Appendix 11 : Further Angolan horse mackerel assessments

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This document reports preliminary results of fitting a Schaefer surplus production model to three sets of 1985+ survey biomass estimates from the Angolan horse mackerel fishery. These biomass estimates are for:

i) *T. trecae* only
ii) *T. capensis* only
iii) *T. trecae* plus *T capensis*

For each of these biomass series, a corresponding catch series from 1985 has been defined. Table 1 reports the survey biomass series, and Table 2 reports the catch series. As the "raw" catch data for Angolan horse mackerel from 1985 is for *T. trecae* only, an assumed catch series for *T. capensis* was calculated using the observed ratios of *T. trecae* and *T. capensis* from the survey biomass estimates. It was thus assumed that the proportion of *T. capensis* and *T. trecae* are the same in both the catch and survey biomass series. The biomass estimates are treated as relative indices in the model fit, with an estimable multiplicative bias factor q in relation to absolute abundance.

Catch data (for both species combined) is also available for 1973-1984. A fourth assessment is thus reported, which uses this catch series in conjunction with the *T. capensis* plus *T. trecae* survey biomass series (for 1985+). For this assessment, it is assumes that $B_{1973} = K$ (i.e. the α value, where $\alpha = B_{start\ year} / K$, is fixed at 1.0).

Results

The model output is presented in Table 3. A minimum constraint of 0.10 on the r parameter is imposed. This was necessary as in some cases, the model would fit an impossible low r value. Convergence was not achieved for any of the fits (ADMB was used). The model appeared in general to have difficulty in fitting to the data.

Table 1: Biomass survey estimates (‘000 t) used for the assessments reported here, as well as the relative ratios between the two species. Note that for some years more than one survey was conducted and the average for that year is used. Linear interpolation has also been used to estimate biomass in years for which no surveys were conducted.

	Ratio *trecae*	**Ratio *capensis***	**Biomass *trecae***	**Biomass *capensis***	**Total Biomass *capensis* + *trecae***
1985	0.67	0.33	450	220	670
1986	0.88	0.12	130	40	170
1987	0.82	0.18	193	70	263
1988	0.75	0.25	255	100	355
1989	0.69	0.31	318	130	448
1990	0.66	0.34	209	220	429
1991	0.62	0.38	100	310	410
1992	0.68	0.32	92	248	340
1993	0.74	0.26	84	187	271
1994	0.80	0.20	76	125	201
1995	0.86	0.14	68	63	131
1996	0.95	0.05	433	21	454
1997	0.95	0.05	210	23	233
1998	0.66	0.34	141	129	270
1999	0.71	0.29	124	128	252
2000	0.58	0.42	92	242	334
2001	0.32	0.68	64	187	251
2002	0.64	0.36	118	92	210
2003	0.56	0.44	120	133	253
2004	0.85	0.15	32	39	71

Table 2: Catch (t) series used for the various assessments.

	Total	*T. trecae*	*T. capensis*
1973	191694		
1974	132994		
1975	128208		
1976	45723		
1977	252565		
1978	380150		
1979	297247		
1980	109665		
1981	142216		
1982	105072		
1983	109985		
1984	54923		
1985	43493	29140	14353
1986	105060	92453	12607
1987	95302	77830	17472
1988	100683	75848	24835
1989	122664	84638	38026
1990	74366	48710	20947
1991	54190	33598	13728
1992	113547	77212	25548
1993	85635	63370	16842
1994	62430	49944	10509
1995	61050	52503	8547
1996	145017	137766	7251
1997	162144	154037	8107
1998	72365	47761	24604
1999	53634	38080	15554
2000	57778	33511	24267
2001	375000	120000	255000
2002	125560	80358	45202
2003	107143	60000	47143

Table 3: Model output statistics. [Note: r is constrained to be ≥ 0.1.]

	T. trecae **1985+**	***T. capensis*** **1985+**	**Both species 1985+**	**Both species 1973+**
K	1274	1123	2998	942
r	0.1	0.1	0.1	0.91
α	1.0	0.94	0.4	1.0 fixed
q	0.18	0.11	0.29	0.34
MSY	32	28	75	214
RY(2005)	26	27	37	155
B_{2004}/K	0.35	0.64	0.19	0.59

Figure 1a: Catch series (t) for the Angolan horse mackerel fishery..

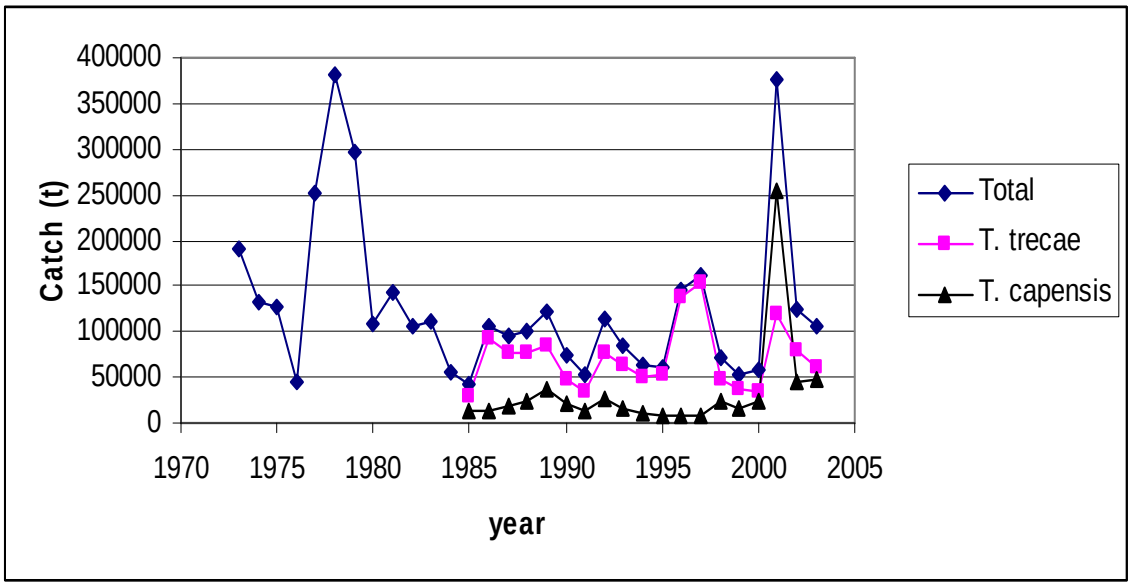

Figure 1b: Survey biomass estimates for the Angolan horse mackerel fishery.

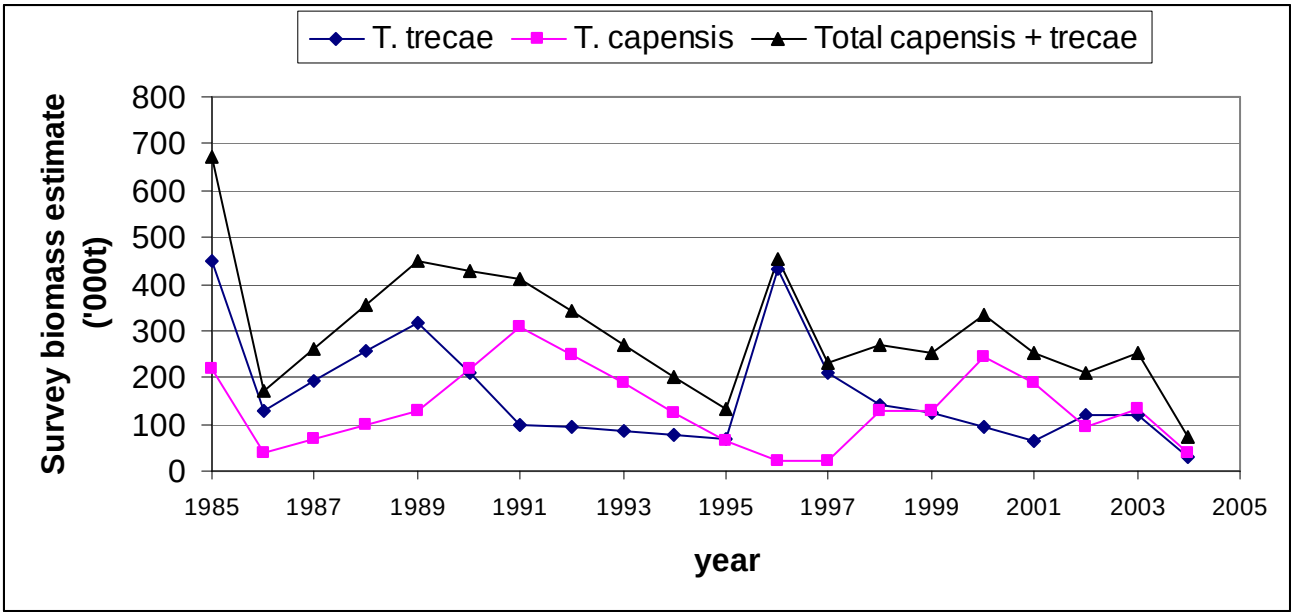

Figure 2a: Model fit to *T. trecae* (1985+) survey biomass estimates.

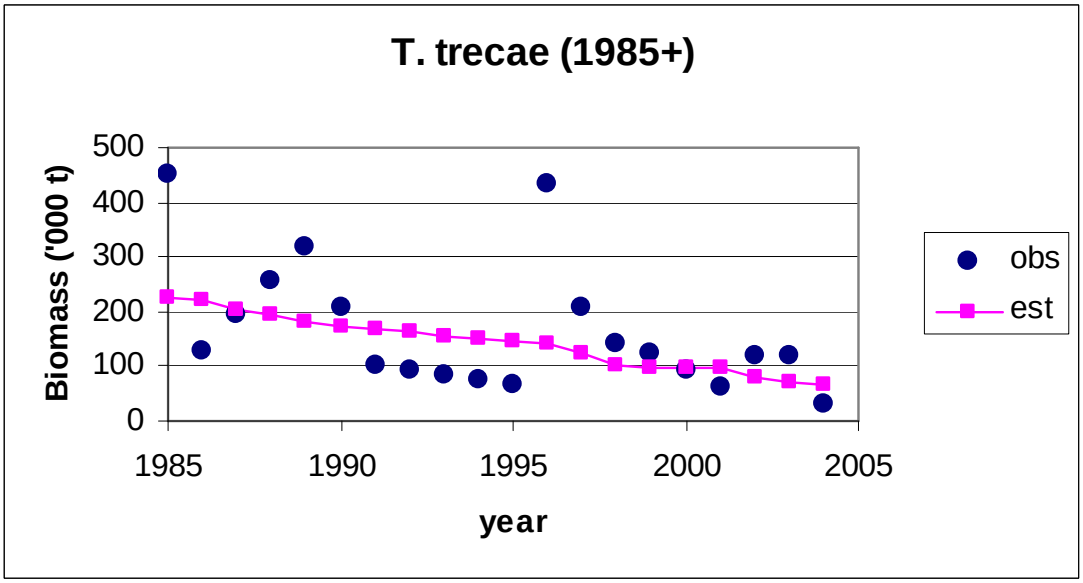

Figure 2b: Model fit to *T. capensis* (1985+) survey biomass estimates.

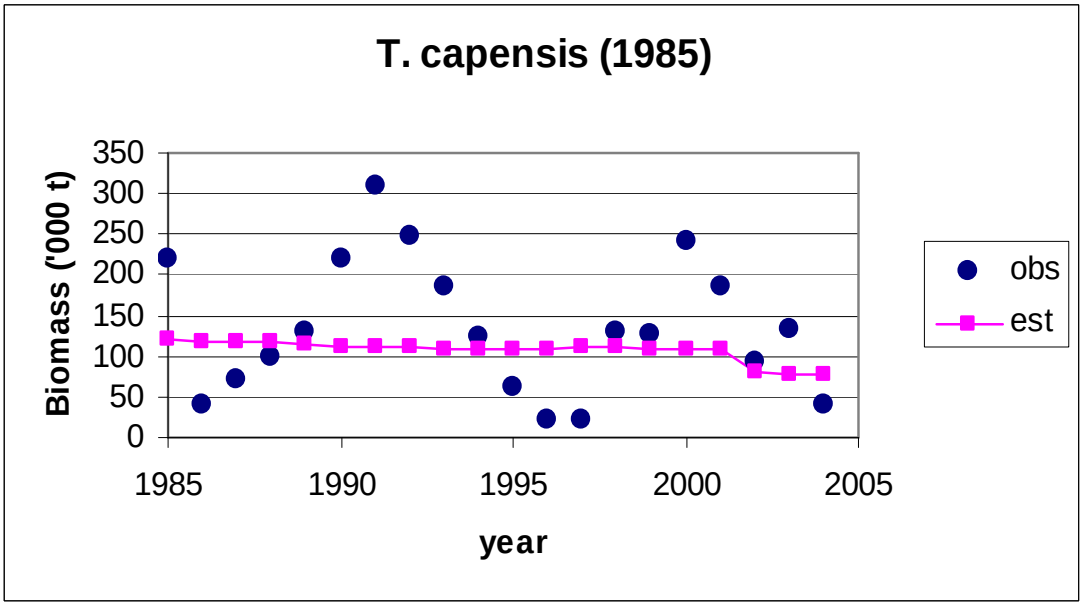

Figure 2c: Model fit to *T. trecae* + *T. capensis* (1985+) survey biomass estimates.

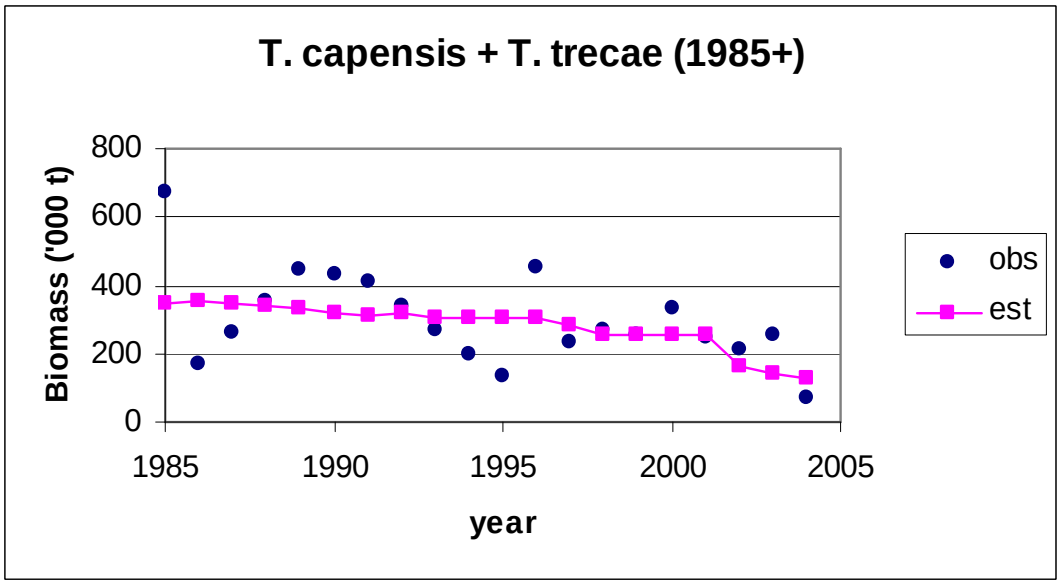

Figure 2d: Model fit to *T. trecae* + *T. capensis* (1985+) survey biomass estimates – model starts in 1973.