UNITED STATES DEPARTMENT OF COMMERCE
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March 16, 2010

Mr. Robert Mahood
Executive Director
South Atlantic Fishery Management Council
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

Dear Mr. Mahood,

Please find attached the SEFSC Technical Document entitled, ***"Updated projections of Atlantic king mackerel stock unit 2010 in response to request from the SSC South Atlantic Council."*** This report is in response to your January 28, 2010 letter, re: Request for Updated Atlantic King Mackerel Projections.

Please contact Dr. Tom Jamir at (305) 361-4260 or email tom.jamir@noaa.gov if you have any questions or clarifications.

Sincerely,

Theo R. Brainerd

Bonnie Ponwith, Ph.D.
Science Director

Attachment

Cc: SAFMC – Bob Mahood
SAFMC – Greg Waugh
SAFMC – John Carmichael
SAFMC – Carolyn Belcher
F/SER – Roy Crabtree
F/SER – Jack McGovern
F/SEC – Theo Brainerd
F/SEC – Peter Thompson
F/SEC – Tom Jamir
F/SEC – Sophia Howard

Technical Document:

Updated projections of Atlantic king mackerel stock unit 2010 in response to request from the SSC South Atlantic Council.

Sustainable Fisheries Division: Pelagic Species Branch.

Southeast Fisheries Science Center

Miami Laboratory March 15 2010.

Introduction

The SSC of the South Atlantic Council requested updates of the available measures of recruitment, landings and projected status of the Atlantic king mackerel (*Scomberomorus cavalla*) migratory unit (Memorandum from B. Mahood SSC Jan 19/2010). The specifications for the requested projections included:

1. Use base VPA model adopted by the SSC from the SEDAR-16 stock assessment
2. Incorporate 2007/08 and 2008/09 fishing year observed catches
3. Account for cumulative uncertainty over time and provide the catch and F associated with a 27.5% chance of overfishing occurring over the projection period:
    a. ABC changes should begin with the 2011/12 fishing year (Fyear = Apr 1st to Mar 31st of the next calendar year); assume the current TAC is reached in the interim FYs (2009/10 and 2010/11).
    b. Provide projections for 1 year (2011/12), 3 years (up to 2013/14), 7 years (up to 2018/19), and 10 years (2021/2022).
    c. Provide associated updated estimates of the OFL (yield at the F_{MSY} proxy) over the same periods as the ABC values.

Landings

The estimated landings for ATL king in 2007/08 were 10,459,850 lbs, of which 3,614,928 lbs were from the commercial fisheries (including the 50% split of the catch in the mixing area-- Monroe-Volusia FL counties from Nov 1st to Mar 31st) and 6,844,922 lbs were from the recreational fisheries (including the dead discards). The updated landings for ATL king in 2008/09 were 8,116,220 lbs (4,211,385 lbs commercial and 3,904,834 lbs recreational). Recreational estimates of catch from the MRFSS and headboat fisheries were provided in numbers of fish and converted to weight using an average weight of 7.88 lbs per fish (the mean of the last five years 2002-06 of the observed recreational catch at size). Wave 2 estimates from MRFSS were equally split between corresponding months to allocate the summer-winter catch by area.

Projections

The updated stock projections use the same software (PRO-2BOX, Porch 2002) and follow the same protocols as the projections presented to the SSC after SEDAR-16. Uncertainty in the VPA output (and therefore the starting point for the projections) was incorporated by bootstrapping the residuals of

the base VPA fits to the indices of abundance. Uncertainty in future recruitment was modeled as lognormal deviations from a Beverton-Holt stock recruitment (S-R) relationship with a fixed steepness of 0.95 and maximum expected recruitment equal to the geometric mean of VPA estimated recruits over the years for which indices of stock and recruitment were both available (1989-2004). Fishery selectivity was held constant at the average of the estimates for the last three years in the VPA (2004/04-2006/07). Discards rates remained constant for all fisheries (33% mortality for Headboat discards, 20% mortality for MRFSS B2 live discards, no significant discards from the commercial fisheries). The projected landings were set to equal to the estimates reported above for FY 2007/08 (10,459,850 lbs) and FY 2008/09 (8,116,220 lbs). As requested, the projected landings during FY 08/09 and FY 09/10 were set to the current TAC (10.0 million lbs). Management changes were assumed to take effect beginning in FY 2011/12. Constant catch and constant fishing mortality scenarios were projected as described below:

a. Constant catch for the period 2011/12 -2020/2021.

Constant TAC runs	
6 million lbs	10 million lbs
6.25 million lbs	10.25 million lbs
6.5 million lbs	10.5 million lbs
6.75 million lbs	10.75 million lbs
7 million lbs	11 million lbs
7.25 million lbs	11.25 million lbs
7.5 million lbs	11.5 million lbs
7.75 million lbs	11.75 million lbs
8 million lbs	12 million lbs
8.25 million lbs	12.25 million lbs
8.5 million lbs	12.5 million lbs
8.75 million lbs	12.75 million lbs
9 million lbs	13 million lbs
9.25 million lbs	13.25 million lbs
9.5 million lbs	13.5 million lbs
9.75 million lbs	13.75 million lbs
	14 million lbs

b. Constant fishing mortality F for the period 2011/12 – 2020/2021.

Constant Fishing mortality runs
F_{MSY} proxy = $F_{30\%SPR}$
F_{OY} proxy = 0.75*$F_{30\%SPR}$
Other F = $F_{40\%SPR}$
= $F_{current}$
= F_{max}
= $F_{0.1}$
= 0.85*$F_{30\%SPR}$
= 0.65*$F_{30\%SPR}$

a: Constant catch projections

Table 1 and Figure 1 below show the probability of exceeding the reference fishing mortality rate of F_{MSY} ($F_{30\%SPR}$) under the constant catch scenarios. Green shading indicates scenarios with lower than 27.5% probability of exceeding of F_{MSY}. Yellow shading indicates scenarios with probability close to 27.5%. Red shading indicates scenarios that have a probability greater than 27.5% of exceeding F_{MSY}. Overall TAC (landings) of 9.50 million pounds or below will achieve the target 27.5% probability of exceeding F_{MSY} (Fig 1). Except in the near term projection years 2011/12 – 2013/14 when the stock can sustain higher catches due to recent higher than average estimated recruitment cohorts. The fishing mortality (median F apical) trends for each of the constant catch scenarios are shown in table 2.

Table 1.

TAC	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
6.00	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.25	0.006	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.50	0.009	0.008	0.004	0.002	0.001	0.000	0.000	0.001	0.001	0.001	0.000
6.75	0.011	0.010	0.007	0.006	0.003	0.004	0.002	0.001	0.001	0.001	0.001
7.00	0.016	0.014	0.011	0.007	0.005	0.005	0.002	0.002	0.002	0.002	0.001
7.25	0.019	0.024	0.013	0.011	0.012	0.010	0.007	0.004	0.003	0.004	0.004
7.50	0.025	0.030	0.020	0.014	0.023	0.018	0.013	0.011	0.011	0.010	0.008
7.75	0.033	0.032	0.028	0.028	0.026	0.024	0.021	0.022	0.018	0.023	0.019
8.00	0.039	0.041	0.042	0.041	0.041	0.041	0.034	0.029	0.032	0.041	0.036
8.25	0.052	0.056	0.059	0.055	0.054	0.054	0.053	0.050	0.056	0.057	0.060
8.50	0.064	0.073	0.078	0.083	0.080	0.078	0.086	0.089	0.082	0.096	0.100
8.75	0.077	0.098	0.103	0.110	0.110	0.109	0.115	0.125	0.137	0.145	0.147
9.00	0.089	0.119	0.127	0.141	0.149	0.152	0.169	0.180	0.189	0.203	0.207
9.25	0.104	0.131	0.156	0.179	0.185	0.214	0.231	0.239	0.262	0.277	0.292
9.50	0.123	0.168	0.180	0.214	0.246	0.270	0.300	0.310	0.321	0.353	0.375
9.75	0.155	0.189	0.212	0.261	0.304	0.339	0.366	0.385	0.407	0.437	0.464
10.00	0.179	0.224	0.262	0.315	0.364	0.411	0.443	0.475	0.502	0.529	0.557
10.25	0.199	0.260	0.313	0.367	0.428	0.484	0.515	0.554	0.597	0.622	0.637
10.50	0.233	0.295	0.348	0.429	0.491	0.534	0.582	0.635	0.672	0.698	0.711
10.75	0.254	0.325	0.404	0.485	0.550	0.607	0.655	0.703	0.736	0.753	0.772
11.00	0.280	0.364	0.450	0.535	0.609	0.663	0.716	0.762	0.790	0.813	0.830
11.25	0.307	0.407	0.495	0.579	0.653	0.718	0.771	0.808	0.839	0.855	0.884
11.50	0.336	0.450	0.538	0.639	0.713	0.771	0.810	0.856	0.871	0.895	0.913
11.75	0.363	0.477	0.572	0.686	0.758	0.811	0.845	0.878	0.897	0.921	0.936
12.00	0.404	0.524	0.621	0.734	0.805	0.856	0.878	0.907	0.920	0.943	0.958
12.25	0.430	0.558	0.664	0.769	0.833	0.881	0.911	0.932	0.945	0.959	0.971
12.50	0.460	0.594	0.704	0.800	0.872	0.911	0.942	0.950	0.967	0.975	0.983
12.75	0.486	0.639	0.741	0.835	0.891	0.934	0.954	0.962	0.978	0.985	0.990
13.00	0.514	0.668	0.778	0.861	0.919	0.945	0.965	0.978	0.986	0.988	0.991
13.25	0.545	0.702	0.807	0.881	0.937	0.964	0.974	0.985	0.989	0.991	0.992
13.50	0.577	0.736	0.834	0.908	0.952	0.975	0.984	0.990	0.991	0.994	0.995
13.75	0.606	0.766	0.859	0.927	0.966	0.978	0.989	0.992	0.993	0.994	0.998
14.00	0.635	0.789	0.884	0.945	0.974	0.988	0.991	0.993	0.994	0.995	0.998

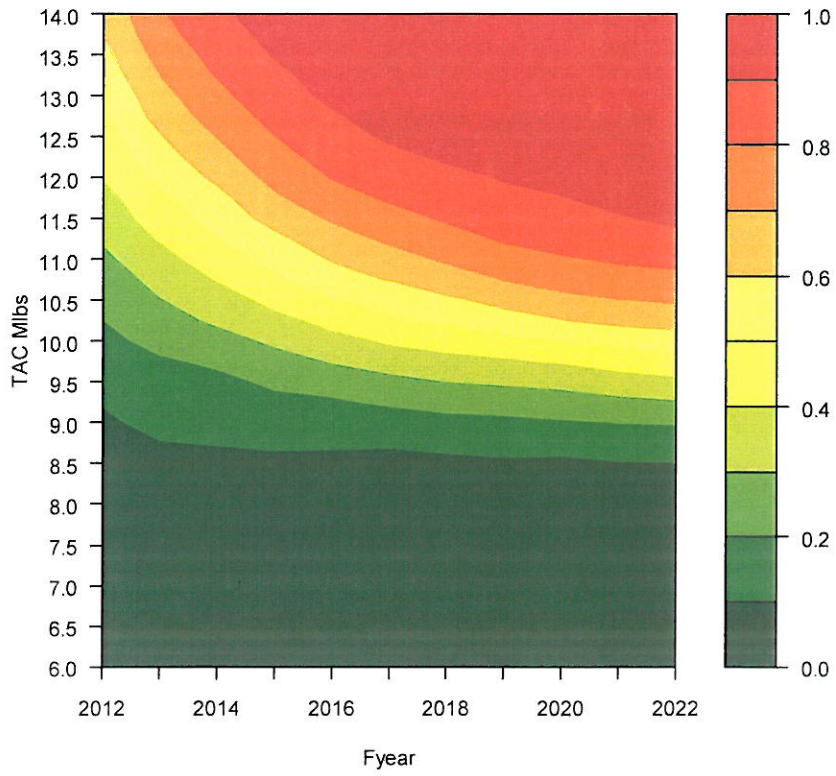

Figure 1. Probability plot of F > F ref (ref = F30%SPR) for ATL king mackerel stock projection under different constant total CATCH levels starting in 2011 FY.

Table 2. Median Fishing mortality rate (F apical) at each scenario of constant TAC projections for Atlantic king mackerel.

TAC	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
6.00	0.151	0.148	0.144	0.141	0.138	0.136	0.132	0.130	0.129	0.127	0.127
6.25	0.157	0.155	0.151	0.149	0.146	0.144	0.141	0.139	0.137	0.135	0.135
6.50	0.164	0.162	0.159	0.157	0.155	0.153	0.149	0.147	0.146	0.144	0.144
6.75	0.171	0.170	0.167	0.166	0.163	0.162	0.159	0.157	0.156	0.153	0.153
7.00	0.177	0.177	0.175	0.174	0.172	0.172	0.168	0.166	0.166	0.163	0.163
7.25	0.184	0.185	0.183	0.183	0.182	0.182	0.178	0.176	0.176	0.173	0.174
7.50	0.191	0.192	0.191	0.192	0.191	0.192	0.189	0.187	0.187	0.185	0.185
7.75	0.198	0.200	0.200	0.202	0.201	0.202	0.199	0.198	0.199	0.196	0.197
8.00	0.205	0.208	0.209	0.211	0.211	0.213	0.211	0.210	0.211	0.209	0.210
8.25	0.212	0.216	0.218	0.221	0.222	0.225	0.223	0.222	0.224	0.222	0.223
8.50	0.219	0.224	0.227	0.232	0.233	0.238	0.236	0.235	0.238	0.236	0.238
8.75	0.226	0.232	0.237	0.242	0.245	0.250	0.249	0.250	0.252	0.252	0.254
9.00	0.233	0.241	0.246	0.254	0.257	0.263	0.264	0.265	0.268	0.269	0.271
9.25	0.240	0.249	0.256	0.265	0.270	0.276	0.279	0.281	0.285	0.287	0.290
9.50	0.247	0.258	0.266	0.277	0.284	0.290	0.294	0.298	0.303	0.308	0.311
9.75	0.254	0.266	0.277	0.289	0.298	0.306	0.311	0.317	0.323	0.328	0.334
10.00	0.261	0.275	0.287	0.301	0.312	0.322	0.329	0.337	0.345	0.351	0.360
10.25	0.268	0.284	0.298	0.314	0.327	0.339	0.349	0.358	0.368	0.377	0.388
10.50	0.275	0.294	0.309	0.328	0.343	0.357	0.370	0.380	0.395	0.407	0.421
10.75	0.283	0.303	0.321	0.342	0.359	0.375	0.393	0.406	0.423	0.440	0.456
11.00	0.290	0.313	0.333	0.357	0.375	0.397	0.417	0.433	0.453	0.477	0.498
11.25	0.297	0.322	0.345	0.372	0.393	0.420	0.442	0.464	0.487	0.519	0.544
11.50	0.305	0.332	0.358	0.388	0.412	0.443	0.470	0.498	0.526	0.566	0.598
11.75	0.312	0.342	0.370	0.404	0.433	0.468	0.500	0.533	0.572	0.620	0.664
12.00	0.320	0.352	0.384	0.421	0.454	0.495	0.532	0.574	0.621	0.688	0.744
12.25	0.327	0.362	0.397	0.439	0.477	0.524	0.569	0.618	0.677	0.762	0.838
12.50	0.335	0.372	0.411	0.457	0.501	0.555	0.608	0.669	0.744	0.846	0.957
12.75	0.342	0.383	0.425	0.477	0.525	0.589	0.652	0.725	0.824	0.961	1.109
13.00	0.350	0.393	0.440	0.498	0.552	0.627	0.702	0.792	0.921	1.102	1.314
13.25	0.358	0.404	0.455	0.520	0.581	0.669	0.758	0.868	1.028	1.270	1.591
13.50	0.365	0.415	0.470	0.542	0.612	0.713	0.818	0.960	1.168	1.507	1.965
13.75	0.373	0.426	0.485	0.565	0.645	0.758	0.886	1.066	1.342	1.819	2.000
14.00	0.381	0.438	0.502	0.589	0.678	0.809	0.961	1.190	1.565	2.000	2.000

b: constant F scenarios

The median yields (million lbs) under the different scenarios of constant fishing rate are shown in Table 3. The F_{MSY} proxy adopted by the SSC councils was $F_{30\%SPR}$ and $F_{current}$ refers to the geometric mean of the last 3 years in the VPA (2004/06). Figure 2, shows the projected yields when fishing at F_{MSY} starting in 2011/12 FY.

Table 3. Expected median yield (million lbs) under constant fishing mortality rate projection.

Fcte	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
F30%SPR	12.8359	11.64758	10.88326	10.28744	9.942731	9.727974	9.672907	9.531938	9.493392	9.436123	9.356828
F40%SPR	9.200441	8.89978	8.730176	8.564978	8.452643	8.418502	8.429515	8.420705	8.426211	8.404185	8.395374
Fcurrent	13.46586	12.03855	11.14868	10.42401	10.08921	9.867841	9.774229	9.623348	9.538546	9.480176	9.374449
Fmax	24.91189	17.63877	14.03524	12.00881	11.03744	10.52093	10.25771	10.09031	9.959251	9.805066	9.654185
F0.1	11.62445	10.75441	10.22577	9.754405	9.536344	9.374449	9.338106	9.246696	9.183921	9.138767	9.124449
0.85F30%SPR	10.45925	9.852423	9.562775	9.232379	9.085903	8.973568	8.937225	8.914097	8.907489	8.865639	8.803965
0.75F30%SPR	9.373348	9.014317	8.875551	8.674009	8.564978	8.508811	8.504405	8.492291	8.512115	8.491189	8.462555
0.65F30%SPR	8.360132	8.1663	8.150881	8.01652	7.968062	7.952643	7.996696	7.984581	8.015419	8.013216	7.959251

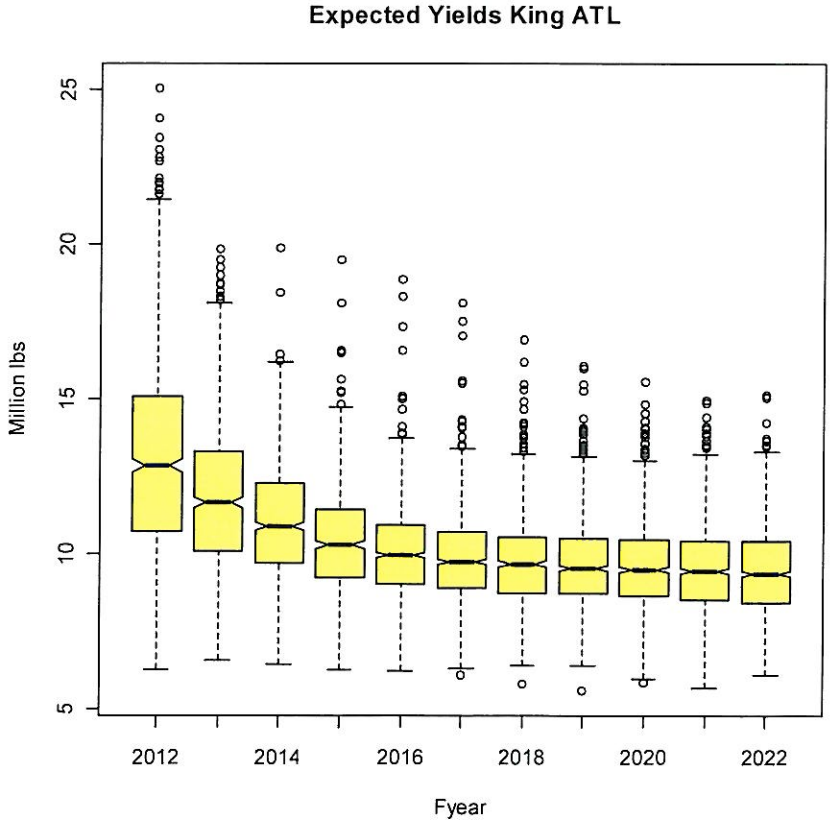

Figure 2. Boxplot distribution of expected yields (landings) of Atlantic king mackerel when fishing at a constant fishing rate of F_{MSY} ($F_{30\%SPR}$). Boxes represent 25-75 percentiles of the projections and the dashed whiskers represent 95% percentile of the projections.

Recruitment trends

The only index of recruitment available for Atlantic king mackerel is the SEAMAP Atlantic trawl survey (representing primarily age 0). This index has been updated through 2009 using the same standardization protocol as adopted during SEDAR 16 (Table 4)

Table 4. Standardized SEAMAP index of relative abundance with estimated coefficients of variation for Atlantic king mackerel. Values for 2004 and 2005 differed as in SEDAR 16; the current estimates reflect the final input values. (Table and analysis provided by the SEFSC Pascagoula Laboratory, W. Ingram)

Survey Year	*Nominal Frequency*	*N*	*Index*	*Scaled Index*	*CV*
1989	0.23396	265	1.31281	0.74460	0.19654
1990	0.39416	274	3.98747	2.26162	0.14289
1991	0.21190	269	1.13275	0.64247	0.20600
1992	0.17329	277	1.35606	0.76913	0.22540
1993	0.16606	277	0.75689	0.42930	0.23052
1994	0.18773	277	1.17756	0.66789	0.21581
1995	0.25632	277	2.07861	1.17895	0.18250
1996	0.34657	277	3.66240	2.07725	0.15314
1997	0.19134	277	0.95009	0.53887	0.22070
1998	0.25271	277	2.96931	1.68414	0.18347
1999	0.29603	277	2.01171	1.14101	0.16901
2000	0.20578	277	1.41002	0.79974	0.20514
2001	0.17320	306	0.78519	0.44534	0.21791
2002	0.21242	306	0.87709	0.49747	0.19510
2003	0.25163	306	1.70521	0.96716	0.17912
2004	0.24183	306	2.19795	1.24664	0.18296
2005	0.19281	306	2.15468	1.22210	0.20606
2006	0.19608	306	1.72253	0.97699	0.20504
2007	0.22549	306	1.97548	1.12045	0.19087

Survey Year	Nominal Frequency	N	Index	Scaled Index	CV
2008	0.16340	306	1.87289	1.06227	0.22473
2009	0.16667	336	0.92847	0.52661	0.21178