Helena Geromont visit to JRC under the scope of the a4a initiative
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1 Introduction

The a4a visiting scientists program has given very good results, by allowing the a4a network to grow sustainability, while simultaneously creating the opportunity to have independent revisions of the methods being developed.

The visit of Helena Geromont, Research Scientist of the Marine Resource Assessment and Management (MARAM) Group (University of Cape Town, South Africa), and mainly involved in management procedure (MP) development and testing, was very productive in getting external expert cooperation and review of the initiative's methods.

The Terms of Reference for Ms. Geromont's visit were:

- Test and revise the a4a HCR approach applied to data limited stocks;
- Training in FLR/FLa4a;
- Application of FLR/FLa4a to South Africa Panga stock;
- Work on the MC simulation used by FLa4a;

2 Agenda

- Day 01
  - Introduction to FLR and a4a
  - Discussion of the ADMB methods used by FLa4a
- Day 02
  - Presentation and discussion of the methodology used for conditioning operating models by FLa4a
  - Seminar "A review of data-poor assessment methods and their application to management".
  - Discussion about the application of the data-limited HCR developed in Jardim (2014) to various stocks.
- Day 03

- Discussion about results obtained with the simulation of the HCR
- Discussion about a4a and its potential applications
- Closing remarks

3 Major subjects discussed

3.1 Training on FLR and FLa4a

A full day of training on the methods developed under FLR and FLa4a was carried out and was warmly welcomed by Helena. The concentration on the R implementation of the methods allowed us to pass along the main features of the FLR code, without having to spend too much time in details of implementation.

3.2 Methods for data poor stocks

Helena's main line of research is on assessment and management methods for data poor stocks. The definition of data poor stocks can range from stocks with no data to stocks with data which is not of enough quality to run an analytical assessment. The a4a stock assessment framework was not developed for these cases. a4a assumes that an statistical catch-at-age type of assessment is justifiable.

Nevertheless, the management side of a4a, based on MSEs which are still under development, considers the possibility of using harvest control rules that don't rely on indicators of stock status derived from analytical stock assessment models.

The work carried out on this subject was focused on the usage of the HCRs published by Jardim, et.al, 2014 (to be published on the special number of Fisheries Research on DLS) and its application to the South African Panga stock.

Additionally, the work by Chato-Osio, also to be published in the same special issues, was discussed. This work uses Productivity and Susceptibility analysis (PSA) to assess the vulnerability of the unassessed Mediterranean demersal stocks and to predict the exploitation status using the available knowledge on the assessed stocks.

A topic of discussion with Helena was also a JRC contribution to the FAO draft report on data poor stock assessments.

3.3 a4a methods for conditioning operating models

The methods developed to condition operating models, which are described in the technical document "a4a approach to stock assessment and management" [CHECK NAME], were discussed. The simplicity of the implementation of a quite complex methodology, was recognized as a major asset of the initiative.

The discussions focused around the need to have distinct methods for the OM and the management procedure. South Africa runs full assessments and uses the operating model approach for the large fisheries. But the rule is to use model-free HCRs, to avoid the instability that stock assessment models may create, and reduce the work load that a model dependent HCR requires, notably yearly stock assessments.

In Europe the usage of model dependent HCR is the rule, although model-free HCR are being though for situations when the stock assessment is not considered of high quality, and dropped by the RFMO's advice.

4 Feedback by Helena Geromont

Monday 3 November

The visit to the JRC Fishreg Group commenced with the FLR developers who gave an introduction to the a4a package. Thanks in particular to Iago Mosqueira who guided me gently through the some simple code options and subsequently gave me the scripts to try out. A summary of the assessment code was given as well as an outline of the projection code, Flash, currently under development. As my interest is management procedure (MP) evaluation, of particular interest was the differentiation in FLR of the operating model from the estimator, or MP (harvest control rule), with FLBiol.R describing the true dynamics of the stock and FLStock.R corresponding to the stock assessment or harvest control rule. The main problem in MP testing is often that information of the operating model (OM) is to known to the estimator (MP). This can become an issue when the same type of model is used to describe the underlying dynamics of the stock (OM) and used in the MP to estimate stock status and management reference points to generate catch advice. From a purely South African MP point of view, the complex assessment model, which fits to quantitative data in the likelihood function, in addition to the incorporation of Bayesian priors based on qualitative knowledge, is typically used as the operating model, while the harvest control rules are generally simple model or empirical rules. The reasoning is that the complexity should be incorporated in the OM rather than the MP. I believe (perhaps wrongly) that the European application is somewhat different, with the MP typically rather complex and age/length-structured, and the fitting to data done in the MP rather than OM.

Afternoon discussions centered on the incorporation of uncertainty into assessments and operating models. Typical assessment problems encountered with auto-differentiating within ADMB model builder (such as a non-positive definite Hessian) were discussed. Ernesto has succeeded in reducing the occurrence by changing the sequence (phases) in which the model parameters are estimated. Another reason for not finding the global minimum of the objective function is sometimes due to some discontinuity in the code. Under such circumstances, an easy check is to call the ADMB executable with a -simplex command. As discussed, the most frequent reason for encountering non-positive definite Hessians are related to the quality of the data being fitted: non-informative data and contrasting trends in data typically result in a flat functional domain with no well-defined global minimum. Under such circumstances it might be worth re-calling the minimization routine, this time leaving out, or down-weighting (increasing the variance), of the problematic data (typically the index of abundance) in the fit.

4.1 Tuesday 4 November

In the morning Finley Scott and Ernesto Jardim gave a presentation of a paper recently submitted to ICES that investigates the incorporation of different sources of uncertainty into the assessment model for the Iberian hake stock (Scott et al. submitted). The discussion centered around how best to incorporate uncertainty pertaining to the life-history parameters into the stock assessment, the correlation between the life-history parameters, their relation with natural mortality, M, and its age-dependence of the latter. Viable methods to evaluate the results/outcomes from different models were also discussed. As model selection based on AIC is not a viable option across these models, model averaging (which assumes that all models are equally plausible) was used to integrate over results. I believe a natural progression for this work would be to use the suite of assessment models as the set of operating models on which management procedures are simulation tested, rather than attempting to apply it as an integrated-assessment. More complex assessments generally do not lead to better, or more robust, management advice (Geromont and Butterworth 2014).

The presentation of my FAO review of simple assessment methods that rely on limited data, described in Geromont and Butterworth (Draft), was followed by a general discussion of data-poor

methods with some suggestions by the group for additions and improvements. Problems associated with the practice of labeling stocks as either data-rich or data-poor was addressed and it was pointed out that most stocks fall somewhere within a continuum ranging from data-poor to data-rich. Furthermore, many of the empirical harvest control rules are applicable to (and have been mplemented for) data-rich stocks. There is also a distinction to be made between limited data and poor data, the latter being a reality for most stocks worldwide. Further discussions with Giacomo Chato Osio and Iago Mosqueira, who co-authored the paper summarising the simulation testing of various catch-only methods (Rosenberg 2014), would certainly prove instructive, in particular to ascertain the merits (and pitfalls) of basing management advice on a catch time series when additional data are lacking or unreliable (for example as applied by Chato to Mediterranean stocks). The afternoon was dedicated to attempting to integrate some harvest control rules proposed by Jardim et al. (In review) into my ADMB projection code for comparative purposes and possible application to data-moderate stocks for which a fairly reliable index of abundance is available. Preliminary results show that the rule based on the confidence intervals of the survey data (CI rule) demonstrates stable performance. Further tuning would be required before comparisons with the performance of other rules are made.

4.2 Wednesday 5 November

The focus of the third day of the visit was to set up a FLR simulation framework for a South African stock and then to perform projections with some simple harvest control rules from Jardim et al. (In review). The stock selected was panga, a bycatch in the demersal trawl fishery for hake, for which fairly reliable indices of abundance are available. However, this stock is also a major component of the commercial linefishery in South Africa for which data are sorely lacking. This stock is therefore labeled data-poor and was selected as an example stock for application of some harvest control rules described in the FAO datapoor draft review. For comparative purposes, Ernesto and Iago kindly offered to simulation test some HCRs for this stock using the FLR framework and the FLR life-history generator. A central Git repository has been created for the work to enable me to access and use the source code after my visit to the JRC. The initial assessment, based on the life-history parameters alone, indicate that the stock is prone to over-exploitation with low probability of recovery because of its longevity (and relatively high age-at-maturity) and low productivity (low K). Suggestions by the JRC scientists are that the life-history parameters are perhaps not well estimated and do not describe the species: the parameters correspond rather to a deep-sea species (please note that the biology parameters are based on dated research). Initial deterministic results compare performance of three HCRs based either on a panga survey index or, alternatively, mean length of catch data. While the ICES ratio rule are unable to rebuild the panga biomass, the length-based rule and CI rule perform much better in keeping TAC advice reasonably stable while at the same time recovering stock biomass levels. Thanks to Ernesto and Iago for simulating the SA panga stock and providing the source code for further investigation.

I would like to thank all members of the JRC FISHREG Group with whom I had the pleasure to interact. May the visit spawn fruitful future collaborations!

Helena Geromont

5 Bibliography

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