

Objectives

Due to dwindling stocks of marine resources, there is increasing interest in aquaculture of both food and ornamental species. Therefore information about lifecycles of a number of very different species is required, complemented by information on behaviour and activity. Investigation of respiration physiology with advanced equipment can give detailed information about metabolic adaptations and oxygen requirements in different phases of development, including energy turnover.

Metabolic data reveal energy requirements and food conversion. Therefore potential applications in aquaculture or health care can be optimisation of metabolism and subsequently growth or reproduction efforts. Studies about metabolism have a long tradition. Nevertheless there are many examples of unsuitable experimental setups and numerous data, which are biased in one way or another.

The recent introduction of intelligent flow-through systems or intermittent flow-through systems in combination with simultaneous observation of the activity level has led to a new quality in respiration physiology experiments. The use of computerized monitoring of water quality parameters together with infrared video recording reduces potential stress through handling to a minimum.

The development of three generations of respiration apparatus and numerous measurements on both polar, tropical and temperate fish species revealed the lowest ever recorded resting metabolism for a fish.

This method can also be applied to early life stages of fish and to invertebrates such as crustaceans, bivalves and echinoderms using the right oxygen sensor for every experimental setup.

Contents

The 2–3 weeks course will take place at the ZMT or in one of our partner institutions.

General introduction

- Animal respiration
- Animal behaviour
- Activity levels
- Background of O<sub>2</sub> measurements
- Selection of suitable organisms
- Setup of campaign

Practical work and tools

- Sensors and other IR-observations
- Structure and function relationship
- Choosing the right setup for different ecotypes
- Water quality requirements

Data processing and interpretation

- Automated sampling
- Mean and progressive mean
- Step value (behaviour)
- Comparative approach

Center for Tropical Marine Ecology

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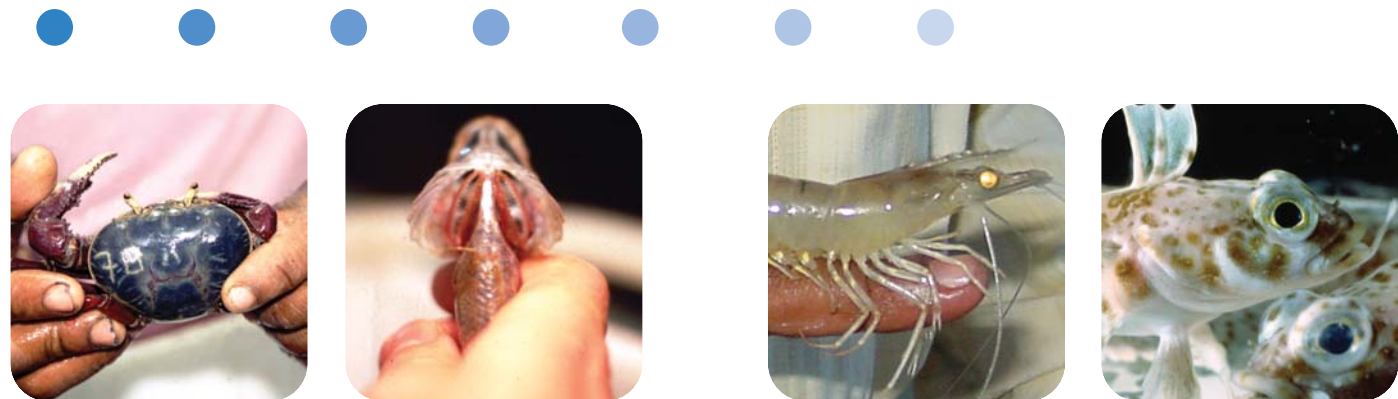
in cooperation with  
the Institute for Polar Ecology in Kiel and  
the Federal Research Institute for Fisheries  
in Hamburg

Bremen 2004

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Design: kube und trinh, grafische formgebung  
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## Participants and Fees

This course (15–20 participants) is aimed at students, lecturers, researchers, coastal managers, aquaculturists and those interested in all aspects related to the physiology of marine organisms.

Participants should be proficient in English and hold an undergraduate degree in biology or have equivalent experience.

ZMT-certificates for successful participants can be issued on request.

The ZMT is a non-profit institution. Participation fees will be fixed in cooperation with the hosting institution.

## Background

Since 1991 the ZMT has been engaged in educational and training activities in tropical aquatic ecology. This includes special courses for postgraduates in Bremen and at partner institutions around the world. Based on this experience, the ZMT offers tailor-made training courses within its course curriculum “The Sea and its Resources”. They are carried out in close cooperation with scientists from other German research institutions, covering a wide range of topics, including:

- Coastal Marine Systems
- Sampling Strategies and Methods
- Tropical Ecosystems and Resources
- Resource Availability and Vulnerability

## Further

### ZMT – Special Courses

#### Ecology and Taxonomy

- Ecology and early life stages of marine organisms; ZMT Bremen
- Coral reef ecology; State Polytechnic College of Palawan, Philippines
- Mangrove ecology; Bung Hatta University, Indonesia
- Benthos ecology with emphasis on tropical coastal ecosystems; ZMT Bremen; CIMAR, Costa Rica
- Taxonomy of corals; Bung Hatta University, Indonesia
- Fish ecology; Belem / Bragança, Brazil
- Taxonomy and ecology of reef fishes; Bung Hatta University, Indonesia

#### Physiology

- Ecophysiology of tropical marine organisms; Bung Hatta University, Indonesia
- Respiration, activity and behaviour of tropical fishes; Bung Hatta University and Soedirman University, Indonesia
- Respiration physiology of fishes; Belem / Bragança, Brazil

#### Fisheries Biology

- Population dynamics of marine fishes / Ecology of eggs and larvae of marine fishes; College of Fisheries Mangalore, India
- Fisheries biology and marine fishes; University of Cape Coast, Ghana; State Polytechnic College of Palawan, Philippines
- Early life history of fishes (within BENEFIT); ZMT Bremen
- Fishes in estuaries; Bragança, Brazil
- Introduction to fisheries science; Bragança, Brazil
- Fish population dynamics; Soedirman University, Indonesia

#### Biogeochemistry

- Coastal pollution, its effect and diagnosis in natural communities; ZMT Bremen
- Biogeochemistry and ecology of tropical coastal seas; Institute of Oceanography, Nha Trang, Vietnam
- Aquatic chemistry; Universidade Federal do Pará, Brazil

#### Coastal Management

- Coastal zone management planning; Universitas Riau, Pekanbaru, Indonesia
- Coastal management: Options and issues in interdisciplinary work between the social and natural sciences; ZMT Bremen
- Coastal resources management; State Polytechnic College of Palawan, Philippines

#### Methodology

- Sampling strategies for marine ecological research; ZMT Bremen
- Relational databases in interdisciplinary research; Universidade Federal do Pará, Brazil
- Experimental ecology using different methods of the analysis of variance; Universidade Federal do Pará, Brazil
- Methodology in social sciences, participation and interdisciplinarity; University of Bragança, Brazil
- Introduction into systems analysis; Universidade Federal do Pará, Brazil

#### Ecosystem Modelling

- Trophic modelling using ECOPATH II – steady state and concepts; ZMT Bremen; Universidad Católica del Norte, Chile; Centro de Investigaciones Pesqueras, Cuba
- Modelling and simulation in ecology and species conservation; Pesina, Italy
- Mathematical modelling in ecology; Universidade Federal do Pará, Brazil
- Food webs and energy flow in marine ecosystems including modelling; Universidad Agraria, Perú
- Neighbourhood modelling in plant ecology; online course, ([www-user.uni-bremen.de/~uberger/seminars.html](http://www-user.uni-bremen.de/~uberger/seminars.html))

