DAIMON Toolbox Fact Sheets:

Methods to Study the Impact of Dumped Munitions on Marine Biota

Assessment category 1: Munitions detection and identification

Toolbox component: Munitions detection

Fact Sheet 1.1: Munitions detection procedure with a hydroacoustic and magnetometry equipment

Author: Miłosz Grabowski, Institute of Oceanology of the Polish Academy of Sciences (IOPAS)

What is it?

The procedure allows detecting sunken munition placed on the seabed and beneath it in a relatively short time, on a large area. It is based on remote sensing methods, hence it is safe even for highly corroded munitions. The risk of leakage or spreading out dangerous substances to the environment is minimal during the survey. It further provides crucial information about the area of investigation and object placed in it.

What does it tell you?

Correctly conduced procedures and data processing provide information about the exact location of dumped objects located on the seabed and under it. Based on collected hydroacoustic and magnetometric data, the human operator can select munitions-like targets among all detected objects. Also, it provides information about the dimensions and geometry of objects. Additionally, detailled seabed maps and images of sediments structures that build the sea bottom are produced as outputs of the procedure.

How to measure it?

***Matrix*:** Surface and sub bottom sediments

***Equipment*:**

- Research vessel
- Differential global positioning system (DGPS)
- Towed side scan sonar
- Autonomous underwater vehicle (AUV) with high frequency side scan sonar and magnetometer
- Sub bottom profiler
- Underwater navigational system (USBL)
- Ship winches

- Hydrographic data acquisition and processing software (HYPACK, SonarWiz, QINSy etc.)

Method: Measurements and calibration of hydroacoustic and magnetometry equipment should be done as a regular hydrographic survey with the IHO and NOAA standards and based on equipment's manuals. Additional information about example equipment and detailled step-by-step description of the procedure itself can be found in Grabowski et al. (2018) and Bełdowski et al. (2018).

How to analyse and assess the data?

Data analysis consists of four steps:

- Preparation of sonar mosaics and seismograms
- Marking all potential munition targets on sonar mosaics and seismograms
- Preparation of maps of magnetic anomalies
- Selecting most interesting, munition-like objects for further investigation

Collected data should be processed with suitable hydrographic software (HYPACK, SonarWiz, QPS). Based on it, the operator should point all interesting targets, measure them, and validate them with magnetometric data. The output of the procedure is a detailed map of the sea bottom of the area of interest (sonar mosaics) with an overlay map of the magnetic anomalies, a database of all detected objects with its measured geometry (length, width, height) and images of sub-bottom sediment structures with marked artifacts.

When the procedure is done, another step should be conducted (fact sheet x.x) to perform visual inspection and identification of selected objects.

Data: Data generated in the DAIMON project are available in the AMUCAD database provided by EGEOS (https://www.amucad.org).

References

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National Oceanic and Atmospheric Administration, Office of Coast Survey (2014) *Field Procedure Manual.* https://nauticalcharts.noaa.gov/publications/docs/standards-and-requirements/ fpm/2014-fpm-final.pdf

Equipment and software manuals