



**NorFA/SLIP Ph.D. Course in  
Individual-based population models:  
Current use, future prospects, and  
limitations**

**“Søminestationen”, Holbæk, Denmark  
24-29 August 2002**



## 1. Aim

Individual Based Population Models (IBPMs) apply a bottom-up approach to modelling population dynamics in time and space. It means that a population is defined by the characteristics of its constituent individuals. Since individuals with different characteristics (age, stage, size, etc.) may behave differently, population dynamics can only be predicted by integrating the life histories of all individuals. Individual-based models have shown especially useful as tools for understanding the interplay between behaviour, population dynamics and evolutionary processes. IBPMs usually possess a high degree of biological realism, at the expense of simplicity.

The purpose of the course was to introduce Individual Based Population Models as a tool to understand and predict population dynamics. The aim of the course was therefore:

- (1) To present the participants to a number of case-studies involving IBPMs in order to demonstrate their potential in population ecology, but also to discuss their limitations.
- (2) To encourage the participants to build their own models by introducing them to relevant software.
- (3) To allow the participants to present their own projects in order to achieve feedback and input from the other participants.
- (4) To establish long-term contacts between the participants for the purpose of initiating collaborative projects.

## 2. Organisation

The course was organised jointly by the University of Copenhagen and the National Environmental Research Institute (NERI). The organizing committee comprised Associate Professor Gösta Nachman (Dept. of Population Ecology, University of Copenhagen), Professor Henrik Gislason (Marine Biological Laboratory, University of Copenhagen), Senior Scientist Chris J. Topping (NERI/Kalø) and Ph.D. student Jane Uhd Jepsen (Dept. of Population Ecology, University of Copenhagen). Funding was provided by grant from NorFa supplemented by funds from the Danish research school in fisheries biology, SLIP, one of the five research schools under Fishnet ([www.fishnet.dk](http://www.fishnet.dk)).

The course was advertised by NorFa, through contact persons at the Nordic Universities, through Fishnet and on the course home page (<http://www.zi.ku.dk/ibpm-net/norfa/index.html>).

### 3. Participants and teachers

The course was attended by 33 students (see Annex 1) and 9 teachers/organizers. The students came from Denmark (15), Norway (6), Sweden (6), Finland (1), Iceland (1), Estonia (1), the UK (1) and Germany (2). Four of the students were associated with the SLIP network and 13 were female.

The teachers were Professor Donald L. DeAngelis (University of Miami, USA), Dr Volker Grimm (UFZ Centre for Environmental Research, Leipzig-Halle, Germany), Dr Geir Huse (University of Bergen), Prof. Roland Lamberson (Humboldt State University, USA), Senior Scientist Wolf Mooij (Netherlands Institute of Ecology, The Netherlands), Associate Prof. Gösta Nachman (University of Copenhagen), Professor Esa Ranta (University of Helsinki, Finland) and Senior Scientist Chris J. Topping (NERI, Denmark).

### 4. Outline

The course consisted of a combination of morning lectures, afternoon exercises and group discussions. The students presented their own research topics in the evenings.

Each morning, three one-hour lectures presented case studies or summarized experience with IBPMs. The afternoon exercises usually consisted of hands-on demonstrations of IBPM software and some specific tasks or problems to be solved with the software (e.g. estimation of extinction rates, effect of agricultural practices on vole abundance). The exercises were performed on PCs in groups of two to three students. After the exercises the students and the teachers met in discussion groups for one hour to discuss general questions pertaining to IBPMs, the pros and cons of the models presented and questions relating to the practical problems encountered during model construction and validation. In the evening the students gave 20-minute presentations of their own projects. Due to a lack of time these presentations had to be split into two separate sessions dealing with aquatic and terrestrial ecology, respectively.

Wednesday evening was used for an excursion to the Viking museum in Roskilde and a sailing trip on Roskilde Fjord.

A detailed course program is enclosed as Annex 2.



## 5. Course material

The course material consisted of a number of papers and copies of PowerPoint slides. Most of the lectures and student presentations have been made available at the website of the course (<http://www.zi.ku.dk/ibpm-net/norfa/index.html>).

## 6. Course evaluation

From the course organizers point of view the course went very well. The lectures were well prepared and inspiring, the physical facilities excellent and the overall course plan worked fine. The discussions after the presentations and among the participants in the breaks and during the excursion demonstrated that the students gained a lot of knowledge and ideas. The social atmosphere was relaxed, the professional interactions among the participants were intense and a lot of important contacts were established that no doubt will be maintained as valuable networks among future Nordic researchers in the field of individual based modelling.

It was also a great asset to include examples from both terrestrial and aquatic ecology. Although approaches were sometimes slightly different, by far the majority of principles and problems in the application of IBPMs were identical and including examples from both aquatic and terrestrial ecology allowed the students to evaluate the full scope of IBPMs. The only drawback was perhaps that the program was very tight. It might have been better to extend the duration of the course by one more day, to avoid the separation of the student presentations into aquatic and terrestrial ecology.

At the end of the course the students were asked to fill in an evaluation form. A summary of the evaluations is given in Annex 3. The evaluation showed that the students overall considered the course to be good or excellent. The main drawbacks mentioned were a lack of introductory lectures at the beginning of the course and the shortage of time.



## Annex 1.

### List of participants

Name	University	e-mail
Anderson, Jens	Umeå University	<a href="mailto:jens.andersson@eg.umu.se">jens.andersson@eg.umu.se</a>
Bach, Lars	University of Aarhus	<a href="mailto:lbach@EVALife.dk">lbach@EVALife.dk</a>
Bang, Anders	University of Aarhus	<a href="mailto:anders.bang@biology.au.dk">anders.bang@biology.au.dk</a>
Berge, Therese With	Norwegian Crop Research Inst	<a href="mailto:therese.berge@planteforsk.no">therese.berge@planteforsk.no</a>
Berglund, Johnny	Umeå University	<a href="mailto:johnny.berglund@eg.umu.se">johnny.berglund@eg.umu.se</a>
Bergström, Ulf	Umeå University	<a href="mailto:ulf.bergstrom@eg.umu.se">ulf.bergstrom@eg.umu.se</a>
Bladt, Jesper	University of Aarhus	<a href="mailto:bladt@daimi.au.dk">bladt@daimi.au.dk</a>
Bølstad, Mikkel Soya	University of Copenhagen	<a href="mailto:msbolstad@zi.ku.dk">msbolstad@zi.ku.dk</a>
Dalin, Peter	Swedish University of Agricultural Sciences, Uppsala	<a href="mailto:peter.dalin@entom.slu.se">peter.dalin@entom.slu.se</a>
Darden, Safi-Kirstine	University of Copenhagen	<a href="mailto:s-kdarden@zi.ku.dk">s-kdarden@zi.ku.dk</a>
Davis, Stephen	Danish Pest Infestation Laboratory	<a href="mailto:stephen.davis@ua.ac.be">stephen.davis@ua.ac.be</a>
Edwards, Helen	University of York	<a href="mailto:hje105@york.ac.uk">hje105@york.ac.uk</a>
Eliassen, Sigrunn	University of Bergen	<a href="mailto:sigrunn.eliassen@ifm.uib.no">sigrunn.eliassen@ifm.uib.no</a>
Gårdmark, Anna	Lund University	<a href="mailto:anna.gardmark@teorekol.lu.se">anna.gardmark@teorekol.lu.se</a>
Hagelskjær, Jens	University of Aarhus	<a href="mailto:jens.hagelskjaer@biology.au.dk">jens.hagelskjaer@biology.au.dk</a>
Hendrichsen, Ditte	University of Copenhagen	<a href="mailto:dkh@dmu.dk">dkh@dmu.dk</a>
Høye, Toke	University of Copenhagen	<a href="mailto:tthoye@zi.ku.dk">tthoye@zi.ku.dk</a>
Javois, Juhan	Tartu University	<a href="mailto:juku@ut.ee">juku@ut.ee</a>
Johannesen, Edda	University of Paris XI	<a href="mailto:edda.johannesen@epc.u-psud.fr">edda.johannesen@epc.u-psud.fr</a>
Jonsdottir, Gudmunda Ingibjörg	University of Iceland	<a href="mailto:ingibj@hafro.is">ingibj@hafro.is</a>
Katajisto, Jonna	University of Helsinki	<a href="mailto:jonna.katajisto@helsinki.fi">jonna.katajisto@helsinki.fi</a>
Moe, Jannicke	University of Oslo	<a href="mailto:jmoe@bio.uio.no">jmoe@bio.uio.no</a>
Nielsson, Fredrik	Denmarks Technical University	<a href="mailto:afn@imm.dtu.dk">afn@imm.dtu.dk</a>
Sand, Mikkel	University of Copenhagen	<a href="mailto:mks@dfu.min.dk">mks@dfu.min.dk</a>
Schmidt, Niels Martin	Royal Veterinary and Agricultural University, Copenhagen	<a href="mailto:nms@kvl.dk">nms@kvl.dk</a>
Sell, Anne	Hamburg University	<a href="mailto:anne.sell@uni-hamburg.de">anne.sell@uni-hamburg.de</a>
Stige, Leif Christian	University of Oslo	<a href="mailto:l.c.stige@bio.uio.no">l.c.stige@bio.uio.no</a>
Strand, Espen	University of Bergen	<a href="mailto:espen.strand@ifm.uib.no">espen.strand@ifm.uib.no</a>
Thygesen, Uffe	Danish Institute for Fisheries Research	<a href="mailto:uht@dfu.min.dk">uht@dfu.min.dk</a>
Tushabe, Herbert	University of Copenhagen	<a href="mailto:htushabe@hotmail.com">htushabe@hotmail.com</a>
Uhd Jepsen, Jane	University of Copenhagen	<a href="mailto:juj@dmu.dk">juj@dmu.dk</a>
Verduin, Jennifer	Hamburg University	<a href="mailto:jennifer.verduin@uni-hamburg.de">jennifer.verduin@uni-hamburg.de</a>
Östman, Örjan	Swedish University of Agricultural Sciences, Uppsala	<a href="mailto:orjan@ostman@evp.slu.se">orjan@ostman@evp.slu.se</a>

Annex 2.

## Day to day program

### Saturday Aug. 24

Afternoon:  
c. 13.00-           Arrival  
18.00-19.00       Dinner

Evening:            Social activities

### Sunday Aug. 25

Morning (Chairman: Henrik Gislason):  
07.30-08.15        Breakfast  
08.30-09.30        Don DeAngelis: "[Developing and testing a spatially-explicit individual-based model for a wildlife population](#)"  
09.45-10.45        Roland Lamberson: "[Seeking realistic behavior from virtual fish](#)"  
11.15-12.15        Chris Topping: "[Developing ALMaSS, a landscape-scale IBM simulations for wildlife management in Denmark](#)"  
12.30-13.30        Lunch

Afternoon:  
14.00- c. 17        Chris Topping: Demonstration of ALMaSS and using it to analyse consequences for wildlife if the landscape undergoes changes (exercise)  
17.00-18.00        Group discussions  
18.00-19.00        Dinner

Evening:  
19.30-21.30        [Student presentations](#) in two sessions dealing with aquatic and terrestrial ecology, respectively  
21.30-              Social activities

### Monday Aug. 26

Morning (Chairman: Volker Grimm):  
07.30-08.15        Breakfast  
08.30-09.30        Gösta Nachman: "[Viability of a spadefoot toad metapopulation in a fragmented environment](#)"  
09.45-10.45        Esa Ranta: "[An individual-based model on large-scale synchronisation of life history events in flowering plants](#)"  
11.15-12.15        Roland Lamberson: "[Individual and population-level analysis and validation of an individual-based trout model](#)"  
12.30-13.30        Lunch

Afternoon:  
14.00- c.17.00     Roland Lamberson: "[How to analyze simulation models: computer experiments](#)" (exercise)  
17.00-18.00        Group discussions  
18.00-19.00        Dinner

Evening:  
19-30-21.30        [Student presentations](#) in two sessions dealing with aquatic and terrestrial ecology, respectively  
21.30-              Social activities

### Tuesday Aug. 27

Morning (Chairman: Gösta Nachman):

07.30-08.15 Breakfast  
08.30-09.30 Geir Huse: "[Implementing behaviour and life history strategies in IBMs](#)"  
09.45-10.45 Wolf Mooij: "[Population dynamics of the Snail Kite in the Everglades](#)"  
11.15-12.15 Volker Grimm: "[Towards structurally realistic models: pattern-oriented modelling](#)"  
12.30-13.30 Lunch

Afternoon:

14.00- c.17.00 Volker Grimm: "How to analyze simulation models: computer experiments" (exercise)  
17.00-18.00 Group discussions  
18.00-19.00 Dinner

Evening:

19.30-21.30 [Student presentations](#) in two sessions dealing with aquatic and terrestrial ecology, respectively  
21.30- Social activities

### Wednesday Aug. 28

Morning (Chairman: Roland Lamberson):

07.30-08.15 Breakfast  
08.30-09.30 Geir Huse: "[Spatially explicit IBMs of fish populations](#)"  
09.45-10.45 Esa Ranta: "[Sustainable harvest of Finnish moose populations](#)"  
11.15-12.15 Wolf Mooij: "[An introduction to some individual-based methods and to the exercises](#)"  
12.30-13.00 Lunch

Afternoon:

13.15-16.15 Wolf Mooij: "OSIRIS - an individual based simulation tool" (exercise)  
16.40-23.45 Excursion and party dinner

### Thursday Aug. 29

Morning (Chairman: Chris Topping):

08.00-08.45 Breakfast  
09.00-10.00 Gösta Nachman and Mads C. Forchhammer: "[A spatially explicit model of red foxes and sarcoptic mange](#) (part 1) & [IBM meets traditional Population Ecology](#) (part 2)"  
10.15-11.15 Don DeAngelis: "[A survey of what has been learned from individual-based models](#)"  
11.30-12.45 Plenum discussion: "[Individual-based population models: How do we proceed from where we are now?](#)"  
12.45-13.00 Some concluding remarks  
13.00-14.00 Lunch

Afternoon:

14.00- Departure

Annex 3.

## Summary of the Students' Evaluation of the Course

Please answer the following questions. Do not hesitate to include supplementary comments that you may think relevant. Don't write your name anywhere. We would like the questionnaire to be anonymous.

### Overall evaluation

What is your overall opinion about the course?

Poor .....	0
Not very good .....	0
OK.....	3
Good.....	13.5
Excellent .....	9.5

### Course content

Did the course provide a reasonable overview of the subject?

Yes .....	18
To some extent .....	8
No, important items were missing .....	0

Comments (e.g. missing topics)

- ?? A general introduction to basic modelling concepts and methodologies was missing.
- ?? The course assumed I knew all about the theory of IBMs and there was no discussion on limitations, consequences, etc, or even why IBMs should be applied instead of other models.
- ?? The course drove straight into advanced modelling.
- ?? The course was intense and tried to cover too much in too little time, but the overview was good.
- ?? The course was well organized.

Were the topics included adequately covered?

Yes .....	13
To some extent .....	13
No .....	0

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

- ?? Too little on basic methodology and theoretical modelling, the course jumped straight into advanced modelling and practical examples.
- ?? The examples lacked diversity (lacked interesting or fun questions to solve, too many complex examples).
- ?? Too little discussion on when and why IBMs should be used, nor on the data types.
- ?? I need references on basic modelling.

## Lectures

How was the level of the lectures?

Too low .....	0.5
Adequate .....	22
Too high .....	2.5
No answer .....	1

Comments

- ?? The lectures were pitched at a reasonable level, gave good examples of models and were mostly enjoyable and fun.
- ?? I am uncomfortable with modelling, so the first lectures were too hard and practical (although the teachers adjusted the level towards the end of the course, and gave a more conceptual overview).
- ?? The order of the lectures could have been better: the lectures on examples should come after the theoretical ones.
- ?? It was difficult to follow the structure of the course: an overview at the start would have helped.

Were the lectures well prepared and easy to understand?

Yes .....	21
To some extent .....	4
No .....	0
No answer .....	1

Comments

- ?? The lectures were well organized, but the course structure was unclear.
- ?? The lectures were too advanced at first and I got lost in terminology, but then the level of the course got easier.
- ?? It was not easy to see where IBMs fit into general ecosystem modelling – the connection between the data available and the model chosen was obscure.
- ?? I needed a more conceptual modelling course.

## Exercises

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

Yes .....	8.5
To some extent .....	14.5
No .....	3

Comments

- ?? The placement of each exercise within the overall structure of the course was unclear.
- ?? I have modelled before, so the exercises were very practical and useful – it was nice to see other people's working models.
- ?? I'm a beginner, and there were no basic modelling exercises, so it is difficult to see how I can apply the knowledge I gained (aside from a few keyboard shortcuts).
- ?? There were not enough exercises.
- ?? I still don't know why I should use IBMs, or how the underlying rules work.
- ?? The exercises dealt with many models, and it took some time to get to know each one.
- ?? Many exercises were step-by-step demonstrations to full programs. I would have preferred to build my own model from scratch.
- ?? Volker's and Wolf's exercises were fun!

## Discussion groups

Was it a good idea to have discussion groups at the end of each day?

Yes .....	14
To some extent .....	10
No .....	1
No answer .....	1

### Comments

- ?? The discussion groups were a great way to digest the knowledge learned, and to discuss general issues.
- ?? The level of the participants was too varied, so the discussions tended to be unstructured and roaming; perhaps better to have predefined topics?
- ?? The discussion leaders tended to take over discussion and dominate – if they'd been rotated the input might have been more variable.
- ?? It was difficult to engage in a discussion after such intense, tiring days, and the topics end up being a repetition of the lecture subjects.
- ?? The course was too intense – cut the exercises short or do away with the discussions.

## Student presentations

Was there time enough available for the student presentations?

Yes .....	20
To some extent .....	2
No .....	3
No answer .....	1

### Comments

- ?? There wasn't enough time to hear all the presentations!
- ?? Pity that there had to be two sessions – I wanted to see all the presentations.
- ?? The course should have combined the discussion sessions and exercises with the student presentations, to give a clearer, more integrated approach.
- ?? The division into aquatic or marine projects was not natural.
- ?? This was an excellent opportunity to present my project, despite taking place in the evening.

## Other activities

Was there sufficient free time to socialize and discuss with the other students and the teachers during the course?

Yes .....	9
To some extent .....	11
No .....	5
No answer .....	1

## Comments

- ?? The informal socialising is a very important aspect of a course like this.
- ?? The course was very intense so there was little time to socialize.
- ?? I didn't have time to socialise in between lectures, and I didn't feel very sociable at the end of the day.
- ?? The venue did not allow you to get too far afield, so you were "forced" to socialise.

## Course material

Were the distributed papers and other material sufficient?

Yes .....	15
To some extent .....	8
No .....	2
No answer .....	1

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

- ?? I could have used a few introductory references ahead of the course.
- ?? I want to know more about the topics learned – I need additional references.
- ?? There was too little printed material, e.g. slide printouts and a course schedule were missing.
- ?? The references given were quite easy to obtain.
- ?? I expect the missing information (especially the slides) to be put up on the website eventually.

## Logistics

Were the computer facilities for the exercises adequate?

Yes .....	22.5
To some extent .....	1.5
No .....	1
No answer .....	1

Comments

- ?? There were not enough computers – there should have been one for each participant.
- ?? The facilities were impressive.
- ?? The lack of computers promoted team work.

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

Poor .....	0
Not very good .....	0
OK .....	0
Good .....	2
Excellent .....	23
No answer .....	1

Comments

- ?? The food was extraordinarily memorable – keep the cooks!
- ?? The social evening was partially spoiled by the daily feasts at the course venue.

## Overall balance and timing

Was the balance between lectures and exercises right?

Yes .....	17
To some extent .....	5
No .....	1
No answer .....	3

Comments

- ?? The course was too intense – add an extra day!
- ?? An entire morning of lectures is sufficient.
- ?? I wanted more exercises (and fewer discussion sessions).
- ?? There should have been fewer software demonstrations, and more basic tutorials and problem-solving exercises.
- ?? I need more references.

Was the time assigned to each subject appropriate?

Too short.....	2
Yes .....	19
Too long.....	1
No answer .....	4

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

- ?? The course seemed unstructured.
- ?? I'm not familiar with modelling, so I cannot tell whether the subject balance was adequate.
- ?? I expected a more general approach, with an introduction to methodology.
- ?? We needed more time – perhaps add an extra day?

Was the overall duration of the course appropriate?

Too short.....	8.5
Yes .....	14.5
Too long.....	0
No answer .....	3

Comments

- ?? The course was too short – add one more day or two to even the pace.
- ?? The course was too intense – no one can concentrate that hard for that long.

## Relevance

Do you think the course will be relevant for your future scientific career?

Yes .....	19
Don't know.....	2
Probably not .....	0
Not at all.....	0
No answer .....	5

## Comments

- ?? The course will be very relevant for my career.
- ?? IBMs are in fashion in ecology today.
- ?? I would like to use IBMs later, but not in my present project.
- ?? I hope I have use for IBMs someday.
- ?? The contact with scientists from other cultures was very useful.

## Etc.

Please give any additional comments - frustrations, suggestions for future improvements in similar courses, follow up activities etc.

- ?? An excellent course – thank you!
- ?? The course needs a gentler, more conceptual introduction to modelling. It felt more like a workshop or a symposium than a course.
- ?? The course has inspired me to learn more modelling.
- ?? The international profile of the course was a boon!