Appendix B: BBRKC Stock Assessment Input Files

The data file:

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## #======================================================================
## #======================================================================
## # Gmacs Main  Data  File  Version 1.1:  BBRKC Example
## # GEAR_INDEX   DESCRIPTION
## #    1        : Pot fishery retained catch.
## #    1        : Pot fishery with discarded catch.
## #    2        : Trawl bycatch
## #    3        : Trawl survey
## #    4        : BSFRF survey
##
## # Fisheries:  1 Pot Fishery,  2 Pot Discard,  3 Trawl by-catch, 4 BSFRF
## # Surveys:    3 NMFS  Trawl Survey, 4 BSFRF Survey
## #======================================================================
##
## 1975  # Start year
## 2014  # End year
## 2015  # Projection year
## 4     # Number of seasons
## 4     # Number  of  distinct  data  groups  (among fishing fleets and surveys)
## 1     # Number  of  sexes
## 2     # Number  of  shell condition types
## 1     # Number  of  maturity  types
## 20    # Number  of  size-classes  in  the model
## 4     # Season recruitment occurs
## 1     # Season molting and growth occurs
## 2     # Season to calculate SSB
## 1     # Season for N output
## # size_breaks (a  vector  giving  the break points  between size  intervals,  dim=nclass+1)
## 65  70  75  80  85  90  95  100 105 110 115 120 125 130 135 140 145 150 155 160 165
## # weight-at-length input method (1 = allometry w_l = a*l^b, 2 = vector by sex)
## 2
## # weight-at-length  allometry w_l = a*l^b
## 4.03E-07
## ##  b (male,  female)
## 3.141334
## ## Males
## 0.224781 0.281351 0.346923 0.422209 0.507927 0.604802 0.713564 0.83495 0.9697 1.11856 1.28229 1.4616
## # Male  mature  weight-at-length  (weight * proportion  mature)
## 0 0 0 0 0 0 0 0 0 0 0 0 1.432 1.625 1.835 2.063 2.31  2.576 2.862 3.169 3.7
## # Proportion  mature  by  sex
## 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1
## # Natural mortality per season input type (1 = vector by season, 2 = matrix by season/year)
## 1
## # Proportion of the total natural mortality to be applied each season (must add to 1)
## 0.3  0.3  0.3  0.1
## # Fishing fleet names (delimited  with  : no  spaces  in  names)
## Pot_Fishery:Trawl_Bycatch
## # Survey  names (delimited  with  : no  spaces  in  names)
## NMFS_Trawl:BSFRF
## # Number  of  catch data  frames
## 3
## # Number  of  rows  in  each  data  frame
```

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## 39  24  38
## #0.5  # Time  between survey  and fishery
## ## ------------------------------------------------------------------------------------  ##
## ##  CATCH DATA
## ##  Type  of  catch:  1 = retained, 2 = discard,  3 =
## ##  Units of  catch:  1 = biomass,  2 = numbers
## ##  for BBRKC Units are in  1000 mt  for landed  & million crabs for discards.
## ## ------------------------------------------------------------------------------------  ##
## ##  Male  Retained  1000
## ##  year  seas  fleet sex obs     cv    type  units molt  effort  discard_mortality
##      1975  2     1     1   23281.2 0.05  1     1     1     0       0
##      1976  2     1     1   28993.6 0.05  1     1     1     0       0
##      1977  2     1     1   31736.9 0.05  1     1     1     0       0
##      1978  2 1 1 39743 0.05  1 1 1 0 0
##      1979  2 1 1 48910 0.05  1 1 1 0 0
##      1980  2 1 1 58943.6 0.05  1 1 1 0 0
##      1981  2 1 1 15236.8 0.05  1 1 1 0 0
##      1982  2 1 1 1361.32 0.05  1 1 1 0 0
##      1983  2 1 1 1 0.05  1 1 1 0 0
##      1984  2 1 1 1897.1  0.05  1 1 1 0 0
##      1985  2 1 1 1893.75 0.05  1 1 1 0 0
##      1986  2 1 1 5168.19 0.05  1 1 1 0 0
##      1987  2 1 1 5574.24 0.05  1 1 1 0 0
##      1988  2 1 1 3351.05 0.05  1 1 1 0 0
##      1989  2 1 1 4656.03 0.05  1 1 1 0 0
##      1990  2 1 1 9272.79 0.05  1 1 1 0 0
##      1991  2 1 1 7885.25 0.05  1 1 1 0 0
##      1992  2 1 1 3681.81 0.05  1 1 1 0 0
##      1993  2 1 1 6659.64 0.05  1 1 1 0 0
##      1994  2 1 1 42.1841 0.05  1 1 1 0 0
##      1995  2 1 1 36.2874 0.05  1 1 1 0 0
##      1996  2 1 1 3861.89 0.05  1 1 1 0 0
##      1997  2 1 1 4042.14 0.05  1 1 1 0 0
##      1998  2 1 1 6779.39 0.05  1 1 1 0 0
##      1999  2 1 1 5377.79 0.05  1 1 1 0 0
##      2000  2 1 1 3738.05 0.05  1 1 1 0 0
##      2001  2 1 1 3865.97 0.05  1 1 1 0 0
##      2002  2 1 1 4384.42 0.05  1 1 1 0 0
##      2003  2 1 1 7135.46 0.05  1 1 1 0 0
##      2004  2 1 1 7006.64 0.05  1 1 1 0 0
##      2005  2 1 1 8399.62 0.05  1 1 1 0 0
##      2006  2 1 1 7143.17 0.05  1 1 1 0 0
##      2007  2 1 1 9303.95 0.05  1 1 1 0 0
##      2008  2 1 1 9216.07 0.05  1 1 1 0 0
##      2009  2 1 1 7272.47 0.05  1 1 1 0 0
##      2010  2 1 1 6761.53 0.05  1 1 1 0 0
##      2011  2 1 1 3607.09 0.05  1 1 1 0 0
##      2012  2 1 1 3621.73 0.05  1 1 1 0 0
##      2013  2 1 1 3990.99 0.05  1 1 1 0 0
## ##  Male  discards  Pot fishery 1000
##    1990  2 1 1 526.914 0.05  2 2 1 0 0.2
##    1991  2 1 1 407.824 0.05  2 2 1 0 0.2
##    1992  2 1 1 552.009 0.05  2 2 1 0 0.2
##    1993  2 1 1 763.157 0.05  2 2 1 0 0.2
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##    1994  2 1 1 3.81194 0.05  2 2 1 0 0.2
##    1995  2 1 1 3.27373 0.05  2 2 1 0 0.2
##    1996  2 1 1 164.636 0.05  2 2 1 0 0.2
##    1997  2 1 1 244.687 0.05  2 2 1 0 0.2
##    1998  2 1 1 959.712 0.05  2 2 1 0 0.2
##    1999  2 1 1 314.171 0.05  2 2 1 0 0.2
##    2000  2 1 1 360.833 0.05  2 2 1 0 0.2
##    2001  2 1 1 417.875 0.05  2 2 1 0 0.2
##    2002  2 1 1 442.658 0.05  2 2 1 0 0.2
##    2003  2 1 1 918.858 0.05  2 2 1 0 0.2
##    2004  2 1 1 345.549 0.05  2 2 1 0 0.2
##    2005  2 1 1 1359.53 0.05  2 2 1 0 0.2
##    2006  2 1 1 563.751 0.05  2 2 1 0 0.2
##    2007  2 1 1 1001.31 0.05  2 2 1 0 0.2
##    2008  2 1 1 1165.51 0.05  2 2 1 0 0.2
##    2009  2 1 1 888.124 0.05  2 2 1 0 0.2
##    2010  2 1 1 797.476 0.05  2 2 1 0 0.2
##    2011  2 1 1 394.962 0.05  2 2 1 0 0.2
##    2012  2 1 1 205.155 0.05  2 2 1 0 0.2
##    2013  2 1 1 310.579 0.05  2 2 1 0 0.2
## ##  Trawl fishery discards  1000
##    1976  2 2 1 682.795 0.05  2 2 1 0 0.8
##    1977  2 2 1 1249.85 0.05  2 2 1 0 0.8
##    1978  2 2 1 1320.62 0.05  2 2 1 0 0.8
##    1979  2 2 1 1331.94 0.05  2 2 1 0 0.8
##    1980  2 2 1 1036.5  0.05  2 2 1 0 0.8
##    1981  2 2 1 219.383 0.05  2 2 1 0 0.8
##    1982  2 2 1 574.888 0.05  2 2 1 0 0.8
##    1983  2 2 1 420.443 0.05  2 2 1 0 0.8
##    1984  2 2 1 1094.04 0.05  2 2 1 0 0.8
##    1985  2 2 1 390.061 0.05  2 2 1 0 0.8
##    1986  2 2 1 200.606 0.05  2 2 1 0 0.8
##    1987  2 2 1 186.436 0.05  2 2 1 0 0.8
##    1988  2 2 1 597.816 0.05  2 2 1 0 0.8
##    1989  2 2 1 174.066 0.05  2 2 1 0 0.8
##    1990  2 2 1 247.553 0.05  2 2 1 0 0.8
##    1991  2 2 1 315.959 0.05  2 2 1 0 0.8
##    1992  2 2 1 335.39  0.05  2 2 1 0 0.8
##    1993  2 2 1 426.564 0.05  2 2 1 0 0.8
##    1994  2 2 1 88.9147 0.05  2 2 1 0 0.8
##    1995  2 2 1 194.24  0.05  2 2 1 0 0.8
##    1996  2 2 1 106.509 0.05  2 2 1 0 0.8
##    1997  2 2 1 73.4005 0.05  2 2 1 0 0.8
##    1998  2 2 1 159.848 0.05  2 2 1 0 0.8
##    1999  2 2 1 201.575 0.05  2 2 1 0 0.8
##    2000  2 2 1 100.354 0.05  2 2 1 0 0.8
##    2001  2 2 1 164.565 0.05  2 2 1 0 0.8
##    2002  2 2 1 155.091 0.05  2 2 1 0 0.8
##    2003  2 2 1 172.32  0.05  2 2 1 0 0.8
##    2004  2 2 1 119.557 0.05  2 2 1 0 0.8
##    2005  2 2 1 155.222 0.05  2 2 1 0 0.8
##    2006  2 2 1 116.676 0.05  2 2 1 0 0.8
##    2007  2 2 1 138.486 0.05  2 2 1 0 0.8
##    2008  2 2 1 159.516 0.05  2 2 1 0 0.8
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##   2009  2 2 1 103.743 0.05  2 2 1 0 0.8
##   2010  2 2 1 89.0308 0.05  2 2 1 0 0.8
##   2011  2 2 1 69.2305 0.05  2 2 1 0 0.8
##   2012  2 2 1 62.2251 0.05  2 2 1 0 0.8
##   2013  2 2 1 126.832 0.05  2 2 1 0 0.8
##
## ##  ------------------------------------------------------------------------------------  ##
## ##  RELATIVE  ABUNDANCE DATA
## ##  Units of  Abundance:  1 = biomass,  2 = numbers
## ##  TODO: add column for maturity for terminal molt life-histories
## ##  for BBRKC Units are in  million crabs for Abundance.
## ##  ------------------------------------------------------------------------------------  ##
## ##  Number  of  relative  abundance indicies
## 2
## ##  Number  of  rows  in  each  index
## 40  2
## # Survey  data  (abundance  indices,  units are millions  of  crabs)
## # Year, Seas, Fleet,  Sex,  Abundance,  CV     units
##   1975  1     3       1     146028      0.188  1
##   1976  1     3       1     200083      0.169  1
##   1977  1     3       1     237777      0.141  1
##   1978  1     3       1     203160      0.155  1
##   1979  1     3       1     160779      0.133  1
##   1980  1     3       1     164259      0.221  1
##   1981  1     3       1     64005       0.121  1
##   1982  1     3       1     72147.9     0.259  1
##   1983  1     3       1     35370.1     0.216  1
##   1984  1     3       1     82562.7     0.678  1
##   1985  1     3       1     27003.7     0.158  1
##   1986  1     3       1     40811.3     0.428  1
##   1987  1     3       1     46611.1     0.209  1
##   1988  1     3       1     34918.7     0.217  1
##   1989  1     3       1     48290.5     0.214  1
##   1990  1     3       1     36269.9     0.214  1
##   1991  1     3       1     70018.5     0.441  1
##   1992  1     3       1     25255.4     0.174  1
##   1993  1     3       1     36426.3     0.174  1
##   1994  1     3       1     23115.7     0.173  1
##   1995  1     3       1     27468.5     0.276  1
##   1996  1     3       1     27078.4     0.201  1
##   1997  1     3       1     60276.3     0.263  1
##   1998  1     3       1     46352.9     0.178  1
##   1999  1     3       1     40696.1     0.161  1
##   2000  1     3       1     39292.6     0.178  1
##   2001  1     3       1     28161.3     0.178  1
##   2002  1     3       1     45261.7     0.203  1
##   2003  1     3       1     55153       0.164  1
##   2004  1     3       1     60162.2     0.163  1
##   2005  1     3       1     55066.5     0.173  1
##   2006  1     3       1     51211.5     0.122  1
##   2007  1     3       1     58063.2     0.135  1
##   2008  1     3       1     55233.2     0.104  1
##   2009  1     3       1     43948.1     0.287  1
##   2010  1     3       1     36353.3     0.15   1
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##   2011  1     3       1     25064       0.141  1
##   2012  1     3       1     30605.4     0.162  1
##   2013  1     3       1     39542.5     0.245  1
##   2014  1     3       1     59205.2     0.191  1
##   2007  1     4       1     130352.8    0.2164 1
##   2008  1     4       1     106040.9    0.1939 1
## ##  Number  of  length  frequency matrices
## 6
## ##  Number  of  rows  in  each  matrix
## 36  22  37  40  40  2
## ##  Number  of  bins  in  each  matrix  (columns  of  size  data)
## 20  20  20  20  20  20
## ##  SIZE  COMPOSITION DATA  FOR ALL FLEETS
## ##  ------------------------------------------------------------------------------------  ##
## ##  SIZE  COMP  LEGEND
## ##  Sex:  1 = male, 2 = female, 0 = both  sexes combined
## ##  Type  of  composition:  1 = retained, 2 = discard,  0 = total composition
## ##  Maturity  state:  1 = immature, 2 = mature, 0 = both  states  combined
## ##  Shell condition:  1 = new shell,  2 = old shell,  0 = both  shell types combined
## ##  ------------------------------------------------------------------------------------  ##
## ##length  proportions of  retained  males
## ##Year, Seas, Fleet,  Sex,  Type, Shell,  Maturity, Nsamp,  DataVec
##   1975  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0071  0.0741  0.1721  0.2239  0.2122  0.1464  0.085
##   1976  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0016  0.029 0.1418  0.2316  0.2199  0.1635  0.1071
##   1977  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0017  0.0192  0.1382  0.2442  0.2226  0.1605  0.104
##   1978  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0012  0.0209  0.1441  0.2588  0.2401  0.1673  0.096
##   1979  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0013  0.0119  0.0747  0.1649  0.1998  0.2004  0.155
##   1980  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0008  0.0138  0.0919  0.1771  0.195 0.1792  0.1404
##   1981  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0006  0.0225  0.1164  0.1743  0.1711  0.1584  0.128
##   1982  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0 0.0544  0.2576  0.2802  0.1667  0.0837  0.0508  0.
##   1984  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0003  0.0023  0.0654  0.311 0.3135  0.1763  0.0846
##   1985  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0005  0.0044  0.079 0.2869  0.3098  0.1898  0.086 0.
##   1986  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0016  0.0531  0.2613  0.3289  0.2084  0.0978  0.035
##   1987  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0013  0.0284  0.1895  0.3045  0.2522  0.1421  0.050
##   1988  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0 0.0202  0.1294  0.2646  0.2471  0.1876  0.1033  0.
##   1989  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0005  0.0187  0.1211  0.2209  0.219 0.1908  0.1197
##   1990  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0003  0 0.0146  0.0887  0.1801  0.1707  0.1728  0.143
##   1991  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0001  0.0005  0.0141  0.0848  0.1651  0.179 0.1739
##   1992  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0.0003  0.0002  0.0005  0.0095  0.0638  0.1317  0.1673
##   1993  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0014  0.0138  0.094 0.1789  0.1739  0.1596  0.1331
##   1996  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0006  0.0006  0.0129  0.0779  0.1407  0.162 0.1771
##   1997  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0004  0.0003  0.0138  0.0899  0.1486  0.1603  0.1699
##   1998  1 1 1 1 0 0 100 0 0 0 0 0 0 0.0001  0.0001  0.0001  0.0001  0.0004  0.0002  0.0008  0.0225
##   1999  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0.0001  0 0.0001  0.0147  0.1313  0.2575  0.2292  0.1624
##   2000  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0.0001  0.0001  0 0.0001  0.0003  0.0111  0.0931  0.1945  0.
##   2001  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0.0001  0.0001  0.0001  0.0002  0.0002  0.0012  0.0181  0.0836
##   2002  1 1 1 1 0 0 100 0 0 0 0 0 0 0.0001  0 0.0001  0.0001  0.0001  0 0.0002  0.0151  0.108 0.1884
##   2003  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0.0001  0.0001  0.0002  0.0009  0.0243  0.1464  0.232 0.187
##   2004  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0002  0.0064  0.0514  0.1302  0.1702  0.1971  0.163
##   2005  1 1 1 1 0 0 100 0 0 0 0 0 0 0.0001  0 0 0 0.0001  0.0001  0.0008  0.015 0.0859  0.1543  0.160
##   2006  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0.0001  0.0001  0.0004  0.0102  0.0739  0.1905  0.2203
##   2007  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0002  0.0003  0.0067  0.0871  0.1833  0.1934  0.1846
##   2008  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0001  0.0002  0.01  0.0746  0.1457  0.1619  0.179 0.
##   2009  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0002  0.0108  0.1152  0.2215  0.1968  0.1588  0.108
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##   2010  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0.0003  0.0091  0.0986  0.2244  0.2238  0.1861  0.11
##   2011  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0003  0.0001  0.0003  0.0114  0.118 0.2436  0.2292  0.
##   2012  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0.0001  0 0.0001  0 0 0.0044  0.0499  0.1249  0.173 0.1886
##   2013  1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0.0001  0.0001  0 0 0.0001  0.0001  0.0054  0.0525  0.1271  0.
## ##length  proportions of  pot discarded males
## ##Year, Seas, Fleet,  Sex,  Type, Shell,  Maturity, Nsamp,  DataVec
##   1990  1 1 1 2 0 0 100 0.0011  0 0.0011  0.008 0.0046  0.0126  0.0069  0.0378  0.0504  0.0767  0.12
##   1991  1 1 1 2 0 0 100 0.0033  0.0101  0.0197  0.0214  0.0242  0.0394  0.0326  0.063 0.0624  0.0692
##   1992  1 1 1 2 0 0 100 0 0.0009  0.0012  0.0111  0.0222  0.0549  0.0869  0.1143  0.1183  0.123 0.11
##   1993  1 1 1 2 0 0 100 0.0019  0.0045  0.0057  0.005 0.0062  0.0122  0.0312  0.0571  0.0778  0.108
##   1996  1 1 1 2 0 0 100 0 0 0 0.0131  0.0524  0.083 0.0742  0.0306  0.048 0.0699  0.0611  0.1004  0.
##   1997  1 1 1 2 0 0 100 0 0.0002  0.0005  0.0007  0.0015  0.0197  0.0553  0.109 0.1268  0.1304  0.10
##   1998  1 1 1 2 0 0 100 0.0002  0.0005  0.0008  0.0044  0.007 0.01  0.0104  0.0175  0.0391  0.097 0.
##   1999  1 1 1 2 0 0 100 0 0 0 0.0086  0.0086  0.0029  0.0076  0.0086  0.0143  0.0286  0.063 0.126 0.
##   2000  1 1 1 2 0 0 100 0.0003  0.0051  0.0192  0.0483  0.0613  0.0576  0.0595  0.0581  0.0532  0.05
##   2001  1 1 1 2 0 0 100 0.0016  0.0057  0.0093  0.0115  0.0155  0.0302  0.0568  0.0866  0.1009  0.11
##   2002  1 1 1 2 0 0 100 0.0012  0.0061  0.006 0.0091  0.0065  0.0104  0.0133  0.0335  0.063 0.1142
##   2003  1 1 1 2 0 0 100 0.0081  0.0119  0.0146  0.0317  0.0552  0.0666  0.072 0.067 0.0642  0.0599
##   2004  1 1 1 2 0 0 100 0.0004  0.0074  0.0177  0.0403  0.051 0.0483  0.0615  0.1087  0.1384  0.1452
##   2005  1 1 1 2 0 0 100 0.0002  0.0008  0.0015  0.0029  0.0076  0.022 0.0343  0.0418  0.0454  0.0658
##   2006  1 1 1 2 0 0 100 0.0003  0.0013  0.0044  0.015 0.0312  0.0377  0.0368  0.0346  0.0452  0.0766
##   2007  1 1 1 2 0 0 100 0.0012  0.0042  0.0068  0.0098  0.0171  0.0366  0.0658  0.085 0.0928  0.0857
##   2008  1 1 1 2 0 0 100 0.0001  0.0003  0.0012  0.0046  0.0108  0.0141  0.0159  0.0214  0.0441  0.08
##   2009  1 1 1 2 0 0 100 0.0004  0.001 0.0018  0.0032  0.0041  0.0073  0.0178  0.0402  0.0631  0.0705
##   2010  1 1 1 2 0 0 100 0.0007  0.0011  0.0025  0.0055  0.0085  0.0119  0.0148  0.0218  0.0341  0.05
##   2011  1 1 1 2 0 0 100 0.0017  0.0066  0.0112  0.0199  0.0204  0.0188  0.0272  0.0309  0.0409  0.05
##   2012  1 1 1 2 0 0 100 0.0006  0.0008  0.0024  0.0042  0.0111  0.0262  0.0416  0.0563  0.0534  0.05
##   2013  1 1 1 2 0 0 100 0.0001  0.0016  0.004 0.0052  0.011 0.0137  0.0227  0.0353  0.06  0.0871  0.
## #length proportions of  trawl male  bycatch
## ##Year, Seas, Fleet,  Sex,  Type, Shell,  Maturity, Nsamp,  DataVec
##   1976  1 2 1 0 0 0 50  0 0 0 0 0 0.013 0.0087  0.0043  0.0216  0.0087  0.026 0.039 0.0433  0.0649
##   1977  1 2 1 0 0 0 50  0.0036  0.0009  0.0009  0.0009  0.0026  0.0035  0.0079  0.0097  0.0317  0.04
##   1978  1 2 1 0 0 0 50  0 0 0 0 0 0 0 0.0025  0.0012  0.0025  0.0149  0.0274  0.0511  0.0872  0.1245
##   1979  1 2 1 0 0 0 50  0.0178  0.0013  0.0025  0.0013  0.0025  0.0076  0.0038  0.0025  0.0013  0.00
##   1980  1 2 1 0 0 0 50  0.0531  0.0207  0.0096  0.0135  0.0142  0.0163  0.0274  0.0263  0.038 0.0375
##   1981  1 2 1 0 0 0 50  0.0262  0.0028  0.0045  0.0066  0.0112  0.0175  0.0279  0.0349  0.0386  0.05
##   1982  1 2 1 0 0 0 50  0.0701  0.0268  0.0247  0.0326  0.0356  0.0443  0.0409  0.0403  0.0401  0.04
##   1983  1 2 1 0 0 0 50  0.0231  0.0214  0.0336  0.0344  0.0311  0.0319  0.0377  0.0445  0.0473  0.04
##   1984  1 2 1 0 0 0 50  0.0366  0.0156  0.0147  0.0199  0.027 0.0342  0.0399  0.0407  0.0431  0.0476
##   1985  1 2 1 0 0 0 50  0.0051  0.0014  0.0034  0.0059  0.01  0.0164  0.0256  0.0396  0.0357  0.0446
##   1986  1 2 1 0 0 0 50  0.0038  0.0019  0.0085  0.0019  0.0056  0.0136  0.0193  0.0357  0.016 0.0249
##   1987  1 2 1 0 0 0 50  0.002 0 0.001 0.002 0.005 0.008 0.019 0.0271  0.017 0.022 0.0441  0.0491  0.
##   1988  1 2 1 0 0 0 50  0.0048  0.0048  0.0063  0.0016  0.0032  0 0.0095  0.0174  0.0127  0.0396  0.
##   1989  1 2 1 0 0 0 50  0.0049  0.0025  0.0019  0.0008  0.0021  0.0021  0.0049  0.0047  0.0098  0.01
##   1990  1 2 1 0 0 0 50  0.0052  0.0052  0.0078  0.0017  0.0069  0.0069  0.0225  0.0207  0.038 0.038
##   1991  1 2 1 0 0 0 50  0.0032  0.0063  0.0032  0.0063  0.0159  0.0127  0.0127  0.0159  0.0317  0.02
##   1992  1 2 1 0 0 0 50  0.0203  0.0203  0.0203  0.0023  0.0068  0.009 0.0135  0.0023  0.0113  0.0158
##   1994  1 2 1 0 0 0 50  0.0035  0.0017  0.0035  0.0069  0.0017  0 0 0 0 0 0.0017  0.0017  0.0087  0.
##   1995  1 2 1 0 0 0 50  0.0072  0.029 0.0145  0.0072  0 0.0072  0 0.0072  0.0072  0.0145  0 0.0145
##   1996  1 2 1 0 0 0 50  0.001 0.0015  0.0025  0.003 0.004 0.009 0.014 0.0156  0.0206  0.0276  0.0346
##   1997  1 2 1 0 0 0 50  0 0 0.0018  0.0018  0.0107  0.022 0.0386  0.054 0.0516  0.051 0.0427  0.0291
##   1998  1 2 1 0 0 0 50  0.0004  0.0004  0.0004  0 0 0.0008  0.0028  0.0035  0.0067  0.013 0.0268  0.
##   1999  1 2 1 0 0 0 50  0.002 0.0007  0.001 0.0003  0.0007  0 0.0033  0.0017  0.0023  0.0056  0.0083
##   2000  1 2 1 0 0 0 50  0 0 0.0012  0.0006  0.0006  0.003 0.0042  0.0162  0.0222  0.0258  0.0252  0.
```

```
##   2001  1 2 1 0 0 0 50  0 0.0001  0.001 0.0006  0.0023  0.0071  0.008 0.0111  0.0192  0.0208  0.0224
##   2002  1 2 1 0 0 0 50  0.0004  0.0004  0.0002  0.0019  0.0012  0.0023  0.0017  0.0025  0.005 0.0105
##   2003  1 2 1 0 0 0 50  0.0011  0.0008  0.0034  0.0099  0.0145  0.0149  0.0202  0.0122  0.0103  0.012
##   2004  1 2 1 0 0 0 50  0 0.0003  0.0016  0.0047  0.0028  0.0072  0.0094  0.0225  0.026 0.0232  0.028
##   2005  1 2 1 0 0 0 50  0.0016  0.0016  0.0016  0.0027  0.003 0.0065  0.0084  0.0155  0.0098  0.013 0
##   2006  1 2 1 0 0 0 50  0.0006  0 0 0 0.0006  0.0014  0.0023  0.0055  0.0075  0.0179  0.0182  0.0234
##   2007  1 2 1 0 0 0 50  0 0.0005  0 0.0009  0.0028  0.0019  0.0028  0.0081  0.009 0.0104  0.0171  0.0
##   2008  1 2 1 0 0 0 50  0.0007  0 0.0003  0.001 0.0024  0.0014  0.0021  0.0041  0.0145  0.0237  0.029
##   2009  1 2 1 0 0 0 50  0.0004  0.0004  0.0004  0.0017  0.0017  0.0021  0.0021  0.0072  0.0102  0.011
##   2010  1 2 1 0 0 0 50  0.0025  0.0031  0.0037  0.0025  0.0031  0.0056  0.005 0.0068  0.013 0.0124  0
##   2011  1 2 1 0 0 0 50  0 0.0006  0.0012  0.003 0.003 0.0053  0.0024  0.0047  0.0059  0.0041  0.0053
##   2012  1 2 1 0 0 0 50  0 0.0006  0.0003  0.0006  0.0012  0.0015  0.0051  0.0075  0.0105  0.0128  0.0
##   2013  1 2 1 0 0 0 50  0.007 0.0095  0.0147  0.0245  0.0203  0.0178  0.0203  0.0208  0.0225  0.0254
## ##length  proportions of  survey  newshell  males
## ##Year, Seas, Fleet,  Sex,  Type, Shell,  Maturity, Nsamp,  DataVec
##   1975  1 3 1 1 1 0 200 0.03433 0.06119 0.03631 0.03701 0.03626 0.02684 0.02746 0.02043 0.02199 0.025
##   1976  1 3 1 1 1 0 200 0.00232 0.01279 0.02937 0.05077 0.06104 0.04581 0.04776 0.03559 0.03199 0.028
##   1977  1 3 1 1 1 0 200 0.00722 0.00558 0.00666 0.01007 0.0195  0.037 0.04363 0.04307 0.04013 0.04302
##   1978  1 3 1 1 1 0 200 0.00415 0.0114  0.01313 0.02219 0.01618 0.0153  0.0153  0.02585 0.02749 0.027
##   1979  1 3 1 1 1 0 200 0.00801 0.008 0.01059 0.01598 0.01392 0.01592 0.01244 0.01397 0.01354 0.0178
##   1980  1 3 1 1 1 0 200 0.00713 0.01445 0.02854 0.0319  0.03189 0.03189 0.02635 0.02638 0.02288 0.019
##   1981  1 3 1 1 1 0 200 0.03277 0.0196  0.01678 0.0252  0.03727 0.03277 0.03133 0.0292  0.02759 0.029
##   1982  1 3 1 1 1 0 200 0.07924 0.08112 0.06821 0.02812 0.02304 0.03021 0.03407 0.02807 0.01868 0.015
##   1983  1 3 1 1 1 0 200 0.03252 0.03556 0.0497  0.06649 0.07859 0.07774 0.05655 0.04214 0.03545 0.034
##   1984  1 3 1 1 1 0 200 0.01493 0.0625  0.13306 0.14261 0.06919 0.03343 0.01442 0.01346 0.0133  0.009
##   1985  1 3 1 1 1 0 200 0.00261 0.01279 0.02442 0.03954 0.0589  0.05817 0.04235 0.04026 0.05909 0.060
##   1986  1 3 1 1 1 0 200 0.01118 0.01788 0.0248  0.0201  0.02318 0.01475 0.03917 0.04  0.05364 0.04764
##   1987  1 3 1 1 1 0 200 0.00151 0.00715 0.03314 0.0523  0.04666 0.03193 0.02963 0.02928 0.03029 0.024
##   1988  1 3 1 1 1 0 200 0.00132 0.00098 0.00662 0.01068 0.01094 0.02158 0.04663 0.04339 0.03932 0.037
##   1989  1 3 1 1 1 0 200 0.00151 0.00009 0 0.00228 0.01414 0.032 0.01664 0.03469 0.02244 0.03796 0.037
##   1990  1 3 1 1 1 0 200 0.00132 0.01104 0.01571 0.03616 0.03285 0.01009 0.0075  0.00623 0.01313 0.022
##   1991  1 3 1 1 1 0 200 0.00103 0.00876 0.0213  0.01581 0.02487 0.01952 0.01114 0.02291 0.02011 0.011
##   1992  1 3 1 1 1 0 200 0.001 0 0.00202 0.01106 0.0252  0.03333 0.05097 0.04886 0.03395 0.03348 0.025
##   1993  1 3 1 1 1 0 200 0.00208 0.01094 0.01291 0.00906 0.00804 0.01357 0.01066 0.01917 0.01955 0.033
##   1994  1 3 1 1 1 0 200 0.00162 0 0.00309 0.02093 0.01757 0.01239 0.01098 0.01082 0.01688 0.03227 0.0
##   1995  1 3 1 1 1 0 200 0.02826 0.06829 0.05574 0.02203 0.01101 0.01592 0.02133 0.02355 0.02568 0.028
##   1996  1 3 1 1 1 0 200 0.02719 0.01292 0.02918 0.05291 0.06042 0.05874 0.02691 0.01981 0.01098 0.014
##   1997  1 3 1 1 1 0 200 0 0.00357 0.00221 0.00519 0.0127  0.05636 0.09427 0.10657 0.09022 0.05071 0.0
##   1998  1 3 1 1 1 0 200 0.02085 0.01739 0.01031 0.01272 0.012 0.01014 0.01345 0.01472 0.02013 0.04373
##   1999  1 3 1 1 1 0 200 0.05825 0.02444 0.01335 0.01038 0.01196 0.01036 0.00963 0.01225 0.00326 0.000
##   2000  1 3 1 1 1 0 200 0.00175 0.00473 0.01944 0.03949 0.03095 0.01993 0.02272 0.01626 0.01888 0.014
##   2001  1 3 1 1 1 0 200 0.00689 0.00496 0.01061 0.0149  0.0156  0.04136 0.03572 0.05159 0.03394 0.019
##   2002  1 3 1 1 1 0 200 0.05335 0.06381 0.0436  0.02682 0.01193 0.00793 0.00606 0.00736 0.01535 0.017
##   2003  1 3 1 1 1 0 200 0.01604 0.0074  0.0154  0.02495 0.04249 0.0342  0.03247 0.018 0.00959 0.01390
##   2004  1 3 1 1 1 0 200 0.04684 0.03651 0.03383 0.02365 0.02226 0.01926 0.02833 0.04015 0.03578 0.035
##   2005  1 3 1 1 1 0 200 0.03525 0.05861 0.04185 0.01599 0.00976 0.02277 0.02344 0.02146 0.01842 0.010
##   2006  1 3 1 1 1 0 200 0.01329 0.01976 0.01658 0.02765 0.02838 0.03548 0.01857 0.02076 0.01179 0.017
##   2007  1 3 1 1 1 0 200 0.00172 0.00246 0.00532 0.00837 0.01967 0.02715 0.03091 0.04028 0.03332 0.024
##   2008  1 3 1 1 1 0 200 0 0.00076 0.00363 0.00577 0.01395 0.01669 0.01814 0.0223  0.03342 0.04313 0.0
##   2009  1 3 1 1 1 0 200 0.00095 0.00048 0.0037  0.00527 0.00532 0.01039 0.00965 0.02253 0.03192 0.020
##   2010  1 3 1 1 1 0 200 0 0.00334 0.00803 0.00943 0.00774 0.00538 0.01608 0.01344 0.01295 0.01526 0.0
##   2011  1 3 1 1 1 0 200 0.00362 0.00438 0.0125  0.02044 0.01569 0.01317 0.01676 0.01505 0.01822 0.011
##   2012  1 3 1 1 1 0 200 0.00247 0.00398 0.01202 0.01593 0.01281 0.0227  0.03362 0.02474 0.01742 0.017
##   2013  1 3 1 1 1 0 200 0.00082 0.00253 0.01232 0.01451 0.01006 0.01741 0.01341 0.02352 0.02798 0.020
```

```
##   2014  1 3 1 1 1 0 200 0 0.00046 0.00259 0.003 0.01598 0.03132 0.04239 0.03212 0.02832 0.01706 0.02
##   ##length  proportions of  survey  oldshell  males
##   ##Year, Seas, Fleet,  Sex,  Type, Shell,  Maturity, Nsamp,  DataVec
##   1975  1 3 1 0 2 0 200 0 0.00011 0 0.00022 0 0.00011 0 0.00085 0.00065 0.0015  0.00086 0.00138 0.002
##   1976  1 3 1 0 2 0 200 0 0 0 0.00004 0.00004 0 0 0.00002 0.00052 0.00042 0.00093 0.00365 0.00268 0.0
##   1977  1 3 1 0 2 0 200 0 0 0 0 0 0.00041 0.00065 0.00018 0.00068 0.00083 0.00118 0.0024  0.00243 0.0
##   1978  1 3 1 0 2 0 200 0.00014 0.00055 0.00048 0.00182 0.00106 0.00376 0.00253 0.00205 0.00207 0.002
##   1979  1 3 1 0 2 0 200 0.00015 0.00093 0.00064 0.00022 0.00073 0.00111 0.00024 0.00039 0.00039 0.000
##   1980  1 3 1 0 2 0 200 0 0 0 0 0 0.00045 0.0003  0 0 0.00016 0.00038 0.00045 0.00097 0.00121 0.0018
##   1981  1 3 1 0 2 0 200 0.00016 0 0.00061 0 0.001 0.00073 0.00059 0.00247 0.00146 0.00418 0.00419 0.0
##   1982  1 3 1 0 2 0 200 0 0 0 0.00055 0.00095 0.00079 0.0012  0.00065 0.00105 0.00129 0.00173 0.0013
##   1983  1 3 1 0 2 0 200 0 0 0 0 0.00146 0.00051 0.00342 0.00467 0.00427 0.00572 0.00909 0.00952 0.005
##   1984  1 3 1 0 2 0 200 0 0.00012 0.00014 0.00003 0.00017 0.00004 0.00044 0.00027 0.00024 0.00267 0.0
##   1985  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0 0.00106 0.0009  0 0.00182 0.00573 0 0.00351 0.00085 0 0.0019
##   1986  1 3 1 0 2 0 200 0 0 0 0 0 0.00088 0.00162 0 0.00224 0.00088 0.00462 0.00643 0.01135 0.01506 0
##   1987  1 3 1 0 2 0 200 0 0 0 0 0.00039 0.00039 0 0.00041 0.00082 0.00119 0.00226 0.0036  0.00689 0.0
##   1988  1 3 1 0 2 0 200 0 0 0 0 0.00205 0 0 0 0 0 0.0008  0.00288 0.00569 0.00855 0.00952 0.01509 0.0
##   1989  1 3 1 0 2 0 200 0 0 0.00081 0 0 0 0 0.00009 0.00146 0.00516 0.0015  0.00074 0.00748 0.00942 0
##   1990  1 3 1 0 2 0 200 0 0 0 0 0.00072 0 0.00072 0.00071 0.00255 0.00453 0.00316 0.00923 0.01085 0.0
##   1991  1 3 1 0 2 0 200 0 0 0.00058 0.00059 0.00112 0.0017  0.0023  0.0039  0.00156 0.00516 0.00215 0
##   1992  1 3 1 0 2 0 200 0 0 0 0.00165 0 0.00217 0.00423 0.00391 0.00423 0.00645 0.00318 0.0033  0.01
##   1993  1 3 1 0 2 0 200 0 0 0.00069 0.00137 0.00145 0.00203 0.00344 0.00422 0.01136 0.01032 0.01999 0
##   1994  1 3 1 0 2 0 200 0 0 0 0.00277 0.00591 0.00277 0.00138 0.00651 0.00443 0.0031  0.01053 0.0123
##   1995  1 3 1 0 2 0 200 0 0 0 0 0 0.00099 0.00086 0.00198 0.0018  0.00173 0.0056  0.00478 0.01026 0.0
##   1996  1 3 1 0 2 0 200 0.00062 0.00062 0.00062 0 0.00274 0.00064 0.00065 0.00268 0.00072 0.00324 0.0
##   1997  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0.00041 0.00075 0.00083 0.00216 0.00257 0.00276 0.00386 0.0028
##   1998  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0.00217 0.0025  0.00293 0.00589 0.0132  0.01047 0.01061 0.0118
##   1999  1 3 1 0 2 0 200 0 0 0 0 0 0.00062 0.0025  0.00253 0.00142 0.00658 0.00563 0.00129 0.01054 0.0
##   2000  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0 0.00112 0.00061 0.00239 0.00876 0.01636 0.02809 0.02766 0.02
##   2001  1 3 1 0 2 0 200 0 0 0 0 0 0.00073 0.00143 0.00075 0.00067 0 0.00347 0.00344 0.00412 0.00794 0
##   2002  1 3 1 0 2 0 200 0 0 0 0.00041 0 0.00114 0.00154 0.00326 0.00757 0.0088  0.0135  0.00862 0.00
##   2003  1 3 1 0 2 0 200 0 0 0 0.0004  0 0.00037 0.00077 0.00039 0.00188 0.00155 0.00156 0.0036  0.00
##   2004  1 3 1 0 2 0 200 0 0 0 0 0 0.00062 0.00051 0.00014 0.00032 0.00034 0 0.00034 0.00007 0.00044 0
##   2005  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0 0 0.00091 0.00113 0.00119 0.00323 0.00177 0.00295 0.00415 0.0
##   2006  1 3 1 0 2 0 200 0 0 0.00071 0 0.00073 0.00144 0.00241 0 0.00111 0.00175 0.0011  0.00076 0.00
##   2007  1 3 1 0 2 0 200 0 0 0 0 0 0 0.00369 0.00339 0.00527 0.00455 0.00307 0.00526 0.00834 0.00878 0
##   2008  1 3 1 0 2 0 200 0 0 0 0.00074 0.00037 0.00148 0.00074 0.00075 0.00203 0.00037 0.0024  0.0039
##   2009  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0 0.00101 0.00386 0.00786 0.00793 0.00778 0.0066  0.00689 0.00
##   2010  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0 0 0 0.00278 0.00578 0.00817 0.01021 0.00947 0.00903 0.01066 0
##   2011  1 3 1 0 2 0 200 0 0 0 0 0.00118 0.00061 0 0 0 0.00123 0.00193 0.00385 0.00252 0.00962 0.0101
##   2012  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0 0 0 0.00071 0.00222 0.00326 0.00686 0.0076  0.00575 0.00834 0
##   2013  1 3 1 0 2 0 200 0 0 0 0 0 0 0 0 0 0 0.00091 0.0074  0.00914 0.01228 0.01594 0.01743 0.02119 0
##   2014  1 3 1 0 2 0 200 0 0 0 0 0 0 0.00129 0.00267 0.00295 0.00214 0.00176 0.00686 0.00739 0.00817 0
## ##Year, Seas, Fleet,  Sex,  Type, Shell,  Maturity, Nsamp,  DataVec
##   2007  1 4 1 0 0 0 628 0.0045  0.0074  0.0103  0.0155  0.0198  0.0321  0.0532  0.0491  0.0443  0.03
##   2008  1 4 1 0 0 0 907 0.0017  0.001 0.0093  0.0119  0.0175  0.0279  0.0267  0.0348  0.0428  0.0596
## ##  Growth data (increment)
## # nobs_growth
## 20
## ##  Note  SM  used  loewss  regression  for males BBRKC data
## ##  and cubic spine to  interpolate 3 sets  of  female  BBRKC data
## # MidPoint Sex Increment CV
##   67.5  1 16.510674 0.2
##   72.5  1 16.454438 0.2
```

```
##   77.5  1 16.398615 0.2
##   82.5  1 16.343118 0.2
##   87.5  1 16.287715 0.2
##   92.5  1 16.23213  0.2
##   97.5  1 16.176368 0.2
##   102.5 1 16.123732 0.2
##   107.5 1 16.069744 0.2
##   112.5 1 16.013906 0.2
##   117.5 1 15.957058 0.2
##   122.5 1 15.900084 0.2
##   127.5 1 15.843143 0.2
##   132.5 1 15.786395 0.2
##   137.5 1 15.732966 0.2
##   142.5 1 15.68064  0.2
##   147.5 1 15.628775 0.2
##   152.5 1 15.577259 0.2
##   157.5 1 15.526092 0.2
##   162.5 1 15.475241 0.2
## # Use custom transition matrix (0=no, 1=growth matrix, 2=transition matrix, i.e. growth and molting)
## 0
## # The growth matrix (if not using just fill with zeros)
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## ##  eof
## 9999
```

The match 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
##   11.0       -10        40          2       0  -10.0    40.0         # log(R0)
##   15.0       -10        40          2       0  -10.0    40.0         # log(Rini)
##   10.0       -10        20         -1       1   10.0    35.0         # log(Rbar)
##   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 co
##  -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  100    200    0      1     200   -1     1975   2014
```

```
##    1     2     2   0    156  100    200    0      1     200   -1     1975   2014
## # Gear-2
##    2     3     1   0     90   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  77.63   60    200    0      1     200   -3     1975   1981
##    3     6     2   0     96   60    200    0      1     200   -4     1975   1981
##    3     7     1   0  89.48   60    200    0      1     200   -3     1982   2014
##    3     8     2   0    145   60    200    0      1     200   -4     1982   2014
## # Gear-4
##    4     9     1   0  78.02    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                                          phz    start  end       ##
## ## index index par sex  ival  lb    ub     prior p1     p2     mirror period period    ##
## # 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
## ##     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
##    0.935    0.001   5      4    0  0.001         5     0           4       # NMFS trawl
##    1.0      0.001   5     -4    0  0.001         5     0           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
## ## ---------------------------------------------------------------------------------- ##
## ## Mean_F  STD_PHZ1  STD_PHZ2     PHZ
##      0.20      0.05      5.00      1  # Trap
##      0.01      0.05      5.00      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
##  1   2   3   4   5   6 # Composition aggregator
## # 1   1   1   1   1   1 # LAMBDA
##  0.1   0.1   0.1   0.1   0.1   0.1 # 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)
## ##      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
##    0.1
## ## 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
##    3       # Estimated rec_ini phase
##    0       # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
##    1       # Initial conditions (0 = Unfished, 1 = Steady-state fished, 2 = Free parameters)
##    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 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 #
## #                  4 -> gamma
## # ---------------------------------------------------------------------------------- #
## # ntheta
##   9
## # ---------------------------------------------------------------------------------- #
## # ival        lb        ub        phz   prior     p1      p2         # parameter         #
## # ---------------------------------------------------------------------------------- #
##   0.18      0.01         1        -4       2   0.18    0.02         # M
##   11.0       -10        40         2       0  -10.0    40.0         # log(R0)
##   15.0       -10        40         2       0  -10.0    40.0         # log(Rini)
##   10.0       -10        20        -1       1   10.0    35.0         # log(Rbar)
##   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 co
##  -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  100    200    0      1     200   -1     1975   2014
##    1     2     2   0    156  100    200    0      1     200   -1     1975   2014
## # Gear-2
##    2     3     1   0     90   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  77.63   60    200    0      1     200   -3     1975   1981
##    3     6     2   0     96   60    200    0      1     200   -4     1975   1981
##    3     7     1   0  89.48   60    200    0      1     200   -3     1982   2014
##    3     8     2   0    145   60    200    0      1     200   -4     1982   2014
## # Gear-4
##    4     9     1   0  78.02    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                                                 phz    start  end        ##
## ## index index par sex  ival  lb    ub     prior p1     p2     mirror period period     ##
## # 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
## ##     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
##    0.935    0.001   5      4    0  0.001         5     0            4       # NMFS trawl
##    1.0      0.001   5     -4    0  0.001         5     0            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
## ## -------------------------------------------------------------------------------- ##
## ## Mean_F  STD_PHZ1  STD_PHZ2     PHZ
##      0.20      0.05      5.00       1  # Trap
##      0.01      0.05      5.00       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
##  1   2   3   4   5   6 # Composition aggregator
## # 1   1   1   1   1   1 # LAMBDA
##  0.1   0.1   0.1   0.1   0.1   0.1 # 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)
## ##      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
##    0.1
## ## 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
##    3       # Estimated rec_ini phase
##    0       # VERBOSE FLAG (0 = off, 1 = on, 2 = objective func)
##    1       # Initial conditions (0 = Unfished, 1 = Steady-state fished, 2 = Free parameters)
##    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
```