Report of the Training Course: Approaches to the Integrated Assessment of Status and Trends in Marine Ecosystems

17–19 October 2011

ICES Headquarters, Copenhagen

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Participants at the course "Approaches to the Integrated Assessment of Status and Trends in Marine Ecosystems" conducted 17–19 October 2011. From left to right: Xinhua Zhu, Antonios Stamoulis, Margit Eero, Didzis Ustups, Maria Boström, David Clubb, Paris Vasilakopoulos, Zane Zhang, Francisco Baldó, Evangelia Chatzinikolaou, Rabea Diekmann, Grégoire Certain, Francisco Velasco, Nick Taylor, Christian Möllmann, Corinne Martin, Irene Huse, Cecilie Hansen, Philip Boulcott, Mirella Kanerva, Lorenza Conti, Kristiina Vuori, Dorleta Garcia, Beatriz Guijarro, Joan Fabres, Michael Schirripa, Gonçalo Carneiro.

Report of the ICES training course:

"Approaches to the Integrated Assessment of Status and Trends in Marine Ecosystems"

by

Rabea Diekmann and Christian Möllmann

Summary

The first course "Approaches to the Integrated Assessment of Status and Trends in Marine Ecosystems" was conducted 17–19 October 2011 at ICES Headquarters in Copenhagen. 25 students participated in the course coming from a very diverse range of backgrounds, but with the majority working in scientific institutions. The different experiences *e.g.* with the software used during the exercises posed challenges to meet the right level of information but also presented the opportunity to have lively and efficient discussions about data interpretation and the use of results for the ecosystem based management. Thus, from our perspective the course was a success.

Students represented 11 countries, including 10 member countries (Belgium, Canada, Denmark, Finland, France, Norway, Spain, Sweden, USA and UK) and one other (Greece). Although the pre-knowledge of e.g. programming in R was very different, the class accomplished all exercises and all students were able to apply the provided code in a correct way.

Most participants heard about the course from colleagues by e-mail (72%) or via other platforms distributed by ICES (28%).

Feedbacks from 20 students were recorded using the course evaluation questionnaire. The outcome mainly reflected our own impression and the personal feedback we got. The course generally got a very good evaluation but also more extreme opinions were found, which was not surprising given the different backgrounds and experiences of participants. The questionnaire's summary indicates that the material covered was average (40%) or above average (55%), although for one participant the course content was too easy (5%). Similarly, the degree of difficulty was estimated as being average or above average (45% and 40%), with two participants rating the course as too difficult and one as too easy. The majority of participants evaluated the quality of the course outline as good to very good (40% and 55%), and similar results were achieved for the helpfulness of teaching staff and the usefulness of course materials. For the clarity of presentations most participants found them to be good or very good (45% and 50%) but one student also noted this as being below average. Overall, the course was evaluated to be good to very good (35–55% and 35–70%). 10% rated the course as average although the rating for teaching and organization was above throughout.

Individual comments and suggestions were:

- It would be helpful to have more specific advises for the exercises, more explanations to what to look for/what to expect from what we are doing, and maybe more explanations of the code (that's probably something related to the knowledge of R.). Overall a nice course, though.

- Useful introduction and framing of the use of the methods explained later. Possibility of broadening the variables brought into the Integrated Assessment i.e. pollution, eutrophication, etc.

- Good materials provided and clarity.

- I think my expectations were more focused in ecosystem assessment, but my final impression is that the course is more focused in regime shifts, detection and explanation. I think this fact has to be reflected in the title of the course.

- Very good: hands-on approach largely centred around exercises. This made things difficult for me, due to my lack of familiarity with R and many of the statistical techniques, but that is my problem. It was a good and worthwhile push, anyway. Maybe make clearer at the outset, what is the desired level of R-familiarity necessary to fully take advantage of the course.

- It might help students if those who don't use R need to be identified before groups are formed.

- Presentation on ICES was a waste of time; presentations on statistics were too fast/too complicated with insufficient explanation.

- I liked the practical application of the methods on real datasets. The course started out with a good introduction to the relevance of ecosystem context for management in general and the steps involved in ecosystem approach to management. What I missed is that we never really got back to this issue during the course. We analysed and discussed changes in ecosystems, but if and how would these actually be relevant in a management context, this was not touched upon. This could perhaps be considered in future courses on this subject.

- Great lecturers, very well prepared. Great to go home with literature, scripts, etc. Good mix between theory and practice.

Recommendations

1) The exercises of this course, similar to other ICES training courses, were based on R. The reason for this is that it is a freely available software and thus can be used by all participants also in their institutes. In the course announcement we recommended that participants should have a basic knowledge in R and prior to the course gave further recommendations how to get started. However, approximately 25% of the participants were not really familiar with the software and probably needed further support. In future courses these participants should be identified beforehand and maybe an online introduction (tailored to the necessary skills for the course) and/or an additional half-day training session should be provided. Nevertheless, for this specific course a very basic knowledge was sufficient as the provided code was generalized to fit to different datasets, and user-specific adaptations were minimal.

2) In this course the exercises were designed in a way that we simulated the work performed in some ICES working groups (such as WGIAB, WGINOSE), analysing time-series and investigating ecosystem changes. For those unfamiliar with this setup, it may be better to provide more detailed exercise descriptions with e.g. step-by-step explanations what is done by the R-code.

3) The statistical knowledge of participants was very diverse and so were the opinions about the complexity of lectures. For some methods used in the course fewer mathematical explanations can be sufficient, and this might improve the clarity, especially when more methods analysing ecosystem changes would be introduced in future.

4) In this three day course some methods useful for integrated analyses were only shortly introduced and time was too short to apply them in the exercises. Thus, provided that more time is available, further methods could be explained *e.g.* to identify important drivers of ecosystem change.

5) In the final session it is necessary to tackle again the problem, how to apply the results of the empirical analysis in ecosystem based management. A comparison to other '"integrated" approaches should be made.

In case this course would be repeated, we would recommend prolonging it to four days in order to make the presentation and application of methods less condense, having more time to give explanations in R and giving the possibility to experience with other techniques and also inferential statistics.

Course description

Objective

The course had two major goals: 1) Participants should get the necessary ecological background to perform a sound integrated ecosystem analysis. They should be able to make a reasonable data selection based on a number of criteria, prepare (i.e. transform or standardize) the data appropriately, and use various statistical techniques to describe the ecosystem. Here a number of multivariate and time-series tools were applied or introduced (e.g. direct and indirect gradient analyses (PCA, RDA etc.), STARS, Chronological Clustering, MAFA); 2) Participants should get familiar with interpreting multivariate ecosystem analyses correctly and with performing analyses to identify the potential driving forces. Based on this knowledge and the evaluation of potential indicators and threshold levels, participants should be able to give recommendations on the EAM.

Course material was circulated to all participants prior to the course and was downloadable from the ICES SharePoint site. This included several background documents, software information, R packages and an R help file. Further documents including pdf's of the presentations were uploaded during the course.

Course Programme and Instructors

The three-day course was organized as a combination of lectures and exercises and the original time schedule was largely maintained. At the beginning lecturers gave background information about the Ecosystem Approach to Management and the role of integrated ecosystem analyses within the framework. Furthermore, theoretical ecological concepts about ecosystem functioning, resilience and regime shifts were introduced. In a second step the methodological approaches and statistical background were explained. This was followed by exercises evaluating the ecosystem status of a theoretical example. For this the participants were divided into groups with each group analysing one specific example. Finally this example was used to perform an integrated ecosystem assessment at various levels of complexity and to give a concluding evaluation about observed ecosystem dynamics, sudden changes and trophic interactions. On each training day the results of the groups were shortly presented in plenary.

Day 1:

1. Lecture (1.5h): Introduction to different approaches of ecosystem-based management and the role of integrated ecosystem analyses of status and trends
2. Lecture (1h): How to apply Integrated Ecosystem Analyses in EAM → A perspective from the Baltic Sea
3. Lecture (1h): Requirements for performing Integrated Ecosystem Analyses
4. Exercise: Data selection and handling, exploration, preparations for multivariate analyses, first steps in order to perform time-series analyses of single variables

Day 2:

5. Lecture (1.5h): Ecological theories about ecosystem dynamics, trophic interactions, regime shifts and resilience
6. Lecture (2h): Direct and indirect gradient analyses and their use in IEAs: Statistical background
7. Lecture (0.5h): How to perform gradient analyses in R
8. Exercise: Application of gradient analyses on virtual or (if requested) real datasets

Day 3:

9. Lecture (2.5h): Time-series analyses to investigate (1) sudden changes, (2) common trends, and (3) the effects of explanatory variables on multivariate data: Statistical background
10. Exercise: Perform time-series analyses on virtual or (if requested) real datasets
11. Presentations: How did marine ecosystems develop: A summary of the results and interpretations given by participants
12. Discussion: How to implement the outcome of integrated ecosystem analyses in the EAM

Lectures on theoretical background or statistical techniques alternated with "practicals", where mostly the introduced analytical techniques were applied to "real" datasets. Groups were built with three to four people that were using the same dataset

and thus encouraged interactions to discuss data selections, modifications, analytical steps and interpretation of results.

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