

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

Doug S. Butterworth and William M. L. Robinson

MARAM (Marine Resource Assessment and Management Group)
Department of Mathematics and Applied Mathematics,
University of Cape Town

April 2014

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.

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.

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 pointed out in Butterworth (2014, pg 4), 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 very 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.

References

- Butterworth DS. 2014. A composite proposal related to the penguin colony closure programme. Document FISHERIES/2014/MAR/SWG-PEL/ICTT/16rev. 8pp.
- Pichegru L, Ludynia K, Makhado AB, McInnes A, Moseley C, Robinson K, Sherley R, Steinfurth A, Waller L and Crawford RJM / Butterworth DS. 2014. Comments on: Insufficient precautionary management of South Africa's purse-seine fishery for conservation of the African Penguin (FISHERIES/2013/SWG-PEL/ICTT/4) by Pichegru *et al.* Document FISHERIES/2014/MAR/SWG-PEL/ICTT/2b. 20pp.
- Robinson WML. 2013. Modelling the impact of the South African small pelagic fishery on African penguin dynamics. PhD thesis, University of Cape Town. xiv + 207 pp.
- Sherley RB, Underhill LG, Barham BJ, Barham PJ, Coetzee JC, Crawford RJM, Dyer BM, Mario Leshoro T and Upfold L. 2013. Influence of local and regional prey availability on breeding performance of African penguins *Spheniscus demersus*. *Mar Ecol Prog Ser* 473: 291–301.
- Weller F, Cecchini L-A, Shannon LJ, Sherley RB, Crawford RJM, Altwegg R, Scott L, Stewart T and Jarre A. 2014. A system dynamics approach to modelling multiple drivers of the African penguin population on Robben Island, South Africa. *Ecological Modelling*, 277: 38–56.

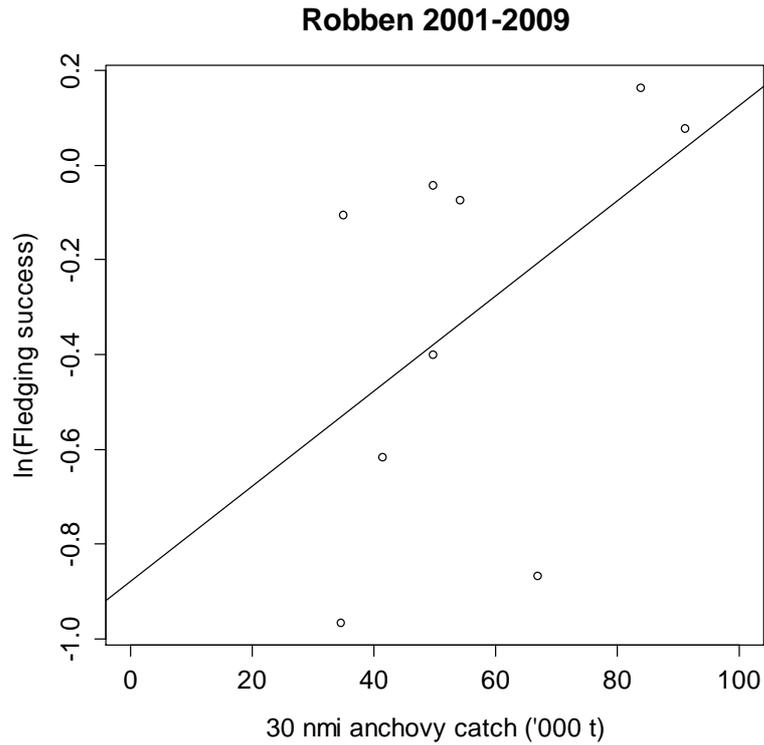


Figure 1: Log of fledging success at Robben Island from 2001 to 2009 regressed against catch of anchovy in the 30 nautical mile zone.

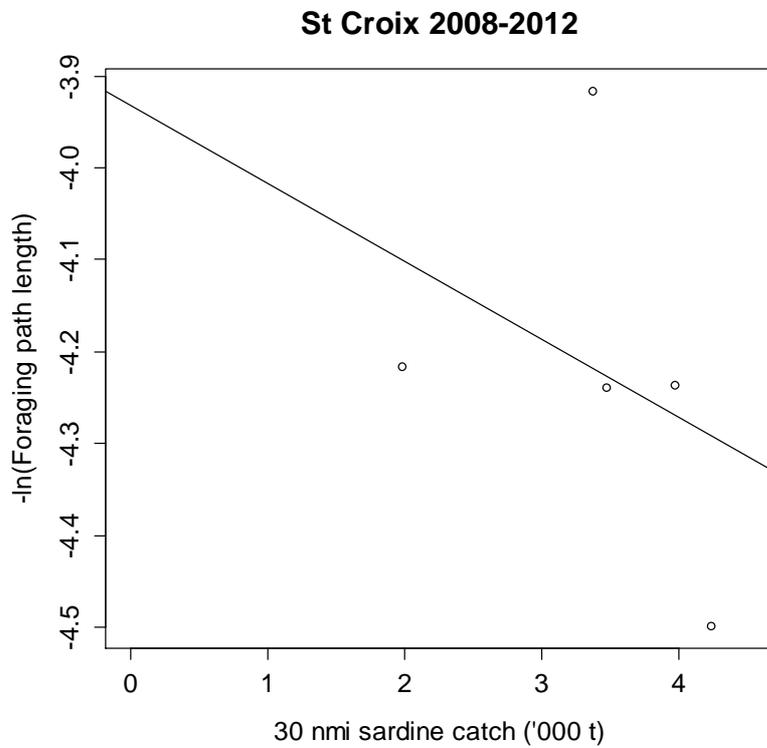


Figure 2: Negative log of foraging path length at St Croix Island from 2008 to 2012 regressed against catch of sardine in the 30 nautical mile zone.