Initial comments on two documents contributed to inform APBMP discussions

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Summary

This document provides brief comments on some aspects of two documents submitted under the APBMP discussion heading for the 22 September PWG meeting, particularly as regards food scarcity being a (major) contributing factor to the decrease in penguin numbers. The simple calculations presented, and inferences drawn, in the second (FISHERIES/2020/SEP/SWG-PEL/94) are suggested to be flawed and misleading, and to necessitate a rethink of the key initial diagram in the draft BMP document which these have informed. Further consideration needs to be given to attempting to quantify the impact of breeding habitat loss on the decline in penguin numbers.

Note: Extracts from documents on which comments are made are shown in *red italics*.

FISHERIES/2020/SEP/SWG-PEL/92

Attaining population stability at some key sites in the metapopulation (like Robben and Dassen islands) may require even bigger gains.

This makes an implicit assumption that requires further discussion. To devil's advocate, should one assume that the Robben and Dassen penguin colonies have viable long-term future prospects (even, say, in the absence of fishing)? Given that the sardine population in the west may currently be in a "low" regime, together with this species' eastward distributional shift, could breeding habitat loss (the reduction in guano nesting sites) mean that these colonies are unfortunately no longer viable and are destined for extinction anyway? Their (temporary?) increase in the 1990's was primarily the result of immigration (likely from Dyer Island) and a brief sardine population boom. Despite much higher anchovy levels this century, these have not seemed to result in much benefit these penguin colonies.

All of these estimates are taken at face value from their respective sources – and their use here is neither meant to reflect an endorsement, nor otherwise, of the methods or models used to generate those estimates.

Fair enough and a reasonable approach to take, though at some stage it will be necessary to address this, as some of these results are arguably flawed.

Robinson et al. (2015) suggested that this is based on the impact of food availability on adult mortality only.

That statement is incorrect. The model allows also for variation over time in juvenile mortality (as a component of overall reproductive success), though that variation showed no correlation with anchovy recruitment.

But there is also another aspect of the Robinson *et al*[1]. model that needs rechecking. The inferences it makes about the impact of reductions in local sardine abundance and their effect on penguin mortality, are driven by the decrease in adult survival rate indicated by penguin tagging data. However, most of those tags were placed in a single year (related to a major oil spill event) , so that the implication of a

[1] ICES JMS 72 (2015) 1822-1833

decrease in survival being due to lower sardine abundance is confounded by the possibility that it was rather the effect of penguins' having a natural mortality which increases with age. Availability of updated data to try to distinguish these two possibilities is a priority.

Table 1: *A summary of the annual percent change in the African penguin population growth rate attributed to various threats/conservation actions.*

This Table omits a key (albeit difficult to quantify) contributor. This is breeding habitat loss, and consequent suboptimal breeding sites. The Table deals only with the potential positive impact of artificial nests.

FISHERIES/2020/SEP/SWG-PEL/94

Regarding reduction in the number of penguin breeders in the Western Cape, as is a key input to the opening pie chart involving allocation of causes of this reduction in the draft APBMP report:

Mortality to seals: 2400 3%
Mortality to oiling: 324 1%
Mortality to food scarcity (balance) 45240 65%

The assumption that all losses of breeding African penguins in the Western Cape between 2001 and 2009, other than those attributed to seals and oiling, was based on extensive monitoring of colonies in the region that showed no substantial mortality from other causes and on publications that attributed heightened mortality to food scarcity, especially following the collapse of the sardine (Crawford et al. 2011, Sherley et al. 2014, Robinson et al. 2015).

The approach used here is flawed, and consequently leads to incorrect inferences.

A population is stable when additions from hatching of chicks (reproduction output) are balanced by deaths from natural mortality. It declines when either or both the first drops or the second increases, and a dynamic model (which can still be rather simple) is needed to capture that. From there one needs to assess the possible contributions of various factors to the reduction in reproductive rate and the increase in the natural mortality rate (and the first two factors in the table above can readily be included in such a calculation).

Effectively the argument presented is that food scarcity is the ONLY factor that can be causing the changes to either or both of these rates that result in a net decline rate. However, that is not necessarily the case. Even at the height of the sardine boom some 20 years ago, 10% of the adult penguins died each year (from what – food shortage?). Penguins, like all (and particularly the smaller) animals in the ocean, are subject to natural predation, and observers are not necessarily going to see every (even most) carcasses (furthermore, other predators may be less choosy than seals about the parts of their prey which they eat). Thus, for example, sub-optimal breeding sites are likely to lead to juveniles which are generally less fit, and hence less able to avoid natural predators. Consequently, breeding habitat loss could, in principle, be accounting for a large component of what is presently being ascribed here to "starvation".

Given the critical perception which the opening pie chart diagram provides for the rest of the draft APBMP report, that chart clearly needs to be radically rethought.