Assessment of Trace metals in sediments of the CEN

479. Data for TM were available for 26 stations: 22 from Malta with all three TM (Cd, Hg and Pb) and 4 from Greece with Cd and Pb only. Most stations (23) were classified in high status (Figure 3.1.4.2.1.C). One station, in the IONS offshore, was classified in moderate status due to the concentration of Cd. Two stations were classified in poor status due to the high concentrations of Hg and Pb. These two stations were located at the Port il- Kbir off Valetta, an area affected by industrial plants and marine traffic.

480. Although most of the stations (88%) were in-GES, it is not possible to classify the Sub-region nor the sub-division as a whole. Twenty-two sampling stations were located along the coast of Malta (CENS), 2 on the offshore area of the IONS and 2 on the offshore of the CENS. Due to the uneven distribution of the stations, it is not possible to assess an environmental status to the whole sub-region regarding TM in sediments.

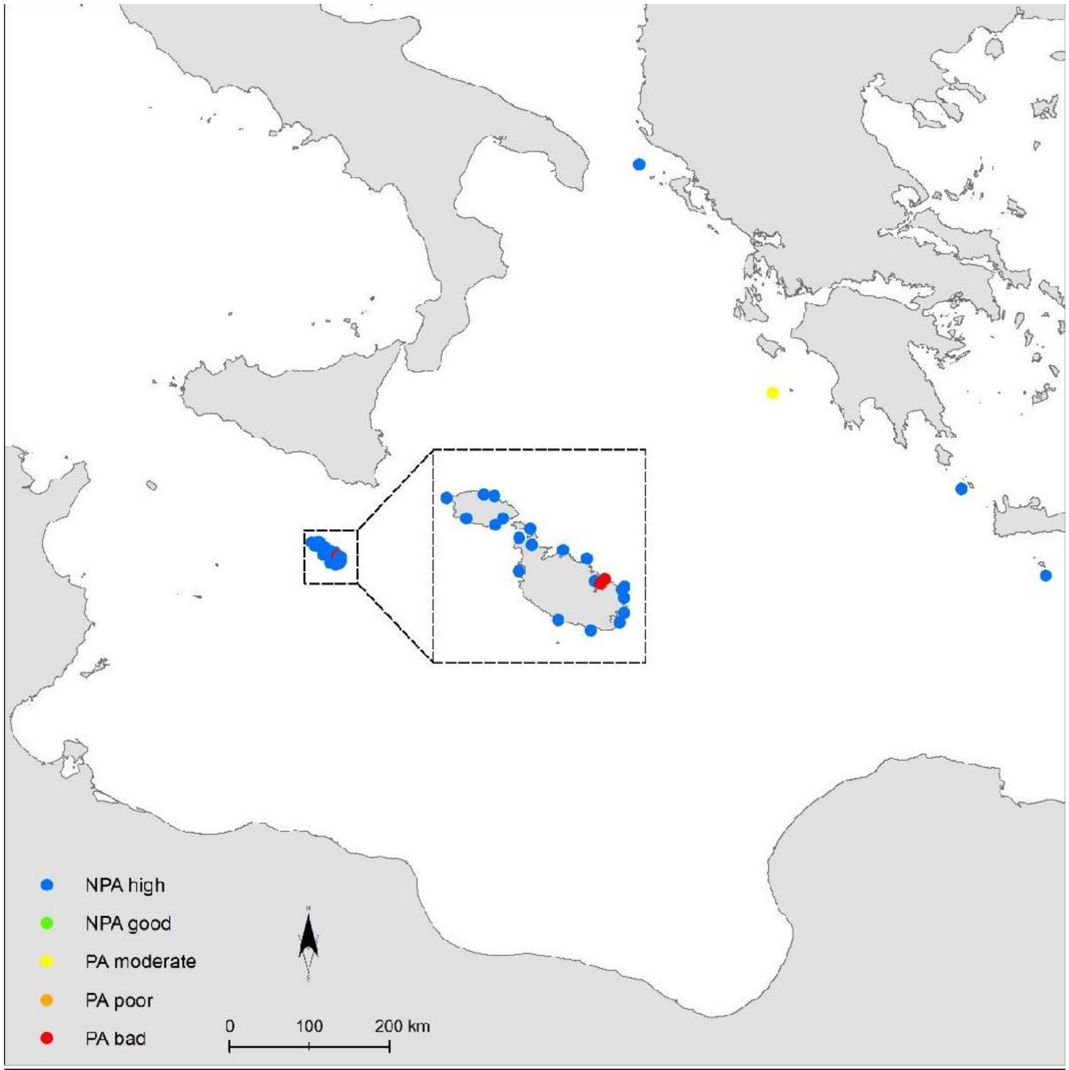


Figure CEN 3.1.4.2.1.C. Results of the CHASE+ approach to assess the environmental status of TM in sediments in the CEN, using MED_BACs as thresholds. Stations in blue - NPAhigh (CS=0.0-0.5); stations in green- NPAgood (CS =0.5-1.0); Stations in yellow- PAmoderate (CS =1.0-2.0); stations in brown - PApoor (CS =2.0-5.0) and stations in red - PAbad (CS > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES. The coastal area of Malta was enlarged to improve visibility and clarity (i.e. area delimited by broken line).

Assessment of Σ_{16} PAHs and of Σ_5 PAHs in sediments of the CEN

481. *Σ_{16} PAHs in sediments* were available only for 21 stations in Greece (20 in the IONS, 1 in CENS) and 5 stations in Tunisia (CENS)[93]. All the stations in Tunisia were classified in-GES and assigned a high environmental status. Out of the 21 stations reported by Greece, 12 stations (52%) of the stations were in-GES and 10 were non-GES (48%), with 4 stations in moderate status, 5 stations in poor status

[93] Jebara et al., 2021

and 1 station in bad status (Figure 3.1.4.2.2.C). The non-GES stations were located along the eastern Ionian coast, in the Gulf of Patras and the Gulf or Corinth, with 4 stations in poor status and one station in bad status in Kerkyraiki.

482. In brief, due to the lack of data it was impossible to classify the environmental status of the CENS sub-divisions nor of the CEN Sub-region for Σ_{16} PAHs in sediments. Non-GES stations were located in the Gulf of Patras, Gulf or Corinth and in Kerkyraiki.

483. *Σ_5 PAHs in sediments* were available only for 21 stations in Greece (20 in the IONS, 1 in CENS) and 25 stations in Malta (CENS). The classification of the stations reported by Greece were better using Σ_5 PAHs compared to Σ_{16} PAHs: 16 stations (76%) of the stations were in-GES and 5 were non-GES (24%), with 3 stations in moderate status, 2 stations in poor status and no station in bad status. Non-GES stations were located in the Gulf of Patras, Gulf or Corinth and in Kerkyraiki. Out of the 25 stations reported by Malta, 15 stations (60%) of the stations were in-GES and 10 were non-GES (24%), with 2 stations in moderate status, 4 stations in poor status and 4 stations in bad status (Figure CEN 3.1.4.2.3.C). The non-GES stations were located at the north-eastern and south-eastern part of Malta, in particular two stations were located at the Port il- Kbir off Valetta, an area affected by industrial plants and marine traffic, and impacted by TM in sediments as well, as explained for Trace metals. Two additional stations in bad status were located at the Operational Wied Ghammieq, affected by industrial plants. However, due to the lack of data and uneven distribution of the stations it was not possible to classify the environmental status to the whole sub-division nor the sub-region with respect to Σ_5 PAHs in sediments. It must also be noted that in the absence of data reported for Σ_{16} PAHs, as mandatory parameter, these initial findings were provided as indicative for Σ_5 PAHs, as non-mandatory parameter reported by the two CPs.

484. In brief, due to the lack of data and uneven distribution of the stations it was impossible to classify the environmental status of the whole sub-division nor the sub-region with respect to Σ_5 PAHs in sediments. Stations with non-GES status were located in Port il- Kbir off Valetta, Operational Wied Ghammieq, in the Gulf of Patras, Gulf or Corinth and in Kerkyraiki.

Assessment of Σ_7 PCBs in sediments of the CEN

485. Σ_7 PCBs in sediments were available only for 5 stations in Tunisia (CENS)[94]. Four of the stations were classified in-GES, in good status while only one, Chebba, was classified as non-GES, in moderate status. Concentrations of all individual PCBs were higher at the location of Chebba than those from other locations, which could be linked to the discharge of wastewater from the neighboring fishing port in this area (Jebara et al., 2021).

486. The meagre data on Σ_7 PCBs in sediments in the CEN does not allow for the regional assessment of the CEN nor of its sub-divisions.

[94] Jebara et al., 2021

Assessment of Organochlorinated contaminants other than Σ_7 PCBs in sediments of the CEN

487. Malta reported the concentration of hexachlorobenzene in sediments, one of the mandatory organochlorine contaminants, for 22 stations. All the concentrations were below the detection limit of 0.05 µg/kg dry wt.

488. Given only Malta reported the concentration of hexachlorobenzene in sediments, one of the mandatory organochlorine contaminants, only this compound could not be used for GES assessment.

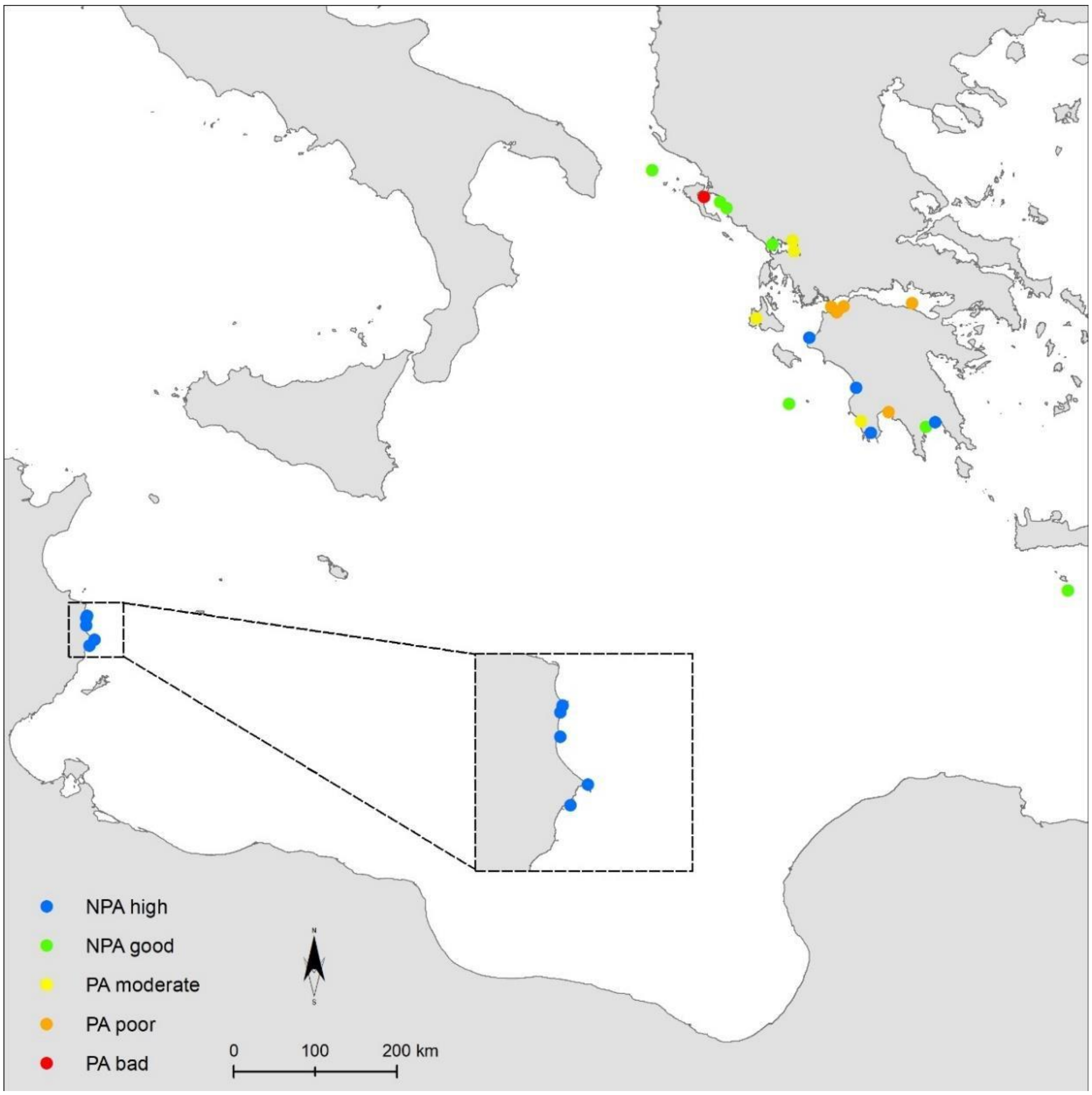


Figure CEN 3.1.4.2.2.C. Results of the CHASE+ approach to assess the environmental status of Σ_{16} PAHs in sediments in the CEN, using MED_BACs as thresholds. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES. Part of the coastal area of Tunisia was enlarged to improve visibility and clarity (i.e. area delimited by broken line).

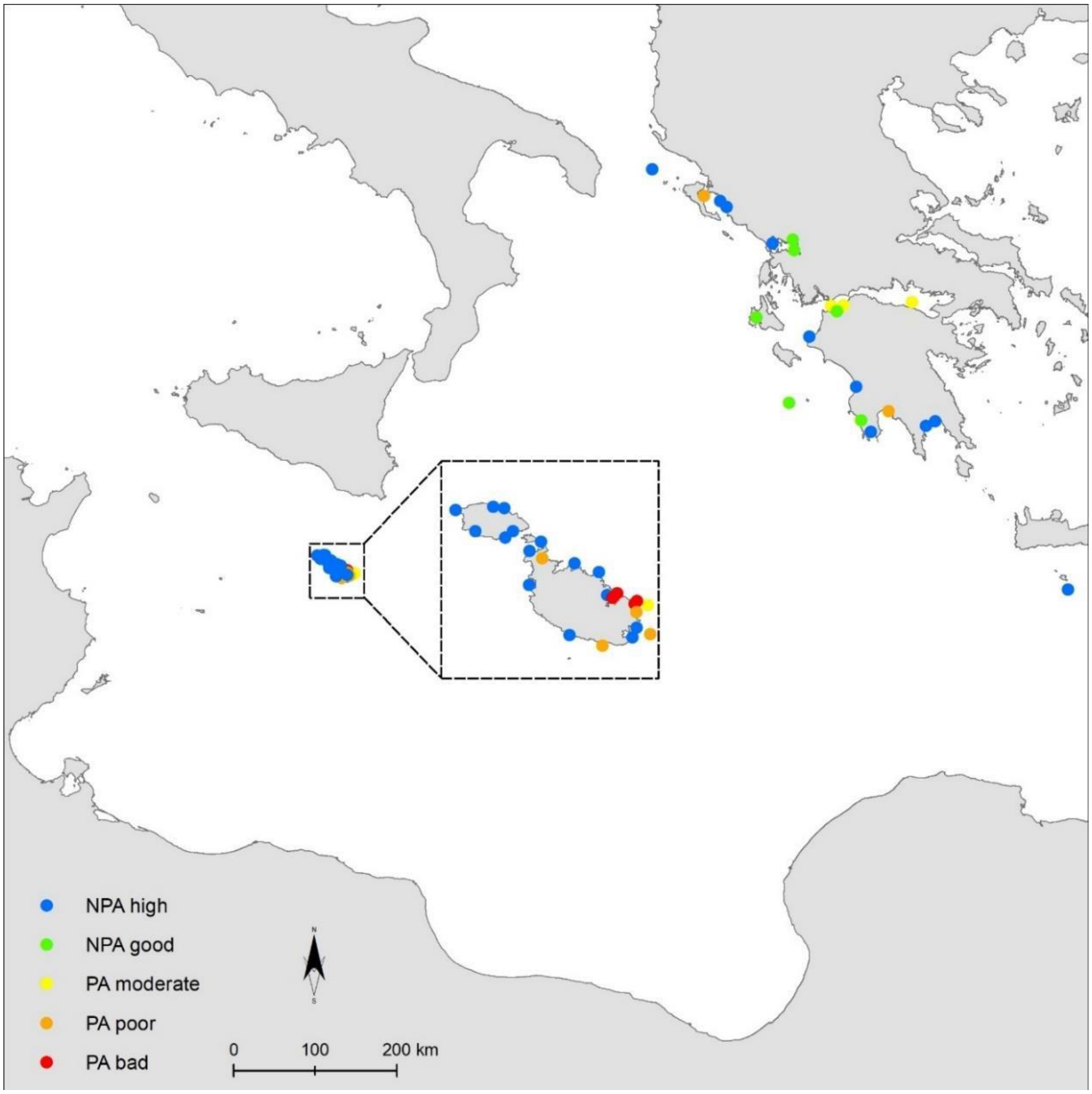


Figure CEN 3.1.4.2.3.C. Results of the CHASE+ approach to assess the environmental status of Σ_5 PAHs in sediments in the CEN, using MED_BACs as thresholds. Criteria for Σ_5 PAHs were not adopted in Decisions IG.22/7 and IG.23/6 (COP 19 and COP 20) and not addressed in UNEP/MED WG. 533/3. Here we used the sum of the individual BAC values as provided for the 5 PAHs compounds in UNEP/MED WG. 533/3 as Σ_5 PAHs_BAC. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green-NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES. The coastal area of Malta was enlarged to improve visibility and clarity (i.e. area delimited by broken line).

Assessment of Trace metals in biota of the CEN

489. *M. barbatus*: Cd and Pb in all the 5 samples for which Malta reported data were below the detection limit (100 and 250 for Cd and Pb, respectively). The detection limits were much higher than the MED_BACs for these metals in *M. barbatus* (Table 3.1.4.2.2.). Hg in all the 5 samples were non-GES, with 3 samples classified in moderate status, one in poor status and one in bad status.

490. *M. galloprovincialis*. Data were available only for Italy (EMODNet). All the 8 samples were in-GES, 7 classified in high status and one in good status .

491. The meagre data on biota for the CEN does not allow for the regional assessment of the CEN nor of its sub-divisions.

2.1.1.2 The IMAP GES assessment of the Adriatic Sea Sub-region (ADR)

492. The integration and aggregation rules were elaborated in the context of the NEAT tool application for GES assessment of IMAP Common Indicator 17 in the Adriatic Sea Sub-region, including optimal temporal and spatial integration and aggregation of the assessment findings within nested approach agreed for IMAP implementation. The GES was assessed by applying the NEAT tool on the Adriatic nested scheme. The Contaminants' data were aggregated and integrated per habitat (sediments, mussels) while the various levels of spatial integration (nesting) are provided to ensure scaling of the assessment findings i.e., integration of the assessment findings to the level that is considered meaningful for CI 17. The NEAT IMAP GES Assessment methodology was applied on the spatial scope of the finest areas of assessment and the areas of assessment nested to the levels of integration that are considered meaningful.

NEAT is a structured, hierarchical tool for making marine status assessments (Berg et al., 2017; Borja et al., 2016), and freely available at www.devotes-project.eu/neat. The use of NEAT is not limited to the assessment of biodiversity but can be used for assessment of pollution impact. The analysis provides an overall assessment for each case study area and a separate assessment for each of the ecosystem components included in the assessment. The final value has an associated uncertainty value, which is the probability of being determinative in a certain class status (GES - nonGES) (Uusitalo et al., 2016). Essentially, the final assessment value is calculated as a weighted average. The weighting factors are based on the respective surface of the areas and are combined with the respective monitoring data for the indicator/chemical contaminant in question. The total weight of a SAU is not the simple ratio of each SAU area to the total area of the parent SAU. The process of distributing the weight is more complex. SAU weighting by the NEAT tool has two options: i) do not weight by SAU area: weights are calculated based just on the nesting hierarchy of the SAUs; ii) weight by SAU area: weights are calculated based on the nesting hierarchy and the SAU surface area. For the present assessment the option ii) was followed.

The IMAP NEAT GES assessment methodology was tested, and thereafter applied, first to the assessment of contaminants (CI 17), and then to chl*a* (CI 13) and nutrients (CI 14) in the Adriatic Sea Sub-region. The first step in implementing the nested approach was the delimitation of the areas of assessment within the Adriatic Sea Sub-region and later on within the Western Mediterranean Sub-region based on the areas of monitoring defined by concerned Contracting Parties, along with the harmonization of the scales approach between the Contracting Parties (CPs) i.e., scaling up the marine assessment to sub-regional and regional scales within the integration process as required under IMAP. The definition of the areas of assessment is undertaken as indicated in IMAP by applying relevant criteria, e.g. representativeness/importance of the areas of monitoring for establishing areas of assessment; presence of impacts of pressures in monitoring areas; sufficiency of quality assured data for establishing the areas of assessment covering as many as possible IMAP Common Indicators to the extent possible, and ensuring that adequate consideration is given to the risk based principle (both in pristine areas and areas under pressure). The existing monitoring and assessment areas defined by the concerned CPs were used, in case they were compatible with IMAP requirements; in case inconsistency appeared, the necessary adjustments were undertaken.

The IMAP Spatial Assessment Units (SAUs) were defined in the 3 steps approach per each of the Adriatic countries separately; afterward, their nesting within three sub-divisions of the Adriatic Sea sub-region was undertaken i.e., in the North, Central and South Adriatic. Following the methodology applied in the Adriatic Sea Sub-region, the same approach was applied to the Western Mediterranean Sub-region. For the step of nesting, the areas of assessment were first classified under the 3 sub-divisions of the Western Mediterranean Sea (i.e. ALBS, CWMS, TYRS). Relevant geographical information in the form of GIS-based layers were coupled, along with application of the rules of integration and aggregation.

In order to assess the uncertainty in the final assessment value, the standard error/ standard deviation of every observed indicator value is used (Borja et al., 2016). Therefore, the standard deviation values as obtained from the monitoring data play a major role in the uncertainty associated with the final assessment result. This emphasizes the importance of the standard deviation for the accuracy and evaluation of the final assessment result. The NEAT approach ensures that a balance is achieved between a too broad scale, that can mask significant areas of impact in certain parts of a region or subregion, and a very fine scale that could lead to very complicated assessment processes.

Available data

493. Data on contaminants (Cd, Hg, Pb, PAHs and PCBs) have been collected from all Contracting Parties bordering the Adriatic Sea for the years 2015 to 2021, except from Bosnia and Herzegovina[95] that does not monitor contaminants in marine environment. Details on the temporal and spatial availability of data per IMAP SAUs, per environmental matrix (sediments, biota) and per contaminants group (trace metals (TM), PAHs, PCBs) are provided here-below in Table 3.1.4.3.1 .The spatiotemporal coverage varies largely among the various IMAP SAUs. Sediments stations have in general higher spatial coverage. For some IMAP SAUs data are not existent or correspond to only 1 or 2 stations sampled once. Trace metals in sediments are monitored in the highest number of stations (205) and all SAUs have at least one station sampled once, followed by PAHs stations (125) and PCBs (59). The Central Adriatic subdivision is the least monitored for PAHs in sediments while it is not at all monitored for PCBs in sediments. All monitoring stations for biota refer to samplings of the mussel species, *Mytilus galloprovincialis*, therefore no data on organic compounds are available for fish matrix. Regarding the spatial coverage of monitoring stations for biota this is by far lower than that in sediments. Trace metals are monitored in 64 stations, PAHs in 29 and PCBs in 38. Contaminants' data in fish were scarce, reported only for trace metals in 27 stations in Croatian waters and 4 stations in Montenegrin waters. In addition, not always the same fish species was sampled making comparisons and harmonized assessment difficult.

494. A set of criteria was applied to propose the scope of the areas of monitoring. To better understand differences in the spatial coverage of the SAUs the ratio of number of stations to surface of the area (no of stations/km^2) is calculated. This ratio was calculated to support application of the criteria related to representativeness of the areas of monitoring for establishing areas of assessment. It is understood that the highest the ratio, the better the spatial coverage. However, in areas with limited presence of pressures a low ratio may be equally suitable for the purposes of a sound assessment. For this reason, the calculated ratios are only indicative and comparisons among them should be made keeping in mind the specific features of the SAUs. On the Adriatic sub-division level, the North Adriatic Sea is better covered by monitoring stations. Further to this criterion, the spatial distribution of monitoring

[95] Bosnia and Herzegovina has not been included in the present GES assessment due to lack of data on contaminants, however IMAP SAUs were set for this CP

stations and its comparison with the sufficiency of quality-assured data as collated for NEAT application were analyzed, i.e., the spatial coverage of monitoring data collected per each SAU in the Adriatic Sea and per environmental matrix (sediments, biota) and per contaminant group (trace metals (TM), PAHs, PCBs) separately. Table 4.3.2.1. provides the temporal coverage of monitoring data used again per each SAU in the Adriatic Sea and per environmental matrix (sediments, biota) and per contaminant group (trace metals (TM), PAHs, PCBs) separately.

Table 3.1.4.3.1. Data availability per year and country for the assessment of EO 9 – CI 17 (contaminants) in the Adriatic Sea (ADR) Sub-region, as available by up to 31st Oct 2022.

Source	**IMAP-File**	**Country**	**Year**	**Cd**	**Hg**	**Pb**	**Σ_{16} PAHs**	**Σ_{5} PAHs**	**Σ_{7} PCBs**	**Lindane**	**Dieldrin**	**Hexachlorobenzene**	**p.p' DDE**
Sediment													
IMAP_IS		Albania	2020	6	6	6		6					
IMAP_IS	520	Croatia	2017	37	37	37							
IMAP_IS	520	Croatia	2019	30	30	30							
IMAP_IS	652	Greece	2018	1		1	1						
IMAP_IS	457	Italy	2016	42	42	42	23	38	38	52		52	
IMAP_IS	457	Italy	2017	40	40	40	14	30	22	41		41	
IMAP_IS	457	Italy	2018	24	24	24	14	17	16	30		30	
IMAP_IS	457	Italy	2019	11		26				26		10	
EMODNet		Italy	2016	90	72	97							
EMODNet		Italy	2017	74	61	80							
MED POL		Montenegro	2016	5	5	5							
MED POL		Montenegro	2017	15	15	15							
MED POL		Montenegro	2018	6	6	6	6						
IMAP_IS		Montenegro	2019	29	29	29	29	29	29	12	29	29	29
IMAP_IS		Montenegro	2020	12	12	12	12	12	12	12	12	12	12
IMAP_IS		Montenegro	2021	19	19	19							
MED POL		Slovenia	2016				7	7					
IMAP_IS	204,657	Slovenia	2019	5	5	5	5	5	5	5	5	5	5
M. galloprovincialis													
IMAP_IS	520	Croatia	2019	19	19	19			19				
IMAP_IS	520	Croatia	2020	18	16	18							
IMAP_IS	460	Italy	2016	8	15	8		4		8		15	
IMAP_IS	460	Italy	2017	10	18	10		11		10		18	
IMAP_IS	460	Italy	2018	8	19	8		8		12		16	
IMAP_IS	460	Italy	2019		7							7	
EMODNet		Italy	2016		15								
EMODNet		Italy	2017		19								
EMODNet		Italy	2018		2								
MED POL		Montenegro	2018	8	8	8	8						
IMAP_IS		Montenegro	2019	10	10	10	11	11	11				
IMAP_IS		Montenegro	2020	10	10	10	10	10	10				
MED POL		Slovenia	2017	3	3	3							
IMAP_IS		Slovenia	2018	3	3	3							
IMAP_IS	204,657	Slovenia	2019	3	3	3	3	3					
IMAP_IS	439,658	Slovenia	2020	3	3	3	3	3					
IMAP_IS	656	Slovenia	2021	3	3	3	3	3					
M. barbatus													

Source	IMAP-File	Country	Year	Cd	Hg	Pb	Σ_{16} PAHs	Σ_5 PAHs	Σ_7 PCBs	Lindane	Dieldrin	Hexachlorobenzene	p.p' DDE
IMAP_IS	520	Croatia	2019	1		1							
IMAP_IS	520	Croatia	2020	10	10	10							
MED POL		Montenegro	2018	8	8	8							

495. For the application of the NEAT software, data on contaminants were grouped per parameters, ecosystem components (i.e. for the purpose of present NEAT application these are considered biota and sediment matrixes) and SAUs in all the Adriatic sub-divisions (NAS, CAS, SAS). Average concentrations (arithmetic means) and their respective standard errors were then calculated in the respective groups.

Arithmetic mean concentration: $C = \frac{\sum_{i=1}^{n} C_i}{n}$,

Standard Deviation: $SD = \sqrt{\frac{\sum_{i=1}^{n}(C_i - C)^2}{n-1}}$,

Standard Error : $SE = \frac{SD}{\sqrt{n}}$

where, C is the average (arithmetic mean) concentration for each SAU, C_i is the individual contaminant concentration measured in each station/date in the SAU, and n is the total number of concentration records for each SAU; SD is the sample standard deviation for a specific contaminant and SAU and SE is the standard error for a specific contaminant and SAU.

496. Several records on PAHs and PCBs individual compounds were reported as below detection limit values (DL) or were left blank. In a separate technical paper, prepared by MED POL in consultations with OWG EO9, it was recommended to incorporate into the BC and BAC calculations of the BDL values and not to exclude them[96]. For the present application of NEAT these cases were substituted by the BDL/2 value, given a rather small quantum of data available, this does not influence the calculation of the assessment findings. In the Slovenian data, the BDL values were left blank so these were substituted by a value equal to 1µg/kg which corresponds to the average BDL/2 value from the whole data set. Furthermore, due to this fact, but also considering the list of substances the monitoring of which is mandatory according to IMAP[97], the sum of the 16 EPA compounds (Σ_{16}PAHs) and sum of the 7 PCBs compounds (Σ_7PCBs) was taken into account for the present assessment. In this way the assessment results show the cumulative impact by each of these two groups of contaminants. A detailed data matrix was prepared and used for the NEAT software application.

The integration of the areas of assessment and assessment results by applying the 4 levels nesting approach

497. Following the rules of integration of assessments within the nested approach, for the assessment of EO9 Common Indicators, the coastal monitoring zone is equal to the respective assessment zone as

[96] In a separate technical paper, prepared by MEDPOL in consultations with OWG on Contaminants, it was suggested to 'replace BDL values with a fraction of the reported value. The fraction could be 1 (BDL value), 0.5 (BDL/2), 0.7 (BDL/SQRT(2)), other' and not exclude BDL values from BC calculation. The decision to replace BDL with the reported value or a fraction of it should be based on the available data and expert evaluation. Italy, Spain and France supported the use of LOD/2 or LOQ/2 in the BCs calculation. Israel pointed out that the US- EPA suggests this only when less than 15% of data is BDLs. Therefore, the calculation for the assessment criteria was performed with the reported value and not half of it. This is because the wide range of BDL values for a specific contaminant in a specific matrix, depending on the country and it varies even within the country.

[97] According to IMAP i.e. IMAP Guidance Fact Sheet and Data Dictionaries for IMAP CI 17, monitoring of the sum of 7 PCB congeners: 28, 52,101,118,138,153 and 180 and sum of 16 US EPA PAHs is considered mandatory.

defined for the purposes of the present work. For the offshore zone, monitoring areas may be representative of broader assessment areas beyond territorial waters and in these cases the offshore monitoring areas are not necessarily equal to the offshore assessment areas. The stations positioned within the offshore zone are considered representative of a wider offshore area, as officially declared by the countries.

498. In the absence of declared areas of monitoring by all the concerned CPs, following the rationale of the IMAP national monitoring programmes and distribution of the monitoring stations, as well as the NEAT assessment methodology, the two zones of areas of monitoring are defined for the purposes of the present work: i) the coastal zone and ii) the offshore zone.

499. Detailed explanation on data sources used and methodology followed for setting of the two zones (coastal and offshore) is provided for the purpose of the present work. In summary, GIS layers collected from different sources (International Hydrographic Organization - IHO, European Environment Information and Observation Network - EIONET, VLIZ Maritime Boundaries Geodatabase) by the MEDCIS project were used for the present work for Slovenia, Croatia and Italy; for Albania, Montenegro and Greece these data were not accurate or do not include the relevant information and therefore were replaced/corrected in line with relevant national sources i.e. results of GEF Adriatic Project and provisions of relevant national legal acts. The MEDCIS work takes into consideration the existence of bays and inlets which are numerous in particular in the east part of the Adriatic Sea and calculates the baseline using the straight baseline method by joining appropriate points.

500. For IMAP CI 17, integration of assessments up to the subdivision level is considered meaningful. Therefore, the three main subdivisions of the Adriatic Sea, namely, North, Central and South Adriatic (NAS, CAS, SAS) have been chosen following the specific geomorphological features as available in relevant scientific sources (e.g. bottom depths and slope areas, existence of deep depression, salinity and temperature gradient, water mass exchanges) (Cushman-Roisin et al., 2001). The coverage of the 3 sub-divisions is shown in Figure 3.1.4.3.1.

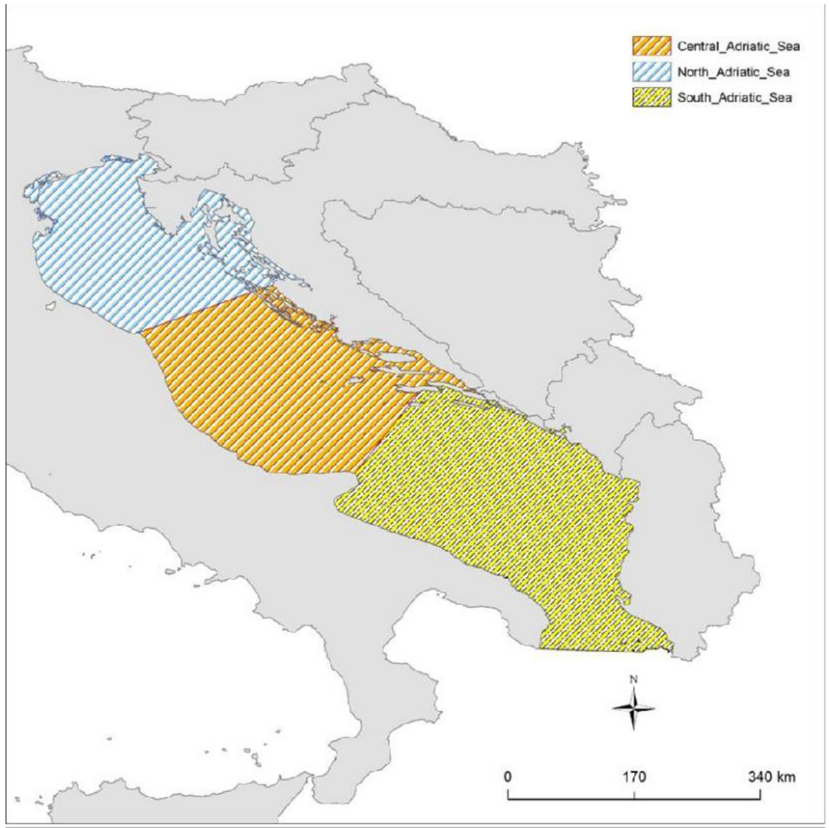


Figure 3.1.4.3.1. The 3 subdivisions of the Adriatic subregion defined based on Cushman-Roisin et al. (2001).

501. The four following steps for integration of the areas of assessment was followed to accomplish the objectives of the NEAT IMAP GES Assessment :

- Step 1 "Defining coastal and offshore waters";
- Step 2 "Recognizing scope of IMAP areas of monitoring";
- Step 3 "Setting IMAP area of assessment":
- Step 4 "Nesting of the areas of assessment within application of NEAT tool" by applying the 4 levels nesting scheme where 1st level is the finest and 4th level is the highest:
  - 1st level provided nesting of all national IMAP SAUs & sub-SAUs within the two key IMAP assessment zones per country, i.e. coastal and offshore zones;
  - 2nd level provided nesting of the assessment areas set in the key IMAP assessment zones i.e. coastal and offshore zones, on the sub-division level i.e. i) NAS coastal, NAS offshore; ii) CAS coastal, CAS offshore; iii) SAS coastal, SAS offshore);
  - 3rd level provided nesting of the areas of assessment within the 3 sub-divisions (NAS, CAS, SAS);
  - 4th level provided nesting of the areas of assessment within the Adriatic Sea Sub-region

502. Similarly, the integration of the assessment results is conducted following the 4 levels nesting approach:

- 1st level: Detailed assessment results provided per sub-SAUs and SAUs;
- 2nd level: Integrated assessment results provided per i) NAS coastal (NAS-1), NAS offshore (NAS-12); ii) CAS coastal (CAS-1), CAS offshore (CAS-12); iii) SAS coastal (SAS-1), SAS offshore (SAS-12);
- 3rd level: Integrated assessment results provided per subdivision NAS, CAS, SAS;
- 4thlevel: Integrated assessment results provided for the Adriatic Sea Sub-region.

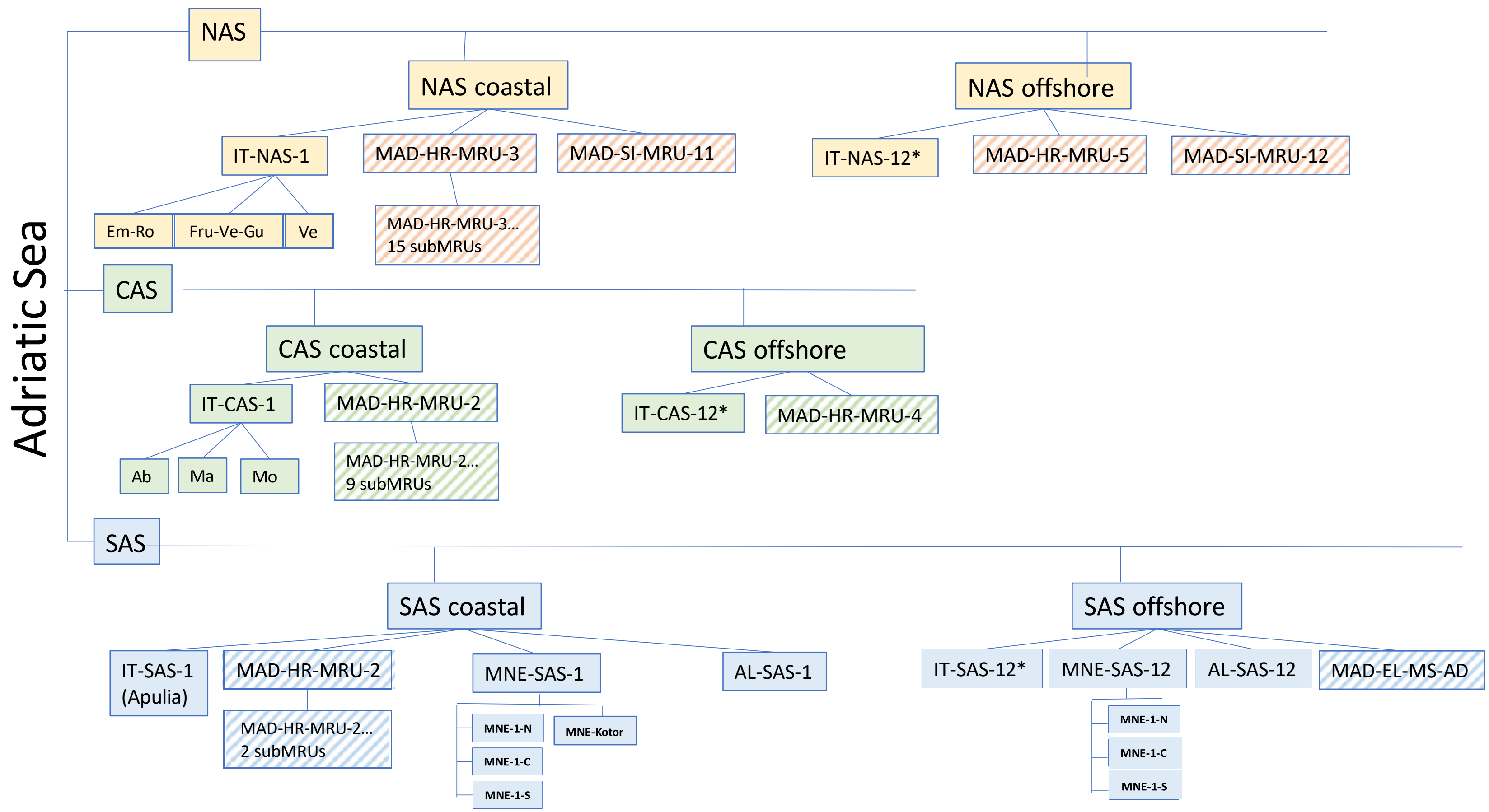
503. The graphical depiction of this nesting scheme is shown in Figure 3.1.4.3.2. .

504. Further to spatial analysis of the monitoring stations distribution, along with recognition of corresponding monitoring and assessment areas, as well as optimal nesting of the finest areas of assessment, , the scope of all Adriatic SAUs and subSAUS were defined. All of them were introduced in the NEAT tool along with their respective codes and surface area (km^2).

505. Within each SAU under 'habitats' the sediments and biota are introduced. Under 'ecosystem component' the 5 chemical compounds of EO9/CI17 are assigned. For each SAU and 'Ecological Component' (EO9 contaminants in our case) and 'Habitat' (sediments, biota), average value and standard deviation per chemical compound is inserted.

506. The use of NEAT tool requires two boundary limit values for the best and worse conditions (these are not threshold values but the minimum and maximum values that determine the scale of the assessment) and one threshold value for the GES – non GEs status. For the present analysis, the two boundary limit values are: i) zero contaminant concentration for the best conditions; ii) the maximum concentration of contaminants used for the present analysis for the worse conditions.

507. These boundary limits are mandatory by the tool which then produces five status classes linearly, depending on the distance of the concentrations from the two boundary limit values and the GES-non GES threshold. However, the user may also assign threshold values for all other status classes as appropriate. A 5-class assessment scale 'High-Good-Moderate-Poor-Bad' is then produced.



*For Italy the offshore IMAP SAUs areas (IT-NAS-O, IT-CAS-O, IT-SAS-O) is calculated by subtracting the surface of area of the coastal zone from the surface area of the 3 official MRUs (IT-NAS-0001, IT-CAS-0001, IT-SAS-0001).

Figure 3.1.4.3.2.: The nesting scheme of the SAUs defined for the Adriatic Sea based on the available information. Shaded boxes correspond to official MRUs declared by the countries that are EU MSs and that were decided to be used as IMAP SAUs.

Setting the GES/non GES boundary value/threshold

508. Upgrading of the baselines and threshold values for IMAP CI 17 in the Mediterranean Sea is an ongoing process. The present assessment analysis applying the NEAT tool was conducted for each subdivision using the assessment criteria for the GES-non GES threshold, based on BAC values shown in Table 3.1.4.3.2.

Table 3.1.4.3.2: The BAC values calculated for the Adriatic Sea and used for the present assessment

	Adriatic BAC (μg/kg dry wt)	
	Sediments	**Biota (MG)**
Cd	180	944
Hg	75	113
Pb	23550	1500
$^{*}\Sigma_{16}$ PAHs	61.5	9.9
$^{+}\Sigma_{7}$ PCBs	0.21	17.3

509. The final marine environment quality status assessment regarding CI17 in the Mediterranean Sea provides in a consolidated manner the individual assessments for each of the sub-regions and/or sub-divisions. Therefore, all individual assessments were harmonized to the extent possible in order to ensure the compatibility of the assessments.

510. In line with an updated assessment classification for a harmonized application of NEAT and CHASE+ tools in the four Mediterannean Sea sub-regions , the Boundary limits of the 5-class assessment scale and class Threshold values were applied for NEAT GES Assessment of the Adriatic Sea-Sub-region (Table 3.1.4.3.3).

Table 3.1.4.3.3: Boundary limits of the assessment scale and class Threshold values used for the application of the NEAT tool for IMAP.

	Low Boundary limit	**Threshold** High/Good	**Threshold** Good/Moderate	**Threshold** Moderate/poor	**Threshold** Poor/Bad	**Upper Boundary Limit**
Sediments	**(μg/kg)**	**0.5 (xBAC) (μg/kg)**	**xBAC (μg/kg)**	**2(x BAC) (μg/kg)**	**5(xBAC)**	**Max. conc. (μg/kg)**
Cd	0	135	270	540	1350	9000
Hg	0	56.5	113	225	563	14200
Pb	0	17662	35325	70650	176625	356000
$^{*}\Sigma_{16}$ PAHs	0	61.5	123	246	615	26649
$^{+}\Sigma_{7}$ PCBs	0	0.21	0.42	0.8	2.1	434
Biota (*M. galloprovincialis*)						
Cd	0	708	1416	2832	7080	9000
Hg	0	85	170	339	848	10000
Pb	0	1125	2250	4500	11250	167884
$^{+}\Sigma_{7}$ PCBs	0	17.3	34.6	69	173	180

*sum of the individual BACs or xBACs values of the 16 PAH compounds
$^{+}$ sum of the individual BACs or xBACs values of the 7 PCB compounds

511. The two boundary limit values, mandatory by the NEAT tool, were applied: i) zero contaminant concentration for the best conditions; ii) the maximum concentration of contaminants used for the present analysis for the worse conditions.

512. In line with such defined the two boundary limits, a five-class assessment scale ‘High-Good-Moderate-Poor-Bad’ was linearly set, depending on the distance of the concentrations from the two boundary limit values and the GES-nonGES threshold.

513. The data (i.e. average values inserted), as well as boundary limits and threshold values are normalized by NEAT in a scale of 0 to 1 to be comparable among parameters and to facilitate aggregation on the CI or EO level, as follows:

$0 \leq$ bad $< 0.2 \leq$ poor $< 0.4 \leq$ moderate $< 0.6 \leq$ good $< 0.8 \leq$ high ≤ 1

514. The decision rule of GES/ non-GES is by comparison to the boundary class defined by the (xBAC) and this is above/ below Good (0.6).

515. NEAT aggregated data by calculating the average of normalized values of contaminants (Cd, Pb, PAHs, etc.) on the SAU level. This can be done either per each contaminant per habitat (i.e., sediments, biota) separately or for all contaminants per habitats (i.e. sediments, biota) within specific SAU. The first option leads to one value for each chemical compound separately for a specific SAU.

516. The process is then repeated for all nested SAUs (in a weighted or non- weighted mode) for all ecosystem components - contaminants separately, or for all ecosystem components by habitat (sediments, biota). In the weighted mode a weighting factor based on the surface area of each SAU is used.