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Citizen science as a tool for the environmental quality assessment of Mediterranean coastal habitats

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1 Introduction

1.1 Environmental quality assessment and the need of reliable indices

The human impacts on the ecosystems and living resources have grown in the last century. Coastal areas are among the most threatened marine environment and the need of environmental quality assessment tools is urgent (Rosenberg et al. 2004). This can be obtained by developing and applying reliable biotic indices, which may provide complementary information on marine community and support decision-making processes.

1.1.1 Types of indices

Different types of indices have been used in ecology for environmental quality assessment ranging from species diversity to biotic indices, from single metric to multimetric indices.

Species diversity indices are focused on the trade-off between diversity and disturbance: as a classic paradigm, normally the diversity increase when the disturbance decreases (e.g. Rosenberg et al. 2001). Measures of local species diversity (α-diversity; *sensu* Whittaker 1972) may focus on the number of living specie (species richness), on the relative dominance in terms of individual abundance (evenness, e.g. Pielou and Simpson indices) or on the combination of these two components (e.g. Shannon index; Magurran 2004). A biotic index is a measure for rating the environmental quality based on biological and ecological attributes of the organism living in the study site. It should provide quantitative information on ecological condition, structure and functioning of ecosystems (Jørgensen et al. 2005, Ponti et al. 2009). The multimetric approach provides an integrate analysis by combining different categories of metrics which reflect various environmental and community conditions (Jameson et al. 2001).

1.1.2 Review of indices available for the Mediterranean marine habitats

According to the current European legislation, the achievement and maintaining good status for marine coastal water are compulsory goals for the European national governments. Through the enforcement of the Water Framework Directive (WFD; Directive 2000/60/EC) and the Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC), the European Union encourages the conservation of aquatic systems and the development of management strategies for water resources. Thus, tools to assess the ecological quality status of marine environment are mandatory for achieving the settled goals and adopting strategies to preserve the water quality from worsening. With these aims, several studies were focused on the identification of biological indicators and biotic indices able to assess the ecological water quality of marine ecosystem (Casazza et al. 2002, Borja et al. 2004, Simboura et al. 2005, Borja et al. 2009, Leonardsson et al. 2009, Van Hoey et al. 2010). Some of the proposed ecological indices take into account the presence/absence of a given indicator species, while others are focused on the species diversity, the different ecological strategies adopted by organisms, or finally the energy variation in the system as a results of a changes in the biomass of specimens (Salas et al. 2006).

Among the indices developed to assess the environmental quality of Mediterranean habitats, there are: the CARtographic of LITtoral rocky shore communities (CARLIT), which is based on the occurrence of macroalgae communities (Ballesteros et al. 2007a, Ballesteros et al. 2007b, Mangialajo et al. 2007, Asnaghi et al. 2009); the Ecological Evaluation Index (EEI), for subtidal coastal and transitional waters, focusing on the morpho-fuctional characteristic of the most common macroalgae and their growth strategy (Orfanidis et al. 2011); and the Ecosystem-Based Quality Index (EBQI) dedicated to assess the functioning of the posidonia meadows (Personnic et al. 2014). Review of the indices developed for the Mediterranean coastal lagoons can be found in Jørgensen et al. (2005) and in Ponti et al. (2009).

For evaluate the ecological quality of Mediterranean coralligenous assemblages (*sensu* Ballesteros 2006) the most relevant indices are: the Coralligenous Assemblage Index (CAI; Deter et al. 2012), the Coralligenous Assessment by

Reef Scape Estimate index (COARSE; Gatti et al. 2012, Gatti et al. 2015) and the Ecological Status of Coralligenous Assemblages (ESCA; Cecchi et al. 2014).

The CAI is a multimetric index based on percent cover of bryozoans, sludge and builder species (Deter et al. 2012).

The purpose of CAI is to evaluate the water quality on the base of coralligenous assemblages. Coralligenous assemblages were analysed using two non-destructive protocols: photographic quadrats and demography of erected species. The sample sites were chosen to represent different human pressure. The metrics were selected through a linear regression based on a different index (*Anthropogenic Pressure Index*) that includes three descriptors of water quality according to thresholds set by the Agency for French waters. The reference conditions were defined as the best result among the selected metrics for the index. The index was developed using one-year data in one area, therefore it need for more validation.

COARSE multimetric index integrates biological, ecological and geomorphologic information obtained using a Rapid Visual Assessment technique, which appear very subjective, with metrics of doubtful utility and a limited replication. Furthermore, the construction and validation was done without using independent dataset.

The ESCA multimetric index is mainly based on the macroalgae assemblages (Cecchi et al. 2014). The index was developed based on previous impact evaluation studies on the NIS *Caulerpa cylindracea,* the increasing rate of sedimentation and the nutrient enrichment. It was validated on an independent dataset collected during a 3-year study carried out at five sites in the Tyrrhenian Sea, and tested on a gradient of anthropogenic stressors. Assemblage descriptors selected as metrics were: presence/absence and abundance of sensitive taxa/groups, α-diversity and β-diversity of assemblages.

On overall, the proposed indices for coralligenous habitats still seem unreliable, approximate, little based on ecological and functional, and lacking in a rigorous definition of the reference conditions.

1.2 Thematic maps

The Mediterranean Sea is a global biodiversity hot spot challenged by increasing human pressure, which includes pollution, habitat modification, harvesting and climate change (Worm et al. 2006, Jackson 2008, Micheli et al. 2013). The implementation of efficient management tools, such as thematic maps, are needed to ensure long-term ecosystem conservation and the availability of goods and services they provide (Palumbi et al. 2009, Curtin & Prellezo 2010, Katsanevakis et al. 2011, Craig 2012, Ostendorf 2011, Bierman et al. 2011).

The Integrated Coastal Zone Management (ICZM) and the Ecosystem Based Management (EBM) are integrated approaches that consider the entire ecosystem, including humans. It provides a mechanism for a strategic and integrated plan-based approach for marine management. Given the territorial nature of EBM, the diagnostic cartography is the tool needed for its application (Curtin & Prellezo 2010, Katsanevakis et al. 2011, Bianchi et al. 2012, Meidinger et al. 2013). Through the application of suitable indicator and indices, diagnostic cartography describes, links and visually represents the relationship between human impacts and the status of coastal and marine ecosystem.

1.2.1 Territorial units and administrative boundaries

Thematic maps are designed to communicate quantitative and/ or qualitative data (attributes) related to defined areas. Areas are normally divided in small and manageable units, which are called territorial unit. Territorial units may coincide with administrative territories (e.g. municipalities, provinces, management and monitoring zones within a marine protected area), otherwise they could be defined according to environmental criteria (e.g. habitats) or ultimately they could be represented by grid cells of manageable size (Bianchi et al. 2012). The choice of suitable territorial unit depends on several considerations including the objective and purpose of spatial analysis, data organization, distribution and density of collected data, which has to be consistent with the spatial resolution.

Below the main typologies of thematic maps are described.

1.2.2 Species distribution and habitats mapping

Along with the morpho-bathymetric and sedimentological maps, habitat and bionomic maps are among the most common cartographic tools used to characterise the marine environment. They provide the basis for subsequent spatial analyses (Bianchi et al. 2012, Meidinger et al. 2013). Bionomic maps are important to understand ecological processes occurring in marine habitats.

1.2.3 Maps of natural emergencies

A natural emergency is a natural feature, species or habitat, which requires intervention to prevent a status worsening. Therefore, natural emergencies may be represented by protected species and/or protected habitats according to national laws and international conventions. From a management point of view, protected species can be distinguished in three main categories: those in need of strict protection (e.g. Annex IV of the European Habitats Directive, 92/43/EEC); those requiring to be considered in the management actions (e.g. Annex V of the Habitats Directive); and those listed as endangered but no particular conservation measures are required (e.g. in the Annexes of the Washington Convention on the International Trade in Endangered Species of wild fauna and flora, CITES; Bianchi et al. 2012). By analogy, threatened habitats could be divided in priority habitats, for which protection is mandatory (e.g. *Posidonia oceanica* meadow and coastal lagoons in the Annex I of the Habitats Directive), and other sensitive habitats which should deserve more attention (e.g. the coralligenous and other calcareous bio-concretions in the Mediterranean Sea, UNEP-MAP-RAC/SPA 2008). Thus, a natural emergencies map provides synthetic information showing the level of attention and practical intervention that should be given to distinct areas of the marine territory. However, the information on the updated distribution of protected species are hardly available for mapping (Possingham et al. 2007).

1.2.4 Environmental degradation and risk maps

Environmental degradation is the deterioration in environmental quality through depletion of resources and it is caused, directly or indirectly, by human activities.

A map describing the environmental degradation has to take into account the level, intensity and quality, of coastal urbanization and visualize indices/ indicators of marine ecosystem alterations (Borja et al. 2009, Bianchi et al. 2012, Coll et al. 2012). The levels of degradation could be represented by different colour. Each colour means a decrease in naturalness, hence an increase in environmental degradation. Specific symbols overlaid can inform on potential risks (infrastructures, pollution, urban and tourist development, fishery for examples) in the investigated area (Bianchi et al. 2012).

1.2.5 Vulnerability maps

The fragility or vulnerability to exogenous and endogenous stress factors is the capacity of the ecosystem of maintains its structure and functions when facing real or potential unfavourable influences. Vulnerability may be assigned at the habitat level (e.g. in Bellan-Santini et al. 2002) and can account for the rarity of each habitat in the area of interest (Bianchi et al. 2012).

1.2.6 Environmental and ecological quality maps

Measure and mapping the environmental and ecological quality is one of the most important steps in ICZM and EBM. According to Bianchi et al. (2012), the overall environmental quality may be assessed by combining the potential quality of the habitats (obtained, for instance, assigning a natural, economic, aesthetic, and rarity values to each habitat; Bardat et al. 1997) with the level of degradation or integrity (e.g. considering the physical, chemical and biological characteristics, as provided in the MSFD for the seafloors). In this respect, adequate indicators and indices, for instance based on sensitivity of species towards diverse sources of disturbance, may provide further insights in different habitats (Diaz et al. 2004, Rosenberg et al. 2004, Van Hoey et al. 2010).

1.2.7 Susceptibility to use map

Using different colours, a susceptibility to use map provides indications on the potential use of a given site for human activities. These maps highlight the relationship between the habitat importance according to law and the presence of protected species according to law as well. The result is an easy management tool to discriminate areas subordinated to conservation (strict protection) from areas where the conservation is not tightly required (maximum availability) (Bianchi et al. 2012).

1.3 Citizen science: an essential contribution

Citizen science (CS) is the involvement of non-technical volunteers as researchers. CS has grown up in the last decades and it has become more important in conservation science (Whitelaw et al. 2003, Conrad & Hilchey 2011). The growing factors are primarily the increasing awareness that volunteers are a free source of skills, labour-force and computational power and secondly the existence of informatics tools that can spread easily the information about project and gathering data from the participants (Silvertown 2009). However, there is scepticism about the reliability of the data collected by the volunteers since they are often lack of experience and knowledge. Especially, the data generated by volunteers' surveys could contain great levels of bias or variability. The differences in skills among the volunteers would lead to decreased accuracy in measurements and misidentification of species. Actually, they are potentially a great scientific resource and not a means to acquire high quality data cheaply. The science has neither the manpower nor the financial resources and the time to cope with the demands that scientific research requires. The volunteers then become a large workforce and could contribute to applied research through their participation in monitoring programs in which experience scientists lead them. So the citizens could help scientists to collect broad-scale data thereby bridging the funds and time lack (Mumby et al. 1995, Dickinson et al. 2010, Zoellick et al. 2012, Tulloch et al. 2013, Bird et al. 2013, Whitelaw et al. 2003, Conrad & Hilchey 2011, Foster-Smith & Evans 2003, Holt et al. 2013).
CS should be an essential contribution to scientific research not only for the data collections, but also above all for the translation of science into policy and action laying the basis for participatory government. Citizen science projects can

enhance the ability of decision-makers, stakeholders and non-government organizations to monitor, manage and conserve natural resources, while citizen volunteers are increasingly involved in local issues and more awareness in environmental threats and careful about theirs everyday actions toward the environment (Alaback 2012, Conrad & Hilchey 2011, Whitelaw et al. 2003, Tulloch et al. 2013).

1.3.1 Development of indices based on data collected by volunteers

Citizen science provides a large amount of data about species occurrence and distribution around the world and over long spans of time. Several projects have used these data for descriptive statistics, developing indices and, on overall, for advancing scientific knowledge.

Over the past three decades, the growing of scuba diving activities has encouraged the broad involvement of recreational divers for marine monitoring. Two broadly successful citizen science programs are the ones developed by Reef Check Foundation (www.reefcheck.org; Hodgson 1999, Hodgson 2001, Hodgson et al. 2006), based in California and with several national agencies around the World, and Coral Watch non-profit organization (www.coralwatch.org), based in Australia. The aim of both is to integrate global reef monitoring with participants education. Coral Watch has recruited volunteers from more than 60 countries and its methodology has been applied in several published scientific papers (Leiper et al. 2009, Fabricius et al. 2011, Marshall et al. 2012). So far, Reef Check monitoring activities has provided 8851 surveys in more than 4500 reefs and 82 countries (http://data.reefcheck.us/; last accessed 27/05/2015). Today both, Reef Check and Coral Watch are listed among the major monitoring programs for the tropical coral reef status assessment (Hill & Wilkinson 2004).

Based on the Reef Check monitoring data and biological information on the searched fishes, extracted from the FishBase database (www.fishbase.org), a Coral Reef Index of Biological Integrity (CRIBI) were proposed by Nguyen et al. 2009.

The REEF Volunteer Fish Survey Project, launched in 1990 by the Reef Environmental Education Foundation (www.reef.org), has developed two indices based on data collecting by scuba divers and snorkelers volunteers: the density index (Den) and the percent sighting frequency (%SF). They respectively provide the relative density of species and the frequency with which these species were observed. Since the project's inception, over 40,000 surveys have been conducted in the coastal waters of North America, tropical western Atlantic, Gulf of California and Hawaii (Pattengill-Semmens & Semmens 2003).

Reef Watch (www.reefwatch.asn.au) is an environmental monitoring program that aims to gather quality information on the status of southern Australia marine environment (Turner et al. 2006).

The National Geographic Field Scope combines citizen science and cartography. Since 2008, this project allows the participants to upload their data and to visualize and to analyse them by online map (Switzer et al. 2012). For instance, in the Chesapeake Bay Field Scope, citizen scientists can investigate water quality issues.

A relevant example of the contribution of volunteers in marine conservation programs are provided by NOAA initiatives for the US marine sanctuaries (www.volunteer.noaa.gov). European examples of the involvement of volunteers in marine monitoring projects include the project NELOS (www.nelos.be) in Belgium and The Netherlands, Seasearch (www.seasearch.co.uk) in the United Kingdom, COMBER project in Greece (www.comber.hcmr.gr), and several protocols proposed by Reef Check Italia *onlus* (RCI) for the Mediterranean Sea (www.reefcheckitalia.it; Cerrano et al. 2014). In particular, divers engaged by RCI, since 2006 have provided a huge amount of data on presence and abundance of selected key species along the Italian coasts and the project is rapidly spreading through the Mediterranean Sea.

1.4 Aims of the study

The growing need to assess the environmental status of the Mediterranean coastal marine habitats and the large availability of data collected by Reef Check Italia onlus (RCI) SCUBA diver volunteers suggest the possibility to develop innovative and reliable indices that may support decision makers in applying conservation strategies. The main aim of this study was the development of innovative indices to assess the ecological quality of the Mediterranean subtidal rocky shores and coralligenous habitats. The scope was achieved evaluating the reliability of data collected by RCI volunteers, analysing the spatial and temporal distribution of RCI available data, and resuming the knowledge on the biology and ecology of the monitored species. Subtidal rocky shores and coralligenous were chosen for two main reasons. Firstly, these are the habitats more visited by SCUBA divers; therefore, most data are referring to them. In general, the subtidal rocky bottom are strongly affected by several stressor such as coastal urbanisation, land use, fishing and tourist activities (Pinedo et al. 2007), that increase pollution, turbidity and sedimentation (Airoldi & Cinelli 1997, Sala 2004). Moreover, the coralligenous habitats, which are biogenic temperate reefs growing in dim light conditions (Ballesteros 2006), are among the most diverse and threatened habitats in the Mediterranean Sea (Bianchi & Morri 2000, Ballesteros 2006, Coll et al. 2010). These habitats being characterized by slow-growing and long-lived species are highly vulnerable to a wide range of disturbance such as destructive fishing practices, climate change, pollution or invasive non-indigenous species (NIS; Garrabou et al. 2002, Ballesteros 2006, Kipson et al. 2011).

Here three main categories of indices were developed: indices based on species diversity, indices on the occurrence non-indigenous species, and indices on species sensitive toward physical, chemical and biological disturbances. As case studies, indices were applied to stretches of coastline defined according to management criteria (province territories and marine protected areas). When possible, obtained results were compared to independent environmental assessments carried out by with traditional methods.

2 Material and methods

2.1 The Reef Check Italia onlus protocol

Reef Check Italia *onlus* (RCI; www.reefcheckitalia.it) is a Mediterranean partner of the word-wide Reef Check Foundation (www.reefcheck.org). Its mission is twofold: to train non-scientists to collect and provide accurate and useful data for science and management, and to promote environmental education and public awareness, which are among major pillars in nature conservation. Since 2006, RCI has developed the Underwater Coastal Environmental Monitoring (U-CEM) protocol for the Mediterranean Sea (Cerrano et al. 2014) to collect data on selected key species and habitats from diver volunteers.

2.1.1 Visual census method and participant training

The RCI U-CEM protocol is based on visual census of 43 easily recognisable selected taxa, searched along a random path, at variable depths and time. This approach derived from the timed swims method applied for tropical reef monitoring (Hill & Wilkinson 2004). Key taxa were selected according to one or a combination of the following criteria: be under law protection (EU Directives or Conventions), be a habitat forming species, be threatened by human activities (i.e. habitat loss, pollution, divers), be commercially exploited, be sensitive to climate change, be a Non-Indigenous Species (NIS) (Table 2.1). They are Mediterranean key indicator taxa, thus it is important monitoring theirs distribution and abundance changes. In training courses, volunteers are made aware on the reasons of taxa selection and they learn how to recognize them. When it is not easy to discriminate between species, genus or higher taxonomic levels were used, as in the case of seahorses (Curtis 2006).

Table 2.1 List of the considered taxa and their main features, to highlight the reason of their selection. Habitus: S= sessile; M=motile; SW: free-swimming. Protection status: B2-3, 1979 Bern Convention on the conservation of European wildlife and natural habitats, Annex 2-3; P2-3, 1995 Protocol concerning Mediterranean specially protected areas and biological diversity (after Barcelona 1976), Annex 2-3; H4-5, 1992 European Habitats Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora, Annex 4-5; Cd, 1973 CITES Convention on international trade in endangered species of wild fauna and flora, Annex d. (*) one or more protected species belong to this genus, (**) the two Mediterranean species belong to this genus are protected.

Taxon	Class	Habitus	Typical habitats	Depth Range (m)	Protection	Habitat forming	Human exploitation	Sensitive to divers	Sensitive to pollution	Sensitive to habitat loss	Sensitive to global .	Non-Indigenous Species
Caulerpa cylindracea	Ulvophyceae	S	rocky shore	1-40		✓						✓
Caulerpa taxifolia	Ulvophyceae	S	rocky shore	1-40		✓						✓
Ircinia spp.	Demospongiae	S	coralligenous	1-200	P2 (*)	✓						
Axinella spp.	Demospongiae	S	coralligenous	5-200	P2 B2 (*)	✓						
Aplysina spp.	Demospongiae	S	rocky shore, cave	2-100	P2 B2 (**)	✓						
Geodia cydonium	Demospongiae	S	rocky shore, detritic	5-100	P2					✓		
Tethya spp.	Demospongiae	S	rocky shore, detritic	1-30	P2					✓		
Corallium rubrum	Anthozoa	S	coralligenous, cave	15-500	P3 B2 H5	✓	✓	✓			✓	
Paramuricea clavata	Anthozoa	S	coralligenous	15-150		✓		✓			✓	
Eunicella cavolinii	Anthozoa	S	coralligenous	5-200		✓		✓			✓	
Eunicella singularis	Anthozoa	S	coralligenous	5-100				✓			✓	
Eunicella verrucosa	Anthozoa	S	soft bottom	15-120				✓				
Maasella edwardsi	Anthozoa	S	rocky shore	2-30							✓	
Cornularia cornucopiae	Anthozoa	S	rocky shore	1-20						✓		
Parazoanthus axinellae	Anthozoa	S	rocky shore	1-150							✓	
Epizoanthus spp.	Anthozoa	S	rocky shore, artificial reef	1-50							✓	
Savalia savaglia	Anthozoa	S	coralligenous	10-200	P2 B2	✓		✓		✓	✓	
Cladocora caespitosa	Anthozoa	S	coralligenous	1-40	P2 Cd	✓			✓		✓	
Astroides calycularis	Anthozoa	S	rocky shore	1-40	P2 B2 Cd	✓						
Balanophyllia europaea	Anthozoa	S	rocky shore	0-40	Cd						✓	

Taxon	Class	Habitus	Typical habitats	Depth Range (m)	Protection	Habitat forming	Human exploitation	Sensitive to divers	Sensitive to pollution	Sensitive to habitat loss	Sensitive to global	Non-Indigenous Species
Leptopsammia pruvoti	Anthozoa	S	coralligenous	5-100	Cd	✓		✓				
Patella ferruginea	Gastropoda	M	rocky shore	0-1	P2 B2 H4		✓					
Rapana venosa	Gastropoda	M	rocky shore, artificial reef	0-15								✓
Pinna nobilis	Bivalvia	S	seagrasses, detritic	2-40	P2 H4		✓	✓		✓		
Arca noae	Bivalvia	S	rocky shore	1-60			✓				✓	
Chlamys spp.	Bivalvia	S	rocky shore	5-100			✓					
Pecten jacobaeus	Bivalvia	M	soft bottom	20-200			✓					
Palinurus elephas	Malacostraca	M	coralligenous, cave	5-150	P3 B3		✓					
Homarus gammarus	Malacostraca	M	coralligenous, cave	5-150	P3 B3		✓					
Scyllarides latus	Malacostraca	M	rocky shore, cave	4-100	P3 B3 H5		✓					
Paracentrotus lividus	Echinoidea	M	rocky shore	0-30	P3	✓	✓					
Centrostephanus longispinus	Echinoidea	M	rocky shore	10-200	P2 B2 H4				✓		✓	
Ophidiaster ophidianus	Asteroidea	M	rocky shore	1-100	P2 B2				✓		✓	
Microcosmus spp.	Ascidiacea	S	rocky shore	3-100			✓				✓	
Polycitor adriaticus	Ascidiacea	S	rocky shore, detritic	10-50		✓						
Aplidium tabarquensis	Ascidiacea	S	rocky shore, detritic	10-50		✓						
Aplidium conicum	Ascidiacea	S	rocky shore, detritic	3-50		✓			✓			
Hippocampus spp.	Actinopterygii	SW	seagrasses	2-40	P2 Cd (**)		✓			✓	✓	
Conger conger	Actinopterygii	SW	rocky shore, wreck	1-1,000			✓					
Sciaena umbra	Actinopterygii	SW	rocky shore	5-200	P3 B3		✓					
Chromis chromis	Actinopterygii	SW	rocky shore	2-40					✓			
Diplodus spp.	Actinopterygii	SW	rocky shore	1-100			✓		✓	✓		
Trisopterus minutus	Actinopterygii	SW	detritic	15 - 200			✓	✓	✓	✓		
					Tot.:	16	16	8	7	8	15	3

After a training and examination, the participants were certified as RCI Mediterranean EcoDiver, identified by a unique personal code and allowed to make independent observations on the presence/ absence and abundance of the selected taxa. For any monitoring dive, date and time, site name, geographic coordinates, underwater visibility and habitat typology (e.g. sandy bottom, rocky bottom, artificial reef and so on), survey depth range (min and max, m) and observation time (minutes dedicated to monitoring) were recorded. Before the dive, each volunteer chooses which and how many taxa he/she will search. During the dive, abundances were recorded according to 7 numerical or descriptive (for uncountable species) classes ranging from 0 (absent) to 6 (several crowded areas or more than 51 specimens). Minimum and maximum observation depths are recorded for each actually encountered taxon. The EcoDiver's observations are sent to the online Reef Check database through an Internet form or a dedicated Smartphone app. Each EcoDiver enters data autonomously and is nominally responsible for the provided data.

2.1.2 Data mining and validation

Data check and validation is a key component of valuable citizen science. Some typing errors are prevented in the input phase. Data extracted from the database, through Microsoft® Access® queries, are subject to a quality control based on automatic rules (i.e. matching among species, habitats and depth) and converted in comma-separated values (CSV) files, for further analyses. Through a script in R (a freeware environment for statistical computing and graphics; www.r-project.org; R Core Team 2012), which uses the Shapefile package (Stabler 2013), CSV files are checked for other possible errors (e.g. inversion between minimum and maximum depths). Then CSV files are converted in Esri shapefiles, a popular geospatial vector data format for Geographic Information System (GIS), containing a point feature for each observation values, including absences, and the corresponding attributes (e.g. observer name, searching and finding depth, etc.). A shapefile for each taxon, one for all the surveys (i.e. single dives) and an overall one, with all the taxa together, are generated. On QGIS platform (a free and open source GIS; http://qgis.org; QGIS Development-Team 2015), the correspondence between locations, place names and territory features of newly submitted data are manually checked by overlapping territory administrative boundaries, toponyms, depth contours and aerial photographs. Not matching data are relocated, when possible, or deleted.

2.1.3 Volunteers data survey validation

To evaluate the reliability of data collected by EcoDivers, an experimental comparison was carried out. Ten participants were divided in three training levels: two “very experts” (i.e. Marine Biologists and RCI’ trainers), four “expert” (i.e. Marine Biologists and RCI EcoDivers), and four trained RCI EcoDiver (i.e. without any academic training in marine sciences).

At the Gallinara Island (SV), two dive sites were randomly selected. At each site, volunteers kept independent records of the presence, abundance and depth of 20 previously selected target species along a predefined belt transect of 100 × 6 m. The dive profile varied from 3 to 30 m depth. Data were recorded applying the RCI U-CEM protocol, except for the constrained path, and registered into online database by each participant independently. Multivariate assemblages’ data were analysed using principal coordinate analysis (PCO) based on Bray-Curtis similarities without data transformations (Anderson & Willis 2003). Differences in assemblages found between the two sites (random factor) and the three volunteer levels (fixed factor) were assessed by a two way crossed permutational non-parametric multivariate analysis of variance (PERMANOVA, α=0.05, Anderson & ter Braak 2003). The analyses were performed using the software PRIMER v. 6 (Anderson et al. 2008).

2.2 Territorial units and temporal periods

RCI U-CEM data are unevenly distributed in spatial and time because are affected by territorial distribution, preferences and behaviour of the volunteers. Information collected by a single EcoDiver in a single place and date could be not representative of the mean abundance of the target species in the area. To overcome this issue, data collected by several independent divers within defined areas and time spans can be pooled and analysed together. Areas of interest and periods should be defined according to the scope of the analysis, as monitoring and management purposes, for instance. Therefore, areas of interest may be represented by territorial units (TU) coinciding with administrative territories like municipalities, provinces, marine protected areas (MPAs), management and monitoring zones within MPAs, otherwise they could be mapped habitats or simply grid cells of manageable size. The minimum TU size is represented by the area normally explored by divers and taking into account the accuracy of the positioning, in the best case made with a nautical GPS. Based on these considerations, recommended minimum TU should be higher than 0.25 km^2 (e.g. 500 × 500 m). Time span could be range between few months, in case of intensive monitoring programs and several volunteers involved, to multi years for broad scale analyses. All the analyses presented in this work were carried out on the data collected from 2006 to 2014 and using as territorial units the stretch of sea, 3 nm wide, for each Italian, Slovenian and Croatian province. Alternatively, marine protected areas borders were used to identify management TUs.

In practices, provincial stretches of sea were obtained by create a 3 nm buffer around the Mediterranean coastlines, obtained from the Global Self-consistent Hierarchical High-resolution Geography Database, which also provide updated national borders (GSHHG; Wessel & Smith 1996, Fourcy & Lorvelec 2013; free available from www.ngdc.noaa.gov/mgg/shorelines/gshhs.html). Italian province border are obtained from the national geo-portal (Geoportale Nazionale, www.pcn.minambiente.it/GN/). Provincial TUs were coded according to ISO 3166 hierarchical approach (Codes of representation of countries name and their subdivision, www.iso.org/iso/home/standards/country_codes.htm). MPAs and other marine protected zones boundaries were obtained from the World Database on Protected Areas (WDPA) made available by IUCN-UNEP-WCMC, (www.protectedplanet.net). Each observation in the database (i.e. each point in the overall shapefile) was coded according to both the provincial and protected area of pertinence using the corresponding codes. Provincial and protected TUs were prepared using the QGIS platform (QGIS Development-Team 2015). In particular, observation coding was done using the “Add polygon attributes to points” algorithm, available in the processing toolbox (QGIS v. 2.8.1).

2.3 Development of indices

The Mediterranean Reef Check Visual Census Indices (MRC-VCi) were developed as a suite of useful tools for the environmental quality assessment of Mediterranean subtidal marine environment. All the MRC-VCi were based on data provided by several independent observations carried out by EcoDivers within defined areas and time spans. Since the sampling method (i.e. *visual census*) is non-destructive, measures can be replicated according to the U-CEM protocol, as required by any monitoring program.

2.3.1 Species diversity indices

The Mediterranean Reef Check Diversity Indices (*MRC-Di*) resemble the traditional species diversity indices (Magurran 2004), widely applied in coastal areas ecological quality assessments (e.g. Gray 2001, Ponti et al. 2009). Main differences consist in the limited number of taxa available (up to 43) and in the abundance estimation, by classes instead of integer counts. The *MRC-Di* suit is composed by the Mediterranean Reef Check Species richness ratio ($MRC\text{-}S_{ratio}$), the Mediterranean Reef Check Species diversity (*MRC-D*) and the Mediterranean Reef Check Species heterogeneity (*MRC-H*).

To ensure the robustness of the indices, the following minimum requirements are imposed:

- minimum TU size: 0.25 km^2
- minimum trained observers (i.e. diver volunteers): 4
- minimum number of observations (including absences): 30
- minimum searched taxa: 20 (up to 43)

For each observation, including absence, the abundance classes were converted in abundance scores (*Sc*; Table 2.2).

Table 2.2 Abundance class to score conversion.

Abundance numerical class	Abundance descriptive class	Score (*Sc*)
0	absent	0
1	isolated specimen	1
2	some scattered specimens	2
5	several scattered specimens	3
10	a crowded area	4
50	some crowded areas	5
100	several crowded areas	6

Mediterranean Reef Check Species richness ratio (*$MRC\text{-}S_{ratio}$*) resembles the species richness (S) and represents the proportion of taxa found compared to those searched (taxa searched). This index is based only on presence/absence species data.

$$\boldsymbol{MRC\text{-}S_{ratio}} = \textbf{Taxa found / Taxa searched}$$

The $MRC\text{-}S_{ratio}$ index ranges between 0 (no taxa found) and 1 (all searched taxa were found). The maximum number of species that can be found is 43, according to the U-CEM protocol. However, the ratio between taxa searched and taxa found could be affected by the volunteer's choices and by the amount of data available.

Mediterranean Reef Check Species diversity (*MRC-D*) resembles the Simpson's diversity index (*1-D*; Simpson 1949), which is considered one of the most meaningful and robust diversity measure available (Magurran 2004).

$$\boldsymbol{MRC\text{-}D = 1\text{-}\sum p_i^2}$$

where p_i is the proportional abundance of the *i*th observation calculated on the abundance class score (*Sc*).

The *MRC-D* index varies from 0 (no diversity) to 1 (maximum diversity) and emphasizes the evenness of the searched taxa.

Mediterranean Reef Check Species heterogeneity (*MRC-H*) resembles the Shannon's index (*H'*, Shannon & Weaver 1949) and mainly represents the overall heterogeneity of the searched taxa. Higher numbers indicate high species diversity and low numbers low species diversity.

$$\boldsymbol{MRC\text{-}H = \sum (p_i \times \log_2 p_i)}$$

where p_i is the proportional abundance of the *i*th observation calculated on the abundance class score (*Sc*).

The *MRC-H* index tends to vary from 0 to 5. The index allows to distinguish the differences between areas with the same number of species and with the same number of individuals, but in different proportion.

To meet the WFD and MSFD requirements, calculated indices should be classified in five ecological classes, corresponding to ecosystem health status. In the first instance, the index values obtained for each TUs were subjected to frequency distribution analysis (the Sturges's algorithm was used to compute the numbers of classes to be used in the analysis, Sturges 1926) and tested for normality. If the data were normally distributed, the ecological class intervals were based on quintiles (i.e. five quantiles). This ensures that each class is equally represented (Evans 1977). When the distribution was bimodal or multimodal, natural breaks approach based on the Jenks optimization method (Jenks 1967) was used. This minimizes value differences among data within the same class and emphasizes the difference among the classes (Evans 1977). When the frequency distribution was homogeneous (rectangular), the class intervals were defined by dividing the range of values in equal intervals. A colour was assigned of each ecological class using red, orange, yellow, green and blue, in the order, to indicate increasing ecological status.

2.3.2 Non-indigenous species indices

Three easily recognisable NIS species are included in the RCI list of target taxa: two are green algae *Caulerpa cylindracea* Sonder, 1845 and *Caulerpa taxifolia* (M. Vahl) C. Agardh, 1817 and one is the gastropod mollusc *Rapana venosa* (Valenciennes, 1846). In order to assess the presence and abundance of these selected NIS, two simple indices were developed. To ensure the robustness of the indices, the following minimum requirements are imposed:

- minimum TU size: 0.25 km^2
- minimum trained observers (i.e. diver volunteers): 3
- minimum number of observations (including absences): 10

For each observation, including absence, the abundance class were converted in abundance score class (*Sc*; Table 2.2).

Mediterranean Reef Check presence percentage (*MRC- $SP_{presence\ \%}$*) represents the percentage of sighting of the selected NIS compared to the number of times it was searched, including absences.

$$MRC\text{-}SP_{presence\ \%} = (sightings\ /\ times\ searched)$$

The index is based only on presence/absence data.

Mediterranean Reef Check abundance percentage (*MRC-$SP_{abundance\ \%}$*) represents the mean percentage abundance of the selected NIS. It is obtained through the sum of the abundance scores in case of sightings (*Sc* from 1 to 6; Table 2.2) divided by the sum of the abundance scores in case of sightings plus the count of absences recorded (i.e. *Sc* = 0).

$$MRC\text{-}SP_{abundance\ \%} = \sum Sc_{1..6}\ /\ (\sum Sc_{1..6} + n\ Sc_0)$$

Both indices range between 0, in case of never sighted, and 1 (i.e. in the range 0-100%). These indices can be easily calculated for any of the 43 species included in the U-CEM protocol, not only the NIS, therefore these indices could be also used for broad-scale species distribution analyses.

The index values, obtained for each TUs, were subjected to frequency distribution analysis and tested for normality. The indices values were classified in five classes, the first correspond to the absence (never sighted), the others values were divided in equal intervals ranging from 0 to 1. Considering the negative impact of the NIS, a colour was then assigned to each class using blue, green, orange, yellow and red, in the order, to indicate decreasing ecological status (i.e. increasing presence and abundance of NIS).

2.3.3 Species sensitive assessment

The present work mainly focus on subtidal rocky bottom and coralligenous habitats, therefore their most representative species included in the U-CEM taxa list were selected and further analysed. This selection resulted in a subset of 22 species and 3 genera (Table 2.3).

Following the approach of the Marine Life Information Network for Britain and Ireland (MarLIN, www.marlin.ac.uk; Hiscock 1997, Hiscock et al. 1999, Tyler-Walters & Jackson 1999, revised: January 2000, Hiscock et al. 2003), a sensitive assessment has been done for each of the sub selected taxon. MarLIN sensitive assessment approach is based on the review of available literature on the life history, distribution, environmental preference (Table 2.4) and any effects of disturbance agent on the chosen species (Hiscock & Tyler-Walters 2006).

Table 2.3 Taxa selected for the sensitive assessment and their typical habitats.

Taxon	Typical habitats
Caulerpa cylindracea	rocky bottom
Caulerpa taxifolia	rocky bottom
Axinella spp.	coralligenous
Aplysina spp.	rocky bottom, cave
Geodia cydonium	rocky bottom, detritic
Corallium rubrum	coralligenous, cave
Paramuricea clavata	coralligenous
Eunicella cavolinii	coralligenous
Eunicella singularis	coralligenous
Eunicella verrucosa	soft bottom, coralligenous
Parazoanthus axinellae	rocky bottom
Savalia savaglia	coralligenous
Cladocora caespitosa	coralligenous
Astroides calycularis	rocky bottom
Balanophyllia europaea	rocky bottom
Leptopsammia pruvoti	coralligenous
Rapana venosa	rocky bottom, artificial reef
Arca noae	rocky bottom
Palinurus elephas	coralligenous, cave
Homarus gammarus	coralligenous, cave
Paracentrotus lividus	rocky bottom
Hippocampus spp.	seagrasses
Conger conger	rocky bottom, wreck
Sciaena umbra	rocky bottom
Chromis chromis	rocky bottom

Table 2.4 General information need for assessment (MarLIN, www.marlin.ac.uk).

Taxonomy	Phylum
	Class
	Order
	Family
	Genus
	Species
	Authority
Habitat information	Physiographic preference
	Biological zone preferences
	Substratum/ habitat preferences
	Tidal strenght preferences
	Wave exposure preferences
	Salinity preferences
	Depth range
	Other preferences
	Migration pattern
	Is the species native?
	Origin

General biology	Typical abundance Male size range Male size at maturity Female size range Female size at maturity Growth form Growth rate Body flexibility Mobility Characteristic feeding methods Typically feeds on Sociability Environmental position Supports (Depend on/ support) Is the species toxic?
Reproduction and longevity	Reproductive type Reproductive frequency Developmental mechanism Fecundity (number of eggs) Generation time Age at maturity Dispersal potential Larval settling time Time of first gamete Time of last gamete Life span
Ecosystem importance	Protection Does the species create space in the assemblage? Does it occupy space and exclude? Does the species provide habitat structure? Does the species provide an important food source? For what? Medicinal use Aquaculture use Harvested (targered) Harvested (by-catch) Curio use Culinary use
Threats	

According to MarLIN (Hiscock et al. 2003, Hiscock & Tyler-Walters 2006), the sensitivity is the susceptibility of a species to be damaged, or die, from a disturb agent and it is determined by its biological and physical characteristics. Intolerance must be assessed in relation to specific physical, chemical and biological disturbance agents (Hiscock et al. 1999, Tyler-Walters & Jackson 1999, revised: January 2000, Hiscock & Tyler-Walters 2006; Table 2.5). The recoverability is the ability of a species to redress damage sustained because of disturbance agents. On overall, the sensitivity is dependent on the intolerance of a species to be damaged from a disturbance agent and the time taken for its subsequent recovery (Tyler-Walters & Jackson 1999, revised: January 2000).

Table 2.5 Disturbance agents taking into consideration for evaluating the species sensitive (MarLIN, www.marlin.ac.uk).

Physical disturbs	Substratum loss
	Smothering
	Changes in suspended sediment
	Desiccation
	Changes in emergence
	Changes in water flow rate
	Changes in temperature
	Changes in turbidity
	Changes in wave exposure
	Noise
	Visual presence
	Physical disturbance or abrasion
	Displacement
Chemical disturbs	Changes in levels of synthetic chemicals
	Changes in levels of heavy metals
	Changes in levels of hydrocarbons
	Changes in levels of radionuclides
	Changes in levels of nutrients
	Changes in salinity
	Changes in oxygenation
Biological disturbs	Introduction of microbial pathogens and parasites
	Introduction of alien or non- native species
	Specific targeted extraction of this species
	Specific targeted extraction of other species

For each taxa and disturb agent, an intolerance and a recoverability value were attributed based on the MarLIN standard benchmarks (Tyler-Walters & Jackson 1999, revised: January 2000). The use of standard benchmarks allows sensitivity not only to be assessed relative to a specific change in an environmental factor but also to be compared between different species (Hiscock et al. 1999, Tyler-Walters & Jackson 1999, revised: January 2000). The intolerance rank ranges from "high" (maximum intolerance) to "not sensitive" (lowest intolerance). The recoverability rank ranges from "none" (no recoverability) to "immediate" (full recovery within a few days). Where the species is protected from the disturbance agent, the rating applies is “not relevant” both for the intolerance and for the recoverability (Hiscock et al. 1999). The species sensitivity toward each disturbance agent was established by combining the intolerance and recoverability ranks (Table 2.6).

Table 2.6 Combination between taxa intolerance and recoverability to obtain sensitivity (MarLIN, www.marlin.ac.uk).

		Recoverability						
		None	Very low (>25 yr)	Low (>10/25 yrs)	Moderate (>5/10 yrs)	High (1/5 yrs)	Very high (<1 yr)	Immediate (<1 week)
Intolerance	High	Very high	Very high	High	Moderate	Moderate	Low	Very Low
	Intermediate	Very high	High	High	Moderate	Low	Low	Very Low
	Low	High	Moderate	Moderate	Low	Low	Very low	NS
	Tolerant	NS	NS	NS	NS	NS	NS	NS
	Tolerant*	NS*	NS*	NS*	NS*	NS*	NS*	NS*
	Not relevant	NR	NR	NR	NR	NR	NR	NR

The sensitivity rank varies from “very high” to “not sensitive”. When the species is protected from the factor, the rank is “not relevant”. For detailed ranks definition see Hiscock et al. 1999, Tyler-Walters & Jackson 1999, revised: January 2000 and for further information about the MarLIN procedure applied see Hiscock 1997, Hiscock et al. 1999, Tyler-Walters & Jackson 1999, revised: January 2000, Hiscock et al. 2003, Hiscock & Tyler-Walters 2006 and the MarLIN website (www.marlin.ac.uk). Thus, the sensitive quality scores were converted in numerical scores (Table 2.7).

Table 2.7 Conversion between sensitive quality class and sensitive quantitative score (MarLIN, www.marlin.ac.uk).

Sensitive quality class	Sensitive quantitative score
Very high	5
High	4
Moderate	3
Low	2
Very low	1
Not sensitive	0
Not relevant/Insufficient information	NA

A confidence scale indicates a judgment of the specificity of the information available to support the sensitivity assessment. It ranges from “high” (i.e. specific sources on sensitivity and recoverability to a particular factor) to "very low" (i.e. informed judgment). "Not relevant" is used when no relevant information has been found or for insufficient information (Hiscock et al. 1999, Tyler-Walters & Jackson 1999, revised: January 2000).

The complete procedure used to assess taxa sensitivity includes the following steps (Fig. 2.1):

1. a review of relevant available information for the taxa in question;
2. collate key information;
3. the identification of the likely intolerance of the taxa to external factors;
4. the identification of the likely recoverability of the taxa to external factors;
5. the identification of the likely sensitivity of the taxa to external factors;
6. the conversion of the sensitivity judgment to a numeric value;
7. an assessment of the quality of the data used (confidence level);
8. the conversion of the confidence level to a numeric value;
9. peer review (referees comments and modification of conclusions if necessary).

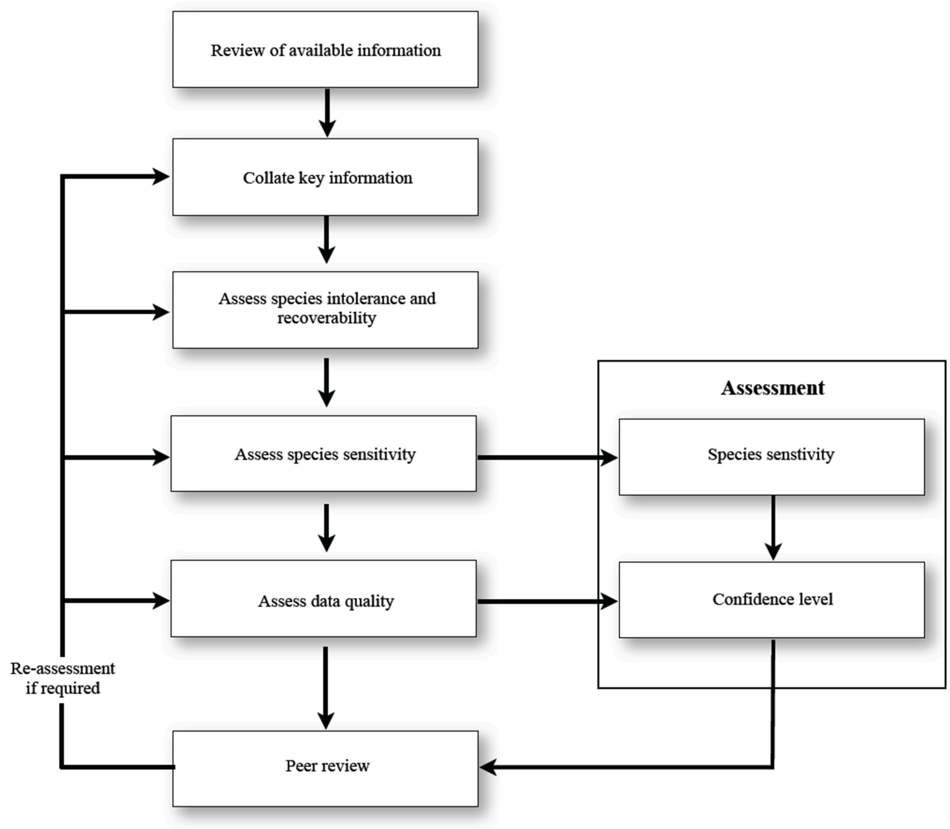


Fig. 2.1 Sensitive assessment procedure.

2.3.4 Species sensitivity indices

In order to evaluate the ecological status of the Mediterranean rocky bottoms based on the sensitivity of species, the Mediterranean Reef Check Species sensitivity indices (*MRC-Ss*) suite was developed. According to the main group of disturbance agents listed in MarLIN, four indices were included in the suit. The MRC-Species sensitive index toward physical disturbs ($MRS\text{-}Ss_{phy}$), the MRC-Species sensitive index toward chemical disturbs ($MRS\text{-}Ss_{chem}$) and the MRC-Species sensitive index toward biological disturbs ($MRS\text{-}Ss_{bio}$) were respectively calculated on the mean sensitive value of each species toward physical (MSV_{phy}), chemical (MSV_{chem}) and biological (MSV_{bio}) disturbance factors. The overall MRC-Species sensitivity index ($MRC\text{-}Ss_{tot}$) was calculated from the mean sensitive value of each species toward each disturbance agent (MSV_{tot}).

To ensure the robustness of the indices, the following minimum requirements are imposed:

- minimum TU size: 0.25 km^2
- minimum trained observers (i.e. diver volunteers): 4
- minimum number of observations (including absences): 30
- minimum searched taxa: 15 (up to 25)

For each observation, including absence, the abundance class were converted in abundance score class (*Sc*; Table 2.2).

Mediterranean Reef Check Species sensitive index toward physical disturbs ($MRC\text{-}Ss_{phy}$) mainly represents the mean sensitive value of the sighted taxa toward physical disturbance factors (MSV_{phy}), weighted by their observed abundance class.

$$MRC\text{-}Ss_{phy} = \sum (Sc_i \times MSV_{(phy)i}) / \sum Sc_i$$

where $MSV_{(phy)i}$ refers to the taxon in the *i*th observation.

Mediterranean Reef Check Species sensitive index toward chemical disturbs ($MRC\text{-}Ss_{chem}$) mainly represents the mean sensitive value of the sighted taxa toward chemical disturbance factors (MSV_{chem}), weighted by their observed abundance class.

$$\boldsymbol{MRC\text{-}Ss_{chem} = \sum (Sc_i \times MSV_{(chem)i}) / \sum Sc_i}$$

where $\boldsymbol{MSV_{(chem)i}}$ refers to the taxon in the *i*th observation.

Mediterranean Reef Check Species sensitive index toward biological disturbs (*MRC-Ss*$_{bio}$) mainly represents the mean sensitive value of the sighted taxa toward biological disturbance factors (MSV_{bio}), weighted by their observed abundance class.

$$\boldsymbol{MRC\text{-}Ss_{bio} = \sum (Sc_i \times MSV_{(bio)i}) / \sum Sc_i}$$

where $\boldsymbol{MSV_{(bio)i}}$ refers to the taxon in the *i*th observation.

Overall Mediterranean Reef Check Species sensitive index (*MRC-Ss*$_{tot}$) mainly represents the mean sensitive value of the sighted taxa toward all possible disturbance factors (MSV_{tot}), weighted by their observed abundance class.

$$\boldsymbol{MRC\text{-}Ss_{tot} = \sum (Sc_i \times MSV_{(tot)i}) / \sum Sc_i}$$

where $\boldsymbol{MSV_{(tot)i}}$ refers to the taxon in the *i*th observation.

All the indices theoretically range between 0 and 5, even if the extremes are impossible to achieve. They increase with increasing of the mean sensitivity of the species sighted and, in less extent, with their abundance.
The index values, obtained for each TUs, were subjected to frequency distribution analysis and tested for normality. The ecological class intervals were identified using quintiles among all the indices values obtained and a colour was then assigned to each class: blue, green, yellow, orange and red, in the order, to indicate increasing mean sensitivity of the assemblages.

2.4 Effectiveness of *MRC-Ssi* indices

The effectiveness of a biotic index is its ability to measure and correctly reflect the conditions for which has been developed. The *MRC-Ssi* indices are intended to measure the mean sensitivity of the assemblages, which should be related with the intensities of human disturbances in the area. Greater the impacts, lower should be the sensitivity of the assemblages. Ideally, the indices should be tested in a wide range of condition, from highly impacted to pristine areas. Unfortunately, through the Mediterranean Sea is quite impossible to find pristine areas that can be used as reference conditions. Where undisturbed areas cannot be found historical data or experts' judgment could represent theoretical reference condition (Andersen et al. 2004, Stoddard et al. 2006, Mangialajo et al. 2007). In the present study, the indices were compared with an assessment carried out with traditional methods within the Tavolara Capo Coda Cavallo MPA (Bianchi et al. 2012). In particular, the MPA Environmental quality map was used (www.amptavolara.com/en/home-page/). For the comparison, the area was divided in UTM grid cells, 500 m per side each. *MRC-Ssi* indices were calculated for each cell where enough data were available.

All the *MRC indices*, frequency distribution analyses and normality tests were calculated by routines write in R (R Core Team 2012). The Reshape (Wickham 2014), Vegan (Oksanen et al. 2015) and Normest R packages (Pearson chi-square normality test, H_0: the data are normally distributed, $\alpha = 0.05$, Thode 2002, Gross & Ligges 2015) were used.

3 Results

3.1 Reliability of data collected by RCI volunteers

In order to assess the reliability of the RCI dataset, ability of divers with different training level were compared in a field test carried out at the Gallinara Island, which included 2 surveys and 10 independent observers. Patterns of similarities among observed assemblages are shown in the PCO ordination plot (Fig. 3.1). The first two axes of the PCO explained 34.8 and 28.9% of the total variation. The scatter plot shows some degrees of separation between the two sites, but not among the observer training levels.

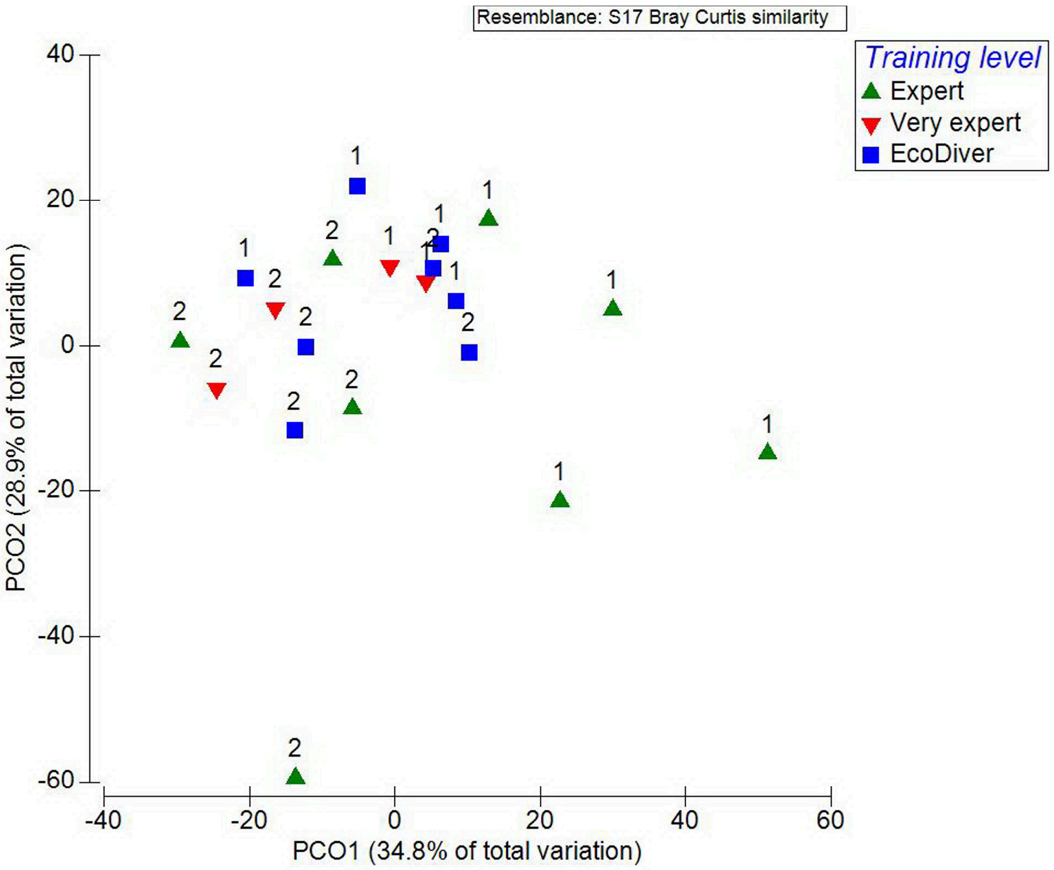


Fig. 3.1 PCO ordination based on Bray-Curtis similarities. The level of experience is indicated with different symbols and colours, while the dive sites are indicated by numers.

The pattern was confirmed by the PERMANOVA test, showing significant difference only between sites not among training levels (Table 3.1). Even if some minor differences among operators were obtained (points in the PCO are not exactly coincident), these represent a random effect related to the accuracy of the method, as occurs in any visual census. Therefore, the method appeared quite robust, able to distinguish assemblages between sites, and not affected by the training levels of the operators. In other words, the minimum training provided by RCI appears adequate.

Table 3.1 Results from PERMANOVA on Bray-Curtis similarities abundance data

Source	df	SS	MS	Pseudo-F	*P* (perm)	Unique perms	*P* (MC)
Training level (Tl)	2	3280	1639.9	1.544	0.2865	180	0.3049
Site (Si)	1	3429	3429.2	3.977	0.0045	9959	0.0127
Tl × Si	2	2125	1062.3	1.232	0.3213	9940	0.3151
Res	14	12072	862.3				
Total	19	20999					

3.2 RCI database contents

At the last data mining (22/05/2015), the whole RCI database includes 31’190 observations, including absences, carried out in 3’585 surveys (i.e. individual dives). That includes several data collected before the establishment of the current U-CEM protocol and/or without fulfilling the U-CEM standard. Limiting the dataset to the interval 2006-2014 and excluding data with not satisfy the U-CEM standard, 24’966 observation in 2’434 survey were retained for further analyses. In the 2014, the number of surveys (Fig. 3.2) and observations (Fig. 3.3) were largely increased compared to the previous years, which could be related to a relevant increase of EcoDiver volunteers in the last year (Fig. 3.4). On average, each EcoDiver investigate 10.23 ± 0.19 s.e. taxa and spend 35.2 ± 0.4 s.e. minutes per dive.

On overall, the most surveyed habitats were rocky bottoms (Fig. 3.5) and most of the surveys were carried out within 40 m in depth (Fig. 3.6). Moreover, EcoDivers put more efforts in searching the most attractive species, including those to which there is greater awareness, like NIS (Fig. 3.7).

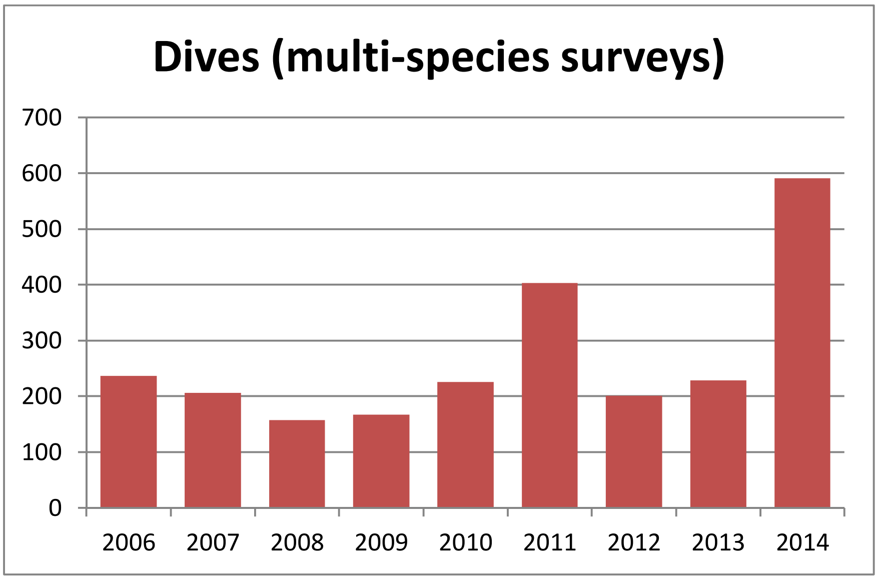


Fig. 3.2 Surveys annually carried out between 2006 and 2014.

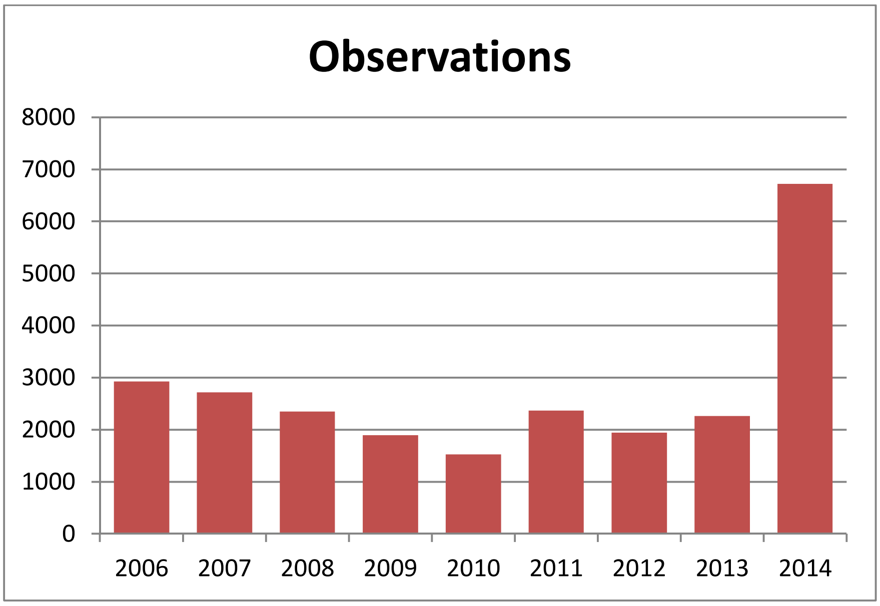


Fig. 3.3 Observations annually recorded between 2006 and 2014.

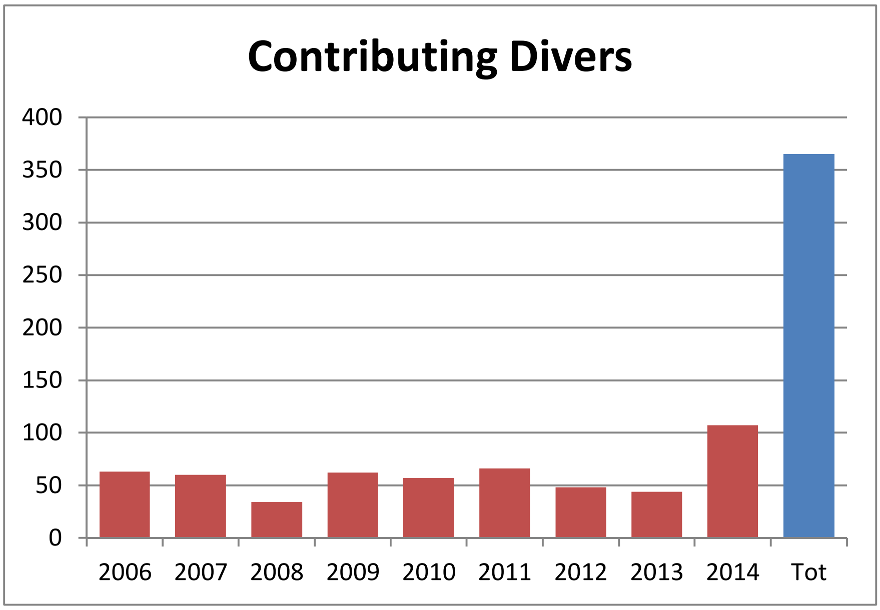


Fig. 3.4 Participating EcoDivers between 2006 and 2014.

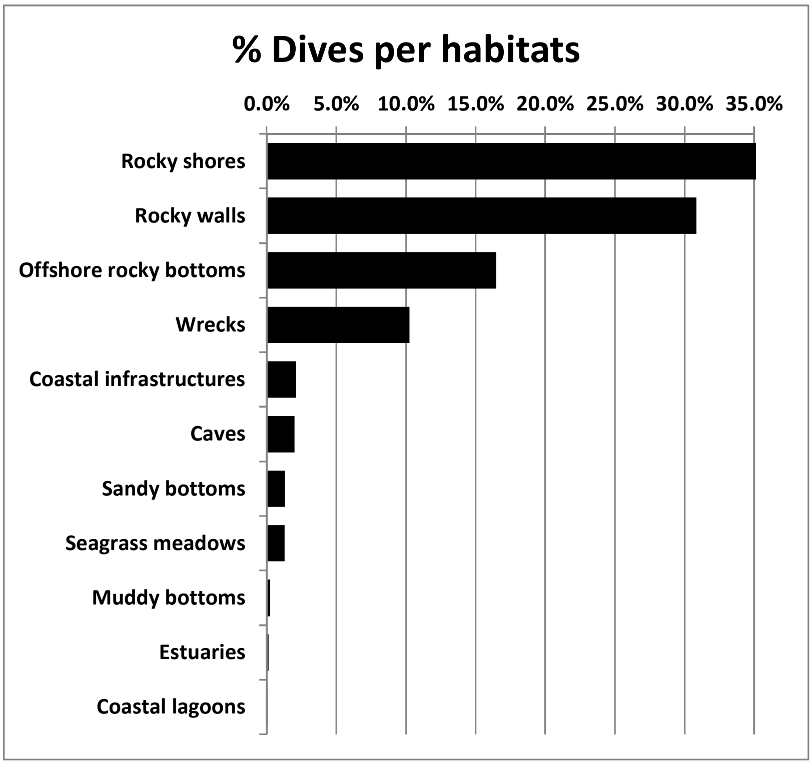


Fig. 3.5 Surveys distribution per habitats.

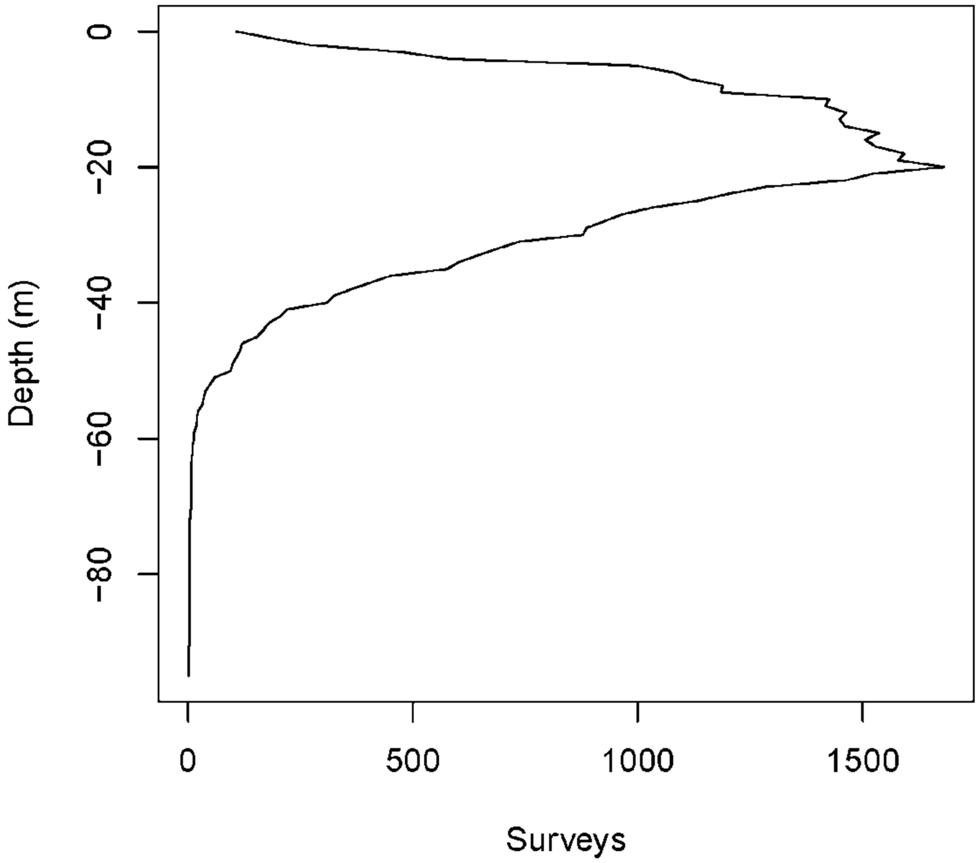


Fig. 3.6 Surveys depth distribution.

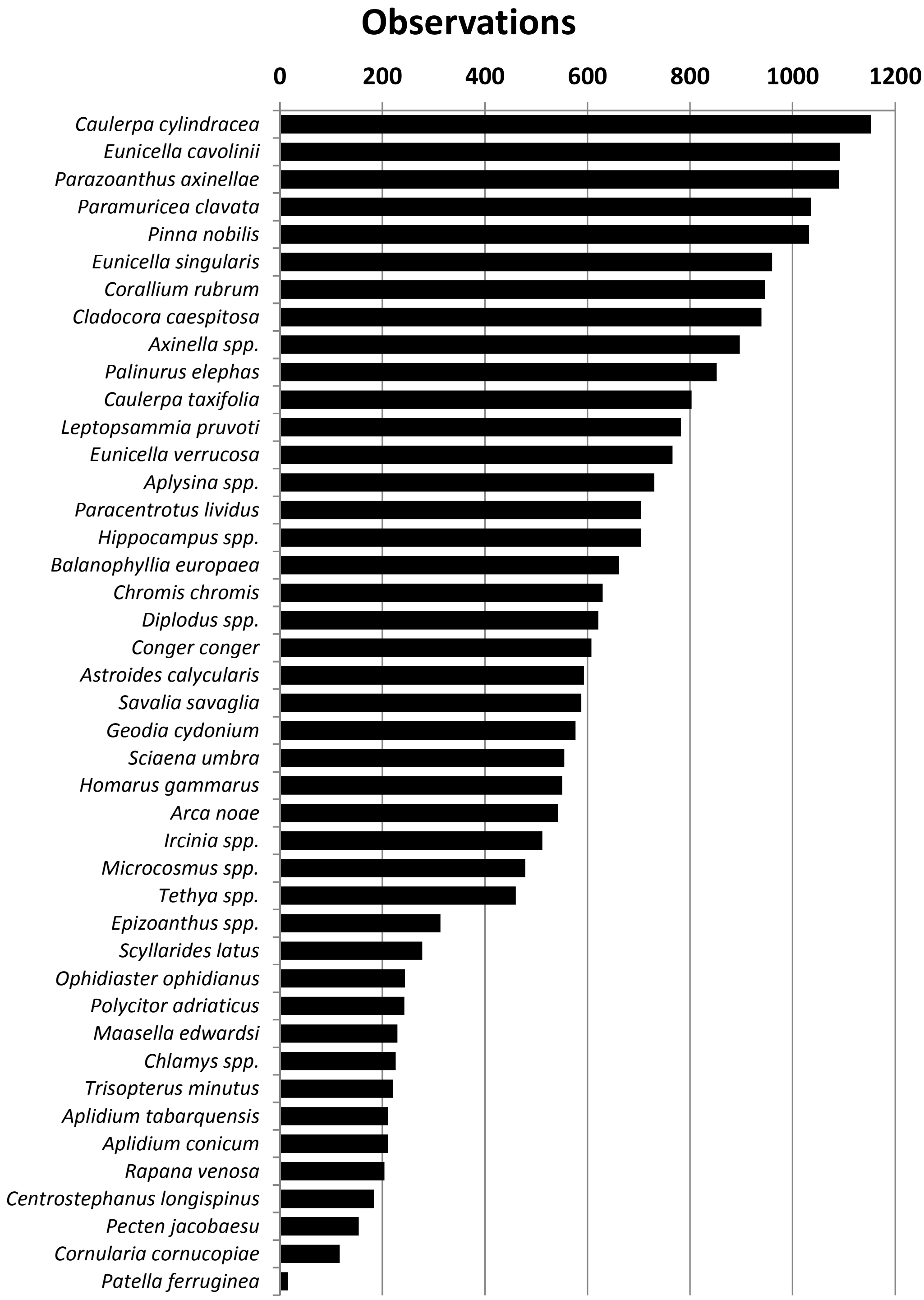


Fig. 3.7 Observation effort distribution among taxa.

3.3 Mediterranean Reef Check Diversity indices

3.3.1 Mediterranean Reef Check Species richness ratio index

The *MRC-*S_{ratio} index values calculated for provincial coastal areas ranged from 0.17 to 0.96 (Annex 1) and were normally distributed (Pearson chi-square normality test, $p = 0.74$) (Fig. 3.8).

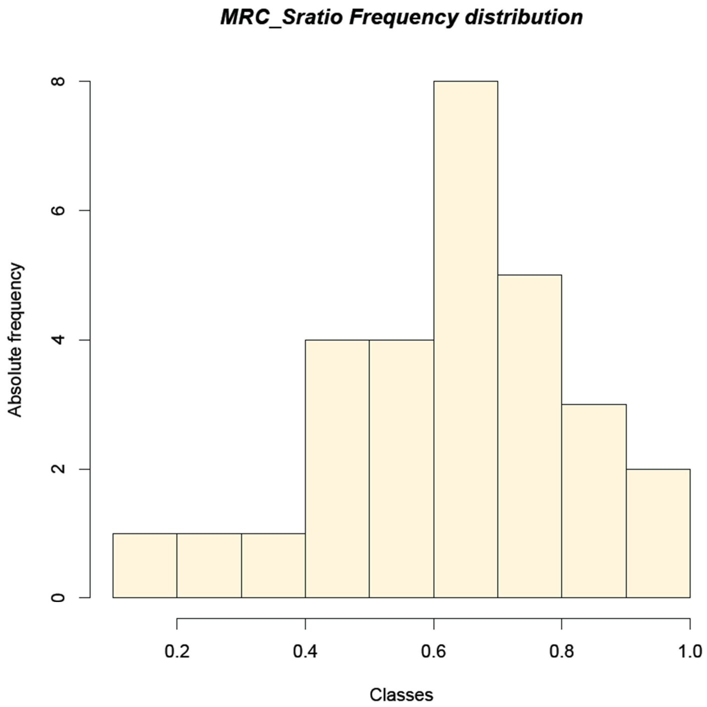


Fig. 3.8 Frequency distribution of *MRC-*S_{ratio} index values in the coastal provinces.

Five classes of equal intervals were chosen and a possible interpretation scale for species richness ratio and ecological status was proposed (Table 3.2). The highest obtained values were in the province of Genoa, Grosseto, Reggio Calabria, Savona and Trapani as it shows in blue colour in the map (Fig. 3.9). The lowest value was in Messina where only 4 out of the 24 searched species were found.

Table 3.2 Proposed classification scheme for the *MRC-S*$_{ratio}$ index.

	MRC-S$_{ratio}$	Species richness ratio	Ecological status
	0.00 – 0.20	Very low	Bad
	0.20 – 0.40	Low	Poor
	0.40 – 0.60	Mean	Moderate
	0.60– 0.80	High	Good
	0.80 – 1.00	Very high	High

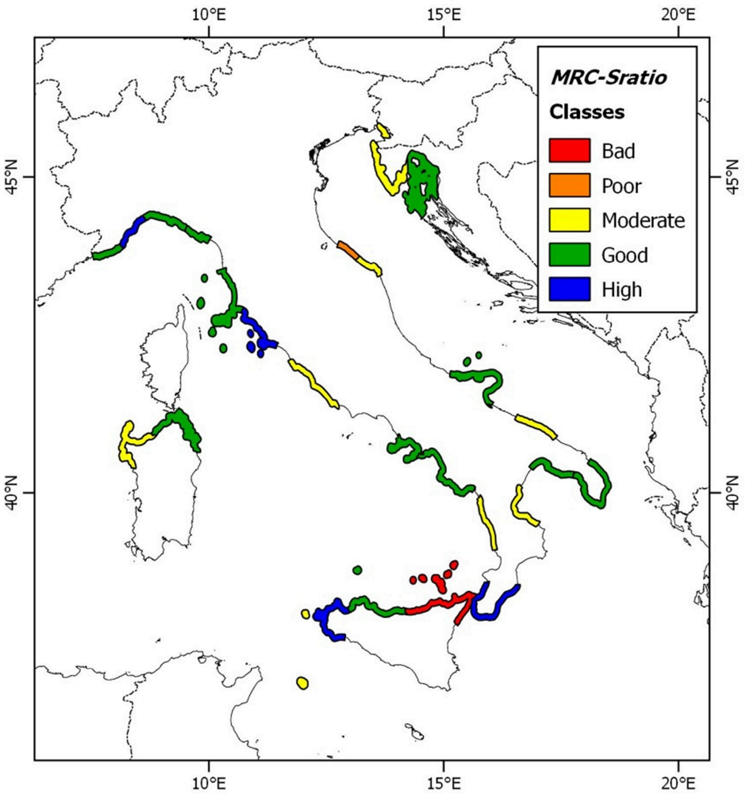


Fig. 3.9 *MRC-S*$_{ratio}$ index values in the coastal provinces (Mercator projection, WGS84).

There is no linear correlation between obtained index values and taxa searched (p = 0.06, r = 0.36 R^2 = 0.08) therefore it could be excluded that volunteers choices affects the index results.

3.3.2 Mediterranean Reef Check Species diversity index

The *MRC-D* index values calculated for provincial coastal areas ranged from 0.69 to 0.95 (Annex 1) and were not normally distributed (Pearson chi-square normality test, p = 4.69e-06) (Fig. 3.10). The natural breaks were used to define five classes and a possible interpretation scale for species diversity and ecological status is proposed in Table 3.3.

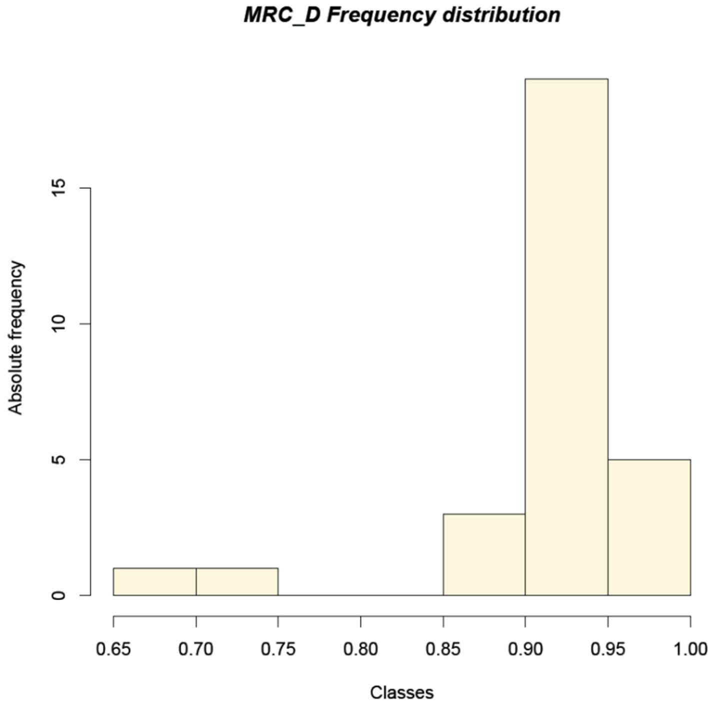


Fig. 3.10 Frequency distribution of *MRC-D* index values in the coastal provinces.

Table 3.3 Proposed classification scheme for the *MRC-D* index.

	MRC-D	**Species diversity**	**Ecological status**
	0.00 – 0.69	Very low	Bad
	0.69 – 0.72	Low	Poor
	0.72 – 0.89	Mean	Moderate
	0.89 – 0.94	High	Good
	0.94 – 1.00	Very high	High

The map shows that the Italian west side has a greater diversity than the east side, except for Messina province which showed the lowest value (0.69).

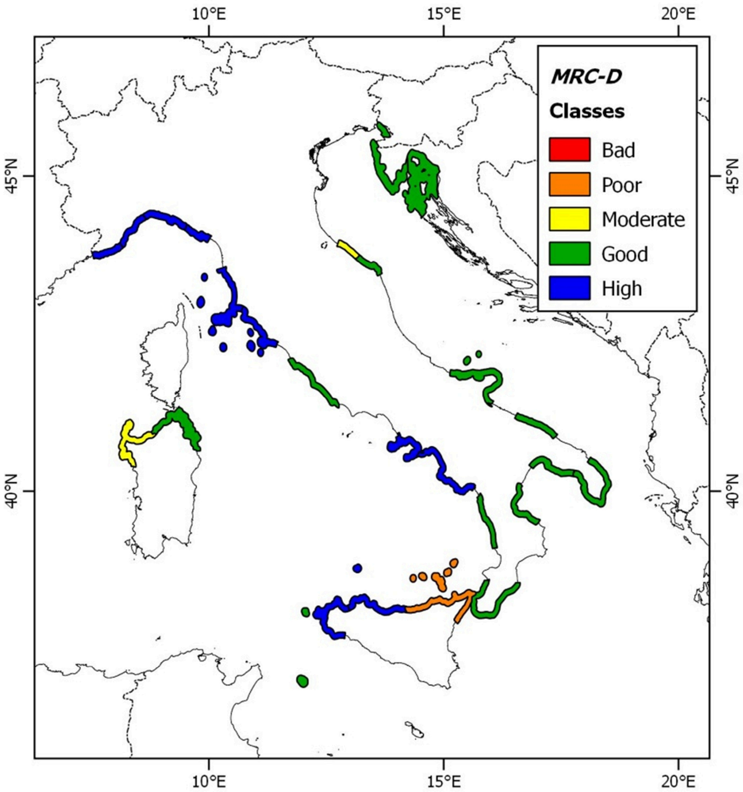


Fig. 3.11 ***MRC-D*** **index values in the coastal provinces (Mercator projection, WGS84).**

3.3.3 Mediterranean Reef Check Species heterogeneity index

The *MRC-H* index values calculated for provincial coastal areas ranged from 1.86 (Messina province) to 4.70 (Savona province) (Annex 1) and were normally distributed (Pearson chi-square normality test, $p = 0.05$) (Fig. 3.12).

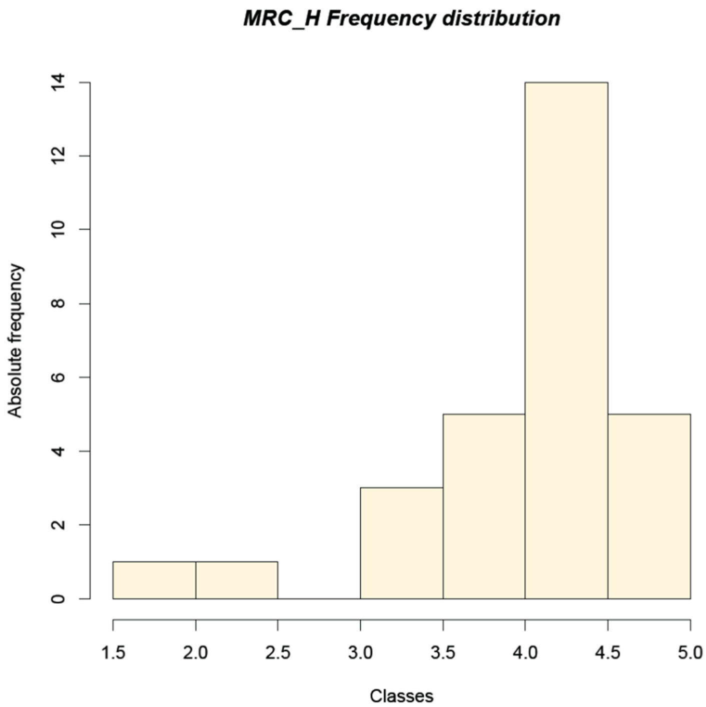


Fig. 3.12 Frequency distribution of *MRC-H* index values in the coastal provinces.

Five classes using quintiles were chosen and a possible interpretation scale for species heterogeneity and ecological status was proposed in Table 3.4.

Table 3.4 Proposed classification scheme for the *MRC-H* index.

	MRC-H	**Species heterogeneity**	**Ecological status**
	0.00 – 3.32	Very low	Bad
	3.32 – 4.00	Low	Poor
	4.00 – 4.30	Mean	Moderate
	4.30 – 4.54	High	Good
	4.54 – 5.00	Very high	High

Provinces with the highest values were Grosseto, Livorno, Naples and Savona. However, most provinces fall in the mean range with moderate ecological status (Fig. 3.13).

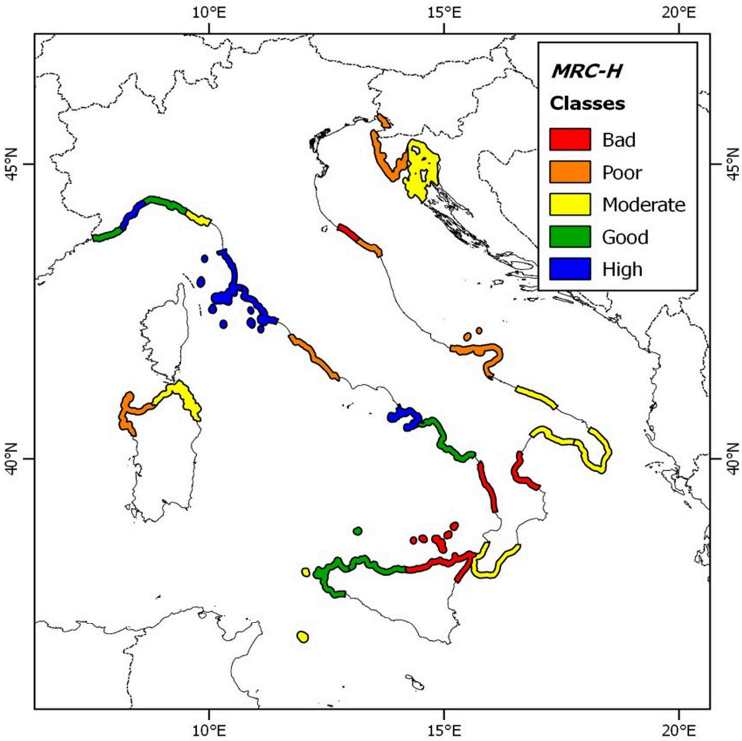


Fig. 3.13 *MRC-H* index values in the coastal provinces (Mercator projection, WGS84).

3.4 Mediterranean Reef Check NIS indices

A possible interpretation scale for species presence (sighting frequency) and mean abundance, which can be applied for any species, and a corresponding ecological status in case of NIS was proposed (Table 3.5). It was based on the confirmed absence and 4 equal intervals of percentage.

Table 3.5 Proposed classification scheme for the *MRC-SP* indices.

	MRC-SP*presence %* ***MRC-SP****abundance %*	**sighting frequency**	**mean abundance**	**Ecological status (NIS)**
(blue)	0 – 0	Absent	Absent	High
(green)	0 – 25	Rare	Rare	Good
(yellow)	25 – 50	Infrequent	Medium abundant	Moderate
(orange)	50 – 75	Frequent	Abundant	Poor
(red)	75 – 100	Very frequent	Very abundant	Bad

3.4.1 *Caulerpa cylindracea*

The $MRC\text{-}C.cylindracea_{presence\ \%}$ index values calculated for provincial coastal areas ranged from 0 to 0.94, while the $MRC\text{-}C.cylindracea_{abundance\ \%}$ index values from 0 to 0.98 (Annex 2). The $MRC\text{-}C.cylindracea_{presence\ \%}$ index values were normally distributed (Pearson chi-square normality test, p = 0.86), while $MRC\text{-}C.cylindracea_{abundance\ \%}$ index values were not normally distributed (Pearson chi-square normality test, p = 0.02) (Fig. 3.14).

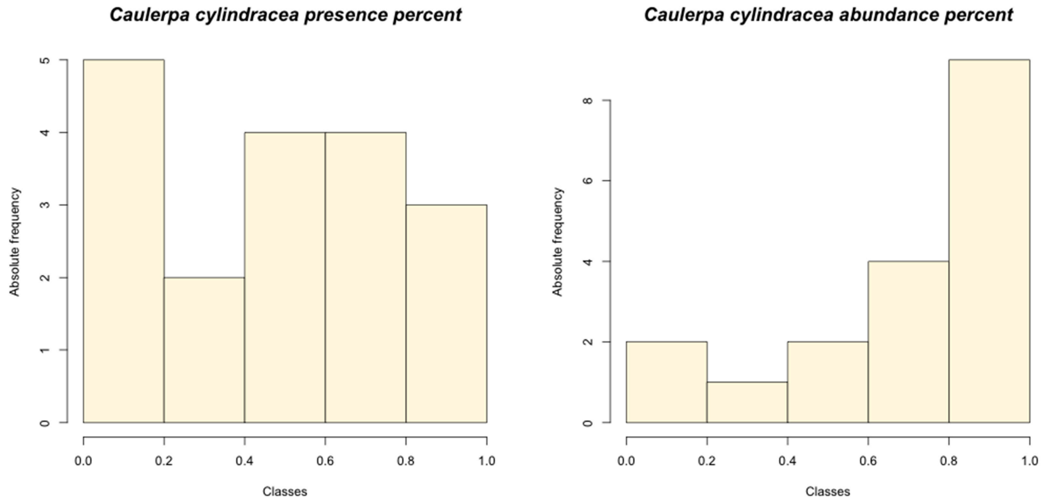


Fig. 3.14 Frequency distribution of *MRC-SP* indices values obtained for *C. cylindracea*.

C. cylindracea was introduced in the Mediterranean Sea from south-western Australia in the early '90s (Klein & Verlaque 2008). Its first record in the Mediterranean Sea comes from Libya in 1990 and the primary vehicle of introduction could be attributed to maritime traffic or aquaria trade (Klein & Verlaque 2008). The species is rapidly spreading across the Mediterranean via both sexual and vegetative reproduction and thanks to shipping, fishing and currents, dramatically altering the local benthic communities (Klein & Verlaque 2008). Nowadays, this species are present in many Italian coastal zones as confirmed by the map (Fig. 3.15). The most affected provinces are in Liguria, Tuscany, Sicily, and Apulia Regions. In particular, along the coast of the Liguria Region first records of *C. cylindracea* come from the province of Genoa from Quinto and date back to 1995 (Bussotti et al. 1996). Thereafter, some records have been reported the spread of *C. cylindracea* from east to west Ligurian coast (Montefalcone et al. 2007a, Montefalcone et al. 2007b, Piazzi et al. 2005, Tunesi et al. 2007).

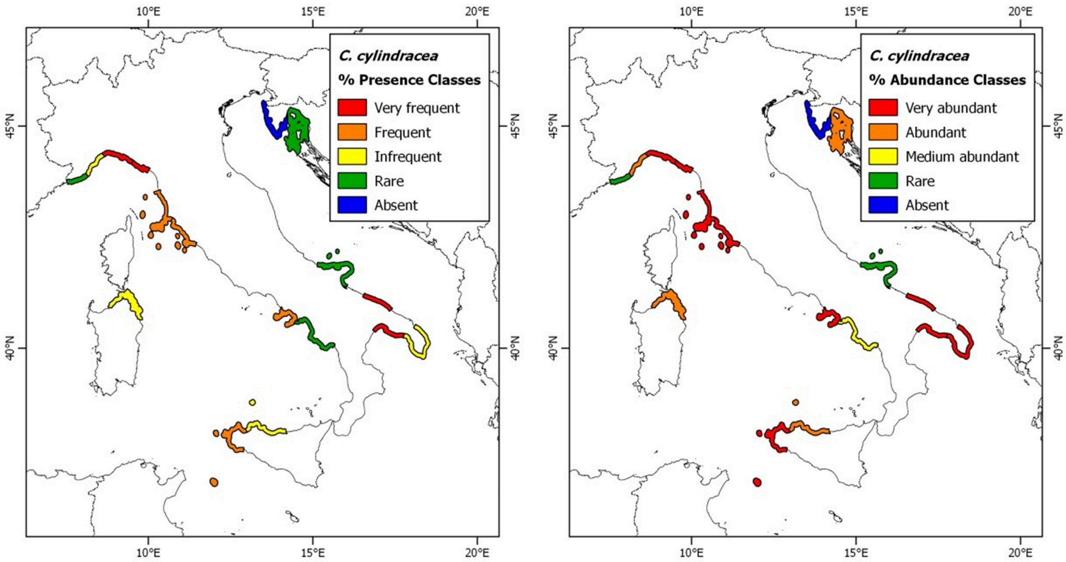


Fig. 3.15 ***MRC-SP*** **indices values in the coastal provinces (Mercator projection, WGS84).**

3.4.2 *Caulerpa taxifolia*

The *MRC-C.taxifolia*$_{presence\ \%}$ index values calculated for provincial coastal areas ranged from 0 to 0.20, while the *MRC-C.taxifolia*$_{\mathrm{ab.perc}}$ index values from 0 to 0.38 (Annex 2). The *MRC-C.taxifolia*$_{presence\ \%}$ index and *MRC-C.taxifoliaa*$_{abundance\ \%}$

index values were not normally distributed (Pearson chi-square normality test, $p_{presence\ \%} = 3.16e\text{-}05$ and $p_{abundance\ \%} = 4.75e\text{-}05$) (Fig. 3.16).

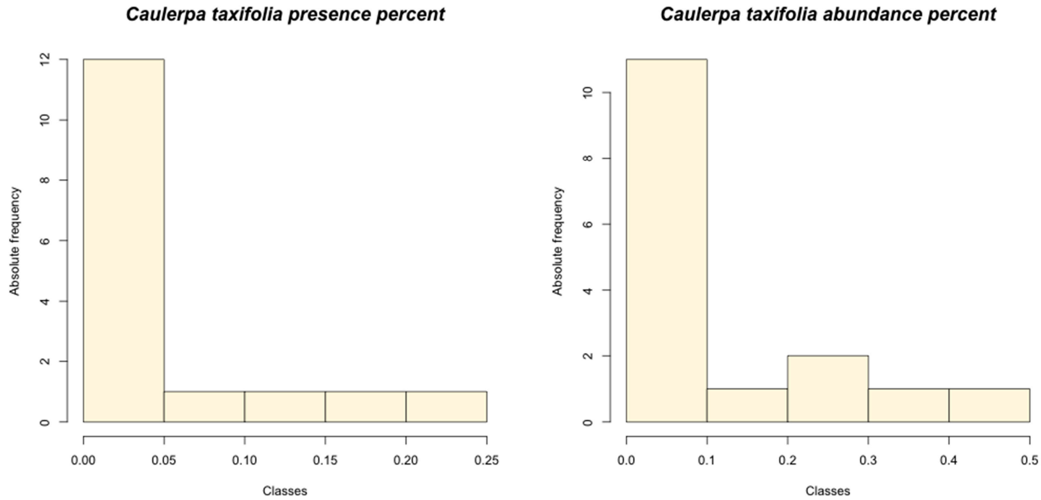


Fig. 3.16 Frequency distribution of *MRC-SP* indices values obtained for *C. taxifolia*.

The green algae *C. taxifolia* in the Mediterranean Sea has spread steadily since its introduction in 1984 from the aquarium in Monaco (Meinesz & Hesse 1991, Boudouresque et al. 1995). At the end of 2000, it has colonized thousands of hectares mainly in six Mediterranean countries: Spain, France, Monaco, Italy, Croatia and Tunisia (Relini et al. 2000). In Italy the first discovery of *C. taxifolia* was made in 1992 in Imperia (GE) harbour (Relini & Torchia 1992). Nowadays it is recorded in Liguria, Tuscany, Sicily and Calabria (Meinesz et al. 2001).

The indices show the absence of *C. taxifolia* along some Adriatic and southern Italian coasts, where enough data were collected. Although *C. taxifolia* issue has been extensively reported in magazine and scientific journals (Klein & Verlaque 2008), its distributional pattern appeared less concerned than *C. cylindracea* ones along the Italian coasts (Fig. 3.17).

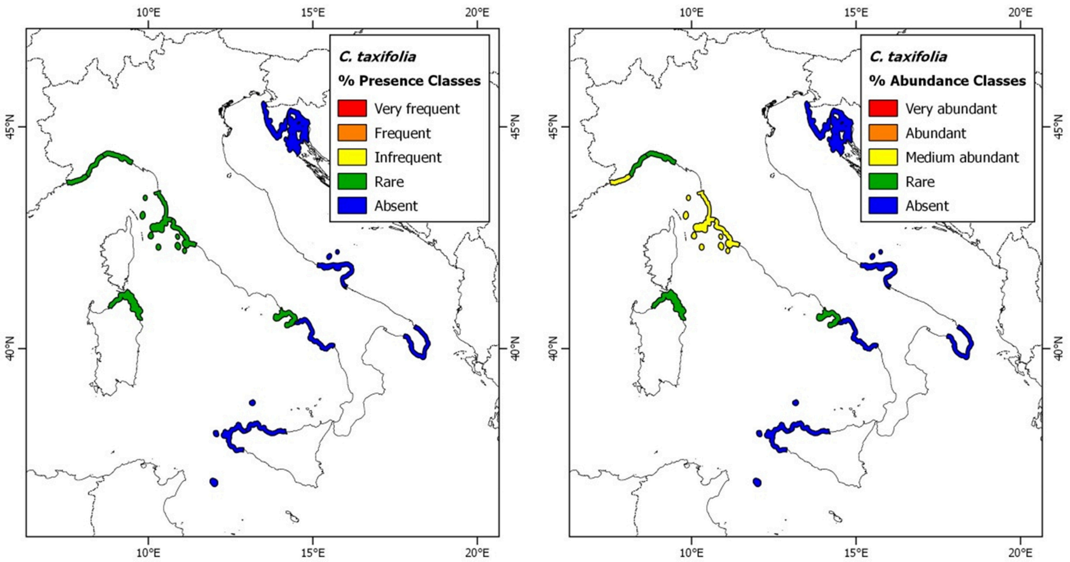


Fig. 3.17 ***MRC-SP*** **indices values in the coastal provinces (Mercator projection, WGS84).**

3.4.3 *Rapana venosa*

The $MRC\text{-}R.venosa_{presence\ \%}$ index values calculated for provincial coastal areas ranged from 0 to 0.83, while the $MRC\text{-}R.venosa_{abundance\ \%}$ index values from 0 to 0.90 (Annex 2). Frequency distribution of $MRC\text{-}R.venosa_{presence\ \%}$ index and $MRC\text{-}R.venosa_{abundance\ \%}$ index in Fig. 3.18.

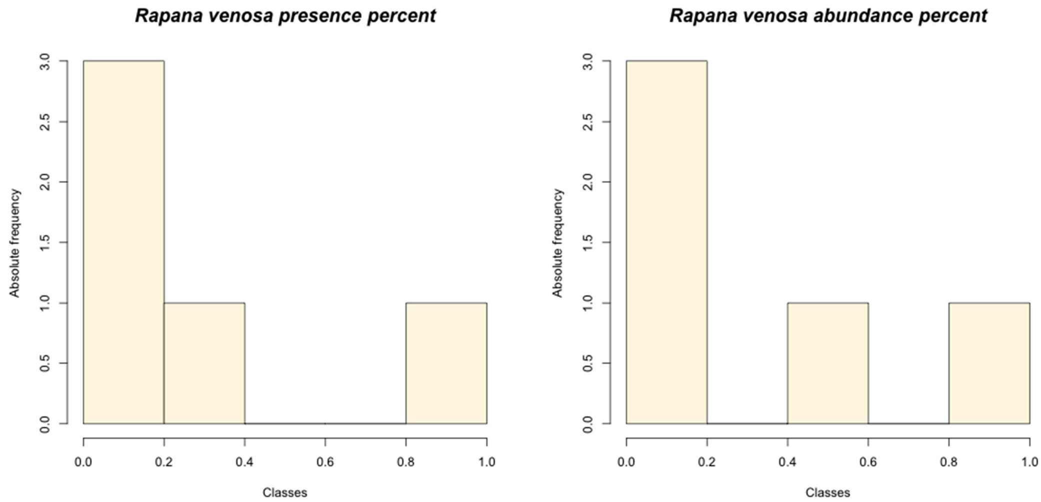


Fig. 3.18 Frequency distribution of *MRC-SP* indices values obtained for *R. venosa*.

R. venosa is native in Japan and East Cina. It is an invasive species in the northern Adriatic and the Black Sea, and in many other parts of the world. In the Mediterranean Sea, it was recorded firstly in 1974 in the northern Adriatic, from off Ravenna-Cattolica area (Ghisotti 1974), before 1983 in the Gulf of Trieste (Crocetta 2011), successively from northern Aegean Sea (Koutsoubas & Voultsiadou-Koukoura 1991) and Slovenia (De Min & Vio 1997). The mode of introduction was accidental and in independently way in the Black Sea and in the Adriatic Sea. Planktonic larvae may have arrived through ships' ballast water, but the transport of egg masses with marine farming products is more likely. The reasons for its success in establishing are the dietary flexibility and the broad ecological tolerance (Savini et al. 2004, Savini & Occhipinti-Ambrogi 2006).

The data collected by volunteers on this species are very few and highlighted its presence just in the Adriatic Sea (Fig. 3.19). The strong species presence in the Pesaro-Urbino province coastal area confirmed the distribution pattern reported in literature (see www.ciesm.org/atlas/Rapanavenosa.html), but some records in the northern Apulia region indicated the increasing spread of the species.

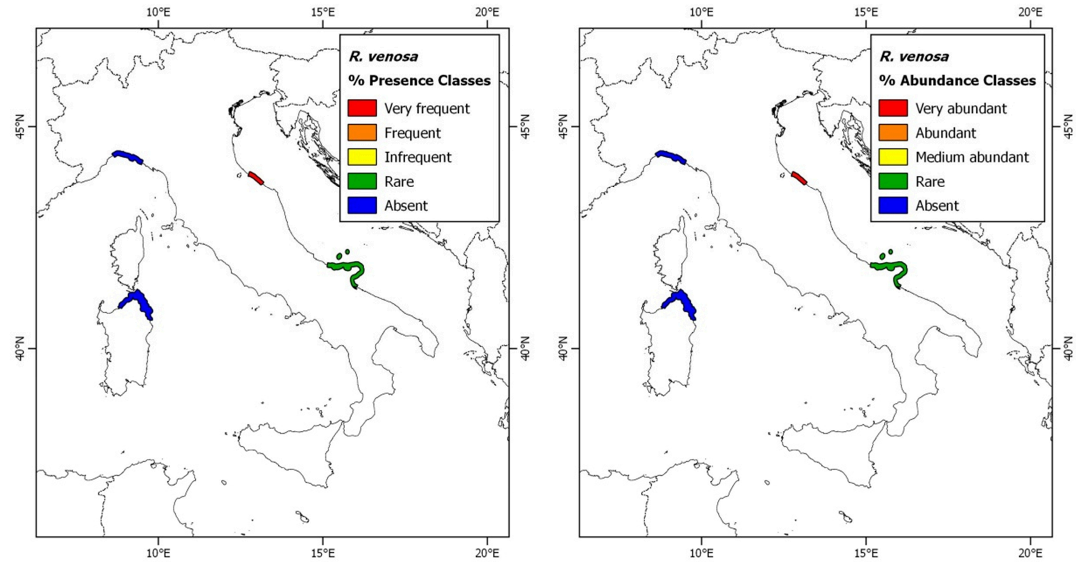


Fig. 3.19 *MRC-SP* indices values in the coastal provinces (Mercator projection, WGS84).

3.5 Mediterranean Reef Check Species sensitive indices

Sensitivities of selected species toward physical, chemical and biological source of disturbance were assessed according to available literature. References and assigned scores were reported in the Annex 3.

The $MRC\text{-}Ss_{tot}$ index, $MRC\text{-}Ss_{phy,}$ $MRC\text{-}Ss_{chem}$ and $MRC\text{-}Ss_{bio}$ values calculated for province coastal areas ranged between 0.22 and 3.6 (Annex 4 - Table 1). They were normally distributed (Pearson chi-square normality test, $p_{tot} = 0.43$, $p_{phy} = 0.79$, $p_{chem} = 0.37$ and $p_{bio} = 0.06$) (Fig. 3.20).

A possible interpretation scale for the mean sensitivity of the assemblages is proposed in Table 3.6.

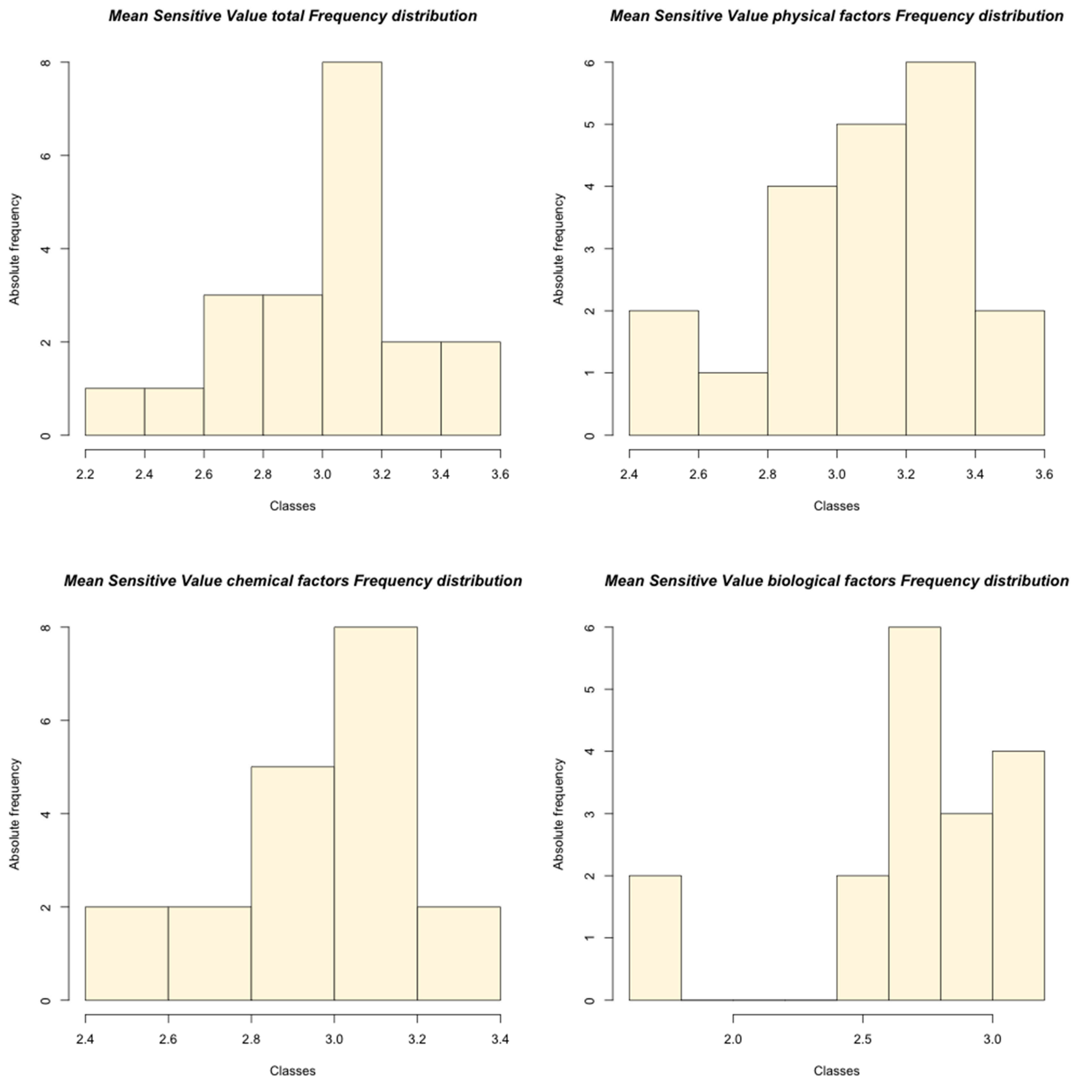


Fig. 3.20 Frequency distribution of *MRC-SP* indices values obtained for *R. venosa*.

Table 3.6 Proposed classification scheme for the *MRC-Ss* indices.

	MRS-Ss	Sensitivity of the assemblages
	0.00 – 2.74	Very low
	2.74 – 2.94	Low
	2.94 – 3.08	Moderate
	3.08 – 3.19	High
	3.19 – 5.00	Very high

The maps in Fig. 3.21 show the mean sensitivities of assemblages towards physical, chemical, biological and overall disturbs found in each coastal province.

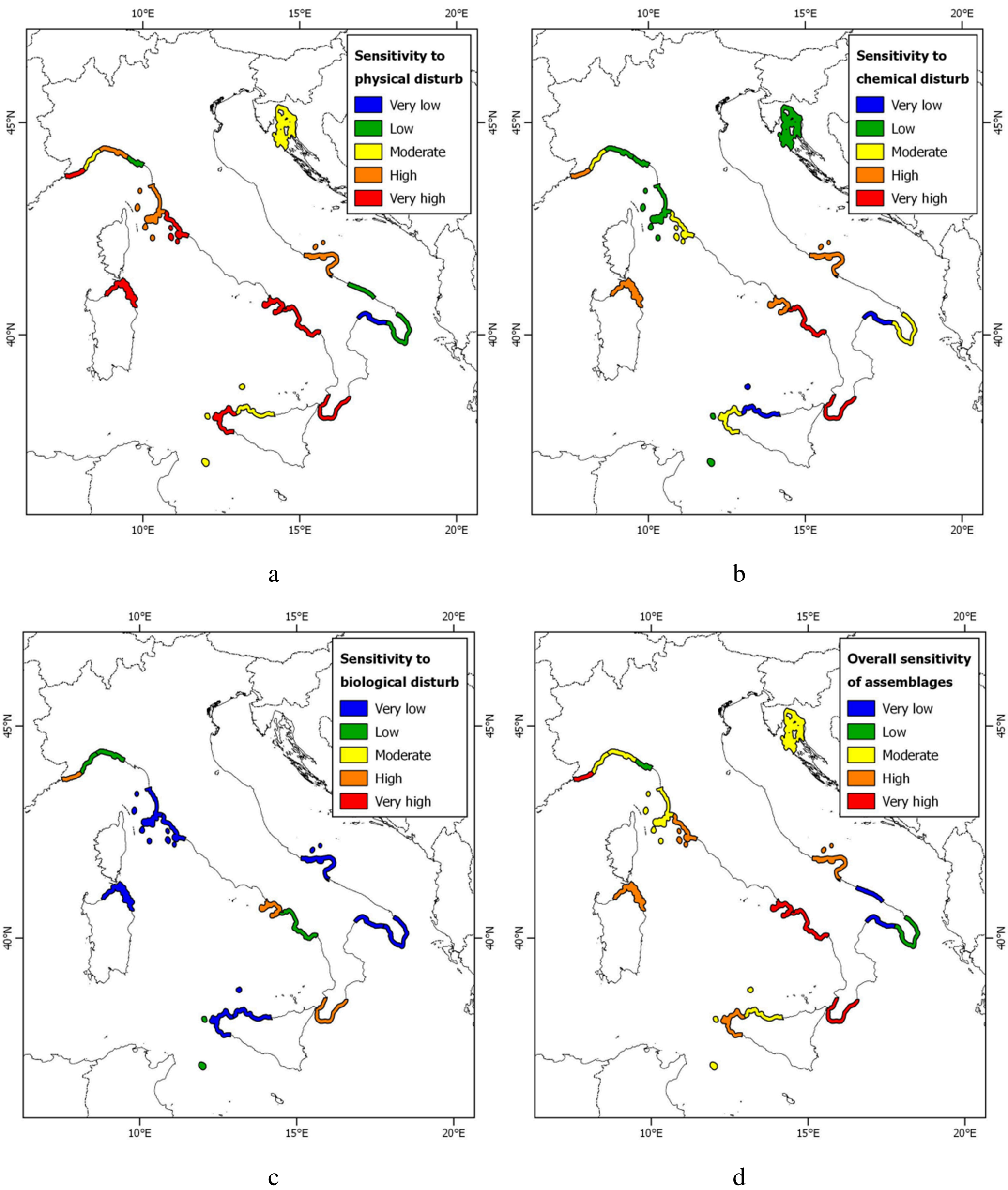


Fig. 3.21 *MRC-Ss* indices values in the coastal provinces (Mercator projection, WGS84).

Assemblages very sensitive toward physical threatens were found in the province of Imperia, Grosseto, Olbia, Naples, Salerno, Reggio Calabria and Trapani, while those less sensitive were found in Taranto (Fig. 3.21a).

Assemblages very sensitive toward chemical threatens were found in the provinces of Reggio Calabria, Naples and Salerno, while those less sensitive were found in Palermo and Taranto (Fig. 3.21b).

Assemblages sensitive toward biological threatens were found in the provinces of Reggio Calabria, Naples and Imperia, while those less sensitive were found in Foggia, Grosseto, Lecce, Livorno, Otranto, Palermo, Taranto and Trapani (Fig. 3.21c).

Assemblages very sensitive toward overall threatens were found in the provinces of Imperia, Napoli, Salerno and Reggio Calabria, while those less sensitive were found in Taranto and Bari (Fig. 3.21d).

3.5.1 *MRC-Ss* indices applied to Marine Protected Areas

The species sensitivity indices (*MRC-Ss*) were calculated for all MPAs and other marine protected zones, according to the boundaries obtained from the World Database on Protected Areas and if enough data were available (Annex 4 - Table 2). As an example, the mean overall sensitivity assessment calculated in Portofino MPA, Tavolara Capo Coda Cavallo MPA, Isole Tremiti MPA and Tegnùe of Chioggia No Take Zone (NTZ) were shown in Fig. 3.22.

Tavolara Capo Coda Cavallo MPA showed very sensitive assemblages as could be expected in a well-managed area with limited anthropic impacts, as it really is. Isole Tremiti MPA presented sensitive assemblages, in agreement with the overall low disturbance in the area, and perhaps there are some room for environmental quality improvement through management. The assemblages of Portofino MPA shown moderate sensitivity, that could be the result of several disturbs present in the area, like events of high turbidity and sedimentation, intense coastal, nautical and diving tourism. This result is also in agreement with the presence of the NIS *Caulerpa cylindracea* within the MPA. The assemblages living in the northern Adriatic coralligenous outcrops, included in the Tegnùe of Chioggia NTZ, are among the least sensitive of those found in Mediterranean protected areas. Actually, the northern Adriatic seabed has experienced high anthropic disturb, including several dystrophic crises and intense trawling that may have limited the abundance of sensitive species.

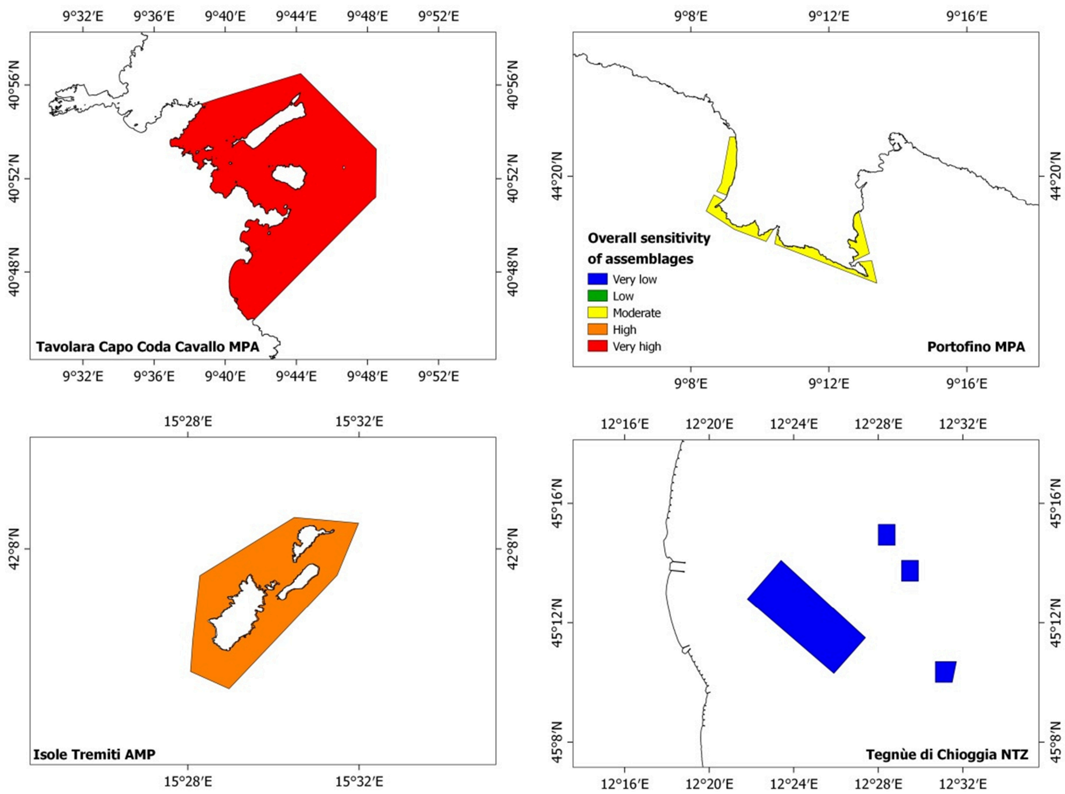
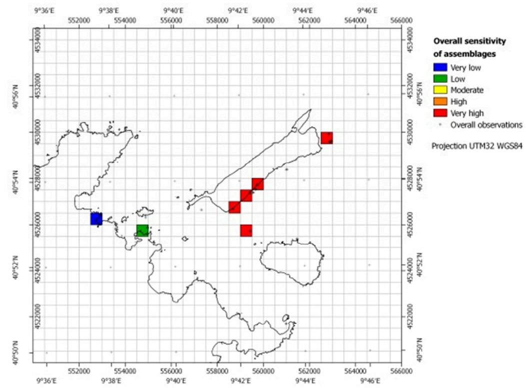


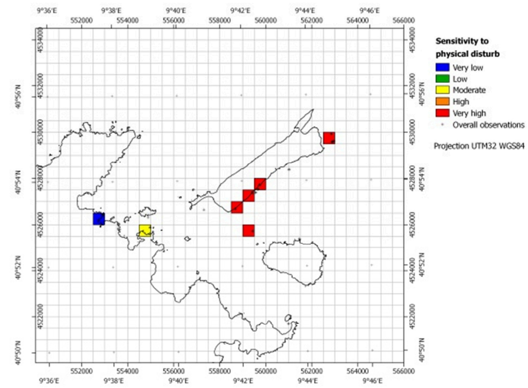
Fig. 3.22 Overall sensitivity assessment of assemblages living in Tavolara Capo Coda Cavallo MPA, Portofino MPA, Isole Tremiti MPA and Tegnùe di Chioggia NTZ.

3.5.2 Effectiveness of the *MRC-Ss* indices

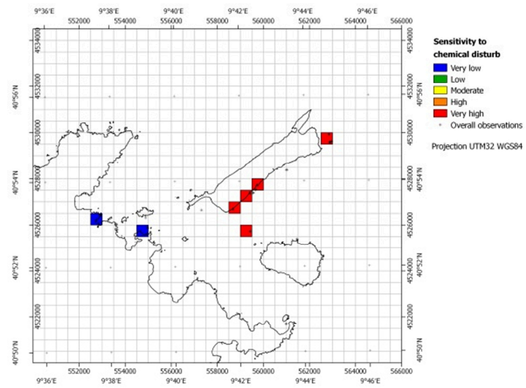
Since is nearly impossible to find pristine habitats in Mediterranean Sea that can be used as reference conditions, the effectiveness of the *MRC-Ss* indices were evaluated by comparison with an assessment carried out with traditional methods within the Tavolara Capo Coda Cavallo MPA (Bianchi et al. 2012). The *MRC-Ssi* indices showed a clear pattern of differentiation between the few cells where enough data were available for the estimation (Annex 4 - Table 3). In particular, Costa Corallina bay, along the main coast showed less sensitive assemblages compared to those found along the Tavolara Island and offshore shoals (Fig. 3.23). That is in agreement with a higher impact along the main coast and the general trend appeared similar those reported in the MPA Environmental quality map (Fig. 3.24).



a



b



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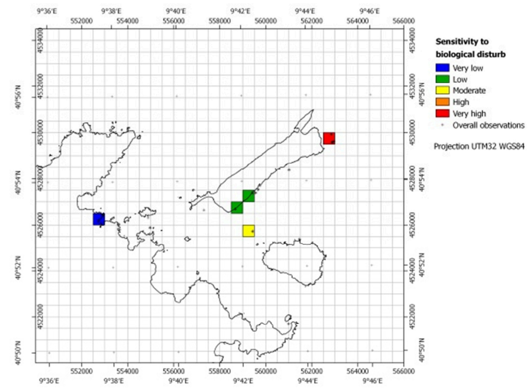

d

Fig. 3.23 *MRC-Ss* indices values within the Tavolara MPA: a) toward overall threats; b) toward physical threats; c) toward chemical threats; d) toward biological threats (UTM32 projection, WGS84).

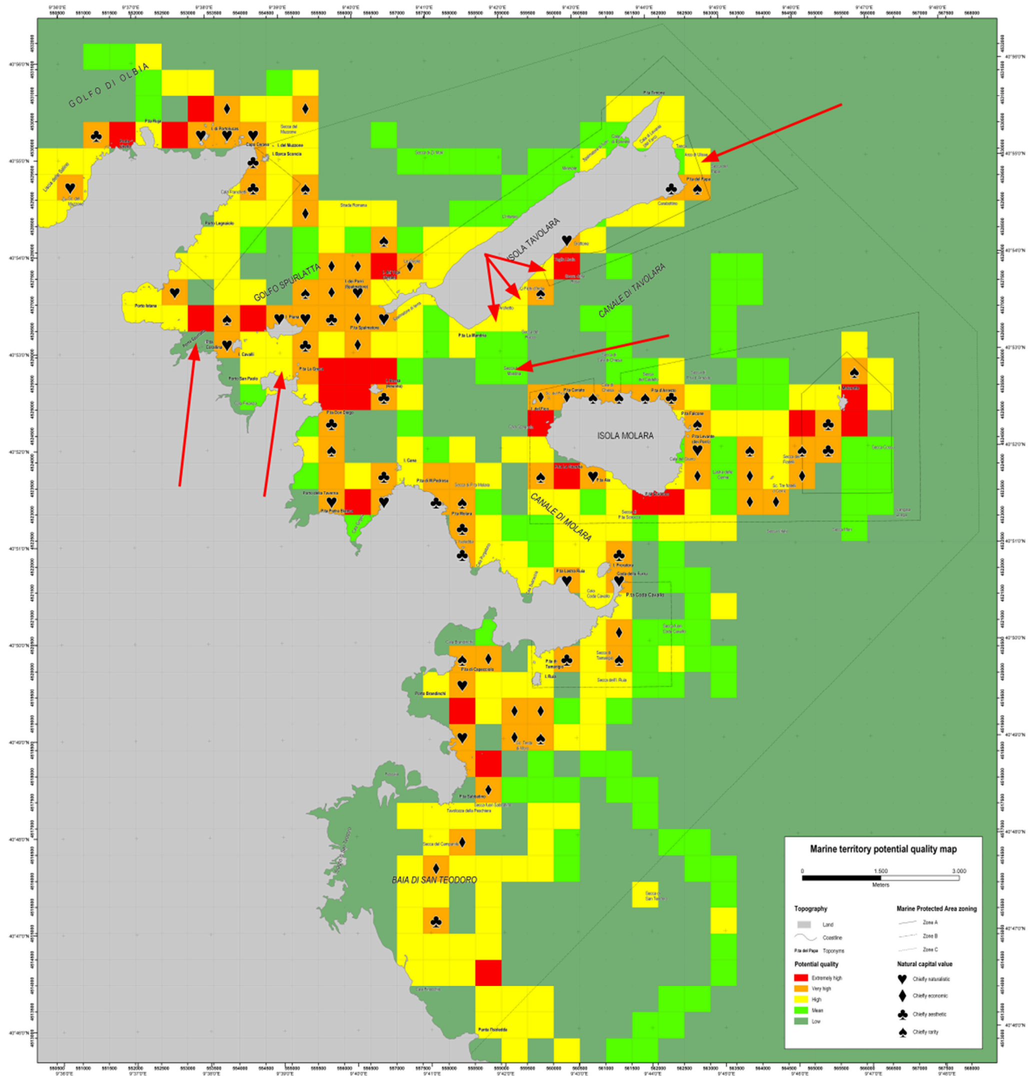

Fig. 3.24 Environmental quality map of Tavolara Capo Coda Cavallo MPA: Red: extremely high environmental quality; Orange: very high environmental quality; Yellow: high environmental quality; Light green: mean environmental quality; Dark green: low environmental quality. Arrows indicate the grid cells where enough RCI data were available in order to calculate the *MRC-Ss* indices (modified from Bianchi et al. 2012; UTM32 projection, WGS84).

4 Discussion

Scuba divers volunteers may support researchers and managers in collecting data over spatial and temporal scales that would impossible to cover otherwise. The U-CEM protocol is a simple but effective visual census approach. It is easy to teach and guarantees an impressive amount of geo-referred data. Strong quality assessment and cross validation of the data collected by lay people are of paramount importance. In this respect, the protocol demands for several automatic and manual data checks, and records not conforming to the required quality were discharged. According to the preliminary test in the field, the training delivered by RCI is enough for the task that EcoDivers are called to do. If the recruitment of volunteers continues over time and the surveyed areas increase, the assessment and the monitoring of Mediterranean Sea would be possible. Its wide replication in space and time opens further study opportunities like on biogeography, NIS dynamics and new perspective for nature conservation.

Biotic indices may allow evaluations of the environmental quality status, but their meaning should be interpreted according to the biological and ecological characteristics on which they are based. However, effectiveness of the indices has to be tested in different conditions and in different areas. Beside biotic indices intended for specialists (e.g. CAI, COARSE, ESCA), well trained volunteers may capture reliable information on the assemblages that can be used in the environmental quality assessment. Analysed data (Fig. 3.7) evidence that divers can easily recognize many species, of hard bottom benthos, including some NIS. The Mediterranean Reef Check visual census indices (MRC-VCi) are based on the data collected according to the RCI U-CEM protocol. These indices provide proximal information on species diversity, allow to evaluate the spreading of NIS, and give information on the mean sensitivity of the assemblages towards different kinds of anthropic threatens. In particular, the non-indigenous species (NIS) have been recognized as a major threat to the integrity of Mediterranean native communities because of their proliferation, spread and impact on resident communities (Hejda et al. 2009). The ecological consequences of an invasive species to an ecosystem can include competitive displacement, impacts on species growth, survival and reproduction (Grosholz 2002). Furthermore, their establishment can drastically change the structure of marine communities (Streftaris & Zenetos 2006, Occhipinti-Ambrogi 2007, Butchart et al. 2010, Coll et al. 2010). Monitoring of NIS' spreading dynamics at the basin spatial scale is difficult but urgent.

The major weakness of these indices is the small number of species considered. This drawback mainly affects the estimation of species richness, especially in habitats less represented by the selected taxa. After all, species have been chosen among the most easily observable by divers, especially in rocky habitats. Furthermore, the high replication and the minimum area adopted improve the reliability of the results.

The most promising indices are those based on the sensitivity of species. The sensitivity of the species was determined on the basis of available knowledge. Unfortunately, many studies on the short- and long-term effects of specific anthropogenic disturbances are missed. For this reason alongside the sensitivity assessments, confidence levels of the information available were reported. On overall, 25 taxa were included in the sensitivity indices. They cover a wide range of biological and ecological features.

In this preliminary study, the MRC-VCi were applied to administrative areas (i.e. provincial coastal zones and marine protected areas) in the attempt to be useful for management purposes. At this stage, the analyses take in account a broad spatial scale and indices clearly evidence the potential of this tool. With a certain degree of approximation, provincial coastal zones that showed assemblages with reduced mean sensitivities (e.g. Taranto, Bari, Palermo, La Spezia) correspond with areas characterized by large industrial areas, big harbours, and dense population. These areas were indicated among those more interested by physical disturbance, chemical pollution and cumulative impacts (see for comparison Fig. 4.1, Fig. 4.2, Fig. 4.3; UNEP/MAP 2012, Micheli et al. 2013). Despite this, it is very difficult to attribute a univocal assessment to areas as large as provinces.

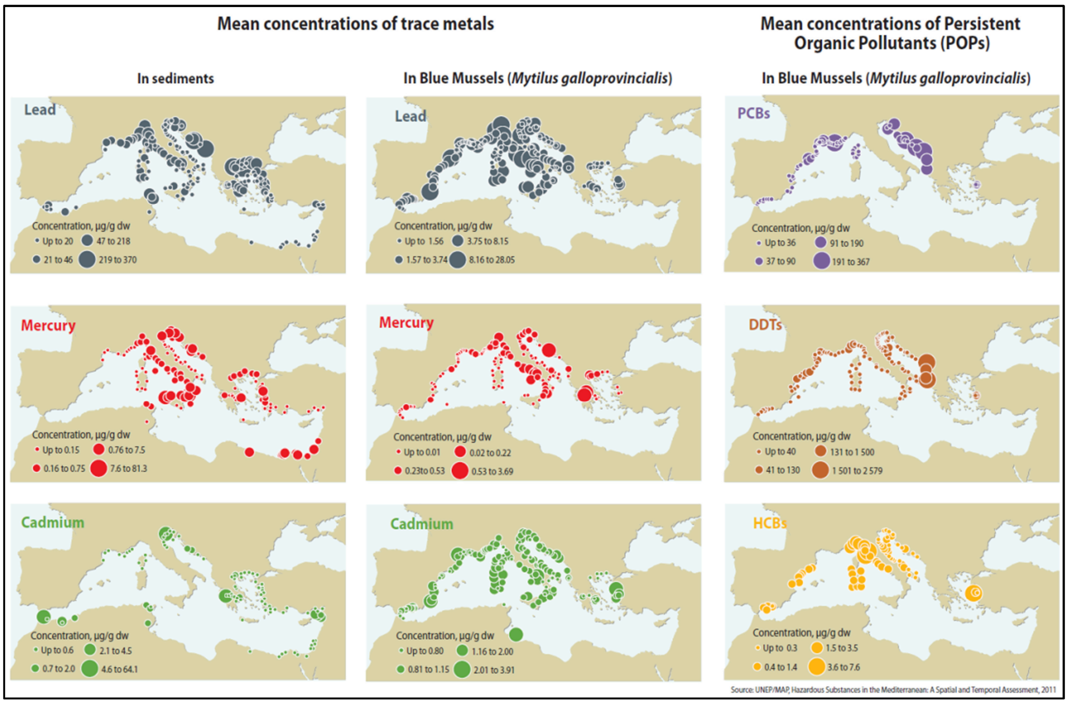

Fig. 4.1 Hazardous substances in the Mediterranean Sea (UNEP/MAP 2012).

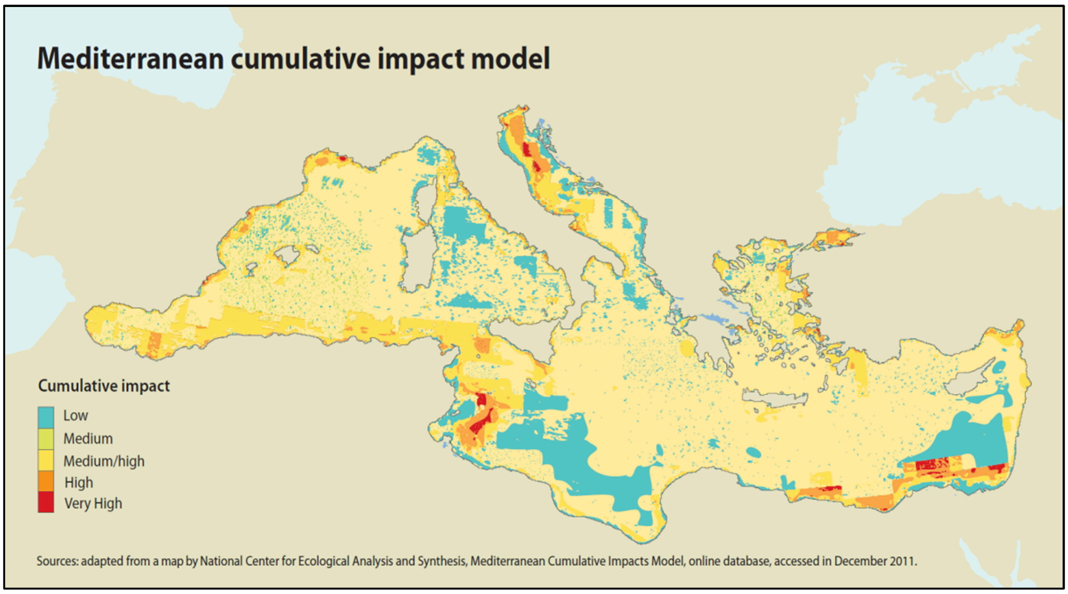

Fig. 4.2 Mediterranean cumulative impact model (UNEP/MAP 2012).

It is evident that coastal provinces are not the best territorial unit to exploit a dataset characterized by a higher detail. This is true especially in those provinces where the geomorphology is very heterogeneous such as archipelagos. According to data available, these indices may be applied to smaller areas (e.g. MPA subzones). In particular, the sensitivity indices may provide reliable results at local scale (i.e. within the Tavolara Capo Coda Cavallo MPA).

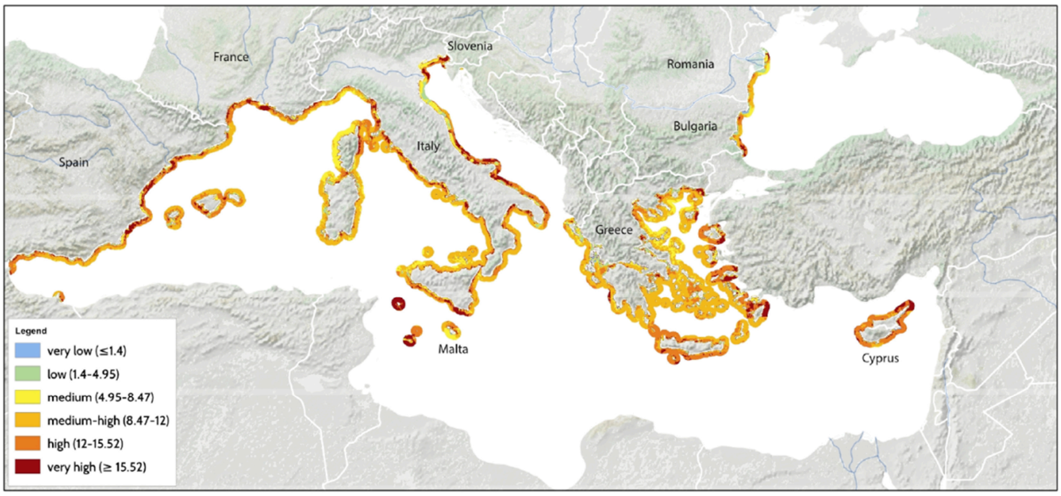

Fig. 4.3 Spatial distribution of cumulative impacts to the territorial waters of Mediterranean EU member state (Micheli et al. 2013).

These indices seem more suited to local assessments even if this requires a greater amount of data and therefore large effort from the volunteers. For instance, the managers of marine protected areas could involve diving centres in contributing to the year-by-year monitoring and conservation of habitats from which they draw sustenance. This could be a way to stimulate a participatory management of the marine environments. However, these indices still require better calibration and higher validation in the field. They also do not want replace professional surveys, but complement them by providing managers with additional information in space and time.

This approach provides a powerful tool for raising awareness of the community and allows a strong integration between researchers, managers and stakeholders, thus providing an efficient strategy to achieve the objectives set by the European Union. However, volunteers need continuous training and further analysis and test on the data collected from them would be appropriate for increasing the robustness of the data.

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Annex 1

Mediterranean Reef Check Diversity indices calculated for provincial coastal areas

Annex 1 - Diversity indices calculated for provincial coastal areas

Zones	Observations	Observers	Searched	Found	MRC_H	MRC_D	MRC_Sratio
HR13	146	3	36	20	NA	NA	NA
HR15	10	1	10	9	NA	NA	NA
HR18	616	4	42	23	3.82	0.92	0.55
HR8	469	6	40	27	4.13	0.93	0.68
ITAG	67	3	26	11	NA	NA	NA
ITAN	391	14	42	18	3.82	0.92	0.43
ITBA	232	11	42	21	4.04	0.93	0.50
ITBR	18	2	13	13	NA	NA	NA
ITBT	14	1	14	9	NA	NA	NA
ITCA	242	1	19	15	NA	NA	NA
ITCH	18	2	18	7	NA	NA	NA
ITCI	12	1	6	0	NA	NA	NA
ITCS	34	5	23	11	3.31	0.89	0.48
ITFG	1532	42	43	26	3.92	0.92	0.60
ITGE	6866	92	43	34	4.41	0.95	0.79
ITGR	1138	43	33	32	4.69	0.96	0.97
ITIM	588	11	38	27	4.36	0.94	0.71
ITKR	26	2	23	5	NA	NA	NA
ITLE	303	13	39	25	4.05	0.93	0.64
ITLI	1308	34	43	32	4.57	0.95	0.74
ITLT	264	3	24	15	NA	NA	NA
ITME	82	4	24	4	1.87	0.70	0.17
ITNA	621	12	35	27	4.55	0.95	0.77
ITNU	70	1	35	2	NA	NA	NA
ITOT	1817	28	43	28	4.23	0.94	0.65
ITPA	792	20	43	32	4.44	0.95	0.74
ITPU	86	12	20	5	2.02	0.73	0.25
ITRA	38	3	33	4	NA	NA	NA
ITRC	243	9	24	21	4.02	0.93	0.88
ITRG	5	1	5	3	NA	NA	NA
ITRM	90	5	27	16	3.64	0.91	0.59
ITRN	2	1	2	2	NA	NA	NA
ITRO	682	1	38	5	NA	NA	NA
ITSA	722	32	42	29	4.33	0.94	0.69
ITSP	207	14	32	21	4.17	0.94	0.66
ITSR	56	3	39	15	NA	NA	NA
ITSS	140	4	24	12	3.35	0.89	0.50
ITSV	1140	58	43	36	4.71	0.95	0.84
ITTA	147	10	30	21	4.09	0.93	0.70
ITTP	350	14	32	26	4.36	0.94	0.81
ITTR	247	4	39	23	4.10	0.93	0.59
ITTS	191	14	34	18	3.84	0.92	0.53

Annex 2

Mediterranean Reef Check NIS indices calculated for provincial coastal areas

Annex 2 - NIS indices for provincial coastal areas

Zones	*C.cylindracea* observations	*C.cylindracea* observers	*C.cylindracea* pres.percent	*C.cylindracea* ab.percent	*C.taxifolia* observations	*C.taxifolia* observers	*C.taxifolia* pres.percent	*C.taxifolia* ab.percent	*R.venosa* observations	*R.venosa* observers	*R.venosa* pres.percent	*R.venosa* ab.percent
HR13	9	3	NA	NA	6	3	NA	NA	0	0	NA	NA
HR15	1	1	NA	NA	0	0	NA	NA	0	0	NA	NA
HR18	26	3	0.00	0.00	25	3	0.00	0.00	14	1	NA	NA
HR8	15	5	0.20	0.56	15	5	0.00	0.00	11	1	NA	NA
ITAG	3	2	NA	NA	3	2	NA	NA	0	0	NA	NA
ITAN	7	3	NA	NA	7	3	NA	NA	7	6	NA	NA
ITBA	13	9	0.92	0.98	5	5	NA	NA	1	1	NA	NA
ITBR	2	2	NA	NA	0	0	NA	NA	0	0	NA	NA
ITBT	1	1	NA	NA	1	1	NA	NA	0	0	NA	NA
ITCA	17	1	NA	NA	12	1	NA	NA	0	0	NA	NA
ITCH	0	0	NA	NA	0	0	NA	NA	0	0	NA	NA
ITCI	2	1	NA	NA	2	1	NA	NA	0	0	NA	NA
ITCS	2	2	NA	NA	1	1	NA	NA	0	0	NA	NA
ITFG	69	14	0.01	0.01	68	12	0.00	0.00	12	4	0.08	0.08
ITGE	379	61	0.77	0.94	203	34	0.03	0.08	26	9	0.00	0.00
ITGR	73	27	0.73	0.92	37	12	0.16	0.28	0	0	NA	NA
ITIM	24	8	0.13	0.25	24	9	0.21	0.39	3	1	NA	NA
ITKR	1	1	NA	NA	1	1	NA	NA	0	0	NA	NA
ITLE	25	12	0.48	0.78	12	6	0.00	0.00	2	1	NA	NA
ITLI	72	21	0.75	0.94	47	10	0.15	0.42	1	1	NA	NA
ITLT	12	2	NA	NA	12	2	NA	NA	0	0	NA	NA
ITME	2	2	NA	NA	2	2	NA	NA	0	0	NA	NA
ITNA	32	7	0.63	0.82	26	5	0.04	0.17	2	1	NA	NA
ITNU	2	1	NA	NA	2	1	NA	NA	2	1	NA	NA
ITOT	96	19	0.38	0.73	66	17	0.02	0.03	11	4	0.00	0.00
ITPA	37	15	0.35	0.63	28	10	0.00	0.00	8	2	NA	NA
ITPU	1	1	NA	NA	0	0	NA	NA	24	12	0.83	0.91
ITRA	1	1	NA	NA	1	1	NA	NA	3	2	NA	NA
ITRC	6	3	NA	NA	9	5	NA	NA	0	0	NA	NA
ITRG	1	1	NA	NA	1	1	NA	NA	0	0	NA	NA
ITRM	4	2	NA	NA	3	1	NA	NA	0	0	NA	NA
ITRN	0	0	NA	NA	0	0	NA	NA	0	0	NA	NA
ITRO	18	1	NA	NA	18	1	NA	NA	18	1	NA	NA
ITSA	35	21	0.20	0.43	28	16	0.00	0.00	7	2	NA	NA
ITSP	17	10	0.94	0.99	5	4	NA	NA	0	0	NA	NA
ITSR	3	3	NA	NA	3	3	NA	NA	1	1	NA	NA
ITSS	5	2	NA	NA	6	2	NA	NA	0	0	NA	NA
ITSV	44	26	0.43	0.74	38	20	0.08	0.20	7	3	NA	NA
ITTA	12	4	1.00	1.00	9	4	NA	NA	0	0	NA	NA
ITTP	19	10	0.53	0.86	15	9	0.00	0.00	0	0	NA	NA
ITTR	10	4	0.60	0.89	10	4	0.00	0.00	3	1	NA	NA
ITTS	3	2	NA	NA	3	2	NA	NA	5	4	NA	NA

Annex 3

Taxa Mean Sensitive Value

Taxa general information and sensitive assessment

Annex 3 - Taxa Mean Sensitivity Values (MSV)

Taxa	MSVtot	MSVphy	MSVchem	MSVbio
Aplidium conicum	NA	NA	NA	NA
Aplidium tabarquensis	NA	NA	NA	NA
Aplysina spp.	3.29	3.18	4.00	3.50
Arca noae	3.00	2.70	3.25	4.00
Astroides calycularis	3.00	2.90	3.00	4.00
Axinella spp.	3.46	3.36	4.00	NA
Balanophyllia europaea	2.79	3.00	3.00	0.00
Bolle	NA	NA	NA	NA
Caulerpa cylindracea	1.06	1.00	1.50	0.00
Caulerpa taxifolia	1.13	1.00	1.75	0.00
Centrostephanus longispinus	NA	NA	NA	NA
Chlamys varia	NA	NA	NA	NA
Chromis chromis	1.91	2.00	0.50	2.67
Cladocora caespitosa	3.07	3.40	3.00	1.50
Conger conger	1.92	1.50	4.00	2.33
Corallium rubrum	4.00	4.38	3.67	3.00
Cornularia cornucopiae	NA	NA	NA	NA
Diplodus spp.	NA	NA	NA	NA
Epizoanthus spp.	NA	NA	NA	NA
Eunicella cavolini	4.00	4.33	3.33	3.50
Eunicella singularis	3.57	3.67	3.30	3.50
Eunicella verrucosa	3.14	3.10	3.33	3.00
Geodia cydonium	2.27	2.33	2.00	2.00
Hippocampus spp.	2.27	2.00	NA	3.33
Homarus gammarus	2.00	1.57	2.00	3.50
Ircinia s.pp	NA	NA	NA	NA
Leptopsammia pruvoti	3.42	3.44	3.33	NA
Maasella edwardsi	NA	NA	NA	NA
Microcosmus spp	NA	NA	NA	NA
Ophidiaster ophidianus	NA	NA	NA	NA
Palinurus elephas	2.18	1.75	2.50	5.00
Paracentrotus lividus	2.57	2.50	3.00	2.00
Paramuricea clavata	4.00	4.25	3.67	3.50
Parazoanthus axinellae	3.43	3.30	3.67	4.00
Patella ferruginea	NA	NA	NA	NA
Pecten jacobaeus	NA	NA	NA	NA
Pinna nobilis	NA	NA	NA	NA
Polycitor adriaticus	NA	NA	NA	NA
Rapana venosa	1.20	0.63	1.40	3.00
Savalia savaglia	3.62	3.38	3.33	4.29
Sciaena umbra	2.73	2.57	2.00	3.33
Scyllarides latus	NA	NA	NA	NA
Tethya spp	NA	NA	NA	NA
Trisopterus minutus	NA	NA	NA	NA

General information		*Aplysina cavernicola*	*Aplysina aerophoba*
Taxonomy	Phylum	Porifera	Porifera
	Class	Demospongiae (Verongimorpha)	Demospongiae (Verongimorpha)
	Order	Verongiida	Verongiida
	Family	Aplysinidae	Aplysinidae
	Genus	*Aplysina*	*Aplysina*
	Species	*Aplysina cavernicola*	*Aplysina aerophoba*
	Authority	Vacelet, 1959	Nardo, 1833
Habitat information	Physiographic preference	Open coast, Offshore seabed	Open coast, Offshore seabed
	Biological zone preferences	Lower infralittoral, Upper circalittoral	Eulittoral, Upper infralittoral
	Substratum/ habitat preferences	Caves, Cliffs, Rocky seabed, Artificial; Rocky shores	Coarse, Seagrass, Rock detritus; Rocky shores
	Tidal strenght preferences	Very weak	Moderately strong
	Wave exposure preferences	Sheltered	Exposed
	Salinity preferences	Full (30-40 psu)	Full (30-40 psu)
	Depth range	dai 25-30 m	1-20 m
	Other preferences	Schiaphilous environment	Calcareous seabad in shallow water
	Migration pattern	No	No
	Is the species native?	Yes	Yes
	Origin	Atlantic-Mediterranean	Atlantic-Mediterranean
General biology	Typical abundance	Locally abundant	Locally abundant
	Male size range	5-12 cm (heigh)	15 cm (height)
	Male size at maturity	Data deficient	Data deficient
	Female size range	5-12 cm (heigh)	15 cm (height)
	Female size at maturity	Data deficient	Data deficient
	Growth form	Regular cylindrical finger-like	Thick plates or big irregular finger-like projections
	Growth rate	Data deficient	Data deficient
	Body flexibility	Low (10-45°)	Low (10-45°)
	Mobility	Permanent attachment	Permanent attachment
	Characteristic feeding methods	Active suspension feeder	Active suspension feeder, Symbiont contribution
	Typically feeds on	Particulate organic matter	Particulate organic matter
	Sociability	Colonial	Colonial
	Environmental position	Epibenthic, Epifaunal	Epibenthic, Epifaunal
	Supports (Depend on/ support)	Host for ectoparasitic (*Entomolepis adriae*)	Host for ectoparasitic (*Pseudoclausia longiseta, Cryptopontius minor* and *Entomolepis adriae*)
	Is the species toxic?	Yes	Yes
Reproduction and longevity	Reproductive type	Asexual reproduction (propagules)	Asexual reproduction (propagules)
	Reproductive frequency	Data deficient	Data deficient
	Developmental mechanism	Data deficient	Data deficient
	Fecundity (number of eggs)	Data deficient	Data deficient
	Generation time	Data deficient	Data deficient
	Age at maturity	Data deficient	Data deficient
	Dispersal potential	Data deficient	Data deficient
	Larval settling time	Data deficient	Data deficient
	Time of first gamete	Data deficient	Data deficient
	Time of last gamete	Data deficient	Data deficient
	Life span	Data deficient	Data deficient
Biotope / ecosystem importance	Protection	Barcelona Convention, Annex II	Barcelona Convention, Annex II
	Does the species create space in the assemblage?	Moderate	Moderate
	Does it occupy space and exclude?	Moderate	Moderate
	Does the species provide habitat structure?	Sheltered, community	Sheltered, community
	Does the species provide an important food source?	Yes	Yes
	For what?	*Luria lurida* (Linnaeus, 1758)	*Luria lurida* (Linnaeus, 1758), *Tylodina pervers*a (Gmelin, 1791)
	Medicinal use	Yes	Yes
	Aquaculture use	/	/
	Harvested (targered)	/	/
	Harvester (by-catch)	/	/
	Curio use	/	/
	Culinary use	/	/
Threats			Indiscriminate exploitation, High temperature
Reference:	Ebel et al. 1997, Hentschel et al. 2001, Becerro et al. 2003, Hoffmann et al. 2005, Hoffmann et al. 2008, Webster et al. 2008, Zucht et al. 2008, Devescovi & Ivesa 2007, Di Camillo et al. 2013		

Aplysina spp. - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	High	Moderate	Low	3
	Smothering	Intermediate	Low	High	High	4
	Changes in suspended sediment	High	High	Moderate	Very low	3
	Desiccation	High	None	Very high	Low	5
	Changes in emergence	High	None	Very high	Very low	5
	Changes in water flow rate	Tolerant	Not relevant	Not sensitive	Low	0
	Changes in temperature	High	Low	High	Moderate	5
	Changes in turbidity	High	High	Moderate	Very low	3
	Changes (increase) in wave exposure	Tolerant	Not relevant	Not sensitive	Low	0
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	High	Very high	Low	Moderate	2
	Displacement	High	Low	High	Moderate	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in salinity	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in oxygenation	Intermediate	Very high	Low	High	4
Biological factors	Introduction of microbial pathogens and parasites	High	Low	High	High	4
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Moderate	Moderate	Moderate	3
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Arca noae*
Taxonomy	Phylum	Mollusca
	Class	Bivalvia (Pteriomorphia)
	Order	Arcoida
	Family	Arcidae
	Genus	*Arca*
	Species	*Arca noae*
	Authority	Linnaeus, 1758
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Uppr circalittoral
	Substratum/ habitat preferences	Bedrock, Cobbles, gravel; Rocky shores
	Tidal strenght preferences	Moderately strong
	Wave exposure preferences	Data deficient
	Salinity preferences	Full (30-40 psu)
	Depth range	3-60 m
	Other preferences	/
	Migration pattern	No
	Is the species native?	Yes
	Origin	Mediterranean endemic
General biology	Typical abundance	Low
	Male size range	1-10 cm
	Male size at maturity	12 mm (Shell Lenght)
	Female size range	1-10 cm
	Female size at maturity	16 mm (SL)
	Growth form	Elongate inequivalvis
	Growth rate	No information found
	Body flexibility	None (< 10°)
	Mobility	Temporary attachment
	Characteristic feeding methods	Active suspension feeder
	Typically feeds on	Suspended organic particles
	Sociability	Solitary
	Environmental position	Epibenthic, Epifaunal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic; Protandric hermafroditism
	Reproductive frequency	No information found
	Developmental mechanism	No information found
	Fecundity (number of eggs)	No information found
	Generation time	No information found
	Age at maturity	No information found
	Dispersal potential	No information found
	Larval settling time	No information found
	Time of first gamete	Spring
	Time of last gamete	Summer
	Life span	10-20 yrs
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	Substratum
	Does the species provide an important food source?	Data deficient
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	/
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	Yes
Description		
Threats		Sensitive to global change, Commercially exploited
References:	Peharda et al. 2002, Peharda et al. 2006, Devescovi & Ivesa 2007, Morton & Peharda 2008, Peric et al. 2013	

Arca noae - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	Low	High	Low	4
	Smothering	High	Low	Very high	High	5
	Changes in suspended sediment	Low	Very high	Very low	Very low	1
	Desiccation	Intermediate	High	Low	Very low	2
	Changes (increase) in emergence	Intermediate	Very high	Very low	Very low	1
	Changes in water flow rate	Low	High	Low	Very low	2
	Changes in temperature	High	Low	High	Very low	4
	Changes in turbidity	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in wave exposure	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Low	Very high	Very low	Very low	1
	Physical disturbance or abrasion	Low	Moderate	Low	Very low	2
	Displacement	High	Low	Very high	High	5
Chemical factors	Changes in levels of synthetic chemicals	High	Low	Very high	Moderate	5
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Tolerant	Not relevant	Not sensitive	Not relevant	0
	Changes in salinity	High	Low	High	Very low	4
	Changes in oxygenation	High	Low	High	Low	4
Biological factors	Introduction of microbial pathogens and parasites	High	Insufficient information	High	Very low	4
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Low	High	Moderate	4
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Very low	na

	General information	*Astroides calycularis*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Hexacorallia)
	Order	Scleractinia
	Family	Dendrophyllidae
	Genus	*Astroides*
	Species	*Astroides calycularis*
	Authority	Pallas, 1766
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral
	Substratum/ habitat preferences	Bedrock, Vertical cliff, Caves; Rocky shores
	Tidal strenght preferences	Elevated
	Wave exposure preferences	Not relevant
	Salinity preferences	Full (30-40 psu)
	Depth range	1-50 m
	Other preferences	Thermophil
	Migration pattern	Non migratory/ Resident
	Is the species native?	Yes
	Origin	Atlantic- Mediterranean
General biology	Typical abundance	High, Locally abundant
	Male size range	Colonies up to 15 cm
	Male size at maturity	3-4 mm lenght (corallites diameter)
	Female size range	Colonies up to 15 cm
	Female size at maturity	3-4 mm lenght (corallites diameter)
	Growth form	Ellipsoid
	Growth rate	No information found
	Body flexibility	None (<10°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder
	Typically feeds on	Zooplankton
	Sociability	Colonial
	Environmental position	Epibenthic
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic, Extracallicular gemmation
	Reproductive frequency	Annual
	Developmental mechanism	No information found
	Fecundity (number of eggs)	8-13 mature oocytes
	Generation time	No information found
	Age at maturity	No information found
	Dispersal potential	<10 m
	Larval settling time	No information found
	Time of first gamete	June
	Time of last gamete	July
	Life span	No information found
Biotope / ecosystem importance	Protection	Annex II, Barcelona Convention, Bern Convention, CITES
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Shelter
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	/
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	/
Threats		Climate change, Increase in suspended sediment
References:	Grubelic et al. 2004, Bianchi 2007, Goffredo et al. 2010, Goffredo et al. 2011a, Goffredo et al. 2011b, Terron-Sigler et al. 2014	

***Astroides calycularis* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	None	Very high	Very low	5
	Smothering	High	None	Very high	Moderate	5
	Changes (increase) in suspended sediment	High	Low	High	Moderate	4
	Desiccation	High	None	Very high	Very low	5
	Changes in emergence	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes (decrease) in water flow rate	High	High	Moderate	Low	3
	Changes (increase) in temperature	Tolerant	Not sensitive	Not sensitive	Moderate	0
	Changes in turbidity	Tolerant	Not sensitive	Not sensitive	Moderate	0
	Changes in wave exposure	Tolerant	Not sensitive	Not sensitive	Low	0
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Intermediate	Moderate	Moderate	Low	3
	Displacement	High	Low	High	Very low	4
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Low	Very high	Very low	Very low	1
	Changes in salinity	High	None	Very high	Very low	5
	Changes in oxygenation	Intermediate	Insufficient information	Insufficient information	Very low	na
Biological factors	Introduction of microbial pathogens and parasites	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Specific targeted extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of other species	Intermediate	Low	High	Very low	4

General information		*Axinella polypoides*	*Axinella cannabina*	*Axinella damicornis*
Taxonomy	Phylum	Porifera	Porifera	Porifera
	Class	Demospongiae (Heteroscleromorpha)	Demospongiae (Heteroscleromorpha)	Demospongiae (Heteroscleromorpha)
	Order	Axinellida	Axinellida	Axinellida
	Family	Axinellidae	Axinellidae	Axinellidae
	Genus	*Axinella*	*Axinella*	*Axinella*
	Species	*Axinella polypoides*	*Axinella cannabina*	*Axinella damicornis*
	Authority	Schmidt, 1862	Esper, 1794	Esper, 1794
Habitat information	Physiographic preference	Open coast, Offshore seabed	Open coast, Offshore seabed	Open coast, Offshore seabed
	Biological zone preferences	Lower infralittoral, Circalittoral	Lower infralittoral, Circalittoral	Lower infralittoral, Circalittoral
	Substratum/ habitat preferences	Bed rock, Large to very large boulders, Detrital; Coralligenous	Bed rock, Large to very large boulders, Detrital; Coralligenous	Sloping rock surface; Rocky shores
	Tidal strenght preferences	Data deficient	Data deficient	Data deficient
	Wave exposure preferences	Exposed, Very exposed	Moderately exposed	Exposed, Moderaetely exposed
	Salinity preferences	Full (30-40 psu)	Full (30-40 psu)	Full (30-40 psu)
	Depth range	5-200 m	10-50/100 m	30 m; Data deficient
	Other preferences	/	/	/
	Migration pattern	Non-migratory/ Resident	Non-migratory/ Resident	Non-migratory/ Resident
	Is the species native?	Yes	Yes	Yes
	Origin	Atlantic-Mediterranean	Atlantic-Mediterranean	Atlantic-Mediterranean
General biology	Typical abundance	Moderate density	Moderate density	Low density
	Male size range	Up to 40 cm	Up to 40 cm	Up to 10 cm
	Male size at maturity	No information found	No information found	No information found
	Female size range	Up to 40 cm	Up to 40 cm	Up to 10 cm
	Female size at maturity	No information found	No information found	No information found
	Growth form	Digitate	Erected	Stubby finger-like shape
	Growth rate	Slow	Slow	No information found
	Body flexibility	Low (10-45°)	High (>45°)	Low (10-45°)
	Mobility	Permanent attachment	Permanent attachment	Permanent attachment
	Characteristic feeding methods	Active suspension feeder	Active suspension feeder	Active suspension feeder
	Typically feeds on	Suspended particulate matter	Suspended particulate matter	Suspended particualte matter
	Sociability	Solitary	Solitary	Solitary
	Environmental position	Epilithic	Epilithic	Epilithic, Epibenthic
	Supports (Depend on/ support)	Indipendent	Indipendent	Indipendent
	Is the species toxic?	Data deficient	Data deficient	No information found
Reproduction and longevity	Reproductive type	No information found	No information found	Gonochoristic
	Reproductive frequency	No information found	No information found	No information found
	Developmental mechanism	No information found	No information found	Oviparous
	Fecundity (number of eggs)	No information found	No information found	No information found
	Generation time	No information found	No information found	No information found
	Age at maturity	No information found	No information found	No information found
	Dispersal potential	No information found	No information found	No information found
	Larval settling time	No information found	No information found	No information found
	Time of first gamete	No information found	Summer	May
	Time of last gamete	No information found	Summer	September
	Life span	No information found	No information found	No information found
Biotope / ecosystem importance	Protection	Bacelona Convention, Annex II	Barcelona Convention, Annex II	None
	Does the species create space in the assemblage?	Moderate	Moderate	Low
	Does it occupy space and exclude?	Moderate	Moderate	Low
	Does the species provide habitat structure?	Community, Shelter	Community	Data deficient
	Does the species provide an important food source?	Data deficient	Yes	No information found
	For what?	/	*Phyllidia flava*	/
	Medicinal use	/		/
	Aquaculture use	/		/
	Harvested (targered)	/		/
	Harvester (by-catch)	Yes		/
	Curio use	/		/
	Culinary use	/		/
Threats		Human exploitation, Fishing nets, high temperature	Human exploitation, Fishing nets, high temperature	Human exploitation, Fishing nets, high temperature
Reference:	Avant 2006, Haber et al. 2011, Riesgo & Maldonado 2008			

Axinellae spp. - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	Insufficient information	High	High	4
	Smothering	Intermediate	Insufficient information	High	Low	4
	Changes (increase) in suspended sediment	Intermediate	Insufficient information	High	Low	4
	Desiccation	High	Insufficient information	High	Low	4
	Changes in emergence	High	Insufficient information	High	Low	4
	Changes in water flow rate	Low	Insufficient information	Moderate	Low	3
	Changes in temperature	Intermediate	Insufficient information	High	Low	4
	Changes in turbidity	Tolerant	Insufficient information	Not sensitive	Moderate	0
	Changes in wave exposure	Intermediate	Insufficient information	High	Very low	4
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Intermediate	Insufficient information	Moderate	Low	3
	Displacement	High	Insufficient information	Moderate	Low	3
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in salinity	High	Insufficient information	High	Low	4
	Changes in oxygenation	Intermediate	Insufficient information	High	Low	4
Biological factors	Introduction of microbial pathogens and parasites	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Specific targeted extraction of this species	Not relevant	Not relevant	Not relevant	Low	na
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Very low	na

	General information	*Balanophyllia europaea*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Hexacorallia)
	Order	Scleractinia
	Family	Dendrophyllidae
	Genus	*Balanophyllia*
	Species	*Balanophyllia (Balanophyllia) europaea*
	Authority	Risso, 1826
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Upper circalittoral
	Substratum/ habitat preferences	Bedrock, Large to very large boulders, Rocky shores
	Tidal strenght preferences	Moderately strong (1-3 kn), Very weak (negligible), Weak (<1kn)
	Wave exposure preferences	Exposed, Moderately exposed, Sheltered
	Salinity preferences	Full (30-40 psu)
	Depth range	1-50 m
	Other preferences	Low sedimentation
	Migration pattern	Non migratory/ Resident
	Is the species native?	Yes
	Origin	Mediterranean endemic
General biology	Typical abundance	Low
	Male size range	Up to 21 mm
	Male size at maturity	6-10 mm lenght
	Female size range	Up to 21 mm
	Female size at maturity	6-10 mm lenght
	Growth form	Cylindrical
	Growth rate	0.2-2.5 mm yr^{-1}
	Body flexibility	None (< 10°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder, Symbiont contribution
	Typically feeds on	Particulate matter including zooplankton
	Sociability	Solitary
	Environmental position	Epibenthic
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Permanent hermaphrodite
	Reproductive frequency	Annual
	Developmental mechanism	Data deficient
	Fecundity (number of eggs)	8-14 mature oocytes 100 mm^{-3} polyp
	Generation time	No information found
	Age at maturity	3 yrs
	Dispersal potential	> 1000 m
	Larval settling time	10 days
	Time of first gamete	August
	Time of last gamete	September
	Life span	10-20 yrs
Biotope / ecosystem importance	Protection	CITES
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	Substratum
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	/
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	/
Threats		Climate change, Coastal pollution, High sedimentation
References:	Goffredo et al. 2002, Goffredo et al. 2004, Goffredo et al. 2008, Airi et al. 2014, Purser et al. 2014, Kruzic & Popijac 2015, Meron et al. 2012, Fantazzini et al. 2013	

***Balanophyllia europaea* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	Very low	Very high	Very low	5
	Smothering	High	Very low	Very high	Low	5
	Changes in suspended sediment	Tolerant	Not sensitive	Not sensitive	High	0
	Desiccation	High	None	Very high	Very low	5
	Changes in emergence	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in water flow rate	Intermediate	Very high	Low	High	2
	Changes in temperature	High	Low	High	High	4
	Changes in turbidity	Tolerant	Not sensitive	Not sensitive	High	0
	Changes in wave exposure	Intermediate	Low	Moderate	Low	3
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Low	High	Low	Low	2
	Displacement	High	Low	High	Low	4
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Tolerant	Not sensitive	Not sensitive	Low	0
	Changes in salinity	High	None	Very high	Very low	5
	Changes in oxygenation	Intermediate	Low	High	Very low	4
Biological factors	Introduction of microbial pathogens and parasites	Tolerant	Not sensitive	Not sensitive	Moderate	0
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Specific targeted extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Caulerpa cylindracea*
Taxonomy	Phylum	Chlorophyta
	Class	Ulvophyceae
	Order	Bryopsidales
	Family	Caulerpaceae
	Genus	*Caulerpa*
	Species	*Caulerpa cylindracea*
	Authority	Sonder, 1845
Habitat information	Physiographic preference	Open coast, Coastal lagoon
	Biological zone preferences	Infralittoral, Circalittoral
	Substratum/ habitat preferences	Bedrock, Sand, Mud, Detritic, Large and small boulders, Seagrass beds, Dead matte
	Tidal strenght preferences	No information found
	Wave exposure preferences	Exposed, Sheltered
	Salinity preferences	Full (30-40 psu)
	Depth range	1-70 m
	Other preferences	/
	Migration pattern	Non- migratory/ Resident
	Is the species native?	No
	Origin	Indo-Pacific
General biology	Typical abundance	High
	Male size range	up to 11 cm
	Male size at maturity	/
	Female size range	up to 11 cm
	Female size at maturity	/
	Growth form	Coarsely branched
	Growth rate	1043 mm y-1
	Body flexibility	High (grater than 45 degrees)
	Mobility	Permanent attachment
	Characteristic feeding methods	Photoautotroph
	Typically feeds on	Not relevant
	Sociability	Not relevant
	Environmental position	Epilithic, Epiphytic
	Supports (Depend on/ support)	Not relevant / Indipendent
	Is the species toxic?	Yes (secondary metabolites cytotoxic, caulerpenyne)
Reproduction and longevity	Reproductive type	Monoecious; Holocarpic
	Reproductive frequency	Annual protracted
	Developmental mechanism	Propagules, fragmentation (asexual); Anisogametes (sexual)
	Fecundity (number of eggs)	No information found
	Generation time	Insufficient information
	Age at maturity	Insufficient information
	Dispersal potential	> 1000 m
	Larval settling time	/
	Time of first gamete	April
	Time of last gamete	December
	Life span	No information found
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Little
	Does it occupy space and exclude?	Lots
	Does the species provide habitat structure?	Shelter
	Does the species provide an important food source?	Yes
	For what?	*Boops boops* (Linnaeus, 1758), *Pagellus acarne* (Risso, 1827), *Sarpa salpa* (Linnaeus, 1758), *Paracentrotus lividus* (Lamarck, 1816)
	Medicinal use	Yes
	Aquaculture use	No
	Harvested (targered)	Yes in South Pacific
	Harvester (by-catch)	No
	Curio use	No
	Culinary use	Yes
Threats		Extreme temperature, Sediment abrasion, Very high hydrodynamism
References:	Ruitton et al. 2005a, Ruitton et al. 2005b, Klein & Verlaque 2008, Bulleri et al. 2010, Cebrian et al. 2011, Gennaro & Piazzi 2011, Infantes et al. 2011, Tejada et al. 2013, Kersting et al. 2014, Boudouresque & Verlaque 2002, Raniello et al. 2004, Occhipinti-Ambrogi 2007, Bulleri et al. 2010, Cebrian et al. 2011, Tomas et al. 2011, Rodrìguez-Prieto et al. 2013	

Caulerpa cylindracea - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	Low	Very high	Very low	Low	1
	Smothering	Low	Very high	Very low	Low	1
	Changes (increase) in suspended sediment	Low	Very high	Very low	Moderate	1
	Desiccation	Low	Very high	Very low	Very low	1
	Changes in emergence	Tolerant	Not relevant	Not sensitive	Low	0
	Changes in water flow rate	Intermediate	Very high	Low	Low	2
	Changes in temperature	Intermediate	High	Low	Moderate	2
	Changes in turbidity	Low	Very high	Very low	Moderate	1
	Changes in wave exposure	Intermediate	Very high	Low	Very low	2
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Tolerant	Not relevant	Not sensitive	Low	0
	Displacement	Tolerant	Not sensitive	Not sensitive	High	0
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes (decrease) in levels of nutrients	Intermediate	Very high	Low	Very low	2
	Changes in levels of nutrients	Tolerant	Not sensitive	Not sensitive	High	0
	Changes (decrease)in salinity	High	Low	High	Very low	4
	Changes in salinity	Tolerant	Not relevant	Not sensitive	Moderate	0
	Changes in oxygenation	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
Biological factors	Introduction of microbial pathogens and parasites	Not relevant	Not relevant	Not relevant	Not relevant	na
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Tolerant	Not sensitive	Not sensitive	Low	0
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Caulerpa taxifolia*
Taxonomy	Phylum	Chlorophyta
	Class	Ulvophyceae
	Order	Bryopsidales
	Family	Caulerpaceae
	Genus	*Caulerpa*
	Species	*Caulerpa taxifolia*
	Authority	(M.Vahl) C.Agardh, 1817
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Circalittoral
	Substratum/ habitat preferences	Bedrock, Sand, Mud, Detritic, Large and small boulders, Seagrass beds, Dead matte
	Tidal strenght preferences	No information found
	Wave exposure preferences	No information found
	Salinity preferences	Full (30-40 psu)
	Depth range	1-100 m
	Other preferences	photophilc and sciaphilic biotopes
	Migration pattern	Non- migratory/ Resident
	Is the species native?	No
	Origin	Indo-Pacific
	Typical abundance	High
	Male size range	up to 40 cm
	Male size at maturity	/
	Female size range	up to 40 cm
	Female size at maturity	/
	Growth form	Coarsely branched
General biology	Growth rate	Highest rate in August/September (14 mm d^{-1} at 4 m depth and 5 mm d^{-1} at 10 m depth)
	Body flexibility	High (grater than 45 degrees)
	Mobility	Permanent attachment
	Characteristic feeding methods	Photoautotroph
	Typically feeds on	Not relevant
	Sociability	Not relevant
	Environmental position	Epilithic, Epiphytic
	Supports (Depend on/ support)	Not relevant / Indipendent
	Is the species toxic?	Yes (secondary metabolites cytotoxic, caulerpenyne)
Reproduction and longevity	Reproductive type	Monoecious (No sexual reproduction in Mediterranean Sea)
	Reproductive frequency	Permanent
	Developmental mechanism	Propagules, fragmentation (asexual)
	Fecundity (number of eggs)	No information found
	Generation time	Insufficient information
	Age at maturity	Insufficient information
	Dispersal potential	> 1000 m
	Larval settling time	/
	Time of first gamete	/
	Time of last gamete	/
	Life span	No information found
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Moderate
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Shelter
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	Yes
	Aquaculture use	No
	Harvested (targered)	Yes in South Pacific
	Harvester (by-catch)	No
	Curio use	No
	Culinary use	Yes
Threats		Extreme temperature, Sediment abrasion, Very high hydrodynamism
References:	Boudouresque et al. 1995, Ceccherelli & Piazzi 2001, Piazzi et al. 2001, Duarte 2002, Glasby et al. 2005, Ruitton et al. 2005a, Ruitton et al. 2005b, Ballesteros 2006, Streftaris & Zenetos 2006, Theil et al. 2007, West et al. 2007, Burfeind & Udy 2009, Infantes et al. 2011, Tejada et al. 2013, Rodrìguez-Prieto et al. 2013	

Caulerpa taxifolia - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	Low	Very high	Very low	Low	1
	Smothering	Low	Very high	Very low	High	1
	Changes in suspended sediment	Tolerant	Not sensitive	Not sensitive	High	0
	Desiccation	Low	Very high	Very low	High	1
	Changes in emergence	Tolerant	Not sensitive	Not sensitive	Moderate	0
	Changes in water flow rate	Intermediate	Very high	Low	Low	2
	Changes in temperature	Intermediate	High	Low	Moderate	2
	Changes in turbidity	Low	Very high	Low	High	2
	Changes (increase) in wave exposure	Intermediate	Very high	Low	Very low	2
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Tolerant	Not relevant	Not sensitive	Low	0
	Displacement	Tolerant	Not sensitive	Not sensitive	High	0
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes (decrease) in levels of nutrients	Intermediate	Very high	Low	High	2
	Changes (increase) in levels of nutrients	Tolerant	Not relevant	Not sensitive	High	0
	Changes (decrease) in salinity	High	Low	High	High	4
	Changes in salinity	Low	Very high	Very low	Moderate	1
	Changes in oxygenation	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
Biological factors	Introduction of microbial pathogens and parasites	Not relevant	Not relevant	Not relevant	Not relevant	na
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Tolerant	Not sensitive	Not sensitive	Low	0
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Chromis chromis*
Taxonomy	Phylum	Chordata (Vertebrata)
	Class	(Gnathostomata) Actinopterygii
	Order	Perciformes
	Family	Pomacentridae
	Genus	*Chromis*
	Species	*Chromis chromis*
	Authority	Linnaeus, 1758
Habitat information	Physiographic preference	Offshore seabed
	Biological zone preferences	Eulittoral, Sublittoral fringe
	Substratum/ habitat preferences	Artificial reef, Seagrass meagow; Rocky shores
	Tidal strenght preferences	Data deficient
	Wave exposure preferences	Sheltered
	Salinity preferences	Full (30-40 psu)
	Depth range	2-40 m
	Other preferences	/
	Migration pattern	No
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Very high
	Male size range	10-150 mm
	Male size at maturity	60-70 mm
	Female size range	10-150 mm
	Female size at maturity	60-70 mm
	Growth form	Pisciform
	Growth rate	Slow-growing species
	Body flexibility	High (> 45°)
	Mobility	Swimmer
	Characteristic feeding methods	Predator
	Typically feeds on	Zooplankton and benthic macroinvertebrates
	Sociability	Gregarious
	Environmental position	Demersal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Biannual
	Developmental mechanism	Planktotrophic
	Fecundity (number of eggs)	Data deficient
	Generation time	Data deficient
	Age at maturity	2 yrs
	Dispersal potential	10-100 m
	Larval settling time	11-30 days
	Time of first gamete	May
	Time of last gamete	September
	Life span	5-10 yrs
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	No
	Does the species provide an important food source?	Yes
	For what?	*Thunnus thynnus* (Linnaeus, 1758), *Scorpaena scrofa* (Linnaeus, 1758), *Scorpaena porcus* (Linnaeus, 1758)
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	No
	Harvester (by-catch)	Yes
	Curio use	/
	Culinary use	/
Threats		Sensitive to pollution, Noise, By-catch
References:	Dulčić & Kraljević 1995, Picciulin et al. 2004, Milazzo et al. 2006, Dulcic 2007, Pinnegar et al. 2007, Bracciali et al. 2012, Bracciali et al. 2014, Codarin et al. 2009, Johansen & Jones 2011, Macpherson & Raventos 2005	

***Chromis chromis* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	High	Moderate	Very low	3
	Smothering	High	High	Moderate	Low	3
	Changes in suspended sediment	Not relevant	Not relevant	Not relevant	Not relevant	na
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in temperature	High	Insufficient information	High	Moderate	4
	Changes in turbidity	Tolerant	Not relevant	Not sensitive	Moderate	0
	Changes in wave exposure	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Noise	Intermediate	Very high	Low	Moderate	2
	Visual presence	Tolerant	Not relevant	Not sensitive	Low	0
	Physical disturbance or abrasion	Not relevant	Not relevant	Not relevant	Not relevant	na
	Displacement	Not relevant	Not relevant	Not relevant	Not relevant	na
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Tolerant	Not relevant	Not sensitive	Moderate	0
	Changes in salinity	Low	Very high	Very low	Moderate	1
	Changes in oxygenation	Not relevant	Not relevant	Not relevant	Not relevant	na
Biological factors	Introduction of microbial pathogens and parasites	Low	High	Low	Moderate	2
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Moderate	Moderate	Moderate	3
	Specific targeted extraction of other species	Intermediate	Moderate	Moderate	Moderate	3

	General information	*Cladocora caespitosa*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Hexacorallia)
	Order	Scleractinia
	Family	Caryophyllidae
	Genus	*Cladocora*
	Species	*Cladocora caespitosa*
	Authority	Linnaeus, 1767
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Upper circalittoral
	Substratum/ habitat preferences	Bedrock, Detric; Coralligenous
	Tidal strenght preferences	Not relevant
	Wave exposure preferences	Not relevant
	Salinity preferences	Full (30-40 psu)
	Depth range	1-40 m
	Other preferences	/
	Migration pattern	Non migratory / Resident
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Locally abundant
	Male size range	More than one meter thick and several tens of meters wide
	Male size at maturity	Data deficient
	Female size range	More than one meter thick and several tens of meters wide
	Female size at maturity	Data deficient
	Growth form	Subspherical
	Growth rate	1.30-6.2 mm yr^{-1}
	Body flexibility	None (<10°)
	Mobility	Pemanent attachment
	Characteristic feeding methods	Passive suspension feeder; Symbiont contribution
	Typically feeds on	Suspended matter
	Sociability	Colonial
	Environmental position	Epibenthic
	Supports (Depend on/ support)	Indipendent / Host for anellidae, molluscs and crustacean
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Permanent hermaphrodite; Asexual
	Reproductive frequency	Annual
	Developmental mechanism	No information found; Fragmentation
	Fecundity (number of eggs)	Insufficient information
	Generation time	Insufficient information
	Age at maturity	3-8 yrs
	Dispersal potential	10-100 m
	Larval settling time	No information found
	Time of first gamete	June
	Time of last gamete	June
	Life span	20-100 yrs
Biotope / ecosystem importance	Protection	Annex II, Barcelona Convention; CITES
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	Shelter
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	/
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	/
Threats		Sensitive to global change and to pollution, Fishing nets and anchoring
References:	Peirano et al. 2001, Rodolfo-Metalpa et al. 2006a, Rodolfo-Metalpa et al. 2006b, Kruzic & Benkovic 2008, Kruzic et al. 2008, Rodolfo-Metalpa et al. 2008, Terron-Sigler et al. 2014, Meron et al. 2012, Kersting et al. 2013, Kersting et al. 2014	

***Cladocora caespitosa* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	Very low	Very high	Very low	5
	Smothering	High	Very low	Very high	Low	5
	Changes in suspended sediment	Low	High	Low	High	2
	Desiccation	High	None	Very high	Very low	5
	Changes in emergence	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in water flow rate	Tolerant	Not sensitive	Not sensitive	Moderate	0
	Changes in temperature	High	Very high	Very low	High	5
	Changes in turbidity	Tolerant	Not sensitive	Not sensitive	High	0
	Changes in wave exposure	Low	High	Low	Very low	2
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	High	Very low	Very high	Very low	5
	Displacement	High	Very low	Very high	Low	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Tolerant	Not sensitive	Not sensitive	High	0
	Changes in salinity	High	None	Very high	Very low	5
	Changes in oxygenation	Intermediate	Low	High	Very low	4
Biological factors	Introduction of microbial pathogens and parasites	Low	Insufficient information	Very low	Very low	1
	Introduction of alien or non- native species	Low	High	Low	High	2
	Specific targeted extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Very low	na

	General information	*Conger conger*
Taxonomy	Phylum	Chordata (Vertebrata)
	Class	(Gnathostomata superclass) Actinopterygii
	Order	Anguilliformes
	Family	Congridae
	Genus	*Conger*
	Species	*Conger conger*
	Authority	Linnaeus, 1758
Habitat information	Physiographic preference	Open coast, Offshore seabed
	Biological zone preferences	Sublittoral fringe, Lower infralittoral, Circalittoral
	Substratum/ habitat preferences	Bedrocks, Artificial reef, Sand; Rocky shores
	Tidal strenght preferences	Data deficient
	Wave exposure preferences	Very sheltered, Moderately exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	1-4000 m
	Other preferences	Nocturnal feeder
	Migration pattern	Seasonal (reproduction)
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Low density, Locally abundant
	Male size range	Up to 2.75 m in lenght
	Male size at maturity	50-75 cm
	Female size range	Up to 2.75 m in lenght
	Female size at maturity	2 m
	Growth form	Anguilliformes
	Growth rate	Data deficient
	Body flexibility	High (> 45°)
	Mobility	Swimmer
	Characteristic feeding methods	Predator
	Typically feeds on	Bottom-living fishes, large crustaceans and octopuses
	Sociability	Solitary
	Environmental position	Epibenthic
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Semelparous
	Developmental mechanism	Leptocephalus
	Fecundity (number of eggs)	> 1,000,000
	Generation time	Data deficient
	Age at maturity	5-15 yrs
	Dispersal potential	> 1000m
	Larval settling time	1-2 yrs to drift (long larval life)
	Time of first gamete	July
	Time of last gamete	September
	Life span	10-20 yrs
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	No
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	Yes
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	Yes
Threats		Human exploitation
References:	Sbaihi et al. 2001, Correia et al. 2002, O'Sullivan et al. 2003, Reeve 2007, Correia et al. 2009, Matic-Skoko et al. 2012, Banaru et al. 2013, Della Torre et al. 2010	

Conger conger - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	High	Moderate	Low	3
	Smothering	Not relevant	Not relevant	Not relevant	Very low	na
	Changes in suspended sediment	Not relevant	Not relevant	Not relevant	Not relevant	na
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Low	Very high	Very low	Very low	1
	Changes in temperature	Intermediate	Moderate	Moderate	Very low	3
	Changes in turbidity	Tolerant	Not relevant	Not sensitive	Low	0
	Changes in wave exposure	Tolerant	Not relevant	Not sensitive	Moderate	0
	Noise	Tolerant	Not relevant	Not sensitive	Low	0
	Visual presence	Low	Insufficient information	Low	Very low	2
	Physical disturbance or abrasion	Intermediate	Insufficient information	Moderate	Very low	3
	Displacement	Not relevant	Not relevant	Not relevant	Not relevant	na
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	High	Low	High	High	4
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in salinity	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in oxygenation	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
Biological factors	Introduction of microbial pathogens and parasites	Tolerant	Not relevant	Not sensitive	Moderate	0
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Low	High	Moderate	4
	Specific targeted extraction of other species	Intermediate	Insufficient information	Moderate	Low	3

	General information	*Corallium rubrum*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Octocorallia)
	Order	Alcyonacea
	Family	Corallidae
	Genus	*Corallium*
	Species	*Corallium rubrum*
	Authority	Linnaeus, 1758
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Lower infralittoral, Circalittoral
	Substratum/ habitat preferences	Rocky cliff, Crevices; Coralligenous
	Tidal strenght preferences	Weak
	Wave exposure preferences	Sheltered; Moderately exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	15-500/ 800 m
	Other preferences	Weak luminosity
	Migration pattern	Non-migratory/ Resident
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Low density
	Male size range	up to 50 cm
	Male size at maturity	No information found
	Female size range	up to 50 cm
	Female size at maturity	1.4-2.3 mm (diameter)
	Growth form	Bushy shape, Arborescent
	Growth rate	0.2-2 cm yr^{-1} in lenght
	Body flexibility	None (< 10 degrees)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder
	Typically feeds on	Suspended matter including plankton
	Sociability	Colonial
	Environmental position	Epibenthic
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual protracted
	Developmental mechanism	Lecithotrophic
	Fecundity (number of eggs)	11 - 100
	Generation time	No information found
	Age at maturity	2 yr
	Dispersal potential	<10 m
	Larval settling time	2-10 days (under laboratory conditions)
	Time of first gamete	July
	Time of last gamete	September
	Life span	100+ yrs
Biotope / ecosystem importance	Protection	Endangered A2c (IUCN Comitato Italiano); Annex III Barcelona Convention; Annex II Bern Convention, Annex V Habitat Directive (92/43/CE)
	Does the species create space in the assemblage?	Little
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Substratum
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	No
	Aquaculture use	No
	Harvested (targered)	Yes
	Harvester (by-catch)	No
	Curio use	Yes
	Culinary use	No
Threats		Commercial exploitation; Sensitive to global change; Sentitive to recreational divers; Boring sponges
References:	Calcinai et al. 2008, Weinbauer et al. 2000, Garrabou et al. 2001, Santangelo & Abbiati 2001, Garrabou & Harmelin 2002, Bramanti et al. 2003, Santangelo et al. 2003, Bramanti et al. 2005, Ballesteros 2006, Tsounis et al. 2006a, Tsounis et al. 2006b, Picciano & Ferrier-Pages 2007, Ribes et al. 2007, Torrents et al. 2008, Ferrier-Pages et al. 2009, Previati et al. 2010b, Torrents & Garrabou 2011, Linares et al. 2012, Cerrano et al. 2013	

***Corallium rubrum* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	None	Very high	Low	5
	Smothering	High	None	Very high	Very low	5
	Changes in suspended sediment	High	None	Very high	Very low	5
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes (decrease) in water flow rate	High	High	Moderate	Moderate	3
	Changes (increase) in temperature	High	Very low	Very high	High	5
	Changes in turbidity	Low	High	Low	Very low	2
	Changes in wave exposure	Not relevant	Not relevant	Not relevant	Not relevant	na
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	High	Very low	Very high	High	5
	Displacement	High	None	Very high	High	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Low	High	Low	Low	2
	Changes in salinity	High	None	Very high	Low	5
	Changes (decrease) in oxygenation	Intermediate	Low	High	Moderate	4
Biological factors	Introduction of microbial pathogens and parasites	Low	High	Low	Moderate	2
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	High	Very low	Very high	High	4
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Eunicella cavolini*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Octocorallia)
	Order	Alcyonacea
	Family	Gorgoniidae
	Genus	*Eunicella*
	Species	*Eunicella cavolini*
	Authority	Koch, 1887
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Circalittoral
	Substratum/ habitat preferences	Rocky cliff, Bedrock, Coralligenous
	Tidal strenght preferences	Moderately strong
	Wave exposure preferences	Moderately exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	5- 200 m
	Other preferences	Low light intensity; Fan orientated perpendicular to the current
	Migration pattern	Resident/ Non migratory
	Is the species native?	Yes
	Origin	Mediterranean endemic
General biology	Typical abundance	High density
	Male size range	up to 50 cm
	Male size at maturity	No information found
	Female size range	up to 50 cm
	Female size at maturity	No information found
	Growth form	Arborescent
	Growth rate	1-2 cm yr^{-1}
	Body flexibility	High (>45°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder
	Typically feeds on	Suspended matter including plankton
	Sociability	Colonial
	Environmental position	Epibenthic, Epifaunal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual
	Developmental mechanism	Planktotrophic
	Fecundity (number of eggs)	No information found
	Generation time	No information found
	Age at maturity	No information found
	Dispersal potential	100-1000m
	Larval settling time	> 30 days
	Time of first gamete	Summer
	Time of last gamete	Summer
	Life span	20-100 yrs
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Little
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Substratum, sheltered
	Does the species provide an important food source?	Yes
	For what?	*Simnia spelta* (Linnaeus, 1758)
	Medicinal use	No
	Aquaculture use	No
	Harvested (targered)	No
	Harvester (by-catch)	No
	Curio use	No
	Culinary use	No
Threats		Sensitive to divers, Sensitive to global change, Fishing nets and anchoring, Mucilage
References:	Russo 1985, Weinbauer & Velimirov 1995a, b, 1996a, b, Ballesteros 2006, Bavestrello et al. 2010, Gori et al. 2011, Munari et al. 2013, Previati et al. 2010b, Giuliani et al. 2005, Cerrano & Bavestrello 2008, Cocito et al. 2013, Carella et al. 2014, Cerrano et al. 2005, Cerrano et al. 2000	

Eunicella cavolinii - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	None	Very high	Low	5
	Smothering	High	Very low	Very high	Low	5
	Changes in suspended sediment	Intermediate	Very low	Very high	Low	5
	Desiccation	High	None	Very high	Very low	5
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Intermediate	High	Low	Low	2
	Changes (increase) in temperature	High	Low	High	High	4
	Changes in turbidity	High	High	Moderate	Very low	3
	Changes in wave exposure	Not relevant	Not relevant	Not relevant	Low	na
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	High	Very low	Very high	Moderate	5
	Displacement	High	None	Very high	Very low	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Low	High	Low	Low	2
	Changes in salinity	High	Low	High	Low	4
	Changes (decrease) in oxygenation	Intermediate	Low	High	Moderate	4
Biological factors	Introduction of microbial pathogens and parasites	Low	None	High	High	4
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Moderate	Moderate	Low	3
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Eunicella singularis*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Octocorallia)
	Order	Alcyonacea
	Family	Gorgoniidae
	Genus	*Eunicella*
	Species	*Eunicella singularis*
	Authority	Esper, 1791
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Upper circalittoral
	Substratum/ habitat preferences	Bedrock, Detric, Pebbles; Coralligenous
	Tidal strenght preferences	No information found
	Wave exposure preferences	Not exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	2-100 m
	Other preferences	Well-lit location
	Migration pattern	Resident/ Non migratory
	Is the species native?	Yes
	Origin	Mediterranean endemic
General biology	Typical abundance	High density
	Male size range	Up to 70 cm
	Male size at maturity	No information found
	Female size range	Up to 70 cm
	Female size at maturity	No information found
	Growth form	Candlestick-like shape
	Growth rate	8-40 mm yr^{-1}
	Body flexibility	High (>45 degree)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder; Symbiont contribution
	Typically feeds on	Suspended matter
	Sociability	Colonial
	Environmental position	Epibenthic, Epifaunal
	Supports (Depend on/ support)	Indipendent / Zooxanthellae (*Symbiodinium* Freudenthal, 1962)
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual
	Developmental mechanism	Planktotrophic
	Fecundity (number of eggs)	1,000-10,000
	Generation time	No information found
	Age at maturity	No information found
	Dispersal potential	10-100m
	Larval settling time	2-10 days
	Time of first gamete	June
	Time of last gamete	July
	Life span	20-100 yrs
Biotope / ecosystem importance	Protection	Vulnerable A2ce (IUCN Comitato Italiano)
	Does the species create space in the assemblage?	Little
	Does it occupy space and exclude?	Modereate
	Does the species provide habitat structure?	Substratum; Shelter
	Does the species provide an important food source?	Yes
	For what?	*Marionia blainvillea* (Risso, 1818) , *Tritonia nilsodhneri* Marcus Ev., 1983*, Simnia spelta* (Linnaeus, 1758)
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	/
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	/
Threats		Sensitive to divers, Sensitive to global change, Fishing nets and anchoring, Mucilage
References:	Coma et al. 2006, Ribes et al. 2007, Linares et al. 2008, Ferrier-Pages et al. 2009, Bavestrello et al. 2010, Previati et al. 2010b, Gori et al. 2011, Huete-Stauffer et al. 2011, Torrents & Garrabou 2011, Kersting et al. 2013, Munari et al. 2013, Pey et al. 2013, Carella et al. 2014, Ferrier-Pages et al. 2015, Weinberg 1979, Weinberg & Weinberg 1979, Pey et al. 2013, Cerrano et al. 2000	

Eunicella singularis - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	None	Very high	Low	5
	Smothering	High	Very low	Very high	Low	5
	Changes in suspended sediment	Intermediate	Moderate	Moderate	Low	3
	Desiccation	Not relevant	Not relevant	Not relevant	Very low	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Intermediate	Moderate	Moderate	Low	3
	Changes in temperature	High	Moderate	Moderate	High	3
	Changes in turbidity	High	High	Moderate	Very low	3
	Changes in wave exposure	Low	Moderate	Low	Low	2
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	High	Low	High	Moderate	4
	Displacement	High	None	Very high	Very low	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Low	High	Low	Low	2
	Changes (decrease)in salinity	High	Very low	Very high	Low	5
	Changes (decrease) in oxygenation	Intermediate	Moderate	Moderate	Moderate	3
Biological factors	Introduction of microbial pathogens and parasites	Low	None	High	High	4
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Moderate	Moderate	Low	3
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Eunicella verrucosa*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Octocorallia)
	Order	Alcyonacea
	Family	Gorgoniidae
	Genus	Eunicella
	Species	*Eunicella verrucosa*
	Authority	Pallas, 1766
Habitat information	Physiographic preference	Open coast, Offshore seabed, Strait
	Biological zone preferences	Circalittoral
	Substratum/ habitat preferences	Bedrock, Large to very large boulders, Soft bottom, Artificial; Coralligenous
	Tidal strenght preferences	Moderately strong (1-3 kn)
	Wave exposure preferences	Exposed, Moderately exposed, Sheltered, Very exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	15-120 m
	Other preferences	/
	Migration pattern	Non-migratory/ Resident
	Is the species native?	Yes
	Origin?	Atlantic-Mediterranean
General biology	Typical abundance	Moderate density
	Male size range	Data deficient
	Male size at maturity	Data deficient
	Female size range	Data deficient
	Female size at maturity	Data deficient
	Growth form	Arborescent/ Arbuscular
	Growth rate	10 mm yr^{-1}
	Body flexibility	High (> 45°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder
	Typically feeds on	Suspended matter including plankton
	Sociability	Colonial
	Environmental position	Epibenthic
	Supports	/
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	No information found
	Reproductive frequency	Annual episodic
	Developmental mechanism	Lecithotrophic
	Fecundity (number of eggs)	Data deficient
	Generation time	No information found
	Age at maturity	No information found
	Dispersal potential	100-1000 m
	Larval settling time	Not relevant
	Time of first gamete	No information found
	Time of last gamete	No information found
	Life span	20-100 yrs
Biotope / ecosystem importance	Protection	VU A1d ver. 2.3 (IUCN red list)
	Does the species create space in the assemblage?	Moderate
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Community
	Does the species provide and important food source?	/
	For what?	/
Threats		Sensitive to global change, Fishing nets and anchoring
References:	Hiscock 2007, Bavestrello et al. 2010, Haber et al. 2011	

***Eunicella verrucosa* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	None	Very high	Moderate	5
	Smothering	High	Very low	Very high	Moderate	5
	Changes (increase) in suspended sediment	Low	Very high	Very low	Moderate	1
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Intermediate	Moderate	Moderate	Moderate	3
	Changes (decrease) in temperature	Low	High	Low	Moderate	2
	Changes (increase) in temperature	Low	Moderate	Low	Low	2
	Changes (decrease) in turbidity	Intermediate	Moderate	Moderate	Low	3
	Changes (increase) in turbidity	Low	Very high	Very low	Very low	1
	Changes in wave exposure	Not relevant	Not relevant	Not relevant	Low	na
	Noise	Not relevant	Not relevant	Not relevant	High	na
	Visual presence	Not relevant	Not relevant	Not relevant	High	na
	Physical disturbance or abrasion	Intermediate	Low	High	Moderate	4
	Displacement	High	None	Very high	Moderate	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Tolerant	Not relevant	Not sensitive	Moderate	0
	Changes (decrease) in salinity	High	None	Very high	Moderate	5
	Changes in oxygenation	High	None	Very high	Moderate	5
Biological factors	Introduction of microbial pathogens and parasites	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Moderate	Moderate	Moderate	3
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Geodia cydonium*
Taxonomy	Phylum	Porifera
	Class	Demospongiae
	Order	Astrophorida
	Family	Geodidae
	Genus	*Geodia*
	Species	*Geodia cydonium*
	Authority	Jameson, 1811
Habitat information	Physiographic preference	Open coast, Enclosed coast
	Biological zone preferences	Infralittoral, Upper circalittoral
	Substratum/ habitat preferences	Detritic, Rocky shores, Caves, Lagoon
	Tidal strenght preferences	Weak
	Wave exposure preferences	Sheltered, Moderately exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	2-100 m
	Other preferences	/
	Migration pattern	Resident / non migratory
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Locally abundant
	Male size range	20 cm (mean diameter)
	Male size at maturity	no information found
	Female size range	20 cm (mean diameter)
	Female size at maturity	No information found
	Growth form	Irregularly massive, Subspherical
	Growth rate	26%/yr diameter
	Body flexibility	None (<10°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Active suspension feeder
	Typically feeds on	Suspended particulate matter
	Sociability	Solitary
	Environmental position	Epibenthic
	Supports (Depend on/ support)	Indipendent; Host for crustacean (*Apseudopsis acutifrons* and *Leptochelia savignyi*) and polychaetes (*Ceratonereis costae* and *Sphaerosyllis bulbosa*)
	Is the species toxic?	Data deficient
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual episodic
	Developmental mechanism	Data deficient
	Fecundity (number of eggs)	No information found
	Generation time	No information found
	Age at maturity	No information found
	Dispersal potential	No information found
	Larval settling time	No information found
	Time of first gamete	April/ May
	Time of last gamete	August/ September
	Life span	No information found
Biotope / ecosystem importance	Protection	ASPIM annex II
	Does the species create space in the assemblage?	Moderate
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Substratum; Shelter
	Does the species provide an important food source?	No information found
	For what?	/
	Medicinal use	Yes
	Aquaculture use	No
	Harvested (targered)	No
	Harvester (by-catch)	No
	Curio use	No
	Culinary use	No
Threats		Sensitive to habitat loss
References:	Gherardi et al. 2001, Mercurio et al. 2006, 2007, Corriero et al. 1984, Turicchia et al. 2013	

***Geodia cydonium* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	Very low	Very high	Moderate	5
	Smothering	Intermediate	Insufficient information	Moderate	Low	3
	Changes in suspended sediment	Tolerant	Not relevant	Not sensitive	Moderate	0
	Desiccation	High	Insufficient information	High	Low	4
	Changes (increase) in emergence	High	Insufficient information	High	Very low	4
	Changes in water flow rate	Low	High	Low	Moderate	2
	Changes in temperature	High	Insufficient information	Moderate	Very low	3
	Changes in turbidity	Tolerant	Not relevant	Not sensitive	Moderate	0
	Changes (decrease) in wave exposure	Tolerant	Not relevant	Not sensitive	Low	0
	Changes (increase) in wave exposure	Intermediate	Very high	Low	Low	2
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Intermediate	High	Low	Modereate	2
	Displacement	High	High	Moderate	Low	3
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in salinity	Low	High	Low	Low	2
	Changes in oxygenation	Intermediate	High	Low	Low	2
Biological factors	Introduction of microbial pathogens and parasites	Moderate	Insufficient information	Low	Very low	2
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Specific targeted extraction of this species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

General information		*Hippocampus hippocampus*	*Hippocampus guttulatus*
Taxonomy	Phylum	Chordata (Vertebrata)	Chordata (Vertebrata)
	Class	(Gnathostomata) Actinopterygii	(Gnathostomata) Actinopterygii
	Order	Syngnathiformes	Syngnathiformes
	Family	Syngnathidae	Syngnathidae
	Genus	*Hippocampus*	*Hippocampus*
	Species	*Hippocampus hippocampus*	*Hippocampus guttulatus*
	Authority	Linnaeus, 1758	Cuvier, 1829
Habitat information	Physiographic preference	Offshore seabed, Estuary, Lagoon	Offshore seabed, Estuary, Lagoon
	Biological zone preferences	Eulittoral, Sublittoral fringe, Strait	Eulittoral, Sublittoral fringe, Strait
	Substratum/ habitat preferences	Macroalgae and seagrass, Bedrock, Mud, Artificial	Macroalgae and seagrass, Bedrock, Mud, Artificial
	Tidal strenght preferences	Very weak (negligible), Weak (<1kn)	Very weak (negligible), Weak (<1kn)
	Wave exposure preferences	Sheltered, Moderately exposed	Sheltered, Moderately exposed
	Salinity preferences	Variable (18-40 psu)	Variable (18-40 psu)
	Depth range	2-40 m	2-40 m
	Other preferences	Camouflage, Monogamous mating system	Camouflage, Monogamous mating system
	Migration pattern	Non-migratory/ Resident	Non-migratory/ Resident
	Is the species native?	Yes	Yes
	Origin	Atlantic_Mediterranean	Atlantic_Mediterranean
General biology	Typical abundance	Low density, Patchy	Low density, Patchy
	Male size range	15 cm	up to 15 cm
	Male size at maturity	> 87 mm	110-130 mm
	Female size range	15 cm	up to 15 cm
	Female size at maturity	> 87 mm	125 mm
	Growth form	Horse-like head	Horse-like head
	Growth rate	Data deficient	Data deficient
	Body flexibility	Tail highly flexible	Tail highly flexible
	Mobility	Swimmer	Swimmer
	Characteristic feeding methods	Predator	Predator
	Typically feeds on	Organic debris, plankton, brine shrimp, small crustaceans and small fish	Organic debris, plankton, brine shrimp, small crustaceans and small fish
	Sociability	Solitary	Solitary
	Environmental position	Demersal	Demersal
	Supports (Depend on/ support)	Indipendent	Indipendent
	Is the species toxic?	No	No
Reproduction and longevity	Reproductive type	Gonochoristic	Gonochoristic
	Reproductive frequency	Annual episodic	Annual episodic
	Developmental mechanism	Viviparous (parental care)	Viviparous (parental care)
	Fecundity (number of eggs)	50-250	50-250
	Generation time	Insufficient information	Insufficient information
	Age at maturity	6-12 months	6-12 months
	Dispersal potential	Low dispersal	Low dispersal
	Larval settling time	Not relevant	Not relevant
	Time of first gamete	April	March
	Time of last gamete	November	October
	Life span	1-5 yrs	1-5 yrs
Biotope / ecosystem importance	Protection	Barcelona convention, Annex II; Bern Convention, Annex II; CITES	Barcelona convention, Annex II; Bern Convention, Annex II; CITES
	Does the species create space in the assemblage?	Minor	Minor
	Does it occupy space and exclude?	Minor	Minor
	Does the species provide habitat structure?	No information found	No information found
	Does the species provide an important food source?	No information found	No information found
	For what?	/	/
	Medicinal use	Yes	Yes
	Aquaculture use	/	/
	Harvested (targered)	Yes (acquarium trade)	Yes (acquarium trade)
	Harvester (by-catch)	/	/
	Curio use	Yes	Yes
	Culinary use	/	/
Threats		Sensitive to habitat loss, to climate change, Human exploitation, Acquarium fish trade	Sensitive to habitat loss, to climate change, Human exploitation, Acquarium fish trade
Reference:	Curtis 2006, Curtis & Vincent 2006, Neish 2007, Sabatini & Ballerstedt 2007, Kitsos et al. 2008, Planas et al. 2010, Gristina et al. 2015		

***Hippocampus* sp. - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	Low	High	Very low	4
	Smothering	Low	High	Low	Very low	2
	Changes in suspended sediment	Low	Very high	Very low	Low	1
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	0
	Changes (decrease) in emergence	Intermediate	Moderate	Moderate	Low	3
	Changes (increase) in emergence	Low	Very high	Very low	Low	1
	Changes (increase)in water flow rate	Intermediate	Moderate	Moderate	Low	3
	Changes in temperature	Intermediate	Moderate	Moderate	Low	3
	Changes in turbidity	Low	Very high	Very low	Very low	1
	Changes in wave exposure	Intermediate	Moderate	Moderate	Low	3
	Noise	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Visual presence	Tolerant	Not relevant	Not sensitive	Very low	0
	Physical disturbance or abrasion	Intermediate	Moderate	Moderate	Very low	3
	Displacement	Tolerant	Not relevant	Not sensitive	Low	na
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in levels of nutrients	Insufficient information	Insufficient information	Insufficient information	Low	na
	Changes in salinity	Insufficient information	Insufficient information	Insufficient information	Low	na
	Changes in oxygenation	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
Biological factors	Introduction of microbial pathogens and parasites	Intermediate	Moderate	Moderate	Moderate	3
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Moderate	Moderate	Moderate	3
	Specific targeted extraction of other species	Intermediate	Low	High	Low	4

	General information	*Homarus gammarus*
Taxonomy	Phylum	Arthropoda (Crustacea)
	Class	Malacostraca (Eumalacostraca)
	Order	Decapoda
	Family	Nephropidae
	Genus	*Homarus*
	Species	*Homarus gammarus*
	Authority	Linnaeus, 1758
Habitat information	Physiographic preference	Open coast, Offshore seabed
	Biological zone preferences	Infralittoral, Circalittoral
	Substratum/ habitat preferences	Bedrock, Sand, Mud, Caves, Crevices; Coralligenous
	Tidal strenght preferences	No information found
	Wave exposure preferences	Sheltered
	Salinity preferences	Full (30-40 psu)
	Depth range	5-150 m
	Other preferences	Nocturnal
	Migration pattern	Nephropidae
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Moderate
	Male size range	600 mm
	Male size at maturity	75-80 mm
	Female size range	600 mm
	Female size at maturity	75-80 mm
	Growth form	Articulate
	Growth rate	7.1 mm $moult^{-1}$
	Body flexibility	None (<10°)
	Mobility	Swimmer, Crawler
	Characteristic feeding methods	Omnivore
	Typically feeds on	Echinoderms, small gastripods and bivalves, microalgae, shrimp larvae, bryozoans, annelids
	Sociability	Gregarious
	Environmental position	Epifaunal / Demersal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Biennial
	Developmental mechanism	Oviparous
	Fecundity (number of eggs)	8,000-15,000
	Generation time	Data deficient
	Age at maturity	6 yrs
	Dispersal potential	>100m
	Larval settling time	Data deficient
	Time of first gamete	July
	Time of last gamete	August
	Life span	10-20 yrs
Biotope / ecosystem importance	Protection	ASPIM, Annex III; Bern Convention Annex III
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	No
	Does the species provide an important food source?	Insufficient information
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	Yes
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	Yes
Threats		Human exploitation
References:	Smith et al. 1998, Lucu & Devescovi 1999, Smith et al. 1999, Marino-Balsa et al. 2000, Charmantier et al. 2001, Lizarraga-Cubedo et al. 2003, Agnalt et al. 2007, Wilson 2008, Galparsoro et al. 2009, Noel et al. 2011, Bateman et al. 2012, Vogt 2012, Davies et al. 2014	

***Homarus gammarus* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Smothering	Intermediate	Moderate	Moderate	Low	3
	Changes in suspended sediment	Tolerant	Not relevant	Not sensitive	Low	0
	Desiccation	Not relevant	Not relevant	Not relevant	Moderate	na
	Changes (increase) in emergence	Not relevant	Not relevant	Not relevant	Moderate	na
	Changes in water flow rate	Tolerant	Not relevant	Not sensitive	Moderate	0
	Changes in temperature	High	Moderate	Moderate	Low	3
	Changes in turbidity	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in wave exposure	Not relevant	Not relevant	Not relevant	Very low	na
	Noise	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Visual presence	Intermediate	Insufficient information	Moderate	Very low	3
	Physical disturbance or abrasion	Low	High	Low	High	2
	Displacement	Tolerant	Not relevant	Not sensitive	Moderate	0
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in levels of heavy metals	Low	High	Low	Moderate	2
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes in levels of nutrients	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Changes (decrease) in salinity	Low	Very high	Very low	High	1
	Changes in oxygenation	Intermediate	Moderate	Moderate	Very low	3
Biological factors	Introduction of microbial pathogens and parasites	Low	High	Low	Moderate	2
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Not relevant	na
	Specific targeted extraction of this species	High	Very low	Very high	Moderate	5
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	***Leptopsammia pruvoti***
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Hexacorallia)
	Order	Scleractinia
	Family	Dendrophylliidae
	Genus	*Leptopsammia*
	Species	*Leptopsammia pruvoti*
	Authority	Lacaze-Duthiers (1897)
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Lower Circalittoral
	Substratum/ habitat preferences	Bedrock, Large to very large boulders, Small boulders, Caves; Coralligenous
	Tidal strenght preferences	Moderately strong (1-3 kn), Weak (<1kn), Very weak (negligible)
	Wave exposure preferences	Exposed, Moderately exposed, Sheltered
	Salinity preferences	Full (30-40 psu)
	Depth range	10-40 m
	Other preferences	/
	Migration pattern	Resident
	Is the species native?	Yes
General biology	Typical abundance	Low density
	Male size range	up to 60 mm
	Male size at maturity	3 mm
	Female size range	up to 60 mm
	Female size at maturity	3 mm
	Growth form	Radial, Cylindrical
	Growth rate	1.3 mm yr^{-1}
	Body flexibility	/
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder
	Typically feeds on	/
	Sociability	Solitary, Gregarious
	Environmental position	Epifaunal
	Supports	Indipendet
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Insufficient information
	Developmental mechanism	Lecithotrophic
	Fecundity (number of eggs)	11-100
	Generation time	Insufficient information
	Age at maturity	Insufficient information
	Dispersal potential	< 10m
	Larval settling time	1 day
	Time of first gamete	July
	Time of last gamete	September
	Life span	Insufficient information
Biotope / ecosystem importance	Protection	CITES
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	Substratum
	Does the species provide an important food source?	No
	For what?	/
Threats		Sensitive to divers
References:	Goffredo et al. 2006, Jackson 2008	

Leptopsammia pruvoti **- sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	None	Very high	High	5
	Smothering	High	None	Very high	Moderate	5
	Changes (increase) in suspended sediment	Intermediate	None	High	Moderate	4
	Desiccation	Not relevant	Not relevant	Not relevant	Very low	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes (increase) in water flow rate	Low	Very high	Very low	Moderate	1
	Changes (increase) in temperature	Intermediate	Low	High	Moderate	4
	Changes (increase) in turbidity	Tolerant	Not relevant	Not sensitive	Low	0
	Changes (increase) in wave exposure	Low	Moderate	Low	Low	2
	Noise	Not relevant	Not relevant	Not relevant	Moderate	na
	Visual presence	Not relevant	Not relevant	Not relevant	High	na
	Physical disturbance or abrasion	High	None	Very high	Moderate	5
	Displacement	High	None	Very high	High	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Low	Very high	Very low	Very low	1
	Changes in salinity	High	None	Very high	Moderate	5
	Changes in oxygenation	Intermediate	Low	High	Moderate	4
Biological factors	Introduction of microbial pathogens and parasites	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Specific targeted extraction of this species	Not relevant	Not relevant	Not relevant	Moderate	na
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Low	na

	General information	*Palinurus elephas*
Taxonomy	Phylum	Arthropoda (Crustacea)
	Class	Malacostraca (Eumalacostraca)
	Order	Decapoda
	Family	Palinuridae
	Genus	*Palinurus*
	Species	*Palinurus elephas*
	Authority	Fabricius, 1787
Habitat information	Physiographic preference	Open coast, Offshore seabed
	Biological zone preferences	Infralittoral, Circalittoral
	Substratum/ habitat preferences	Bedrock, Large to very large boulders, Small boulders, Crevice, Cave; Coralligenous
	Tidal strenght preferences	Data deficient
	Wave exposure preferences	Exposed, Extremely exposed, Very exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	5-200 m
	Other preferences	Nocturnal
	Migration pattern	Active
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Moderate
	Male size range	400-500 mm (Total Lenght); 85-193 mm (Carapace Lenght)
	Male size at maturity	82 mm (CL)
	Female size range	400-500 mm (TL); 85-193 mm (CL)
	Female size at maturity	76-77 mm (CL)
	Growth form	Articulate
	Growth rate	12 mm yr^{-1}
	Body flexibility	None (<10°)
	Mobility	Swimmer, Crawler
	Characteristic feeding methods	Omnivore
	Typically feeds on	Echinoderms, small gastripods and bivalves, microalgae, shrimp larvae, bryozoans, annelids
	Sociability	Gregarious
	Environmental position	Epifaunal, Demersal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual protacted
	Developmental mechanism	Oviparous
	Fecundity (number of eggs)	10,000-200,000
	Generation time	insufficient information
	Age at maturity	4-5 yrs; Labile: depends on environmental condition
	Dispersal potential	>100m
	Larval settling time	1-6 months
	Time of first gamete	july
	Time of last gamete	october
	Life span	20-100 yrs
Biotope / ecosystem importance	Protection	VU A2bd ver. 3.1 (IUCN red list), Barcelona Convention Annex III, Bern Convention Annex III
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	No
	Does the species provide an important food source?	Insufficient information
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	Yes
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	Yes
Threats		Human exploitation
References:	Goni et al. 2003, Goni & Latrouite 2005	

Palinurus elephas - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	Low	None	High	Low	4
	Smothering	Intermediate	Moderate	Moderate	Low	3
	Changes in suspended sediment	Tolerant	Not relevant	Not sensitive	Low	0
	Desiccation	Not relevant	Not relevant	Not relevant	Moderate	na
	Changes (increase) in emergence	Not relevant	Not relevant	Not relevant	Moderate	na
	Changes in water flow rate	Tolerant	Not relevant	Not sensitive	Low	0
	Changes in temperature	High	Moderate	Moderate	Moderate	3
	Changes in turbidity	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in wave exposure	Not relevant	Not relevant	Not relevant	Very low	na
	Noise	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Visual presence	Intermediate	Insufficient information	Moderate	Very low	3
	Physical disturbance or abrasion	Low	Very high	Very low	Very low	1
	Displacement	Tolerant	Not relevant	Not sensitive	Moderate	0
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in salinity	Intermediate	High	Low	Very low	2
	Changes in oxygenation	Intermediate	Moderate	Moderate	Very low	3
Biological factors	Introduction of microbial pathogens and parasites	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Specific targeted extraction of this species	High	Very low	Very high	Moderate	5
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Paracentrotus lividus*
Taxonomy	Phylum	Echinodermata
	Class	Echinoidea
	Order	Camarodonta
	Family	Parechinidae
	Genus	*Paracentrotus*
	Species	*Paracentrotus lividus*
	Authority	Lamarck, 1816
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Upper circalittoral
	Substratum/ habitat preferences	Bedrock, Rock pools, Seagrass meadows; Rocky shores
	Tidal strenght preferences	Moderately
	Wave exposure preferences	Sheltered, Extremely sheltered, Moderately exposed
	Salinity preferences	Full (30-40 psu); Variable (18-40 psu)
	Depth range	0-80 m
	Other preferences	/
	Migration pattern	Non migratory / Resident
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	High density
	Male size range	up to 7 cm
	Male size at maturity	almost 40 mm
	Female size range	up to 7 cm
	Female size at maturity	almost 40 mm
	Growth form	Globose
	Growth rate	6-8 mm yr^{-1}
	Body flexibility	None (<10°)
	Mobility	Crawler
	Characteristic feeding methods	Herbivore; Passive suspension feeder
	Typically feeds on	Macroalgae, Seagrass, Organic particles
	Sociability	Solitary, Gregarious
	Environmental position	Epifaunal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual protracted
	Developmental mechanism	Planktotrophic
	Fecundity (number of eggs)	> 1,000,000
	Generation time	1 yr
	Age at maturity	1-2 yrs
	Dispersal potential	> 1000 m
	Larval settling time	> 30 days (20-40 days)
	Time of first gamete	April
	Time of last gamete	September
	Life span	5-10 yrs
Biotope / ecosystem importance	Protection	Annex III, Barcelona Convention
	Does the species create space in the assemblage?	Dominant
	Does it occupy space and exclude?	Dominant
	Does the species provide habitat structure?	Shelter
	Does the species provide an important food source?	Yes
	For what?	*Diplodus sargus* (Linnaeus, 1758)*, Diplodus vulgaris (*Geoffroy Saint-Hilaire, 1)*,* Crabs, Starfish, Birds
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	Yes
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	Yes
Threats		Human exploitation, Sensitive to pollution
References:	Bressan et al. 1995, Lozano et al. 1995, Turon et al. 1995, Warnau et al. 1996, Sala et al. 1998, Fernandez & Boudouresque 2000, Ruitton et al. 2000, Hereu et al. 2004, Fernandez et al. 2006, Gianguzza et al. 2006, Pizzolla 2007, Coma et al. 2011, Jacinto & Cruz 2012, Jacinto et al. 2013, Pages et al. 2013, Tejada et al. 2013	

Paracentrotus lividus - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	High	Moderate	High	3
	Smothering	High	Low	High	Very low	4
	Changes in suspended sediment	High	Moderate	Moderate	High	3
	Desiccation	High	Insufficient information	Very high	Very low	5
	Changes in emergence	Intermediate	Insufficient information	High	Very low	4
	Changes in water flow rate	Low	Very high	Very low	Moderate	1
	Changes (increase) in temperature	Intermediate	Low	High	Very low	4
	Changes in turbidity	High	Moderate	Moderate	High	3
	Changes in wave exposure	Intermediate	High	Low	High	1
	Noise	Tolerant	Not relevant	Not sensitive	Very low	0
	Visual presence	Not relevant	Not relevant	Not relevant	Very low	na
	Physical disturbance or abrasion	Intermediate	High	Low	Low	2
	Displacement	Tolerant	Not relevant	Not sensitive	Low	0
Chemical factors	Changes in levels of synthetic chemicals	High	Low	High	Moderate	5
	Changes in levels of heavy metals	High	High	Moderate	Moderate	3
	Changes in levels of hydrocarbons	Intermediate	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Intermediate	Moderate	Moderate	High	3
	Changes in levels of nutrients	Tolerant	Not sensitive	Not sensitive	High	0
	Changes (decrease) in salinity	High	Moderate	Moderate	High	3
	Changes in oxygenation	High	Low	High	Low	4
Biological factors	Introduction of microbial pathogens and parasites	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Introduction of alien or non- native species	Tolerant	Not relevant	Not sensitive	High	0
	Specific targeted extraction of this species	High	Low	High	Moderate	4
	Specific targeted extraction of other species	Low	Moderate	Low	Low	2

	General information	*Paramuricea clavata*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Octocorallia)
	Order	Alcyonacea
	Family	Plexauridae
	Genus	*Paramuricea*
	Species	*Paramuricea clavata*
	Authority	Risso, 1826
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Lower infralittoral, Circalittoral
	Substratum/ habitat preferences	Rocky cliff, Bedrock; Coralligenous
	Tidal strenght preferences	Strong
	Wave exposure preferences	Exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	15-250 m
	Other preferences	Low irradiance
	Migration pattern	Non-migratory/ Resident
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	High density
	Male size range	0-1.5m
	Male size at maturity	30 cm
	Female size range	0-1.5m
	Female size at maturity	20 cm
	Growth form	Arborescent form
	Growth rate	1-5 cm yr^{-1}
	Body flexibility	High (>45°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder
	Typically feeds on	Suspended matter including plankton
	Sociability	Colonial
	Environmental position	Epibenthic
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual
	Developmental mechanism	Lecithotrophic
	Fecundity (number of eggs)	10,000-100,000
	Generation time	/
	Age at maturity	7-13 yrs
	Dispersal potential	<10 m
	Larval settling time	<1 day
	Time of first gamete	June
	Time of last gamete	July
	Life span	20-100 yrs
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Little
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Substratum, Shelter
	Does the species provide an important food source?	Yes
	For what?	*Hermodice carunculata* (Pallas, 1766)
	Medicinal use	No
	Aquaculture use	No
	Harvested (targered)	No
	Harvester (by-catch)	Yes
	Curio use	No
	Culinary use	No
Threats		Sensitive to divers, Sensitive to global change, Fishing nets and anchoring, Mucilage
References:	Coma et al. 1994, Coma et al. 1995a, Coma et al. 1995b, Bavestrello et al. 1997, Garrabou 1999, Perez et al. 2000, Coma et al. 2002, Santangelo et al. 2003, Cerrano et al. 2005, Ballesteros 2006, Bally & Garrabou 2007, Linares et al. 2007, Ribes et al. 2007, Cerrano & Bavestrello 2008, Cupido et al. 2008, Linares et al. 2008, Bavestrello et al. 2010, Previati et al. 2010b, Gori et al. 2011, Huete-Stauffer et al. 2011, Torrents & Garrabou 2011, Cocito et al. 2013, Munari et al. 2013, Ferrier-Pages et al. 2015, Munari et al. 2013, Ponti et al. 2014, Giuliani et al. 2005, Cerrano et al. 2000	

Paramuricea clavata - sensitivity assessment

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
	Substratum loss	High	None	Very high	Low	5
	Smothering	High	Very low	Very high	Low	5
	Changes (increase) in suspended sediment	Intermediate	Very low	Very high	Very low	5
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in (increase) water flow rate	Intermediate	High	Low	Low	2
Physical factors	Changes (increase) in temperature	High	Very low	Very high	High	5
	Changes (increase) in turbidity	Low	High	Low	Moderate	2
	Changes (increase) in wave exposure	Not relevant	Not relevant	Not relevant	Not relevant	na
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	High	Very low	Very high	High	5
	Displacement	High	None	Very high	Low	5
	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
Chemical factors	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Low	High	Low	Moderate	2
	Changes (decrease) in salinity	High	None	Very high	Low	5
	Changes (decrease) in oxygenation	High	Low	High	Moderate	4
	Introduction of microbial pathogens and parasites	High	Low	High	High	4
Biological factors	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	Moderate	Moderate	Low	3
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Parazoanthus axinellae*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Hexacorallia)
	Order	Zoantharia
	Family	Parazoanthidae
	Genus	*Parazoanthus*
	Species	*Parazoanthus axinellae*
	Authority	Schmidt, 1862
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Infralittoral, Circalittoral
	Substratum/ habitat preferences	Bedrock, Organic substrate (sponges, shells and worm tubes); Rocky shores
	Tidal strenght preferences	Strong
	Wave exposure preferences	No information found
	Salinity preferences	Full (30-40 psu)
	Depth range	1-150/350 m
	Other preferences	/
	Migration pattern	Non migratory/ Resident
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Locally abundant
	Male size range	Up to 2 cm tall
	Male size at maturity	Polyps 1.5 cm tall and 0.5 cm in diameter
	Female size range	Up to 2 cm tall
	Female size at maturity	Polyps 1.5 cm tall and 0.5 cm in diameter
	Growth form	Polypoid
	Growth rate	Data deficient
	Body flexibility	High (>45°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension feeder
	Typically feeds on	No information found
	Sociability	Colonial
	Environmental position	Epifaunal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic, Fission, Fragmentation
	Reproductive frequency	Annual
	Developmental mechanism	Planktotrophic
	Fecundity (number of eggs)	No information found
	Generation time	No information found
	Age at maturity	No information found
	Dispersal potential	10-100 m
	Larval settling time	No information found
	Time of first gamete	July
	Time of last gamete	October
	Life span	Data deficient
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Little
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	No
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	/
	Harvester (by-catch)	/
	Curio use	/
	Culinary use	/
Threats		Sensitive to global change, Fishing nets and anchoring
References:	Garrabou 1999, Cerrano et al. 2006, Ager 2007, Previati et al. 2010a, Ryland 1997	

Parazoanthus axinellae **- sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	Low	High	Moderate	4
	Smothering	High	Moderate	Moderate	Low	3
	Changes in suspended sediment	Intermediate	Moderate	Moderate	Low	3
	Desiccation	High	None	Very high	Very low	5
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Low	High	Low	Very low	2
	Changes in temperature	High	Very low	Very high	High	5
	Changes in turbidity	Tolerant	Not relevant	Not sensitive	Low	0
	Changes in wave exposure	Intermediate	Moderate	Moderate	Low	3
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Intermediate	Moderate	Moderate	Low	3
	Displacement	High	None	Very high	Low	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Low	High	Low	Low	2
	Changes in salinity	High	None	Very high	Low	5
	Changes in oxygenation	Intermediate	Low	High	Moderate	4
Biological factors	Introduction of microbial pathogens and parasites	Low	None	High	Moderate	4
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Not relevant	Not relevant	Not relevant	Moderate	na
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Moderate	na

	General information	*Rapana venosa*
Taxonomy	Phylum	Mollusca
	Class	Gastropoda (Caenogastropoda)
	Order	Neogastropoda
	Family	Muricidae (Rapaninae)
	Genus	*Rapana*
	Species	*Rapana venosa*
	Authority	Valenciennes, 1846
Habitat information	Physiographic preference	Open coast, Strait, Estuary, Enclosed coast
	Biological zone preferences	Upper infralittoral
	Substratum/ habitat preferences	Artificial, Bedrock, Soft bottom, Mud; Rocky shores
	Tidal strenght preferences	Moderately strong, Strong, Very strong, Weak
	Wave exposure preferences	Exposed, Sheltered
	Salinity preferences	Full (30-40 psu); Variable (18-40 psu)
	Depth range	4- 20 m
	Other preferences	/
	Migration pattern	Resident/ Non- migratory
	Is the species native?	No
	Origin	Pacific Ocean
General biology	Typical abundance	Moderate, High
	Male size range	6-17 cm
	Male size at maturity	Data deficient
	Female size range	Up to 17 cm
	Female size at maturity	8-10 cm (Shell Height)
	Growth form	Knobbly
	Growth rate	20-40 mm yr^{-1} (first year)
	Body flexibility	None (<10°)
	Mobility	Burrower
	Characteristic feeding methods	Predator
	Typically feeds on	Mussels and cokles
	Sociability	Solitary
	Environmental position	Epibenthic, Epifaunal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Biannual protracted
	Developmental mechanism	Planktotrophic
	Fecundity (number of eggs)	100,000-1,000,000
	Generation time	1 yr
	Age at maturity	Data deficient
	Dispersal potential	100-1000 m
	Larval settling time	11-30 days
	Time of first gamete	Spring
	Time of last gamete	Summer
	Life span	11-20 yrs
Biotope / ecosystem importance	Protection	None
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	Substratum
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	No
	Harvester (by-catch)	No
	Curio use	/
	Culinary use	Yes
Threats		TBT/ imposex, *Alexandrium monilatum* toxin is lethal
References:	Onat & Topcuoglu 1999, Chung et al. 2002	

***Rapana venosa* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	Tolerant	Not sensitive	Not sensitive	Low	0
	Smothering	Low	High	Very low	Very low	1
	Changes in suspended sediment	Not relevant	Not relevant	Not relevant	Not relevant	na
	Desiccation	Intermediate	Very high	Very low	Very low	1
	Changes in emergence	Low	Very high	Very low	Very low	1
	Changes in water flow rate	Tolerant	Not sensitive	Not sensitive	Very low	0
	Changes in temperature	Intermediate	High	Low	Moderate	2
	Changes in turbidity	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in wave exposure	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Noise	Not relevant	Not relevant	Not relevant	Not relevant	na
	Visual presence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Physical disturbance or abrasion	Low	Immediate	Not sensitive	Very low	0
	Displacement	Tolerant	Not sensitive	Not sensitive	Low	0
Chemical factors	Changes in levels of synthetic chemicals	High	Low	Very high	Moderate	5
	Changes in levels of heavy metals	Tolerant	Not sensitive	Not sensitive	Very low	0
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	High	Very high	Very low	High	1
	Changes in levels of nutrients	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in salinity	Tolerant	Not sensitive	Not sensitive	High	0
	Changes in oxygenation	Low	Very high	Very low	Low	1
Biological factors	Introduction of microbial pathogens and parasites	High	Low	High	Moderate	4
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	Intermediate	High	Low	Low	2
	Specific targeted extraction of other species	Not relevant	Not relevant	Not relevant	Not relevant	na

	General information	*Savalia savaglia*
Taxonomy	Phylum	Cnidaria
	Class	Anthozoa (Hexacorallia)
	Order	Zoantharia
	Family	Parazoanthidae
	Genus	*Savalia*
	Species	*Savalia savaglia*
	Authority	Bertoloni, 1819
Habitat information	Physiographic preference	Open coast
	Biological zone preferences	Lower infralittoral, Circalittoral
	Substratum/ habitat preferences	Rocky cliff, Bedrock; Coralligenous
	Tidal strenght preferences	Strong
	Wave exposure preferences	Exposed, Moderately exposed
	Salinity preferences	Full (30-40 psu)
	Depth range	20-600 m
	Other preferences	Thermophilous species
	Migration pattern	Non-migratory/ Resident
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Low
	Male size range	up to 2 m high
	Male size at maturity	No information found
	Female size range	up to 2 m high
	Female size at maturity	No information found
	Growth form	Branch-like colonies
	Growth rate	5-8 cm yr^{-1} during the overgrowing stage; During the deposit of its own skeleton the growth slows down to 14-45 µm yr^{-1} (at its basal diameter)
	Body flexibility	High (>45°)
	Mobility	Permanent attachment
	Characteristic feeding methods	Passive suspension
	Typically feeds on	Suspension matter
	Sociability	Colonial
	Environmental position	Epibenthic, Epifaunal
	Supports (Depend on/ support)	Parasite on sea fans
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristc
	Reproductive frequency	Annual
	Developmental mechanism	Data deficient
	Fecundity (number of eggs)	No information found
	Generation time	No information found
	Age at maturity	6-7 yr
	Dispersal potential	No information found
	Larval settling time	No information found
	Time of first gamete	may
	Time of last gamete	december
	Life span	100+ yrs
Biotope / ecosystem importance	Protection	Barcelona Convention Annex II, Bern Convention Annex II
	Does the species create space in the assemblage?	Little
	Does it occupy space and exclude?	Moderate
	Does the species provide habitat structure?	Substratum, Shelter
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	/
	Aquaculture use	/
	Harvested (targered)	/
	Harvester (by-catch)	/
	Curio use	Yes
	Culinary use	/
Threats		Sensitive to global change, Fishing nets and anchoring, Unregulated collection for ornamental and jewellery, Sensitive to divers and habitat loss
References:	Cerrano et al. 2010, Previati et al. 2010a, Ryland 1997	

***Savalia savaglia* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	None	Very high	Low	5
	Smothering	High	Low	High	Low	4
	Changes (increase) in suspended sediment	Intermediate	Moderate	Moderate	Very low	3
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Low	High	Low	Very low	2
	Changes (increase) in temperature	Intermediate	Moderate	Moderate	Low	3
	Changes (increase) in turbidity	Tolerant	Not relevant	Not sensitive	Low	0
	Changes (increase) in wave exposure	Not relevant	Not relevant	Not relevant	Low	na
	Noise	Not relevant	Not relevant	Not relevant	Very low	na
	Visual presence	Not relevant	Not relevant	Not relevant	Very low	na
	Physical disturbance or abrasion	High	Very low	Very high	Low	5
	Displacement	High	None	Very high	Low	5
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes (increase) in levels of nutrients	Low	High	Low	Low	2
	Changes (increase) in salinity	High	Low	High	Moderate	4
	Changes (decrease) in oxygenation	Intermediate	Low	High	Moderate	4
Biological factors	Introduction of microbial pathogens and parasites	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Introduction of alien or non- native species	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Specific targeted extraction of this species	High	Very low	Very high	Low	5
	Specific targeted extraction of other species	High	Very low	Very high	Low	5

	General information	*Sciaena umbra*
Taxonomy	Phylum	Chordata (Vertebrata)
	Class	(Gnathostomata) Actinopterygii
	Order	Perciformes
	Family	Sciaenidae
	Genus	*Sciaena*
	Species	*Sciaena umbra*
	Authority	Linnaeus, 1758
Habitat information	Physiographic preference	Inshore waters, Offshore seabed
	Biological zone preferences	Eulittoral, Infralittoral, Upper circalittoral
	Substratum/ habitat preferences	Seagrass meadow, Crevices, Bedrock, Sand, Artificial, Lagoon; Rocky shores
	Tidal strenght preferences	Data deficient
	Wave exposure preferences	Sheltered
	Salinity preferences	Full (30-40 psu); Variable (18-40 psu)
	Depth range	20-200 m
	Other preferences	Nocturnal feeder
	Migration pattern	No
	Is the species native?	Yes
	Origin	Atlantic-Mediterranean
General biology	Typical abundance	Abundant
	Male size range	50-70 cm (TL)
	Male size at maturity	25 cm
	Female size range	50-70 cm (TL)
	Female size at maturity	30 cm
	Growth form	Perciformes
	Growth rate	1-10 cm yr^{-1}
	Body flexibility	High (>45°)
	Mobility	Swimmer
	Characteristic feeding methods	Predator
	Typically feeds on	Small fishes, Crustaceans
	Sociability	Gregarious
	Environmental position	Demersal
	Supports (Depend on/ support)	Indipendent
	Is the species toxic?	No
Reproduction and longevity	Reproductive type	Gonochoristic
	Reproductive frequency	Annual protracted
	Developmental mechanism	Planktotrophic
	Fecundity (number of eggs)	Data deficient
	Generation time	Data deficient
	Age at maturity	2-3 yrs
	Dispersal potential	> 1000m
	Larval settling time	3-4 days
	Time of first gamete	May
	Time of last gamete	August
	Life span	10-20 yrs
Biotope / ecosystem importance	Protection	Barcelona Convention Annex III, Berm Convention Annex III
	Does the species create space in the assemblage?	Minor
	Does it occupy space and exclude?	Minor
	Does the species provide habitat structure?	No
	Does the species provide an important food source?	No
	For what?	/
	Medicinal use	Yes
	Aquaculture use	/
	Harvested (targered)	Yes
	Harvester (by-catch)	Yes
	Curio use	Yes
	Culinary use	Yes
Threats		Human exploitation, By-catch
References:	La Mesa et al. 2008, Engin & Seyhan 2009, Grau et al. 2009, Picciulin et al. 2012	

***Sciaena umbra* - sensitivity assessment**

	Factors	Intolerance	Recoverability	Sensitivity	Confidence	Mean sensitivity
Physical factors	Substratum loss	High	High	Moderate	Very low	3
	Smothering	High	High	Moderate	Low	3
	Changes in suspended sediment	Not relevant	Not relevant	Not relevant	Not relevant	na
	Desiccation	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in emergence	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in water flow rate	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in temperature	Intermediate	Moderate	Moderate	Very low	3
	Changes in turbidity	Tolerant	Not relevant	Not sensitive	Low	0
	Changes in wave exposure	Not relevant	Not relevant	Not relevant	Very low	na
	Noise	Intermediate	Very high	Low	Moderate	2
	Visual presence	Intermediate	Insufficient information	Moderate	Low	3
	Physical disturbance or abrasion	High	Insufficient information	High	Not relevant	4
	Displacement	Not relevant	Not relevant	Not relevant	Not relevant	na
Chemical factors	Changes in levels of synthetic chemicals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of heavy metals	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of hydrocarbons	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of radionuclides	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
	Changes in levels of nutrients	Not relevant	Not relevant	Not relevant	Not relevant	na
	Changes in salinity	Low	High	Low	Very low	2
	Changes in oxygenation	Insufficient information	Insufficient information	Insufficient information	Insufficient information	na
Biological factors	Introduction of microbial pathogens and parasites	Low	High	Low	Low	2
	Introduction of alien or non- native species	Not relevant	Not relevant	Not relevant	Not relevant	na
	Specific targeted extraction of this species	High	Very low	Very high	Moderate	5
	Specific targeted extraction of other species	High	Insufficient information	Moderate	Low	3

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Annex 4

Table 1 - Mediterranean Reef Check Sensitivity indices calculated for provincial coastal areas

Table 2 - Mediterranean Reef Check Sensitivity indices calculated for protected areas

Table 3 - Mediterranean Reef Check Sensitivity indices calculated for grid cells within Tavolara MPA

Annex 4 - Table 1 Sensitivity indices calculated for provincial coastal areas

Zones	MSVtotobservations	MSVtotobservers	MSVtotsearched	MSVtot	MSVphyobservations	MSVphyobservers	MSVphysearched	MSVphy	MSVchemobservations	MSVchemobservers	MSVchemsearched	MSVchem	MSVbioobservations	MSVbioobservers	MSVbiosearched	MSVbio
HR13	48	3	13	NA	48	3	13	NA	48	3	13	NA	38	3	11	NA
HR15	8	1	8	NA	8	1	8	NA	8	1	8	NA	7	1	7	NA
HR18	79	4	14	NA	79	4	14	NA	77	4	13	NA	67	4	12	NA
HR8	108	6	16	2.95	108	6	16	2.98	107	6	15	2.88	86	6	14	NA
ITAG	13	3	7	NA	13	3	7	NA	13	3	7	NA	11	3	6	NA
ITAN	74	11	9	NA	74	11	9	NA	74	11	9	NA	74	11	9	NA
ITBA	112	11	15	2.73	112	11	15	2.79	103	11	14	NA	95	11	14	NA
ITBR	12	2	9	NA	12	2	9	NA	12	2	9	NA	11	2	8	NA
ITBT	6	1	6	NA	6	1	6	NA	6	1	6	NA	6	1	6	NA
ITCA	74	1	14	NA	74	1	14	NA	72	1	13	NA	68	1	13	NA
ITCH	5	2	5	NA	5	2	5	NA	5	2	5	NA	5	2	5	NA
ITCI	0	0	0	NA	0	0	0	NA	0	0	0	NA	0	0	0	NA
ITCS	12	4	9	NA	12	4	9	NA	12	4	9	NA	11	4	8	NA
ITFG	410	39	19	3.12	410	39	19	3.15	410	39	19	3.16	294	38	17	2.48
ITGE	3372	89	23	3.06	3372	89	23	3.13	3363	89	22	2.86	2977	89	21	2.78
ITGR	639	42	23	3.13	639	42	23	3.24	637	42	22	3.02	596	42	21	2.65
ITIM	271	11	20	3.19	271	11	20	3.22	271	11	20	3.15	231	11	18	3.19
ITKR	4	2	4	NA	4	2	4	NA	4	2	4	NA	3	2	3	NA
ITLE	96	13	19	2.79	96	13	19	2.85	93	13	18	2.99	77	13	17	1.78
ITLI	597	31	23	3.02	597	31	23	3.08	592	31	22	2.91	526	31	21	2.71
ITLT	61	3	12	NA	61	3	12	NA	61	3	12	NA	51	3	10	NA
ITME	10	4	3	NA	10	4	3	NA	10	4	3	NA	10	4	3	NA
ITNA	323	12	20	3.24	323	12	20	3.29	323	12	20	3.19	297	12	18	3.13
ITNU	4	1	2	NA	4	1	2	NA	4	1	2	NA	4	1	2	NA
ITOT	654	27	20	3.16	654	27	20	3.24	651	27	19	3.16	550	27	18	2.51
ITPA	225	18	20	2.97	225	18	20	3.06	224	18	19	2.74	209	18	18	2.67
ITPU	22	11	3	NA	22	11	3	NA	22	11	3	NA	22	11	3	NA
ITRA	4	3	3	NA	4	3	3	NA	3	3	2	NA	4	3	3	NA
ITRC	82	9	18	3.44	82	9	18	3.54	81	9	17	3.30	73	9	16	3.18
ITRG	3	1	3	NA	3	1	3	NA	3	1	3	NA	3	1	3	NA
ITRM	37	5	14	NA	37	5	14	NA	36	5	13	NA	29	5	12	NA
ITRN	1	1	1	NA	1	1	1	NA	1	1	1	NA	1	1	1	NA
ITRO	3	1	2	NA	3	1	2	NA	3	1	2	NA	3	1	2	NA
ITSA	307	30	21	3.24	307	30	21	3.30	306	30	20	3.19	262	30	19	2.94
ITSP	128	14	16	2.76	128	14	16	2.82	128	14	16	2.76	120	14	14	NA
ITSR	15	3	11	NA	15	3	11	NA	15	3	11	NA	13	3	10	NA
ITSS	33	4	11	NA	33	4	11	NA	33	4	11	NA	27	4	9	NA
ITSV	497	57	23	2.98	497	57	23	2.97	486	57	22	3.08	437	57	21	2.76
ITTA	67	9	16	2.39	67	9	16	2.42	64	9	15	2.48	63	9	15	1.79
ITTP	122	13	17	3.18	122	13	17	3.31	122	13	17	3.03	115	13	15	2.65
ITTR	70	4	18	3.03	70	4	18	3.07	70	4	18	2.92	63	4	16	2.84
ITTS	43	12	9	NA	43	12	9	NA	42	12	8	NA	43	12	9	NA

Annex 4 - Table 2 Sensitivity indices calculated for protected areas

Zones	Name	MSVtotobservations	MSVtotobservers	MSVtotsearched	MSVtot	MSVphyobservations	MSVphyobservers	MSVphysearched	MSVphy	MSVchemobservations	MSVchemobservers	MSVchemsearched	MSVchem	MSVbioobservations	MSVbioobservers	MSVbiosearched	MSVbio
1	Paguro NTZ	167	19	9	NA	167	19	9	NA	167	19	9	NA	165	19	8	NA
2523	Kornati	8	1	8	NA	8	1	8	NA	8	1	8	NA	7	1	7	NA
5977	Portofino MPA	3110	83	23	3.05	3110	83	23	3.13	3101	83	22	2.84	2751	83	21	2.78
13160	Cinque Terre MPA	55	9	14	NA	55	9	14	NA	55	9	14	NA	48	9	12	NA
13164	Isole Tremiti MPA	311	25	18	3.14	311	25	18	3.19	311	25	18	3.20	228	25	16	2.37
13165	Punta Campanella MPA	156	9	18	3.15	156	9	18	3.22	156	9	18	3.07	141	9	16	2.87
13167	Porto Cesareo MPA	6	2	6	NA	6	2	6	NA	6	2	6	NA	4	2	4	NA
13168	Capo Rizzuto MPA	4	2	4	NA	4	2	4	NA	4	2	4	NA	3	2	3	NA
13170	Isole Egadi MPA	65	4	11	NA	65	4	11	NA	65	4	11	NA	63	4	10	NA
16154	Isola di Ustica MPA	121	7	18	3.12	121	7	18	3.22	120	7	17	2.88	111	7	16	2.93
20721	Secche di Tor Paterno MPA	41	2	17	NA	41	2	17	NA	41	2	17	NA	37	2	15	NA
32674	Arcipelago Toscano MPA	42	10	13	NA	42	10	13	NA	42	10	13	NA	37	10	12	NA
68068	Piallassa della Baiona e Risega	1	1	1	NA	1	1	1	NA	1	1	1	NA	1	1	1	NA
166438	Arcipelago di La Maddalena National Park	72	1	13	NA	72	1	13	NA	72	1	13	NA	62	1	11	NA
178828	Isole di Ventotene e Santo Stefano	57	2	11	NA	57	2	11	NA	57	2	11	NA	48	2	9	NA
182731	Capo Gallo - Isola delle Femmine	74	12	13	NA	74	12	13	NA	74	12	13	NA	70	12	12	NA
182732	Capo Caccia Isola Piana	6	2	5	NA	6	2	5	NA	6	2	5	NA	6	2	5	NA
182733	Isole Pelagie	13	3	7	NA	13	3	7	NA	13	3	7	NA	11	3	6	NA
182734	Isola dell'Asinara	25	3	10	NA	25	3	10	NA	25	3	10	NA	19	3	8	NA
306217	Cabo de Palos MPA	20	2	10	NA	20	2	10	NA	20	2	10	NA	18	2	9	NA
365002	Miramare MPA	37	12	8	NA	37	12	8	NA	37	12	8	NA	37	12	8	NA
365003	Tavolara - Punta Coda Cavallo MPA	169	20	16	3.39	169	20	16	3.50	169	20	16	3.28	143	20	14	NA
390447	Regno di Nettuno MPA	8	2	7	NA	8	2	7	NA	8	2	7	NA	8	2	7	NA
390448	Santa Maria di Castellabate MPA	0	0	0	NA	0	0	0	NA	0	0	0	NA	0	0	0	NA
390449	Costa degli Infreschi e della Masseta MPA	34	6	16	3.03	34	6	16	3.16	33	6	15	2.91	31	6	14	NA
390450	Plemmirio MPA	12	2	10	NA	12	2	10	NA	12	2	10	NA	10	2	9	NA
390513	Isola di Bergeggi MPA	31	6	13	NA	31	6	13	NA	31	6	13	NA	29	6	11	NA
555526873	Cap Martin	11	2	7	NA	11	2	7	NA	11	2	7	NA	10	2	6	NA
555526874	Cap Ferrat	4	1	4	NA	4	1	4	NA	4	1	4	NA	3	1	3	NA
555526890	Porto/scandola/revellata/calvi/calanches de Piana	22	6	10	NA	22	6	10	NA	22	6	10	NA	15	5	8	NA
555529062	Fondali tra Capo Circeo e Terracina	1	1	1	NA	1	1	1	NA	1	1	1	NA	1	1	1	NA
555529461	Duna di Campomarino	8	2	7	NA	8	2	7	NA	8	2	7	NA	7	2	6	NA
555529465	Posidonieto Isola di San Pietro - Torre Canneto	24	3	12	NA	24	3	12	NA	24	3	12	NA	23	3	11	NA
555529466	Bosco Tramazzone	6	1	6	NA	6	1	6	NA	6	1	6	NA	5	1	5	NA
555529467	Litorale Brindisino	6	1	6	NA	6	1	6	NA	6	1	6	NA	6	1	6	NA
555529480	Montagna Spaccata e Rupi di San Mauro	8	1	3	NA	8	1	3	NA	8	1	3	NA	5	1	2	NA
555529937	Isola Rossa - Costa Paradiso	365	4	14	NA	365	4	14	NA	362	4	13	NA	305	4	12	NA
555539549	Iles d'Hyères	7	1	6	NA	7	1	6	NA	7	1	6	NA	7	1	6	NA
555540360	Isola di Pianosa - area terrestre e marina	33	4	10	NA	33	4	10	NA	33	4	10	NA	25	4	8	NA
555540553	Costa Viola	42	7	12	NA	42	7	12	NA	42	7	12	NA	35	7	10	NA
555540558	Isola di Pantelleria e area marina circostante	53	3	18	NA	53	3	18	NA	53	3	18	NA	48	3	16	NA
555540569	Arcipelago delle Eolie - area marina e terrestre	7	2	2	NA	7	2	2	NA	7	2	2	NA	7	2	2	NA
555540587	Capo Figari, Cala Sabina, Punta Canigione e Isola Figarolo	13	1	5	NA	13	1	5	NA	13	1	5	NA	10	1	4	NA
555544140	Tegnùe of Chioggia NTZ	434	38	16	2.49	434	38	16	2.39	433	38	15	2.51	407	38	14	NA
555547508	Natural Reserve of Bouches de Bonifacio	2	1	2	NA	2	1	2	NA	2	1	2	NA	2	1	2	NA

Annex 4 - Table 3 Sensitivity indices calculated for grid cells within Tavolara MPA

Zones	MSVtot	MSVphy	MSVchem	MSVbio
443	3.75	3.90	3.50	3.63
554	NA	NA	NA	NA
589	3.45	3.55	3.32	NA
626	3.50	3.66	3.26	2.90
627	NA	NA	NA	NA
660	NA	NA	NA	NA
663	3.44	3.58	3.29	2.81
689	2.59	2.66	2.45	1.97
691	NA	NA	NA	NA
693	NA	NA	NA	NA
729	NA	NA	NA	NA
731	2.93	3.00	2.72	NA
740	3.47	3.54	3.46	3.05
782	NA	NA	NA	NA
1047	NA	NA	NA	NA