STATUS OF BOCACCIO OFF CALIFORNIA IN 2005

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Table of Contents

Executive Summary – Bocaccio

Approach: This assessment was conducted as an "update" which follows the methodology and assumptions of the 2003 bocaccio assessment as closely as possible. The main difference from the previous assessment is addition or revision of recent data. The assessment used the original Stock Synthesis model (SS1), and does not develop an equivalent new Stock Synthesis 2 (SS2) version of the assessment. Accordingly, some features of SS2 output, such as precision estimates, do not appear in this update assessment.

Stock: Bocaccio rockfish (*Sebastes paucispinis*) occurring in waters off the state of California. For management purposes, the stock may be considered to reside in U.S. waters south of Cape Mendocino. This stock assessment treats the resource in Southern and Central California as a combined unit.

Catches: Catches have declined steeply from the 1970s, reflecting both a long-term decline in abundance and progressive restrictions on harvest of bocaccio (Table ES1). Values of catches since 2000 are imprecise because of management-induced discarding. Recent discards in the trawl fishery have been monitored; for lack of better information, discard rates in other commercial fisheries are assumed to be similar those for the trawl fishery. Discards in the recreational fishery are given by RecFIN. Details are given in Table ES2.

Data and assessment: The last assessment was conducted in 2003. Like the previous assessment, this update assessment uses the original length-based stock synthesis (SS1) model (synl32r.exe, compiled 4/2/2003), with input data extending back to 1951. Data include catches from five fisheries segments reflecting three statewide commercial gears (trawl, setnet, hook&line), and separate southern California and central/northern California recreational fisheries, length compositions from six sources (all five fisheries segments, and the Triennial Survey), and six indexes of abundance (trawl logbook CPUE, three recreational CPUEs, Triennial Survey abundance, and CalCOFI larval index of spawning output). The assumed natural mortality rate (M) was 0.15/yr in accordance with the 2003 assessment.

Unresolved problems and major uncertainties: Within the scope of an update assessment, there were no unresolved problems or uncertainties. The STATc model developed in the 2003 assessment is the focus of the update, with more limited consideration of the STARb1 and STARb2 models.

Table ES1. Summary of historical bocaccio catches (including discards)

	Trawl	Hook&Line	Setnet	RecSOUTH	RecNORTH	Total
1950	1287	200	0	39	86	1612
1960	2163	351	0	63	125	2702
1970	1660	298	0	289	204	2451
1975	4212	812	0	450	276	5750
1980	3643	310	151	1755	178	6037
1990	1124	344	659	233	91	2451
1991	706	177	442	200	92	1617
1992	488	464	570	167	92	1781
1993	559	402	413	109	19	1502
1994	526	208	270	215	5	1224
1995	377	70	283	44	3	777
1996	288	97	95	67	26	573
1997	230	58	36	49	107	480
1998	73	45	39	29	23	209
1999	45	21	7	71	53	197
2000	51	21	2	52	60	186
2001	59	35	4	60	49	207
2002	44	7	0	76	8	135
2003	2	9	0	11	0	22
2004	11	10	1	59	2	83

Table ES2. Estimated recent fishery removals (mtons) of bocaccio. Parentheses indicate value used in 2003 assessment.

	TRAWL				Hook&Line		SETNET		RecSouth	RecNorth	Total
	Retained	Discarded	Total	Tot/retained	Retained	Est Total	Retained	Est Total	A + B1	A + B1	
2000	17.4	34.0	51(54)	3.0	7.0	21(21)	0.8	2(2)	52	60	186(187)
2001	13.1	45.7	59(37)	4.5	7.8	35(23)	0.9	4(2)	60	49	207(187)
2002	17.7	25.8	44(99)	2.5	3.0	7(17)	0.2	0(1)	76	8	135(201)
2003	0.1	1.8	2	20.3	0.5	9	0.0	0	11	0	22
2004	5.9	5.4	11	1.9	5.4	10	0.4	1	59	2	83

Reference points: Values in this discussion are from the STATc model; values for the two STAR models are given in Table ES3. Population reproductive potential is measured as spawning output (units of billion eggs). Unfished abundance cannot be estimated reliably from historical stock and recruitment due to lack of curvature in the relationship. An imprecise estimate of unfished spawning output was obtained by multiplying the average age-1 recruitment (1951 to 1986) by unfished SPR, giving 13402 billion eggs.

The 50%SPR exploitation rate (Catch/Biomass age 1+) is 0.0632 (F=0.108 at full selectivity), which is used as a proxy Fmsy rate by the PFMC. Proxy Bmsy (40% of Bunfished) corresponds to an equilibrium total biomass of 27,970MT, and if this is fished at proxy Fmsy, the MSY is estimated to be 1768MT. Calculations related to MSY are very imprecise.

Table ES3. Management reference points for bocaccio.

Model	STAT C	STAR B1	STAR B2
Unfished spawning output (SB0) (billion eggs)	13402	13444	13044
Current spawning output (SB2005) (billion eggs)	1430	1638	1074
Relative depletion (2005)	10.7%	12.2%	8.2%
Unfished summary (age 1+) biomass (B0) mtons	69924	70065	68051
Current summary (age 1+) biomass (B2005) mtons	8561	10357	6477
Unfished recruitment (R0)	5333	5349	5188
SB(40%) (MSY proxy size = 0.4 x SB0)	5361	5378	5218
Summary (age 1+) biomass at SB(40%)	31974	28026	27220
Exploitation rate (C/B1+) at MSY (rockfish proxy F50%)	0.0632	0.0641	0.0631
MSY (F50% x 40% x B0)	1768	1796	1718
ABC (F50% x B2005)	541	664	409
OY using 40-10 policy	50	172	0

Exploitation status: From the STATc model, the estimated spawning output in 2005 is 1430 billion eggs, or 10.7% of the estimated unfished level. The estimated 2005 total biomass (age 1+) is 8561MT. The 2004 exploitation rate of 0.0103 was well below the maximum fishing mortality threshold (see Figure ES1). At Fmsy, the STATc model gives a 2005 catch (ABC) of 541MT and a "40-10" policy OY of 50MT.

Management performance: The 2003 OY was set at 20MT, and the retained catch was about 12 MT (Table ES2). Including mortality of estimated discards, estimated total kill was 22 MT. The 2004 OY was set at 199MT, with a realized catch of 78MT. Discards brought the estimated kill to 83MT. Thus, recent management has been achieving total removals at (2003) or well below (2004) maximum target levels. The ten-year history of management performance is given in Table ES4.

Table ES4. Recent history of management performance.

Year	Commercial Catch	Commercial Discard	Commercial Total	Recreational Catch	Recreational Discard	Recreational Total	Total Catch	Total Discard	Total Total	ABC	OY
1995	730	*	730	31	2	33	761	2	763	1700	1700
1996	480	*	480	89	4	93	569	4	573	1700	1700
1997	324	*	324	146	11	157	470	11	481	265	265
1998	157	*	157	51	0	51	208	0	208	230	230
1999	73	*	73	120	4	124	193	4	197	230	230
2000	25	49	74	103	9	112	128	58	186	164	100
2001	22	76	98	103	6	109	125	82	207	122	100
2002	21	30	51	82	2	84	103	32	135	122	100
2003	1	10	11	9	2	11	10	12	22	244	<20
2004	12	10	22	54	8	62	66	18	84	400	199
2005										566	307

* Discarded commercial catch was not estimated and is assumed to be negligible.

Forecasts: The SS1 program was used to forecast abundance (spawning output) levels through 2016 (Table ES5, Figure ES2), based on an assumed exploitation rate of 0.0498. Median estimates of abundance approximately double over that period, and there is an approximately 1% chance of decline in spawning output, though there is a 7% chance of decline in OY due to age composition effects. Note that rebuilding projections using the SSC model (required by the formal rebuilding analysis) are likely to differ from those based on the SS1 model.

Decision tables: Because an update assessment implies that no change in policy is under consideration, no decision tables were prepared.

Table ES5. Median SS1 projected abundances of bocaccio, at exploitation rate of 0.0498.

Year	Median Spawning Output	Depletion	Median Catch (MT)
2005	1430	10.7%	281
2006	1504	11.2%	271
2007	1554	11.6%	268
2008	1601	11.9%	274
2009	1653	12.3%	295
2010	1711	12.8%	327
2011	1812	13.5%	368
2012	1962	14.6%	423
2013	2130	15.9%	471
2014	2364	17.6%	505
2015	2594	19.4%	511
2016	2804	20.9%	527

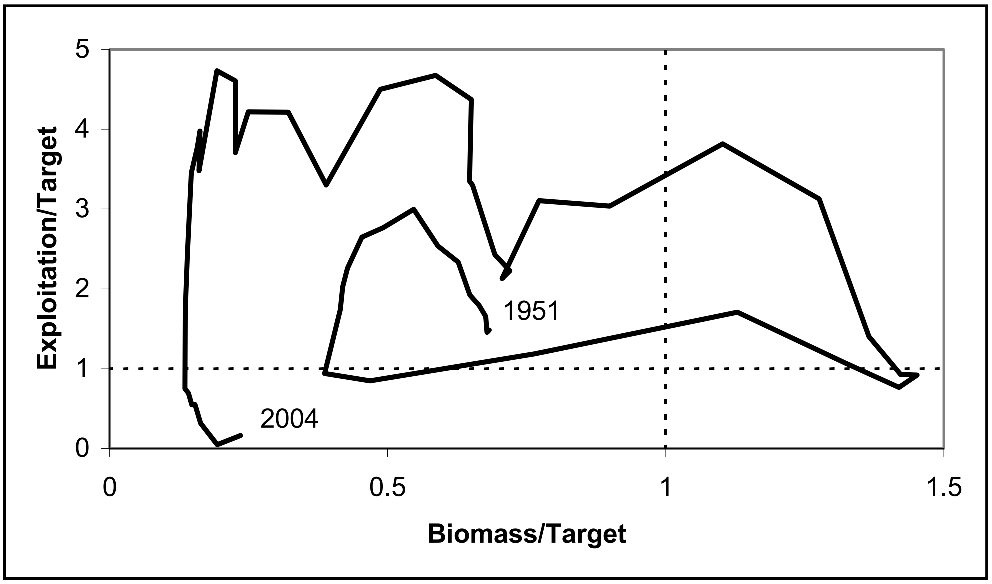


Figure ES1. "Phase diagram" of historical abundances and exploitation rates relative to target (Bmsy, Fmsy) levels.

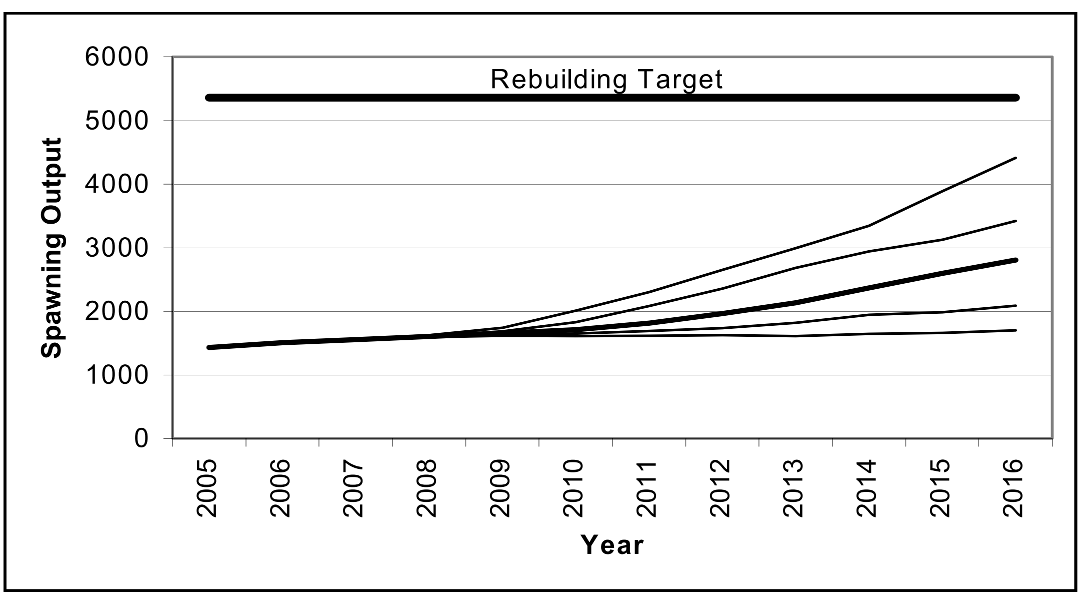


Figure ES2. STATc model forecast abundances (10, 25, 50, 75, 90 percentiles) at an exploitation rate of 0.0498.

Introduction

A full stock assessment of bocaccio off California was last conducted in 2003 (MacCall 2003a). This assessment is an "update" assessment, and attempts to adhere as closely as possible to the model framework established in 2003. Three models were presented in the 2003 assessment, and are summarized in Table 1. The STARb1 and STARb2 models omit portions of the data; the STATc model includes all of the data sources and has been the primary basis of management decisions.

Fishery data

Catches

Five distinct fishery segments are recognized in this assessment: commercial trawl, hook and line and set net gears, and recreational fisheries north and south of Pt. Conception. Recent estimates of recreational catch and discards (Table 2) were obtained from the RecFIN database. Commercial catches were obtained from the CALCOM database (Don Pearson, SWFSC, pers. comm.), and bycatch/discard estimates from the trawl fishery were provided by Jim Hastie (NWFSC, pers. comm.). Estimated catches for 1999 and earlier were unchanged. No discard estimates were available for hook and line or set net gears; discard rates were assumed to be identical to those for trawl gear. The estimated combined catch and discard during 2000-2002 (528 mtons) is slightly lower than was used in the 2003 assessment (575 mtons). Historical catches are shown in Figure 1.

Length Compositions

Length compositions of retained bocaccio are available from only the southern California recreational fishery in 2003, but in 2004 are available for all fishery segments except commercial hook and line. In addition, the length composition of fish landed by the southern California recreational fishery in the first six months of 2005 is used in this analysis. The 2003-2005 time series of lengths compositions for the southern California recreational fishery is shown in Figure 2, and sample sizes are given in Table 3. The strong 1999 year class remains dominant, but a new year class becomes apparent in 2005. All 2004 fishery length compositions are shown in Figure 3; length compositions for the two commercial fishery segments include sex-specific lengths.

Fishery-Dependent Abundance Indexes

No attempt was made to update the recreational fishery CPUE abundance indexes because of difficulty interpreting catch rates under the strong restrictions that were placed on landing bocaccio.

Surveys and Indexes

Triennial Survey

A Triennial Trawl Survey was conducted in 2004 (data provided by Mark Wilkins, AFSC, and Beth Horness, NWFSC, pers. comm.). The length composition of bocaccio taken in that survey is show in Figure 3. As was done previously, I used a simple log-transformed GLM to produce year-specific indexes of abundance. This approach allows a consistent interpretation of the survey results even though the Conception area was not sampled in 1980, 1983 and 1986. The GLM predicts stratum means with fixed area, depth and year effects (Figure 4), and the new index values are consistent with those used in the 2003 assessment.

CalCOFI Survey

The 2003 assessment included the January 2003 CalCOFI ichthyoplankton survey, but did not include the April 2003 survey. This assessment includes both 2003 CalCOFI surveys, as well as January, April and November 2004, and January 2005 (Richard Charter, SWFSC, pers. comm.). Sample sizes are given in Table 3. As before, a delta-lognormal GLM with fixed year, month and station effects was use to produce annual index values (Figure 5). Consistency between values in the 2003 assessment and this assessment is shown in Figure 6. The index value for 2003 decreased slightly when the April survey results were included.

Recruitment Indexes

In its review of the 2003 assessment, the STAR Panel recommended excluding use of recruitment indexes. Those indexes are not used in this assessment, and updated values were not calculated.

Assessment Model

The assessment was conducted using the “Stock Synthesis 1" length-based maximum likelihood model (synl32r.exe, compiled 4/2/2003); in accordance with the terms of reference for “update” assessments, no attempt was made to re-fit the model in Stock Synthesis 2. As in the 2003 assessment, natural mortality rate is set at M=0.15. All three of the models (STARb1, STARb2 and STATc) developed in the 2003 assessment are updated here.

Model Tuning

Abundance index CVs were set at the same values as were used in the 2003 assessment (Table 1). Effective sample sizes for recent length compositions were calculated from the previous regressions (Figure 24 in MacCall 2003a), and are given in Table 3.

Model Results and Projections

Model results are compared in Table 4, and more details are given in Table 5; abundance trajectories, recruitments and exploitation rates are shown in Figures7-9. Fits to abundance time series are shown in Figure 10 and fits to length compositions are shown in Figure 11. All three models are in general agreement for the most recent 30 years (models STARb1 and STARb2 differ in estimation of early recruitments). Trajectories of spawning output relative to its unfished level for three versions of model STATc are shown in Figure 12. The original STATc model and its 2003 equivalent using 2005 data are nearly identical. The 2005 update produces slightly lower estimates of relative abundance for earlier years, but is in close agreement for the most recent years.

Stock Synthesis projections of the STATc model through year 2016 under current fishing intensity used re-sampling of ln(R/S) values for the 1970 through 2003 year classes (Figure 12). Growth in abundance slows during the next few years as the 1999 year class passes its peak cohort biomass. Projections begin to diverge in 2010 as simulated future cohorts enter the spawning population, but the median projection shows good growth potential and is consistent with the projections in the 2003 rebuilding plan (MacCall 2003b).

Other Issues

The following analyses provide information on sensitivity of the model results to various sources of uncertainty. In some cases they indicate aspects of the model that can be improved, but they were not implemented in this "update" treatment.

Revised calculation of Triennial Survey abundance indexes: The Triennial Trawl Survey was one of the more problematic data sources in the 2003 assessment, and the index based on swept-area biomass estimates had the poorest fit (highest log RMSE) of the several abundance indexes that were used. The unexpectedly low 2001 Triennial Survey estimate has now been followed by a sharp increase in the 2004 abundance index, confirming patterns seen in CalCOFI and CPUE indexes. Also, John Field (pers. comm.) has been investigating use of a delta-GLM approach to calculating indexes of abundance from the Triennial Survey data, and has found this approach to produce a much higher correlation with predictions from the 2005 STARb1 model (which does not use the Triennial Survey Index) than does the Triennial swept-area index. The pattern of Triennial trawl stations tends to avoid the rocky habitats preferred by bocaccio, and explicit consideration of presence/absence in the delta-GLM approach may address this problem.

Sensitivity to assumed value of natural mortality rate M: Results for use of alternative values of natural mortality rate (0.1, 0.125. 0.15, 0.175, 0.2) in the STATc model are shown in Table 5.

Retrospective analysis: A retrospective analysis was conducted by dropping data collected after a nominal terminal year. Ten models were fit, corresponding to terminal years of 1996 through 2005. Estimated time series of spawning output are shown in Figure 13. There appears to be very little retrospective pattern or bias for terminal years 2002 through 2005. Patterns for earlier terminal years tend to fall below the more recent model estimates, presumably because of the very low abundance indexes from the 1995, 1998 and 2001 Triennial Surveys.

Revised historical catches: New estimates of historical commercial catches of bocaccio have become available for California (Don Pearson, SWFSC, pers. comm.). These new estimates were in part made possible by discovery of 613 samples taken from southern California fisheries during 1978-1985. Early set net landings saw the largest revisions, whereas estimated trawl landings were changed very little (Figure 14). A version of Model STATc incorporating the new historical landings estimates was similar to the model using the original landings data (Table 3, bottom), indicating that this is not a major source of uncertainty.

Research and data needs

This issue is not addressed in this update assessment. However, a useful discussion is presented in the STAR Panel Report.

Acknowledgements

I would like to thank people who provided updated data sets used in this assessment: Don Pearson, Richard Charter, Beth Horness, Mark Wilkins, and Jim Hastie. My thanks also extend to the much larger number of people who did the field work and data processing that underlie the summary information I received.

References

MacCall, A. 2003a. Status of bocaccio off California in 2003. Pacific Fishery Management Council.
MacCall, A. 2003b. Bocaccio rebuilding analysis for 2003. Pacific Fishery Management Council.

Table 1. Summary of 2003 bocaccio models. Bold type indicates updated aspects of the models.

M = 0.15
Years: background, 1951 to **2002**
Recruitments (age 1):

STAR B1:	expval 1951-59, individual 1960-**2001, expval 2002, 2003**; SRR lambda=0
STAR B2:	expval 1951-69, individual 1970-**2001, expval 2002, 2003**; SRR lambda=0
STAT C:	expval 1951-59, individual 1960-**2001, expval 2002, 2003**: SRR lambda=0.1
Age bins:	1 to 21+
Length bins:	24, 26, …… 66, 68, 72,76, 80+
Growth:	Von Bertalanffy fitted in model, separate male and female curves
Length CVs:	0.107 at age 1.5, 0.033 at age 99

Modeled Segments:	Selectivity form	First LF	Last LF	Nyears	Sexes	Used?
Trawl	Dbl. Logistic	1978	**2002**	**25**	yes	all
Hook and Line	Dbl. Logistic	1980	**2002**	**22**	yes	all
Set Net	Dbl. Logistic	1978	**2002**	**18**	yes	all
Recreational South	Dbl. Logistic	1975	**2002**	**24**	no	all
Recreational North	Dbl. Logistic	1980	**2002**	**23**	no	all
Triennial Trawl Survey	Dbl. Logistic	1977	**2001**	**9**	yes	not in STAR B1

Abundance Indexes	Selectivity source	First	Last	Nyears	CV	Used?
RecFIN CPUE North	Rec North	1980	2002	20	0.67	not in STAR B2
CDFG CPUE North	Rec North	1987	1998	12	0.37	all
RecFIN CPUE South	Rec South	1980	2002	20	0.71	not in STAR B2
Trawl CPUE (north)	Trawl	1982	1996	15	0.32	all
Triennial Trawl	Triennial	1977	**2001**	**9**	0.81	not in STAR B1
CalCOFI Larval	Spawn Ogive	1951	**2003**	**47**	0.68	all

Recruitment Indexes	Selectivity source	First	Last	Nyears	CV	Used?
Power Plant Ent'nment	age 1	1972	2000	29	2.10	no
Cen Cal Juvenile Trawl	age 1	1983	2002	20	2.05	no
Rec Pier CPUE	age 1	1980	2002	20	3.29	no

Table 2. Estimated recent fishery removals (mtons) of bocaccio. Parentheses indicate value used in 2003 assessment.

	TRAWL				Hook&Line		SETNET		RecSouth	RecNorth	Total
	Retained	Discarded	Total	Tot/retained	Retained	Est Total	Retained	Est Total	A + B1	A + B1	
2000	17.4	34.0	51(54)	3.0	7.0	21(21)	0.8	2(2)	52	60	186(187)
2001	13.1	45.7	59(37)	4.5	7.8	35(23)	0.9	4(2)	60	49	207(187)
2002	17.7	25.8	44(99)	2.5	3.0	7(17)	0.2	0(1)	76	8	135(201)
2003	0.1	1.8	2	20.3	0.5	9	0.0	0	11	0	22
2004	5.9	5.4	11	1.9	5.4	10	0.4	1	59	2	83

Table 3. Sample size and model tuning information for updated information sources.

Length Compositions	Year	Nobs	Neff	Units
Trawl	2004	110	78	Fish
Set Net	2004	17	17	Fish
So Calif Recreational	2003	122	84	Fish
	2004	827	86	Fish
	2005	137	84	Fish
No Calif Recreational	2004	80	14	Fish
Triennial Survey	2004	33	23	Hauls
Abundance Index	**Year**	**NoCalif**	**So Calif**	**Units**
CalCOFI	2003	114	77	Stations
	2004	110	68	Stations
	2005	127	50	Stations

Table 4. Comparison of model results.

Model	Total Biomass mt, age 1+	Spawning Output	Spawn Output Unfished	Spawn Output rel to Unfished
STAR B1	(exclude Triennial Survey index)			
2003 original	8913	1136	13412	8.5%
2003 revised	9101	1165	13421	8.7%
2005 new	10357	1638	13444	12.2%
STAR B2	(exclude Recreational CPUE)			
2003 original	5455	733	13064	5.6%
2003 revised	5562	749	13021	5.8%
2005 new	6477	1074	13044	8.2%
STAT C	(use all abundance indexes)			
2003 original	7133	984	13387	7.4%
2003 revised	7406	1030	13397	7.7%
2005 new	7650	1298	13196	9.8%
2005 historical C	8034	1362	13342	10.2%

Table 5. Results of model STATc.

Year	Spawning Output	Relative Abundance	Total age1+ Biomass	Recruits at age 1	Catch	Exploitation Rate
unfished avg	13402	100%	69924	5333	0	0
at MSY	5361	40%	27969	n/a	1768	6.3%
1995	751	5.6%	4994	755	777	15.6%
1996	737	5.5%	4673	413	573	12.3%
1997	731	5.5%	4562	953	480	10.5%
1998	728	5.4%	4409	234	209	4.7%
1999	760	5.7%	4497	362	197	4.4%
2000	795	5.9%	5374	5235	186	3.5%
2001	825	6.2%	5939	50	207	3.5%
2002	878	6.6%	6698	291	135	2.0%
2003	1038	7.7%	7361	413	22	0.3%
2004	1261	9.4%	8078	1342	83	1.0%
2005	1430	10.7%	8561	885		

Table 6. Results of using alternative values of natural mortality rate (M) in the STATc model.

M	0.1	0.125	0.15	0.175	0.2
LogLike	-1733.3	-1711.3	-1700.2	-1702.7	-1719.5
(not valid for inference on M due to lack of age comps)					
(all use original tuning based on m=0.15--others are not optimally tuned)					
TotB2005	12335	10392	8561	7263	6390
SpOut2005	2138	1768	1430	1191	1032
Ravg51-86	3675	4452	5333	6344	6817
S/Runfished	5.234	3.538	2.513	1.861	1.602
Bunfished	19238	15752	13402	11807	10920
Relative Sp Out	11.1%	11.2%	10.7%	10.1%	9.5%
ExpRate(0.5)	0.0491	0.0561	0.0632	0.0699	0.074
ABC=E*TotB2005	606	583	541	508	473
projmedianSpOut2016	4900	3782	2804	1870	1613
increase rel to 2005	2.29	2.14	1.96	1.57	1.56

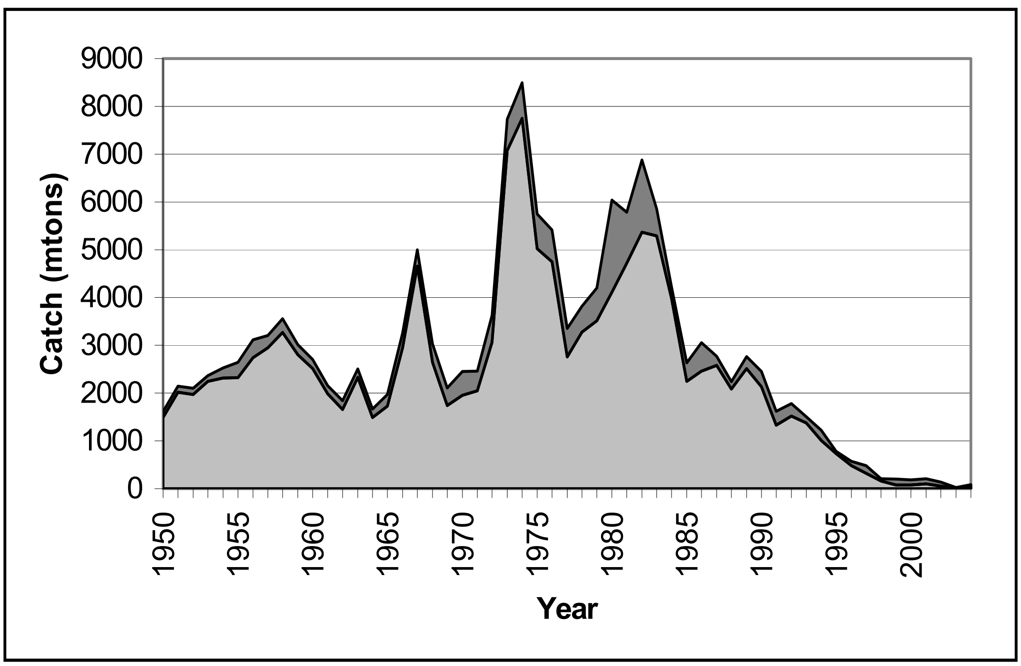
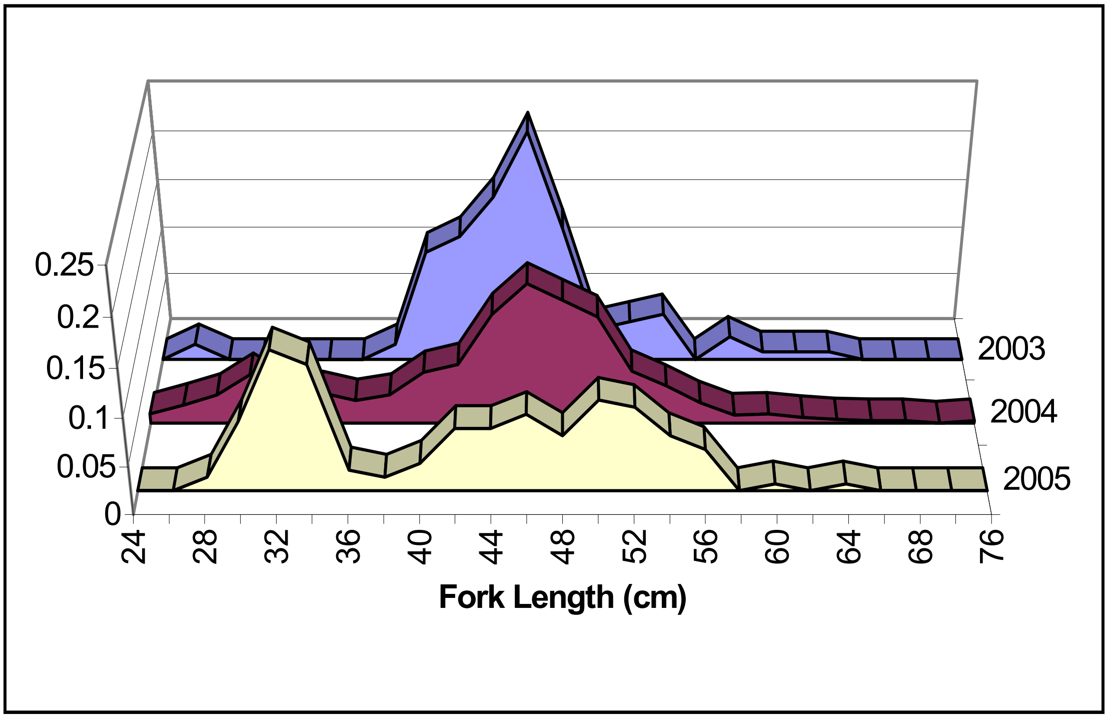


Figure 1. History of bocaccio catches. Light shading is commercial catch, dark shading is recreational catch.



Fugure 2. Length composition of bocaccio landed by the southern California recreational fishery.

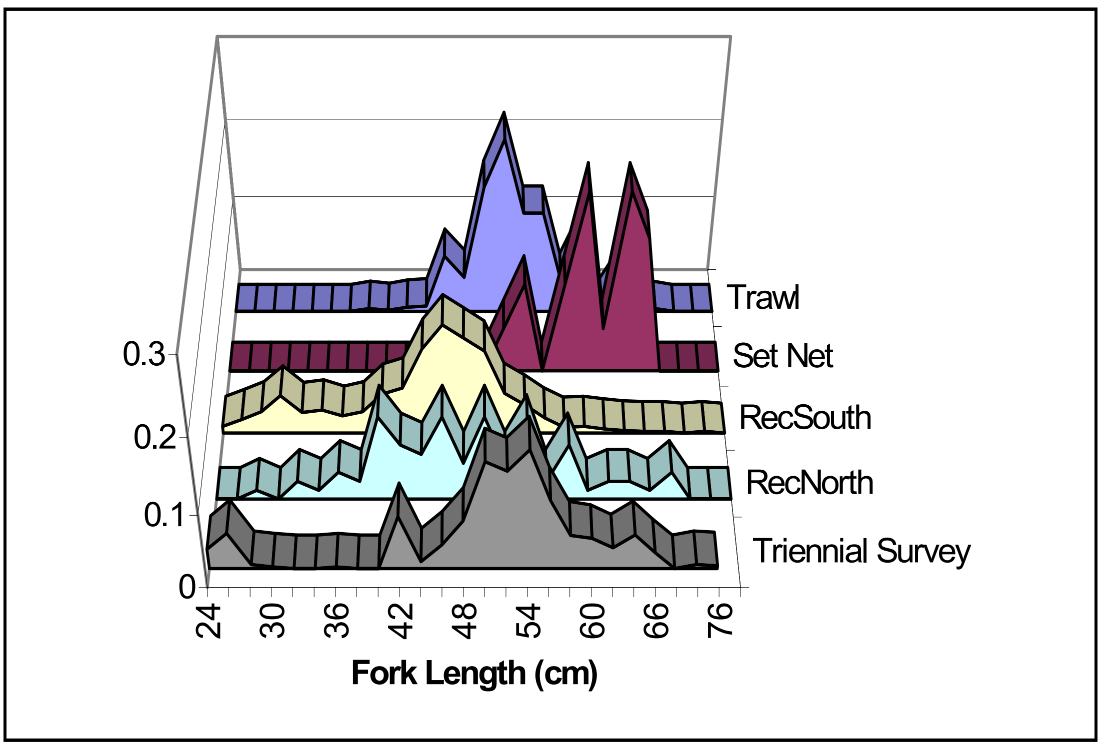


Figure 3. Length compositions of bocaccio in 2004.

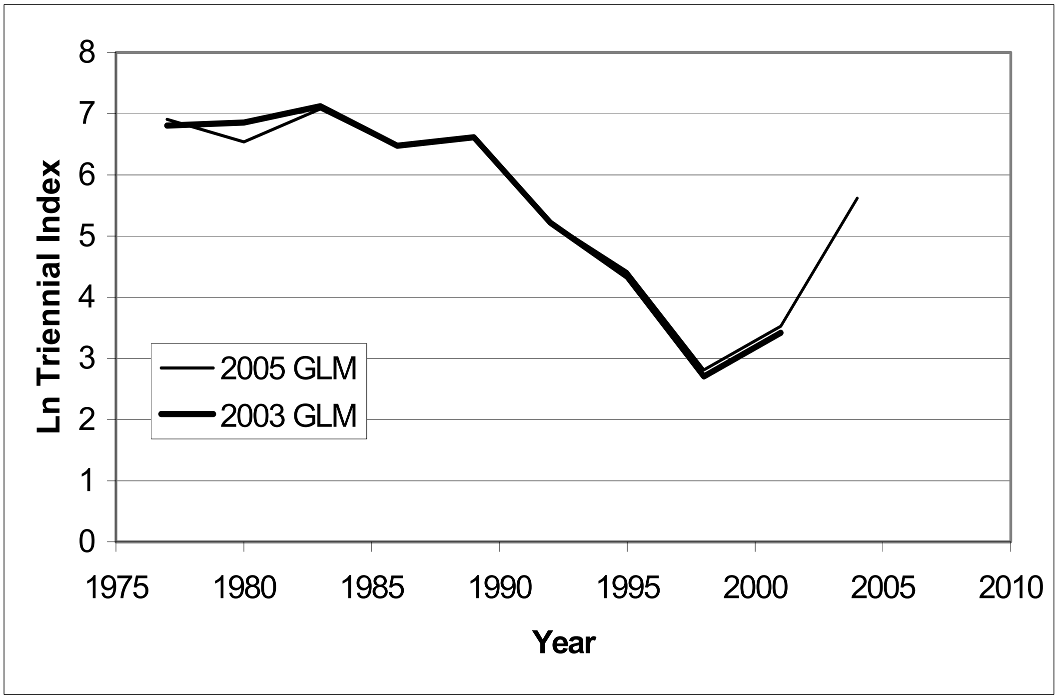


Figure 4. Triennial Trawl Survey index of boaccio abundance.

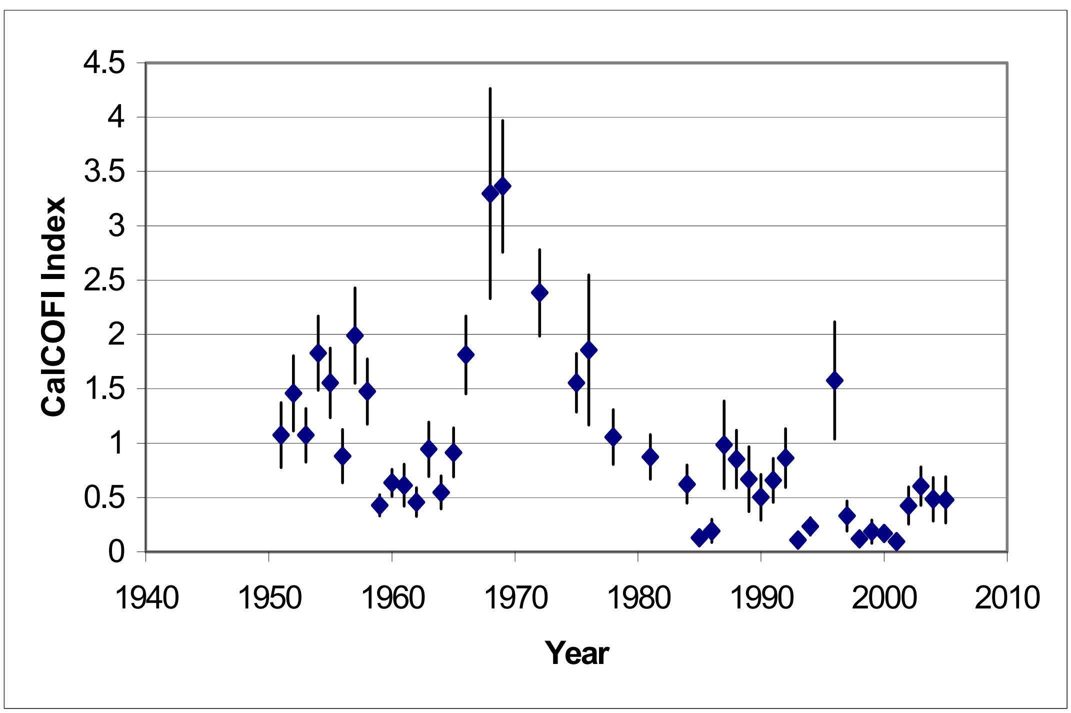


Figure 5. CalCOFI Survey index of bocaccio spawning output. Error bars are ± 1SE.

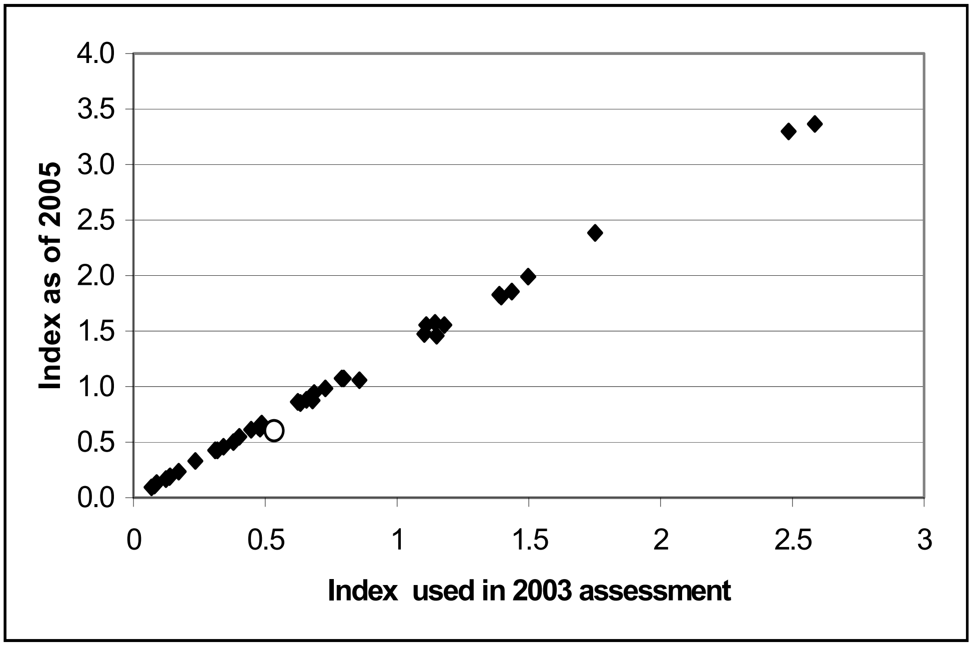


Figure 6. Comparison of previous and current annual index values from CalCOFI surveys. Open circle is value for 2003.

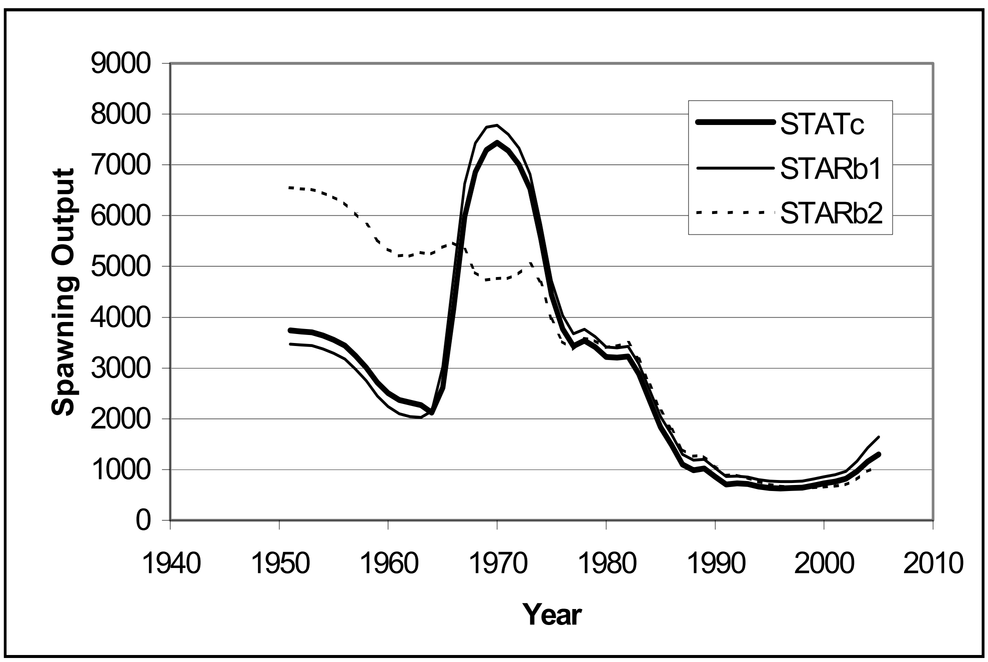


Figure 7. Results of the three bocaccio models updated to 2005.

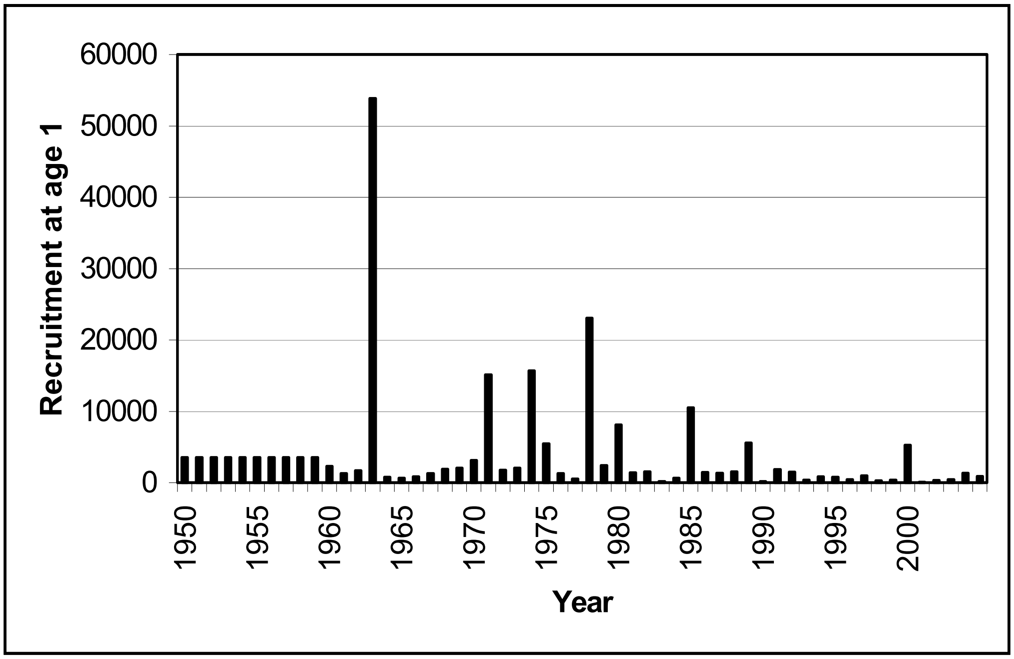


Figure 8. History of recruitments estimated by updated STATc model.

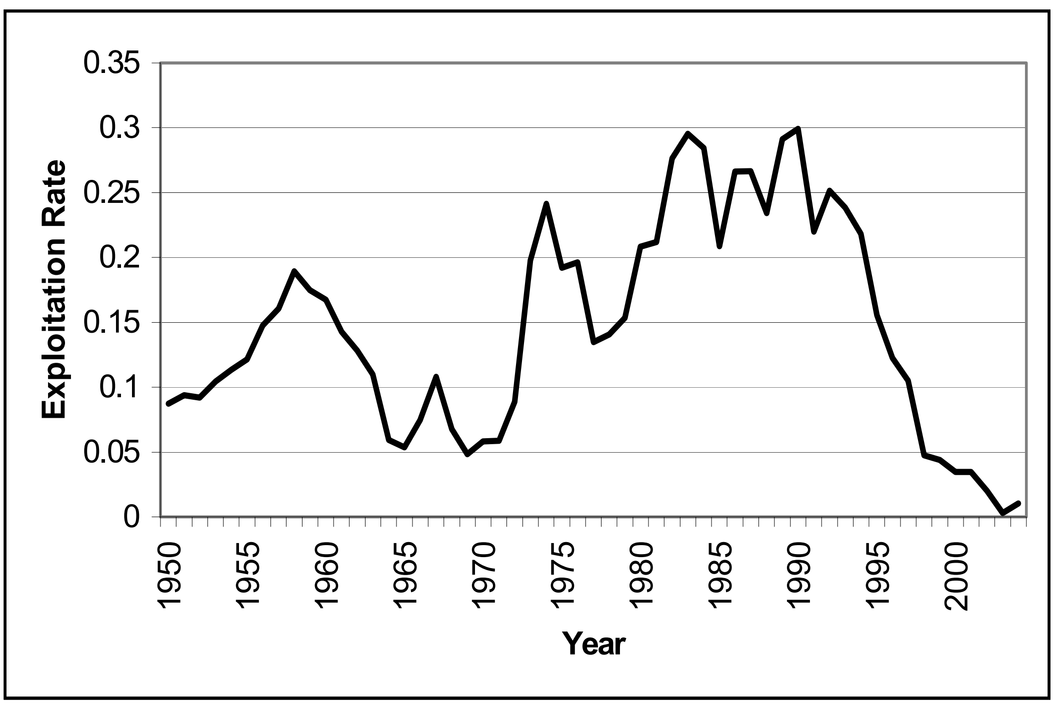


Figure 9. History of exploitation rates estimated by updated STATc model.

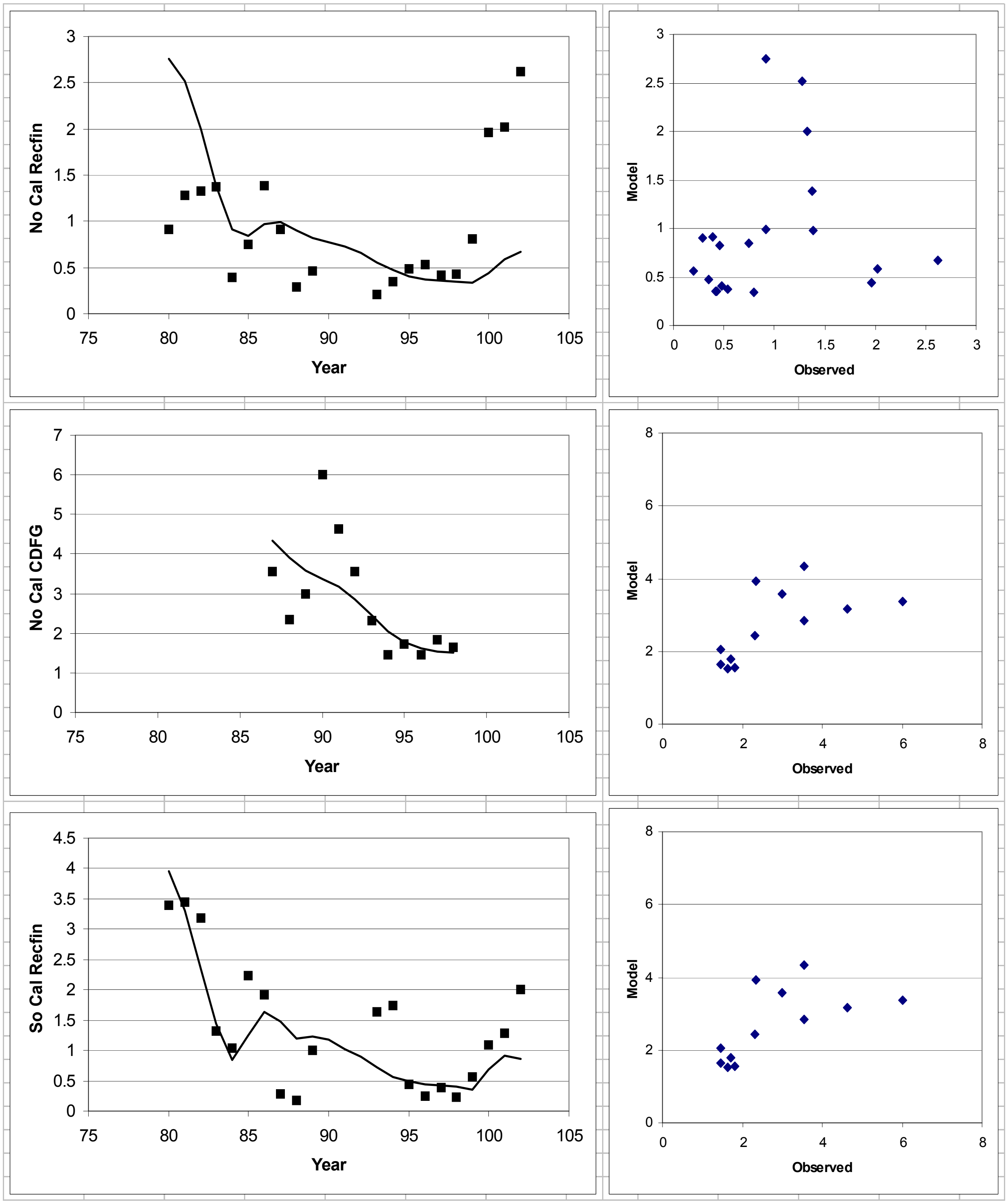


Figure 10. Updated STATc model fits to abundance indexes.

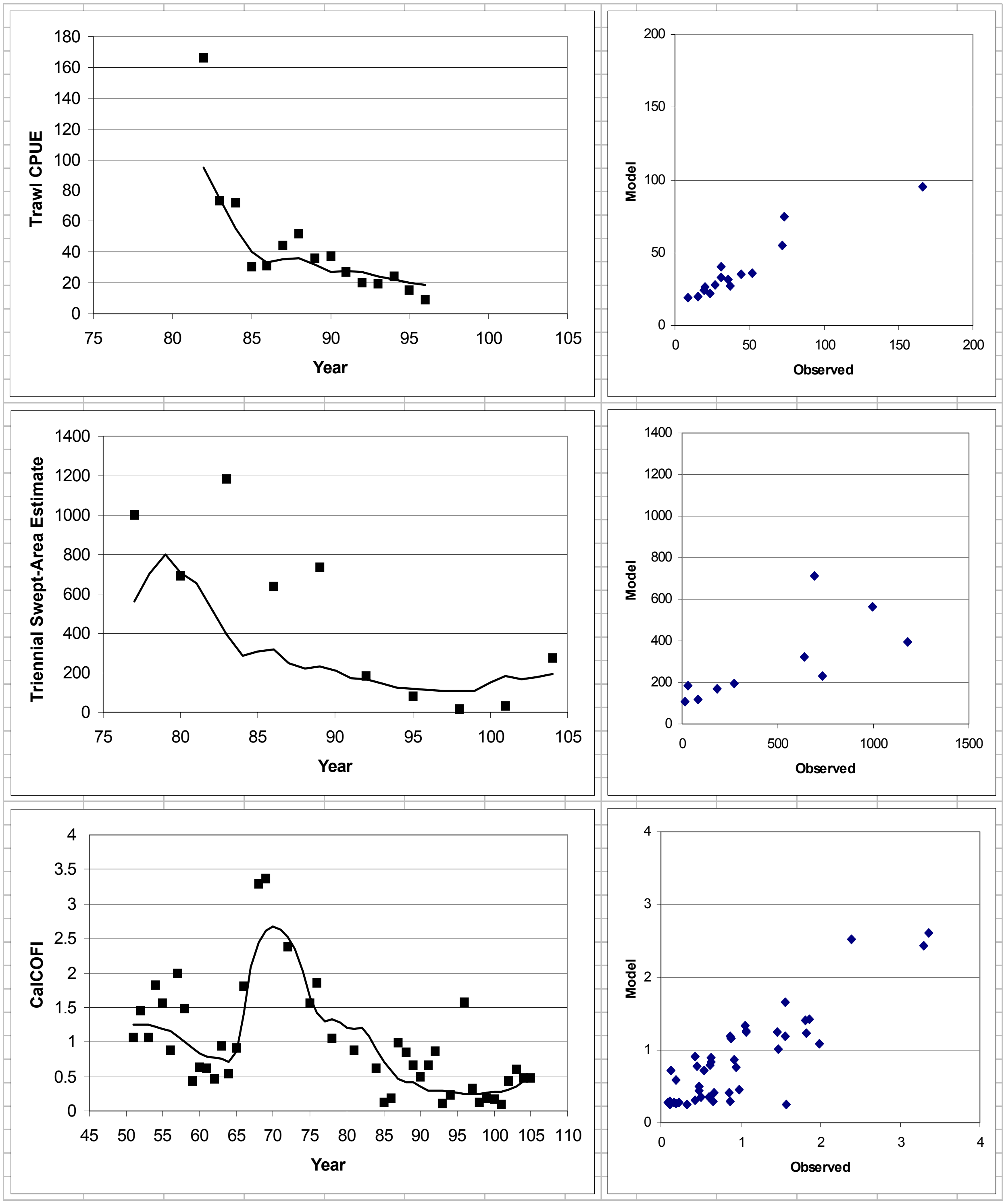


Figure 10. cont.   Updated STATc model fits to abundance indexes.

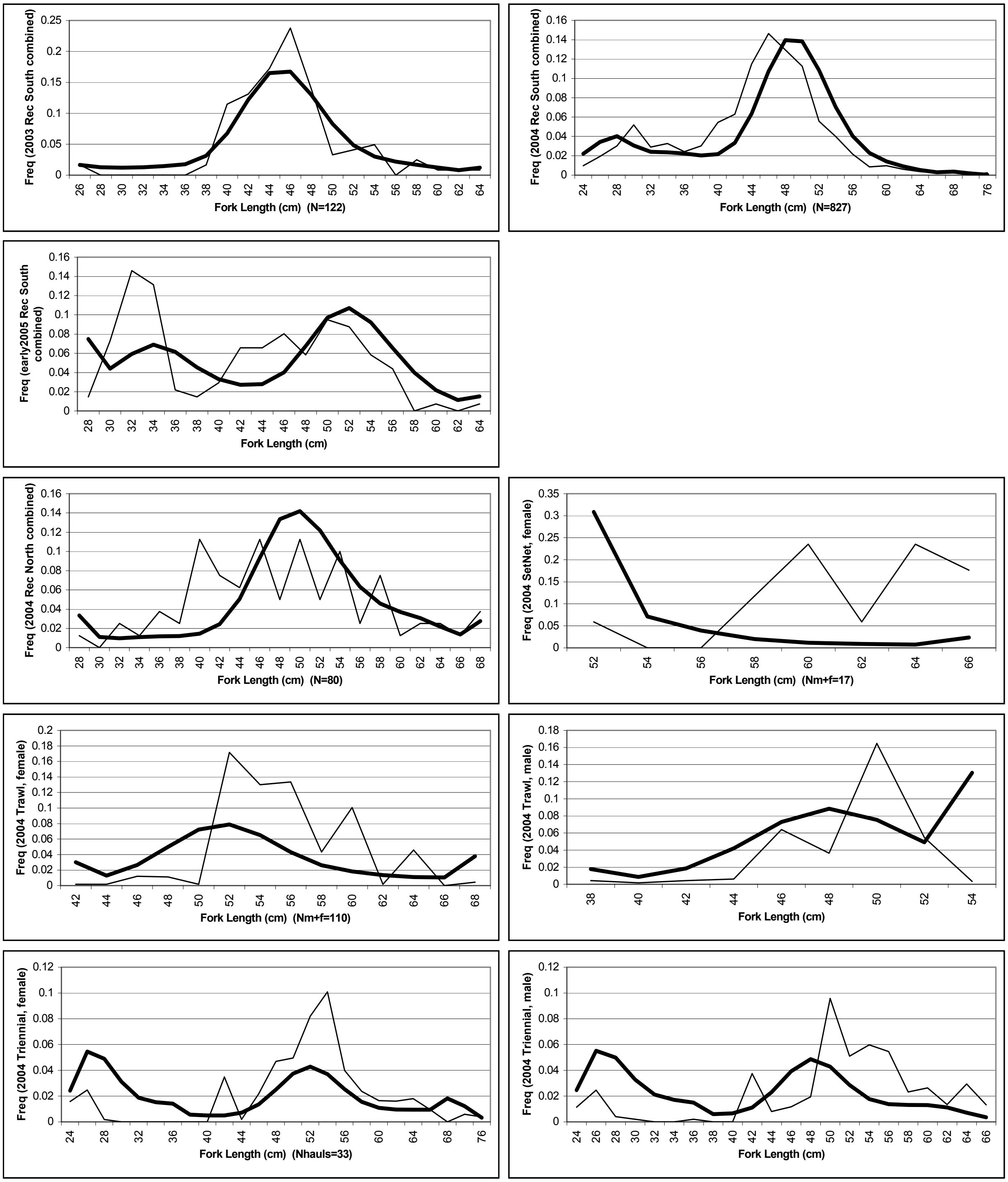


Figure 11. Updated STATc model fits to new length composition data. Thin line is observed, thick line is model fit.

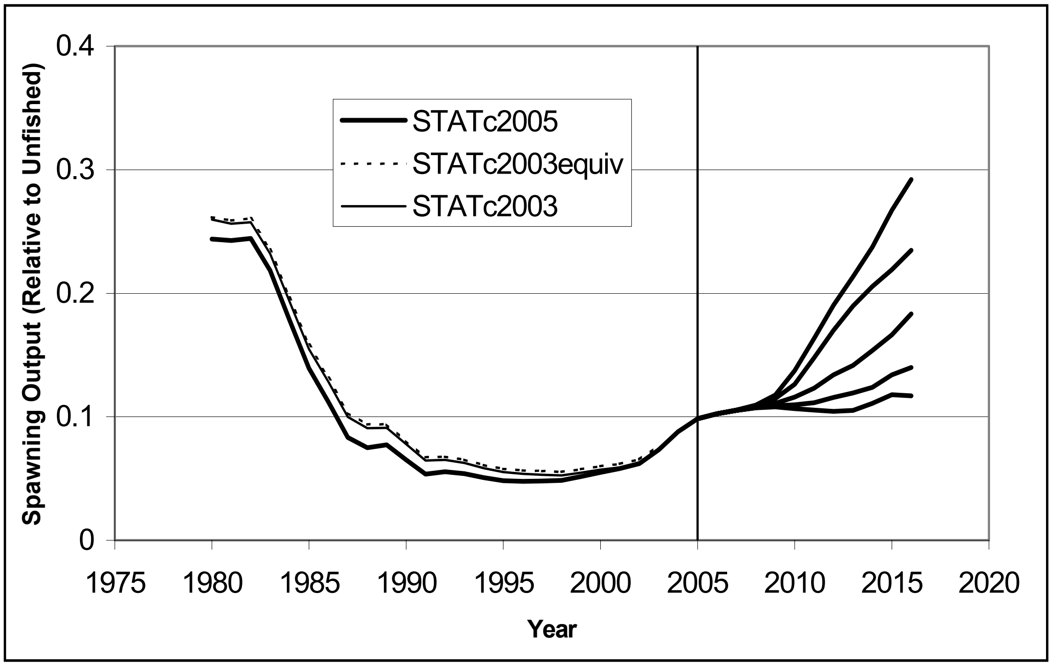


Figure 12. Comparison of original and updated STATc model, and SS1 projections at an exploitation rate of 0.0498. Projections are 10%, 25%, 50%, 75% and 90% probability levels.

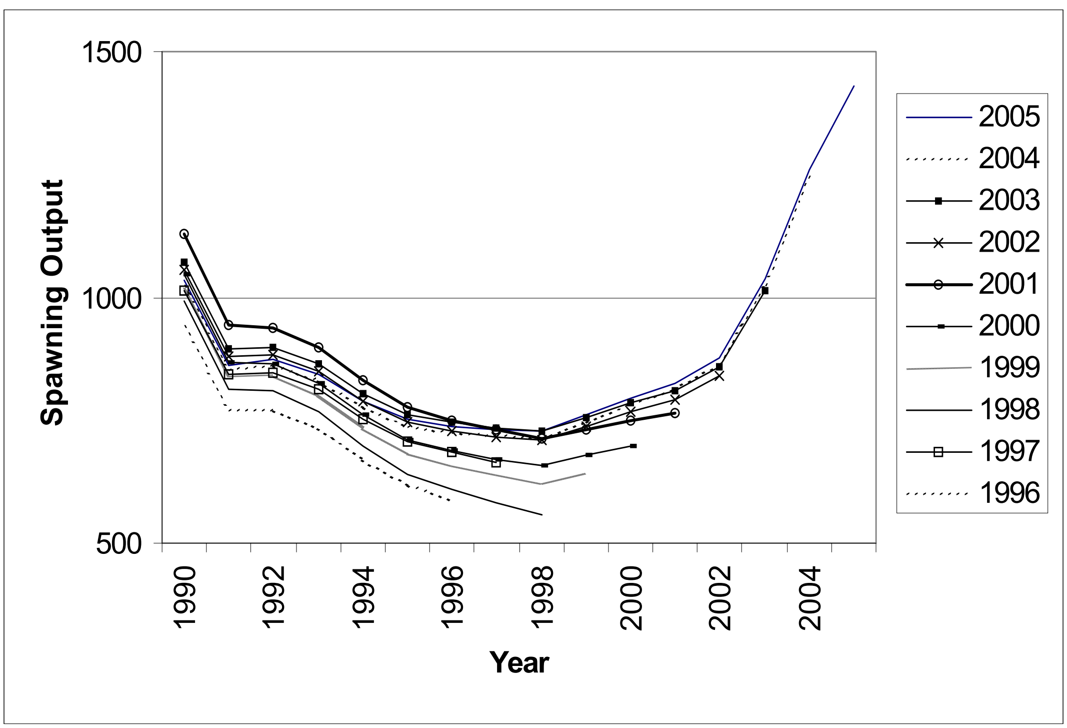
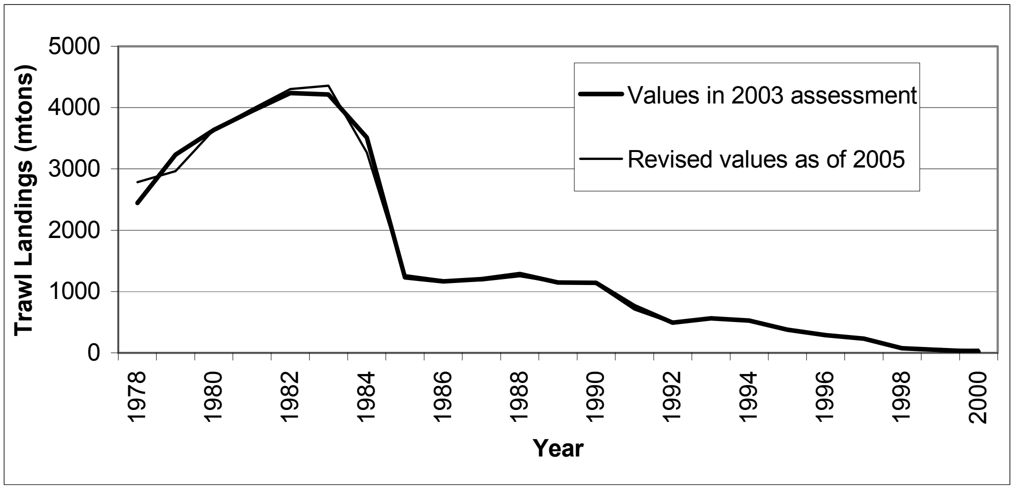
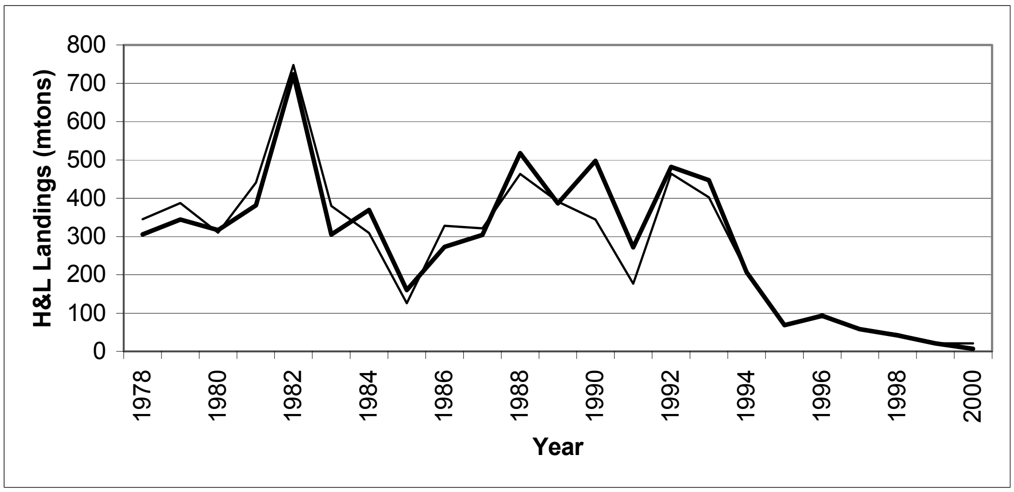


Figure 13. Retrospective pattern of bocaccio abundance using STATc model. Legend indicates most recent year of data used in retrospective assessment.





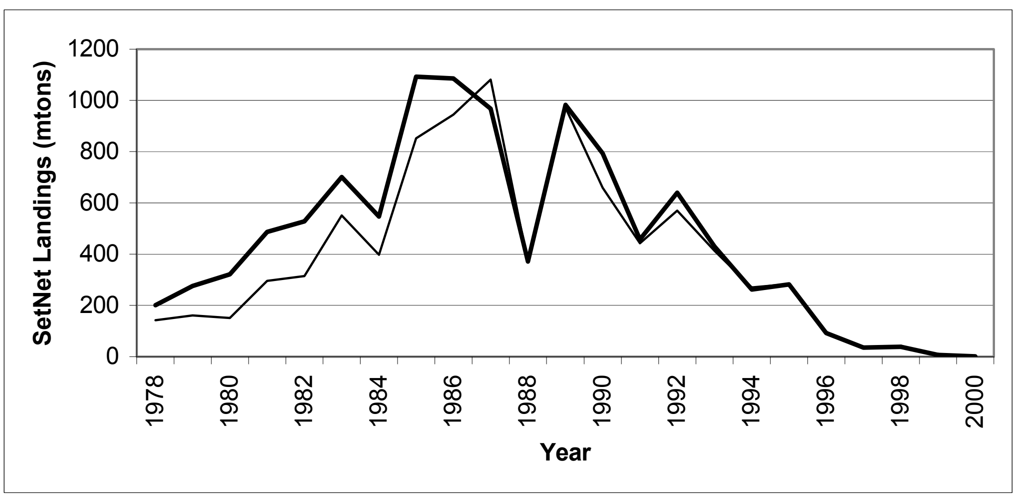


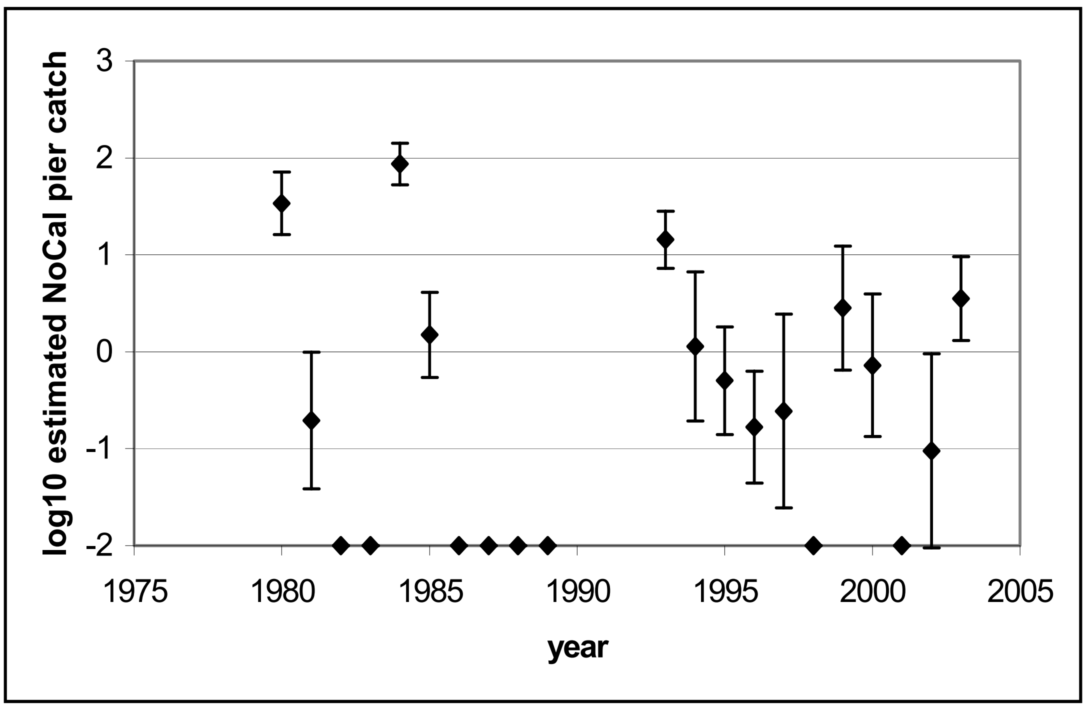
Figure 14. Comparison of historical commercial bocaccio landings used in the 2003 assessment and recently revised historical estimates.

Appendix A. Responses to STAR Panel requests.

The STAR Panel report lists six requested analyses.

1. Do the length data suggest a strong 2003/2004 yearclass?

Answer: The lower 2005 mode in Assessment Figure 1 ranges from 29 to 35cm. Because this is taken from the first 6 months of 2005, these would correspond to age 2 fish, or the 2003 year class. There isn't much evidence of them as 1 year olds in the 2004 length compositions, but selectivities are such that the model didn't really expect to see much except perhaps in the Triennial Survey (see Assessment Figure 8). The 2003 year class was evident in some other data including observations from submersibles off Santa Barbara (Milton Love, UCSB, pers. comm.), and the recreational catch from piers (see figure below–this information is not used in the update because the previous STAR Panel eliminated it).



Appendix A Figure 1. History of estimated bocaccio catch (typically young of the year) from northern California piers (from RecFIN). This suggests that 2003 may be a recruitment year for bocaccio.

2. Provide a profile in M

This is included in the assessment (Assessment Table 5).

3. Provide plots of the fits to the abundance indices and the length-frequency data.

These are included in the assessment (Assessment Figures 7 and 8).

4. Conduct 10-year projections under the default 40-10 harvest policy.

	Spawning Output					40-10 Catch (mtons)				
Year/Percentile	10	25	median	75	90	10	25	median	75	90
2005	1430	1430	1430	1430	1430	50	50	50	50	50
2006	1542	1542	1542	1542	1542	103	103	104	104	110
2007	1622	1622	1622	1623	1628	134	136	140	147	178
2008	1688	1691	1696	1709	1768	154	163	172	208	299
2009	1725	1739	1767	1834	2059	162	187	209	307	494
2010	1731	1788	1839	2013	2390	159	214	266	503	695
2011	1717	1837	1934	2326	2667	168	223	368	650	826
2012	1727	1872	2142	2650	2919	176	252	453	716	955
2013	1754	1932	2308	2768	3096	180	297	561	841	1108
2014	1769	2013	2468	2894	3425	186	356	630	954	1321
2015	1765	2132	2681	3072	3653	199	430	756	1090	1367
2016	1811	2286	2820	3331	3938	254	497	834	1273	1531

5. Summarize the STATc model in a table.

This is included in the assessment (Assessment Table 1).

6. Conduct a retrospective analysis.

This is included in the assessment (Assessment Figure 10).

Appendix B. Data file for model STATc2005.

```
2005BocacciodataforCalifornia
  2000      1trawl   H&L    setnet  recSO   recCEN
    50    1   1287   200     0     39     86
    51    1   1738   277     0     35     98
    52    1   1691   276     0     45     86
    53    1   1921   321     0     56     72
    54    1   1979   337     0    122     91
    55    1   2034   290     0    213    108
    56    1   2383   356     0    256    121
    57    1   2584   365     0    138    120
    58    1   2621   649     0     95    193
    59    1   2236   565     0     57    160
    60    1   2163   351     0     63    125
    61    1   1631   354     0     72     94
    62    1   1316   343     0     68    109
    63    1   1939   386     0     67    111
    64    1   1229   259     0     94     85
    65    1   1417   305     0    117    132
    66    1   2614   332     0    170    142
    67    1   4325   328     0    210    140
    68    1   2319   321     0    223    166
    69    1   1436   304     0    212    154
    70    1   1660   298     0    289    204
    71    1   1624   424     0    244    167
    72    1   2460   598     0    339    226
    73    1   6033  1040     0    401    260
    74    1   6968   778     0    459    289
    75    1   4212   812     0    450    276
    76    1   3969   776     0    417    248
    77    1   2172   581     0    377    218
    78    1   2785   345   142    350    196
    79    1   2963   387   161    445    242
    80    1   3643   310   151   1755    178
    81    1   3977   441   296    841    230
    82    1   4302   748   314   1158    358
    83    1   4361   380   551    265    301
    84    1   3269   309   398    177     67
    85    1   1268   126   852    321     66
    86    1   1183   328   945    428    171
    87    1   1179   321  1081     90    103
    88    1   1252   463   368    107     44
    89    1   1146   391   971    179     78
    90    1   1124   344   659    233     91
    91    1    706   177   442    200     92
    92    1    488   464   570    167     92
    93    1    559   402   413    109     19
    94    1    526   208   270    215      5
    95    1    377    70   283     44      3
    96    1    288    97    95     67     26
    97    1    230    58    36     49    107
    98    1     73    45    39     29     23
    99    1     45    21     7     71     53
   100    1     51    21     2     52     60
   101    1     59    35     4     60     49
   102    1     44     7     0     76      8
   103    1      2     9     0     11      0
   104    1     11    10     1     59      2
```

```
-1    1    1    1    1    1    1    1    1END    OF    CATCH   DATA
-1    1    1    1END    OF    EFFORT  DATA
73    1    7    12  697.38 -826.84Age1rec'tIndex(powerplants)
74    1    7    12  105.92 -107.16Age1rec'tIndex(powerplants)
75    1    7    12  228.84 -199.85Age1rec'tIndex(powerplants)
76    1    7    12  266.47 -237.74Age1rec'tIndex(powerplants)
77    1    7    12   43.85  -43.95Age1rec'tIndex(powerplants)
78    1    7    12  640.21 -198.21Age1rec'tIndex(powerplants)
79    1    7    12  116.33    -122Age1rec'tIndex(powerplants)
80    1    7    12   52.49  -41.53Age1rec'tIndex(powerplants)
81    1    7    12   31.35  -27.16Age1rec'tIndex(powerplants)
82    1    7    12   13.48  -14.11Age1rec'tIndex(powerplants)
83    1    7    12    0.14   -0.29Age1rec'tIndex(powerplants)
84    1    7    12    0.07   -0.18Age1rec'tIndex(powerplants)
85    1    7    12   24.75  -22.24Age1rec'tIndex(powerplants)
86    1    7    12   17.02   -10.4Age1rec'tIndex(powerplants)
87    1    7    12    6.38   -6.33Age1rec'tIndex(powerplants)
88    1    7    12   28.11   -41.1Age1rec'tIndex(powerplants)
89    1    7    12  485.79 -381.52Age1rec'tIndex(powerplants)
90    1    7    12    9.12   -12.3Age1rec'tIndex(powerplants)
91    1    7    12    7.56   -5.54Age1rec'tIndex(powerplants)
92    1    7    12   37.78  -31.77Age1rec'tIndex(powerplants)
93    1    7    12    5.64   -6.66Age1rec'tIndex(powerplants)
94    1    7    12     0.5   -1.01Age1rec'tIndex(powerplants)
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96    1    7    12    8.24  -10.68Age1rec'tIndex(powerplants)
97    1    7    12    1.69   -2.48Age1rec'tIndex(powerplants)
98    1    7    12    2.64   -4.51Age1rec'tIndex(powerplants)
99    1    7    12    0.07   -0.18Age1rec'tIndex(powerplants)
100   1    7    12   81.81 -111.54Age1rec'tIndex(powerplants)
101   1    7    12   14.66  -12.72Age1rec'tIndex(powerplants)
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81    1    7    6    1.28   -0.64MRFnorth
82    1    7    6   1.326  -0.663MRFnorth
83    1    7    6   1.377  -0.689MRFnorth
84    1    7    6   0.388  -0.194MRFnorth
85    1    7    6    0.75  -0.375MRFnorth
86    1    7    6    1.39  -0.695MRFnorth
87    1    7    6   0.914  -0.457MRFnorth
88    1    7    6   0.294  -0.147MRFnorth
89    1    7    6   0.457  -0.228MRFnorth
90    1    7    6      -9      -9Placeholder
91    1    7    6      -9      -9Placeholder
92    1    7    6      -9      -9Placeholder
93    1    7    6   0.202  -0.101MRFnorth
94    1    7    6   0.351  -0.175MRFnorth
95    1    7    6   0.482  -0.241MRFnorth
96    1    7    6   0.535  -0.268MRFnorth
97    1    7    6    0.42   -0.21MRFnorth
98    1    7    6   0.432  -0.216MRFnorth
99    1    7    6   0.802  -0.401MRFnorth
100   1    7    6   1.961   -0.98MRFnorth
101   1    7    6   2.022  -1.011MRFnorth
102   1    7    6   2.618  -1.309MRFnorth
80    1    7    8   3.401  -1.701MRFsoCAL
81    1    7    8   3.447  -1.724MRFsoCAL
82    1    7    8   3.173  -1.587MRFsoCAL
83    1    7    8   1.318  -0.659MRFsoCAL
84    1    7    8   1.034  -0.517MRFsoCAL
```

85	1	7	8	2.224	-1.112MRFsoCAL
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94	1	7	8	1.732	-0.86605MRFsoCAL
95	1	7	8	0.448	-0.22416MRFsoCAL
96	1	7	8	0.246	-0.12295MRFsoCAL
97	1	7	8	0.395	-0.19748MRFsoCAL
98	1	7	8	0.234	-0.1171MRFsoCAL
99	1	7	8	0.566	-0.28304MRFsoCAL
100	1	7	8	1.098	-0.54899MRFsoCAL
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102	1	7	8	2.01	-1.00489MRFsoCAL
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92	1	1	11	0.862	-9	CalCOFIindex
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86	1	7	10	637.5	-9	1986TRIENNIAINDEX
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88	1	7	10	-9	-9	Placeholder
89	1	7	10	735.5	-9	1989TRIENNIAINDEX
90	1	7	10	-9	-9	Placeholder
91	1	7	10	-9	-9	Placeholder
92	1	7	10	186	-9	1992TRIENNIAINDEX
93	1	7	10	-9	-9	Placeholder
94	1	7	10	-9	-9	Placeholder
95	1	7	10	82.7	-9	1995TRIENNIAINDEX
96	1	7	10	-9	-9	Placeholder
97	1	7	10	-9	-9	Placeholder
98	1	7	10	16.7	-9	1998TRIENNIAINDEX
99	1	7	10	-9	-9	Placeholder
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101	1	7	10	34	-9	2001TRIENNIAINDEX
102	1	7	10	-9	-9	Placeholder
103	1	7	10	-9	-9	Placeholder
104	1	7	10	274.6	-9	2004TRIENNIAINDEX
84	1	7	13	0.004	-0.002	JuvSurveyrectmt
85	1	7	13	17.384	-8.692	JuvSurveyrectmt
86	1	7	13	0.004	-0.002	JuvSurveyrectmt
87	1	7	13	0.695	-0.3475	JuvSurveyrectmt
88	1	7	13	0.994	-0.497	JuvSurveyrectmt
89	1	7	13	1.095	-0.5475	JuvSurveyrectmt
90	1	7	13	0.182	-0.091	JuvSurveyrectmt
91	1	7	13	0.091	-0.0455	JuvSurveyrectmt
92	1	7	13	0.515	-0.2575	JuvSurveyrectmt
93	1	7	13	0.002	-0.001	JuvSurveyrectmt
94	1	7	13	0.129	-0.0645	JuvSurveyrectmt
95	1	7	13	0.007	-0.0035	JuvSurveyrectmt
96	1	7	13	0.013	-0.0065	JuvSurveyrectmt
97	1	7	13	0.004	-0.002	JuvSurveyrectmt
98	1	7	13	0.018	-0.009	JuvSurveyrectmt
99	1	7	13	0.004	-0.002	JuvSurveyrectmt
100	1	7	13	0.027	-0.0135	JuvSurveyrectmt

101	1	7	13	0.051	-0.0255JuvSurveyrectmt
102	1	7	13	0.079	-0.0395JuvSurveyrectmt
103	1	7	13	0.342	-0.171JuvSurveyrectmt
82	1	7	9	166.4	-83.2areaweightedCPUEfromRalston
83	1	7	9	73.1	-36.55areaweightedCPUEfromRalston
84	1	7	9	72.3	-36.15areaweightedCPUEfromRalston
85	1	7	9	30.7	-15.35areaweightedCPUEfromRalston
86	1	7	9	31.2	-15.6areaweightedCPUEfromRalston
87	1	7	9	44.4	-22.2areaweightedCPUEfromRalston
88	1	7	9	51.6	-25.8areaweightedCPUEfromRalston
89	1	7	9	35.8	-17.9areaweightedCPUEfromRalston
90	1	7	9	37.1	-18.55areaweightedCPUEfromRalston
91	1	7	9	26.9	-13.45areaweightedCPUEfromRalston
92	1	7	9	20.4	-10.2areaweightedCPUEfromRalston
93	1	7	9	19.7	-9.85areaweightedCPUEfromRalston
94	1	7	9	23.9	-11.95areaweightedCPUEfromRalston
95	1	7	9	15.2	-7.6areaweightedCPUEfromRalston
96	1	7	9	8.7	-4.35areaweightedCPUEfromRalston
87	1	7	7	3.545	-1.7725VandenbergCPUE
88	1	7	7	2.349	-1.1745VandenbergCPUE
89	1	7	7	3.001	-1.5005VandenbergCPUE
90	1	7	7	6.009	-3.0045VandenbergCPUE
91	1	7	7	4.637	-2.3185VandenbergCPUE
92	1	7	7	3.543	-1.7715VandenbergCPUE
93	1	7	7	2.319	-1.1595VandenbergCPUE
94	1	7	7	1.46	-0.73VandenbergCPUE
95	1	7	7	1.721	-0.8605VandenbergCPUE
96	1	7	7	1.457	-0.7285VandenbergCPUE
97	1	7	7	1.823	-0.9115VandenbergCPUE
98	1	7	7	1.646	-0.823VandenbergCPUE
81	1	7	14	33.058	-16.529MRFpierRectmt
82	1	7	14	2.807	-1.4035MRFpierRectmt
83	1	7	14	0.003	-0.0015MRFpierRectmt
84	1	7	14	0.005	-0.0025MRFpierRectmt
85	1	7	14	43.127	-21.5635MRFpierRectmt
86	1	7	14	6.987	-3.4935MRFpierRectmt
87	1	7	14	0.498	-0.249MRFpierRectmt
88	1	7	14	13.529	-6.7645MRFpierRectmt
89	1	7	14	77.056	-38.528MRFpierRectmt
90	1	7	14	1.081	-0.5405MRFpierRectmt
91	1	7	14	-9	-9Placeholder
92	1	7	14	-9	-9Placeholder
93	1	7	14	-9	-9Placeholder
94	1	7	14	18.623	-9.3115MRFpierRectmt
95	1	7	14	0.003	-0.0015MRFpierRectmt
96	1	7	14	0.312	-0.156MRFpierRectmt
97	1	7	14	0.13	-0.065MRFpierRectmt
98	1	7	14	0.003	-0.0015MRFpierRectmt
99	1	7	14	0.003	-0.0015MRFpierRectmt
100	1	7	14	0.105	-0.0525MRFpierRectmt
101	1	7	14	0.003	-0.0015MRFpierRectmt
102	1	7	14	0.003	-0.0015MRFpierRectmt
103	1	7	14	0.003	-0.0015MRFpierRectmt
-1	1	1	1	1	1END OF

-1 -1<== No aging error(noused)

-1 -1

-1 -1

25 25<==25lengthbins24..68at2cm,72,76 bins

24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58

```
60 62 64 66 68 72 76 80
47.6 -0.2876length@50%matureslopeEcheverria1987
6.17E-06 3.1712Length-weightparsfemale1995TriennialTrawl(Ralston)
0.22475 0.03657eggs/kginterceptandslopeReinterpretedfromPhillipsbyRalston1996
6.17E-06 3.1712Length-weightparsmale1995TriennialTrawl(Ralston)
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297 212 129 93 52 29 32 14 1
77 1 4 4 0 122 1 1 25 25 0nfish= 11155
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332 177 106 72 60 42 24 7 1
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6 6 10 6 5 4
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24126 3567 65386 98731 54853 28300 21256 0 0 0 0
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6     8     6     8     5     2
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14 1 0 0 0 0 0
85 1 5 4 0 95 1 1 25 25 0nfish= 532
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16 9 6 4 3 0
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8 5 3 1 0 1 0
86 1 5 4 0 168 1 1 25 25 0nfish= 942
8 19 13 25 64 167 245 167 47 4 2 8 13 14 15 16 19 27
16 17 12 12 8 3 1
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24 42 22 7 24 7 2
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5 1 6 1 2 1
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25 14 13 9 14 8 3
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24 14 9 14 6 1
92 1 1 4 3 108 1 1 25 25 0nfish= 1630nsamps= 70
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813 620 612 235 153 0 0 0
92 1 3 4 3 76 1 1 25 25 0nfish= 1258nsamps= 59

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716   328  1076    75   302  1041   307    60
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1910   488   240     0     0     0     0     0
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    0     0     0     0    34    20   133   631  1000  5553  5909  6107  3835  3040  2416  2431   228
  0     0     0     0     0     0     0     0
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65    63    29    25    29    12     1
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 560  2774  2012   932  1003  2104   307     0
    0     0     0     0     0   108   270  2093  2490  8751 15388 17606 18755  7807  9129  7837
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    0     0     0     0     0     0     0    43    99   149   479   761  1086   657   596   290   179   296
127    40    40    40     0     0     0
   94     1     3     4     3    54     1     1    25    25     0nfish=      802nsamps=     41
    0     0     0     0     0     0     0     0    28   347   937  2668  7577  8562  7744  2641     0   228
577   347   694   394     0     0     0
    0     0     0     0     0     0     0   572    31   916  4385  5181  3798  3816  1028  1228   349     0
   0     0     0     0     0     0     0
   94     1     4     4     0    85     1     1    25    25     0nfish=      377
    0     0     1     0     5     5    20    18    27    29    24    23    31    43    48    29    30    17     5
6     9     4     2     1     0
   94     1     5     4     0   139     1     1    25    25     0nfish=      776
   13    15     8     9     6    14    16    47    62    65    62    76    61    65    54    60    39    27    17
   17    15     9    13     5     1
   95     1     1     4     3    89     1     1    25    25     0nfish=      675nsamps=     34
    0     0     0     0     0     0     0     0  1135   722  1245  1596  4843  2575  3809  3385  2474
2890  4301  6036  1052  6006  1194  2006     0
    0     0   116     0     0   264     0  1016    35  2092  2030  7474  6464  9455  8122  5351  3407
4898  5547  4561   261   856  1013     0     0
```

```
    95      1      2      4      3     12      1      1     25     25      0nfish=      162nsamps=      9
      0      0      0      0      0      0      0      0      0     15    573    110    472   1152    683   1002   1346    555
468      0      0      0     15      0      0
      0      0      0      0      0    101      0      0      0     60    117    603    694    411     72      0      0    173      0
 72      0      0      0      0      0
    95      1      3      4      3     43      1      1     25     25      0nfish=      563nsamps=     28
      0      0      0      0      0      0      0      0     64     64    530    905    859   3754   3693   2751    993    407
992    573    516    121    274      0      0
      0      0      0      0      0      0      0      0    121    450   2698   4606   4915   2009    753    370    272      0
 0      0      0      0      0      0      0
    95      1      4      4      0     35      1      1     25     25      0nfish=       35
      0      0      1      0      0      1      0      1      0      3      4      4      3      6      3      4      2      2      0      1
 0      0      0      0      0
    95      1      5      4      0    145      1      1     25     25      0nfish=      814
      8      2      6     11     44     47     49     34     36     45     70     84     94     62     63     31     35     28     17
   15     11      6      8      6      2
    95      1     10      4      3     32      1      1     25     25      0nfish=         nsamps=     47
  38523   4910   6679   9058   6603  17061  13025      0      0      0   3865  12666   8638   3176   4698   4931
 7691  24654  14793   6344   9448      0   7782   4799      0
  18880   7366   7366   4911  28832  30902  15926   7303      0   7920   4931   2987  19661   7880  20389
12992  17781   2290   8263   7833      0      0      0      0      0
    96      1      1      4      3     88      1      1     25     25      0nfish=      636nsamps=     31
      0      0      0      0      0    200   1557     59   2531   8096   6126   2320   1439   3015   4075   8648   3891
2903   3482   1048     87    259   1312      0     35
      0      0      0    131      0      0   1688    105    341   7051   6188   2919  14589   6376   4675    760   5227
3663    315   1001     35      0      0      0      0
    96      1      2      4      3     41      1      1     25     25      0nfish=      622nsamps=     31
      0      0      0      0      0     20      6      0     89    271    312    322    904   1020   1078    920    767    702
271    144    133      0     17     93      0
      0      0      0      0      0     47     40     47    182    278    301    674    789    542    443    104     54      0
 19      0      0      0      0      0      0
    96      1      3      4      3     24      1      1     25     25      0nfish=      170nsamps=      7
      0      0      0      0      0      0    175      0      0      0      0    391   1672   2231   4115   2257   1404    190
499      0      0      0      0      0      0
      0      0      0      0      0      0      0      0      0      0    648   3009   3642   3270   1821    216    283    190
 0      0      0      0      0      0      0
    96      1      4      4      0     84      1      1     25     25      0nfish=      114
      1      2      2      6      7      7      6      4      2      3     10      5     10     12      7     13      9      3      1      1
  0      1      2      0      0
    96      1      5      4      0    146      1      1     25     25      0nfish=      817
      5      2     11     19     44     31     37     35     49     61     56     57     71     67     46     52     47     31     30
   22     20      8     10      3      3
    97      1      1      4      3     95      1      1     25     25      0nfish=      991nsamps=     45
      0      0      0      0      0      0      0    124    129    597    176    472    630   1778   1975   1777   1909
1240   1863   1414   1570    865    875   2688    435
      0      0      0      0      0     39     39     94    473   1018    546   2160   2263   3327   1664   2771   4061
2889   2359    613   2062     93    171      0      0
    97      1      2      4      3     29      1      1     25     25      0nfish=      465nsamps=     22
      0      0      0      0      0      0      0      0      0     41     39    131    189    282    445    569    642    219
473    214    168    155    478     15      0
      0      0      0      0      0      0     15      0      0     13     57     87    209    201     84    233     27     15      0
  0      0      0      0      0      0
    97      1      3      4      3     21      1      1     25     25      0nfish=      104nsamps=      4
      0      0      0      0      0      0      0      0     41      0     67     67    391    108    695    497    323    189    175
   74      0      0      0      0      0
      0      0      0      0      0      0      0      0     41     67    108    190    985    486    263     67    115     74      0
  0      0      0      0      0      0
    97      1      4      4      0     54      1      1     25     25      0nfish=       54
      0      1      0      1      5      2      2      3      7     11      6      1      4      4      2      2      0      0      2      0
```

1 0 0 0 0
97 1 5 4 0 314 1 1 25 25 0nfish= 1759
14 2 5 19 30 42 68 66 91 88 109 114 128 145 137 126 132 145
78 85 47 20 51 15 2
98 1 1 4 3 84 1 1 25 25 0nfish= 430nsamps= 24
0 0 0 0 246 380 213 211 201 164 628 988 1219 1977 1339 699 524
280 1153 702 1265 1170 917 189 27
0 0 0 0 47 344 477 170 549 611 1158 1340 1989 2673 1004 1533 1434
1871 1057 362 299 146 0 0 0
98 1 2 4 3 21 1 1 25 25 0nfish= 347nsamps= 16
0 0 0 0 0 0 15 15 17 91 32 316 229 323 334 416 262 197
49 0 0 40 0 17 0
0 0 0 0 0 0 0 0 51 81 185 257 212 189 183 62 59 0 25
0 0 0 0 0 0
98 1 3 4 3 26 1 1 25 25 0nfish= 212nsamps= 10
0 0 0 0 0 0 0 0 0 0 16 819 811 2487 984 154 2387 51 46
35 0 21 0 0 0
0 0 0 0 0 0 0 0 16 42 70 1544 178 216 870 60 0 0 0
8 0 0 0 0 0
98 1 4 4 0 84 1 1 25 25 0nfish= 106
0 1 0 1 7 9 8 8 11 6 10 13 9 5 4 5 5 2 2 0
0 0 0 0 0
98 1 5 4 0 167 1 1 25 25 0nfish= 937
10 4 6 31 38 36 13 36 49 72 77 79 79 52 81 59 60 43 37
27 16 14 5 12 1
98 1 10 4 3 25 1 1 25 25 0nfish= nsamps= 37
2284 0 0 7550 21844 21579 10836 6785 0 0 0 3677 0 0 1734 0 0
3612 0 2098 2788 0 3113 0 0
0 0 4407 2997 12517 5118 2627 0 0 0 0 1366 2178 13373 3612 0 2178
5118 0 3128 0 0 0 0 0
99 1 1 4 3 84 1 1 25 25 0nfish= 424nsamps= 17
0 0 0 0 0 0 398 1242 1755 1006 240 111 272 465 432 212 232
221 484 943 150 70 460 714 0
0 0 0 21 19 324 570 1168 1074 426 287 277 473 767 907 662 967
599 450 399 0 0 0 0 0
99 1 2 4 3 8 1 1 25 25 0nfish= 114nsamps= 6
0 0 0 0 0 0 0 0 0 0 148 0 218 256 228 832 660 328 140
298 164 0 0 0 0
0 0 0 0 0 0 0 74 0 0 74 74 186 636 446 238 490 350 612
112 112 0 112 0 0
99 1 4 4 0 85 1 1 25 25 0nfish= 421
0 3 4 1 3 4 11 7 13 15 28 34 46 63 40 45 41 21 22
11 2 2 3 2 0
99 1 5 4 0 114 1 1 25 25 0nfish= 637
2 0 1 3 10 13 11 38 44 47 34 41 57 71 47 40 50 30 35
21 22 8 6 6 0
100 1 1 4 3 80 1 1 25 25 0nfish= 191nsamps= 10
0 0 0 26 158 39 39 79 0 159 276 458 249 432 273 0 101 148
77 53 112 150 56 37 48
0 0 0 105 39 92 105 79 106 88 271 572 267 232 53 19 114 55
20 48 27 21 0 0 0
100 1 2 4 3 12 1 1 25 25 0nfish= 69nsamps= 9
0 0 0 28 0 0 0 0 0 0 66 28 0 160 94 132 56 132 28
0 0 0 28 0 0
0 0 0 0 0 0 0 0 0 66 160 226 122 132 160 28 28 56 56
56 56 28 0 0 0
100 1 4 4 0 85 1 1 25 25 0nfish= 505
30 69 85 40 31 14 7 2 5 8 12 8 27 20 26 35 27 18 20
11 6 4 0 0 0

100 1 5 4 0 50 1 1 25 25 0nfish= 282
10 26 19 12 8 18 10 14 15 18 26 7 15 9 4 5 6 5 11
8 17 10 5 1 3
101 1 1 4 3 88 1 1 25 25 0nfish= 617nsamps= 25
0 0 3 60 228 235 144 229 211 82 29 50 91 121 147 44 75 6
123 17 22 17 167 0 77
0 0 12 75 247 255 103 235 49 31 54 91 250 131 42 25 6 92
474 0 158 0 77 0 0
101 1 2 4 3 24 1 1 25 25 0nfish= 233nsamps= 18
0 0 0 0 0 18 90 56 9 20 20 42 49 31 76 114 90 147 51
62 81 34 25 0 0
0 0 0 3 9 18 45 57 20 0 33 69 51 88 91 84 82 43 80
46 0 0 0 0 0
101 1 4 4 0 85 1 1 25 25 0nfish= 380
1 1 10 27 80 78 78 38 12 10 4 3 9 9 7 1 4 2 2 2
2 0 0 0 0
101 1 5 4 0 58 1 1 25 25 0nfish= 324
1 2 1 10 27 53 48 17 16 15 11 23 17 17 24 10 12 10 4
1 1 0 2 2 0
101 1 10 4 3 21 1 1 25 25 0nfish= 114nsamps= 31
0 0 0 2367 28385 11560 25465 3103 5351 2289 2289 0 0 0 2516 0 0
2516 0 0 0 0 2744 0 0
0 0 0 2539 21189 22364 34500 2984 5031 0 0 0 0 8417 3103 4878 5804
0 2047 2047 0 0 0 0 0
102 1 1 4 3 82 1 1 25 25 0nfish= 320nsamps= 15
0 0 0 0 0 0 0 218 510 552 341 337 123 54 236 393 114 173
163 153 340 131 120 0 70
0 0 0 0 57 78 93 259 661 307 281 199 178 336 61 73 0 0
90 30 3 0 0 0 0
102 1 2 4 3 1 1 1 25 25 0nfish= 14nsamps= 1
0 0 0 0 0 0 0 0 0 2 2 0 2 4 8 2 2 0 0 0
0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 6 0 0 0 0 0
0 0 0 0 0
102 1 3 4 3 17 1 1 25 25 0nfish= 25nsamps= 1
0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0
0 0 0 2 0
0 0 0 0 0 0 0 0 0 0 0 2 2 10 20 14 0 0 0 0
0 0 0 0 0
102 1 4 4 0 86 1 1 25 25 0nfish= 771
0 1 2 3 2 20 39 83 137 139 117 72 22 21 31 27 16 13 15
4 3 2 2 0 0
102 1 5 4 0 32 1 1 25 25 0nfish= 180
0 0 0 0 0 1 1 7 29 43 33 17 2 8 7 11 6 8 3 2
2 0 0 0 0
103 1 4 4 0 84 1 1 25 25 0nfish= 122
0 2 0 0 0 0 0 2 14 16 21 29 17 4 5 6 0 3 1 1
1 0 0 0 0
104 1 1 4 3 78 1 1 25 25 0nfish= 110nsamps=
0 0 0 0 0 0 0 0 0 2 2 14 13 2 198 150 154 50 116
2 53 0 5 0 0
0 0 0 0 0 0 0 5 2 5 7 74 42 190 63 4 0 0 0 0
0 0 0 0 0
104 1 3 4 3 17 1 1 25 25 0nfish= 17nsamps=
0 0 0 0 0 0 0 0 0 0 0 0 0 0 4 0 0 8 16 4
16 12 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 8 0 0 0 0
0 0 0 0 0
104 1 4 4 0 86 1 1 25 25 0nfish= 827

```
     8    16    25    43    24    27    20    25    45    52    95   121   107    93    46    33    18     7
8     5     3     2     2     0     2
   104     1     5     4     0    14     1     1    25    25     0nfish=      80
     0     0     1     0     2     1     3     2     9     6     5     9     4     9     4     8     2     6     1     2
2     1     3     0     0
   104     1    10     4     3    23     1     1    25    25     0nfish=     216nsamps=      33
  19065  29801   2189      0      0      0      0      0      0  42045   2356  26204  56703  59820  99071 121898
48127  28657  19776  19405  21625  11473      3   7044   4580
  13679  29672   4912   2456      0      0   2456      0      0  45264   9674  14121  23379 115715  61595
72185  65801  27955  31884  16194  35618  15942      0      0      0
   105     1     4     4     0    84     1     1    25    25     0nfish=     137
     0     0     2    10    20    18     3     2     4     9     9    11     8    13    12     8     6     0     1     0
  1     0     0     0     0
```

Appendix C. Parameter file for model STATc2005.

```
boc2005.csv     **** UNKNOWN CONVERGENCE STATUS
statc2005.r01
statc2005.par
2003 assessment postSTAR include all & 0.1srr, rconst to 59 (correct ogive)
     10.000000        .000100     BEGIN AND END DELTA F PER LOOP1
   3   .95               FIRST LOOP1 FOR LAMBDA & VALUE
   1.100                 MAX VALUE FOR CROSS DERIVATIVE
   1 READ HESSIAN
STARB2.hes
   1 WRITE HESSIAN
STARB2.hes
    .001               MIN SAMPLE FRAC. PER AGE
   1  21   1  21        MINAGE, MAXAGE,  SUMMARY AGE RANGE
    51   105            BEGIN YEAR, END YEAR
  1       12  0  0  0    NPER, MON/PER
  1.00                 SPAWNMONTH
  5  9 NFISHERY, NSURVEY
  2 N SEXES
   50000.  REF RECR LEVEL
  0 MORTOPT
    .150000     .010000     .250000 'M              '   0     1  0     .000000   .0000 !   1 NO PICK    .000      -1.      .0000000
 -999.000000     .010000    1.000000 'M SAME FOR M+F  '   0     1  0     .000000   .0000 !   2 NO PICK    .000      -1.      .0000000
   TRAWL    TYPE:  1
  7 SELECTIVITY PATTERN
   0   0   0   2   0   0   0  AGE TYPES USED
    1.00000       .10 ' TWL CATCH BIOMASS  '  ! # =  1 VALUE:         .00000
    1.00000       .30 ' TWL  SIZE COMPS    '  ! # =  2 VALUE:     -563.64340
  1  1  0  0  0  0  SEL. COMPONENTS
   51.002423   20.000000   70.000000 'Trawl:transition'   2     1  0     .000000   .0000 !   3 OK         .009     -32.      .2336254
    .000001     .000001    1.000000 'Trawl:InitSelect'   0     1  0     .000000   .0000 !   4 NO PICK    .000      -1.      .0000000
    .507959     .001000    1.000000 'Trawl:SmlInflect'   2     1  0     .500000  1.0000 !   5 OK         .000  -47722.      .0001270
    .331894     .001000    3.000000 'Trawl:SmlSlope  '   2     1  0     .900000  1.0000 !   6 OK         .000   -3459.      .0004838
    .615234     .001000    1.000000 'Trawl:femfinal  '   2     1  0    1.000000  1.0000 !   7 OK         .000   -5288.      .0013579
    .380634     .001000    1.000000 'Trawl:feminflct '   2     1  0     .500000  1.0000 !   8 OK         .000   -3174.      .0009012
   1.347485     .001000    5.000000 'Trawl:femSlope  '   0     1  0     .900000  1.0000 !   9 NO PICK    .000      -1.      .0000000
   H&L      TYPE:  2
  7 SELECTIVITY PATTERN
   0   0   0   4   0   0   0  AGE TYPES USED
    1.00000       .10 ' H&Lso CATCH BIOMASS'  ! # =  3 VALUE:         .00000
```

```
  1.00000      .30 ' H&Lso SIZE COMPS   ' ! # =  4 VALUE:     -201.26749
1  1  0  0  0  0  SEL. COMPONENTS
 48.626937   20.000000   70.000000 'H&L:transition   '   2     1  0     .000000   .0000 !  10 OK        .003      -8.      .6962957
  .003039    .000001    1.000000 'H&L:InitSelect  '   2     1  0     .000000   .0000 !  11 OK        .000  -56876.      .0000243
  .841892    .001000    1.000000 'H&L:SmlInflect  '   2     1  0     .500000  1.0000 !  12 OK        .000   -1953.      .0027765
  .328569    .001000    3.000000 'H&L:SmlSlope    '   2     1  0     .900000  1.0000 !  13 OK        .000   -2407.      .0015414
  .277009    .001000    1.000000 'H&L:femfinal    '   2     1  0    1.000000  1.0000 !  14 OK        .000    -342.      .0170349
  .398141    .001000    1.000000 'H&L:feminflct   '   2     1  0     .500000  1.0000 !  15 OK        .000    -309.      .0095814
  .252101    .001000    5.000000 'H&L:femSlope    '   2     1  0     .900000  1.0000 !  16 OK       -.001     -88.      .0386679
SETNET    TYPE:  3
7 SELECTIVITY PATTERN
 0   0   0   6   0   0   0  AGE TYPES USED
  1.00000      .10 'SetNetCATCHBIOM     ' ! # =  5 VALUE:          .00000
  1.00000      .30 'SetNetSizeComps     ' ! # =  6 VALUE:     -293.76197
1  1  0  0  0  0  SEL. COMPONENTS
 49.684185   20.000000   60.000000 'StNso:transition'   2     1  0     .000000   .0000 !  17 OK        .016     -18.      .2830915
  .004245    .000001    1.000000 'StNso:InitSelect'   2     1  0     .000000   .0000 !  18 OK        .000 -305677.      .0000036
  .776996    .001000     .990000 'StNso:YngInflect'   2     1  0     .500000  1.0000 !  19 OK       -.001  -11707.      .0004140
  .659426    .001000    3.000000 'StNso:YngSlope  '   2     1  0     .900000  1.0000 !  20 OK        .001    -432.      .0043002
  .168587    .001000    1.000000 'StNso:femfinal  '   2     1  0     .000000   .0000 !  21 OK        .001    -850.      .0034676
  .001000    .001000    1.000000 'StNso:feminflct '   2     1  0     .500000  1.0000 !  22 BOUND     .000      -1.      .0557780
  .179194    .001000    5.000000 'StNso:femSlope  '   2     1  0     .900000  1.0000 !  23 OK        .000   -1915.      .0029324
RECLso    TYPE:  4
7 SELECTIVITY PATTERN
 0   0   0   8   0   0   0  AGE TYPES USED
  1.00000      .10 'RECLsoCATCHBIOM     ' ! # =  7 VALUE:          .00000
  1.00000      .30 'RECLsoSIZECOMPS     ' ! # =  8 VALUE:     -300.13908
1  1  0  0  0  0  SEL. COMPONENTS
 42.961026   15.000000   60.000000 'RCLso:transition'   2     1  0     .000000   .0000 !  24 OK        .012      -3.     1.7840597
  .148881    .000001    1.000000 'RCLso:InitSelect'   2     1  0     .000000   .0000 !  25 OK        .000   -2535.      .0004555
  .001000    .001000    1.000000 'RCLso:SmlInflect'   2     1  0     .500000  1.0000 !  26 BOUND     .000      -1.      .0000000
  .231881    .001000    5.000000 'RCLso:SmlSlope  '   2     1  0     .900000  1.0000 !  27 OK        .000   -1620.      .0010147
  .068163    .001000    1.000000 'RCLso:femfinal  '   2     1  0     .000000   .0000 !  28 OK        .000   -3652.      .0007763
  .367078    .001000    1.000000 'RCLso:feminflct '   2     1  0     .500000  1.0000 !  29 OK        .000   -4944.      .0010696
  .282903    .001000    5.000000 'RCLso:femSlope  '   2     1  0     .900000  1.0000 !  30 OK        .000   -1012.      .0024685
RECLnor   TYPE:  5
7 SELECTIVITY PATTERN
 0   0   0  10   0   0   0  AGE TYPES USED
  1.00000      .10 'RECLnorCATCHBIOM    ' ! # =  9 VALUE:          .00000
  1.00000      .30 'RECLnorSIZECOMPS    ' ! # = 10 VALUE:     -261.12321
1  1  0  0  0  0  SEL. COMPONENTS
```

```
48.379190   15.000000   60.000000 'RCLno:transition'   2     1  0     .000000   .0000 !  31 OK        -.011      -2.     2.2825913
  .065784     .000001    1.000000 'RCLno:InitSelect'   2     1  0     .000000   .0000 !  32 OK         .000  -12027.      .0001144
  .497121     .001000    1.000000 'RCLno:SmlInflect'   2     1  0     .500000  1.0000 !  33 OK         .000    -576.      .0059430
  .129545     .001000    5.000000 'RCLno:SmlSlope  '   2     1  0     .900000  1.0000 !  34 OK         .001    -968.      .0018149
  .326916     .001000    1.000000 'RCLno:femfinal  '   2     1  0     .000000   .0000 !  35 OK        -.001    -331.      .0088951
  .600288     .001000    1.000000 'RCLno:feminflct '   2     1  0     .500000  1.0000 !  36 OK         .001    -768.      .0036037
  .323885     .001000    5.000000 'RCLno:femSlope  '   2     1  0     .900000  1.0000 !  37 OK        -.001     -65.      .0313081
 NoRec   TYPE:  6
2 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .000176  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   1.00000       .67 'RecFINnoCPUE       '  ! # = 11 VALUE:       -5.43043
  5.000000    -.200000    1.000000 'NoCalCPU:Seltype'   0   -80  0     .000000   .0000 !  38 NO PICK    .000      -1.      .0000000
 24.000000     .010000   24.000000 'NoCalCPUl:minsiz'   0   -80  0     .000000   .0000 !  39 NO PICK    .000      -1.      .0000000
 76.000000     .001000   76.000000 'NoCalCPUl:maxsiz'   0   -80  0     .000000   .0000 !  40 NO PICK    .000      -1.      .0000000
DFGcpuN   TYPE:  7
2 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .000767  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   1.00000       .37 ' NoCalDFG          '  ! # = 12 VALUE:        8.18099
  5.000000    -.200000    1.000000 'NoCalDFG:Seltyp '   0   -87  0     .000000   .0000 !  41 NO PICK    .000      -1.      .0000000
 24.000000     .010000   24.000000 'NoCalDFG:minsi  '   0   -87  0     .000000   .0000 !  42 NO PICK    .000      -1.      .0000000
 76.000000     .001000   76.000000 'NOCalDFG:maxsi  '   0   -87  0     .000000   .0000 !  43 NO PICK    .000      -1.      .0000000
SoRecFI   TYPE:  8
2 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .000203  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   1.00000       .71 'RecFINsoCPUE       '  ! # = 13 VALUE:       -4.08451
  4.000000    -.200000    1.000000 'SoCalCPU:Seltype'   0   -80  0     .000000   .0000 !  44 NO PICK    .000      -1.      .0000000
 24.000000     .010000   24.000000 'SoCalCPUl:minsiz'   0   -80  0     .000000   .0000 !  45 NO PICK    .000      -1.      .0000000
 76.000000     .001000   76.000000 'SoCalCPUl:maxsiz'   0   -80  0     .000000   .0000 !  46 NO PICK    .000      -1.      .0000000
TwlCPUE   TYPE:  9
2 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .005250  0  1  1 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   1.00000       .32 'TrawlCPUE          '  ! # = 14 VALUE:        9.48978
  1.000000    -.200000    1.000000 'TrawlSeltype    '   0   -82  0     .000000   .0000 !  47 NO PICK    .000      -1.      .0000000
 20.000000     .010000   20.000000 'TrawlCPUE:minsiz'   0   -82  0     .000000   .0000 !  48 NO PICK    .000      -1.      .0000000
 84.000000     .001000   84.000000 'TrawlCPUE:maxsiz'   0   -82  0     .000000   .0000 !  49 NO PICK    .000      -1.      .0000000
TRITRAW   TYPE: 10
7 SELECTIVITY PATTERN
```

```
 0   0   0  16   0   0   0  AGE TYPES USED
   .049772  0  1  1 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   1.00000       .81 'TRI SURVEY BIO      '  ! # = 15 VALUE:       -5.47490
   1.00000       .30 'TRI SIZE COMPS      '  ! # = 16 VALUE:      -77.67198
 1  1  0  0  0  0  SEL. COMPONENTS
 34.265662   26.000000   76.000000 'TriSv:transition'   2    89  0     .000000   .0000 !  50 BIG DX     .680      -2.      .5817321
   .373898     .001000    1.000000 'TriSv:InitSelect'   2    89  0     .000000   .0000 !  51 OK         .002     -52.      .0198294
   .001000     .001000    1.000000 'TriSv:YngInflect'   2    89  0     .500000  1.0000 !  52 BOUND      .000      -1.      .0000000
  3.000000     .001000    3.000000 'TriSv:YngSlope  '   2    89  0     .900000  1.0000 !  53 BOUND      .000      -1.      .0000000
   .457369     .001000    1.000000 'TriSv:femfinal  '   2    89  0     .000000   .0000 !  54 OK         .001    -187.      .0059375
   .001000     .001000    1.000000 'TriSv:feminflct '   2    89  0     .500000  1.0000 !  55 BOUND      .000      -1.      .0000000
  5.000000     .001000    5.000000 'TriSv:femSlope  '   2    89  0     .900000  1.0000 !  56 BOUND      .000      -1.      .0000000
 CALCOFI   TYPE: 11
 4 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .000344  0  1  1 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   1.00000       .68 'CALCOFISPB          '  ! # = 17 VALUE:       -1.31698
 PowPlnt   TYPE: 12
 3 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .011493  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
    .00000      2.10 'PowPltRectIndex     '  ! # = 18 VALUE:      -35.27806
  1.000000     .000000    1.000000 'PowplntAge1Nos  '   0   -73  0     .000000   .0000 !  57 NO PICK    .000      -1.      .0000000
  1.000000     .000000    1.000000 'PowplntAge1Nos  '   0   -73  0     .000000   .0000 !  58 NO PICK    .000      -1.      .0000000
JuvSurv    TYPE: 13
 3 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .000083  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
    .00000      2.05 'CenCalJuvIndex      '  ! # = 19 VALUE:      -25.18580
  1.000000     .000000    1.000000 'JuvSurvAge1Nos  '   0   -84  0     .000000   .0000 !  59 NO PICK    .000      -1.      .0000000
  1.000000     .000000    1.000000 'JuvSurvAge1Nos  '   0   -84  0     .000000   .0000 !  60 NO PICK    .000      -1.      .0000000
PierCPU    TYPE: 14
 3 SELECTIVITY PATTERN
 0   0   0   0   0   0   0  AGE TYPES USED
   .000294  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
    .00000      3.29 'PierRectIndex       '  ! # = 20 VALUE:      -32.57300
  1.000000     .000000    1.000000 'PierIndex1Nos   '   0   -81  0     .000000   .0000 !  61 NO PICK    .000      -1.      .0000000
  1.000000     .000000    1.000000 'PierIndex1Nos   '   0   -81  0     .000000   .0000 !  62 NO PICK    .000      -1.      .0000000
 1 AGEERR: 1: MULTINOMIAL,  0: S(LOG(P))=CONSTANT,  -1: S=P*Q/N
500.000 : MAX N FOR MULTINOMIAL
 3 1=%CORRECT, 2=C.V., 3=%AGREE, 4=READ %AGREE @AGE
```

```
   .800000    .300000    .950000 'p AGREE. @1     '  0   80  0    .000000   .0000 !  63 NO PICK    .000     -1.     .0000000
   .050000    .000000    .900000 'p agree @21     '  0   80  0    .000000   .0000 !  64 NO PICK    .000     -1.     .0000000
  1.000000    .001000   2.000000 'POWER           '  0   80  0    .000000   .0000 !  65 NO PICK    .000     -1.     .0000000
   .150000    .010000    .300000 'OLD DISCOUNT    '  0   80  0    .000000   .0000 !  66 NO PICK    .000     -1.     .0000000
   .000001    .001000    .100000 '%MIS-SEXED      '  0   80  0    .000000   .0000 !  67 NO PICK    .000     -1.     .0000000
 0 END OF EFFORT
 0 FIX n FMORTs
 0  MATURITY
 1  GROWTH: 1=CONSTANT, 2=MORT. INFLUENCE
 1.5000 99.0000  AGE AT WHICH L1 AND L2 OCCUR
 1 1=NORMAL, 2=LOGNORMAL
  27.000000   20.000000   60.000000 'FEMALE L1       '  0    1  0    .000000   .0000 !  68 NO PICK    .000     -1.     .0000000
  75.892728   60.000000   90.000000 'FEMALE LINF     '  0    1  0    .000000   .0000 !  69 NO PICK    .000     -1.     .0000000
   .185524    .050000    .400000 'FEMALE K        '  2    1  0    .000000   .0000 !  70 OK         .000-2560487.    .0000019
   .107000    .010000    .990000 'FEMALE CV1      '  0    1  0    .000000   .0000 !  71 NO PICK    .000     -1.     .0000000
   .033000    .010000    .990000 'FEMALE CV21     '  0    1  0    .000000   .0000 !  72 NO PICK    .000     -1.     .0000000
-999.000000   20.000000   40.000000 'MALE L1         '  0    1  0    .000000   .0000 !  73 NO PICK    .000     -1.     .0000000
  65.555310   50.000000   80.000000 'MALE LINF       '  0    1  0    .000000   .0000 !  74 NO PICK    .000     -1.     .0000000
   .210339    .100000    .400000 'MALE K          '  2    1  0    .000000   .0000 !  75 OK         .000-1356466.    .0000031
-999.000000    .010000    .990000 'MALE CV1        '  0    1  0    .000000   .0000 !  76 NO PICK    .000     -1.     .0000000
-999.000000    .010000    .990000 'MALE CV21       '  0    1  0    .000000   .0000 !  77 NO PICK    .000     -1.     .0000000
        0  DEFINE MARKET CATEGORIES
 0 ENVIRONMENTAL FXN:    [-INDEX]  [FXN TYPE(1-4)]  [ENVVAR USED]
 0 ESTIMATE N ENVIRON VALUES
21 PENALTIES
    .00000      .30 ' Parm Penalty     '  ! # = 21 VALUE:     -175.99263
-1  1.0  1.0
 0 ENVIRONMENT EFFECT ON EXP(RECR)
22  STOCK-RECR
 3 1=B-H, 2=RICKER, 3=new B-H, 4=HOCKEY
 0 disabled option
    .10000    -1.00 'SPAWN RECR.       '  ! # = 22 VALUE:      -40.76046
    .00001     -.30 'S-R means         '  ! # = 23 VALUE:     -389.16673
  10.000000    .001000   10.000000 'VIR. RECR. MULT.'  2    1  0    .000000   .0000 !  78 BOUND      .000     -1.     .0000000
   .210967    .100000    .990000 'B-H S/R PAR.    '  2    1  0    .000000   .0000 !  79 OK        -.001    -331.    .0031255
   .070451    .001000   10.000000 'BACK RECR.      '  0    1  0    .000000   .0000 !  80 NO PICK    .000     -1.     .0000000
  1.000000    .010000   2.000000 'S/R STD.        '  0    1  0    .000000   .0000 !  81 NO PICK    .000     -1.     .0000000
   .000000   -.100000    .100000 'RECR. TREND     '  0    1  0    .000000   .0000 !  82 NO PICK    .000     -1.     .0000000
  1.000000    .000000   2.000000 'RECR. MULT.     '  0    1  0    .000000   .0000 !  83 NO PICK    .000     -1.     .0000000
-2 INIT AGE COMP
-999.000000    .001000   30.000000 'Recruit 51      ' -2   51  0    .000000   .0000 !  84 NO PICK    .000     -1.     .0000000
```

-999.000000	.001000	30.000000	'Recruit 52 '	-2	52	0	.000000	.0000 !	85	NO PICK	.000	-1.	.0000000
-999.000000	.001000	30.000000	'Recruit 53 '	-2	53	0	.000000	.0000 !	86	NO PICK	.000	-1.	.0000000
-999.000000	.001000	30.000000	'Recruit 54 '	-2	54	0	.000000	.0000 !	87	NO PICK	.000	-1.	.0000000
-999.000000	.001000	30.000000	'Recruit 55 '	-2	55	0	.000000	.0000 !	88	NO PICK	.000	-1.	.0000000
-999.000000	.001000	30.000000	'Recruit 56 '	-2	56	0	.000000	.0000 !	89	NO PICK	.000	-1.	.0000000
-999.000000	.001000	30.000000	'Recruit 57 '	-2	57	0	.000000	.0000 !	90	NO PICK	.000	-1.	.0000000
-999.000000	.001000	30.000000	'Recruit 58 '	-2	58	0	.000000	.0000 !	91	NO PICK	.000	-1.	.0000000
-999.000000	.001000	30.000000	'Recruit 59 '	-2	59	0	.000000	.0000 !	92	NO PICK	.000	-1.	.0000000
.045565	.001000	30.000000	'Recruit 60 '	2	60	0	.000000	.0000 !	93	OK	.000	-8753.	.0010027
.025359	.001000	30.000000	'Recruit 61 '	2	61	0	.000000	.0000 !	94	OK	.000	-10633.	.0008144
.033960	.001000	30.000000	'Recruit 62 '	2	62	0	.000000	.0000 !	95	OK	-.009	-12715.	.0007293
1.076550	.001000	30.000000	'Recruit 63 '	2	63	0	.000000	.0000 !	96	OK	.012	-15010.	.0006142
.015333	.001000	30.000000	'Recruit 64 '	2	64	0	.000000	.0000 !	97	OK	.000	-17847.	.0004594
.012048	.001000	30.000000	'Recruit 65 '	2	65	0	.000000	.0000 !	98	OK	.000	-21205.	.0003769
.016041	.001000	30.000000	'Recruit 66 '	2	66	0	.000000	.0000 !	99	OK	.000	-24637.	.0003372
.024944	.001000	30.000000	'Recruit 67 '	2	67	0	.000000	.0000 !	100	OK	-.001	-28499.	.0003124
.037208	.001000	30.000000	'Recruit 68 '	2	68	0	.000000	.0000 !	101	OK	-.001	-31881.	.0002844
.040829	.001000	30.000000	'Recruit 69 '	2	69	0	.000000	.0000 !	102	OK	-.002	-34495.	.0002651
.061828	.001000	30.000000	'Recruit 70 '	2	70	0	.000000	.0000 !	103	OK	.001	-36331.	.0002481
.302368	.001000	30.000000	'Recruit 71 '	2	71	0	.000000	.0000 !	104	OK	.001	-38314.	.0002322
.034635	.001000	30.000000	'Recruit 72 '	2	72	0	.000000	.0000 !	105	OK	.000	-42718.	.0001899
.040776	.001000	30.000000	'Recruit 73 '	2	73	0	.000000	.0000 !	106	OK	.000	-48350.	.0001522
.313355	.001000	30.000000	'Recruit 74 '	2	74	0	.000000	.0000 !	107	OK	.000	-57821.	.0001301
.109022	.001000	30.000000	'Recruit 75 '	2	75	0	.000000	.0000 !	108	OK	.000	-68712.	.0000868
.025157	.001000	30.000000	'Recruit 76 '	2	76	0	.000000	.0000 !	109	OK	.000	-87187.	.0000403
.010213	.001000	30.000000	'Recruit 77 '	2	77	0	.000000	.0000 !	110	OK	.000	-102358.	.0000269
.460586	.001000	30.000000	'Recruit 78 '	2	78	0	.000000	.0000 !	111	OK	.000	-75193.	.0000954
.047342	.001000	30.000000	'Recruit 79 '	2	79	0	.000000	.0000 !	112	OK	.000	-74937.	.0000892
.161792	.001000	30.000000	'RECRUIT 80 '	2	80	0	.000000	.0000 !	113	OK	.000	-78438.	.0000734
.027891	.001000	30.000000	'RECRUIT 81 '	2	81	0	.000000	.0000 !	114	OK	.000	-97605.	.0000426
.030406	.001000	30.000000	'RECRUIT 82 '	2	82	0	.000000	.0000 !	115	OK	.000	-139017.	.0000213
.003027	.001000	30.000000	'RECRUIT 83 '	2	83	0	.000000	.0000 !	116	OK	.000	-326212.	.0000055
.011718	.001000	30.000000	'RECRUIT 84 '	2	84	0	.000000	.0000 !	117	OK	.000	-182457.	.0000113
.209487	.001000	30.000000	'RECRUIT 85 '	2	85	0	.000000	.0000 !	118	OK	.000	-101657.	.0000329
.028269	.001000	30.000000	'RECRUIT 86 '	2	86	0	.000000	.0000 !	119	OK	.000	-141012.	.0000188
.026648	.001000	30.000000	'RECRUIT 87 '	2	87	0	.000000	.0000 !	120	OK	.000	-174062.	.0000119
.030992	.001000	30.000000	'RECRUIT 88 '	2	88	0	.000000	.0000 !	121	OK	.000	-152300.	.0000123
.111289	.001000	30.000000	'RECRUIT 89 '	2	89	0	.000000	.0000 !	122	OK	.000	-105958.	.0000209
.003343	.001000	30.000000	'RECRUIT 90 '	2	90	0	.000000	.0000 !	123	OK	.000	-192184.	.0000092
.036446	.001000	30.000000	'RECRUIT 91 '	2	91	0	.000000	.0000 !	124	OK	.000	-172259.	.0000106
.029704	.001000	30.000000	'RECRUIT 92 '	2	92	0	.000000	.0000 !	125	OK	.000	-212770.	.0000087

.007470	.001000	30.000000	'RECRUIT 93	'	2	93	0	.000000	.0000	! 126	OK	.000	-366491.	.0000047
.016599	.001000	30.000000	'RECRUIT 94	'	2	94	0	.000000	.0000	! 127	OK	.000	-382530.	.0000047
.015096	.001000	30.000000	'RECRUIT 95	'	2	95	0	.000000	.0000	! 128	OK	.000	-438094.	.0000042
.008269	.001000	30.000000	'RECRUIT 96	'	2	96	0	.000000	.0000	! 129	OK	.000	-515939.	.0000030
.019050	.001000	30.000000	'RECRUIT 97	'	2	97	0	.000000	.0000	! 130	OK	.000	-349835.	.0000059
.004687	.001000	30.000000	'RECRUIT 98	'	2	98	0	.000000	.0000	! 131	OK	.000	-537504.	.0000026
.007250	.001000	30.000000	'RECRUIT 99	'	2	99	0	.000000	.0000	! 132	OK	.000	-222246.	.0000055
.104709	.001000	30.000000	'RECRUIT 100	'	2	100	0	.000000	.0000	! 133	OK	.000	-15407.	.0001665
.001000	.001000	30.000000	'RECRUIT 101	'	2	101	0	.000000	.0000	! 134	BOUND	.000	-1.	.0000000
.005815	.001000	30.000000	'RECRUIT 102	'	2	102	0	.000000	.0000	! 135	OK	.000	-172583.	.0000076
.008258	.001000	30.000000	'RECRUIT 103	'	2	103	0	.000000	.0000	! 136	OK	.000	-134412.	.0000100
.026838	.001000	30.000000	'RECRUIT 104	'	2	104	0	.000000	.0000	! 137	OK	.000	-33794.	.0000414
-.017699	.001000	30.000000	'RECRUIT 105	'	-2	105	0	.000000	.0000	! 138	NO PICK	.000	-1.	.0000000