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Scientific tools for Marine Ecosystems Approach to Management - The MEECE Model Library

Marine Ecosystem Models are built on a diversity of approaches and programming languages to answer specific scientific questions. Each modelling tool is designed, programmed and optimised with a particular problem in mind, often focussing on particular components of the ecosystem. The resulting landscape of marine ecosystem models is thus as **complex** as it is **diverse**.

This diversity poses distinct **challenges** for the application and comparison of models, and for the assessment of the results across research teams and ecosystems, limiting the ability of environmental managers, policy makers and other stakeholders to make sound decisions.

The MEECE Model Library (Figure 1) provides and disseminates the **technical information necessary** for a competent, **non-expert user to apply** and evaluate a range of marine ecosystem **modelling tools**.

What is the MEECE `Model Library`?

The **Marine Ecosystem Evolution in a Changing Environment** (MEECE) Project aims to improve the knowledge base on marine ecosystems and their response to climate and anthropogenic driving forces. To achieve this, a suite of modelling tools have been identified, each targeting the major trophic components of the marine ecosystem, from phytoplankton to exploitable fish resources. The Model Library provides a source of key technical information for the application and modular coupling of these key modelling tools. The **objectives & approach of the Model Library** are as follows:

Objectives	Approach
Make existing modelling tools accessible and transparent	Extend the use of the MEECE modelling tools by **compiling the technical information** necessary to apply each tool by competent, non-expert users (e.g. technical user guides, access to programming code)
Provide modelling tools for Ecosystem Approach to Management (EAM) and to Fisheries Management (EAFM)	Develop a prototype of a modular modelling software structure capable of **assessing the impacts of both anthropogenic and climatic pressures** on marine ecosystems, their environment and their resources

Figure 1: MEECE Model Library offers user guides and access to source code for a range of modelling tools. The Library supports the application of the European Marine Strategy Framework Directive by mapping the capacity of its tools onto the descriptors of Good Environmental Status (GES).

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Relevance to the EU`s Integrated Maritime Policy (IMP)

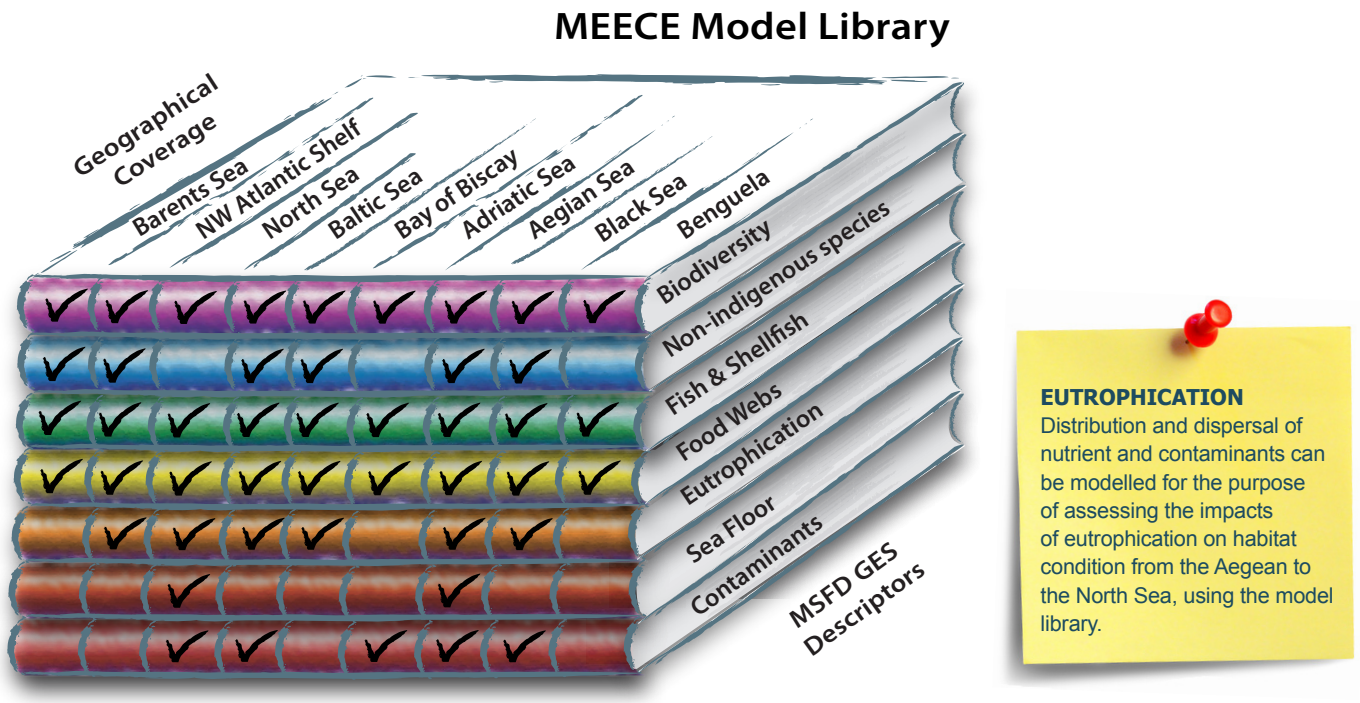
MEECE aims to expand the knowledge base on marine ecosystems` response to multiple pressures and provide innovative predictive scientific tools for the implementation of the **EU`s Integrated Maritime Policy**.

To this end, the Model Library provides the modular building blocks to construct coupled end-to-end models in order to answer questions with an **Ecosystem Approach to Management** (EAM) in mind, and test specific responses such as the impacts of pressures on marine biodiversity, consequences of invasive species or pollutant dispersal and eutrophication, under specific future scenarios.

BIODIVERSITY
Ecosystem structure and habitat condition in European waters can be modelled within MEECE by multiple model couplings with the purpose of assessing impacts of anthropogenic and climate pressures on biodiversity.

The Model Library can be used to implement the IMP`s **Marine Strategy Framework Directive (MSFD)**, by allowing users to search for delivering **Good Environmental Status (GES) Descriptors** and Ecological Quality Objectives (indicators). Figure 2 introduces the current suite of models available.

The Library currently proposes modelling tools that can be applied in European Seas to address questions on 8 of the 11 GES Descriptors for the regional sea of interest. Technical information necessary to apply the ecosystem models is provided.



EUTROPHICATION
Distribution and dispersal of nutrient and contaminants can be modelled for the purpose of assessing the impacts of eutrophication on habitat condition from the Aegean to the North Sea, using the model library.

Figure 2: The modelling tools available by European Seas and per MSFD GES Descriptor. The Library will include additional models as documentation becomes available.

COMMERCIAL SPECIES
Tools for assessing the biomass and productivity of key species in marine ecosystems, as well as the abundance and distribution of commercial species, are provided through various coupling tools between models.

Future Development

MEECE will continue to enrich the Model Library with both established and emerging modelling tools. Users and developers are encouraged to submit additional models for their region in order to expand the coverage for the European Seas and the full list of Good Environmental Status Descriptors.

For further details or to contribute to the MEECE Model Library contact; Ivo Grigorov (ivo_grigorov@hotmail.com), Michael St John (msj@aqua.dtu.dk). For specific model tool performance per geographic area or GES indicator, **visit www.meece.eu/library.aspx**

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