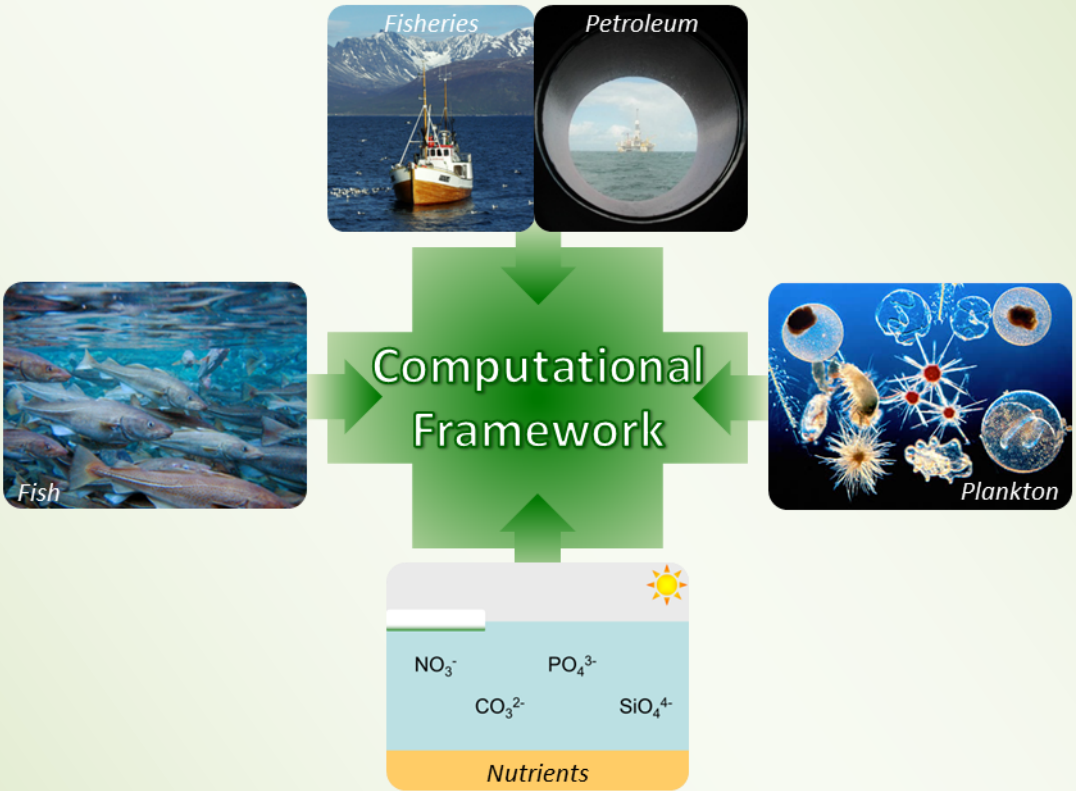
The Joint Industry Programme

SYMBIOSES

An integrated modeling framework for decision support in marine ecosystem based management



The SYMBIOSES modeling system evaluates potential impacts to the marine ecosystem resulting from combinations of petroleum and fisheries activities

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SYMBIOSES


Photo: K. Forberg

International maritime policies aim to achieve environmental sustainability through effective regulation and management of sea-based activities, such as transport, offshore energy, tourism, coastal development, fisheries, and aquaculture. Ecosystem based management (EBM) is the accepted regulatory mechanism for managing the sustainable use of marine goods and services while maintaining good environmental status.

The SYMBIOSES RTD (Research & Technology Development) initiative creates a new modeling system designed to support the practical application of EBM as an effective management approach. SYMBIOSES is expected to move forward from today's regulatory risk assessment procedures towards procedures that are more ecologically-relevant.

The system connects individual models into a computational framework located on a super-computer. It is designed to simulate marine ecosystem components in three dimensional space and time and predict impacts from selected combinations of sea based activities i.e. fisheries and petroleum operations. Model output will be visualized through a user-friendly graphical interface.

Case study - Lofoten/Barents Sea

The SYMBIOSES modeling system targets selected marine ecosystem components and maritime activities (fishing and petroleum industries) within the Lofoten/Barents Sea region.

The system includes seven models connected to a computational framework that runs on the STALLO supercomputer at the University of Tromsø Computer Centre (see Fig. 1).

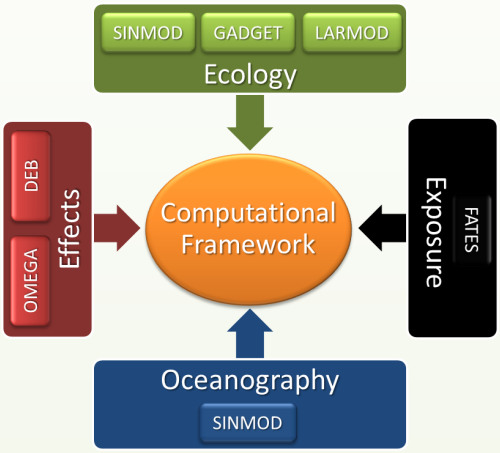

Fig.1 SYMBIOSES links a suite of models into a single, integrated computational framework.

Three ecological models are used to simulate the distribution and behavior of different life stages of important commercial fish, zooplankton, zooplankton prey, and phytoplankton species (see Fig. 2). Two ecotoxicology models will simulate the chemical uptake and effects on growth, mortality, and reproduction of marine organisms. An oil transport and fate model is used to trace chemicals in the marine environment and a physical model simulates the hydrodynamic features of the region.

Connecting these seven models into the computational framework allows prediction of population level changes in key commercial fish species linked to the Lofoten/Barents Sea region. Existing and new ecology and ecotoxicology datasets are being acquired during the project for model validation and to establish current environmental conditions.

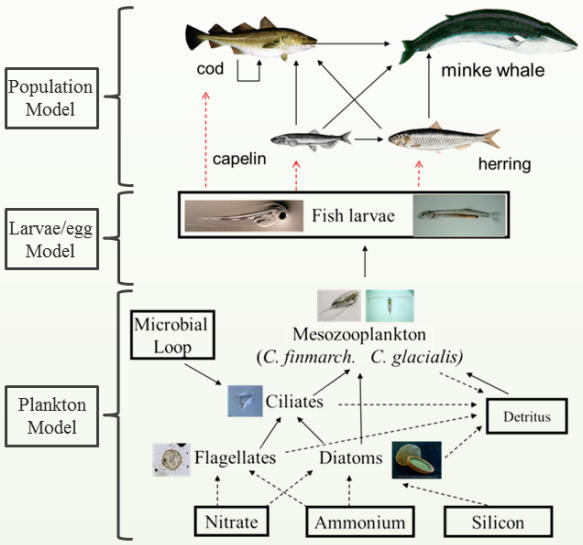

Fig.2 Three models form the SYMBIOSES ecosystem. Individual-based larvae (LARMOD) and plankton (SINMOD) models are linked via recruitment (larval survival) to a multispecies population model (GADGET)

A variety of stakeholders, from government, industry, and public interest groups are engaged in the stewardship of the valuable and unique natural resources located in the Lofoten/Barents Sea region. The SYMBIOSES aim is to become a vital aid to impact and risk analysis, management, decision-making and stakeholder communication for the region.

Project lead:

Akvaplan niva

Project partners:

INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET

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International Research Institute of Stavanger

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WAGENINGEN UR

UNIVERSITY OF NORDLAND

NIVA

SINTEF

COWI

CEES
Centre for Ecological and Evolutionary Synthesis

Programme Manager:

JoLynn Carroll

Akvaplan-niva

Phone: +47 777 50 314

e-mail: jc@akvaplan.niva.no