

**DLMtool training (v5.1)**



In collaboration with Fisheries and Oceans Canada

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September 2017

**Course agenda**

***Lecture 1 Introduction Wed Oct 25th (9:30am – 11:30am, Pacific)***

Problem statement, MSE concepts, what is DLMtool?

Exercise 1a & 1b. Online demo and a reading assignment

***Lecture 2 Running DLMtool Wed Nov 1st (9:30am – 11:30am, Pacific)***

Installation, a basic DLMtool run, building operating models

Exercises 2a-c. Installation, a no-frills DLMtool run, customizing operating models

***Lecture 3 Customizing DLMtool Wed Nov 8th (9:30am – 11:30am, Pacific)***

Customizing DLMtool, making management recommendations

Exercises 3a-d. Selecting MPs, custom metrics, formatting data, calculating advice

***Lecture 4 Advanced DLMtool Wed Nov 22nd (9:30am – 11:30am, Pacific)***

Advanced operating model specification, custom management procedures

Exercises 4a-c. Custom operating model parameters, input / output control MPs

***Lecture 5 DFO case studies Wed Dec 6th (9:30am – 11:30am, Pacific)***

Creating operating model templates, how Capelin and Jonah Crab OMs were specified

Exercises 5a-b. Specify your own OM, produce MSE diagnostic report.

***Remedial session Wed Jan 10th (9:30am – 11:30am, Pacific)***

Revisions to Capelin and Jonah Crab, frequently asked questions following Lecture 5

Review operating model development

**Lecture 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, 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

Take home exercise 1a: Online demo 1 hour

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

Take home exercise 1b: DLMtool software description paper 1 hour

**Lecture 2: Running DLMtool and building operating models 2 hours**

Audience: Quantitative fisheries scientists familiar with R

Purpose: Demonstrate how to get DLMtool working and providing familiarity with a DLMtool MSE process and the OO design of DLMtool,

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?). Learn how to build and customize operating models.

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 and Visualizing operating models
* Running and Visualizing MSEs
* Evaluating performance / trade-off plots

Lecture 2c: Modifying operating models 1 hour

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

Take home Exercise 2a: An R script for installation and validating installation 10 minutes

Take home 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

Take home Exercise 2c: Modifying operating models 1 hour

**Lecture 3: Customizing DLMtool and making recommendations 2 hours**

Audience: Quantitative fisheries scientists familiar with R

Purpose: Inform users on some of the basic functionality / flexibility of the toolkit. Learn how to make management recommendations using DLMtool

Objectives: Understand OO design of DLMtool, be able to customize operating models, producing custom performance metrics, formatting DLMtool data, calculating recommendations.

Lecture 3a: Specifying MPs and other MSE outputs 30 minutes

* Specifying MPs for MSE
* Convergence diagnostics
* Value of information (VOI) and cost of current uncertainties (CCU)

Lecture 3b: Custom performance analysis 30 minutes

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

Lecture 3c: The format of fishery data for DLMtool 30 minutes

* Time series data
* Parameters
* Uncertainty

Lecture 3d: Running MPs 40 minutes

* Can / Can’t / Needed functions
* Calculating TAC or effort recommendations
* Sensitivity analysis

Take home exercise 3a: Selecting MPs and other MSE outputs 30 minutes

Take home exercise 3b: Custom performance metrics 30 minutes

Take home exercise 3c: Processing data 30 minutes

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

Take home exercise 3d: Calculating management advice 40 minutes

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

**Lecture 4: Advanced DLMtool 2 hours**

Audience: Quantitative fisheries scientists familiar with R (who have completed Lecture 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 4a: 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 4b: 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 4c: Custom Management Procedures 2: input controls 30 minutes

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

Take home exercise 4a: 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

Take home exercise 4b: Custom output control MPs 40 minutes

Take home exercise 4c: Custom input control MPs 30 minutes

**Lecture 5: Developing case studies – Capelin and Jonah crab 2 hours**

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

Purpose: Demonstrate how to work-up operating models from scratch from assessments and also when data are limited.

Objectives: Users should understand how to develop operating model objects and also

Lecture 5a: Operating model templates and automatic reporting 20 minutes

* The OM directory functions
* OM excel functions
* Markdown OM report building

Lecture 5b: How Capelin and Jonah crab case studies were developed 90 minutes

* Capelin
* Jonah Crab

Lecture 5c: Results for Capelin and Jonah Crab 10 minutes

Take home exercise 5a: develop an operating model from scratch using DLMtool

Take home exercise 5b: Conduct an MSE and produce a brief 2 page report on your findings (e.g. performance of MPs, tradeoffs, VOI, CCU).

**Remedial session 3 hours**

Audience: Quantitative fishery scientists familiar with R (who have completed Lecture 5)

Purpose: Discuss issue arising in development of DFO case studies since Lecture 5.

Objectives: Consolidate operating model building concepts and help to finalize DFO case studies for future research.