Agenda Item G.2.a
Attachment 1
September 2007

Suggestions for generic topics for "off-year" workshops

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Given there is a scheduled meeting to discuss workshop topics for 2008, Steve Ralston asked if I would make some notes on issues which I thought could be considered for the workshops. There have certainly been a number of important generic issues which have arisen during the 2007 STAR Panel meetings – which do need to be addressed.

I am not convinced that previous workshops have been as effective as they might have been in addressing generic issues. I know that some good work was presented at the 2006 workshops, but I get the impression that there was less than a fully coordinated approach taken to solving identified problems.

I see two potential extremes in the process that could be used for the 2008 workshops.

One extreme goes like this: there is an announcement to potential participants that there will be a workshop on such and such a theme; a date and venue are specified and people let the organizer know if they want to present something; everyone then gets together for the day, there are presentations, a general discussion, and some conclusions and recommendations are made and written up in a report.

At the other end of the spectrum: specific topics are identified for a workshop (with an identified theme); projects are defined, in each case, with a detailed specification of the problem that needs to investigated/solved; researchers with the requisite skills are identified and contracted to work on the projects; the researchers present their results at the workshop; there is a general discussion, and some conclusions and recommendations are made and written up in a report.

I believe that the latter approach is preferable to the former. I suspect that the 2006 approach was perhaps closer to the former than the latter.

Below I list some issues, under general headings, which I think could be usefully addressed by some funded projects – the results of which could be discussed at workshops. Alternatively, perhaps a workshop is needed to discuss research priorities and make recommendations on projects to be funded. I am not familiar with your research planning procedures so it is difficult for me to judge. I am well aware, that several issues have been identified many times and the same recommendations have been made by STAR Panels, year after year.

Data accessibility and catch histories

It is somewhat inefficient for assessment authors to rely on the composition of STAR Panels to inform them of relevant data sources for their assessment. By the time the STAR Panel has convened it is often too late to obtain relevant data, let alone to include it in the assessment.

- Establish a *meta* database of all data relevant to groundfish stock assessment. The database should include enough detail about the nature and quality of the data that a stock assessment author can make a well informed decision on whether it could be useful for their stock assessment.
- Establish *accessible* online databases for all data relevant to groundfish stock assessment, so that assessment authors can obtain the *raw* data if required.
- Establish a database for historical groundfish catch histories, "best" guesses and estimates of uncertainty (and processes for updating and revising the database). There must be a coordinated and comprehensive approach to developing this database (it must *not* be a compilation of individually constructed catch histories.)

Abundance indices

With many fisheries under severe regulation it is difficult or impossible to monitor abundance using fishery data. Fishery independent abundance indices are needed. A number of trawl survey indices are developing but there are also a number of important species which are poorly surveyed by trawl. Other methods are needed for these species.

- Consider all species and stocks which need to be monitored.
- Identify which species are adequately monitored by current time series and which are not.
- Identify suitable methods for species which are not adequately monitored.
- Develop a prioritized schedule for conducting the required surveys (development of new time series or continuation of existing time series).

Triennial time series

The Triennial trawl survey has had a shift in timing. The surveys fall into two blocks: mid July-mid September timing for 1980-1992; and June-mid August timing for 1995-2004. Within the second block there is a trend towards earlier start dates and finish dates with the 2004 survey being the earliest. The 2004 survey is also notable for many species showing very large increases from 2001. Further, for some species the Triennial survey is unlikely to adequately sample the population. These species need to be identified. It is unacceptable to throw everything into the stock assessment model and hope that something sensible will emerge. Discernment is needed.

Conduct a comprehensive multi-species study of the Triennial trawl survey results:

- check for years with unusual "catchability" (i.e., do "too many species" show a marked increase or decrease in abundance in some years – look for indicator species which are less likely to have been affected by fishing)
- identify species for which the survey cannot be expected to provide abundance indices (those with higher densities on non-trawlable ground; those that are "too" semi-demersal; those which have highly variable catch rates)
- check for day-of-year effects for species for which abundance indices are defensible (e.g., perform a GLM on the Triennial survey data; GLM on NWFSC survey data; examine seasonal CPUE in fisheries data)
- if necessary incorporate day-of-year effects into the GLMM analysis used to produce abundance indices
- consider approaches to using the abundance indices from the Triennial survey in stock assessment (e.g., seasonally corrected or splitting the time series into two blocks).

Development of informed priors

Ideally, an informed prior should be developed for the proportionality constant (q or "catchability") associated with each abundance time series used in a stock assessment model. This is often done for fishery independent surveys but can, in theory, also be done for CPUE indices which retain some measure of units. Even if a prior is not used in the estimation model, it is a necessary to have it before the estimated value of q can be used as a legitimate diagnostic. Many times I have heard people say "that value of q is just not plausible". They clearly have in their mind an "informed prior", but it may be very uninformed in that they do not have a clear understanding of all of the factors that affect a particular q. The correct equations need to be used in the development of informed priors for survey qs. Ancillary data needs to be made available to help bound some components. Expert opinion will also be needed. Groups of related species are best done together (as they will share ancillary data sources and experts will have opinions on the relative values of their components).

I suggest that trawl surveys for groundfish be tackled first:

- identify defensible trawl survey abundance time series for a range of species (and stocks)
- identify the appropriate equations for trawl survey qs for each stock (e.g., proportion of non-trawlable ground will matter for some species and not others; as will their relative densities on trawlable and non-trawlable ground)
- identify, collate, and analyze relevant sources of ancillary data on the parameters within the equations
- identify *small* groups of experts to develop ranges and "best guesses" for each parameter (and hence to priors for each trawl survey q)

Recreational CPUE indices

For some important recreational species, there may be little choice but to use CPUE indices despite the imposition of regulations. However, it is crucial to have the full context within which to interpret and analyze CPUE indices. For many species, the same type of data are available and the same regulations have been implemented. Therefore, it would be efficient to do a comprehensive study over the whole recreational sector.

- Conduct and publish a full descriptive analysis of the recreational fisheries and fleets for CPUE interpretation (not limited to "groundfish trips" – interactions with other target species are important).
- Develop standard and validated methods for producing recreational CPUE indices which deal with the peculiarities of the recreational data and regulation changes. (The method of Stephens and MacCall for filtering recreational fishing trips is promising but remains largely unvalidated.)
- Specifically consider the use of random variables as explanatory variables. These have been used as proxies for habitat, but they introduce the "errors within variables" problem, and potentially may remove valid biomass signals from the response variables.
- Specifically consider the use of combined models (binomial model combined with a positive catch rate model) and whether they are robust to non-biomass factors that could drive the occurrence of zeroes.

Stock assessment modeling issues

Use of age and length data

The whole issue of how best to use age and length data in a stock assessment has not been resolved. The over-riding consideration for addressing these issues is whether the approach leads to a "better" stock assessment or not. Often, assessment authors appear to strive for greater reality through greater complexity and the inclusion of each and every data source that could conceivably be relevant. More data and more complexity does not necessarily mean a "better" assessment. There is much work that could be done looking at the following questions:

- What are the appropriate statistical distributions to use when modeling length and age data? (Properties of the data must be examined analytically and/or through bootstrapping.)
- If multinomial distributions are appropriate, how should effective sample sizes be determined (the existing equations of Stewart and Miller are not based on the observation error inherent in the data – rather on modeling choices and assumptions made in the 2005 stock assessments – again, analytical and/or bootstrap methods are needed).
- How should non-independent age and length data be jointly tuned? (E.g., when an age sub-sample of a length frequency is included as conditional age-at-length data, together with the length frequency.)

- Is it always best to estimate growth within the model? If so, how much conditional age-at-length data is desirable?
- How much violation of the assumption of constant proportions of age-at-length is allowable in conditional age-at-length data, before seasonal growth should be modeled? (E.g., when fish are growing during the sampling period.)

Estimation of R_0, recruitment deviations, sigmaR, natural mortality, and steepness
It is not clear how best to determine which year to start estimating recruitment deviations. Nor is it clear how best to estimate sigmaR (should sigmaR be tuned or not?). Estimation of steepness is also a thorny issue, as is the imposition of a stock recruitment relationship. Natural mortality is of course another problem.

There are least three general ways to configure a "forward projection statistical stock assessment model". An integrated model with a fully specified catch history and internally consistent relationship between R_0, recruitments, stock recruitment relationship, and B_0 can be configured with or without a penalty forcing recruitment deviations to follow the stock recruitment curve (in the latter case, recruitments are simply estimated to best fit the data and the stock-recruitment relationship is an output of the results). A third alternative is to start the model in a non-equilibrium state when data first become informative (and hence a full catch history is not needed).

It would be useful if some guidance was available on when different configurations were preferable – in terms of the conditions under which each method delivers the most "reliable" estimators. Some help will be available in the literature but there are no definitive studies. Retrospective analysis and bootstrapping methods are *not* adequate to investigate these questions. Nothing short of a full simulation study with a "complex" operating model and alternative (simpler) estimation models will do. A number of generic stock assessments will need to be simulated over a multi-dimensional operating model space (e.g., different true values of R_0, steepness, natural mortality, sigmaR, etc) to investigate the relative performance of the alternative estimators (in terms of accuracy – not just bias) and their robustness to violation of estimation model assumptions.