

# DAIMON A 2.5 Toolbox for the Assessment of Marine Munitions Impact on Biota

T. Lang<sup>1</sup>, U. Kammann<sup>1</sup>, M. Brenner<sup>2</sup>, K. Lehtonen<sup>3</sup>, P. Vanninen<sup>4</sup>

- <sup>1</sup> Thünen-Institute of Fisheries Ecology (TI-FI)
- <sup>2</sup> Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI)
- <sup>3</sup> Finnish Environment Institute (SYKE)
- <sup>4</sup> Finnish Institute for Verification of the Chemical Weapons Convention (VERIFIN)



Fig. 1: Components of the DAIMON A 2.5 Toolbox

**The case:**  
For a given geographical maritime area there is suspicion that dumping of munitions took place in the past.

**The concern:**  
Do these munitions and their toxic chemical components pose a threat to marine organisms in their habitat?

**Questions to be answered by using the Toolbox:**

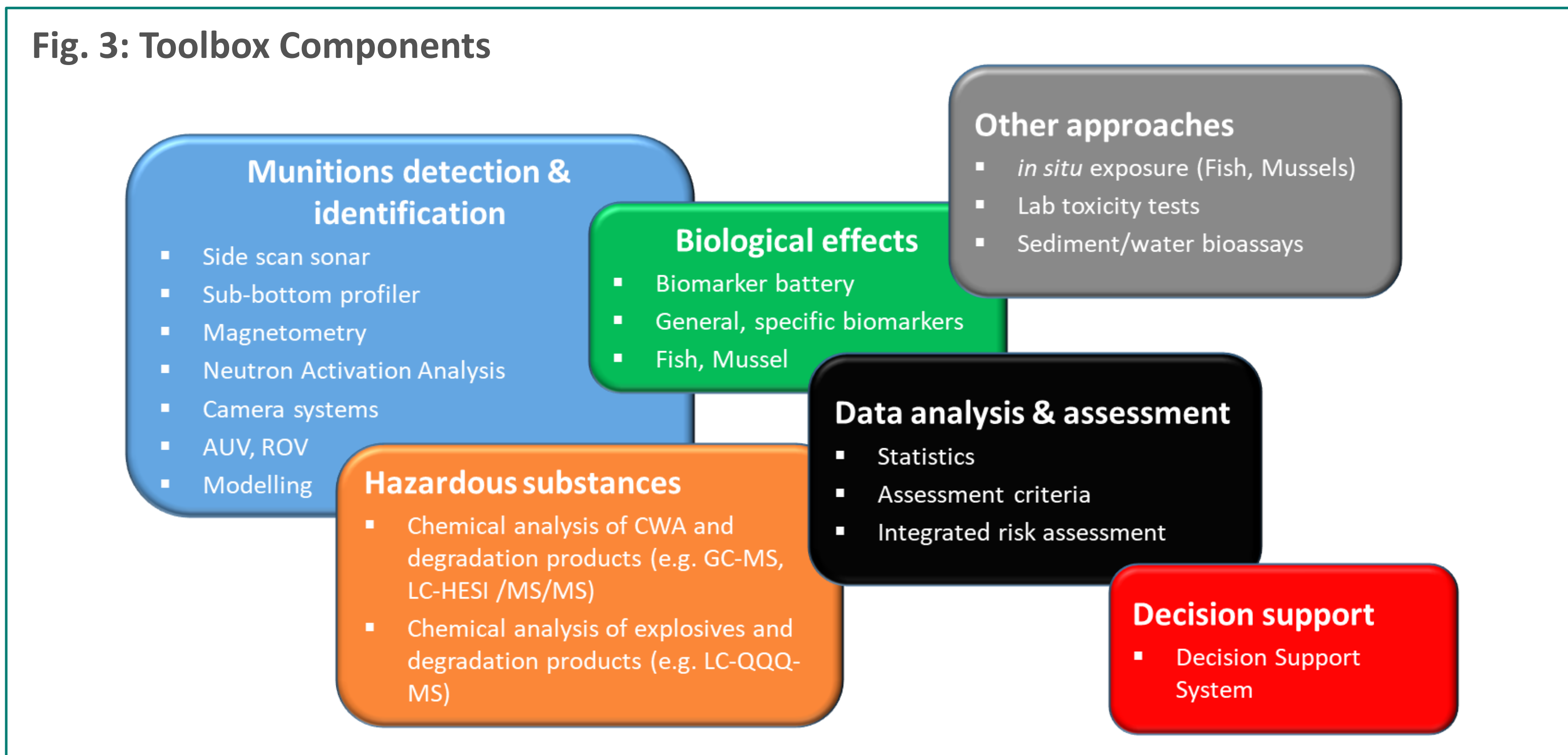
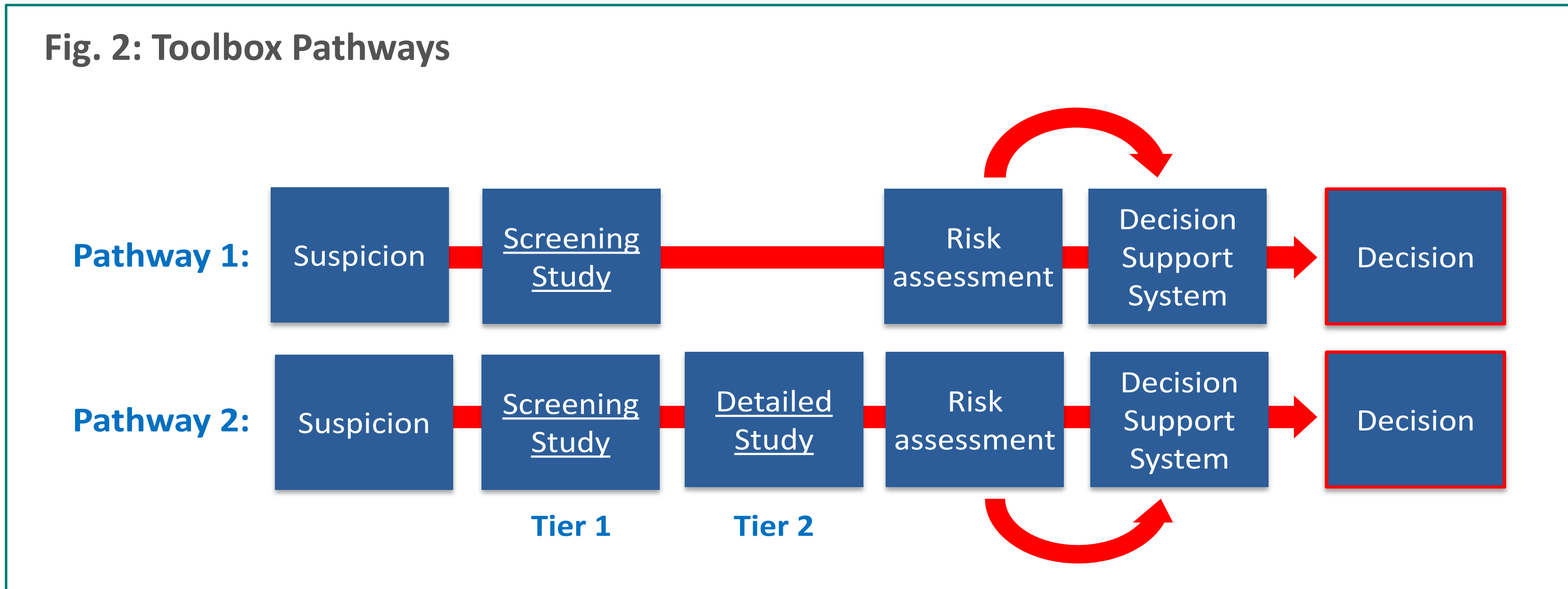
- Is munitions present and what type of munitions is it (chemical or conventional)?
- Are hazardous substances (CWA or explosives) released into the marine environment?
- Do these substances cause biological effects affecting the health of marine organisms (e.g. fish, bivalves)?
- Overall, is there a reason for environmental concern?
- Decision: Is there a need for action (e.g. monitoring or remediation)?

The **DAIMON A 2.5 Toolbox** provides a strategy for analysing and assessing ecological threats associated with dumped chemical or conventional marine munitions. Its major components are recommendations and methodological guidelines (fact sheets) for chemical and biological techniques to measure the release of harmful substances into the environment as well as their effects on marine biota.

The Toolbox is based on two tiers, a **Screening Study** for a first assessment and a following **Detailed Study** if required (see Fig. 2). The design of these studies and the methods applied depend on risk scenarios to be analysed and assessed. For the Screening Study, a selected number of robust and easy-to-apply methods to measure chemical munitions compounds in the environment as well as their *in situ* biological effects is recommended. The Detailed Study is carried out if more specific information is needed and constitutes an extension of the Screening Study. It comprises a broader set of methods and may include other approaches (see Fig. 3).

The results of the Screening Study and/or the Detailed Study form the basis of risk assessments, the results of which are fed into the DAIMON Decision Support System.

**Conclusion: The Toolbox is considered ready to be tested in practice.**



Tab. 1: How to apply the Toolbox

Example 1: Screening Study	Yes	No	Method	Fact Sheet No.
Presence of dumped munition	X		Sonar, ROV, Camera	XXX
- chemical munitions?		X	Sonar, ROV, Camera, Catalogue	XXX
- conventional munitions?	X		Sonar, ROV, Camera, Catalogue	XXX
Chemical screening of sediment	X		Chemical screening for TNT /-metabolites in sediments	XXX
Fish biomarker 1		X	3.1: Externally visible fish diseases	XXX
Fish Biomarker 2	X		6.2: Liver tumors in fish	XXX
Fish Biomarker 3	X		7.1: Micronucleus assay	XXX
Results of the Screening Study: Dumped conventional munitions was found and TNT–related compounds were detected in sediment. Two out of three biomarkers responded and, thus, fish are regarded as affected. A Detailed Study is not required , risk assessment can be done and decisions can be taken.				