DLMtool Course (v4.1)

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Course agenda

-- Day 1 --

1. Introduction
2. Running DLMtool
3. Customizing DLMtool

-- Day 2 --

4. Making recommendations with DLMtool
5. Advanced DLMtool
6. Robustness testing and ecosystem considerations

-- Day 3 --

Case Study 1: longtail tuna

Case Study 2: yellowfin tuna

DATA-LIMITED METHODS TOOLKIT

Module 1: Introduction **(~ 2 hours)**

Audience: Non quantitative fisheries audience including: managers, scientists and policy analysts

Purpose: Provide users with a conceptual framework for later modules; brief fishery managers on potential value

Objectives: Understand the problem DLMtool solves, its conceptual underpinnings, DLMtool features, and its current use in management and see a user friendly demo of DLMtool MSE in action.

Lecture 1a: Foreword (< 10 minutes)

- Objectives
- Intended audience (skill set)
- Course outline
- Online resources

Lecture 1b: Background (~ 30 minutes)

- Problem statement (why we need to 'crunch the numbers')
- Terminology
- MSE
- Detailed outcomes (MPs, robustness testing, VOI)

Lecture 1c: What is DLMtool? (~ 30 minutes)

- Overview (free R package, simulation testing, software design considerations)
- Features
- Case studies (SEDAR, California, DFO)
- Correct usage
- Online demo
- Future additions

Lecture 1d: How do management procedures work? (~ 20 minutes)

- Anatomy of an MP
- Schematic examples of MPs

Exercise 1: Online demo (~ 30 minutes)

- Specifying simulations
- Understanding MSE
- Summarizing performance
- Interpreting trade-offs

DATA-LIMITED METHODS TOOLKIT

Module 2: Running DLMtool **(~ 1h 5m)**

Audience: Quantitative fisheries scientists familiar with R

Purpose: Demonstrate how to get DLMtool working and providing familiarity with a DLMtool MSE process

Objectives: Get all users to the same stage WRT software installation before continuing with later modules; Understand the basic structure of a DLMtool MSE run; reinforce an understanding of what performance metrics are telling us (e.g. what is a simulation, really what is 'POF' anyway?)

Lecture 2a: Getting started (~ 10 minutes)

- Installation (RStudio, R, installing package from CRAN)
- Loading the package
- Setting up parallel processing and loading objects
- Check installation and test run
- Getting help

Lecture 2b: A simple 'no frills' run of DLMtool (~ 30 minutes)

- SOO design: Stock, Fleet, Observation and Implementation objects
- Constructing operating models
- Visualizing operating models
- Running an MSE
- Visualizing MSE runs
- Evaluating performance
- Trade-off plots

Exercise 2a: An R script for installation and validating installation (~ 10 minutes)

Exercise 2b: A basic DLMtool run (~ 15 minutes)

- Finding alternative pre-specified Stock, Fleet, Observation error (Obs) Implementation error (Imp) objects.
- Constructing an operating model (OM) from these premade objects.
- Visualizing DLMtool Stock, Fleet, Obs, Imp and OM objects
- Evaluating MSE outcomes for varying operating models
- Understanding the various pre-specified performance metrics

DATA-LIMITED METHODS TOOLKIT

Module 3: Customizing DLMtool **(~ 4 hours)**

Audience: Quantitative fisheries scientists familiar with R

Purpose: Educate and inform users on some of the basic functionality / flexibility of the toolkit

Objectives: Understand OO design of DLMtool, be able to customize operating models, MSE running options and produce custom performance metrics

Lecture 3a: Modifying operating models (~ 1 hour)

- .csv input file conventions
- Stock objects
- Fleet objects
- Observation objects
- Implementation error objects

Lecture 3b: Specifying MPs and other MSE outputs (~ 30 minutes)

- Specifying MPs for MSE
- Convergence diagnostics
- Value of information (VOI)
- Cost of current uncertainties (CCU)

Lecture 3c: Custom performance analysis (~ 30 minutes)

- Interpreting the data stored in the MSE object (MSE object structure)
- Designing performance metrics
- User plots

Exercise 3a: Modifying operating models (~ 1 hour)

Exercise 3b: Selecting MPs and other MSE outputs (~ 30 minutes)

Exercise 3c: Custom performance metrics (~ 30 minutes)

DATA-LIMITED METHODS TOOLKIT

Module 4: Making recommendations with DLMtool **(~ 2h 20m)**

Audience: Quantitative fisheries scientists familiar with R (who have completed Module 3)

Purpose: Make management recommendations using DLMtool

Objectives: Learn how to process data to provide management advice using the MPs of DLMtool

Lecture 4a: The format of fishery data for DLMtool (~ 30 minutes)

- Time series data
- Parameters
- Uncertainty

Lecture 4b: Running MPs (~ 40 minutes)

- Can / Can't / Needed functions
- Calculating TAC or effort recommendations
- Sensitivity analysis

Exercise 4a: Processing data (~ 30 minutes)

- Explore Data object
- Import Data object from .csv files
- Determine which MPs can be applied to Data

Exercise 4b: Calculating management advice (~ 40 minutes)

- Apply Output controls to Data object
- Apply Input controls to Data object
- Sensitivity analysis on TAC recommendations

DATA-LIMITED METHODS TOOLKIT

Module 5: Advanced DLMtool **(~ 4h 10m)**

Audience: Quantitative fisheries scientists familiar with R (who have completed Module 3)

Purpose: Build on previous models to provide a complete account of DLMtool functionality

Objectives: Learn advanced features of DLMtool – currently big issues are OM specification and custom MPs

Lecture 5a: Advanced operating model specification (~ 30 minutes)

- Specifying historical effort trends
- Time varying selectivity
- Parameter cross correlation
- Conditioning operating models by SRA
- Conditioning operating models by SS

Lecture 5b: Custom Management Procedures 1: output controls (~ 40 minutes)

- The format of DLMtool simulated data (Data)
- A constant catch MP
- A more complex output control MP
- Tips for MP design

Lecture 5c: Custom MPs 2: input controls (~ 30 minutes)

- Effort controls
- Spatial controls
- Size limits (relative to maturity and in absolute terms)

Exercise 5a: Advanced operating model specification (~ 30 minutes)

- Specifying historical effort trends
- Time varying selectivity
- Preserving correlation among estimated growth parameters
- Conditioning OM by Stochastic Stock Reduction Analysis
- Conditioning OM by Stock Synthesis

Exercise 5b: Custom output control MPs (~ 40 minutes)

Exercise 5c: Custom input control MPs (~ 30 minutes)

DATA-LIMITED METHODS TOOLKIT

Module 6: Robustness Testing and Ecosystem Considerations **(~ 2h 40m)**

Audience: Quantitative fishery scientists familiar with R (who have completed Module 3)

Purpose: Demonstrate the role of robustness testing and provide examples of how wider ecosystem impacts may be addressed by simulating time-varying operating model parameters

Objectives: Users should understand the difference between sensitivity in management recommendations versus sensitivity in selection of management procedures. Users should consider what ecosystem changes may be occurring in their system and construct operating models to address these.

Lecture 6a: Robustness testing and MP selection (~ 40 minutes)

- MP selection by satisficing
- Quality of data
- Fishing efficiency (output versus input controls)
- Implementation error
- Gaining confidence in a management system

Lecture 6b: Time varying parameters and ecosystem considerations (~ 40 minutes)

- Growth
- M
- Recruitment

Exercise 6a: Robustness testing (~40 minutes)

Exercise 6b: Time varying parameters and ecosystem considerations (~40 minutes)

Case Study 1: IOTC case study, longtail tuna **(~3 hours)**

Audience:	Quantitative fishery scientists familiar with R (who have completed Module 3)
Purpose:	Describe how operating models were developed for a data-limited ABNJ tuna stock
Objectives:	Users should understand the various data-limited methods for specifying operating models that make use of life-history theory, imputation and historical stock reconstruction

Lecture CS1: longtail tuna operating model specification	(~1 hour)
Exercise CS1: longtail tuna analyses and interpretation	(~2 hours)

Case Study 2: IOTC case study, yellowfin tuna **(~3 hours)**

Audience:	Quantitative fishery scientists familiar with R (who have completed Module 3)
Purpose:	Describe how operating models were developed for a relatively data rich ABNJ tuna stock
Objectives:	Users should understand how to convert stock assessment outputs to DLMtool operating model specification using the various tools available in the package.

Lecture CS2: yellowfin tuna operating model specification	(~1 hour)
Exercise CS2: yellowfin tuna analyses and interpretation	(~2 hours)