Some further comments relating to the proposal to base anchovy TACs on expected exploitation rates

C.L. de Moor*

Correspondence email: *carryn.demoor@uct.ac.za*

Following the direction provided by the chair and vice-chair at the last Small Pelagic Scientific Working Group meeting that discussion on topics will no longer be recorded unless contained in documentation, this document provides some further comments cautioning against the proposal to base anchovy TACs on expected exploitation rates.

- The use of ER_{MSY} (or an approximation to it based on F_{MSY}) in "Proposal F" of Annexure A of Bergh (2020) could be taken to imply that "sustainable fisheries" correspond with ER_{MSY} or F_{MSY}. However, due to the uncertainty in the underlying mathematical models of population dynamics, the Precautionary Approach (FAO 1995) requires that the use of fishing mortality to provide management advice should not exceed F_{MSY} (Sissenwine 1978, UN 1995, Caddy and Mahone 1995).
- de Moor (2020a) cautioned against setting a TAC based on a desired exploitation rate using the most recently estimated biomass due to the higher uncertainty surrounding a final year estimate. This uncertainty typically reduces once further data become available to better inform the size of, for example, recent year classes. Retrospective runs of the assessment by de Moor (2020b) show that on average (median) the final year's biomass has been overestimated by 13% (14%) compared to the most recent assessment, with an adjustment of 6% following just one more year's data becoming available (Table 1). In other words, the current estimated biomass in November 2019 could be estimated to be 6% lower once the 2020 survey and commercial data become available and could be 13-14% lower after further year's data become available. Had the anchovy TACs been set based on a *desired* exploitation rate, the *realised* exploitation rates would have been 13-14% higher than that intended at the time when the TAC was set.
- Annexure A of Bergh (2020) notes that the steepness of 0.34 estimated for South African anchovy is relatively low compared to all other stocks in the RAM legacy database (this comparison made against all species). Even though the Beverton Holt stock recruitment relationship has been accepted as the best reflection of a spawer biomass relationship for South African anchovy since 2012, this estimate of steepness is relatively robust between alternative stock recruitment relationships (de Moor 2020c) and is determined using what some might consider to be an impressively long time series of data. This further cautions the direct comparison of South African anchovy with other resources.

References

Bergh M. 2020. A contribution to assessing whether the South African anchovy resource is underexploited. Department of Forestry, Fisheries and the Environment: Branch Fisheries Document FISHERIES/2020/MAY/SWG-PEL/38rev.

Caddy JF and Mahone R. 1995. Reference points for fisheries management. FAO Fish. Tech. Pap. No 347. Rome, FAO. 83pp.

de Moor CL. 2020a. Some comments relating to the proposal by FISHERIES/2020/JUN/SWG-PEL/38rev. Department of Forestry, Fisheries and the Environment: Branch Fisheries Document FISHERIES/2020/JUN/SWG-PEL/41.

de Moor CL. 2020b. The South African anchovy assessment with an informative prior distribution on the bias in the hydro-acoustic survey estimates of abundance. Department of Forestry, Fisheries and the Environment: Branch Fisheries Document FISHERIES/2020/JUN/SWG-PEL/40.

* MARAM (Marine Resource Assessment and Management Group), Department of Mathematics and Applied Mathematics, University of Cape Town, Rondebosch, 7701, South Africa.

de Moor CL. 2020c. Further results pertaining to the South African anchovy assessment. Department of Forestry, Fisheries and the Environment: Branch Fisheries Document FISHERIES/2020/MAR/SWG-PEL/15.

FAO 1995. Precautionary Approach to Fisheries. Part 1. Guidelines on the Precautionary Approach to Capture Fisheries and Species Introductions. FAO Fish. Tech. Pap. No 350/1. Rome

Sissenwine MP. 1978. Is MSY an adequate foundation for optimum yield? Fisheries 3:22-24,37-42

United Nations (UN) 1995. Agreement for the implementation of the provisions of United Nations Convention on the Law of the Sea of 10 December 1982 relating to the conservation and management of straddling fish stocks and highly migratory fish stocks. United Nations General Assembly Document A/CONF.164/37 (8 September 1995)

Table 1. The anchovy biomass estimated in the final year of each retrospective assessment (columns) as a ratio of that estimated in the same year during assessments with additional year's data (rows). The average (median) of the biomass estimated in y given data available up to y compared to that estimated given data available to y+1 is 1.06 (1.06). The average (median) of the biomass estimated in y given data available up to y compared to that estimated given data available to 2019 is 1.13 (1.14).

		Year of comparison biomass								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
Final year of data in assessment	2019	1.33	1.14	0.85	0.95	1.13	1.26	1.11	1.18	1.25
	2018	1.30	1.10	0.85	0.95	1.12	1.23	1.08	1.08	
	2017	1.29	1.08	0.86	0.95	1.11	1.21	1.06		
	2016	1.18	0.96	0.94	0.96	1.07	1.09			
	2015	1.17	0.95	0.96	0.96	1.04				
	2014	1.17	0.95	0.94	0.95					
	2013	1.18	0.96	0.94						
	2012	1.19	0.96							
	2011	1.20								

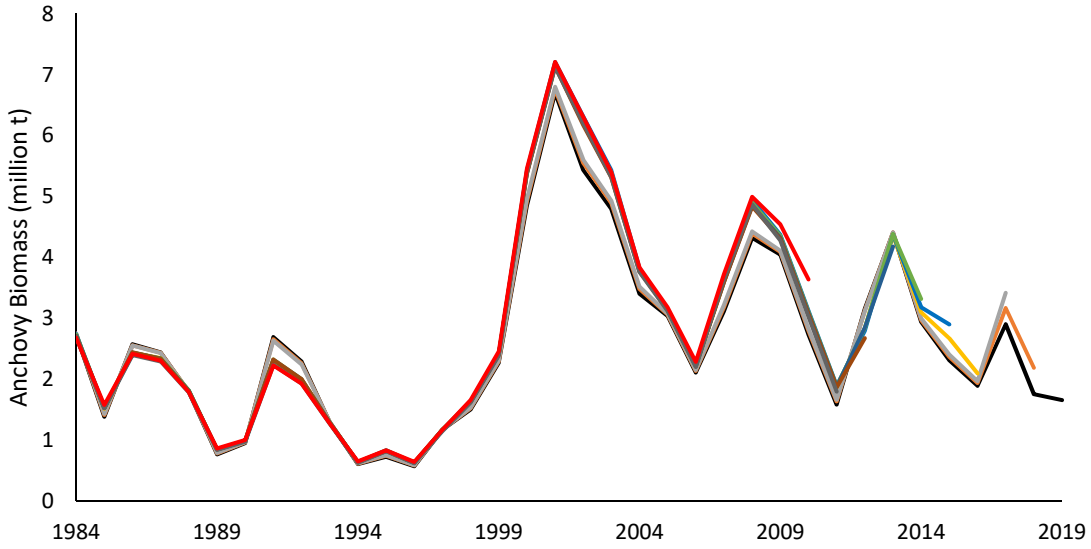

Figure 1. The historical model estimated anchovy biomass (de Moor 2020b), estimated with progressively fewer year's data (retrospective runs).