Richard Hillary visit to JRC under the scope of the a4a initiative, Ispra, 14-15/May/2012

May 31, 2012

1 Introduction

As agreed previously, the a4a initiative is promoting a programme of visiting scientists with the aim of getting external expert cooperation and revision of the initiative's tasks. The visit of Richard Hillary (CSIRO, Australia) expert in modelling and Management Strategies Evaluation was considered of major relevance.

2 Agenda

- Day 01
  - Presentation on non-parametric models for data-limited stocks
  - Presentation of the a4a initiative
  - Presentation and discussion about the a4a assessment model
  - Discussion on Bayesian methods and applications in EU
  - Planning of work on extensions of FLR and implementation of Bayesian methods
- Day 02
  - Open seminaire to JRC on the development of MSE and Management Plans for South Pacific Bluefin Tuna
  - Discussion on current status of MSE development in EU
  - Discuss a4a proposals and possible cooperation
  - Discussion about the implementation of MSE for IOTC.

3 Discussion

The a4a's objectives, progress and ideas were discussed. See section 5 for Richard Hillary's feedback and comments. The opinion was supportive and considering the initiative relevant, not only for Europe but for many other areas where similar problems exist.

The model presented by R.H., a non-parametric biomass dynamic model, was developed to be applied to stocks with reduced information. It matches the a4a objectives regarding the development of a stock assessment model to be deployed on moderated data stocks. An attempt to include the

model on a4a model testing will be carried out for which it will be necessary to further develop some automatic model settings.

The a4a statistical catch at age model was discussed and was met with positive feedback. The idea of integrating out linear parameters to reduce the size of the optimization was considered a good idea. The fact that this allowed structured random effects to be implemented for catchability (smooth selectivity functions) and recruitment (auto-correlation) without much increase in the number of parameters in the objective function was seen as a nice addition and if it did not take much more investment in time would be a worthwhile addition to the functionality of the model. Modelling the log link rather than on the log scale was briefly discussed (this would allow zero indices and catches to be modelled directly), the issue of zero catches was not considered a big enough problem to warrant the increase in model fitting time that would result from such a change. Approximating the distribution of the model parameters by a multivariate normal with variance matrix based the Hessian at the mode of the objective function was considered a good first approximation given that the likelihood is normal. However, if there were concerns about this the problem could be cast in a Bayesian setting and samples from the posterior distribution of the model parameters could be achieved using an MCMC with proposal distribution given by a multivariate t-distribution on 2 degrees of freedom using the previously computed variance matrix.

Regarding Management Strategies Evaluation (MSE) the Southern Bluefin Tuna process was described in an open seminaire to JRC. The discussion about MSE continued in a smaller group afterwards. Specific solutions to common problems in the EU area regarding the development of MSE were discussed:

- Stocks with short time series - A recent paper[1] deals with this issue.
- Short time for development - The meta-MSE approach suggested by New Zealand is one possible approach but it's a major task and requires a long time to simulate all scenarios. In Australia there's a clear management system [2] which makes development easier, once that it's not necessary to agree on HCR or other management options and all actors know the system, which improves communications. This is not the case in Europe. In general, having a limited time for development will always result in sub-optimal analysis and limited quality advice.
- Missing catches - One possible approach is to use distinct levels of over-catch in robustness testing. OM conditioning will always be a problem if total removals are unknown.
- Year lag between assessments - In the case of bluefin the catch for the next three years is set during the assessment year. There's some adjustments that can be made every year, as long as they're within the inter-annual variability boundaries and the cumulative catch over the period is constant. The alternative would be to have a strategy for the period between assessments, *e.g.* reducing F or increasing SSB by some amount.

Given his experience with the development of MSE procedures and his past involvement in IOTC, work on IOTC MSE was discussed with Dr Hillary. The development of operating models for IO albacore, for which no reliable stock assessment could be used as basis, could be based on simple population model with the following characteristics:

- Biological parameters inferred from work on South Pacific albacore soon to be published by CSIRO.

[1] Bentley, Nokome and Langley, Adam D. 2012. Feasible stock trajectories: a flexible and efficient sequential estimator for use in fisheries management procedures. CJFAS, 69:1, 161-177. http://www.nrcresearchpress.com/doi/abs/10.1139/f2011-143

[2] Smith, A., Fulton, E., Hobday, A., Smith, D. and Shoulder, P. 2007. Scientific tools to support the practical implementation of ecosystem-based fisheries management. ICES J. Mar. Sci. 64:4, 633-639. http://icesjms.oxfordjournals.org/content/64/4/633.full

- Two are structure able to accommodate changes in effort due to piracy and the increasing catches on fresh tuna longliners from Indonesia.
- Movement hypothesis linked to oceanographic conditions and age distribution in catches.
- Seasonal model to include the yearly migrations around the subtropical gyre.
- TWN CPUE as main index of abundance, but alternative trends well covered in robustness trials.

Contacts will be made with CSIRO experts on S Pacific albacore for collaboration with IOTC work.

4 Cooperation with a4a

Options for collaboration with a4a were discussed and the following tasks were identified as possibilities:

- Involvement on a4a model development
- Include the non-parametric biomass dynamic model on the a4a model testing exercise
- JRC visit for 2/3 weeks in March 2013
  - collaborate on the analysis of model testing results
  - collaborate in MSE development
  - course on advanced stock assessment
  - prepare paper or presentation on a4a modelling work

5 Feedback

The a4a initiative is of fundamental relevance not just to the majority of EU stocks, but to the majority of stocks around the world. The stocks of commercial interest all over the globe mostly fall into, or are slightly below, the a4a data specification range. For obvious (but sometimes slightly disappointing) reasons the major focus of stock assessment development and MSE work has been placed towards the data-rich end of the spectrum. What this initiative does is make a clear statement about where the focus should now move to, and not just as a matter of necessity given the data collection processes going on within the EU. There has a been a wide acknowledgement that we should also be working on the data not-so-poor to data-poor areas where we could do something quantitative in relation to stock assessment, but given it is not data rich that actually requires some further thought and tool development.

The team leading the a4a initiative at the JRC has made a number of advances that deserve attention:

- Made a clear definition of where the focus of the initiative is. Often, vague problem definitions are the primary cause of when similar programs tend to either fizzle out or spread themselves too wide and ultimately fall short of their initial goals. Having spent some time defining the basis of the problem will likely make the resultant (non-trivial) process of tool development and testing much more tractable.

- Made contact with a wide range of international and cross-discipline scientists which will both aid in the dissemination of the work and hopefully strengthen the core details of the work as well.
- Made the sometimes difficult decision to develop a purpose-build assessment model structure with the specific problem in mind.

To further add to the last bullet point above:

There are, to date, a number of efficient and very flexible stock assessment "black-box" software packages available (Stock Synthesis, CASAL, Multifan-CL) and, from experience, there is often pressure to use one of these packages if one is thinking of undertaking age-structured stock assessment work. One of the main issues that a number of people have experienced is that this often requires tailoring the data and the problem to suit the assessment package, which is the wrong way round. These packages are 'top-down' in the sense that they can often handle a level of complexity far beyond most assessment needs in some senses, but minor specificities of each given problem cannot always be accommodated satisfactorily. The proposed a4a model has a number of potential advantages that make the development of such a specific tool worthwhile. Perhaps the primary advantage is that it has a 'bottom-up' ethos, in the sense that the complexity is being built in as required and not pre-specified in an often confusing array of switches and options. In a mirror of the Einstein quote, it will be as complex as it needs to be, but no more. The level of attention being given to making the model computationally tractable and, hence, testable, is also to be praised - it does not matter whether it is a simple empirical management procedure or a more complicated assessment model, to be able to test it and have some faith that it works for the given problem automatically makes it preferable to a more complex untested approach.

In summary, I think the a4a initiative can be expected to a have a significantly positive impact within the EU but also in the wider fisheries milieu. These are problems that all fisheries and fisheries scientists face, and are beginning to realise need more work. My institution (CSIRO) has confirmed their support of the approach and my involvement with it and I look forward to future collaboration.