

# ICES TCMSE10 REPORT 2010

## Report of the Training Course: Management Strategy Evaluation (including FLR) (TCMSE10)

5-9 April 2010



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Participants at the Joint ICES-ICCAT training course: “Management Strategy Evaluation, including FLR”, 5-9 April 2010, Centro Tecnológico del Mar, CETMAR, Bouzas, Vigo, Spain. The course was given by Laurence Kell, ICCAT Secretariat ([www.iccat.int](http://www.iccat.int)), Spain (instructor) and Iago Mosqueira , CEFAS, UK (instructor).

## Report of the ICES-ICCAT training course:

# **“Management Strategy Evaluation, including FLR”**

by

Laurence Kell and Iago Mosqueira

## **1 Summary**

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The course ‘Management Strategy Evaluation (including FLR)’ was held in CETMAR, Centro Tecnológico del Mar, Bouzas, Vigo, Spain, between 5-9 of April 2010. A total of 23 participants [from 12 countries](#), fulfilling the necessary requirements, attended the course. Participants came from various disciplines involved in fisheries research: i.e stock assessment, management, economics, biology and computational fisheries science.

The course was intense, as the subject, Management Strategy Evaluation, required covering a lot of material in just 5 days. Examples were based on current application of MSE within ICES and ICCAT but also by STECF and the IWC. For example the development of North Sea Cod management plans, the evaluation of generic harvest control rules by STECF, bio-economic evaluation of Mediterranean swordfish recovery plans, evaluation of CITES criteria for Atlantic bluefin and implementation of a management procedure for Bryde’s whales. Data used were from current ICES and ICCAT assessments and participants also worked on their own datasets during the course, e.g. tropical tuna catch and effort data, Iberian sardine, Western waters herring, Southern hake and North Atlantic albacore.

An important area covered by the course was how to consider uncertainty in stock assessment assumptions, data and results and translate such uncertainty into probabilistic statements about management outcomes. This involved both stock assessment but also derivation of reference points and indicators and how to build harvest control rules and then test them. Although participants were able to run and replicate all analyses and examples the ultimate level of success by participants in learning the principles and techniques involved was related to previous experience with the tools employed (i.e. R as a language and Monte Carlo simulation [as](#) a general approach). However, student participation was very active, and some students presented relevant bits of their work that connected to the course content.

The instructors generally considered the course a success, although the approach taken was maybe too broad for some participants and too restricted for others. This is reflected in the slight disparity of views gathered through the feedback form. Presenting the technical and conceptual tools of this type of analysis is a challenging exercise that will benefit from a detailed analysis of the experience of this course.

Ultimately the funders of fisheries science judge it on how it translates into management advice. Therefore building capacity in management strategies evaluation will continue to be important objective in the short to medium term.

## 2 Recommendations

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From the feedback obtained during the course and through the form, and the observations and discussion of the experience, the instructors feel some improvements could be made to the course along the following lines:

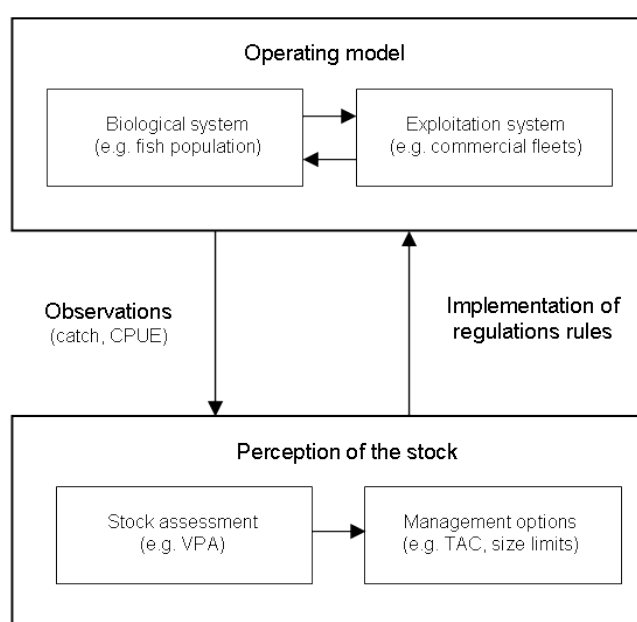
- Ensuring attendants are sufficiently proficient in R, especially with the tools used. Some general recommendations along the lines of required R skills were given, however, attendees varied from those who had very little experience of R to those who had published their own packages on CRAN. There are three options either i) only accepting students with enough experience of the R language, ii) by engaging with them in advance and providing material to help them mastering the language before the course or iii) providing introductory courses in R related to stock assessment. This would have consequences for courses and budgets.
- Some participants thought that the programme was too ambitious for 5 days. However, during the course it was apparent that to achieve the main course objective of demonstrating how to conduct an MSE none of the earlier material could be omitted, particularly given the varied backgrounds of the participants. This meant that a wide array of fields had to be covered in the course, i.e. from basic computational statistics, to R programming, stock assessment, fisheries biology, presentation of advice.
- A possible division for this course could be established along the lines of the stock assessment ones. A first course would cover R and stochastic simulation, while a second one would concentrate on harvest control rules, management objectives and their evaluation together with issues of presentation of advice to stakeholders.
- Visually engaging ways of presenting what is in essence computer source code are not easy to find, i.e. use of GUIs versus programming on the command line. Renewed effort could be made to find better ways of showing source code, its structure and the results obtained at the same time. On the other hand, the current format, based around providing and explaining commented source code, enables re-use of material for individual applications. Many attendants managed to use most of the code on their own data, which should help understanding and encourage future use.
- The link to other ICES courses was also raised by some comments. Aside from the use of R in different ways, other courses do not directly link to what was presented in this one, except for the relatively small section on stock assessment. This could be related to the necessary focus on stock assessment of the other quantitative courses, which leave less room for questions on biology and modelling of stock dynamics that are of relevance in MSE.
- The use of R by working groups, and its presence in some, if not all, of the quantitative course in ICES training programme, might call for some support for basic teaching on R by ICES. This could be achieved through the training programme itself, or by use of web-based technologies as a way of providing tailored training in R for the needs of participants in ICES training programme and working groups.

- The instructors intend to maintain contact with attendants in the near future, in order to help them with possible applications of the ideas discussed, but also to provide them with some extra teaching material that was requested during the course, covering mostly particular elements of the R language extensively used in the FLR libraries and for which available tutorials and examples are few or difficult to follow.
- Finally, the instructors are in the process of assembling a new set of material, informed by the valuable feedback and experience of this course that will hopefully make any future training in this area much simpler and even more successful.

### 3 Course description

The adoption of the precautionary approach for fisheries management requires a formal consideration of uncertainty. Therefore, since 1998 ICES advice on fisheries management has consisted of a dual system of limit and “precautionary approach” reference points, the latter providing a buffer to safeguard against natural variability and uncertainty in the assessment, and ensuring that limit reference points are avoided with high probability. Traditional stock assessment mainly considers uncertainty in observations and processes (e.g. recruitment), whereas uncertainty about the actual dynamics (i.e. model uncertainty) has a larger impact on achieving management objectives.

The World Summit on Sustainable Development (WSSD, Johannesburg 2002) commits signatories to maintain or restore stocks to levels that can produce the maximum sustainable yield (MSY) by 2015. A main management objective e.g. for ICCAT stocks, is to maintain stocks at levels which will permit the maximum sustainable catch. There is therefore a pressing need to develop new precautionary management advice based on targets rather than limits. This training course demonstrated how to conduct Management Strategy Evaluation (MSE) using FLR (<http://flr-project.org/>) to develop long term management plans that were robust to uncertainty.



It was assumed that participants had knowledge of stock assessment, including estimation of stock status and biological reference points. The course were conducted using R ([www.r-project.org/](http://www.r-project.org/)) and experience in using R or similar modelling languages were assumed.

Case studies were based upon ICES and ICCAT stocks. Course participants were welcomed to bring their own data.

By the end of the course, the participants were able to:

Run a stock assessment in R/FLR.

Develop Harvest Control Rules (HCRs) that generates the management outcomes based upon stock assessment outputs and biological reference points.

Evaluate the performance of alternative sampling and assessment procedures and HCRs given uncertainty.

Evaluate the trade-offs between risk to the stock and benefits to fishers of alternative scientific advice and management plans.

## 4 Course Programme

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The five-day course were organised as a series of morning and afternoon sessions. Hands-on exercises were linked to each topic and scheduled throughout the course. Assignments were conducted in the open-source programming language R and the FLR sets of packages. For a detailed programme see Annex 2.

Day	Lecture	Topic
<b>Monday</b>	1	<b>R &amp; FLR</b>
	2	Using R Using FLR with case study data sets
<b>Tuesday</b>	3	<b>Management Procedures I</b>
	4	VPA based stock assessment
	5	Biological reference points Non-linear modelling of stock recruitment data
<b>Wednesday</b>	6	<b>Management Procedures II</b>
	7	Stock projection Harvest control rules
<b>Thursday</b>	8	<b>Operating models:</b> Data rich examples
	9	Data poor examples
<b>Friday</b>	10	<b>Evaluation</b> Translating models into advice
	11	Bio-economics

## Annex 1: List of participants

### ICES/ICCAT Training Course on Management Strategy Evaluation (including FLR), Vigo, Spain from 5-9 April 2010

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## **Annex 2: Detailed course programme**

<b>Time</b>	<b>Event</b>	
<b>Monday, 5 April 2010</b> <b>Introduction</b>		
9.00 – 9.30	Welcome: (SAP, LK, IM) ICES Training and What is ICES? (SAP) About this course: (LK, IM) Introduction of participants and lecturers	
9.30 – 10.00	Introduction to MSE, FLR and some other acronyms (LK)	
10.00 – 10:30	The R language: installation and some advanced features (IM)	
10.30 – 11:00	<b>Tea/Coffee</b>	
11:30-13:00	Tutorial - Installation and FLCore (IM)	
13:00-14:00	<b>Lunch</b>	
14.30 – 15.30	<i>Tutorial - Installation and FLCore(cont.)</i>	
15.30 – 16.00	Assignment – Loading data, plotting, building objects	
16.00 – 16.30	<b>Tea/Coffee</b>	
16.30 – 18.00	Assignment – Loading data, plotting, building objects (cont.)	
18.00 – 20.00	<i>Icebreaker</i>	
<b>Tuesday, 6 April 2010</b>		

<b>Modeling biological populations</b>		
9.00 – 10.00	Modeling biological populations (LK)	
10.00 – 11.00	<i>Non-linear modeling of stock recruitment data using FLSR (IM)</i>	
11.00 – 11.30	<b>Tea/Coffee</b>	
11.30 – 13.00	Tutorial - Fitting SR models using FLSR (IM)	
13.00 – 14.30	<b>Lunch</b>	
14.30 – 15.00	Tutorial - Modeling growth and maturity (IM)	
15.00 – 16.00	Tutorial - Simulating a population (LK)	
16:00 – 16:30	<b>Tea/Coffee</b>	
16:30 – 18:00	Tutorial - Indicators (LK)	
<b>Wednesday, 7 April 2010</b> <b>Stock status, Harvest Control Rules and Management Procedures</b>		
9.00 – 10:00	Biological productivity and limits to exploitation (LK)	
10:00 – 11:00	Tutorial - Biological, and economic, reference points from FLBRP (LK)	
11.00- 11.30	<b>Tea/Coffee</b>	
11.30 – 13.00	<i>Tutorial - Stock assessment using FLXSA and FLSP (IM)</i>	
13:00-14:30	<b>Lunch</b>	
14.30 – 16.00	Tutorial - Harvest control rules (LK,IM)	

16.30 – 16.30	<b>Tea/Coffee</b>	
16.30 – 18.00	Tutorial – Management procedures (LK, IM)	
<b>Thursday, 8 April 2010</b> <b>Building operating models</b>		
9.00 – 10.00	Conditioning, OMs (IM)	
10:00 – 11:00	Tutorial - MSE for a data-poor situation (IM)	
11.00 – 11.30	<b>Tea/Coffee</b>	
11.30 – 13.00	<i>Tutorial - MSE for a data-poor situation (cont.)</i>	
13.00 – 14.30	<b>Lunch</b> & Group photo	
14.30 – 16.00	Tutorial - MSE for a data-rich situation (LK)	
16.00 – 16.30	<b>Tea/Coffee</b>	
16.30- 17.00	Tutorial - MSE for a data-rich situation (cont.)	
17.00 – 18.00	Assignment - Putting together a simple MSE for your own data	
20.00 – late	Course dinner (optional, expenses to be covered by participants)	
<b>Friday, 9 April 2010</b> <b>Translating models into advice</b>		
9.00 – 10.00	Advice from MSE, communication (LK,IM)	
10:00 – 11:00	Tutorial - Bio-economics (LK)	
11.00 – 11.30	<b>Tea/Coffee</b>	



10.45 - 13.00	Tutorial - Bio-economics (cont.)	
13.00 - 14.30	<b>Lunch</b>	
14.30 - 15.00	Demonstration - Extending classes, new packages (IM)	
15.00 - 15.30	Demonstration - ADMB (LK)	
15:30 - 16:00	<b>Tea/Coffee</b>	
16.00 - 17.00	Final discussion, Q&A and closing	