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## THE IMPLEMENTATION OF THE MARINE STRATEGY FRAMEWORK DIRECTIVE IN ITALY: KNOWLEDGE TO SUPPORT THE MANAGEMENT

### *L'IMPLEMENTAZIONE DELLA DIRETTIVA QUADRO PER LA STRATEGIA MARINA IN ITALIA: LA CONOSCENZA A SUPPORTO DELLA GESTIONE*

**Abstract** - *The main objective of the MSFD is to achieve or maintain GES in the marine environment by the year 2020. According to MSFD, GES is defined in terms of 11 descriptors and using a number of criteria and indicators associated to each descriptor. National implementation of the Directive is illustrated through the analysis of selected descriptors.*

**Key-words:** *Marine Strategy Framework Directive, Good Environmental Status, environmental target.*

**Introduction** - In the last decades awareness has raised that “pressure on natural marine resources and the demand for marine ecological services are often too high and that the European Community needs to reduce its impact on marine waters regardless of where their effects occur” (Directive 2008/56/EC). On the other hand, “The marine environment is a precious heritage that must be protected, preserved and, where practicable, restored with the ultimate aim of maintaining biodiversity and providing diverse and dynamic oceans and seas which are clean, healthy and productive” (EC, 2013).

To meet these needs, the European Parliament and the Council of the European Union, on 17<sup>th</sup> June 2008, enacted the Marine Strategy Framework Directive 2008/56/EC (MSFD); Italy, as due by all Member States, transposed it in its national legislation through the Legislative Decree n. 190 of 13<sup>th</sup> October 2010. The Directive promotes the integration of environmental considerations into all relevant policy areas and constitutes the environmental pillar of the future Integrated Maritime Policy (IMP) for the European Union (Casazza *et al.*, 2007; Tunesi *et al.*, 2008).

The MSFD main objective is to establish a framework for all Member States to take the necessary measures to achieve and/or maintain Good Environmental Status (GES) in the marine environment by 2020. The Directive applies to all marine waters, seabed and subsoil of areas where Member States have and/or exercise jurisdictional rights, which entail an integral part of different marine regions and subregions. The different steps for the application of the Directive (“General provisions”) are being described in details along this paper.

After legal transposition and designation of the competent Authority/ies responsible for the implementation of the Directive, Member States have to develop marine strategies, in respect of the marine regions/subregions concerned, for their marine waters; these strategies shall follow a plan of action which consists of a “preparation phase” and a “programme of measures”.

The Italian Dlgs.190/2010 states (art. 4) the Ministry of the Environment and for the Protection of Land and Sea (MATTM), as the Competent Authority for the Marine Strategy, with coordination functions for national activities; a specific Technical Committee has been established, under art. 5, for this purpose. Members of the Technical Committee, under the Presidency of MATTM, include: one representative from each Region and the Autonomous Provinces, a representative

of the Union of Italian Provinces, a representative of the National Association of Italian Municipalities, one representative for each of the following ministries: Ministry of Agriculture Policies and Forestry, Ministry of Infrastructure and Transport, Ministry of Health, Ministry of Defence, Ministry of Foreign Affairs, Ministry of Research, Ministry for Cultural Assets, Activities and Tourism, Ministry for Economic Development and the Department for Regional Affairs. The Italian National Institute for Environmental Protection and Research (ISPRA) supports the Ministry of the Environment for scientific, technical and coordination activities, under definition of specific Administrative Arrangements.

#### *Areas of interest and international cooperation*

The Directive divides the European marine waters in four Marine Regions: the Baltic Sea, the Black Sea, the Mediterranean Sea and the North-east Atlantic Ocean, including the waters surrounding the Azores, Madeira and the Canary Islands. Some regions have been further subdivided, considering the specificities of particular areas, into specific subregions. In the Mediterranean, four subregions have been identified:

- a) The Western Mediterranean Sea,
- b) The Adriatic Sea,
- c) The Ionian Sea and the Central Mediterranean Sea,
- d) The Aegean and Levantine Sea.

Italian marine waters belong to the three first subregions.

The diverse conditions, problems and needs of the various marine regions or subregions require different and specific approaches and solutions. These diversities should be taken into consideration during the different phases of the Directive's implementation: preparation, planning and application of measures to achieve good environmental status in the Community's marine environment. Each Member State should therefore develop a marine strategy for its marine waters which, while being specific to its own waters, reflects the overall perspective of the marine region or subregion concerned. By reason of the transboundary nature of the marine environment, Member States should cooperate to ensure the coordinated development of MS marine strategies for each marine region/subregion, where both EU Member States and third countries co-exist. Every effort should be made to ensure close coordination with all countries included in the marine region. Third countries should be invited to participate in the process laid down in MSFD, thereby facilitating achievement of good environmental status in the entire marine region. Where practical and appropriate, existing regional institutional cooperation structure, such as Regional Sea Conventions (RSC) shall be used. The effectiveness of using these tools is clearly related to the structure and actions' capability of the four different RSC which, in their marine regions, include diverse Contracting Parties i.e. EU or not EU Members, resulting into political, economical and social differences.

Within the Mediterranean RSC, the Barcelona Convention (UNEP/MAP), only one third of Contracting Parties are EU Members and the diversities of the Mediterranean countries are substantial. To facilitate addressing and applying the important principles and actions of the MSFD to the entire marine region a specific Project (ECAP) is being developed within the Convention; its actions and related timing is gradually improving but, at the moment, it is not sufficient for the Mediterranean EU Members to achieve the necessary coordination required by the Directive, in due time.

In this framework, the Med-EU MS, where feasible, are self organising, on a voluntary base, at the level of subregions. A few meetings already occurred for the Western Mediterranean among Italy, France and Spain and one between Italy, Slovenia and Malta for the Adriatic Sea and the Central Mediterranean. Just recently

the European Commission highlighted the need to strengthen the coordination among the Mediterranean EU MS and is trying to facilitate more meetings among these countries.

Actions at international level are fundamental to achieve effective cooperation and coordination, therefore the Directive should further enhance the coherence of the Community contribution to all international agreements. For example, the Regular Process for global reporting and assessment of the state of the marine environment, including socio-economic aspects, established under the auspices of the United Nations, organised a Regional Workshop in Brussels (June 2012), where Italy participated.

The Community and its Member States are each parties to the United Nations Convention on the Law of the Sea (Unclos) approved by Council Decision 98/392/EC of 23 March 1998. The obligations of the Community and its Member States under those agreements should therefore be taken fully into account in this Directive. In addition to the provisions applicable to the marine waters of the Parties, the Unclos includes general obligations to ensure that activities under the jurisdiction or control of a Party do not cause damage beyond its marine waters, and to avoid that damage or hazards are transferred from one area to another or that one type of pollution is transformed into another.

Following Unclos, Italy recently established, by Decree of President of the Republic n. 209 of 27<sup>th</sup> October 2011, an Ecological Protected Zone including Tyrrhenian Sea, Ligurian Sea and a sea area, from the western Sardinia coast up to approximately 200 miles extension where National and Community Law applies in relation to prevention and mitigation of all types of marine pollution, biodiversity and marine ecosystems protection, with particular regard to the protection of marine mammals and preservation of cultural heritage found in its sea bed. As a consequence, MSFD applies also to such Ecological Protected Zone, covering all the Western Mediterranean Sea Basin pertaining to Italy (Fig. 1).

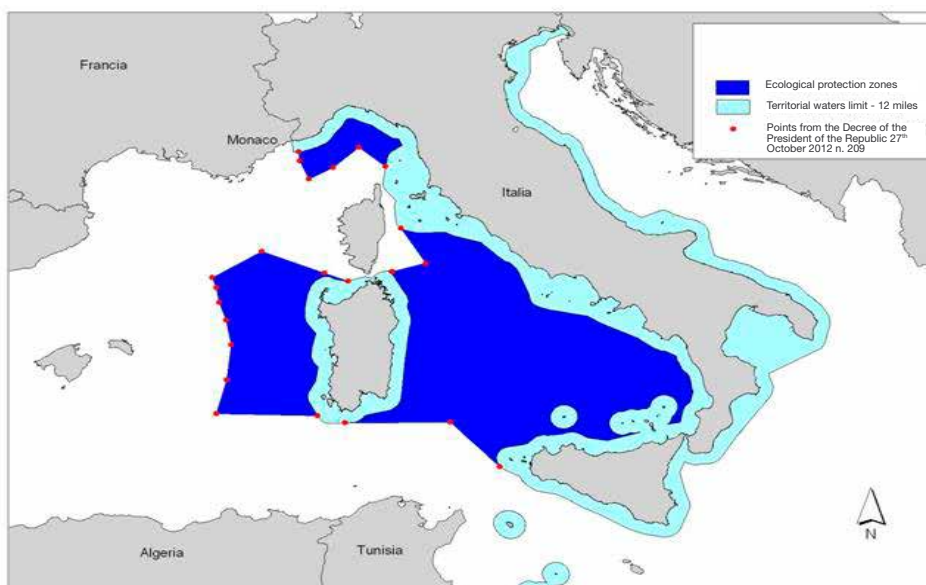


Fig. 1 - MSFD marine waters application in Italy.

*L'applicazione della MSFD nelle acque marine in Italia.*

### *MSFD and relations with other EC Directives and the Common Fishery Policy*

Many EU policies affect the marine environment, in particular those dealing with fisheries, transport, industry, agriculture, regional development, research, energy, external relations, as well as important elements of environment policy such as water. But these policies are not specifically designed to protect the marine environment in a coordinated manner. Accordingly, human activities impacting the marine environment are addressed in a sector by-sector manner.

The MSFD aims at ensuring the coherence, consistency and integration of measures taken pursuant to various other EU legal instruments in order to meet its key objective. Therefore, as stipulated by Article 20, when considering the contribution of the MSFD to international obligations and commitments, it is necessary to take into account obligations set and measures provided by other EU legislation at community level (EC, 2012a).

Marine environmental protection under MSFD includes establishment of protected areas, in particular taking in consideration areas already designated or that have to be designated under Habitats Directive 92/43/EEC, Birds Directive 79/409/EEC and under other international or regional agreements to which the European Community or Member States concerned are Parties. Furthermore, establishing such protected areas under MSFD will be an important step towards fulfilling the commitments undertaken at the World Summit on Sustainable Development and in the Convention on Biological Diversity, so to contribute to the creation of coherent and representative networks of such areas.

In relation to fishery, the proposed reform of the Common Fishery Policy (CFP) in 2012 requires all stock to be above levels capable of producing maximum sustainable yield and to take into account the environmental impacts of fishing. It requires expressly integrating the objectives of the MSFD. Thus the Marine Directive complements the CFP, providing the link between fishery policies and other essential aspects of environmental protection.

Other examples of crucial coherence with other Directives on environmental protection are highlighted in the field of water policy. Coastal waters, including their seabed and subsoil, are an integral part of the marine environment, and as such are covered by MSFD, but also the Water Framework Directive (2000/60/EC) already address coastal waters protection for some specific points. In order to ensure complementarity while avoiding unnecessary overlaps, those aspects of the environmental status of the marine environment not already addressed through the Water Framework Directive or other Community legislation, are specifically covered by MSFD.

**Articulation of the MSFD - main aspects** - In view of the dynamic nature of marine ecosystems and their natural variability, and given that the pressures and impacts on them may vary with the evolvement of different patterns of human activity and the impact of climate change, it is essential to recognise that the determination of good environmental status may have to be adapted over time. Accordingly, it is appropriated that also programmes of measures for the protection and management of the marine environment be flexible and adaptive, taking into account the scientific and technological developments. As a consequence MSFD envisages an updating process of marine strategies on a regular basis, based on a six-year cycle (Fig. 2) made of the following steps:

1. Initial assessment of state characteristics, pressures and impacts – art. 8
2. Determination of GES – art. 9
3. Establishment of environmental targets – art. 10
4. Monitoring programmes – art. 11
5. Programmes of measures – art. 13

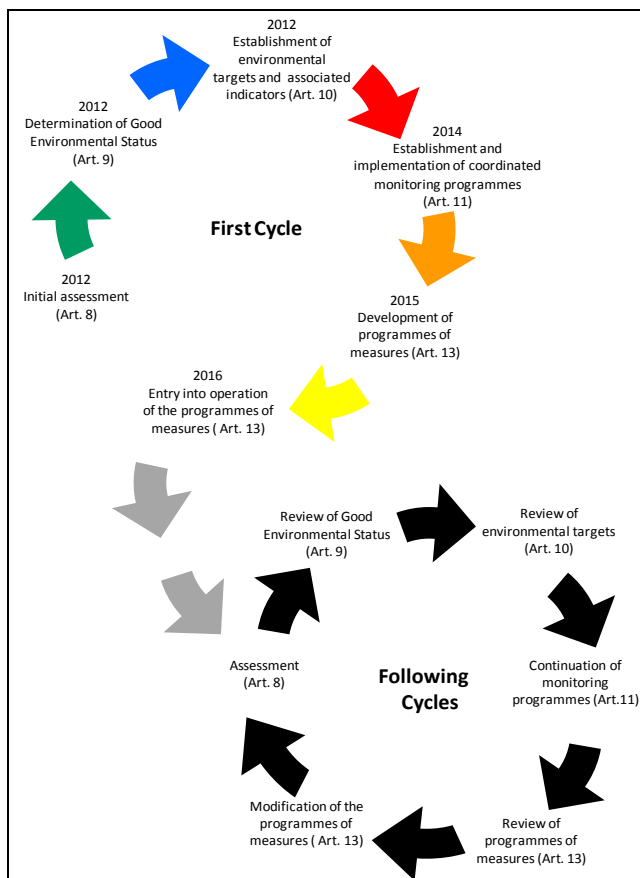


Fig. 2 - The MSFD management cycle (EC, 2011b).  
 Il ciclo di gestione della MSFD (EC, 2011b).

As a first step in the preparation of programmes of measures, Member States across a marine region or subregion should undertake, following art. 8 of MSFD, an analysis of the features or characteristics of, and pressures and impacts on, their marine waters, identifying the predominant pressures and impacts on those waters, and an economic and social analysis of their use and of the cost of degradation of the marine environment.

On the basis of such analyses, Member States should then determine for their marine waters a set of characteristics for good environmental status (art. 9 of MSFD).

The Commission Decision (EC, 2010) indicates the approach to be adopted for the determination of GES, outlining for the 11 descriptors under the MSFD, 26 criteria and 56 associated indicators (Tunesi, 2012). The 11 descriptors consist of statement defining environmental objective to be respected and covers state, pressures and impacts of marine environment: biodiversity, non-indigenous species, extraction of commercial fishes (fishing), food web, eutrophication, sea-floor integrity, hydrologic processes, contaminants in water, sediments and biota, contaminants in seafood, marine litter and underwater noise.

Furthermore, also assessment of state characteristics, pressures and impacts should be ideally based using criteria and indicators defined in the Commission

Decision following a detailed matrix established in the Commission Staff Working Paper (EC, 2011a). For the first cycle of MSFD, starting from 2012, initial assessment has been based on available data and information with a poor use of indicators, most of which have to be made fully operational by 2018.

The next step towards achieving good environmental status is the establishment of environmental targets (art. 10) and monitoring programmes (art. 11) for ongoing assessment, enabling the state of the marine waters concerned to be evaluated on a regular basis.

Member States should then establish and implement programmes of measures (art. 13) which are designed to achieve or maintain good environmental status in the waters concerned, while accommodating existing Community and international requirements and the needs of the marine region or subregion concerned. Those measures should be based on an ecosystem-based approach to the management of human activities and devised on the basis of the precautionary principle and the principles that preventive action should be taken, that environmental damage should, as a priority, be rectified at source and that the polluter should pay.

However, it should be recognised that achieving or maintaining GES in every aspect may not be possible in all marine waters by 2020. In this respect, MSFD consider two special cases. The first special case refers to the situation where it is impossible for a Member State to meet its environmental targets because:

- a) of action or inaction for which the Member State concerned is not responsible;
- b) of natural causes or force majeure;
- c) of actions which that Member State has itself taken for reasons of overriding public interest which outweigh the negative impact on the environment;
- d) natural conditions do not allow timely improvement in the status of marine waters.

Anyway, the Member State concerned should substantiate why it considers that such a special case has arisen and identify the area concerned, and should take appropriate ad-hoc measures with the aim of continuing to pursue the environmental targets, preventing further deterioration in the status of the marine waters affected and mitigating the adverse impact within the marine region or subregion concerned.

The second special case refers to the situation where a Member State identifies an issue which has an impact on the environmental status of its marine waters, perhaps even of the entire marine region or subregion concerned, but which cannot be tackled by measures taken at national level or which is linked to another Community policy or to an international agreement. In such a case, arrangements should be made to inform the Commission of this within the framework of notification of programmes of measures and, where Community action is needed, to make appropriate recommendations to the Commission and the Council.

Indeed, the objectives of MSFD, namely protection and preservation of the marine environment, the prevention of its deterioration and where practicable the restoration of that environment in areas where it has been adversely affected, cannot be sufficiently achieved by Member States and can therefore, by reason of the scale and effects of the Directive, be better achieved at Community level, the Community may adopt measures, in accordance with the principle of subsidiarity as set out in Article 5 of the Treaty.

Furthermore, programmes of measures executed under marine strategies will be effective only if they are devised on the basis of a sound knowledge of the state of the marine environment in a particular area and are tailored as closely as possible to the needs of the waters concerned in the case of each Member State and from the general perspective of the marine region or subregion concerned, an appropriate

framework is needed at national level for marine research and monitoring operations. Also at Community level, recognition of marine issues in the Seventh Framework Programme on Research and Development and Horizon 2020 is an important step in that direction.

In order to ensure cohesion of action across the Community as a whole and in relation to commitments at global level, Member States have to notify the Commission of the steps taken under art. 8, 9, 10, 11 and 13 by a reporting exercise, in order to enable the Commission, following art. 12, to assess whether, in the case of each Member State, the elements notified constitute an appropriate framework to meet the requirements MSFD and may ask the Member State concerned to provide any additional information that is available and necessary. The Commission shall also consider the coherence of frameworks within the different marine regions or subregions and across the Community. Within six months of receiving the report, the Commission informs Member States concerned whether, in its opinion, the elements notified are consistent with this Directive and provides guidance on any modifications it considers necessary.

At the time of writing, Italy has finalized and notified to the Commission its report on Initial assessment (art. 8), determination of GES (art. 9) and environmental targets (art. 10) on 30<sup>th</sup> April 2013 and is waiting for the Commission assessment response.

The “initial assessment” (I.A.) of the state of the marine environment, as well as the evaluation of GES, were to be conducted only on the basis of existing data and information. To this regard ISPRA activated the collaboration of the different Italian holders of data and information in order to validate, elaborate environmental and socio-economic data and determine GES for the 11 descriptors. Scientific contributions provided by an extensive network of national experts and researchers (more than 250) from 24 Universities (including 20 referring to CoNISMa), 6 CNR Institutes, ARPA, ENEA, CIBRA, INGV, ISS, OGS, SZN, Zooprofylactic Institutes, Marine Protected Areas, Research Centre of Cesenatico, foundations and environmental groups.

To ensure the active involvement of the general public in the establishment, implementation and updating of marine strategies, art. 19 of MSFD prescribes a proper public information process on the different elements of marine strategies, their related updates, as well as, upon request, relevant information used for the development of the marine strategies. Italy has carried on such process thought the implementation of a web site - <http://www.strategiamarina.isprambiente.it/> where all relevant products have been published together with an on-line questionnaire whose responses have been taken into account in the final version of Report MSFD.

**The assessment areas** - Article 25 and 24(2) of MSFD foresee a role for the Regulatory Committee in the definition of technical formats to be adopted by Member States for transmission and processing of analytical, statistical and cartographic data related to Report MSFD. Following a subsequent agreement between Member States and the Commission, a specific Working Group has been established to define such technical formats and information standards, that is Working Group on Data and Information Knowledge Exchange – WG DIKE. For the first cycle of reporting, some additional tools have been developed in WG DIKE, such as the possibility to identify specific assessment areas inside subregions where initial assessment (art. 8) can be carried out (EC, 2012b).

Such approach, i.e. defining assessment areas inside subregions, enabled to choose a proper spatial scale where is possible to restrict the assessment and also



future monitoring programmes with defined characteristics, pressures and impacts. In particular, Report MSFD requires, for each characteristics and pressure, to define at least one assessment area per subregion. Some criteria and constraint have been considered to define assessment areas. In particular every assessment area should:

- be representative of relevant elements for the specific characteristics or pressure to which the area is associated (e.g. extension of predominant habitats, presence and habitat of species, area subject to input of contaminants or nutrients);
- include pressures, impacts or activities related to the specific characteristics or pressure;
- be the target for future monitoring programmes and programmes of measures.

In fact, the most important aspect is that the total number and extension of assessment areas should allow, for each characteristics and pressure, to determine GES at subregion scale. Following such criteria, for each assessment area the relevant components are:

- pressures/activities;
- specific elements (e.g. predominant habitats, species, functional groups);
- indicators.

Considering the geographical extension, the main characteristic of assessment area, the methodology developed for its definition is based essentially on GIS procedures and spatial analysis elaboration. First of all, GIS layers representing information on pressures/activities and specific elements have been produced for each subregion. Such layers have been transformed in gridded format by spatialization procedures in order to compare them more easily.

Specific indicators and associated indices have been selected according to available data and information and calculated on gridded layers. Assessment area should also include ideally at the same time reference condition zones, zones subject to impacts but restorable by proper foreseeable programmes of measures and zones too impacted to be restored. In this context reference condition zones should be understood as zone with a sustainable level of pressure and not “only” in a pristine status. Such partition should guarantee that reaching GES in assessment areas assures GES at subregion scale. Superimposing different layers produced list of assessment areas with list of predominant habitats, functional groups and species impacted with also an estimate of the percentage of assessment areas subjected to specific pressures, impacts or activities.

Tab. 1 shows the number of assessment areas subdivided for subregions, characteristics and pressures.

**GES determination** - The determination of GES must be done for each subregion and for each of the 11 Descriptors (MSFD - Annex 1). Following the Commission Decision (EC, 2010), for each descriptor a set of criteria and indicators have been established. According to the structure of Report MSFD, for the first cycle, i.e. 2012 Report, determination of GES could be made choosing one of the following levels:

- level of indicator (at least one indicator for each descriptor);
- level of criteria (at least one criteria for each descriptor);
- level of descriptor.

Choosing the level of indicator means that at least one indicator should be selected among the available indicators established by the Commission Decision for the descriptor. For such indicator one or more indexes should be considered and a threshold value must be defined at subregion scale so to indicate that GES is reached if the value of index is above or below such threshold.

Tab. 1 - Number of assessment areas proposed by Italy subdivided for subregion and characteristics and pressures.

*Numero di aree di valutazione proposte dall'Italia suddivise per sottoregione e per caratteristiche e pressioni.*

	Western Mediterranean Sea	Ionian Sea & Central Mediterranean Sea	Adriatic Sea
Physical features	3	2	3
Habitats	10	3	4
Functional groups	8	5	4
Species	17	15	11
Ecosystem	1	1	1
Non-indigenous species inventory	1	1	1
Other features	1	1	1
Physical loss	4	2	2
Physical damage	3	2	2
Underwater noise	1	1	1
Marine litter	3	2	2
Hydrological processes	1	1	1
Contaminants	4	3	4
Nutrients enrichments	4	2	3
Microbial pathogens	1	1	1
Non-indigenous species	1	1	1
Extraction of species	3	2	2
Marine acidification	3	2	3
Socio-economic analysis	3	1	1

In order to identify such threshold, it is necessary to evaluate the index in the assessment areas associated to the characteristics or pressures belonging to the descriptor. These specific thresholds values coming from different assessment areas have to be spatially integrated using some kind of criteria such as, for example the “one out all out” principle. According to such principle if the index fails to respect the threshold value in at least one of the assessment area, GES is not reached at subregion scale. So even if only one indicator is selected for the descriptor, at least some kind of spatial integration procedure taking into account all the assessment areas involved is required in order to define GES at subregion scale (EC, 2012b).

Considering two or more indicators for descriptor implies an integration of the different threshold values and index evaluation associated to the indicators, in order to produce a single combine indicator and threshold value representative of all the indicators considered. The determination of GES at the level of criteria implies an integration of all the indicators belonging to the selected criteria. Such integration scheme reproduces for the determination of GES at the level of descriptor where all criteria belonging to the descriptor have to be integrated to produce a single threshold value for GES assessment at subregion scale.

MS Italy has defined GES qualitatively at the level of indicator for each descriptor, in some cases also threshold values have been given but most of indicators selected have to be implemented and made fully operational by 2018 setting specific monitoring programmes starting from 2014 (Tab. 2). Among the 56 indicators listed in the Commission Decision, Italy has selected 35. Only 8 indicators are already fully operational in 2012, 27 will be operational by 2018.

Tab. 2 - Time in which the indicators, selected for the determination of GES, will be operational.  
*Periodo in cui gli indicatori selezionati per la determinazione del GES saranno operativi.*

Descriptor	Indicators selected for the determination of GES	Indicator operational in or by		
		2012	2014	2018
D. 1	1.2.1 Population abundance and/or biomass, as appropriate (class structure, sex ratio, fecundity rates, survival/mortality rates)		Only for birds	✓
	1.3.1 Population demographic characteristics (e.g. Body size or age)		Only for birds	✓
	1.3.2 Population genetic structure, where appropriate			
	1.5.1 Habitat area			✓
	1.6.1 Condition of the typical species and communities			✓
	1.6.2 Relative abundance and/or biomass, as appropriate			✓
D. 2	2.1.1 Trends in abundance, temporal occurrence and spatial distribution in the wild of non-indigenous species, particularly invasive non-indigenous species, notably in risk areas, in relation to the main vectors and pathways of spreading of such species			✓
	2.2.2 Impacts of non-indigenous invasive species at the level of species, habitats and ecosystem, where feasible			✓
D. 3	3.1.1 Fishing mortality (F)	✓		
	3.1.2. Ratio between catch and biomass index (hereinafter 'catch/biomass ratio')	✓		
	3.2.1 Spawning Stock Biomass (SSB)	✓		
	3.2.2 Biomass indices	✓		
	3.3.3 95 % percentile of the fish length distribution observed in research vessel surveys	✓		
D. 4	1.7.1 Composition and relative proportions of ecosystem components (habitats and species)			✓
	4.1.1 Performance of key predator species using their production per unit biomass (productivity)			✓
	4.2.1 Large fish (by weight)			✓
	4.3.1 Abundance trends of functionally important selected groups/species			✓
D. 5	5.1.1 Nutrients concentration in the water column			✓
	5.1.2 Nutrient ratios (silica, nitrogen and phosphorus), where appropriate			✓
	5.2.1 Chlorophyll concentration in the water column			✓
	5.2.2 Water transparency related to increase in suspended algae, where relevant			✓
	5.2.4 Species shift in floristic composition such as diatom to flagellate ratio, benthic to pelagic shifts, as well as bloom events of nuisance/toxic algal blooms (e.g. cyanobacteria) caused by human activities			✓
	5.3.2 Dissolved oxygen, i.e. changes due to increased organic matter decomposition and size of the area concerned			✓

Descriptor	Indicators selected for the determination of GES	Indicator operational in or by		
		2012	2014	2018
D. 6	6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types			✓
D. 7	7.1.1 Extent of area affected by permanent alterations		✓	
D. 8	8.1.1 Concentration of the contaminants mentioned above, measured in the relevant matrix (such as biota, sediment and water) in a way that ensures comparability with the assessments under Directive 2000/60/EC	✓		radio nuclides
	8.2.1 Levels of pollution effects on the ecosystem components concerned, having regard to the selected biological processes and taxonomic groups where a cause/effect relationship has been established and needs to be monitored	✓		radio nuclides
D. 9	9.1.1 Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels	✓		
D. 10	10.1.1 Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source			✓
	10.1.2 Trends in the amount of litter in the water column (including floating at the surface) and deposited on the sea- floor, including analysis of its composition, spatial distribution and, where possible, source			✓
	10.1.3 Trends in the amount, distribution and, where possible, composition of micro-particles (in particular micro- plastics)			✓
	10.2.1 Trends in the amount and composition of litter ingested by marine animals (e.g. stomach analysis)			✓
D. 11	11.1.1 Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as Sound Exposure Level (in dB re 1µPa 2 .s) or as peak sound pressure level (in dB re 1µPa peak) at one metre, measured over the frequency band 10 Hz to 10 kHz			✓
	11.2.1 Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1µPa RMS; average noise level in these octave bands over a year) measured by observation stations and/or with the use of models if appropriate			✓

In order to show concrete results of the implementation process of MSFD by Italy, the descriptors 1, 2, 4 and 6 will be illustrated hereinafter.

For Descriptor 1 on Biodiversity, the following 4 of seven criteria included in the Commission Decision have been selected:

- 1.2 Population size
- 1.3 Population condition
- 1.5 Habitat extent
- 1.6 Habitat condition

Criteria 1.7 on Ecosystem structure has been considered only for Descriptor 4 on Food Webs. Tab. 3 summarizes which indicators and biological components have been considered to determine GES for the Descriptor 1, according to Annex 1 reference and term lists (EC, 2012b). As an example, Tab. 4 shows qualitative GES description for indicator 1.2.1.

Tab. 3 - Descriptor 1 - Indicators and biological components considered by Italy to determine GES.

*Descrittore 1 – Indicatori e componenti biologiche considerate dall'Italia per la determinazione del GES.*

<b>Indicator</b>	<b>Biological component</b>
1.2.1 on Population abundance and/or biomass, as appropriate	Marine birds <i>Pinna nobilis</i> Coastal fish species Marine reptiles ( <i>Caretta caretta</i> ) Marine mammals
1.3.1 Population demographic characteristics (e.g. Body size or age class structure, sex ratio, fecundity rates, survival/mortality rates)	<i>Patella ferruginea</i> Marine birds Coastal fish species
1.3.2 Population genetic structure, where appropriate	Fish
1.5.1 Habitat area	Benthic habitat ( <i>Posidonia oceanica</i> , mærl)
1.6.1 Condition of the typical species and communities	Benthic habitat (Coralligenous, deep corals) Demersal elasmobranchs Coastal fish fauna
1.6.2 Relative abundance and/or biomass, as appropriate	Pelagic habitat (Plancton) Demersal elasmobranchs

For Descriptor 2 on Non-indigenous species, GES has been proposed taking into account the following indicators:

- 2.1.1 - Trends in abundance, temporal occurrence and spatial distribution in the wild of non-indigenous species, particularly invasive non-indigenous species, notably in risk areas, in relation to the main vectors and pathways of spreading of such species
- 2.2.2 - Impacts of non-indigenous invasive species at the level of species, habitats and ecosystem, where feasible

Indicator of impact 2.2.1 on *Ratio between invasive non-indigenous species and native species in some well studied taxonomic groups (e.g. fish, macroalgae, molluscs) that may provide a measure of change in species composition (e.g. further to the displacement of native species)* has been considered not practical because it requires an extremely high effort of sampling compared to the indication of the impact that

could provide. Indeed, impacts that may fall into this category are not known in any of the three sub-Mediterranean regions.

GES for indicator 2.1.1 is regarded as a condition in which there is no increase in the value of the indicator (invasive species abundance and frequency) with respect to the value observed in specific areas with both a high probability of introduction of non-indigenous species and high ecological value.

In such specific areas, for indicator 2.2.2, GES is a condition with no increase of impact, estimated by using as indicator the value of Biopollution Index according to the method of Olenin *et al.* (2007).

Tab. 4 - Qualitative GES description for indicator 1.2.1.

*Descrizione qualitative del GES per l'indicatore 1.2.1.*

Biological component	Description of GES
Birds	The populations of seabirds should be compatible with conservation status compliant to Birds Directive and, where relevant, AEWa agreement. In particular, the GES is achieved when the abundance of populations of key species (selected according to their actual and total dependence on the marine environment) does not fall below the average values at baseline.
<i>Pinna nobilis</i>	GES is achieved when the number of individual per square meters of <i>Pinna nobilis</i> is maintained in a specific area or not significantly altered due to anthropogenic causes.
Coastal fish species	GES is achieved when the values of abundance (number of individuals per 125 square meters) and biomass (weight of individuals per 125 square meters) for the species <i>Diplodus sargus</i> , <i>Diplodus vulgaris</i> , <i>Epinephelus marginatus</i> are equal to or exceed the thresholds.
Marine reptiles ( <i>Caretta caretta</i> )	GES is reached when the trend of the abundance of the populations of <i>Caretta caretta</i> is stable or not reducing in a statistically significant way taking into account the natural variability compared to the current situation.
Marine mammals	GES is reached when the trend of the abundance of the populations of cetacean species, selected according to their ecological representativeness ( <i>Balaenoptera physalus</i> , <i>Tursiops truncatus</i> and <i>Stenella coeruleoalba</i> ) is stable or not reducing in a statistically significant way taking into account the natural variability compared to the current situation.

Regarding Descriptor 4 on Food Webs, Commission Decision has proposed 4 indicators, namely:

1.7.1 - Composition and relative proportions of ecosystem components (habitats and species)

4.1.1 - Performance of key predator species using their production per unit biomass (productivity)

4.2.1 - Large fish Index (by weight)

4.3.1 - Abundance trends of functionally important selected groups/species

The use of indicator 4.1.1 has been excluded for GES definition because this indicator has been proposed on the basis of data and time series that are available for two species of mammals and seabirds in the North Sea, which implies that it is not applicable in the Mediterranean context.

For indicator 1.7.1 GES is reached when main ecosystem components are in line with prevailing natural conditions. To do this, first of all, it is necessary to identify in each ecosystem the prevailing functional groups and habitats. It appears more complex to assess which of these functional groups are not in line with prevailing physiographic, ecological and climatic conditions prevailing, since this evaluation assumes that data are available for most of the functional groups and habitats but, in general, this is not the case.

Regarding the functional groups, it has been possible to estimate with quantitative approach the trend in the following groups:

- Demersal fishes;
- Demersal elasmobranchs;
- Deep sea elasmobranchs;
- Deep sea fishes.

As regards the analysis of prevailing habitats, only preliminary mapping data with the scale of precision required for most of the marine areas taken into consideration by MSFD are available (almost no data for the sub-region Ionian Sea and the Central Mediterranean) and even less is available on the assessments of their status. Nevertheless, at least for the Western Mediterranean Sea and the Adriatic Sea, it is possible to provide sufficient data on the type of prevailing substrate/habitat, but a strong uncertainty associated with the assessment of the impacts on these elements remains due to the absence of thresholds and reference data of “sea truth”.

Large Fish Indicator (LFI) related to indicator 4.2.1 has been proposed to catch functional characteristics of food webs, but data available for Length Frequency Distribution (LFD) must be converted to biomass data, in order to apply LFI. The set of approximations related to the use of allometric relations, not always precise, and the limited number of species for which LFD data are available, make the LFI difficult to use. As a consequence no threshold value has been defined for such indicator.

According to Commission Decision, for indicator 4.3.1, it is necessary to identify changes in population status potentially affecting food web structure on the basis of suitable groups/species including:

- Groups with fast turnover rates (e.g. phytoplankton, zooplankton, jellyfish, bivalve molluscs, short-living pelagic fish) that will respond quickly to ecosystem change and are useful as early warning indicators,
- Groups/species that are targeted by human activities or that are indirectly affected by them (in particular, by-catch and discards),
- Habitat-defining groups/species,
- Groups/species at the top of the food web,
- Long-distance anadromous and catadromous migrating species,
- Groups/species that are tightly linked to specific groups/species at another trophic level.

For Italy, GES is reached when no significant abundance trend is observed which indicates an alteration toward a bad status, for the following list:

- Seagrasses
- Phytoplankton
- Zooplankton
- Jellyfish
- Bony fishes
- Elasmobranchs
- Ichthyophagous fish

- Marine reptiles
- Marine mammals

As regards sea floor integrity treated by Descriptor 6, only indicator 6.1.2 on *Extent of the seabed significantly affected by human activities for the different substrate types* has been used for GES definition because abrasion mainly due to fishing activities has been identified as one of the main pressures.

The qualitative description of GES is the following: GES is characterized by the absence of significant pressure due to abrasion, determined by fisheries that operate on the seabed (demersal, “*rapido*” and hydraulic dredges), and seal (coastal defense works, platforms, cables, etc.) of biogenic substrates.

The term “biogenic substrates” includes the following habitats: *Posidonia oceanica*, Mäerl, coralligenous beds, *tegnùe*, deep corals.

In particular on biogenic substrates:

- The pressure determined by the fishing is always considered as significant, as a consequence it must be absent, taking into account a limit of uncertainty (10%) inherent with the method of evaluation of the presence of the pressure;
- The pressure due to sealing is always considered as significant and must be, without prejudice of any provisions resulting from the application of different regulations.

On other types of “non biogenic substrate” (sand, mud, mixed, etc.):

- The pressure determined by the fisheries that interact on the seabed in an active way (otter trawl, “*rapido*” and hydraulic dredge) is considered to be significant when the area interested by the pressure is higher than a maximum acceptable percentage of area (taking into account a specific temporal unit) to be determined by 2018.

The pressure determined by sealing does not contribute to determine GES.

**Establishment of environmental targets** - Environmental targets have to be defined in order to reach the GES by 2020 as the MSFD requires. The scale of the Targets is the subregion as the GES. European Commission (2011b) has identified two types of targets:

- GES target;
- Interim GES target.

“GES target” guarantees that if the target is reached also GES is reached. “Interim GES target” do not guarantee once reached, that GES is also reached but they represent an intermediate step in the process of reaching GES.

Identification of targets implies the selection of one indicator and one threshold value associated to target, so target is reached if the value of the index of its indicator is above or below the threshold value. Indicators for targets can be classified according to the following list:

- State (e.g. status of a species);
- Pressure (e.g. concentration of contaminants);
- Impacts (e.g. dissolved oxygen concentration);
- Operational.

Indicators for targets do not necessarily belong to Commission Decision list for GES assessment. Operational indicators are usually associated with the implementation of measures such as administrative act that mitigate specific pressures, for example reduction of fishing vessels in specific areas for a period of time.



Environmental targets defined in 2012 must be reached by 2018, when a new cycle of assessment of characteristics and pressures, revision of GES and targets will be carried out (Fig. 1).

Due to the lack of information and data, and the poor level of implementation of indicators for GES determination, MS Italy has adopted mainly operational targets which, in many cases, are linked with on-going measures prescribed by other European Directive such as Habitats Directive, Urban Waste Water Directive, Nitrate Directive or prescription following Common Fishery Policy.

Environmental targets can be associated to one descriptor or more descriptors. For example, targets specific only for Descriptor 1 are the following:

- Implementation of control measures and training to avoid picking activities of benthic species – Indicators 1.2.1, 1.3.1;
- Implementation of training measures and awareness to reduce mortality from by-catch of demersal elasmobranchs – Indicators 1.6.1, 1.6.2;
- Mitigation of accidental catches: implementation of a mechanism for assessing the sustainability of accidental mortality caused by fishing activities on cetaceans – Indicator 1.2.1

Tab. 5 shows the proposed targets associated to more than one descriptor.

Tab. 5 - List of the environmental targets proposed by Italy associated to more than one descriptor.  
*Lista dei traguardi ambientali proposti dall'Italia associati a più di un descrittore.*

Environmental Target	Descriptor
Reduction of by-catch in the areas of aggregation of <i>Caretta caretta</i>	D1, D4
Limitation of the impacts resulting from physical loss of biogenic substrates	D1, D6
Limitation of fishing on biogenic substrates	D1, D6, D3
Limitation of fishing on non biogenic substrates	D6, D3
Species exploited by commercial fishing	D1, D3

Target proposed for Descriptor 2, on non-indigenous species, regards the implementation of an early warning system that provides, very quickly, the information on introduced species and the vector of introduction and dispersion so that the competent authorities can take appropriate actions (EEA, 2010).

For Descriptor 4 a general target is also proposed in order to consider more general interaction with Descriptors 1, 3, 6 and 5.

By 2018 it will be necessary to make progress towards improving the status of the individual structural components of ecosystems by the implementation of environmental targets identified within the MSFD descriptors considered as a all (in particular D1, D3, D6, D5). In geographic areas (assessment areas or ecosystems) with critical situation, targets are geared towards mitigation/removal of the causes of human disturbance.

**Concluding remarks** - The MSFD clearly highlights the need for adequate information to support the management of human activities. The overview on the results achieved by Italy underlines the need for adequate data, and a deeper ecological and environmental knowledge, essential to identify clear relationships of cause and effect.

At present, despite the large number of data and information related to the marine environment collected at national level, on the basis of existing data and

information has not been possible to develop an overall assessment of the status of the marine environment as required by the Directive, mainly due to an inadequacy of such data/information characterized by an insufficient spatial and temporal scales and lack of homogeneity in the methodologies adopted.

On the basis of the selected descriptors illustrated in this paper, it is possible to conclude that several gaps and ambiguities remain in relation to the Descriptors 1, 2, 4 and 6. Even if a number of pressure/state interactions are qualitatively relatively well known in relation to specific ecosystem components, there is still a need of further quantitative understanding. There is still an insufficient integration among the different disciplines supporting the understanding of the relationships between human pressures and their adverse effects on marine ecosystems and biological diversity. For instance, the initial assessment has shown that Italy has a relatively small proportion of benthic habitats mapped at the appropriate resolution, with a heavy dependence on modeling being used to assess habitat distribution in particular for the western subregion. For this reason there is the need of developing specific pressure-based assessments, conceived taking in considerations the following aspects:

- spatial distribution and extent of benthic habitats;
- spatial distribution and intensity of pressures;
- understanding of the relations between pressures and their impacts on habitats.

And consider also the need of incorporating the effects of cumulative impacts (Korpinen *et al.*, 2012).

The lack of existing indicators and targets for habitats stress the need of specific research activities to face the aspects related to the scale of the assessment and the identification of quantitative thresholds.

Regarding environmental targets, in order not to overburden the financial resources, Italy has established, in most cases, operational targets that are directly linked to management actions. This approach allows the use of a series of measures already enforceable in the framework of existing legislation whose funding is already provided.

The next key steps are the development of monitoring programmes, by 15 July 2014, that can fill the gaps in knowledge and standardizing as much as possible methodological approaches.

Through the monitoring programmes will be collected data to validate the indicators for the assessment of good environmental status. Moreover, there will be the need to implement additional measures to those already existing and strengthen controls and compliance with the existing rules. The future monitoring programs should be determined by reference and, as far as possible, by integrating existing or forthcoming implementation, planned within other legal frameworks (Habitats, Birds, Water Framework Directives and Common Fisheries Policy) and international commitments such as the Barcelona Convention, the Convention on Biological Diversity and the United Nations Convention on the law of the Sea, that define rights and responsibilities of States in the use of the seas and oceans.

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