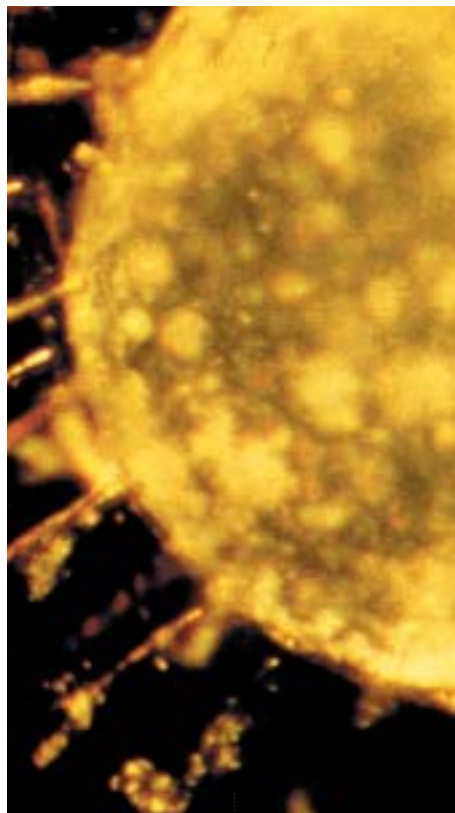




The Sea and Its Resources

Special Courses

Fish Population Dynamics



Background

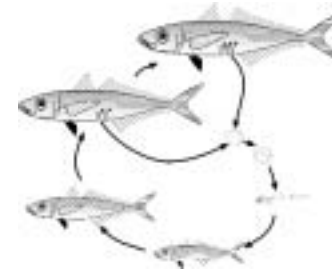
Since its establishment in 1991, ZMT has been engaged in a wide range of educational and training activities in the field of tropical aquatic ecology. This includes the organization and implementation of special courses for postgraduates in Bremen and at partner institutions around the world. Based on this experience, ZMT today is prepared to offer upon request tailor-made training courses under the umbrella of the overall course curriculum **The Sea and Its Resources**, established in 2001 between ZMT and Indonesian universities. Through close collaboration with scientists of the University Bremen and the Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, courses and lectures can be conducted in topics such as

- Introduction to Coastal Marine Systems,
- Sampling Strategies and Methods for Sea Exploration,
- Tropical Ecosystems and Resources and
- Resource Availability and Vulnerability.

The module **Fish Population Dynamics** covers part of the topic **Tropical Ecosystems and Resources**.

Objectives and content

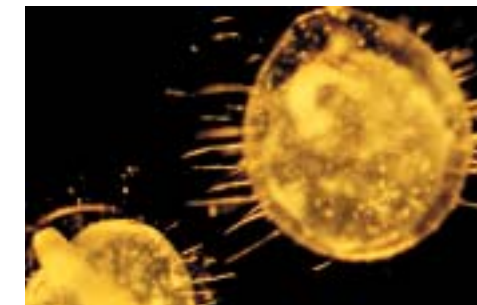
A sound management of coastal fish stocks, which aims at the sustainable development of populations and their maintenance at pristine levels, either for ecological or commercial purposes, has to consider the different behavioural traits of the populations concerned. Yet, for most of the species, there is currently no information available regarding their life history, largely because of a lack of knowledge of the identity and ecology of their early life-cycle stages.



Since **early life stages** and their pelagic phases constitute the most critical period in the life of a fish, this knowledge is crucial and its application to population dynamics essential.

The objective of the first part of the course module is to provide basic knowledge concerning the early life history of fish as a major issue in marine fisheries. This part introduces historical milestones in ichthyoplankton research, provides an overview on the actual state-of-the-art and aims to supply participants with a set of methodologies to identify marine fish species and stages. Egg development until hatching, larval development, taxonomy, and morphological adaptations are themes discussed. The differences within characteristics between larval and adult fishes in morphological structures, in requirements to suit the habitat and in behavioural patterns will be elaborated.

Besides an investigation of the ontogenetic development in fishes, estimation of biomass, growth and production of exploited stocks is essential for a sustainable management. A key factor in this area is the determination of the age of the fishes in their different life cycle stages. The purpose of the second part of the course module is to use age as a population dynamics tool for determination of **fish growth** as a basis for yield forecast models, the estimation of fish mortality in fisheries impact studies, and for growth back calculation in growth rate analysis. This part provides the participants with background knowledge in the estimation of age and growth of individuals and populations, as well as practical experience in extracting and reading otoliths. General lectures focus on the history of fishing, including the development of fisheries legislation and the evolution of fishing techniques, and on the status of fisheries and their management with particular emphasis on tropical environments.



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Study content and course structure

The course extends over two weeks (5 days weekly, 6 hours daily); a one-day excursion for fieldwork (ichthyoplankton survey) can be offered additionally depending on local facilities.

The complete course is structured as follows:

Part I: Early Life History of Fish

Lectures

- Classification and systematics of fishes
- Historical remarks on marine fish fauna and ichthyoplankton research
- Gonad and egg development until hatching in marine fish
- Criteria for egg identification
- Different stages in larval development
- Morphological characteristics of larvae
- Criteria for larvae identification
- Larval behaviour and interactions with the environment
- Design and evaluation of ichthyoplankton surveys

Practical work

- Identification and drawing of a complete egg and larval developmental series of single species
- Identification and drawing of different taxa of fish larvae
- Identification of fish eggs and larvae by means of scientific literature and computer-based identification programs such as FISHBASE/LarvalBase
- Exercise on planning, data evaluation and data presentation of an ichthyoplankton survey (based on data from a local field trip and/or of a ZMT cruise).

Part II:

Age and Growth as Tools in Population Dynamics

Lectures

Introduction to fisheries science:
A short overview of the evolution of fisheries science and its main research fields

Theoretical background of otolith composition and growth

History of fishing and development of fisheries legislation

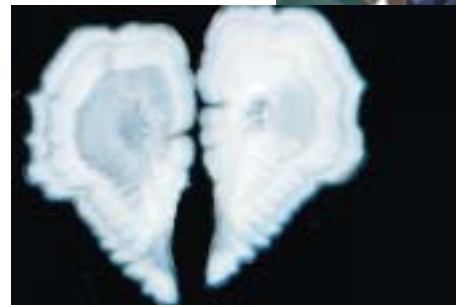
Evolution of fishing techniques

Estuarine and coastal fisheries

Fisheries management

Practical work

- Preparation of otoliths for age analysis
- Fish growth and mortality: Interpretation of seasonal growth patterns in otoliths
- Larval growth and mortality: Analysing larval growth increments in otoliths
- Growth curves and calculations: Different mathematical models used and their parameters
- Length-frequency analysis: Introduction to the computer program FISAT



Examination

Evaluation of course participants through written examinations for each part is performed to assess the level of comprehension of the main problems discussed during the course.

Participants

This course is aimed at students, lecturers, researchers and those interested in all aspects related to the sea and its resources. Participants should at least have an undergraduate degree in biological science or equivalent experience. A total of 20 participants may be accepted. The instruction language is English and participants must have a good working knowledge of this language. Certificates are provided for regular participation and successful passing of the written examinations.

Expenses

Participation fees are charged to cover the costs of the course; the amount will be fixed in cooperation with the attending institution.

- 1993 ECOPATH II steady state ecosystem modelling; ZMT Bremen
Benthos ecology with emphasis on tropical coastal ecosystems; ZMT Bremen
- 1994 Mangrove ecology; Bung Hatta University, Padang, Indonesia
Sampling strategies for marine ecological research; ZMT Bremen
- 1995 Ecophysiology of tropical marine organisms; Bung Hatta University, Padang, Indonesia
Ecología de comunidades de los sedimentos marinos -Marine Benthos Ecology; CIMAR San José, Costa Rica
- 1996 Ecology and early life stages of marine organisms; ZMT Bremen
Modelling and simulation in ecology and species conservation; Pesina, Italy
- ZMT-Special Courses
- Taxonomy of corals; Bung Hatta University, Padang, Indonesia
- 1997 Respiration, activity and behaviour of tropical fishes; Bung Hatta University, Padang, Indonesia
Coastal pollution, its effect and diagnosis in natural communities; ZMT Bremen
Taxonomy of fishes; Bung Hatta University, Padang, Indonesia
Modelación trófica mediante el modelo ECOPATH II; Univ. Católica del Norte, Coquimbo, Chile
- 1998 PP and CO₂ –exchange of macro- u. microalgae in the tidal range; Wadden Sea Station, Sylt
Relational databases in interdisciplinary research; Universidade Federal do Pará, Brasil
Coastal zone management planning; Universitas Riau, Pekanbaru, Indonesia
Population dynamics of marine fishes/ Ecology of eggs and larvae of marine fishes; College of Fisheries, Mangalore, India
Coastal management: Options and issues in interdisciplinary work between the social and natural sciences; Bremen
Introduction into experimental ecology using different methods of the analysis of variance; Universidade Federal do Pará, Brasil
Modelamento matemático em ecologia; Universidade Federal do Pará, Brasil
- 1999 Fisheries biology; University of Cape Coast, Ghana
Análises de polens: introducao a palinologia UFPA; Belém, Brasil
Palinología de Cuaternario; Universidade Luterana do Brasil, Canoas, Brasil
- 2000 Respiration physiology of fishes; Belem/Braganca, Brasil
Fish ecology; Belem/Braganca, Brasil
Food webs and energy flow in marine ecosystems including modelling; Universidad Agraria, La Molina, Peru
Early life history of fishes (within BENEFIT); ZMT Bremen
Biogeochemistry and ecology of tropical coastal seas; Institute of Oceanography, Nha Trang, Vietnam
Aquatic chemistry; Universidade Federal do Pará, Brasil
Fishes in estuaries; Braganca, Brasil
Metologias nas Ciências Sociais, Participação e Interdisciplinaridade; University Braganca, Brasil
- 2001 Introduction into systems analysis; Universidade Federal do Pará, Brasil
Neighbourhood modelling in plant ecology, Online Course; <http://www.zmt.uni-bremen.de/zmt/berger/spatialModeling/Introduction.htm>
Marine fishes; State Polytechnic College of Palawan (SPCP), Puerto Princesa, Philippines
Introduction to fisheries science; Braganca, Brasil
- 2002 Palaeovegetation dynamics: evidence, analysis and interpretation; Universidade Federal do Rio Grande do Sul, Porto Alegre
Training course in fish population dynamics; General Soedirman University, Purwokerto, Indonesia
Introduction in concepts of trophic modelling and ECOPATH software; Centro de Investigaciones Pesqueras, Havana, Cuba
Coral reef ecology; State Polytechnic College of Palawan (SPCP), Puerto Princesa, Philippines

