Appendix to Gmacs Example Stock Assessment

The OneSex 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
##   9
## # ------------------------------------------------------------------------------------- #
## # ival        lb        ub        phz   prior     p1      p2         # parameter         #
## # ------------------------------------------------------------------------------------- #
##   0.18      0.01         1         -4       2   0.18    0.02         # M
##   10.0       -10        20         -2       1   10.1    30.1         # logR0
##   10.0       -10        20          2       1   10.0    35.0         # logR1
##   10.0       -10        20          1       1   10.0    35.0         # logRbar
##   72.0        55       100         -2       1   72.5    7.25         # Recruitment Expected Value
##   0.561      0.1         5         -3       0    0.1     5.0         # Recruitment scale (variance c
##  -0.40       -10      0.75         -4       0  -10.0    0.75         # ln(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
## ## ------------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------------- ##
## ## GROWTH PARAM CONTROLS                                                                 ##
## ## nGrwth
## ##                                                                                       ##
## ## Two lines for each parameter if split sex, one line if not                           ##
## ## ------------------------------------------------------------------------------------- ##
## # ival        lb        ub        phz   prior     p1      p2         # parameter         #
## # ------------------------------------------------------------------------------------- #
##   17.5      10.0      30.0         -3       0    0.0   999.0         # alpha males or combined
##   0.10       0.0       0.5         -3       0    0.0   999.0         # beta males or combined
##   0.30       0.01      1.0         -3       0    0.0   999.0         # gscale males or combined
##  140.5      65.0     165.0         -4       0    0.0   999.0         # molt_mu males or combined
##   0.071      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                      ##
## ## LEGEND sel_type:1=coefficients,2=logistic,3=logistic95                                 ##
## ##        Index: use +ve for selectivity, -ve for retention
## ##        sex dep: 0 for sex-independent, 1 for sex-dependent.
## ## ------------------------------------------------------------------------------------- ##
## ## ivector for number of year blocks or nodes
## ## POT       TBycatch  NMFS_S   BSFR_S
## ## Gear-1    Gear-2    Gear-3   Gear-4
##    1         1         2        1         # Selectivity periods
##    0         0         0        0         # sex specific selectivity
##    3         3         3        3         # male selectivity type
## ## Gear-1    Gear-2    Gear-3   Gear-4
##    1         1         1        1         # Retention periods
##    0         0         0        0         # sex specific retention
##    3         2         2        2         # male retention type
##    1         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    129    1    200    0      1     200   -1     1975   2014
##    1     2     2   0    156    1    200    0      1     200   -1     1975   2014
## # Gear-2
##    2     3     1   0    090    10   200    0      10    200    2     1975   2014
##    2     4     2   0    180    10   200    0      10    200   -2     1975   2014
## # Gear-3
##    3     5     1   0    136   60    200    0       1    200   -3     1975   1981
##    3     6     2   0    182   60    200    0       1    200   -3     1975   1981
##    3     7     1   0     95   60    200    0       1    200   -3     1982   2014
##    3     8     2   0    140   60    200    0       1    200   -3     1982   2014
## # Gear-4
##    4     9     1   0     80    1    200    0       1    200   -4     1975   2014
##    4     10    2   0     90    1    200    0       1    200   -4     1975   2014
## ## ------------------------------------------------------------------------------------- ##
## ## Retained
## # Gear-1
##   -1     11    1   0    133   50    200    0      1    900   -1     1975   2014
##   -1     12    2   0    137   50    200    0      1    900   -1     1975   2014
## # Gear-2
##   -2     15    1   0    595    1    700    0      1    900   -3     1975   2014
##   -2     16    2   0     10    1    700    0      1    900   -3     1975   2014
## # Gear-3
##   -3     17    1   0    590    1    700    0      1    900   -3     1975   1981
##   -3     18    2   0     10    1    700    0      1    900   -3     1982   2014
## # Gear-4
##   -4     19    1   0    580    1    700    0      1    900   -3     1975   2014
##   -4     20    2   0     20    1    700    0      1    900   -3     1975   2014
## ## ------------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------------- ##
## ## PRIORS FOR CATCHABILITY
## ##  TYPE: 0 = UNIFORM, 1 = NORMAL (log-space), 2 = time-varying (nyi)
```

```
## ##  LAMBDA: Arbitrary relative weights for each series, 0 = do not fit.
## ## ------------------------------------------------------------------------------------- ##
## ## SURVEYS/INDICES ONLY
## ## NMFS  BSFRF
## ## TYPE     Mean_q    SD_q      LAMBDA
##      1      0.843136  0.01       5
##      1      1.000     0.03       1
## ## ------------------------------------------------------------------------------------- ##
## ## ------------------------------------------------------------------------------------- ##
## ## PENALTIES FOR AVERAGE FISHING MORTALITY RATE FOR EACH GEAR
## ## ------------------------------------------------------------------------------------- ##
## ## Mean_F  STD_PHZ1  STD_PHZ2     PHZ
##      0.20      0.05     45.50      1  # Trap
##      0.05      0.05     45.50      1  # Trawl
##      0.00      2.00     20.00     -1  # NMFS
##      0.00      2.00     20.00     -1  # BSFRF
## ## ------------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------------- ##
## ## OPTIONS FOR SIZE COMPOSTION DATA (COLUMN FOR EACH MATRIX)
## ## LIKELIHOOD OPTIONS:
## ##  • 0 ignore composition data in model fitting.
## ##  • 1 multinomial with estimated/fixed sample size
## ##  • 2 robust_multi. Robust approximation to multinomial
## ##  • 3 logistic normal  (NIY)
## ##  • 4 multivariate-t   (NIY)
## ## AUTOTAIL COMPRESSION:
## ##   - pmin is the cumulative proportion used in tail compression.
## ## ------------------------------------------------------------------------------------- ##
## # 1   1   1   1   1   1 # Type of likelihood.
##  2   2   2   2   2   2 # Type of likelihood.
##  0   0   0   0   0   0 # Auto tail compression (pmin)
## -4  -4  -4  -4  -4  -4 # Phz for estimating effective sample size (if appl.)
##  1   2   3   4   4   5 # Composition aggregator
## ## ------------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------------- ##
## ## 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)
##   3
## ## Phase of estimation
##  2
## ## STDEV in m_dev for Random walk
##   0.40
## ## Number of nodes for cubic spline or number of step-changes for option 3
##   4
## ## Year position of the knots (vector must be equal to the number of nodes)
##    1976 1980 1985 1994
##
```

```
## ## ------------------------------------------------------------------------------------- ##
## ## OTHER CONTROLS
## ## ------------------------------------------------------------------------------------- ##
##   3       # Estimated rec_dev phase
##   0       # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
##   0       # INITIALIZE MODEL AT UNFISHED RECRUITS (0=FALSE, 1=TRUE)
##   1984    # First year for average recruitment for Bspr calculation.
##   2014    # 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 TwoSex model control file:

```
## # Model 1, fixed multinomial sample sizes
## # ------------------------------------------------------------------------------------------ #
## # Controls for leading parameter vector theta
## # LEGEND FOR PRIOR:
## #                  0 -> uniform
## #                  1 -> normal
## #                  2 -> lognormal
## #                  3 -> beta
## #                  4 -> gamma
## # ------------------------------------------------------------------------------------------ #
## # ntheta
##   9
## # ------------------------------------------------------------------------------------------ #
## # ival        lb        ub        phz   prior     p1      p2         # parameter          #
## # ------------------------------------------------------------------------------------------ #
##   0.18      0.01         1         -4       2   0.18    0.04         # M
##    7.0       -10        20         -2       1   10.0    30.0         # logR0
##   11.0       -10        20          2       1   10.0    30.0         # logR1 To estimate if NOT init
##   10.0       -10        20          1       1   10.0    30.0         # logRbar To estimate if NOT in
##   72.0        55       100         -4       1   72.5    7.25         # Recruitment Expected Value
##   0.561      0.1         5         -3       0    0.1     5.0         # Recruitment scale (variance c
##  -0.40       -10      0.75         -4       0  -10.0    0.75         # ln(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
## ## ------------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------------- ##
## ## GROWTH PARAM CONTROLS                                                                 ##
## ## nGrwth                                                                               ##
## ##                                                                                      ##
## ## Two lines for each parameter if split sex, one line if not                           ##
## ## ------------------------------------------------------------------------------------- ##
## # ival        lb        ub        phz   prior     p1      p2         # parameter        ##
## ## ------------------------------------------------------------------------------------- ##
##   17.5       1.0      90.0         -3       0    0.0    999.0         # alpha males or combined
```

```
##   17.5       1.0      90.0         -3       0    0.0    999.0         # alpha
##    0.10      0.0       0.9         -3       0    0.0    999.0         # beta males or combined
##    0.10      0.0       0.9         -3       0    0.0    999.0         # beta
##    0.30      0.0      90.0         -4       0    0.0    999.0         # gscale males or combined
##    0.30      0.15     90.0         -4       0    0.0    999.0         # gscale
##  140.5       1.0     195.0         -3       0    0.0    999.0         # molt_mu males or combined
##  400.0       1.0     999.0         -4       0    0.0    999.0         # molt_mu
##    0.071     0.0001    9.0         -4       0    0.0    999.0         # molt_cv males or combined
##    0.1       0.0001    9.0         -4       0    0.0    999.0         # molt_cv
## ## ------------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------------- ##
## ## SELECTIVITY CONTROLS                                                                  ##
## ##    -Each gear must have a selectivity and a retention selectivity                     ##
## ## LEGEND sel type: 1 = coefficients, 2 = logistic, 3 = logistic95, 4 = double normal   ##
## ##        gear index: use +ve for selectivity, -ve for retentio                          ##
## ##        sex dep: 0 for sex-independent, 1 for sex-dependent.                           ##
## ## ------------------------------------------------------------------------------------- ##
## ## ivector for number of year periods or nodes                                          ##
## ## Gear-1    Gear-2    Gear-3   Gear-4
##    1         1         2        1         # Selectivity periods
##    1         0         1        1         # sex specific selectivity
##    3         3         3        3         # male   selectivity type
##    3         3         3        3         # female selectivity type
## ## Gear-1    Gear-2    Gear-3   Gear-4
##    1         1         1        1         # Retention periods
##    1         0         0        0         # sex specific retention
##    3         2         2        2         # male   retention type
##    2         2         2        2         # female retention type
##    1         0         0        0         # male   retention flag (0 = no, 1 = yes)
##    0         0         0        0         # female 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     ##
## ## ------------------------------------------------------------------------------------- ##
## ## Selectivity P(capture of all sizes)
## # Gear-1
##    1     1     1   1    100    5    185    0      10    200    3     1975   2014
##    1     2     2   1    120    5    185    0      10    200   -1     1975   2014
##    1     1     1   2     80   60    150    0      10    200    3     1975   2014
##    1     2     2   2     95   60    150    0      10    200   -1     1975   2014
## # Gear-2
##    2     3     1   0    110    5    185    0      10    200    3     1975   2014
##    2     4     2   0    150    5    185    0      10    200    3     1975   2014
## # Gear-3
##    3     5     1   1     74   60    200    0       1    200   -3     1975   1981
##    3     6     2   1     95   60    200    0       1    200   -3     1975   1981
##    3     7     1   1     95   60    200    0       1    200   -3     1982   2014
##    3     8     2   1    140   60    200    0       1    200   -3     1982   2014
##    3     5     1   2     90   60    200    0       1    200   -3     1975   1981
##    3     6     2   2    160   60    200    0       1    200   -3     1975   1981
##    3     7     1   2    100   60    200    0       1    200   -3     1982   2014
##    3     8     2   2    170   60    200    0       1    200   -3     1982   2014
## # Gear-4
```

```
##    4     9     1   1     70    1    200    0       1    200    4     1975   2014
##    4     10    2   1     90    1    200    0       1    200   -4     1975   2014
##    4     9     1   2    110    1    200    0       1    200    4     1975   2014
##    4     10    2   2    190    1    200    0       1    200   -4     1975   2014
## ## ------------------------------------------------------------------------------------ ##
## ## Retained
## # Gear-1
##   -1     11    1   1    133   50    200    0       1    900   -4     1975   2014
##   -1     12    2   1    137   50    200    0       1    900   -4     1975   2014
##   -1     13    1   2    591    1    700    0       1    900   -3     1975   2014
##   -1     14    2   2     11    1    700    0       1    900   -3     1975   2014
## # Gear-2
##   -2     15    1   0    595    1    700    0       1    900   -3     1975   2014
##   -2     16    2   0     10    1    700    0       1    900   -3     1975   2014
## # Gear-3
##   -3     17    1   0    590    1    700    0       1    900   -3     1975   1981
##   -3     18    2   0     10    1    700    0       1    900   -3     1982   2014
## # Gear-4
##   -4     19    1   0    580    1    700    0       1    900   -3     1975   2014
##   -4     20    2   0     20    1    700    0       1    900   -3     1975   2014
## ## ------------------------------------------------------------------------------------ ##
##
## ## ------------------------------------------------------------------------------------ ##
## ## PRIORS FOR CATCHABILITY
## ##  TYPE: 0 = UNIFORM, 1 = NORMAL (log-space), 2 = time-varying (nyi)
## ## ------------------------------------------------------------------------------------ ##
## ## SURVEYS/INDICES ONLY
## ## NMFS  BSFRF
## ## TYPE     Mean_q    SD_q      CPUE_Lambda
##      1      0.843136  0.03      1 # 0.896 is the magic number * 0.941 (Jies max selex)
##      1      1.0       0.03      1
## ## ------------------------------------------------------------------------------------ ##
##
## ## ------------------------------------------------------------------------------------ ##
## ## PENALTIES FOR AVERAGE FISHING MORTALITY RATE FOR EACH GEAR
## ## ------------------------------------------------------------------------------------ ##
## ## Trap  Trawl NMFS  BSFRF
## ## Mean_F  STD_PHZ1  STD_PHZ2  PHZ
##      0.20      0.05     45.50    1  #TRAP
##      0.05      0.05     45.50    1  #Trawl
##      0.00      2.00     20.00   -1  #NMFS trawl survey (0 catch)
##      0.00      2.00     20.00   -1  #BSFRF (0)
## ## ------------------------------------------------------------------------------------ ##
##
## ## ------------------------------------------------------------------------------------ ##
## ## OPTIONS FOR SIZE COMPOSTION DATA (COLUMN FOR EACH MATRIX)
## ## LIKELIHOOD OPTIONS:
## ##   -1) multinomial with estimated/fixed sample size
## ##   -2) robust_multi. Robust approximation to multinomial
## ##   -3) logistic normal (NIY)
## ##   -4) multivariate-t  (NIY)
## ## AUTOTAIL COMPRESSION:
## ##   - pmin is the cumulative proportion used in tail compression.
## ## ------------------------------------------------------------------------------------ ##
```

```
## # 2   2   2   2   2   2   2   2   2   # Type of likelihood.
##  1   1   1   1   1   1   1   1   1   # Type of likelihood.
##  0   0   0   0   0   0   0   0   0   # Auto tail compression (pmin)
## -4  -4  -4  -4  -4  -4  -4  -4  -4   # Phz for estimating effective sample size (if appl.)
##  1   2   2   3   3   4   4   4   5   # Composition aggregator
## ## ------------------------------------------------------------------------------------- ##
##
## ## ------------------------------------------------------------------------------------- ##
## ## 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)
##   3
## ## Phase of estimation
##   3
## ## STDEV in m_dev for Random walk
##   0.80
## ## Number of nodes for cubic spline or number of step-changes for option 3
##   4
## ## Year position of the knots (vector must be equal to the number of nodes)
##   1976 1980 1985 1994
##
## ## ------------------------------------------------------------------------------------- ##
## ## OTHER CONTROLS
## ## ------------------------------------------------------------------------------------- ##
##   3       # Estimated rec_dev phase
##   0       # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
##   0       # INITIALIZE MODEL AT UNFISHED RECRUITS (0=FALSE, 1=TRUE)
##   1984    # First year for average recruitment for Bspr calculation.
##   2014    # 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
```