

# Course in tidal flat ecology: Field experiments as a tool for marine research

## 1. Involved Consortia

NEBROC (Netherlands Bremen Oceanography Cooperation)

ECOLMAS (European Graduate College in Marine Science)

MARBEF (EU Network of Excellence: Marine Biodiversity and Ecosystem Functioning)

## 2. Time and location of the training course

Arrival            Sa., 08.09.07

Departure        Fr., 14.09.07

Alfred Wegener Institute for Polar and Marine Research

Wadden Sea Station Sylt

Hafenstrasse 43

25992 List

Germany

## 3. Organization of the training course

Karsten Reise

Jaap van der Meer

Nils Volkenborn

## 4. Description and program of the training course

Intertidal habitats offer an ideal testing ground for ecological hypotheses. Experimental work is indispensable for benthic research to reveal the cause of pattern. Due to conspicuous spatial and temporal variation benthic environments provide ample coordinate space to investigate the interplay of biodiversity and ecosystem functioning. During emersion they are easily accessible and allow the establishment of elaborate experimental set-ups. On the other hand, harsh environmental constraints, such as wave action and tidal currents complicate experimental research in the intertidal and may entail experimental artifacts. The course aims to discuss the advances, potentials, and restrictions of experimental benthic research.

We start with an introduction to the history of experimental benthic research and theory. The background will be broadened by a side-glance to terrestrial experimental research. We will treat statistical aspects of experimental set-ups such as randomization, replication, and blocking and introduce students to the potential of multifactorial approaches. We will provide an overview on common univariate and multivariate statistical analysis. Ongoing field experiments on tidal flats around the island of Sylt will

be used for hands-on experience. Students will map out sampling strategies, analyse data and present their results. The course also allocates time for discussions on own problems and ideas presented by students. The course will combine lectures and practice in a unique seashore environment.

## **Preliminary programme**

### **Day 0**

19.00 Welcome at the Wadden Sea Station

### **Day 1**

9.00 Welcome and introduction to the course (Karsten Reise, Jaap van der Meer)

9.30 Round of individual introductions (up to 5 min for each participants on own work, interests, and expectations to the course)

11.00 Coffee Break

11.30 **Historical aspects of intertidal experimental research.** (NN)  
Introduction to the work of e.g. Paine, Connell, Reise, Woodin  
Problems and criticisms of experimental work e.g. by Underwood, Raffaelli

13.00 Lunch

14.00 *Wet walk across Koenigshafen tidal flats (get in touch with the environment)*

16.30 Coffee Break

17.00 Student PhD work presentations and discussion (4 students, each 15 min)

19.30 Barbecue at the Wadden Sea Station

### **Day 2**

9.00 **Sampling theory and experimental design** (NN)  
Statistical aspects such as randomization, replication, cross-over effects, experimental blocking

10.30 Coffee Break

- 11.00 **Statistical analysis of field-experimental data I** (NN)  
Data transformation, ANOVA, GLM, repeated measurements,
- 12.30 Lunch
- 14.00 **Theoretical introduction to some field experiments running on Sylt** (NN, Nils Volkenborn)
- 15.00 *Wet walk and visiting running some field experiments running on Sylt intertidal flats (lugworm exclusion experiment, filter feeder experiment, predator exclosures)*
- 17.30 Coffee Break
- 18.00 Student PhD work presentations and discussion (4 students, each 15 min)
- 20.00 Dinner

### **Day 3**

- 9.00 **Introduction to some relevant ecological theory** (NN)  
Population ecology, competition and predation  
Biodiversity and ecosystem functioning  
Ecosystem engineering
- 10.30 Coffee Break
- 11.00 **Statistical analysis of field-experimental data II** (NN)  
Multivariate analysis (Bray Curtis similarity, MDS, ANOSIM, SIMPER, BioEnv)
- 12.00 Lunch
- 13.00 Field work on plots of running field experiments on intertidal flats in small groups (3-4 students per group)  
Planning of sampling strategy  
Sampling and measurements  
Data analysis  
Preparation of presentation
- 20.00 “Dinner on the beach” at Wonnemeyer’s Restaurant

### **Day 4**

- 9.00 Student field work presentations

10.30 Coffee Break

11.00 **Scale and experimental design** (NN)

13.00 Lunch

14.00 Dry walk dunes

16.30 Coffee Break

17.00 Student PhD work presentations and discussion (4 students, each 15 min)

19.00 Dinner

## **Day 5**

9.00 **Experimental work in the terrestrial ecology: what can we learn?** (NN)

10.30 Coffee Break

11.00 **Multivariate statistical analysis and mathematical modelling** (NN)

12.30 Lunch

13.30 Students discuss their own experiments; pose questions etc.

15.00 Island trip

19.00 Dinner

## **5. Contact address with e-mail**

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## 6. Tentative audience of the training course

The training course is addressed to PhD students of marine environmental sciences. The course will also be integrated in Ecolmas (European Graduate College in Marine Science, a joint graduate school for marine sciences)  
Up to 16 students admitted.

## 7. Relation with MarBEF objectives

The course will be especially relate to MarBEF Theme 2: Marine Biodiversity and Ecosystem Functioning: *“Overall objective to generate theory, models and tests of the relationship between marine biodiversity (assessed at different levels of organization: genetic, traditional species, and functional groups) and ecosystem function through the integration of theoretical and modelling exercises, comparative analyses **and carefully-designed experimental tests.**”* (from MarBEF web page)

Intertidal habitats offer ideal testing ground for experimental research regarding biodiversity and ecosystem functioning in the marine environment. We believe that sophisticated experimental testing is essential for a better understanding of biodiversity-ecosystem functioning relations.

The apparent problem of traditional small scale experiments relates to the importance of scale in experimental research. Thus, the course will also be tangent to MarBEF Theme 1: Global Patterns of Marine Biodiversity across Ecosystems:

*“Measurement of marine biodiversity tends to be possible only on limited spatial and/or temporal scales, far smaller than those required for such management. To bridge this vital gap we need to understand the large-scale and long-term patterns of biodiversity in European waters, and what it is that small-scale, short-term measurements tell us about larger scale patterns.”* (from MarBEF homepage)

Multifactorial approaches and repeated measurement designs in experimental research have the potential to increase our understanding of effect variation in space and time and to improve the transferability of results from small scale experiments to broader temporal and spatial scales.