



SLIP Ph.D. Course in Multispecies Fisheries Models

Hirtshals, 1-10 August 2001



Participants

The course was attended by 12 participants, four of which were Danish. Three of the Danish students were associated with the SLIP network and the fourth had just finished his Master degree but had applied for a SLIP Ph.D. at the University of Aarhus. Of the remaining participants, two came from Sweden, two from Portugal, one from Italy, one from Estonia, one from Brazil and one from Canada. Four of the twelve students were female. A list of participants and teachers is enclosed as Annex 1.

Teachers

The teachers consisted of Dr Villy Christensen (Univ. of British Columbia, Canada), Prof. Jeremy Collie (Univ. of Rhode Island, USA), Prof. Henrik Gislason (Univ. of Copenhagen, Denmark (organizer)) and senior advisor Morten Vinther (Danish Institute for Fisheries Research). Prof. John Pope (Univ. of Tromsø) had to cancel his participation at the last moment due to illness.

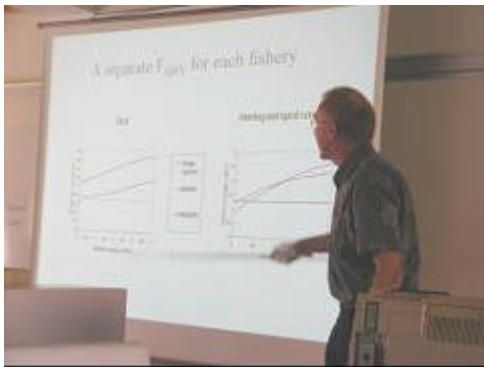
Content

The course presented three families of multispecies fisheries models (Lotka-Volterra, MSVPA/MSFOR/4M and ECOPATH/ECOSIM/ECOSPACE) to the students. A description of the day-to-day program is given in Annex 2.

The first day introduced Lotka-Volterra models to the students and made them perform an exercise where a three-species Lotka-Volterra model was fitted to a simulated set of data with AD Model Builder. The second day started with a discussion of the results of the exercise after which the students were introduced to MSVPA. In the afternoon the students were divided into three groups and used a simple spreadsheet version of the MSVPA/MSFOR model to investigate the sensitivity of the model to changes in input parameters, to compare runs with a partial set of food contents data, and to study the differences and similarities between multi- and single species predictions. On the third day the results were presented after which the 4M model was described. After a short visit to the North Sea Museum, where Henrik Flintegaard took us behind the scenes, the afternoon was spent on using 4M to investigate possible recovery strategies for North Sea cod. In the evening students and teachers were invited home to Villy Christensen. On Saturday morning a short visit to *Dana* was arranged by Karl Johan Stæhr (DFU). After the visit, a case study of the application of MSVPA to data from Georges Bank was presented. The use and definition of multispecies reference points for fisheries management was dealt with in two subsequent lectures and discussed in plenum. In the afternoon the students presented their own projects.

On Sunday the students were taken on an excursion along the coast. The main theme was the geology of the region. Monday morning started with an introduction to ECOPATH and a demonstration of how the model could be tuned to data from the North Sea. After lunch an invited lecture by Poul Degnbol discussed modern rationality and the use and abuse of complex models in policy formulation and decision making. Later on the major features of ECOSIM were explained and the simulations from a North Sea version compared to output from the MSVPA. This

continued on Tuesday with computer demonstrations of advanced features in ECOSIM and a brief introduction to ECOSPACE. After the Tuesday lunch the students visited the SINTEF tank for testing trawl performance and design where Ulrik Jes Hansen demonstrated the use of the tank. In the evening the students were taken on a tour to the Hirtshals fish auction and the bunker museum. Wednesday morning a guest lecture by Uffe Thygesen (DFU) presented methods for validating and comparing complex models from a statistical point of view after which it was discussed in plenum how the three model families could be compared. The students were divided into three groups to examine the functional relationships of the models, the goodness of the fit to the available data, and how the models differed in forward projections. A simple case study from the Baltic for which a MSVPA including cod, herring and sprat already existed was selected and ECOSIM and a three species Lotka-Volterra model tuned or fitted to the data. The latter model was extended by a term describing the intake of herring, sprat and other food by cod allowing it to be fitted to biomass and stomach content data. Thursday morning Niels Gerner Andersen (DFU) gave an overview of the problems involved in using stomach evacuation experiments and bioenergetics to estimating food intake after which the comparisons of the models continued for the rest of the day. Saturday morning was used for finalizing the comparisons and preparing the presentations and writing up a small report in each group. The results were presented and discussed after lunch. Although much of the work was preliminary the exercise had increased the students understanding of the differences between the models and the difficulties involved in comparing their behaviour. After coffee, a short presentation and discussion of the results from the evaluation concluded the course.



Course material

The course material consisted of publications describing the models and their applications (Annex 3) as well as copies of overheads from the lectures. The computer programs distributed included a test version of AD Model Builder (Otter Research), a spreadsheet version of a MSFOR/MSVPA for the Baltic, the North Sea 4M, and ECOPATH/ECOSIM for the North Sea and the Baltic. The models, the programs used, the results from the exercises, a number of the presentations in PowerPoint, and other useful material such as the list of the participants and course photos were transferred to a CD and each of the participants was supplied with a copy.

Evaluation

The course was evaluated by a questionnaire (Annex 4) followed by a general discussion. The overall opinion was that the course had been good (7 students) or excellent (5 students). It was proposed to use more time on Lotka-Volterra models, to explain MSFOR better, to demonstrate 4M and ECOPATH/ECOSIM on a simpler system than the North Sea, and to allow more time for making model comparisons. All of the students considered the facilities at the North Sea Centre to be excellent and the idea of having additional lecturers involved to be good. However, some suggested that more should have been done to integrate the students socially from the start, i.e. by arranging a bowling evening early in the course or by making them present their own work at the very beginning of the course instead of on Saturday afternoon.



Annex 1.
List of participants

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Annex 2.

Day to day program

Wednesday 1

09.00 – 09.30	Introduction
09.30 – 10.30	Multispecies interactions in marine fish communities: the empirical evidence
10.45 – 12.00	Lotka-Volterra models: historical and theoretical development
13.00 – 13.45	Lotka-Volterra models continued
14.00 – 15.00	Difference-equation forms and Fisheries applications
15.00 – 17.00	Computer exercise: fitting 2 and 3-species models with AD Model Builder

Thursday 2

09.00 – 10.30	Continue exercise and wrap-up session to answer questions from yesterday's lectures and exercise
10.45 – 11.30	Introduction to MSVPA and MSFOR
11.30 – 12.00	Baltic MSVPA and MSFOR
13.00 – 17.00	Computer exercises in groups a) Compare single and multispecies short and long term predictions b) Examine the effect of removing part of the stomach content data. c) Investigate the sensitivity of the model to changes in parameters such as M1, Food conversion, input F and Other food

Friday 3

09.00 – 10.00	Group presentations
10.30 – 12.00	The North Sea MSVPA The 4M model & tuning of input F
13.00 – 14.00	Visit to the North Museum
14.00 – 17.00	Computer exercises in groups with the 4M model How to recover North Sea Cod?

Saturday 4

09.00 – 10.00	Group presentations
10.30 – 11.00	The Georges Bank MSVPA
11.00 – 12.00	Multispecies reference levels for Baltic fish stocks The Amoeba approach to presenting multivariate results
13.00 – 17.30	Presentations of the participants own projects
20.00 – 24.00	Hirtshals bowling centre

Sunday 5

Excursion to Rubjerg Fyr, Raabjerg mile, Skagen Museum and Grenen

Monday 6

09.00 – 12.00	ECOPATH
13.00 – 13.45	A sociologist's view on modern rationality, modeling and fisheries management (Poul Degnbol, Director, IFM)
13.00 – 14.00	ECOSIM
14.00 – 17.00	Demonstration of the North Sea ECOPATH and ECOSIM

Tuesday 7

09.00 – 12.00	Exercises with the North Sea ECOPATH and ECOSIM
13.00 – 14.00	Visit to SINTEF and demonstration of the tank for testing fishing gear (Ulrik Jes Hansen)
14.00 – 17.00	ECOPATH/ECOSIM & ECOSPACE, demonstration of advanced features
20.00 – 22.00	Visit to Hirtshals fish auction and the bunker museum

Wednesday 8

09.00 – 10.30	Model validation and comparison (Uffe Thygesen, DFU)
11.00 – 12.00	Discussion on how to compare L-V models, MSVPA/MSFOR and ECOPATH and ECOSIM
13.00 – 17.00	Comparison of models in groups a) Functional relationships, b) Goodness of fit, c) Forward projections

Thursday 9

09.00 – 10.30	Estimation of food consumption rates (Niels Gerner Andersen, DFU)
10.30 – 12.00	Comparison of models (cont.)

Friday 10

09.00 – 12.00	Comparison of models (cont.)
13.00 – 14.00	Presentation of results
15.00 – 16.00	Summary, evaluation and closing

Breakfast was served at 08.00, coffee in a 15-minute morning break, lunch between 12.00 and 13.00, coffee again in the evening around 15.00 and dinner at 18.30.

Annex 3.

List of papers distributed to the students

- Allison, K. DeLong, and Collie, J.S., 2001. Fitting Multispecies Models – an exercise using AD Model Builder. 5. pp. (mimeo.)
- Andersen, N.G. 2001. A gastric evacuation model for three predatory gadoids and implications of using pooled field data of stomach contents to estimate food rations. (submitted to *Journal of Fish Biology*), 25 p.
- Andersen, N.G., 1999. The effects of predator size, temperature, and prey characteristics on gastric evacuation in whiting. *Journal of Fish Biology* 54:287-301.
- Christensen, V. 2001. Exercise on using Ecopath with Ecosim. 5. pp.
- Christensen, V., 2001. Should Ecopath be used only in situations where data are inadequate to use more detailed and realistic methods like MSVPA? Lecture note 1p. (mimeo)
- Christensen, V., Walters, C., and Pauly, D., 2000. ECOPATH with ECOSIM: A Users Guide. Fisheries Centre, University of British Columbia, Vancouver, Canada and ICLARM, Penang Malaysia. 130 p.
- Collie, J.S., 2001. Lecture notes on Lotka-Volterra models. 16 pp. + 1 pp. refs.
- Gislason, H., 1999. Single and Multispecies reference points for Baltic fish stocks. *ICES Journal of Marine Science* 56: 571-583.
- Hollowed, A.B., Bax, N., Beamish, R., Collie, J., Fogarty, M., Livingston, P., Pope, J., and Rice, J. 2000. Are multispecies models an improvement on single-species models for measuring fishing impacts on marine ecosystems? *ICES Journal of Marine Science*, 57: 707-719.
- Magnusson, K.G., 1995. An overview of multispecies VPA – theory and applications. *Reviews in Fish Biology and Fisheries* 5: 195-212.
- Pauly, D., Christensen, V., and Walters, C., 2000. Ecopath, Ecosim, and Ecospace as tools for evaluating ecosystems impacts of fishing. *ICES Journal of Marine Science* 57: 697-706.
- Pauly, D., Christensen, V., Dalsgaard, J., Froese, R and Torres, Fr. Jr., 1998. Fishing Down Marine Food Webs. *Science* 279: 860-863.
- Pope, J.G., 1991. The ICES Multispecies Assessment Working Group: evolution, insights, and future problems. *ICES mar. Sci. Symp.* 193:22-33.
- Vinther, M., 2001. 4M exercise: Recovery plan for the North Sea cod. 2 pp. (mimeo)
- Walters, C., Christensen, V., and Pauly, D., 1997. Structuring dynamic models of exploited ecosystems from trophic mass-balance assessments. *Reviews in Fish Biology and Fisheries* 7: 139-172
- Walters, C., Pauly, D., and Christensen, V., 1999. Ecospace: Prediction of Mesoscale Spatial Patterns in Trophic Relationships of Exploited Ecosystems, with Emphasis on the Impacts of Marine Protected Areas. *Ecosystems* 2:539-554.
- Walters, C., Pauly, D., Christensen, V., and Kitchell, J.F., 2000. Representing Density Dependent Consequences of Life History Strategies in Aquatic Ecosystems: EcoSIM II. *Ecosystems* 3:70-83

Annex 4.

Evaluation of the SLIP Ph.D. Course on Multispecies Fisheries Models 1-10 August 2001

Please give us your opinion on to the following questions. Do not hesitate to include supplementary comments that you may not think relevant. Do not write your name anywhere, it is an anonymous questionnaire.

Overall evaluation

What is your overall opinion about the course?

Poor.....	0
Not very good.....	0
OK.....	0
Good.....	7
Excellent.....	5

Course content

Did the course provide a reasonable overview of the subject?

Yes.....	12
To some extent.....	0
No, important items were missing.....	0

Comments (e.g. missing topics)

- ?? Validation part should have been longer
- ?? Short overview of other types of models preferable
- ?? Good introduction

Where the topics included adequately covered?

Yes.....	10
To some extent.....	2
No.....	0

Comments (e.g. topics receiving insufficient/too much attention)

- ?? More time for complex models needed
- ?? More on Lotka Volterra
- ?? Need a discussion on how to improve models
- ?? Key papers should have been distributed before the course

Lectures

How was the level of the lectures?

Too low..... 0
Adequate..... 12
Too high..... 1

Comments

Were the lectures well prepared and easy to understand?

Yes..... 11
To some extent..... 1
No..... 0

Comments

Exercises

Were the exercises useful for understanding the functioning of the models?

Yes..... 11
To some extent..... 1
No..... 0

Comments

Other activities

Was the time spent on introducing to other institutions in the North Sea Center (IFM, SINTEF, DANA etc.) reasonable?

Yes..... 12
To some extent..... 0
No..... 0

Comments

Course material

Were the distributed papers and other material sufficient?

Yes..... 10
To some extent..... 2
No..... 0

Comments (e.g. suggestions for additional papers, handouts etc.)

Were there a sufficient number of computers available to perform the exercises?

Yes 12
To some extent 0
No 0

Comments

Logistics

How was the physical framework - accommodation, lecture room, food etc.?

Poor 0
Not very good 0
OK 0
Good 0
Excellent 12

Comments

Overall balance and timing

Was the balance between lectures and exercises right?

Yes 12
To some extent 0
No 0

Comments

Was the time assigned to each subject appropriate?

Too short 1
Yes 11
Too long 0

Comments (e.g. which subjects were given to much or too little time?)

Was the overall duration of the course appropriate?

Too short 2
Yes 11
Too long 1

Comments

Relevance

Do you think that the course will be relevant for your future career in fisheries science?

Yes 11
Don't know 1
Probably not 0
Not at all 0

Comments

Etc.

How did you receive information about the course?

?? Henrik G, My University, www.ecopath.org, Colleague, ICES website, SLIP network, the web,

Do you have suggestions that might help us to advertise future courses?

Please give any additional comments on the course - frustrations, suggestions for future improvements in similar courses etc. etc.