Policy Brief
from project BONUS DESTONY
No 1/3

How do virtual tools support the management of the Baltic Sea?

Successful management of the Baltic Sea ecosystem is facilitated by the availability of well-functioning decision support tools.

Over the years several such tools have been developed, ranging from conceptual models to complex operational systems linked to databases.

This policy brief gives an overview of the existing decision support tools developed for the Baltic Sea and their availability, and discusses how well they support an ecosystem-based management.

In the Baltic Sea region, human activities at sea and in the drainage basin have led to various threats to the ecosystem, such as eutrophication, overfishing and the release of hazardous substances. To combat these problems, a variety of regional and global instruments have been developed, such as the Baltic Sea Action Plan and several EU directives and policies.

PHOTO: SHUTTERSTOCK

Highlights

- Although there exist a wide range of decision support tools for the Baltic Sea ecosystem (BONUS DESTONY identified 42 of them) not that many are easily accessible.
- Only two DSTs cover the full DAPSIWRM cycle (se figure on page 2), suggesting the ecosystem approach is not yet very well represented among the currently available DSTs.
- The priority areas defined in the Baltic Sea Action plan are well addressed by the DSTs. Underwater noise is addressed by one DST, and marine litter is not addressed by any tools.
- A considerable share of end-users had no idea or only a faint understanding of what DSTs are; lack of information and experience were named as the main factors stopping potential end-users from applying DSTs.
- 40 percent of the developers/hosts feel that their tools have not been used to their full potential – this highlights a knowledge gap between the developers and users of DSTs.

When striving to implement these policies, decision-makers have to deal with a vast amount of environmental as well as societal information. They have to interpret this information to better understand, for example, what is happening in the sea and relate that to human actions. Over the years a number of tools, so called *decision support tools* (DSTs), have been developed to assist them in the decision-making process.

In an inventory undertaken by the BONUS DESTONY project, as many as 42 such decision support tools for the management of the Baltic Sea were identified (for a full list see page 4). The common denominator of DSTs is that their purpose is to support decision-making in relation to change in the aquatic environment at a local, regional, national or international management scale.

To define a decision support tool BONUS DESTONY set up a list of criteria (see box on page 3). The definition includes that DSTs are interactive, in the sense that the end-user is requested to provide input data or information and will subsequently get outputs related to that. The DSTs should also be virtual, meaning that they can be accessed and operated on the internet.

Analysis of 40 of the identified DSTs shows that only 12 of them fulfil all these criteria. The criterion most often not fulfilled is for the tool to be accessed and operated online. Also, around 20 percent of them are not interactive or not accessible without unreasonable effort. Another 14 DSTs fulfil at least four of the definition criteria.

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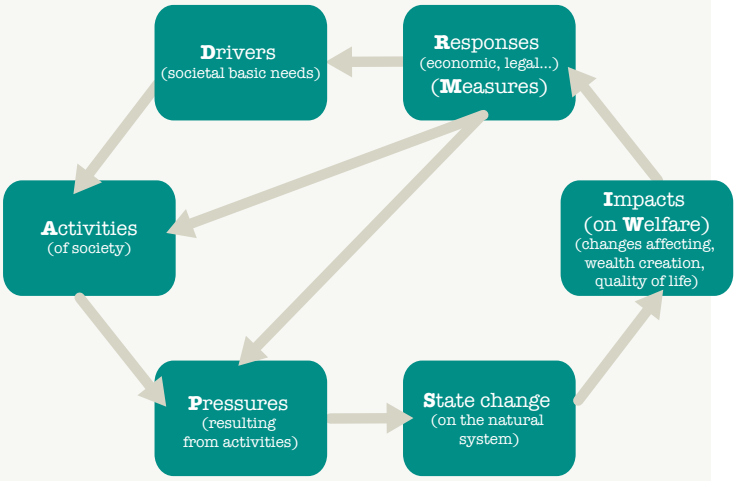
Science for a better future of the Baltic Sea region

The DAPSIWRM framework



The DAPSIWRM framework describes the links and interactions between Drivers (defining the needs), Activities (human activities to fill the needs), Pressures (caused by the activities), State changes (how the pressures effect the environment), Impacts on Welfare (how society is impacted) and Response using Measures (management actions).

Adapted from Borja et al 2016. Frontiers in Marine Science https://www.frontiersin.org/articles/10.3389/fmars.2016.00020/full#B108

Different kinds of tools

The majority of the tools can be described as different types of assessment tools and models, but also planning tools and tools for stakeholders were identified. Most DSTs deal with eutrophication-related questions but many also cover questions related to biodiversity and conservation, contaminants, cumulative effects of pressures or relate to marine spatial planning. Only a few tools address fishery management, non-indigenous species, underwater noise or hydrography. No tools related to marine litter were found.

A majority of the DSTs could be used for questions related to the important policies for the Baltic Sea, most commonly the Marine Strategy Framework Directive, followed by Baltic Sea Action Plan, Water Framework Directive and Maritime Spatial Planning Directive.

Suitability for ecosystem based management

Management of the ecosystem is basically management of human *activities* and actors. That calls for estimating environmental *status* or the *impact* of environmental change on society (*welfare*), identifying man-made *pressures* and their *drivers*, or helping to evaluate the need for *responses (measures)* to reduce pressure. The relation between these segments is described in the DAPSIWRM framework, which is a further development of the more well known DPSIR framework.

Analysis by BONUS DESTONY shows that all segments of the DAPSIWRM framework are represented by DSTs. Nine DSTs address one segment (most commonly the state changes), whereas 12 of them cover two segments of the framework. Only two DSTs cover the full DAPSIWRM cycle.

Most of the tools focus on the links between *activities, pressures* and *state changes*. The *drivers* segment is only addressed by the two DSTs that cover the full cycle and which are dealing with questions related to impact evaluations and sea-area use. Only two tools cover the link between *state* and *impact on welfare* and only one addresses the link between *impact on welfare and responses/measures.*

The lack of DSTs addressing the *impacts on welfare* (decline of ecosystem services) indicates that the socio-economic perspective is missing. The tools are useful in defining and quantifying the interactions between the environment and society, but they seldom provide solutions for an integrated management of the marine environment. As a group, the DSTs are therefore not yet able to support management based on an ecosystem approach.

Developed and applied in different ways

A survey to developers and hosts of the identified tools shows that two thirds of the DSTs were initiated as a response to management needs. End-users had a strong role in the initiation phase of the process in about 40 percent of the cases. In only 14 percent of the cases had they taken active part in the development phase as team members.

Tools addressing eutrophication-related problems are an exception as they have normally been developed in closer cooperation with end-users. In half of the DSTs end-users have been part of the development team.

About 40 percent of the hosts/developers say that although their tool is used broadly, it is not applied to support management to the extent they expected.

When the potential end-users of DSTs are asked about their use of tools it is clear that the tools are used for many different purposes. Most users answer that they use the tools as *input for own/other*

PHOTO: JERKER LOKRANTZ/AZOTE

What is a decision support tool (DST)?

A decision support tool as defined by BONUS DESTONY should meet 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.)

assessment/analysis, but almost as many say that they use them *to assess a specific problem* or to *assess different scenarios, for communication with stakeholder and public* or to *get a first idea of things.*

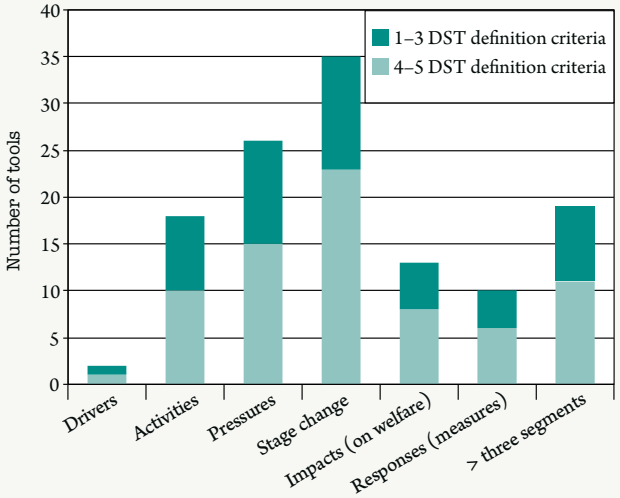
A considerable share of end-users had no idea or only a faint understanding of what DSTs are. The main factor that the potential end-users report as having stopped them from using DSTs is *lack of knowledge about availability* of tools followed by *lack of experience.*

The experiences of end-users and hosts can be interpreted as a clear information gap: on the one hand, end-users do not know about the existence of tools, or do not possess the experience to use them – and on the other hand, according to DST hosts, the existing tools are not used to their full potential.

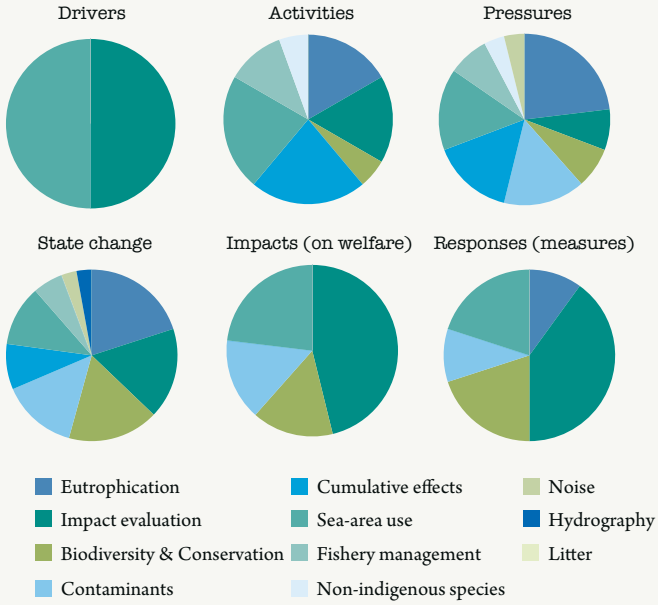
One way to remedy this could be to get end-users more actively involved in the tool development. Another way to reduce the information gap is active information exchange. BONUS DESTONY is contributing to that through the development of an online catalogue of existing DSTs in the Baltic Sea and drainage basin. The catalogue will enable end-users to search among DSTs and find the tool that best fits their needs, and it will also give hosts an option to distribute information of their tool.

In March 2020, BONUS DESTONY will report on the performance of existing DSTs. It will also provide proposals on which items are in greatest need of future development and publish the virtual DST catalogue. ■

Number of tools covering DAPSIWRM segments



Analysis by BONUS DESTONY of 40 identified decision support tools shows that a majority of the tools address the state changes of the environment.



The environmental problems dealt with by the tools vary in accordance to the DAPSIWRM segment addressed. Most tools deal with eutrophication related issues.

Which of the following aspects has stopped you from using DSTs?

A questionnaire answered by 108 potential end-users show lack of knowledge and lack of experience has stopped most of them from using DSTs.

Decision support tools for the management of the Baltic Sea ecosystem			
Name	**Category**	**Problems addressed**	**DAPSIWRM segments addressed**
ACC-HUMAN	Model	Hazardous substances	P, S, IW
BaltCost*	Model	Eutrophication	R, I
Baltic Explorer	Planning tool	Marine activities	D, A, P, S, IW, RM
BALTSEM-POP	Model	Organic pollutants	P, S
BEAT 3.0	Assessment tool	Degradation of biodiversity	S
BIAS	Model	UW noise	P, S
BSII	Assessment tool	Cumulative impacts of pressures	A, P, S
BSPI	Assessment tool	Cumulative pressures	A, P
BWMC tool	Assessment tool	Dispersal of alien species	A, P
CHASE	Assessment tool	Hazardous substances	S
EcoImpactMapper	Assessment tool	Cumulative impacts of pressures	A, P, S
ERGOM-MOM	Model	Eutrophication	P, S
EUTRO-OPER	Assessment tool	Eutrophication	S
FIT	Assessment tool	Fishery impacts	A, P, S
GETM-GITM	Model	Hydrodynamic and transport	S
HEAT 3.0	Assessment tool	Eutrophication	S
Indicator-based ICZM 'Best-practice' Evaluation Tool	Assessment tool	Various problems	S, IW, RM
InVest	Model	Multiple	S, IW
LPI	Assessment tool	Biodiversity loss	P, S
MareFrame	Stakeholder tool	Fish/fisheries	A, P, S
Marmoni tool	Assessment tool	Biodiversity	S
Marxan	Planning tool	All	A, P, S, IW, RM
MESAT	Assessment tool	Impact of ecological degradation and/or restoration	S, IW
MIRACLE	Stakeholder tool	Eutrophication	A, P
MIRADI	Stakeholder tool	Conservation	A, P, S, IW, RM
MONERIS	Model	Eutrophication	P
Mytilus	Assessment tool	Planning activities, cumulative impacts	A, P, S
NEAT	Assessment tool	Loss of biodiversity	S
NEST	Model	Eutrophication, contaminants, fish	A, P, S, IW, RM
POPCYCLING-Baltic	Model	Hazardous substances	P, S
RAUMIS	Model	Agricultural indicators, production, income, management	A, P, S, RM
Recreation Site Values	Model	Benefits of recreational use	A, S, IW
SAF	Stakeholder tool	Multiple	D, A, P, S, IW, RM
SOCOPSE	Planning tool	Contaminants	P, S, IW, RM
Stakeholder Preference and Planning Tool	Stakeholder tool	Various problems	IW, RM
Symphony	Model	Marine spatial planning	A, P, S
TargetEcon*	Model	Eutrophication	R, I
Tool4MSP	Planning tool	Human marine activities	A, P, S, IW
WATERS IA tool	Assessment tool	Mainly eutrophication, also other pressures	S
VEMALA	Model	Water quality, nutrient load	A, P, S
VEMU 3	Assessment tool	Eutrophication	P, S
Zonation	Model	Conservation	S, IW, RM

Highlighted tools fulfill four or five of the DESTONY DST criteria.

* Not included in the analysis at this point.

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-Lehtinen, Finnish Environmental Institute, SYKE. Participating partners are Leibniz Institute for Baltic Sea Research Warnemünde IOW, Aarhus University and Stockholm University Baltic Sea Center.

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CONTACT

Co-ordinator: Vivi Fleming-Lehtinen,
Finnish Environmental Institute, SYKE

e-mail: Vivi.Fleming-Lehtinen@ymparisto.fi

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