# Report of the Training Course: Stock Assessment Introduction (TCSAI2010)

11-15 January 2010

ICES Headquarters, Copenhagen

ICES

CIEM

International Council for
the Exploration of the Sea

Conseil International pour
l'Exploration de la Mer

**International Council for the Exploration of the Sea**
**Conseil International pour l'Exploration de la Mer**

Recommended format for purposes of citation:

ICES. 2010. Report of the Training Course: Stock Assessment Introduction (TCSAI2010), 11-15 January 2010, ICES Headquarters, Copenhagen. 11 pp.

The document is a report of an Expert Group under the auspices of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council.

# Contents

Participants at the course "Introduction to Stock Assessment" conducted 11-15 January 2010 at ICES Headqarters in Copenhagen. The course was given by Steve Cadrin, NOAA, USA (instructor) and Iago Mosqueira, CEFAS, UK (assistant instructor).

## Summary

The second course in the ICES Training Programme was an introduction to stock assessment, conducted 11-15 January 2010 at ICES Headqarters in Copenhagen. The same course was offered in August 2009 by the same instructors. Thirty-three students participated in the second course, and they all attended all lectures and completed all assignments. From the perspective of the instructors, the course was a success.

An ambitious outline of topics was taught, from simple model fitting and biological production to commonly used stock assessment methods (biomass dynamics model, virtual population analysis and statistical catch-at-age model) as well as biological reference points through stochastic long-term projection. Each day was scheduled with lectures on stock assessment concepts each morning and application of stock assessment models during afternoon assignments. Students completed assignments by programming in Excel and R.

The number of students was appropriate. Students represented 15 countries and had diverse backgrounds, representing young working group members, academic researchers, fishery organizations and conservation groups. Despite a wide range of experience in modelling and statistics, all students who completed the course mastered the spreadsheet assignments as well as the exercises in R.

Feedback from students was solicited using a course evaluation questionnaire. Results indicate that the amount of material covered and degree of difficulty was "average" to "too much/too difficult," course organization and the course description were "good" to "very good," helpfulness of teaching staff, usefulness of course materials and clarity of presentation were "high." Overall, the course content was "average to "very good", organisation and quality of teaching were "good" to "very good." Individual feedback included:

- "I had great value of this course. At times there was a lot of information at one time, but the teachers presented the material in a very good way. I am very satisfied with this course and will recommend it to others."

- "My only negative comment is that the presentation of R were a little bit fast. I have some experience with R and were able to keep up. But I imagine that those participants that were not familiar with it were having trouble understanding it."

- "I would have liked to hear more about input data and solutions to lack of input data. For instance, what if you don't have age reading data or age readings are bad for older ages."

- "Thanks for a very well prepared and inspiring course."

- "The assignments in Excel were very helpful, could even do more. The presentations in R were also interesting, but with my limited R knowledge, the presentation of the scripts was sometimes too fast to follow. So maybe it would be nice to put the R-part into a course by its own means, this would allow the participants to practice and play more with R and become acquainted with programming. Alternatively, all assignments could be done in R, but that would take more time

and reduce the number of performable assignments. Also, the Excel-assignments are a good way to demonstrate the principles. So my final suggestion: Leave this course as it is, but take out the R. Offer an extra course (if ICES does not so already), where people learn to use R."

- "I think it is difficult to improve this course because it is nearly perfect. I have learnt a lot of things on stock assessment particularly during the assignments it will be very helpful for my PhD. Steve and Iago were very available during all of the course. Thank you for everything."

- "I think that all the arguments had have really exhaustive explanation and the quality of the material was very good. Maybe the amount of the arguments treated was high for just one week working, but in the complex the course was great."

- "This is more than an introduction. Perhaps it should be split up into two course-packages. So you have in total three stock assessment courses at ICES."

- "Just want to say the facilities were excellent, staff friendly, food really good - thank you!"

- "excellent teaching and cover of topics"

- "Highlight: The very applied and detailed plaice VPA example on Wednesday afternoon: All necessary info was presented and we could follow easily the way of how it works in practise. (A bit contrary) most of the other examples were a little bit too rushed (at least for my taste), i.e. the presentation of necessary info was a bit too aggregated and thus it appeared as if not all necessary detail was presented (maybe it was, but the slides were too full to grasp it in the short period of time). Hence I found it more difficult to follow those examples. Suggestion: keep these examples as well, but spend a bit more time on them and spread the info that is currently compressed on a few slides only several more slides."

- "At the end of a "chapter", when checking whether everything is clear or whether there are further questions, allow the group a little more time to think about questions and whether everything is clear. Half a minute is not always enough to digest the lesson and to come up with critical questions..."

- "I missed a bit more and deeper critical reflections on assessment models in general as well as on some specific critical assumptions and caveats. - Maybe this was not the objective of this introductory course... but I do see a future need for creative thinking like: What are the weakest assumptions that need to be improved... What else could we do to better manage fisheries instead of model based assessments... Will there be courses dealing with such issues? Maybe the announced course on advice and communication or the stakeholder assessment course in October? I'm very interested in this!"

- "Regarding the R part: I think it is very useful to learn how to do the assessments in R and it was well presented, but probably, it could have been organised in a better way, for example: compressing the R parts all into the last 1-2 days of the course, and requiring that the participants of this part know R already. This

would -additionally- constitute an extra repetition of the whole course material again. :-)"

- "Thanks for the hard work of so well preparing this course and for the endurance of teaching us all day long! I'd just suggest to allow us and yourself to regularly take a few moments of silence (to think/digest or to breathe, resp.) during the lecture..."

- "I think 35 students is too much, but teachers and ICES staff were very helpfulness."

- "very dense but very relevant"

- "perhaps more time for a synthesis at the end of the week to more clearly relate various levels of data availability with the different methods covered during the week."

- "very useful overall, many thanks!."

Students heard about the course primarily through the ICES website (43% of responses), emails from ICES (36% of responses), the ICES newsletter, through their supervisors or other personal contacts.

Unlike the first time the course was offered, when only a few students used R for assignments, all students attempted all of the assignments in both Excel and R, even though R was an optional aspect of the course. The greater use of programming in this class should help students to be better prepared for ICES work and the advanced ICES courses. Some of the students expecting more conceptual and less quantitative understanding might have registered for the class for stakeholders "Opening the box: Stock assessment and fisheries advice for stakeholders, NGOs and policy-makers. 5-7 October 2010."

Revisions to the course also appeared to be effective. Communication with students before class regarding software installations, preparations for statistics and programming, and bringing example data helped to elevate the level of material and approaches used in the course. Students appeared to take advantage of having the lecture material available before the course. Given that early communication with students and access to the sharepoint appeared to help students, earlier review of applicants, acceptance and communications may help further.

Late afternoon sessions were a workshop in which groups of students went in different directions in the same theme:
- Some were completing the spreadsheet assignment (adding diagnostic plots, revising the model, 'extra credit' questions)
- Other students were repeating the assignment in R
- Other students were fitting the model to their data

The partnership of instructors was effective, with complimentary skills for helping students to understand difficult topics and debugging various programming problems. Once again, the ICES secretariat gave the course participants a warm welcome, and provided a pleasant working environment that will help to promote future involvement in ICES by the students.

## Annex 1: List of participants

| Name | Address | Country | Email |
|---|---|---|---|
| Steve Cadrin (instructor) | Steve Cadrin, NOAA/UMass CMER Director, School for Marine Science & Technology, 200 Mill Road, Suite 325 Fairhaven, MA 02719 | USA | Steven.Cadrin@NOAA.gov |
| Iago Mosqueira (assistant instructor) | Systems Modelling, Cefas Pakefield Rd. Lowestoft, NR33 0HT | UK | iago.mosqueira@cefas.co.uk |

| Name | Institute | Country | Email |
|---|---|---|---|
| Hendrik Stouten | Institute for Agricultural and Fisheries Research and Ghent University Unit Animal Sciences – Fisheries Ankerstraat 1 8400 Oostende | Belgium | hendrik.stouten@ugent.be |
| Marie-Julie Roux | Government of Canada Department of Fisheries and Oceans Central and Arctic Region Arctic Aquatic Research Division Arctic stock assessment and Integrated Ecosystem Research Section 5204 50th Avenue, Suite 101 Yellowknife, NT X1A 1E2 | Canada | marie-julie.roux@dfo-mpo.gc.ca |
| Teunis Jansen | Technical University of Denmark DTU AQUA - National Institute of Aquatic Resources Section of Population-& ecosystem dynamics Charlottenlund castle DK 2920 Charlottenlund | Denmark | tej@Aqua.dtu.dk |
| Mickael Drogou | IFREMER Département Sciences & Technologies Halieutiques (STH) IFREMER Centre de Brest, BP 70, 29280 Plouzane | France | mickael.drogou@ifremer.fr |

| NAME | INSTITUTE | COUNTRY | EMAIL |
|---|---|---|---|
| Michael Gras | University of Caen Basse Normandie (France) Institute of Fondamental and applied Biology, UMR Physiology and ecophysiology of the marine mollusk Université de Caen Batiment Science C, Esplanade la paix, 14032 Caen Cedex | France | michael.gras@unicaen.fr |
| Matthias Bernreuther | Johann Heinrich von Thuenen-Institute (vTI); Federal Research Institute for Rural Areas, Forestry and Fisheries Institute of Sea Fisheries Palmaille 9 22767 Hamburg | Germeny | matthias.bernreuther@vti.bund.de |
| Wolfgang Nikolaus Probst | Johann Heinrich von Thünen-Institute Institute of Baltic Sea Fisheries Alter Hafen Süd 2 18069 Rostock | Germeny | nikolaus.probst@vti.bund.de |
| Anja Retzel | Greenlandic Institute of Natural Resources Department of Fish and Shrimp P.O. box 570 3900 Nuuk | Greenland | anre@natur.gl |
| Rasmus Nygaard | Pinngortitaleriffik - Greenland Institute of Natural Resources Postbox 570, 3900 Nuuk | Greenland | rany@natur.gl www.natur.gl, Skype: rasmus.nygaard |
| Nanette Hammeken Arboe | Greenland Institute of Natural Resources Department of Fish and Shrimp Greenland Institute of Natural Resources, P.O. Box 570, DK-3900 Nuuk | Greenland | naha@natur.gl |
| Hocine BENCHIKH | University College Cork Zoology Ecology and Plant Science Department Zoology Ecology and Plant Science Department (ZEPS) Distillery Field North Mall University College Cork | Ireland | ciaolho@yahoo.fr |
| Piera Carpi | CNR-ISMAR (National Research Council - Institute of Marine Science) Largo Fiera della Pesca 2, 60125 - Ancona | Italy | p.carpi@an.ismar.cnr.it |

| NAME | INSTITUTE | COUNTRY | EMAIL |
|---|---|---|---|
| Björn Stockhausen | European Commission - Joint Research Center Institute for the Protection and Security of the Citizen (IPSC) Maritime Affairs Unit Unit Building 5A, TP 051 Via E. Fermi I-21027 Ispra | Italy | bjorn.stockhausen@jrc.ec.europa.eu |
| Tessa van der Hammen | IMARES Fisheries PO Box 68 1970 AB IJmuiden | Netherlands | tessa.vanderhammen@wur.nl |
| Sascha Fässler | Wageningen IMARES Fisheries Haringkade 1 P.O. Box 68 1970 AB IJmuiden | Netherlands | sascha.fassler@wur.nl |
| Christine Röckmann | IMARES (Institute for Marine Resources and Ecosystem Studies) P.O.Box 68 1970 AB Ijmuiden | Netherlands | Christine.Rockmann@wur.nl |
| Tone Vollen | Institute of Marine Research Tromsø branch P.O. Box 6404 N-9294 Tromsø | Norway | tone.vollen@imr.no |
| Boonchai Stensholt | Institute of Marine Research Demersal fish Nordnesgaten 50 Post Box 1870 Nordnes N-5817 Bergen | Norway | boonchai@imr.no |
| Kristin Windsland | Institute of Marine Research Division 422: Benthic habitats and shellfish Institute of Marine Research Postboks 6404 9294 Tromsoe | Norway | kristin.windsland@imr.no |
| Ann Merete Hjelset | Institute of Marine Research P.O. Box 6404 N-9294 Tromsø | Norway | ann.merete.hjelset@imr.no |
| Veronika Ryabchun | Atlantic Research Institute of Marine Fisheries and Oceanography (AtlantNIRO) 5, Dm. Donskoy Str., Kaliningrad | Russia | ryabchun.v@gmail.com |

| Name | Institute | Country | Email |
|------|-----------|---------|-------|
| Victoria Ivanovich | Atlantic Research Institute of Marine Fisheries and Oceanography (AtlantNIRO) 5, laboratory of the Baltic Sea Dm. Donskoy Str., Kaliningrad | Russia | ivanovich@atlant.baltnet.ru |
| Isabel Riveiro | IEO Instituto Español de Oceanografía (Spanish Institute of Oceanography) Fisheries<br><br>Investigadora Centro Oceanográfico de Vigo IEO (Instituto Español de Oceanografía) Subida a Radio Faro, 50 36390 Vigo Pontevedra España 26 Apdo. 1552, 36200 Vigo | Spain | isabel.riveiro@vi.ieo.es |
| Gersom Costas | Instituto Espanol de Oceanografia Fisheries department Instituto Español de Oceanografia PO 1552 36200 Vigo | Spain | gersom.costas@vi.ieo.es |
| Håkan Wennhage | Swedish Board of Fisheries Institute of Marine Research P.O. Box 4, 453 21 Lysekil | Sweden | hakan.wennhage@fiskeriverket.se |
| Ulrika Beier | Swedish Board of Fisheries Department of Research and Development Institute of Freshwater Research Stångholmsvägen 2 SE-178 93 Drottningholm | Sweden | ulrika.beier@fiskeriverket.se |
| Mikaela Bergenius | Swedish Board of Fisheries Institute of Coastal Research Skolgatan 6, Box 109, 74242 Öregrund | Sweden | mikaela.bergenius@fiskeriverket.se |
| William Turrell | Marine Scotland - Science Fisheries Management 375 Victoria Road Aberdeen AB11 9DB | UK | turrellb@marlab.ac.uk |
| Timothy Earl | Cefas Fisheries Stock assessment and fishery management team Cefas Lowestoft Laboratory Pakefield Road Lowestoft Suffolk NR33 0HT | UK | timothy.earl@cefas.co.uk |

| Name | Institute | Country | Email |
|------|-----------|---------|-------|
| Lisa Readdy | Centre for Environment, fisheries & Aquaculture Science (Cefas) Fisheries /Sea and Oceans/Fisheries management Lowestoft Laboratory Pakefield Road Lowestoft Suffolk NR33 0HT | UK | lisa.readdy@cefas.co.uk |
| Christopher Lynam | Cefas Fisheries Pakefield Road Lowestoft Suffolk NR33 0HT | UK | chris.lynam@cefas.co.uk |
| Wetjens Dimmlich | Marine Stewardship Council Fisheries Mountbarrow House 6-20 Elizabeth St London SW1W 9RB | UK | wetjens.dimmlich@msc.org |
| Rui Catarino | Marine Scotland /Marine Laboratory Program Fisheries Management/ Fishery Systems Group PO Box 101, 375 Victoria Road, Aberdeen, AB11 9DB | UK | r.catarino@marlab.ac.uk |

## Annex 2: Course description

**Objective**

The general objective of the course is to train stock assessment scientists and advisors in basic population dynamics and stock assessment. The course is intended not only to present the theoretical elements but also to guide participants on how to put theory into practice through case studies and hands-on exercises on the computer. Specific objectives are:

1. Understanding the role of stock assessment in fisheries science
2. Familiarity with conventional stock assessment models
3. Experience in basic model building and parameter estimation

By the end of the course, the participants will:

- Be aware of single species assessment methods as applied to North Atlantic fisheries.
- Understand the data collection needs for different assessment methods.
- Be familiar with indicators and reference points, both biological and economic, as tools in fisheries management.
- Be introduced to the application of methods for multigear and multispecies assessment.
- Develop knowledge on bioeconomic fisheries processes by using simulation models to improve scientific advice for managers.

This course provides instruction, demonstration and exercises in population modelling, as applied to fishery resources. Stock assessment synthesizes information on life history, fishery monitoring and resource surveys using mathematical models of population dynamics. Results from stock assessments are used to determine stock size, sustainability of the fishery and evaluate the consequences of alternative fishery management actions. First principles of population dynamics are reviewed from the perspective of model building, and several dimensions of complexity are explored. A wide range of conventional stock assessment methods are introduced.

There are two general goals of the course. The first is to provide a sound foundation in the fundamentals of stock assessment. Stock assessment modelling continues to advance at a rapid pace. However, understanding the basics of population dynamics is necessary to develop an intuition for fisheries models, for accurate interpretation and model development. Therefore we will emphasize a conceptual understanding, supported by quantitative applications that are designed to illustrate model properties.

The second goal of the course is to prepare students to take the next steps in a stock assessment career: learning the advanced aspects needed for their particular applications.

The ICES Training Programme also includes courses in advanced stock assessment, Bayesian techniques for stock assessment, Management Strategy Evaluation and Ecosystem Modeling for Fisheries Management. Therefore, advanced topics and programming skills will be introduced in preparation for more advanced ICES courses or to approach the same topics through self-learning.

## Annex 3: Course Programme and Instructors

The five-day course is organized as a series of morning sessions that are focused on theoretical concepts and afternoon sessions on more applied concepts associated with assignments and  work sessions.  All of the assignments will be completed in Excel, but the same analyses will be demonstrated in R, an open-source, statistical programming language (see flr-project.org).

| Day | Lecture | Topic |
|---|---|---|
| Monday | 1 | Introduction & objectives |
| | 2 | Model fitting |
| | | assignment: stock-recruit |
| Tuesday | 3 | Biological Production |
| | 4 | Biomass dynamics |
| | | assignment: production |
| Wednesday | 5 | Demographics |
| | 6 | Virtual population analysis |
| | | assignment: VPA |
| Thursday | 7 | Simulation |
| | 8 | Statistical catch at age |
| | | assignment: SCAA |
| Friday | 9 | Reference points |
| | 10 | Projection |
| | | assignment: MSY |

**Instructors:**
Steve Cadrin, NOAA/UMass CMER Director
School for Marine Science & Technology
200 Mill Road, Suite 325
Fairhaven, MA  02719 U.S.A.
(508)910-6358 (508)910-6396 fax

Iago Mosqueira, Systems Modelling, Cefas
Pakefield Rd.
Lowestoft, NR33 0HT
U.K.
+44 (0)1502 558003
+34 986 305132

## Annex 4: Recommendations

1. Start the process of student selection and acceptance earlier to give students a longer period to prepare for the course with access to the sharepoint and recommended readings.

2. Prepare willing students beforehand for the R part of the course by providing introductory material tailored to the R skills necessary to follow the assigments, The suggestion of concentrating some of the R teaching could be explored. Maybe dedicating to R one of the afternoon sessions, for example.