

AN OVERVIEW OF THE MARAM/IWS/DEC14/Peng/B SERIES OF DOCUMENTS

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MARAM/IWS/DEC14/Peng/B1: An Overview of the *MARAM/IWS/DEC14/Peng/B* Series of Documents - DS Butterworth

A brief summary is given of the main contents and conclusions of each document in this series.

MARAM/IWS/DEC14/Peng/B2: A Composite Proposal related to the Penguin Colony Closure Programme - DS Butterworth

Proposals are made in the light of the results of analyses conducted regarding future field and modelling research and action to be taken on island closures. The island closure feasibility study should be concluded as adequate estimates of residual variance to enable power analyses to be conducted have been obtained for all four islands. Dassen and Robben Islands should be open to fishing, but for 2015 St Croix should be closed and Bird Island open, with a further review of this situation a year hence. Future field research, including possibly small scale surveys, should focus on St Croix Island.

MARAM/IWS/DEC14/Peng/B3a: Quantifying the projected impact of the South African sardine fishery on the Robben Island penguin colony (with Supplementary material in Peng/B2b) - WML Robinson, DS Butterworth, EE Plaganyi

This is a document on the verge of re-submission for Journal publication following response to reviewers' comments. It reports the development of a model of the impact of fishing on Robben Island penguins, with the penguin adult survival rate found to be dependent on sardine abundance. Importantly in the context of possible island closures, penguin reproductive success is found to be independent of the abundance of anchovy recruiting at the time of the breeding season (Fig. 8).

MARAM/IWS/DEC14/Peng/B4: Analyses of the Results from the Island Closure Feasibility Study for the Dassen/Robben and St Croix/Bird Island Pairs - WML. Robinson, DS Butterworth, LB Furman

The results from the Island Closure Feasibility Study are analysed using the GLMs agreed at the 2010 international stock assessment workshop. Estimates of residual variance for a random year effects GLM for the various penguin response variables are considered to now be sufficiently precise to enable power analyses to be conducted, so that the feasibility study may be considered successfully concluded. For the Dassen and Robben Islands about 80% of the estimates of the fishing effect parameter λ are positive, with this same proportion maintained for those of these estimates which are significant at the 5% level. Thus the preponderance of the evidence from these analyses is that the impact of fishing around these islands is positive. Analyses for the Eastern Cape colonies suggest a weakly positive effect at Bird Island, but a somewhat stronger negative effect at St Croix. The power analyses suggest that for Dassen and Robben Islands the likely period required for further data collection would typically be in the vicinity of five years, which extends to about seven in the absence of future closures. For the two Eastern Cape islands, statistically significant (5%) results seem unlikely to be achieved in the foreseeable future – a result which may be a consequence of the relatively low levels of sardine catches typically taken close to those islands.

Updated results given corrected and slightly extended foraging distance and duration data will be advised shortly. The Panel is asked to advise whether they would wish results prepared for an alternative basis for the power calculations (time permitting).

MARAM/IWS/DEC14/Peng/B5: Application of the “River Model” to estimate the impact of fishing on the amount of anchovy available to west coast penguin colonies - CL de Moor, DS Butterworth

A simple approach is used to estimate the extent to which the amount of anchovy recruits of the year which would otherwise have been available to penguin colonies off the West Coast during their breeding season has been reduced by past levels of fishing. Results suggest that over the past decade, the extent of this reduction has been small: a median of 5-6% and at most some 25%.

MARAM/IWS/DEC14/Peng/B6: An Analysis of the Small Scale Surveys of ANCHOVY Abundance around Robben and Dassen Islands from 2009 to 2013 - WML Robinson, DS Butterworth

The results from the small scale hydroacoustic surveys of the abundance of anchovy around Robben and Dassen islands over the 2009-2013 period are analysed. Based primarily on AIC_c, the model selected has the same trend in abundance with year for the two islands, compatible with an assumption used by in the GLM analyses of the impact of closures to pelagic fishing around these islands on penguin reproductive success. The abundance estimates from the island surveys, though compatible also with the May recruitment survey trends, show appreciably larger variance. This raises the question of whether these small scale surveys merit continuation, unless it would be possible to increase their frequency considerably - an option which seems logistically impractical.

MARAM/IWS/DEC14/Peng/B7: Comments on the Weller *et al.* Robben Island penguin model simulations, in particular as regards the impact on penguins of fishing restrictions around the island - DS Butterworth and WML Robinson

Some initial comments are provided on the Weller *et al.* (2014) model of the penguin population at Robben Island. Some general concerns are raised as regards the approach as a whole, and the absence of a good fit to the available data. More specific reservations are raised about the quantification of the relationship developed relating penguin egg and chick survival rates to fish abundance, and in particular the associated assumption that a time series of catches provides a reliable index of that abundance. Further comments await more information promised on the basis underlying of the “Expert opinion” advised to have informed the selection of the values of key parameters of the model.

MARAM/IWS/DEC14/Peng/B8: 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 - DS Butterworth, WML Robinson

Queries are raised about the consistency of arguments which suggest 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.

MARAM/IWS/DEC14/Peng/B9: Do Catch-based Indices provide a Reliable Index of Annual Recruitment for the South African Anchovy Population? - DS Butterworth, N Moosa, SJ Johnston

The ability of catch-based measures (both catch itself and measures of catch-rate/CPUE such as catch-per-set) to provide reliable indices of abundance of the annual anchovy recruitment on the South African west coast is investigated. The measures considered for the fishery as a whole reflect at most a 30% increase across the turn of the century, way below the some three-fold increase indicated by the acoustic surveys and population assessment. The same is true for similar measures from catches made close to Robben or to Dassen Island, except when catches within 10 nm of these islands are considered; nevertheless the CVs about the associated relationships are some 70%, which is hopelessly too large to provide reliable predictions of anchovy recruitment. Thus this study has not revealed any evidence to support the suggestion that anchovy catch- related measures might provide meaningful indices of anchovy recruitment abundance.

MARAM/IWS/DEC14/Peng/B10: Responses to Reservations Raised Concerning the GLM Analyses of and Inferences Drawn from the Results from the Island Closure Feasibility Study -DS Butterworth

Responses are provided to a number of reservations which have been raised locally over the past year to the GLM approach for analysis of the island closure feasibility study, and conclusions inferred from the results. The issues covered range from whether catch provides an index of local fish abundance, the Clark model of a relation between shoal size and predation, comparisons with what occurred in Namibia, the appropriate period for which islands need to be closed, an argued need to apply model selection methods when developing the basis for a power analysis, whether a step-function relationship is appropriate for describing the different results from closure vs non-closure of an area around an island to fishing, and what the default conclusion about the impact of fishing near to penguin colonies should be.

MARAM/IWS/DEC14/Peng/B11: Responses to Previous Panel Recommendations on Penguin Research: DS Butterworth, WML Robinson

Brief progress reports are made against each of the penguin-related recommendations of the 2010 and 2011 International Stock Assessment Review Panels.