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User Needs Analysis for the Definition of Operational Coastal Services

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Table S1. Parameters grouped into specific typology defined by their properties.

Parameters Typology	Parameters
Bio-geo-chemical	Nutrients, CDOM, Chlorophyll a, Hydrocarbons, Dissolved Oxygen, pH, Salinity, Phytoplankton, Surface biological m asses, TSM, Fecal bacteria, Salinity, Temperature
Land Cover	Habitat characterization, Seabottom vegetation cover, Seabottom vegetation cover, Sediment properties
Physical	Current, Waves, Temperature, Sea level,
Geomorphologic	Bathymetry, DEM/DTM/DSM, Coastline, Subsidence,
Hydro-meteo	Meteorological drivers, Flooding,
Pollutants transport	Turbidity, River flow
Land use and manmade structures	Defense and port structures, Land use, Sea use, Aquaculture plants,

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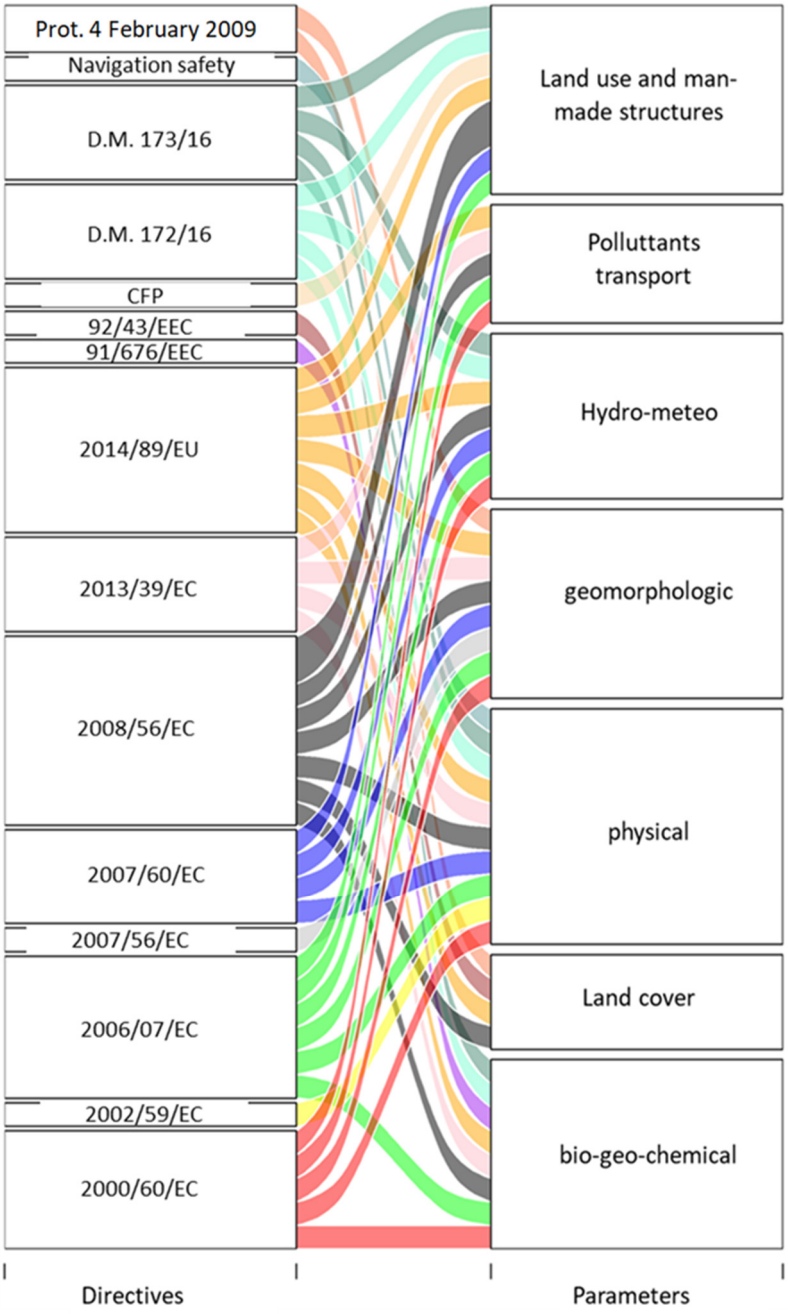


Figure S1. Sankey diagram representing relation between directives and different typology of parameters.

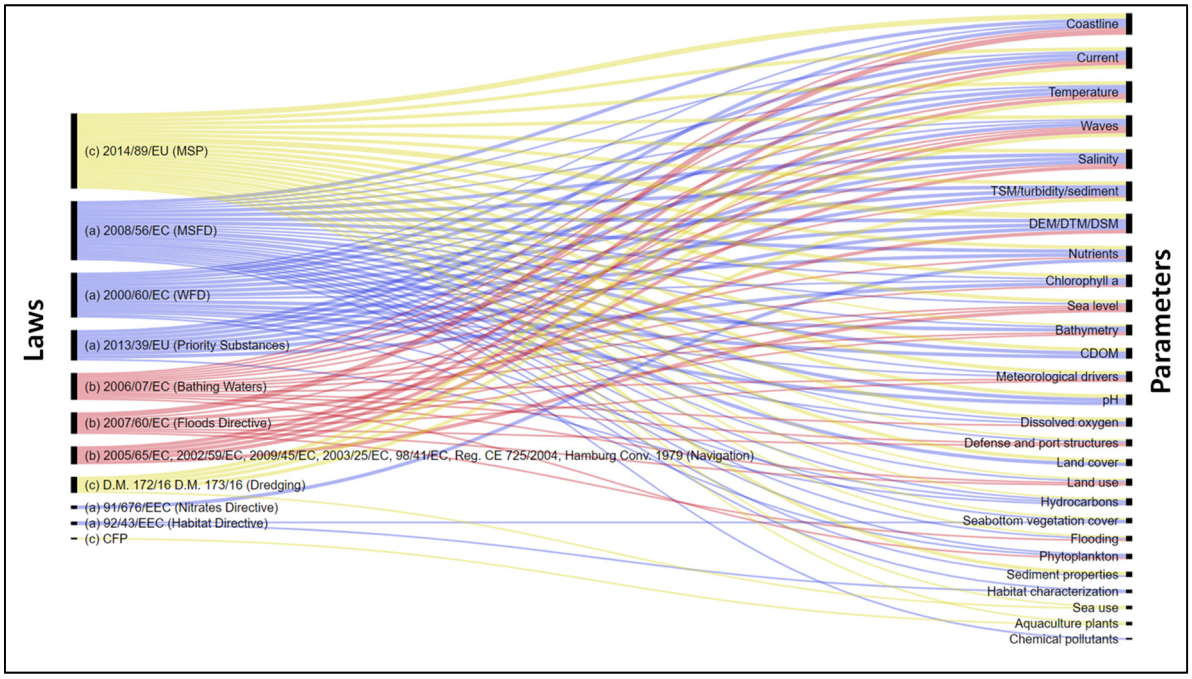


Figure S2. Sankey diagram connecting required parameters and European Directives. The links between laws and parameters have different colors depending on the main directives topic: (**a**) blue for directives linked to environmental protection, (**b**) red for directives linked to risk and human health, (**c**) yellow for directives linked to anthropic activities management.

Table S2. Description of the main European Directives and Italian Laws, grouped for topic.

Topic	European Directives	Italian Laws
Environmental protection	▪ **2000/60/EC**: Directive establishing a framework for Community action in the field of water policy. ▪ **2008/56/EC**: Directive establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). ▪ **2013/39/EU**: Directive amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. ▪ **91/676/EEC**: Directive concerning the protection of waters against pollution caused by nitrates from agricultural sources. ▪ **92/43/EEC**: Directive on the conservation of natural habitats and of wild fauna and flora.	▪ **D.Lgs. 152/2006**: Environmental regulations. ▪ **D.M. 260/2010**: Regulation containing the technical criteria for the classification of the state of surface water bodies. ▪ **D.Lgs. 190/2010**: Implementation of Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy. ▪ **D.Lgs. 152/1999**: Provisions on the protection of waters from pollution and implementation of Directive 91/271/EEC concerning the treatment of urban waste water and of Directive 91/676/EEC relating to the protection of water from pollution caused by nitrates from agricultural sources. ▪ **D.Lgs. 172/2015**: Implementation of Directive 2013/39/EU, which amends Directives 2000/60/EC as regards priority substances in the field of water policy. ▪ **D.P.R. 120/2003**: Regulation concerning the implementation of Directive 92/43 / EEC relating to the conservation of natural and semi-natural habitats, as well as wild flora and fauna. ▪ **D.M. 172/16**: Regulation governing the procedures and technical standards for dredging operations in sites of national interest ▪ **D.M. 173/16**: Regulation containing the modalities and technical criteria for the authorization of immersion in the sea of dredged seabed sediments. ▪ **L. 28/06/2016 n. 132**: Establishment of the national network system for environmental protection and regulation of the Institute for environmental protection and research.
Risk and human health	▪ **2006/07/EC**: Directive concerning the management of bathing water quality and repealing Directive 76/160/EEC. ▪ **2007/60/EC**: Directive on the assessment and management of flood risks.	▪ **D.Lgs. 116/2008**: Implementation of Directive 2006/7/EC relating to the management of the quality of bathing water and repeal of Directive 76/160 / EEC

Topic	European Directives	Italian Laws
		▪ **D.M. 30/03/2010**: Definition of the criteria for determining the prohibition of bathing, as well as modalities and technical specifications for the implementation of D.Lgs. 116/2008. ▪ **D.Lgs. 49/2010**: Implementation of Directive 2007/60/EC on the assessment and management of flood risks. ▪ **D.Lgs. 1/2018**: Civil Protection code.
Anthropic activities management	▪ **2014/89/EU**: Directive establishing a framework for maritime spatial planning. ▪ **2005/65/EC**: Directive on enhancing port security. ▪ **2002/59/EC**: Directive establishing a Community vessel traffic monitoring and information system and repealing Council Directive 93/75/EEC ▪ **2009/45/EC**: Directive on safety rules and standards for passenger ships. ▪ **2003/25/EC**: Directive on specific stability requirements for ro-ro passenger ships. ▪ **98/41/EC**: Directive on the registration of persons sailing on board passenger ships operating to or from ports of the Member States of the Community ▪ Reg. CE **725/2004**: Regulation on enhancing ship and port facility security. ▪ **Hamburg Convention 1979**: International Convention on Maritime Search and Rescue ▪ **ICZM**, **Prot. 4/2/2009**: Recommendation on Integrated Coastal Zone Management ▪ **Common Fishery Polices (CFP):** a set of rules for managing European fishing fleets and for conserving fish stocks	▪ **D.Lgs. 201/2016**: Implementation of Directive 2014/89/EU establishing a framework for maritime spatial planning. ▪ **D.Lgs. 196/2005:** Implementation of Directive 2002/59/EC on the establishment of a Community system for monitoring and information on ship traffic. ▪ **D.Lgs. 187/2008**: Amendments and additions to the D.Lgs. 196/2005. ▪ **D.Lgs. 65/2005**: Implementation of Directive 2003/25/EC relating to specific stability requirements for ro-ro passenger ships. ▪ **D.Lgs. 25/2018**: Implementation of Directive (EU) 2016/844, which amends Directive 2009/45/EC, relating to the provisions and safety standards for passenger ships. ▪ **D. Interm. 14/07/2003**: Decree of the Ministry of the Interior regarding the oppositions against illegal immigration ▪ **D.Lgs. 286/1998**: Consolidated text concerning immigration regulations and regulations on the status of foreigners. ▪ **D.P.R. 662/94**: Implementation of the law 3 April, n. 147/1989, concerning accession to the international convention on maritime search and rescue. ▪ **D.Lgs 4/2012**: Measures for the reorganization of the legislation on fisheries and aquaculture ▪ **D.Lgs. 203/2007**: Implementation of Directive 2005/65 / EC on the improvement of safety in ports. ▪ **L. 979/1982**: Regulations for the defence of the Sea. ▪ **R. D. 327/1942**: Approval of the definitive text of the Navigation Code ▪ **D.Lgs. 145/2015**: Implementation of Directive 2013/30/EU on the safety of operations at sea in the hydrocarbon sector.

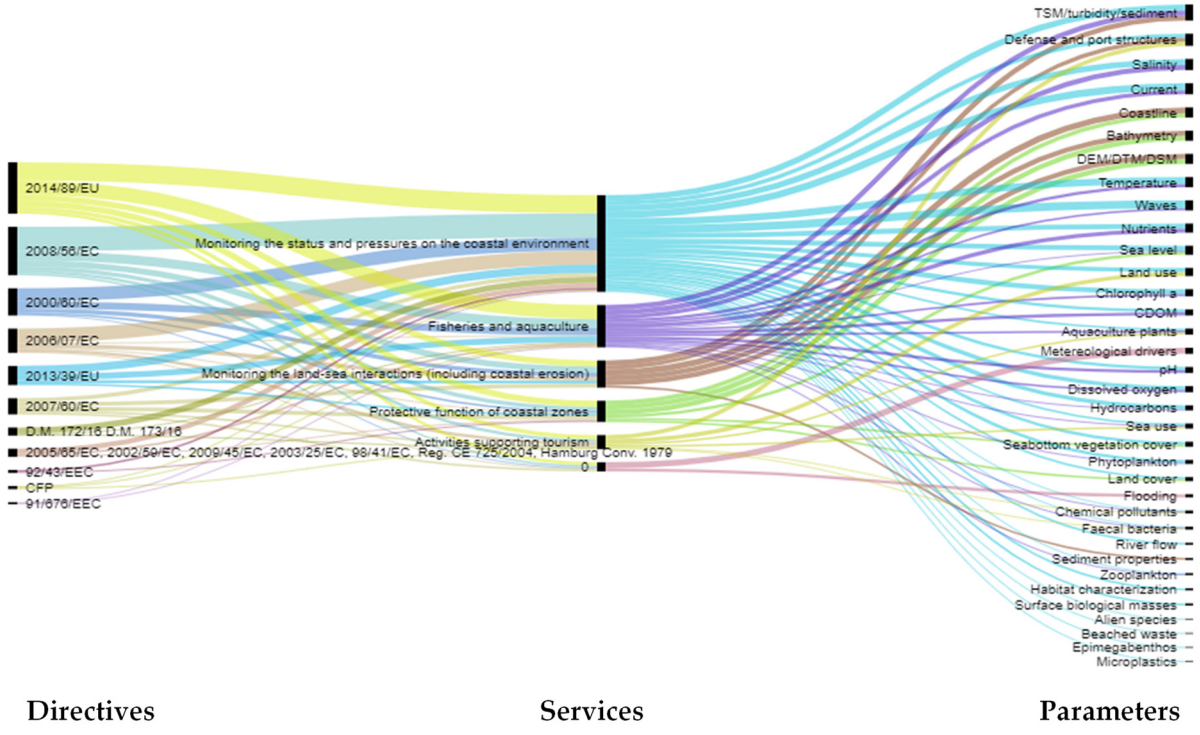


Figure S3. Sankey diagram representing the relations between European Directives (on the left), thematic services identified in the Copernicus Marine-Land RoadMap (in the middle) and parameters (on the right). Service "0" represents the lack of services for some parameters and related directives.

Table S3. Copernicus Marine-Land RoadMap services and relative parameters provided.

RoadMap CMEMS + CLMS Services				
Monitoring the Status and Pressures on the Coastal Environment	**Monitoring the Land-Sea Interactions (Including Coastal Erosion)**	**Fisheries and Aquaculture**	**Activities Supporting Tourism**	**Protective Function of Coastal Zones**
Alien species	Bathymetry	Aquaculture plants	Aquaculture plants	Bathymetry
Aquaculture plants	Coastline	CDOM	Chemical pollutants	Coastline
Beached waste	Defense and port structures	Chlorophyll a	Defense and port structures	DEM/DTM/DSM
CDOM	DEM/DTM/DSM	Chemical pollutants	Faecal bacteria	Land cover
Chlorophyll a	Sediment properties	Current	Hydrocarbons	Sea level
Chemical pollutants	TSM/turbidity/ sediment	Dissolved oxygen	Land use	Seabottom vegetation cover
Current		Faecal bacteria	Sea use	
Defense and port structures		Phytoplankton	Surface biological masses	
Dissolved oxygen		Hydrocarbons		
Epimegabenthos		Nutrients		
Faecal bacteria		pH		
Phytoplankton		Salinity		
Habitat characterization		Sea level		
Hydrocarbons		Sea use		
Land cover		Surface biological masses		
Land use		Temperature		
Microplastics		TSM/turbidity/sediment		

Nutrients	Waves
pH	Zooplankton
River flow	
Salinity	
Sea level	
Sea use	
Seabottom vegetation cover	
Surface biological masses	
Temperature	
TSM/turbidity/sediment	
Waves	
Zooplankton	

Table S4. comparison between the clustered spatial resolution of Italian downstream services and Copernicus Core services.

Parameters	**National Coastal Services**		**Copernicus Core Services**
	Coastal Services	**Spatial Resolution (Clustered)**	**Spatial Resolution (Clustered)**
Bathymetry	Specific products for hot spot areas (port areas and aquaculture) (L2)	5 m/25 m	250 m/500 m
Bathymetry	Coastal geomorphology monitoring (L1)	1 m /5 m	250 m/500 m
Bathymetry	Coastal geomorphology monitoring (L1)	50 m/250 m	250 m/500 m
CDOM	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
CDOM	Specific products for hot spot areas (port areas and aquaculture) (L2)	5 m/25 m	1 Km/5 Km
Chlorophyll a	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Chlorophyll a	Specific products for hot spot areas (port areas and aquaculture) (L2)	50 m/250 m	1 Km/5 Km
Current	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Current	Specific products for hot spot areas (port areas and aquaculture) (L2)	5 m/25 m	1 Km/5 Km
DEM/DTM/DSM	Coastal geomorphology monitoring (L1)	1 m/5 m	25 m/50 m
DEM/DTM/DSM	Emerged coast characterization (L2)	1 m/5 m	25 m/50 m
Dissolved oxygen	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Dissolved oxygen	Specific products for hot spot areas (port areas and aquaculture) (L2)	50 m/250 m	1 Km/5 Km
Land cover	Emerged coast characterization (L2)	1 m/5 m	5 m/25 m
Land cover	Habitat and Ecosystem services monitoring (L1)	1 m/5 m	5 m/25 m
Meteorological drivers	Specific products for hot spot areas (port areas and aquaculture) (L2)	50 m/250 m	10 Km/15 Km
Nutrients	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Nutrients	Specific products for hot spot areas (port areas and aquaculture) (L2)	50 m/250 m	1 Km/5 Km
Phytoplankton	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km

Salinity	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Salinity	Specific products for hot spot areas (port areas and aquaculture) (L2)	50 m/250 m	1 Km/5 Km
Sea level	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Sea level	Specific products for hot spot areas (port areas and aquaculture) (L2)	50 m/250 m	1 Km/5 Km
Temperature	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Temperature	Specific products for hot spot areas (port areas and aquaculture) (L2)	5 m/25 m	1 Km/5 Km
Waves	Sea state monitoring and forecasting (L1)	250 m/500 m	1 Km/5 Km
Waves	Specific products for hot spot areas (port areas and aquaculture) (L2)	50 m/250 m	1 Km/5 Km