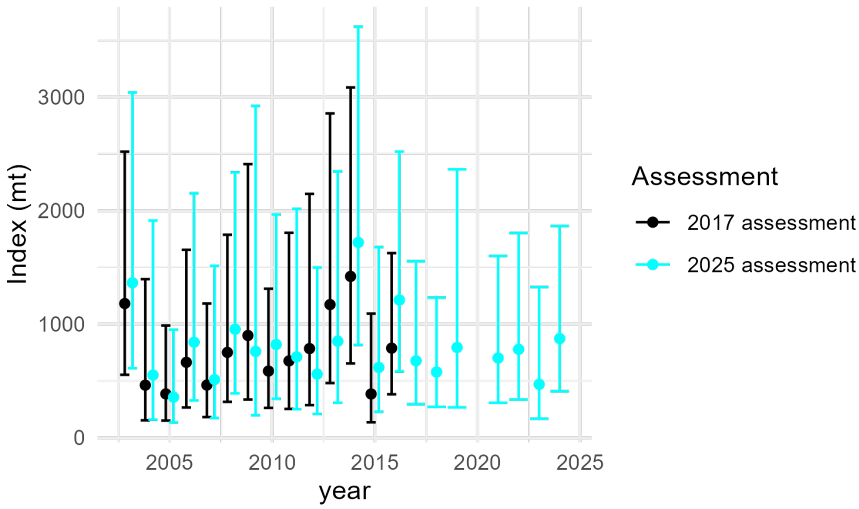

Figure 10: Comparison of the 2017 NWFSC West Coast Groundfish Bottom Trawl Survey (WCGBTS) and the current WCBTS index of abundance.

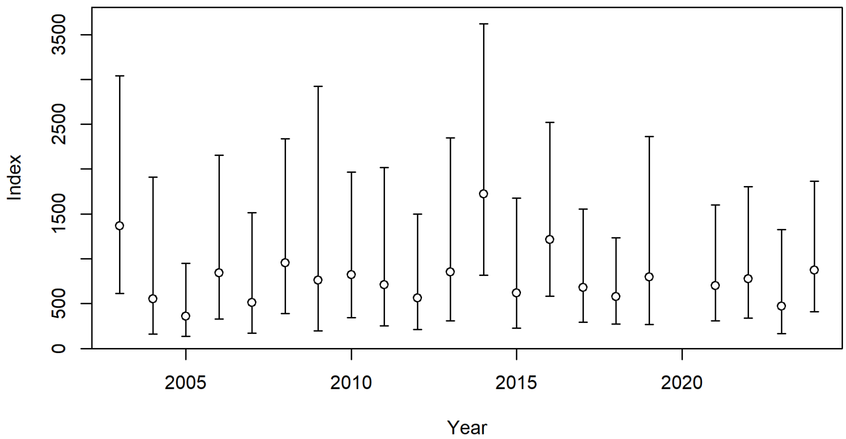

Figure 11: Annual relative index of abundance for the West Coast Groundfish Bottom Trawl Survey (WCGBTS).

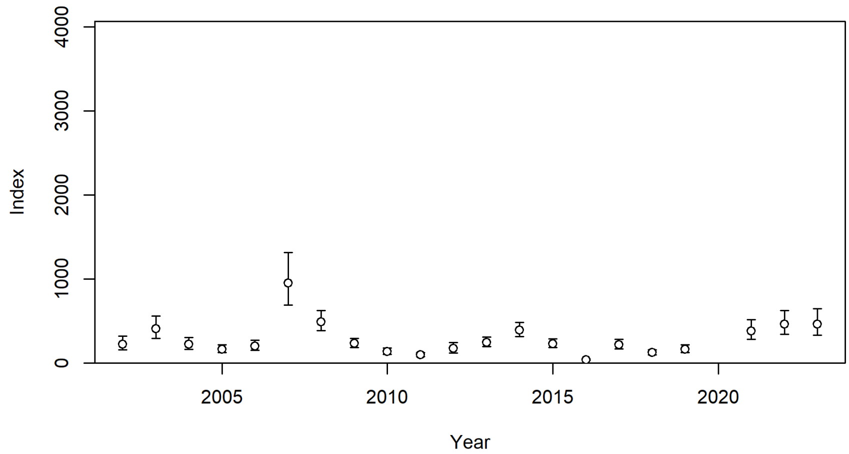

Figure 12: Annual relative index of abundance for the IPHC longline survey.

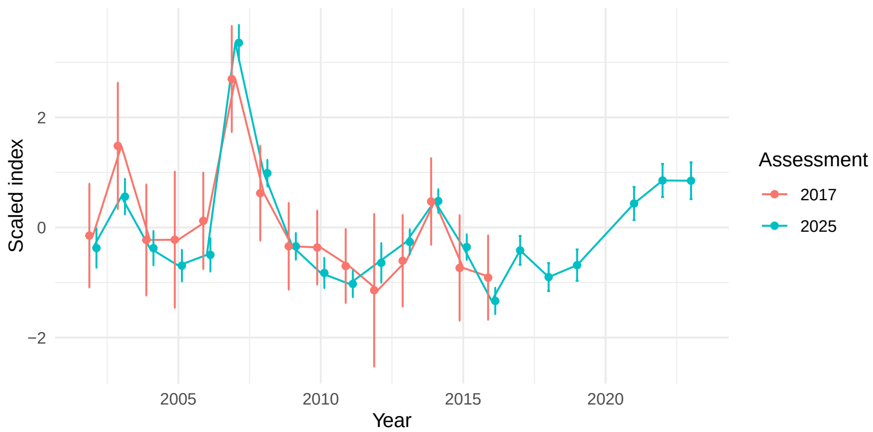

Figure 13: Comparison of the 2017 and the current IPHC index of abundance.

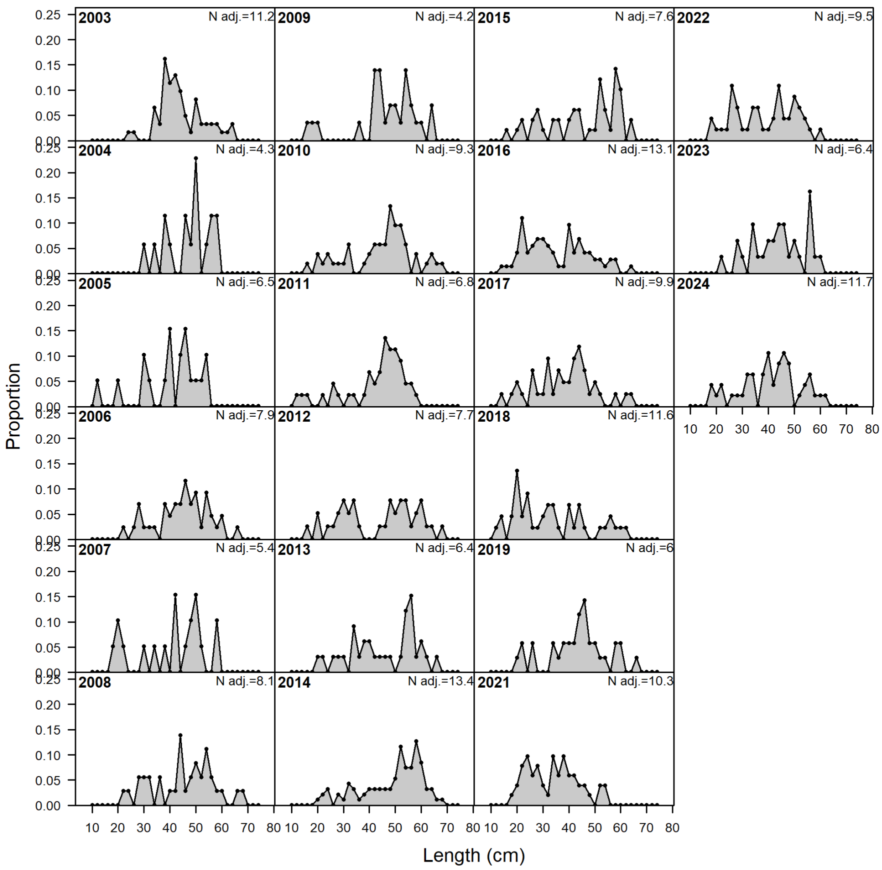

Figure 14: Annual length composition data for the WCBTS.

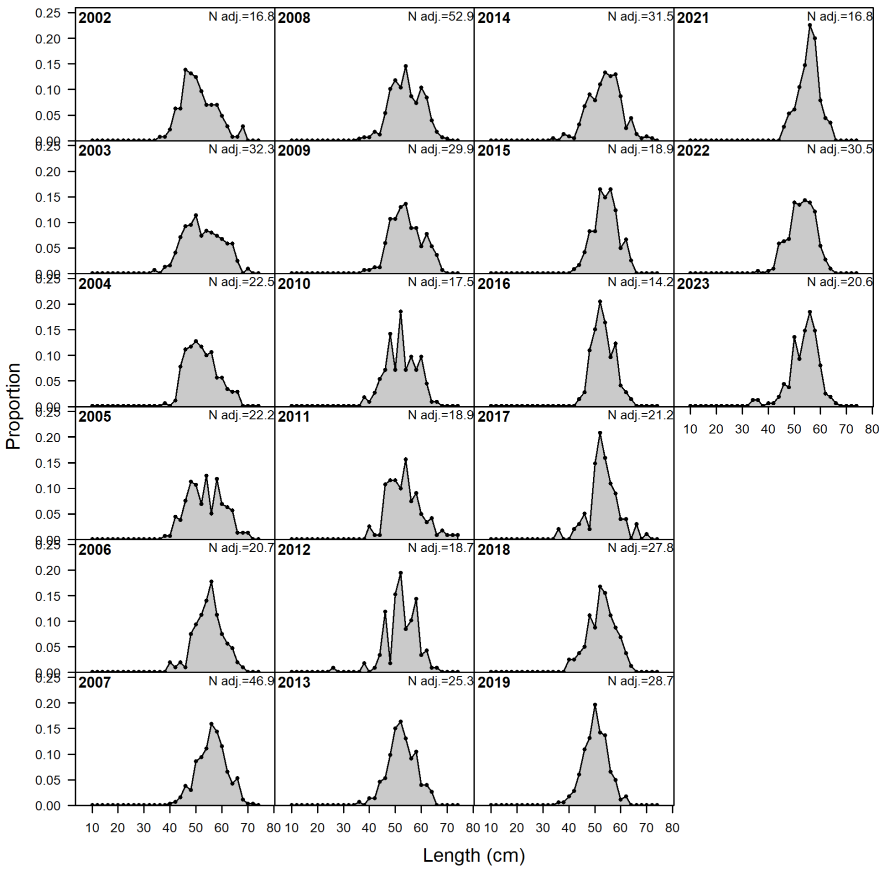

Figure 15: Annual length composition data from the IPHC longline survey.

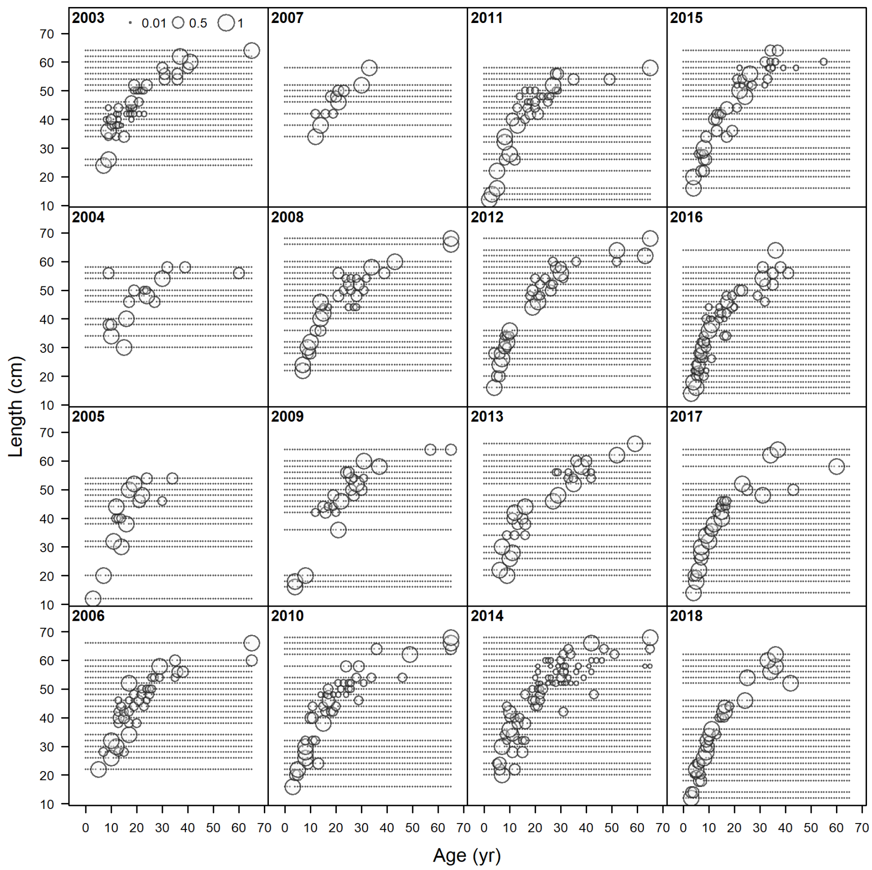

Figure 16: Annual unsexed conditional age-at-length data for the WCBTS (1 of 2).

5

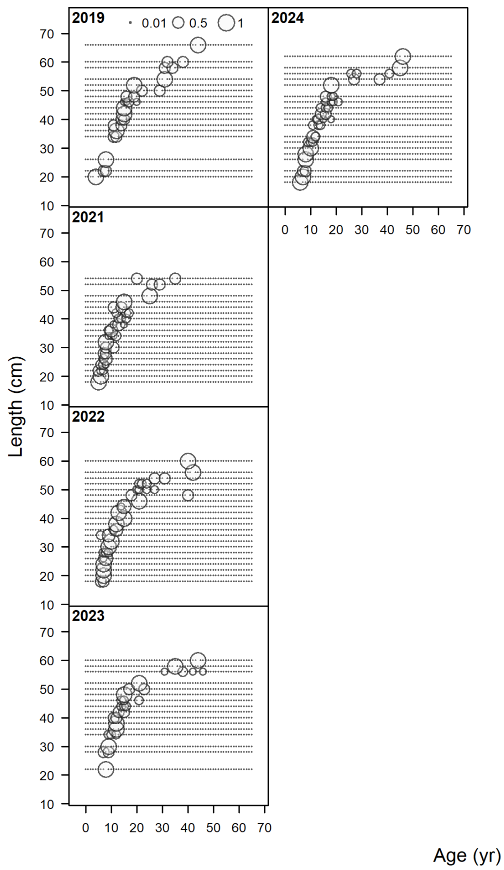

Figure 17: Annual unsexed conditional age-at-length data for the WCBTS (2 of 2).

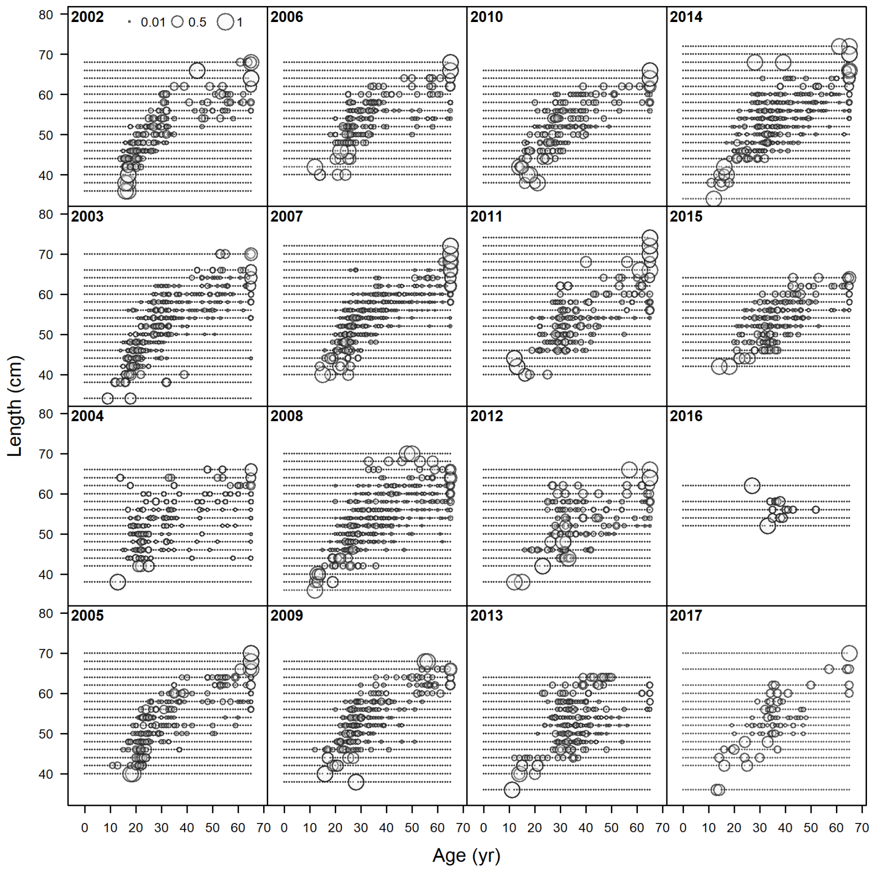

Figure 18: Annual unsexed conditional age-at-length data for the IPHC (1 of 2).

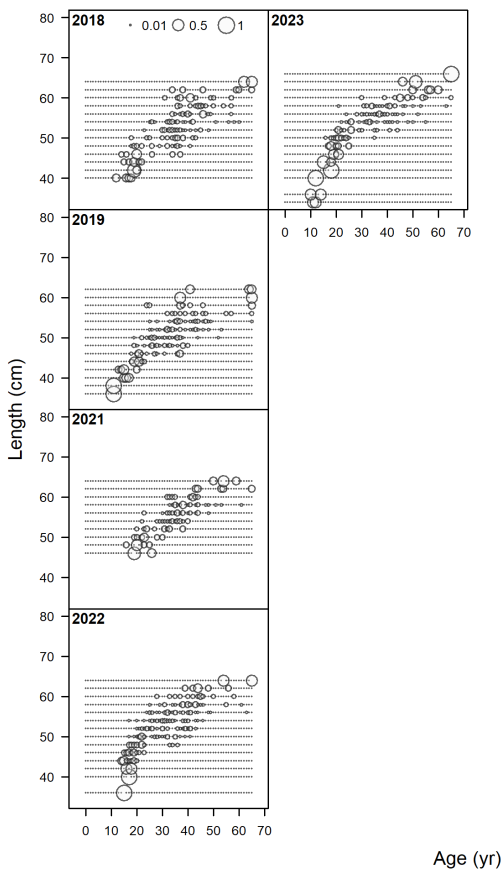

Figure 19: nnual unsexed conditional age-at-length data for the IPHC (1 of 2).

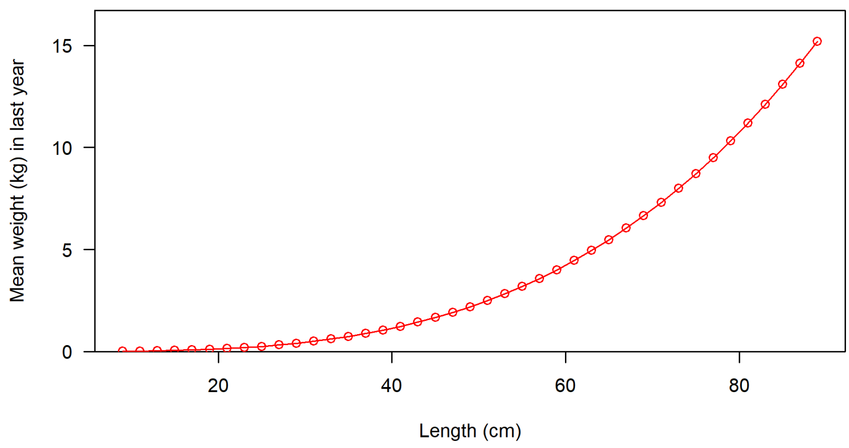

Figure 20: Updated weight-at-length relationship.

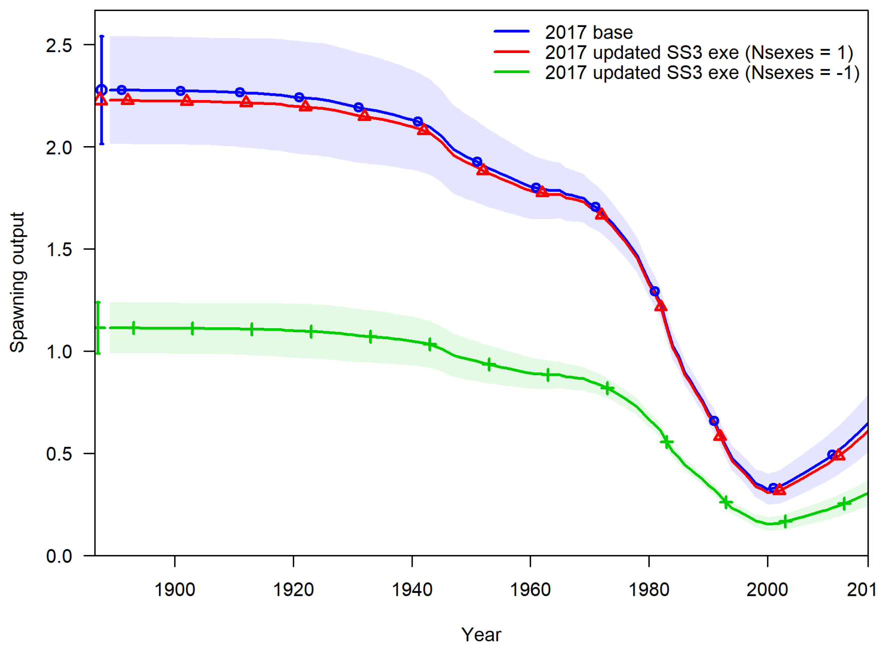

Figure 21: Comparison of the spawning output for the 2017 model with the updated SS3 executable and a single-sex model.

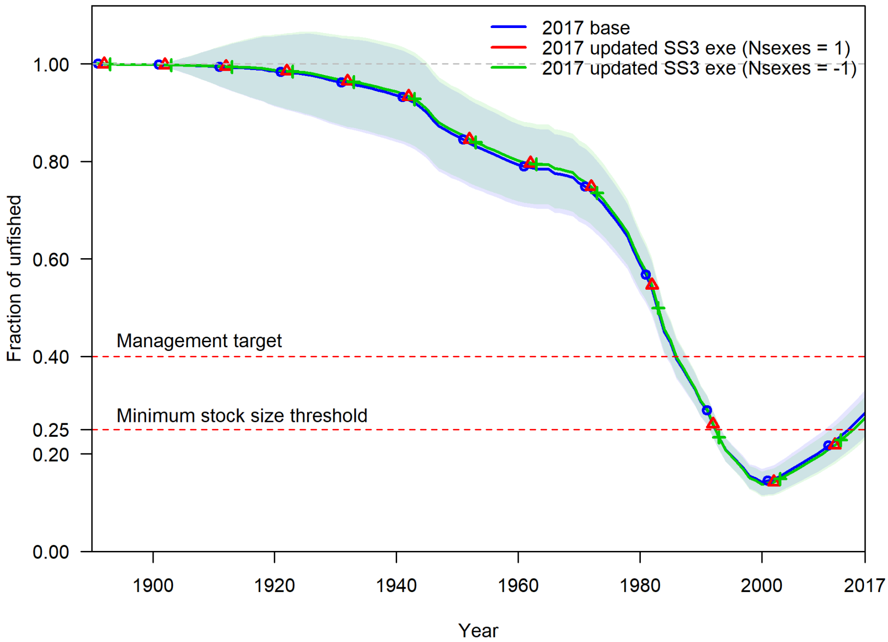

Figure 22: Comparison of the stock status for the 2017 model with the updated SS3 executable and a single-sex model.

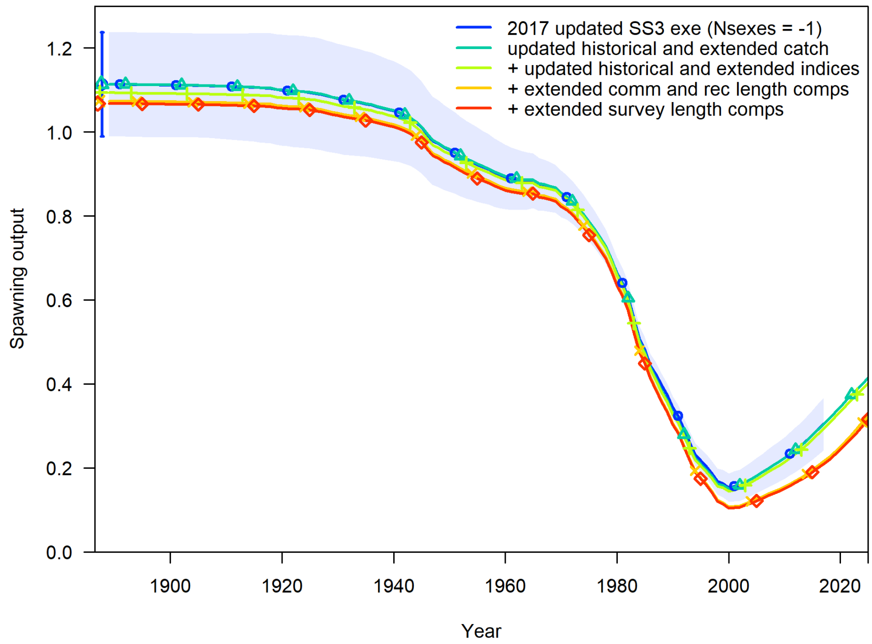

Figure 23: Comparison of the spawning output of the 2017 model with an updated SS3 executable (blue), updated catch data (dark green), updated indices (light green), new fishery length composition data (orange), and survey length composition data (red).

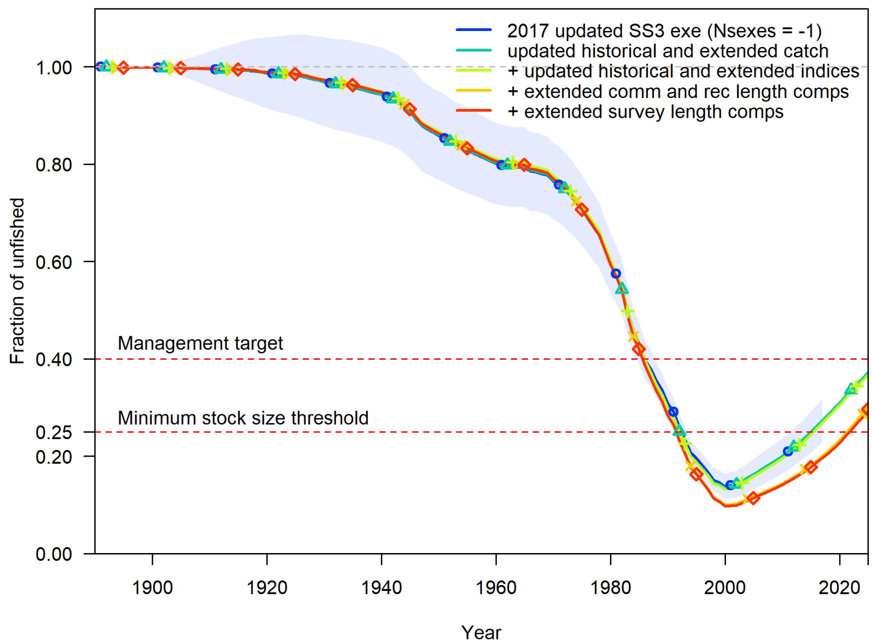

Figure 24: Comparison of the stock status of the 2017 model with an updated SS3 executable (blue), updated catch data (dark green), updated indices (light green), new fishery length composition data (orange), and survey length composition data (red).

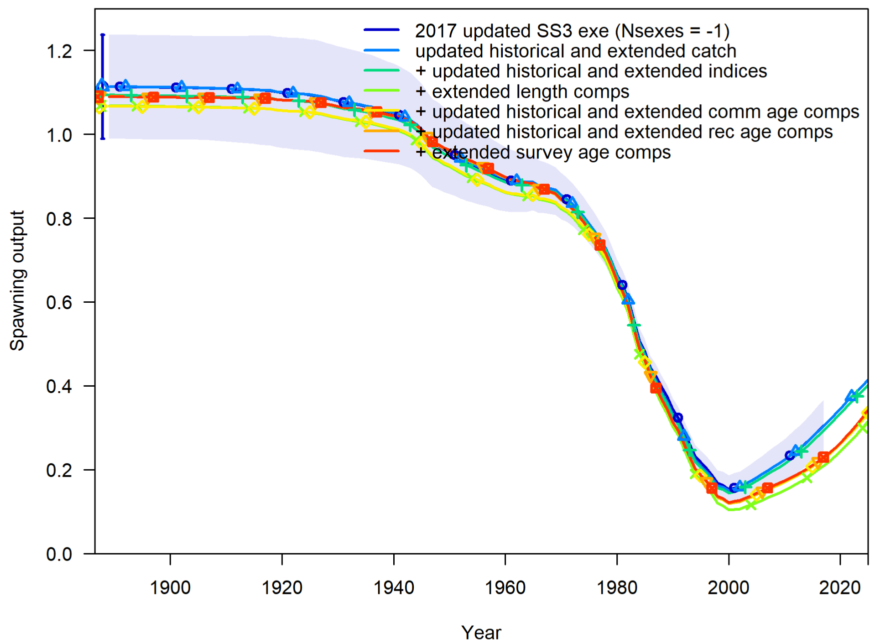

Figure 25: Comparison of the spawning output of the 2017 model with an updated SS3 executable (blue), updated catch data (light blue), updated indices (dark green), new fishery length composition data (light green), and commercial (yellow), recreational (orange), and survey (red) age composition data.

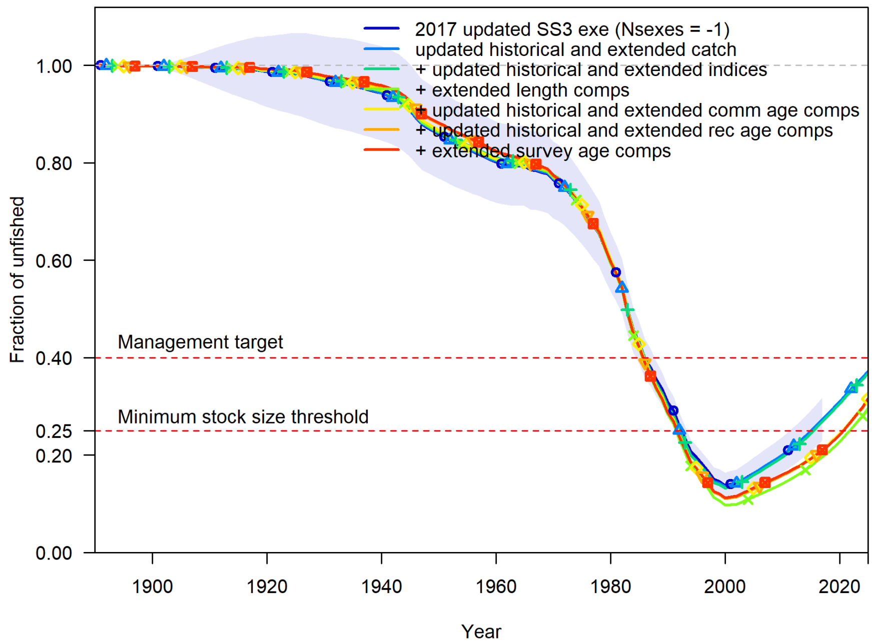

Figure 26: Comparison of the stock status of the 2017 model with an updated SS3 executable (blue), updated catch data (light blue), updated indices (dark green), new fishery length composition data (light green), and commercial (yellow), recreational (orange), and survey (red) age composition data.

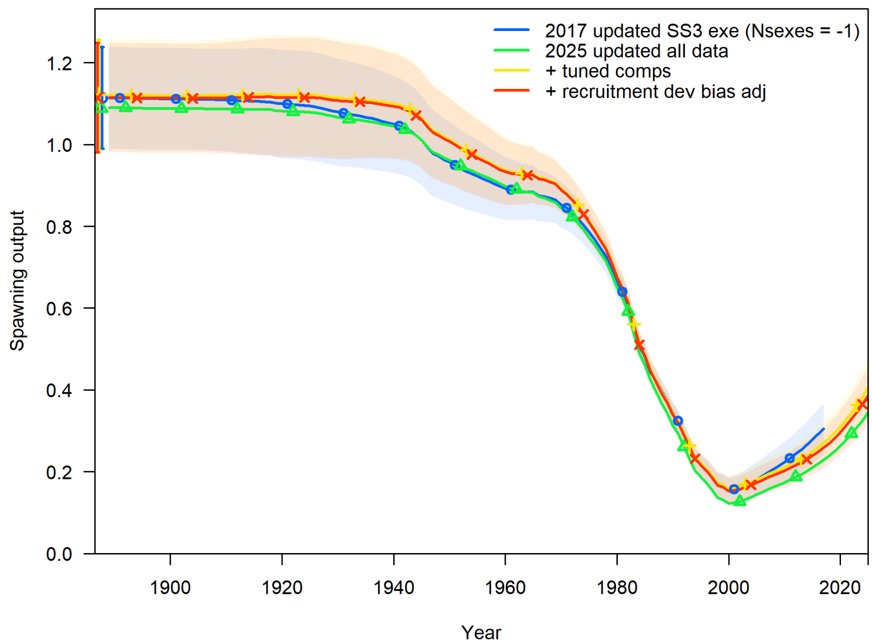

Figure 27: Comparison of the spawning output of the 2017 model with an updated SS3 executable (blue), 2025 model with all available updated data (green), with tuned compositional data (yellow), and with the updated recruitment bias adjustment ramp (red).

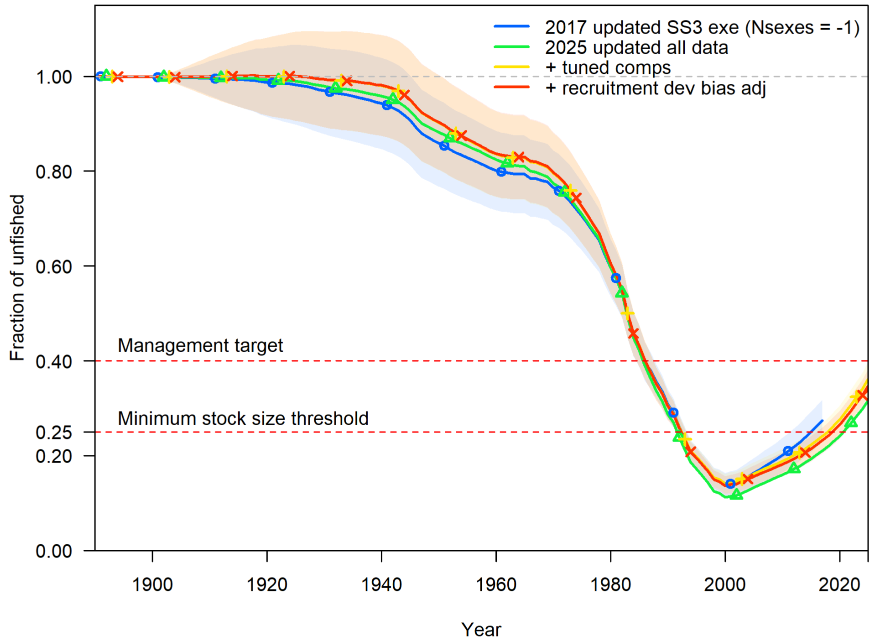

Figure 28: Comparison of the stock status of the 2017 model with an updated SS3 executable (blue), 2025 model with all available updated data (green), with tuned compositional data (yellow), and with the updated recruitment bias adjustment ramp (red).

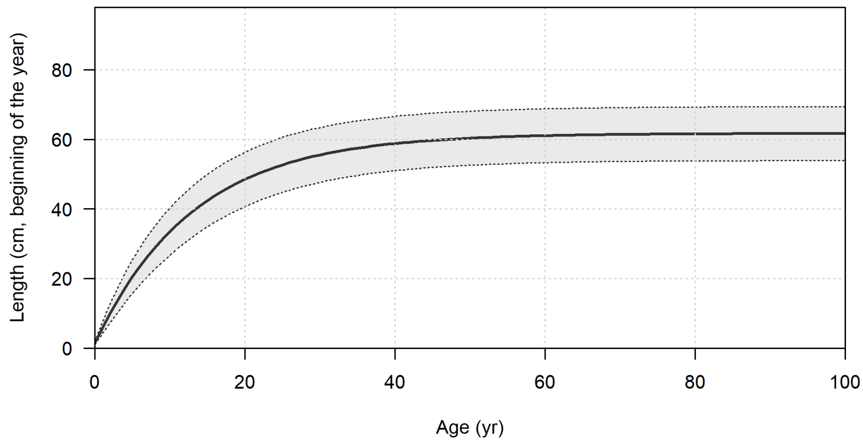

Figure 29: Length at age in the beginning of the year in the ending year of the model.

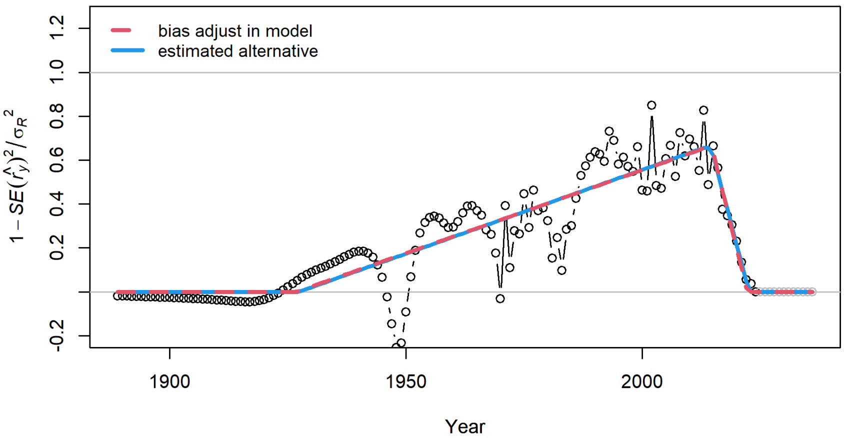

Figure 30: Points are transformed variances. Red line shows current settings for bias adjustment specified in the control file. Blue line shows least squares estimate of alternative bias adjustment relationship for recruitment deviations.

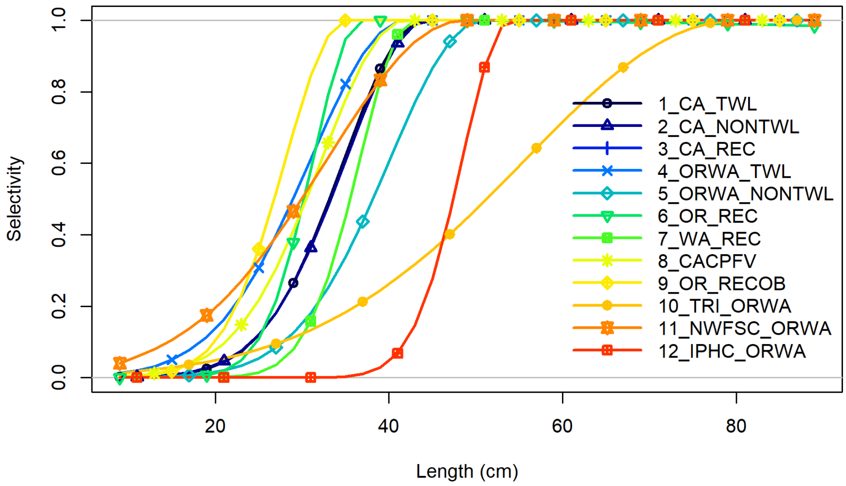

Figure 31: Estimated selectivity at length for all fleets.

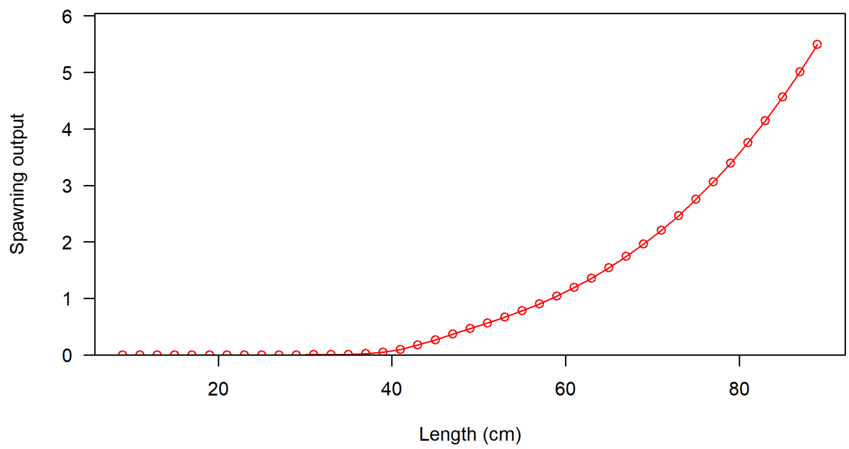

Figure 32: Spawning output at length.

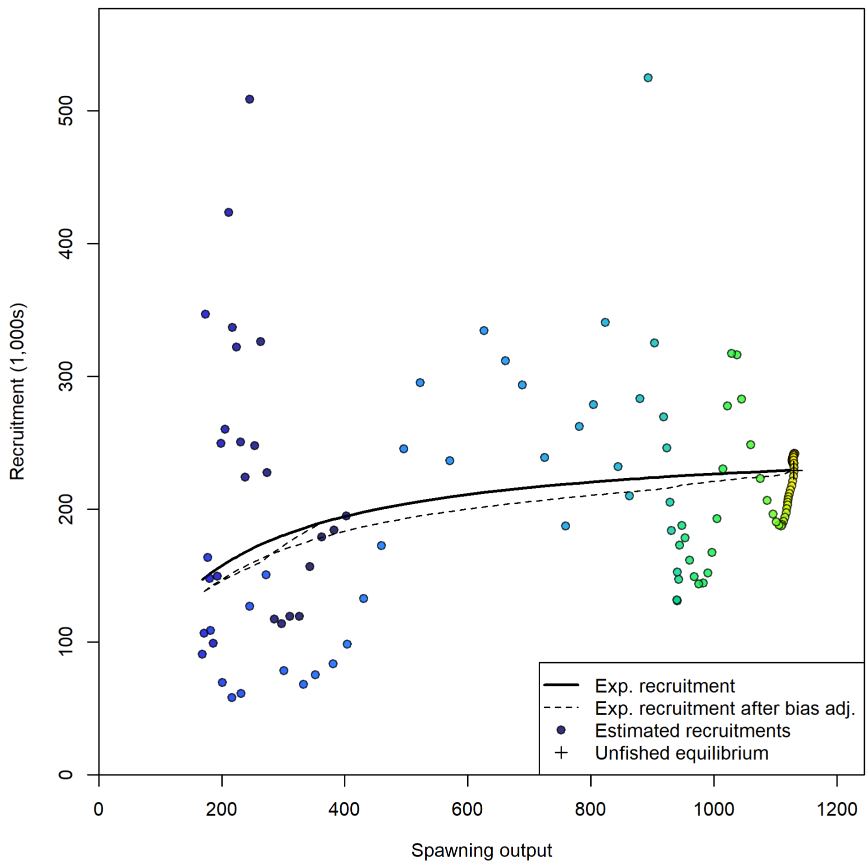

Figure 33: Stock-recruit curve. Point colors indicate year, with warmer colors indicating earlier years and cooler colors in showing later years.

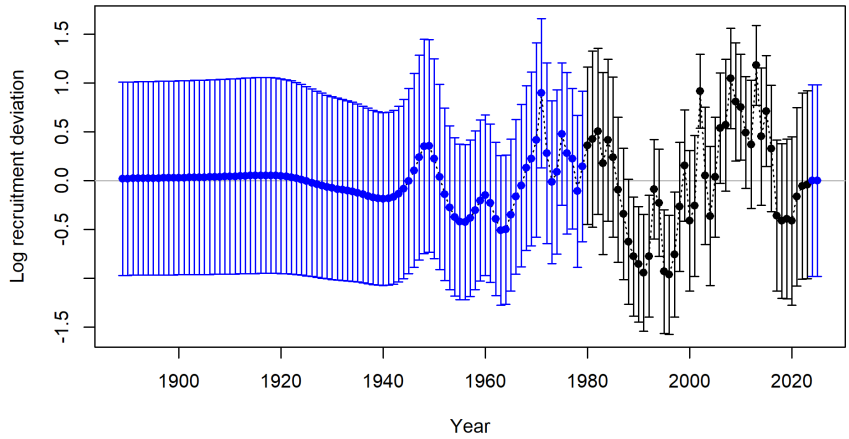

Figure 34: Estimated recruitment deviations with 95% intervals.

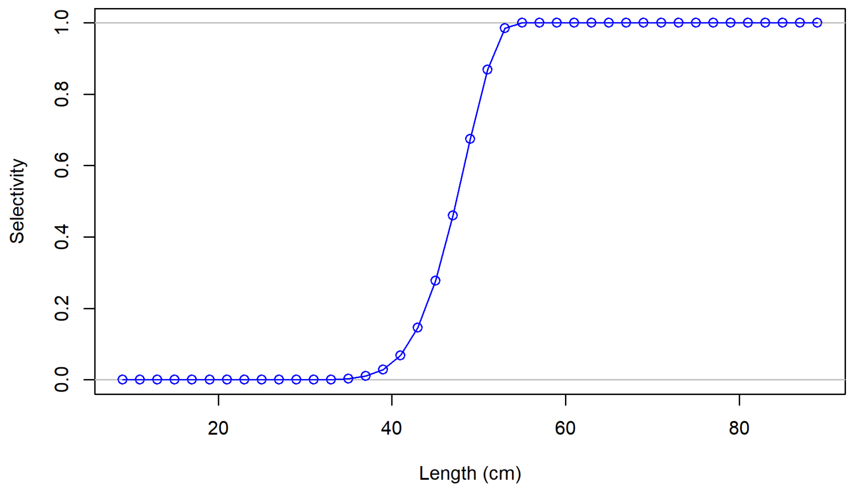

Figure 35: Estimated selectivity for the IPHC longline survey for Oregon/Washington (Fleet 12).

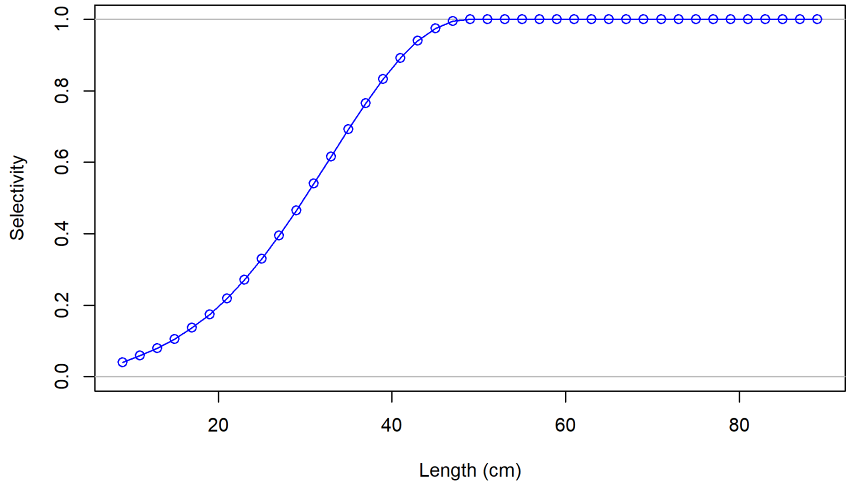

Figure 36: Estimated selectivity for the WCBTS for Oregon/Washington (Fleet 11).

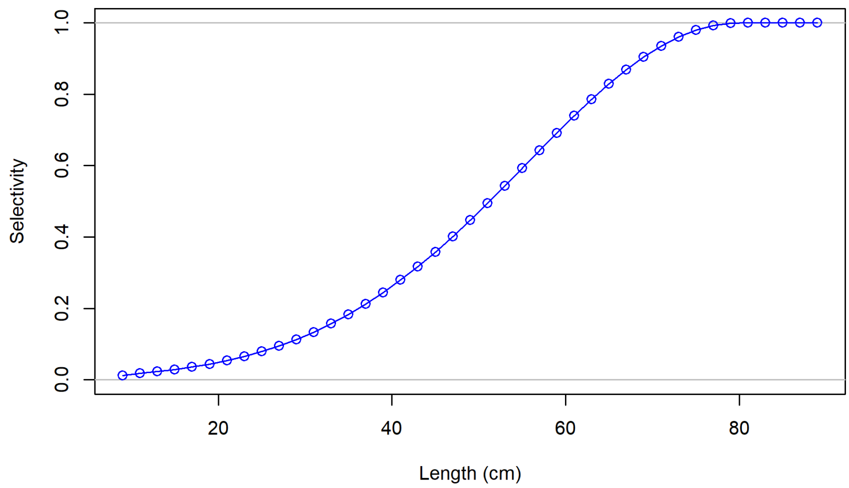

Figure 37: Estimated selectivity for the Triennial bottom trawl survey for Oregon/Washington (Fleet 10).

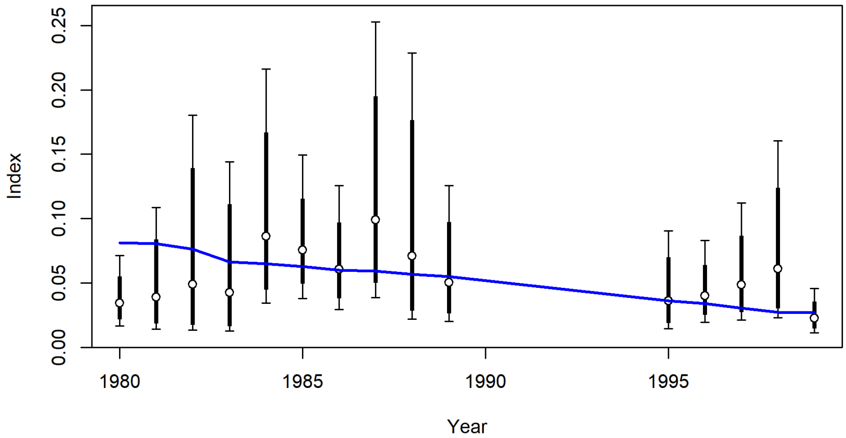

Figure 38: Fit to the California MRFSS recreational index.

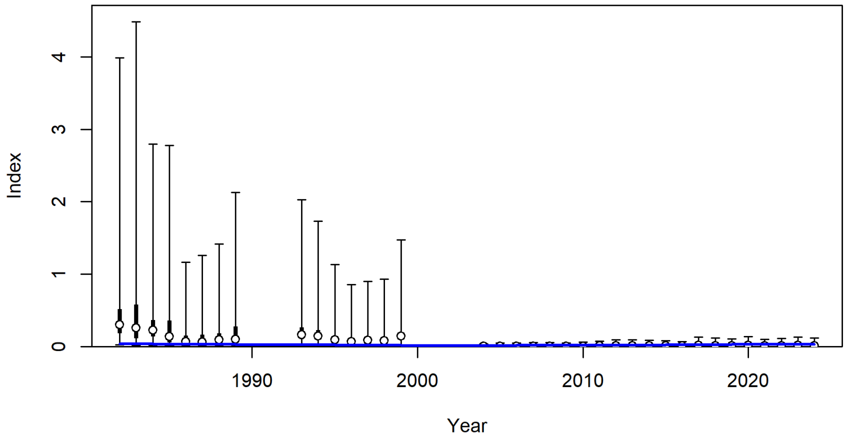

Figure 39: Fit to the Oregon recreational index.

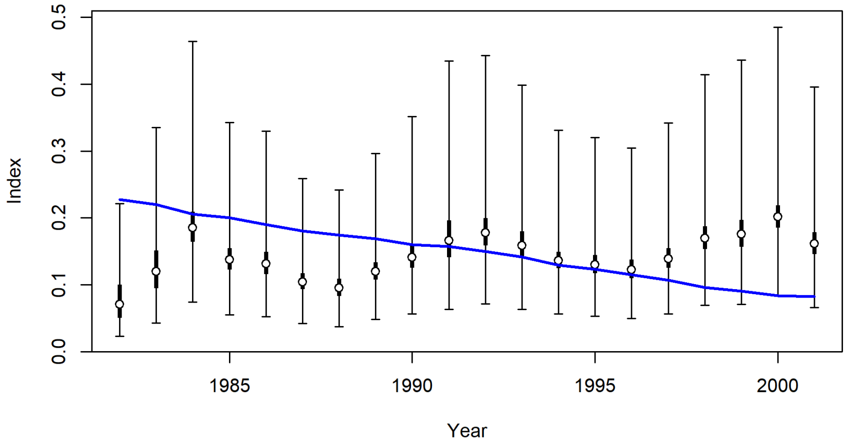

Figure 40: Fit to the Washington recreational index.

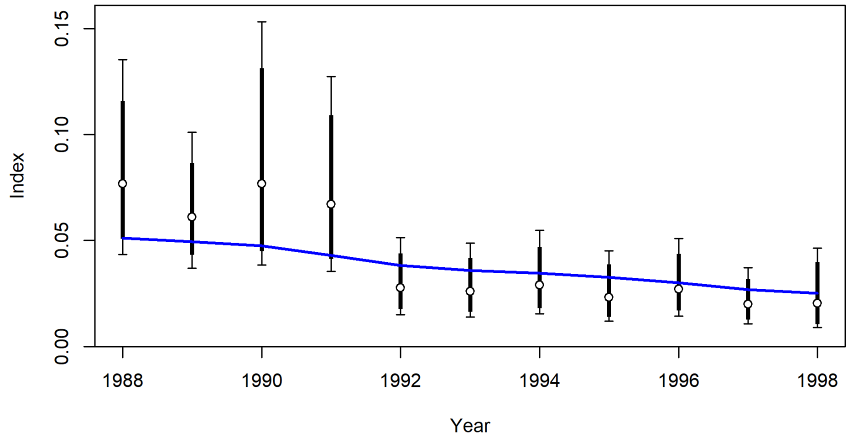

Figure 41: Fit to the California CPFV observer index.

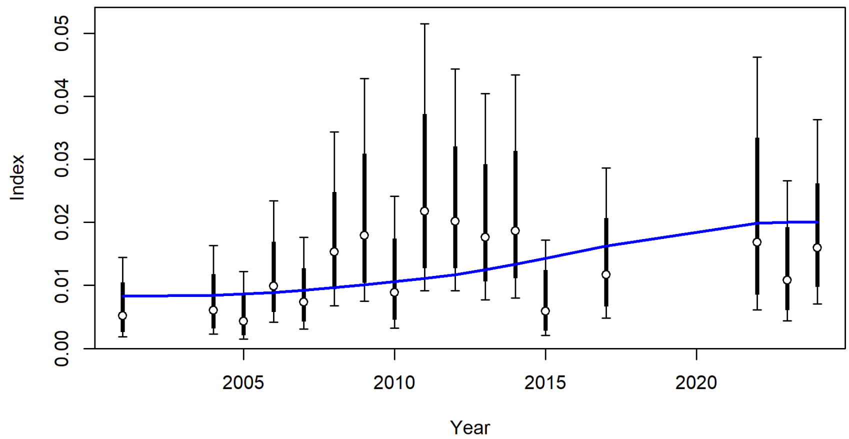

Figure 42: Fit to the Oregon onboard observer (ORFS) index.

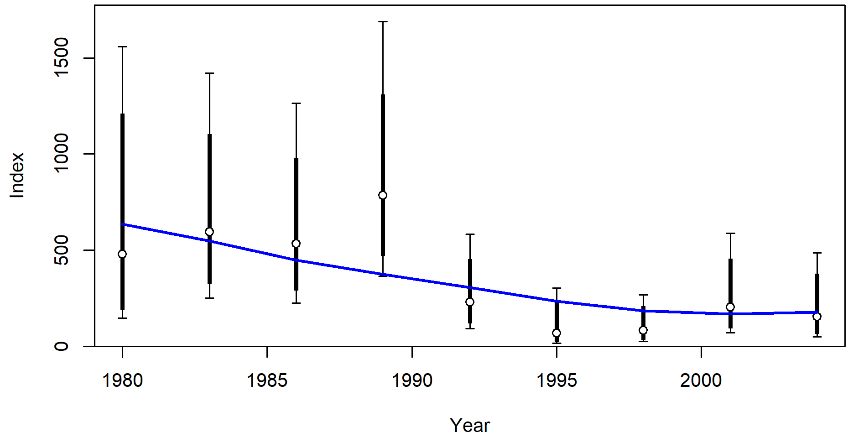

Figure 43: Fit to the Triennial survey index.

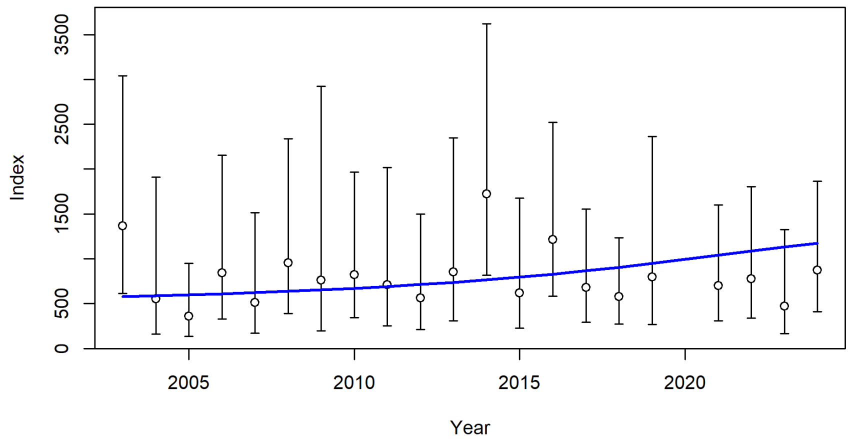

Figure 44: Fit to the WCBTS index.

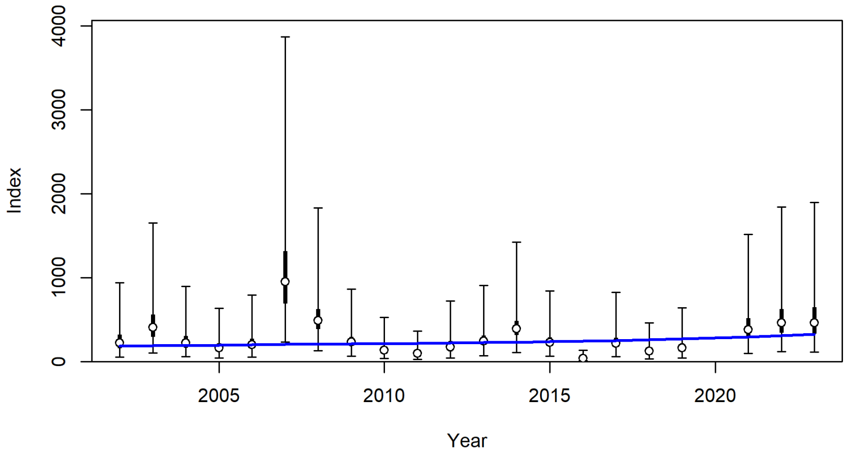

Figure 45: Fit to the IPHC survey index.

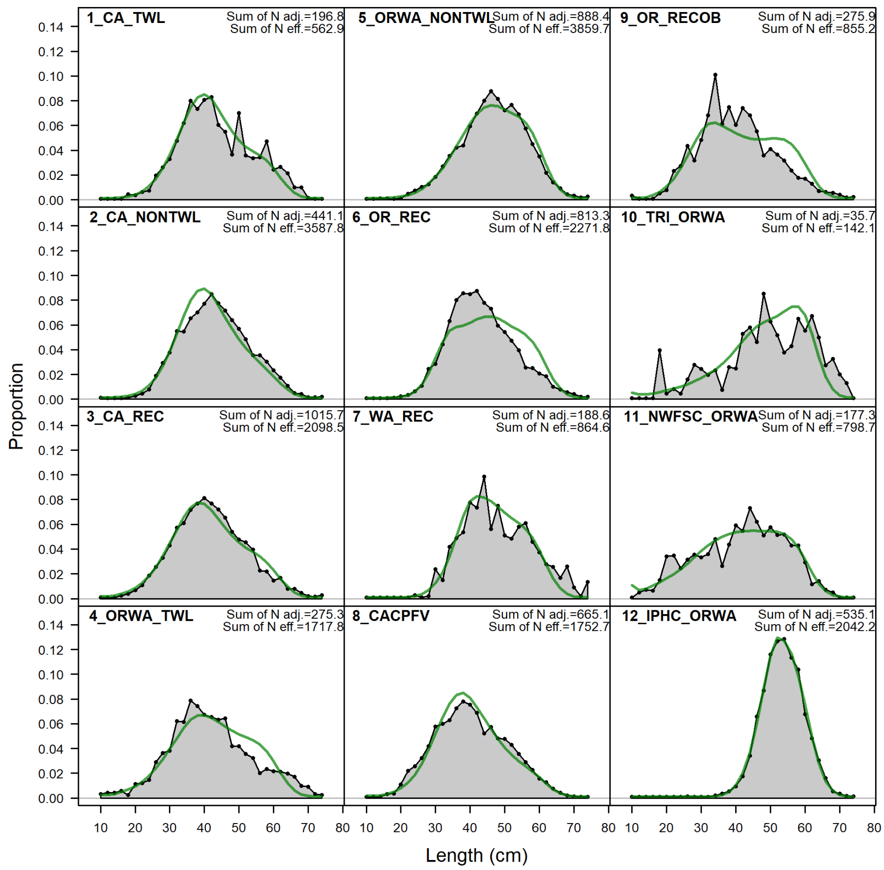

Figure 46: Fit to length composition data, aggregated across time by fleet.

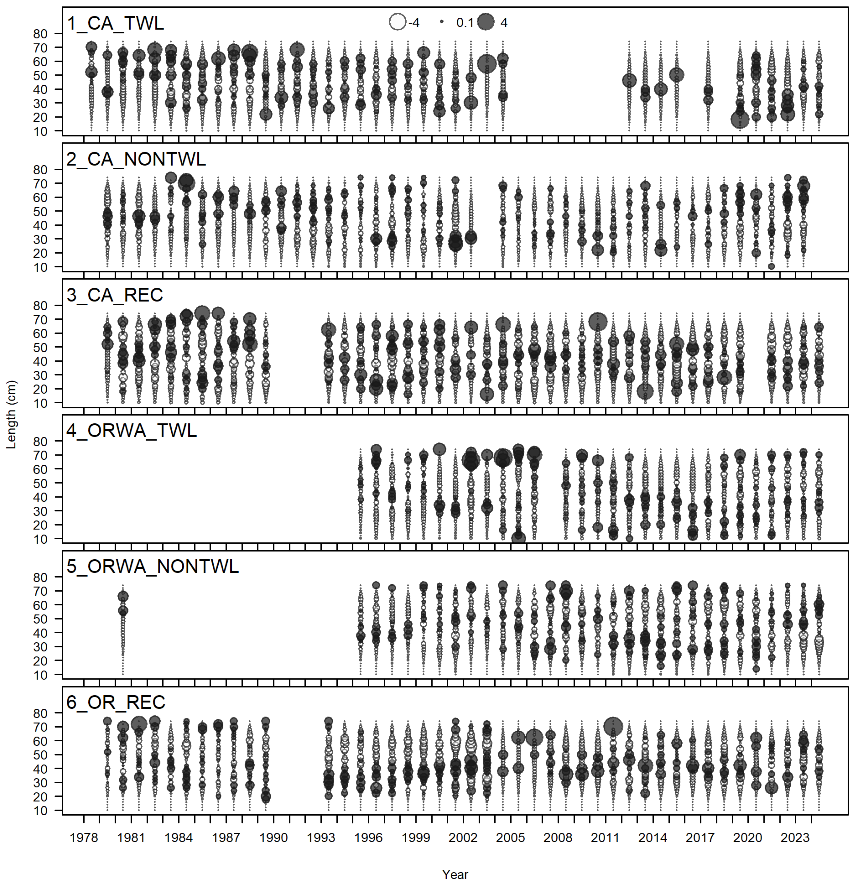

Figure 47: Pearson residuals, comparing across fleets, for length composition data (1 of 2). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

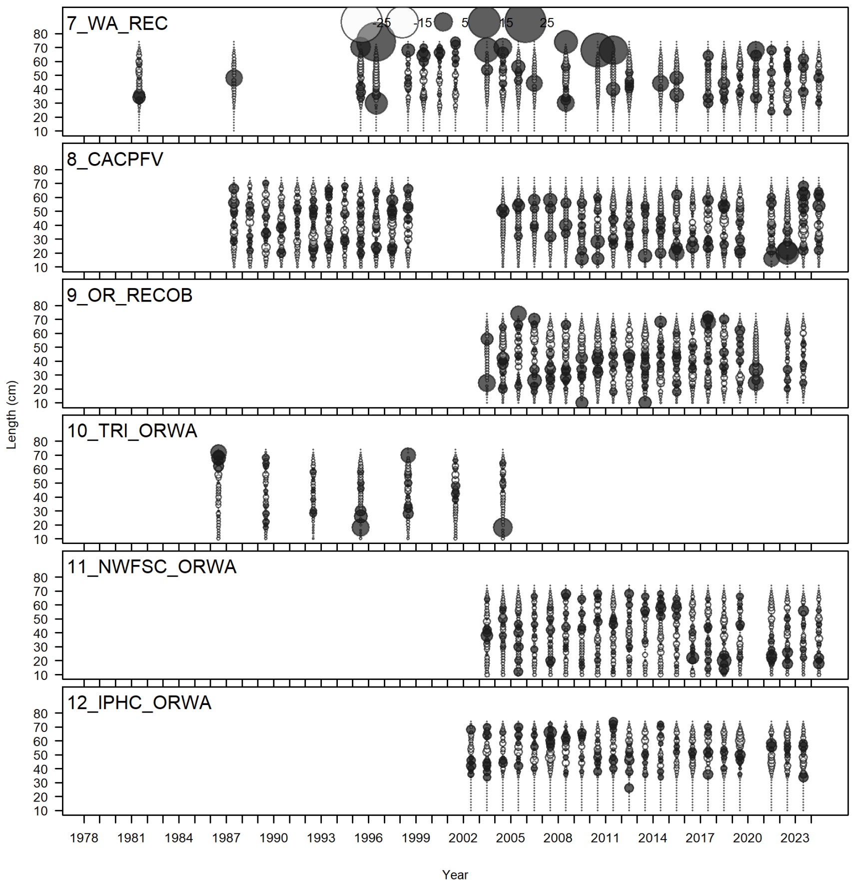

Figure 48: Pearson residuals, comparing across fleets, for length composition data (2 of 2). Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

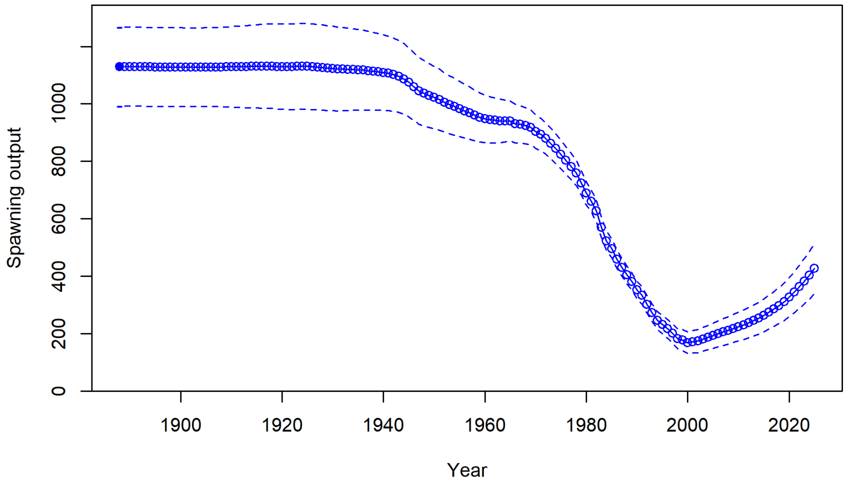

Figure 49: Estimated spawning output over time for both areas combined.

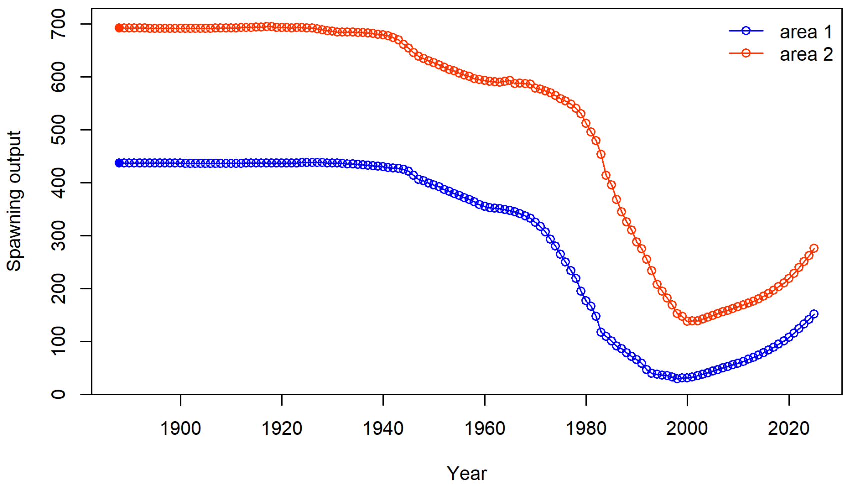

Figure 50: Estimated spawning output over time and by area (Area 1 is California, Area 2 is Oregon/Washington combined).

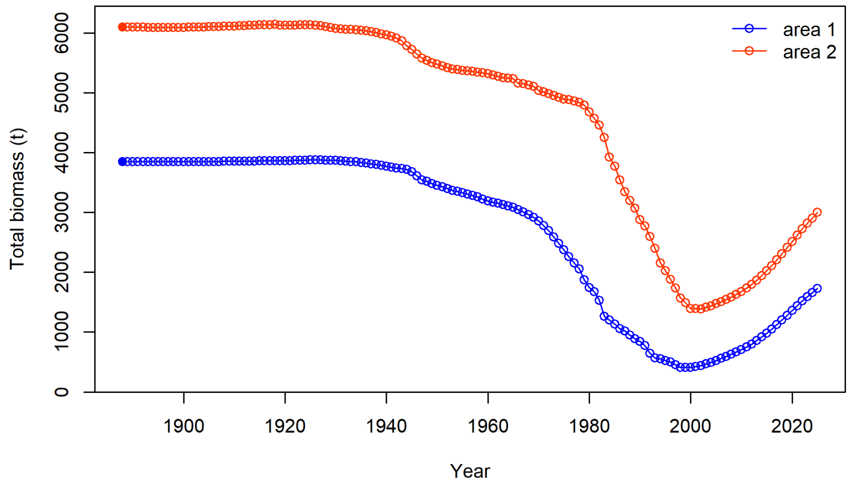

Figure 51: Total biomass (t) over time and by area (Area 1 is California, Area 2 is Oregon/Washington combined).

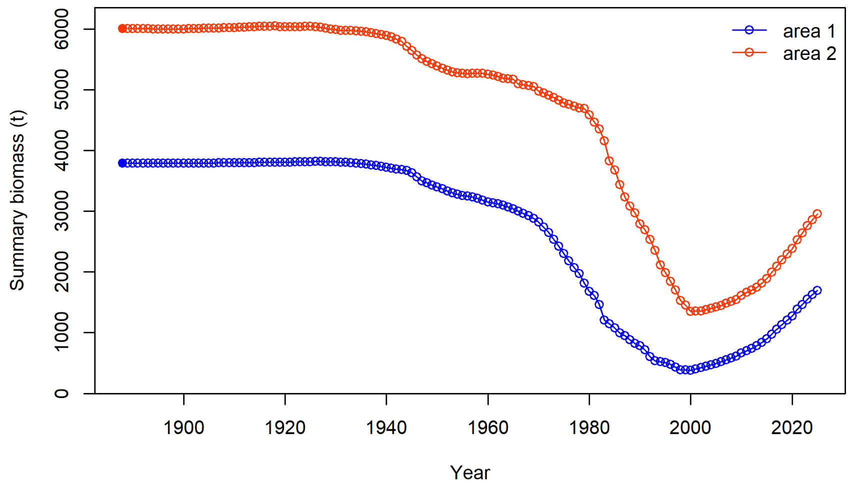

Figure 52: Summary biomass (t) over time and by area (Area 1 is California, Area 2 is Oregon/Washington combined).

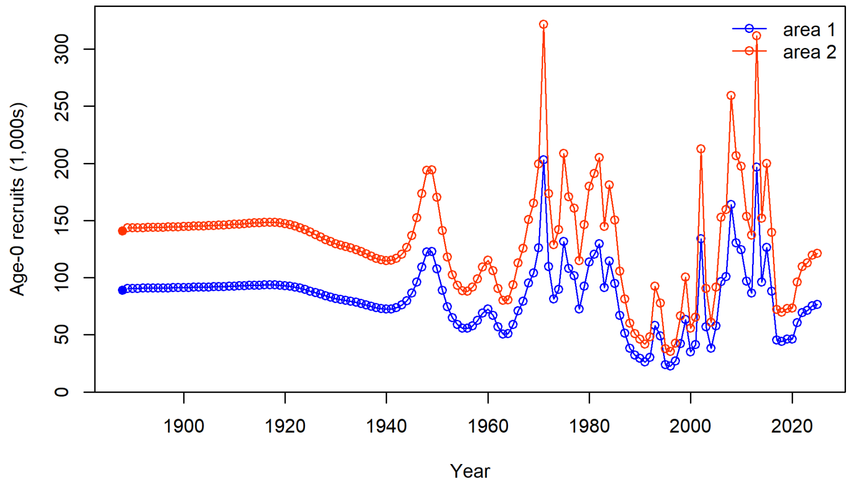

Figure 53: Age 0 recruits (1000s) over time and by area (Area 1 is California, Area 2 is Oregon/Washington combined).

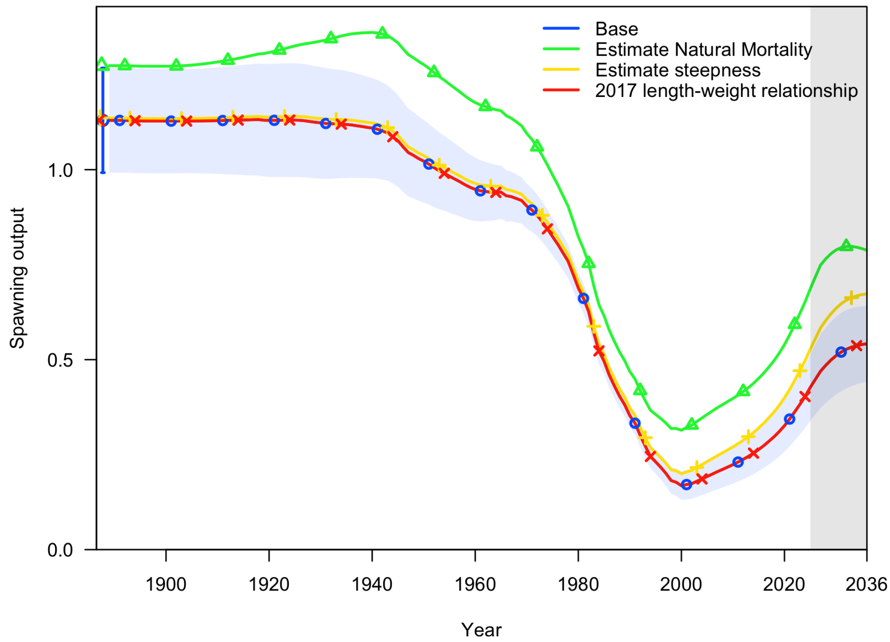

Figure 54: Spawning output across model structure sensitivities.

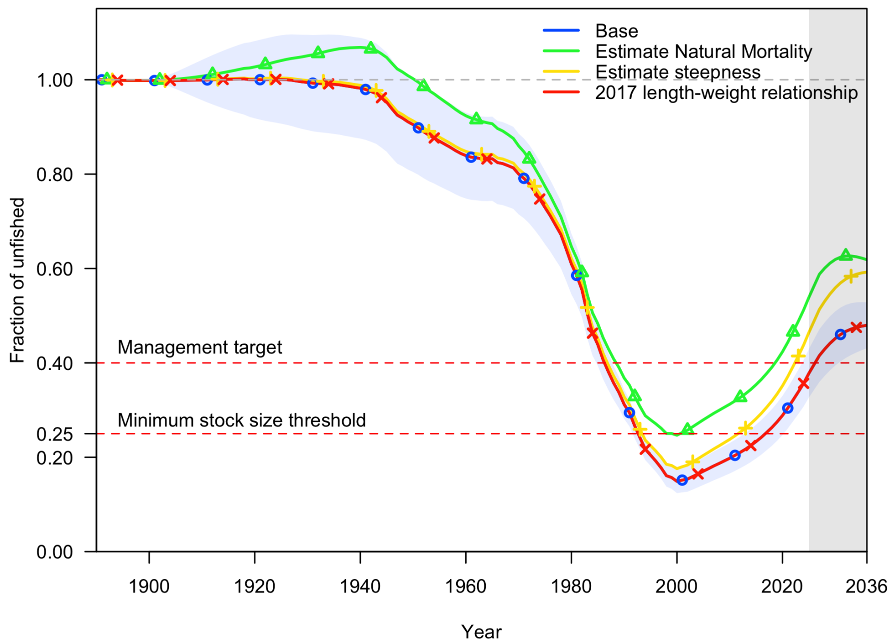

Figure 55: Relative spawning output across model structure sensitivities.

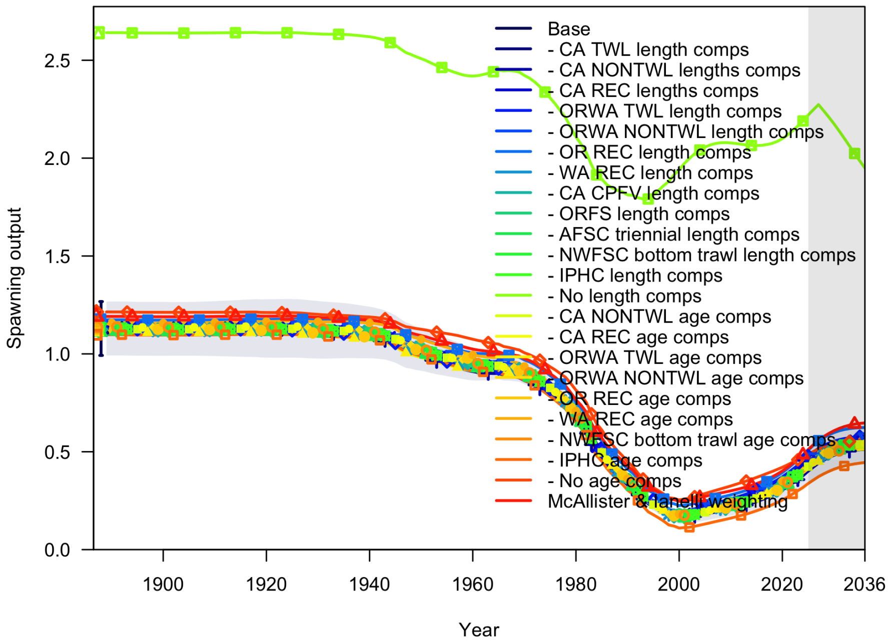

Figure 56: Spawning output across dataset inclusion sensitivities.

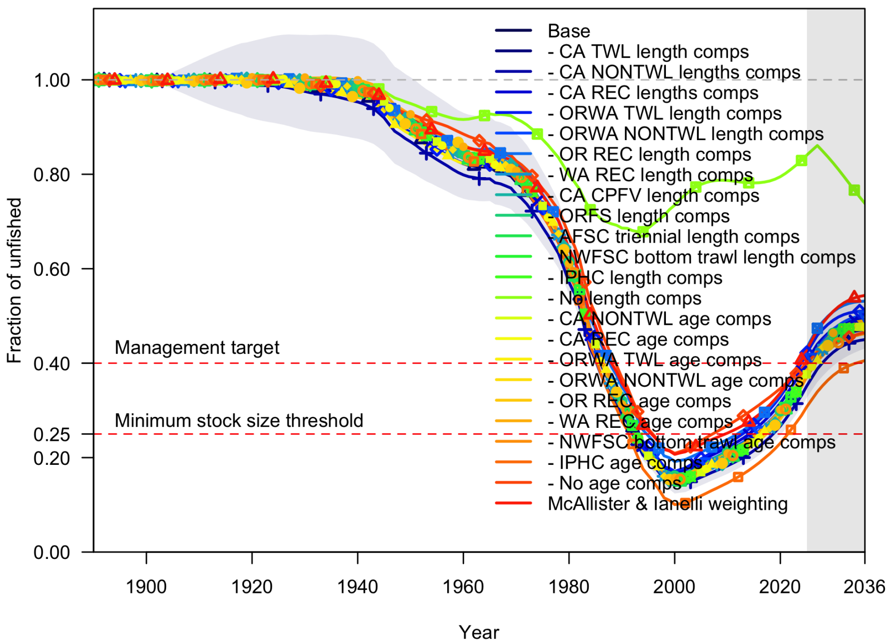

Figure 57: Relative spawning output across dataset inclusion sensitivities.

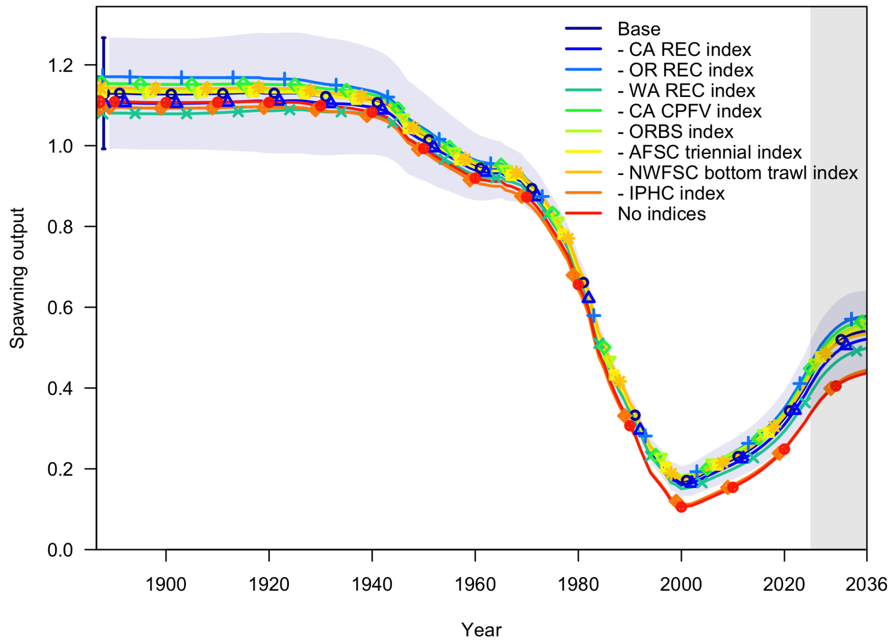

Figure 58: Spawning output across index inclusion sensitivities.

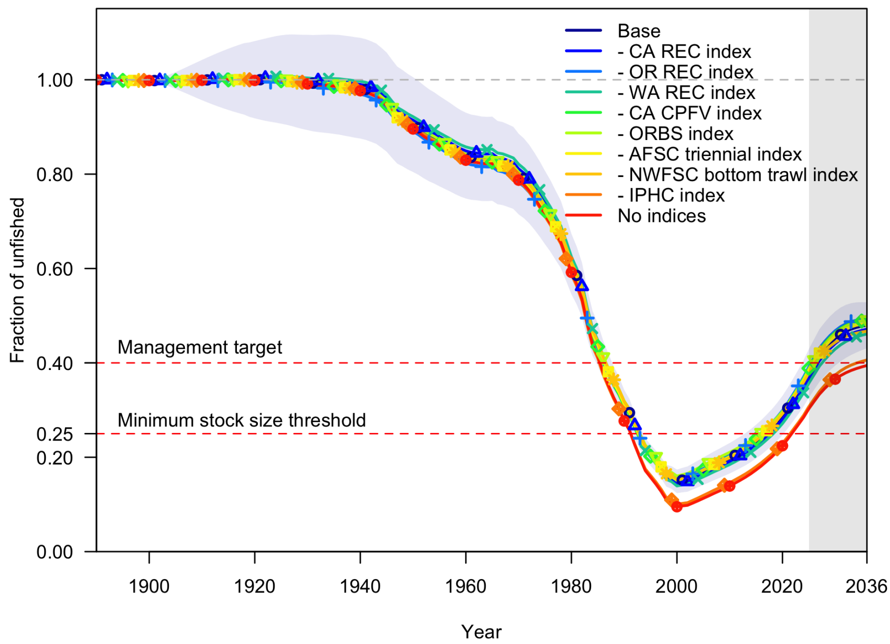

Figure 59: Relative spawning output across index inclusion sensitivities.

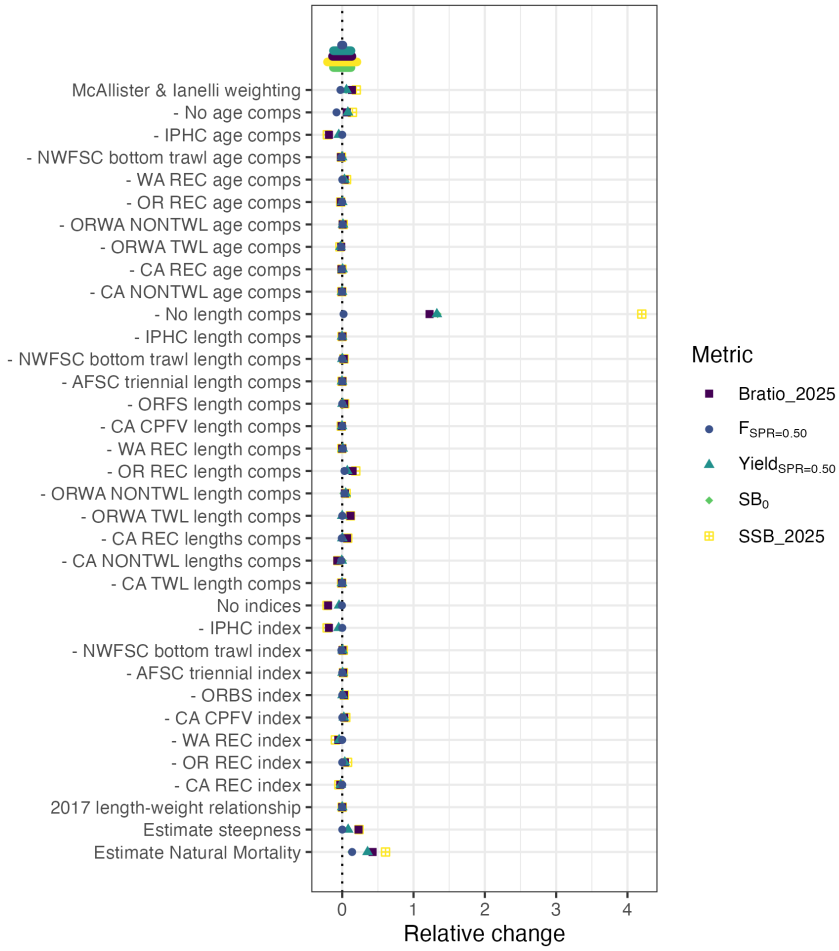

Figure 60: Relative change in management quantities across models conducted as sensitivities.

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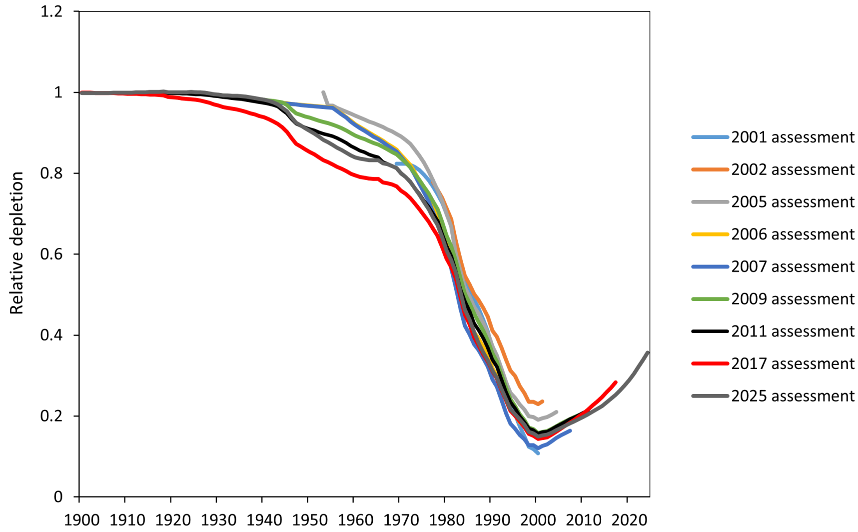

Figure 61: Relative depletion (spawning output) across Yelloweye Rockfish assessments over time.

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