Report of the Training Course: Trawl Survey Design and Evaluation

10–14 October 2011

ICES Headquarters, Copenhagen

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Contents

Participants at the course "Trawl Survey Design and Evaluation" conducted 10–14 October 2011. From left to right: Sascha Fässler, Kelle Moreau, Peter McCorriston, Bente Limmer, David Reid (Instructor), Doug Beare (Instructor), Donald Clark, Philippe Schwab, Francisco Sobrado Llompart, Paul Dolder, Corinne Martin, Elena Guijarro Garcia, Vaishav Soni, Kalvi Hubel, Tracey Fairweather, Matthias Bernreuther, Francesca Vitale, Giuseppe Scarcella, Lorna Teal.

Report of the ICES training course:

"Trawl Survey Design and Evaluation"

By

David Reid and Doug Beare

Summary

The first Trawl Survey Design and Evaluation Course in the ICES Training Programme was conducted from 10–14 October 2011 at ICES Headquarters in Copenhagen. Seventeen students participated and, from the perspective of both the instructors and students the course was a success. Participants represented a variety of trawl surveys and not only those from Europe. One attendee, for example, ran a 1 month long trawl survey on the Grand Banks while another was involved in a South African survey of hake. Interaction between the tutors and students was good and there were lively and interesting discussions throughout.

The course covered a wide range of issues relating to survey development and was explicitly intended to consider as many aspects of operating a trawl survey and making use of the data as possible. The target audience was intentionally wide, including those who had no previous experience through to experienced cruise leaders. For beginners, the course was intended to provide a guide to what was involved in trawl surveys, and what to think about when starting a new survey up, or joining an existing survey. For the more experienced hands, the course was intended to re-awaken their interest in questioning the conduct and practice of the surveys. One common feature reported by many of the participants was that when they asked why a particular approach was taken, the usual reply was that this was how it had always been done! It was this response that the course was designed to remove and to urge questioning and thought about the surveys.

Particular aspects covered, included the building, maintenance and monitoring of trawl gear in action. The understanding of fish behaviour in front of, and around the trawl, during surveying, as well as sources of bias and variance were also comprehensively addressed. While the lecture course included more traditional survey design aspects, e.g. stratification, station placement and random/systematic sampling, the course took the subject matter beyond this to all the issues involved with carrying out trawl surveys. A final key element was the anticipated need to expand the scope of the surveys to deliver data into the EAFM, and the MSFD. This aspect also encompassed the calculation of biodiversity and fish community indicators.

The course format was based on a series of lectures in the morning, followed by a series of R-based analysis exercises focusing on the DATRAS pan-European trawl survey database in the afternoon. The course tutors produced a library of R-scripts (see http://code.google.com/p/datras/downloads/list) for simple generic analyses of *ALL* DATRAS datasets. The exercises began with analyses and plotting of the station or haul data followed by steadily more sophisticated treatments of the data including how length frequency data age–length keys are combined to calculate numbers-at-age indices. On the final days students experimented with modern regression techniques (e.g. GLM and GAM) and how to calculate various 'Community Indicators' such as 'The Large Fish Index'. This was extremely ambitious but by the end of the

course students were using generic R-code to produce maps, plots etc. of trawl survey data from as far east as Estonia; to as far west as Rockall!

Feedback from 14 students was recorded using the course evaluation questionnaire. Results indicate that the amount of material covered was "average" (57%) and above "average" (43%). Degree of difficulty was below "average" (7%), "average" (64%) and "above average" (21%). Quality of the course outline, the course description, helpfulness of teaching staff, usefulness of course materials, clarity of presentation, course content, and quality of teaching were "average" (0–14%) to "very good" (57–93%).

Most participants heard about the course from colleagues (80%).

Individual comments and suggestions were:

- *"I found the lectures and discussions very informative and useful; they have given me perspective and a framework for moving forward. I have no experience with R so, though I managed to get each of the practicals to work, I feel that I would need loads more time with my own data and an R manual in order to apply the code. Having said that, I did not expect detailed beginner tutorials which would use up too much time. I am happy to take the code away and see what I can do. The facilities for the course were great and I found the course very satisfactory"*

- *"The practicals should not be related only on DATRAS."*

- *"The course provided an excellent and comprehensive overview of many aspects of survey design, gear use/performance, an insight into ecosystem surveys and the pitfalls/biases to be aware of when working with survey data. It was taught clearly and there was plenty of room for open discussions in the group, which was very useful. The practical part of the course had also been well thought through and prepared and everyone now has a useful tool at their fingertips (R library) for exploring, plotting and starting to analyse datras (or other) data. Overall I am very pleased with the course and found the week extremely useful."*

- *"Big name labels in front of everyone and 10 minutes frequent pauses were highly appreciated. Keep them! A correspondence between lectures and practical exercise could be useful."*

- *"As most participants don't have necessarily a big knowledge of R, it would be useful to have more support during practicals, as one instructor isn't enough to help everyone".*

- *"Perfect fit between announced content and real content, very helpful teachers!"*

- *"The course was VERY WELL structured and achieved a healthy balance of theory and hands-on practical sessions. It was very pragmatic and allowed the participants to go away after the course with a collection of useful software that allows them to analyse survey data. You really got the impression that the two teachers thought hard about how to best organize the course before it started - this seems logical but can by no means be said about other ICES courses, unfortunately. This course should serve as a standard or model to plan other courses!"*

- *"This course is very useful. Time is very limited and survey design is a complex issue but nevertheless I cannot think of anything important that has not been covered. We got a lot of information to improve our surveys; the course has answered questions and arose many more, which is a good thing. The course is as well a great opportunity to meet people with similar problems and hear different views and approaches to solve them. The practicals have also been very good, and now we have many useful R scripts that would otherwise have taken us R novices ages to*

produce on our own. On the other hand, as a struggling R beginner I would have liked to have the time to look at the code behind the practicals and learn tips and possible sources of trouble for future reference, but I realize that this is outside the scope of the course. In short, I am very happy I could take part and will strongly recommend it to my colleagues. Congratulations and thanks to Søren and the ace (and patient) instructors".

- *"Good features: have the course taught by experts in their fields / going away with r script and knowledge that I can directly apply to my research / helpfulness of teaching staff / fruits and hot drinks at will Suggestion for improvement: longer lunch break / cheaper course location (e.g. southern Europe)"*

- *"The interactive nature was very good. The materials provided are very good."*

- *"Good mix of lectures/practicals. Very useful material to take away and lectures got you thinking."*

Recommendations

1) Expand the scope of the ecosystem component of the course. Development of the use of surveys to provide data and inputs to the EAFM is becoming very important in many countries. However, the adaptation of the surveys to deliver useful and appropriate data has yet to be determined, and this would make a very suitable extension to the course

2) The course was designed initially without an explicit link between the lectures and the days' practicals. It might be better in future to organize the course with a tighter link between the lecture content and the subject matter for the practicals.

Course description

Objective

The objective of the course is to provide a thorough grounding in the design and implementation of trawl surveys which will be useful for both beginners and experts. Students will be guided through the entire process of going to sea, collecting and storing the data, preparing them for stock assessments, and submission to ICES. Emphasis will be placed on how the data can be visualized and how problems of misinterpretation due to confounding can be avoided.

Course lectures will cover:

1) Initial considerations such as defining objectives, whether a trawl survey is appropriate relative to other approaches (acoustic, ichthyoplankton, TV), and the possible influence of variables such as time of year, tide, and time of day.

2) Basics of survey design. Defining survey area, placing stations, and definition of strata.

3) Gear types and specification, the "ideal" trawl survey.

4) Practical aspects of preparing to go to sea, calibration of gear, and maintenance.

5) Trawl performance monitoring.

6) How and what of the catch to sample. Length/weight frequency data, age/length data, sexual maturity data. How many fish to sample, raising factors?

7) Analysing the results.

8) Understanding fish behaviour in the survey trawl capture process

9) Sources of bias and variance and approaches to deal with them

10) Trawl surveys and their value for the Ecosystem Approach to Fisheries Management.

Course 'practicals' will cover:

1) Application of age length keys.

2) Calculation of trawl survey abundance at age indices.

3) Production of maps using ICES DATRAS data and R. Plotting trawl tracks, scaled circles, overlaying bathymetry. Simple interpolation methods.

4) Statistical methods for assessing differences in trawl data from comparative surveys.

5) Calculation of EAFM type "indicators" (large fish, biodiversity, species richness, size at sexual maturity).

6) Simulations to show impact of confounding or non-random sampling.

Course Programme and Instructors

The course was five days. The morning sessions consisted of lectures on background and theory. The afternoons were arranged as computer 'practicals' where trawl survey data analysis was demonstrated using software such as Excel and R. During these afternoon sessions interaction among the course participants was encouraged.

The course included applied examples, case studies, and hand-on exercises on the computer.

Participants were required to bring their own laptops (Mac with virtualization is OK) to connect to the ICES network, and also to have R (freely downloadable from http://www.r-project.org/) installed prior to arrival.

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