




GAME

Global Approach by Modular Experiments

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

March 4th 2009

Hokkaido University, Sapporo, Japan

IFM-GEOMAR






GAME: **G**lobal **A**pproach by **M**odular **E**xperiments

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: **G**lobal **A**pproach by **M**odular **E**xperiments

Where are we?

Sources:
Microsoft
Wikipedia

Staff:

330 Scientists

200 Others

IFM-GEOMAR

Leibniz Institute of Marine Sciences at the University of Kiel

IFM-GEOMAR
Leibniz-Institut für Meereswissenschaften
an der Universität 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 …

IFM-GEOMAR
Leibniz-Institut für Meereswissenschaften
an der Universität Kiel

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






GAME

Global Approach by Modular Experiments

is supported by:

IFM-GEOMAR

Stiftung Mercator

IDEEN BEFLÜGELN.

Universitätsstiftung Kiel

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

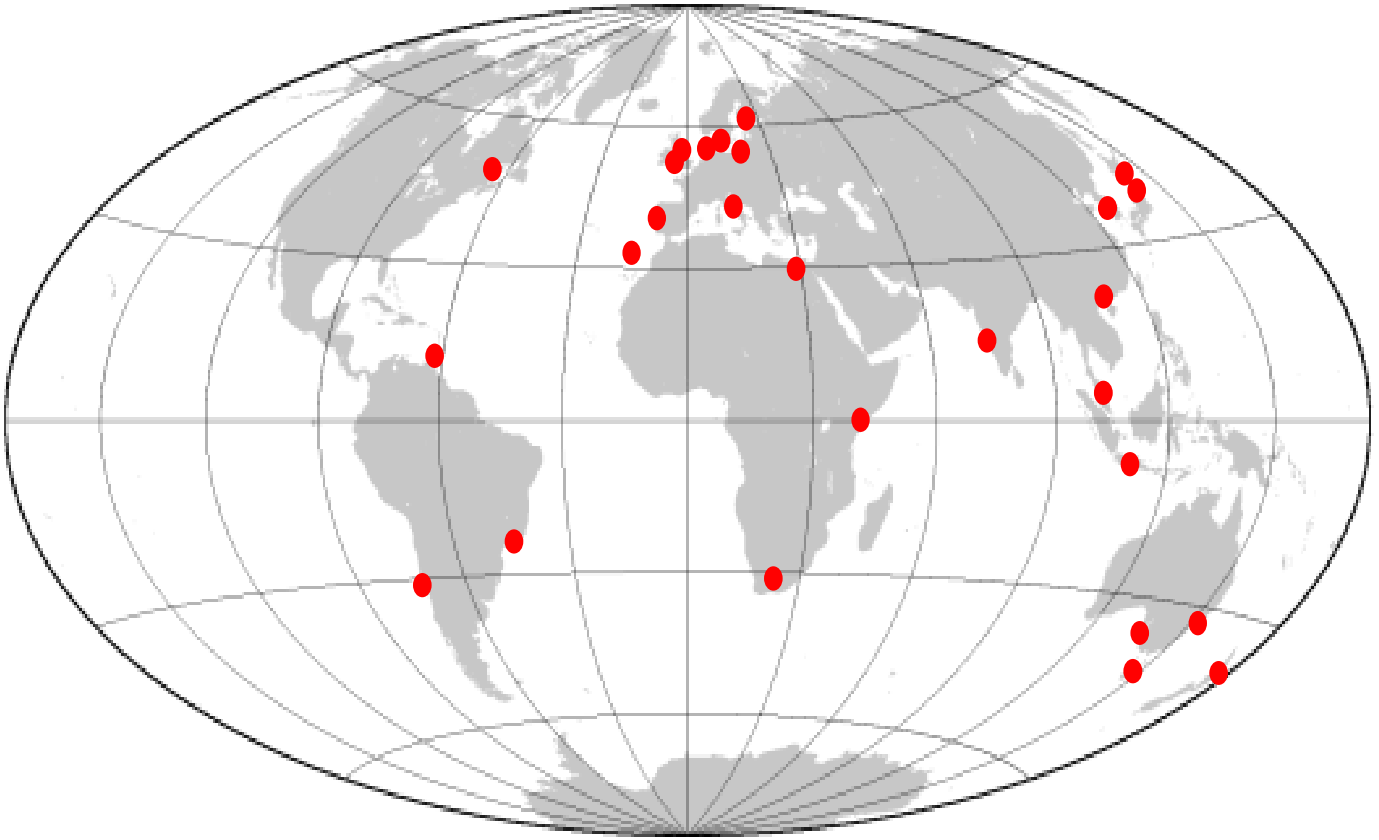





Solution: spatial replication of experiments

GAME: the global approach

Global Approach by Modular Experiments



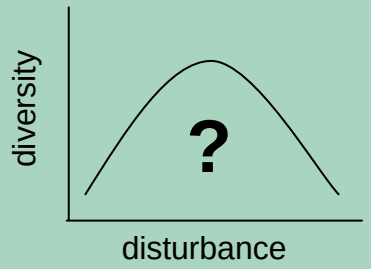
27 stations in 21 countries.

Scope: Modular experiments





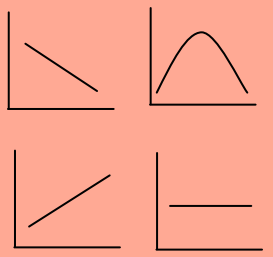

1. One question: e.g. is the disturbance-diversity relationship generally unimodal?



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

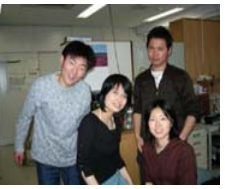
3. Different ecosystems: e.g. in Australia, Brazil, Chile, Japan, Italy, Sweden….

4. One answer?



Research topics



GAME is studying the effects of

<u>stress and disturbance</u> on

- **Populations**
- **Species interactions**
- **Community structure and composition**

Research topics






Pilot study: Effects of **UV radiation** on shallow water hardbottom communities (2000 - 2002).

#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)

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

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

#6: Flexibility in algal response to herbivory: influence of grazing pressure on the **speed of defence induction** (2007-2009)

Species interactions

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Research topics

Pilot study: Effects of **UV radiation** on shallow water hardbottom communities (2000 - 2002).

Community dynamics

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

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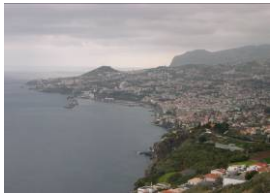
Structure: Teamwork on both hemispheres

18 experiments per project…..

…in 9 different countries worldwide.









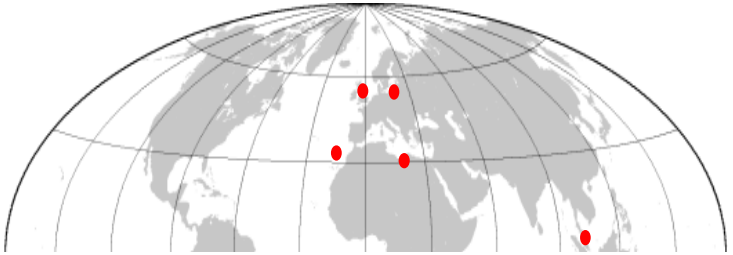
18 students per project…

…working together in binational teams.



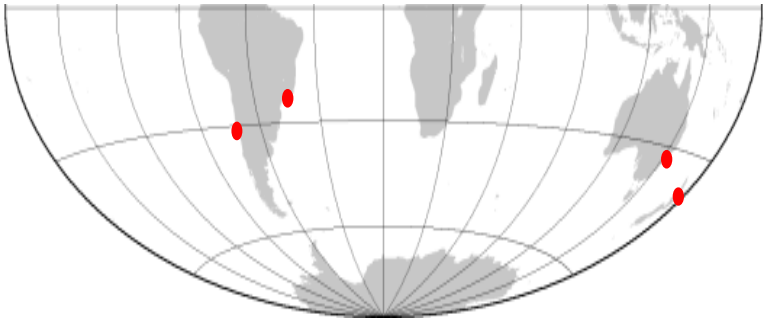


Structure: Teamwork on both hemispheres



Northern hemisphere experiments: May to October
5 countries

Southern hemisphere experiments: November to April
4 countries



Structure: 12 months of GAME

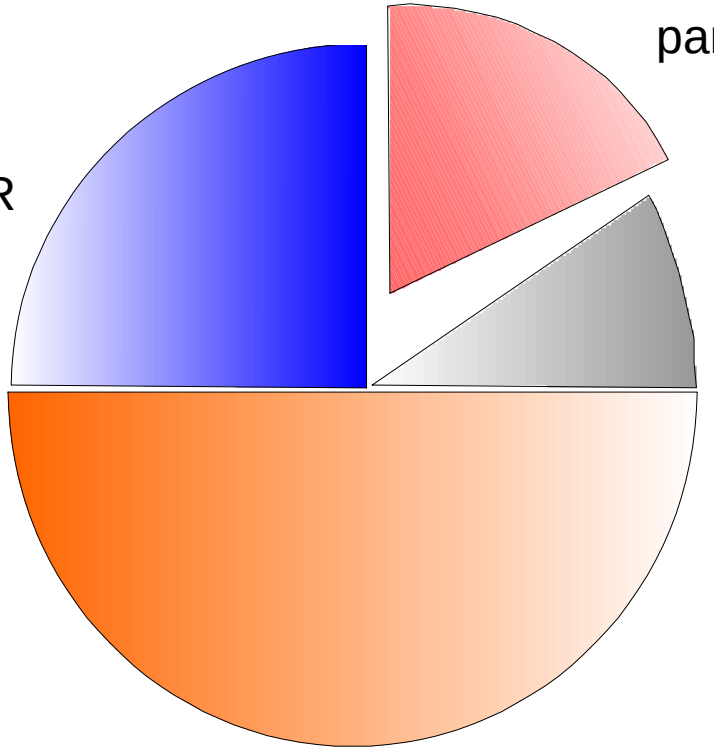





Temporal structure

Analysis, interpretation, publication, **3 months**, IFM-GEOMAR

Preparation, **2 months**, IFM-GEOMAR and partner institutes



Introductory course, **1 month**, IFM-GEOMAR

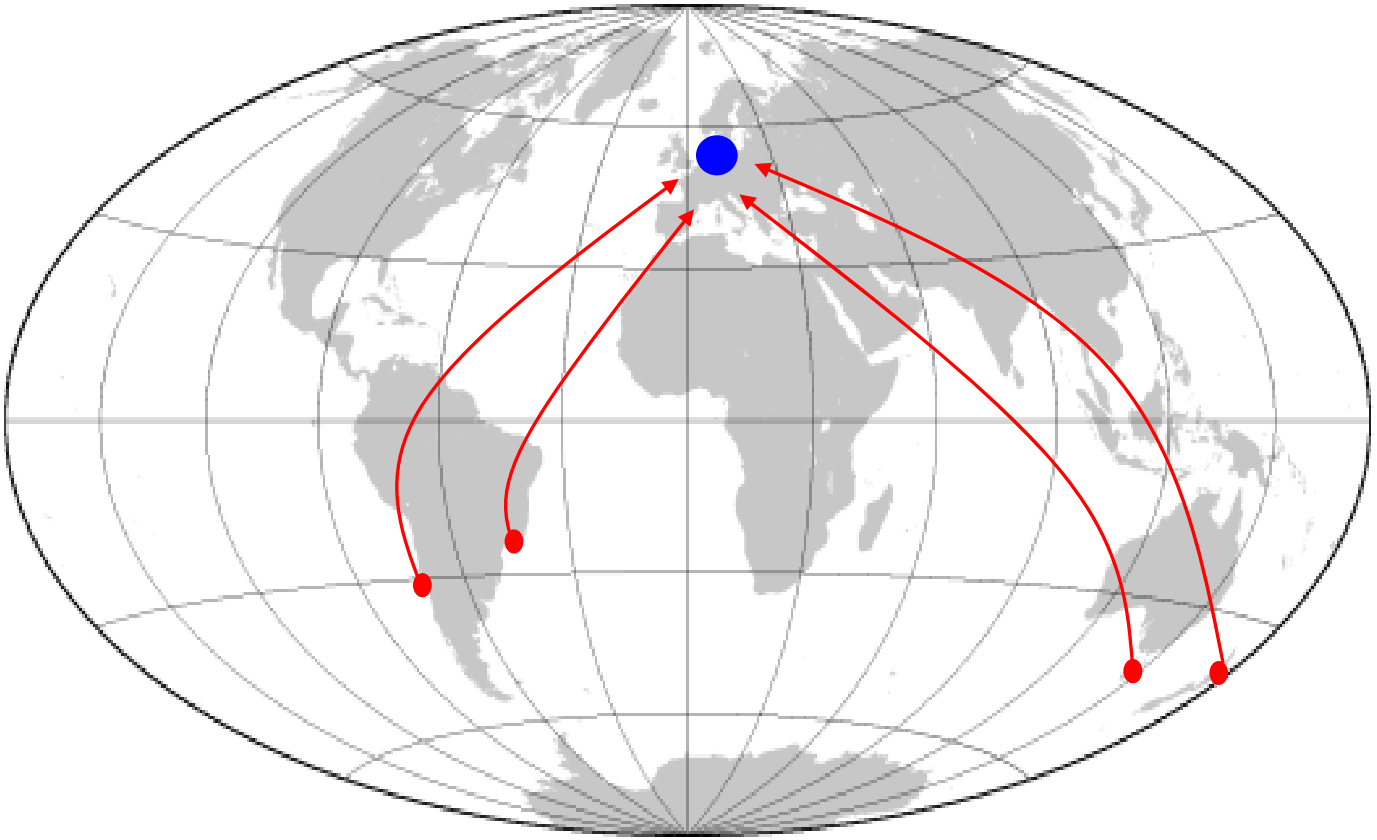
Experiments, **6 months**, at partner institutes

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

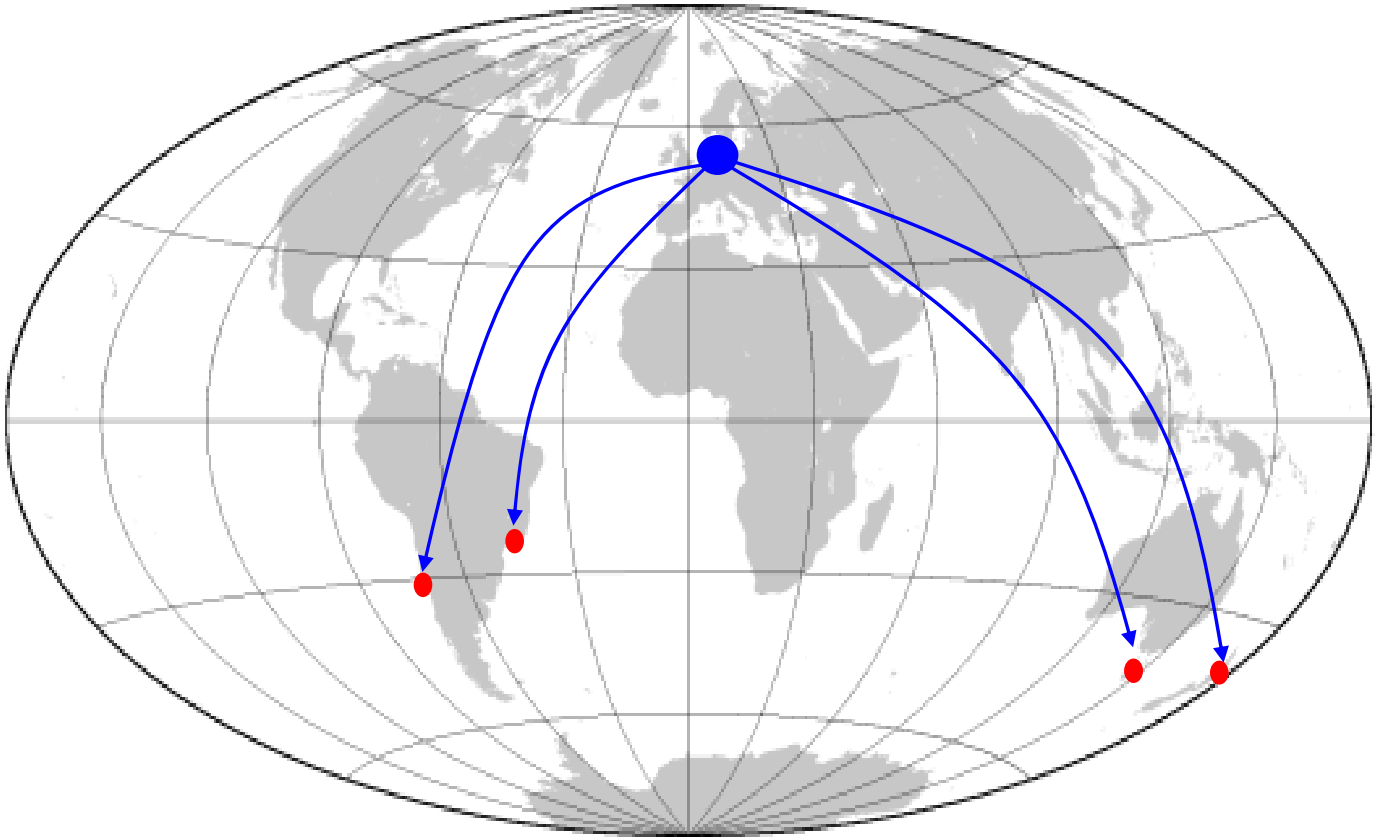
- Evaluation:
  Writing a preliminary material & methods section as a self-test and to inform local supervisors

Structure (e.g. southern hemisphere project)



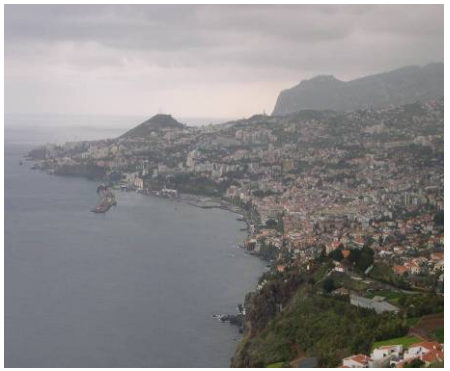



Experimental work at partner institutes in binational teams



Structure: study sites

Chile



Madeira Island, Portugal

Tasmania, Australia

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

27

Structure: study organisms

Fouling communities grown on artificial hardsubstrata

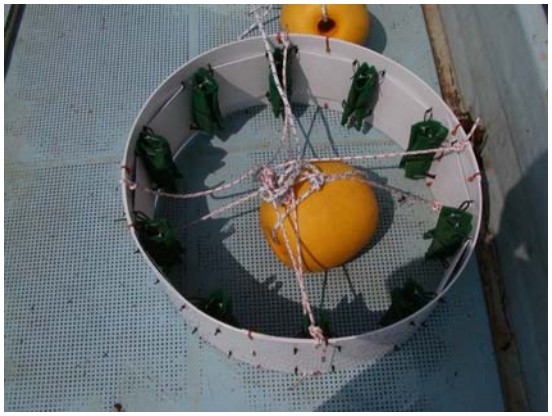
Structure: experimental set-ups

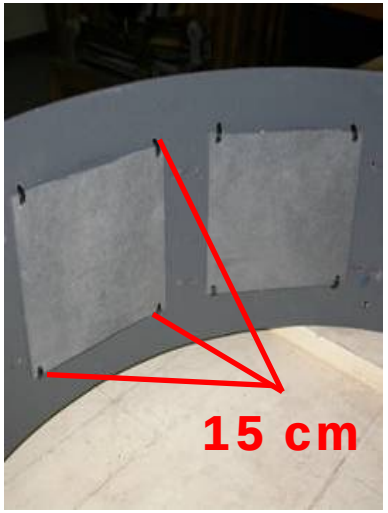
Need to be….

- **Identical across study sites**
- **Simple**
- **Robust**
- **Inexpensive**

Structure: experimental set-ups

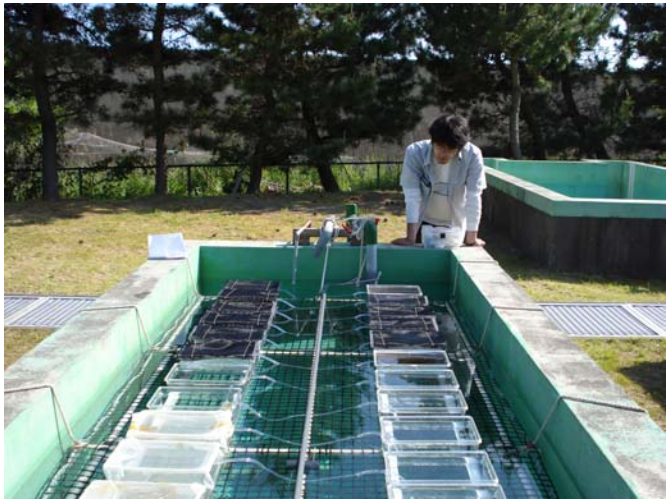
Field installations for studies on community ecology

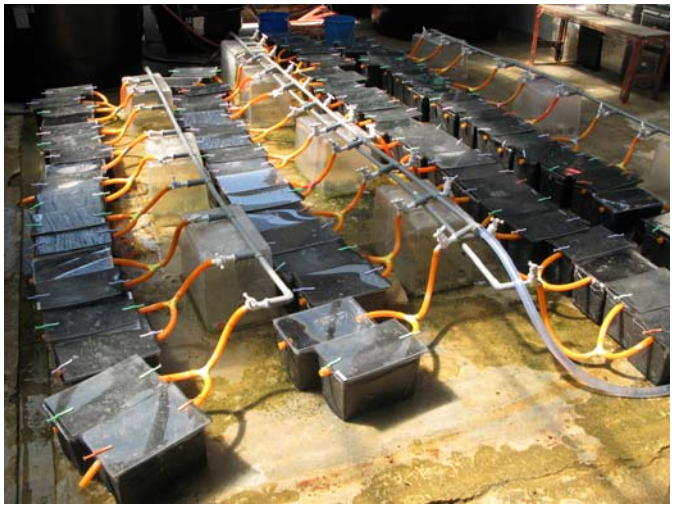




Structure: experimental set-ups

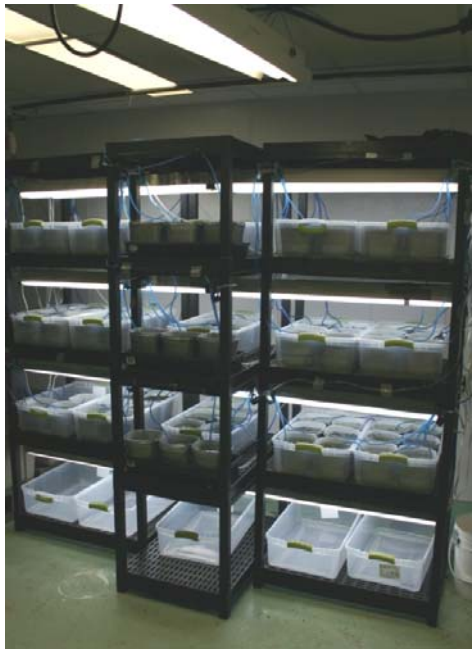
Mesocoms for studies on species interactions





Structure: experimental set-ups

Lab installations for studies on species interactions

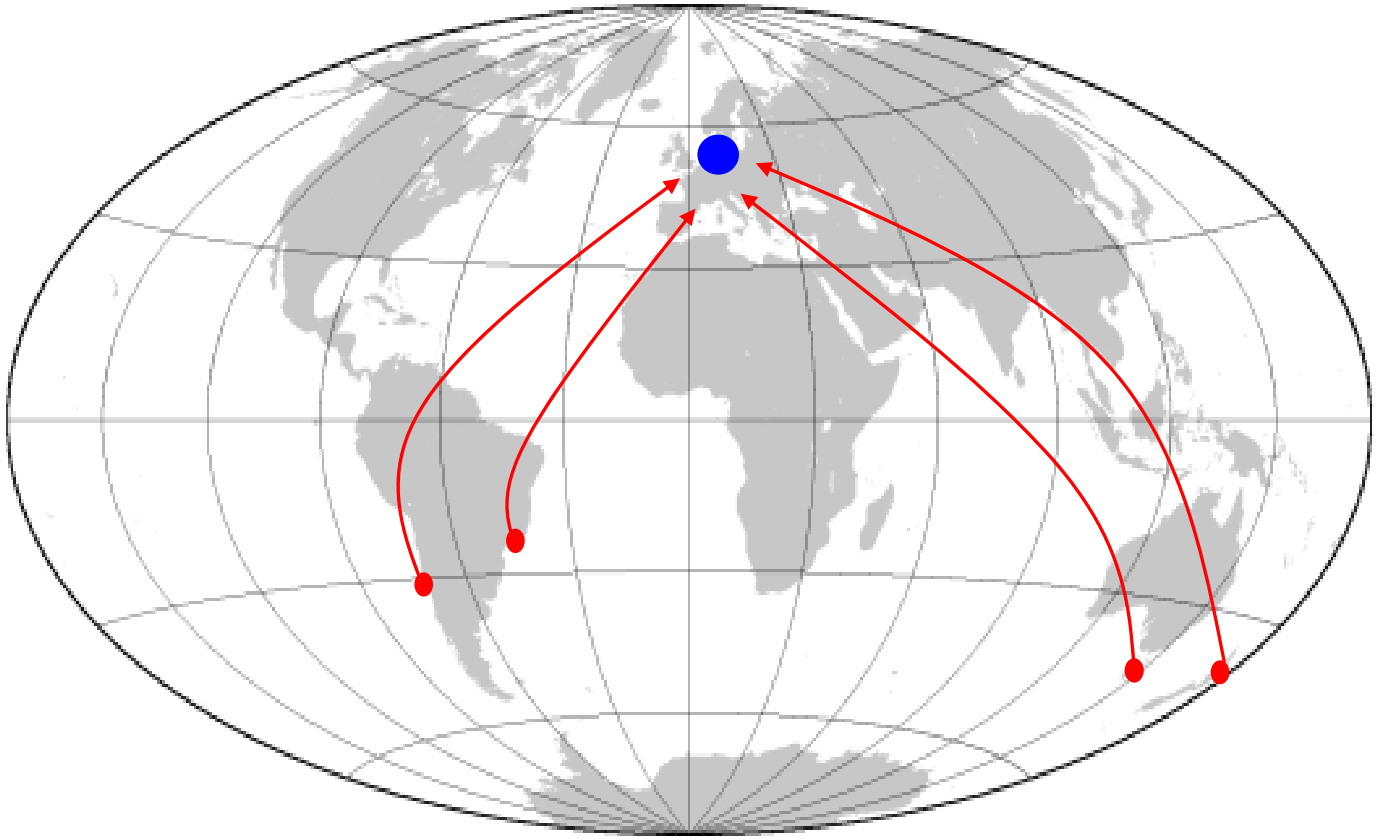


Structure (e.g. southern hemisphere project)






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

Survey






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






GAME
Global Approach by Modular Experiments

Thank you for listening!

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