

GES4SEAS TOOLBOX:



SUPPORTING MEMBER STATES AND REGIONAL SEAS CONVENTIONS IN MARINE ENVIRONMENTAL ASSESSMENT

What is the GES4SEAS Toolbox?

The GES4SEAS toolbox is an innovative, science-based and open-access software, designed to help assess the cumulative impacts of human activities at sea and evaluate their effects on marine ecosystems, developed by a European project (www.ges4seas.eu). It supports integrated environmental assessments, aligning with the goals of the EU Marine Strategy Framework Directive (MSFD) and the needs of Regional Seas Conventions (RSCs).

This toolbox offers a flexible spatial analysis framework and comes with two main powerful indicator categories already implemented (others can be added):

Cumulative Impact/Combined Effects Assessment (CIA/CEA)

NEAT: Nested Environmental status Assessment Tool

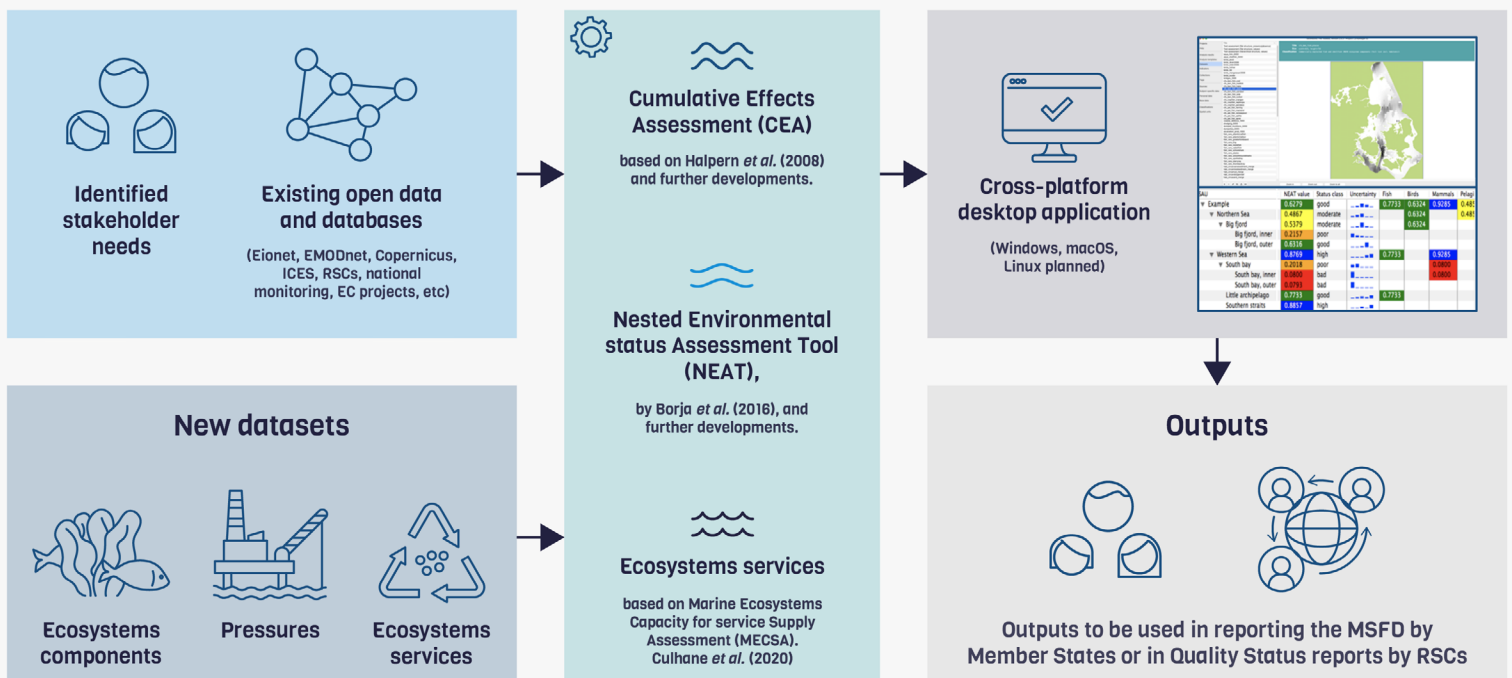
Together, these tools offer a comprehensive, user-friendly solution for evaluating environmental pressures and state across marine regions.

The Toolbox

Version 2.1 released.

- Public Version: December 2025,
- Final: August 2026

For experts on EU marine policy implementation (MSFD, WFD, MSPD, HBD)



1. Mapping the potential effects of Cumulative Pressures: CIA/CEA

The CIA/CEA framework builds on the widely recognized method by Halpern *et al.* (2008), which has become a global standard for mapping the combined effects of multiple human pressures on marine ecosystems.

Key Features:

Improved methodology: GES4SEAS enhances the original Halpern approach by:

- Introducing a hierarchical weighting of ecosystem components based on their taxonomy or other schemes
- Using dose-response relationships for the sensitivity of ecosystem components in addition to static sensitivity scores
- Replacing expert-based sensitivity scores with data- and literature-based scoring
- Proven track record: The method has been successfully applied in regional seas such as the Baltic, North-East Atlantic, Mediterranean, and Black Seas, using 9 sites across Europe, 1 in French Polynesia and 1 for the whole Europe.
- Policy relevance: It supports RSCs and national authorities in identifying hotspots of cumulative pressures, guiding marine spatial planning and management.



2. Assessing Environmental Status: NEAT

NEAT (Nested Environmental status Assessment Tool) is a multi-metric, indicator-based status assessment framework originally developed in the EU DEVOTES project. It allows integrated assessments of GES by combining various ecological indicators into a single, coherent evaluation.

Key Features:

- Flexible and scalable: it can be applied at local, national, and regional scales.
- Supports multiple themes: it evaluates biodiversity (species, biotopes), marine litter, or overall ecosystem health and can also be used for pressure-related assessments such as eutrophication or contaminants.
- Designed for practical use by authorities and scientists, with a clear interface and robust methodology.
- It has already been used in major European assessments, including Marine Messages II and the upcoming Marine Messages III by the European Environment Agency (EEA).



3.

Technical Framework – A Flexible Toolbox

The GES4SEAS toolbox is not just scientifically robust—it is also technically versatile, transparent and open access. Although primarily targeting the MSFD, the toolbox is flexible by design and can be adapted to other needs such as the Biodiversity Strategy and support a wide range of uses.

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Built for Flexibility and Customization

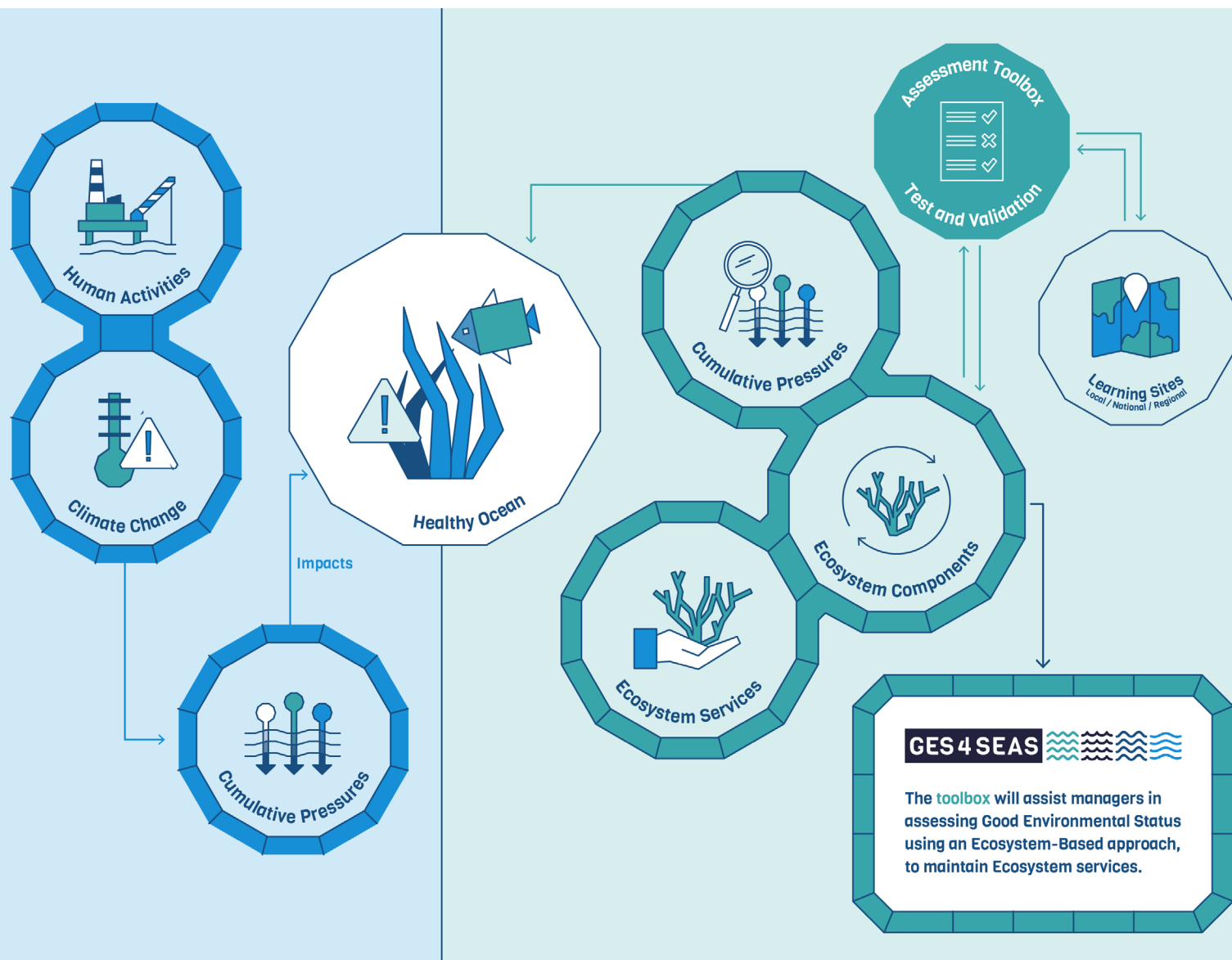
The toolbox is built on a generic, modular spatial framework that allows users to:

- Integrate any kind of (marine) data
- Conduct custom analyses tailored to specific goals
- Easily add new indicators and analyses or expand the implemented methods as new knowledge emerges

This flexibility ensures the toolbox remains relevant for diverse applications, from marine spatial planning to ecosystem service assessments.

Three Core Components

- **Datasets:** Supports both spatial data (e.g., maps) and non-spatial data (e.g., tables, matrices). Includes tools for importing, visualizing, and managing metadata.
- **Indicators:** Over 600 indicators, representing key aspects of ecosystem status and human pressures. Some indicators are already implemented with pre-configured workflows for direct analysis (such as the two main indicators CIA/CEA and NEAT)
- **Analyses:** Users can visually build data processing workflows (in the form of flowcharts) to process the imported datasets. Outputs include maps, tables, and numeric results. Enables transparent, repeatable assessments and documentation. Each project in the toolbox bundles these components, allowing users to manage multiple assessments independently.



Standards-Based and Interoperable

The toolbox is aligned with widely accepted frameworks and classifications:

- DAPSI(W)R(M) framework for linking human activities to ecosystem responses
- MSFD descriptors and criteria, including metadata for using Annex III for pressures and activities
- CICES (Common International Classification of Ecosystem Services) for ecosystem service assessments
- Open standards for import and export data formats

This ensures consistency with EU directives and interoperability with other tools and datasets.

Smart Data Management

All project data are stored in a database, ensuring:

- Consistency across projects
- Easy sharing of project files between users
- Easy upgrade to new software versions
- Automatic updates to background data when the software evolves

This makes the toolbox a collaborative, future-proof platform for environmental assessment.

