Supporting and networking young researchers:

a new concept in teaching marine sciences

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International Workshop on the Field Training Course for the Integrated Environmental Sciences

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GAME: Global Approach by Modular Experiments

An international research and student training programme in marine benthic ecology

My talk:

1. Aims
2. Scope
3. Research topics
4. Structure
5. Six years of GAME: a successful story
GAME: Global Approach by Modular Experiments

Where are we?

Sources: Microsoft Wikipedia
Staff:
330 Scientists
200 Others

IFM-GEOMAR
Leibniz Institute of Marine Sciences
at the University of Kiel
Mission

to understand the physical, chemical, biological, and geological processes in the ocean and their interaction with the seafloor and the atmosphere

... from the seafloor to the atmosphere ...
Over-Arching Research Themes at IFM-GEOMAR

- Role of the Ocean in Global Change
- Human Impact on Marine Ecosystems
- Living and Non-Living Marine Resources
- Plate Boundary Processes
- Natural Hazards
is supported by:
Aims

- Studying global change in the marine environment
- Making robust conclusions and predictions based on experiments replicated worldwide
- Training students in a global network of marine research institutions
- Consolidating scientific contacts and boosting international collaborations
- Transferring knowledge and building capacities in marine sciences
Aims

In short,…

- Researching
- Teaching
- Networking
Aims: students & partners

GAME invites:

- Master or PhD students worldwide...
- ...who have a background in biology, ecology or environmental sciences
- Research institutions with a focus in marine ecology
- Scientists who are willing to supervise students during a short-term research project
Scope

Scientific motivation

Complexity

Interactions

NOISE

Feedback mechanisms

Variable system parameters
Scope

Solution: spatial replication of experiments

GAME: the global approach

27 stations in 21 countries.
**Scope**: Modular experiments

1. **One question**: e.g. is the disturbance-diversity relationship generally unimodal?

2. **One experiment**: e.g. applying physical disturbance regimes to fouling communities.

3. **Different ecosystems**: e.g. in Australia, Brazil, Chile, Japan, Italy, Sweden....

4. **One answer?**
GAME is studying the effects of stress and disturbance on

• Populations

• Species interactions

• Community structure and composition
Research topics


#1: Inducible chemical defences in macroalgae (2002 - 2004)

#2: Interactive effects of disturbance and eutrophication on hardbottom communities (2003 - 2005)

#3: Effects of regular and irregular disturbance regimes on hardbottom communities (2004 - 2006)


#5: Effects of environmental stress on anti-feeding and anti-fouling defences in macroalgae (2006-2008)

Research topics

Species interactions


#1: Inducible **chemical defenses** in macroalgae (2002 - 2004)

#2: Interactive effects of **disturbance and eutrophication** on hardbottom communities (2003 - 2005)

#3: Effects of **regular and irregular disturbance regimes** on hardbottom communities (2004 - 2006)

#4: Marine invasion ecology: factors determining the **stability of fouling communities** (2005-2007)

#5: Effects of **environmental stress** on anti-feeding and anti-fouling **defenses** in macroalgae (2006-2008)

Research topics


**Community dynamics**

#1: Inducible **chemical defenses** in macroalgae (2002 - 2004)

#2: Interactive effects of **disturbance and eutrophication** on hardbottom communities (2003 - 2005)

#3: Effects of **regular and irregular disturbance regimes** on hardbottom communities (2004 - 2006)

#4: Marine invasion ecology: factors determining the **stability of fouling communities** (2005-2007)

#5: Effects of **environmental stress** on anti-feeding and anti-fouling **defenses** in macroalgae (2006-2008)

Structure: Teamwork on both hemispheres

18 experiments per project.....

...in 9 different countries worldwide.

18 students per project...

...working together in binational teams.
Structure: Teamwork on both hemispheres

Northern hemisphere experiments: May to October
5 countries

Southern hemisphere experiments: November to April
4 countries
**Structure:** 12 months of GAME

### Temporal structure

- **Preparation, 2 months**, IFM-GEOMAR and partner institutes
- **Introductory course, 1 month**, IFM-GEOMAR
- **Experiments, 6 months**, at partner institutes
- **Analysis, interpretation, publication, 3 months**, IFM-GEOMAR
**Structure** (e.g. southern hemisphere project)

Introductory course with a multinational team of students
Structure: Introductory course

Contents

• Scientific background: concepts in ecology

• Tools in literature research: data bases and online resources

• Planning a successful study: the design of experiments in ecology

• Running an experiment: materials and methods

• Data analysis: basic tools in biostatistics

• Local marine ecosystems: Baltic Sea
Structure: Introductory course

Aims

• Equipping all students with comprehensive knowledge about the study planned....

• ...irregardless of their background

• Testing all methods and the data analyses for their efficiency

• Creating a productive team atmosphere

• Evaluation:
  Writing a preliminary material & methods section as a self-test and to inform local supervisors
**Structure** (e.g. southern hemisphere project)

Experimental work at partner institutes in binational teams
Structure: study sites

Madeira Island, Portugal

Tasmania, Australia

Chile

England

New Zealand

Malaysia
Structure: study organisms

Sessile invertebrates and macroalgae
Structure: study organisms

- *Fucus vesiculosus*
- *Fucus distichus distichus*
- *Fucus distichus edentatus*

Macroalgae and mesograzers

- *Gammarus oceanicus*
Structure: study organisms

Fouling communities grown on artificial hardsubstrata
Structure: experimental set-ups

Need to be....

• Identical across study sites

• Simple

• Robust

• Inexpensive
Structure: experimental set-ups

Field installations for studies on community ecology

15 cm
Structure: experimental set-ups

Mesocoms for studies on species interactions
Structure: experimental set-ups

Lab installations for studies on species interactions
Structure (e.g. southern hemisphere project)

Analysis course with a multinational team of students
Structure: Analysis course

Contents

• Analysing ecological data: advanced techniques in biostatistics

• Interpreting complex data sets

• Communicating science:
  a) Scientific writing
  b) Poster presentations
  c) Oral presentations

• Presentation of results at German universities

• Local marine ecosystems: European Wadden Sea
Structure: Analysis course

Aims

• Comparing patterns across ecosystems

• Imparting competence in data analysis

• Communicating results in the form of
  a) Diploma or master theses
  b) Peer-reviewed articles
  c) Conference contributions
After 6 years of GAME….

• 98 students successfully accomplished the programme

• 27 research institutions in 21 countries participated in GAME

• 24 publications are accepted by or already published in peer-reviewed journals

• 26 presentations at international conferences
Outlook

The next GAME project will start in April 2009

Does stress tolerance differ between indigenous and non-indigenous marine species?

Visit GAME at:
www.ifm-geomar.de/game
Acknowledgements

Thank you for listening!