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
```