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APPROPRIATENESS AND AVAILABILITY OF THE *MNEMIOPSIS LEIDYI* AND *BEROE OVATA* DATA ON THE BLACK SEA

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Abstract. The article is based on the results achieved in the framework of the EMODnet Sea Basin Checkpoint Lot 4: Black Sea project. It aimed to assess the basin scale monitoring systems on the basis of input data sets for 11 prescribed Challenges including Alien species (Challenge 11). The quality assessment based upon ISO and INSPIRE principles is subdivided into two categories “appropriateness” and “availability”. In term of the gelatinous zooplankton alien species five Targeted products (tables and digital maps) were produced which serve as basis for the input data sets adequacy assessment. The quality scores of the products are estimated as sufficient due to non-uniform coverage of the data in time and space.

Keywords: alien species, checkpoint, data base assessment

INTRODUCTION

Availability and accessibility of marine data, their cross-borders exchanges and multiple usage are hot topics. The aim of the EMODnet BlackSeaCheckpoint project has been to assess the quality and to identify the gaps of the monitoring data sets for the entire Black Sea towards eleven targeted applications or "Challenges" (Wind farm siting, Marine protected areas, Oil platforms leak, Climate, Coasts, Fisheries management, Fisheries impact, Eutrophication, River inputs, Bathymetry and Alien species) and to point out the steps for optimizing the monitoring systems in term of availability, operational reliability, efficiency, time consistency, space consistency etc.[1].

The alien species are important issue in the marine ecosystems and therefore they are one of the elements of the Marine Strategy Framework Directive (Descriptor 2). Penetration and introduction of non-native species in the Black Sea in some cases enriched the biodiversity but in the most of cases they have negative effect on the native populations (predation pressure, parasitism, competition etc.). Development of reliable indicators and thresholds for Good Environmental Status suggests using of all of the available data sets. Additionally the development of adequate indicators requires sufficient amount of data which should be assessed periodically.

The scope of Challenge 11 - Alien species has been: a) to identify sources of the alien species data in the Black Sea basin; b) to check the fitness for use of the current available datasets; c) to develop indicators which determine the impacts on ecosystem and economy and d) to indicate the gaps of the current monitoring systems.

The article presents the main results of the availability and the appropriateness assessment of the existing *Mnemiopsis leidyi* and *Beroe ovata* alien species data bases in the Black sea. The outcomes of the project are five Targeted Data Products (tables and digital maps) which include information about species name, family, year of introduction, reason for introduction, geographical area, impact on ecosystem and economy.

MATERIAL AND METHODS

For the availability assessment the following data sources were used:

- Black Sea *M. leidyi* database [2];

- project's databases (SESAME; ARENA; PERSEUS; Stock assessment of Black Sea Anchovy using acoustic method and establishing a monitoring model for National Fisheries Data Collection Program; NATO SfP-971818 ODBMS Black Sea Project [3]);

- Bulgarian National Monitoring Programme Database [4].

Only two databases (Black Sea Database created in framework of NATO SfP-971818 ODBMS Black Sea Project and Bulgarian National Monitoring Programme [3, 4]) have been found to be suitable for generation of the Targeted Data Products (TDPs) and appropriateness assessment.

Methodology

Detailed description of the assessment methodology is given in the Black Sea Checkpoint First and Second Data Adequacy Reports (DARs) [5, 6].

It provides quantitative and qualitative information on:

- how the input data sets are made available to Challenges (Availability Indicators). The potential input data sets and the availability indicators are estimated (Table 1);

- and what is the quality of the monitoring data for the Challenge products (Appropriateness Indicators). The calculation of appropriateness indicators has been done for the Data Product Specification (DPS), Upstream Data (UD) and Targeted Data Products (TDP) quality elements (Table 2).

Table 1. Availability indicators used for assessment of the input data sets [5].

Availability **How are data made available to the challenges?**	
Visibility	
Easily found	**Can the data sets or series of datasets be found easily?**
EU Inspire Catalogue service	**Is the datasets referenced by a EU catalogue service or other bodies (private or public), national or international non EU services?**
Accessibility	
Visibility of data policy	**How visible is the data policy adopted by data providers?**
Data policy	**What is the data policy?**
Pricing	**What is the cost basis?**
Data delivery mechanism	**What services are available to the user to access data?**
Readiness of format for use	**How ready is the format for operational use?**
Performance	
Responsiveness	

Table 2. Appropriateness quality elements used for assessment of the DPS, UDs and TDPs [6].

Appropriateness **What is the quality for challenges (products & data)?**	
Appropriateness	
Spatial domain	**Horizontal spatial coverage** **Horizontal resolution**
Vertical domain	**Vertical spatial coverage** **Vertical resolution**
Temporal domain	**Temporal coverage** **Temporal resolution**
Thematic domain	**Number of characteristics** **Thematic accuracy**
Expert domain	**Purpose** **Lineage** **Usage** **Credibility** **Temporal validity**

The gaps of the monitoring system for the Black Sea are evaluated based on combination of the availability, appropriateness indicators and expert opinions.

The expert evaluation of the "fitness for purpose" of the Targeted Products and input data quality has been done according to the scale presented in Table 3.

Table 3. Targeted Products quality scores and their meaning [6]

SCORE	MEANING
1 EXCELLENT	**completely meets the scope of the Targeted Product**
2 VERY GOOD	**meets more than 70% of the scope of the Targeted Product**
3 GOOD	**meets less than 50% of the scope of the Targeted Product**
4 SUFFICIENT	**does not adequately meet the scope but is a starting point**
5 INADEQUATE	**does not fulfill the scope and is not usable**

Data processing

The data are subdivided into two Categories of characteristics (P02) - Zooplankton wet weight biomass and Zooplankton taxonomy-related abundance per unit volume of the water column. All available input datasets (meta data bases) are checked using eight "availability" indicators (Table 1). The indicators are classified based upon a three value range color scale: "red" meaning "not adequate", "yellow" "partly adequate" and "green" "fully adequate" [5].

The data used for generation of the products which present the distribution of *M. leydyi* and *B. ovata* are quality assured (QA). The QA check include detection of stations with different names but the same geographic location; detection of stations with the same name but with different geographic locations. Afterward the values at stations with different names but the same geographic location are averaged; stations with the same name but in different geographic locations are renamed; the units are recalculated from ind/m^3 and g/m^3 to ind/m^2 and g/m^2 for representative visualization.

For assessment of *M. leydyi* impact on the ecosystem the original data are used without any transformations.

Inverse distance weighted (IDW) method [7] have been used to produce the digital maps of the alien species abundance and biomass distribution.

RESULTS AND DISCUSSION

The inventory process identifies seven data sources and 24 input data sets (Upstream Data) usable for the purpose of the availability assessment. Based on the application of the Availability Indicators (Table 1) it has been found that the unavailability and restrictions on the data sharing imposed by some projects makes the data "not adequate" or "partly adequate" for the next stage of the evaluation [4].

Two available data bases (6 UDs) are used for development of the following products:

BLACKSEA_CH11_Product_1 Table of *Mnemiopsis leidyi* alien species abundance and biomass distribution in the Black Sea [8]

The product is based on the data from 23 available datasets from the Black Sea Database created in framework of the NATO SfP-971818 ODBMS Black Sea Project [3] and the Bulgarian National Monitoring Programme [4]. The product includes two characteristics - abundance and biomass of the species. Both of them are equally important for the Targeted Product quality. Although the data are not evenly distributed in space and time the product is useful for visualization of the *M. leidyi* alien species distribution in the Black Sea (Fig. 1).

BLACKSEA_CH11_Product_2 Digital map of *Mnemiopsis leidyi* alien species abundance distribution in the Black Sea [9]

The product is based on data from 21 available datasets i.e. all mentioned above except two datasets where abundance data are missing. It is useful for assessing the species distribution in the Black Sea although the data are not evenly distributed in space and time (Fig. 2).

BLACKSEA_CH11_Product_3 Digital map of *Mnemiopsis leidyi* alien species biomass distribution in the Black Sea [10]

The product is based on the data from the same 23 datasets. It is useful for assessing the species biomass distribution in the Black Sea although the data are not evenly distributed in space and time (Fig. 3).

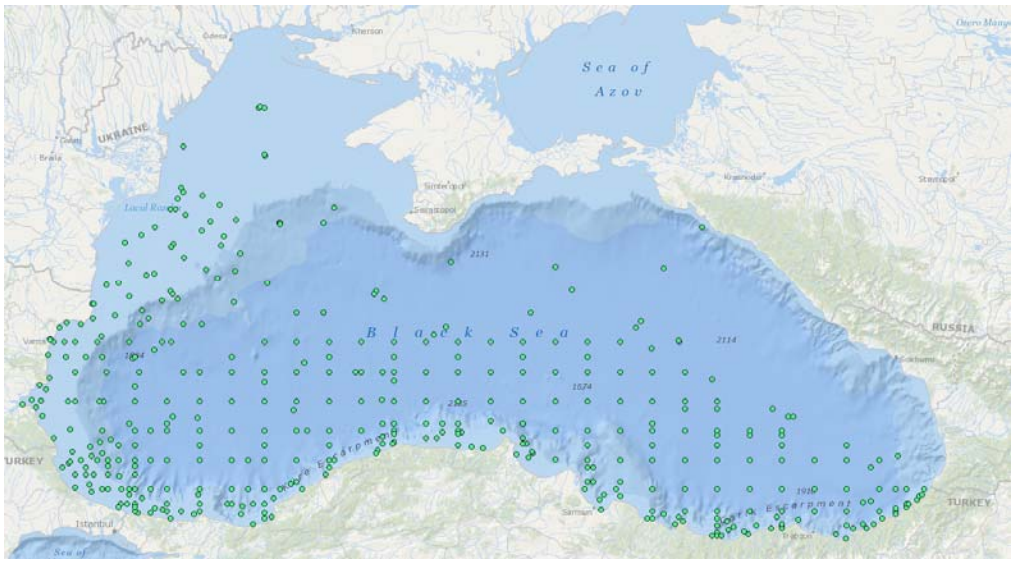

Fig. 1. Map of *Mnemiopsis leidyi* alien species abundance and biomass data distribution in the Black Sea (BLACKSEA_CH11_Product_1)

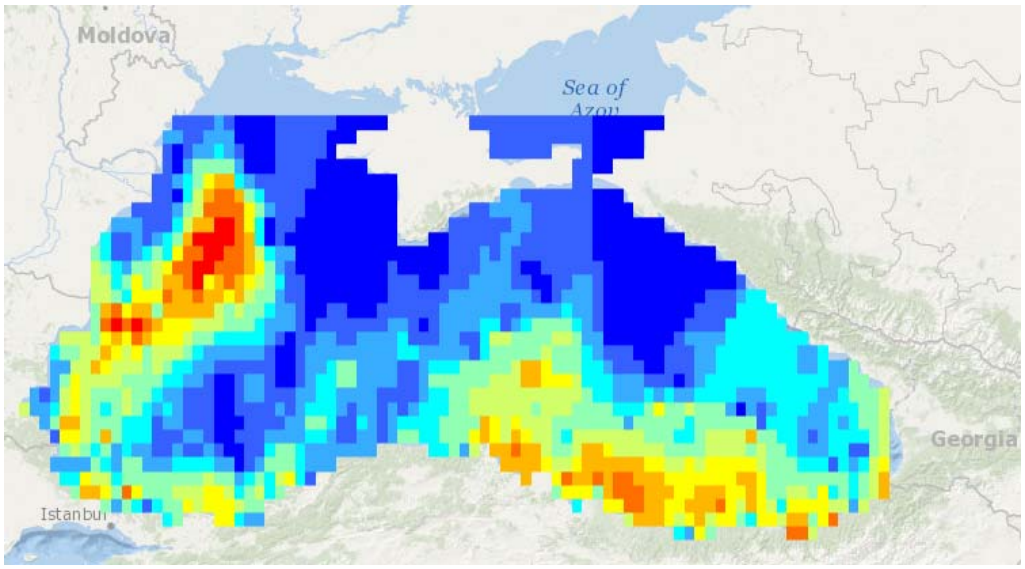

Fig. 2. Digital map of *Mnemiopsis leidyi* alien species abundance distribution in the Black Sea (BLACKSEA_CH11_Product_2)

BLACKSEA_CH11_Product_4 Table of *Beroe ovata* alien species abundance and biomass distribution in the Black Sea [11]

The table includes 15 available datasets from the Bulgarian National Monitoring Programme [4]. The data are not evenly distributed in space and time. The product does not adequately meet the scope to assess the species distribution on the entire Black Sea but is a starting point (Fig. 4).

BLACKSEA_CH11_Product_5 Table of *Mnemiopsis leidyi* alien species abundance and biomass distribution in the Black Sea as indicators for impact on the ecosystem and economy [12]

The table includes 24 available datasets with the original values (g/m^3; ind/m^3) from the Black Sea Database created in framework of the NATO SfP-971818 ODBMS Black Sea Project [3] and the Bulgarian National Monitoring Programme [4]. The both characteristics - abundance and biomass of the species are equally important for the Targeted Product quality. Being an invasive species but not only alien Mnemiopsis affects the ecosystem even with its presence in the environment. The publications of Vinogradov et al., 2005 and Shiganova et al., 2014 [13, 14] took thresholds for Good Environmental Status (GES) < $4g/m^3$ ($120\ g/m^2$) and <5 ind/m^3 respectively. In concentration above these thresholds the species affects the ecosystem. The data modifications of Product 1 (data averaging) do not allow reliable assessment of this impact on the ecosystem.

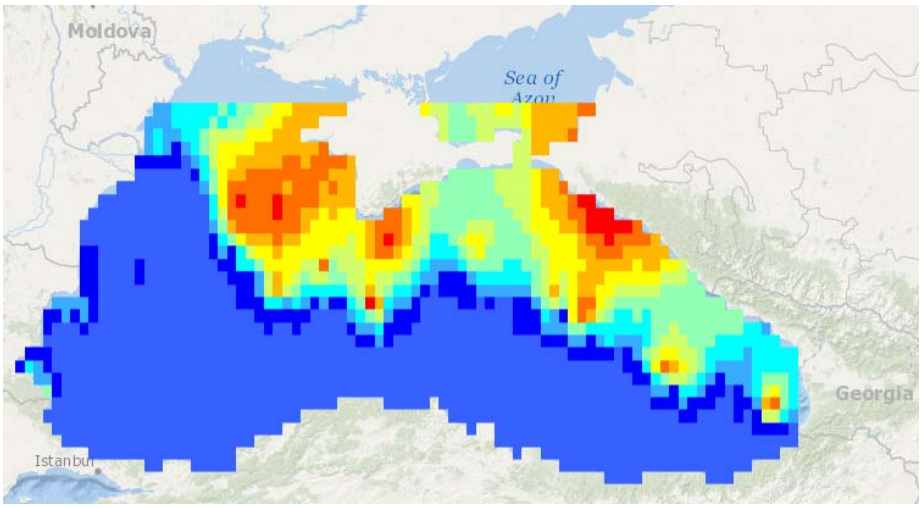

Fig. 3. Digital map of *Mnemiopsis leidyi* alien species biomass distribution in the Black Sea (BLACKSEA_CH11_Product_3)

Fig. 4. Map of *Beroe ovata* alien species abundance and biomass data distribution in the Black Sea (BLACKSEA_CH11_Product_4)

Based on the expert opinion the quality elements which affect the quality of the *M. leidyi* alien species products (BLACKSEA_CH11_Product_1, BLACKSEA_CH11_Product_2, BLACKSEA_CH11_Product_3 BLACKSEA_CH11_Product_5) are:

- *Horizontal Spatial Coverage and Horizontal Resolution.* The data are insufficient in the Northern part of the basin;

- *Temporal Coverage and Temporal Resolution.* The data doesn't cover the whole period from the species settlement in 1982 till now. The databases would be more complete if they contain seasonal and annual data.

The limitations on the quality of the product due to the input dataset used (fitness for use) are:

- *Horizontal Spatial Coverage and Horizontal Resolution.* Each of used 23 UDs (21 UDs for Product 2) has different horizontal coverage and resolution which are not enough to present the species distribution in the entire Black Sea.

- *Temporal Coverage and Temporal Resolution.* The datasets cover relatively short time spans related to the monitoring campaigns.

The most important gaps in the input data sets are:

- Lack of long-term annual and seasonal data for the period from the species settlement till now.

- Sparse and unevenly distributed sampling stations reduce the reliability of the product.

The quality elements which affect the Product 4 quality are:

- *Horizontal Spatial Coverage and Horizontal Resolution.* The data covers only the Western part of the sea basin;

- *Temporal Coverage and Temporal Resolution*. The data doesn't cover the whole period from the species settlement in 1997 till now. The databases would be more complete if they contain seasonal and annual data.

The limitations on the quality of the product due to the input dataset used (fitness for use) are:

- *Horizontal Spatial Coverage and Horizontal Resolution.* Each of used 15 UDs has different horizontal coverage and resolution which are not enough to present the species distribution in the entire Black sea.

- *Temporal Coverage and Temporal Resolution.* The datasets cover relatively short time span related to monitoring campaigns.

The most important gaps in the input data sets are:

- Lack of long-term annual and seasonal data for the period from the species settlement till now.

- Sparse and unevenly distributed sampling stations reduce the reliability of the product.

The quality scores assigned by the CH 11 experts to the Targeted Products developed in order to evaluate the adequacy of the observational system at the Black Sea basin level is "sufficient"- does not adequately meet the scope but is a starting point (Table 3).

CONCLUSIONS

The species populations are dynamic systems with annual, seasonal and spatial variations. Our recommendations for the *M. leidyi* and *B. ovata* databases are in terms of the completeness - the data should be acquired in regular time intervals (seasonally) and with representative density of the stations net.

Other disadvantages of the existing datasets are the unavailability and restrictions on the data sharing imposed in frameworks of some projects.

In term of Product 5 new indicators should be proposed and tested.

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