Appendix to Gmacs SMBKC Stock Assessment

The base model data file:

```
## Warning in file(con, "r"): cannot open file '../../examples/smbkc2/model_1/
## sm15.dat': No such file or directory

## Error in file(con, "r"): cannot open the connection

## Error in ts[i]: object of type 'closure' is not subsettable
```

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 (varia
##   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 number
##   14.0      5.00    18.00         1      0   5.00   15.00        # logN0 vector of initial number
##   13.5      5.00    18.00         1      0   5.00   15.00        # logN0 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                                        phz    start  end       ##
## ## index index par sex   ival    lb      ub      prior p1     p2     mirror period period    ##
## # Gear-1
##    1      1     1   0    0.432928096608 0.001 2.0    0        0       1     -2     1978   2008
##    1      2     2   0    0.670336057209 0.001 2.0    0        0       1     -2     1978   2008
##    1      3     3   0    1.0        0.001 2.0    0        0       1     -2     1978   2008
##    1      1     1   0    0.392207758620 0.001 2.0    0        0       1     -2     2009   2015
##    1      2     2   0    0.956150805823 0.001 2.0    0        0       1     -2     2009   2015
##    1      3     3   0    1.0        0.001 2.0    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    0.79506450558 0.001 2.0    0        0       1     -2     1978   2015
##    4      9     2   0    1.08723867992 0.001 2.0    0        0       1     -2     1978   2015
##    4      10    3   0    1.0        0.001 2.0    0        0       1     -2     1978   2015
## # Gear-5
##    5      11    1   0    0.405292074017 0.001 2.0    0        0       1     -2     1978   2015
##    5      12    2   0    0.855141058500 0.001 2.0    0        0       1     -2     1978   2015
##    5      13    3   0    1.0        0.001 2.0    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
## 4.26724288404e-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
##    1   1   1   # LAMBDA
```

4

```
## ## ---------------------------------------------------------------------- ##
##
## ## ---------------------------------------------------------------------- ##
## ## TIME VARYING NATURAL MORTALIIY 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 (varia
##   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 number
##  14.0      5.00      18.00      1       0   5.00   15.00       # logN0 vector of initial number
##  13.5      5.00      18.00      1       0   5.00   15.00       # logN0 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                                         phz  start  end         ##
## ## index index par sex  ival   lb    ub      prior p1      p2      mirror period period    ##
## # Gear-1
##    1     1    1   0   0.432928096608 0.001 2.0    0      0       1     2     1978   2008
##    1     2    2   0   0.670336057209 0.001 1.0    0      0       1     2     1978   2008
##    1     3    3   0   1.0            0.001 2.0    0      0       1    -2     1978   2008
##    1     1    1   0   0.392207758620 0.001 2.0    0      0       1     2     2009   2015
##    1     2    2   0   0.956150805823 0.001 1.0    0      0       1     2     2009   2015
##    1     3    3   0   1.0            0.001 2.0    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   0.79506450558  0.001 2.0    0      0       1     2     1978   2015
##    4     9    2   0   1.08723867992  0.001 1.0    0      0       1     2     1978   2015
##    4    10    3   0   1.0            0.001 2.0    0      0       1    -2     1978   2015
## # Gear-5
##    5    11    1   0   0.405292074017 0.001 2.0    0      0       1     2     1978   2015
##    5    12    2   0   0.855141058500 0.001 1.0    0      0       1     2     1978   2015
##    5    13    3   0   1.0            0.001 2.0    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
## 4.26724288404e-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
##    1   1   1   # LAMBDA
## ## ------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------- ##
## ## TIME VARYING NATURAL MORTALIIY 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 number
##   14.0       5.00     18.00       1      0   5.00   15.00        # logN0 vector of initial number
##   13.5       5.00     18.00       1      0   5.00   15.00        # logN0 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                                       phz   start  end        ##
## ## index index par sex  ival  lb     ub      prior p1      p2      mirror period period    ##
## # Gear-1
##    1      1     1   0   0.432928096608 0.001 2.0    0       0        1     2     1978   2008
##    1      2     2   0   0.670336057209 0.001 1.0    0       0        1     2     1978   2008
##    1      3     3   0   1.0            0.001 2.0    0       0        1    -2     1978   2008
##    1      1     1   0   0.392207758620 0.001 2.0    0       0        1     2     2009   2015
##    1      2     2   0   0.956150805823 0.001 1.0    0       0        1     2     2009   2015
##    1      3     3   0   1.0            0.001 2.0    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   0.79506450558  0.001 2.0    0       0        1     2     1978   2015
##    4      9     2   0   1.08723867992  0.001 1.0    0       0        1     2     1978   2015
##    4     10     3   0   1.0            0.001 2.0    0       0        1    -2     1978   2015
## # Gear-5
##    5     11     1   0   0.405292074017 0.001 2.0    0       0        1     2     1978   2015
##    5     12     2   0   0.855141058500 0.001 1.0    0       0        1     2     1978   2015
##    5     13     3   0   1.0            0.001 2.0    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
## 4.26724288404e-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
##    1   1   1  # LAMBDA
## ## -------------------------------------------------------------------------------- ##
##
## ## -------------------------------------------------------------------------------- ##
## ## TIME VARYING NATURAL MORTALIIY 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
## 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
```

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 (varia
##   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 number
##   14.0      5.00     18.00         1       0    5.00   15.00      # logN0 vector of initial number
##   13.5      5.00     18.00         1       0    5.00   15.00      # logN0 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                                          phz   start  end        ##
## ## index index par sex  ival  lb    ub      prior p1     p2     mirror period period    ##
## # Gear-1
##    1     1    1   0  0.432928096608 0.001 2.0    0        0      1     2    1978   2008
##    1     2    2   0  0.670336057209 0.001 1.0    0        0      1     2    1978   2008
##    1     3    3   0  1.0            0.001 2.0    0        0      1    -2    1978   2008
##    1     1    1   0  0.392207758620 0.001 2.0    0        0      1     2    2009   2015
##    1     2    2   0  0.956150805823 0.001 1.0    0        0      1     2    2009   2015
##    1     3    3   0  1.0            0.001 2.0    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  0.79506450558  0.001 2.0    0        0      1     2    1978   2015
##    4     9    2   0  1.08723867992  0.001 1.0    0        0      1     2    1978   2015
##    4    10    3   0  1.0            0.001 2.0    0        0      1    -2    1978   2015
## # Gear-5
##    5    11    1   0  0.405292074017 0.001 2.0    0        0      1     2    1978   2015
##    5    12    2   0  0.855141058500 0.001 1.0    0        0      1     2    1978   2015
##    5    13    3   0  1.0            0.001 2.0    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
## 4.26724288404e-06 0 5     1     0      0       9.0    0          0.2      # 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
## #  1   1   1   # LAMBDA
##    1.6281   0.9533   3.5785
## ## ------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------- ##
## ## TIME VARYING NATURAL MORTALIIY 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
## 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
```