UNITED
NATIONS

EP

UNEP/MED WG.556/Inf.5/Rev.1

United Nations
Environment Programme
Mediterranean Action Plan

Distr.: General
17 February 2023

Original: English only

Meeting of the Ecosystem Approach Correspondence Group on Pollution Monitoring

Athens, Greece, 1-2 March 2023

Agenda item 3: 2023 Mediterranean Quality Status Report (QSR) - Pollution Ecological Objectives (EO5, EO9) The Marine Environment Assessment in the Areas with Insufficient Data: The Assessment Results of IMAP Common Indicators 13&14 in the Western Mediterranean Sea Sub-region by Applying the Simplified G/M and EQSR Assessment Methodologies

UNEP/MAP
Athens, 2023

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List of Abbreviations / Acronyms

Chl *a*	Chlorophyll *a*
CI	Common Indicator
COP	Conference of the Parties
CORMON	Correspondence Group on Monitoring
CPs	Contracting Parties
DIN	Dissolved Inorganic Nitrogen
EIONET	European Environment Information and Observation Network
EO	Ecological Objective
ESRI	Environmental Systems Research Institute
EU	European Union
GES	Good Environmental Status
nonGES	not Good Environmental Status
IMAP	Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria
MAP	Mediterranean Action Plan
MED POL	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Sea
MED QSR	Mediterranean Quality Status Report
MSFD	Marine Strategy Framework Directive
MSs	Member States
NEAT	Nested Environmental Assessment Tool
SAU	Spatial Assessment Unit
TP	Total Phosphorous
WMS	West Mediterranean Sea

1. Introduction

1. To implement the recommendations of the Meeting of CorMon on Pollution Monitoring (Teleconference, 26-27 April 2021) and the Meeting of the MEDPOL Focal Points (Resumed Session, 9 July 2021), the methodologies proposed for assessment of eutrophication were tested in the Adriatic Sea Sub-region. Along with the application of the NEAT assessment methodology in the Adriatic Sea Sub-region, and further to data availability, the application of the Ecological quality ratio (EQR); the Simplified EQR methodology, and the Simplified methodology based on G/M comparison was also explored in other three Mediterranean Sub-regions.

2. The application of the EQR methodology was found relevant for assessment of IMAP Common Indicators 13 and 14 where full set assessment criteria for Chl*a*, DIN and TP exist. It is also necessary to perform the typology related assessment. Given the lack of data reported by the CPs, this methodology was impossible to apply for any sub-region/sub-division of the Mediterranean within the preparation of the 2023 MED QSR.

3. The application of the simplified EQR methodology was found relevant where complementary data availability i.e., *in situ* and from remote sensing is found for Chla only and the typology related assessment is not possible to apply. Due to absence of the homogenous quality assured data reported by the CPs even for Chla only, an application of the simplified EQR methodology was also impossible in the sub-region/sub-division of the Mediterranean within the preparation of the 2023 MED QSR, with an exception of the water of Italy in the Tyrrhenian Sea and the CWMS, as well as the Adriatic Sea Sub-region which was assessed by applying the NEAT GES assessment methodology.

4. Given the lack of quality-assured data, the assessment of Common Indicator 14: Chl *a* within the preparation of the 2023 MED QSR was undertaken in the Central Part Sub-division of the Western Mediterranean Sea Sub-region (CWMS): the Waters of France; the Alboran (ALB) and the Levantine Balearic (LEV-BAL) Sub-division of the WMS: the Waters of Spain, the Southern part of the CWMS Sub-division: the Waters of Algeria, Morocco and Tunisia; and the Tyrrhenian Sea Sub-division and part of CWMS Sub-division: the waters of Italy, by applying the Simplified G/M comparison assessment methodology on the satellite-derived Chl *a* data.

5. The assessment of the Common Indicator CI 14, by applying the simplified G/M comparison method on the satellite-derived Chl a data, was harmonized at the level of the WMS, further to initial work presented at the Meeting of CorMon Pollution, 1-2 March 2023[1]. This simplified method has the advantage to overcome the lack of in situ data, relying on satellite-derived products for surface Chl *a* concentration at a daily frequency. Even though this assessment is useful to provide a picture at the regional scale, in some cases finer methods are available at the local scale. For the sake of consistency with scientific work undertaken at the national level, the assessment of the French part of CWMS also takes account of the comparison between the regional and national assessments, whereby in the case of discrepancy, precedence was given to the national scientific expertise[2]. Also, the assessment of the Spanish waters includes inputs provided by national authorities as explained here-below.

2. Data availability and elaboration

6. A detailed data analysis was performed for the Western Mediterranean Sea (WMS) in order to decide on the assessment methodologies that can be found optimal at the level of Sub-divisions given the present lack of data reporting.

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[1] UNEP/MED WG.556/3

[2] HERLORY O., BRIAND J. M., BOUCHOUCHA M., DEROLEZ V., MUNARON D., CIMITERRA N., TOMASINO C., GONZALEZ J.-L., GIRAUD A., BOISSERY P. (2022) Directive Cadre sur l’Eau. Bassin Rhône Méditerranée Corse - Année 2021. RST.ODE/UL/LER-PAC/22-11. 89pp. https://archimer.ifremer.fr/doc/00820/93161/99746.pdf

7. Table 1 informs on data availability in WMS by considering data reported in IMAP IS by 31st October, the cut-off date for data reporting. Figure 1 shows the locations of sampling stations in the WMS Sub-region.

Table 1. Data availability by country and year for the WMS Sub-region showing data reported by the CPs for the assessment of EO5 (CI13 and CI14) up to 31st October 2022.

Country	Year	Amon	Ntri	Ntra	Phos	Tphs	Slca	Cphl	Temp	Psal	Doxy
Algeria	2016-2021	No data provided									
France	2016	-	-	-	-	-	-	130	179	179	74
	2017	66	-	66	66	-	43	130	324	340	116
	2018	56	-	56	56	-	56	129	326	326	108
	2019	126	-	126	126	-	126	126	344	342	117
	2020	102	-	102	102	-	95	120	349	350	129
Morocco	2016-2021	No valid data provided									
Italy	2015-2020	By 31st October 2022, Italy reported data relevant to the WMS Sub-region, in 4 data files with all together 1,081,853 data points up to 2019. On 17 Nov 2022 data for 2020 were also provided. Without building of a dedicated quality assured database, it is impossible to analyse the data availability and ensure their use for the assessment. It should be noted that quantum of data reported guarantees a near monthly sampling frequency on 27 profiles with 4 stations in the 5-year period. All IMAP mandatory parameters were measured.									
Spain	2019	8	86	86	95	-	-	95	95	95	95
	2020	306	311	311	295	-	-	290	304	304	310
	2021	300	300	300	141	-	-	294	302	302	302
	2022	274	322	322	168	-	-	291	318	318	318
Tunisia	2016-2021	No data provided									

Amon - Ammonium; Ntri- Nitrite; Ntra – Nitrate; Phos – Orthophosphate; Tphs—Total phosphorous; Slca – Orthosilicate; Cphl – Chlorophyll *a*; Temp – temperature; Psal – Salinity; Doxy – Dissolved Oxygen.

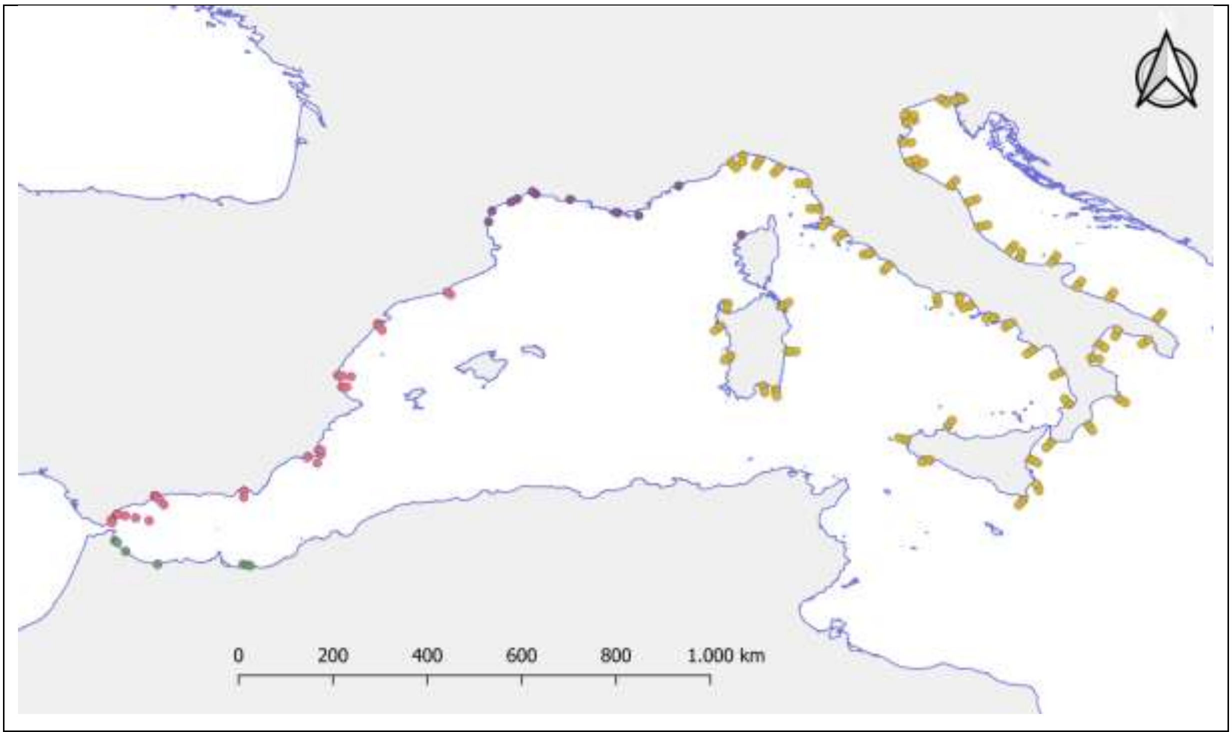

Figure 1. The locations of sampling stations in the WMS Sub-region

8. From Table 1 it can be found that the CPs in the southern Mediterranean rim did not report data as required by Decision IG.23/6 of COP 20 related to the 2017 Mediterranean Quality Status Report, and Decision IG.24/4 of COP21 providing the 2023 MED QSR Roadmap implementation.

9. Morocco provided data related to one sampling undertaken in 2021. However, data were not compliant with the format of IMAP DDs and DSs. France, Italy and Spain reported data at the level shown in Table 1, however, only data of Italy can be utilized for the assessment as they comprise all the necessary parameters, and provide optimal geographical coverage and sampling frequency.

10. Considering data reported from Italy, as well as their significant quantum, but also the lack of data quality assurance performed at the level of IMAP IS, an effort was provided to ensure more advanced assessment within the expected work for the Tyrrhenian Sea.

11. France provided data for 12 stations of which only 6 can be used for the assessment since at these stations data were reported both for CI13 (Key nutrients) and CI14 (Chla). For other 6 stations only data for physical parameters (T, S, O_2) were reported. The sampling frequency is near monthly, but the geographical coverage is poor as the stations are very close to the coast (from 10-300 m).

12. Spain reported data for 42 stations on 10 profiles extending offshore zone sometime beyond 20 km distance from the coastline. Most of IMAP mandatory parameters were provided. However, both Spain and France did not report data for Total phosphorus. The sampling frequency was two times per year that is not in line with the IMAP requirement, which for example in the best case of oligotrophic waters requires bimonthly frequency in the Coastal Waters (CW) and seasonal frequency in the Offshore Waters (OW).

13. Some of data were reported to IMAP IS very close to the 31st of October, the cut-off date for data reporting, and without having a functional data quality control at the level of IMAP IS, at this late stage it was impossible to undertake data quality control and evaluation including through direct exchange with the CPs. A significant quantum of data reported also contributed to such situation.

14. Given the above explained status of data reported, in particular lack of homogenous and quality assured data reported in line with IMAP requirements, it was necessary to explore the use of alternative data sources.

15. For Spanish waters, remote sensing data for surface Chl *a* concentrations in the Alboran Sea and the Levantine-Balearic Sub-divisions were received from the SMED algorithm (Gómez-Jakobsen et al, 2018), by combining the data from the sensors MODIS-Aqua and VIIRS-SNPP in a coherent way, according with the procedure published in Gómez-Jakobsen et al. 2022. Chl *a* data for French waters were provided by ARGANS France. For the Southern part of the Western Mediterranean Sea Sub-region, data were provided by ARGANS France. It consists of Level 4 monthly values of concentration of Chl *a* with a resolution of 1 x 1 km for the period from April 2016 to March 2021. The file format was NetCDF-4 (.nc). Chl *a* concentration data were daily evaluated via the OC5 algorithm developed by IFREMER and maintained/improved by ARGANS.

16. Using only Chl *a* data, with a good geographical coverage (1 x 1 km) and high sensing frequency (daily), it is possible to tentatively develop a simple assessment method, by applying ecological rules and a comparison of the obtained values to the defined Good/Moderate (G/M) boundary.

17. For Italian waters, the Copernicus satellite Chl*a* dataset were used. The Copernicus services - the Mediterranean Sea Ocean Satellite Observations, the Italian National Research Council (CNR – Rome, Italy), elaborated the Bio-Geo_Chemical (BGC) regional datasets. Chl a concentration (CHL) were evaluated via region-specific algorithms (Case 1 waters: Volpe et al., 20193, with new coefficients; Case 2 waters, Berthon and Zibordi, 2004[4]), and the interpolated gap-free Chl

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[3] Volpe, G., Colella, S., Brando, V. E., Forneris, V., Padula, F. L., Cicco, A. D., ... & Santoleri, R. (2019). Mediterranean ocean colour Level 3 operational multi-sensor processing. Ocean Science, 15(1), 127-146

[4] Berthon, J.-F., Zibordi, G. (2004) Bio-optical relationships for the northern Adriatic Sea. Int. J. Remote Sens., 25, 1527-1532.

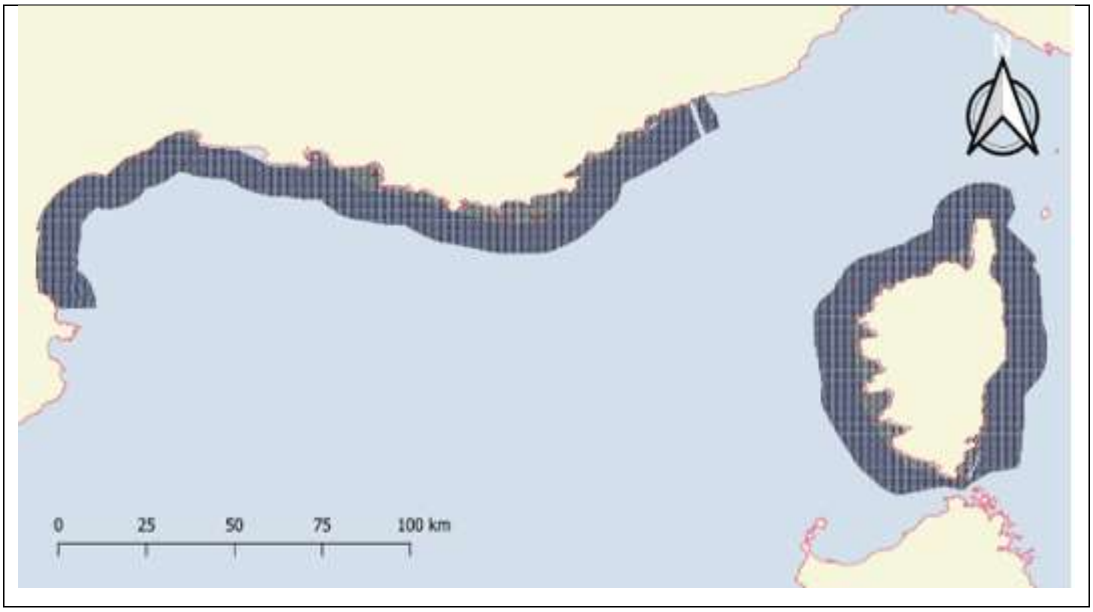
concentration (to provide a ”“cloud free”″ product) was estimated by means of a modified version of the DINEOF algorithm (Volpe et al., 2018[5]).

18. The Copernicus product with ID: OCEANCOLOUR_MED_BGC_MY_009_144 was downloaded for the period from Jan 2016 to Dec 2020. It consists of Level 4 monthly values of Chlorophyll a concentration (CHL) with a resolution of 1 x 1 km. The file format is NetCDF-4 (.nc).

19. Data elaboration was performed by using R, an open-source language widely used for statistical analysis and graphical presentation (R Development Core Team, 2022)[6]. Maps are elaborated using QGIS 3.28, an open-source GIS tool.

20. The data were transferred to R data table using the tidync package. The transfer and data elaboration were time demanding as the data were comprised of i) 8,840,786 data records for the Spanish Waters; and ii) 17,319 data points and 1,059,486 observations for the French Waters, and 31,507 data points and 1,941,429 observations for the Southern part of the WMS, altogether extracted from a WMS dataset consisting of 46,277,527 observations. For the elaboration of Tyrrhenian data 64,851 data point were used pertaining to 3,678,959 observation and extracted from 22,269,588 observations.

21. The parameter values were expressed in µg/L of Chl *a*, for the geometric mean (GM) calculated over the year in at least a five-year period as required in the COMMISSION DECISION (EU) 2018/229[7]. These GM annual values were later used as a metric for the development of the assessment criteria and present assessment of CI 14. An annual GM[8] value was calculated for every point of the satellite derived Chl *a* data grid as shown in Figure 2 for the French waters; Figure 3 for the Southern part of the WMS; Figure 4 for the Spanish waters and Figure 5 for the Italian wasters.



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[5] Volpe, G., Buongiorno Nardelli, B., Colella, S., Pisano, A. and Santoleri, R. (2018). An Operational Interpolated Ocean Colour Product in the Mediterranean Sea, in New Frontiers in Operational Oceanography, edited by E. P. Chassignet, A. Pascual, J. Tintorè, and J. Verron, pp. 227–244

[6] R Development Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. http://www.R-project.org

[7] Commission Decision (EU) 2018/229 of 12 February 2018 establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, the values of the Member State monitoring system classifications as a result of the intercalibration.

[8] Attila, J., Kauppila, P., Kallio, K.Y., Alasalmi, H., Keto, V., Bruun, E and Koponen, S. Applicability of Earth Observation chlorophyll-a data in assessment of water status via MERIS — With implications for the use of OLCI sensors. Remote Sensing of Environment 212 (2018) 273–287. https://doi.org/10.1016/j.rse.2018.02.043

Figure 2. The French part of the Central Western Mediterranean Sea Sub-division (CWMS): The dots in the Assessment Zones represent the data in the grid (1 x 1 km).

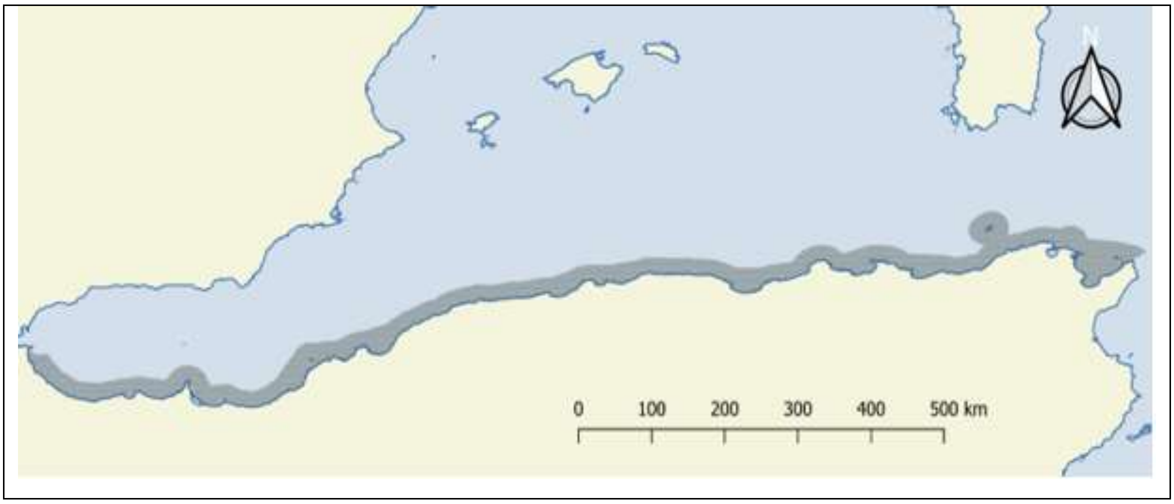

Figure 3. The Southern part of the Central Western Mediterranean Sea Sub-division (CWMS): The dots in the Assessment Zones represent the data in the grid (1 x 1 km).

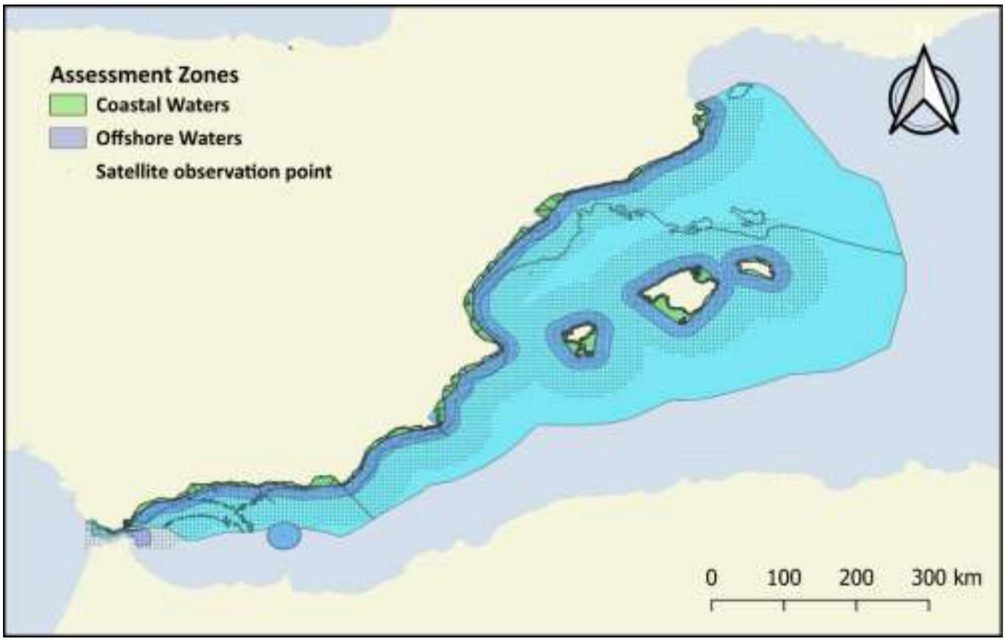

Figure 4. The Alboran Sea and the Levantine Balearic Sub-division: The dots in the assessment zones represent the data in the grid (1 x 1 km) near coast and in open waters (4 x 4 km).

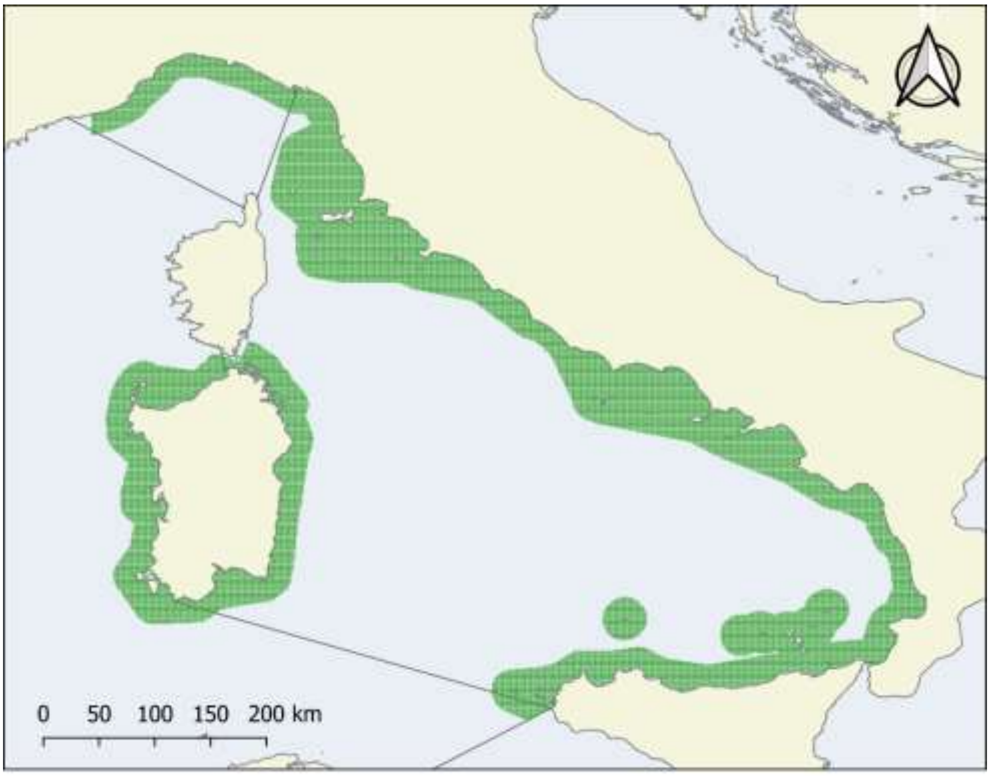

Figure 5. The Tyrrhenian Sea Sub-division and Italian part of the Central Western Mediterranean Sea Sub-division: The dots in the assessment zones represent the data in the grid 1 x 1 km.

3. Setting of the areas of assessment

22. Following the rationale of the IMAP national monitoring programmes related to distribution of the monitoring stations, as well as the rules for integration and aggregation of the assessment products as elaborated in UNEP/MED WG.509/Inf.10/Rev.2, the two zones of assessment were defined in the Western Mediterranean Sea Sub-divisions for the purposes of the present work: i) the coastal zone and ii) the offshore zone by applying the same approach as applied to the AEL and the CEN Sub-regions.

23. For purpose of the present work, the GIS layers for the Assessment Areas were provided by France and Spain, as well as from other relevant sources (International Hydrographic Organization – IHO Seas subdivisions, European Environment Information and Observation Network – EIONET (WFD delimitation (2018)); VLIZ marine subregions).

24. The principle of the NEAT IMAP GES assessment methodology applied in the Adriatic Sea Sub-region, as well as in the Western Mediterranean Sea Sub-region regarding CI 17, for setting of the spatial assessment units (SAUs) within the two main assessment zones along the IMAP nesting scheme, was also followed for setting of the coastal (CW) and the offshore monitoring zones (OW) for CI 14 in the Western Mediterranean Sea Sub-region.

25. The CW included internal waters and one Nautical Mile outward. The offshore waters start at the outward border of CW and extend to 20 km outward given there is no eutrophication issues further in offshore[9], but also due to correspondence of this coverage to the area where national monitoring programmes are performed. In addition, the IMAP Spatial Assessment Units (SAUs) were set in the waters of Spain by taking account of the specific circulation pattern in the Spanish waters which influences the biogeochemical processes in the area.

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[9] See Lefebvre and Devreker 2020

The Central Western Mediterranean Sea Subdivision: the Waters of France

26. The French Offshore Waters (OW) were divided in the FRD_E (East of Rhone waters) and the FRD_W (West of Rhone waters) as shown in Figure 6 (upper map). For the French Coastal Waters (CW), the division to water bodies (WB) set for implementation of the EU WFD was also used for setting IMAP SAUs and subSAUs. Consequently, the WFDs coding was used for the present work (Figure 5 - lower map). The finest IMAP subSAUs set in the French part of the CWMS for the purpose of the present CI 14 assessment are shown in Table 2. Figure 5 depicts the finest IMAP subSAUs nesting in the two main assessment zones i.e., CW and OW of the French part of the CWMS.

Table 2. The finest IMAP spatial assessment units (SAUs) for EO5 – CIs 13&14. For comparison, an overview shows the spatial assessment units set for assessment of CI 17(UNEP/MAP WG.550/10).

AZ		SAU	SubSAUs (WFD_WB)*	WT	CI_17
CW		FRD_W	DC01	IIIW	FR_CWM_M_C
CW		FRD_W	DC02A	IIA	FR_CWM_M_C
CW		FRD_W	DC02B	IIA	FR_CWM_M_C
CW		FRD_W	DC02C	IIA	FR_CWM_M_C
CW		FRD_W	DC02D	IIA	FR_CWM_M_C
CW		FRD_W	DC02E	IIA	FR_CWM_M_C
CW		FRD_W	DC02F	IIA	FR_CWM_M_C
CW		FRD_E	DC04	I	FR_CWM_M_C
CW		FRD_E	DC05	IIA	FR_CWM_M_C
CW		FRD_E	DC06A	IIIW	FR_CWM_M_C
CW		FRD_E	DC06B	IIIW	FR_CWM_M_C
CW		FRD_E	DC07A	IIIW	FR_CWM_M_C
CW		FRD_E	DC07B	IIIW	FR_CWM_M_C
CW		FRD_E	DC07C	IIIW	FR_CWM_M_C
CW		FRD_E	DC07D	IIIW	FR_CWM_M_C
CW		FRD_E	DC07E	IIIW	FR_CWM_M_C
CW		FRD_E	DC07F	IIIW	FR_CWM_M_C
CW		FRD_E	DC07G	IIIW	FR_CWM_M_C
CW		FRD_E	DC07H	IIIW	FR_CWM_M_C
CW		FRD_E	DC07I	IIIW	FR_CWM_M_C
CW		FRD_E	DC07J	IIIW	FR_CWM_M_C
CW		FRD_E	DC08A	IIIW	FR_CWM_M_C
CW		FRD_E	DC08B	IIIW	FR_CWM_M_C
CW		FRD_E	DC08C	IIIW	FR_CWM_M_C
CW		FRD_E	DC08D	IIIW	FR_CWM_M_C
CW		FRD_E	DC08E	IIIW	FR_CWM_M_C
CW		FRD_E	DC09A	IIIW	FR_CWM_M_C
CW		FRD_E	DC09B	IIIW	FR_CWM_M_C
CW		FRD_E	DC09C	IIIW	FR_CWM_M_C
CW		FRD_E	DC09D	IIIW	FR_CWM_M_C
CW		FRD_E	DC10A	IIIW	FR_CWM_M_C
CW		FRD_E	DC10C	IIIW	FR_CWM_M_C
CW		FRE_W	EC01AB	W (islands)	FR_CWM_Corse_C
CW		FRE_W	EC01C	W (islands)	FR_CWM_Corse_C
CW		FRE_W	EC01D	W (islands)	FR_CWM_Corse_C

AZ		SAU	SubSAUs (WFD_WB)*	WT	CI_17
CW		FRE_W	EC01E	W (islands)	FR_CWM_Corse_C
CW		FRE_E	EC02AB	W (islands)	FR_TYR_Corse_C
CW		FRE_E	EC02C	W (islands)	FR_TYR_Corse_C
CW		FRE_E	EC02D	W (islands)	FR_TYR_Corse_C
CW		FRE_E	EC03AD	W (islands)	FR_TYR_Corse_C
CW		FRE_E	EC03B	W (islands)	FR_TYR_Corse_C
CW		FRE_E	EC03C	W (islands)	FR_TYR_Corse_C
CW		FRE_W	EC03EG	W (islands)	FR_CWM_Corse_C
CW		FRE_W	EC03F	W (islands)	FR_CWM_Corse_C
CW		FRE_W	EC04B	W (islands)	FR_CWM_Corse_C
CW		FRE_W	EC04AC	W (islands)	FR_CWM_Corse_C
OW		FRD_W		IIA	FR_CWM_M_O
OW		FRD_E		IIIW	FR_CWM_M_O
OW		FRD_E		IIIW	FR_CWM_M_O
OW		FRE_W		W (islands)	FR_CWM_Corse_O
OW		FRE_E		W (islands)	FR_TYR_Corse_O

*****The finest subSAUs set for France correspond to EU Water Framework Directive Water Bodies (WFD_WB)

Figure 6. The nesting of the finest IMAP subSAUs set for the French OW assessment zone (upper map); and depiction of the finest IMAP subSAUs set in CW assessment zone (lower map). For setting IMAP sub SAUs along the coast of France, the WFD water bodies were considered.

<u>The Alboran Sea and Levantine-Balearic Subdivision of the WMS: The Waters of Spain</u>

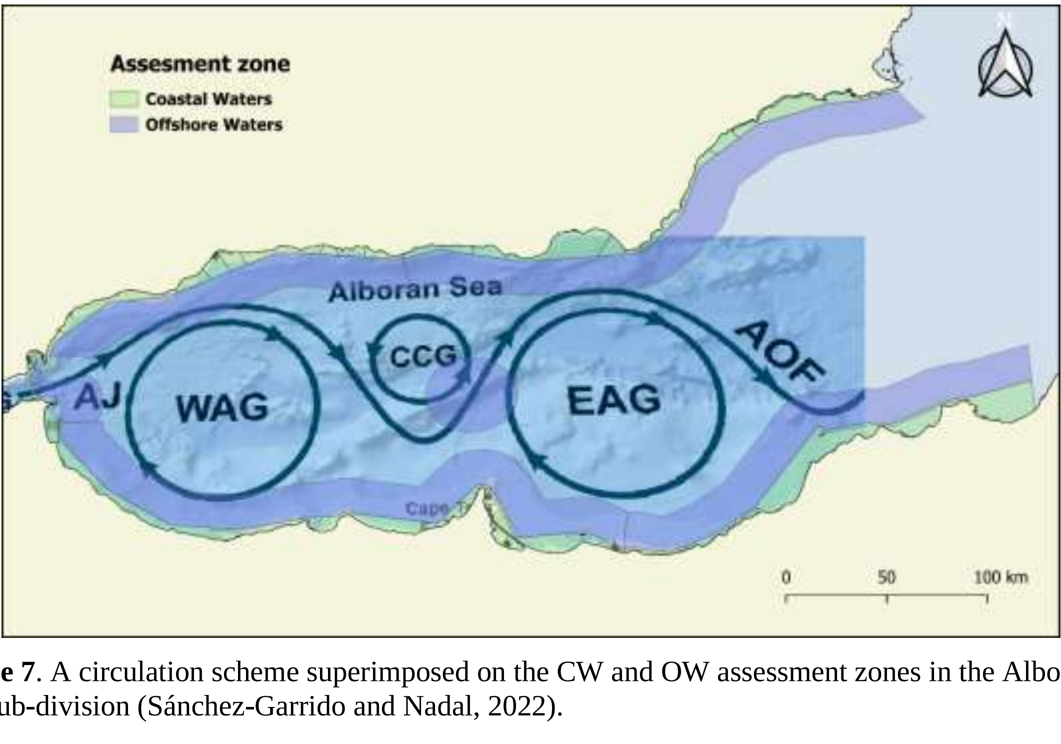


Figure 7. A circulation scheme superimposed on the CW and OW assessment zones in the Alboran Sea Sub-division (Sánchez-Garrido and Nadal, 2022).

27. The Spanish OWs were divided in the ESPE (East of Motril) and the ESPW (West of Motril) in the ALB Subdivision and ESPL (mainland) and ESPI (islands) of the LEV-BAL Subdivision, as shown in Figure 8. For the Spanish CW, the division to water bodies (WB) set for implementation of the WFD was also used for setting IMAP SAUs. Consequently, the WFDs coding was used for the present work (Figure 9). The MSFD Assessment Water Units of Spain were considered as well as proposed by the national authorities (Figure 10).

28. The finest IMAP SAUs set in the ALB and LEV-BAL sub-divisions for the purpose of the present CI 14 assessment are shown in Table 3. Figure 9 depicts the finest IMAP SAUs nesting in the CW of the ALB and LEV-BAL Subdivisions.

Table 3. The IMAP spatial assessment units (SAUs) along with the finest spatial assessment units (subSAUs) set for assessment of Chl *a* satellite-derived data. The IMAP SAUs correspond to WFD water bodies, and IMAP sub-SAUs correspond to the finer delineation of WFD water bodies, as available for Spain in EIONET. The correlation is also provided for IMAP SAUs and subSAUs with Spanish MSFD assessment water units (AWU column), as depicted in Figure 6.

AZ	**SAU**	**subSAU***	**MSFD AWU**	**AZ**	**SAU**	**subSAU***	**MSFD AWU**
Alboran Sea Subdivision				**Levantine – Balearic Subdivision**			
OW	ESPW		ALBP1	OW	ESPL		LEVON
OW	ESPE		ALBO1	OW	ESPI		LEVOS
CW	ES060	ES060MSPF610000	ALBC1	CW	ES070	ES070MSPF010300010	LEVC1
CW	ES060	ES060MSPF610001	ALBC1	CW	ES070	ES070MSPF010300020	LEVC1
CW	ES060	ES060MSPF610002	ALBC1	CW	ES070	ES070MSPF010300030	LEVC1
CW	ES060	ES060MSPF610003	ALBC1	CW	ES070	ES070MSPF010300040	LEVC1
CW	ES060	ES060MSPF610004	ALBC1	CW	ES080	ES080MSPFC001	LEVC2
CW	ES060	ES060MSPF610005	ALBC1	CW	ES080	ES080MSPFC002	LEVC2
CW	ES060	ES060MSPF610006	ALBC1	CW	ES080	ES080MSPFC003	LEVC2
CW	ES060	ES060MSPF610007	ALBC1	CW	ES080	ES080MSPFC004	LEVC2
CW	ES060	ES060MSPF610008	ALBP2	CW	ES080	ES080MSPFC0041	LEVC2
CW	ES060	ES060MSPF610009	ALBP2	CW	ES080	ES080MSPFC005	LEVC2
CW	ES060	ES060MSPF610010	ALBP2	CW	ES080	ES080MSPFC006	LEVC2
CW	ES060	ES060MSPF610011	ALBP2	CW	ES080	ES080MSPFC007	LEVC2
CW	ES060	ES060MSPF610012	ALBP2	CW	ES080	ES080MSPFC008	LEVC2
CW	ES060	ES060MSPF610013	ALBP2	CW	ES080	ES080MSPFC0081	LEVC2
CW	ES060	ES060MSPF610014	ALBP2	CW	ES080	ES080MSPFC009	LEVC2
CW	ES060	ES060MSPF610015	ALBP2	CW	ES080	ES080MSPFC010	LEVC2
CW	ES060	ES060MSPF610016	ALBP2	CW	ES080	ES080MSPFC0101	LEVC2
CW	ES060	ES060MSPF610017	ALBC2	CW	ES080	ES080MSPFC0102	LEVC2
CW	ES060	ES060MSPF610018	ALBC2	CW	ES080	ES080MSPFC011	LEVC1
CW	ES060	ES060MSPF610019	LEVC1	CW	ES080	ES080MSPFC012	LEVC1
CW	ES060	ES060MSPF610020	LEVC1	CW	ES080	ES080MSPFC013	LEVC1
CW	ES060	ES060MSPF610021	ALBC1	CW	ES080	ES080MSPFC014	LEVC1
CW	ES060	ES060MSPF610023	ALBC1	CW	ES080	ES080MSPFC015	LEVC1
CW	ES060	ES060MSPF610024	ALBC1	CW	ES080	ES080MSPFC016	LEVC1
CW	ES060	ES060MSPF610025	ALBP2	CW	ES080	ES080MSPFC0161	LEVC2
CW	ES060	ES060MSPF610026	ALBP2	CW	ES080	ES080MSPFC017	LEVC1
CW	ES060	ES060MSPF610037	LEVC1	CW	ES091	ES091MSPF894	LEVDE
CW	ES070	ES070MSPF002120005	LEVC1	CW	ES091	ES091MSPF895	LEVDE
CW	ES070	ES070MSPF002150006	LEVC1	CW	ES091	ES091MSPF896	LEVDE
CW	ES070	ES070MSPF002150007	LEVC1	CW	ES100	ES100MSPFC1	LEVC2
CW	ES070	ES070MSPF010300060	LEVC1	CW	ES100	ES100MSPFC10	LEVC1
CW	ES070	ES070MSPF010300070	LEVC1	CW	ES100	ES100MSPFC11	LEVC1
CW	ES070	ES070MSPF010300080	LEVC1	CW	ES100	ES100MSPFC12	LEVC1
CW	ES070	ES070MSPF010300090	LEVC1	CW	ES100	ES100MSPFC14	LEVC1
CW	ES070	ES070MSPF010300100	LEVC1	CW	ES100	ES100MSPFC15	LEVC1
CW	ES070	ES070MSPF010300110	LEVC1	CW	ES100	ES100MSPFC16	LEVC2
CW	ES070	ES070MSPF010300120	LEVC1	CW	ES100	ES100MSPFC17	LEVC2
CW	ES070	ES070MSPF010300130	LEVC1	CW	ES100	ES100MSPFC18	LEVC2
CW	ES070	ES070MSPF010300140	LEVC1	CW	ES100	ES100MSPFC19	LEVC2
				CW	ES100	ES100MSPFC2	LEVC2
				CW	ES100	ES100MSPFC20	LEVC2
				CW	ES100	ES100MSPFC21	LEVC2
				CW	ES100	ES100MSPFC22	LEVC2
				CW	ES100	ES100MSPFC23	LEVC2
				CW	ES100	ES100MSPFC24	LEVC2
				CW	ES100	ES100MSPFC25	LEVC2
				CW	ES100	ES100MSPFC26	LEVC2
				CW	ES100	ES100MSPFC27	LEVC2

AZ	**SAU**	**subSAU***	**MSFD AWU**	**AZ**	**SAU**	**subSAU***	**MSFD AWU**
Alboran Sea Subdivision				**Levantine – Balearic Subdivision**			
				CW	ES100	ES100MSPFC28	LEVC1
				CW	ES100	ES100MSPFC29	LEVC1
				CW	ES100	ES100MSPFC3	LEVC1
				CW	ES100	ES100MSPFC30	LEVC1
				CW	ES100	ES100MSPFC31	LEVC1
				CW	ES100	ES100MSPFC32	LEVC1
				CW	ES100	ES100MSPFC36	LEVC2
				CW	ES100	ES100MSPFC37	LEVC2
				CW	ES100	ES100MSPFC4	LEVC1
				CW	ES100	ES100MSPFC5	LEVC1
				CW	ES100	ES100MSPFC6	LEVC1
				CW	ES100	ES100MSPFC7	LEVC2
				CW	ES100	ES100MSPFC8	LEVC2
				CW	ES100	ES100MSPFC9	LEVC2
				CW	ES110	ES110MSPFEFMC08M4	LEVOS
				CW	ES110	ES110MSPFEFMCp03	LEVOS
				CW	ES110	ES110MSPFEFMCp04	LEVOS
				CW	ES110	ES110MSPFEIMC01M2	LEVOS
				CW	ES110	ES110MSPFEIMC02M4	LEVOS
				CW	ES110	ES110MSPFEIMC03M4	LEVOS
				CW	ES110	ES110MSPFEIMC04M4	LEVOS
				CW	ES110	ES110MSPFEIMC05M3	LEVOS
				CW	ES110	ES110MSPFEIMC06M4	LEVOS
				CW	ES110	ES110MSPFEIMC07M3	LEVOS
				CW	ES110	ES110MSPFEIMCM01	LEVOS
				CW	ES110	ES110MSPFEIMCp01	LEVOS
				CW	ES110	ES110MSPFEIMCp02	LEVOS
				CW	ES110	ES110MSPFFOMC09M3	LEVOS
				CW	ES110	ES110MSPFFOMC10M2	LEVOS
				CW	ES110	ES110MSPFFOMCM01	LEVOS
				CW	ES110	ES110MSPFMAMC01M2	LEVOS
				CW	ES110	ES110MSPFMAMC02M3	LEVOS
				CW	ES110	ES110MSPFMAMC03M2	LEVOS
				CW	ES110	ES110MSPFMAMC04M2	LEVOS
				CW	ES110	ES110MSPFMAMC05M3	LEVC1
				CW	ES110	ES110MSPFMAMC06M2	LEVOS
				CW	ES110	ES110MSPFMAMC07M3	LEVC1
				CW	ES110	ES110MSPFMAMC08M3	LEVOS
				CW	ES110	ES110MSPFMAMC09M3	LEVOS
				CW	ES110	ES110MSPFMAMC10M2	LEVOS
				CW	ES110	ES110MSPFMAMC11M3	LEVOS
				CW	ES110	ES110MSPFMAMC12M2	LEVOS
				CW	ES110	ES110MSPFMAMC13M2	LEVOS
				CW	ES110	ES110MSPFMAMC14M3	LEVC1
				CW	ES110	ES110MSPFMAMC15M3	LEVOS
				CW	ES110	ES110MSPFMAMC16M3	LEVOS
				CW	ES110	ES110MSPFMAMCM01	LEVC1
				CW	ES110	ES110MSPFMAMCM02	LEVC1
				CW	ES110	ES110MSPFMAMCp01	LEVOS
				CW	ES110	ES110MSPFMAMCp02	LEVOS
				CW	ES110	ES110MSPFMEMC01M2	LEVOS
				CW	ES110	ES110MSPFMEMC02M3	LEVOS
				CW	ES110	ES110MSPFMEMC04M4	LEVOS
				CW	ES110	ES110MSPFMEMC05M2	LEVOS
				CW	ES110	ES110MSPFMEMCM01	LEVOS

*****The finer subSAU set for Spain correspond to WFD_WB

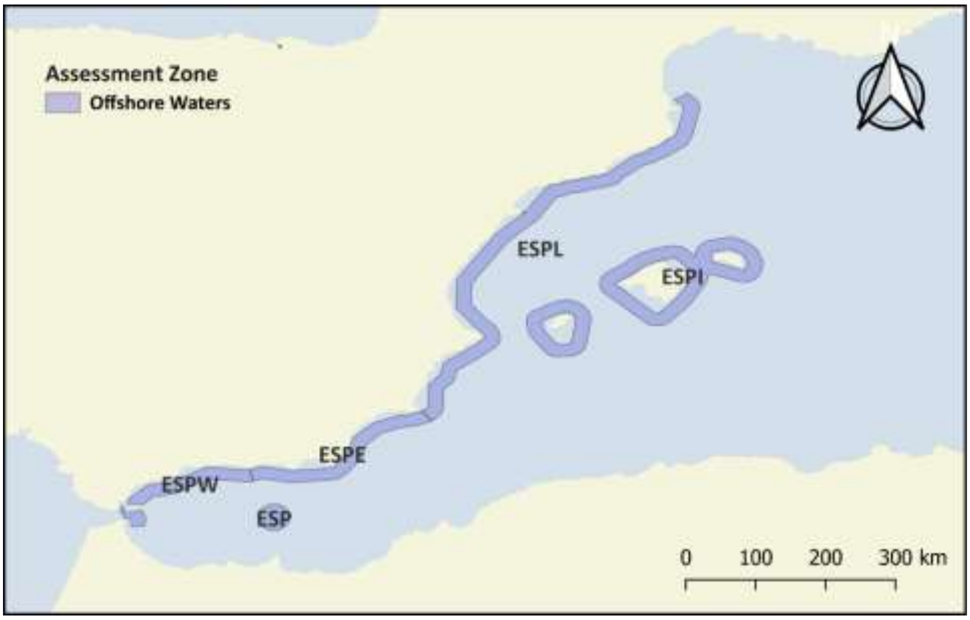
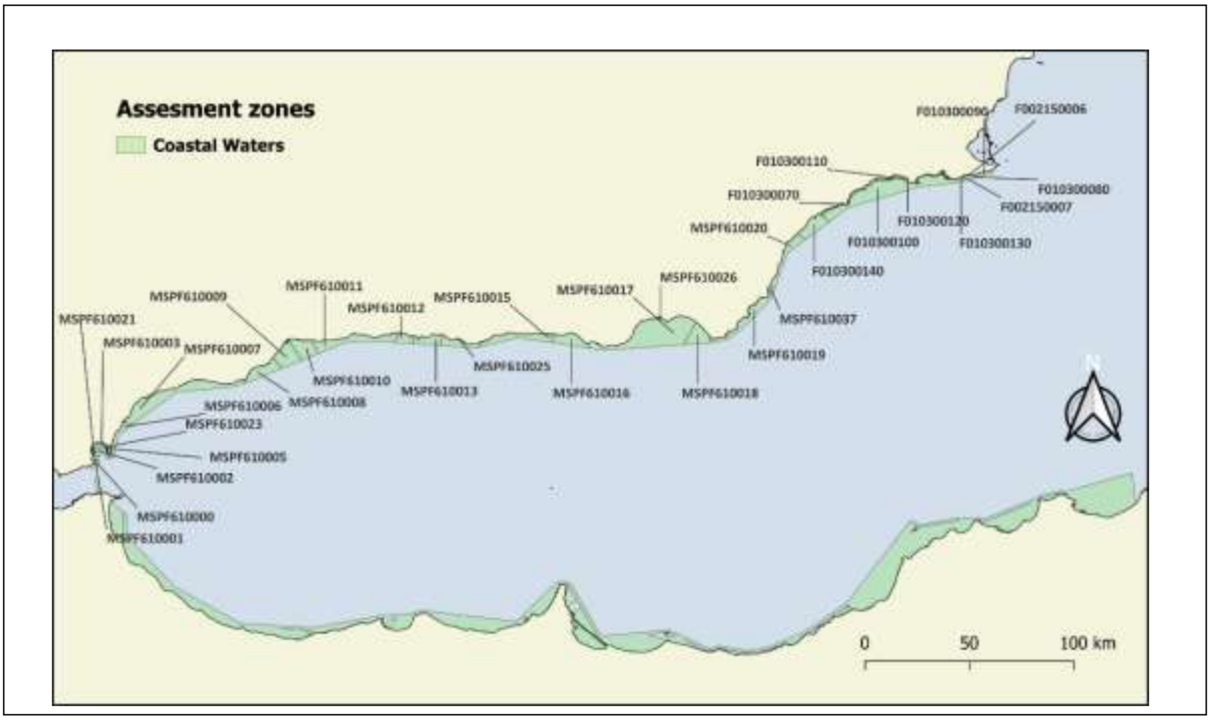


Figure 8. The nesting of the IMAP SAUs (shown in Table 1) as set for the ALB and LEV-BAL Subdivision in the OW assessment zone



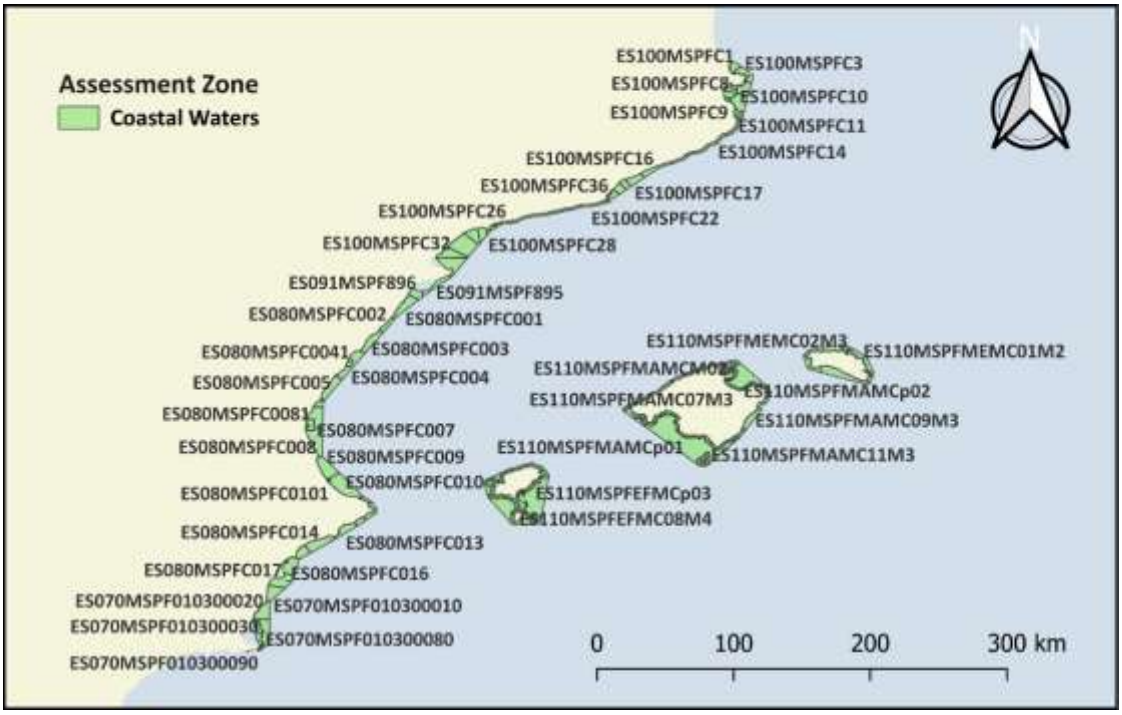


Figure 9. The nesting of the finest IMAP SAUs set for the ALB Sub-division(shown in Table 1) (upper map) and the LEV-BAL Sub-division (lower map), in CW assessment zone. For setting IMAP SAUs along the coast of Spain, the WFD water bodies were considered in order to determine dominating assessment water typology for setting the assessment criteria.

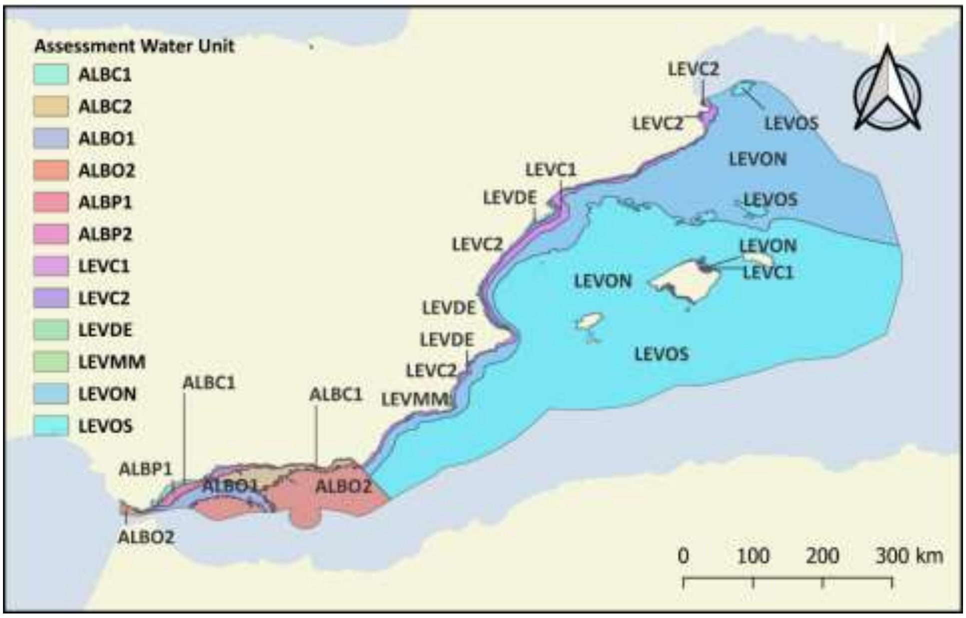


Figure 10. The MSFD Assessment Water Units of Spain.

Southern part of the Central Western Mediterranean Sea Sub-division (CWMS): <u>The Waters of Algeria, Morocco and Tunisia</u>

29. The Moroccan Coastal (CW) and Offshore Waters (OW) were divided in the 4 SAUs i.e., the CW and OW MAR_W (West of the Cape of the Three Forks) and the CW and OW MAR_E (East of the Cape of the Three Forks). The Western part of the Moroccan CW and OW mainly encompasses

the Western Alboran Gyre (Sánchez-Garrido and Nadal, 2022)[10]. For the Algerian CW and OW, division in the SAUs follows the delimitation of the coastal river basins. For each AZ, the following nine SAUs were obtained: ORAN_W, ORAN_C; ORAN_E, DAHRA, ALGIERS; ALGIERS_E, CONSTANTINE_W, CONSTANTINE_C and CONSTANTIE_E. The Tunisian CW and OW in the WMS were divided in the four SAUs i.e., the CW and OW TUN_WMS_W (west of Cap Blanc) and the CW and OW =TUN_WMS_E (east of Cap Blanc). The eastern SAUs are influenced by the Bizerte Lagoon and the Gulf of Tunis.

30. The IMAP SAUs set in the Southern part of the Central WMS Sub-division for the purpose of the present CI 14 assessment are shown in Table 4. Figure 11 depicts the finest IMAP SAUs nesting in the two main assessment zones i.e. CW and OW of the Southern part of the CWMS Sub-division.

Table 4. The IMAP spatial assessment units (SAUs) for EO5 – CIs 13&14.

Country	AZ	SAU
MAR	CW	MAR_W
MAR	CW	MAR_E
MAR	OW	MAR_W
MAR	OW	MAR_E
DZA	CW	ORAN_E
DZA	CW	ORAN_W
DZA	CW	ORAN_C
DZA	CW	DAHRA
DZA	CW	ALGIERS
DZA	CW	ALGIERS_E
DZA	CW	CONSTANTINE_W
DZA	CW	CONSTANTINE_C
DZA	CW	CONSTANTINE_E
DZA	OW	ORAN_W
DZA	OW	ORAN_C
DZA	OW	ORAN_E
DZA	OW	DAHRA
DZA	OW	ALGIERS
DZA	OW	ALGIERS_E
DZA	OW	CONSTANTINE_W
DZA	OW	CONSTANTINE_C
DZA	OW	CONSTANTINE_E
TUN	CW	TUN_WMS_W
TUN	CW	TUN_WMS_E
TUN	OW	TUN_WMS_W
TUN	OW	TUN_WMS_E

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[10] Sanchez-Garrido, J.C., Nadal, I. (2022) The Alboran Sea circulation and its biological response: A review. Front. Mar. Sci. 9:933390. doi: 10.3389/fmars.2022.933390

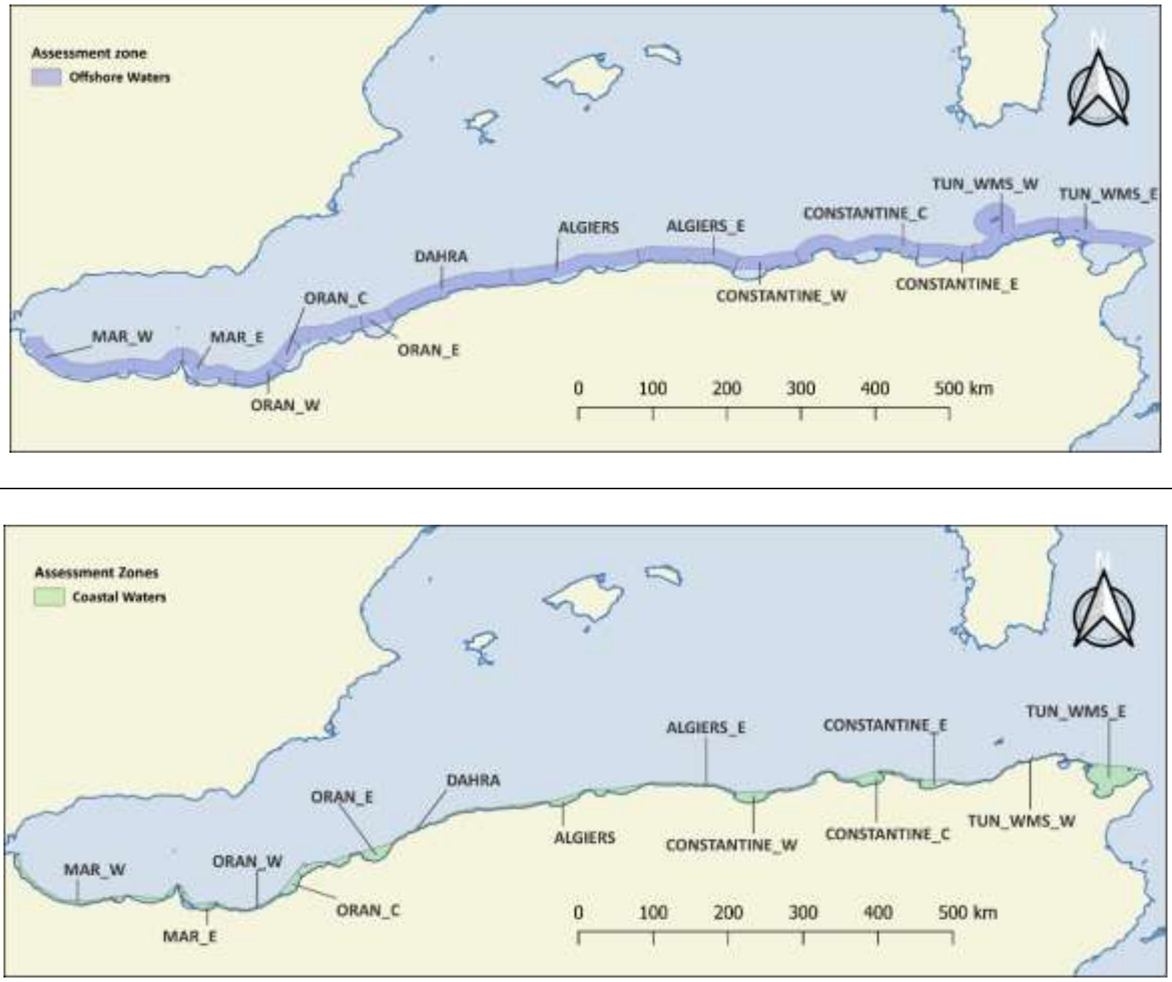


Figure 11. The nesting of the IMAP SAUs set for the OW assessment zone (upper map) in the Southern part of the CWMS; and depiction of the IMAP SAUs set in CW assessment zone (lower map).

The Tyrrhenian Sea Sub-division and part of the Central Western Mediterranean Sea Sub-division: The Waters of Italy

31. The Italian Coastal (CW) and Offshore (OW) waters were divided in eight assessment units (SAUs) located North of Civitavecchia (IT_TYR_N), out of the main Tyrrhenian circulation patterns); and South of Civitavecchia (IT_TYR_S), as shown in Figure 11 (upper map). For the Sardinia Island, the assessment units are IT_ISL_W (West coast) and IT_ISL_E (East coast). To obtain the codes of eight SAUs, the prefix AZ was added resulting in the following coding of the SAUs: CW_IT_TYR_N, OW_IT_TYR_N, etc.

32. The finest IMAP subSAUs set in the Italian part of the Tyrrhenian Sea and CWMS for the purpose of the present CI 14 assessment are shown in Table 5. Figure 12 depicts the finest IMAP subSAUs nesting in the two main assessment zones i.e., CW and OW.

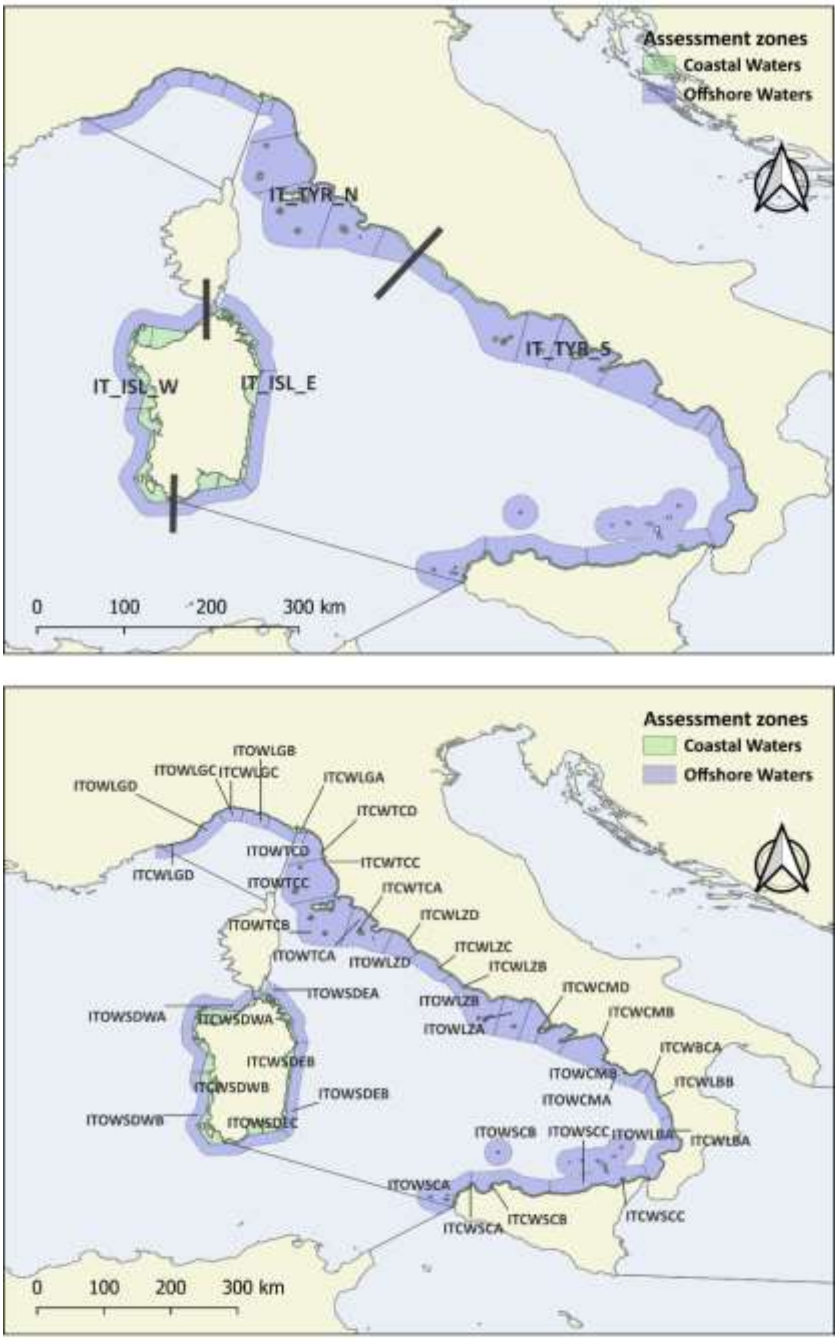


Figure 12. The nesting of the IMAP SAUs set for OW and CW in the Tyrrhenian and Italian part of CWMS (upper map); and depiction of the finest IMAP subSAUs (lower map).

Table 5. The IMAP spatial assessment units (subSAUs) set for EO5 – CIs 13&14 in the Italian waters.

AZ	**SAU**	**subSAU**
CW	CW_ITA_ISL_E	ITCWSDEA
CW	CW_ITA_ISL_E	ITCWSDEB
CW	CW_ITA_ISL_E	ITCWSDEC
CW	CW_ITA_ISL_W	ITCWSDWA
CW	CW_ITA_ISL_W	ITCWSDWB
CW	CW_ITA_TYR_N	ITCWLGA
CW	CW_ITA_TYR_N	ITCWLGB
CW	CW_ITA_TYR_N	ITCWLGC
CW	CW_ITA_TYR_N	ITCWLGD
CW	CW_ITA_TYR_N	ITCWLZD
CW	CW_ITA_TYR_N	ITCWTCA
CW	CW_ITA_TYR_N	ITCWTCB
CW	CW_ITA_TYR_N	ITCWTCC
CW	CW_ITA_TYR_N	ITCWTCD
CW	CW_ITA_TYR_S	ITCWBCA
CW	CW_ITA_TYR_S	ITCWCMA
CW	CW_ITA_TYR_S	ITCWCMB
CW	CW_ITA_TYR_S	ITCWCMC
CW	CW_ITA_TYR_S	ITCWCMD
CW	CW_ITA_TYR_S	ITCWLBA
CW	CW_ITA_TYR_S	ITCWLBB
CW	CW_ITA_TYR_S	ITCWLZA
CW	CW_ITA_TYR_S	ITCWLZB
CW	CW_ITA_TYR_S	ITCWLZC
CW	CW_ITA_TYR_S	ITCWSCA
CW	CW_ITA_TYR_S	ITCWSCB
CW	CW_ITA_TYR_S	ITCWSCC
OW	OW_ITA_ISL_E	ITOWSDEA
OW	OW_ITA_ISL_E	ITOWSDEB
OW	OW_ITA_ISL_E	ITOWSDEC
OW	OW_ITA_ISL_W	ITOWSDWA
OW	OW_ITA_ISL_W	ITOWSDWB
OW	OW_ITA_TYR_N	ITOWLGA
OW	OW_ITA_TYR_N	ITOWLGB
OW	OW_ITA_TYR_N	ITOWLGC
OW	OW_ITA_TYR_N	ITOWLGD
OW	OW_ITA_TYR_N	ITOWLZD
OW	OW_ITA_TYR_N	ITOWTCA
OW	OW_ITA_TYR_N	ITOWTCB
OW	OW_ITA_TYR_N	ITOWTCC
OW	OW_ITA_TYR_N	ITOWTCD
OW	OW_ITA_TYR_S	ITOWBCA
OW	OW_ITA_TYR_S	ITOWCMA
OW	OW_ITA_TYR_S	ITOWCMB

AZ	SAU	subSAU
OW	OW_ITA_TYR_S	ITOWCMC
OW	OW_ITA_TYR_S	ITOWCMD
OW	OW_ITA_TYR_S	ITOWLBA
OW	OW_ITA_TYR_S	ITOWLBB
OW	OW_ITA_TYR_S	ITOWLZA
OW	OW_ITA_TYR_S	ITOWLZB
OW	OW_ITA_TYR_S	ITOWLZC
OW	OW_ITA_TYR_S	ITOWSCA
OW	OW_ITA_TYR_S	ITOWSCB
OW	OW_ITA_TYR_S	ITOWSCC

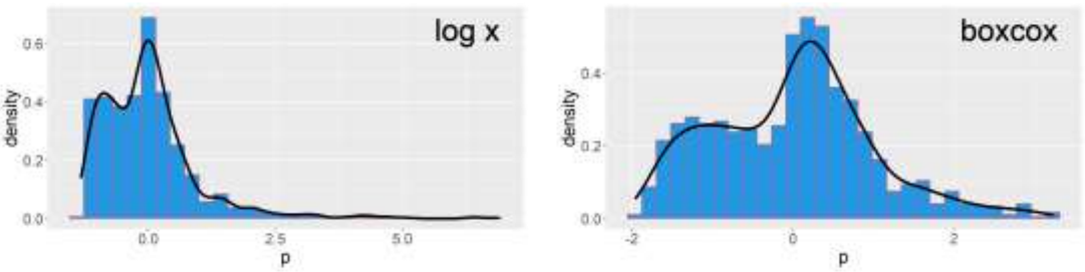
4. Setting the good/non good boundary value/threshold for the Simplified G/M comparison assessment methodology application in the WMS Sub-region

33. The definition of baseline and threshold values for IMAP CIs 13 and 14 in the Mediterranean Sea is an ongoing process. Detail information on their present status is provided in UNEP/MED WG.533/10, Appendix II[11]. The setting of GES-nonGES boundary limits within GES assessment of the Adriatic Sea Sub-region for IMAP CIs 13 and 14 were based on the boundary and reference values defined for TP and DIN, and updated ones for Chl a, as approved in UNEP/MED WG.533/10, Appendix II by the Meeting of CorMon on Pollution Monitoring (17 and 30 May 2022).

34. Within the present work, the attributes were added to all new satellite-derived Chla data points in order to allow their use for calculation of the assessment criteria by the CW and OW, and SAUs in the WMS.

35. Namely, the use of a new parameter for assessment i.e., satellite derived Chla imposes calculation of a new set of assessment criteria if there is no tested relationship of the satellite derived Chla data with *in situ* measured Chla data based on effects-pressures relationship. Namely, the use of reference and boundary water types related values, as set by the Decision IG.23/6 of COP 20 (MED QSR), was impossible for the present work.

36. In order to calculate the assessment criteria applicable within the present work, the annual GM values for satellite derived Chla data were normalized using the R package bestNormalize. Then, the normalization process was tested for usual normalisation transformation, log x, boxcox, yeojohnson and Ordered Quantile normalizing transformation (orderNorm). The best normalisation was obtained with orderNorm() as shown in Figure 13, and it was used for calculation of the assessment criteria applied to deliver the present CI 14 assessment.



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[11] UNEP/MED WG.533/10, Appendix II: Assessment Criteria. Assessment Criteria Methodologies for IMAP Common Indicator 13: Reference and Boundary Values for DIN and TP in the Adriatic Sea Sub-region, Meeting of the Ecosystem Approach Correspondence Group on Pollution Monitoring, Videoconference, 27 and 30 May 2022., pp 59.

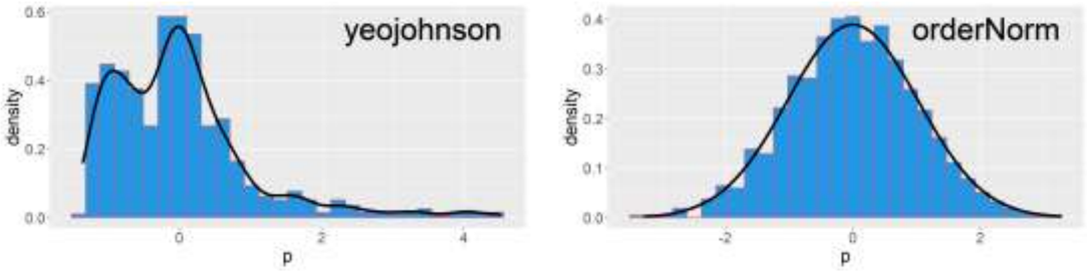

Figure 13. The distribution plot for various normalization transformation.

37. The Ordered Quantile (ORQ) normalization transformation, orderNorm(), is a rank-based procedure by which the values of a vector are mapped to their percentile, which is then mapped to the same percentile of the normal distribution. Without the presence of links to non-systematic processes, this essentially guarantees that the transformation leads to a uniform distribution.

38. The transformation is:

$$g(x) = \Phi^{-1}((rank(x) - .5)/(length(x)))$$

where Φ refers to the standard normal cdf, rank(x) refers to each observation's rank, and length(x) refers to the number of observations.

39. By itself, this method is certainly not new; the earliest mention of it is in a 1947 paper by Bartlett[12]. This equation was outlined explicitly in Van der Waerden (195213), and expounded upon in Beasley (2009[14]).

40. Using linear interpolation between these percentiles, the ORQ normalization becomes a 1-1 transformation. This transformation can be performed on the satellite derived Chla data and inverted via the predict function.

41. The normalization of data is important as it allows generation of the comparable datasets for different assessment zones within the specific Sub-region/Sub-division, and then at upper level between different Sub-regions/subdivision. Further to comparable datasets, it ensures calculation of all aspects relevant to data distribution i.e., z-scores, percentiles, means, etc.

42. The UNEP/MAP Guideline (UNEP(DEC)/MED WG.372/3[15]) defines reference conditions as the state of the marine environment (or a component) in which there is no disturbance or very minor disturbance from the pressures of human activities. Reference conditions (RC) may not necessarily reflect “background” or “historical” conditions, and it is up to the regulator to decide whether GES will represent pristine or slightly impacted but still “good” status (UNEP(DEC)/MED WG.372/3). For the present assessment of CI 14, the RC values were calculated from the normalized values and were represented by the 10th percentile.

43. Thresholds were used to define the boundary limit between the acceptable and the unacceptable environmental status i.e., the Good Environmental Status and non-Good Environmental Statuses. Further to the work undertaken in the Baltic Sea in the Baltic Sea (Andersen et al. 2011[16];

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[12] Bartlett, M. S. (1947) "The Use of Transformations." Biometrics, vol. 3, no. 1, pp. 39-52. JSTOR www.jstor.org/stable/3001536

[13] Van der Waerden BL. Order tests for the two-sample problem and their power. 1952;55:453-458. Ser A.

[14] Beasley TM, Erickson S, Allison DB (2009) Rank-based inverse normal transformations are increasingly used, but are they merited? Behav. Genet.; 39(5): 580-595. pmid:19526352

[15] UNEP(DEC)/MED WG.372/3 (2012) Approaches for definition of GES and setting targets for the pollution related ecological objectives in the framework of the ecosystem approach. (EO5: eutrophication, EP9: contaminants, EP10: marine litter, EO11: noise). Sarajevo, Bosnia and Herzegovina

[16] Andersen, J. H., Axe, P., Backer, H., Carstensen, J., Claussen, U., Fleming-Lehtinen, V., et al. (2011). Getting the measure of eutrophication in the Baltic Sea: towards improved assessment principles and methods. Biogeochemistry, 106(2), 137–156.

HELCOM 2010[17]), for an indicator showing positive response (i.e., nutrients and Chla), the threshold value has an upper limit of +50 % deviation from reference conditions. Setting the threshold to 50 % implies that low levels of disturbance (defined as less than +50 % deviation) resulting from human activity are considered acceptable, while moderate (i.e., greater than +50 %) deviations are not considered acceptable for the water body in question.

44. A further modification to this rule was applied within the present work in the Western Mediterranean Sea Sub-region given the 50th percentile represents the mean value of the distribution, and the 85th percentile ~ mean +1 SD represents the G/M threshold. It was necessary to use these criteria given expert-based analysis of the satellite-derived Chl *a* preliminary indicates that most of the assessed waters are in the high status.

45. For the French coastal part of the CWMS, an additional modification to the above rule was applied further to the recent expert-based analysis of satellite derived products for Chl*a*, realised at the local scale of coastal water masses[18]) over the period 2016-2021. It indicates that most coastal waters are in either good or very good status regarding Chl *a* concentration. Waters above the G/M threshold (oN85), set for satellite derived Chl *a* data, were classified as in good status if the calculated values were very close to the G/M threshold (oN85) taking also account of the water masses features. In addition, the status assigned by applying the criteria as provided in Table 6 was adjusted further to the justification provided by France in relation to the national assessments derived by applying the G/nonG back transformed threshold based on *in situ* measurements i.e., the national assessment criteria which correspond to 90th percentile transformed to G/M, as also provided by UNEP/MAP Decision 22/7.

46. The transformation of percentile to z-scores were obtained using the pnorm() an qnorm() functions in R. The RC values (oN10) and the G/M thresholds (oN85) were calculated from the normalized values through the predict function. The assessment criteria calculation as presented in Tables 6, 7, 8 and 9 show the results obtained by the Assessment zones and SAUs.

47. To obtain the assessment criteria for the subSAUs in Spanish waters, they are paired with the assessment water types (AWT), considering that the predominant AWT in the subSAU determined the selection of the assessment criteria. The codes assigned to AWTs are the same as the codes of the MSFD AWUs. At the SAU level, many AWTs coexist, and therefore, different strategies must be considered; for example, one strategy can be to consider that if no more than 10% of subSAUs, normalized by their surface are in non-good status, then the SAU related to these subSAUs is considered in non-good status.

48. As it is elaborated above, there is a difference between the thresholds calculated from the satellite-derived data used for the present assessment and the assessment criteria calculated from *in situ* measurements, i.e., both national thresholds of Spain which are in compliance with the Marine Strategy Framework Directive (2008/56/EC) and Water Framework Directive (2000/60/EC), and the assessment criteria as adopted by UNEP/MAP IMAP Decision 22/7. Given this difference, the regional assessment findings do not fully match the eutrophication evaluation performed by Spain by applying the assessment criteria calculated from *in situ* measurements[19].

Table 6: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP spatial assessment units in the French part of the CWMS Sub-division. Dominant water type out of all Water Types (WT) assigned to different sub-SAUs within related SAUs are also presented. Table shows the Coastal water masses typology (WT) and corresponding G/M threshold (oN85), based on the use of satellite-derived Chl *a* data, as well as back transformed G/M threshold based on *in situ* measurements i.e., the national assessment criteria which correspond to 90th percentile transformed to G/M, as also provided in UNEP/MAP Decision 22/7.

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[17] HELCOM. (2010). Ecosystem health of the Baltic Sea 2003-2007: HELCOM Initial Holistic Assessment.

[18] Technical justification provided by France

[19] **https://www.miteco.gob.es/es/costas/temas/proteccion-medio-marino/estrategias-marinas/**

AZ	**SAU**	**WT**	**oN50**	**oN50+50**	**oN90**	**oN10**	**oN85**	**oN25**	good/non-good	
									P90	**GM**
		I							10	4,12
CW	FRD_E	IIIW	0,258	0,388	0,562	0,193	0,415	0,22	1,89	0,78
CW	FRD_W	IIA	1,039	1,558	1,544	0,612	1,409	0,772	3,5	1,44
CW	FRE_E	III Isl.	0,212	0,318	0,414	0,161	0,327	0,185	1,22	0,50
CW	FRE_W	III Isl.	0,168	0,253	0,251	0,133	0,222	0,147	1,22	0,50
OW	FRD_E	IIIW	0,228	0,343	0,676	0,189	0,589	0,207	1,89	0,78
OW	FRD_W	IIA	0,447	0,67	0,757	0,321	0,674	0,372	3,5	1,44
OW	FRE_E	III Isl.	0,16	0,24	0,187	0,144	0,179	0,15	1,22	0,50
OW	FRE_W	III Isl.	0,158	0,237	0,186	0,14	0,181	0,148	1,22	0,50

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile i.e. G/M threshold based on use of satellite-derived data, oN25 – 25th percentile; P90 – G/M threshold from 90th percentile of *in situ* measurements ; GM - G/M threshold as GM back transformed from 90th percentile of *in situ* measurements.

Table 7: Reference conditions (oN10) and G/M threshold (oN85) calculated from satellite-derived Chl *a* data and set by Spanish Water Types. The codes assigned to the assessment water types (AWT) are the same as the codes of the MSFD AWUs. oN85 represents G/M boundary threshold calculated from the satellite-derived Chl *a* data (shared by Spain). P90 represents 90th percentile back transformed from oN85. FP90 represents G/M threshold calculated from the satellite-derived Chl *a* data (as shared by Spain) by using 90th percentile annual values and applying the same calculation method as for calculation of oN85. ESP represents national G/M threshold values of Spain, expressed as 90th percentile, and calculated from *in situ* measurements (national reports for ALB and LEV-BAL as shared by Spain). There are no significant differences between thresholds calculated from satellite-derived data and thresholds calculated from *in situ* measured data, although they cannot be identical.

AWT	**oN50**	**oN50+50**	**oN90**	**oN10**	**oN85**	**oN25**	**P90**	**FP90**	**ESP**
ALBC1	0,702	1,052	0,957	0,544	0,915	0,617	2,218	2,403	2,47
ALBC2	0,297	0,445	0,407	0,241	0,378	0,258	0,916	0,942	1,65
ALBO1	0,332	0,498	0,390	0,261	0,379	0,288	0,919	0,579	1,99
ALBO2	0,225	0,338	0,293	0,177	0,276	0,198	0,669	0,539	0,68
ALBP1	0,465	0,698	0,612	0,377	0,569	0,419	1,379	1,186	2,89
ALBP2	0,448	0,673	0,611	0,327	0,571	0,376	1,384	1,542	2,03
LEVC1	0,269	0,404	0,374	0,192	0,347	0,226	0,841	0,714	1,80
LEVC2	0,498	0,746	0,711	0,375	0,658	0,420	1,595	0,976	2,00
LEVDE	0,823	1,234	0,949	0,741	0,944	0,769	2,289	1,236	2,30
LEVON	0,179	0,269	0,230	0,139	0,218	0,157	0,529	0,435	0,60
LEVOS	0,123	0,184	0,158	0,103	0,150	0,110	0,364	0,312	0,26

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile, oN25 – 25th percentile, P90 – 90th perc. Back transformed from oN85, FP90 – 90th perc. Calculated from mean annual values of the 90th perc., ESP – 90th perc. Represents Spanish G/M threshold values

Table 8: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP spatial assessment units in the Southern part of the CWMS.

Country	**AZ**	**oN50**	**oN50+50**	**oN90**	**oN10**	**oN85**	**oN25**
MAR	CW	6017	0,449	0,674	0,713	0,277	0,637
MAR	OW	22360	0,294	0,441	0,389	0,227	0,363
DZA	CW	20982	0,319	0,478	0,74	0,205	0,592
DZA	OW	73665	0,21	0,316	0,283	0,167	0,267
TUN	CW	8787	0,229	0,344	0,577	0,162	0,477
TUN	OW	25350	0,162	0,243	0,208	0,132	0,193

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile i.e., G/M threshold based on use of satellite-derived data, oN25 – 25th percentile

Table 9: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP SAUs in the Italian waters in the Tyrrhenian Sea and the part of CWMS.

AZ	**SAU**	**oN50**	**oN50+50**	**oN90**	**oN10**	**oN85**	**oN25**
CW	CW_ITA_ISL_E	0,095	0,142	0,213	0,067	0,151	0,074
CW	CW_ITA_ISL_W	0,104	0,156	0,225	0,079	0,169	0,087
CW	CW_ITA_TYR_N	0,348	0,522	1,074	0,085	0,882	0,117
CW	CW_ITA_TYR_S	0,263	0,395	1,389	0,085	1,124	0,121
OW	OW_ITA_ISL_E	0,074	0,112	0,099	0,059	0,095	0,063
OW	OW_ITA_ISL_W	0,083	0,124	0,102	0,068	0,098	0,075
OW	OW_ITA_TYR_N	0,095	0,143	0,209	0,079	0,156	0,084
OW	OW_ITA_TYR_S	0,077	0,116	0,146	0,061	0,111	0,067
oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile i.e., G/M threshold based on use of satellite-derived data, oN25 – 25th percentile,							

49. To obtain the assessment criteria for subSAUs in Spanish waters, they are paired with the assessment water types (AWT), considering that the predominant AWT in the subSAU is used for selection of the assessment criteria. The codes assigned to AWTs are the same as the codes of the MSFD AWUs. At the SAU level, many AWTs coexist, and different strategies must be considered; for example, one strategy can be to consider that if no more than 10% of SubSAUs, normalized by their surface, is in non-good status then the SAU is assigned in good status.

50. As it is elaborated above, there is a difference between the thresholds calculated from the satellite-derived data used for the present assessment and the assessment criteria calculated from *in situ* measurements, i.e., both national thresholds of Spain which are in compliance with the Marine Strategy Framework Directive (2008/56/CE) and Water Framework Directive (2000/60/CE), and the assessment criteria as adopted by UNEP/MAP IMAP Decision 22/7. Consequently, the regional assessment findings do not fully match the eutrophication evaluation performed by Spain.[20]

51. Finally, each observation point, or area were classified in good or non-good status, comparing the concentrations of chl *a* to G/M threshold i.e., the back transformed 85th percentile of normalized distribution.

52. In addition, to decide on good/non-good status in the French waters, the local scientific expertise regarding ecosystem functioning, water masses characteristics (hydrology, water renewal, confinement of the water mass) and satellite-derived product analyses were taken into account as provided by France.

53. It should be noted that by selecting the 85th percentile of the normalized distribution as G/M boundary limit, therefore as the limit between the acceptable and the unacceptable status i.e., good and non-good status in the WMS, the compatibility of the present classification was achieved with a

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[20] https://www.miteco.gob.es/es/costas/temas/proteccion-medio-marino/estrategias-marinas/

five classes GES/non GES scale set in the Adriatic Sea Sub-region. The harmonization was achieved to the maximum possible extent given the Simplified assessment methodology based on G/M comparison and NEAT GES assessment methodology are different methodologies which application across the Mediterranean Sub-regions/Sub-divisions was conditioned with the statuses of data reported by the CPs. Therefore, the bias assessment of CI 14 within the 2023 MED QSR was avoided as the Simplified G/M method relay on the assessment criteria corresponding to RC and G/M as stated in the Decision 22/7 on Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (UNEP/MAP, 2016). Based on statistical calculations and related selection of the 85th percentile ~ mean +1 SD represents the G/M threshold, the synchronization was achieved to the maximal possible extent between the classification statuses assigned in the WMS , and those in the Adriatic Sea Sub-region.

An application of the EQR Methodology in the Tyrrhenian Sea Sub-division and part of the CWMS: the Waters of Italy

54. The ecological quality ratio (EQR) is a dimensionless measure of the observed value of an indicator compared with reference conditions. The ratio goes from 0 (large deviation) to 1 (when the observed value is equal or better than the reference conditions). The EQR method was used, and typology related assessment performed. The water type was determined as a five-year arithmetic mean of salinity and compared to the ranges as shown in Table 10. The water types distribution in the Tyrrhenian Sea is presented on Figure 12.a.

55. The EQR assessment methodology was applied on in situ Chla data reported by Italy to IMAP IS. However, in situ data available for nutrients were not evaluated given the lack of assessment criteria developed for nutrients in the Tyrrhenian Sea.

56. The likely GES or likely non GES classes are assigned to the assessment units for the assessment of the Tyrrhenian Sea Sub-division and part of the CWMS by applying the EQR assessment methodology. Namely, an application of this methodology allows the use of the reference conditions and boundaries for the five ecological quality classes and therefore supports the assessment undertaken to be considered as the assessment of good environmental status. Although only one parameter was assessed the assessment is considered likely GES/non-GES given the finest discrimination of the assessment classes is possible by application of the EQR. As explained above, for the application of the simplified G/M comparison, the two status classes i.e., good and non-good expressed as good and moderate status (i.e. G/M) are assigned to the units assessed regarding Chl *a*, as only one parameter assessed.

Table 10: Major coastal water types with density and salinity boundary

	Type I	Type IIA Tyrrhenian	Type IIIW
σ_t (density)	<25	25<d<27	>27
S (salinity)	<34.5	34.5<S<37.5	>37.5

57. The EQR, which is set as the relative deviation from the reference conditions (RC), must be calculated for every boundary using the simple equation:

$$EQR_{actual} = RC/Chl\ a_{annual\ GM} \qquad (1)$$

where for Chl $a_{\text{annual GM}}$,the Chl *a* concentrations defined for every boundary must be used. As Chl *a* concentrations are derived using non-linear relationships, the corresponding EQRs are not on a linear equidistant scale. To calculate the EQRs values normalized (Anon., 2005)[21] to the scale from 0 to 1 (EQR_{norm}) and set equidistantly, with respect to the above calculated values (designated as EQR_{actual}), the following conversion functions were used:

$$EQR_{norm} = 0.259 \ln(EQR_{actual}) + 0.947 \qquad \text{Type I CW} \qquad (2)$$

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[21] Anonymous, 2005. Guidance on the intercalibration process 2004-2006. Common Implementation Strategy for the Water Framework Directive Guidance Document No 14:26 pp

$EQR_{norm} = 0.244 \ln(EQR_{actual}) + 0.946$ Type IIA Tyrrhenian CW (3)

58. The actual and normalized EQRs for all boundaries of Water Types I and II A in the Tyrrhenian Sea are shown in Tables 9.a and 9.b, respectively.

Table 9.a: Reference conditions and boundaries of ecological quality classes expressed by different parameters for Water Type I in coastal and open waters of the Tyrrhenian Sea. Normalized EQRs were used for ecological quality assessment.

Boundaries	**TRIX**	**$c(\mathrm{Chl}a_{\mathrm{aGM}})/\mu g\ L^{-1}$**	**$\mathrm{Chla}_{\mathrm{aGM}}$**	
			EQR_{actual}	**$EQR_{normalized}$**
RC		1.40	1.00	1.00
H/G	4.25	2.0	0.70	0.85
G/M	**5.25**	**5.0**	**0.28**	**0.62**
M/P	6.25	12.6	0.11	0.38
P/B	7	25.0	0.06	0.20

Table 9.b: Reference conditions and boundaries of ecological quality classes expressed by different parameters for Water Type IIA in coastal and open waters of the Tyrrhenian Sea. Normalized EQRs were used for ecological quality assessment.

Boundaries	**TRIX**	**$c(\mathrm{Chl}a_{\mathrm{aGM}})/\mu g\ L^{-1}$**	**$\mathrm{Chla}_{\mathrm{aGM}}$**	
			EQR_{actual}	**$EQR_{normalized}$**
RC		0.32	1.00	1.00
H/G	4	0.48	0.66	0.84
G/M	**5**	**1.2**	**0.27**	**0.62**
M/P	6	2.9	0.11	0.40
P/B	7	7.3	0.04	0.18

59. By applying the above shown assessment criteria, the assessed subSAU were classified likely in GES or non-GES status, comparing the $EQR_{normalized}$ to the G/M boundary of 0.62 set as the good/non good status boundary limit.

60. Contrarily to the five ecological classes approach adopted for Water Types I and IIA in the Tyrrhenian Sea, a single threshold approach is used for Water Type III W. The GES/non GES threshold value applied was 0.48 µg/L representing an annual GM value of H/G boundary for Water Types IIA.

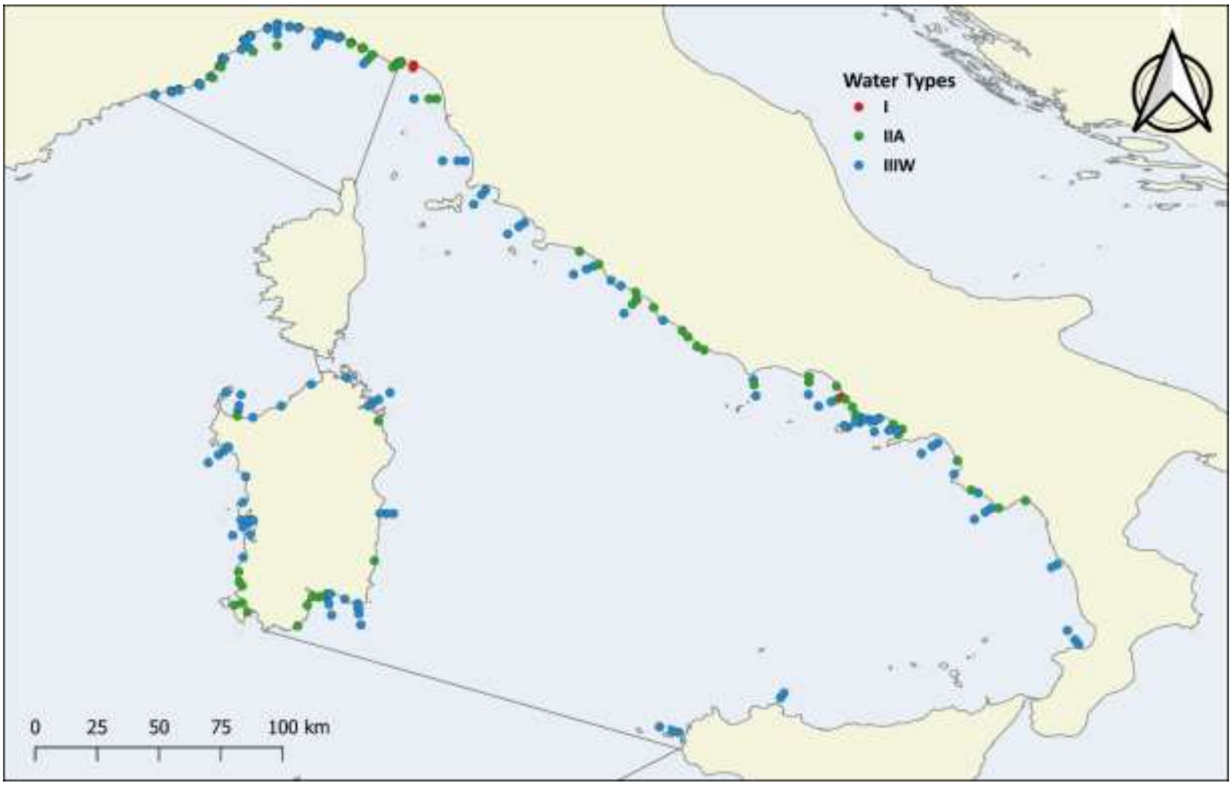

Figure 14: Water types along the Tyrrhenian Sea Sub-division and part of the CWMS: The Waters of Italy.

5. Results of the Assessment of CI 14 in the Western Mediterranean Sea Sub-region

61. As for the AEL and the CEN, the two status classes i.e. good and non-good are assigned to the units assessed in the WMS by applying the simplified G/M assessment methodology since the assessment findings are based on the use of only one parameter and therefore, the integrated consideration of the minimum of parameters needed to assess the good environmental status for IMAP CIs 13 and 14 i.e. the GES was impossible.

62. Upon setting the reference conditions and the G/M threshold, each observation point, or area were classified in good and non-good status , by comparing the value of the indicator i.e., the satellite derived Chla to the G/M threshold, i.e. the back transformed 85th percentile of normalized distribution.

63. The results of CI 14 assessment using the satellite-derived Chl *a* data are presented in Tables 10-17, and Figure 15-18 . The likely good status (Figure 15) corresponds to the RC conditions, as well as to the values below the 85th percentile of normalized distribution set as good/non-good status boundary (i.e., blue coloured cells in Tables 10 -17). The non-good status corresponds to the class above G/M boundary limit (i.e., red coloured cells). The assessment results show that all evaluated assessment zones can be considered in good status regarding assessment of the satellite derived Chl *a* data.

	GES			non-GES		
IMAP/NEAT	RC	High	Good	Moderate	Poor	Bad
Boundary limits and normalized NEAT scores	< RC/H limit, not in score scale	1 < score ≤ 0.8	0.8<score≤ 0.6	0.6<score ≤ 0.4	0.4< score ≤0.2	Score<0.2
IMAP/Simplified G/M	🟦	🟦		🟥		
Boundary limits*	≤10th %	>10th% CHL_GM ≤85th%		CHL_GM >85th %		
G/NG threshold			**G/M**			

*** Percentile are calculated from normalized (with Ordered Quantile transformation) annual geometric mean (for at list 5 year)**

Figure 15: Assessment classification for harmonized IMAP/NEAT and IMAP Simplified G/M assessment methodologies application in the Mediterannean Sea sub-regions.

64. In addition, to decide on good/non-good status in the French waters, the local scientific expertise regarding ecosystem functioning, water masses characteristics (hydrology, water renewal, confinement of the water mass) and satellite-derived product analyses were taken into account as provided by France.

The Central Sub-division of the WMS (CWMS): The Waters of France

65. Despite good status assigned to the assessment zones, it should be noted that in the French CW assessment zone (Tables 10&11, and Figure 16), for which the finest SAUs were defined in line with WFD, one out of the 46 SubSAU namely EC03b (Golfe de Porto Vecchio) was in non-good status though the low number of pixels (n=13) included in the assessment reflects the high uncertainty associated to mean computation. The Gulf of Porto Vecchio is a small embayment characterised by the presence of both muddy and sandy sediments. In such shallow coastal environments, resuspension processes complexify water optical properties leading to overestimation of Chl - *a* concentrations when using satellite-derived products (Gohin et al. 2020[22]). Also, Ganzin et al. (2010) observed that satellite-derived products in the area can be 30% higher than the mean values computed over a 6-year period. Water renewal is also very low in this area making it more sensitive to pressures and basin derived inputs.

66. Six out of 46 SubSAUs were above the G/M threshold (oN85) but were still classified in good status given the calculated values were very close to the G/M threshold (oN85), and taking also account of the water masses features. For the present assessment, the national G/nonG back transformed values (90th percentile > GM, based on *in situ* measurements, corresponding to UNEP/MAP Decision 22/7) were also used. Amongst these 6 water masses, the four are located in the FRD-E assessment zone namely DC04 (Golfe de Fos), DC06A (Petite Rade de Marseille), DC07I (Cap de L'estéral – Cap de Brégançon) and DC08B (Ouest Fréjus- Saint Raphaël). The two revised water masses are located in Corsica Island (FRE) and correspond to EC04B (Golfe D'Ajaccio) and EC01C (Golfe de Saint Florent). Water mass DC04 (Golfe de Fos) is a highly modified water mass characterised by a high spatial heterogeneity in Chl *a* distribution. For other water masses (DC06A, DC07I and DC08B; EF04B and EC01C in Corsica), hydrodynamic studies revealed a very low annual renewal of water masses thus explaining slight accumulation of low phytoplankton biomass levels (Ganzin et al. 2010[23]).

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[22] J. Mar. Sci. Eng. 2020, 8, 665; **https://doi.org/10.3390/jmse8090665**

[23] https://archimer.ifremer.fr/doc/00028/13931/11104.pdf

Table 10. Results of the assessment (G_NG.oN85 - the good status corresponding to all values below the 85th percentile set as good/non-good boundary limit) of the French part of the CWMS provided for the Assessment Zones (AZ) and Spatial Assessment Units (SAUs). Blue coloured AZs indicate good status.

Country	AZ	SAU	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
France	CW	FRD_E	8347	0,316	0,258	0,388	0,193	0,415	G
France	CW	FRD_W	1784	0,990	1,039	1,558	0,612	1,409	G
France	CW	FRE_E	2358	0,249	0,212	0,318	0,161	0,327	G
France	CW	FRE_W	5733	0,208	0,168	0,253	0,133	0,222	G
France	OW	FRD_E	30648	0,303	0,228	0,343	0,189	0,589	G
France	OW	FRD_W	13656	0,478	0,447	0,67	0,321	0,674	G
France	OW	FRE_E	16698	0,178	0,160	0,24	0,144	0,179	G
France	OW	FRE_W	24450	0,179	0,158	0,237	0,140	0,181	G

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile set as G/M threshold based on the use of satellite-derived Chl *a* data; G/NG oN85 - the good status corresponding to all values below the 85th percentile set as good/non-good boundary limit.

Table 11. Result of the assessment (G_NG.oN85- the good status corresponding to all values below the 85th percentile set as G/M i.e. good/non-good status boundary limit based on satellite-derived Chl *a* data) of the French coastal waters (CW) in the CWMS provided for the finest Spatial Assessment Units (SAUs). Blue coloured subSAUs indicate good status; Red coloured subSAU indicates non-good status. Light blue colour corresponds to subSAUs reconsidered as in good status following justification provided by French authorities; * - indicates the subSAUs reconsidered as in good status given the water mass typology, and WB evaluated as Type I; 90th percentile was used as included in the national assessment criteria, based on *in situ* measurements, further to the request and justification of local hydrological conditions (e.g. highly modified water mass characterised by a strong spatial heterogeneity but no eutrophication processes exist), as provided by French authorities (it corresponds to 90th percentile transformed to G/M, as provided in UNEP/MAP Decision 22/7); ** - indicates subSAUs reconsidered as in good status following expert-based justification provided by French authorities, and WBs are in WT IIIW; since the assessment values are close to the good/non-good boundary limit set by using satellite derived Chl *a* data i.e., oN85 – 85th percentile (G/NG oN85 threshold), the national assessment criteria, based on *in situ* measurements, were used further to the justification of local hydrological conditions (e.g. semi-enclosed bay or confined areas with very low annual water renewal, slight accumulation of phytoplankton biomass without eutrophication), as provided by French authorities (the national G/nG assessment criteria correspond to 90th percentile transformed to G/M, as provided in UNEP/MAP Decision 22/7).

Country	AZ	SAU	subSAUs (WFD_WB)	CHL_N	CHL_GM	oN50+50	oN10	oN85	G/nG	G_NG.oN85	G/nG **.
France	CW	FRD_W	DC01	162	0,545	1,558	0,612	1,409		G	
France	CW	FRD_W	DC02A	654	0,855	1,558	0,612	1,409		G	
France	CW	FRD_W	DC02B	149	1,375	1,558	0,612	1,409		G	
France	CW	FRD_W	DC02C	78	1,041	1,558	0,612	1,409		G	
France	CW	FRD_W	DC02D	135	0,947	1,558	0,612	1,409		G	
France	CW	FRD_W	DC02E	78	1,026	1,558	0,612	1,409		G	
France	CW	FRD_W	DC02F	528	1,297	1,558	0,612	1,409		G	
France	CW		DC04*	553	1,108				**4,12**	G	
France	CW	FRD_E	DC05	525	0,371	0,388	0,193	0,415		G	
France	CW	FRD_E	DC06A**	93	0,525	0,388	0,193	0,415	**0,780**	**NG**	**G**

Country	AZ	SAU	subSAUs (WFD_WB)	CHL_N	CHL_GM	oN50+50	oN10	oN85	G/nG	G_NG.oN85	G/nG **.
France	CW	FRD_E	DC06B	586	0,411	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07A	61	0,290	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07B	547	0,261	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07C	192	0,239	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07D	114	0,236	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07E	190	0,396	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07F	685	0,302	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07G	82	0,409	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07H	1577	0,243	0,388	0,193	0,415		G	
France	CW	FRD_E	DC07I**	276	0,448	0,388	0,193	0,415	**0,780**	NG	G
France	CW	FRD_E	DC07J	871	0,21	0,388	0,193	0,415		G	
France	CW	FRD_E	DC08A	385	0,287	0,388	0,193	0,415		G	
France	CW	FRD_E	DC08B**	119	0,470	0,388	0,193	0,415	**0,780**	NG	G
France	CW	FRD_E	DC08C	116	0,274	0,388	0,193	0,415		G	
France	CW	FRD_E	DC08D	298	0,242	0,388	0,193	0,415		G	
France	CW	FRD_E	DC08E	437	0,342	0,388	0,193	0,415		G	
France	CW	FRD_E	DC09A	30	0,275	0,388	0,193	0,415		G	
France	CW	FRD_E	DC09B	372	0,300	0,388	0,193	0,415		G	
France	CW	FRD_E	DC09C	53	0,226	0,388	0,193	0,415		G	
France	CW	FRD_E	DC09D	**NOT EVALUATED – NO CONSISTENT SATALLITE DATA**							
France	CW	FRD_E	DC10A	114	0,215	0,388	0,193	0,415		G	
France	CW	FRD_E	DC10C	71	0,252	0,388	0,193	0,415		G	
France	CW	FRE_W	EC01AB	1229	0,195	0,253	0,133	0,222		G	
France	CW	FRE_W	EC01C**	116	0,252	0,253	0,133	0,222	**0,500**	NG	G
France	CW	FRE_W	EC01D	144	0,189	0,253	0,133	0,222		G	
France	CW	FRE_W	EC01E	168	0,184	0,253	0,133	0,222		G	
France	CW	FRE_E	EC02AB	360	0,174	0,318	0,161	0,327		G	
France	CW	FRE_E	EC02C	240	0,273	0,318	0,161	0,327		G	
France	CW	FRE_E	EC02D	672	0,307	0,318	0,161	0,327		G	
France	CW	FRE_E	EC03AD	1056	0,234	0,318	0,161	0,327		G	
France	CW	FRE_E	EC03B	19	1,233	0,318	0,161	0,327		NG	
France	CW	FRE_E	EC03C	11	0,291	0,318	0,161	0,327		G	
France	CW	FRE_W	EC03EG	771	0,200	0,253	0,133	0,222		G	
France	CW	FRE_W	EC03F	**NOT EVALUATED – NO CONSISTENT SATALLITE DATA**							
France	CW	FRE_W	EC04AC	2715	0,205	0,253	0,133	0,222		G	
France	CW	FRE_W	EC04B**	590	0,272	0,253	0,133	0,222	**0,500**	NG	G

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/M threshold)

The Alboran Sea and Levantine-Balearic Subdivision of the WMS: The Waters of Spain

67. The evaluation was performed on 70 out of 149 SubSAUs.

68. Despite good status assigned to the assessment zones, it should be noted that in the CW assessment zone of Spanish waters (Tables 12 &13, and Figure 17), for which the finest SAUs were defined in line with WFD, there are 8 out of 70 subSAUs which are likely in non-good status.

69. These 8 subSAUs are located as follows: one subSAU close to the Mar Menor (ES070MSPF010300030) one subSAU ES080MSPFC017 of the Segura River mouth; two subSAUs (ES080MSPFC006 and ES080MSPFC0081) near Valencia; two subSAUs ES080MSPFC001 and ES100MSPFC32 close to the Ebro River mouth; one subSAU ES100MSPFC3 close to the French border; and one subSAU ES110MSPFMAMCp02 on the Mallorca Island in the Alcudia Gulf.

70. The local sources of pollution are probably the main driver contributing to the weakened status of most non-good subSAUs. The most important problem that needs to be addressed is the non-good status in the Mallorca Island area. A more detailed analysis indicates that the ranges of observed values in the Islands area is very low 0,05-0,20 µg/L. At narrow ranges the statistics is not always performed in acceptable manner. This suggests a necessity to use the satellite-derived data in these areas with caution or different elaboration strategies need to be provided.

71. As it is explained above for setting the good/non-good boundary limit there is a slight difference between the thresholds calculated from the satellite-derived data used for the present assessment and the assessment criteria calculated from *in situ* measurements, which resulted in the regional assessment findings which do not fully match the eutrophication evaluation performed by Spain by applying the assessment.

Table 12. Result of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit) of the Spanish OW and CW in the ALB and LEV-BAL Subdivision at the level of Spatial Assessment Units (SAUs). Blue coloured SAUs indicate good status, Red coloured SAUs indicate noon-good status. For CW, as in the SAU a multiplicity of Assessment Water Types can coexist, further adjusted assessment approach was used. The SAU is in good status if less than 10 % of the area of the SAU is in non-good status. For the calculation of the affected area, the number of observation points (CHL_N) per SAU was used since these points represent the observation grid (1x1 km) and their surface is very close to the area of the SAU (expressed in km^2). The sum of the observation points in non-good (∑**N (NG)**), along with the percent of the SAU in non-good (%G/NG) from the total sum of the observation points (∑**N**) in SAU, were calculated.

AZ	**SAU**	**CHL_N**	**CHL_GM**	**oN50+50**	**oN10**	**oN85**	**G_NG.oN85**	
OW	ESPW	904	0,385	0,571	0,265	0,508	**G**	
OW	ESPE	1580	0,196	0,288	0,133	0,276	**G**	
OW	ESPL	3752	0,213	0,306	0,149	0,276	**G**	
OW	ESPI	3644	0,115	0,17	0,1	0,137	**G**	
		∑N	**∑N (NG$_{oN85}$)**	**%G/NG$_{oN85}$**	**∑N (NG$_{oN50+50}$)**	**%G/NG$_{oN50+50}$**	**G/NG$_{oN85}$**	**G/NG$_{oN50+50}$**
CW	ES060	532	0	0,0	0	0,0	**G**	**G**
CW	ES070	500	16	3,2	16	3,2	**G**	**G**
CW	ES080	540	80	14,8	40	7,4	**NG**	**G**
CW	ES091	104	0	0,0	0	0,0	**G**	**G**
CW	ES100	340	56	16,5	0	0,0	**NG**	**G**
CW	ES110	668	96	14,4	0	0,0	**NG**	**G**

Table 13. Result of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit) of the Spanish OW and CW in the ALB and LEV-BAL Subdivision at the level of the finest Spatial Assessment Units (subSAUs). Blue coloured subSAUs indicate good status, Red coloured subSAUs indicate non-good status.

AZ	**SAU**	**subSAUs**	**CHL_N**	**CHL_GM**	**oN50+50**	**oN10**	**oN85**	**G_NG.oN85**
OW	ESPW		904	0,385	0,571	0,265	0,508	G
OW	ESPE		1580	0,196	0,288	0,133	0,276	G
OW	ESPL		3752	0,213	0,306	0,149	0,276	G
OW	ESPI		3644	0,115	0,17	0,1	0,137	G
CW	ES060	ES060MSPF610007	72	0,765	1,178	0,577	0,959	G

AZ	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	ES060	ES060MSPF610008	32	0,532	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610009	32	0,549	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610010	32	0,565	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610011	36	0,506	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610012	24	0,401	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610013	28	0,384	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610014	12	0,368	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610015	36	0,359	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610016	24	0,328	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610017	148	0,286	0,378	0,213	0,39	G
CW	ES060	ES060MSPF610018	36	0,242	0,378	0,213	0,39	G
CW	ES060	ES060MSPF610019	12	0,19	0,36	0,165	0,309	G
CW	ES060	ES060MSPF610020	8	0,195	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300010	32	0,274	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300020	44	0,226	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300030	16	0,331	0,36	0,165	0,309	NG
CW	ES070	ES070MSPF010300080	112	0,227	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300080	112	0,227	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300100	152	0,18	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300140	32	0,19	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC001	28	0,544	0,588	0,274	0,516	NG
CW	ES080	ES080MSPFC003	20	0,389	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC004	52	0,41	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC005	28	0,451	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC006	12	0,541	0,588	0,274	0,516	NG
CW	ES080	ES080MSPFC007	40	0,377	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC008	68	0,356	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC0081	8	0,613	0,588	0,274	0,516	NG
CW	ES080	ES080MSPFC009	48	0,433	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC010	96	0,366	0,588	0,274	0,516	G

AZ	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	ES080	ES080MSPFC013	16	0,216	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC014	36	0,184	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC015	24	0,207	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC016	32	0,26	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC017	32	0,364	0,36	0,165	0,309	NG
CW	ES091	ES091MSPF894	72	0,523	0,904	0,334	0,775	G
CW	ES091	ES091MSPF895	16	0,77	0,904	0,334	0,775	G
CW	ES091	ES091MSPF896	16	0,658	0,904	0,334	0,775	G
CW	ES100	ES100MSPFC1	8	0,348	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC10	52	0,283	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC12	4	0,268	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC14	4	0,269	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC17	16	0,272	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC18	8	0,316	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC19	12	0,314	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC20	8	0,33	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC28	4	0,283	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC29	20	0,305	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC3	32	0,314	0,36	0,165	0,309	NG
CW	ES100	ES100MSPFC30	28	0,278	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC31	68	0,26	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC32	24	0,355	0,36	0,165	0,309	NG
CW	ES100	ES100MSPFC5	32	0,268	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC7	12	0,315	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC8	8	0,312	0,588	0,274	0,516	G
CW	ES110	ES110MSPFEFMCp03	156	0,129	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEFMCp04	104	0,126	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEIMC01M2	4	0,114	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEIMCp01	8	0,117	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEIMCp02	4	0,121	0,17	0,1	0,137	G

AZ	**SAU**	**subSAUs**	**CHL_N**	**CHL_GM**	**oN50+50**	**oN10**	**oN85**	**G_NG.oN85**
CW	ES110	ES110MSPFFOMC09M3	8	0,126	0,17	0,1	0,137	G
CW	ES110	ES110MSPFMAMC01M2	4	0,103	0,17	0,1	0,137	G
CW	ES110	ES110MSPFMAMCp01	280	0,111	0,17	0,1	0,137	G
CW	ES110	ES110MSPFMAMCp02	96	0,144	0,17	0,1	0,137	NG
CW	ES110	ES110MSPFMEMC01M2	4	0,117	0,17	0,1	0,137	G

oN50+50 – Mean + 50%, oN10 – 10th percentile – RC boundary, oN85 – 85th percentile – G/M threshold

The Southern Part of the CWMS Sub-division: The Waters of Algeria, Morocco and Tunisia

72. All the SAUs assessed in the Southern part of the WMS were in good status (Tables 14 and 15, Figure 18). It must be noted that the assessment was not possible at the level of the finest spatial assessment units i.e., subSAUs, as for other sub-divisions in the WMS, therefore, resulting in a less confidential assessment, given the absence of finer water bodies delineation and related water typology characterization.

73. Due to a less confidential assessment in this part of the WMS, some specific examples of drivers and pressures were mapped from the scientific literature, as elaborated in Section 1, for example, the Oran harbor (Algeria) which receives the discharge of wastewater; the Ghazaouet harbour which is exposed to chemicals coming mainly from industrial activities; the shoreline such as Bousfer under the impact of the seawater desalination plant in Oran Bay and the Beni Saf desalination plant.

Table 14. Results of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as good/non-good boundary limit) of the Southern part of the CWMS provided for the Assessment Zones (AZ). Blue coloured AZs indicate good status.

Country	AZ	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
MAR	CW	6035	0,450	0,449	0,674	0,277	0,637	**G**
MAR	OW	22360	0,297	0,294	0,441	0,227	0,363	**G**
DZA	CW	21189	0,361	0,319	0,478	0,205	0,592	**G**
DZA	OW	73665	0,215	0,21	0,316	0,167	0,267	**G**
TUN	CW	8859	0,278	0,229	0,344	0,162	0,477	**G**
TUN	OW	25350	0,166	0,162	0,243	0,132	0,193	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/NG threshold)

Table 15. Result of the assessment (G_NG.oN85- the good class corresponding to all values below the 85th percentile set as good/non-good boundary limit based on satellite-derived Chl *a* data) of the Southern part of the CWMS provided for the Spatial Assessment Units (SAUs). Blue coloured SAUs indicate the good status.

Country	AZ	SAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
MAR	CW	MAR_W	4345	0,499	0,674	0,277	0,637	**G**
MAR	CW	MAR_E	1690	0,343	0,674	0,277	0,637	**G**
MAR	OW	MAR_W	16070	0,320	0,441	0,227	0,363	**G**
MAR	OW	MAR_E	6290	0,245	0,441	0,227	0,363	**G**
DZA	CW	ORAN_W	648	0,43	0,478	0,205	0,592	**G**
DZA	CW	ORAN_C	3913	0,311	0,478	0,205	0,592	**G**
DZA	CW	ORAN_E	2226	0,368	0,478	0,205	0,592	**G**
DZA	CW	DAHRA	1565	0,523	0,478	0,205	0,592	**G**
DZA	CW	ALGIERS	3480	0,486	0,478	0,205	0,592	**G**
DZA	CW	ALGIERS_E	1315	0,346	0,478	0,205	0,592	**G**
DZA	CW	CONSTANTINE_W	2629	0,340	0,478	0,205	0,592	**G**
DZA	CW	CONSTANTINE_C	3483	0,261	0,478	0,205	0,592	**G**
DZA	CW	CONSTANTINE_E	1930	0,389	0,478	0,205	0,592	**G**
DZA	OW	ORAN_W	4380	0,237	0,316	0,167	0,267	**G**
DZA	OW	ORAN_C	9840	0,225	0,316	0,167	0,267	**G**

Country	**AZ**	**SAU**	**CHL_N**	**CHL_GM**	**oN50+50**	**oN10**	**oN85**	**G_NG.oN85**
DZA	OW	ORAN_E	2695	0,238	0,316	0,167	0,267	**G**
DZA	OW	DAHRA	12320	0,244	0,316	0,167	0,267	**G**
DZA	OW	ALGIERS	12050	0,232	0,316	0,167	0,267	**G**
DZA	OW	ALGIERS_E	9250	0,214	0,316	0,167	0,267	**G**
DZA	OW	CONSTANTINE_W	5685	0,202	0,316	0,167	0,267	**G**
DZA	OW	CONSTANTINE_C	12310	0,183	0,316	0,167	0,267	**G**
DZA	OW	CONSTANTINE_E	5135	0,171	0,316	0,167	0,267	**G**
TUN	CW	TUN_WMS_W	811	0,334	0,344	0,162	0,477	**G**
TUN	CW	TUN_WMS_E	8048	0,273	0,344	0,162	0,477	**G**
TUN	OW	TUN_WMS_W	15335	0,159	0,243	0,132	0,193	**G**
TUN	OW	TUN_WMS_E	10015	0,176	0,243	0,132	0,193	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/NG threshold)

<u>The Tyrrhenian Sea Sub-division and part of the CWMS: The Waters of Italy</u>

74. Despite likely good status assigned to the assessment zones in the waters of Italy, there are 9 out of 54 subSAUs that are in non-good status (Tables 16 &17, and Figures 19&20).

75. These 9 subSAUs are located as follows: in front of the Arno River mouth (ITCWTCD and ITOWTCD); in front of the Tiber River mouth (ITCWLZ and ITOWLZC); close to the Napoli urban agglomeration (ITOWCMC, ITOWCMD, ITCWCMC and ITCWCMD) and SW part of Sardinia Island (ITCWSDWB). The evaluation shows the impact of the Arno and Tiber Rivers, the two main rivers in the area related to their nutrient inputs' contribution. Both the CW and OW are under impacts of the Napoli metropolitan area (4,250,000 residents), whereby the propagation of their effects toward the north is evident due to the water circulation[24]. The local effect of the Oristano lagoon, as anthropogenically heavily impacted area, probably contributes to the weakened classification of CW in SW Sardinia Island.

76. Further to the assessment of the CW in the area of Napoli, the subSAUs ITCWCMC and ITCWCMD can be indicated as in good status. However, it must be recognized that using the 50th percentile for the development of the assessment criteria is not applicable in heavily impacted areas, such as the heavily impacted urban coastal areas. Therefore, an adjustment by using the 25th percentile of the calculated values resulted in the classification of the subSAUs ITCWCMC and ITCWCMD B in non-good status, as also recognized in the existing literature sources.

77. Given the significant quantum of data reported in IMAP IS for the waters of Italy, the assessment results provided by the application of the simplified G/M comparison based on the use of satellite-derived Chl a data were complemented with the assessment results derived from the application of the EQR methodology.

78. The evaluation was possible only at the subSAU level since the SAU wider area of integration does not support the evaluation of different water types which coexist in the same space. Specifically, the water type IIIW cannot be evaluated by applying the EQR methodology, but by providing a simple comparison of the measured concentrations to a threshold. Namely, a five classes scale could not be set for water type IIIW since the discrimination limit between the two contiguous Chla annual G_mean values would not allow for proper and safe classification (Giovanardi et al., 2018). Therefore, the boundary values for WT III are based on the H/G values for WT II. Mixing the assessment methods is not statistically permitted.

79. The results are presented in Table 18 and Figures 20 &21. The 43 subSAUs were evaluated out of the 54 subSAUs. All evaluated subSAUs were in good status with the exception of one (ITCWLZC) located in front of the Tiber River mouth indicating the influence of freshwater input of nutrients in that area. As expected, a more accurate assessment is obtained at the level of monitoring stations. The non-good is confirmed for the Tiber River mouth, both for CW and OW which are under the impact of the Napoli metropolitan area, as well as for CW in SW Sardinia Island close to Oristano lagoon which is an anthropogenically heavily impacted area.

80. The results obtained from an application of the simplified G/M comparison assessment methodology based on the use of satellite-derived Chl a data were confirmed by an application of the EQR methodology based on the in situ Chl a data reported to IMAP IS, both at the level of subSAUs and monitoring stations. This confirms the accuracy of data obtained from the remote sensing for the assessment of EO5.

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[24] Iacono, R.; Napolitano, E.; Palma, M.; Sannino, G. The Tyrrhenian Sea Circulation: A Review of Recent Work. Sustainability 2021, 13, 6371. https://doi.org/10.3390/su13116371

Table 16. Results of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit) for the Italian waters in the Tyrrhenian Sea and part of the CWMS provided at the level of the Spatial Assessment Units (SAUs). Blue coloured SAUs indicate good status.

AZ	SAU	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
CW	CW_ITA_ISL_E	8552	0,123	0,095	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_W	14080	0,141	0,104	0,156	0,079	0,169	**G**
CW	CW_ITA_TYR_N	5771	0,392	0,348	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_S	8772	0,319	0,263	0,395	0,085	1,124	**G**
OW	OW_ITA_ISL_E	24780	0,075	0,074	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_W	30285	0,084	0,083	0,124	0,068	0,098	**G**
OW	OW_ITA_TYR_N	85659	0,114	0,095	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_S	143789	0,088	0,077	0,116	0,061	0,111	**G**
CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/NG threshold)								

Table 17. Result of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit based on satellite derived Chl *a* data) for the Italian waters in the Tyrrhenian Sea and part of the CWMS at the level of the finest Spatial Assessment Units (subSAUs). Blue coloured subSAUs indicate good status. Red coloured SAUs indicate non-good status.

AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	CW_ITA_ISL_E	ITCWSDEA	2259	0,121	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_E	ITCWSDEB	2887	0,109	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_E	ITCWSDEC	3406	0,137	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_W	ITCWSDWA	8314	0,116	0,156	0,079	0,169	**G**
CW	CW_ITA_ISL_W	ITCWSDWB	5766	0,185	0,156	0,079	0,169	**NG**
CW	CW_ITA_TYR_N	ITCWLGA	761	0,616	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLGB	276	0,522	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLGC	143	0,409	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLGD	534	0,253	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLZD	599	0,787	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWTCA	1014	0,43	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWTCB	1311	0,176	0,522	0,085	0,882	**G**

AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	CW_ITA_TYR_N	ITCWTCC	789	0,317	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWTCD	344	1,730	0,522	0,085	0,882	**NG**
CW	CW_ITA_TYR_S	ITCWBCA	64	0,212	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMA	432	0,162	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMB	702	0,275	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMC	801	0,327	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMD	495	1,014	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLBA	572	0,233	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLBB	478	0,198	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLZA	654	0,409	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLZB	1468	0,390	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLZC	844	1,253	0,395	0,085	1,124	**NG**
CW	CW_ITA_TYR_S	ITCWSCA	378	0,322	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWSCB	883	0,178	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWSCC	1001	0,133	0,395	0,085	1,124	**G**
OW	OW_ITA_ISL_E	ITOWSDEA	8730	0,090	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_E	ITOWSDEB	10495	0,066	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_E	ITOWSDEC	5555	0,072	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_W	ITOWSDWA	15955	0,084	0,124	0,068	0,098	**G**
OW	OW_ITA_ISL_W	ITOWSDWB	14330	0,083	0,124	0,068	0,098	**G**
OW	OW_ITA_TYR_N	ITOWLGA	4859	0,126	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLGB	3545	0,109	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLGC	2720	0,112	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLGD	7785	0,105	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLZD	5559	0,141	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCA	13450	0,116	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCB	22405	0,098	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCC	19399	0,098	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCD	5937	0,267	0,143	0,079	0,156	**NG**
OW	OW_ITA_TYR_S	ITOWBCA	1929	0,075	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWCMA	5617	0,074	0,116	0,061	0,111	**G**

AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
OW	OW_ITA_TYR_S	ITOWCMB	11225	0,094	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWCMC	6385	0,123	0,116	0,061	0,111	**NG**
OW	OW_ITA_TYR_S	ITOWCMD	7155	0,171	0,116	0,061	0,111	**NG**
OW	OW_ITA_TYR_S	ITOWLBA	10334	0,075	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLBB	4301	0,071	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLZA	10625	0,099	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLZB	16280	0,100	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLZC	5465	0,202	0,116	0,061	0,111	**NG**
OW	OW_ITA_TYR_S	ITOWSCA	12688	0,090	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWSCB	17915	0,074	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWSCC	33870	0,067	0,116	0,061	0,111	**G**
CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/NG threshold)								

Table 18. Result of the assessment derived by application of the EQR methodology in the Tyrrhenian Sea and CWMS: the Waters of Italy provided at the level of the subSAUs. Blue-coloured subSAUs indicate likely in GES. Red-coloured subSAUs indicate likely in non-GES. Only the evaluated subSAUs are presented. For the present application of the EQR methodology, the following GES/non GES boundary values were applied: $EQR_{normalized}$ <0,62 – non GES; * type IIIW: GM > 0,48 non GES.

AZ	subSAU	CHL_GM/µg L^{-1}	$EQR_{normalized}$	GES/non GES
CW	ITCWCMA	0,131	1,00	**G**
CW	ITCWCMB	0,205	1,00	**G**
CW	ITCWCMC	0,529	0,74	**G**
CW	ITCWCMD	0,705	0,74	**G**
CW	ITCWLGA	0,241	0,99	**G**
CW	ITCWLGB	0,199	1,00	**G**
CW	ITCWLGC	0,247	0,97	**G**
CW	ITCWLGD	0,167	1,00	**G**
CW	ITCWLZA	0,347	0,94	**G**
CW	ITCWLZB	0,637	0,78	**G**
CW	ITCWLZC	0,994	0,53	**NG**
CW	ITCWLZD	0,478	0,69	**G**

AZ	subSAU	CHL_GM/µg L^{-1}	$EQR_{normalized}$	GES/non GES
CW	ITCWSDEA	0,116	1,00	**G**
CW	ITCWSDEB	0,098	1,00	**G**
CW	ITCWSDEC	0,045	1,00	**G**
CW	ITCWSDWA	0,139	0,93	**G**
CW	ITCWSDWB	0,624	0,83	**G**
OW	ITOWCMA	0,117	*	**G**
OW	ITOWCMB	0,151	*	**G**
OW	ITOWCMC	0,279	*	**G**
OW	ITOWCMD	0,260	0,87	**G**
OW	ITOWLBA	0,125	*	**G**
OW	ITOWLBB	0,094	*	**G**
OW	ITOWLGA	0,166	1,00	**G**
OW	ITOWLGB	0,185	*	**G**
OW	ITOWLGC	0,203	0,99	**G**
OW	ITOWLGD	0,195	0,98	**G**
OW	ITOWLZA	0,242	0,98	**G**
OW	ITOWLZB	0,251	0,95	**G**
OW	ITOWLZC	0,200	0,98	**G**
OW	ITOWLZD	0,173	0,63	**G**
OW	ITOWSCA	0,129	*	**G**
OW	ITOWSCB	0,082	*	**G**
OW	ITOWSDEA	0,164	*	**G**
OW	ITOWSDEB	0,170	*	**G**
OW	ITOWSDEC	0,034	*	**G**
OW	ITOWSDWA	0,153	*	**G**
OW	ITOWSDWB	0,217	*	**G**
OW	ITOWTCA	0,129	*	**G**
OW	ITOWTCB	0,138	*	**G**
OW	ITOWTCC	0,119	*	**G**
OW	ITOWTCD	0,295	0,93	**G**

6. Conclusions and Key Findings

<u>The Central Part Sub-division of the WMS: The Waters of France</u>

81. The results of the CI 14 assessment provided by applying the Simplified G/M assessment methodology based on the satellite-derived Chl *a* data are shown by respective colour in Figure 16.

82. The map depicts the acceptable and non-acceptable statuses i.e., good/non-good status assigned at the level of subSAUs set in the French part of the CWMS.

83. As explained above, the good status corresponds to the RC conditions class (column G_NG.oN85 in Tables 10 and 11), as well as to the class between the RC and G/M boundary limit, set as the back transformed 85th percentile of normalized distribution (i.e., blue coloured cells in the last column of Tables 10 and 11), which is depicted in blue coloured SAUs in Figure 15. The likely non-good status corresponds to the class above G/M boundary limit (i.e., red coloured cell(s) in the last column of Tables 11) which is depicted in red coloured SAUs in Figure 16.

84. The results of CI 14 assessment using the satellite-derived Chla data confirm that all assessed zones can be considered in good status, with the exception of 1 out of 46 subSAUs which is in non-good status (i.e., ECO3B). For four subSAUs located in the FRD_E Assessment Zone and two in the Corsica Island assessment zone (FRE), the assessment finding was reconsidered as in good status. In fact, a discrepancy that appeared between national and sub-regional assessments was addressed further to the justification provided by France which is based on i) the presence of WT I in water body DC04; ii) the presence of WT IIIW in water bodies DC06A; DC07I; DC08B; EC01C; EC04B and DC04; iii) the specific national knowledge of the local hydrological and environmental conditions.

85. To the weakened status of a very limited semi-enclosed area in the Corsica Island Assessment Zone (FRE; Gulf of Porto Vecchio), the very low number of pixels integrated into the assessment and the complexity of water properties related to sediment resuspension may be associated with high uncertainty in the mean computation. Along with potential local sources of pollution, the enclosed feature of the Gulf of Porto Vecchio with very low water renewal, are probably the main contributing drivers to the high values of Chl a observed in the area. The results of the present CI 14 assessment in the French part of the CWMS represent only an indication of possible good/non-good status at the level of the subSAUs, whereby subSAUs are not set at the same level of spatial finesse. Namely, the reliability of the assessment was negatively affected by the lack of data reported by the CPs in IMAP IS, and therefore impossibility to use the IMAP NEAT GES assessment as applied to the Adriatic Sea Sub-region.

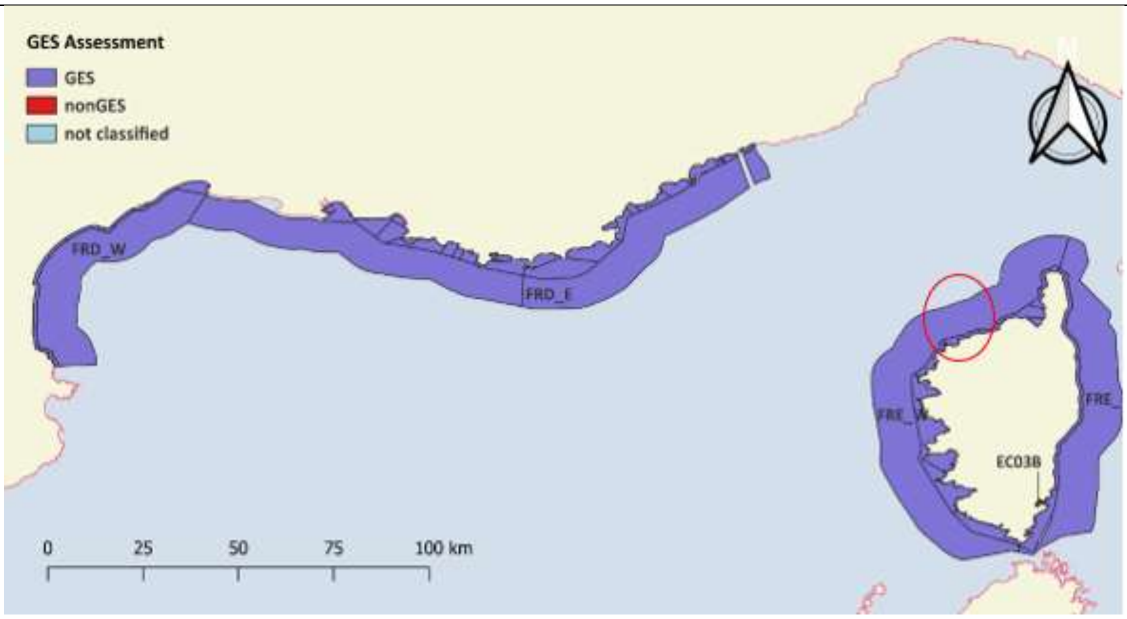

Figure 16: The assessment results for CI 14 in the French waters of the CWMS.

The Alboran Sea and Levantine-Balearic Subdivisions of the WMS: The Waters of Spain

86. The results of the CI 14 assessment provided by applying the Simplified G/M assessment methodology on the satellite-derived Chl *a* are shown by respective colours in Figure 17.

87. The map depicts the acceptable and non-acceptable statuses i.e., good/non-good status assigned at the level of SAUs set in the Alboran Sea and Levantine-Balearic Subdivision of the WMS.

88. As explained above, the good status corresponds to the RC conditions class (column oN10 in Tables 12 and 13), as well as to the class between the RC and G/M boundary limit, set as the back transformed 85th percentile of normalized distribution (i.e., blue coloured cells in the last column of Tables 12 and 13), which is depicted in blue coloured subSAUs in Figure 17. The non-good status corresponds to the class above G/M boundary limit (i.e. red coloured cells in the last column of Table 13) which is depicted in red coloured subSAUs in Figure 17.

89. The results of CI 14 assessment using the satellite-derived Chl *a* data confirm that all evaluated assessment zones can be considered in good status, with the exception of 8 subSAUs set in line with WFD in the CW assessment zone of Spain and located as follows: one subSAUclose to the Mar Menor (ES070MSPF010300030); one subSAU ES080MSPFC017west of Alicante; two subSAUs (ES080MSPFC006 and ES080MSPFC0081) near Valencia; two subSAUs i.e., ES080MSPFC001 and ES100MSPFC32 close to the Ebro River mouth; one subSAU ES100MSPFC3 close to the French border; and one subSAU ES110MSPFMAMCp02 on the Mallorca Island in the Alcudia Gulf.

90. The results of the present CI 14 assessment in the ALB and LEV-BAL Sub-divisions of the WMS represent only an indication of possible good/non-good status at the level of subSAUs, whereby the subSAUs are not set at the same level of spatial finesse. Namely, the reliability of the assessment was negatively affected by the lack of data reported by the CPs in IMAP IS, and therefore impossibility to use the IMAP NEAT GES assessment as applied to the Adriatic Sea Sub-region. The local sources of pollution are probably the main driver contributing to the weakened status of most non-goods subSAUs.

91. Observed non-good status in one subSAU in the Mallorca Island area, where the ranges of observed values are very low (0,05-0,20 µg/L), indicate that the statistics does not always perform acceptable. This suggests using the satellite-data in these areas with caution or different elaboration strategies need to be provided.

92. As it is explained above (Section 4), there is a slight difference between the thresholds calculated from the satellite-derived data used for the present assessment and the assessment criteria calculated from *in situ* measurements, which resulted in the regional assessment findings which do not fully match the eutrophication evaluation performed by Spain by applying the assessment criteria calculated from *in situ* measurements.

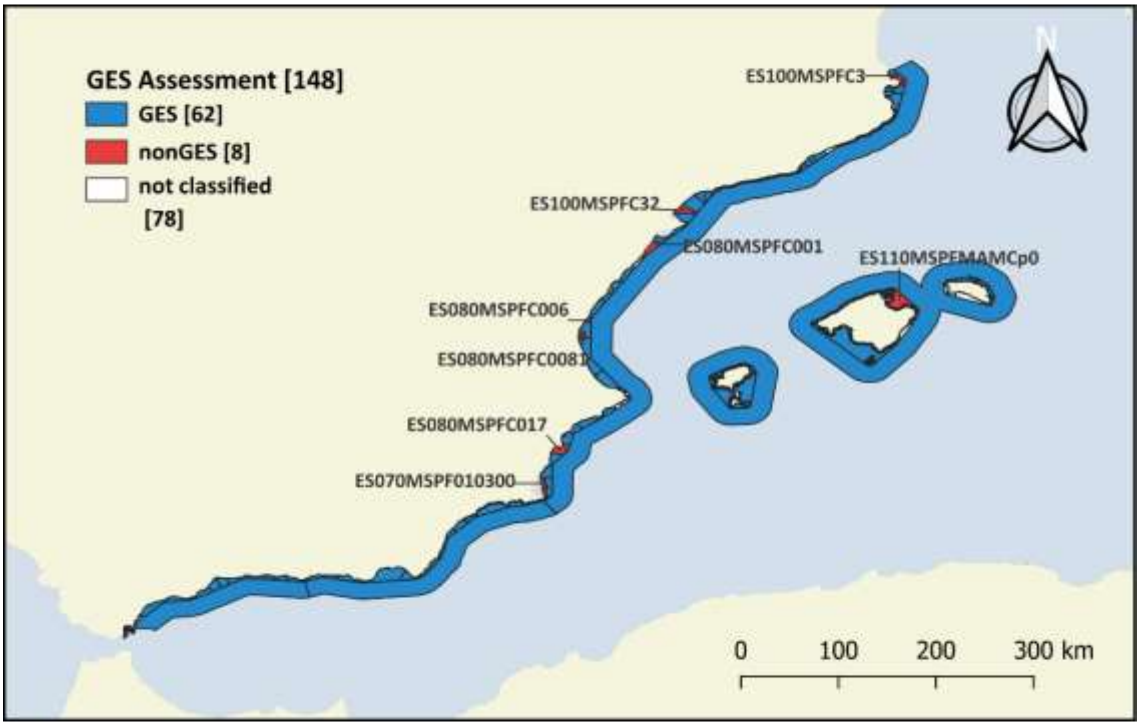

Figure 17: The assessment results for CI 14 in the Alboran Sea and Levantine-Balearic Subdivisions of the WMS.

The Southern Part Subdivision of the WMS: The Waters of Algeria, Morocco and Tunisia

93. The results of the CI 14 assessment provided by applying the Simplified G/M assessment methodology based on the satellite derived Chl *a* are shown by respective colours in Figure 18.

94. The map depicts the acceptable and non-acceptable statuses i.e. good/non-good status assigned at the level of SAUs set in the Southern part of the WMS.

95. The results of CI 14 assessment using the satellite derived Chl *a* data confirm that all zones and SAUs assessed in the Sothern part of WMS can be considered in good status. The non-good status corresponding to the class above G/M boundary limit was not found in the assessment of the Southern part of the CWMS. However, it must be noted that the assessment was impossible at the level of the finest spatial assessment units (subSAUs), as for other sub-divisions in the WMS, therefore, resulting in a less confidential assessment, given the absence of finer water bodies delineation and related water typology characterization.

96. The results of the present CI 14 assessment in the Southern part of the WMS represent only an indication of possible good/non-good status at the level of SAUs, whereby the SAUs are not set at the same level of spatial finesse. Namely, the reliability of the assessment was negatively affected by the lack of data reported by the CPs in IMAP IS, as well as the lack of finer water bodies delineation, and therefore impossibility to use the IMAP NEAT GES assessment as applied to the Adriatic Sea Sub-region.

97. Although the non-good status was not found in the present assessment of the Southern part of the CWMS, some specific examples of drivers and pressures were mapped from the scientific literature. The Oran harbor (Algeria) which receives the discharge of wastewater, while the Ghazaouet harbor is exposed to chemicals coming mainly from industrial activities. In addition, the high rate of urbanization around the harbor contributes to anthropogenic contamination (Kaddour et al. 2021). Algeria also has seawater desalination plants along its shoreline such as the Bousfer desalination plant in Oran Bay and the Beni Saf desalination plant.

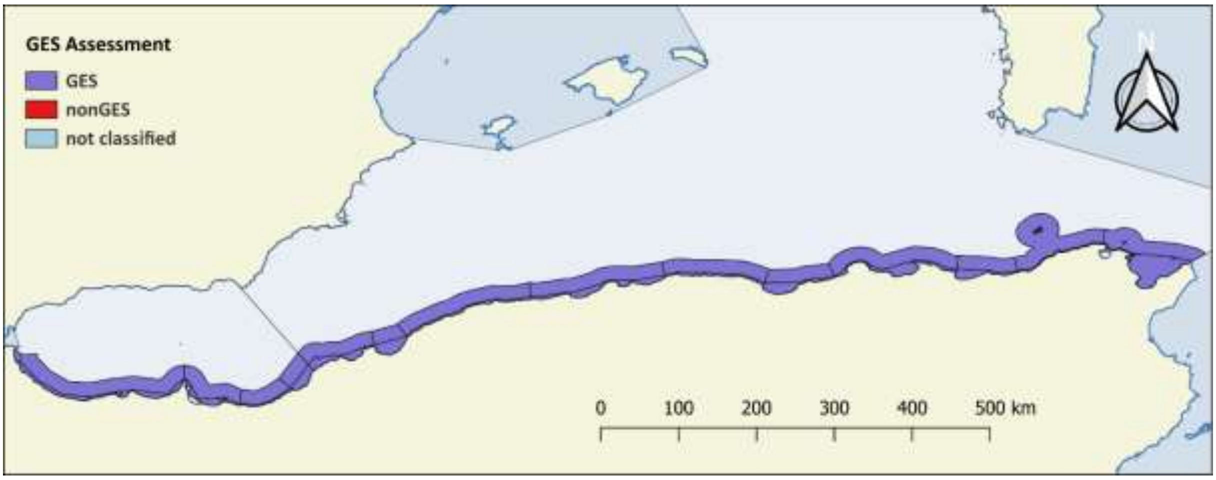

Figure 18: The assessment results for CI 14 in the Southern part of the CWMS.

The Tyrrhenian Sea and part of the CWMS: The Waters of Italy

98. Despite likely good status assigned to the assessment zones in the waters of Italy, there are 9 out of 54 subSAUs that are likely in non - good status (Tables 16, 17 and 18, and Figures 19, 20 and 21). They are located as follows: in front of the Arno River mouth (ITCWTCD and ITOWTCD); in front of the Tiber River mouth (ITCWLZ and ITOWLZC); close to the Napoli urban agglomeration (ITOWCMC, ITOWCMD, ITCWCMC and ITCWCMD) and SW part of Sardinia Island (ITCWSDWB). The evaluation shows the impact of the Arno and Tiber Rivers, as well as the impacts of the Napoli metropolitan area (4,250,000 residents). The weakened classification of CW in SW Sardinia Island is related to the local effect of the Oristano lagoon, as anthropogenically heavily impacted area.

99. In addition, an application of the 25th percentile of the calculated values resulted in the classification of the subSAUs ITCWCMC and ITCWCMD B in non-good status.

100. The above elaborated assessment findings were confirmed by applying both the simplified G/M comparison assessment methodology based on the use of satellite-derived Chl *a* and the EQR methodology based on the in situ Chl *a* data reported by Italy in IMAP IS. This confirms the accuracy of data obtained from the remote sensing for the assessment of EO5.

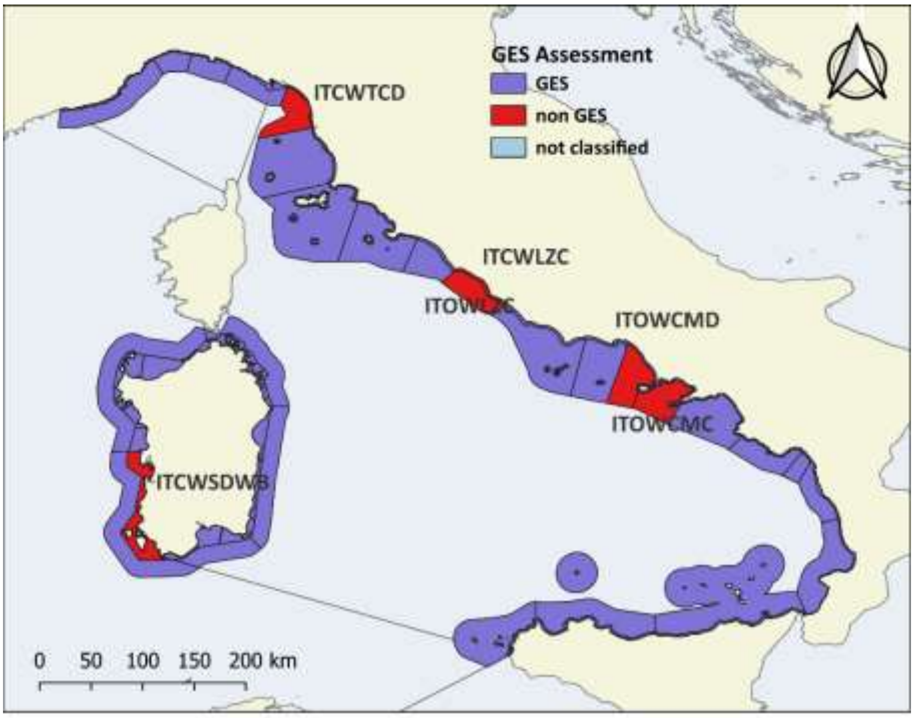

Figure 19: The assessment results for CI 14 in the Italian waters in the Tyrrhenian Sea and the CWMS.

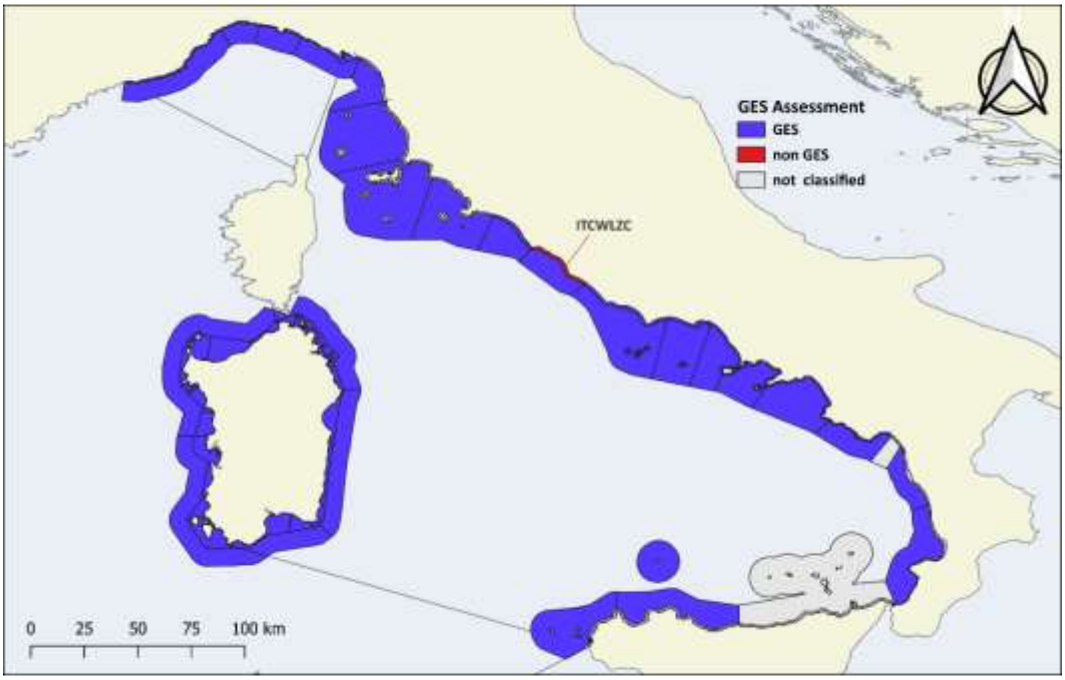

Figure 20: Result of the GES assessment by applying the EQR methodology in the Italian waters in the Tyrrhenian Sea and CWMS at the level of subSAUs.

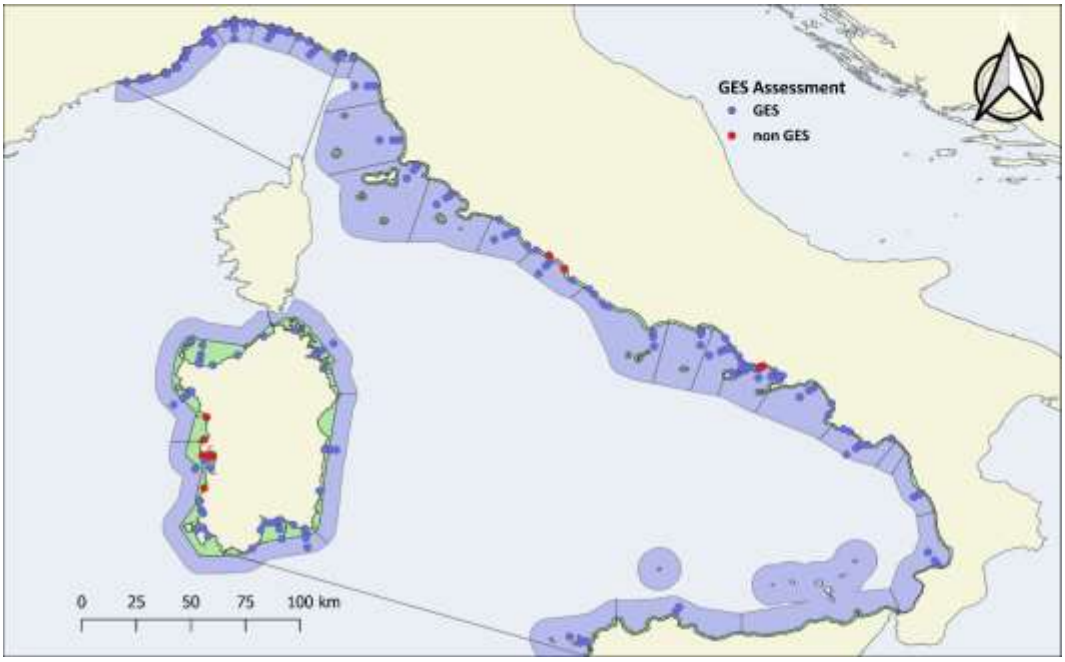

Figure 21: Result of the GES assessment by applying the EQR method for the Italian part of the Tyrrhenian Sea and CWMS at the level of monitoring stations.

101. The assessment results in the Tyrrhenian Sea and CWMS show the accuracy of the assessments based on the use satellite - derived Chl*a* data for assessment of the status of marine environment. This encourages future decision-making regarding inclusion of an additional sub-indicator i.e., a parameter within the monitoring of CI 14. Namely, coupling of satellite-derived Chl *a* data with Chl *a* concentrations *in situ* measured would greatly enhance the IMAP monitoring and assessment.

<u>Interrelation of drivers and pressures, as found in the literature sources, and assessment findings</u>

102. Despite likely good status assigned to the assessment zones, the assessment performed using the finer IMAP sub-SAUs found some sub-SAUs in non-good status. The below findings derived from literature sources support the assessment findings which indicate a few spatial assessment units in non-good status [25].

103. Drivers and pressures with high impact related to eutrophication are found in the WMS[26]. The Spanish Mediterranean coastal zone may be affected by eutrophication mainly due to anthropogenic pressures, like agriculture (e.g., in Ebro Delta, rice field cultivation covers up to 65% of the area resulting in outputs of inorganic nutrients to nearby bays through drainage channels and the IMAP sub-SAUs ES100MSPFC32 in the vicinity was in non-good status), aquaculture, tourism, construction of harbors, intense urbanization, and industrialization. In French Mediterranean coast, the Gulf of Lion is one of the most historically known to be influenced by natural and anthropogenic inputs of nutrients, receiving a large inputs of rural, urbanized, and industrialized discharges through the Rhone River, which is the most important source of water and organic compounds in the Mediterranean Sea

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[25] The present assessment undertaken at the regional level, by using the satellite-derived Chl *a* data, indicates also weakened status in a few assessment areas along the coast of France, however, national authorities found that some regional assessment findings do not fully match the national assessments based on the use of in situ measurements. A presence of non-optimal compatibility of the regional and national assessments was also expressed by the authorities of Spain.

[26] Agriculture (runoff and riverine discharge), Industry (land based sources; industrial wastewater discharge), aquaculture (coastal shellfish and fish farming activities), coastal urbanization and tourism (domestic wastewater discharge), seawater desalination, ports and maritime operations (dredging).

(Tsikoti et al., 2021). A 13 km^2 area in front of the Rhone river plume was assessed as in non-good status due to the combined negative effects of high nutrient and Chl *a* concentrations, and high turbidity (Lefebvre and Devreker, 2020). The northern coasts of the Balearic Archipelago may be affected by the productivity imported from the Gulf of Lion, showing slightly higher concentration in the offshore northeastern waters. Indeed, IMAP sub-SAU ES110MSPFMAMCp02 on the Mallorca Island in the Alcudia Gulf was classified in non-good. In contrast, the southern waters of the Archipelago showed a pattern almost not influenced by the coasts (Gómez-Jakobsen et al., 2022)

104. The Mediterranean Sea hosts around 400 coastal lagoons covering a surface of over 640 000 ha, that are important drivers for regional economies by way of fisheries, aquaculture, tourism. recreation and increased urbanization. Cataudella et al. (2015) presents the reports of Algeria, France, Italy, Spain and Tunisia on their coastal lagoons in the WMS. Many coastal suffer from eutrophication due to nutrient loadings from their watershed. Therefore, by being connected with the adjacent sea via inlets (natural or artificial) the lagoons may exert pressure into the coastal environment (Cataudella et al., 2015; De Wit et al, 2020; Perez-Ruzafa et al., 2010). One example of a well-studied lagoon is the Mar Menor. It is located in the region of Murcia, is relatively shallow (mean depth of 3.6 m) and is isolated from the sea by a 22 km sand coastal barrier (called La Manga) that is crossed by five channels, through which waters are exchanged with the Mediterranean Sea. The drivers and pressures on Mar Menor include tourism and agriculture along its shoreline. The drainage area of the lagoon, known as Campo de Cartagena, is characterized by intensive agriculture, and its southern zone was a very active mining region for hundreds of years, although this area is currently abandoned (Gómez-Jakobsen et al., 2022; Jimeno-Sáez et al., 2020). Further to the above findings based on literature sources, it should also be noted that subSAU. close to the Mar Menor (ES070MSPF010300030) and subSAU ES080MSPFC017 near the Segura River mouth were classified in non-good status.

105. Another example of a well-studied lagoon is the Thau Lagoon. The Thau lagoon is a microtidal and restricted coastal lagoon, connected to the Mediterranean Sea through two permanent inlets, the Sète channel in the north, which is responsible for 90% of sea water exchanges, and the Pisses-Saumes channel in the south. The lagoon covers 68 km^2 and has a mean depth of 4 m. The Vène and Pallas rivers are the two main natural tributaries to the lagoon and contribute more than 50% of total freshwater inflow into the lagoon. Approximately half the watershed's permanent population (about 103,500 inh. in 2015) is located in the city of Sète. Shellfish (Crassostrea gigas and M. galloprovincialis) farming structures cover about 20% of the surface of the water body in three cultivation zones (Marseillan, Mèze and Bouzigues). Up to the 1960s, the increase in anthropogenic inputs, linked to the exponential growth of the human population in the lagoon watershed, has contaminated shellfish farms and caused the eutrophication of Thau lagoon, with significant socio-economic and ecological impacts. Starting from the 1970s and for 40 years, responses have been applied to remediate the lagoon’s environment, such as improvement of the wastewater treatment systems in the watershed, and management actions reducing N and P inputs. The lagoon, which was eutrophic in the 1970s, shifted to a moderately eutrophic state in the 1990s and to a mesotrophic state in the 2000s (Derolez et al., 2020).

106. Specific studies have identified possible drivers and pressures along the WMS. Riverine loads of N and P were mapped for European rivers (Grizzetti et al., 2017). De Wit et al. (2020) mapped the French coastal lagooFlo et al. (2019) mapped the continental pressures (urban, industrial, agriculture and rivers) along the Catalan coast. Campillo et al. (2017) described some of the DPs along the Spanish Mediterranean coast: 1) Areas affected by harbour, urban, industrial activities (Barcelona, Vallcarca, Tarragona, Castellon, Valencia, Cartagena, Malaga and Algeciras) and mining (Portman). 2) Coastal sites situated close to medium-sized urban nuclei (Cadaques, Blanes, Peníscola, Cullera, Almunecar and Fuengirola; 3) Ebro Delta and Peníscola, which come under the influence of the discharges from the River Ebro. Areas far from pollution sources (Guardamar, Calahonda, Torrox, Manilva and Estrecho) and marine protected areas (Medas and Columbretes Islands; La Herradura) were identified as well. The Cartagena coastal zone is pressured by multiple stressors emerging from anthropogenic activities, including an intense commercial and recreational shipping activity, naval military and fishing activities (Martinez-Gomes et al., 2017). ns. In Algeria, the Oran harbor (Algeria)

receives the discharge of wastewaters, while the Ghazaouet harbor is exposed to chemicals coming mainly from industrial activities. In addition, the high rate of urbanization around the harbor contributes to the anthropogenic contamination (Kaddour et al. 2021).

107. The area close to the Napoli urban agglomeration (ITOWCMC, ITOWCMD, ITCWCMC and ITCWCMD) was classified in non-good status. The Gulf of Naples is a marginal basin of the southeastern Tyrrhenian Sea, that is semi-enclosed by the Bay of Pozzuoli in the northern part, the Bay of Naples in the northeastern, and the Gulf of Castellammare in the southeastern part. This area has a heavy commercial and touristic traffic due to harbor of Naples, and a high population density that are a source of municipal and commercial discharges. Moreover, the Gulf of Pozzuoli has intensive fishing as well as mussel cultivation and production facilities (Esposito et al., 2020 and references therein). Due to the general circulation, pollutants from the area may be transported northwards along the coast and affect other areas (Iacono et al., 2021). The same is true for the discharges of the Arno and Tiber Rivers.

108. Mariculture, a pressure causing impacts related to eutrophication is extensive in the WMS, Italy included. For example, large fish farms are present in the Ligurian Sea near Genoa (Mendoza Beltran et al., 2018) and in the Tyrrhenian Sea, Gulf of Follonica, located south of Livorno (Zoli et al., 2023). The latter may influence the classification of sub-SAUs ITCWTCD and ITOWTCD in non-good status.

109. Coastal lagoons may influence water quality of Sardinia, as explained above for other areas of the WMS. The Cabras Lagoon, the largest lagoon in Sardinia, is connected to the Gulf of Oristano via three narrow creeks flowing into the canal and bypassing the Scolmatore, with limited water exchange. However, environmental degradation due to eutrophication, similar to other lagoons in the Oristano Lagoon-Gulf system has been occurring, causing among others, a decrease in fishery activities (Padedda et al., 2019).

Specific pressures

110. Aquaculture: In the Mediterranean Sea, the sea bass (*Dicentrarchus labrax*) and the gilt-head sea bream (*Sparus aurata*) are among the most harvested fishes (Greece, Spain or France). In France, Corsica has had among the highest production for these two species for many years. The impact of fish farms on the surrounding environment is acknowledged, mainly due to the accumulation of organic matter under the cages; but also due to the release of high concentrations of nutrients to the environment. Specifically in Corsica, one large fish farm (producing 850 tons of fish per year) is located at the entrance to the d’Ajaccio Bay and one in Propiano (producing 150 tons of fish per year) (Dubois et al., 2021). It should also be noted that the present regional assessment by using satellite-derived Chl *a* classified one coastal area of assessment along the northern part Corsica coast in non-good status (sub SAU EC03B close to Golfe de Porto Vecchio).

111. Seawater desalination: Spain has more than 700 small and medium size desalination plants concentrated in its’ southern and eastern shores and in Spain. Algeria has large seawater desalination plants, such as the Bousfer desalination plant in Oran Bay and the Beni Saf desalination plant. As of 2013, 31% of the desalination effort in the Mediterranean was concentrated in Spain and 20% in Algeria. Morocco and Tunisia also desalinate seawater, but in a much lesser scale (UNEP/MAP, 2017).

Annex I

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