Agenda of
INTERNATIONAL TRAINING COURSE ON
"Fishery Stock Assessment and Ecosystem Modeling"
September 16 – 22, 2015

Indian National Centre for Ocean Information Services
(INCOIS), Hyderabad, India

Day 01: Wednesday, September 16, 2015	
09-30 - 09:45 Hrs	Registration
09:45 – 10:00 Hrs	Introduction of participants 20min
10:00 – 10:45 Hrs	Introductory talks on "Stock Assessment Practices in India" by CMLRE, CMFRI, FSI on their methods
10:45 – 11:15 Hrs	Tea / Coffee Break
11:15 – 13:00 Hrs	Stock assessment introduction & basic theory (Dr. Owen Hamel & Dr. Aaron Berger) - Learning more about knowledge and skill levels, - Goals of fisheries stock assessment
13:00 - 14:00 Hrs	Lunch Break
14:00 - 15:30 Hrs	Stock Assessment (Dr. Owen Hamel & Dr. Aaron Berger) - General population theory (births, deaths, recruitment, growth), - Modeling of exploited populations
15:30 - 16:00 Hrs	Break (sign up for mini project help)
16:00 - 18:00 Hrs	Begin mini-projects in linear modeling & statistics, and acoustics. This could include a basic lesson in R or examples of data analysis using R.
Day 02: Thursday, September 17, 2015	
09:30 - 10:30 Hrs	Stock assessment lectures (continued….) - Discuss concept of surplus production & sustainable yield - Equilibrium concept and reference points
10:30 - 11:00 Hrs	Tea / Coffee Break
11:00 - 13:00 Hrs	Data for stock assessment (Dr. Owen Hamel & Dr. Aaron Berger) - What informs us of population trends & dynamics, etc - Biological metrics - Fishery-dependent data (catch, CPUE, compositions, etc) - Fishery-independent data (index of abundance, compositions, etc)
12:00 – 13:00 Hrs	Introduction to linear time-series analysis for environmental data - Introduction lectures (Dr. Eli Holmes)
13:00 - 14:00 Hrs	Lunch Break
14:00 - 15:30 Hrs	Introduction to linear time-series analysis for environmental data (Introduction lectures (Dr. Eli Holmes)
15:30 - 16:00 Hrs	Tea / Coffee Break (sign up for mini-project help)
16:00 - 18:00 Hrs	- Mini-projects/practicum in linear modeling & statistics, stock assessment, and acoustics* *OR* - Brainstorming session

Day 03: Friday, September 18, 2015	
09:30 - 10:30 Hrs	Acoustics-trawl surveys I: Generalities (DR. Juan Zwolinski, via Skype) - Sound and Acoustic Instruments - Fisheries acoustics - Survey Design - Data Analysis
10:30 - 11:00 Hrs	Tea / Coffee Break
11:00 - 13:00 Hrs	Data collection programs (Dr. Owen Hamel & Dr. Aaron Berger) Data-assessment connection (limited, moderate, full) Examples - Combining compositional samples - Maturity ogive
13:00 - 14:00 Hrs	Lunch Break
14:00 - 15:30 Hrs	Stock Assessment Models (Dr. Owen Hamel & Dr. Aaron Berger) - Different types of models - Surplus production - Per recruit - Stage structured (age, length)
15:30 – 16:00 Hrs	Tea / Coffee Break
16:00 - 18:00 Hrs	- Mini-projects in linear modeling & statistics, stock assessment, and acoustics *OR* - Brainstorming session

Day 04: Saturday, September 19, 2015	
09:30 - 10:30 Hrs	Acoustic-trawl surveys II: Applications to the California Current Ecosystem (Dr. Juan Zwolinski, via Skype) - Epipelagic community of the California Current - Seasonal Surveys - Sardine dynamics and productivity
10:30 - 11:00 Hrs	Tea / Coffee Break
11:00 - 13:00 Hrs	Stock Assessment Models (Owen & Aaron) - Integrated analysis - Multi-data series - Tagging data
13:00 - 14:00 Hrs	Lunch Break
14:00 - 15:30 Hrs	Examples of Stock assessment models (Owen & Aaron) - Surplus production - Stage structured models - Demonstrate SS and R4SS Show different levels of complexity of models within SS
15:30 - 16:00 Hrs	Tea / Coffee Break
16:00 – 18:00 Hrs	- Mini-projects/practicum in linear modeling & statistics, stock assessment, and acoustics *OR* - Brainstorming session

Day 05: Sunday, September 20, 2015	
09:30 - 10:30 Hrs	Fisheries ecology – concepts, trophic levels (Dr. E. Vivekanandan)
10:30 - 11:00 Hrs	Tea / Coffee Break

11:00 - 12:00 Hrs	Principles of ecosystem modeling (Dr. K. S. Mohamed)
12:00 – 13:00 Hrs	Introduction to ecosystem based fisheries management and ECOPATH software (Dr. K. S. Mohamed)
13:00 - 14:00 Hrs	Lunch Break
14:00 - 14:30 Hrs	Basic inputs – fishery catch, landings, discards, length frequency, prices, fleets etc (Dr. K. S. Mohamed)
14:30 – 15:00 Hrs	Basic parameterization – ecological groupings – concepts, examples
15:00 – 15:30 Hrs	Biomass estimations – VPA, swept area, Gulland etc, Consumption – Aspect ratios, W_{∞}, Q/B ratio estimation (Dr. E. Vivekanandan and Dr. K.S. Mohamed)
15:30 - 16:00 Hrs	Break
16:00 – 16:30 Hrs	Estimation of primary productivity, phytoplankton biomass; Estimation of secondary production – zooplankton biomass, biomass of benthic organisms (Dr. K. S. Mohamed)
16:30 – 17:00 Hrs	Methods of estimation of diets – stomach content analysis of carnivores, herbivores and omnivores, preparation of diet matrices (Dr. E. Vivekanandan)
17:00 – 17:30 Hrs	Estimation of detritus biomass; Data pedigree – methods of estimation and pedigree index (Dr. K. S. Mohamed)
17:30 - 18:30 Hrs	- Mini-projects/practicum in linear modeling & statistics, stock assessment, acoustics, ecosystem modeling *OR* - Brainstorming session

Day 05: Monday, September 21, 2015	
09:30 - 10:15 Hrs	Mass balancing procedures – manual and auto methods (Dr. K. S. Mohamed)
10:15 - 11:00 Hrs	Parameter evaluation – outputs, net efficiency, omnivory index, respiration (Dr. E. Vivekanandan)
11:00 – 11:30 Hrs	Tea / Coffee Break
11:30 – 12:15 Hrs	Practical – Data inputs and trials (Dr. E. Vivekanandan and Dr. K. S. Mohamed)
12:15 – 13:00 Hrs	Parameter evaluation – outputs, total system throughput, trophic level of fishery, Niche overlap, connectance index, mixed trophic impact, predation mortality, network analysis etc. etc. (Dr. E. Vivekanandan)
13:00 – 14:00 Hrs	Lunch Break
14:00 - 14:45 Hrs	Principles of ECOSIM (Dr. K. S. Mohamed)
14:45 – 15:30 Hrs	Preparation of scenarios for simulation (Dr. K. S. Mohamed)
15:30 – 16:00 Hrs	Tea / Coffee Break
16:00 – 16:45 Hrs	ECOSIM trails (Dr. K. S. Mohamed)
16:45 - 18:00 Hrs	- Mini-projects/practicum in linear modeling & statistics, stock assessment, acoustics, ecosystem modeling *OR* - Brainstorming session

Day 06: Tuesday, September 22, 2015	
09:30 - 10:30 Hrs	Report out from Mini-projects or final lectures
10:30 - 11:00 Hrs	Tea / Coffee Break
11:00 - 13:00 Hrs	Report out from Mini-projects

13:00 - 14:00 Hrs	Lunch Break
14:00 - 15:30 Hrs	Future plans, next steps
15:30 - 16:00 Hrs	Tea / Coffee Break
16:00 - 17:00 Hrs	Final comments

Proposed Breakout Groups for "Mini-Projects"

GR-01:Stock assessment	GR-02: Acoustics	GR-03Linear Modeling & Statistics	GR-04 Ecosystem Modeling
Dr. Owen Hamel Dr. Aaron Berger	Dr. Juan Zwolinski	Dr. Eli Holmes	Dr. K. S. Mohamed and Dr. E. Vivekanandan

Scientific questions to be addressed during breakout sessions by each group will be in on stock assessment, acoustics questions using linear modeling and statistics as tools. For Stock assessment the practicum / mini-projects can include

- Deterministic and stochasitc models
- Error types and uncertainty
- Fitting models to data
- Examples of sub-models, e.g.
  - Length/weight relationship
  - Growth (vonB)
  - Recruitment (BevHolt)
  - Mortality (catch curve)
- CPUE

Data requirements for Stock Assessment Mini-projects:

1. Catch data including landings and any discard at sea.
2. Indices - Survey (fishery-independent) or Fishery-Dependent catch per unit effort (CPUE)
3. Length and Age composition data from fisheries and surveys - Also age at length or data with both length and age.
4. Weight data - weight at length and weight at age.
5. Information on the natural mortality rate and/or longevity.
6. Information on maturity at age and/or length and also fecundity at size.
7. For all of these, information on how the data was collected – randomized or stratified, or opportunistic sampling, for example.
8. In addition, information on how the fisheries operate and how they have changed over time - gear changes, target changes, location changes, etc.

Computer and Software Requirements

Data Analysis

Computer requirements: workshop participants should bring a laptop. PC, Mac or Linux.

Software requirements

All software used is free and open-source

* Download and install the latest version of R http://cran.r-project.org/

* Download and install RStudio http://www.rstudio.com/products/rstudio/download/

Metadata:

Please bring data sets that you would like to work on during the mini-project sessions each day. Data format for participant data Preferably, data should be in comma-delimited files in the format below. Data in Excel files can be easily converted to comma-delimited files. This shows an example of how yearly time series data would look in a .csv (comma-delimited file). NA denotes missing values. Note that a missing year is input as NAs; it is not left off.

Year, Site1, Site2, Temperature, pH

1990, 10, 25.2, 26, 7.2

1991, 11.2, 26.1, 27, 7.1

1992, NA, NA, NA, NA

1993, 12.3, NA, NA, 7.0

1994, NA, 26.4, 30, 6.9