

# Overcoming the challenges of indicator integration and arriving at a full-bodied classification of Good Environmental Status *sensu* the MSFD



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# Or: Selecting the right tools?



# Take home message



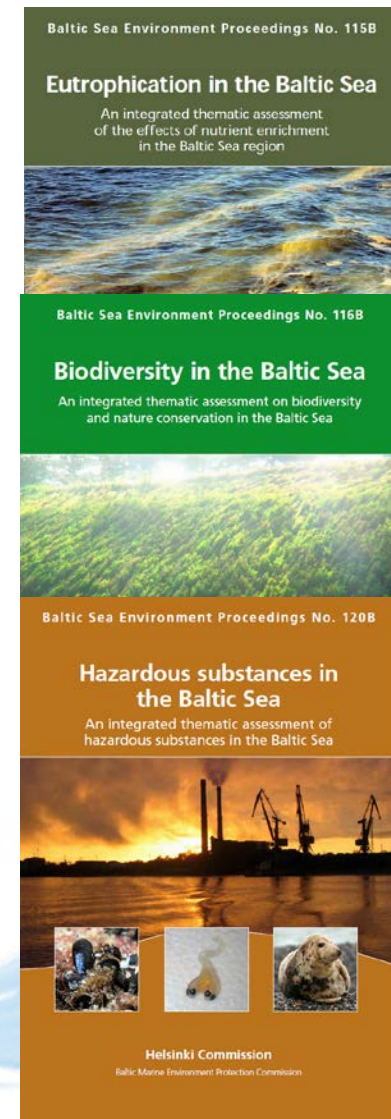
- A perfect assessment tool does not exist ...
- ... but some tools, including HOLAS 1.0, are useful ...

# Extract of the HELCOM Baltic Sea Action Plan: Vision, goals and ecological objectives

Vision	GES goals	Ecological objectives
<p>A healthy Baltic Sea environment, with diverse biological components functioning in balance, resulting in a good ecological status and supporting a wide range of sustainable human economic and social activities</p>	<p><b>Eutrophication:</b> The Baltic Sea unaffected by eutrophication</p>	<p>Concentrations of nutrients close to natural levels Clear water Natural level of algal blooms Natural distribution and occurrence of plants and animals Natural oxygen levels</p>
	<p><b>Hazardous substances:</b> The Baltic Sea life undisturbed by hazardous substances</p>	<p>Concentrations of hazardous substances close to natural levels All fish safe to eat Healthy wildlife Radioactivity at pre-Chernobyl level</p>
	<p><b>Biodiversity:</b> Favourable conservation status of Baltic Sea biodiversity</p>	<p>Natural marine and coastal landscapes Thriving and balanced communities of plants and animals Viable populations of species</p>

# Hence, baselines were needed in order to measure progress

- **HELCOM EUTRO-PRO 2007-2009:**
- Output: An integrated thematic assessment of the effects of nutrient enrichment in the Baltic Sea Region
- **HELCOM BIO 2008-2009:**
- Output: An integrated thematic assessment of biodiversity and nature conservation in the Baltic Sea
- **HELCOM HAZAS 2009-2010:**
- Output: An integrated thematic assessment of hazardous substances in the Baltic Sea



# All three thematic assessments were tool-based

- **HEAT: The HELCOM eutrophication Assessment Tool**

Andersen, J.H., P. Axe, H. Backer, J. Carstensen, U. Claussen, V. Fleming-Lehtinen, M. Järvinen, H. Kaartokallio, S. Knuuttila, S. Korpinen, M. Laamanen, E. Lysiak-Pastuszek, G. Martin, F. Møhlenberg, C. Murray, G. Nausch, A. Norkko, & A. Villnäs (2011): Getting the measure of eutrophication in the Baltic Sea: towards improved assessment principles and methods. *Biogeochemistry* 106: 137-156.

Fleming-Lehtinen, V., J.H. Andersen, J. Carstensen, E. Lysiak-Pastuszek, C. Murray, M. Pyhälä & M. Laamanen (2015): Recent developments in assessment methodology reveal an expanding eutrophication problem area in the Baltic Sea. *Ecological Indicators* 48:380-388.



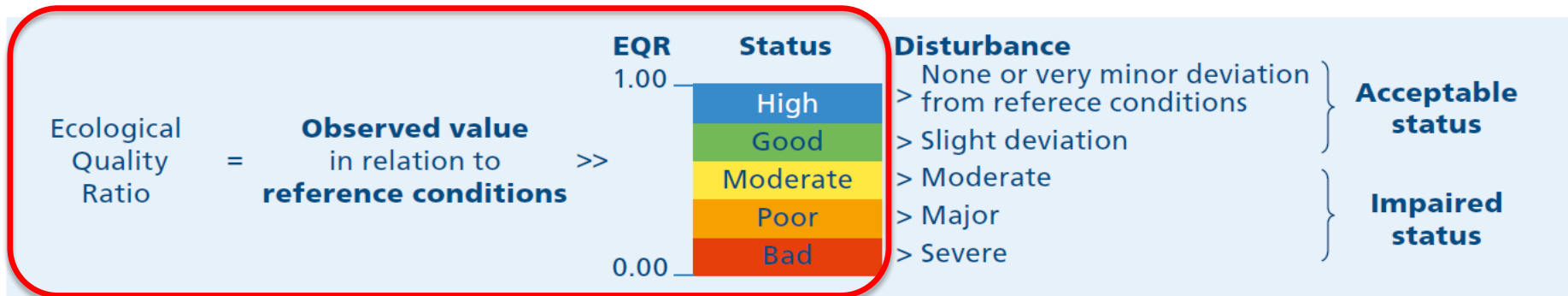
- **BEAT: The HELCOM Biodiversity Assessment Tool**

Andersen, J.H., K. Dahl, C. Göke, M. Hartvig, S. Korpinen, C. Murray, A. Rindorf, H. Skov & M. Vinther (2014): Integrated assessment of marine biodiversity status using a prototype indicator-based assessment tool. *Frontiers in Marine Science* 1:55. DOI: 10.3389/fmars.2014.00055.

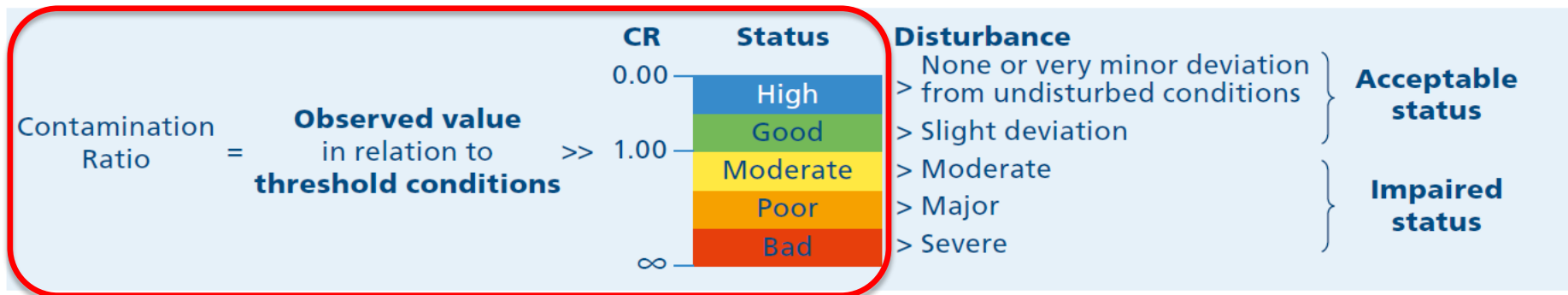
- **CHASE: The HELCOM Chemical Status Assessment Tool**

Andersen, J.H., C. Murray, M.M. Larsen, N. Green, T. Høgåsen, K. Gustavson, E. Boalt, E. Garnaga, M. Haarich, J. Manio, J. Strand & S. Korpinen (submitted): A prototype tool for integrated assessment of chemical status.

# Thematic assessment principles for HEAT/BEAT and CHASE:



**Figure 1.4** The assessment of 'eutrophication status' and 'biodiversity status' is based on the use of the Ecological Quality Ratio (EQR) and classifications are made for groups of indicators, not for single indicators. See Section 1.6 and HELCOM (2006) for details.



**Figure 1.5** The assessment of 'hazardous substances status' is based on the use of the so-called Contamination Ratio (CR). The classifications of 'hazardous substances status' are made for groups of indicators, not for single indicators. See Section 1.6 and HELCOM (2010a) for details.

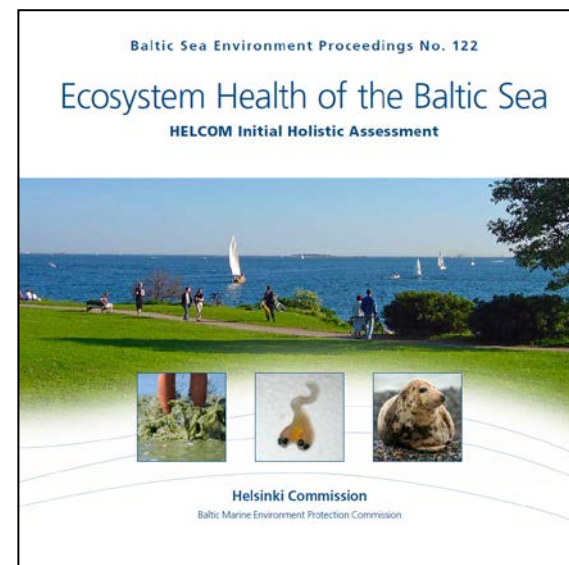
# How to get from thematic tools to a tool for assessment of GEnS?

- Same indicators should be used
- Double counting was not allowed
- Aim at coordination with WFD
- New framework was developed:

HEAT  
BEAT  
CHASE



HELCOM Holistic Assessment Tool



- Good Environmental Status = 'Ecosystem health'



# The three dilemmas faced:

- Few groups (one or two) and averaging amongst many indicators may potentially lead to 'thinning' and potentially to 'upwards' misclassification (lessons learned from the development of the CHASE prototype tool)
- Many groups and stringent use of the 'one out, all out' principle may potentially lead to 'downwards' misclassifications (lessons learned from OSPAR COMP and HEAT)
- Further, for many MSFD descriptors, good indicators and target values does not yet exist

...

# HOLAS 1.0 assessment principles

- **Step 1:** Indicators are nested in 3 categories (CI: biology; CII: chemistry; CIII: supporting)
- **Step 2a:** For categories I and II, a weighted average Ecological Quality Ratio ( $EQR_{bio}$  and  $EQR_{supp}$ ) is calculated (ranging from 1.0–0 *sensu* the WFD)
- **Step 2b:** For category II, a Chemical Score ( $CS_{chem}$ ) is calculated
- **Step 3:** Categories I, II and III are classified in five classes (High, Good, Moderate, Poor and Bad)
- **Step 4:** Category classifications are combined (using the lowest ranging classification cf. the OO-AO principle) into a final classification of 'ecosystem health' (in 5 classes)

# A key challenge is the integration within groups of indicators ...

- Average across indicators used
- Weighted average across indicators used
- Conditional rules
- Scoring or rating
- Multi-metric approaches
- Multi-dimensional approaches
- Decision tree
- Probabilistic

From Borja et al. (2014)

frontiers in  
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## Tales from a thousand and one ways to integrate marine ecosystem components when assessing the environmental status

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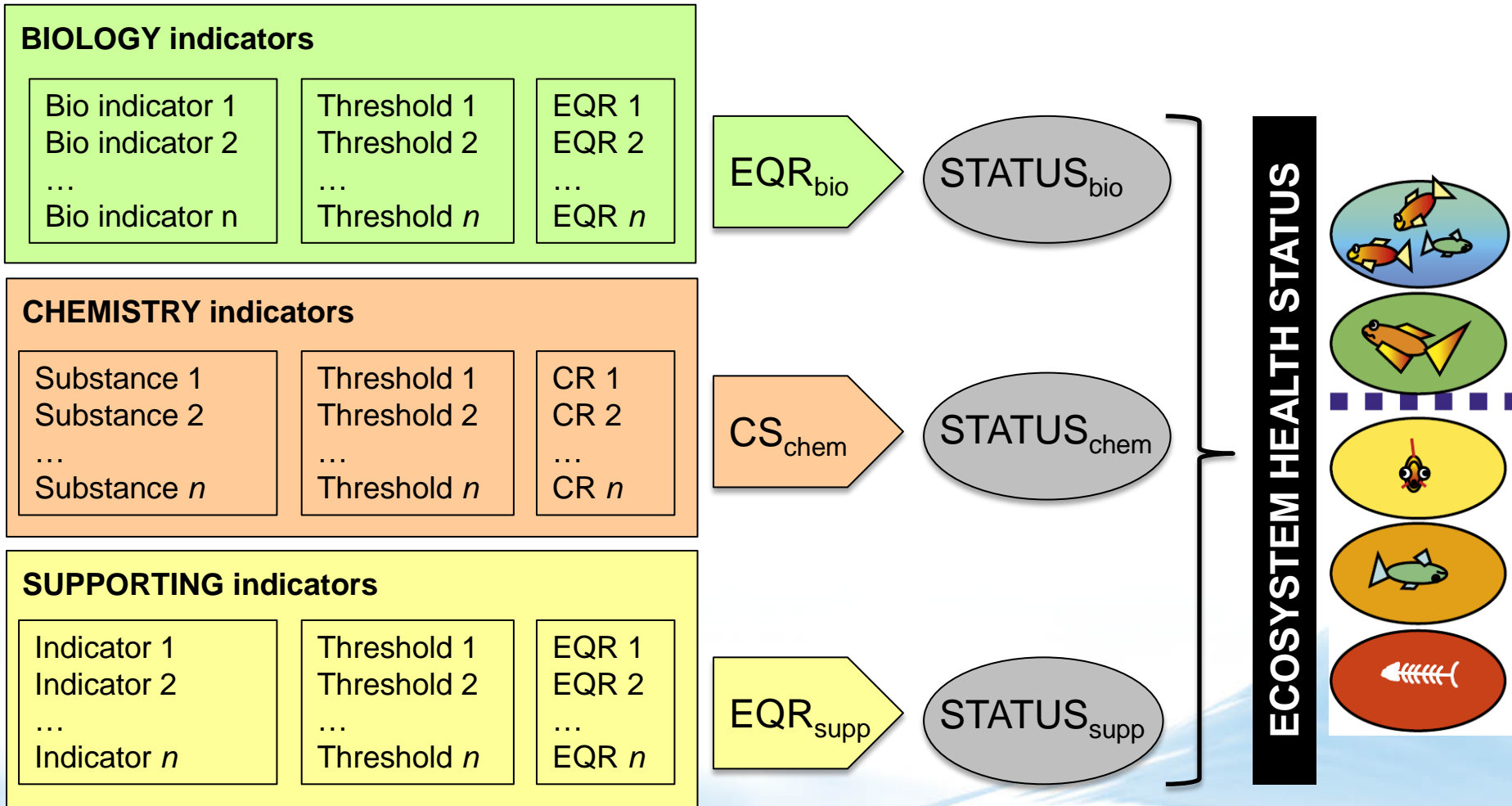
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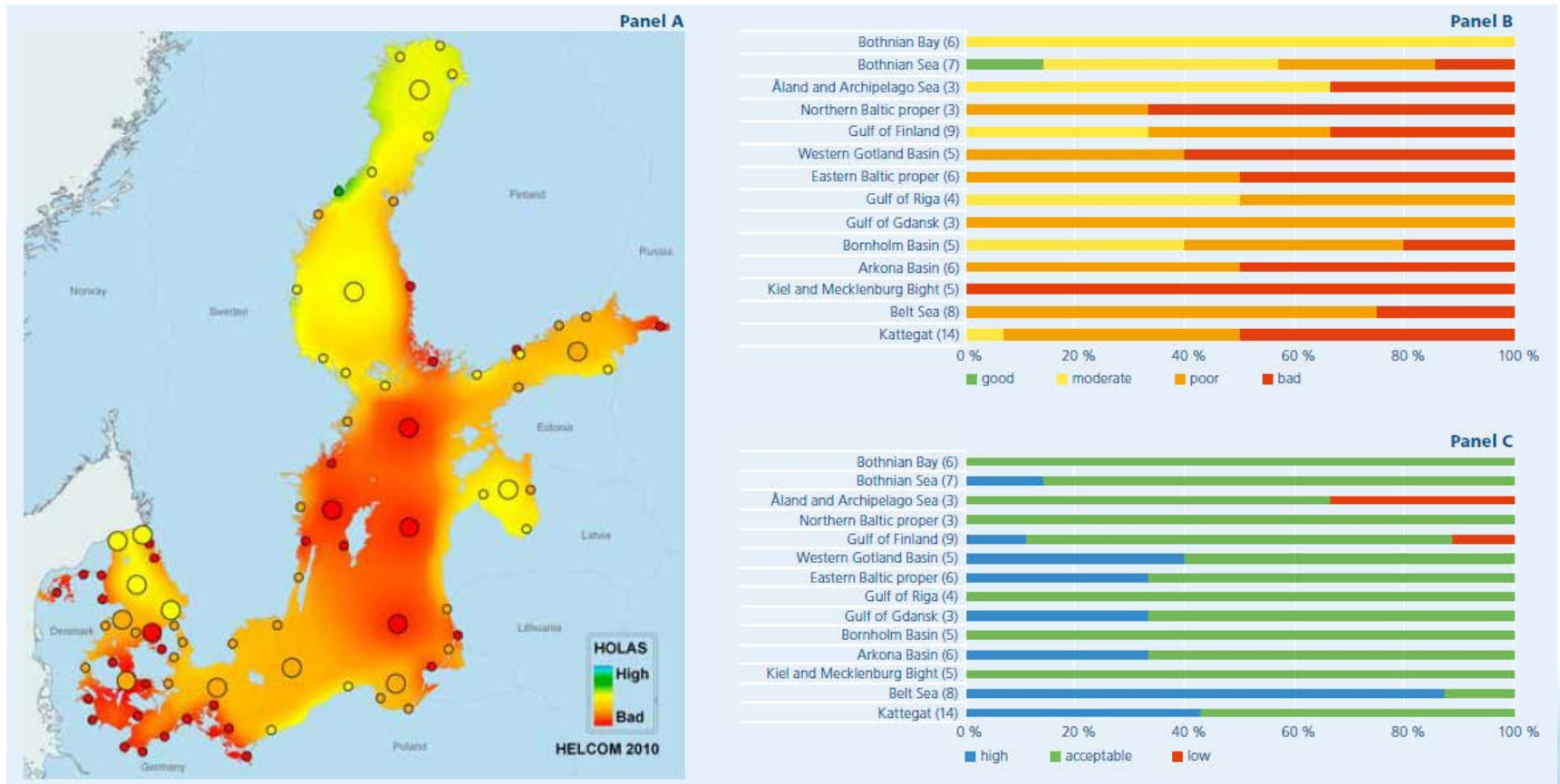
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# Conceptual HOLAS 1.0 diagram



# Classification of 'ecosystem health' / GEnS in the Baltic Sea



- All open parts are impaired, some coastal waterbodies have or might have a good status

# Key messages

**Mission is accomplished – the integration challenges were overcome**

and

**the approach used is simple, transparent, well-documented and can be reproduced**

but

**there is room for improvements**

**Therefore** better indicators with science-based target values as well as a better assessment framework are needed ...