

**REPORT ON PROGRESS ON RECOMMENDATIONS BY THE INTERNATIONAL  
REVIEW PANEL REPORT FOR THE 2012 INTERNATIONAL FISHERIES STOCK  
ASSESSMENT WORKSHOP**

**26 - 30 November 2012, UCT**

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Report commentary is given in **red bold underlined** following pertinent extracts from the report. However for line fishery-related items, the progress report overlaps a number of issues, so it has been given as a whole commencing on pg 4.

### **Summary of general issues**

#### *Line fishery*

The method outlined in Winker *et al.* (in press) shows considerable promise for standardizing multi-species catch per unit effort data such as for the South African line fishery. Initial simulation testing shows that the method is robust to a range of uncertainties in the way such data are generated. The Panel spent considerable time with the analysts to understand why the method performed well in the simulations, and while many analyses have been undertaken, the Panel identified desirable additional work. Results to date support the conclusion that the method is suitable for application to the South African line fishery, but until further testing is completed it should continue to be applied in conjunction with alternative methods for standardizing multi-species CPUE. In particular, the Panel **strongly supports** comparing the results from the method which treats the PC-scores as covariates with those from a method in which the records by fishing tactic (or group of fishing tactics) are analysed using a hurdle model (i.e., a model which accounts for both the probability of a zero catch and the size of the catch-rate given that the catch is non-zero).

#### *Hake surveys*

The Panel is concerned that *Africana* may be unable to conduct a hake survey during January 2013 and perhaps beyond. Surveys provide indices of abundance that are independent of fishing operations and hence are essentially the only way to identify and correct for effects of changing fishery catchability on CPUE as an index of abundance if such a change is taking place. Moreover, surveys provide scientific data on other issues which are of assessment and management relevance (such as information on the sex ratio of hake, and trends in by-catch species). The Panel therefore **strongly supports** that a survey of some form (see below) be conducted using an industry vessel during January 2013 (even if *Africana* is available), and that plans be developed now to address the possibility that future surveys will not be conducted using *Africana*, given that the vessel is nearing the end of its working life.

If *Africana* is available in January 2013, the primary aim of including an industry vessel in the survey would be to calibrate *Africana* against that vessel, which should use the “new gear” used by *Africana* and be operated to replicate *Africana* as closely as possible. Any calibration data from the industry vessel could be used subsequently to calibrate *Africana* with a new survey vessel should one become available in the future, thus maintaining continuity in the current survey time series. The Panel recommends consulting reports on

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research vessel calibration exercises and develop a Calibration Workplan that can be implemented with industry and / or research vessel replacements for *Africana* (NMFS, 2010; Fowler and Showell, 2009).

If *Africana* is not available in January 2013, the survey using an industry vessel should go ahead as outlined above, but without the calibration to *Africana*. The survey on the industry vessel would then form the first point of a potential new survey time-series should *Africana* be unavailable for future surveys. However, the new data point should not be used in the OMP until a sufficient time series is built up or a calibration with *Africana* is completed. Any sex and length data collected could, however, be used in conditioning the operating model used to select a revised OMP in 2014.

Whatever surveys are conducted in January 2013, the Panel **strongly recommends** that a comprehensive plan be developed as soon as possible to ensure the ongoing provision of scientific survey data for hake (and other demersal species). Such a plan should factor in contingencies concerning the future availability of survey vessels (both industry and government vessels), and the need for calibration between vessels. Priority should be given to ensuring the continuity of comparable survey indices. If future surveys are to be conducted using industry vessels, consideration should be given to the use of multiple vessels and the estimation of between-vessel efficiency. This is particularly important if it is likely that the same industry vessel will not be used for each survey.

The Panel noted that missing surveys potentially impact an application of the current OMP. Such an application should consider the increased risk associated with the missing information, which may require a downward adjustment to the TAC. However, analyses were specified which could indicate that such an adjustment may not be necessary.

***Africana* has remained unavailable since April 2012, precluding any calibration studies of *Africana* versus industry vessel(s)**

**In accordance with the Panel's recommendation, a west coast survey was conducted on an industry vessel (the *MV Andromeda*) in February-March 2013. The resultant abundance indices have not (and will not) be used in the hake OMP until such time as a calibration study with the *Africana* has been conducted, if such a calibration is deemed necessary (to be discussed during the 2013 workshop)**

**In the absence of a January 2013 west coast survey abundance estimate for inclusion into the OMP, an abundance estimate was calculated using the results of the January 2013 BCC transboundary survey conducted by the *Dr Fridtjof Nansen*. This survey encompassed most of the area routinely covered during the *Africana* west coast surveys, and a conversion of the *Nansen* abundance estimate to an "*Africana*" abundance estimate was enabled by the availability of data from several years of co-occurring surveys being conducted by the two vessels on the west coast at the same time of year.**

**It is unlikely that the *Africana* will be available to conduct the January 2014 west coast survey. A request to again use the *Andromeda* for the January 2014 survey, as well as a calibration survey once the *Africana* is operational, has been submitted in accordance with the Panel's recommendation that**

**"a comprehensive plan be developed as soon as possible to ensure the ongoing provision of scientific survey data for hake (and other demersal species). Such a plan should factor in contingencies concerning the future availability of survey vessels (both industry and government vessels), and the need for calibration between vessels. Priority should be given to**

*ensuring the continuity of comparable survey indices. If future surveys are to be conducted using industry vessels, consideration should be given to the use of multiple vessels and the estimation of between-vessel efficiency. This is particularly important if it is likely that the same industry vessel will not be used for each survey”.*

*It is unlikely that the second component of this recommendation (i.e. the use of multiple industry vessels) will be implemented due to the substantial costs and budgetary constraints, so efforts will be directed at developing an *Andromeda* time series that can either be converted to an *Africana* time series (depending on decisions regarding the need for calibrations), or form the basis for a new time series. The possibility of conducting calibration studies among industry vessels (if such studies are considered to be necessary) is being explored.*

*Further advice from the Panel on how best to proceed in these circumstances will be sought during the 2013 workshop.*

## **Linefish**

B.1 (\*) The approach of Winker *et al.* (in press) performs well in the simulations conducted to date. This method should be used to construct standardized CPUE indices, along with methods which involve analysing the catch rate data by fishing tactic (or a group of fishing tactics), and the method of Stephens and MacCall (2004). Comparing the results from the method which treats the PC-scores as covariates with those from a method in which the records by fishing tactic (or group of fishing tactics) are analysed using a hurdle model (i.e. accounting for the information contained in the zero and non-zero catches) is particularly important. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE; Consideration and refinement of simulation trials to test proposed approach.*]

B.2 (H) The probability of obtaining a zero catch appears to change over time for some species. It is therefore necessary to consider models (e.g., hurdle models) which include the probability of a zero catch. If a logistic model is used to model the probability of capturing at least some of the species of interest, care needs to be taken when specifying the reference values for covariates other than the year factor because the values chosen can impact the estimates of trend in abundance. Consider setting the values for these covariates to the medians in the actual data set. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE*]

B.3 (H) Provide standard regression diagnostics (e.g. q-q plots, residuals vs covariates, etc.) for both the binomial and lognormal submodels. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE.*]

B.4 (H) Consider possible Year\*FT and Year\*PC interactions in the log-normal and binomial models to explore whether the estimated abundance trend differs among fishing tactics. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE.*]

B.5 (H) Rather than analysing the entire data set in one analysis, analyse the data by “Group”, where a group is a set of records which are clustered together using, say, Clara. This should provide some insight into whether the problems encountered when applying the hurdle model

are due to analysing data when the probability of capturing a species of interest is virtually zero for a set of records. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE.*]

B.6 (H). The plots of histograms of PC-scores by habitat confirmed that the method was able to discriminate between habitats (where different habitats correspond to different probabilities of capture, and of catchability values given capture, for each species) in the simulation analysis conducted during the workshop. A plot should be created where the PC-scores are plotted by year and habitat to allow an exploration of whether or not trends in overall species abundance over time reduce the ability to discriminate among habitats. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE.*]

**B.7.** (H). Future simulation tests of the CPUE standardization method should consider (1) gear saturation; (2) fishing in multiple habitats during the same trip; and (3) a non-zero (but perhaps small) probability of capture for all species in all habitats. Data sets from the simulations should be compared with actual data sets to “condition” the specifications of the simulations as closely as possible to the actual situation. [*Consideration and refinement of simulation trials to test proposed approach.*]

B.8 (M) Explore if the CPUE standardization of Winker *et al.* (in press) can be applied in other South African fisheries. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE; Consideration and refinement of simulation trials to test proposed approach.*]

**B.9** (M) Develop heuristics to decide which transformation (root 2, root 4, no transformation...) to apply to the proportions of species in the catch, and how many PC-axes to include in the GAM. [*Review approach proposed for taking targeting into account in GLM standardisation of CPUE; Consideration and refinement of simulation trials to test proposed approach.*]

### Progress on the linefish CPUE standardisation

#### GENERAL

Most of the research efforts since last year’s workshop focused on simulation testing of the DPC standardization method (MARAM IWS/DEC13/Linefish CPUE/P1), which addressed recommendations outlined under B1, B2, B7 and B9. It was necessary to prioritise the points below (particularly 1 and 4) by means of further simulation testing. We agree with the other recommendations by the panel, and these will be addressed in 2014-2015.

#### Specific points that were addressed are:

1. The inclusion of zeros in the standardization procedure (B1, B2)
2. Fishing in more than one habitat during the trip (B7)
3. Including a non-zero (but perhaps small) probability of capture for all species in all habitats (B7).

4. Develop heuristics to decide which transformation (root 2, root 4) to apply to the proportions of species in the catch, and how many PC-axes to include in the GAM (B9).

Point 1: Zeros

The panel recommended the application of hurdle models to include the information contained in the zero catches. However, there were severe difficulties to implement hurdle models within the operating model in an unbiased manner. The main problem was that the binomial model is highly sensitive to the reference values of covariates (e.g. medians in the actual data set) when predicting the encounter probabilities.

To overcome this problem, we used a tweedie error model, which is suitable to model skewed continuous data with high proportion of zeros in a natural way (see MARAM IWS/DEC13/Linefish CPUE/P1). The main advantage of the tweedie distribution was that the estimated relative abundance trends were insensitive to the choice of reference covariate values. Preliminary analysis indicated that negative binomial and quasi-Poisson error models performed equally well for cases where the operating model generated catches as discrete counts.

Point 2: Fishing of multiple habitats

The simulation model permits the targeting of up to two habitats during each trip such that the catch composition can represent mixtures of two fishing strategies. This was realized by introducing a 25% probability that an additional habitat is targeted (see MARAM IWS/DEC13/Linefish CPUE/P1).

Further simulation testing might be warranted to explicitly determine a threshold for maximum levels of mixed-targeting within a single trip that can be handled by the DPC, e.g. by increasing the probability of targeting an alternative habitat.

Point 3: Admitting small encounter probabilities across all habitats

This has been resolved and was implemented in the operational model used for the simulation testing by setting the catchability  $q$  to very small values for unfavourable habitats of a given species (see MARAM IWS/DEC13/Linefish CPUE/P1).

Point 4: heuristics for selecting the optimal number of Principal Components (PCs) to be included in the GAM

In general, fourth-root transformations of the catch composition performed consistently better than square-root transformations in terms of accurately estimating the true abundance trend and year effect. The likely reason is that in this way the abundance information contained in the PC predictors is shifted further away from abundance in response variable.

We considered a number heuristics for the selection of the optimal number of PCs for inclusions as predictor variable in the GAM. Standard model selection criteria, such as AIC, BIC and Deviance performed poorly and consistently led to the selection of the most complex DPC model, associated with a heavy penalty on accuracy.

**By contrast, heuristics based on the Eigenvalues of the Principal Components (Kaiser-Guttman rule and Cattell's Scree test) showed promising properties for selecting the optimum number of PCs. Recently, we have tested two additional non-graphical procedures that automatically and objectively choose the optimum number of PCs (This can be presented on request).**

### **Workplan for 2014-2015**

**The primary paper (MARAM IWS/DEC13/Linefish CPUE/P1) has made a good start in testing the liability of the DPC for one fishery.**

1. **Further simulation testing will involve a comparison of DPC vs using Cluster of fishing tactics as categorical variable vs. using bycatch catch-rates as predictors.**
2. **Empirical tests are possible using time series of survey CPUE data from shore-based angling with up to three known and recorded fishing tactics. Here we are going to test the clustering of fishing tactic approach vs. the DPC approach**
3. **The method can be applied to at least three other South African fisheries, including large pelagic longlines (Tuna and Shark), demersal trawl and KZN recreational shore-based shore angling. The results of different standardization methods will be compared.**

## **Surveys**

### *D.2 Hake*

DB.1 (H) The approach in MARAM IWS/NOV12/SURV/HK/P2add is appropriate for evaluating the implications of the impact of survey estimates on the performance of the OMP for the Cape hakes. The current set of results suggests that having surveys in only two out of every three years will not increase risk much, but additional analyses along the following lines are necessary for further understanding of the impact on risk of missing surveys:

- Consider a scenario in which there is no survey for an additional number of years before surveys are conducted again by *Africana*.  
**The effect of no future surveys on projections under the current OMP was investigated - see MARAM IWS/DEC13/Hake/BG5.**
- Assume that the most recent commercial trawl CPUE series are governed by the equation  $CPUE_y = q e^{\beta \cdot y} B_y$ , starting from 1992 (when net lining is assumed to have ceased), and estimate the rate of increase in catchability (there are closed form maximum likelihood estimates for both  $q$  and  $\beta$ ). Use the estimates of  $\beta$  (and their uncertainty) to select scenarios regarding the possible rate of increase in catchability in the future.  
**This will be considered during the present OMP review.**
- Consider a scenario in which new West and south Coast surveys commence in January 2013 and in which the results from these surveys are treated as new indices. This would entail modifying the OMP to specify how the results from a new survey would be used, which may mean that this suggestion cannot be implemented until a full review of the hake OMP is undertaken.  
**This will be considered during the present OMP review.**
- Consider a scenario in which new West and South Coast surveys commence in January 2013 and the results from these surveys are treated as continuations of the existing West and South coast series. Assume that catchabilities for the new surveys



are 20% larger and 20% smaller than the estimates of survey catchability currently used for forecasting.

**This will be considered during the present OMP review.**

- Consider a sensitivity test in which there is a “recruitment failure” (implemented as recruitment deviation of ~ -3) in some future year.

**This will be considered during the present OMP review.**

[Review role of survey inputs to current OMP.]

DB.2 (H) In addition to showing the results of forecasts for the different scenarios regarding the future availability of survey estimates as differences (e.g., in risk) from the reference case, consider re-tuning the current OMP so that the lower 2.5%iles of the depletion distributions for *M. paradoxus* for all years until 2020 are at least as large as under the present tuning for the current reference case. The results from this analysis should be expressed as reductions in catch to achieve the same level of risk. Analyses should be conducted to determine the cost of (a) starting a new survey time-series where the new survey vessel and *Africana* cannot be calibrated, and (b) continuing the current survey series using an industry vessel.

[Review role of survey inputs to current OMP.]

**This was investigated in MARAM IWS/DEC13/Hake/BG5. The cost of a) and b) above was however not determined.**

## References

- NMFS NFSC 2010, Estimation of Albatross IV to Henry B. Bigelow Calibration Factors. NMFS-NEFSC Ref Doc. 10-05.
- Fowler, G.M. and Showell, M.A. 2009. Calibration of bottom trawl survey vessels: comparative fishing between the Alfred Needler and Teleost on the Scotian Shelf during the summer of 2005. Can. Tech. Rep. Fish. Aquat. Sci. 2824: iv + 25 p.
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