

Training course on Fish Stock Assessment methods and models

Mombasa, Kenya, 27 September-8 October 2010

Course contents (summary)

Part I. Introduction: The role of Fish Stock Assessment in the Fisheries Management process

1. Why manage fisheries? Basic concepts (the reaction of renewable resources to exploitation, the evolution of unmanaged fisheries, etc)
2. General approaches to Fisheries Management and main types of fisheries management measures: Input control, output control and technical measures;
3. Biological Reference Points and Management Control Rules, including the Precautionary Approach to Fisheries Management
4. The contribution of Fish Stock Assessment to appropriate fisheries management:
 - Definition of Biological Reference Points
 - Assessment of the relative merits of alternative fisheries management measures

Part II. Modelling fish stocks

1. Basic concepts on fish stocks and fisheries:
 - ∞ Fish life cycles and the effect of fishing on stock dynamics;
 - ∞ The factors leading to change in abundance of a fish stock: Recruitment, Growth and mortality
2. Models for fish population dynamics: Biomass dynamic models v/s structural models
3. Long-term projections v/s short-term projections: The concept of equilibrium conditions.
4. Production models (PMs). Basic assumptions and development of the models; Main features and response to exploitation of exploited fish populations according to PMs; Biological Reference Points from PMs; Long-term and short-term population and catch projections using Production Models; Analyzing the effect of fishing on fish stocks
5. Structural or dynamic pool models (SMs): Basic assumptions and development of the models: The cohort concept, Main features and response to exploitation of exploited fish populations according to Structural Models, Biological Reference Points from SMs. Long-term and short-term population and catch projections using Structural Models (including Yield per Recruit Analysis)
6. Evolution of different stock indicators under exploitation pressure. Simple indicators. Use of length as a proxy for age, and the relative age concept
7. The recruitment process and Stock-Recruitment models (Basic concepts)

Part III. Estimation of model parameters: Fitting models to data

1. Basic concepts of model fitting and parameter estimation theory. Goodness of fit, and residual analysis. Direct fitting or the use of proxies. The link model concept.
2. Dynamic production models: Data usually available, the fitting process and assessing the goodness of fit. Particular issues of concern with fitting Production models
3. Structural models: Data usually available, the fitting process and assessing goodness of fit. Particular issues of concern with fitting Structural models. Running age-based and length-based models. Simple and complex fitting processes
4. Individual growth models: Use of age data and replacements when only length information is available
5. Quick-and-dirty methods
6. Stock-Recruitment models (brief mention)

Part IV. Critical aspects of practical fish stock assessment

1. Main assumptions: the unit stock; the uniformity of fishing; environmental variability;
 - ∞ Consequences of invalid assumptions and ways to approach these.
2. Steps in an Assessment:
 - ∞ review of fishery,
 - ∞ consolidation of data and exploratory analysis;
 - ∞ selection of models
 - ∞ fitting of models;
 - ∞ estimation of Biological Reference Points and assessment of stock status relative to these BRPs;
 - ∞ short-term projections
 - ∞ elaboration of recommendations for Fisheries Management measures.

Part V. Pelagic Stock Assessment Issues

1. Introduction to the processes involved with International Regional Fisheries Management Organizations, in particular the IOTC.
2. Overview of the general characteristics and most problematic issues in pelagic fisheries from a stock assessment perspective (e.g. widespread international fisheries with mixed species targeting, poorly quantified spatial stock structure, reliance on commercial CPUE as a relative abundance index, large-scale tagging programs, etc).
3. Contrasting examples of the approaches used for the individual tuna and billfish species, which span a range of complexity from simple data-based empirical indicators, through highly aggregated deterministic surplus production models, to highly disaggregated integrated models using Stock Synthesis and Multifan-CL.

4. An introduction to Management Strategy Evaluation. This is the process of designing and testing management systems to be robust to the inevitable uncertainties that arise in stock assessment. While this is not yet used in the IOTC, we can discuss examples from other fisheries.

General course approach and information

Computational tools:

The course will be intensively based on exercises carried out by the participants, using computer spreadsheets (Excel, Open Office Calc).

Participants should be minimally conversant with computers, and especially with the use of computer spreadsheets for scientific calculations

In the first days of the course, participants will be given an overview of tools and techniques for programming with spreadsheets.

During the last few days of the course, participants will assess a simulated fishery, and prepare the corresponding Assessment Report.

Requirements:

A laptop with Windows operating system

Bibliography:

- ∞ Caddy, J.F. & Mahon, R. (1995). Reference points for fishery management. *FAO Fish. Tech. Pap.* 349: 80p.
- ∞ Cadima, E. (1991). Some relationships among biological reference points in general production models. *ICCAT, Coll. Vol. Sc. Papers*, (39):27-30.
- ∞ Cadima, E.L. 2003. Fish stock assessment manual. *FAO Fisheries Technical Paper*. No. 393. Rome, FAO. 161p.
- ∞ Cadima, E. & Palma, C. (1997). Cohort analysis from annual length catch compositions. WD presented to the Working Group on the assessment of the Southern Shelf Demersal Stocks. Copenhagen, 1-10 September, 1997.
- ∞ FAO (1995). Code of Conduct for Responsible Fisheries, Rome, FAO, 41 p.
- ∞ FAO (1996), Precautionary approach to fisheries. *FAO Fish. Tech. Pap.* 350 (2): 210p.
- ∞ Haddon, M. 2001. Modeling and Quantitative Methods in Fisheries. Chapman and Hall/CRC
- ∞ Sparre P. & Venema S. 1998. Introduction to Tropical Fish Stock Assessment - Part 1: Manual. *FAO Fisheries Technical Paper* 306/1 Rev. 2