

# TROPHOS

## HIGHER TROPHIC LEVELS IN THE SOUTHERN NORTH SEA

**Duration of the project:** 01/02/2002 – 30/04/2006  
**Budget:** € 1.048.000  
**Keywords:** North Sea Ecosystem, Benthos, Population Dynamics, Sampling, Food Web

### CONTEXT

TROPHOS is a co-operation between five Belgian institutes (RUG–Marine Biology, KULeuven–Aquatic Ecology, Institute of Nature Conservation (IN), Management Unit of the North Sea Mathematical Models (MUMM) and Flanders Marine Institute (VLIZ)) and one Dutch institute (NIOO-CEME) and aims at a better understanding of processes structuring the higher trophic levels in the North Sea. As we will not ignore the link between ecosystem functioning and aquatic biodiversity, our results will also serve in aspects of sustainable management for those areas on the Belgian Continental Shelf (BCS) of the North Sea, which fulfil the criteria for protection status in marine reserves.

### PROJECT DESCRIPTION

#### Objectives

Research within TROPHOS will focus on processes structuring the higher trophic levels in the North Sea ecosystem. Special attention will be given to:

- The food web interactions that shape the benthic communities. This will make it possible to unravel how food cascades into animal biomass. Detailed research on C-cycling within the benthic food web will be performed.
- The dispersal mechanisms on the BCS. This is mainly of importance for those species that have a pelagic life-style or have pelagic larvae. The impact of certain behavioural aspects (swimming, sinking,...) on the dispersal will be investigated as well.
- The importance of the benthic communities in the functioning of the total BCS ecosystem. It will be examined whether or not Phaeocystis can be used as a food source by the infauna of the benthos. In addition, sediment community oxygen consumption rates that will be performed in BCS sediments will shed light on total benthic metabolism.
- The Belgian coastal waters are internationally very important areas for a number of sea and coastal birds. Studying the distribution patterns of the possible food sources (i.c. pelagic fish) of these birds will lead to a better understanding of their spatial distribution patterns. Population dynamics of gulls and terns in the outer harbour of Zeebrugge will be studied as well.

#### Methodology

■ Food web interactions: This task will be executed by RUG-Marine Biology Section and NIOO-CEME and is focussed on meiobenthos. Monthly sampling of two stations, showing a clearly different food web structure, will allow describing changes in the composition and densities of the meiobenthos when changes in the primary production in the water column will occur. The primary production will sink to the sea floor and acts as an important food source for the benthos. Possible consumption of phytoplankton can be studied by comparing the natural occurring stable isotopes of the meiobenthos with those present in the phytoplankton. Changes in bacterial diversity will be assessed by means of DGGE. The benthic response to the sedimentation of the spring phytoplankton bloom will be evaluated through experiments with enriched and labelled (stable isotopes <sup>13</sup>C and <sup>15</sup>N) phytoplankton. Benthic food web flows and the benthic contribution to the metabolism of the ecosystem will be inferred from inverse modelling.

■ Dispersal mechanisms of key species: This part of TROPHOS will be performed by KULeuven, RUG and MUMM. Larvae and post larvae of fish and Mesopodopsis, sole and gobies will be sampled using the appropriate sampling gear. Population-specific life history characteristics (e.g. fertility, survival, growth...) will be collected. Genotyping will be done with at least 8 DNA microsatellites per fish (KULeuven) or with SSCP combined with sequencing of variable nuclear and mitochondrial loci (Mesopodopsis (RUG) and Gyrodactylus (KULeuven)). The behaviour of the planktonic stages of the fishes and Mesopodopsis will be modelled with a combined 3-D hydrodynamic and particle tracking model by MUMM.

■ Coastal and sea birds: This part of TROPHOS will be a combined effort of RUG and IN. Pelagic fish will be collected monthly at 7 locations on the BCS by means of a MIC-net at the surface and near the bottom. Frequency of sampling will be diminished towards the end of the project. Species composition, length distribution, abundance, zooplankton density and a number of environmental variables will be measured. Distribution patterns of Common Tern, Sandwich Tern, Auk, Common Guillemot and Great Crested Grebe will be compared with the horizontal distribution of their prey fish. An analysis of the content of the stomach will be performed on fresh corpses of Guillemot, Auk and Great Crested Grebes found during beach bird surveys along the coast and birds accidentally caught in fishing nets. Population size of seabirds nesting in Zeebrugge will be determined. Laying date, clutch size, predation rate, hatching success, chick growth and survival will be measured. Nest attendance and prey specific foraging time will be established. Food intake and diet composition of Sandwich and Common Tern chicks will be measured from a hide. Food composition of adult terns will be identified by means of otholiths

and other food remains found in faeces and pellets. Variation in food composition will be compared to fluctuations in food availability. Reading of ringed Sandwich Tern, Common Tern, Herring Gull and Lesser Black-backed Gull will be analysed and migration between colonies will be assessed.

#### Interaction between the different partners

Strong interactions between the various partners in this project are foreseen. The benthic-pelagic coupling theme will be a result of a strong co-operation between RUG and NIOO-CEME, while VLIZ offers ship time on their research vessel Zeeleeuw. Sampling campaigns will be a joint effort and researchers belonging to both institutes will conduct the experiments. KULeuven and RUG will work together on the theme covering the dispersal mechanisms of species having pelagic life stages. These mechanisms will be modelled as a result of collaboration between the KULeuven and RUG teams and the modellers at MUMM. IN and RUG will be the partners tackling the problems relating to the causal aspects of the distribution of seabirds: RUG will work on the pelagic fish data, while bird data will be analysed at IN.

Data management and dissemination of results: VLIZ will be responsible for the data management, valorisation and exploitation. By developing databases and websites, data gathered in the framework of TROPHOS will be made available to the public. VLIZ will also develop and implement modalities and technical solutions for data-exchange between the partners within TROPHOS.

#### Link with international programmes

- DIVERSITAS (ICSU, SCOPE, IUBS, IUMS, UNESCO-MAB).
- IGBP (International Geosphere – Biosphere Programme).
- LOICZ (Land Ocean Interactions in the Coastal Zone, IGBP, ICSU).

#### Expected results and/or products

- Scientific results will be published in peer-reviewed journals.
- Data of the benthos and seabirds on the BCS will be made public through the website. An atlas with distribution maps will be provided as well.
- Monitoring designs for the follow-up of nature conservation will be developed (potential Marine Protected Areas).
- Bio-indicator species and bio-indicator communities for anthropogenic threats will be identified and tested.
- Detailed food web interactions will be identified for the first time in the higher trophic levels of the North Sea.
- Coupling between hydrodynamic models and dispersal mechanisms of selected species will be explained.
- Population dynamics of gulls and terns will help in setting the criteria for protected areas, habitats and species.
- Results will be made available to the public, end-users, governmental bodies.

## PARTNERS

### Activities

#### RUG

The Marine Biology Section is responsible for the

overall co-ordination, diversity, density and biomass of meiobenthos, diversity of bacterial communities, stable isotope work.

#### NIOO-CEME

The Centre for Estuarine and Marine Ecology of the Netherlands Institute for Ecology focuses on experimental work using stable isotopes, modelling of food-web flows.

#### KULeuven

The Laboratory of Aquatic Ecology works on the life history and dispersal of organisms with pelagic life stages.

#### MUMM

The Management Unit of the North Sea Mathematical Models will be in charge of the development of a dispersion model for organisms with a pelagic life stage.

#### IN

The Institute of Nature Conservation focuses on causal aspects of seabird distribution.

#### VLIZ

The Flanders Marine Institute is responsible for the data management, valorisation and exploitation of results.

## CONTACT INFORMATION

**website of the network:**  
[www.vliz.be/projects/trophos](http://www.vliz.be/projects/trophos)

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#### Users Committee

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