

High transparency but lack of confidence assessment in Baltic Sea decision support tools

Decision support tools for management of the Baltic Sea environment are generally scientifically documented and their methodology is transparent. However, the confidence in the outputs they generate is seldom well communicated – a feature highly requested by the end-users.

A new database created by project BONUS DESTONY collects information about available tools as well as assessments of how well they meet fifteen important performance criteria.

Managers and decision makers have a variety of decision support tools, DSTs, to their help when handling environmental issues in the Baltic Sea region. The BONUS DESTONY project has identified 42 tools with the purpose to support decision-making in relation to change in the aquatic environment at a local, regional, national or international management scale.

A large diversity can be seen among the tools but they can roughly be divided into four groups: models, stakeholder tools, assessment tools and planning tools. The DSTs address different environmental issues, most frequently eutrophication, but tools that deal with impact evaluation, biodiversity & conservation and contaminants are also common.

Most of the tools are used to give an explicit outcome to answer a specific quantitative question. The majority of DSTs address human activities, their pressures and environmental status changes, but there is less focus on impacts on societal welfare and management responses. Tools addressing economic aspects exist, but are only rarely developed into DSTs. The tools seldom provide solutions for a complete ecosystem approach or integrated management of marine environment, but such holistic approaches are also not frequently requested by the end-users.

Criteria for definition and performance

BONUS DESTONY set up five definition criteria for DSTs, which a tool ideally should fulfill (see box on page 2). The identified tools have been assessed based on these criteria and a set of fifteen performance criteria, developed by the project (see table on page 3).

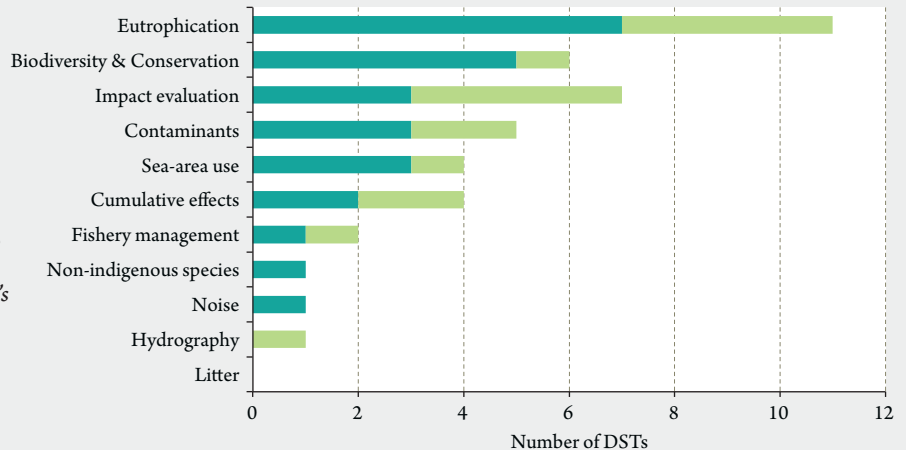
Highlights

- A wide range of decision support tools, DSTs, are available for use in the Baltic Sea region.
- The majority of DSTs address human activities, their pressures and environmental status changes. Less focus is on the societal impacts and on management responses. Only a few DSTs fully incorporate the ecosystem approach.
- The performance criteria that users perceive as most important are PC3 Transparency, PC7 Confidence assessment of results, PC4 Management relevance to the Baltic Sea and PC15 Time effort.
- Generally, the analyzed tools perform well regarding PC1 Scientific documentation, PC3 Transparency and PC4 Management relevance for the Baltic Sea. A general weakness regards confidence assessment, as confidence in the outputs is often not well communicated. Whereas most DSTs are flexible in terms of spatial settings, temporal limitations are often found.
- 42 decision support tools have been collected in the DESTONY Database, publicly accessible at nest.su.se/bonus_dst



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Distribution of DSTs in different problem areas



Eutrophication is the problem area most frequently addressed by decision support tools, DSTs. The dark bars show the totally 26 tools that fulfill four or five of BONUS DESTONY's five definition criteria, while the lighter bars show the remaining 16 tools that have been identified.

The performance criteria address the basis of the tools, such as to what extent they have been scientifically documented, the complexity of the method used and the transparency, as well as how difficult and time demanding it is to use them. Even aspects such as the management relevance to the Baltic Sea and the broadness of components in the DAPSIWRM framework addressed by the tools have been evaluated (see page 3 for a full list of performance criteria). The DAPSIWRM is a further development of the more well-known DPSIR framework, in which the relation between man-made pressures and their drivers, the state of the environment and the impact of that on society and measures to reduce pressure is illustrated. The framework has been used by BONUS DESTONY as a way of evaluating how well the tools adopt an ecosystem approach and was further described in the previous policy brief *How do virtual tools support the management of the Baltic Sea?*, published in October 2019.

The DSTs have been assessed by DESTONY experts on a five-step scale for each performance criterion, where 1 generally means that the tool does not fulfil the criterion and 5 means that it fully complies.

What is a decision support tool (DST)?

According to BONUS DESTONY an ideal decision support tool should meet as many as possible of the following criteria:

- The purpose of the tool is to support decision-making in relation to degradation of the aquatic environment at the local, regional, national or international management scale.
- It is interactive in the sense that the end-user is requested for input data or information and will subsequently get outputs related to that.
- It is virtual in the sense that it can be accessed and operated on the internet. (A tool is not virtual if you need to download it to your computer.)
- It is primarily developed for use in the Baltic Sea or its drainage basin, or it has been adapted to the Baltic Sea.
- It is applicable and accessible by the end-user without unreasonable effort. (Possible unreasonable effort: the tool cannot be found or the tool needs to be used by the host.)

In total, 42 decision support tools have been identified and assessed by the project. The 26 tools that meet four or five of the criteria above have been further analyzed against a set of performance criteria (see table on page 3 for an overview).

Strengths and weaknesses of the tools

When taking a closer look at the tools that fulfill four or five of the DST definition criteria, almost all of them (96%) score 4 or 5 when it comes to *PC4 Management relevance for the Baltic Sea*. They also do well in *PC1 Scientific documentation* (82% of the tools score 4 or 5) and *Transparency* (77% scored 4 or 5).

The lowest performance is found when it comes to *PC7 Confidence assessment of results* and *PC8 Data dependencies*, where only 19% and 15%, respectively, score 4 or 5. The DSTs seldom incorporate temporal trends or projections into future ones; hence *PC6 Temporal limitations* also receive low scores. For 65% of the tools, the output has no temporal dimension (equaling 1 on the scale), although the tools relating to eutrophication and contaminant pollution generally receive higher scores.

In general, the performance of the tools correspond well to the end-user needs. From an end-user perspective the most important performance criteria, among the fifteen, are *PC3 Transparency*, *PC7 Confidence assessment of results* and *PC4 Management relevance to the Baltic Sea*. These three are rated as Important or Very important by most of the 108 persons answering a survey from BONUS DESTONY. As mentioned above, the available tools generally perform well when it comes to two of these; *PC3 Transparency* and *PC4 Management relevance*. More unsatisfactory for the end-users is the lack of assessing the confidence of the results among the tools (*PC7*). Most of the tools (58%) either do not assess the uncertainty associated with the outcome at all (score 1) or provide only a qualitative expert judgement of the results (score 2), highlighting that this aspect will need attention in further DST development. Noteworthy, tools dealing with biodiversity issues are generally better at documenting confidence.

Even *PC15 Time effort* is important to the end-users, according to the survey, in particular to people working in administration. A majority of the tools, (62%), score 4 or 5 in this criterion, meaning that both the preparation and application of the tool could be done in few days or less.

The least important performance criteria, according to end-users, are *PC11 Thematic broadness*, *PC10 Transferability* and *PC12 Broadness of components of the DAPSIWRM addressed*. The analyzed tools also perform poorer in these aspects, 42% of the tools score 4 or 5 on the criterion *PC11 Thematic broadness*, as an example.

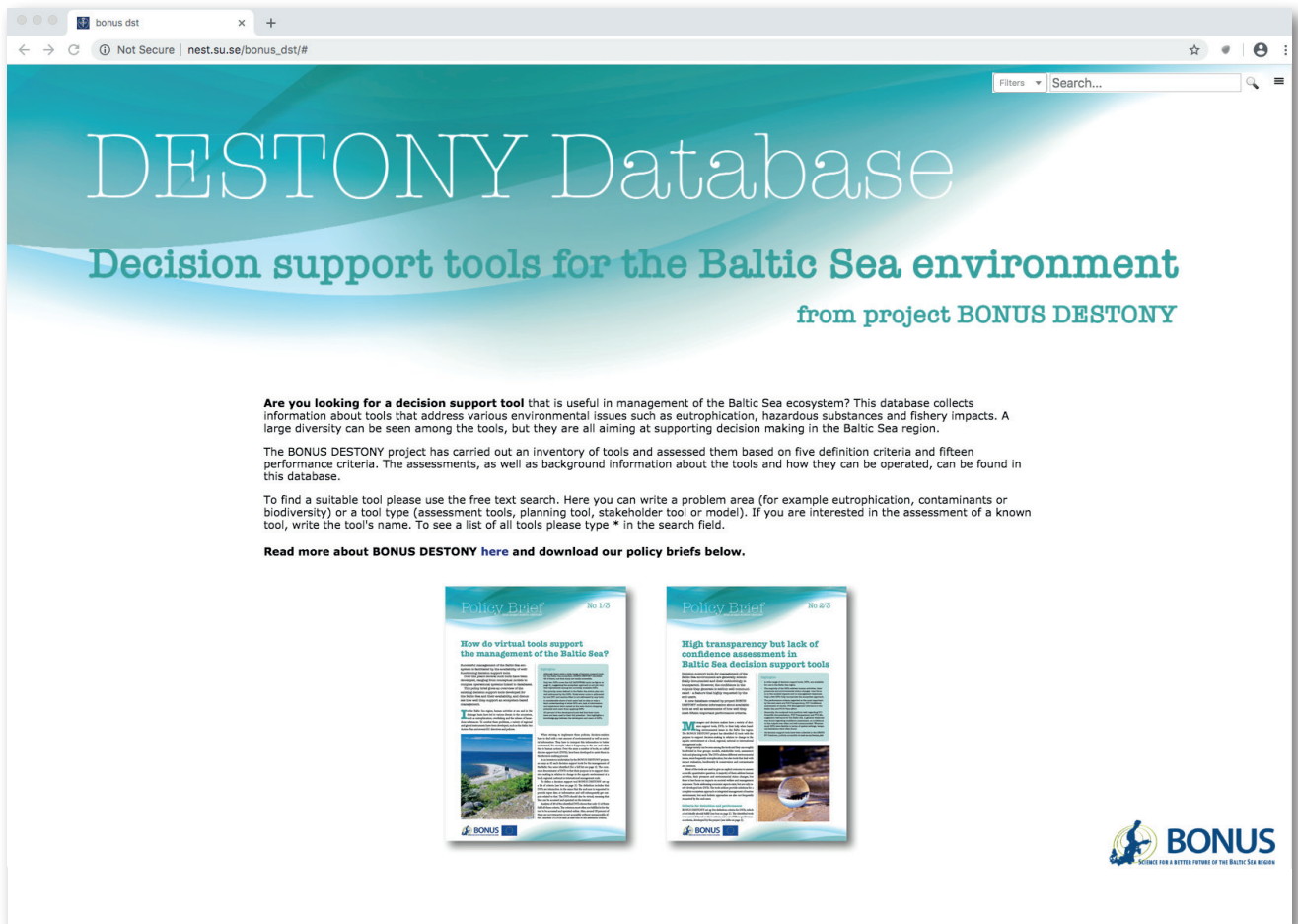


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PERFORMANCE CRITERIA FOR DECISION SUPPORT TOOLS												
Performance criteria	Description	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
PC1: Scientific documentation	Has the DST been documented in scientific publication?											
PC2: Complexity of method	How simple or complex is the method used for calculating the output?											
PC3: Transparency of the DST	Are all the processing described, the code public, documentation understandable?											
PC4: Management relevance to the Baltic Sea	To what extent is the output related to making decisions on responses/measures?											
PC5: Spatial limitations	Is the spatial scale of the tool restricted or can it be adapted according to management needs?											
PC6: Temporal limitations	Is the tool dynamic, i.e. describing changes over time? Does the output have a temporal dimension that can be expressed as years?											
PC7: Confidence assessment of results / Level of uncertainty	Does the tool assess the uncertainty associated with the output, and does this assessment account for all or a subset of potential uncertainties?											
PC8: Data dependencies	Does the tool work with missing values? Is it sensitive to changes in the type of input?											
PC9: Testing and validation	Has the DST been applied to different systems and tested independently?											
PC10: Transferability	How easily can the tool be adapted to other systems (e.g. North Sea, fresh water systems, etc.) by the end-user?											
PC 11: Thematic broadness	How generic is the DST? For example, which and how many policy issues (e.g. eutrophication, biodiversity, pollution, aritime activities etc.) does it address?											
PC12: Broadness of components of the DPSIR/ DAPSIWRM addressed	How broadly does the tool handle the management chain of events, from drivers to pressures, state changes, social impacts and responses of society, i. e. how many components of the DAPSIWRM cycle does it address?											
PC13: Suitability to components operationally applied in the Baltic Sea	How well does the tool fit in with the approaches and methodology already agreed upon in the area? Is the output directly suitable as input, or collaborative interpretation with output from other operational tools?											
PC14: Ease of use / Expertise required	Is the tool generally applicable to non-expert users or restricted to experts? Is the DST easy to apply?											
PC15: Time effort	How much time is needed to apply the DST?											

The performance is the percentage of the 26 analyzed tools receive that score 4 or 5 in that specific criterion (on a 1-5 scale). The importance is the percentage of 108 end-users answering this criterion as Important or Very important (scale: Not important at all- Not so important-Important-Very important).

Importance to end-users
 Performance of DSTs



42 decision support tools are currently included in the BONUS DESTONY database. A user web-interface enables anyone to free text search the new database and retrieve information included on the DSTs. The database is available at nest.su.se/bonus_dst.

New database stores tool information

In order for end-users to find a suitable tool, BONUS DESTONY has created an online catalogue of existing DSTs.

Information about 42 decision support tools are currently available in the database. For each tool useful background information is provided, as well as information on where the tool and documentation on its use can be found. Data is also provided on how many of the DESTONY definition criteria the tool fulfil and how it performs regarding the fifteen performance criteria. This enables an end-user both to find a tool in his or her area of interest and to evaluate if, for example, the time effort, ease of use or the confidence assessment of the results is at a desired level.

Although the database today is populated with the 42 tools that have been evaluated by BONUS DESTONY, it is possible for

DST developers or hosts to have their DSTs added to the database. It is also the hope of BONUS DESTONY that the database can function as a prototype for further projects that include tools from other fields or from other geographical areas.

Good decisions are facilitated by good decision support tools. The BONUS DESTONY database is a way to raise awareness of existing tools and contribute to their utilisation.

Earlier publications in this series:
HOW DO VIRTUAL TOOLS SUPPORT THE MANAGEMENT OF THE BALTIC SEA?
 Policy Brief 1/3, published October 2019.

THE BONUS DESTONY PROJECT

DESTONY is short for Decision support tool for management of the Baltic Sea ecosystem. The project runs 2018–2020 and is coordinated by Vivi Fleming, Finnish Environmental Institute (SYKE). Participating partners are Leibniz Institute for Baltic Sea Research Warnemünde (IOW), Aarhus University and Stockholm University Baltic Sea Center.

BONUS DESTONY receives funding from BONUS (Art. 185), which is jointly funded by the EU, the Academy of Finland, Innovation Fund Denmark and the Swedish Research Council Formas.

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www.bonusportal.org/projects/synthesis_2018-2020/destony

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