Report of the Training Course: Stock Assessment Advanced (TCSAA2010)

1-5 February 2010

ICES Headquarters, Copenhagen

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Contents

Participants at the course "Stock Assessment Advanced" conducted 1-5 February 2010 at ICES Headquarters in Copenhagen. The course was given by Richard D. Methot Jr. (USA) (instructor); Chris Darby (UK) (instructor); James Ianelli (USA) (instructor).

Report of the ICES Training Course Stock Assessment Advanced,

1-5 February, 2010

by

Richard Methot, Chris Darby, James Ianelli

1 Summary

A course in advanced stock assessment topics was held at ICES headquarters during Feb. 1-5, 2010. 32 students from 14 nations participated in the course. Three primary topics were covered during the week of presentations, demonstrations, and hands-on sessions. Richard Methot focused on introducing participants to the Stock Synthesis assessment program. Jim Ianelli presented a general introduction to separable models and graphical methods for investigating patterns in data. Chris Darby led the class through data investigation methods and use of diagnostics for XSA. The first three days were scheduled with lectures on data screening, model concepts, interpretation and application. The last two days had a greater emphasis on user analysis of example data sets and work on the data that the participants had brought with them. The ICES SharePoint provided a very efficient system for distributing course materials to the participants.

Presentations on how to present results from actual stock assessments were illustrated. Here the emphasis was to show the available data in a comprehensible way and, importantly, how data affect assessment results and trends in quota recommendations. A number of ways of projecting assessment results were presented. This included a brief introduction to management strategy evaluations and their relationship to control rules used for management.

As an exercise, and to illustrate integrated analysis concepts, a spreadsheet model was assembled and distributed to work with throughout the week. This provided a way of showing differences with fitting an age structured model to diverse data, and the use of different likelihood functions (i.e., lognormal compared to multinomial fitting for age (or length) composition data. This model was also extended to show how projections can be implemented to evaluate alternative harvest rates. A third example from this included examining the impact of shifting age at selection relative to harvest rates to show yield isopleths from a simple Excel model.

Examples of processing extensive fishery data sets were distributed with a subset from a real fishery (with actual values simulated to avoid confidentiality issues). Accompanying this dataset was an example of how fishery data may often include erroneous records or observations from vessels that may only have participated in the fishery briefly and hence may be unsuitable for including in a CPUE index analysis. The step-by-step script that was provided highlighted where analytical issues can arise. Importantly, it provided some basic exploratory evaluations including finding appropriate transformations of CPUE data.

The course emphasized examining input data (data processing/exploration) and output diagnostics. For the integrated analysis in particular, the importance of under-

standing uncertainty in observations was highlighted. Evaluating input sample size estimates (governing the degree of observation error for compositional data) was illustrated. The sensitivity of assessment model results (along with quota management control rules, if they exist) was illustrated via retrospective patterns and the effect of adding new data. The importance of transparency in presenting results to managers and stake-holders was emphasized.

The sections on Stock Synthesis (SS) started with a general introduction to the concept of integrated analysis which is based on forward simulating models and which are capable of using a wide variety of data types for calibration of the model. The SS presentations included a wide range of examples: a simple configuration that mimicked a biomass dynamics model, using both size and age data, partitioning catch into discarded and landed portions, and use of multiple areas with movement among areas. Additional topics included an examination of time-varying catchability for a CPUE time series, and use of generalized size composition data such as catch by weight category. The North Sea plaice data set was used as an example for configuring SS in a strictly age-structured mode and it produced results that were very similar to those from XSA. This collection of SS presentations provided an overview of the model′s capabilities, but not an in-depth, hands-on opportunity, although some students produced complete SS models for their data by the end of the week.

Challenges:

The range of students was extremely varied with some coming direct from the beginner′s course and many with several years experience in modeling and analysis. The range was perhaps too wide in that it presented a significant challenge in giving all participants an understanding of the model structures and concepts and keeping them involved in the course at all times.

Coverage of 2 different assessment approaches (Synthesis and XSA) generated excellent discussions but may have been confusing for some students as a result of the range of abilities. There may be scope for running a current assessment methods course looking at methods ICES is using and a workshop looking at methods ICES could be moving towards.

Logistics:

The number of participants on the course was just manageable given the size of the meeting room, the range of computer hardware, directory structures etc. These resulted in initial setup problems, but once overcome the facilities, sharepoint and network systems worked well and facilitated efficient distribution of information prior to and during the course. The ratio of students to instructors was especially difficult when assisting individual students to set up new models on their computers. It would be advisable to run the course with fewer participants in future years.

2 Recommendations

The diversity of assessment methods used in ICES is growing. For example, WKROUND 2010 reviewed five assessments: two use XSA, one uses a statistical catch at age method, one uses Stock Synthesis, and one uses GADGET. This diversity poses a tremendous challenge for the review panels and highlights the importance of

the Training Programme's goals. This first class in advanced stock assessment methods was designed to improve understanding of current ICES assessment practices through sessions focused on advanced use of XSA diagnostics and data exploration. The class also presented new assessment perspectives including an introduction to Stock Synthesis. In retrospect, this breadth was overly ambitious for one training session, especially given the wide range of interest and preparation among the class participants.

The concept of "Advanced Stock Assessment" is a broad umbrella that covers data analysis, fishery evaluations, statistics, computation, mathematical modelling, and policy advice. Consequently, covering an appropriate mix of these topics with hands-on exercises for such a large and diverse group of students was challenging. We suggest that future courses in advanced stock assessment focus on a narrower range of specific topics. This would make it easier to define a set of prerequisites for the class participants and to limit the size of the class to a more manageable number; closer to 20. Some of these courses could be run for just three days, rather than trying to get too many topics into five days and maxing out student's ability to learn.

Other planned training classes include Management Strategy Evaluation and Bayesian Analysis, both of which are focused topics within advanced stock assessment. There also is probably a need for an intermediate class to follow-up on the topics in the introductory class and to prepare students for the focused topics of the advanced classes. The topics covered in the first Advanced Stock Assessment class could perhaps be divided into 3 more focused sessions:

Age-Structured Methods

Cover age-structured models (XSA, ADCAM, various separable models) currently used in ICES and comparable models from the NOAA Toolbox. Include a detailed comparison of XSA to a separable model using an example.

Size-Structured Methods

Stock Synthesis, GADGET

Data Analysis

Development of catch-at-age, CPUE calibration, spatial analysis and data exploration.

Some suggestions for improvement of the course by participants: To participants the course seemed a little unorganised i.e. no clear pattern of what was being presented. It was useful to be exposed to alternative methods being used, but more guidance on how to select appropriate models for the data you have would have been preferred. As the expertise in the group was very different, a structure with presentations in the morning and then parallel hands on exercises on the same topic but at different levels would be good. So people can choose which exercise matches their level of expertise.

The course was too much "this is my model and how can I make the data work in the model" and too little "what do my data tell me and how can I use them".

It seems that the attendees to this course could be split in to two camps: firstly those who work with XSA and would like to learn more about the applications of SS, including a more technical analysis; secondly those who would like to learn more about different advanced methods for stock assessment (less focussed on XSA and SS and

compare and contrast with other analytical methods). Maybe there should be two different courses to satisfy each of the above? i.e one comparing the outcomes and applications of different methods for stock assessment (possibly based on two or three different datasets). Another would focus on XSA and SS.

Develop a written tutorial for the simplest case of stock synthesis if possible - presented early would allow participants to complete a run of the model. This came together by the end of the week but initially the model was quite overwhelming in its complexity.

The stock syntheses work was good, but it assumed a higher degree of basic statistics than I have. Some guide as to underlying statistic beforehand would have been good so you could prepare beforehand.

Maybe zip up all files on share point for easy download? (i.e. blackfin input files).

3 Course description

Objective

The general objective of this course is to provide additional training for stock assessment scientists who are familiar with the basic techniques of fishery stock assessment. The course will present the mathematical background to the techniques, as well as software packages developed to implement those techniques. Trainees will apply the techniques to case studies relevant to the ICES area. The specific learning objectives for the course are:

1) Understanding the principles behind constructing population dynamics models and identifying their associated estimation methods.
2) Experience using techniques to summarize and plot fisheries data.
3) Experience with the XSA through FLR.
4) Experience with Integrated Analysis through Stock Synthesis which estimates confidence distributions for stock abundance and productivity parameters (see Figure).
5) Familiarity with decision analysis as a means of summarizing the outcomes from stock assessments.

By the end of the course, the participants will:

- Be able to summarize raw fisheries and survey data in a form that can be included in common stock assessment packages.
- Be aware of stock assessment methods based on Virtual Population Analysis and Integrated Analyses, as well as how and when to apply these methods.
- Have a working knowledge of XSA and Stock Synthesis.
- Be able to use the results from stock assessments to document the trade-offs between alternative catch limits given stock assessment uncertainties.

4 Course Programme

The five-day course is organized as a series of morning and afternoon sessions. Hands-on exercises will be linked to each topic and scheduled throughout the course. Assignments will be conducted in the open-source programming language R, the FLR package, and the SS package.

	AM	PM
Mon	Intro, Opening Presentations	Getting to Know Your Data
Tue	Data	Intro to Stock Synthesis; Age Structured Production Models
Wed	XSA	Semi-Separable Integrated Analysis
Thur	Stock Synthesis Approach to Plaice Data	Additional SS Topics: Movement, time-varying properties
Fri	Model Tuning and Decision Analysis	Model Comparisons

Session durations are approximate and will adapt to pace of class
Model demonstrations and hands-on sessions included
Lunch at 1200-1300; coffee breaks in AM and PM
Social after Monday PM session; class dinner at ICES Thurs evening

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