SEDAR 21-RW-02: Computer code for the SEDAR 21 age-structured production model for blacknose sharks

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Background

The model used in the blacknose shark assessments was an age-structured production model, originally developed by Clay Porch at the SEFSC in Miami, which has been used in assessments of Atlantic white marlin (Porch 2003) and several species of Atlantic sharks since 2002 (e.g., SEDAR 11 for sandbar and blacktip sharks; SEDAR 13 for Atlantic sharpnose, bonnethead, and blacknose sharks). The model is written in AD Model Builder software (Otter Research 2004) and includes three files. The first two files are input files: the first includes information on data fed into the model for the GOM and SA stocks(.dat file; Appendix A & B respectively), the third and fourth include information on the parameters, allowing one to specify bounds and prior distributions for the GOM and SA stocks (.prm file; Appendix C & D, respectively). The template for the model is in SEDAR 21-RW-01.

References

Otter Research Ltd, 2004. An Introduction to AD Model Builder version 7.1.1. Box 2040, Sidney, British Columbia.

Porch, C. E. 2003a. A preliminary assessment of Atlantic white marlin (*Tetrapturus albidus*) using a state-space implementation of an age-structured model. SCRS/02/68 23pp.

SEDAR 11. 2006. Stock assessment report: large coastal shark complex, blacktip and sandbar shark. Highly Migratory Species Management Division, NOAA, Silver Spring, MD.

SEDAR 13. 2007. Stock assessment report: small coastal shark complex, Atlantic sharpnose, blacknose, bonnethead and finetooth shark. Highly Migratory Species Management Division, NOAA, Silver Spring, MD.

Appendix A: AD Model Builder data input file for the GOM stock

##

 # GENERAL INFORMATION--blacknose

##

 # first and last year of data

1950 2009

 # number of years of historical period

22

 # number of years to project

0

 # starting value for pup survival (allows model to start away from mode; enter 0 to start at best_guess in .prm file)

0

 # first and last age of data

1 14

 # number of seasons (months) per year

12

 # type of overall variance parameter (1 = log scale variance, 2 = observation scale variance, 0=force equal weighting)

1

 # pupping season (integer representing season/month of year when spawning occurs)

6

 # maturity schedule (fraction of each age class that is sexually mature)

0.00002 0.00047 0.00985 0.17509 0.81906 0.98975 0.99951 0.99998 1 1 1 1 1 1

 # fecundity schedule (index of per capita fecundity of each age class)

2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5

##

 # CATCH INFORMATION

##

 # number of catch data series (if there are no series, there should be no entries after the next line below)

6

 # method of setting prehistoric effort (--*--input an integer FOR EACH FLEET--***--)**

 # 0 = set equal to effort input values

 # 1 = set equal to constant specified in the parameter file

 # 2 = linearly interpolate from the constant specified in the parameter file for year 1

 # to the estimate for the first year of the "modern" period

1 1 2 2 2 1

 # pdf of observation error for each series (1) lognormal, (2) normal

1 1 1 1 1 1

 # units (1=numbers, 2=weight)

1 1 1 1 1 1

 # season (month) when fishing begins for each series

1 1 1 1 1 1

 # season (month) when fishing ends for each series

10 10 10 10 10 10

 # set of catch variance parameters each series is linked to

1 1 1 1 1 1

 # set of q (catchability) parameters each series is linked to

1 2 3 4 5 6

 # set of s (selectivity) parameters each series is linked to

1 5 1 1 6 1

 # set of e (effort) parameters each series is linked to

1 2 3 4 5 1

 # observed catches by set

#Com-BLL	Com-GN		Com-L	Rec	Shrimp BLL-discards	Year
0	0	0	320	0		1950
0	0	0	4640	0		1951
0	0	0	8959	0		1952
0	0	0	13278	0		1953
0	0	0	17598	0		1954
0	0	0	21917	0		1955
0	0	1	26237	0		1956
0	0	1	30556	0		1957
0	0	1	34875	0		1958
0	0	1	39195	0		1959
0	0	1	47833	0		1960
0	0	1	33862	0		1961
0	0	1	40773	0		1962
0	0	1	46081	0		1963
0	0	1	49405	0		1964
0	0	1	43301	0		1965
0	0	2	40661	0		1966
0	0	2	47119	0		1967
0	0	2	47967	0		1968
0	0	2	55478	0		1969
0	0	2	46466	0		1970
0	0	2	47557	0		1971
0	0	2	69855	0		1972
0	0	2	59445	0		1973
0	0	2	54073	0		1974
0	0	2	43974	0		1975
0	0	2	47515	0		1976
0	0	3	50258	0		1977
0	0	3	56419	0		1978
0	0	3	55117	0		1979
0	0	3	32121	0		1980
224	0	3	38772	193		1981
448	0	3	36504	387		1982
672	0	3	13837	33245	580	1983

897	0	3	0	34228	774	1984	
1121	0	3	1746	31129	967	1985	
1345	0	3	2068	32788	1161	1986	
1569	313	4	14486	31829	1354	1987	
1793	626	4	8905	25715	1548	1988	
2017	939	4	1793	25888	1741	1989	
2242	1252	4	1875	29903	1934	1990	
2466	1565	4	0	34196	2128	1991	
2690	1878	4	4383	34392	2321	1992	
2914	2191	4	4547	32511	2515	1993	
3138	2505	4	14305	30019	2708	1994	
10218	0	20	2814	30909	9245	1995	
2515	0	4	12413	33461	2106	1996	
3545	0	43	11078	38115	1744	1997	
2072	1185	23	9573	38961	1450	1998	
510	1128	511	5294	36315	84	1999	
3244	0	956	6894	35703	2671	2000	
1555	24	14	14854	38769	0	2001	
3806	2940	398	10808	43518	3045	2002	
3027	16	5	5906	34529	1552	2003	
1931	0	80	15071	31306	652	2004	
9221	103	26	7101	22953	6475	2005	
16355	937	17	9438	19554	8416	2006	
4255	314	48	5809	17381	967	2007	
2166	9	31	3716	13193	368	2008	
3929	69	32	4775	15668	896	2009	

#	annual	scaling	factors				
#Com-BLL		Com-GN		Com-L	Rec	Shrimp BLL-discards	Year
2	2	2	2	2	2	1950	
2	2	2	2	2	2	1951	
2	2	2	2	2	2	1952	
2	2	2	2	2	2	1953	
2	2	2	2	2	2	1954	
2	2	2	2	2	2	1955	
2	2	2	2	2	2	1956	
2	2	2	2	2	2	1957	
2	2	2	2	2	2	1958	
2	2	2	2	2	2	1959	
2	2	2	2	2	2	1960	
2	2	2	2	2	2	1961	
2	2	2	2	2	2	1962	
2	2	2	2	2	2	1963	
2	2	2	2	2	2	1964	
2	2	2	2	2	2	1965	
2	2	2	2	2	2	1966	
2	2	2	2	2	2	1967	
2	2	2	2	2	2	1968	
2	2	2	2	2	2	1969	
2	2	2	2	2	2	1970	
2	2	2	2	2	2	1971	
2	2	2	2	1	2	1972	
2	2	2	2	1	2	1973	
2	2	2	2	1	2	1974	
2	2	2	2	1	2	1975	
2	2	2	2	1	2	1976	
2	2	2	2	1	2	1977	

2 2 2 2 1 2 1978
2 2 2 2 1 2 1979
2 2 2 2 1 2 1980
2 2 2 1 1 1 1981
2 2 2 1 1 1 1982
2 2 2 1 1 1 1983
2 2 2 1 1 1 1984
2 2 2 1 1 1 1985
2 2 2 1 1 1 1986
2 2 2 1 1 1 1987
2 2 2 1 1 1 1988
2 2 2 1 1 1 1989
2 2 2 1 1 1 1990
2 2 2 1 1 1 1991
2 2 2 1 1 1 1992
2 2 2 1 1 1 1993
2 2 2 1 1 1 1994
1 2 1 1 1 1 1995
1 1 1 1 1 1 1996
1 1 1 1 1 1 1997
1 1 1 1 1 1 1998
1 1 1 1 1 1 1999
1 1 1 1 1 1 2000
1 1 1 1 1 1 2001
1 1 1 1 1 1 2002
1 1 1 1 1 1 2003
1 1 1 1 1 1 2004
1 1 1 1 1 1 2005
1 1 1 1 1 1 2006
1 1 1 1 1 1 2007
1 1 1 1 1 1 2008
1 1 1 1 1 1 2009
###

 # INDICES OF ABUNDANCE (e.g., CPUE) If there are no series, there should be no entries between the comment lines.

###

 # number of index data series

8
 # pdf of observation error for each series (1) lognormal, (2) normal

1 1 1 1 1 1 1 1
 # units (1=numbers, 2=weight)

1 1 1 1 1 1 1 1
 # season (month) when index begins for each series

1 1 1 1 1 1 1 1

 # season (month) when index ends for each series
12 12 12 12 12 12 12 12
 # option to (1) scale or (0) not to scale index observations
0 0 0 0 0 0 0 0

 # set of index variance parameters each series is linked to
1 1 1 1 1 1 1 1
 # set of q parameters each series is linked to
7 8 9 10 11 12 13 14
 # set of s parameters each series is linked to
1 2 2 1 1 4 3 1
 # observed indices by series (last column is for year)

#NMFS SE BLL	SEAMAPSummer	SEAMAP fall	PC GN adul	PC GN juvs	MML	DISL BLLOP	Year
-1	-1	-1	-1	-1	-1	-1	1950
-1	-1	-1	-1	-1	-1	-1	1951
-1	-1	-1	-1	-1	-1	-1	1952
-1	-1	-1	-1	-1	-1	-1	1953
-1	-1	-1	-1	-1	-1	-1	1954
-1	-1	-1	-1	-1	-1	-1	1955
-1	-1	-1	-1	-1	-1	-1	1956
-1	-1	-1	-1	-1	-1	-1	1957
-1	-1	-1	-1	-1	-1	-1	1958
-1	-1	-1	-1	-1	-1	-1	1959
-1	-1	-1	-1	-1	-1	-1	1960
-1	-1	-1	-1	-1	-1	-1	1961
-1	-1	-1	-1	-1	-1	-1	1962
-1	-1	-1	-1	-1	-1	-1	1963
-1	-1	-1	-1	-1	-1	-1	1964
-1	-1	-1	-1	-1	-1	-1	1965
-1	-1	-1	-1	-1	-1	-1	1966
-1	-1	-1	-1	-1	-1	-1	1967
-1	-1	-1	-1	-1	-1	-1	1968
-1	-1	-1	-1	-1	-1	-1	1969
-1	-1	-1	-1	-1	-1	-1	1970
-1	-1	-1	-1	-1	-1	-1	1971
-1	-1	-1	-1	-1	-1	-1	1972
-1	-1	-1	-1	-1	-1	-1	1973
-1	-1	-1	-1	-1	-1	-1	1974
-1	-1	-1	-1	-1	-1	-1	1975
-1	-1	-1	-1	-1	-1	-1	1976
-1	-1	-1	-1	-1	-1	-1	1977
-1	-1	-1	-1	-1	-1	-1	1978
-1	-1	-1	-1	-1	-1	-1	1979
-1	-1	-1	-1	-1	-1	-1	1980
-1	-1	-1	-1	-1	-1	-1	1981
-1	-1	-1	-1	-1	-1	-1	1982
-1	-1	-1	-1	-1	-1	-1	1983
-1	-1	-1	-1	-1	-1	-1	1984
-1	-1	-1	-1	-1	-1	-1	1985
-1	-1	-1	-1	-1	-1	-1	1986
-1	0.530301981	0.773440686	-1	-1	-1	-1	1987
-1	0.550094462	0.696481414	-1	-1	-1	-1	1988
-1	1.256253771	0.607497255	-1	-1	-1	-1	1989
-1	0.482754528	1.050494066	-1	-1	-1	-1	1990
-1	0.816724201	0.985078685	-1	-1	-1	-1	1991
-1	0.599461914	1.116149945	-1	-1	-1	-1	1992
-1	1.112246412	0.554828253	-1	-1	-1	-1	1993
-1	0.649056865	0.826350186	-1	-1	-1	-1	0.075211484 1994
0.49842268	0.564654448	1.698154441	-1	-1	-1	-1	0.241630351 1995

1.136450624 0.914776605 0.937219637 0.965360691 2.264705882 -1 -1
0.157498077 1996
0.767847279 0.95026657 0.882145658 0.551281823 1.338235294 -1 -1
0.192104589 1997
-1 0.772589244 0.906916924 1.394015361 0.617647059 -1 -1
0.318841323 1998
0.626446095 0.569204443 1.223411931 -1 2.213235294 -1 -1
0.797487824 1999
0.661228294 0.96095906 1.045684111 -1 0.102941176 -1 -1 -1
2000
0.860721981 2.009050535 0.676039107 0.842364919 0.823529412 -1 -1
0.122583953 2001
0.671893857 0.820591697 0.82057824 0.811961956 1.080882353 -1 -1
1.555447321 2002
1.643742948 1.478976053 1.099074607 0.659358797 1.029411765 0.395739028 -1
0.968674699 2003
1.537783689 1.096776427 0.860260365 1.610819779 0.772058824 1.268930821 -1
1.44685978 2004
0.500145297 1.204611322 1.201526638 1.243095078 0.566176471 1.06047038 -1
2.980005127 2005
1.680064507 0.974609047 0.771516704 -1 0.720588235 0.743474464 1.92036
2.964624455 2006
0.713016752 0.811491706 1.383823914 0.425115622 0.977941176 1.155702618 0.98698
1.510228147 2007
1.177316959 1.2264513 1.727254666 2.022413725 0.875 2.120338024 0.76021
1.275365291 2008
1.52491904 2.648097409 1.156072568 0.47421225 0.617647059 0.255344666 0.33245
0.39343758 2009
annual scaling factors for observation variance (use this option to scale up the variance for observations based on very little data)
#NMFS SE BLL SEAMAP Summer SEAMAP fall PC GN adul PC GN juvs MML DISL
BLLOP Year
1 1 1 1 1 1 1 1 1950
1 1 1 1 1 1 1 1 1951
1 1 1 1 1 1 1 1 1952
1 1 1 1 1 1 1 1 1953
1 1 1 1 1 1 1 1 1954
1 1 1 1 1 1 1 1 1955
1 1 1 1 1 1 1 1 1956
1 1 1 1 1 1 1 1 1957
1 1 1 1 1 1 1 1 1958
1 1 1 1 1 1 1 1 1959
1 1 1 1 1 1 1 1 1960
1 1 1 1 1 1 1 1 1961
1 1 1 1 1 1 1 1 1962
1 1 1 1 1 1 1 1 1963
1 1 1 1 1 1 1 1 1964
1 1 1 1 1 1 1 1 1965
1 1 1 1 1 1 1 1 1966
1 1 1 1 1 1 1 1 1967
1 1 1 1 1 1 1 1 1968
1 1 1 1 1 1 1 1 1969
1 1 1 1 1 1 1 1 1970
1 1 1 1 1 1 1 1 1971
1 1 1 1 1 1 1 1 1972
1 1 1 1 1 1 1 1 1973

1 1 1 1 1 1 1 1 1974
1 1 1 1 1 1 1 1 1975
1 1 1 1 1 1 1 1 1976
1 1 1 1 1 1 1 1 1977
1 1 1 1 1 1 1 1 1978
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1 1 1 1 1 1 1 1 1980
1 1 1 1 1 1 1 1 1981
1 1 1 1 1 1 1 1 1982
1 1 1 1 1 1 1 1 1983
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1 1 1 1 1 1 1 1 1987
1 1 1 1 1 1 1 1 1988
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1 1 1 1 1 1 1 1 2004
1 1 1 1 1 1 1 1 2005
1 1 1 1 1 1 1 1 2006
1 1 1 1 1 1 1 1 2007
1 1 1 1 1 1 1 1 2008
1 1 1 1 1 1 1 1 2009

##

 # EFFORT OBSERVATIONS If there are no series, there should be no entries between the comment lines.

##
 # number of effort data series
0
##
 # AGE COMPOSITION OBSERVATIONS If there are no series, there should be no entries between the comment lines.
##
 # number of age-composition series (If there are no series,there should be no more entries in this section)
0

Appendix B: AD Model Builder data input file for Age-Structured Production Model

##

 # GENERAL INFORMATION--blacknose

##

 # first and last year of data

1950 2009

 # number of years of historical period

22
 # number of years to project

0
 # starting value for pup survival (allows model to start away from mode; enter 0 to start at best_guess in .prm file)
0
 # first and last age of data

1 20
 # number of seasons (months) per year

12
 # type of overall variance parameter (1 = log scale variance, 2 = observation scale variance, 0=force equal weighting)

1
 # pupping season (integer representing season/month of year when spawning occurs)

6
 # maturity schedule (fraction of each age class that is sexually mature)

0.00002 0.00047 0.00985 0.17509 0.81906 0.98975 0.99951 0.99998 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000
 # fecundity schedule (index of per capita fecundity of each age class)

1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25
##

 # CATCH INFORMATION

##

 # number of catch data series (if there are no series, there should be no entries after the next line below)

6
 # method of setting prehistoric effort (--*--input an integer FOR EACH FLEET--***--)**

 # 0 = set equal to effort input values

 # 1 = set equal to constant specified in the parameter file

 # 2 = linearly interpolate from the constant specified in the parameter file for year 1

 # to the estimate for the first year of the "modern" period

1 1 2 2 2 1

 # pdf of observation error for each series (1) lognormal, (2) normal

1 1 1 1 1 1
 # units (1=numbers, 2=weight)

1 1 1 1 1 1

 # season (month) when fishing begins for each series

1 1 1 1 1 1

 # season (month) when fishing ends for each series

12 12 12 12 12 12

 # set of catch variance parameters each series is linked to

1 1 1 1 1 1
 # set of q (catchability) parameters each series is linked to

1 2 3 4 5 6

 # set of s (selectivity) parameters each series is linked to

6 4 1 1 5 6

 # set of e (effort) parameters each series is linked to

1 2 3 4 5 6
 # observed catches by set

#BLL	GN	L	Rec	Shrimp	BLL-discards	Year		
0	0	0	0	0	0	303	1950	
0	0	0	0	0	0	586	1951	
0	0	0	0	1	0	868	1952	
0	0	0	0	1	0	1151	1953	0
0	0	0	0	1	0	1433	1954	0
0	0	0	0	2	0	1716	1955	0
0	0	0	0	2	0	1998	1956	0
0	0	0	0	2	0	2281	1957	0
0	0	0	0	3	0	2563	1958	0
0	0	0	0	3	0	2846	1959	0

0 0 4 0 3128 0
1960
0 0 4 0 2215 0
1961
0 0 4 0 2667 0
1962
0 0 5 0 3014 0
1963
0 0 5 0 3231 0
1964
0 0 5 0 2832 0
1965
0 0 6 0 2659 0
1966
0 0 6 0 3082 0
1967
0 0 6 0 3137 0
1968
0 0 7 0 3628 0
1969
0 0 7 0 3039 0
1970
0 0 7 0 3110 0
1971
0 0 8 0 4569 0
1972
0 0 8 0 3888 0
1973
0 0 8 0 3536 0
1974
0 0 9 0 2876 0
1975
0 0 9 0 3108 0
1976
0 0 9 0 3287 0
1977
0 0 10 0 3690 0
1978
0 0 10 0 3605 0
1979
0 0 11 0 2101 0
1980
397 0 11 0 2536 120 1981
794 0 11 0 2387 239 1982
1191 0 12 119 2174 359 1983
1587 0 12 844 2239 479 1984 #3277
1984 0 12 172 2036 599 1985 #4096
2381 0 13 0 2144 718 1986 #4916
2778 2077 13 59 2082 838 1987 #5735 #1144
3175 4154 13 4668 1682 958 1988 #6554 #2288
3572 6232 14 0 1693 1077 1989 #7374 #3433
3968 8309 14 2400 1956 1197 1990 #8193 #4577
4365 10386 14 8 2236 1317 1991 #9012 #5721
4762 12463 15 551 2249 1437 1992 #9831 #6865
5159 14540 15 0 2126 1556 1993 #10651 #8010
5556 16617 15 170 1963 1676 1994 #11470 #9154

5434	12550	0	0		2021	564		1995		
6125	14573	763	1				2188	156	1996	
14082	26004	45	1				2493	580	1997	
5617	14428	20	974			2548	0		1998	
5458	20685	29	733			2375	637		1999	
10249	32154	0			3346	2335	9318	2000		
4177	28525	15	31			2535	2517	2001		
3071	18340	124	537			2846	3071	2002		
7358	12482	85	709			2258	2453	2003		
3958	7942	34	30			2047	1319	2004		
612		12208	254		0			1501	184	2005
2736	11498	14	476			1279	456		2006	
705		12035	77		3368	1137	163		2007	
3963	19097	139	2				863		90	2008
9792	19292	146	1070		1025	0			2009	

#	annual	scaling	factors					
#Com-BLL		Com-GN		Com-L	Rec	Shrimp	Year	
2	2	2	2	2	2	1950		
2	2	2	2	2	2	1951		
2	2	2	2	2	2	1952		
2	2	2	2	2	2	1953		
2	2	2	2	2	2	1954		
2	2	2	2	2	2	1955		
2	2	2	2	2	2	1956		
2	2	2	2	2	2	1957		
2	2	2	2	2	2	1958		
2	2	2	2	2	2	1959		
2	2	2	2	2	2	1960		
2	2	2	2	2	2	1961		
2	2	2	2	2	2	1962		
2	2	2	2	2	2	1963		
2	2	2	2	2	2	1964		
2	2	2	2	2	2	1965		
2	2	2	2	2	2	1966		
2	2	2	2	2	2	1967		
2	2	2	2	2	2	1968		
2	2	2	2	2	2	1969		
2	2	2	2	2	2	1970		
2	2	2	2	2	2	1971		
2	2	2	2	1	2	1972		
2	2	2	2	1	2	1973		
2	2	2	2	1	2	1974		
2	2	2	2	1	2	1975		
2	2	2	2	1	2	1976		
2	2	2	2	1	2	1977		
2	2	2	2	1	2	1978		
2	2	2	2	1	2	1979		
2	2	2	2	1	2	1980		
2	2	2	1	1	2	1981		
2	2	2	1	1	2	1982		
2	2	2	1	1	2	1983		
2	2	2	1	1	2	1984		
2	2	2	1	1	2	1985		
2	2	2	1	1	2	1986		
2	2	2	1	1	2	1987		
2	2	2	1	1	2	1988		

2 2 2 1 1 2 1989
2 2 2 1 1 2 1990
2 2 2 1 1 2 1991
2 2 2 1 1 2 1992
2 2 2 1 1 2 1993
2 2 2 1 1 2 1994
1 2 1 1 1 1 1995
1 1 1 1 1 1 1996
1 1 1 1 1 1 1997
1 1 1 1 1 1 1998
1 1 1 1 1 1 1999
1 1 1 1 1 1 2000
1 1 1 1 1 1 2001
1 1 1 1 1 1 2002
1 1 1 1 1 1 2003
1 1 1 1 1 1 2004
1 1 1 1 1 1 2005
1 1 1 1 1 1 2006
1 1 1 1 1 1 2007
1 1 1 1 1 1 2008
1 1 1 1 1 1 2009
##

 # INDICES OF ABUNDANCE (e.g., CPUE) If there are no series, there should be no entries between the comment lines.

##

 # number of index data series

7
 # pdf of observation error for each series (1) lognormal, (2) normal

1 1 1 1 1 1 1
 # units (1=numbers, 2=weight)

1 1 1 1 1 1 1
 # season (month) when index begins for each series

1 1 1 1 1 1 1

 # season (month) when index ends for each series
12 12 12 12 12 12 12
 # option to (1) scale or (0) not to scale index observations
0 0 0 0 0 0 0
 # set of index variance parameters each series is linked to
1 1 1 1 1 1 1
 # set of q parameters each series is linked to
7 8 9 10 11 12 13
 # set of s parameters each series is linked to
1 1 3 1 6 2 4
 # observed indices by series (last column is for year)
#NMFS SCDNR UNC GADNR BLLOP DGNOP GNlogs Year
-1 -1 -1 -1 -1 -1 -1 1950

-1	-1	-1	-1	-1	-1	-1
1951						
-1	-1	-1	-1	-1	-1	-1
1952						
-1	-1	-1	-1	-1	-1	-1
1953						
-1	-1	-1	-1	-1	-1	-1
1954						
-1	-1	-1	-1	-1	-1	-1
1955						
-1	-1	-1	-1	-1	-1	-1
1956						
-1	-1	-1	-1	-1	-1	-1
1957						
-1	-1	-1	-1	-1	-1	-1
1958						
-1	-1	-1	-1	-1	-1	-1
1959						
-1	-1	-1	-1	-1	-1	-1
1960						
-1	-1	-1	-1	-1	-1	-1
1961						
-1	-1	-1	-1	-1	-1	-1
1962						
-1	-1	-1	-1	-1	-1	-1
1963						
-1	-1	-1	-1	-1	-1	-1
1964						
-1	-1	-1	-1	-1	-1	-1
1965						
-1	-1	-1	-1	-1	-1	-1
1966						
-1	-1	-1	-1	-1	-1	-1
1967						
-1	-1	-1	-1	-1	-1	-1
1968						
-1	-1	-1	-1	-1	-1	-1
1969						
-1	-1	-1	-1	-1	-1	-1
1970						
-1	-1	-1	-1	-1	-1	-1
1971						
-1	-1	3.362	-1	-1	-1	-1
1972						
-1	-1	5.212	-1	-1	-1	-1
1973						
-1	-1	1.886	-1	-1	-1	-1
1974						
-1	-1	2.315	-1	-1	-1	-1
1975						
-1	-1	2.101	-1	-1	-1	-1
1976						
-1	-1	3.325	-1	-1	-1	-1
1977						
-1	-1	3.346	-1	-1	-1	-1
1978						

-1 -1 1.884 -1 -1 -1 -1
1979
-1 -1 1.072 -1 -1 -1 -1
1980
-1 -1 0.537 -1 -1 -1 -1
1981
-1 -1 0.816 -1 -1 -1 -1
1982
-1 -1 0.675 -1 -1 -1 -1
1983
-1 -1 0.879 -1 -1 -1 -1
1984
-1 -1 0.502 -1 -1 -1 -1
1985
-1 -1 0.307 -1 -1 -1 -1
1986
-1 -1 0.597 -1 -1 -1 -1
1987
-1 -1 1.236 -1 -1 -1 -1
1988
-1 -1 0.443 -1 -1 -1 -1
1989
-1 -1 0.240 -1 -1 -1 -1
1990
-1 -1 0.563 -1 -1 -1 -1
1991
-1 -1 1.083 -1 -1 -1 -1
1992
-1 -1 1.006 -1 -1 0.839 -1 1993
-1 -1 0.508 -1 1.155 1.990 -1 1994
-1 -1 0.250 -1 0.662 0.833 -1 1995
-1 -1 0.409 -1 1.008 -1 -1 1996
0.147 -1 0.202 -1 0.135 -1 -1 1997
-1 0.934 0.112 -1 0.379 0.492 0.420 1998
2.269 1.275 0.134 -1 2.171 0.642 0.435 1999
0.532 0.813 0.147 -1 4.026 2.912 0.732 2000
-1 0.770 0.237 -1 2.514 1.241 0.370 2001
1.339 1.567 0.117 -1 1.169 0.947 0.450 2002
-1 1.638 0.075 -1 0.088 0.967 0.763 2003
0.328 0.599 0.205 -1 0.092 0.563 0.283 2004
-1 0.668 0.220 -1 0.602 2.606 0.903 2005
1.407 0.737 0.384 -1 0.317 0.239 1.047 2006
-1 -1 0.894 0.521 1.210 0.729 0.558 2007
2.479 -1 0.241 1.305 0.325 -1 4.576 2008
0.499 -1 0.477 1.173 0.146 -1 1.463 2009
#annual scaling factors for observation variance (use this option to scale up the variance for observations based on very little data)
#NMFS SE BLL SEAMAP Summer SEAMAP fall PC GN adul PC GN juvs MML DISL
BLLOP Year
1 1 10 1 1 1 1 1950
1 1 10 1 1 1 1 1951
1 1 10 1 1 1 1 1952
1 1 10 1 1 1 1 1953
1 1 10 1 1 1 1 1954
1 1 10 1 1 1 1 1955
1 1 10 1 1 1 1 1956

1	1	10	1	1	1	1	1957
1	1	10	1	1	1	1	1958
1	1	10	1	1	1	1	1959
1	1	10	1	1	1	1	1960
1	1	10	1	1	1	1	1961
1	1	10	1	1	1	1	1962
1	1	10	1	1	1	1	1963
1	1	10	1	1	1	1	1964
1	1	10	1	1	1	1	1965
1	1	10	1	1	1	1	1966
1	1	10	1	1	1	1	1967
1	1	10	1	1	1	1	1968
1	1	10	1	1	1	1	1969
1	1	10	1	1	1	1	1970
1	1	10	1	1	1	1	1971
1	1	10	1	1	1	1	1972
1	1	10	1	1	1	1	1973
1	1	10	1	1	1	1	1974
1	1	10	1	1	1	1	1975
1	1	10	1	1	1	1	1976
1	1	10	1	1	1	1	1977
1	1	10	1	1	1	1	1978
1	1	10	1	1	1	1	1979
1	1	10	1	1	1	1	1980
1	1	10	1	1	1	1	1981
1	1	10	1	1	1	1	1982
1	1	10	1	1	1	1	1983
1	1	10	1	1	1	1	1984
1	1	10	1	1	1	1	1985
1	1	10	1	1	1	1	1986
1	1	10	1	1	1	1	1987
1	1	10	1	1	1	1	1988
1	1	10	1	1	1	1	1989
1	1	10	1	1	1	1	1990
1	1	10	1	1	1	1	1991
1	1	10	1	1	1	1	1992
1	1	10	1	1	1	1	1993
1	1	10	1	1	1	1	1994
1	1	10	1	1	1	1	1995
1	1	10	1	1	1	1	1996
1	1	10	1	1	1	1	1997
1	1	10	1	1	1	1	1998
1	1	10	1	1	1	1	1999
1	1	10	1	1	1	1	2000
1	1	10	1	1	1	1	2001
1	1	10	1	1	1	1	2002
1	1	10	1	1	1	1	2003
1	1	10	1	1	1	1	2004
1	1	10	1	1	1	1	2005
1	1	10	1	1	1	1	2006
1	1	10	1	1	1	1	2007
1	1	10	1	1	1	1	2008
1	1	10	1	1	1	1	2009

##

 # EFFORT OBSERVATIONS If there are no series, there should be no entries between the comment lines.

##
 # number of effort data series
0
##
 # AGE COMPOSITION OBSERVATIONS If there are no series, there should be no entries between the comment lines.
##
 # number of age-composition series (If there are no series,there should be no more entries in this section)
0

Appendix C: AD Model Builder parameter input file for Age-Structured Production Model

```
#################################################################################################
# PARAMETER INPUT FILE--Blacknose
#################################################################################################
#
#=============================================================================
============================
# Total number of process parameters (must match number of entries in 'Specifications 1'
section)
#=============================================================================
============================
77
#=============================================================================
============================
# Number of sets of each class of parameters (must be at least 1)
#=============================================================================
============================
# q (catchability)
# |    Effort
# |    |    Vulnerability (selectivity)
# |    |    |    catch observation variance scalar
# |    |    |    |    index variance scalar
# |    |    |    |    |    effort variance scalar
# |    |    |    |    |    |
#-------------------------------------------------------------------------------------------

  14   6    6    1    1    1
#=============================================================================
============================
```

Specifications 1: process parameters and observation error parameters

#===
==========================
class (nature) of parameter (1=constant, 2-4 = polynomial of degree x, 5=knife edge, 6=logistic, 7=gamma, 8=Chapman-Richards, 10=Bev-Holt, 15=double logistic, 22=age-specific vector)
| best estimate (or central tendency of prior)
| | lower bound upper bound
| | | | phase to estimate (-1 = don't estimate)

| | | | | prior density (0 = frequentist...1= lognormal, 2=normal, 3=uniform)
| | | | | | prior variance

| | | | | | |
#--

Natural mortality rate

22	0.2939	0.00E+00	1.00E+00	-1	0	-0.2
22	0.2555	0.00E+00	1.00E+00	-1	0	-0.2
22	0.2337	0.00E+00	1.00E+00	-1	0	-0.2
22	0.2201	0.00E+00	1.00E+00	-1	0	-0.2
22	0.2112	0.00E+00	1.00E+00	-1	0	-0.2
22	0.2051	0.00E+00	1.00E+00	-1	0	-0.2
22	0.2009	0.00E+00	1.00E+00	-1	0	-0.2
22	0.1979	0.00E+00	1.00E+00	-1	0	-0.2
22	0.1957	0.00E+00	1.00E+00	-1	0	-0.2
22	0.1941	0.00E+00	1.00E+00	-1	0	-0.2
22	0.1930	0.00E+00	1.00E+00	-1	0	-0.2
22	0.1922	0.00E+00	1.00E+00	-1	0	-0.2
22	0.1915	0.00E+00	1.00E+00	-1	0	-0.2
22	0.1911	0.00E+00	1.00E+00	-1	0	-0.2

Recruitment (10=Beverton/Holt, 11=Ricker) second column is for alpha and beta parms

10	1.76E+07	0.1000E+06	1.0000E+8	3	3	-0.7000E+00
10	0.745	0.6000E+00	0.9000E+00	-2	1	-0.2500E+00

Growth (type 8 = von Bertalanfy/Richards, Linf, K, t0, m, a, b (weight=al^b)

8	104.3	1.00E-01	1.00E+5	-1	0	1.00E+00
8	0.3	0.00E+00	1.00E+12	-1	0	1.00E+00
8	-1.71	-3	1.00E+12	-1	0	1.00E+00
8	1	0.00E+00	1.00E+12	-1	0	1.00E+00
8	1.65E-06	-1.00E+00	1.00E+12	-1	0	1.00E+00

```
 8       3.34        0.00E+00    1.00E+12                -1        0        1.00E+00
#von bert unit conversion factors (scalar, constant) for L-W  (new_Length_unit =
scalar*old_Length_unit + constant)
#    (--***-- FIX First ENTRIES TO 1.0, Second to 0.0 IF NO UNIT CONVERSION IS
NEEDED)
 8       1.00E+00          0.00E+00    1.00E+02             -1        0        -1.00E+00
 8       0.00E+00    -1.00E+00         1.00E+02             -1        0        -1.00E+00
# catchability (FOR CATCH SERIES)
 1      1.1000E-04    1.1000E-07      1.1000E+01    1    1      0.1000E+01

 1      1.1000E-05    1.1000E-10      1.1000E+01    1    1      0.1000E+01

 1      1.1000E-05    1.1000E-07      1.1000E+01    1    1      0.1000E+01

 1      1.1000E-04    1.1000E-06      1.1000E+01    1    1      0.1000E+01

 1      1.1000E-03    1.1000E-06      1.1000E+01    1    1      0.1000E+01
 1      1.1000E-04    1.1000E-06      1.1000E+01    1    1      0.1000E+01
# catchability (FOR INDEX SERIES)
 1      5.6990E-04    1.1000E-10      0.1000E-02    1    1      0.1000E+01
 1      3.4360E-05    1.1000E-10      0.1000E-02    1    1      0.1000E+01
 1      5.6990E-04    1.1000E-10      0.1000E-02    1    1      0.1000E+01
 1      3.4360E-04    1.1000E-10      0.1000E-02    1    1      0.1000E+01
 1      5.6990E-04    1.1000E-10      0.1000E-02    1    1      0.1000E+01
 1      2.2490E-03    1.1000E-10      0.1000E-02    1    1      0.1000E+01
 1      3.4360E-03    1.1000E-10      0.1000E-02    1    1      0.1000E+01
 1      5.6990E-04    1.1000E-10      0.1000E-02    1    1      0.1000E+01
# effort for "prehistoric" period when data is sparse (1950-1971)
 1      0.00          0.0          1.0000E+00    2    3      -0.3000E+00
 1      0.00          0.0          1.0000E+00    2    3      -0.3000E+00
 1      0.00001       0.0          1.0000E+00    2    3      -0.3000E+00
 1      0.00001       0.0          1.0000E+00    2    3      -0.3000E+00
 1      0.01          0.0          1.0000E+00    2    3      -0.3000E+00
 1      0.00          0.0          1.0000E+00    2    3      -0.3000E+00
# effort for period with useful data (1972-2009)
 1      0.40          0.0          1.0000E+0     3    3      -0.3000E+00
 1      0.28          0.0          1.0000E+0     3    3      -0.3000E+00
 1      0.05          0.0          1.0000E+0     3    3      -0.3000E+00
 1      0.14          0.0          1.0000E+0     3    3      -0.3000E+00
 1      0.60          0.0          1.0000E+0     3    3      -0.3000E+00
 1      0.40          0.0          1.0000E+0     3    3      -0.3000E+00
# vulnerability (selectivity)
#---S1 logistic longline age 2 (BLLOP, GADNR, SCDNAR Red Drum, PC GN adult& juves,
recreational, Comm BLL, lines)
 6      1.136305      0.0000E-10     0.2000E+02     -1    0      0.1000E+01
 6      0.084647      0.0000E+00      4.0000E+01     -1    2      0.6250E-01
```

```
#---S2 SEAMAP pre-TED  (seamap summer and fall, and shrimp bycatch pre-1990)
 15      0.01          0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      0.5           0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      2.5           0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      0.75          0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      0.989         0.0000E-10       0.2000E+02    -1     0       0.1000E+01
#---S3 DISL
  6     3.682281       0.0000E-10       0.2000E+02    -1     0       0.1000E+01
  6     0.658098       0.0000E+00       4.0000E+01    -1     2       0.6250E-01
#---S4 Dome-shaped age 5 (MML LL)
 15      2             0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      0.7           0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      7             0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      0.5           0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      0.97          0.0000E-10       0.2000E+02    -1     0       0.1000E+01
#---S5 Dome-shaped age 2  (GN logs, Comm nets)
 15      0.5           0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      0.5           0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      4             0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      1.5           0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      0.75          0.0000E-10       0.2000E+02    -1     0       0.1000E+01
#---S6 Seamap post ted  (shrimp bycatch post-1990)
 15      0.01          0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      0.1           0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      1             0.0000E-10       0.2000E+02    -1     0       0.1000E+01
 15      0.1           0.0000E+00       0.4000E+02    -1     2       0.6250E-01
 15      0.989         0.0000E-10       0.2000E+02    -1     0       0.1000E+01
# catch observation error variance scalar
 1       1.0000E+00       0.1000E+00    0.5000E+01    -1      0       0.1000E+01
# index observation error variance scalar
 1       1.0000E+00       0.1000E+00    0.9000E+01    -4      0       0.1000E+01
# effort observation error variance scalar
 1       1.0000E+00    0.1000E+00       0.5000E+01    5      1       0.1000E+01
#=========================================================================
==========================
# Specifications 2: process ERROR parameters

#=========================================================================
==========================
#    best estimate (or central tendency of prior)

#   |              lower bound    upper bound

#   |              |              |              phase to estimate (-1 = don't estimate)
```

```
#   |           |           |           |    prior density (1= lognormal, 2=normal, 3=uniform)

#   |           |           |           |    |      prior variance

#   |           |           |           |    |      |
#---------------------------------------------------------------------------------------------

# overall variance (negative value indicates a CV)
  -7.5000E+00      -55.000E+00      -1.0000E-02     5     3       0.1000E+01

# recruitment process variation parameters (allows year to year fluctuations)

#    correlation coefficient
   0.75000E+00      -0.1000E-31       0.9900E+00    -1     0       0.1000E+01

#    variance (should be log-scale variance if prior density = 1 or arithmetic scale variance if prior
= 2)
#      Note: this variance is NOT multiplied by the overall variance parameter

   -0.25         0.0000E+00       0.1000E+21      -1     0       0.1000E+01

#    annual deviation parameters (last entry is arbitrary for deviations)

   0.0000E+00      -0.5000E+01       0.5000E+01    -1     0      -0.4000E+00

# catchability process variation parameters (allows year to year fluctuations)

#    correlation coefficients
   0.0000E+00      -0.1000E-31       0.9900E+00    -1     0       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00    -1     0       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00    -1     0       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00    -1     0       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00    -1     0       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00    -1     0       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00     -1     1       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00     -1     1       0.1000E+02

   0.0000E+00      -0.1000E-31       0.9900E+00     -1     1       0.1000E+02
```

0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02
0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02
0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02

variance scalars (multiplied by overall variance)

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

annual deviation parameters (last entry is arbitrary for deviations)

0.0000E+00 -0.5000E+01 0.5000E+01 -1 0 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -1 0 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -1 0 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -1 0 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -1 0 0.1000E+01

```
 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01

 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01

 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01

 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01
 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01

 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01

 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01
 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01
 0.0000E+00     -0.5000E+01      0.5000E+01   -1    0      0.1000E+01

# effort process variation parameters (allows year to year fluctuations)

#    correlation coefficients
 0.500E+00      0.0000E+00      0.9900E+00    -1    0      0.1000E+01
 0.500E+00      0.0000E+00      0.9900E+00    -1    0      0.1000E+01

 0.500E+00      0.0000E+00      0.9900E+00    -1    0      0.1000E+01

 0.500E+00      0.0000E+00      0.9900E+00    -1    0      0.1000E+01

 0.500E+00      0.0000E+00      0.9900E+00    -1    0      0.1000E+01
 0.500E+00      0.0000E+00      0.9900E+00    -1    0      0.1000E+01

#    variance (should be log-scale variance if prior density = 1 or arithmetic scale variance if prior
= 2)
#      Note: this variance is NOT multiplied by the overall variance parameter

 1000.00        0.0000E+00      0.1000E+21    -1    0      0.1000E+01
 1000.00        0.0000E+00      0.1000E+21    -1    0      0.1000E+01

 1000.00        0.0000E+00      0.1000E+21    -1    0      0.1000E+01

 1000.00        0.0000E+00      0.1000E+21    -1    0      0.1000E+01

 1000.00        0.0000E+00      0.1000E+21    -1    0      0.1000E+01
 1000.00        0.0000E+00      0.1000E+21    -1    0      0.1000E+01

#    annual deviation parameters (last entry is arbitrary for deviations)

 0.000E-03     -15.000E+00      0.1000E+02     4    1      0.1000E+01
```

0.000E-03 -15.000E+00 0.1000E+02 4 1 0.1000E+01

0.000E-03 -15.000E+00 0.1000E+02 4 1 0.1000E+01

0.000E-03 -15.000E+00 0.1000E+02 4 1 0.1000E+01

0.000E-03 -15.000E+00 0.1000E+02 4 1 0.1000E+01
0.000E-03 -15.000E+00 0.1000E+02 4 1 0.1000E+01

Appendix D: AD Model Builder parameter input file for the SA stock

```
#################################################################################
##################
# PARAMETER INPUT FILE--Blacknose
#################################################################################
##################
#
#=================================================================
============================
# Total number of process parameters (must match number of entries in 'Specifications 1'
section)
#=================================================================
============================
76
#=================================================================
============================
# Number of sets of each class of parameters (must be at least 1)
#=================================================================
============================
# q (catchability)
# |   Effort
# |   |   Vulnerability (selectivity)
# |   |   |   catch observation variance scalar
# |   |   |   |   index variance scalar
# |   |   |   |   |   effort variance scalar
# |   |   |   |   |   |
#-------------------------------------------------------------------------------------------

 13   6   6   1   1   1
#=================================================================
============================
# Specifications 1: process parameters and observation error parameters

#=================================================================
============================
```

```
#  class (nature) of parameter (1=constant, 2-4 = polynomial of degree x, 5=knife edge, 6=logistic, 7=gamma, 8=Chapman-Richards, 10=Bev-Holt, 15=double logistic, 22=age-specific vector )
# |       best estimate (or central tendency of prior)

# |     |            lower bound    upper bound
# |     |            |            |           phase to estimate (-1 = don't estimate)

# |     |            |            |           |    prior density (0 = frequentist...1= lognormal, 2=normal, 3=uniform)
# |     |            |            |           |    |      prior variance

# |     |            |            |           |    |      |
#-------------------------------------------------------------------------------------------

# Natural mortality rate
22       0.208943877   0.00E+00              1.00E+00              -1       0        -0.2
22       0.208943877   0.00E+00              1.00E+00              -1       0        -0.2
22       0.208943877   0.00E+00              1.00E+00              -1       0        -0.2
22       0.208943877   0.00E+00              1.00E+00              -1       0        -0.2
22       0.208943877   0.00E+00              1.00E+00              -1       0        -0.2
22       0.205146777   0.00E+00              1.00E+00              -1       0        -0.2
22       0.200897579   0.00E+00              1.00E+00              -1       0        -0.2
22       0.197879801   0.00E+00              1.00E+00              -1       0        -0.2
22       0.195711571   0.00E+00              1.00E+00              -1       0        -0.2
22       0.194140773   0.00E+00              1.00E+00              -1       0        -0.2
22       0.192995974   0.00E+00              1.00E+00              -1       0        -0.2
22       0.192158016   0.00E+00              1.00E+00              -1       0        -0.2
22       0.191542708   0.00E+00              1.00E+00              -1       0        -0.2
22       0.191089842   0.00E+00              1.00E+00              -1       0        -0.2
22       0.190755963   0.00E+00              1.00E+00              -1       0        -0.2
22       0.190509498   0.00E+00              1.00E+00              -1       0        -0.2
22       0.190327393   0.00E+00              1.00E+00              -1       0        -0.2
22       0.190192748   0.00E+00              1.00E+00              -1       0        -0.2
22       0.190093145   0.00E+00              1.00E+00              -1       0        -0.2
22       0.190019435   0.00E+00              1.00E+00              -1       0        -0.2
# Recruitment (10=Beverton/Holt, 11=Ricker)     second column is for alpha and beta parms
10       1.45E+06        0.1000E+05        1.0000E+10        3       1       -0.7000E+00

10       0.81            0.5000E+00        0.9900E+00        -2      1       -0.2500E+00

# Growth (type 8 = von Bertalanfy/Richards, Linf, K, t0, m, a, b (weight=al^b)

 8       104.3           1.00E-04              1.00E+12              -1       0        1.00E+00
 8       0.3             0.00E+00              1.00E+12              -1       0        1.00E+00
```

```
 8      -1.71          -3              1.00E+12              -1      0       1.00E+00
 8      1              0.00E+00        1.00E+12              -1      0       1.00E+00
 8      1.65E-06             -1.00E+00       1.00E+12              -1      0       1.00E+00
 8      3.34           0.00E+00        1.00E+12              -1      0       1.00E+00
#von bert unit conversion factors (scalar, constant) for L-W  (new_Length_unit =
scalar*old_Length_unit + constant)
#    (--***-- FIX First ENTRIES TO 1.0, Second to 0.0 IF NO UNIT CONVERSION IS
NEEDED)
 8      1.00E+00          0.00E+00          1.00E+02      -1      0       -1.00E+00
 8      0.00E+00      -1.00E+00       1.00E+02      -1      0       -1.00E+00
# catchability (FOR CATCH AND INDEX SERIES)
 1      1.0000E-04          1.1000E-06      0.9900E+00    2   1      0.1000E+01

 1      1.0000E-04          1.1000E-06      0.9900E+00    2   1      0.1000E+01

 1      1.0000E-04          1.1000E-06      0.9900E+00    2   1      0.1000E+01

 1      1.0000E-04          1.1000E-06      0.9900E+00    2   1      0.1000E+01

 1      1.0000E-04          1.1000E-06      0.9900E+00    2   1      0.1000E+01
 1      1.0000E-04          1.1000E-06      0.9900E+00    2   1      0.1000E+01
# catchability (FOR INDEX SERIES)
 1      5.6990E-04    1.1000E-08      0.1000E-01    2    1      0.1000E+01
 1      3.4360E-04    1.1000E-07      0.1000E-01    1    1      0.1000E+01
 1      5.6990E-04    1.1000E-07      0.1000E-01    2    1      0.1000E+01
 1      3.4360E-04    1.1000E-07      0.1000E-01    1    1      0.1000E+01
 1      5.6990E-03    1.1000E-08      0.1000E-01    2    1      0.1000E+01
 1      2.2490E-03    1.1000E-08      0.1000E-01    2    1      0.1000E+01
 1      3.4360E-03    1.1000E-08      0.1000E-01    1    1      0.1000E+01
# effort for "prehistoric" period when data is sparse (1950-1971)
 1      0.00          0.0          0.9900E+00    4   3     -0.3000E+00
 1      0.00          0.0          0.9900E+00    4   3     -0.3000E+00
 1      0.00001       0.0          0.9900E+00    4   3     -0.3000E+00
 1      0.001         0.0          0.9900E+00    4   3     -0.3000E+00
 1      0.001         0.0          0.9900E+00    4   3     -0.3000E+00
 1      0.00          0.0          0.9900E+00    4   3     -0.3000E+00
# effort for period with useful data (1972-2005)
 1      0.28          0.0          1.0000E+00    3   3      -0.3000E+00
 1      0.70          0.0          1.0000E+00    3   3      -0.3000E+00
 1      0.05          0.0          1.0000E+00    3   3      -0.3000E+00
 1      0.15          0.0          1.0000E+00    3   3      -0.3000E+00
 1      0.3           0.0          1.0000E+00    3   3      -0.3000E+00
 1      0.28          0.0          1.0000E+00    3   3      -0.3000E+00
# vulnerability (selectivity)
#---S1 logistic longline age 2 (NMFS SE LL, GADNR Red Drum, SCDNR Hist Red Drum,
Rec, Com-BLL, Com-L)
```

```
  6      1.136305      0.0001      0.2000E+02    -1     3      0.1000E+01
  6      0.084647      0.0000E+00      4.0000    -1     1      0.6250E-01
#---S2 DGNOP
  6      4          0.0000E-10      0.2000E+02    -1     3      0.1000E+01
  6      2          0.0000E+00      4.0000E+00    -1     1      0.6250E-01
#---S3 UNC
  6      4          0.0000E-10      0.2000E+02    -1     3      0.1000E+01
  6      3          0.0000E+00      4.0000E+00    -1     1      0.6250E-01
#---S4 Dome-shaped age 2  (GN logs, Comm nets)
  15     0.5          0.0000E-10      0.2000E+02    -1     0      0.1000E+01
  15     0.5          0.0000E+00      0.4000E+02    -4     2      0.6250E-01
  15     4          0.0000E-10      0.2000E+02    -1     0      0.1000E+01
  15     1.5          0.0000E+00      0.4000E+02    -4     2      0.6250E-01
  15     0.75         0.0000E-10      0.2000E+02    -1     0      0.1000E+01
#---S5 Seamap post ted  (shrimp bycatch post-1990)
15     0.01          0.0000E-10      0.2000E+02    -1     0      0.1000E+01
15     0.1           0.0000E+00      0.4000E+02    -4     2      0.6250E-01
15     1           0.0000E-10      0.2000E+02    -1     0      0.1000E+01
15     0.1           0.0000E+00      0.4000E+02    -4     2      0.6250E-01
15     0.989         0.0000E-10      0.2000E+02    -1     0      0.1000E+01
#---S6 logistic longline 2 (BLLOP, SA only)
  6      1.65646      0.0000E-10      0.2000E+02    -1     0      0.1000E+01
  6      0.01408      0.0000E+00      4.0000E+01    -1     2      0.6250E-01
# catch observation error variance scalar
  1      1.0000E+00      0.1000E+00    0.5000E+01    -2     1      0.1000E+01

# index observation error variance scalar
  1      1.0000E+00      0.1000E+00    0.9000E+01    -4     1      0.1000E+01

# effort observation error variance scalar
  1      1.0000E+00    0.1000E+00      0.5000E+01    -3     1      0.1000E+01

#=================================================================
============================
# Specifications 2: process ERROR parameters

#=================================================================
============================
#    best estimate (or central tendency of prior)

#    |            lower bound    upper bound

#    |            |            |           phase to estimate (-1 = don't estimate)

#    |            |            |           |    prior density (1= lognormal, 2=normal, 3=uniform)
```

```
#   |              |              |            |    |       prior variance

#   |              |              |            |    |       |
#------------------------------------------------------------------------------------------------

# overall variance (negative value indicates a CV)

  -7.5000E+00     -2000.000E+00     -0.1000E-02     5     3      0.1000E+01

# recruitment process variation parameters (allows year to year fluctuations)

#   correlation coefficient
   0.5000E+00     -0.1000E-31      0.9900E+00    -2     3      0.1000E+01

#   variance (should be log-scale variance if prior density = 1 or arithmetic scale variance if
prior = 2)
#     Note: this variance is NOT multiplied by the overall variance parameter

   -0.25         0.0000E+00      0.1000E+21      -1     1      0.1000E+01

#   annual deviation parameters (last entry is arbitrary for deviations)

   0.0000E+00     -0.5000E+01      0.5000E+01    -4     1     -0.4000E+00

# catchability process variation parameters (allows year to year fluctuations)

#   correlation coefficients
   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02
   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02

   0.0000E+00     -0.1000E-31      0.9900E+00    -1     1      0.1000E+02
```

0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 1 0.1000E+02

 # variance scalars (multiplied by overall variance)

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.9900E+00 -1 0 0.1000E+02
0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

0.0000E+00 -0.1000E-31 0.1000E+21 -1 0 0.1000E+02

 # annual deviation parameters (last entry is arbitrary for deviations)

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01
0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01
0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

0.0000E+00 -0.5000E+01 0.5000E+01 -5 1 0.1000E+01

 # effort process variation parameters (allows year to year fluctuations)

 # correlation coefficients

0.500E+00 0.0000E+00 0.9900E+00 -1 1 0.1000E+01
0.500E+00 0.0000E+00 0.9900E+00 -1 1 0.1000E+01

0.500E+00 0.0000E+00 0.9900E+00 -1 1 0.1000E+01

0.500E+00 0.0000E+00 0.9900E+00 -1 1 0.1000E+01

0.500E+00 0.0000E+00 0.9900E+00 -1 1 0.1000E+01

0.500E+00 0.0000E+00 0.9900E+00 -1 1 0.1000E+01

 # variance (should be log-scale variance if prior density = 1 or arithmetic scale variance if prior = 2)
 # Note: this variance is NOT multiplied by the overall variance parameter

750.00 0.0000E+00 0.1000E+21 -1 1 0.1000E+01
750.00 0.0000E+00 0.1000E+21 -1 1 0.1000E+01

750.00 0.0000E+00 0.1000E+21 -1 1 0.1000E+01

750.00 0.0000E+00 0.1000E+21 -1 1 0.1000E+01

750.00 0.0000E+00 0.1000E+21 -1 1 0.1000E+01

750.00 0.0000E+00 0.1000E+21 -1 1 0.1000E+01

 # annual deviation parameters (last entry is arbitrary for deviations)

0.000E-03 -15.000E+00 0.7000E+02 5 1 0.1000E+01
0.000E-03 -15.000E+00 0.7000E+02 5 1 0.1000E+01

0.000E-03 -15.000E+00 0.7000E+02 5 1 0.1000E+01

0.000E-03 -15.000E+00 0.7000E+02 5 1 0.1000E+01

0.000E-03 -15.000E+00 0.7000E+02 5 1 0.1000E+01

0.000E-03 -15.000E+00 0.7000E+02 5 1 0.1000E+01