

**COMMENTS ON SHERLEY *et al.* 2018**

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The Sherley et al. (2018) (“RSPB”) paper provides some useful further information about penguin-fishery interactions, and the availability of new data series on chick survival is particularly welcome.

Nevertheless, it is important to appreciate that certain key analyses in RSPB are open to question, or at least require further discussion, before certain results in RSPB might be accepted for informing management recommendations. I summarise some of these reservations below, especially in the light of points made in initial discussion of RSPB in a small meeting held at DAFF, Foretrust on 29 June.

First though, I suspect that there has been a misunderstanding about the 2016 International Panel conclusions amongst some of those present at the meeting on the 29th as regards some of the methods used in RSPB. I do not see the complete endorsement of RSPB (and specifically the random effects estimation approach it uses) in the report of that panel review that some seem to suggest to be the case. Para C.1.3 of the report states only that the results examined passed a necessary test for acceptability of the approach; that does not amount to passing a sufficient test. Furthermore the specific recommendation of the Panel (see Para C.1.5.2) was that further work on disaggregated data (as analysed in RSPB) follow the same approach as in Andrea Ross-Gillespie’s analysis of aggregated data (using the approach advised by the Panel the previous year) in MARAM/IWS/DEC16/Peng\_Clos/P1.

The fundamental matter at issue here concerns accounting for non-independence in disaggregated data in a way that ensures that precision in the form of estimated standard errors is not biased low, so that statistical significance is not mistakenly inferred. The aggregated approach is one standard method to ensure against this. The random effects approach (as used in equations 2.1 and 2.2 of RSPB) certainly takes care of SOME of the non-independence. But the question of why any specific implementation of that approach should necessarily account for all (or even most) of this effect has been repeatedly asked, but has remained unanswered for many years. The practical import of this is that the RSBP’s estimates of standard errors of closure effects are negatively biased to an unknown extent, and therefore cannot be claimed to meet the criterion for establishing that closure would ensure (for a 5% significance level) a positive change to the penguin population trend that is above the agreed threshold level of 1% pa.

There are further issues in RSPB that require either attention, or at least more clarification than was possible in the time available at the June 29<sup>th</sup> meeting. For example, the work by Andrea Ross-Gillespie also indicated the presence of a small sample size effect leading to what was termed a “GLM bias” (present for both catch and closure estimators), which needed to be taken into account in computation of power (and therefore also for detection of whether or not estimates from existing data provided statistically significant results for the effect of fishing

parameter). The possible impact of this bias and taking it into account would seem to still await investigation for the approach applied in RSPB.

Furthermore, the random effects approach rests on the assumption that the associated residuals are iid. RSPB seems not to report the results of diagnostics to confirm this.

The generation of future data to inform on estimation power also needs further clarification, as one interpretation of the brief explanation given in the text of RSPB is that the procedure used is questionable, as is its application within a Bayesian framework. The survival rate model used is also not fully explained.

Some results reported appear contradictory and merit further discussion: for example why does closure improve chick survival at Dassen, but result in worse body condition there. An explanation was offered for this ex post-facto at the meeting on the 29<sup>th</sup>, but that is not very satisfactory given that response variables were originally selected given assurances that they would behave monotonically (at least) to a reduction in fishing.

While certainly there are some results suggestive of a negative effect of fishing on penguin reproductive success (including juvenile survival effects) at Robben, others indicate otherwise (for example the Robinson et al. 2015 model - ICES JMS 72: 1822-33) of Robben island penguins indicates no impact of anchovy abundance on this parameter. All analyses need to be considered in an integrative manner before any conclusions might be drawn as to whether closure of the neighbourhood of Robben Island to pelagic fishing might enhance penguin recovery.