Objectives for the Management of the South African Pelagic Fishery for Anchovy and Sardine, using OMP-13

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Introduction

During the MARAM International Stock Assessment Workshop in Cape Town, December 2011, it was recommended that clear broad objectives for the management of the anchovy and sardine fisheries would assist good decision making by all stake-holders (Anon. 2011). This document outlines a suggested list of qualitative objectives for the management of these fisheries under OMP-13 in three tiers. The first tier consists of "non-negotiable" objectives, which will in due course be defined quantitatively. A second tier consists of core decision objectives, while a third tier consists of further trade-off objectives. The objectives are split between those which address target resource (i.e. sardine or anchovy) concerns, those which address industry concerns and those which address ecosystem concerns. Naturally trade-offs between the objectives in each of these three sets of concerns will exist. At this stage, assigning quantitative definitions to each objective is not attempted.

"Non-negotiable" objectives

The non-negotiable objectives in the management of anchovy and sardine have historically been incorporated in the "Risk" criteria. The risk criteria consist of two parts: the risk definition and the risk level. In summary, the definition relates to a level of biomass ("risk threshold") to which the future projections are tuned, while the level relates to how frequently future projections should be allowed to drop below the risk threshold during a specified period (historically taken to be 20 years) (see de Moor and Butterworth 2008, de Moor *et al*. 2011 for further details).

An objective process to choose acceptable risk criteria has been established (see eg Anon. 2011 and Appendix D of de Moor and Butterworth 2010) and will be followed with the updated assessments and new MP simulation testing framework.

Core decision objectives

Table 1 lists the target resource, socio-economic/industry and ecosystem core decision objectives for the anchovy and sardine fisheries. For each objective, the performance statistic required to measure this objective is also listed. These core decision objectives are those which will be accorded the highest weight in choosing amongst alternative candidate MPs.

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Trade-off objectives

Table 2 lists the further target resource, socio-economic/industry and ecosystem trade-off objectives for the anchovy and sardine fisheries. Again, the performance statistic(s) required to measure each objective are listed. These further trade-off objectives are those which are to be used as a "third tier" check when choosing amongst alternative candidate MPs and to help inform on trade-offs between competing objectives.

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References

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Table 1. Core decision objectives and corresponding performance statistics. The performance statistics relating to the target resource objectives will be reported in terms of the number of assumed underlying stocks. The performance statistics relating to the socio-economic/industry objectives will be reported by area[1]. The performance statistics relating to the ecosystem objectives will be dependent on the "west" stock 1+ biomass projections for the two-stock OM (Operating Model) and a proportion of the total 1+ biomass (taken to mimic the portion of the stock west of Cape Agulhas) for the single-stock OM.

Concern		Objective	Performance Statistic
Target resource	P1	Avoid the resource declining to an unacceptably low level	Minimum biomass over the projection period : carrying capacity Minimum biomass over the projection period : risk threshold
	P2	Sound resource at the end of the projection period	1+ biomass at the end of the projection period : carrying capacity 1+ biomass at the end of the projection period : risk threshold 1+ biomass at the end of the projection period : 1+ biomass at the beginning of the projection period
Socio-economic/industry	S1	Maximize average directed sardine and anchovy annual catch, subject to the known trade-off between these directed fisheries	Average annual directed catch over the projection period
	S2	Minimize average inter-annual variation in the directed sardine and anchovy catch	Average annual variation in the directed catch over the projection period
Ecosystem	E1	Avoid an unacceptable fishery-induced impact on top predators. (As a first step, it has been agreed that considering the impact of alternative candidate MPs on the dynamics of penguins on Robben Island would be used as a proxy index for top predator/ecosystem impacts.)	Rate of increase of number of moulters of penguins on Robben island over the first 5 and 10 years of the projection period Number of moulters of penguins on Robben Island 5 and 10 years into the projection period : current (this goes to probability of decline), together with same ratio expected in the absence of any pelagic fishing over that period

[1] For the case of a single area TAC and two-stock OM, these statistics can be reported per stock. For the case of a two-area TAC and a single-stock OM, the average annual directed sardine TAC and variation in this TAC can be reported by area, although the catch statistics can only be reported for the single stock.

Table 2. Further trade-off objectives and corresponding performance statistics. The performance statistics relating to the target resource and ecosystem objectives will be reported in terms of the number of assumed underlying stocks. The performance statistics relating to the socio-economic/industry objectives will be reported by area.

Concern		Objective	Performance Statistic
Target resource	P3	If the resource does drop to an undesirably low abundance at any point during the projection period, Exceptional Circumstances should be declared, and on a basis that the probability of false positives and false negatives should be minimised	Proportion of times Exceptional Circumstances are declared and the true biomass is below the corresponding threshold Proportion of times Exceptional Circumstances are declared and the true biomass is above the corresponding threshold Proportion of times Exceptional Circumstances are not declared and the true biomass is below the corresponding threshold Proportion of times Exceptional Circumstances are not declared and the true biomass is above the corresponding threshold
	P4	If the resource does drop below the Exceptional Circumstances threshold, it must recover quickly to above that level	Trajectories of lower 2.5 or 5%ile of the projected biomass will be monitored. (Note that this performance statistic is less quantitative than others and requires "tick tests" of each individual trajectory which performs poorly.)
Socio-economic/Industry	S3	Exceptional Circumstances should not be declared too frequently	Proportion of times during the projection period that the directed TAC decreases below the minimum TAC Average number of years for which Exceptional Circumstances, if declared, are declared consecutively
Ecosystem	E2	Ensure the biomass of sardine remains sufficient over time both west and south of Cape Agulhas	The same performance statistic as used in E1 provides an index of the sardine biomass west of Cape Agulhas For a 1 stock model, which assumes full mixing, and provided that there is no sardine distribution shift away from the south coast, OMP control parameters that secure adequate performance for the west coast penguin performance statistics under E1 would be assumed to also secure such adequacy for predators south of Cape Agulhas For a 2-stock OM, in the absence of a predator model for south coast penguin colonies, biomass proportional reduction statistics for the south stock similar to those required for the west stock to achieve E1 will be used. Average number of years for which observed sardine biomass west of Cape Agulhas remains below a threshold of 336 000t[2], once it drops below this threshold

[2] The threshold of 336 000t corresponds to the index of 0.25 of the maximum historic observed sardine biomass west of Cape Agulhas (Figures 4a, 5a and 6a of Robinson and Butterworth (2012)); their analyses indicate that it is below this threshold that Robben Island penguin natural mortality rates start to increase.

Table 2 (continued).

Ecosystem	E3	Ensure a combined sardine and anchovy biomass sufficient to avoid potential catastrophic ecosystem implications	Proportion of times the future combined biomass drops below a[3] lower percentile of historic (1984-2011) combined biomass Proportion of times the future combined biomass of sardine and anchovy drops below one third[4] of their maximum historic (1984-2011) combined biomass, both in the presence and in the absence of fishing.

[3] The percentile (eg 10% or 20%) will be chosen once the operating models have been completed and the implication of the percentile on historic combined biomass can be determined.
[4] The fraction one third relates to the result on Cury *et al*. (2011) that seabirds experience consistently reduced and more variable productivity below this prey abundance level.