

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  $w_l = a \cdot l^b$ , 2 = vector by sex)
## 2
## # weight-at-length allometry  $w_l = a \cdot l^b$ 
## 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 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 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 indices
## 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 0.0071 0.0741 0.1721 0.2239 0.2122 0.1464 0.083
## 1976 1 1 1 1 0 0 100 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 0.0017 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 0.0012 0.0209 0.1441 0.2588 0.2401 0.1673 0.099
## 1979 1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0013 0.0119 0.0747 0.1649 0.1998 0.2004 0.153
## 1980 1 1 1 1 0 0 100 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 0.0006 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 0.0544 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 0.0016 0.0531 0.2613 0.3289 0.2084 0.0978 0.033
## 1987 1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0 0.0013 0.0284 0.1895 0.3045 0.2522 0.1421 0.055
## 1988 1 1 1 1 0 0 100 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 0.0005 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 0.14
## 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 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 0.0014 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 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 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 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 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 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 0 0.0001 0.0001 0.0002 0.0009 0.0243 0.1464 0.232 0.18
## 2004 1 1 1 1 0 0 100 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 0 0 0 0 0.0001 0 0 0.0001 0.0001 0.0008 0.015 0.0859 0.1543 0.16
## 2006 1 1 1 1 0 0 100 0 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 0.0002 0.0108 0.1152 0.2215 0.1968 0.1588 0.103

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## 2010 1 1 1 1 0 0 100 0 0 0 0 0 0 0 0 0 0 0.0003 0.0091 0.0986 0.2244 0.2238 0.1861 0.114
## 2011 1 1 1 1 0 0 100 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 0.0001 0 0.0001 0 0.0044 0.0499 0.1249 0.173 0.1886 0
## 2013 1 1 1 1 0 0 100 0 0 0 0 0 0 0 0.0001 0.0001 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 0
## 1996 1 1 1 2 0 0 100 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 0.0086 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 0
## 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 0
## 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 0.013 0.0087 0.0043 0.0216 0.0087 0.026 0.039 0.0433 0.0649 0
## 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 0.0025 0.0012 0.0025 0.0149 0.0274 0.0511 0.0872 0.1245 0
## 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 0
## 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 0.0017 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 0
## 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 0.0018 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 0.0008 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 0.0012 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 0.011
## 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 0.02
## 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
## 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.
## 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 0.02
## 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 0.01
## 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
## 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.
## 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 0.02
## 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 0.02
## 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 0.0430
## 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 0.02
## 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 0.01
## 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 0.02
## 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 0.01
## 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 0.03
## 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 0.00
## 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 0.06
## 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 0.0476
## 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 0.02
## 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 0.03
## 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 0.03
## 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 0.02
## 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 0.01
## 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 0.02
## 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 0.03
## 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.
## 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 0.02
## 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 0.01
## 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.
## 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 0.0437
## 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 0.00
## 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 0.01
## 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 0.01
## 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 0.01
## 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 0.0139
## 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 0.03
## 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 0.01
## 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 0.01
## 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 0.02
## 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.
## 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 0.02
## 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.
## 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 0.01
## 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 0.01
## 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 0.02

```



```

## 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 0.00
## 1976 1 3 1 0 2 0 200 0 0 0.00004 0.00004 0 0 0.00002 0.00052 0.00042 0.00093 0.00365 0.00268 0.
## 1977 1 3 1 0 2 0 200 0 0 0 0 0.00041 0.00065 0.00018 0.00068 0.00083 0.00118 0.0024 0.00243 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 0.00
## 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 0.00
## 1980 1 3 1 0 2 0 200 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.
## 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 0.00146 0.00051 0.00342 0.00467 0.00427 0.00572 0.00909 0.00952 0.00
## 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.
## 1985 1 3 1 0 2 0 200 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 0.00088 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 0.00039 0.00039 0 0.00041 0.00082 0.00119 0.00226 0.0036 0.00689 0.
## 1988 1 3 1 0 2 0 200 0 0 0 0.00205 0 0 0 0.0008 0.00288 0.00569 0.00855 0.00952 0.01509 0.
## 1989 1 3 1 0 2 0 200 0 0 0.00081 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 0.00072 0 0.00072 0.00071 0.00255 0.00453 0.00316 0.00923 0.01085 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 0.00165 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 0.00277 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 0.00099 0.00086 0.00198 0.0018 0.00173 0.0056 0.00478 0.01026 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.
## 1997 1 3 1 0 2 0 200 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 0.00217 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 0.00062 0.0025 0.00253 0.00142 0.00658 0.00563 0.00129 0.01054 0.
## 2000 1 3 1 0 2 0 200 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 0.00073 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 0.00041 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 0.0004 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 0.00062 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 0.00091 0.00113 0.00119 0.00323 0.00177 0.00295 0.00415 0.
## 2006 1 3 1 0 2 0 200 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 0.00369 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 0.00074 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 0.00101 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 0.00278 0.00578 0.00817 0.01021 0.00947 0.00903 0.01066 0.
## 2011 1 3 1 0 2 0 200 0 0 0 0.00118 0.00061 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 0.00071 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 0.00091 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 0.00129 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
## ## 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 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
## ## index index par sex  ival  lb    ub    prior p1    p2      phz  start end
## ## ----- ##
## # 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
## ## index index par sex ival lb ub prior p1 p2 phz start end ##
## ## 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 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
## ## index index par sex ival lb ub prior p1 p2 phz start end ##
## ## ----- ##
## # 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
## ## 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
## ## 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 MORTALITY 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

```