A catalogue of indicators/indices on Biodiversity Descriptors for MSFD and future developments

Working Session: Marine Biodiversity & Ecosystem Functioning
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The story:

Within the frame of MSFD implementation in the Southern European Seas and the scientific support offered to the Competent Authorities and stakeholders, a series of DG ENV funded projects have been collaborating with the LIFEWATCH infrastructure regarding the Biodiversity Descriptors on constructing, maintenance and sustainability of resources and outcomes/products developed:

INTEGRATED REGIONAL MONITORING IMPLEMENTATION STRATEGY IN THE SOUTH EUROPEAN SEAS (2013-2015, www.iris-ses.eu)

ACTION PLANS FOR INTEGRATED REGIONAL MONITORING PROGRAMMES, COORDINATED PROGRAMMES OF MEASURES AND ADDRESSING DATA AND KNOWLEDGE GAPS IN MEDITERRANEAN SEA (2015-2017, www.actionmed.eu)

SUPPORT MEDITERRANEAN MEMBER STATES TOWARDS COHERENT AND COORDINATED IMPLEMENTATION OF THE SECOND PHASE OF THE MSFD (2017-2019, www.medcis.eu)

SUPPORT MEDITERRANEAN MEMBER STATES TOWARDS IMPLEMENTATION OF THE MARINE STRATEGY FRAMEWORK DIRECTIVE NEW GES DECISION AND PROGRAMMES OF MEASURES AND CONTRIBUTE TO REGIONAL /SUBREGIONAL COOPERATION (2019-2021, www.medregion.eu)

IRIS-SES

- developed an effective, open-access and open-resource, long lasting, continuously updated e-Learning platform with MSFD descriptors related short interviews and power-point lectures available on the IRIS-SES website, through the use of the Lifewatch EU project (also on LifeWatch Service Centre e-Learning area).

Aiming to offer to the MSFD stakeholder community (including students) a platform, with training tools available for the dissemination of the importance of monitoring the ecological/environmental status of our seas, as well as the relevance and characteristics of MSFD descriptors.

In IRIS-SES training material, were included:

- *morpho-functional diversity as body size diversity (D1),*
- *zooplankton diversity and pelagic food web dynamics in Adriatic (D1, D4),*
- *alien species to marine Mediterranean ecosystems (D2),*
- *nutrient & phytoplankton dynamics and HABs in the Black Sea (D5),*
- *smart monitoring for phytoplankton blooms – remote sensing (D1, D5),*
- *bioturbation and sea bed integrity (D6),*
- *interactions of biotic and abiotic components of the sea bed ecosystem (D6),*
- *problems raising from nano-particle contaminants and critical pressures from POPs in marine ecosystems and organism responses and contaminant bio-magnification (D8),*
- *the ecological impact of marine litter (D10).*

- Within **ActionMed** we performed a review on how EU MSs deal with biodiversity indicators in their IAs, identifying the commonalities and differences between nationally selected indicators, by considering important information sources with respect to biodiversity descriptors/indicators, GES, and targets, such as EU research projects (i.e. PERSEUS, DEVOTES, EMBOS etc.).
- Best practices of biodiversity tools of other regional approaches (i.e. OSPAR biodiversity assessment, HELCOM Biodiversity Assessment Tool (BEAT); MARMONI Marine Biodiversity Assessment Tool etc) were also considered, in order to categorize indicators and produce an indicator inventory.
- The **produced inventory of biodiversity descriptors**, being a freely available e-catalogue, has been published for open consultation on the ActionMed webportal (http://actionmed.eu/explore-the-electronic-catalogue-on-biodiversity-descriptor/).
- Advanced functions of the catalogue, linking descriptors/indicator to metrics for computational purposes were available by the end of the project on the LifeWatch-ITA webportal, with application to case studies.

- Also we collected information to build study cases in the biodiversity databases of marine LifeWatch Virtual Research Environments (VREs), to be made available as in kind contributions by LifeWatch-ITALY and LifeWatch-GREECE, in order to develop experimental tests of uncertainty associated to biodiversity indicators currently used by MSs or scientific networks.
- The case studies have been applied on an idealised transect from inland brackish water to the open sea, to take also into account the natural gradient of nutrients, with decreasing concentrations along increasing distance from the coastal source of freshwater/anthropogenic effluents and nutrient input.
- Finally, a GIS tool related to Biodiversity (D1) and Seafloor Integrity (D6) descriptors developed as a toolbox, in order to assess the degree of vulnerability of the benthic habitats to human stressors. The design of the GIS tool has been based on the outcomes of the UNEP/MAP Biodiversity online working group, the HELCOM Baltic Sea Impact (2010) and the OSPAR BH3 indicator addressing the pressures causing physical damage to the seafloor habitats. **Thus, the main concept of the GIS tool is to relate the sensitivity of Mediterranean priority habitats to the pressure type and intensity**.

Some examples

The GIS tool

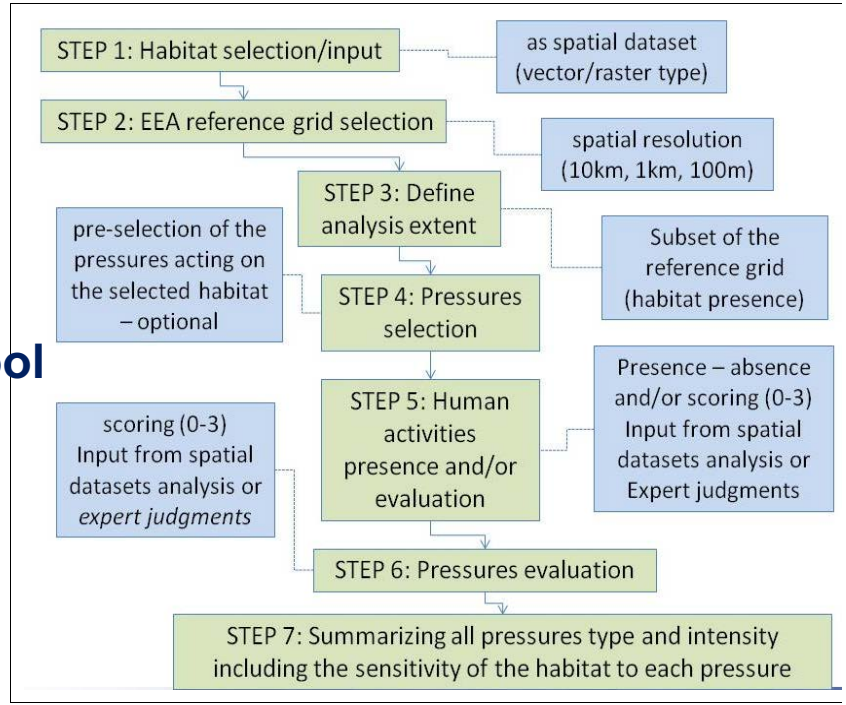


Figure 2. The workflow of the Benthic Habitat Risk Assessment tool

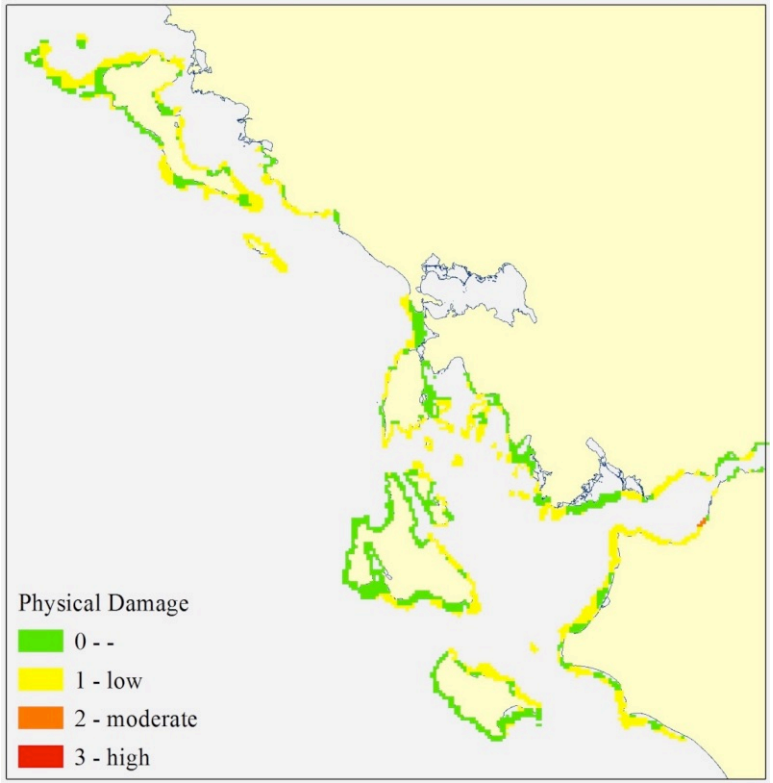


Figure 10. Assessment of the physical damage of the meadows regarding the bottom trawlers activity (step 6).

Within the Proposals for the Mid- & Long-term Action Plans:

Availability, accessibility and visualization (possibly via GIS Tools) of large datasets is crucial to define monitoring strategies and interpret their output.

Pivotal role of data portal and virtual research environment *(e.g. EMODnet, LifeWatch-ERIC).*

Integration of European Research Infrastructures *in the implementation of European Directives, can reinforce the EU policy towards a wise and efficient process of ensuring ecosystem health at the EU scale*

Electronic catalogue on Biodiversity Descriptor

Created by: Francesco Cozzoli; francesco.cozzoli@unisalento.it

Fields

Index name

Element: Phytoplankton

Descriptor: D1

from (year): 2006

to (year): 2015

Author name

Typology

Download

Index	Element	Title	Authors	Year	Published.on	Typology	Associated.descriptors
Abundance of phytoplankton	Phytoplankton	ESTRATEGIA MARINA DEMARCACION MARINA CANARIA PARTE IV. DESCRIPTORES DEL BUEN ESTADO AMBIENTAL DESCRIPTOR 1: BIODIVERSIDAD EVALUACION INICIAL Y BUEN ESTADO AMBIENTAL	de Armas D, Bellas J	2012	AZTI-JGR - D1 - Canarias Spanish Ministry of Agriculture, Food and Environment	Report	D1-D4-D5
Abundance of phytoplankton	Phytoplankton	ESTRATEGIA MARINA DEMARCACION MARINA NORATLANTICA PARTE IV. DESCRIPTORES DEL BUEN ESTADO AMBIENTAL DESCRIPTOR 1: BIODIVERSIDAD EVALUACION INICIAL Y BUEN STADO AMBIENT	de Armas D, Bellas J	2012	AZTI-JGR - D1 - Noratlantica Spanish Ministry of Agriculture, Food and Environment	Report	D1-D4-D5
Abundance of selected phytoplankton species and taxa groups	Phytoplankton	ESTRATEGIA MARINA DEMARCACION MARINA NORATLANTICA PARTE IV. DESCRIPTORES DEL BUEN ESTADO AMBIENTAL DESCRIPTOR 1: BIODIVERSIDAD	de Armas D, Bellas J	2012	AZTI-JGR - D1 - Noratlantica Spanish Ministry of Agriculture, Food and Environment	Report	D1-D3-D4-D5

As additional deliverable to the case studies task of ActionMed, a web-tool for phytoplankton dataset has been produced and available on the ActionMed website (http://actionmed.eu/).

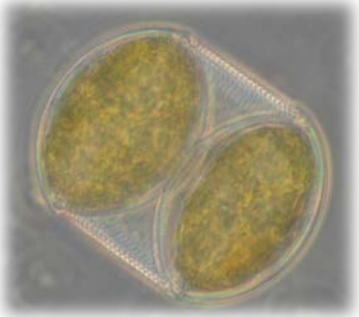
The webtool is able to calculate a large number of phytoplankton community indicators and provides support for correlation, similarity and time series analysis.

The webtool allows:

1) the analysis of the datasets described in a study case;
2) the upload of phytoplankton datasets organized according to the LIFEWATCH standards

Descriptor 1: Biodiversity

Pelagic Habitats as Biodiversity component included in the COMMISSION DECISION (EU) 2017/848



Theme

Pelagic habitats (relating to Descriptor 1)

Criteria, including criteria elements, and methodological standards

Criteria elements	Criteria	Methodological standards
Pelagic broad habitat types (variable salinity (1)), coastal, shelf and oceanic/beyond shelf), if present in the region or subregion, and other habitat types as defined in the second paragraph. Member States may select, through regional or subregional cooperation, additional habitat types according to the criteria laid down under 'specifications for the selection of species and habitats'.	D1C6 — Primary: The condition of the habitat type, including its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), is not adversely affected due to anthropogenic pressures. Member States shall establish threshold values for the condition of each habitat type, ensuring compatibility with related values set under Descriptors 2, 5 and 8, through regional or subregional cooperation.	*Scale of assessment:* Subdivision of region or subregion as used for assessments of benthic broad habitat types, reflecting biogeographic differences in species composition of the habitat type. *Use of criteria:* The extent to which good environmental status has been achieved shall be expressed for each area assessed as: (a) an estimate of the proportion and extent of each habitat type assessed that has achieved the threshold value set; (b) a list of broad habitat types in the assessment area that were not assessed.

(1) Retained for situations where estuarine plumes extend beyond waters designated as Transitional Waters under Directive 2000/60/EC.

Issues identified:

According to the latest revision of the GES definitions,
all 8 Mediterranean MSs have defined GES at the Biodiversity Descriptor 1 level,

However, not all of them in relation to pelagic habitats and plankton communities

The level of coherence among them is still low for pelagic habitats

MEDCIS contribution:

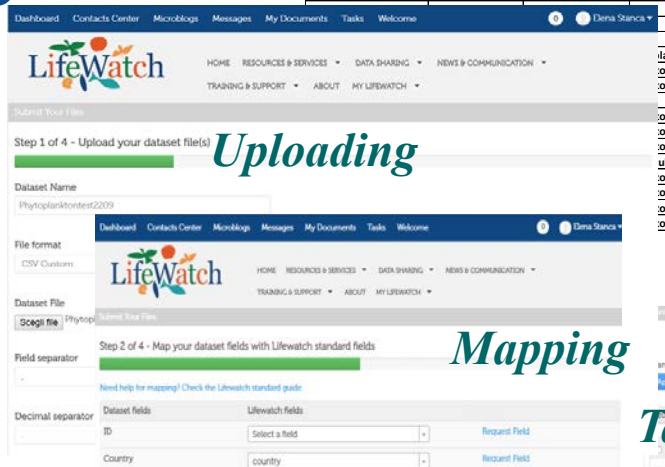
Issues to be addressed & resources to be used as the e-catalogue on Biodiversity descriptor developed in ActionMed

- Review the use of existing diversity indicators for different plankton groups in the Mediterranean
- Compare existing approaches of GES definitions for D1
- Practices in other European seas

Focus on plankton indicators for phytoplankton, zooplankton and prokaryotes

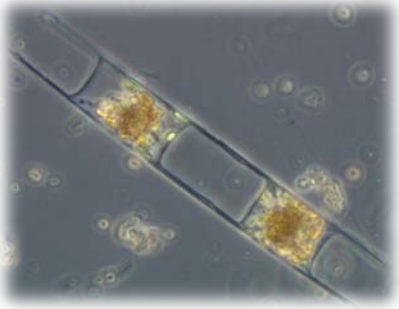
Data resources

For the phytoplankton case study



Class	Order	Family	Genus	Taxa	Shape	Measurement Remarks	Internal and external structures	Class
Dinophyceae	Peridiniales	Protoperidiniaceae	Protoperidinium	Protoperidinium spp.	Double cone	Frontal	Thecate	
Dinophyceae	Peridiniales	Protoperidiniaceae	Protoperidinium	Protoperidinium spp.	Double cone	Frontal	Thecate	50
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	Tetraselmis	Tetraselmis spp.	Prolate spheroid	Unique		93
Chlorodendrophyceae	Chlorodendrales	Chlorodendraceae	Tetraselmis	Tetraselmis spp.	Prolate spheroid	Unique		93
Cryptophyceae				Cryptophyceae	cone+half sphere	Unique	flagella	11
Cryptophyceae				Cryptophyceae	cone+half sphere	Unique	flagella	11
Dinophyceae				Dinophyceae	Prolate spheroid	lessthan20	Thecate	505
				Dinophyceae	Prolate spheroid	lessthan20	Thecate	505
				cf. Imantonia sp.	Sphere	Unique		971
				cf. Imantonia sp.	Sphere	Unique		971
la				Ollicola vangoorii	Prolate spheroid	Unique		99
oceros				Chaetoceros spp.	Prism on elliptic base	Valvar		30
oceros				Chaetoceros spp.	Prism on elliptic base	Valvar		30
				Prymnesiophyceae	Prolate spheroid	lessthan20		804
oceros				Chaetoceros decipiens	Prism on elliptic base	Girdle		34
oceros				Chaetoceros decipiens	Prism on elliptic base	Girdle		34
oceros				Chaetoceros decipiens	Prism on elliptic base	Girdle		34
ula				Navicula spp.	Prism on elliptic base	Valvar		6
oceros				Chaetoceros wighamii	Prism on elliptic base	Girdle		39
oceros				Chaetoceros wighamii	Prism on elliptic base	Girdle		39
oceros				Chaetoceros wighamii	Prism on elliptic base	Girdle		39
oceros				Chaetoceros spp.	Prism on elliptic base	Girdle		31

Computation



- Index_Workflow, on Phytoplankton Virtual Research Environment, provided by LifeWatch Italy (www.lifewatchitaly.eu)
- 8 different indices commonly used in phytoplankton ecology were calculated

Taxonomic richness

Margalef's diversity

$$M' = \frac{R' - 1}{\log N}$$

Pielou's evenness

$$E' = \frac{H'}{\log R'}$$

Sheldon's evenness

$$Sh' = \frac{e^{H'}}{R'}$$

BergerParker's dominance

$$BP' = \frac{n_1}{N}$$

Shannon - Wiener's diversity

$$H' = -\sum p_i \times \ln p_i$$

Simpson's diversity

$$S' = \sum p_i^2$$

McNaughton's dominance

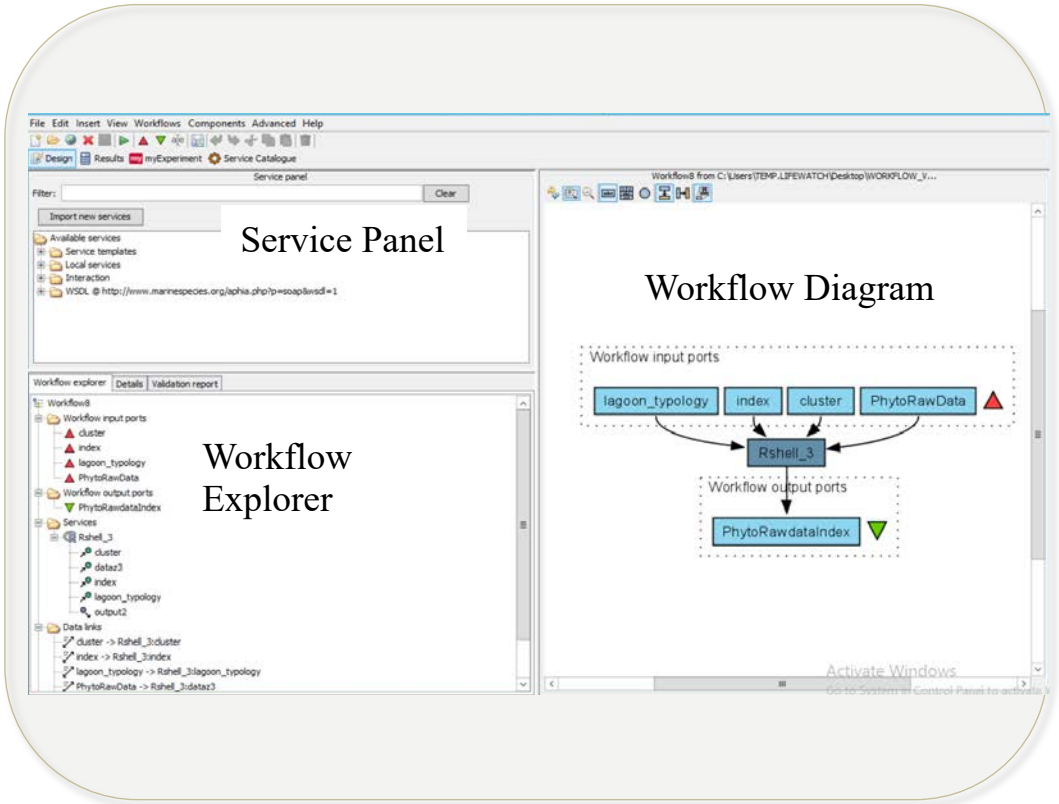
$$McN' = \frac{n_1 + n_2}{N}$$

Index workflow

WORKFLOW ORCHESTRATOR

Phyto VRE

TOOLS/SERVICES



Computation

Index workflow output

country	locality	parenteventi	month	year	depth	R	Shannon_H	Shannon_H_	Simpson_D	Menhinick_D	Margalef_D	Gleason_D	McIntosh_M	Hurlbert_PIE	Pielou_J	Sheldon_J	LudwReyn_J	BergerParke	McNaughton	Hulburt
ITALY	Alimini-Otranto	MC_FA01	10	2013	0	33	2,139	8,493	0,814	0,208	3,159	3,257	1,422	0,84	0,612	0,257	0,234	0,295	0,55	54,98
ITALY	Alimini-Otranto	MC_FA01	10	2014	0	35	2,179	8,837	0,8	0,109	2,945	3,032	1,443	0,824	0,613	0,252	0,23	0,327	0,612	61,241
ITALY	Alimini-Otranto	MC_FA01	10	2015	0	47	2,334	10,322	0,85	0,085	3,642	3,721	1,384	0,869	0,606	0,22	0,203	0,26	0,457	45,717
ITALY	Alimini-Otranto	MC_FA01	11	2012	0	14	0,773	2,165	0,291	0,049	1,149	1,238	1,836	0,313	0,293	0,155	0,09	0,84	0,891	89,087
ITALY	Alimini-Otranto	MC_FA01	11	2016	0	24	1,695	6,653	0,783	0,019	1,616	1,686	1,464	0,817	0,596	0,277	0,246	0,391	0,55	54,391
ITALY	Alimini-Otranto	MC_FA01	1	2013	0	36	1,769	5,863	0,723	0,054	2,695	2,772	1,524	0,744	0,494	0,163	0,139	0,433	0,712	71,218
ITALY	Alimini-Otranto	MC_FA01	12	2014	0	32	1,779	5,926	0,728	0,073	2,546	2,628	1,518	0,751	0,513	0,185	0,159	0,419	0,711	71,083
ITALY	Alimini-Otranto	MC_FA01	12	2015	0	24	2,006	7,434	0,81	0,138	2,228	2,325	1,428	0,845	0,631	0,31	0,28	0,287	0,544	54,404
ITALY	Alimini-Otranto	MC_FA01	12	2016	0	17	1,186	3,274	0,548	0,044	1,341	1,425	1,668	0,583	0,419	0,193	0,142	0,648	0,778	77,755
ITALY	Alimini-Otranto	MC_FA01	2	2014	0	17	2,172	8,777	0,845	0,145	1,68	1,784	1,382	0,898	0,767	0,516	0,486	0,28	0,475	47,522
ITALY	Alimini-Otranto	MC_FA01	2	2015	0	43	1,861	6,432	0,745	0,066	3,24	3,317	1,502	0,763	0,495	0,15	0,129	0,427	0,626	62,622
ITALY	Alimini-Otranto	MC_FA01	3	2013	0	21	1,495	4,458	0,647	0,126	1,354	2,052	1,585	0,679	0,491	0,212	0,173	0,522	0,794	79,44
ITALY	Alimini-Otranto	MC_FA01	3	2014	0	21	1,633	6,253	0,783	0,029	1,516	1,592	1,464	0,822	0,602	0,298	0,263	0,331	0,614	61,45
ITALY	Alimini-Otranto	MC_FA01	3	2016	0	27	0,479	1,614	0,184	0,091	2,284	2,372	1,897	0,191	0,145	0,06	0,024	0,902	0,95	95,026
ITALY	Alimini-Otranto	MC_FA01	4	2014	0	24	0,689	1,991	0,326	0,075	1,395	2,082	1,815	0,341	0,217	0,083	0,043	0,811	0,911	91,12
ITALY	Alimini-Otranto	MC_FA01	4	2015	0	21	1,533	4,634	0,701	0,044	1,618	1,699	1,543	0,736	0,504	0,221	0,182	0,434	0,737	73,668
ITALY	Alimini-Otranto	MC_FA01	5	2012	0	20	1,397	4,041	0,649	0,075	1,703	1,792	1,586	0,683	0,466	0,202	0,16	0,507	0,797	79,694
ITALY	Alimini-Otranto	MC_FA01	5	2013	0	20	1,375	3,956	0,614	0,065	1,659	1,746	1,616	0,646	0,453	0,198	0,156	0,578	0,771	77,106
ITALY	Alimini-Otranto	MC_FA01	5	2016	0	46	2,604	13,521	0,904	0,06	3,384	3,453	1,309	0,924	0,68	0,294	0,278	0,215	0,333	33,324
ITALY	Alimini-Otranto	MC_FA01	6	2014	0	29	1,175	3,239	0,501	0,072	2,332	2,415	1,702	0,519	0,349	0,112	0,08	0,694	0,77	77,043
ITALY	Alimini-Otranto	MC_FA01	6	2015	0	43	1,845	6,327	0,782	0,038	2,986	3,057	1,466	0,8	0,49	0,147	0,127	0,368	0,593	59,346
ITALY	Alimini-Otranto	MC_FA01	6	2016	0	40	2,033	7,638	0,753	0,261	3,875	3,975	1,487	0,772	0,551	0,191	0,17	0,456	0,592	59,217
ITALY	Alimini-Otranto	MC_FA01	7	2012	0	18	1,8	6,052	0,784	0,072	1,54	1,63	1,459	0,83	0,623	0,336	0,297	0,306	0,58	57,985
ITALY	Alimini-Otranto	MC_FA01	7	2013	0	18	1,618	5,045	0,727	0,107	1,66	1,757	1,513	0,77	0,56	0,28	0,238	0,388	0,699	69,88
ITALY	Alimini-Otranto	MC_FA01	8	2014	0	22	2,266	9,64	0,82	0,212	2,261	2,369	1,41	0,86	0,733	0,438	0,411	0,378	0,474	47,407
ITALY	Alimini-Otranto	MC_FA01	8	2015	0	23	0,926	2,525	0,343	0,108	2,053	2,146	1,802	0,359	0,295	0,11	0,069	0,806	0,863	86,274
ITALY	Alimini-Otranto	MC_FA01	9	2012	0	13	1,722	5,598	0,753	0,066	1,137	1,232	1,489	0,816	0,672	0,431	0,383	0,405	0,639	63,929
ITALY	Alimini-Otranto	MC_FA01	9	2013	0	33	2,379	10,798	0,834	0,231	3,226	3,326	1,397	0,86	0,68	0,327	0,306	0,346	0,496	49,558
ITALY	Alimini-Otranto	MC_FA01	9	2016	0	45	2,954	19,18	0,933	0,167	3,929	4,018	1,255	0,954	0,776	0,426	0,413	0,161	0,234	23,423
ITALY	AMP Torre Guaceto	MC_TG 01	10	2012	0	28	3,009	20,27	0,935	0,122	2,483	2,575	1,249	0,97	0,903	0,724	0,714	0,133	0,255	25,455
ITALY	AMP Torre Guaceto	MC_TG01	10	2014	0	26	2,609	13,585	0,884	0,053	2,018	2,098	1,338	0,919	0,801	0,522	0,503	0,256	0,393	39,252
ITALY	AMP Torre Guaceto	MC_TG01	10	2015	0	19	0,384	1,468	0,134	0,037	1,445	1,525	1,927	0,142	0,13	0,077	0,026	0,93	0,955	95,483
ITALY	AMP Torre Guaceto	MC_TG 01	1	2013	0	30	3,123	22,715	0,942	0,092	2,507	2,593	1,237	0,974	0,918	0,757	0,749	0,145	0,229	22,895
ITALY	AMP Torre Guaceto	MC_TG01	1	2014	0	27	2,848	17,259	0,919	0,062	2,142	2,224	1,282	0,954	0,864	0,639	0,625	0,183	0,302	30,24
ITALY	AMP Torre Guaceto	MC_TG01	12	2013	0	41	3,082	21,808	0,938	0,064	3,096	3,173	1,246	0,962	0,83	0,532	0,52	0,132	0,225	22,494
ITALY	AMP Torre Guaceto	MC_TG01	12	2014	0	23	2,425	11,303	0,873	0,055	1,82	1,903	1,353	0,913	0,773	0,491	0,468	0,253	0,395	39,512
ITALY	AMP Torre Guaceto	MC_TG01	2	2014	0	21	2,695	14,801	0,915	0,061	1,71	1,796	1,287	0,961	0,885	0,705	0,69	0,143	0,287	28,66
ITALY	AMP Torre Guaceto	MC_TG01	2	2015	0	32	2,472	11,851	0,876	0,073	2,551	2,633	1,349	0,905	0,713	0,37	0,35	0,246	0,384	38,437
ITALY	AMP Torre Guaceto	MC_TG 01	3	2013	0	38	3,212	24,824	0,948	0,097	3,1	3,184	1,225	0,973	0,883	0,653	0,644	0,11	0,217	21,668
ITALY	AMP Torre Guaceto	MC_TG01	4	2014	0	22	2,408	11,113	0,865	0,211	2,259	2,367	1,354	0,906	0,779	0,505	0,482	0,276	0,423	42,279
ITALY	AMP Torre Guaceto	MC_TG01	4	2015	0	23	2,372	10,718	0,873	0,204	2,327	2,433	1,345	0,912	0,756	0,466	0,442	0,204	0,367	36,677
ITALY	AMP Torre Guaceto	MC_TG 01	5	2012	0	26	3,028	20,665	0,942	0,084	2,18	2,268	1,237	0,979	0,93	0,795	0,787	0,114	0,211	21,141
ITALY	AMP Torre Guaceto	MC_TG01	5	2013	0	29	3,1	22,198	0,947	0,067	2,305	2,387	1,227	0,981	0,921	0,765	0,757	0,098	0,175	17,504
ITALY	AMP Torre Guaceto	MC_TG01	6	2014	0	28	2,84	17,121	0,929	0,064	2,222	2,305	1,263	0,964	0,852	0,611	0,597	0,133	0,228	22,82
ITALY	AMP Torre Guaceto	MC_TG01	6	2015	0	20	2,167	8,735	0,802	0,151	1,945	2,047	1,434	0,844	0,723	0,437	0,407	0,4	0,51	51,002
ITALY	AMP Torre Guaceto	MC_TG 01	7	2012	0	32	3,131	22,892	0,946	0,1	2,688	2,775	1,228	0,977	0,903	0,715	0,706	0,103	0,194	19,436
ITALY	AMP Torre Guaceto	MC_TG01	8	2013	0	23	2,512	12,332	0,872	0,039	1,726	1,804	1,356	0,911	0,801	0,536	0,515	0,238	0,45	44,951
ITALY	AMP Torre Guaceto	MC_TG01	8	2014	0	26	2,397	10,995	0,868	0,073	2,128	2,214	1,359	0,903	0,736	0,423	0,4	0,248	0,417	41,712
ITALY	AMP Torre Guaceto	MC_TG01	8	2015	0	21	2,132	8,435	0,805	0,054	1,676	1,76	1,438	0,845	0,7	0,402	0,372	0,31	0,602	60,197
ITALY	AMP Torre Guaceto	MC_TG 01	9	2012	0	30	2,95	19,107	0,932	0,088	2,485	2,57	1,257	0,964	0,867	0,637	0,624	0,115	0,224	22,404
ITALY	AMP Torre Guaceto	MC_TG01	9	2013	0	22	2,478	11,912	0,877	0,052	1,734	1,817	1,348	0,918	0,802	0,541	0,52	0,231	0,404	40,432
ITALY	Area Marina Protetta Torre Guaceto	MC_TG01	10	2016	0	18	1,259	3,522	0,471	0,06	1,489	1,577	1,721	0,499	0,436	0,196	0,148	0,721	0,773	77,332
ITALY	Area Marina Protetta Torre Guaceto	MC_TG01	11	2016	0	26	1,884	6,579	0,703	0,077	2,148	2,234	1,541	0,731	0,578	0,253	0,223	0,517	0,645	64,546
ITALY	Area Marina Protetta Torre Guaceto	MC_TG01	1	2017	0	37	2,218	9,184	0,838	0,067	2,851	2,93	1,399	0,862	0,614	0,248	0,227	0,261	0,514	51,4
ITALY	Area Marina Protetta Torre Guaceto	MC_TG01	6	2016	0	20	2,027	7,591	0,811	0,067	1,667	1,755	1,43	0,853	0,677	0,38	0,347	0,353	0,494	49,427
ITALY	Area Marina Protetta Torre Guaceto	MC_TG01	7	2016	0	19	2,608	13,571	0,912	0,108	1,742	1,838	1,29	0,962	0,886	0,714	0,698	0,156	0,294	29,351
ITALY	Bari-S.Vito (Polignano)	MC_BA01	10	2014	0	37	1,47	4,348	0,511	0,211	3,484	3,581	1,69	0,525	0,407	0,118	0,093	0,69	0,79	79,032
ITALY	Bari-S.Vito (Polignano)	MC_BA01	10	2015	0	56	1,515	4,55	0,63	0,214	4,941	5,031	1,602	0,641	0,376	0,081	0,065	0,496	0,846	84,611

We processed

- more than 4000 samples and 85,500 data entries

The 8 different indices common in phytoplankton ecology tested vs.

- eutrophication levels
- seasonality
- spatial axes (latitude and longitude)
- sub-regional scale
- depth
- distance from the coast

Output analysis

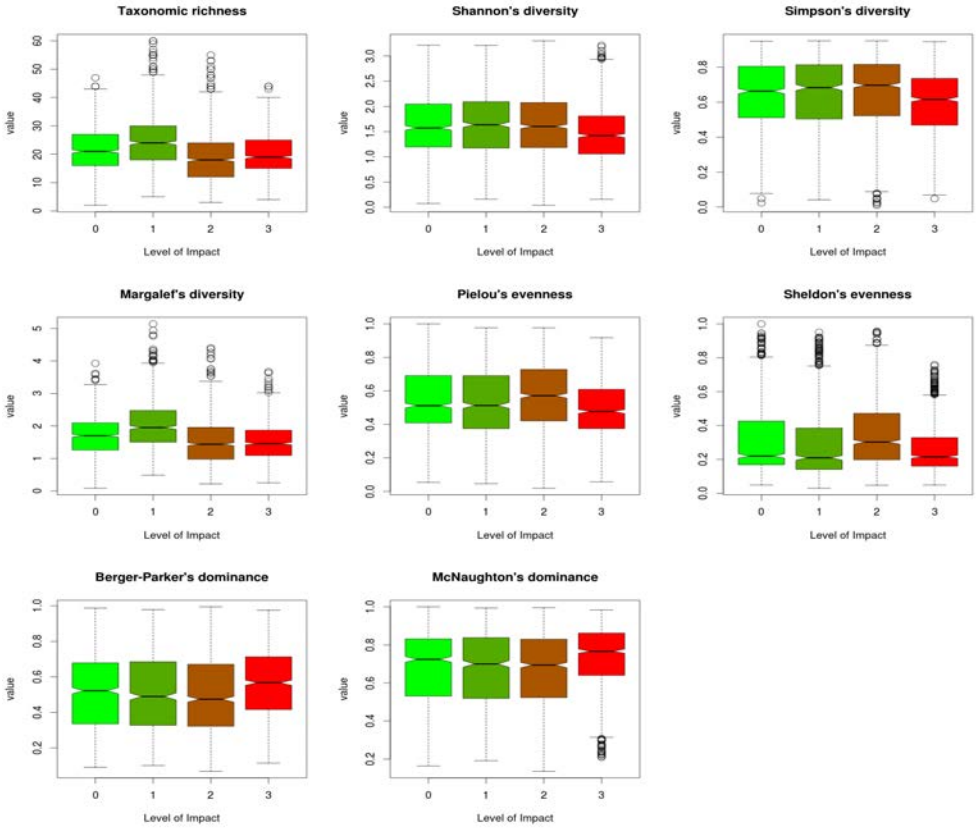
- Distribution of indices across anthropogenic impact levels

❖reference conditions (0)

❖low impact (1)

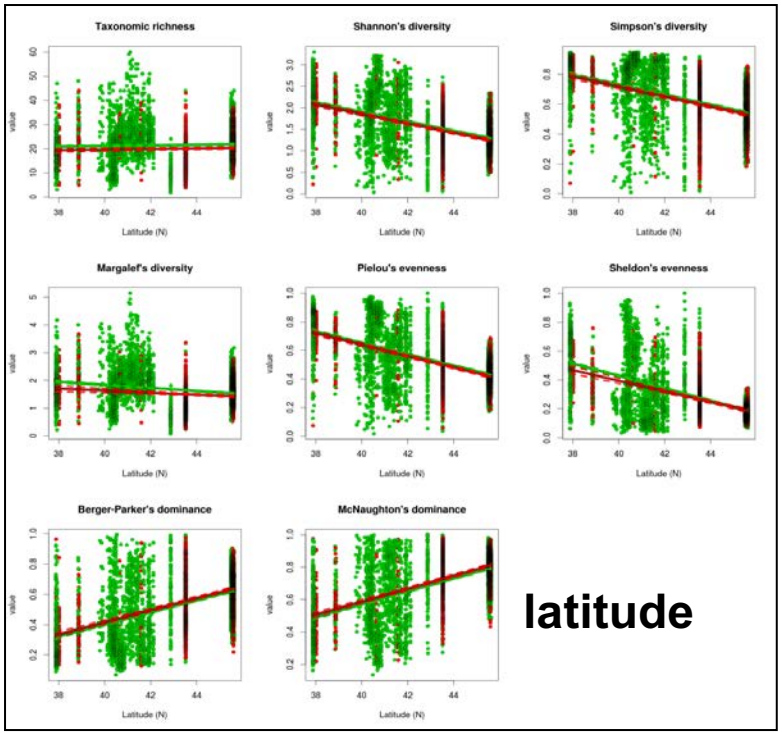
❖moderate impact (2)

❖heavy impact (3)

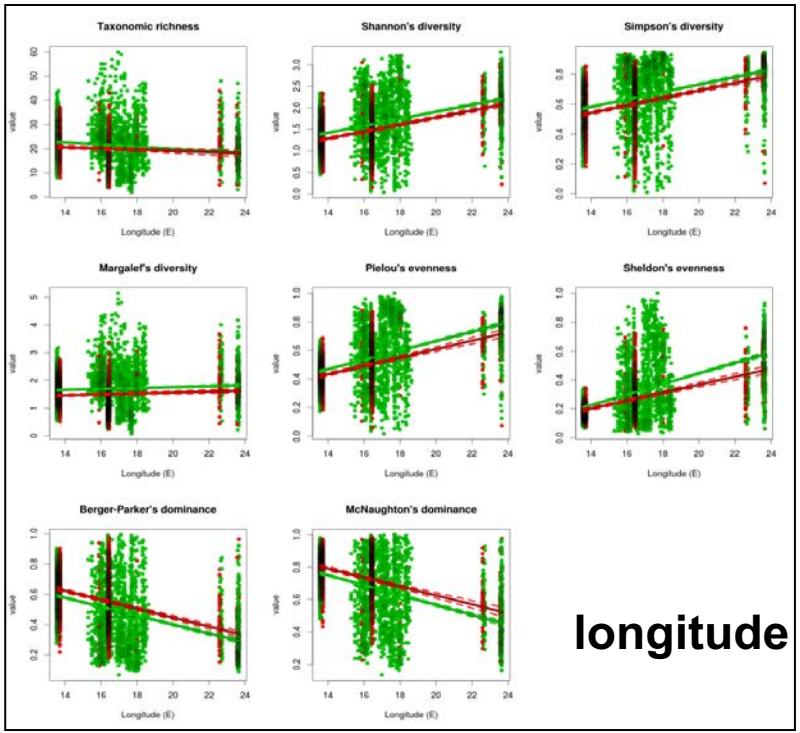


Output analysis

- Distribution of indices along spatial axes



latitude



longitude

non-impacted sites (0, 1, 2)

impacted sites (3)

Conclusions and recommendations from the phytoplankton case studies in the Med:

- biodiversity indices (as the combination of Shannon's/Simpson's diversity and Sheldon's evenness indices) can discriminate the level of eutrophication impact on plankton communities across different coastal environments in the Med

- space-specific thresholds are needed due to the strong variation of biodiversity indices along longitudinal and latitudinal gradients

- sampling across the whole water column is quite imperative because taxonomic indices appear to be more constant across different depths and distances from the coast

- high sampling frequency is very crucial since many indices have bad performances in discriminating impacted sites in summer (July – August)

- more testing of existing plankton biodiversity indicators with good performances is needed in order to construct solid thresholds for the Med.

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Original Articles

Sensitivity of phytoplankton metrics to sample-size: A case study on a large transitional water dataset (WISER)

F. Cozzoli[a,*], E. Stanca[a], G.B. Selmeczy[a], J. Francé[b], I. Varkitzi[c], A. Basset[a]

Ecological Indicators 95 (2018) 203–218

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Review

Pelagic habitats in the Mediterranean Sea: A review of Good Environmental Status (GES) determination for plankton components and identification of gaps and priority needs to improve coherence for the MSFD implementation

I. Varkitzi[a,*], J. Francé[b], A. Basset[c], F. Cozzoli[c], E. Stanca[c], S. Zervoudaki[a], A. Giannakourou[a], G. Assimakopoulou[a], A. Venetsanopoulou[a], P. Mozetič[b], T. Tinta[b,d], S. Skejic[e], O. Vidjak[e], J-F. Cadiou[f], K. Pagou[a]

The work will continue in MEDREGION.

Among the objectives are:

- **Selection of indicators (for D1, D4, D6) based upon criteria established in the Commission Decision (EC, 2017).**
- **Set reference conditions and thresholds (i.e. boundary between good and moderate status.**
- **Integration of multiple indicators, criteria, ecosystem components, and descriptors in multiple temporal and spatial scales.**
- **Perform a gap analysis about pollution pressures on biodiversity in the Mediterranean**

Thank you!