CHASE:
Testing integration of BioEffect indicators using CS_{BE} and ER_{WA}

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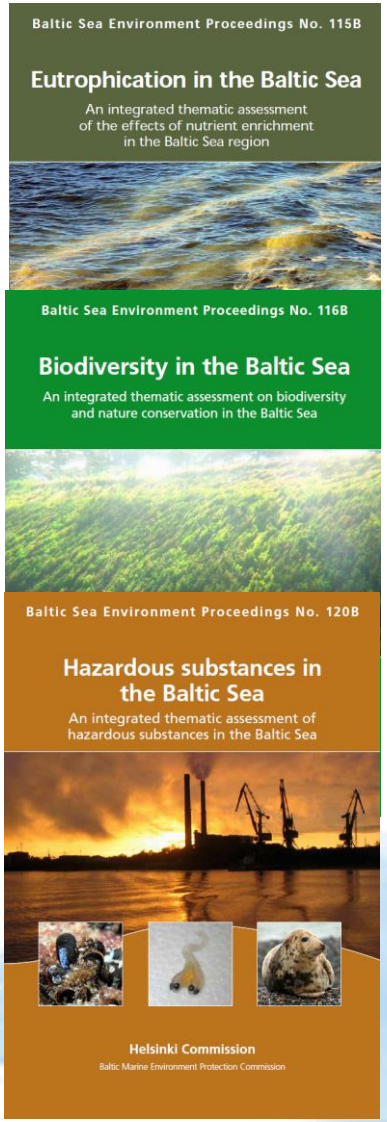
Assessing and integrating

- **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



HEAT, BEAT and CHASE

- **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-Pastuszak, 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-Pastuszak, 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, E. Kallenbach, J. Manio, J. Strand & S. Korpinen (2016): Development and testing of a prototype tool for integrated assessment of chemical status in marine environments. Environmental Monitoring & Assessment. DOI: 10.1007/s10661-016-5121-x

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Thematic assessment principles for HEAT/BEAT and CHASE:

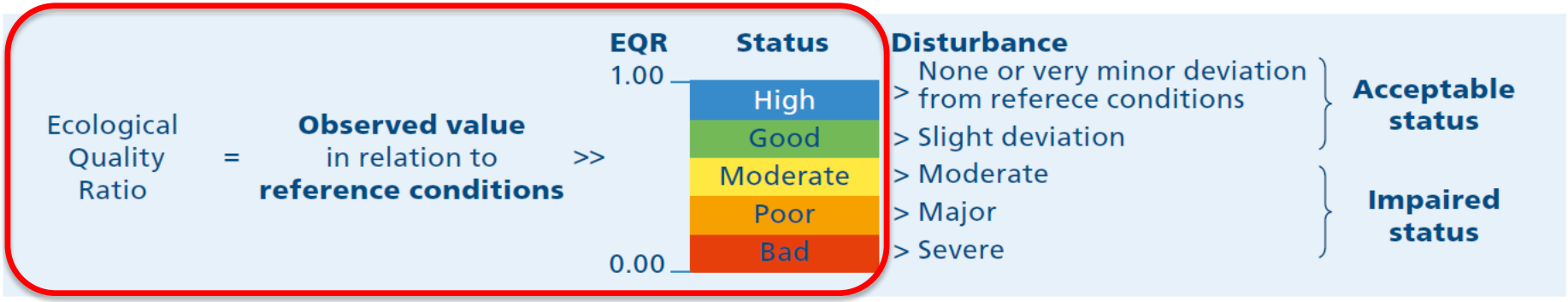


Figure 1.4 The assessment of 'eutrophication status' and 'biodiversity status' is based on the use of the Ecological Quality Ratio (EQR) and classifications are made for groups of indicators, not for single indicators. See Section 1.6 and HELCOM (2006) for details.

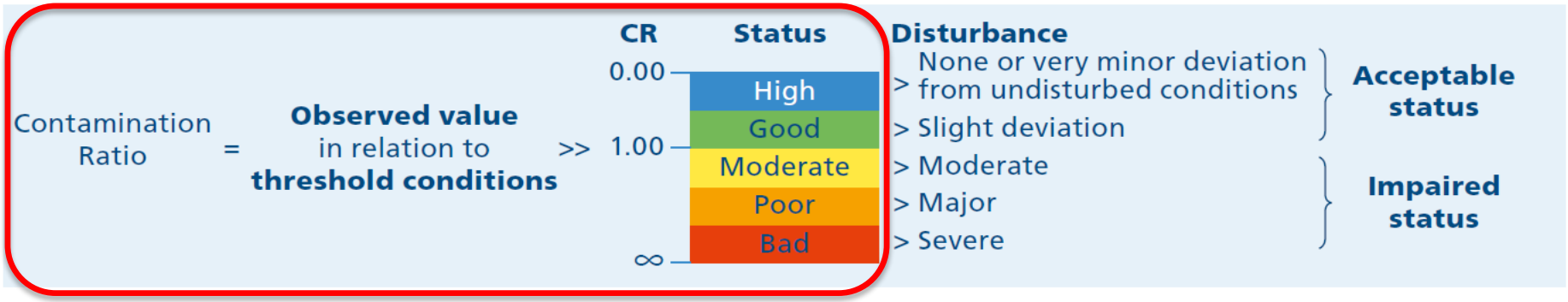
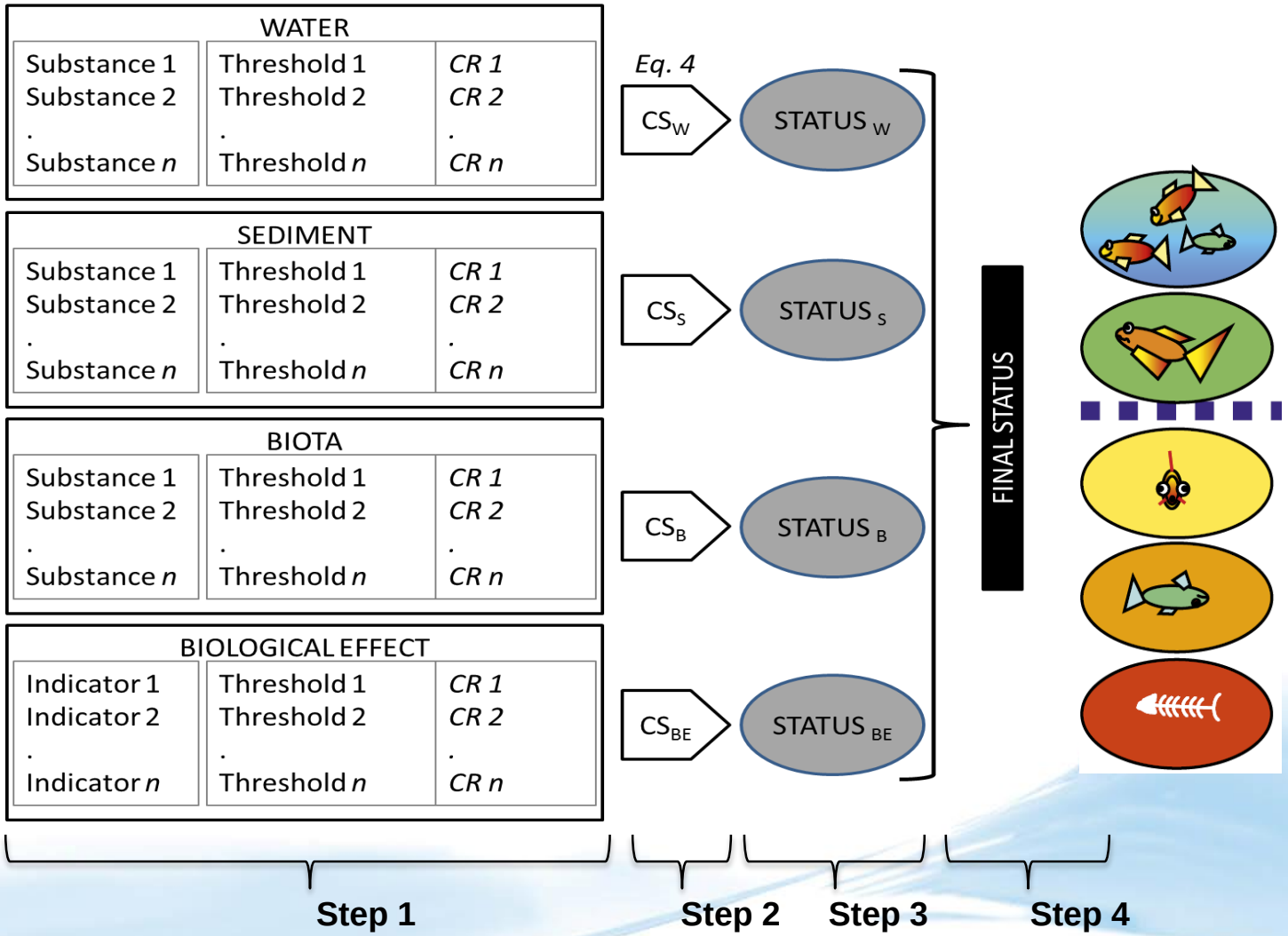


Figure 1.5 The assessment of 'hazardous substances status' is based on the use of the so-called Contamination Ratio (CR). The classifications of 'hazardous substances status' are made for groups of indicators, not for single indicators. See Section 1.6 and HELCOM (2010a) for details.

CHASE 2.0: Conceptual model



A step-wise classification

Substances/indicators are initially nested in 4 categories (CI: water; CII: sediments; CIII: biota and CIV: biological effects)

Step 1 – For each substance/indicator, a Chemical Ratio ($CR = C_{MON} / C_{TRESHOLD}$) is calculated

Step 2 - For each category (I-IV), a Chemical Score (CS) is calculated (C1: CS_W; CII: CS_S; CIII: CS_B and CIV: CS_{BE}):

$$CS = \frac{1}{\sqrt{n}} \sum_{i=1}^{n} CR_i$$

Step 3 – Each category (I-IV) is classified in five classes (High, Good, Moderate, Poor and Bad)

Step 4 – Category-specific classifications are combined (using the lowest ranging classification cf. the OO-AO principle) into a final classification of 'chemical status' (in 5 classes)

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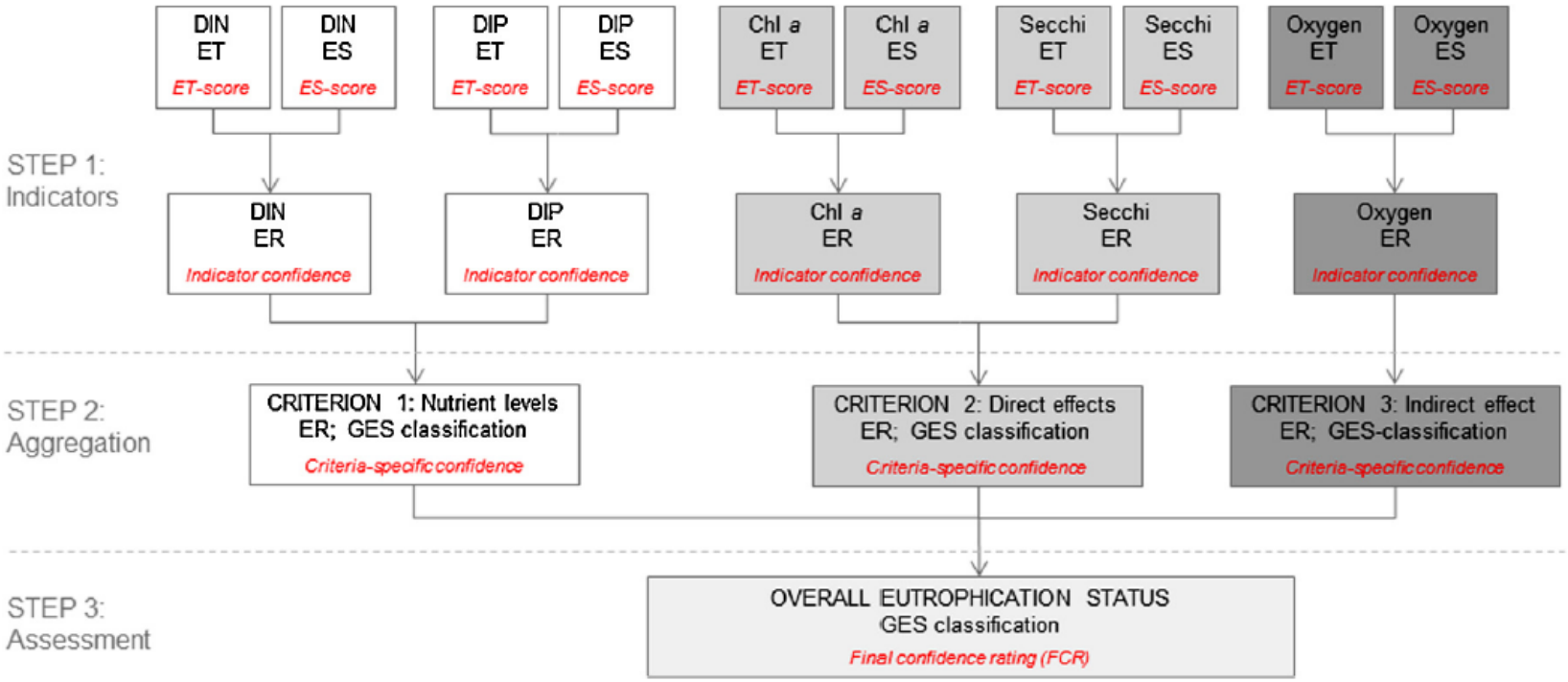
HEAT 3.0: Conceptual model



A step-wise classification

Indicators are initially nested in 4 categories (CI: nutrient levels; CII: direct effects; and CIII: indirect effects)

Step 1 – For each indicator, a Eutrophication Ratio (ER = C_{MON} /$C_{TRESHOLD}$) is calculated

Step 2 - For each category (I-III), a aggregated ER is calculated as a weighted average where ER > 1.0 is 'affected by eutrophication' and ER < 1 is 'unaffected by eutrophication'

Step 3 – Each category (I-III) is classified in five classes (High, Good, Moderate, Poor and Bad)

Step 4 – Category-specific classifications are combined (using the lowest ranging classification cf. the OO-AO principle) into a final classification of 'eutrophication status'

BioEffects - testing

As part of the testing of the CHASE tools we will:

- Integrate C3: BioEffects using CS
- Integrate C3: BioEffects using weighted averages

The results will be included in the revised and test and submitted to relevant for a for consideration….

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Any tricky questions?