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SUPPLEMENTARY MATERIAL

A transnational marine ecological observatory in the Adriatic Sea to harmonize a fragmented approach to monitoring and conservation

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Tab. S1. List of the eleven Marine Strategy Framework Directive (MSFD) descriptors (Annex I, European Commission, 2008).

Descriptor 1.	Biodiversity is maintained
Descriptor 2.	Non-indigenous species do not adversely alter the ecosystem
Descriptor 3.	The population of commercial fish species is healthy
Descriptor 4.	Elements of food webs ensure long-term abundance and reproduction
Descriptor 5.	Eutrophication is minimised
Descriptor 6.	The sea floor integrity ensures functioning of the ecosystem
Descriptor 7.	Permanent alteration of hydrographical conditions does not adversely affect the ecosystem
Descriptor 8.	Concentrations of contaminants give no effects
Descriptor 9.	Contaminants in seafood are below safe levels
Descriptor 10.	Marine litter does not cause harm
Descriptor 11.	Introduction of energy (including underwater noise) does not adversely

Tab. S2. Descriptive indicators - *criteria* - of the MSFD with related criteria codes (EU 2017/848). Each criterion is linked to one MSFD descriptor (listed in Tab. S1).

Criteria code	MSFD descriptive indicators: Criteria
D1C1	Mortality rate from incidental by-catch
D1C2	Population abundance
D1C3	Population demographic characteristics
D1C4	Population distributional range and pattern
D1C5	Habitat for the species
D1C6	Pelagic habitat condition
D2C1	Newly-introduced NIS
D2C2	Established NIS
D2C3	Adverse effects of NIS
D3C1	Fishing mortality rate (F)
D3C2	Spawning stock biomass (SSB)
D3C3	Population age/size distribution
D4C1	Trophic guild species diversity
D4C2	Abundance across trophic guilds
D4C3	Trophic guild size distribution
D4C4	Trophic guild productivity
D5C1	Nutrient concentrations
D5C2	Chlorophyll-a concentrations
D5C3	The number, spatial extent and duration of harmful algal bloom events
D5C4	The photic limit (transparency)
D5C5	The concentration of dissolved oxygen
D5C6	The abundance of opportunistic macroalgae
D5C7	The species composition and relative abundance or depth distribution of macrophyte communities
D5C8	The species composition and relative abundance of macrofaunal communities
D6C1	Spatial extent and distribution of physical loss (permanent change)
D6C2	Spatial extent and distribution of physical disturbance pressures
D6C3	Spatial extent of each habitat type which is adversely affected, through change in its biotic and abiotic structure and its functions by physical disturbance
D6C4	Benthic habitat extent (loss)

Criteria code	MSFD descriptive indicators: Criteria
D6C5	Benthic habitat condition (extent of adverse effects including alteration to its biotic and abiotic structures and its functions)
D7C1	Spatial extent and distribution of permanent alteration of hydrographical conditions to the seabed and water column
D7C2	Spatial extent of each benthic habitat type adversely affected due to permanent alteration of hydrographical conditions.
D8C1	Concentrations of contaminants
D8C2	Health of species and the condition of habitats
D8C3	Spatial extent and duration of significant acute pollution events
D8C4	Effects of significant acute pollution events on the health of species and on the condition of habitats
D9C1	The level of contaminants in edible tissues of seafood
D10C1	The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed
D10C2	The composition, amount and spatial distribution of micro-litter on the coastline, in the surface layer of the water column, and in seabed sediment
D10C3	The amount of litter and micro-litter ingested by marine animals
D10C4	The number of individuals of each species which are adversely affected due to litter, such as by entanglement, other types of injury or mortality, or health effects.
D11C1	Spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources
D11C2	Spatial distribution, temporal extent, and levels of anthropogenic continuous low-frequency sound

Tab. S3. Descriptive indicators - *quality elements* - of the WFD (Annex V; European Commission, 2003) and associated criteria code of the MSFD. Notice that not all quality elements correspond to a MSFD criterion.

WFD descriptive indicators: Biological quality elements (BQE), hydromorphological and chemical and physico-chemical quality elements supporting BQE	Related MSFD Criteria Code
Composition of aquatic flora (macrophyte) Abundance of aquatic flora (macrophyte) Presence of sensitive taxa of flora (macrophyte)	D5C7
Abundance of phytobenthos Composition of phytobenthos Presence of sensitive taxa of phytobenthos	-
Abundance of phytoplankton Composition of phytoplankton Bloom frequency of phytoplankton Bloom intensity of phytoplankton Biomass of phytoplankton	D4C4, D5C2, D5C3
Composition of benthic invertebrate fauna Abundance of benthic invertebrate fauna Presence of sensitive taxa of invertebrate fauna	D6C5, D1C2, D1C3, D1C4
Diversity of invertebrate fauna	-
Composition of fish fauna Abundance of fish fauna Age structure of fish fauna Life cycle of fish fauna Presence of sensitive taxa of fish	D3C2, D3C3, D1C2, D1C4, D1C6, D1C3
Historical flow	-
Modelled flow	-
Real time flow	-
Water table height	-

WFD descriptive indicators: Biological quality elements (BQE), hydromorphological and chemical and physico-chemical quality elements supporting BQE	Related MSFD Criteria Code
Surface water discharge	-
Number and type of barriers	-
Provision for passage of aquatic organisms	-
River cross section	-
Flow	-
Cross sections	-
Particle size	D6C5
Presence of Catchment Water Drainage	-
Location of Catchment Water Drainage	-
Length of the riparian zone	-
Width of the riparian zone	-
Species composition of the riparian zone	-
Continuity of the riparian zone	-
Ground cover of the riparian zone	-
Temperature	D1C6, D5C4, D7C1
Dissolved oxygen	D5C5, D6C3, D6C5, D7C2
Electrical conductivity	D5C4, D7C1, D1C6
pH	D1C6, D5C1, D5C5
Alcalinity	-
Acid Neutralizing Capacity (ANC)	-
Total phosphorus	D5C1, D1C6, D5C5
Soluble reactive phosphorus	D5C1, D1C6, D5C5
Total nitrogen	D5C1, D1C6, D5C5

WFD descriptive indicators: Biological quality elements (BQE), hydromorphological and chemical and physico-chemical quality elements supporting BQE	Related MSFD Criteria Code
Nitrate + nitrite	-
Ammonium	-
Suspended solids	-
Turbidity	D1C6, D5C4, D7C1
Pollution by all priority substances identified as being discharged into the body of water Pollution by other substances identified as being discharged in significant quantities into the body of water	D8C1, D8C3
Composition of other aquatic flora (macrophyte)	D5C7
Abundance of other aquatic flora (macrophyte)	
Mixing patterns	-
Circulation patterns	-
Inflow	-
Outflow	-
Lake surface	-
Lake volume	-
Lake depth	-
Water content of the lake bed	-
Particle size of the lake bed	-
Elemental composition of the lake bed	-
Sedimentation age of the lake bed	-
Sedimentation rate of the lake bed	-
Length of the lake shore	-
Species composition of the riparian zone	-
Vegetation cover	D5C7
Bank features	-
Secchi depth	D5C4, D7C1, D1C6
Colour	-
Total Organic Carbon (TOC)	-

WFD descriptive indicators: Biological quality elements (BQE), hydromorphological and chemical and physico-chemical quality elements supporting BQE	Related MSFD Criteria Code
Presence/absence of invertebrate fauna	D6C5, D1C2, D1C3, D1C4
Bioaccumulation	D9C1
Bioassay	-
Freshwater inputs Residence time	D7C1
Exchange Wave exposure Basin shape	- - -
Particle size of the bed Organic content of the bed	D6C5, D6C3, D5C5, D7C2
Vegetation composition of the tidal zone Vegetation cover of the tidal zone Diversity of phytoplankton	- - -
Diversity of other aquatic flora (Macrophyte)	D5C7
Presence of sensitive taxa of macroalgae	-
Depth cover of macroalgae Distribution cover of macroalgae	- D5C7
Diversity of angiosperms Abundance of angiosperms Presence of sensitive taxa of angiosperms Depth cover of angiosperms Distribution cover of angiosperms	D5C7
Biomass of invertebrate fauna	D5C8, D1C6, D1C4
Tide speed Tide direction	- -
Wave speed Wave direction	D1C6, D7C1
Freshwater flow	D7C1
Hydrological budget Topography	- -

WFD descriptive indicators: Biological quality elements (BQE), hydromorphological and chemical and physico-chemical quality elements supporting BQE	Related MSFD Criteria Code
Particle size of the coastal bed	-
Solid rock of the coastal bed	-
General characteristics of the coastal bed	-
Particle size of the intertidal zone	-
Solid rock of the intertidal zone	-

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Tab. S4. Descriptive indicators - *parameters* - of the HD (EC, 2012) and associated criteria code of the MSFD. Notice that not all parameters correspond to a MSFD criteria.

HD descriptive indicators: Parameters	Related MSFD Criteria Code
Natural range of natural habitat types of community interest	D1C5
Area covered by natural habitat types of community interest	
Specific structure of natural habitat types of community interest	
Necessary functions of natural habitat types of community interest	-
Status of conservation of species in natural habitat types of community interest	D8C2
Population dynamics of animal and plant species of community interest	D1C2, D1C3, D1C4
Natural range of animal and plant species of community interest	D1C4
Presence of habitat for animal and plant species of community interest	D1C5
Population dynamics of animal and plant species of community interest in need of strict protection	D1C2, D1C3, D1C4
Natural range of animal and plant species of community interest in need of strict protection	D1C4
Presence of (sufficiently large) habitat of animal and plant species of community interest in need of strict protection	D1C5
Incidental capture and killing of animals of community interest in need of strict protection	D10C4
Presence of (sufficiently large) habitat of animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures	D1C5

Tab. S5. Descriptive indicators – *parameters* - of the BD (EU 2012) and associated criteria code of the MSFD. Notice that not all parameters correspond to a MSFD criterion.

BD descriptive indicators: Parameters	Related MSFD criteria code
Trends and variations in population for the species birds in the Annex I	
Trends and variations in population for species in danger of extinction	
Trends and variations in population for vulnerable species	D1C2, D1C3, D1C4
Trends and variations in population for species considered rare	
Trends and variations in population for other species requiring particular attention	
Trends and variations in population for migratory species not listed in the Annex I	
National lists of species in danger of extinction	
Listing and ecological description of areas important to migratory species	-
Listing population levels of migratory species as shown by ringing Role of certain species as indicators of pollution	
Adverse effect of chemical pollution on population levels of bird species	D8C4

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