On inconsistencies amongst the rationales offered by Sherley *et al.*, Weller *et al.* and Pichegru *et al.* regarding the impact of fishing restrictions around islands on penguins

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Summary

Queries are raised about the consistency of arguments which imply that both a positive and a negative correlation of catches with measures of penguin reproductive success imply that fishing near island colonies has a negative impact on that success.

Sherley *et al.* (2013, pg 291) argue that the annual catch of a pelagic species in the neighbourhood of an island can be used as an index of the local "availability" (i.e. abundance) of that species. They move on from there to illustrate (their Fig. 3) a positive correlation between penguin breeding success and this argued index of anchovy abundance. Thus bigger catches mean more abundant prey which means penguin reproductive success is enhanced..

Weller *et al.* (2014) based their selection of parameter values for the relationships between penguin breeding success parameters and prey abundance, on relationships such as those in that Fig. 3 (Sherley, pers. commn). Their approach goes on to account for the effect of fishing of the prey species (pelagic fish) on penguins as a reduction in the prey abundance that would otherwise have been present, which hence leads to reduced penguin breeding success. Thus bigger catches mean that the amount of prey is further reduced, so penguin reproductive success is impaired.

Fig. 1 plots the log of fledging success against anchovy catch for the Robben island; this plot evidences a **positive correlation.** From the line of argument above, this indicates that fishing around the island will have a **negative impact** on penguins.

Fig. 2 plots the negative log of foraging path length against sardine catch for the St Croix island, evidencing a **negative correlation**. The line of argument above thus leads to the conclusion that fishing around this island will have a **positive effect** on penguins.

Yet Pichegru *et al*. (2014, pg 7), using these same catch data, arrive at quite the reverse conclusion: that fishing around St Croix has a **negative impact** on penguins.

Clearly the arguments in these two papers, which share a number of authors, are not self-consistent. Their conclusions cannot all be correct.

The basic flaw rests with the assumption by Sherley *et al.* (2013) that catch can be used as an index of abundance of the prey species concerned. As also pointed out in MARAM/IWS/DEC14/Peng/B4, the effects of prey abundance and catch on measures related to penguin breeding success are confounded. The approach in Pichegru *et al*. (2014) to remove this confounding, which is similar to that used by Robinson (2013), is defensible. The arguments made by Sherley *et al.* (2013), in failing to address this confounding, are not.

Thus the inconsistencies between the conclusion by Pichegru *et al*. (2013) regarding the impact of fishing on penguins at St Croix, and that from a combination of the arguments in Sherley *et al.* (2013) and Weller *et al*. (2014), is resolved. The former is defensible; the latter is not, being based on flawed arguments.

In responding to these points verbally during earlier discussion of the above, Sherley argued (if we were understanding him correctly at the time) that the results referenced above did not necessarily reflect an inconsistency, because relationships between breeding success and the effect of catches on prey abundance in the two different regions could manifest different thresholds. However, aside from issues of model parsimony, such a response suffers from incompleteness. If, *a priori*, such different thresholds apply, together with their implied more complex relationships, then (and ideally before any feasibility study or experiment on island closures was initiated), this alternative hypothesis would need to have been spelt out in detail, coupled with an indication of how the parameters of these relations defining these thresholds might be estimated from existing data or data forthcoming in the future. This is not only to be able to address the issue of necessary in-principle falsifiability of any hypothesis put forward, but also to enable power testing of an island closure experiment to determine how long it would need to run to provide sufficient data to be able to discriminate such an hypothesis from others already on the table.

References

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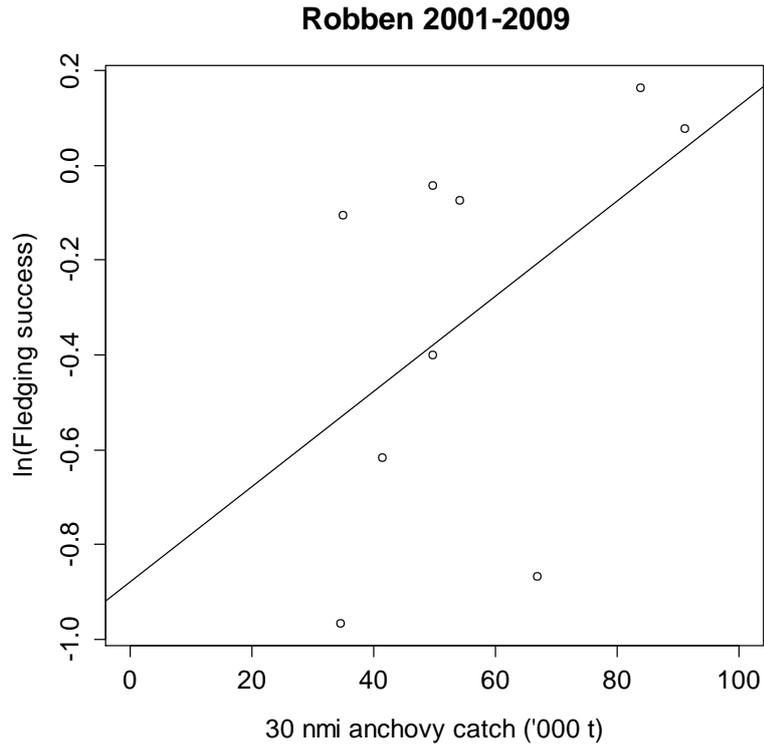
Robben 2001-2009

Figure 1: Log of fledging success at Robben Island from 2001 to 2009 regressed against catch of anchovy in the 30 nautical mile zone.
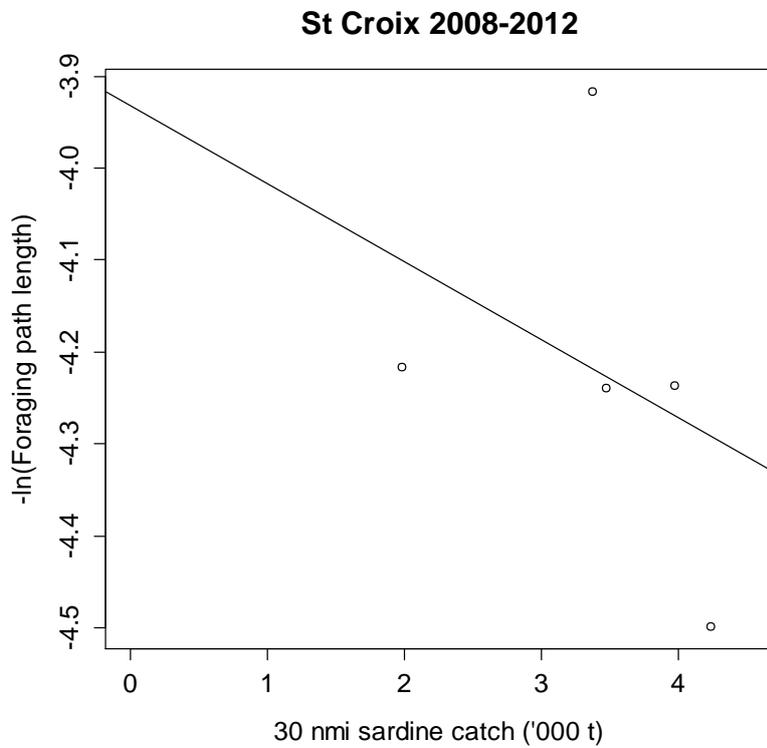
St Croix 2008-2012

Figure 2: Negative log of foraging path length at St Croix Island from 2008 to 2012 regressed against catch of sardine in the 30 nautical mile zone.