MEDITERRANEAN QUALITY STATUS REPORT

The state of the Mediterranean Sea and Coast from 2018-2023

SUMMARY FOR POLICYMAKERS

UN environment programme

Mediterranean Action Plan
Barcelona Convention

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Abbreviations

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
AChE	Acetylcholinesterase
ADR	Adriatic Sea Sub-region
AEGS	Aegean Sea sub-division
AEL	Aegean and Levantine Seas Sub-region
AIS	Automated Identification System
ALBS	Alboran Sea sub-division
AM	Arithmetic mean
ASI	ACCOBAMS Survey Initiative
AZ	Assessment Zone
BAC	Background Assessment Concentrations
BaP	Benzo(a)pyrene
BAT	Best Available Technique
BC	Background Concentration
BChE	Butyrylcholinesterase
BDL	Below Detection Limit
BEP	Best Environmental Practices
BFCOD	7-benzyloxy-4-[trifluoromethyl]-coumarin-O-debenzyloxylase
BV	Baseline Values
BWQ	Bathing Water Quality
C	Concentration
CAS	Central Adriatic Sea sub-division
CAT	Catalase
CCI	Candidate Common Indicator (of IMAP)
CDR	Central Data Repository
CE	Carboxylesterase
CEN	Central Mediterranean Sea Sub-region CENS Central Mediterranean Sea sub-division
CFU	Colony forming units
CHASE+	Chemical Status Assessment Tool
Chl a	Chlorophyll a
CI	Common Indicator
COP	Conference of the Parties
CORMON	Correspondence Group on Monitoring
CP	Contracting Party
CR	Contamination Ratio
CS	Contamination Score
CW	Coastal waters monitoring zone
CWMS	Central Western Mediterranean Sea sub-division
D	Descriptor
DD	Data Dictionary
DIN	Dissolved Inorganic Nitrogen
DL	Detection Limit
dl	Dioxin like
DP	Drivers and Pressures

DPSIR	Driver, pressure, state, impact, response
DS	Data Standard
dw	Dry weight
E. coli	Escherichia coli
EAC	Environmental Assessment Criteria
EC	European Commission
EcAp MED III	EU-Funded Project "Mediterranean Implementation of the Ecosystem Approach, in Coherence with the EU MSFD"
EcoQOs	Ecological Quality Objectives
EDI	Estimated daily intake
EEA	European Environmental Agency
EIONET	European Environment Information and Observation Network
EMODnet	European Marine Observation and Data Network
EO	Ecological Objective
EPR	Extended Producer Responsibility
EQR	Ecological Quality Ratio
EQS	Environmental Quality Standard
ERL	Effects Range Low
EROD	Ethoxyresorufin-O21 deethylase
ESRI	Environmental Systems Research Institute
ETS	Electron Transport System
EU	European Union
EUNIS	European nature information system (of EEA)
EUSeaMap	Modelled mapping product of seabed habitats for European marine regions (of EMODnet)
EWI	Estimated weekly intake
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
FML	Floating Marine Litter
FRA	Fisheries Restricted Area (of GFCM)
G/M	Good/moderate status boundary
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GLY	Glycogen
GM	Geometric mean
GPML	Global Partnership on Marine Litter
GPS	Global Position System
GPx	Glutathione peroxidase
GRd	Glutathione reductase
GRID	Green, Resilient, Inclusive Development
GSA	Geographical subarea (of GFCM)
GSH	Glutathione
GST	Glutathione-S-transferase
HCB	Hexachlorobenzene
HELCOM	Helsinki Commission
HI	Total risk
HQ	Hazard quotient
ICES	International Council for the Exploration of the Sea
ICZM	Integrated Coastal Zone Management
IE	Intestinal enterococci
IHO	International Hydrographic Organization
IMAP	Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria

IMO	International Maritime Organization
INR	International Noise Register
IONS	Ionian Sea sub-division
JRC	Joint Research Centre
LDH	Lactate dehydrogenase
LEVS	Levantine Basin Sea sub-division
LMS	Lysosomal Membrane Stability
LOBE	Level of Onset of Biological Effects
LPO	Lipid peroxidation
MAP	Mediterranean Action Plan
MARPOL	International Convention for the Prevention of Pollution from Ships
MB	Mullus barbatus
MDA	Malondialdehyde
MED	Mediterranean
MedECC	Mediterranean Experts on Climate and environmental Change
MED POL	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Sea
MED QSR	Mediterranean Quality Status Report
MEPC	Marine Environment Protection Committee
MG	Mytilus galloprovincialis
MN	Micronucleus Assay
MP	Microplastic
MPA	Marine Protected Areas
MRL	Maximum residue limit
MRU	Marine Reporting Unit
MSFD	Marine Strategy Framework Directive
MSs	Member States
MT	Metallothionein
MTS	Mid-Term Strategy
NAPs	National Action Plans
NAS	North Adriatic Sea sud-division
NEAT	Nested Environmental Status Assessment Tool
nonGES	not Good Environmental Status
NPA	Non-Problem Area
NRTT	Neutral red retention time
OOAO	One Out All Out
OSPAR	Oslo-Paris Commission, implementing the Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OW	Offshore waters monitoring zone
OWG	Online Working Group
PA	Problem Area
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated dibenzo-para-dioxins
PCDD/Fs	Polychlorinated dibenzo-para-dioxins and dibenzofurans
PCDF	Polychlorinated dibenzofurans
PDBE	Polybrominated diphenyl ethers
PET	Polyethylene terephthalate
PFAS	Per- and polyfluorinated alkyl substances
POPs	Persistent organic pollutants
PPCP	Pharmaceuticals and Personal Care Products
PUHA	Potentially Usable Habitat Area
PWP	Plastic Waste Partnership (Basel Convention)

QSR	Quality Status Report
RC	Reference condition
RSC	Regional Sea Convention
SAS	South Adriatic Sea sub-division
SAU	Spatial Assessment Units
SCP	Sustainable Consumption and Production
SD	Sub-division
SOD	Superoxide dismutase
SOPs	Standard Operations and Procedures
SoS	Stress on Stress
SPA/RAC	Special Protected Areas Regional Activity Centre (of UNEP/MAP)
SUDS	Sustainable Urban Drainage Systems
SUPs	Single-Use Plastics
TEF	Toxic equivalency factor
TG	Task group
THQ	Target hazard quotient
TM	Trace metals
TP	Total Phosphorous
TV	Threshold Value
TYRS	Tyrrhenian Sea sub-division
UHMWPE	Ultra-high Molecular Weight Polyethylene
UNEA	United Nations Environmental Assembly
UNEP	United Nations Environmental Program
UNEP/MAP	United Nations Environment Programme – Mediterranean Action Plan-Barcelona Convention for the protection of the marine environment and coastal region of the Mediterranean
USWM	Urban Storm Water Management
VME	Vulnerable Marine Ecosystem
VTG	Vitellogenin
WFD	Water Framework Directive
WHO	World Health Organization
WMS	Western Mediterranean Sea sub-region
WW	Wet weight
WWTP	Wastewater Treatment Plants

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Foreword

I am delighted to introduce this second edition of the Mediterranean Quality Status Report (2023 MED QSR), a major achievement of the Mediterranean Action Plan (MAP) - Barcelona Convention system. This is the upshot of a collective endeavor involving the Contracting Parties, MAP partners, in particular the scientific community, the Secretariat and the MAP Components.

The Summary for Policy Makers of the second edition of the MED QSR was mandated by the 23rd Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols (COP 23), with the scope to serve as one of the communication products of the 2023 MED QSR, and was prepared in close collaboration with the Contracting Parties to the Barcelona Convention. The Summary for Policy Makers provides at a glance the key highlights, assessment findings, and recommendations towards achieving Good Environmental Status (GES) for the Mediterranean Sea and Coast in line with the respective Ecological Objectives (EOs) and Common Indicators (CIs) of the Integrated Monitoring and Assessment Programme (IMAP).

Monitoring and assessment of the marine and coastal environment have been central to the mandate of the MAP system since its establishment in 1975 as the first regional action plan under the UN Environment Programme's Regional Seas Programme, and since the adoption of the Barcelona Convention one year later. For almost five decades, numerous MAP system-generated monitoring and assessment reports, including the first instalment of MED QSR issued in 2017, contributed to the accumulation of an ever-deeper body of knowledge of the marine and coastal ecosystems.

The MED QSR series builds on a robust conceptual foundation and nationally sourced, quality-assured data submitted by the Contracting Parties to the Barcelona Convention or other reliable sources, to provide an evidence-based intelligible assessment of GES of the Mediterranean Sea and coast, based on a GES /non-GES approach, as defined in the framework of the ecosystem approach and its Integrated Monitoring and Assessment Programme IMAP.

The preparation of the 2023 MED QSR has thus seen coordinated efforts on data acquisition covering the 9 Ecological Objectives, including 23 Common Indicators of IMAP.

A noteworthy fact about the 2023 MED QSR is the way it embodies the scale-shifting versatility that is required for effective environmental assessment. The report blends national data with patterns observed at the regional level. By distilling new knowledge, the report also contributes to other relevant assessment exercises at global, regional and national levels, and the implementation of respective policies and regulatory framework.

As in any endeavor of this magnitude, it was not all plain sailing. Challenges included gaps in data provision that varied at the level of common indicator or ecological objective from one sub-region to another as IMAP was at a relatively early phase of implementation for a number of Contracting Parties.

Thanks to the commitment and support of all Contracting Parties, the Barcelona Convention is making steady progress. The operationalization of a regional data repository – the IMAP InfoSystem – has bolstered the MAP system's ability to produce increasingly robust assessments that feed into a high-resolution understanding of the environmental status of the Mediterranean Sea and coast, while aiming at its further upgrade into an advanced information system which efficiently supports assessments and ensures the validation of uploaded data, for potential use at various scales.

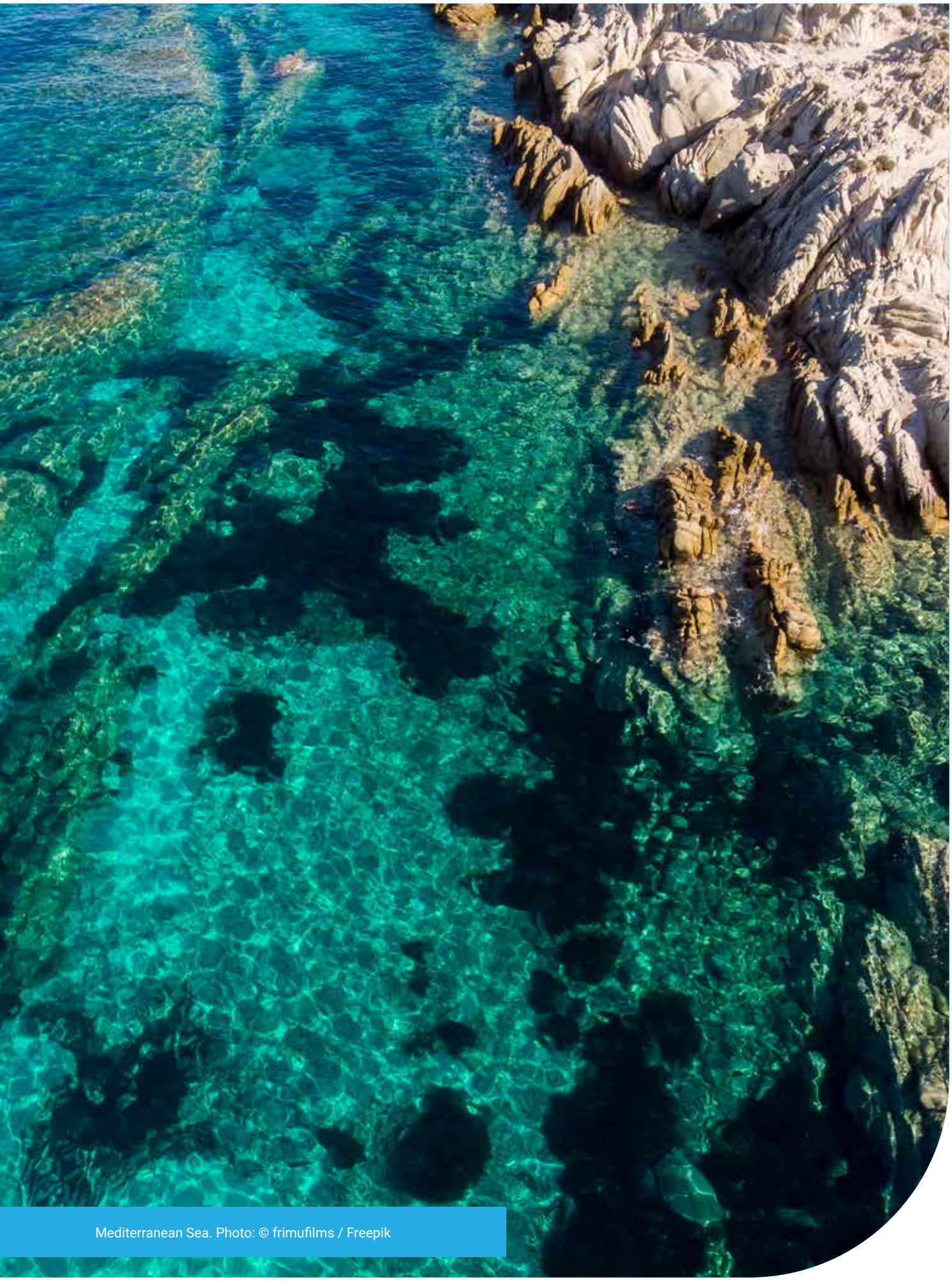
The 2023 MED QSR provides the region with evidence of progress achieved towards GES. We can already notice positive trends confirming the effectiveness of a number of policy and regulatory measures adopted at regional and national levels.

Despite progress, additional enhanced efforts are still required to strengthen the application at the national level of the entire spectrum of commitments, measures and tools adopted by the Contracting Parties for the effective implementation of the Barcelona Convention and its Protocols based on ecosystem approach.

The 2023 MED QSR is available online to ensure that it can be easily accessed and used by policymakers, experts, the public, young people and scientists and indeed, everyone harboring an interest in the marine and coastal environment in the Mediterranean context.

As you start your journey through the pages of the 2023 MED QSR, allow me to thank you and all our Partners for your commitment to a healthy Mediterranean Sea and coast that underpins sustainable development.

Tatjana Hema
Coordinator UNEP/MAP



Mediterranean Sea. Photo: © frimufilms / Freepik

Summary for Policy Makers of the 2023 Mediterranean Quality Status Report

HIGHLIGHTS[1]

Enhancing Biodiversity Protection and Management will need to improve habitat map quality and accuracy and conduct cost-efficient pressure assessments. New specific indicators, including for climate change effects, support to data collection (extended assessment coverage and long-term harmonized monitoring are key to quantify pressures), develop assessment criteria and targets, quota-based management of fisheries, and sustainable stock management. Implementation of preventive measures, strengthening legislative frameworks, control and advanced ballast water management strategies dedicated to NIS impacts will also support the protection of ecosystems.

Combating Eutrophication and Chemical Pollution will need quality data with advanced monitoring methods, including satellite imagery for eutrophication or dedicated to emergent contaminants. The promotion of sustainable practices in aquaculture, agriculture, industry, and tourism are necessary. Harmonized monitoring and reporting, based on best practices, updated environmental assessment criteria, and integrated data for risk analysis will help to better control chemical pollution.

For Marine Litter and microplastics, linking monitoring with measures targeting specific marine litter items are necessary, as well as promoting behavioral changes to reduce cigarette butts and plastic bottles through anti-smoking policies and recycling, Measures to reach GES will need to improve wastewater and sludge treatment, measures to control litter in riverine and storm water systems, and best practices for retrieving derelict fishing gear. Revision of legal frameworks, development of alternative materials and extended producer responsibility systems, will finally strengthen global policy links.

Achieving GES for Hydrography and Noise Pollution will need comprehensive digital spatial database, simplified reporting methods, integration of climate change indicators (hydrographic monitoring), consistent monitoring, data quality, management measures, and apply noise reduction technologies for maritime traffic and seismic surveys.

Management will aim at strengthening the Science-Policy Interface, promote science-based management, support integrated assessments and data validation by IMAP Info System, and consider quality assurance and quality control (QA/QC) mechanisms to ensure IMAP Info system interoperability with national and international databases.

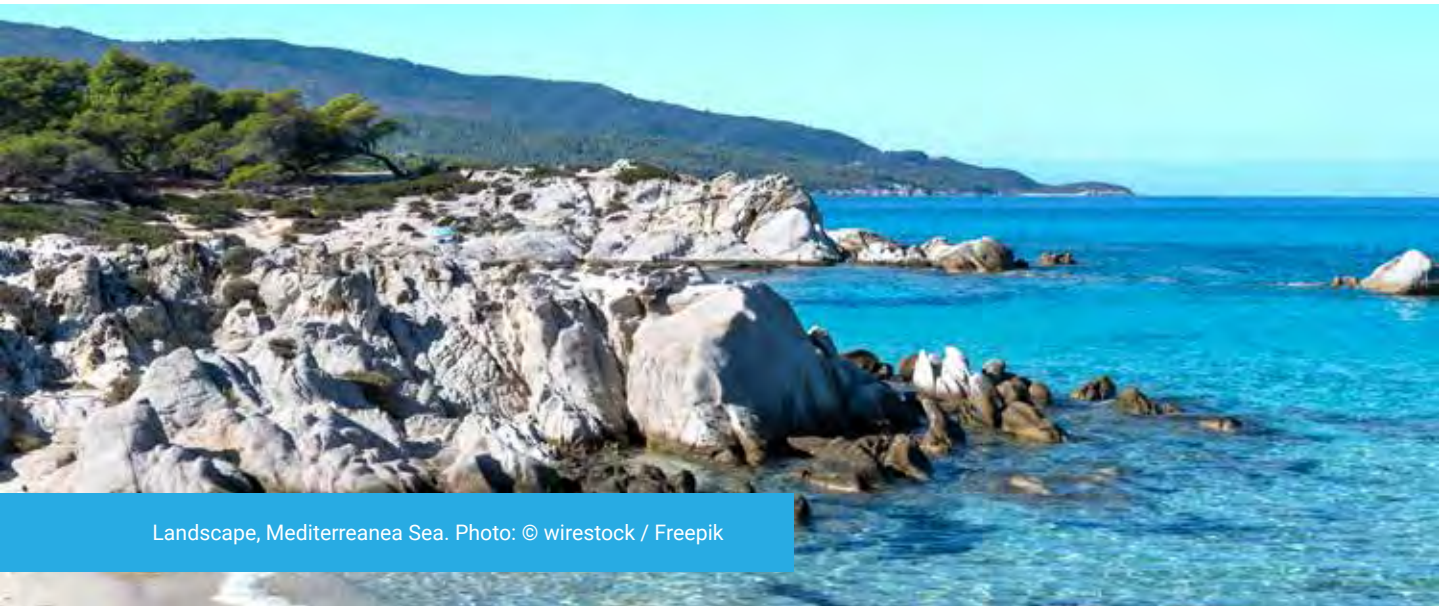
[1] The box on "Highlights" comprises of new text developed by the Experts of the Working Group, in their effort to prepare a number of "Take-home" messages for the respective Ecological Objectives and Common Indicators.

Introduction

While the Mediterranean Action Plan (MAP) was initiated in 1975, leading to the Barcelona Convention in 1976 to combat pollution and later to address broader environmental issues, the MAP Phase II and the Barcelona Convention were amended in 1995 to focus on sustainable development and environmental protection. In 2012, the Contracting Parties to the Barcelona Convention adopted 11 Ecological Objectives (EOs) to achieve GES (Good Environmental Status), guiding efforts to protect and enhance the marine and coastal environment. These Ecological Objectives were implemented into an Integrated Monitoring and Assessment Programme (IMAP). The main product of IMAP is the Quality Status Report (QSR).

Further to an initial assessment of the status of the marine environment, the first-ever Quality Status Report for the Mediterranean (2017 MED QSR), progress was achieved by preparing the 2023 MED QSR using the findings of IMAP, implemented for the period 2017-2023. Compared to the 2017 MED QSR, the 2023 MED QSR benefited from a substantive improvement in terms of thematic and spatial data coverage. However, IMAP also faced several challenges with data inhomogeneity and uneven availability, preventing GES assessments for some of the indicators in the 2023 MED QSR.

In the framework of the UNEP/MAP Medium Term Strategy (MTS) 2022-2027, the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) and its Protocols at their 23rd Meeting (COP23), took note of the 2023 Mediterranean Quality Status Report (2023 MED QSR) (UNEP/MED IG.26/Inf.10); endorsed its provisional Executive Summary, and mandated the preparation of the present Summary for Policy Makers as one of the communication products of the 2023 MED QSR. It is based on the work of a consultant and a dedicated Working Group, composed of some volunteer Contracting Parties, and supported by the Secretariat.



Landscape, Mediterreanea Sea. Photo: © wirestock / Freepik

The Mediterranean Sea

The Mediterranean Sea's unique geographical and ecological characteristics, combined with significant human impact and economic activities, present complex challenges.

The Mediterranean Sea, a semi-enclosed body of water bordered by 21 countries, is uniquely connected to the Atlantic Ocean, Black Sea, and Red Sea. Its diverse geomorphology includes submarine canyons and numerous islands, creating a conducive environment for high biodiversity. The sea hosts approximately 17,000 species of fauna and flora, making it a critical hotspot for marine life.

The Mediterranean Sea exhibits significant seasonal and geographical variations in sea surface temperature, while its deep waters maintain a constant temperature and high salinity. It is recognized as one of the most oligotrophic marine systems, with nutrient inputs mainly originating from Atlantic waters. Climate change has exacerbated the region's vulnerabilities, leading to increased sea temperatures, marine heatwaves, and acidification, which disrupt marine ecosystems and affect the sea's overall health.

Human activities along the densely populated Mediterranean coast have led to substantial chemical pollution. The introduction of non-indigenous species (NIS) through corridors, shipping, aquaculture, and the aquarium trade has significantly altered native ecosystems. Unsustainable production and consumption patterns, characterized by high resource use and low recycling rates, further exacerbate environmental pressures.

Tourism is a major economic driver in the Mediterranean region, although the COVID-19 pandemic severely impacted this sector in 2020-2021. Agriculture, fisheries, and maritime activities heavily contribute to marine degradation, with nutrient runoff causing eutrophication, harmful algal blooms and pesticide infiltration in specific sectors. Fisheries, particularly small-scale operations, play a crucial role in the regional economy, while maritime transport is significant in the Mediterranean Sea, a worldwide transit area, lacking regulations and sustainable practices, and posing ongoing environmental challenges.

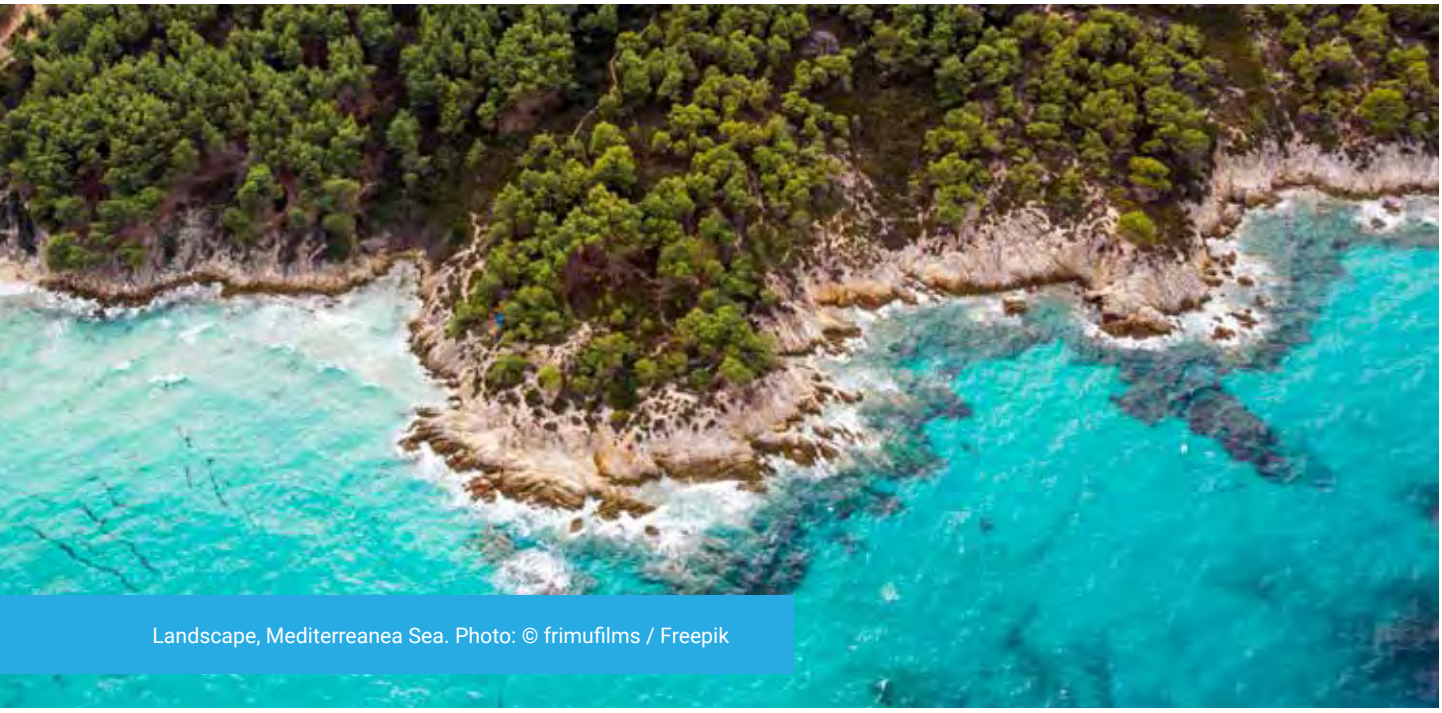
The demand for energy in the Mediterranean region has risen, with notable growth in renewable energy capacity, especially in power generation. Severe water scarcity, driven by population growth, urbanization, and climate change, remains a critical issue. Agriculture is the primary consumer of water, intensifying the region's water management challenges. Effective management strategies are essential to address these resource constraints and ensure sustainable development in the Mediterranean region.

The 2023 Mediterranean Quality Status Report

The 2017 Quality Status Report (MED QSR) for the Mediterranean Sea built on the IMAP structure, providing an overview of marine and coastal ecosystems and identifying knowledge gaps for future assessments. The 2023 MED QSR Roadmap focused on implementing priority activities, including support for national monitoring programs, harmonizing monitoring methods, operationalizing the IMAP Info System, and enhancing regional data-sharing partnerships.

Since 2017, data submission to the IMAP Info System has been significantly enhanced, and the system, developed by INFO/RAC, facilitates data access and processing. The 2023 assessment approach utilized all available IMAP data, supplemented by additional sources, including international databases (e.g., ACCOBAMS, EEA), national reports, regional projects, and policies. Assessments are organized by clusters (Pollution & Marine Litter, Biodiversity & Fisheries, and Coast & Hydrography) and are based on Common and Candidate Indicators. The 2023 MED QSR also implemented methods (e.g., NEAT, Nested Environmental status Assessment Tool; CHASE, Classification of High and Stable Environmental States) to classify, integrate, and aggregate monitoring data and assess environmental conditions, and contribute to better environmental management and decision-making.

The 2023 MED QSR adopts the DPSIR framework, linking environmental drivers, pressures, states, impacts, and policy responses. Effective IMAP design requires bridging gaps between science and policy through a stronger science-policy interface (SPI), ensuring scientific outcomes inform policy and *vice versa*. This promotes evidence-based policies and mutual awareness of challenges and needs in monitoring.



Landscape, Mediterreanea Sea. Photo: © frimufilms / Freepik

Assessment Findings and Measures

Cluster Biodiversity

Biological Biodiversity

Ecological Objective 1 (EO1)
Biological diversity is maintained or enhanced. The quality and occurrence of coastal and marine habitats and the distribution and abundance of coastal and marine species are in line with prevailing physiographic, hydrographic, geographic and climatic conditions)

Common Indicator 1: Habitat distributional range

Common Indicator 2: Condition of the habitat's typical species and communities

Common Indicator 3: Species distributional range

Common Indicator 4: Population abundance of selected species

Common indicator 5: Population demographic characteristics

The uniqueness of the Mediterranean biotope comes from a combination of morphological, chemical and biotic characteristics reflected by the presence of certain ecosystem building species and assemblages. The meadows formed by *Posidonia oceanica* and the bio concretions of the coralligenous assemblages are among the most characteristic marine features of the Mediterranean Sea. They provide a wide range of ecosystem services and sustain many human activities such as fisheries and tourism. They are, however, particularly sensitive and vulnerable to coastal urbanization, pollution, turbidity, anchorages, trawling, etc.

Common Indicator 1:

Key findings

The seabed and its benthic habitats are critical components of the Mediterranean marine ecosystem, providing essential services such as seafood provision, natural coastal protection, and carbon sequestration. Habitats' conditions are impacted across the Mediterranean Sea by various activities and pressure types. However, the current limitation of knowledge prevents the assessment of GES. There is a need to further develop and implement monitoring standards, data flow and assessment methods of impacts, for more habitat types (including pelagic habitats), in a complementary way of other EOs, especially EO4 (food webs) and EO6 (seafloor integrity).

For 2023, the assessment for Habitat Distribution and Condition (IMAP EO1 CI1 and CI2) is preliminary due to limited data, focusing on small areas and scattered data, related to some key habitats like Coralligenous, *Maerl/rhodoliths*, and *Posidonia oceanica* meadows in a few countries. However, it is well documented and assessed through other indicators, that coastal zones face severe pressure from infrastructure development, and offshore habitats are significantly impacted by bottom fishing and dredging. Below 1000 meters, bottom fishing is banned, protecting sensitive deep-sea habitats.

Recommended Measures to Achieve Good Environmental Status (GES) for Seabed Habitats:

- **Improving Habitat Maps** (quality and accuracy of habitat maps (i.e., bathymetry and geomorphology), encourage countries to contribute mapping data).
- **Mapping Activities and Pressures** (cost efficient assessments of seabed pressures, collect more data in the south and east Mediterranean).
- **Monitoring Seabed state** (validation of pressure data through direct observations /video /sampling, ensuring compatibility between countries).
- **Studying Pressure-State Interactions** (improve confidence in the use of calibration of state and pressure relationships).
- **Assessing Climate Change Effects** (better understand carbon storage capacity of sea beds, and blue carbon habitats like Posidonia oceanica meadows).
- **Developing Assessment Methods** (develop/test specific indicators, threshold values)
- **Visualizing Assessment Results** (demonstrate progress and actions towards GES).

Common Indicators 2, 3, 4, 5:

The Mediterranean waters are home to key species and sensitive ecosystems, whilst the deep waters host a unique and fragile fauna. Many of these species are rare and/or threatened and are globally or regionally classified by IUCN as “endangered” or “critically endangered”, such as the monk seal *Monachus monachus*, and cartilaginous fish species (sharks and rays). Many other species populations have strongly regressed during the 20th century.

Key findings:

Without agreed thresholds, it was not feasible to assess Common Indicator 2 for EO1 habitat types for the needs of the 2023 MED QSR. However, rich scientific literature exists, describing the state of these habitats and provides evidence of poor state for many habitat types in multiple locations across the region.

The Monk Seal is a flagship species for the Mediterranean. Assessments show that GES for distribution (CI3) has not been achieved in all countries, but there is moderate range expansion. However, population abundance (CI4) lacks baseline estimates, making validation difficult. Demographic characteristics (CI5) require more detailed and long-term data.

The Mediterranean Sea hosts 25 cetacean species facing various human pressures. GES for cetaceans is challenging to assess due to recently defined baseline values. The IUCN Red-List shows many species are threatened, though some, like the common bottlenose dolphin, have improved status.

Seabirds play a crucial role in the Mediterranean ecosystem. While some species meet GES, data quality issues prevent a comprehensive assessment. Endemic species face multiple pressures, and improved monitoring and data collection are needed to achieve robust GES assessments.

Combining the findings of the 2023 MED QSR assessment regarding marine turtles (loggerheads and green turtles) with literature on research and conservation actions taking place in the Mediterranean, marine turtles can be considered as meeting GES in relation to CI3, CI4 and CI5 (Figure 1). Their distribution is increasing, and nesting levels are stable or rising. However, gaps in monitoring and data reporting need to be addressed for better conservation outcomes, in particular in marine habitats.

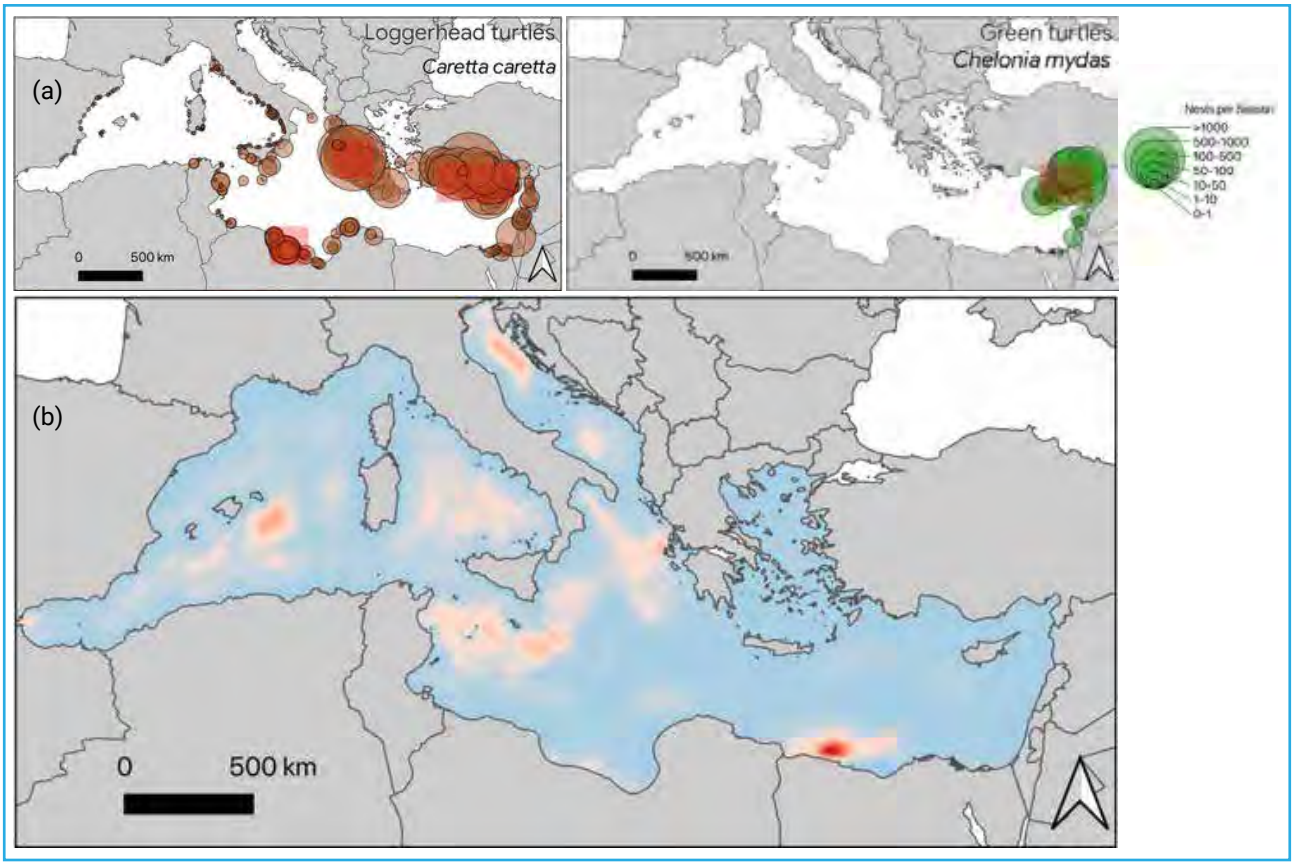


Figure 1: (A) Marine turtle nesting levels across the Mediterranean Sea. Green turtle nesting is confined to the eastern Mediterranean, mainly the extreme north-eastern area, and there are no large nesting aggregations for loggerheads in the western Mediterranean, though nesting levels are currently increasing. (B) Turtle density (number of animals per 25 km^2 grid cells) across the Mediterranean. Modelled distribution and abundance of hard-shelled turtles (mainly loggerheads) after DiMatteo *et al.* (2022). The hotspot off the Egyptian coast is generated from extrapolation and requires verification.

Recommended Measures to Achieve Good Environmental Status (GES) for marine Species

- **Support long-term monitoring for demographic data for Monk Seal:** networks, baseline population estimates, data-sharing platform for photo-identification.
- **Improve data collection and processing for cetaceans:** define pressure hotspots, assess ship strikes, and study climate change impacts, new methods for cumulative effects of pressures, support southern Mediterranean research and the implementation of mitigation tools.
- **Promote quantitative and standardized monitoring for Seabirds:** national and sub regional levels, address data biases, increase monitoring away from breeding colonies, and find a meaningful GES assessment spatial scale.
- **Coordinate monitoring for Marine Turtles:** ensure data from all monitoring programs are standardized and reported, align IMAP reporting with other international requirements, research priorities to include long-term monitoring, bycatch quantification.

Recommended Conservation and Management Measures

- **Regulation of Human Activities:** protect critical habitats, regulate and accompany fishing activities and mitigation efforts, educate the public and manage tourism.
- **Research and Monitoring:** better understand population dynamics and movements, key habitats, use new technologies.
- **Coordination and Data Sharing:** create platforms for data sharing, compatibility across regions.
- **Climate Change Adaptation:** assess and mitigate the impacts of climate change on key habitats and species, promote the use of renewable energy to reduce carbon emissions.

Aerial view of Mediterreanea Sea. Photo: © wirestock / Freepik

Non-Indigenous Species

Ecological Objective 2 (EO2)

Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem

Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species (NIS), particularly invasive non-indigenous species, notably in risk areas.

Common Indicator 6:

Non-indigenous and invasive species (NIS) are increasingly present in the Mediterranean Sea. From the 1970's to 2020, more than 1,199 non-indigenous species have been reported, 513 of which are considered as established, mainly in the eastern Mediterranean Sea. Of those established species, 107 have been flagged as invasive. The NIS in the Mediterranean Sea are linked to four main pathways of introduction: the corridors, shipping (ballast waters and hull fouling), aquaculture, and aquarium trade. Corridors are the most important pathway of introduction (33.7%) followed by shipping (29%) and aquaculture (7.1%).

Key findings:

Most Contracting Parties have developed and are implementing IMAP-compliant monitoring programs and the IMAP Data and Information System is operational, receiving NIS data, facilitating the creation of standardized time series for the next assessment cycle.

Over the past 15-20 years, the rate of new NIS introductions has remained relatively constant in the Western Mediterranean and Adriatic Sea, slightly increasing in the Eastern Mediterranean Sea, and increasing in the Central Mediterranean Sea (Figure 2). Despite the constant annual rate, the cumulative number of NIS in the Mediterranean basin is steadily increasing, primarily through corridors and shipping pathways. There has been a significant increase in monitoring and reporting efforts, driven by policy requirements, scientific interest, and citizen science initiatives, especially in the southern Mediterranean. However, interpretation of trends is complicated by the lack of long-term standardized monitoring data, making it difficult to distinguish between real changes and variations in recording efforts.

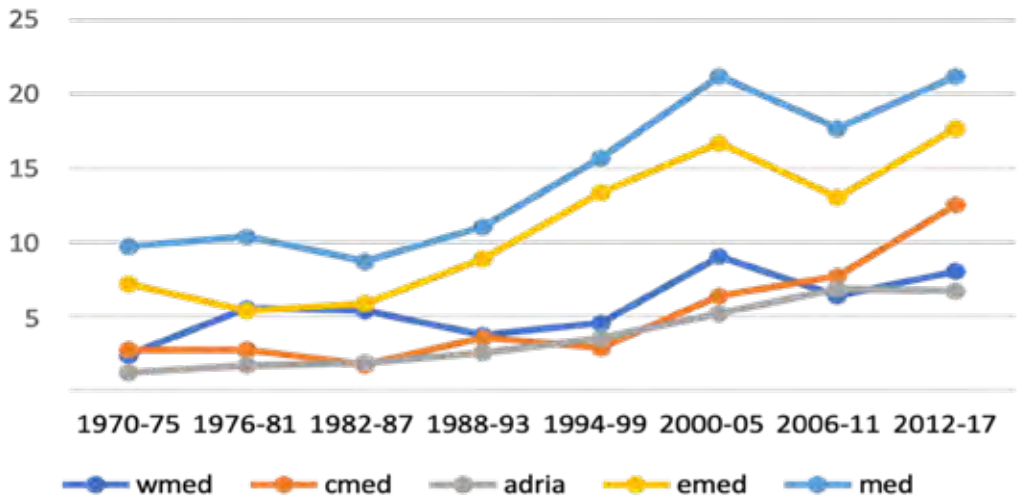


Figure 2: Non indigenous Species introduction rates per period at the level of Mediterranean Sea (med), Western Mediterranean (wmed), Central Mediterranean (cmed), Adriatic Sea (adria), and Eastern Mediterranean (emed).

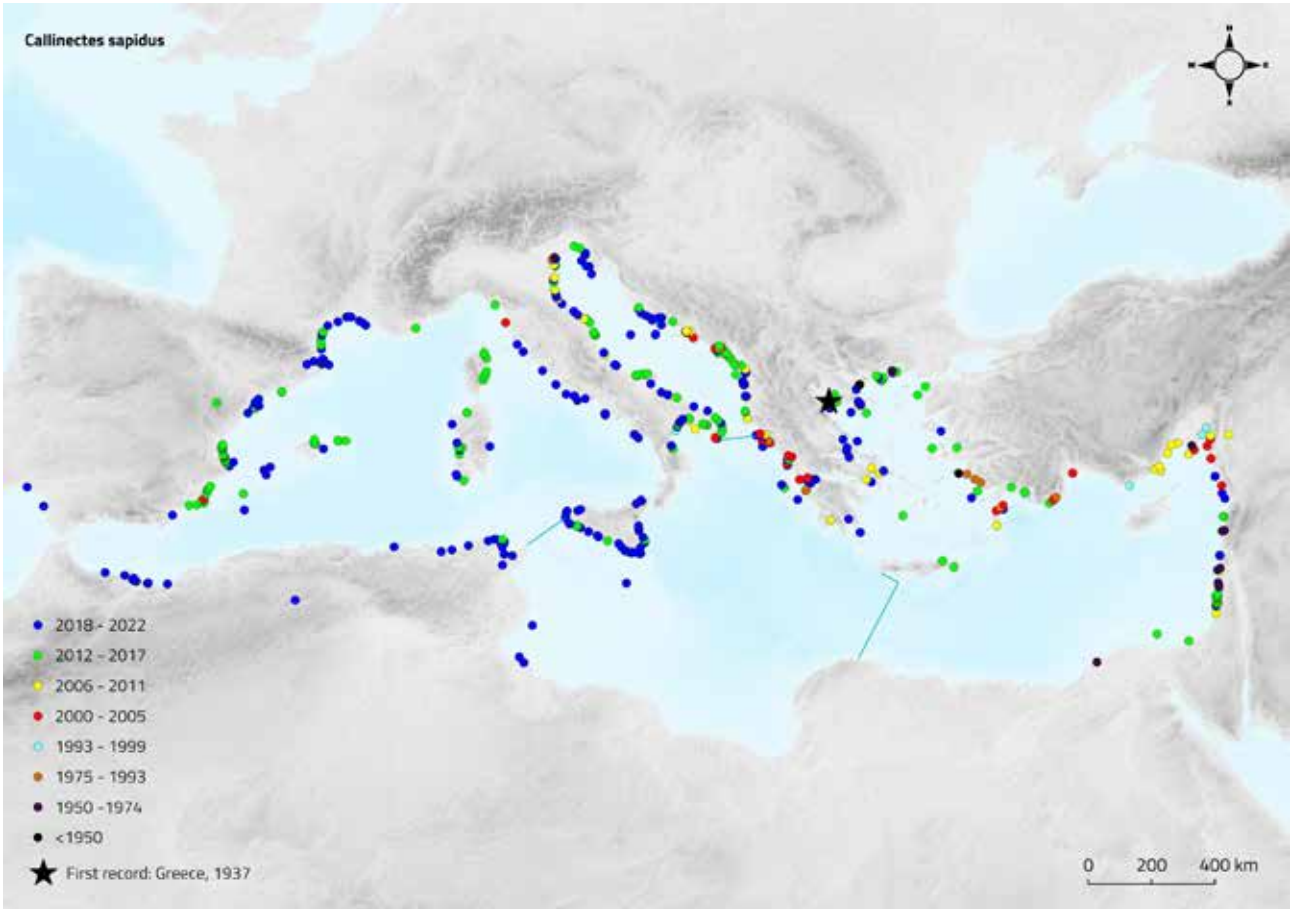


Figure 3: Distribution of *Callinectes sapidus in* the Mediterranean Sea. Colour symbols correspond to different 6-year reporting periods, corresponding frequency histograms depict number of records in each time bin.

Several high-impact NIS have expanded geographically in the last decade, even amid increased detection and reporting efforts (Figure 3). NIS with warm affinities and long-range pelagic dispersal have been favored by climate change, allowing them to establish in cooler regions of the Mediterranean, while anthropogenic dispersal remains a key factor in their spread.

Recommended Actions to Achieve GES for EO2 Common Indicator 6:

- **Improve data Availability, Monitoring Programs**: methodologies to quantify pathway pressure, common methodology to address reporting lags in new NIS data and trends.
- **Developing Assessment Criteria and Quantitative Targets**: further develop of assessment criteria and quantitative targets for the most vulnerable/important species and habitats at risk, coordination with EO1 Common Indicators CI1 and CI2 and EO6 on sea floor integrity.
- **Preventative Measures and Legislative Framework**: updated Action Plan to strengthen legislative and institutional frameworks to systematically assess and manage pathways, development of early warning systems, rapid response plans, and mechanisms to control intentional introductions, targeted impact studies for priority species.
- **Ballast Water Management (BWM) Strategy:** the NIS Action Plan must progress alongside the BWM Strategy for the Mediterranean 2022-2027, focusing on managing ship-mediated introductions from ballast water, national strategies to manage biofouling.

Populations of Commercial Species

Ecological Objective 3 (EO3)

Populations of commercially exploited fish and shellfish are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock

Common Indicator 7: Spawning stock Biomass

Common Indicator 8: Total landings

Common Indicator 9: Fishing Mortality

Fishing is woven into the soul of the Mediterranean, its culture and traditions. Around 80,000 fishing boats ply the waters of the Mediterranean, providing a livelihood for 180,000 people and supporting an industry worth €4.6 billion. A large part of fish stocks is still overfished in the Mediterranean because of increased fleet capacity, illegal fishing, and catches of unwanted species.

Key findings

For Common Indicator 7 (spawning stock biomass), some species under management plans are showing increased biomass due to decreased fishing pressure, while others show no improvement. Across the region, 44% of stocks have low biomass, 19% intermediate, and 37% high.

For Common Indicator 8 (Total Landings), capture fisheries production has stalled since the mid-1990s, with a decrease in 2020 likely due to the COVID-19 pandemic. Average annual landings for the Mediterranean and Black Sea (2018–2020) were 1,189,200 tons, similar to the 2016–2018 average. However, there was a 16% decline in 2020 compared to 2019, possibly due to the pandemic's impact on fleet dynamics, demand, and trade. The Mediterranean Sea alone accounted for 743,100 tons (62% of the total capture fish production).

For Common Indicator 9 (fish mortality), overexploitation of stocks has decreased over the past decade, with an accelerated reduction in the last two years, especially for species under management plans. Most commercial species remain overexploited, with fishing pressure still double what is considered sustainable (average F/FMSY = 2.25). There has been a 10% decrease in overexploitation since 2012 and a 21% reduction in fishing pressure since 2012. Key species like European hake and common sole have seen significant declines in fishing pressure, but pressure on blue and red shrimp continues to increase in the central and eastern Mediterranean.

Recommended measures to Achieve GES for EO3 Common Indicators (commercial species):

- **Extending Assessment Coverage to maintain comprehensive data:** coverage of all regions, regular assessment of key stocks with high landings.
- **Adopting Management Measures:** multiannual management plans, effort control, quota-based management, fisheries restricted areas, and spatio-temporal limits to protect essential habitats and life stages.
- **Improving Scientific Advice and Data Collection:** research programs and pilot studies incorporated into GFCM workplans, scientific data collection and analysis on specific themes, fisheries, or species.
- **Better estimation of Fishing Mortality:** understand fishing capacity, particularly the large proportion of small-scale polyvalent vessels, use long time series, and incorporate environmental and ecosystem variables.
- **Data Collection and Submission:** link with the GFCM Data Collection Reference Framework (DCRF), harmonized scientific surveys and data collection.
- **Accurate Estimation of Total Landings:** improve the monitoring of landings, especially from small-scale polyvalent vessels and varied landing sites, consider various factors affecting total catch/ landings.

Calanque. Photo: © wirestock / Freepik

Cluster Pollution and Marine Litter

Eutrophication

Ecological Objective 5 (EO5)
Human-induced eutrophication is prevented, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters

Common Indicator 13: Concentration of key nutrients in water column

Common Indicator 14: Chlorophyll-a concentration in water column

Eutrophication corresponds to an artificial enrichment of water with nutrients of industrial or agriculture origin, which can disrupt the biological balance of water, resulting in an increased growth of microorganisms that can negatively impact water quality by reducing dissolved oxygen levels. Nutrient enrichment may provoke harmful and toxic algal blooms, causing negative impacts on ecosystems (red-tide, mucilaginous production, biomass accumulation leading to anoxia) and may present serious economic threats for fisheries, aquaculture and tourism. Eutrophication monitoring in the Mediterranean Sea is based on the measurements of dissolved inorganic nitrogen (DIN), and total phosphorus (TP) concentrations for Common Indicator 13, and Chlorophyll 'a' concentration (Chl-a) for Common indicator 14 as indicator of direct effects of nutrient enrichment.

Common Indicators 13, 14:

Key findings

Different assessment concepts were used for assessment of C1s 13 and 14, based on the availability of data as delivered by the CPs through the four Mediterranean Sub-regions (Figure 4). A complete GES assessment for CIs 13 and 14 for all the sub-regions was not possible given the high heterogeneity of type of data and spatial coverage, and the lack of quality-assured, homogenous data. More precisely, in the absence of reported in situ data in the Western and Central Mediterranean Sea sub-regions, as well as in the Aegean and Levantine Seas sub-regions, satellite-derived data of Chlorophyll-a concentrations, provided by either national or European providers had to be used to compensate. **In the Aegean region**, eutrophication is related to the area being one of the most densely populated areas in the world, also linked to urban wastewater, agriculture, riverine discharge, tourism, port operations, and aquaculture. Izmir province and its southern coast (Küçük Menderes, Bakırçay, and Gediz rivers) are significantly affected impacted. Other non-good status areas include such as, Saronikos Gulf, and Thermaikos Gulf, influenced by urbanization, riverine inputs (e.g. Axios River), industry, and agricultural discharges.

In the Levantine basin, most evaluated assessment zones can be considered in good status for Chlorophyll 'a'. Detailed examination showed that only 1 out of 18 units, in the open waters was classified in non-good status (southern Levantine Sea), due to high population density and untreated wastewater. The primary drivers and pressures include agriculture, tourism, urbanization, sewage discharge, desalination.

In the Adriatic Sea, the overall status assessed through the NEAT tool is a Good Environmental Status for all 3 parameters (Total Phosphorus (TP), Dissolved Inorganic Nitrogen (DIN), and Chl-a), with the exception of localized assessment units showing moderate non-GES status for total phosphorus (TP) in few coastal assessment units in the Central Adriatic along the Abruzzo Coast and several coastal and offshore units in the South Adriatic, near the Apulia coast. There, the primary drivers and pressures include aquaculture, tourism, are critical in affecting the natural cycle of nutrients. However, although the two drivers, aquaculture and coastal and maritime tourism, are present in other areas of the Adriatic Sea, they did not impact CI 13 nor CI 14, as represented by the available data.

There is limited data in the Central Mediterranean Sea sub region, with 7 out of 36 units in good status in the Eastern and the Southern parts of the central sub-region. Affected areas (GES not reached) were found in Greece (Ambracian and Patras gulfs, Igoumenitsa), western Libya, and Tunisia (Gulf of Gabès) due to: (i) large urban centers; ii) untreated domestic discharges; iii) industrial discharges, among them phosphogypsum; iv) agrochemical industry; and v) agriculture.

Finally, in the western Mediterranean Sea, several differences between thresholds calculated from satellite data and assessment criteria calculated from *in situ* measurements (regional assessment findings) were observed. Some assessment units are in non-good status in Spain, France, and Italy (in Spain, 8 out of 70 units, including Mar Menor Segura River mouth; Ebro River mouth; French border; Mallorca Island/ Alcudia Gulf), influenced by riverine discharges, urbanization, and tourism, while the main drivers and pressures are agriculture, industry, tourism, and urban development. In the waters of Italy, there are 9 out of 54 sub units in non-good status (Arno and Tiber River mouths; Napoli urban area, SW Sardinia Island). In French waters, 1 (Gulf of Porto Vecchio) out of the 46 Sub units was in non-good status due to the resolution and associated uncertainties integrated into the assessment based on satellite-derived products for Chl-a concentrations.

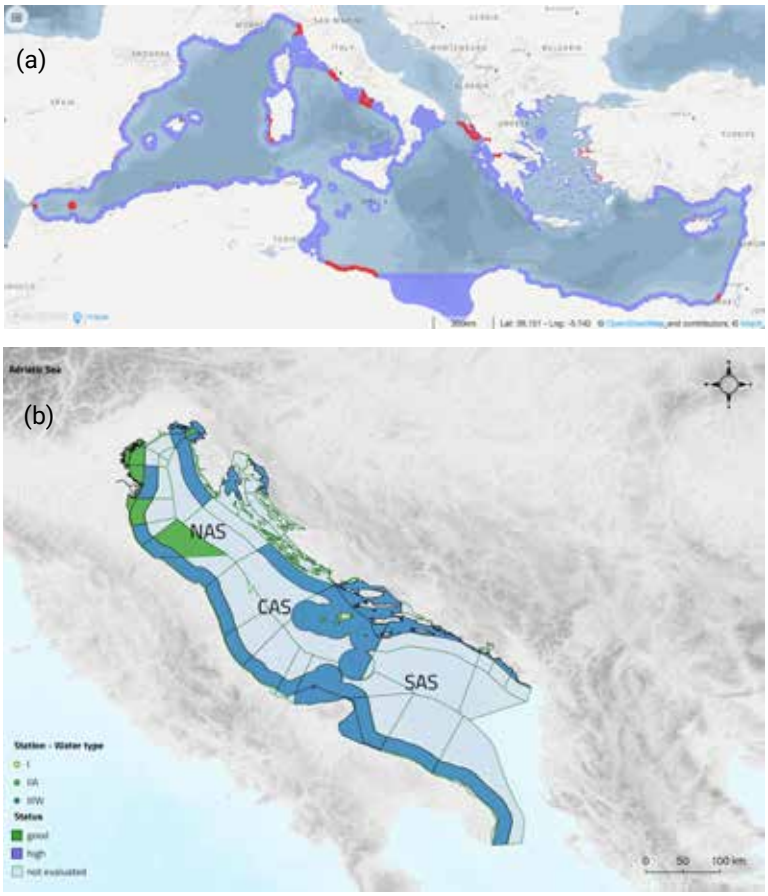


Figure 4: Assessment of Eutrophication (EO5), providing an indication of possible good/non-good status at the level of the sub-Mediterranean regions: (a) Western, Central and Levantine Basins (in situ and satellite derived data) (Red: non-GES, Blue: GES); (b) Adriatic Sea.

Recommended measures to Achieve GES for EO5 Common Indicators (Eutrophication):

- **Improve data availability and quality through enhanced monitoring methodologies and reporting**: Best Available Technology and Best Environmental Practices, including the use of satellite imagery.
- **Promote sustainable practices in aquaculture, agriculture, industry, tourism:** water treatment, limited use of fertilizers.
- **Develop adaptive management strategies**: strengthen regional cooperation, and policy integration to address pollution and achieve GES.

Landscape, Mediterreanea Sea. Photo: © wirestock / Freepik

Chemical Pollution

Ecological Objective 9 (EO9)

Contaminants cause no significant impact on coastal and marine ecosystems and human health

Common Indicator 17: Concentration of key harmful contaminants measured in the relevant matrix (biota, sediment, seawater).

Common Indicator 18: Level of pollution effects of key contaminants where a cause-and-effect relationship has been established.

Common Indicator 19: Occurrence, origin (where possible), extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances), and their impact on biota affected by this pollution.

Common Indicator 20: Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood.

Common Indicator 21: Percentage of intestinal enterococci concentration measurements within established standards.

Pollution is the destruction or degradation of an ecosystem or the natural environment through the introduction, usually by humans, of chemical entities (contaminants) detected in a place where they are not normally found. Despite advances in terms of pollution prevention at source, pressures persist in the Mediterranean Sea. The context around the capacity to achieve a cleaner Mediterranean is complex and evolving. The environment is changing, as are societies, while key drivers, such as climate change and its impacts, are also changing the conditions. In recent years, there have been determined efforts to instill more preventive, circular and sustainable approaches in the Mediterranean region to limit pollution. However, the level of progress remains heterogeneous among the sub regions.

Common Indicator 17:

Key findings

Different assessment concepts were used for assessment of C17 by the Contracting Parties, based on the availability of data, including NEAT (spatial integration from Spatial Assessment Unit level to Sub region level) in the Adriatic and Western Mediterranean Seas, and CHASE+ (environmental assessment providing GES/non-GES status classes at the level of the monitoring stations) in Aegean, Levantine and Central Mediterranean Seas (Figure 5). While NEAT tool provides the results in five classes, CHASE+ indicate the likely environmental status of the Subdivision or areas within the Subdivision, expressed as likely GES or likely non-GES. Therefore, the CHASE+ results should be considered as an initial environmental assessment. The decision rule agreed for CHASE + assessment methodology recommends that only if at least 75% of the elements are in GES, the area should be considered in GES.

The **Aegean Sea sub-division** is likely non-GES, and only 67% of the stations were in GES for TM in sediments as a result of the contribution from only two limited affected areas including i) the Elefsis Bay and inner Saronikos Gulf (Pb and to a lesser degree Cd), and ii) the Aliaga and Yenisakran (Hg and to a lesser degree Pb). Due to the lack of data reported, it was impossible to classify the Aegean sub-division regarding Σ16 PAHs in sediments. Only indications exist for the offshore zone under GES, while the enclosed areas might be found as non-GES. The Aegean sub-division was classified as likely non-GES regarding Σ5 PAHs in sediments (non-mandatory), due to the two areas being limited in spatial scope i) the Elefsis Bay and inner Saronikos Gulf and 2) the area encompassing the coast around Kucukkoy, Dikili, Candarli, Aliaga, and Yenisakran.

The southern part of the Aegean sub-division can be classified as likely in GES. In the Northern and Eastern Levantine Seas, only 69% of the stations were in GES for trace metals, as a consequence of only the two affected areas: i) the Northern Haifa Bay in Israel (Hg concentration, nonGES/ moderate status), and ii) the Dora region (off Beirut), followed by area in the North Lebanon (Cd and Hg concentrations ; nonGES/ moderate status), There is insufficient data for Σ7 Polychlorinated Biphenyls (PCBs), which hinders a comprehensive assessment. The Dora region off Beirut was affected with primary drivers and pressures impacting this region (urban development, industries, wastewater discharges). Although drivers and pressures and non-GES statuses were identified for the CI 17 in the Levantine Basin, essentially no impact was detected using the fish species *Mullus barbatus*, when available. Only one non-GES units (1 out of 15) was found off Paphos (Cyprus) due to the accumulation of Hg, a contaminant also found at high level in another species in Haifa bay. It should be emphasized, that concentrations not in-GES do not necessarily imply a biotic effect.

As for contaminants in sediments in the Adriatic Sea, 80% of assessment units are in Good Environmental Status, while 20% are classified as non-GES, with the highest contamination from Polychlorinated Biphenyls (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs), and mercury (Hg). For mussels, the highest contamination is observed for PCBs which results in 39% of Spatial Assessment Units in non-GES status. In the Northern Adriatic, 19% of the Spatial Assessment Units were in non-GES (3 in Croatia, 3 in Emilia-Romagna and 'Veneto in Italy, 2 offshore units in Italy and Slovenia), because of Hg contamination (moderate status) in sediments and mussels, and PCBs (poor status) contamination in sediments. Most sub-Spatial Assessment Units are classified under High or Good status and in GES in Central Adriatic Sea. while one coastal unit in Croatia (Hg in sediments and Σ7 PCBs in mussels), and one offshore Unit in Italy (Hg in mussels), are classified under Moderate status. In the South Adriatic, most spatial assessment units were classified under high or good status. There was 1 coastal assessment unit in Boka Kotorska Bay in Montenegro, due to the high concentrations of Mercury, some of 16 PHs and 7 PCBs in sediments, and relatively lower levels of lead in sediment and mussels. The primary drivers and pressures contributing to this contamination include industrial activities (dumping, waste discharge), tourism (waste water), port operations and maritime traffic that are significant in the Adriatic Sea. Dumping area for dredging in Emilia Romagna was also identified.

In the central Mediterranean region, there is insufficient data for a comprehensive classification, though most units are in Good Environmental Status (GES) for trace metals. Regarding Σ5PAHs in sediments, Non-GES units were located at the north-eastern and south eastern part of Malta (Port ill- Kbir off Valetta, Wied Ghammieq), and Greece (Gulf of Patras, Gulf or Corinth, Corfu). About impacts on mussels, 8 units were in-GES for trace metals, while for fish (*Mullus barbatus*) 5 units were classified as non-GES (Hg). The primary drivers and pressures impacting specific areas include industrial plants and maritime traffic.

In the western Mediterranean Sea, without data for the southern coast (Algeria, Tunisia). The current status indicates that the Alboran Sea is in Good status (metals in sediments, Cd and Pb in biota), while Off Morocco, 2 units were in moderate status (one for Cd in sediments, one for Pb in sediments). GES has not been reached in one unit along the Spanish coast and another one in France (moderate status, Hg in sediments, Hg and CD in biota in biota), while two units in France were affected by Σ16PAHs in biota. In the Central Western Mediterranean Sub-divisions, 6 out of 7 units were classified in high or good status and one unit was classified as non-GES (Hg, PAHs, and PCBs). While the Tyrrhenian Sea is in Good Environmental Status, several non-GES parameters were identified for some units in Italy (Cd and Hg in sediments, Σ16PAHs and Σ7PCBs). Large Ports and maritime traffic, Coastal urbanization, Tourism, Riverine discharge, Agriculture and aquaculture, Desalination were the most common pressures. Essentially no impact was detected in the environmental status classification of biota.

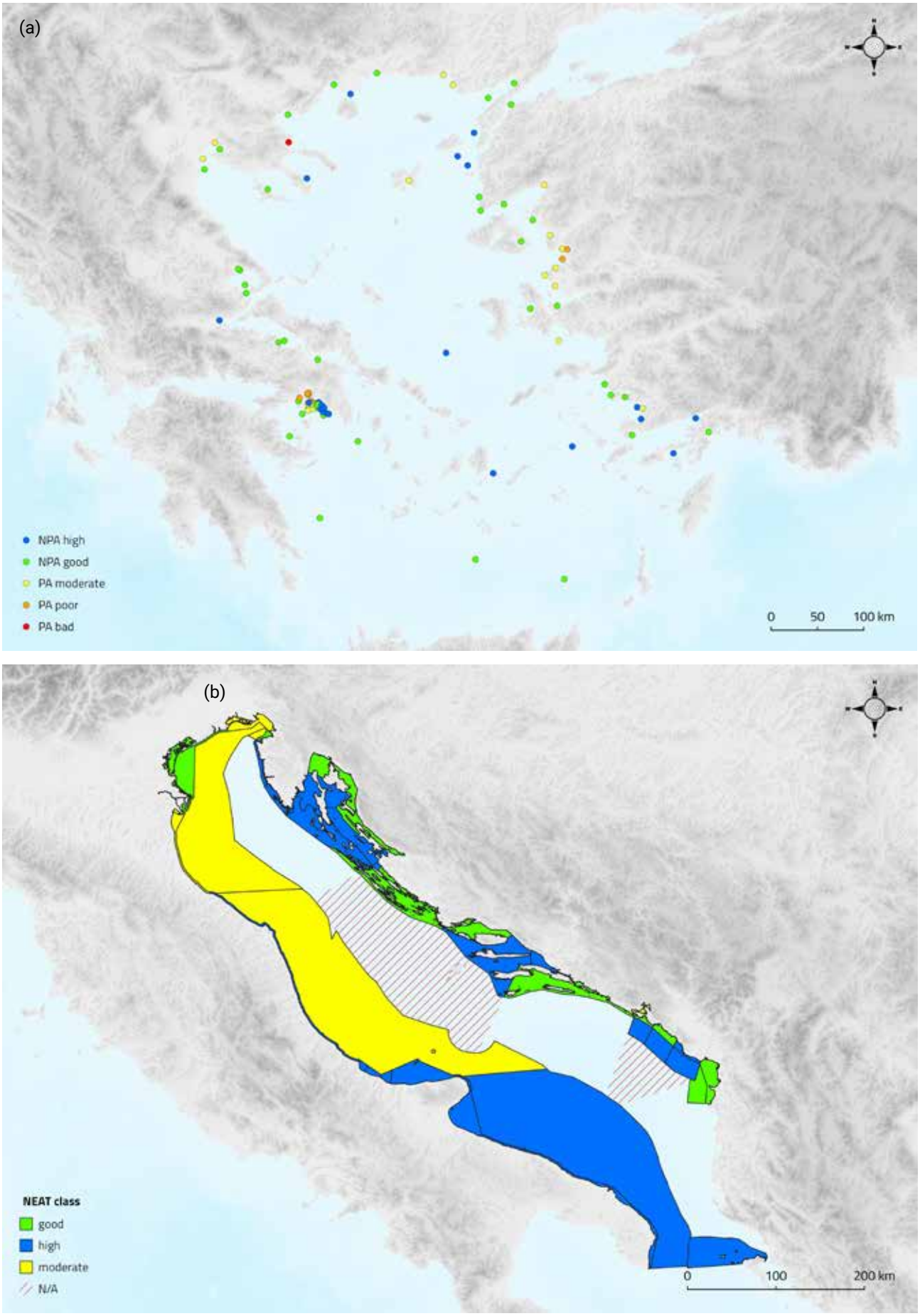


Figure 5: Examples of aggregation of results for contaminants: (a) the Neat assessment results for IMAP Common Indicator 17 (CI17) in the Adriatic Sea region (aggregation of all contaminants per sub-unit); (b) results of the CHASE+ assessment methodology to assess the environmental status of Σ5 PAHs in sediments in the Aegean Sea.

Other Common Indicators:

Key findings

For Common Indicator 18, there is no available data to assess pollution effects on biota in Aegean Sea. In the Levantine basin, although drivers that could exert pressure and cause impact on CI18, were identified, no data were available for impacts on biota. Only two studies on biomarkers showed indications of possible effect of Trace metals in the mollusk *Ruditapes decussatus* from Port Said (Egypt) and in the fish *Mullus barbatus*, *Boops boops* and *Trachurus trachurus* off the coast of Türkiye. Only one study from the scientific literature reported impact of PAHs on some of the biomarkers measured in the specimens of the fish *Mullus barbatus* collected in an important fishery area in the Northern Adriatic Sea (offshore Rimini to Ancona). In the central Mediterranean Sea, with 5 studies for Tunisia and 1 from Italy, biomarker responses were influenced also by seasonality, tissue analyzed, spawning status, and species. Drivers and pressures reported in the scientific literature, encompassed the whole range of them: domestic and industrial discharges, agricultural and riverine runoff, fisheries, harbor and marina utilization, maritime activities, and tourism. Finally, while pressures were identified, there is no available data on pollution effects. In the western Mediterranean Basin, there is no available data on pollution effects.

For Common Indicator 19, assessment (Figure 6) shows a non-Good Environmental Status (non-GES) due to acute pollution events, primarily oil pollution in the Aegean Sea. The pollution effects also indicate a non-GES (Poor status) in the North Adriatic for pollution effects and a moderate status in other areas of the same basin. A good GES status was found for acute pollution events in the Central Mediterranean basin. Finally, a poor status was found in the Alboran Sea, and a moderate status for the other parts of the Mediterranean Sea. In addition to anthropogenic stressors, biomarker responses were influenced also by seasonality, tissue analyzed, spawning status, and on species identity.

For Common Indicator 20, while drivers that could exert pressure and cause impact were identified in the basin, no impact has been detected on seafood safety. Out of the 23 studies found in the literature for the Aegean and Levantine basins, 87% reported concentrations of Trace Metals and organic contaminants below the concentration limits for the regulated contaminants in the EU, 4% reported concentrations above the limits but without risk to human health and 9% reported concentrations above the limits for the regulated contaminants with probable risk to human health. In the Central Mediterranean Sea, while some biota samples have higher than threshold levels of Hg, they remain below EU regulatory limits. In the Western basin, no impact was detected on seafood safety while most bathing waters are in excellent or good status, with some poorly classified units in Morocco. Drivers and pressures reported in 15 relevant studies (4 from Algeria, 2 from Italy, 5 from Spain and 4 from Tunisia), encompassed domestic and industrial discharges, agricultural and riverine runoff, fisheries, harbor and marina utilization, maritime activities, tourism. For 20 out of the 37 studies found in the literature, 78% reported concentrations of Trace Metals and organic contaminants below the concentration limits for the regulated contaminants in the EU and 11% reported concentrations above the limits but without risk to human health. Possible impact was detected in 11% of the studies that reported concentrations above the limits for the regulated contaminants with probable risk to human health.

For Common Indicator 21, limited data indicates that some areas from the Aegean Sea are in non-good status due to high concentrations of enterococci. In the Levantine Basin, mixed results were obtained, with some areas, particularly in Beirut (4 of 38 stations in Lebanon), in non-good status with probable drivers being urban development and industry, discharge of wastewater through marine outfalls and riverine discharge. In the Adriatic Sea, most bathing waters are in good to excellent status, although some areas in Italy and Albania have poor classifications.

Drivers that could exert pressure and cause impact on CI 21 were also detected in the Western Mediterranean Sea, and among them the following: tourism, sporting and recreational activities; ports and maritime works, maritime activities. However, essentially no or very limited impact was detected.

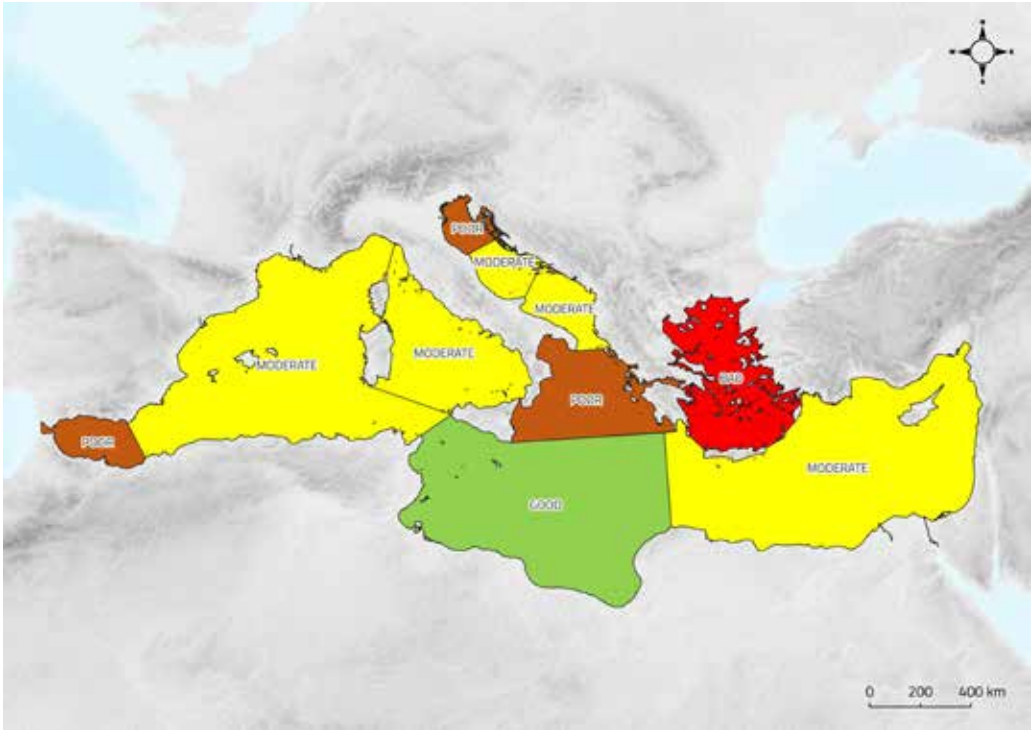


Figure 6: Map of the assessment of the marine environment status for CI 19 for the sub-divisions of the Mediterranean Sea. (Note: assessment results derive from data extrapolation at the scale of each sub region).

Recommended measures to Achieve GES for EO9 Common Indicators (Chemical pollution):

Noting the lack of data on organic contaminants in sediments and biota across all Mediterranean sub-regions, the limited IMAP data other than from **European Environmental Agency (EEA)** and scientific literature for CI 20 and 21 a number of recommendations are key:

- **Improve data availability and quality:** harmonized monitoring and reporting, capacity building, Best Available Technology and Best Environmental Practices, consistent sampling, quality assurance.
- **Specific actions for Common Indicators:** CI17: Update environmental assessment criteria and extend monitoring to emerging contaminants; CI18: Develop and apply new biomarkers and environmental risk analysis tools; CI19: Improve data collection on pollution events and impacts, and define operational criteria; CI20: Harmonize species selection for monitoring and incorporate human health risk assessments; CI21: Ensure consistent and comprehensive data reporting for bathing water quality assessments.
- **Update Environmental Assessment Criteria:** update the list of priority pollutants and commonly agreed IMAP Pollution species, utilize a database of scientific literature and methodologies to derive EAC values, focusing on Mediterranean Sea biota species, update Sub-regional and regional Thresholds to ensure Mediterranean-specific criteria.
- **Integrate Data for Environmental Risk Analysis:** combine chemical and ecotoxicological data to support risk evaluation for marine organisms.
- **Promote sustainable practices** in aquaculture, agriculture, industry, tourism, and maritime operations. **Tailor regional and national plans:** track the effectiveness of measures in areas classified as non-GES or likely non-GES, Strengthened regional cooperation and policy integration.

Marine Litter

Ecological Objective 10 (EO10)
Marine litter does not adversely affect the coastal and marine environment

Common Indicator 22: Trends in the amount of litter washed ashore and/or deposited on coastlines

Common Indicator 23: Trends in the amount of litter in the water column including microplastics and on the seafloor

Marine litter in the Mediterranean Sea is a growing environmental concern, with plastics making up the majority of the waste found in marine environments. This pollution not only affects marine wildlife, causing injuries and fatalities through ingestion and entanglement, but also poses significant threats to human health and coastal economies. The Mediterranean has some of the highest levels of marine litter in the world, with densely populated coastal areas and high tourism rates contributing to the problem. Additionally, the semi-enclosed nature of the Mediterranean basin means that litter tends to accumulate and persist over time. Regional cooperation, continuous monitoring and stricter enforcement of regulations are essential to effectively combat marine litter in the basin.

Common Indicator 22:

Key findings

A total of 931 beach surveys were conducted, collecting approximately 300,000 marine litter items from the Mediterranean coastline (Figure 7a). Only 16% of monitored beaches achieved Good Environmental Status (GES), with 79% not meeting GES criteria. Of the latter, 29% were classified as poor and 25% as bad. Beach litter concentration varied significantly, ranging from 8 to 47,361 items per 100 meters, with an average of 961 ± 3664 items per 100 meters. The Central Mediterranean had the least beach litter (32% of 22 beaches monitored achieved GES). The Adriatic, Eastern, and Western Mediterranean had similar distributions of beaches under GES (14-16%) and non-GES (84-86%). The most common items were plastic/polystyrene pieces (2.5 cm – 50 cm), cigarette butts and filters, and plastic caps and lids, comprising approximately 60% of recorded litter.

Common Indicator 23:

Key findings

For floating marine litter, the total number of floating mega-litter was estimated at 2.9 million items and average density 1.5±0.1 items per km^2, with a high variability (Figure 7b). Data from the ACCOBAMS Aerial Survey Initiative (ASI) in summer 2018 indicated that only 20% of the Mediterranean was free of floating mega-litter. Highest concentrations were found in the central and western Mediterranean (Tyrrhenian, northern Ionian, Adriatic Seas, and Gulf of Gabs) and lowest in the Levantine basin, southern Ionian Sea, and Gulf of Lion. Plastics constituted 68.5% (plastic bags, bottles, toys, etc.), fishery debris 1.7%, and anthropogenic wood-trash 1.9%. The remaining quarter (27.9%) was anthropogenic mega-litter of an undetermined nature.

Seafloor litter concentrations ranged from 0 to 28,228 items per square kilometer, with an average of 570 ± 2,588 items per square kilometer. The majority (88%) of seafloor stations did not achieve GES, with 23% in poor and 53% in bad status classes.

Western Mediterranean was most affected (100% non-GES), followed by Central Mediterranean (81% non-GES), Adriatic (65% non-GES), and Eastern Mediterranean (68% non-GES). Up to 10% of recorded litter was fishery-related items, including synthetic ropes/ strapping bands (39%), fishing nets (27%), and fishing lines (25%), noting that while fishing gear is a small percentage of the marine litter, it has big effects, like ghost nets.

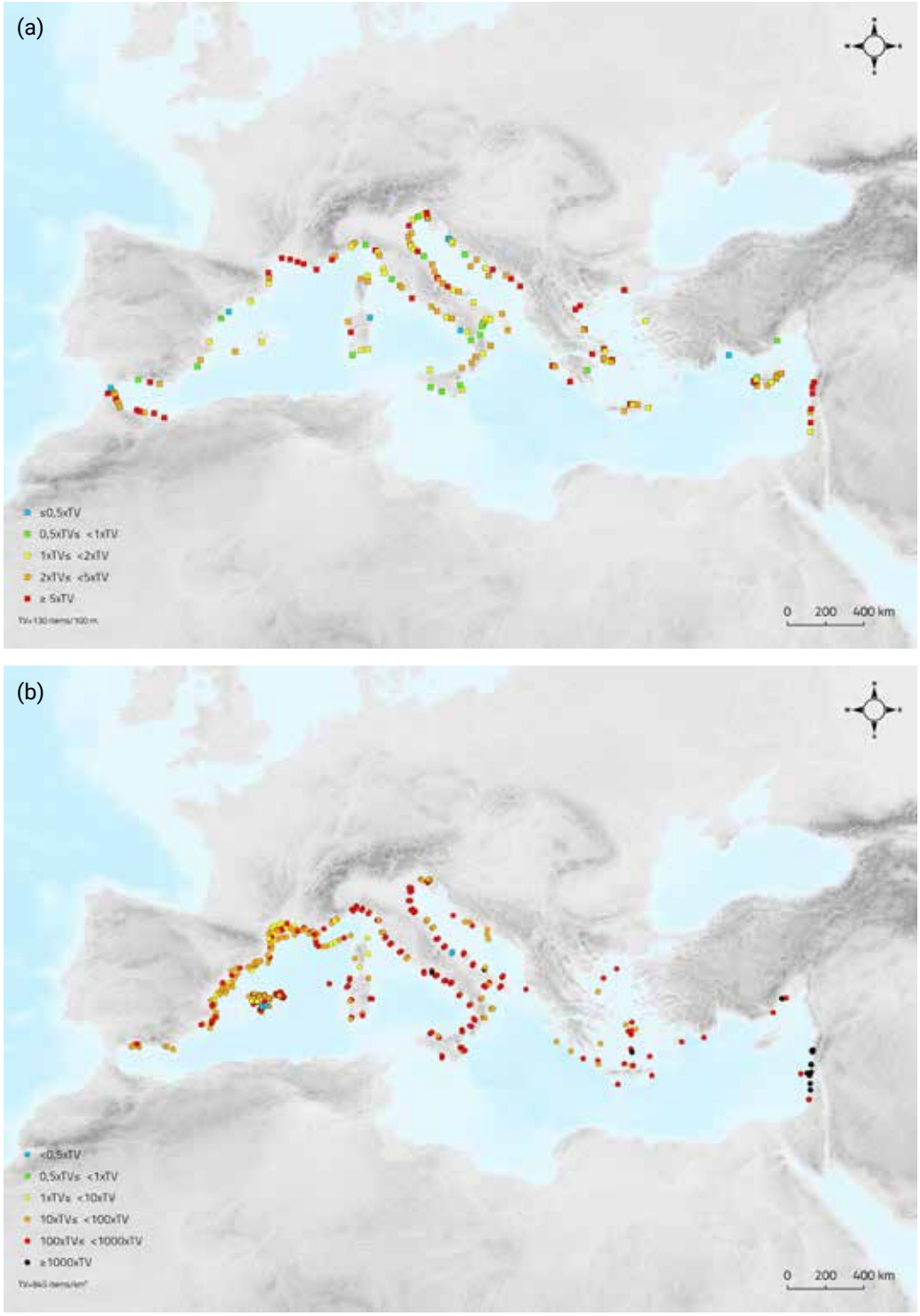
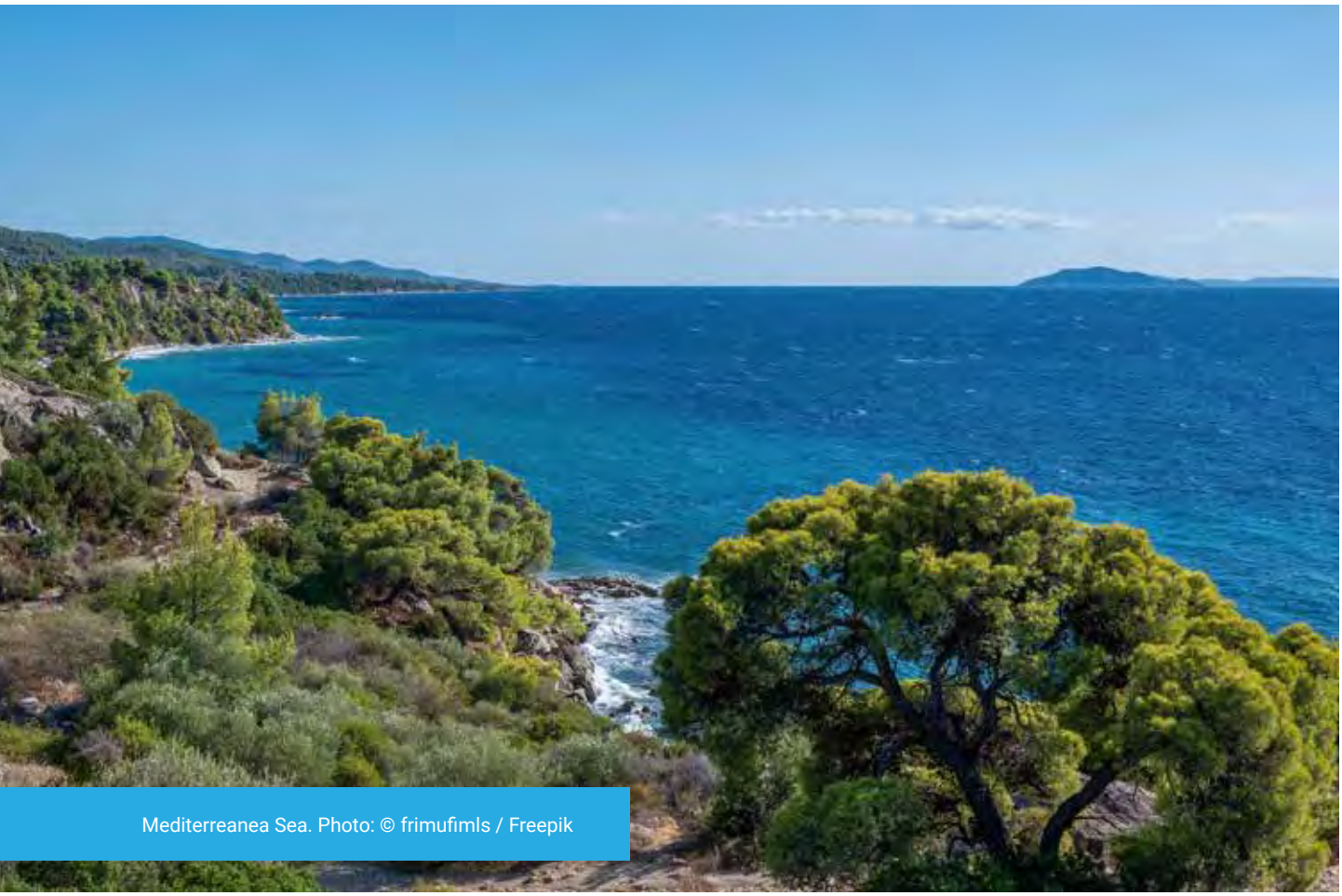


Figure 7: GES assessment classification for: (a) beach macro-litter (CI22); and (b) floating microplastics (CI23) in the Mediterranean Region.

For floating microplastic concentrations, almost all monitored stations (99%) did not achieve GES, with 44% in poor and 49% in bad status classes. Microplastics concentrations varied from 0 to 31 items per square meter, with an average of 0.355 ± 1.99 items per square meter. The most common types were Sheets (37%), Filaments (30%), Pellets (21%), Fragments (7%), Foam (4%), and Granules (1%).

Recommended measures to Achieve GES for EO 10 Common Indicators (Marine Litter):

- **Addressing Assessment Findings and Knowledge Gaps:** link monitoring and assessment with measures, target specific marine litter items like cigarette butts and plastic bottles, promote behavioral changes, prevention measures, recycling, alternative materials and extended producer responsibility schemes.
- **Microplastics Management:** enhance management of microplastics through waste water management, regulatory approvals, education, Control sludge management.
- **Household and Industrial Measures:** ban single-use plastics, promote behavior changes, improve textile designs, and develop household systems to prevent microplastics release.
- **Riverine and Storm Water Management:** implement measures to control litter in riverine systems and urban storm water management plans to minimize plastic leakage into rivers and oceans.
- **Sea based sources:** implement best practices for fishing vessels to retrieve derelict gear and deliver it to port facilities. Address abandoned, lost, and discarded fishing Gear through FAO guidelines, Introduce measures to reduce marine litter from aquaculture, minimizing single-use plastics, and raising awareness among staff.
- **Policy and Regulation Enhancements:** introduce prevention measures to minimize plastic production and consumption, revise legal frameworks, and develop compulsory Extended Producer Responsibility systems, Strengthen links to global initiatives and policies, such as UNEA resolutions, UNEP partnerships, and the IMO Action Plan.



Mediterreanea Sea. Photo: © frimufimls / Freepik

Hydrographic Conditions, Coastal Ecosystems and Landscapes

Ecological Objective 7 (EO7)
Alteration of hydrographical conditions

Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations

The circulation of the Mediterranean Sea is driven by several forces, external ones, like wind stress, strong topographic constraints and internal dynamic processes. The emerging Mediterranean general circulation, therefore, encloses three predominant and interacting spatial scales: basin scale, sub-basin scale, and mesoscale. All countries had difficulties with the monitoring of the EO7 indicators and could therefore provide limited monitoring data. Climate change seems to have far bigger impacts on the habitats and marine ecosystems in general than the impacts of hydrographic alterations caused by new structures.

Common Indicator 15:

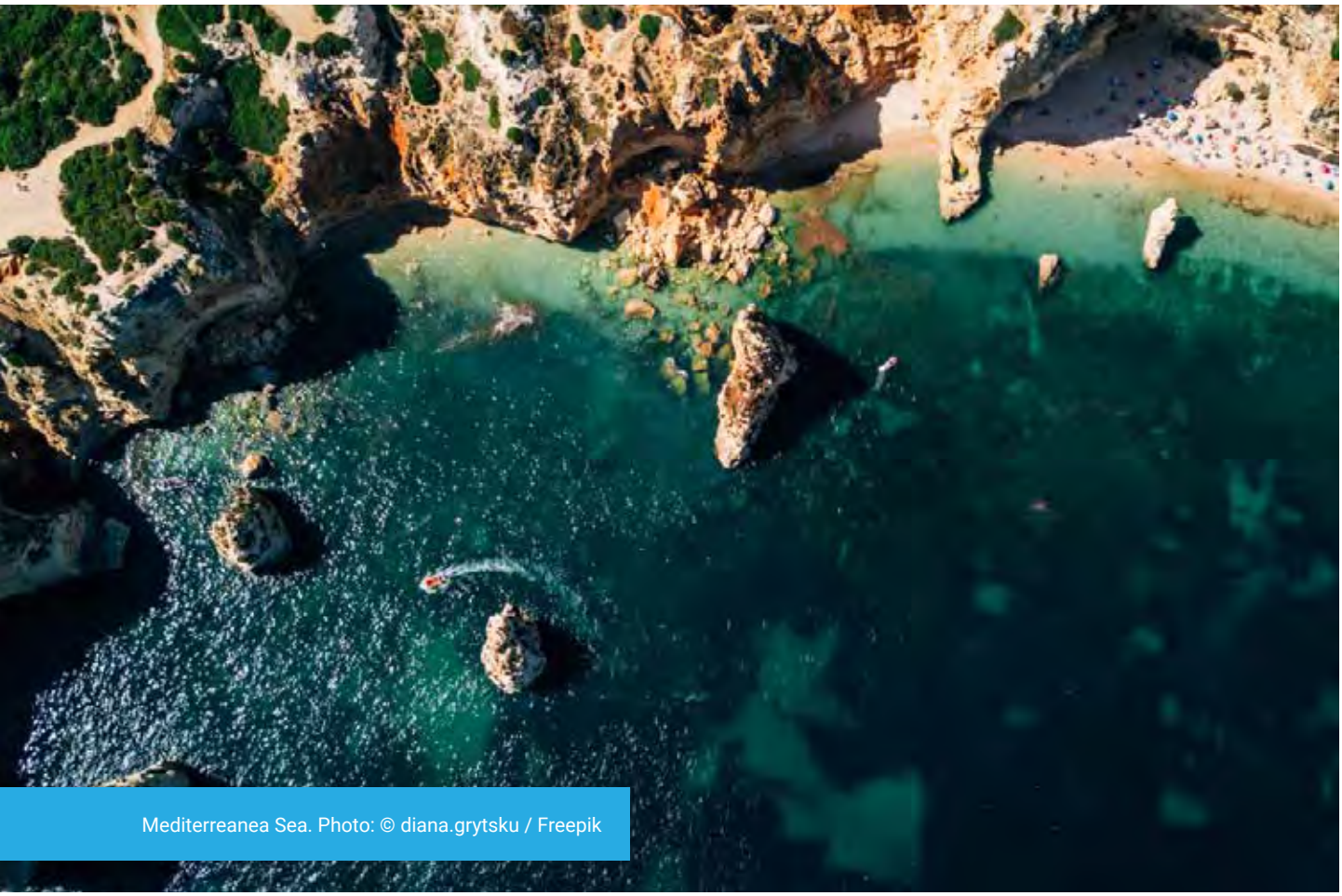
Key findings

Countries have faced significant difficulties in monitoring Common Indicator 15 (CI15), which pertains to the location and extent of habitats directly impacted by hydrographic alterations. As a result, the Good Environmental Status (GES) for this indicator has not been assessed. To address these challenges, a simplified Guiding Factsheet is needed to help countries report on physical habitat loss due to structures' footprints, noting that coordination with EO1 (Biodiversity) and EO6 (Seafloor Integrity) is essential for defining GES.

A baseline assessment was conducted using data from national reports prepared under EcAp MED III and IMAP MPA projects, as well as data from scientific partners like Mercator Ocean. This assessment highlighted that climate change impacts on habitats and marine ecosystems are generally more significant than those caused by hydrographic alterations from new structures.

Recommended Measures and Actions to Maintain/Achieve GES for CI15:

- **Establishment of National IMAP Monitoring Programmes:** collect statistically significant data for local scale models, Map habitats impacted by hydrographic alterations, link EO7 to EO1 and EO6.
- **Creation of a Digital Spatial Database:** compile data, on location of interventions, existing and planned structures, and marine habitats, Utilize resources like Copernicus Marine Services, EMODnet, and spatial planning information systems of individual countries to provide necessary data.
- **Simplification of Indicator Factsheet:** consider revising the existing indicator Factsheet to simplify the reporting method.**Incorporation of Climate Change Indicators:** propose a set of climate change-related indicators within IMAP, including monitoring hydrographic parameters and in-situ data, utilize hydrographic parameters reported within EO5 such as remote sensing.



Mediterreanea Sea. Photo: © diana.grytsku / Freepik

Ecological Objective 8 (EO8)
Coastal ecosystems and Landscapes

Common Indicator 16: Length of coastline subject to physical disturbance due to the influence of human-made structures

Candidate Common Indicator 25: Land cover change

Common Indicator 16:

Key findings

Monitoring data for CI16 covered 57% of the Mediterranean coastline (31,283 km). Of this, 26,658 km (85.2%) is natural, and 4,625 km (14.8%) is artificial (Figure 8).

Data shows that most human-made structures are ports and marinas.

Assessment of changes in physical disturbance is limited due to the lack of comparative data, as only three countries provided two sets of data.

Figure 8: Overview map of the baseline situation for CI 16 (artificial and natural coastline and artificial structures).

Recommended Measures and Actions for GES Achievement:

- **Ensure consistent detail and spatial resolution in monitoring:** standardized cartographic projections, Analyze and categorize existing artificial coastlines, Improve environmental impact monitoring, harmonize mapping methods across countries.
- **Define country-specific GES:** unique national circumstances, Promote nature-based solutions and restrict land-take for second homes.
- **Develop Indicators of Success/ measurable changes in coastline:** e.g. km of restored natural coastline, km of recovered habitats, percentage of nature-based solutions, etc.

Candidate Common Indicator 25:

Key findings

A pilot study in the Adriatic sub-region showed built-up areas occupy 8.77% (2,500 km²) of the coastal zone. From 2012-2018, built-up areas increased by 27 km², indicating a land take trend of 1%. The land cover changed from forests, water bodies, and agricultural land to built-up areas and wetlands. Country-specific GES has not been defined, impeding the assessment.

Recommended Measures and Actions for GES Achievement:

- **Develop a technical manual:** understand coastal ecosystems' integrity and diversity.
- **Define objective GES at sub-regional or country levels:** for better assessment.
- **Protect and restore threatened coastal ecosystems and habitats:** improve environmental impact monitoring and mitigation in built-up areas, analyze and categorize existing built-up areas for potential reduction or natural restoration promote nature-based solutions in new construction areas, encourage sustainable land use, restrict land-take for second homes, categorize existing built-up areas for potential reduction or natural restoration)

Underwater Noise

Ecological Objective 11 (EO11)
Noise from human activities cause no significant impact on marine and coastal ecosystems

Candidate Common Indicator 26: Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animals

Candidate Common Indicator 27: Levels of continuous low frequency sounds with the use of models as Appropriate

Sounds underwater arise from a very wide variety of sources, both natural and human-made (anthropogenic). Natural sounds include those generated by a wide range of marine fauna, waves, rain, wind, and seabed movement, while anthropogenic sounds from human activity at sea include shipping and other marine craft, building and installations, sonar and seismic surveys.

Candidate Common Indicator 26:

Key findings

For the years 2016, 2017, 2019, 2020, 2021 and for all the 4 cetacean species considered (bottlenose dolphin, fin whale, sperm whale, Cuvier's beaked whale), all sub regions are below threshold, i.e., less than 10% of the potentially usable habitat area is affected by noise events as calculated following the adapted assessment methodology. For the year 2018 and for all the 4 species considered, 3 sub-regions are below threshold of affected habitat (Adriatic, Central and western Mediterranean Seas).

Overall, for the Mediterranean Sea region, the environmental status is probably acceptable based on the present preliminary assessment findings, since the whole Mediterranean seems to comply with the 10% GES/non-GES boundary value of impacted habitat of cetaceans selected for this assessment. This conclusion is also supported by the computation of the simple coverage (i.e., without considering the habitat of cetaceans) of the Mediterranean Sea by impulsive noise events, which are below 10% for all year considered.

Candidate Common Indicator 27:

Key findings

Even though detailed quantitative data on continuous noise were not produced for other months than July 2020, with the highest levels of vessel traffic, hence the worst-case scenario. This result was generalized for the entire year 2020. The computation of the extent of exposure resulted in non- GES status for the Western Mediterranean Sea and the Aegean Levantine Sea Sub-regions (> 20% affected habitats), while the status is tolerable (i.e., GES) in the Adriatic Sea and Central Mediterranean Sea Sub- regions.

Recommended Measures and actions required to maintain/achieve GES EO11 (noise):

- **Improve underwater noise data quality and availability:** contribution to the ACCOBAMS regional register for impulsive noise sources, cooperation mechanism to identify the source of long-distance underwater noise, reporting noise generating military activities, specific assessments for species and their habitats.
- **Implement International and Regional management measures (e.g. CMS, IMO, Oceans, ACCOBAMS, etc.):** Promote the application of vessel speed reductions, Integrate the issue of anthropogenic noise in management plans in Marine Protected Areas and critical habitat of cetaceans, apply the precautionary approach, consider atypical mass stranding, support NETCCOBAMS.
- **Best Available noise Technologies s should be applied for marine traffic and seismic air gun surveys:** cavitation, reduced speed, individual vessels management plans, quieting technologies and controlled sound source, voiding sensitive areas and times.

Mediterreanea Sea. Photo: © wirestock / Freepik

Conclusions

The Mediterranean ecosystems are highly vulnerable to coastal urbanization, industrial and agriculture pollution, tourism and trawling disturbances.

The Mediterranean Sea's unique biotope, characterized by species such as *Posidonia oceanica* meadows and coralligenous assemblages, is vital through its ecosystem services like food resources, cultural and recreational use and tourism. However, these ecosystems are highly vulnerable to coastal urbanization, industrial and agriculture pollution, tourism, and trawling disturbances. Ecosystems are essential for seafood provision, coastal protection, and carbon sequestration, but human activities and limited knowledge impede achieving Good Environmental Status (GES) in many areas.

Despite data limitations, the 2023 assessment highlighted severe pressures from infrastructure development and bottom fishing. The Mediterranean waters host endangered species like the monk seal and various cetaceans, with human activities posing significant threats. Data quality issues hinder comprehensive GES assessments for these species. Non-indigenous species (NIS) are a growing concern, with over 1,199 new NIS reported during the five last decades. Monitoring efforts have increased, but the constant introduction rate complicates trend interpretation. Commercial fish stocks in the Mediterranean are overfished, impacting livelihoods and the economy.

Eutrophication, caused by nutrient enrichment, disrupts water ecosystems and poses economic threats. Due to data heterogeneity, complete GES assessment was limited. Chemical pollution persists despite prevention efforts, with varying progress across sub regions. Marine litter, primarily plastics, exert several pressures to the marine ecosystem and associated services for marine life and human health. Monitoring shows high litter levels, with most seafloor stations not achieving GES.

Hydrographic alterations impact marine habitats, with countries facing monitoring challenges. Climate change has greater impacts than new structures. Noise pollution affects cetacean habitats, with varying GES status across sub regions.

Overall, addressing these environmental challenges requires coordinated efforts, enhanced monitoring, data sharing, and implementing effective management and conservation strategies to protect and sustain the Mediterranean marine ecosystem.

Efforts to protect the Mediterranean's biodiversity, combat pollution, manage non-indigenous species, and ensure sustainable use of resources must be intensified through enhanced monitoring, data collection, and coordinated policy implementation. Strengthening science-policy interfaces and utilizing advanced technologies are essential for achieving Good Environmental Status and preserving the region's marine environment.

Learn more:

United Nations Environment Programme (2024): Mediterranean Quality Status Report: The state of the Mediterranean Sea and Coast from 2018-2023. Athens, Greece

Executive Summary of the 2023 Mediterranean Quality Status Report contained in Annex I of Decision IG.26/3 (COP22)