

## 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 #
## #          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
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## ##          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
## ## index index par sex  ival  lb   ub   prior p1    p2    phz  start end    ##
## ## ----- ##
## ## # 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   4    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   4    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  par  sel
## ## index index par sex  ival  lb   ub   prior p1    p2    phz  start end    ##
## ## ----- ##
## ## # 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.
## ## ----- ##

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```

## ## SURVEYS/INDICES ONLY
## ## NMFS BSFRF
## ## TYPE      Mean_q    SD_q      LAMBDA
##      1      0.843136  0.01      1
##      1      1.000    0.03      1
## ## ----- ##
## ## 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 type: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## ival      lb      ub      phz    prior    p1      p2      ##
##      0.001    0.0     10.0    -4     4        1.0    100    # NMFS
##      0.001    0.0     10.0    -4     4        1.0    100    # BSFRF
## ## ----- ##
## ##
## ## ----- ##
## ## 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)
## ## 1  1  1  1  1  1 # Initial value for effective sample size multiplier
## ## -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 MORTALIITY RATES
## ## ----- ##
## ## TYPE:
## ##      0 = constant natural mortality
## ##      1 = Random walk (deviates constrained by variance in M)
## ##      2 = Cubic Spline (deviates constrained by nodes & node-placement)
## ##      3 = Blocked changes (deviates constrained by variance AT specific knots)

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## ##      5 = Blocked changes (deviates constrained by variance AT specific knots relative to base)
##      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
##      2
## ## Year position of the knots (vector must be equal to the number of nodes)
##      1980 1985
##
## ## ----- ##
## ## 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:

```

## ## ----- ##
## ## LEADING PARAMETER CONTROLS ##
## ##      Controls for leading parameter vector (theta) ##
## ## LEGEND ##
## ##      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 in
##      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 PARAMETER CONTROLS ##

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## ##      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      ##
## ##      Selectivity P(capture of all sizes). 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 (NIY), 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      ##
## ## ----- ##
## ## 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      start  end      ##
## ## index index par sex  ival  lb    ub    prior  p1  p2    phz  period period      ##
## ## ----- ##
## # Gear-1
##      1      1      1      1      100    5    185    0      1    999    3    1975    2014
##      1      2      2      1      120    5    185    0      1    999    3    1975    2014
##      1      3      1      2      80    60    150    0      1    999    3    1975    2014
##      1      4      2      2      95    60    150    0      1    999    3    1975    2014
## # Gear-2
##      2      5      1      0      110    5    185    0      1    999    3    1975    2014
##      2      6      2      0      150    5    185    0      1    999    3    1975    2014
## # Gear-3
##      3      7      1      1      74    60    150    0      1    999   -3    1975    1981
##      3      8      2      1      95    60    150    0      1    999   -3    1975    1981

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##      3      9      1      1      95      60      200      0      1      999      -3      1982      2014
##      3     10      2      1     140      60      200      0      1      999      -3      1982      2014
##      3     11      1      2      90      60      200      0      1      999      -3      1975      1981
##      3     12      2      2     160      60      200      0      1      999      -3      1975      1981
##      3     13      1      2     100      60      200      0      1      999      -3      1982      2014
##      3     14      2      2     170      60      200      0      1      999      -3      1982      2014
## # Gear-4
##      4     15      1      1      70      1      200      0      1      999      4      1975      2014
##      4     16      2      1      90      1      200      0      1      999      4      1975      2014
##      4     17      1      2     110      1      200      0      1      999      4      1975      2014
##      4     18      2      2     190      1      200      0      1      999      4      1975      2014
## ## ----- ##
## ## Retained ##
## ## ----- ##
## # Gear-1
##     -1     19      1      1     133      1      999      0      1      999      -4      1975      2014
##     -1     20      2      1     137      1      999      0      1      999      -4      1975      2014
##     -1     21      1      2     591      1      999      0      1      999      -3      1975      2014
##     -1     22      2      2      11      1      999      0      1      999      -3      1975      2014
## # Gear-2
##     -2     23      1      0     595      1      999      0      1      999      -3      1975      2014
##     -2     24      2      0      10      1      999      0      1      999      -3      1975      2014
## # Gear-3
##     -3     25      1      0     590      1      999      0      1      999      -3      1975      1981
##     -3     26      2      0      10      1      999      0      1      999      -3      1982      2014
## # Gear-4
##     -4     27      1      0     580      1      999      0      1      999      -3      1975      2014
##     -4     28      2      0      20      1      999      0      1      999      -3      1975      2014
## ## ----- ##
## ##
## ## ----- ##
## ## PRIORS FOR CATCHABILITY ##
## ## LEGEND ##
## ##      Type: 0 = uniform, 1 = normal (log-space), 2 = time-varying (NIY) ##
## ## ----- ##
## ## Type      Mean_q      SD_q      CPUE_Lambda
##      1      0.843136    0.03      1      # NMFS, 0.896 is the magic number * 0.941 (Jies max selex)
##      1      1.0          0.03      1      # BSFRF
## ## ----- ##
## ##
## ## ----- ##
## ## 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 type: 0 = uniform, 1 = normal, 2 = lognormal, 3 = beta, 4 = gamma ##
## ## ----- ##
## ## ival      lb      ub      phz      prior      p1      p2
##      0.001    0.0     10.0    -4      4          1.0     100    # NMFS
##      0.001    0.0     10.0    -4      4          1.0     100    # BSFRF
## ## ----- ##
## ##
## ## ----- ##
## ## PENALTIES FOR AVERAGE FISHING MORTALITY RATE FOR EACH GEAR ##

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```

## ## ----- ##
## ## Mean_F   STD_PHZ1   STD_PHZ2   PHZ
##   0.20     0.05     45.50     1   # Pot
##   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
## ##   One column for each data matrix
## ## LEGEND
## ##   Likelihood: 1 = Multinomial with estimated/fixed sample size
## ##                  2 = Robust approximation to multinomial
## ##                  3 = logistic normal (NIY)
## ##                  4 = multivariate-t (NIY)
## ##                  5 = Dirichlet
## ## AUTO TAIL COMPRESSION
## ##   pmin is the cumulative proportion used in tail compression
## ## ----- ##
## # 0 0 0 0 0 1 1 1 1 1 # Type of likelihood
## # 1 1 1 1 1 1 1 1 1 1 # Type of likelihood
## # 0 0 0 0 0 0 0 0 0 0 # Auto tail compression (pmin)
## # 1 1 1 1 1 1 1 1 1 1 # Initial value for effective sample size multiplier
## # -4 -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 5 # Composition aggregator
## ## ----- ##
##
## ## ----- ##
## ## TIME VARYING NATURAL MORTALIIY RATES
## ## LEGEND
## ## 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
## ## 3
## ## STDEV in m_dev for Random walk
## ## 0.80
## ## 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)
## ## 1980 1985
## ## ----- ##
##
## ## ----- ##
## ## 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

```