

Appendix to Gmacs SMBKC Stock Assessment

The base model data file:

```
## #=====
## # Gmacs Main Data File Version 1.1: SM15 example
## # GEAR_INDEX DESCRIPTION
## # 1 : Pot fishery retained catch.
## # 1 : Pot fishery with discarded catch.
## # 2 : Trawl bycatch
## # 3 : Fixed bycatch
## # 4 : Trawl survey
## # 5 : Pot survey
##
## # Fisheries: 1 Pot Fishery, 2 Pot Discard, 3 Trawl by-catch, 3 Fixed by-catch
## # Surveys: 4 NMFS Trawl Survey, 5 Pot Survey
## #=====
##
## 1978 # Start year
## 2015 # End year
## 5 # Number of seasons
## 5 # Number of distinct data groups (among fishing fleets and surveys)
## 1 # Number of sexes
## 1 # Number of shell condition types
## 1 # Number of maturity types
## 3 # Number of size-classes in the model
## 5 # Season recruitment occurs
## 5 # Season molting and growth occurs
## 4 # Season to calculate SSB
## # size_breaks (a vector giving the break points between size intervals with dimension nclass+1)
## 90 105 120 135
## # weight-at-length input method (1 = allometry i.e.  $w_l = a \cdot l^b$ , 2 = vector by sex, 3 = matrix by sex)
## 3
## # weight-at-length allometry  $w_l = a \cdot l^b$ 
## 4.03E-07
## # b (male, female)
## 3.141334
## # Male weight-at-length
## 0.000748427 0.001165731 0.001930510
## 0.000748427 0.001165731 0.001688886
## 0.000748427 0.001165731 0.001922246
## 0.000748427 0.001165731 0.001877957
## 0.000748427 0.001165731 0.001938634
## 0.000748427 0.001165731 0.002076413
## 0.000748427 0.001165731 0.001899330
## 0.000748427 0.001165731 0.002116687
## 0.000748427 0.001165731 0.001938784
## 0.000748427 0.001165731 0.001939764
## 0.000748427 0.001165731 0.001871067
## 0.000748427 0.001165731 0.001998295
## 0.000748427 0.001165731 0.001870418
## 0.000748427 0.001165731 0.001969415
## 0.000748427 0.001165731 0.001926859
## 0.000748427 0.001165731 0.002021492
## 0.000748427 0.001165731 0.001931318
## 0.000748427 0.001165731 0.002014407
```

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## 0.000748427 0.001165731 0.001977471
## 0.000748427 0.001165731 0.002099246
## 0.000748427 0.001165731 0.001982478
## 0.000748427 0.001165731 0.001930932
## 0.000748427 0.001165731 0.001930932
## 0.000748427 0.001165731 0.001930932
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## 0.000748427 0.001165731 0.001930932
## 0.000748427 0.001165731 0.001930932
## 0.000748427 0.001165731 0.001891628
## 0.000748427 0.001165731 0.001795721
## 0.000748427 0.001165731 0.001823113
## 0.000748427 0.001165731 0.001807433
## 0.000748427 0.001165731 0.001930932
## 0.000748427 0.001165731 0.001894627
## 0.000748427 0.001165731 0.001930932
## # Male mature weight-at-length (weight * proportion mature)
## 0 0.001165732 0.001945911
## # Proportion mature by sex
## 0 1 1
## # Proportion of the total natural mortality to be applied each season (must add to 1)
## 0 0.0025 0 0.6245 0.373
## # Fishing fleet names (delimited with : no spaces in names)
## Pot_Fishery:Trawl_Bycatch:Fixed_bycatch
## # Survey names (delimited with : no spaces in names)
## NMFS_Trawl:ADFG_Pot
## # Number of catch data frames
## 4
## # Number of rows in each data frame
## 26 14 24 24
## ## CATCH DATA
## ## Type of catch: 1 = retained, 2 = discard
## ## Units of catch: 1 = biomass, 2 = numbers
## ## for SMBKC Units are in number of crab for landed & 1000 kg for discards.
## ## Male Retained
## # year seas fleet sex obs cv type units mult effort discard_mortality
## 1978 2 1 1 436126 0.03 1 2 1 0 0
## 1979 2 1 1 52966 0.03 1 2 1 0 0
## 1980 2 1 1 33162 0.03 1 2 1 0 0
## 1981 2 1 1 1045619 0.03 1 2 1 0 0
## 1982 2 1 1 1935886 0.03 1 2 1 0 0
## 1983 2 1 1 1931990 0.03 1 2 1 0 0
## 1984 2 1 1 841017 0.03 1 2 1 0 0
## 1985 2 1 1 436021 0.03 1 2 1 0 0
## 1986 2 1 1 219548 0.03 1 2 1 0 0
## 1987 2 1 1 227447 0.03 1 2 1 0 0
## 1988 2 1 1 280401 0.03 1 2 1 0 0
## 1989 2 1 1 247641 0.03 1 2 1 0 0
## 1990 2 1 1 391405 0.03 1 2 1 0 0
## 1991 2 1 1 726519 0.03 1 2 1 0 0

```

##	1992	2	1	1	545222	0.03	1	2	1	0	0
##	1993	2	1	1	630353	0.03	1	2	1	0	0
##	1994	2	1	1	827015	0.03	1	2	1	0	0
##	1995	2	1	1	666905	0.03	1	2	1	0	0
##	1996	2	1	1	660665	0.03	1	2	1	0	0
##	1997	2	1	1	939822	0.03	1	2	1	0	0
##	1998	2	1	1	635370	0.03	1	2	1	0	0
##	2009	2	1	1	103376	0.03	1	2	1	0	0
##	2010	2	1	1	298669	0.03	1	2	1	0	0
##	2011	2	1	1	437862	0.03	1	2	1	0	0
##	2012	2	1	1	379386	0.03	1	2	1	0	0
##	2014	2	1	1	69109	0.03	1	2	1	0	0
##	# Male discards Pot fishery										
##	1990	2	1	1	115.656434568	0.6	2	1	1	0	0.2
##	1991	2	1	1	241.060561216	0.6	2	1	1	0	0.2
##	1992	2	1	1	476.447140104	0.6	2	1	1	0	0.2
##	1993	2	1	1	431.576005096	0.6	2	1	1	0	0.2
##	1994	2	1	1	549.19331788	0.6	2	1	1	0	0.2
##	1995	2	1	1	164.704698304	0.6	2	1	1	0	0.2
##	1996	2	1	1	239.734258208	0.6	2	1	1	0	0.2
##	1997	2	1	1	627.2383574	0.6	2	1	1	0	0.2
##	1998	2	1	1	354.302071976	0.6	2	1	1	0	0.2
##	2009	2	1	1	55.960098632	0.2	2	1	1	0	0.2
##	2010	2	1	1	138.189524352	0.2	2	1	1	0	0.2
##	2011	2	1	1	218.339684344	0.2	2	1	1	0	0.2
##	2012	2	1	1	198.372110912	0.2	2	1	1	0	0.2
##	2014	2	1	1	20.631178528	0.2	2	1	1	0	0.2
##	# Trawl fishery discards										
##	1991	2	2	1	3.538	0.31	2	1	1	0	0.8
##	1992	2	2	1	1.996	0.31	2	1	1	0	0.8
##	1993	2	2	1	1.542	0.31	2	1	1	0	0.8
##	1994	2	2	1	0.318	0.31	2	1	1	0	0.8
##	1995	2	2	1	0.635	0.31	2	1	1	0	0.8
##	1996	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	1997	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	1998	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	1999	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	2000	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	2001	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	2002	2	2	1	0.726	0.31	2	1	1	0	0.8
##	2003	2	2	1	0.998	0.31	2	1	1	0	0.8
##	2004	2	2	1	0.091	0.31	2	1	1	0	0.8
##	2005	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	2006	2	2	1	2.812	0.31	2	1	1	0	0.8
##	2007	2	2	1	0.045	0.31	2	1	1	0	0.8
##	2008	2	2	1	0.272	0.31	2	1	1	0	0.8
##	2009	2	2	1	0.635	0.31	2	1	1	0	0.8
##	2010	2	2	1	0.363	0.31	2	1	1	0	0.8
##	2011	2	2	1	0.181	0.31	2	1	1	0	0.8
##	2012	2	2	1	0.590	0.31	2	1	1	0	0.8
##	2013	2	2	1	0.181	0.31	2	1	1	0	0.8
##	2014	2	2	1	0.0001	0.31	2	1	1	0	0.8
##	# Fixed fishery discards										
##	1991	2	3	1	0.045	0.31	2	1	1	0	0.5

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## 1992 2 3 1 2.268 0.31 2 1 1 0 0.5
## 1993 2 3 1 0.0001 0.31 2 1 1 0 0.5
## 1994 2 3 1 0.091 0.31 2 1 1 0 0.5
## 1995 2 3 1 0.136 0.31 2 1 1 0 0.5
## 1996 2 3 1 0.045 0.31 2 1 1 0 0.5
## 1997 2 3 1 0.181 0.31 2 1 1 0 0.5
## 1998 2 3 1 0.907 0.31 2 1 1 0 0.5
## 1999 2 3 1 1.361 0.31 2 1 1 0 0.5
## 2000 2 3 1 0.0001 0.31 2 1 1 0 0.5
## 2001 2 3 1 0.862 0.31 2 1 1 0 0.5
## 2002 2 3 1 0.408 0.31 2 1 1 0 0.5
## 2003 2 3 1 1.134 0.31 2 1 1 0 0.5
## 2004 2 3 1 0.635 0.31 2 1 1 0 0.5
## 2005 2 3 1 0.590 0.31 2 1 1 0 0.5
## 2006 2 3 1 1.451 0.31 2 1 1 0 0.5
## 2007 2 3 1 69.717 0.31 2 1 1 0 0.5
## 2008 2 3 1 6.622 0.31 2 1 1 0 0.5
## 2009 2 3 1 7.530 0.31 2 1 1 0 0.5
## 2010 2 3 1 9.571 0.31 2 1 1 0 0.5
## 2011 2 3 1 0.590 0.31 2 1 1 0 0.5
## 2012 2 3 1 0.0001 0.31 2 1 1 0 0.5
## 2013 2 3 1 0.272 0.31 2 1 1 0 0.5
## 2014 2 3 1 0.136 0.31 2 1 1 0 0.5
## ## RELATIVE ABUNDANCE DATA
## ## Units of abundance: 1 = biomass, 2 = numbers
## ## for SMBKC Units are in crabs for Abundance.
## ## Number of relative abundance indices
## 2
## ## Number of rows in each index
## 38 8
## # Survey data (abundance indices, units are mt for trawl survey and crab/potlift for pot survey)
## # Year, Seas, Fleet, Sex, Abundance, CV units
## 1978 1 4 1 6832.819 0.394 1
## 1979 1 4 1 7989.881 0.463 1
## 1980 1 4 1 9986.830 0.507 1
## 1981 1 4 1 6551.132 0.402 1
## 1982 1 4 1 16221.933 0.344 1
## 1983 1 4 1 9634.250 0.298 1
## 1984 1 4 1 4071.218 0.179 1
## 1985 1 4 1 3110.541 0.210 1
## 1986 1 4 1 1416.849 0.388 1
## 1987 1 4 1 2278.917 0.291 1
## 1988 1 4 1 3158.169 0.252 1
## 1989 1 4 1 6338.622 0.271 1
## 1990 1 4 1 6730.130 0.274 1
## 1991 1 4 1 6948.184 0.248 1
## 1992 1 4 1 7093.272 0.201 1
## 1993 1 4 1 9548.459 0.169 1
## 1994 1 4 1 6539.133 0.176 1
## 1995 1 4 1 5703.591 0.178 1
## 1996 1 4 1 9410.403 0.241 1
## 1997 1 4 1 10924.107 0.337 1
## 1998 1 4 1 7976.839 0.355 1
## 1999 1 4 1 1594.546 0.182 1

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## 2000 1 4 1 2096.795 0.310 1
## 2001 1 4 1 2831.440 0.245 1
## 2002 1 4 1 1732.599 0.320 1
## 2003 1 4 1 1566.675 0.336 1
## 2004 1 4 1 1523.869 0.305 1
## 2005 1 4 1 1642.017 0.371 1
## 2006 1 4 1 3893.875 0.334 1
## 2007 1 4 1 6470.773 0.385 1
## 2008 1 4 1 4654.473 0.284 1
## 2009 1 4 1 6301.470 0.256 1
## 2010 1 4 1 11130.898 0.466 1
## 2011 1 4 1 10931.232 0.558 1
## 2012 1 4 1 6200.219 0.339 1
## 2013 1 4 1 2287.557 0.217 1
## 2014 1 4 1 6029.220 0.449 1
## 2015 1 4 1 5877.433 0.770 1
## 1995 1 5 1 12042.000 0.130 2
## 1998 1 5 1 12531.000 0.060 2
## 2001 1 5 1 8477.000 0.080 2
## 2004 1 5 1 1667.000 0.150 2
## 2007 1 5 1 8643.000 0.090 2
## 2010 1 5 1 10209.000 0.130 2
## 2013 1 5 1 5643.000 0.190 2
## 2015 1 5 1 2805.000 0.180 2
## ## Number of length frequency matrices
## 3
## ## Number of rows in each matrix
## 14 38 8
## ## Number of bins in each matrix (columns of size data)
## 3 3 3
## ## SIZE COMPOSITION DATA FOR ALL FLEETS
## ## SIZE COMP LEGEND
## ## Sex: 1 = male, 2 = female, 0 = both sexes combined
## ## Type of composition: 1 = retained, 2 = discard, 0 = total composition
## ## Maturity state: 1 = immature, 2 = mature, 0 = both states combined
## ## Shell condition: 1 = new shell, 2 = old shell, 0 = both shell types combined
## ##length proportions of pot discarded males
## ##Year, Seas, Fleet, Sex, Type, Shell, Maturity, Nsamp, DataVec
## 1990 2 1 1 0 0 0 15 0.1133 0.3933 0.4933
## 1991 2 1 1 0 0 0 25 0.1329 0.1768 0.6902
## 1992 2 1 1 0 0 0 25 0.1905 0.2677 0.5417
## 1993 2 1 1 0 0 0 25 0.2807 0.2097 0.5096
## 1994 2 1 1 0 0 0 25 0.2942 0.2714 0.4344
## 1995 2 1 1 0 0 0 25 0.1478 0.2127 0.6395
## 1996 2 1 1 0 0 0 25 0.1595 0.2229 0.6176
## 1997 2 1 1 0 0 0 25 0.1818 0.2053 0.6128
## 1998 2 1 1 0 0 0 25 0.1927 0.2162 0.5911
## 2009 2 1 1 0 0 0 50 0.1413 0.3235 0.5352
## 2010 2 1 1 0 0 0 50 0.1314 0.3152 0.5534
## 2011 2 1 1 0 0 0 50 0.1314 0.3051 0.5636
## 2012 2 1 1 0 0 0 50 0.1417 0.3178 0.5406
## 2014 2 1 1 0 0 0 50 0.0939 0.2275 0.6786
## ##length proportions of trawl survey males
## ##Year, Seas, Fleet, Sex, Type, Shell, Maturity, Nsamp, DataVec

```

```

## 1978 1 4 1 0 0 0 50 0.3865 0.3478 0.2657
## 1979 1 4 1 0 0 0 50 0.4281 0.3190 0.2529
## 1980 1 4 1 0 0 0 50 0.3588 0.3220 0.3192
## 1981 1 4 1 0 0 0 50 0.1219 0.3065 0.5716
## 1982 1 4 1 0 0 0 50 0.1671 0.2435 0.5893
## 1983 1 4 1 0 0 0 50 0.1752 0.2726 0.5522
## 1984 1 4 1 0 0 0 50 0.1823 0.2085 0.6092
## 1985 1 4 1 0 0 0 46.5 0.2023 0.2010 0.5967
## 1986 1 4 1 0 0 0 23 0.1984 0.4364 0.3652
## 1987 1 4 1 0 0 0 35.5 0.1944 0.3779 0.4277
## 1988 1 4 1 0 0 0 40.5 0.1879 0.3737 0.4384
## 1989 1 4 1 0 0 0 50 0.4246 0.2259 0.3496
## 1990 1 4 1 0 0 0 50 0.2380 0.2332 0.5288
## 1991 1 4 1 0 0 0 50 0.2274 0.3300 0.4426
## 1992 1 4 1 0 0 0 50 0.2263 0.2911 0.4826
## 1993 1 4 1 0 0 0 50 0.2296 0.2759 0.4945
## 1994 1 4 1 0 0 0 50 0.1989 0.2926 0.5085
## 1995 1 4 1 0 0 0 50 0.2593 0.3005 0.4403
## 1996 1 4 1 0 0 0 50 0.1998 0.3054 0.4948
## 1997 1 4 1 0 0 0 50 0.1622 0.3102 0.5275
## 1998 1 4 1 0 0 0 50 0.1276 0.3212 0.5511
## 1999 1 4 1 0 0 0 26 0.2224 0.2214 0.5562
## 2000 1 4 1 0 0 0 30.5 0.2154 0.2180 0.5665
## 2001 1 4 1 0 0 0 45.5 0.2253 0.2699 0.5048
## 2002 1 4 1 0 0 0 19 0.1127 0.2346 0.6527
## 2003 1 4 1 0 0 0 32.5 0.3762 0.2345 0.3893
## 2004 1 4 1 0 0 0 24 0.2488 0.1848 0.5663
## 2005 1 4 1 0 0 0 21 0.2825 0.2744 0.4431
## 2006 1 4 1 0 0 0 50 0.3276 0.2293 0.4431
## 2007 1 4 1 0 0 0 50 0.4394 0.3525 0.2081
## 2008 1 4 1 0 0 0 50 0.3745 0.2219 0.4036
## 2009 1 4 1 0 0 0 50 0.3057 0.4202 0.2741
## 2010 1 4 1 0 0 0 50 0.4081 0.3371 0.2548
## 2011 1 4 1 0 0 0 50 0.2179 0.3940 0.3881
## 2012 1 4 1 0 0 0 50 0.1573 0.4393 0.4034
## 2013 1 4 1 0 0 0 37 0.2100 0.2834 0.5065
## 2014 1 4 1 0 0 0 50 0.1738 0.3912 0.4350
## 2015 1 4 1 0 0 0 50 0.2340 0.2994 0.4666
## ##length proportions of pot survey
## ##Year, Seas, Fleet, Sex, Type, Shell, Maturity, Nsamp, DataVec
## 1995 1 5 1 0 0 0 100 0.1594 0.2656 0.5751
## 1998 1 5 1 0 0 0 100 0.0769 0.2205 0.7026
## 2001 1 5 1 0 0 0 100 0.1493 0.2049 0.6457
## 2004 1 5 1 0 0 0 100 0.0672 0.2484 0.6845
## 2007 1 5 1 0 0 0 100 0.1257 0.3148 0.5595
## 2010 1 5 1 0 0 0 100 0.1299 0.3209 0.5492
## 2013 1 5 1 0 0 0 100 0.1556 0.2477 0.5967
## 2015 1 5 1 0 0 0 100 0.0706 0.2431 0.6859
## ## Growth data (increment)
## # nobs_growth
## 3
## # MidPoint Sex Increment CV
## 97.5 1 14.1 0.2197
## 112.5 1 14.1 0.2197

```

```
## 127.5 1 14.1 0.2197
## # 97.5 1 13.8 0.2197
## # 112.5 1 14.1 0.2197
## # 127.5 1 14.4 0.2197
## ## eof
## 9999
```

The base model control file:

```
## # Set up to do Stock Reduction Analysis using Catch data and informative priors.
## # Controls for leading parameter vector theta
## # LEGEND FOR PRIOR:
## #
## #         0 -> uniform
## #         1 -> normal
## #         2 -> lognormal
## #         3 -> beta
## #         4 -> gamma
## # ntheta
## 12
## # ival      lb      ub      phz  prior    p1      p2      # parameter      #
## 0.18      0.01      1      -4      2    0.18    0.02      # M
## 14.3      -7.0      30     -2      0     -7      30      # log(R0)
## 10.0      -7.0      20     -1      1    -10.0    20.0     # log(Rini)
## 13.7222   -7.0      20      1      0     -7      30      # log(Rbar)
## 80.0      30.0     310     -2      1    72.5    7.25     # Recruitment size distribution
## 0.25      0.1       7      -4      0     0.1     9.0      # Recruitment size scale (varian
## 0.2      -10.0     0.75    -4      0   -10.0    0.75     # log(sigma_R)
## 0.75      0.20     1.00    -2      3     3.0     2.00     # steepness
## 0.01      0.00     1.00    -3      3     1.01    1.01     # recruitment autocorrelation
## 14.5      5.00     18.00     1      0     5.00    15.00     # logNO vector of initial number
## 14.0      5.00     18.00     1      0     5.00    15.00     # logNO vector of initial number
## 13.5      5.00     18.00     1      0     5.00    15.00     # logNO vector of initial number
## ## GROWTH PARAM CONTROLS
## ## Two lines for each parameter if split sex, one line if not
## # ival      lb      ub      phz  prior    p1      p2      # parameter      #
## 14.1      10.0     30.0     -3      0     0.0     999.0     # alpha males or combined
## 0.0001     0.0     0.01     -3      0     0.0     999.0     # beta males or combined
## 0.45      0.01     1.0      -3      0     0.0     999.0     # gscale males or combined
## 121.5     65.0     145.0    -4      0     0.0     999.0     # molt_mu males or combined
## 0.060      0.0     1.0      -3      0     0.0     999.0     # molt_cv males or combined
##
## ## ----- ##
## ## SELECTIVITY CONTROLS
## ## Each gear must have a selectivity and a retention selectivity. If a uniform
## ## prior is selected for a parameter then the lb and ub are used (p1 and p2 are
## ## ignored)
## ## LEGEND
## ## sel type: 0 = parametric, 1 = coefficients, 2 = logistic, 3 = logistic95,
## ##            4 = double normal (NIY)
## ## gear index: use +ve for selectivity, -ve for retention
## ## sex dep: 0 for sex-independent, 1 for sex-dependent
## ## ----- ##
## ## ivector for number of year periods or nodes
## ##
```



```

## # POT      TBycatch FBycatch NMFS_S ADFG_pot
## # Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
##   2         1         1         1         1      # Selectivity periods
##   0         0         0         0         0      # sex specific selectivity
##   0         3         3         0         0      # male selectivity type
## # Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
##   1         1         1         1         1      # Retention periods
##   0         0         0         0         0      # sex specific retention
##   3         2         2         2         2      # male retention type
##   1         0         0         0         0      # male retention flag (0 -> no, 1 -> yes)
## # gear  par  sel
## # index index par sex  ival  lb   ub   prior p1    p2    phz  start end    ##
## # Gear-1
##   1     1    1  0    0.416198 0.001 2.0   0     0     1   -2   1978 2008
##   1     2    2  0    0.657528 0.001 2.0   0     0     1   -2   1978 2008
##   1     3    3  0    1.0         0.001 1.0   0     0     1   -2   1978 2008
##   1     1    1  0    0.326889 0.001 2.0   0     0     1   -2   2009 2015
##   1     2    2  0    0.806548 0.001 2.0   0     0     1   -2   2009 2015
##   1     3    3  0    1.0         0.001 1.0   0     0     1   -2   2009 2015
## # Gear-2
##   2     7    1  0    40         10.0 200   0    10   200  -3   1978 2015
##   2     8    2  0    60         10.0 200   0    10   200  -3   1978 2015
## # Gear-3
##   3     9    1  0    40         10.0 200   0    10   200  -3   1978 2015
##   3    10    2  0    60         10.0 200   0    10   200  -3   1978 2015
## # Gear-4
##   4     8    1  0    0.655565 0.001 2.0   0     0     1   -2   1978 2015
##   4     9    2  0    0.912882 0.001 2.0   0     0     1   -2   1978 2015
##   4    10    3  0    1.0         0.001 1.0   0     0     1   -2   1978 2015
## # Gear-5
##   5    11    1  0    0.347014 0.001 2.0   0     0     1   -2   1978 2015
##   5    12    2  0    0.720493 0.001 2.0   0     0     1   -2   1978 2015
##   5    13    3  0    1.0         0.001 1.0   0     0     1   -2   1978 2015
## ## Retained
## # Gear-1
##  -1     14    1  0    120    100   200   0     1   900  -1   1978 2015
##  -1     15    2  0    123    110   200   0     1   900  -1   1978 2015
## # Gear-2
##  -2     16    1  0    595     1   700   0     1   900  -3   1978 2015
##  -2     17    2  0     10     1   700   0     1   900  -3   1978 2015
## # Gear-3
##  -3     18    1  0    590     1   700   0     1   900  -3   1978 2015
##  -3     19    2  0     10     1   700   0     1   900  -3   1978 2015
## # Gear-4
##  -4     20    1  0    580     1   700   0     1   900  -3   1978 2015
##  -4     21    2  0     20     1   700   0     1   900  -3   1978 2015
## # Gear-5
##  -5     22    1  0    580     1   700   0     1   900  -3   1978 2015
##  -5     23    2  0     20     1   700   0     1   900  -3   1978 2015
##
## ## ----- ##
## ## PRIORS FOR CATCHABILITY
## ## If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ## and p2 are ignored). ival must be > 0 ##

```

```

## ## LEGEND ##
## ##      prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## LAMBDA: Arbitrary relative weights for each series, 0 = do not fit.
## ## SURVEYS/INDICES ONLY
## ## ival      lb      ub      phz      prior      p1      p2      Analytic?      LAMBDA
## ## 1.0      0      2      -1      0      0      9.0      0      1      # NMFS trawl
## ## 3.98688533089e-06 0 5      1      0      0      9.0      0      1      # ADF&G pot
## ## ----- ##
## ##
## ## ----- ##
## ## ADDITIONAL CV FOR SURVEYS/INDICES ##
## ##      If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ##      and p2 are ignored). ival must be > 0 ##
## ## LEGEND ##
## ##      prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## ival      lb      ub      phz      prior      p1      p2
## ## 0.00001      0.000001      10.0      -4      4      1.0      100      # NMFS
## ## 0.00001      0.000001      10.0      -4      4      1.0      100      # ADF&G
## ## ----- ##
## ##
## ## ----- ##
## ## PENALTIES FOR AVERAGE FISHING MORTALITY RATE FOR EACH GEAR ##
## ## ----- ##
## ## Mean_F      STD_PHZ1      STD_PHZ2      PHZ
## ## 0.3      0.05      50.0      1      # Pot
## ## 0.001      0.05      50.0      1      # Trawl
## ## 0.001      0.05      50.0      1      # Fixed
## ## 0.00      2.00      20.00      -1      # NMFS
## ## 0.00      2.00      20.00      -1      # ADF&G
## ## ----- ##
## ##
## ## ----- ##
## ## OPTIONS FOR SIZE COMPOSTION DATA (COLUMN FOR EACH MATRIX) ##
## ## ----- ##
## ## LIKELIHOOD OPTIONS
## ##      -1) Multinomial with estimated/fixed sample size
## ##      -2) Robust approximation to multinomial
## ##      -3) logistic normal (NIY)
## ##      -4) multivariate-t (NIY)
## ##      -5) Dirichlet
## ## AUTOTAIL COMPRESSION
## ##      pmin is the cumulative proportion used in tail compression.
## ## ----- ##
## ## 1      1      1      # Type of likelihood
## ## 2      2      2      # Type of likelihood
## ## 5      5      5      # Type of likelihood
## ## 0      0      0      # Auto tail compression (pmin)
## ## 1      1      1      # Initial value for effective sample size multiplier
## ## -4      -4      -4      # Phz for estimating effective sample size (if appl.)
## ## 1      2      3      # Composition aggregator
## ## ----- ##
## ##

```

```

## ## ----- ##
## ## TIME VARYING NATURAL MORTALITY RATES ##
## ## ----- ##
## ## TYPE:
## ##      0 = constant natural mortality
## ##      1 = Random walk (deviates constrained by variance in M)
## ##      2 = Cubic Spline (deviates constrained by nodes & node-placement)
## ##      3 = Blocked changes (deviates constrained by variance at specific knots)
## ##      4 = Time blocks
## ## ----- ##
## ## Type
## 3
## ## Phase of estimation
## 4
## ## STDEV in m_dev for Random walk
## 10.0
## ## Number of nodes for cubic spline or number of step-changes for option 3
## 2
## ## Year position of the knots (vector must be equal to the number of nodes)
## 1998 1999
## ## ----- ##
## ## ----- ##
## ## OTHER CONTROLS
## ## ----- ##
## 3      # Estimated rec_dev phase
## 0      # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
## 2      # Initial conditions (0 = Unfished, 1 = Steady-state fished, 2 = Free parameters)
## 1978   # First year for average recruitment for Bspr calculation
## 2015   # Last year for average recruitment for Bspr calculation
## 0.35   # Target SPR ratio for Bmsy proxy
## 1      # Gear index for SPR calculations (i.e. directed fishery)
## 1      # Lambda (proportion of mature male biomass for SPR reference points)
## 1      # Use empirical molt increment data (0 = FALSE, 1 = TRUE)
## 0      # Stock-Recruit-Relationship (0 = None, 1 = Beverton-Holt)
## ## EOF
## 9999

```

The selex model control file:

```
## # Set up to do Stock Reduction Analysis using Catch data and informative priors.
## # Controls for leading parameter vector theta
## # LEGEND FOR PRIOR:
## #
## #         0 -> uniform
## #         1 -> normal
## #         2 -> lognormal
## #         3 -> beta
## #         4 -> gamma
## # ntheta
## 12
## # ival      lb      ub      phz  prior    p1    p2      # parameter      #
## 0.18      0.01      1      -4      2    0.18    0.02    # M
## 14.3      -7.0     30     -2      0     -7      30    # log(R0)
## 10.0      -7.0     20     -1      1   -10.0    20.0    # log(Rini)
## 13.7222   -7.0     20      1      0     -7      30    # log(Rbar)
## 80.0      30.0     310     -2      1    72.5    7.25    # Recruitment size distribution
## 0.25      0.1       7     -4      0     0.1     9.0    # Recruitment size scale (varian
## 0.2      -10.0     0.75    -4      0   -10.0    0.75    # log(sigma_R)
## 0.75      0.20     1.00    -2      3     3.0     2.00    # steepness
## 0.01      0.00     1.00    -3      3     1.01    1.01    # recruitment autocorrelation
## 14.5      5.00     18.00     1      0     5.00    15.00    # logN0 vector of initial numbe
## 14.0      5.00     18.00     1      0     5.00    15.00    # logN0 vector of initial numbe
## 13.5      5.00     18.00     1      0     5.00    15.00    # logN0 vector of initial numbe
## ## GROWTH PARAM CONTROLS
## ## Two lines for each parameter if split sex, one line if not
## # ival      lb      ub      phz  prior    p1    p2      # parameter      #
## 14.1      10.0     30.0     -3      0     0.0    999.0    # alpha males or combined
## 0.0001     0.0      0.01     -3      0     0.0    999.0    # beta males or combined
## 0.45      0.01     1.0      -3      0     0.0    999.0    # gscale males or combined
## 121.5     65.0    145.0     -4      0     0.0    999.0    # molt_mu males or combined
## 0.060     0.0      1.0      -3      0     0.0    999.0    # molt_cv males or combined
##
## ## -----
## ## SELECTIVITY CONTROLS
## ## Each gear must have a selectivity and a retention selectivity. If a uniform
## ## prior is selected for a parameter then the lb and ub are used (p1 and p2 are
## ## ignored)
## ## LEGEND
## ## sel type: 0 = parametric, 1 = coefficients, 2 = logistic, 3 = logistic95,
## ##            4 = double normal (NIY)
## ## gear index: use +ve for selectivity, -ve for retention
## ## sex dep: 0 for sex-independent, 1 for sex-dependent
## ## -----
## ## ivector for number of year periods or nodes
## ## POT      TBycatch FBycatch  NMFS_S  ADFG_pot
## ## Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
## 2          1          1          1          1      # Selectivity periods
## 0          0          0          0          0      # sex specific selectivity
## 0          3          3          0          0      # male selectivity type
## ## Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
## 1          1          1          1          1      # Retention periods
## 0          0          0          0          0      # sex specific retention
```

```

##      3      2      2      2      2      # male retention type
##      1      0      0      0      0      # male retention flag (0 -> no, 1 -> yes)
## ## gear  par  sel
## ## index index par sex ival lb  ub  prior p1  p2  phz  start end  ##
## ## mirror period period  ##
## # Gear-1
##      1      1      1      0      0.416198 0.001 2.0      0      0      1      2      1978      2008
##      1      2      2      0      0.657528 0.001 2.0      0      0      1      2      1978      2008
##      1      3      3      0      1.0      0.001 1.0      0      0      1      -2      1978      2008
##      1      1      1      0      0.326889 0.001 2.0      0      0      1      2      2009      2015
##      1      2      2      0      0.806548 0.001 2.0      0      0      1      2      2009      2015
##      1      3      3      0      1.0      0.001 1.0      0      0      1      -2      2009      2015
## # Gear-2
##      2      7      1      0      40      10.0 200      0      10      200      -3      1978      2015
##      2      8      2      0      60      10.0 200      0      10      200      -3      1978      2015
## # Gear-3
##      3      9      1      0      40      10.0 200      0      10      200      -3      1978      2015
##      3      10     2      0      60      10.0 200      0      10      200      -3      1978      2015
## # Gear-4
##      4      8      1      0      0.655565 0.001 2.0      0      0      1      2      1978      2015
##      4      9      2      0      0.912882 0.001 2.0      0      0      1      2      1978      2015
##      4      10     3      0      1.0      0.001 1.0      0      0      1      -2      1978      2015
## # Gear-5
##      5      11     1      0      0.347014 0.001 2.0      0      0      1      2      1978      2015
##      5      12     2      0      0.720493 0.001 2.0      0      0      1      2      1978      2015
##      5      13     3      0      1.0      0.001 1.0      0      0      1      -2      1978      2015
## ## Retained
## # Gear-1
##      -1      14     1      0      120      100      200      0      1      900      -1      1978      2015
##      -1      15     2      0      123      110      200      0      1      900      -1      1978      2015
## # Gear-2
##      -2      16     1      0      595      1      700      0      1      900      -3      1978      2015
##      -2      17     2      0      10      1      700      0      1      900      -3      1978      2015
## # Gear-3
##      -3      18     1      0      590      1      700      0      1      900      -3      1978      2015
##      -3      19     2      0      10      1      700      0      1      900      -3      1978      2015
## # Gear-4
##      -4      20     1      0      580      1      700      0      1      900      -3      1978      2015
##      -4      21     2      0      20      1      700      0      1      900      -3      1978      2015
## # Gear-5
##      -5      22     1      0      580      1      700      0      1      900      -3      1978      2015
##      -5      23     2      0      20      1      700      0      1      900      -3      1978      2015
##
## ## ----- ##
## ## PRIORS FOR CATCHABILITY
## ##      If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ##      and p2 are ignored). ival must be > 0 ##
## ## LEGEND ##
## ##      prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## LAMBDA: Arbitrary relative weights for each series, 0 = do not fit.
## ## SURVEYS/INDICES ONLY
## ##      ival      lb      ub      phz      prior      p1      p2      Analytic?      LAMBDA
## ##      1.0      0      2      -1      0      0      9.0      0      1      # NMFS trawl
## ## 3.98688533089e-06 0 5      1      0      0      9.0      0      1      # ADF&G pot

```

```

## ## ----- ##
##
## ## ----- ##
## ## ADDITIONAL CV FOR SURVEYS/INDICES ##
## ## If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ## and p2 are ignored). ival must be > 0 ##
## ## LEGEND ##
## ## prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## ival lb ub phz prior p1 p2 ##
## 0.00001 0.000001 10.0 -4 4 1.0 100 # NMFS
## 0.00001 0.000001 10.0 -4 4 1.0 100 # ADF&G
## ## ----- ##
##
## ## ----- ##
## ## PENALTIES FOR AVERAGE FISHING MORTALITY RATE FOR EACH GEAR ##
## ## ----- ##
## ## Mean_F STD_PHZ1 STD_PHZ2 PHZ ##
## 0.3 0.05 50.0 1 # Pot
## 0.001 0.05 50.0 1 # Trawl
## 0.001 0.05 50.0 1 # Fixed
## 0.00 2.00 20.00 -1 # NMFS
## 0.00 2.00 20.00 -1 # ADF&G
## ## ----- ##
##
## ## ----- ##
## ## OPTIONS FOR SIZE COMPOSTION DATA (COLUMN FOR EACH MATRIX) ##
## ## ----- ##
## ## LIKELIHOOD OPTIONS
## ## -1) Multinomial with estimated/fixed sample size
## ## -2) Robust approximation to multinomial
## ## -3) logistic normal (NIY)
## ## -4) multivariate-t (NIY)
## ## -5) Dirichlet
## ## AUTOTAIL COMPRESSION
## ## pmin is the cumulative proportion used in tail compression.
## ## ----- ##
## # 1 1 1 # Type of likelihood
## 2 2 2 # Type of likelihood
## # 5 5 5 # Type of likelihood
## 0 0 0 # Auto tail compression (pmin)
## 1 1 1 # Initial value for effective sample size multiplier
## -4 -4 -4 # Phz for estimating effective sample size (if appl.)
## 1 2 3 # Composition aggregator
## ## ----- ##
##
## ## ----- ##
## ## TIME VARYING NATURAL MORTALIITY RATES ##
## ## ----- ##
## ## TYPE:
## ## 0 = constant natural mortality
## ## 1 = Random walk (deviates constrained by variance in M)
## ## 2 = Cubic Spline (deviates constrained by nodes & node-placement)
## ## 3 = Blocked changes (deviates constrained by variance at specific knots)

```

```

## ##      4 = Time blocks
## ## ----- ##
## ## Type
## 3
## ## Phase of estimation
## 4
## ## STDEV in m_dev for Random walk
## 10.0
## ## Number of nodes for cubic spline or number of step-changes for option 3
## 2
## ## Year position of the knots (vector must be equal to the number of nodes)
## 1998 1999
## ## ----- ##
##
## ## ----- ##
## ## OTHER CONTROLS
## ## ----- ##
## 3      # Estimated rec_dev phase
## 0      # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
## 2      # Initial conditions (0 = Unfished, 1 = Steady-state fished, 2 = Free parameters)
## 1978   # First year for average recruitment for Bspr calculation
## 2015   # Last year for average recruitment for Bspr calculation
## 0.35   # Target SPR ratio for Bmsy proxy
## 1      # Gear index for SPR calculations (i.e. directed fishery)
## 1      # Lambda (proportion of mature male biomass for SPR reference points)
## 1      # Use empirical molt increment data (0 = FALSE, 1 = TRUE)
## 0      # Stock-Recruit-Relationship (0 = None, 1 = Beverton-Holt)
## ## EOF
## 9999

```

The add CV model control file:

```
## # Set up to do Stock Reduction Analysis using Catch data and informative priors.
## # Controls for leading parameter vector theta
## # LEGEND FOR PRIOR:
## #
## #         0 -> uniform
## #         1 -> normal
## #         2 -> lognormal
## #         3 -> beta
## #         4 -> gamma
## # ntheta
## 12
## # ival      lb      ub      phz  prior    p1    p2      # parameter      #
## 0.18      0.01      1      -4      2    0.18    0.02    # M
## 14.3      -7.0     30     -2      0     -7     30     # log(R0)
## 10.0      -7.0     20     -1      1   -10.0    20.0    # log(Rini)
## 13.7222   -7.0     20      1      0     -7     30     # log(Rbar)
## 80.0      30.0     310    -2      1    72.5    7.25    # Recruitment size distribution
## 0.25      0.1       7     -4      0     0.1     9.0     # Recruitment size scale (varian
## 0.2      -10.0     0.75   -4      0   -10.0    0.75    # log(sigma_R)
## 0.75      0.20     1.00   -2      3     3.0     2.00    # steepness
## 0.01      0.00     1.00   -3      3     1.01    1.01    # recruitment autocorrelation
## 14.5      5.00     18.00    1      0     5.00    15.00    # logN0 vector of initial numbe
## 14.0      5.00     18.00    1      0     5.00    15.00    # logN0 vector of initial numbe
## 13.5      5.00     18.00    1      0     5.00    15.00    # logN0 vector of initial numbe
## ## GROWTH PARAM CONTROLS
## ## Two lines for each parameter if split sex, one line if not
## # ival      lb      ub      phz  prior    p1    p2      # parameter      #
## 14.1      10.0     30.0    -3      0     0.0    999.0    # alpha males or combined
## 0.0001     0.0     0.01   -3      0     0.0    999.0    # beta males or combined
## 0.45      0.01     1.0     -3      0     0.0    999.0    # gscale males or combined
## 121.5     65.0    145.0   -4      0     0.0    999.0    # molt_mu males or combined
## 0.060     0.0     1.0     -3      0     0.0    999.0    # molt_cv males or combined
##
## ## -----
## ## SELECTIVITY CONTROLS
## ## Each gear must have a selectivity and a retention selectivity. If a uniform
## ## prior is selected for a parameter then the lb and ub are used (p1 and p2 are
## ## ignored)
## ## LEGEND
## ## sel type: 0 = parametric, 1 = coefficients, 2 = logistic, 3 = logistic95,
## ##            4 = double normal (NIY)
## ## gear index: use +ve for selectivity, -ve for retention
## ## sex dep: 0 for sex-independent, 1 for sex-dependent
## ## -----
## ## ivector for number of year periods or nodes
## ## POT      TBycatch FBycatch  NMFS_S  ADFG_pot
## ## Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
## 2           1         1         1         1      # Selectivity periods
## 0           0         0         0         0      # sex specific selectivity
## 0           3         3         0         0      # male selectivity type
## ## Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
## 1           1         1         1         1      # Retention periods
## 0           0         0         0         0      # sex specific retention
```



```

##      3      2      2      2      2      # male retention type
##      1      0      0      0      0      # male retention flag (0 -> no, 1 -> yes)
## ## gear par sel
## ## index index par sex ival lb ub prior p1 p2 phz start end ##
## ## mirror period period ##
## # Gear-1
## 1 1 1 0 0.416198 0.001 2.0 0 0 1 2 1978 2008
## 1 2 2 0 0.657528 0.001 2.0 0 0 1 2 1978 2008
## 1 3 3 0 1.0 0.001 1.0 0 0 1 -2 1978 2008
## 1 1 1 0 0.326889 0.001 2.0 0 0 1 2 2009 2015
## 1 2 2 0 0.806548 0.001 2.0 0 0 1 2 2009 2015
## 1 3 3 0 1.0 0.001 1.0 0 0 1 -2 2009 2015
## # Gear-2
## 2 7 1 0 40 10.0 200 0 10 200 -3 1978 2015
## 2 8 2 0 60 10.0 200 0 10 200 -3 1978 2015
## # Gear-3
## 3 9 1 0 40 10.0 200 0 10 200 -3 1978 2015
## 3 10 2 0 60 10.0 200 0 10 200 -3 1978 2015
## # Gear-4
## 4 8 1 0 0.655565 0.001 2.0 0 0 1 2 1978 2015
## 4 9 2 0 0.912882 0.001 2.0 0 0 1 2 1978 2015
## 4 10 3 0 1.0 0.001 1.0 0 0 1 -2 1978 2015
## # Gear-5
## 5 11 1 0 0.347014 0.001 2.0 0 0 1 2 1978 2015
## 5 12 2 0 0.720493 0.001 2.0 0 0 1 2 1978 2015
## 5 13 3 0 1.0 0.001 1.0 0 0 1 -2 1978 2015
## ## Retained
## # Gear-1
## -1 14 1 0 120 100 200 0 1 900 -1 1978 2015
## -1 15 2 0 123 110 200 0 1 900 -1 1978 2015
## # Gear-2
## -2 16 1 0 595 1 700 0 1 900 -3 1978 2015
## -2 17 2 0 10 1 700 0 1 900 -3 1978 2015
## # Gear-3
## -3 18 1 0 590 1 700 0 1 900 -3 1978 2015
## -3 19 2 0 10 1 700 0 1 900 -3 1978 2015
## # Gear-4
## -4 20 1 0 580 1 700 0 1 900 -3 1978 2015
## -4 21 2 0 20 1 700 0 1 900 -3 1978 2015
## # Gear-5
## -5 22 1 0 580 1 700 0 1 900 -3 1978 2015
## -5 23 2 0 20 1 700 0 1 900 -3 1978 2015
##
## ## ----- ##
## ## PRIORS FOR CATCHABILITY
## ## If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ## and p2 are ignored). ival must be > 0 ##
## ## LEGEND ##
## ## prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## LAMBDA: Arbitrary relative weights for each series, 0 = do not fit.
## ## SURVEYS/INDICES ONLY
## ## ival lb ub phz prior p1 p2 Analytic? LAMBDA
## 1.0 0 2 -1 0 0 9.0 0 1 # NMFS trawl
## 3.98688533089e-06 0 5 1 0 0 9.0 0 1 # ADF&G pot

```

```

## ## ----- ##
##
## ## ----- ##
## ## ADDITIONAL CV FOR SURVEYS/INDICES ##
## ## If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ## and p2 are ignored). ival must be > 0 ##
## ## LEGEND ##
## ## prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## ival lb ub phz prior p1 p2 ##
## 0.00001 0.000001 10.0 -4 4 1.0 100 # NMFS
## 0.00001 0.000001 10.0 4 4 1.0 100 # ADF&G
## ## ----- ##
##
## ## ----- ##
## ## PENALTIES FOR AVERAGE FISHING MORTALITY RATE FOR EACH GEAR ##
## ## ----- ##
## ## Mean_F STD_PHZ1 STD_PHZ2 PHZ ##
## 0.3 0.05 50.0 1 # Pot
## 0.001 0.05 50.0 1 # Trawl
## 0.001 0.05 50.0 1 # Fixed
## 0.00 2.00 20.00 -1 # NMFS
## 0.00 2.00 20.00 -1 # ADF&G
## ## ----- ##
##
## ## ----- ##
## ## OPTIONS FOR SIZE COMPOSTION DATA (COLUMN FOR EACH MATRIX) ##
## ## ----- ##
## ## LIKELIHOOD OPTIONS
## ## -1) Multinomial with estimated/fixed sample size
## ## -2) Robust approximation to multinomial
## ## -3) logistic normal (NIY)
## ## -4) multivariate-t (NIY)
## ## -5) Dirichlet
## ## AUTOTAIL COMPRESSION
## ## pmin is the cumulative proportion used in tail compression.
## ## ----- ##
## # 1 1 1 # Type of likelihood
## 2 2 2 # Type of likelihood
## # 5 5 5 # Type of likelihood
## 0 0 0 # Auto tail compression (pmin)
## 1 1 1 # Initial value for effective sample size multiplier
## -4 -4 -4 # Phz for estimating effective sample size (if appl.)
## 1 2 3 # Composition aggregator
## ## ----- ##
##
## ## ----- ##
## ## TIME VARYING NATURAL MORTALIITY RATES ##
## ## ----- ##
## ## TYPE:
## ## 0 = constant natural mortality
## ## 1 = Random walk (deviates constrained by variance in M)
## ## 2 = Cubic Spline (deviates constrained by nodes & node-placement)
## ## 3 = Blocked changes (deviates constrained by variance at specific knots)

```

```

## ##      4 = Time blocks
## ## ----- ##
## ## Type
## 3
## ## Phase of estimation
## 4
## ## STDEV in m_dev for Random walk
## 10.0
## ## Number of nodes for cubic spline or number of step-changes for option 3
## 2
## ## Year position of the knots (vector must be equal to the number of nodes)
## 1998 1999
## ## ----- ##
##
## ## ----- ##
## ## OTHER CONTROLS
## ## ----- ##
## 3      # Estimated rec_dev phase
## 0      # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
## 2      # Initial conditions (0 = Unfished, 1 = Steady-state fished, 2 = Free parameters)
## 1978   # First year for average recruitment for Bspr calculation
## 2015   # Last year for average recruitment for Bspr calculation
## 0.35   # Target SPR ratio for Bmsy proxy
## 1      # Gear index for SPR calculations (i.e. directed fishery)
## 1      # Lambda (proportion of mature male biomass for SPR reference points)
## 1      # Use empirical molt increment data (0 = FALSE, 1 = TRUE)
## 0      # Stock-Recruit-Relationship (0 = None, 1 = Beverton-Holt)
## ## EOF
## 9999

```

The no M_{1998} model control file:

```
## # Set up to do Stock Reduction Analysis using Catch data and informative priors.
## # Controls for leading parameter vector theta
## # LEGEND FOR PRIOR:
## #
## #         0 -> uniform
## #         1 -> normal
## #         2 -> lognormal
## #         3 -> beta
## #         4 -> gamma
## # ntheta
## 12
## # ival      lb      ub      phz      prior      p1      p2      # parameter      #
## 0.18      0.01      1      -4      2      0.18      0.02      # M
## 14.3      -7.0      30      -2      0      -7      30      # log(R0)
## 10.0      -7.0      20      -1      1      -10.0      20.0      # log(Rini)
## 13.7222    -7.0      20      1      0      -7      30      # log(Rbar)
## 80.0      30.0      310     -2      1      72.5      7.25      # Recruitment size distribution
## 0.25      0.1      7      -4      0      0.1      9.0      # Recruitment size scale (varian
## 0.2      -10.0      0.75     -4      0      -10.0      0.75      # log(sigma_R)
## 0.75      0.20      1.00     -2      3      3.0      2.00      # steepness
## 0.01      0.00      1.00     -3      3      1.01      1.01      # recruitment autocorrelation
## 14.5      5.00      18.00      1      0      5.00      15.00      # logN0 vector of initial numbe
## 14.0      5.00      18.00      1      0      5.00      15.00      # logN0 vector of initial numbe
## 13.5      5.00      18.00      1      0      5.00      15.00      # logN0 vector of initial numbe
## ## GROWTH PARAM CONTROLS
## ## Two lines for each parameter if split sex, one line if not
## # ival      lb      ub      phz      prior      p1      p2      # parameter      #
## 14.1      10.0      30.0      -3      0      0.0      999.0      # alpha males or combined
## 0.0001     0.0      0.01     -3      0      0.0      999.0      # beta males or combined
## 0.45      0.01      1.0      -3      0      0.0      999.0      # gscale males or combined
## 121.5      65.0      145.0     -4      0      0.0      999.0      # molt_mu males or combined
## 0.060      0.0      1.0      -3      0      0.0      999.0      # molt_cv males or combined
##
## ## -----
## ## SELECTIVITY CONTROLS
## ## Each gear must have a selectivity and a retention selectivity. If a uniform
## ## prior is selected for a parameter then the lb and ub are used (p1 and p2 are
## ## ignored)
## ## LEGEND
## ## sel type: 0 = parametric, 1 = coefficients, 2 = logistic, 3 = logistic95,
## ##            4 = double normal (NIY)
## ## gear index: use +ve for selectivity, -ve for retention
## ## sex dep: 0 for sex-independent, 1 for sex-dependent
## ## -----
## ## ivector for number of year periods or nodes
## ## POT      TBycatch FBycatch NMFS_S ADFG_pot
## ## Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
## 2      1      1      1      1      # Selectivity periods
## 0      0      0      0      0      # sex specific selectivity
## 0      3      3      0      0      # male selectivity type
## ## Gear-1    Gear-2    Gear-3    Gear-4    Gear-5
## 1      1      1      1      1      # Retention periods
## 0      0      0      0      0      # sex specific retention
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##      3      2      2      2      2      # male retention type
##      1      0      0      0      0      # male retention flag (0 -> no, 1 -> yes)
## ## gear par sel
## ## index index par sex ival lb ub prior p1 p2 phz start end ##
## ## mirror period period ##
## # Gear-1
## 1 1 1 0 0.416198 0.001 2.0 0 0 1 2 1978 2008
## 1 2 2 0 0.657528 0.001 2.0 0 0 1 2 1978 2008
## 1 3 3 0 1.0 0.001 1.0 0 0 1 -2 1978 2008
## 1 1 1 0 0.326889 0.001 2.0 0 0 1 2 2009 2015
## 1 2 2 0 0.806548 0.001 2.0 0 0 1 2 2009 2015
## 1 3 3 0 1.0 0.001 1.0 0 0 1 -2 2009 2015
## # Gear-2
## 2 7 1 0 40 10.0 200 0 10 200 -3 1978 2015
## 2 8 2 0 60 10.0 200 0 10 200 -3 1978 2015
## # Gear-3
## 3 9 1 0 40 10.0 200 0 10 200 -3 1978 2015
## 3 10 2 0 60 10.0 200 0 10 200 -3 1978 2015
## # Gear-4
## 4 8 1 0 0.655565 0.001 2.0 0 0 1 2 1978 2015
## 4 9 2 0 0.912882 0.001 2.0 0 0 1 2 1978 2015
## 4 10 3 0 1.0 0.001 1.0 0 0 1 -2 1978 2015
## # Gear-5
## 5 11 1 0 0.347014 0.001 2.0 0 0 1 2 1978 2015
## 5 12 2 0 0.720493 0.001 2.0 0 0 1 2 1978 2015
## 5 13 3 0 1.0 0.001 1.0 0 0 1 -2 1978 2015
## ## Retained
## # Gear-1
## -1 14 1 0 120 100 200 0 1 900 -1 1978 2015
## -1 15 2 0 123 110 200 0 1 900 -1 1978 2015
## # Gear-2
## -2 16 1 0 595 1 700 0 1 900 -3 1978 2015
## -2 17 2 0 10 1 700 0 1 900 -3 1978 2015
## # Gear-3
## -3 18 1 0 590 1 700 0 1 900 -3 1978 2015
## -3 19 2 0 10 1 700 0 1 900 -3 1978 2015
## # Gear-4
## -4 20 1 0 580 1 700 0 1 900 -3 1978 2015
## -4 21 2 0 20 1 700 0 1 900 -3 1978 2015
## # Gear-5
## -5 22 1 0 580 1 700 0 1 900 -3 1978 2015
## -5 23 2 0 20 1 700 0 1 900 -3 1978 2015
##
## ## ----- ##
## ## PRIORS FOR CATCHABILITY
## ## If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ## and p2 are ignored). ival must be > 0 ##
## ## LEGEND ##
## ## prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## LAMBDA: Arbitrary relative weights for each series, 0 = do not fit.
## ## SURVEYS/INDICES ONLY
## ## ival lb ub phz prior p1 p2 Analytic? LAMBDA
## 1.0 0 2 -1 0 0 9.0 0 1 # NMFS trawl
## 3.98688533089e-06 0 5 1 0 0 9.0 0 1 # ADF&G pot

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## ## ----- ##
##
## ## ----- ##
## ## ADDITIONAL CV FOR SURVEYS/INDICES ##
## ## If a uniform prior is selected for a parameter then the lb and ub are used (p1 ##
## ## and p2 are ignored). ival must be > 0 ##
## ## LEGEND ##
## ## prior: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## ival lb ub phz prior p1 p2 ##
## 0.00001 0.000001 10.0 -4 4 1.0 100 # NMFS
## 0.00001 0.000001 10.0 -4 4 1.0 100 # ADF&G
## ## ----- ##
##
## ## ----- ##
## ## PENALTIES FOR AVERAGE FISHING MORTALITY RATE FOR EACH GEAR ##
## ## ----- ##
## ## Mean_F STD_PHZ1 STD_PHZ2 PHZ ##
## 0.3 0.05 50.0 1 # Pot
## 0.001 0.05 50.0 1 # Trawl
## 0.001 0.05 50.0 1 # Fixed
## 0.00 2.00 20.00 -1 # NMFS
## 0.00 2.00 20.00 -1 # ADF&G
## ## ----- ##
##
## ## ----- ##
## ## OPTIONS FOR SIZE COMPOSTION DATA (COLUMN FOR EACH MATRIX) ##
## ## ----- ##
## ## LIKELIHOOD OPTIONS
## ## -1) Multinomial with estimated/fixed sample size
## ## -2) Robust approximation to multinomial
## ## -3) logistic normal (NIY)
## ## -4) multivariate-t (NIY)
## ## -5) Dirichlet
## ## AUTOTAIL COMPRESSION
## ## pmin is the cumulative proportion used in tail compression.
## ## ----- ##
## # 1 1 1 # Type of likelihood
## 2 2 2 # Type of likelihood
## # 5 5 5 # Type of likelihood
## 0 0 0 # Auto tail compression (pmin)
## 1 1 1 # Initial value for effective sample size multiplier
## -4 -4 -4 # Phz for estimating effective sample size (if appl.)
## 1 2 3 # Composition aggregator
## ## ----- ##
##
## ## ----- ##
## ## TIME VARYING NATURAL MORTALIITY RATES ##
## ## ----- ##
## ## TYPE:
## ## 0 = constant natural mortality
## ## 1 = Random walk (deviates constrained by variance in M)
## ## 2 = Cubic Spline (deviates constrained by nodes & node-placement)
## ## 3 = Blocked changes (deviates constrained by variance at specific knots)

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## ##      4 = Time blocks
## ## ----- ##
## ## Type
## 0
## ## Phase of estimation
## 4
## ## STDEV in m_dev for Random walk
## 10.0
## ## Number of nodes for cubic spline or number of step-changes for option 3
## 2
## ## Year position of the knots (vector must be equal to the number of nodes)
## 1998 1999
## ## ----- ##
## ## ----- ##
## ## OTHER CONTROLS
## ## ----- ##
## 3      # Estimated rec_dev phase
## 0      # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
## 2      # Initial conditions (0 = Unfished, 1 = Steady-state fished, 2 = Free parameters)
## 1978   # First year for average recruitment for Bspr calculation
## 2015   # Last year for average recruitment for Bspr calculation
## 0.35   # Target SPR ratio for Bmsy proxy
## 1      # Gear index for SPR calculations (i.e. directed fishery)
## 1      # Lambda (proportion of mature male biomass for SPR reference points)
## 1      # Use empirical molt increment data (0 = FALSE, 1 = TRUE)
## 0      # Stock-Recruit-Relationship (0 = None, 1 = Beverton-Holt)
## ## EOF
## 9999

```