Black Sea Checkpoint
Annex 2 to the Second DAR:
Appropriateness indicators

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1. Introduction

This Annex presents the Quality Elements (QE) composing the appropriateness indicators and the indicator of "Fitness for Use" for the input data sets.

After a list of Targeted products is presented, the appropriateness methodology is introduced followed by the description of the chosen ISO Quality Elements.

2. Black Sea Checkpoint Targeted Products

The Black Sea Checkpoint has developed 62 Targeted Data Products out of the 11 Challenges. The Targeted Products and their components are listed in Table A2.1, A2.2 and A2.3. All the products are available from the EMODnet BlackSea Checkpoint web page at: http://emodnet-blacksea.eu/challenges/

Table A2.1 Targeted Data Product nomenclature, content and format

TDP code	TDP name	TDP description	Components if applicable	Format
CH01 Windfarm siting				
BLACKSEA_CH01_Product_01	A high resolution wind-wave-tides database for the Black Sea area	A focus on determination of the suitability of sites for wind farm development in specific predefined Black Sea areas. The database includes a wide range of atmospheric, wave and tidal information		XYZ Ascii
BLACKSEA_CH01_Product_02	Assessment of the available database	Assessment of the available database through a detailed statistical analysis		XYZ Ascii
BLACKSEA_CH01_Product_03	Assessment of the confidence limits of the data sets for the test regions	Assessment of the confidence limits of the data base by means of evaluation of the two involved numerical models: the wave model WAM (parameter: significant wave height) and SKIRON (wind speed 10m)		PDF
CH02 Marine protected areas				
BLACKSEA_CH02_Product_1	List, position and boundaries of Black Sea network of marine protected areas using IUCN classification	Position and boundaries of Black Sea network of marine protected areas (Georgia, international protected sites, national protected sites, Natura 2000 sites, ecoregion)	1. Black Sea network of marine protected areas BOUNDARIES GEORGIA 2. Black Sea network of marine protected areas BOUNDARIES international protected sites 3. Black Sea network of marine protected areas BOUNDARIES national protected sites 4. Black Sea network of marine protected areas BOUNDARIES Natura 2000 sites 5. Black Sea network	ESRI Shapefile

TDP code	TDP name	TDP description	Components if applicable	Format
			of marine protected areas ECOREGION_Black Sea	
BLACKSEA_CH02_Product_2	Habitat types and mapping of Black Sea network of marine protected areas	Habitat types and mapping in Romania and Bulgaria, under EU Habitats Directive, and EU Sea Map for the whole Black Sea Black Sea network of marine protected areas: habitat types and mapping_EU Habitats Directive RO-BG	1. Coastal lagoons 2. Estuaries 3. Large shallow inlets and bays 4. Mudflats and sandflats not covered by seawater all low tide 5. Sandbanks slightly covered by seawater all the time 6. Reefs 7. Submerged or partially submerged sea caves 8. Habitat types and mapping EU Sea Map – the whole BS	ESRI Shapefile
BLACKSEA_CH02_Product_3	Biodiversity of Black Sea network of marine protected areas	Distribution of marine mammals, fish/mollusks and seabirds Black Sea network of marine protected areas BIODIVERSIT	1. Marine mammals 2. Fish and Invertebrates 3. Seabirds	ESRI Shapefile
BLACKSEA_CH02_Product_4	Qualitative analysis of connectivity between MPAs as seasonal maps of sea surface currents [m/s]	To qualitatively assess the connectivity among different MPAs oceanographic data are used. GIS layers are created to visualized sea surface currents [m/s] on a seasonal basis	1. Winter season 2. Spring 3. Summer 4. Autumn	XYZ Ascii, ESRI Shapefile
BLACKSEA_CH02_Product_5	Qualitative analysis of connectivity between MPAs as seasonal maps of sea surface temperature [deg C]	To qualitatively assess the connectivity among different MPAs oceanographic data are used. GIS layers are created to visualized sea surface temperature [deg C] on a seasonal basis	1. Winter season 2. Spring 3. Summer 4. Autumn	XYZ Ascii, ESRI Shapefile
CH03 Oil platform leaks				
BLACKSEA_CH3_Product_1	Oil Platform Leak Bulletin released on 11 May 2016, fast release, 24h after the incident declared on 10th May 2016 by DG MARE	The forecast/scenario information on ocean currents, atmospheric 10-m wind, waves, the fate and transport of oil leaks emanating from fixed platforms		PDF
BLACKSEA_CH3_Product_2	Oil Platform Leak Bulletin released on 11 May 2016, fast release, 72h after the incident declared on 10th May 2016 by DG MARE	Apart from the likely oil spill trajectory and the oil mass budget components, the possible influence on biota, geomorphology and human activity is evaluated		PDF
CH04 Climate				
BLACKSEA_CH04_Product_1	Map of the change of the average temperature over 2006-2015 period (10 years) - At surface	The product gives the change of the Black Sea sea surface temperature for the period 2006-2015 with spatial resolution of ~4 km. It is based on the CMEMS product SST_BS_SST_L4_REP_OBSERVATIONS_010_022 (1981-2015)		ESRI Shapefile
BLACKSEA_CH04_Pr	Map of the change of the	The product gives the change of		ESRI

TDP code	TDP name	TDP description	Components if applicable	Format
oduct_2	average temperature over 2006-2015 period (10 years) - At mid water column (500m)	the Black Sea temperature at mid-depth 500 m for the period 2006-2015 with spatial resolution of ~3 km. It is based on the CMEMS product BLKSEA_REANALYSIS_PHYS_007_004 (1992-2015)		Shapefile
BLACKSEA_CH04_Product_3	Map of the change of the average temperature over 2006-2015 period (10 years) - At sea bottom (1500m)	The product gives the change of the Black Sea temperature in the deep part 1500 m for the period 2006-2015 with spatial resolution of ~3 km. It is based on the CMEMS product BLKSEA_REANALYSIS_PHYS_007_004 (1992-2015)		ESRI Shapefile
BLACKSEA_CH04_Product_4	Map of the change of the average temperature over 50 years - At surface	The product refers to the sea surface temperature covering the Black Sea basin with sufficient horizontal and temporal resolution for the period 1966-2015, necessary to calculate the trend over 50 years		ESRI Shapefile
BLACKSEA_CH04_Product_5	Map of the change of the average temperature over 50 years - At mid water column (500m)	The product refers to the Black Sea temperature at mid-depth, taken as 500m, with sufficient horizontal and temporal resolution for the period 1966-2015, necessary to calculate the trend over 50 years		ESRI Shapefile
BLACKSEA_CH04_Product_6	Map of the change of the average temperature over 50 years - At sea bottom (1500m)	The product refers to the Black Sea temperature in the deep part, taken as 1500m, with sufficient horizontal and temporal resolution for the period 1966-2015, necessary to calculate the trend over 50 years		ESRI Shapefile
BLACKSEA_CH04_Product_7	Map of the change of the annual mean temperature: over 100 years - At surface	The product refers to the sea surface temperature covering the Black Sea basin with sufficient horizontal and temporal resolution for the period 1916-2015, necessary to calculate the trend over 100 years		ESRI Shapefile
BLACKSEA_CH04_Product_8	Map of the change of the average temperature over 100 years - At mid water column (500m)	The product refers to the Black Sea temperature at mid-depth, taken as 500m, with sufficient horizontal and temporal resolution for the period 1916-2015, necessary to calculate the trend over 100 years		ESRI Shapefile
BLACKSEA_CH04_Product_9	Map of the change of the average temperature over 100 years - At sea bottom (1500m)	The product refers to the Black Sea temperature in the deep part, taken as 1500m, with sufficient horizontal and temporal resolution for the period 1916-2015, necessary to calculate the trend over 100 years		ESRI Shapefile
BLACKSEA_CH04_Product_10	Map of the average extent of sea ice coverage over 2006-2015 period (10 years)	The product gives the sea ice coverage of the Black Sea for the period 2006-2015 with ~4 km horizontal resolution. It is based on the National Snow and Ice Data		ESRI Shapefile

TDP code	TDP name	TDP description	Components if applicable	Format
		Center USA MASIE-NH 4km dataset		
BLACKSEA_CH04_Product_11	Map of the average extent of sea ice coverage over 50 years	The product refers to the sea ice coverage of the Black Sea with sufficient horizontal and temporal resolution for the period 1966-2015, necessary to calculate the average sea ice extent over 50 years		ESRI Shapefile
BLACKSEA_CH04_Product_12	Map of the average extent of sea ice coverage over 100 years	The product refers to the sea ice coverage of the Black Sea with sufficient horizontal and temporal resolution for the period 1916-2015, necessary to calculate the average sea ice extent over 100 years		ESRI Shapefile
BLACKSEA_CH04_Product_13	Time series of annual mean temperature - At surface	The product gives the time series of the annual mean Black Sea sea surface temperature for the period 1982-2015. It is based on the CMEMS product SST_BS_SST_L4_REP_OBSERVATIONS_010_022 (1981-2016)		XLS
BLACKSEA_CH04_Product_14	Time series of annual mean temperature -At mid water column (500 m)	The product gives the time series of the averaged Black Sea temperature at mid-column depth 500 m for the period 1992-2015. It is based on the CMEMS product BLKSEA_REANALYSIS_PHYS_007_004 (1992-2015)		XLS
BLACKSEA_CH04_Product_15	Time series of annual mean temperature - At sea bottom (1500 m)	The product gives the time series of the averaged Black Sea temperature in the deep part, depth 1500 m, for the period 1992-2015. It is based on the CMEMS product BLKSEA_REANALYSIS_PHYS_007_004 (1992-2015)		XLS
BLACKSEA_CH04_Product_16	Time series of average annual internal energy	The product gives the time series of the Black Sea internal energy evaluated from the temperature and salinity of the water column over the period 1992-2015. It is based on the CMEMS product BLKSEA_REANALYSIS_PHYS_007_004 (1992-2015)		XLS
BLACKSEA_CH04_Product_17	Time series of total ice cover in sea over past 100 years	The product gives the annual variations in the sea ice coverage of the Black Sea for the period 2006-2017. It is based on the National Snow and Ice Data Center USA MASIE-NH 4km dataset		XLS
BLACKSEA_CH04_Product_18	Time series of abundance of three most abundant species of phytoplankton	The product gives the time series of the annual concentration of the three most abundant phytoplankton species: Emiliania huxleyi, Pseudosolenia calcar-avis and Ceratium tripos. The periods are different for the different species, ranging from 1969 to 2016. It is based on the data from Black Sea Commission and NATO		XLS

TDP code	TDP name	TDP description	Components if applicable	Format
		ODMBS Black Sea Project databases		
CH05 Coasts				
BLACKSEA_CH05_Product_1	Sea level rise (trend) from altimetry for the last 10 years (2006-2015)	The product includes a map of sea level trend from altimetry for the last 10 years (2006-2015)		ESRI Shapefile
BLACKSEA_CH05_Product_2	Regional sea level time series and trend for 11 sub-regions for the past 10 years (2006-2015)	11 Sub-regions were selected to cover a range of hydrodynamic conditions in the Black Sea: shallow shelf areas ; dynamically inactive central deep-water areas ; dynamically active (including meandering, jets and eddies formation processes) zone associated with the intensive circular current (Rim Current) and attached to the continental slope ; persistent Batumi and Sevastopol anticyclonic gyres		PNG
BLACKSEA_CH05_Product_3	Regional sea level time series and trend for 5 coastal sub-regions for the past 50 years (1966-2015)	Five coastal sub-regions have been identified by considering the geographical locations of available coastal stations and the physical characteristics of the Black Sea		PNG
BLACKSEA_CH05_Product_4	Regional sea level time series and trend for 5 coastal sub-regions for the past 100 years (1916-2015)	Five coastal sub-regions have been identified by considering the geographical locations of available coastal stations and the physical characteristics of the Black Sea		PNG
BLACKSEA_CH05_Product_5	Sea level time series and trend for the past 10 years for each 4 NUTS3 in Turkey	Using the yearly data from Sile, Igneada, Sinop and Trabzon coastal stations from TUDES datasets		PNG
BLACKSEA_CH05_Product_6	Sea level time series and trend for the past 50 years for each NUTS3 from selected coastal stations	Using the yearly data from Batumi, Burgas, Constanza, Poti, Sevastopol, Tuapse and Varna coastal stations		PNG
BLACKSEA_CH05_Product_7	Sea level time series and trend for the past 100 years for each NUTS3 from selected coastal stations	Using yearly data from Batumi, Burgas, Coastanza, Poti, Sevastopol, Tuapse and Varna coastal stations		PNG
BLACKSEA_CH05_Product_8	Sediment mass balance trend for the last 10 years (2006-2015)	Sediment mass balance trend for the last 10 years (2006-2015)		ESRI Shapefile
BLACKSEA_CH05_Product_9	Sediment mass balance trend for the last 50 years (1966-2015)	Sediment mass balance trend for the last 50 years (1966-2015)		ESRI Shapefile
BLACKSEA_CH05_Product_10	Sediment mass balance trend for the last 100 years (1916-2015)	Sediment mass balance trend for the last 100 years (1916-2015)		ESRI Shapefile
CH06 Fishery management				
BLACKSEA_CH06_Product_1	Collated data set of landings, fish and shellfish, by species and year	The product contains data on landings of the main commercial species of fish and shellfish (mass and number) for the whole Black Sea, Romania and Bulgaria 2008-2016	1. Collated data set of LANDINGS by species MASS WHOLE BLACK SEA 2008-2014 2. Collated data set of LANDINGS by species MASS ROMANIA 2010-2016	XLS

TDP code	TDP name	TDP description	Components if applicable	Format
			3. Collated data set of LANDINGS by species NUMBER ROMANIA 2010-2016 4. Collated data set of LANDINGS by species MASS BULGARIA 2009-2015	
BLACKSEA_CH06_Product_2	Collated data set of discards, by species and year	The product contains data on discards of the main commercial species of fish and shellfish (mass and number) for Romania, overall period 2010-2016	1. Collated data set of DISCARDS by species MASS ROMANIA 2010-2016 2. Collated data set of DISCARDS by species NUMBER ROMANIA 2010-2016	XLS
BLACKSEA_CH06_Product_3	Collated data set of by-catch, by species and year	The product contains data on discards of the main commercial species of fish and shellfish (mass and number) for Romania and Bulgaria, overall period 2009-2016		XLS
CH07 Fishery impacts				
BLACKSEA_CH07_Product_1	Extent of fisheries trawlers (bottom trawling) computed from Vessel Monitoring System Dataset (2012-2015)	The product contains data on the extent of trawling fisheries (bottom trawling) computed from Vessel Monitoring System Dataset 2012-2015, Romanian waters	1. Extent of fisheries trawlers (bottom trawling): computed from Vessel Monitoring System Dataset for 2012,Romanian waters 2. Dataset for 2013,Romanian waters 3. Dataset for 2014,Romanian waters 4. Dataset for 2015,Romanian waters	ESRI Shapefile
BLACKSEA_CH07_Product_2	Extent of fisheries impact on the seafloor: sandy habitats where trawling is performed	The product contains data on the extent of fisheries impact on the seafloor: beam trawling areas in Romania, pelagic trawling areas in Romania, bottom and Rapana trawling areas in Turkey	1. Extent of fisheries impact on the seafloor: sandy habitats where trawling is performed_ Childproductcomponent 2.1. Beam trawling areas_Romania 2016 2. Extent of fisheries impact on the seafloor: sandy habitats where trawling is performed_ Childproductcomponent 2.2. Pelagic trawling areas_Romania 2016	ESRI Shapefile

TDP code	TDP name	TDP description	Components if applicable	Format
			3. Extent of fisheries impact on the seafloor: sandy habitats where trawling is performed_ Childproductcomponent 2.3. Trawling areas_Turkey 2014 4. Extent of fisheries impact on the seafloor: sandy habitats where trawling is performed_ Childproductcomponent 2.4. Trawling areas_Turkey_Rapana 2014	
CH08 Eutrophication				
BLACKSEA_CH08_Product_1	Mapping of seasonal Chlorophyll over 10 years (2005-2014)	Produce seasonal maps of eutrophication from satellite chlorophyll data showing general levels	1. Winter concentration of Chlorophyll 2. the same for Spring 3. the same for Summer 4. the same for Autumn	ESRI Shapefile
BLACKSEA_CH08_Product_2	Mapping of mean Chlorophyll trend over 10 years (2005-2014)	A CSI023 indicator (Chlorophyll in transitional, coastal and marine waters) reflects the policy measures taken to reduce loading of nutrients from rivers that affect primary production in the coastal zones		ESRI Shapefile
CH08 River inputs				
BLACKSEA_CH09_Product_1	Monthly mean time series of Water Discharge into Black Sea basin from in situ data (RIVDIS) (1921-1984)	Monthly mean time series of Water Discharge (Qw) [m3/s] into Black Sea basin from in situ data, the temporal extent: 1921 – 1984 for: Danube River from 1921-1984 Kamtehiya River from 1965-1979 Kizilirmak River from 1976-1983 Sakarya River from 1976-1983 Dniester River from 1965-1984 Dnieper River from 1976-1983	1. Monthly mean time series of Danube Discharge 2. the same for Kamtehiya Discharge 3. the same for Kizilirmak Discharge 4. the same for Sakarya Discharge 5. the same for Dniester 6. the same for Dnieper	XLS
BLACKSEA_CH09_Product_2	Yearly mean time series of Water Discharge into Black Sea basin from in situ data (RIVDIS) (1921-1984)	Yearly mean time series of Water Discharge (Qw) [m3/s] into Black Sea basin from in situ data with the temporal general extent of 1921 - 1984: Danube River from 1921-1984 Kamtehiya River from 1965-1979 Kizilirmak River from 1976-1983 Sakarya River from 1976-1983 Dniester River from 1965-1984 Dnieper River from 1952-1984	1. Yearly mean time series of Danube Discharge 2. the same for Kamtehiya 3. the same for Sakarya 4. the same for Kizilirmak 5. the same for Dniester 6. the same for	XLS

TDP code	TDP name	TDP description	Components if applicable	Format
			Dnieper	
BLACKSEA_CH09_Product_3	Time series of daily river discharge at the discharge point into the Black Sea (1981 - 2010) (computed with Hype model)	River discharge [m3/s] into the Black Sea from in situ data available	1. Danube River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 2. Sakarya River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 3. Veleka River monthly daily discharge at the discharge point into the Black Sea (1981 - 2010) 4. Dnister River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 5. South Bug River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 6. Sf.Gheorghe River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 7. Dniper River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 8. Rioni River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 9. Kamchia River daily river discharge at the discharge point into the Black Sea (1981 - 2010) 10. Kizilirmak River monthly mean river discharge at the discharge point into the Black Sea (1981 - 2010) 11. Chorokhi River daily river discharge at the discharge point into the Black Sea (1981 - 2010)	XLS
BLACKSEA_CH09_Product_4	Time series of monthly mean river temperature at the discharge point into the Black Sea (2000-2010)	Time series of monthly mean river temperature at the discharge point into the Black Sea 2000–2010	1. Sakarya monthly mean river temperature at the discharge point into the Black Sea	XLS

TDP code	TDP name	TDP description	Components if applicable	Format
			2. the same for Danube 3. the same for Veleka 4. the same for Chorokhi 5. the same for Dnister 6. Kamchia 7. Kizilirmak 8. Rioni 9. Sf.Gheorghe 10. Dniper 11. South Bug	
BLACKSEA_CH09_Product_5	Time series of River nutrients (nitrate) monthly mean at surface (2000-2010)	River nutrients (nitrate) monthly mean at surface with 2000 – 2010	1. Time series of Veleka River nutrients (nitrate) monthly mean at surface (2000-2010) 2. the same for Chorokhi 3. Dniper 4. Sakarya 5. South Bug 6. Rioni 7. Dnister 8. Sf.Gheorghe 9. Kizilirmak 10. Danube 11. Kamchia	XLS
BLACKSEA_CH09_Product_6	Monthly mean of the phosphorus at river discharge into the Black Sea at surface	Monthly mean of the phosphorus at river discharge into the Black Sea at surface 2000 – 2010	1. Veleka monthly mean of the phosphorus at the discharge point into the Black Sea 2. the same for Dniper 3. Danube 4. Chorokhi 5. Dnister 6. Kizilirmak 7. Sf.Gheorghe 8. South Bug 9. Rioni 10. Sakarya 11. Kamchia	XLS
BLACKSEA_CH09_Product_7	Eel/salmon recruitment and escapement	River eel/salmon recruitment and escapement (biomass)		ESRI Shapefile
CH10 Bathymetry				
BLACKSEA_CH10_Product_1	Black Sea and Azov sea coastlines by digitalization of 14.25 m panchromatic LandSat 7 ETM+ satellite images	Black Sea and Azov Sea coastlines by digitalization of sub meter resolution satellite images		ESRI Shapefile
BLACKSEA_CH10_Product_2	Water depth (bathymetric map)	Contour bathymetric map for the Black Sea and Azov Sea with intervals of 100 meters have been produced using EMODNET bathymetry DTM with a grid size of .125 min * .125 min		ESRI Shapefile
BLACKSEA_CH10_Product_3	Priority areas for surveying for safer	Identification of the priority areas for surveying and safety		ESRI Shapefile

TDP code	TDP name	TDP description	Components if applicable	Format
	navigation (wrt to heavy maritime traffic)	navigation in the Black Sea taking into account emerging needs		
BLACKSEA_CH10_Product_4	Map of uncertainty in water depth concentrated on Bulgarian part of the Black Sea	Map of uncertainty in the water depth for the Black sea basin produce using two hydroacoustic data sets obtained from BGODC database and EMODnet bathymetry portal		image
CH11 Alien species				
BLACKSEA_CH11_Product_1	Table of Mnemiopsis leidyi alien species abundance and biomass distribution in the Black sea	The table of Mnemiopsis leidyi alien species abundance and biomass includes 23 available datasets from the Black Sea Database created in framework of the NATO SfP-971818 ODBMS Black Sea Project http://sfp1.ims.metu.edu.tr/ODBMSDB/ and Bulgarian National Monitoring Programme http://bgodc.io-bas.bg/documents/ The data were submitted on Quality assurance (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 of stations with different names and the same geographic location were averaged. - Stations with the same name but in different geographic locations were renamed. - The units were recalculated from ind/m3 and g/m3 to ind/m2 and g/m2 for more representative spatial surface performance		XLS
BLACKSEA_CH11_Product_2	Digital map of Mnemiopsis leidyi alien species abundance distribution in the Black Sea	The digital map of Mnemiopsis leidyi alien species abundance distribution includes 21 available datasets from the Black Sea Database created in framework of the NATO SfP-971818 ODBMS Black Sea Project and Bulgarian National Monitoring Programme		ESRI Shapefile
BLACKSEA_CH11_Product_3	Digital map of Mnemiopsis leidyi alien species biomass distribution in the Black Sea	The digital map of Mnemiopsis leidyi alien species biomass distribution includes 23 available datasets from the Black Sea Database created in framework of the NATO SfP-971818 ODBMS Black Sea Project and Bulgarian National Monitoring Programme		ESRI Shapefile
BLACKSEA_CH11_Product_4	Table of Beroe ovata alien species abundance and biomass distribution in the Black sea	The table of Beroe ovata alien species abundance and biomass includes 15 available datasets from the Bulgarian National Monitoring Programme. The data were submitted on Quality		XLS

TDP code	TDP name	TDP description	Components if applicable	Format
		assurance. Afterward the units were recalculated from ind/m3 and g/m3 to ind/m2 and g/m2 for more representative spatial surface performance		
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	The table of Mnemiopsis leidyi alien species abundance and biomass includes 24 available datasets with the original values (g/m3; ind/m3) from the Black Sea Database created in framework of the NATO SfP-971818 ODBMS Black Sea Project and Bulgarian National Monitoring Programme. 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 took thresholds for Good Environmental Status (GES) < 4g/m3 (120 g/m2) and <5 ind/m3 respectively. In concentration above these thresholds the species affects the ecosystem. The data modifications of Product 1 do not allow correct assessment of this impact on the ecosystem		XLS
Total number of TDP/Components	**62/142**			

3. The appropriateness assessment methodology

The basic methodology for appropriateness assessment is based upon specific **metadata information and measures** associated to quality elements. Metadata information is related to:

1) the Data Product Specification (DPS);

2) the Targeted Data Product (TDP) description;

3) the Upstream Data (UD) used in the TDP.

The assessment methodology consists of two fundamental steps: the first is the choice of the quality measures that characterize DPS, TDP and UD and the second the definition of the appropriateness indicators based upon the quality measures.

3.1 Data Product Specification and Targeted Product Description nomenclature

A Data Product Specification (DPS) is: ”a detailed description of a dataset or dataset series together with additional information that will enable it to be created, supplied to- and used by- another party” (ISO 19131:2007). In our work, the “dataset” will be called “product” in order not to confuse this with the input datasets required to produce the Challenge Targeted products.

The DPS is a precise technical description of the product in terms of the requirements that it will or may fulfil. The TDP is along the same lines of the DPS but containing a precise technical description of the actual product developed. While the DPS only defines how the product should be, the TDP specifies how it was actually developed. In the Black Sea CheckPoint the DPS and TPD metadata information will be created for each Challenge using the ISO 19131:2007 specifications, the ISO1957: 2013 Data Quality and the ISO 19115 : 2014.

3.2 Upstream Data specification nomenclature

The Black Sea Checkpoint will use the DPS and TDP metadata information to assess the adequacy of the input data sets or Upstream Data (UD) that compose the “monitoring” of the Black Sea at the basin scale.

UD will then be classified on the basis of the same quality elements of the TDP and DPS, continuing the work started in the metadata base of input data sets required by the Challenges. The selection of input data sets was derived from expert specifications of data needed for Challenges products required by the tender. The content of the Checkpoint metadatabase is strongly linked to the specific Challenges chosen by the DGMARE call for tender and the expert opinion.

3.3 Appropriateness quality elements

The Data Product Specifications (DPS), Targeted Product Description (TPD) and Upstream Data (UD) metadata information contain “measures” of ISO quality elements that will allow the construction of the final list of **appropriateness indicators**. The quality elements **chosen for the Black Sea Checkpoint** are:

- ✓ For spatial information
  - **Completeness** of the horizontal or vertical coverage **extent** (for a given resolution) (2 elements)
  - **Accuracy** of the horizontal or vertical **resolution** (or sampling interval) (2 elements)
- ✓ For time information
  - **Completeness** of the temporal coverage extent (for a given resolution)
  - **Accuracy** of the temporal **resolution** (or sampling interval)

- **Temporal quality** of data with respect to time of update

✓ For thematic information

- **Consistency**: list of the characteristics composing the product
- **Accuracy: of the characteristic thematic accuracy with respect to "standards"**

Conceptual consistency is a quality element valid only for the DPS and TDP. In total we have then 8 quality elements common to DPS, TDP and UD.

For each quality element, physical "measure units" have been defined and they are presented in the Table A2.2.

Table A2.2 Quality Elements (QE) for DPS, TPD and UD: definition of measures

	ISO Quality element			DPS, TPD, UD Quality Measure definitions			
#QE	**ISO Quality element**	**ISO sub-element**	**ISO definitions**	**Ids of appropriatenes s measures**	**BS_CKP name of quality measure**	**BS_CKP definition of quality measure**	**Units of quality measur e**
1	Completeness	Omission	Data absent from a data set	XXX.AP.1.1	Horizontal Spatial Coverage	Horizontal coverage extent of product (eg: surface of the Black Sea covered by the product or by the input data set)	km**2
2	Completeness	Omission	Data absent from a data set	XXX.AP.1.2	Vertical Spatial Coverage	Vertical coverage extent of product or the input data set	metres
3	Completeness	Omission	Data absent from a data set	XXX.AP.1.3	Temporal Coverage	Temporal coverage extent of product or the input data set	days
4	Logical consistency	Conceptual consistency	Adherence to rules of the conceptual schema	XXX.AP.2.1	Number of Characteristics	Number of characteristics in product (not applicable to input data set)	integer
5	Thematic accuracy	Classification correcteness	Comparison of classes assigned to features or their attributes to universe of discourse (ground truth or reference data)	XXX.AP.3.1	Horizontal resolution	Averaged horizontal mesh size or equivalent value for the given scale of product or input data set(eg 50m for 1/50 000)	metres
6	Thematic accuracy	Classification correcteness	Comparison of classes assigned to features or their attributes to universe of discourse (ground truth or reference data)	XXX.AP.3.2	Vertical resolution	Average vertical sampling and description of specific vertical sampling schema of the product or the input data set (100 words max)	metres " _" text

	ISO Quality element			DPS, TPD, UD Quality Measure definitions			
#QE	ISO Quality element	ISO sub-element	ISO definitions	Ids of appropriateness measures	BS_CKP name of quality measure	BS_CKP definition of quality measure	Units of quality measure
7	Thematic accuracy	Classification correcteness	Comparison of classes assigned to features or their attributes to universe of discourse (ground truth or reference data)	XXX.AP.3.3	Temporal resolution	Temporal sampling interval of product or input data set	days (real number, i.e. 1 hour is equal to 0.04167)
8	Thematic accuracy	quantitative attribute accuracy	Closeness of the value of a quantitative attribute to value accepted as or known to be true	XXX.AP.3.4	Thematic accuracy	Percentage error of the TPD or UD beyond the accuracy of the DPS and description of error concept for the product or the input data set (100 words max) provided by expert	percentage " –" text
9	Temporal quality	temporal validity	validity of data with respect to time	XXX.AP.4.1	Temporal validity	Max elapsed time between last input data records update and product creation date	days

The identification of the appropriateness is composed by characters (XXX) indicating the DPS (Data Product Specification) or TPD (Targeted Product Description) or UD (Upstream Data - the Input data set), then by AP (appropriateness), followed by a first number indicating the quality element e by a second number indicating the sub-element:

- Example 1: DPS.AP.1.1 indicating the horizontal spatial coverage of the 'ideal' product'.
- Example 2: TPD.AP.1.1 indicating the horizontal spatial coverage of the product as realized by the Challenge.
- Example 3: UD.AP.1.1 indicating the horizontal coverage of the input data set to the specific product.

4. Appropriateness indicators definition

The basic idea of appropriateness indicators is that they are related to “errors” related to the Quality Elements just defined. Appropriateness corresponds then to “low” errors in the specific quality element.

“Errors” for quality elements are defined as the differences between what has been realized and what was “expected” or “required”. DPS includes the requirements or

expectations while TDP and UD are the actual products and input data sets used respectively.

Considering this concept of "errors", for every TDP and UD quality elements (QE), we can write:

$$\mathrm{QE_{TDP}} = \mathrm{QE_{DPS}} \pm \varepsilon_{\mathrm{TDP}} \quad (1)$$

$$\mathrm{QE_{UD}} = \mathrm{QE_{DPS}} \pm \delta_{\mathrm{UD}} \quad (2)$$

where ε, δ are the errors with respect to the specifications given in the DPS QE. These errors can be positive or negative depending if the product or the upstream data quality element are sufficient with respect to the DPS requirements while errors are negative if the QE is deficient with respect to specifications.

An appropriateness indicator for a specific QE can then be defined on the basis of these errors:

$$\varepsilon_{\mathrm{TDP}} = \mathrm{sign}\,(\mathrm{QE_{TDP}} - \mathrm{QE_{DPS}}) \quad (3)$$

$$\delta_{\mathrm{UD}} = \mathrm{sign}\,(\mathrm{QE_{UD}} - \mathrm{QE_{DPS}}) \quad (4)$$

where the "sign" function here is defined in order to have the negative values for the different QE errors represent lower than expected values and the opposite for positive values. Errors will be expressed as percentage errors, i.e.:

$$\varepsilon^{\%}_{TDP} = 100\left(\frac{\varepsilon_{\mathrm{TDP}}}{\mathrm{QE_{DPS}}}\right) \quad (5)$$

$$\delta^{\%}_{UD} = 100\left(\frac{\delta_{\mathrm{UD}}}{\mathrm{QE_{DPS}}}\right) \quad (6)$$

An appropriateness indicator will be defined then for each QE based upon the value of the percentage errors defined in (5) and (6).

4.1 Error Conventions

The choice of "sign" in equations (3) and (4) is crucial in order to have the required meaning of the errors. We then decide to:

- For "completeness" and " consistency" (QE numbers 1,2,3, 4 in Table A2.2), errors will be calculated as TDP or UD minus DPS. This means that:
    - for "coverage" QE the positive value indicates that the TPD or UD is better than DPS requirements

- for “consistency” QE the positive value indicates that the number of characteristics in the TDP are larger than DPS requirements (not applicable for UD)

- For “accuracy” and “temporal quality” QE (QE numbers 5,6, 7 and 9 in Table A2.2), errors will be calculated as DPS minus TDP or UD. A positive value indicates then that the TPD or UD is better than DPS requirement.
- For “consistency” QE (number 8 in Table A2.2) there is no difference carried out, the error is taken to be equal to the value given in the TDP or UD quality elements. The error is provided by the experts, and is an overall description of the error concept for the product or input data set.

The ε, δ error definitions are defined in details in Table A2.3 and A2.4

The QE appropriateness indicator is then defined as:

- **Red: the TDP or UD have the negative values of errors urgent actions are required to provide datasets fit for use by the Challenges – not adequate**
- **Yellow: the TDP or UD have the zero errors. Thus, thay can be considered quite appropriate and monitoring data are fit for use and should be maintained but also improved – partly adequate**
- **Green: the TDP or UD have the positive values errors, no need for further development – totally adequate**

Table A2.3 TDP quality element error definitions

#QE	Indicator short name	Indicator long name	Definition of quality errors (indicators)	Error definition	Units
1	TDP.APE.1.1	Horizontal spatial coverage error	Percentage to which the extent of the horizontal spatial coverage of TPD is compliant with the DPS extent in km**2	('TPD.AP.1.1' - 'DPS.AP.1.1')*100/'DPS.AP.1.1'	Percentage
2	TDP.APE.1.2	Vertical spatial coverage error	Percentage to which the extent of the vertical spatial coverage of TPD is compliant with the DPS extent in metres.	('TPD.AP.1.2' - 'DPS.AP.1.2')*100/'DPS.AP.1.2'	Percentage
3	TDP.APE.1.3	Temporal coverage error	Percentage to which the extent of the temporal coverage of TPD is compliant with the DPS extent in days.	('TPD.AP.1.3' - 'DPS.AP.1.3')*100/'DPS.AP.1.3'	Percentage
4	TDP.APE.2.1	Thematic content error	Percentage of Completeness/Incompleteness of the number of characteristics with respect to the list in DPS	('TPD.AP.2.1' - 'DPS.AP.2.1')*100/'DPS.AP.2.1'	Percentage

#QE	Indicator short name	Indicator long name	Definition of quality errors (indicators)	Error definition	Units
5	TDP.APE.3.1	Horizontal resolution error	Percentage to which the product averaged horizontal mesh size or horizontal scale is compliant with the DPS averaged mesh size or horizontal scale	('DPS.AP.3.1' - 'TDP.AP.3.1')*100/'DPS.AP.3.1'	Percentage
6	TDP.APE.3.2	Vertical resolution error	Percentage to which the product averaged vertical mesh size or vertical scale is compliant with the DPS averaged mesh size or vertical scale	('DPS.AP.3.2' - 'TDP.AP.3.2')*100/'DPS.AP.3.2'	Percentage
7	TDP.APE.3.3	Temporal sampling interval error	Percentage to which the product temporal sampling interval is compliant with the one defined in DPS (percentage to be extracted from text of AP.3.3 measure)	('DPS.AP.3.3' - 'TDP.AP.3.3')*100/'DPS.AP.3.3'	Percentage
8	TDP.APE.3.4	Thematic accuracy errror	Compliance with the value domain of the accuracy defined in DPS	TDP.AP.3.4'	Percentage
9	TDP.APE.4.1	Temporal validity error	Percentage to which the elapsed time of the product is compliant with the max elapsed time specified in DPS.	(DPS.AP.4.1-TDP.AP.4.1) * 100/DPS.AP.4.1	Percentage

Table A2.4 UD quality element error definitions

#QE	Indicator short name	Indicator long name	Definition of quality errors (indicators)	Error definition	Units
1	UD.APE.1.1	Horizontal spatial coverage error	Percentage to which the extent of the horizontal spatial coverage of UD is compliant with the DPS extent in km**2	('UD.AP.1.1' - 'DPS.AP.1.1')*100/'DPS.AP.1.1'	Percentage
2	UD.APE.1.2	Vertical spatial coverage error	Percentage to which the extent of the vertical spatial coverage of UD is compliant with the DPS extent in metres.	('UD.AP.1.2' - 'DPS.AP.1.2')*100/'DPS.AP.1.2'	Percentage
3	UD.APE.1.3	Temporal coverage error	Percentage to which the extent of the temporal coverage of TPD is	('UD.AP.1.3' - 'DPS.AP.1.3')*100/'DPS.AP.1.3'	Percentage

#QE	Indicator short name	Indicator long name	Definition of quality errors (indicators)	Error definition	Units
			compliant with the DPS extent in days.		
4	UD.APE.3.1	Horizontal resolution error	Percentage to which the product averaged horizontal mesh size or horizontal scale is compliant with the DPS averaged mesh size or horizontal scale	('DPS.AP.3.1' - 'UD.AP.3.1')*100/'DPS.AP.3.1'	Percentage
5	UD.APE.3.2	Vertical resolution error	Percentage to which the product averaged vertical mesh size or vertical scale is compliant with the DPS averaged mesh size or vertical scale	('DPS.AP.3.2' - 'UD.AP.3.2')*100/'DPS.AP.3.2'	Percentage
6	UD.APE.3.3	Temporal sampling interval error	Percentage to which the product temporal sampling interval is compliant with the one defined in DPS (percentage to be extracted from text of AP.3.3 measure)	('DPS.AP.3.3' - 'UD.AP.3.3')*100/'DPS.AP.3.3'	Percentage
7	UD.APE.3.4	Thematic accuracy error	Compliance with the value domain of the accuracy defined in DPS	UD.AP.3.4'	Percentage
8	UD.APE.4.1	Temporal validity error	Percentage to which the elapsed time of the product is compliant with the max elapsed time specified in DPS	('DPS.AP.4.1' - 'UD.AP.4.1')*100/'DPS.AP.4.1'	Percentage

5. Fitness for use indicators

The appropriateness indicators for UD defined up to now do not consider the error that propagates from the input data set on the quality of the Targeted product. In other words the UD errors could be larger than the one calculated as a difference with DPS because they greatly impact the quality of the Targeted Product. Vice versa, the UD errors could be large but their impact on the quality of the TDP small.

In mathematical terms, UD and TDP quality elements are two realizations of our expectations, given by DPS and the have two different errors ε, δ. Thus in principle it is possible, in a least square term, to combine these two estimates of the error to give a combined estimate.

We would like then to define a "combined error" for each UD that is defined now as the "fitness for use" error $\Delta_{FU}^{\%}$. The meaning is that for each upstream data set is given by input data set error "modulated" by the product error. Moreover Please note that "fitness" has to have the opposite meaning of "error" so that a change in sign is required.

We can have the following cases:

Errors	$\varepsilon_{TDP}^{\%}$ negative (underfitness)	$\varepsilon_{TDP}^{\%}$ null or positive (overfitness)
$\delta_{UD}^{\%}$ null or positive (overfitness)	$\Delta_{FU}^{\%} = 100 + \delta_{UD}^{\%}$ Over-Fitness for use Explanation: this is the case where the input data set is over fitted but the product is under fit. This may mean that some other input data set degrades the quality of the product, not the specific input data set under investigation	$\Delta_{FU}^{\%} = 100 + \frac{\lvert\varepsilon_{TDP}^{\%}\rvert\lvert\delta_{UD}^{\%}\rvert}{\sqrt{\varepsilon_{TDP}^{\%2} + \delta_{UD}^{\%2}}}$ Over-Fitness for use Explanation: this is the case where both the input data set and the product are over fitting the specifications. If $\varepsilon_{TDP}^{\%}$ is zero then $\Delta_{FU}^{\%} = 100$ meaning that it does not matter how positive is $\delta_{UD}^{\%}$ for that product
$\delta_{UD}^{\%}$ negative (underfitness)	$\Delta_{FU}^{\%} = 100 - \frac{\lvert\varepsilon_{TDP}^{\%}\rvert\lvert\delta_{UD}^{\%}\rvert}{\sqrt{\varepsilon_{TDP}^{\%2} + \delta_{UD}^{\%2}}}$ Under-Fitness for use Explanation: this is the case where both the input data set and the product is underfit. We "modulate" the input data set error with the product error. If both UD and TDP errors are negative FU is assumed zero	$\Delta_{FU}^{\%} = 100 - \frac{\lvert\varepsilon_{TDP}^{\%}\rvert\lvert\delta_{UD}^{\%}\rvert}{\sqrt{\varepsilon_{TDP}^{\%2} + \delta_{UD}^{\%2}}}$ Under-Fitness for use Explanation: this is the case where the input data set is underfit but the final product overfit. We "modulate" the input data set error with the product error. If $\varepsilon_{TDP}^{\%}$ is zero then $\Delta_{FU}^{\%} = 100$ and again it does not matter how negative is $\delta_{UD}^{\%}$ for that product

Applying these formulas to the data, results are not completely convincing, probably due to the scarce statistics of the UD and TDP errors (we have only 237 data sets subdivided among 62 TDP).

The application of FU indicator will be further developed when statistically significant number of errors will be available. The combination formula in fact should be used not with the errors but with the error standard deviations.