



P1.59 - SEAS4GES: THE SELECTION OF ECOSYSTEM-BASED APPROACHES *for* GES

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EBM tool requirements (after **Franco et al., 2023**):

- Tools or approaches to support the practical implementation of EBM **should address the needs of the user**;
- The user should have those **resources (data and skills) required by the tool**; and
- In order to be able to make full and correct use of its outputs, the user should be **aware of the tool's limitations, underlying assumptions, and potential impediments to its application**

1. The importance of ecosystem-based management, EBM, within the GES4SEAS project:

- EBM is a spatial approach that acknowledges the connectivity of the ecological system, the cumulative impacts that arise from (mainly) endogenous pressures, and the co-existence of multiple objectives (after **Smith et al., 2022**);
- Its goal is to maintain ecosystems in a healthy, clean, productive and resilient condition, so that they can provide society with the goods and services upon which it depends.
- Tools or approaches used to implement EBM as part of GES assessments under the EU's MSFD encompass a wide range of strengths and weaknesses;
- It is not appropriate to attempt to define a single 'best' tool - the performance (and hence suitability) of any given tool is unlikely to be consistent across different application scenarios;
- Individual applications present specific sets of circumstances, both in terms of the user's needs and the availability of resources (such as types and qualities of input data, and user-skills) against which the value and suitability of each potential tool should be viewed;
- Depending on the circumstances surrounding its application, any EBM tool or approach may be seen as being more - or less - suitable in the eyes of the particular end-user (as discussed by **Papadopoulou et al., 2025**);
- There is therefore a **clear need for a structured and consistent approach for identifying the optimal EBM tools or approaches, given prevailing circumstances (user needs, and resource availability)**.

2. The SEAS4GES (Selection of Ecosystem-based Approaches 4 GES) tool:

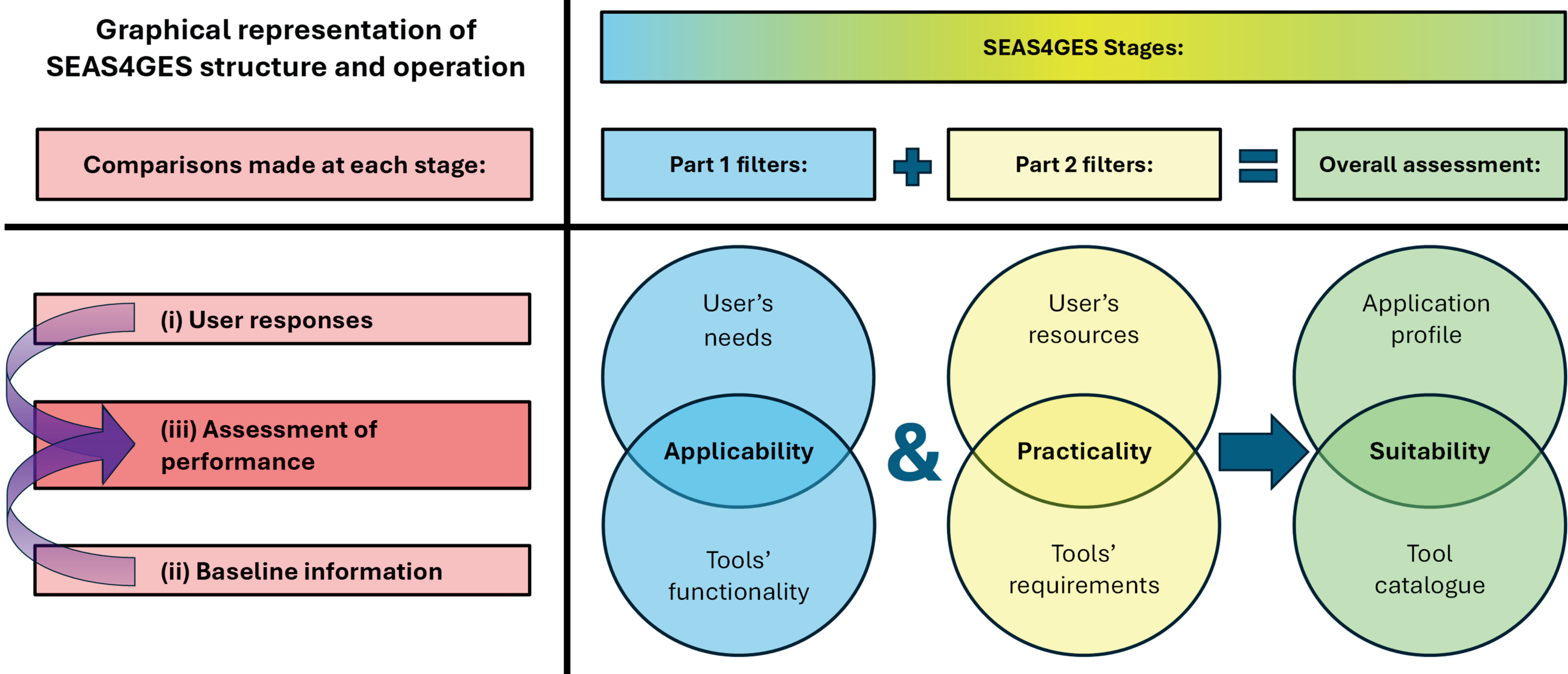
- Within the context of the GES4SEAS project, a brief review and collation of expert opinion identified a range of 35 EBM tools or approaches used by practitioners as part of their GES assessments within a wider EBM framework (**Franco et al., 2023**). Subsequently, an online questionnaire was developed and used to collate information on each tool's products/outputs, and its requirements (in terms of data and expertise). More than 60 responses to this questionnaire (completed by 45 respondents) provided profiles for these tools. Data from the questionnaire were collated and codified, and stored to a simple database.
- An interactive Excel-based decision support tool (SEAS4GES) was then produced (**Barnard et al., 2026**) allowing a user to specify their particular assessment needs, and their ability to provide particular resource types (data/expertise), by providing standardised responses (Yes/No, or selection from restricted picklists) to a series of 14 filters, split into two related sections:

Part 1: User needs - the proposed scope of application? (Filters 1-6)													
1. which particular element or application of EBM do you need to address?													
2. are there particular aspects of marine management that you are interested in and, if so, what are they?													
3. are there particular GES Descriptors that you are especially interested in and, if so, what are they?													
4. do you need the tool to produce spatial outputs (e.g. maps) and, if so, at what scale?													
5. do you need the tool to produce temporal outputs (e.g. future projections/forecasting) and, if so, at what scale?													
6. do you require a measure of the level of confidence in the outputs from the tool?													
Part 2: Meeting the tools' requirements: what information & skills (resources) can the user provide? (Filters 7-14)													
7. are you in a generally 'data poor' situation?													
8. what is the availability of specific spatial/temporal data types?													
9. are quantitative data available for specific variables? If yes, then what variables?													
10. are semi-quantitative data available for specific variables? If yes, then what variables?													
11. are qualitative data available for specific variables? If yes, then what variables?													
12. where empirical data are not available, could expert judgements be used as potential alternatives?													
13. what specific expertise are you or your wider organisation able to apply to your use of the tool?													
14. do the data you have available include confidence/uncertainty information?													

3. SEAS4GES outputs:

The SEAS4GES tool provides two basic colour-coded outputs - a **matrix showing the performance of each of the 35 tools considered against each of the 14 individual assessment filters**, and a **'league table' of EBM tools and approaches, ordered by their overall suitability**. The tool outputs also provide a **direct link to an online PDF file containing all of the tool factsheets**.

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- SEAS4GES assesses how many of the detailed options within each filter are satisfied by each of the 35 tools and expresses this as a series of percentage 'compliance' scores, representing the extent to which the user's needs are satisfied by each approach, or the extent to which the user is able to satisfy the requirements of each approach.
- SEAS4GES also includes factsheets for each tool, which outline the purpose and context of its use; the nature of its assessments (e.g. the EBM element(s) addressed; type(s) of assessment provided; range of inputs required (e.g. variable- and data-types, expertise and other resources), and strengths or weaknesses (including barriers for its practical implementation).

Tools, ordered by applicability/suitability

Rank	Tool ID	Tools/approaches in descending order of suitability	Avg score
1	17.0	Simple assessment index (e.g. M-AMBI)	92%
2	8.0	Biogeochemical models	88%
3	6.2	Cumulative impact spatial mapping (e.g. Magerit et al. 2008)	75%
4	9.1	Biogeochemical models (COPAD box model, also biochemical models being used to consider eutrophication in the North East Atlantic by OSPAR)	69%
5	7.1	Impact risk ranking through linkage-chain frameworks (e.g. CODEM, AQUASIS)	68%
6	7.0	Impact risk ranking through linkage-chain frameworks (e.g. CODEM)	67%
7	10.5	Overarching assessment tools (e.g. NEAT, OM, NEAT)	66%
8	10.0	Overarching assessment tools (e.g. NEAT, OM)	65%
9	1.0	Conceptual models	64%
10	2.1	Semi-quantitative mental models - Fuzzy Cognitive Mapping, Fuzzy Cognitive Modelling (FCM) with Mental Modeler	63%
11	11.0	Ecosystem models (e.g. Ecopath)	62%
12	7.4	Impact risk ranking through linkage-chain frameworks (e.g. CODEM, ICES/Mission Atlantic variation: https://doi.org/10.3389/fmars.2022.1057879)	60%
13	10.1	Marine planning models (e.g. GIS, VAPEN, related to user GIS)	58%
14	6.0	Cumulative impact spatial mapping (e.g. Magerit et al. 2008)	58%
15	8.0	Single species models (e.g. life cycle stock assessment)	57%
16	1.2	Conceptual models (e.g. EBM-AdB)	54%
17	3.1	Knowledge graphs (e.g. EAD DAPS/WILMIS)	53%
18	5.0	Risk based approaches: exposure-effect-hazard-vulnerability (e.g. BOWT)	52%
19	10.1	Conservation planning models (e.g. MARXAN), MARXAN team tools, prioritiser	52%
20	10.0	Descriptor or theme-specific combination of indices and models (e.g. NEAT, NEAT, CHASE)	51%
21	10.1	Head web models (e.g. multi-species models, EVEL, Ecopath with Ecosim and Ecospace)	50%
22	7.1	Impact risk ranking through linkage-chain frameworks (e.g. CODEM, SCARIM)	50%
23	6.1	Cumulative impact spatial mapping (e.g. Magerit et al. 2008), CIMPAL - cumulative impact of invasive alien species	49%
24	10.1	Natural capital accounting, ecosystem services valuation - Ocean Accounts	47%
25	5.1	Risk based approaches: exposure-effect-hazard-vulnerability (e.g. BOWT), Bow tie analysis	46%
26	10.0	Natural capital accounting, ecosystem services valuation	38%
27	1.2	Impact risk ranking through linkage-chain frameworks (e.g. CODEM, CODEM)	35%
28	10.0	Spatial planning models (e.g. GIS, VAPEN, related to user GIS)	34%
29	3.0	Knowledge graphs	34%
30	10.0	Conservation planning models (e.g. MARXAN)	23%
31	10.0	Habitat suitability / species distribution models (e.g. predictive distributions)	15%
32	10.0	Economic models, socioeconomic models (e.g. social goods and benefits valuation)	14%
33	6.0	Biogeochemical models	0%
34	1.1	Conceptual models: MAMBO	0%
35	20.0	Bio-spectrum models	0%

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