Bay of Bengal Large Marine Ecosystem Project and the Indian Ocean Tuna commission

BOBLME/IOTC
Stock Assessment Course
20-24 May, 2013, Bangkok, Thailand

Final Report

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1. Background

Despite the importance of fisheries to the Indian Ocean region, scientific monitoring and management are modest, with most stocks lacking modern scientific stock assessments. Without stock assessments, it is impossible to determine whether fish populations are overexploited or, potentially, underexploited relative to their ability to support sustainable yields. At a national level, fishery yields have been flat over the past decade, while the Indian Ocean countries populations have increased, and thus the need for sustainable protein sources has continued to increase. Does the current plateau in fishery yields represent the maximum sustainable yield or is greater harvest possible? If higher yields are possible, do we get there by fishing harder or by rebuilding overfished stocks?

From a scientific perspective, India and other Indian Ocean countries fisheries represent an opportunity to learn about the success and failure of fishery management strategies across a wide diversity of scales and management approaches. Indian Ocean fisheries range from large-scale industrialized fisheries for pelagic fishes like oil sardine, herring, and tuna to artisanal fisheries for nearshore and estuarine species. No single management approach is likely to be effective at all scales. A growing body of research on small scale and artisanal fisheries suggests that despite the lack of traditional top-down management by the central government, many of these fisheries have managed to avoid the “tragedy of the commons” problem where common-pool resources are inevitably degraded (Feeny et al. 1996; Ostrom et al. 1999). At the same time, recent work on community co-management, a widespread approach to management of small-scale fisheries, has elucidated the characteristics of such systems that lead them to be effective (Gutierrez et al. 2011).

There is currently a lively scientific debate about the global status and trends of marine fisheries. The most recent evaluations suggest that, at a global level, populations of exploited marine fish and invertebrate have declined 38% between 1970 and 2007, but have, on average, been stable since the early 1990s (Hutchings et al. 2010). Approximately two-thirds of marine fish populations are currently below the population size that would produce the maximum sustainable yield, but only one-third of marine fish populations are now being fished at rates that will lead to depletion below this level (Worm et al. 2009). That is, for many overfished populations, fishing has been reduced and the stage is now set for their recovery. These conclusions have been criticized for their reliance on a global stock assessment database (Ricard et al. in press) in which fisheries from developing countries are seriously under-represented. The developers of that database, the only one of its kind, acknowledge this weakness but are limited by the existence and public availability of fisheries data from developing countries like India.

These capacity building initiatives will improve fishery management in the Indian Ocean region, while at the same time increasing our understanding of status and trends of fisheries in developing countries. The data which will be used in these stock assessments already exist, and the work of this Project is synthesis, analysis, and capacity building.

Thus using this justification IOTC along with BOBLME held a workshop in Bangkok, Thailand for 5 days between the 20th and 24th of May. The workshop covered all aspects of how assessments are used within the IOTC context and also how to develop and analyse simple to complex models. The teaching was in two modes:

1) lectures

2) labs developing concepts presented in lectures
2. Introduction

The course covered numerous elements of stock assessment and ecosystem approaches to fisheries assessments. The introduction was made by Dr Hermes, the Chief Technical Advisor (CTA) of the BOBLME Project. The course was taught by Dr Rishi Sharma (IOTC), Dr Jim Ianelli (NOAA) and Dr Dale Kolody (CSIRO). List of participants is in Appendix II.

2.1. Objective

The objectives of the course were threefold:

- a) to convey the basic understanding of data collection programs and their use
- b) to demonstrate how these could be used in an assessment through population dynamic models
- c) to convey basic interactions of fish within an ecosystem

To understand core competency of the students attending, a course survey was developed initially so target instruction would be at the level required based on this survey (Appendix III).

2.2. Approach

The course was run in the format of lectures followed by examples (see Appendix I for agenda). Numerous lectures were covered on the following topics:

1) ecosystems and biomes where fish interact with the region they reside in, and how they feed in areas that have high primary production (as an attribute of oceanic features, tidal mixing or upwelling patterns)
2) life histories and how these factors are important in understanding the population dynamics
3) sampling design and collection of catch and effort data
4) basics of stock assessment
5) climate forcing and the effects on ecosystems
6) spawner and recruit

For accessing material presented in the workshop one can look at the website developed for this (https://sites.google.com/site/stockassessmentbkk2013/home).

Some pictures of the course are in Appendix VI.

3. Workshop effectiveness

A survey was designed for feedback after the course (Appendix IV). The course was developed to build capacity in stock assessment knowledge in the region and this workshop presented some basics of stock assessment and their value. In order to understand if it was useful to the audience a survey was developed that would address the utility of the material presented and whether the course should be modified somewhat. Results of the survey were given in Appendix V.

4. Workshop feedback

28 people attended from 8 different countries in the Bay of Bengal Region; Maldives, Bangladesh, India, Sri Lanka, Myanmar, Thailand, Malaysia and Indonesia. These individuals were from a varied background, but primarily scientists, managers or biologists in their respective agencies. There was a clear demand for more such trainings in the region (Appendix V, Table 1). In addition, the course had very positive feedback, all participants learned a lot, and wished that more such trainings were available and more time would be given to these workshops.
5. Future courses

Course presentation material in electronic format was handed to the participants for making their understanding clearer. Based on the feedback future courses should be held in the region again covering similar material in more depth. The focus would again be on advanced stock assessment techniques and would require computers and computer labs for training. Such courses would probably be focused on lesser individuals and more intensive on programming and computer techniques to be used in the preparing for an assessment.

6. References

Appendix I  Agenda

1) Introduction
   a. Workshop participants overview - Rishi
   b. IOTC Process Overview - Rishi
   c. Data sets and fishery issues - Jim & Rishi
   d. Defining management objectives, pretty good yield - Jim

2) Survey of population dynamics and stock assessment applications
   a. Ocean habitats and species interactions - Rishi
   b. Fisheries management definitions - Rishi
   c. Ecosystem and multispecies methods - Jim

3) Data analysis
   a. Use of R http://www.statmethods.net/ Dale
   b. Excel basics - Jim
   c. Fishery exploratory analysis - Jim

4) Sampling systems
   a. Estimating catch - Rishi
   b. Survey methods - Jim
   c. Introduction to tagging programs - Dale

5) Growth estimation and life history
   a. Organizing available data - Jim
   b. Approaches to growth estimation - Jim
   c. Maturity/spawning characteristics - Jim
   d. Sharing information from other stocks - Jim

6) Population models
   a. \( B_{t+1} = B_t + R_t + G - C_t \) - Rishi
   b. Extend by age - Jim
   c. Depletion methods - Jim

7) Per recruit analysis
   b. Yield – Jim/Dale/Rishi
   c. Harvest rate – Jim/Dale/Rishi

8) Age Structured Models
   a. Basics - Jim
   b. Fitting w/ assumptions - Jim

9) Length-based extensions
   a. Overview of principles - Jim
   b. Available complex packages – Jim/Dale
   c. Fitting an age structured model to length frequencies in excel - Jim


11) Estimating spawning stock and recruit relationships (SR) - Rishi

12) Climate Forcing and Effects - Rishi

13) Dataset examinations Part I - All

14) Dataset examinations Part II - All
## Appendix II List of Participants

### BANGLADESH

<table>
<thead>
<tr>
<th>Name</th>
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<td>Assistant fishery officer</td>
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<tr>
<td>SRI LANKA</td>
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### Appendix III Pre-workshop survey

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Please state what you would like to gain from this workshop or provide any other comments or questions you may have.

Please state what stock assessments you have conducted or responsible for?

Please state your role in your department, and how this workshop will benefit you in the future for your work?
Appendix IV  Survey on advanced stock assessment course in Thailand

Please answer the questions as to relevance (1 being most irrelevant and 5 being most relevant).

1. What is your role within Department of Fisheries in your country?
   Biologist ☐  Manager ☐  Scientist/Research ☐  Academia ☐

2. Did you find this course useful?

3. Would you want another course as a follow up in more depth?

4. Would you want a programming (R and C++) course to be the focus?

5. Do computer labs make some of this material easier to understand?

6. What areas in BOBLME countries would require some analysis?
   Inland ☐  Marine ☐  Both ☐

7. Did you bring your data to analyze in this workshop?
   Yes ☐  No ☐

8. Do you understand the limitations of your dataset?
   Yes ☐  No ☐  Maybe ☐

9. Will there be more efforts to collect data that is useful to SA’s?
   Yes ☐  No ☐  Maybe ☐

10. Is there a need for more workshops and trainings of this sort in the region?
    Yes ☐  No ☐  Maybe ☐

11. Overall course rating.

Other comments
## Appendix V Survey results

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<th>Manager</th>
<th>Scientist/Researcher</th>
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*Note multiple responses were given on this*

### Other comments
- Excellent course. Thanks.
- More training based on data collected in LOA. Follow up in one year for Hilsa.
- Fisheries Working Group.
- Country based training would be more useful.
- Time too short to absorb all this material. More training required.
- Beginner course required for some people as even basic population parameters for stocks need to be estimated.
- Need more time.
- Such training essential for BOBLME for SA.
- Lab exercises more relevant with real data.
- Organize data for workshop so we can analyze data from assessment at workshop.
- Need documents and references in hand before workshop.
- Excellent training.
Appendix VI Course photos
Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand are working together through the Bay of Bengal Large Marine Ecosystem (BOBLME) Project and to lay the foundations for a coordinated programme of action designed to improve the lives of the coastal populations through improved regional management of the Bay of Bengal environment and its fisheries.

The Food and Agriculture Organization (FAO) is the implementing agency for the BOBLME Project.

The Project is funded principally by the Global Environment Facility (GEF), Norway, the Swedish International Development Cooperation Agency, the FAO, and the National Oceanic and Atmospheric Administration of the USA.

For more information, please visit www.boblme.org