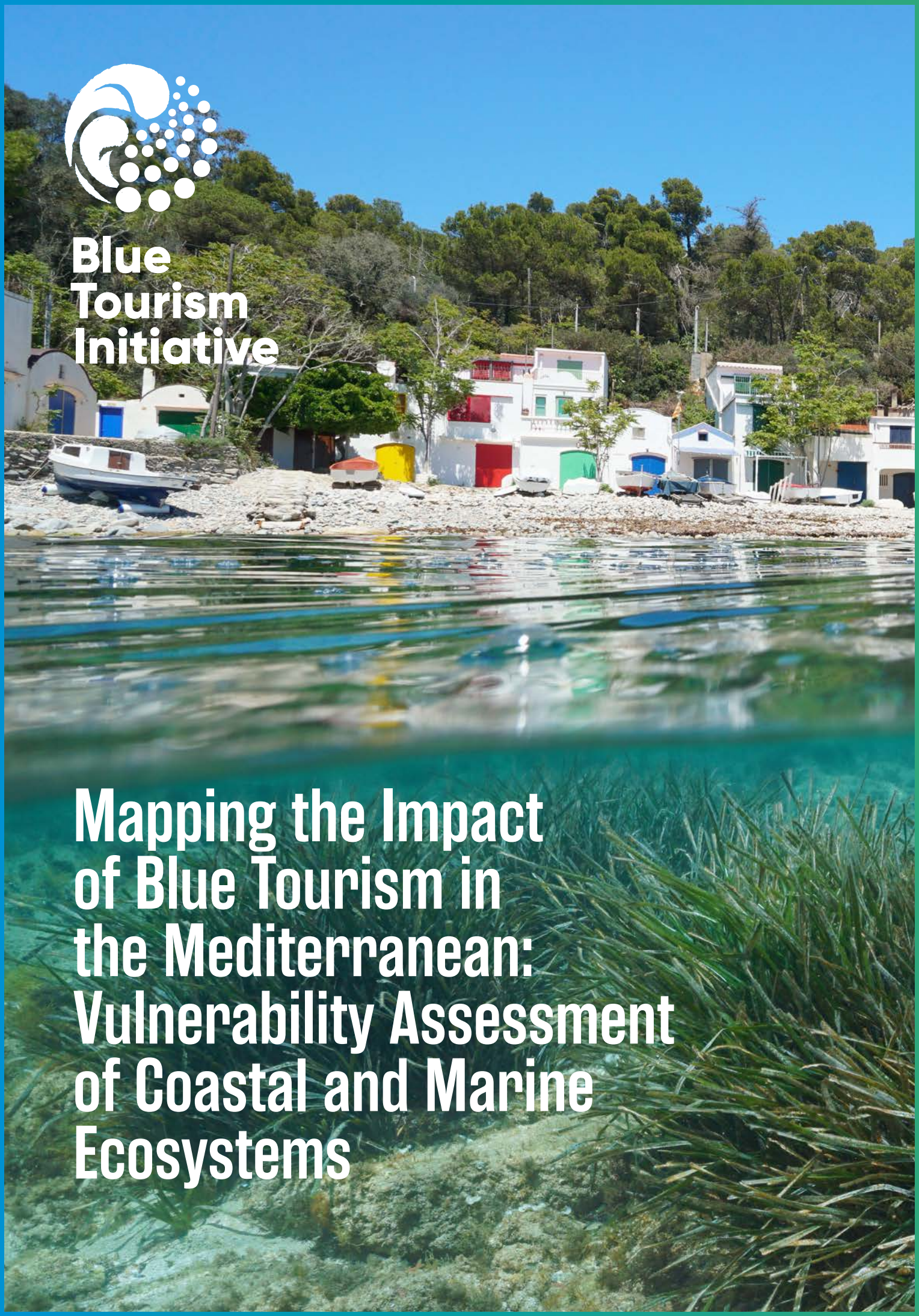

Blue Tourism Initiative

Mapping the Impact of Blue Tourism in the Mediterranean: Vulnerability Assessment of Coastal and Marine Ecosystems

Mapping the Impact of Blue Tourism in the Mediterranean: Vulnerability Assessment of Coastal and Marine Destinations

This report was prepared for IUCN Centre for Mediterranean Cooperation (IUCN-Med) by the European Topic Centre for Spatial Analysis and Synthesis – University of Malaga (ETC-UMA).

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Mapping Blue Tourism: Vulnerability Assessment of Mediterranean Coastal and Marine Ecosystems

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About the Blue Tourism Initiative

The Blue Tourism Initiative is a global multi-stakeholder innovation program focused on the environmental management, governance, and planning of coastal and maritime tourism in three marine regions: the Mediterranean, the Western Indian Ocean and the Caribbean. The project supports the participatory development of sustainable blue tourism initiatives through policy actions and a multi-stakeholder approach to inform the scalability of sustainable blue tourism in other regions.

The objectives of the Blue Tourism Initiative are to:

1. Assess the blue tourism's current global and regional situation, focusing on challenges and opportunities, and recommend directions for sustainable blue tourism development.

2. Support and monitor the implementation of sustainable blue tourism initiatives in the Mediterranean, Western Indian Ocean, and the Caribbean.

3. Integrate sustainable blue tourism management and governance at the regional policy level, share best practices, and raise awareness among key local, national, and regional stakeholders.

The Blue Tourism Initiative is implemented by the Institute for Sustainable Development and International Relations (IDDRI) and think-and-do tank Eco-Union (lead partners); the International Union for Conservation of Nature – Centre for Mediterranean Cooperation (IUCN-Med) in the Mediterranean; Coastal Oceans Research and Development in the Indian Ocean (CORDIO East Africa) in the Western Indian Ocean and the Caribbean Natural Resources Institute (CANARI) in the Caribbean. The initiative is co-funded by the French Global Environmental Facility (FFEM).

Summary

Mapping the vulnerability of Mediterranean areas to tourism can help identify where to improve the management and protection of nature.

The Mediterranean is both a global biodiversity hotspot and one of the world's most popular tourism destinations. While tourism relies on a clean and attractive environment, it can pose significant threats to nature. Ensuring a sustainable tourism sector is therefore vital for healthy Mediterranean ecosystems that can support the livelihoods and wellbeing of communities that depend on them. **Protected and conserved areas**, when effectively managed, are a key tool to safeguarding nature in areas that are under increasing pressure from tourism. Understanding which areas in the Mediterranean are most vulnerable to tourism can help identify priority areas for strengthened management and protection in line with the **global target to effectively protect 30% of coastal and marine areas by 2030, and increase ocean resilience**.

This report provides **a spatial assessment of the vulnerability** of the Mediterranean region to tourism activities linked to coastal and marine areas (i.e. blue tourism) pre and post COVID-19, including:

1. Cumulative impacts of blue tourism on sensitive Mediterranean ecosystems.

2. Impacts of leisure boat activity on the seagrass species *Posidonia oceanica*.

3. Impacts of marine traffic on cetaceans (whales, dolphins, porpoises) in the Pelagos Sanctuary.

Areas of high vulnerability were identified by finding overlaps between areas under pressure from tourism, important areas for biodiversity and protected areas. Vulnerable areas are those that are important to biodiversity, exposed to high tourism pressures and not protected.

Vulnerability to blue tourism in the Mediterranean is driven by high cumulative pressures in some regions, and by a low protection of ecologically sensitive areas in others.

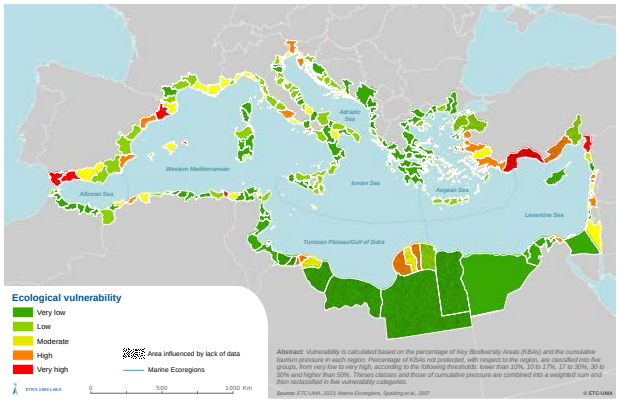
The European Western Mediterranean is experiencing high levels of cumulative tourism pressures both on land and at sea, due to factors like the amount of built-up area, the number of arrivals, the tourism demand, the number of golf courses, the cruise traffic or the marina port moorings. Pressures from tourism are higher on land in the Northern Adriatic and Italian regions around Lazio, while in the Southern Aegean and Cyprus pressures are mainly marine. Outside Europe, Tunisia stands out as having high pressure from tourism on land.

Some areas exposed to high tourism pressure coincide with unprotected ecologically sensitive areas, making them particularly vulnerable. On land, highly vulnerable areas can be found on both ends of the Mediterranean from the Spanish regions of Cádiz and Málaga to the Turkish regions of Antalya and Hatay. Other vulnerable areas are also found in Girona and Menorca (Spain), in the Annaba Province (Algeria) and in the Trieste province (Italy).

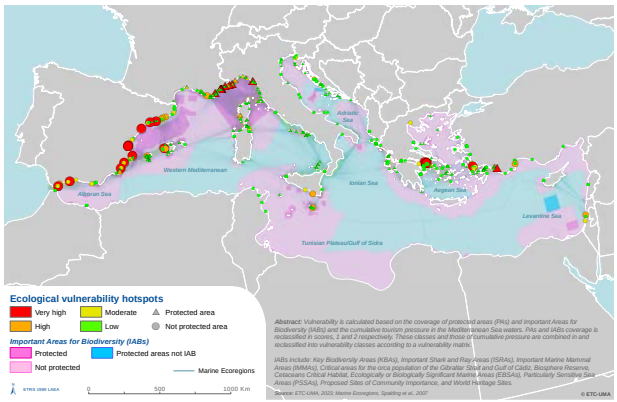
Some **European Union (EU) countries have high vulnerability** despite their relatively high levels of protection **due to high tourism pressure**. Conversely, the high vulnerability in **some non-EU Eastern and Southern Mediterranean countries** that are (for now) exposed to lower levels of tourism, is explained by a **lower share of ecologically vulnerable areas under protection**. **Türkiye´s coastline is notably vulnerable to tourism** likely due to the relatively low number of protected areas in the country´s coastal areas. At sea, hotspots of high vulnerability can be found along the Spanish Alboran Sea, Western Mediterranean and Aegean Sea. **Some highly vulnerable areas overlap with protected areas** in the French and Italian coastal areas in the Ligurian Sea, or the Patara Special Environmental Protection Area of Türkiye. Most of the remaining vulnerability hotspots fall outside protected areas.

The impacts of the COVID-19 pandemic on Mediterranean tourism vary across regions. However, the sector shows clear signs of recovery and intentions to keep growing beyond pre-pandemic levels.

Ecological vulnerability to tourism by NUTS3 or equivalent region in 2022



Ecological vulnerability to tourism in Mediterranean Sea waters in 2022



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Posidonia oceanica meadows are under increasing pressure from leisure boat activity

Posidonia oceanica is a seagrass species, unique to the Mediterranean, which delivers important ecological and societal benefits including providing habitat, sequestering carbon and protecting coastlines. Despite their value, *Posidonia oceanica* meadows are threatened by several pressures including anchoring from leisure boats linked to tourism. Overall, ***Posidonia oceanica* meadows are exposed to higher leisure boat traffic than the rest of territorial waters**. Leisure boat traffic is highest in summer and has been on the rise since 2017 with a marked increase after the pandemic. *Posidonia oceanica* within protected areas are exposed to higher traffic. However, in EU countries, traffic levels in protected and unprotected areas are similar in summer, and higher in unprotected areas in winter.

Collisions with tourism-related vessels threaten whale species in the Northwest Mediterranean

The area around the Pelagos Sanctuary in the Northwest Mediterranean is important for endangered cetaceans, hosting 70% and 50% of the Mediterranean's fin and sperm whales respectively. The area is also covered by a web of busy shipping routes, sometimes crossing protected areas, which are mainly linked to key tourism destinations. Collisions with vessels often result in the death of whales. Moreover, marine traffic can disrupt cetaceans' communication and pollute their habitats. Most ship strikes with cetaceans in the Pelagos Sanctuary area have been recorded from the 1980s to 2000s with a peak of 38 records in the decade of the 2000s. In the 2010s, records dropped to around 11 strikes per year.

The following general conclusions and recommendations can be drawn from this mapping analysis:

- **Conservation actions** at the local and regional level **should be informed by the identification of hotspots for vulnerability** of key habitats and tourism pressures**.**
- **EU countries should work towards reducing pressures** and managing impacts from tourism.
- **Non-EU countries should increase the protected areas** and other effective area-based conservation measures (OECMs) to ensure important biodiversity areas are effectively managed ahead of tourism developments.
- Consistent and harmonised **tourism data should be made more available** at the Mediterranean level, including non-traditional (e.g. vacational) rental markets.

Specific measures are needed to:

- **Reduce leisure boat traffic on seagrass meadows** and ensure appropriate anchoring practices, inside and outside protected areas**.**
- **Protect cetaceans from ship collisions within the particularly sensitive area in the North-Western Mediterranean**, including voluntary speed reductions, increased reporting, improved information on whale aggregations for seafarers and traffic restrictions.

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Acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
EBSA	Ecologically or Biologically Significant Marine Area
EEA	European Environment Agency
EMODNet	European Marine Observation and Data Network
ETRS	European Terrestrial Reference System
EUROSTAT	Statistical office of the European Union
GADM	Database of Global Administrative Areas
GIS	Geographic Information System
GISCO	Geographic Information System of the COmmission
IAB	Important Area for Biodiversity
IMMA	Important Marine Mammal Area
ISRA	Important Shark and Ray Area
IUCN	International Union for the Conservation of Nature
IWC	International Whaling Commission
KBA	Key Biodiversity Area
LAEA	Lambert Azimuthal Equal Area
MENA	Middle East and North Africa
MEOW	Marine Ecoregions of the World
MPA	Marine Protected Area
MSFD	EU Marine Strategy Framework Directive
NUTS (2/3)	Nomenclature of territorial units for statistics (level 2 and 3)
OSM	OpenStreetMap
PA	Protected area
PSSA	Particularly Sensitive Sea Area
UNWTO	United Nations World Tourism Organisation
WDPA	World Database on Protected Areas

Photo 1. **Tourists in Paseo Marítimo de Pedregalejo in Málaga, Spain**

© Turismo Costa del Sol

1. Introduction

More than any other sector, tourism is responsible for the movement of people across the globe. Tourism is also one of the world's largest and fastest-growing economic sectors, responsible for 9% of the global gross domestic product (GDP) and for the creation of 1 in 11 jobs worldwide (WTTC, 2024). Tourism is of major importance to European economies, but a damaged environment could undermine tourism in the future, since tourism needs a clean and attractive environment. Hence, the relevance of tourism is not only limited to its economic impact, but it also has important effects on the social and environmental sphere.

This is particularly true for marine and coastal tourism, and especially in the Mediterranean. As widely known, the Mediterranean region is one of the major global biodiversity and climate change hotspots and, at the same time, the world's leading tourism destination in terms of both international and domestic tourism. The constant increase in tourist arrivals, coupled with tourism-related infrastructure and activities, pose important pressures on the coastal and marine environment and livelihoods, even after the tourism crisis resulting from the COVID-19 pandemic.

The effective management of existing protected areas and the protection of non-protected ecologically sensitive areas are key aspects to mitigating pressures on the environment and ensuring sustainable pathways for both ecosystems and human livelihoods. This is particularly true for Blue Tourism, i.e. coastal and marine tourism, which is very concentrated in space and time. Coastal tourism refers to beach-based tourism and recreational activities, including swimming, sunbathing, and surfing, alongside other activities taking place on the coast and for which the proximity of the sea is advantageous, such as coastal walks or wildlife watching. Meanwhile, maritime tourism refers to predominantly water-based activities, such as sailing, yachting, cruising and other nautical sports (Tonazzini et al., 2019; Balestracci & Sciacca, 2023).

In this context, the Blue Tourism Initiative (2023-2026) promotes a holistic vision of maritime and coastal management in line with worldwide efforts to deliver the 2030 Agenda and with the target to protect 30% of the Earth´s land and sea surface by 2030 established under the Global Biodiversity Framework[1]. The initiative supports exchanges of knowledge, good practices, projects and experiences between three major marine regions sharing similar challenges related to coastal and maritime tourism: the Mediterranean, the Western Indian Ocean and the Caribbean. It aims to improve the governance of coastal and marine tourism to ensure sustainable, inclusive, and resilient development, and address the associated environmental, health, socio-cultural and economic challenges. Within the Blue Tourism Initiative, the IUCN Centre for Mediterranean Cooperation (IUCN-Med), with support from IDDRI and eco-union, will support evidence-based policymaking in

1 The Kunming-Montreal Global Biodiversity Framework (GBF) was adopted by the Convention on Biological Diversity during its fifteenth meeting of the Conference of the Parties. This framework supports the achievement of the Sustainable Development Goals and sets out an ambitious pathway to reach the global vision of a world living in harmony with nature by 2050.

the Mediterranean region, especially in the framework of the Barcelona Convention and other cooperation programmes such as Interreg Euro-MED, Interreg NEXT MED, WestMed, etc. Additionally, IUCN-Med will lead the implementation of three pilot initiatives in Morocco, Tunisia, and Lebanon.

The present report supports the activities that are being developed under the Blue Tourism Initiative by providing a spatial assessment of the vulnerability of the Mediterranean´s coastal areas to pressures stemming from blue tourism, with a specific focus on the role of protected areas in mitigating these pressures. This was done by analysing the overlap of tourism pressures and the biodiversity protection in place. The scope of the study was to conceptualise and design a so-called "Mediterranean Coastal and Marine Tourism Vulnerability Map" and to provide recommendations for improvement.

The results of the study show spatially explicit patterns of tourism pressures at different levels of detail (from NUTS2 to 1 km grid) and provide a first version of the Mediterranean Coastal and Marine Tourism Vulnerability Map. This mapping exercise highlights the interplay between tourism pressure and biodiversity sensitivity and protection. It evidences areas in the Pan-Mediterranean region where mitigation of tourism pressures is of high importance to reduce vulnerabilities and improve ocean resilience.

The report first summarises the assessment questions that guided the study and provides a methodological overview, including a description of the data and methods used for the processing of indicators. The second part of the report analyses and assesses the results of single and combined tourism pressures at the Mediterranean level.

2. Assessment questions

This study was guided by a set of main assessment questions from a general perspective of the cumulative tourism pressures on ecologically sensitive areas, to more targeted analyses of the interplay of specific pressures and ecosystems or species.

To analyse the terrestrial and marine ecological vulnerability in the Mediterranean, we focused on the following question:

- **How do cumulative tourism pressures affect protected areas and important areas for biodiversity?**

For more targeted assessments, we focused on specific species and tourism pressures:

- **How do tourism activities, offer or demand, affect specific species, spatially and temporarily?**
  - **Recreational boat traffic versus *Posidonia oceanica*.**
  - **Marine traffic versus marine megafauna in the Pelagos Sanctuary.**

Finally, we looked at the different levels of tourism pressure before and after the COVID-19 pandemic comparing the changes in the levels of tourism pressure indicators between 2019 and 2022.

3. Methodology

3.1. Overall approach

The approach followed in this study used geospatial data and spatial analysis techniques to highlight pressures arising from tourism, overlay them with Important Areas for Biodiversity[2] (IABs) and assess different degrees of vulnerabilities both inside and outside Marine Protected Areas (MPAs). The basic idea of this approach is to analyse and assess in a spatially explicit way where high intensities and densities of tourism activities overlap with marine protected areas and where sensitive coastal and marine environments are exposed to high degrees of threats.

Figure 1 shows a schematic overview of the study´s methodological approach. The individual tourism pressure indicators were combined to produce a combined tourism pressure map. This was overlaid with a spatial layer of IABs to identify the vulnerabilities at both the basin and pilot region level. This spatially explicit approach allows for the analysis and assessment of vulnerabilities at the local scale or at the level of the whole Mediterranean.

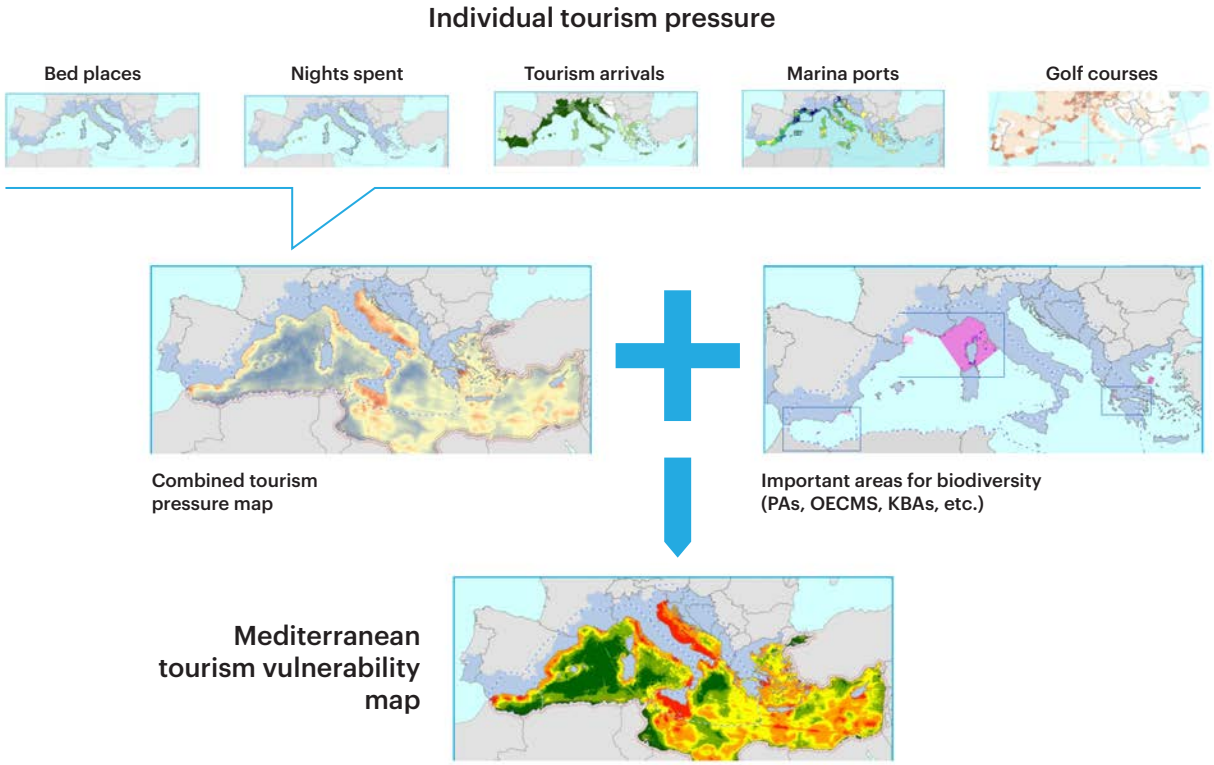
The following section provides further details on the methodological approach.

3.2. Selection and definition of drivers and indicators

The drivers and indicators considered as the most relevant for tourism activity in the Mediterranean were mainly identified based on previous work (Abdul Malak et al., 2015), which were valid for this study and could be improved and updated thanks to the availability of more current, higher quality data. Additional indicators were identified based on new data sources identified through a review of scientific literature on the topic and frequently used data portals (e.g. EUROSTAT, EMODnet, EEA).

Eleven indicators, grouped into four driver categories, were selected for final analysis according to their feasibility of calculation (Table 1).

Figure 1. **Methodological approach**



2 For this assessment, IABs include the following designations: Key Biodiversity Areas (KBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), Particularly Sensitive Sea Areas (PSSAs), Proposed Sites of Community Importance, World Heritage Sites, Important Shark and Ray Areas (ISRAs), Important Marine Mammal Areas (IMMAs), Critical areas for the orca population of the Gibraltar Strait and Gulf of Cadiz, Biosphere Reserves and Cetaceans Critical Habitat.

Table 1. **List of tourism-related drivers and indicators identified for the analysis**

Driver	Indicator
Tourism offer	Number of bed-places in coastal areas (per NUTS2, NUTS3 and km²)
	Number of tourism establishments in coastal areas (per NUTS2, NUTS3 and km²)
	Number of tourism interest sites (accommodation and attractions) (per 1 km pixel)
	Density of golf courses (per NUTS3)
Tourism demand	Number of nights spent at tourist accommodation establishments in coastal areas (per NUTS2, NUTS3 and km²)
	Number of cruise passengers per port
	Number of arrivals (per NUTS2, NUTS3 and km²)
Tourism activities	Marina port capacity (per NUTS3 and km of coast)
	Density of sailing vessels and pleasure crafts (per 1 km pixel)
	Density of passenger vessels (per 1 km pixel)
Tourism-induced pressures	Built-up areas in the coastal buffer (per NUTS3 in the 1 km coastal belt)

3.3. Data review and collection

The main criteria for including the defined indicators in the analysis were the availability and quality of data. After the definition of the indicators, a comprehensive data review was undertaken to ensure the data availability, data quality and fitness for the purpose of the proposed data sources. The required datasets needed to match the following criteria:

- **Spatial coverage** (at least full coverage of one of the regional seas).
- **Temporal coverage** (i.e., data available for 2019 and 2022, or as updated as possible in cases with high data scarcity).
- **Spatial explicitness** (i.e., data linked to a data point, grid cell or small administrative unit, not country statistics).

The selected driver and tourism indicators were used to structure the data collection. Data for each indicator were collected, storing a wide range of attributes for each single dataset, including format (raster, vector, table data), resolution, temporal and spatial coverage, data source, availability, gaps and limitations.

In addition to these, data related to areas of ecological interest, protected areas, both terrestrial and marine, and Key Biodiversity Areas (KBAs)[3], were obtained for the vulnerability analysis.

3 Key Biodiversity Areas (KBAs) are sites of global importance to the planet's overall health and the persistence of biodiversity in terrestrial, freshwater and marine ecosystems. https://www.keybiodiversityareas.org/

3.3.1. General approach used for mapping and data integration

In terms of data coverage, the first step was to clearly define the area of interest for the analysis, including the delimitation of coastal areas to be considered. For the assessment, it was agreed to focus on purely coastal regions (NUTS2 or NUTS3 depending on the case and data availability), that is, those that have territory facing the sea within the Mediterranean region, according to the delimitation of the EU Marine Strategy Framework Directive (MSFD).

The map template was produced to cover the study area and the whole Mediterranean region in an A4 sheet. The templates use a scale of 1:15,000,000 and the European Terrestrial Reference System (ETRS) 1989 Lambert Azimuthal Equal Area (LAEA) projection as the standard reference, providing a square shape that maximises the size of the study areas on the maps. As base information, the template uses the Geographic Information System of the COmmission (GISCO) statistical unit at 1:10,000,000, being the most suitable to the scale of the map, and the Mediterranean ecoregions defined by Spalding et al. (2007). Non-EU countries' administrative subdivisions were based on the Database of Global Administrative Areas (GADM). Equivalent regions to NUTS2 and NUTS3 level were integrated into the mapping template.

The template also includes the standard mapping elements (i.e., legend, north arrow, scale bar) as well as the reference to the source data and a description of the illustrated indicator.

Indicators based on statistics at NUTS 2 and 3 level were integrated into the GISCO and GADM layers. For the calculation of geometries (areas, coastline length, etc.), the version with the highest available resolution (1:1,000,000) was used to obtain the best spatial accuracy. No data areas were identified with the value 999,999,999 to distinguish them from 0 in those cases where this was the real value of the data. EUROSTAT identifies them with the symbol ';' which cannot be used on numeric fields in the GIS layers.

Spatially-explicit indicators produced as raster datasets were processed at 1 km resolution and snapped to a grid at 1km x 1km resolution. This grid is an extension of the reference grid developed for the whole of Europe by the EEA. The grid is used to record land and sea attributes for each grid cell (human activities, pressures, observations, etc.), as well as information related to the species and habitats found at that location. The data for each cell can then be aggregated for reporting purposes, and pressure analysis generated for any larger spatial unit. In this way, spatially explicit analyses can be generated and the input data underlying these analyses can be traced back. This was done with the aim of producing spatially compatible data with other datasets, such as those generated by Rodríguez et al. (2015) for the Mediterranean Sea and to ensure spatial continuity to the assessment in the future.

The final coordinate system for all data is ETRS 1989 LAEA (EPSG:3035), following the EEA standards. It also fits the technical requirements, as a coordinate system projected in meters instead of degrees is needed to calculate some of the indicators.

A full list of the final maps developed during the assessment and their description is available in appendix 7.3.

3.3.2. Data review

The data review is based on a comprehensive evaluation process that considers the thematic content of the data, their

limitations and their relevance. Technical reports and reporting data from national and regional policies and regulations were considered. The data content and its relevance were evaluated across several dimensions: thematic relevance (drivers and pressures covered), format (raster, vector, tabular, etc.), resolution and scale (administrative units, grid, point data etc.), reference data used to produce the dataset, etc. The methodology used to produce the data as well as the uncertainty were considered. Other criteria considered included whether the data belonged to a reliable source, whether they underwent a validation process or whether they had been used in other relevant studies. Links to policies or reporting obligations were also considered.

Data on tourism offer, demand and activities are quite limited in the Mediterranean region. Available data mainly includes the databases available from EUROSTAT, followed by some EMODnet and EEA indicators, and OpenStreetMap (OSM) data. These data did not allow an analysis of the entire Mediterranean region since its coverage was limited to the European Union and collaborating countries. Data for the rest of the countries and regions were provided by IUCN-Med based on United Nations World Tourism Organisation (UNWTO) databases.

Identified sources mostly contain data aggregated by NUTS2 or NUTS3 regions, which require a disaggregation process to obtain spatially explicit tourism indicators.

3.3.3. Data collection

The final data collected for the analysis include:

- Official datasets and statistics from EUROSTAT:
  - GISCO statistical unit dataset containing NUTS regions and territorial land boundaries.
  - GISCO transport network dataset containing port location.
  - Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c).
  - Nights spent at tourist accommodation establishments by NUTS 2 regions (tour_occ_nin2c).
  - Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arn2).
  - Passengers embarked and disembarked in all ports by direction - annual data (mar_pa_aa).

- European Commission datasets:
  - Density of maritime traffic of passenger vessels, sailing vessels and pleasure crafts, produced by EMODnet.

- Global datasets:
  - GADM, the Database of Global Administrative Areas, providing spatial data for non-EU countries administrative subdivisions.
  - Distribution of tourist attractions and accommodation sites available in OSM (December 2023).
  - Distribution of golf courses available in OSM (December 2023).
  - Copernicus Global Land Cover, including the distribution of urban areas and other land uses/land cover classes. Provided by Copernicus Land Monitoring Service.
  - Distribution of protected areas from the World Database on Protected Areas (WDPA), produced by UNEP-WCMC and IUCN.
  - Distribution of protected areas from MAPAMED, the database of Marine Protected Areas in the Mediterranean, produced by SPA/RAC and MedPAN.
  - Key Biodiversity Areas (KBAs), provided by Birdlife International.
  - Distribution of Important Marine Mammal Areas (IMMAs) and Important Shark and Ray Areas (ISRAs), provided by IUCN-Med.
  - Critical areas for the orca population of the Gibraltar Strait and Gulf of Cadiz, produced by the Spanish Ministry of Environment.
  - Marine Ecoregions of the World (MEOW), provided by WWF.

- Mixed sources:
  - Location of marinas and number of moorings, based on georeferencing and data from Portbooker.com, 2024; Plan Bleu, 2014; Spanish Federation of Associations of Recreational Marinas, 2014; EEA, 2014. Produced by ETC-UMA.
  - Databases on tourism offer and demand, including accommodation supply, average length of stay, domestic tourism, employment, expenditure and income, and arrivals. Produced by UNWTO and provided by IUCN-Med.
  - MedCruise Statistics 2022, MedCruise 2023.

3.4. Indicator calculation

3.4.1. Ready to use indicators

Ready to use indicators are based on existing datasets that describe the tourism pressure themselves. In these cases, the only processing required was the harmonisation of the spatial data to adjust it to the study area coverage and to ensure the scale and projection matched the one used in the assessment. Therefore, it was not necessary to modify the original data, simply integrate and represent them in the mapping template. If a region had no data for the reference year (2019 and 2022), the most recent available date was used.

These ready to use indicators are:

- Number of bed-places in coastal areas (per NUTS2)
- Number of tourism establishments in coastal areas (per NUTS2)
- Number of arrivals (per NUTS2)
- Number of nights spent at tourist accommodation establishments in coastal areas (per NUTS2)
- Number of cruise passengers per port
- Density of sailing vessels and pleasure crafts (per 1 km pixel)
- Density of passenger vessels (per 1 km pixel)

3.4.2. Tourism offer and demand indicators by NUTS3 and km^2

Indicators on density of tourism offer and demand include:

- Number of tourism interest sites (accommodation and attractions) (per 1 km pixel)
- Number of bed-places in coastal areas (per NUTS3 and km^2)
- Number of tourism establishments in coastal areas (per NUTS3 and km^2)
- Number of nights spent at tourist accommodation establishments in coastal areas (per NUTS3 and km^2)
- Number of arrivals (per NUTS3 and km^2)

Photo 2. **Tourists on a leisure boat near Lastovo Island, Croatia**

These indicators are based on statistics on bed-places, tourism establishments, nights spent at tourist accommodation establishments and number of arrivals and the distribution of tourism interest sites available in OSM.

OSM data include coordinates with the location of accommodation places and tourist attractions. These coordinates were aggregated and counted at 1 km^2 using the EEA reference grid to calculate the number of sites and the percentage of sites with respect to the total of the NUTS3 or equivalent regions in each pixel.

Total number of accommodation and attractions were used to produce an indicator on the distribution of tourism interest sites, highlighting those locations with a high concentration of points of interest for tourists.

The percentage of sites per 1 km pixel was used to disaggregate NUTS2 (EUROSTAT data) and country level (UNWTO data) tourism offer and demand statistics at 1 km^2, and then aggregated at NUTS3 to provide statistical estimates at this administrative level assuming that most bed-places and establishments, nights and tourist arrivals are in areas with high tourism sites density. The results of these estimates were divided by the total area (km^2) of each region for a comparative value according to their sizes. If some region had no data for the reference year (2022), the most recent available date was used.

Data on the number of establishments and bed-places were not available for regions of Albania, Libya and Türkiye. Therefore, they were estimated from OSM accommodation sites data (number of establishments) and the average of bed-places per establishment in the Mediterranean region (number of bed-places). These regions were highlighted on the maps as areas influenced by lack of data, where the estimates could have a greater margin of error.

3.4.3. Marinas and recreational shipping, number of moorings

This indicator represents the number of moorings in marina ports per kilometre of coastline for each NUTS3 or equivalent region (e.g. province). The total number of moorings was obtained from the data compiled by ETC-UMA on the location and capacity of the marinas, assigning each port its corresponding NUTS3 code and counting the total number of moorings. This value was divided by the length of the region's coastline in km. Results show low to high intensive capacity for this activity by region.

3.4.4. Density of golf courses (per NUTS3)

This indicator represents the surface percentage occupied by golf courses in NUTS3 or equivalent regions as a proxy of the potential environmental pressure of this activity. Total extent per region was calculated using OSM data including the location and delimitation of golf courses. This spatial information was overlaid with the administrative regions to assign the corresponding NUTS3 code to golf areas. The indicator was then calculated by summing the coverage dedicated to golf within each region and dividing it by the total area, thus obtaining the percentage of golf courses in each NUTS3 or equivalent region.

3.4.5. Built-up areas in the coastal buffer

This indicator represents the percentage of built-up area in the first 1km of the coastal strip of the Mediterranean region per NUTS3 or equivalent region. Calculations are based on the distribution of urban areas in Copernicus Global Land Cover, year 2019, using a pixel count at 100 m and a buffer of 1 km from the coastline. The indicator was calculated by adding the total urban area within each region and dividing it by the total area of the regional 1 km coastal buffer, thus obtaining the percentage of built-up area in each case.

Photo 3. **Marina in the Pontine Archipelago, Italy**

3.5. Combined pressure

3.5.1. Land cumulative tourism pressure indicator

Single indicators were combined in a cumulative tourism pressure indicator to represent the added effect from different sources of pressure. It was only possible to produce this indicator at the NUTS3 level due to limitations in the scale of the data. This, however, offers an indicator that is easy to interpret and communicate.

Indicators on built up areas, golf courses, marina port capacity, cruise passengers, tourist arrivals and tourism density, measured as number of beds and establishments, were reclassified in five categories from very low to very high according to the statistical distribution of values (based on natural breaks). These categories were represented by numbers from 1 to 5, being 1 the minimum pressure value (very low) and 5 the maximum (very high). The indicator on the number of nights was excluded due to lack of data in non-EU countries. However, this indicator may be somewhat redundant with the number of arrivals, so its omission is not predicted to have a serious impact on the results.

After the reclassification of values of each individual indicator, their combined value was calculated for each NUTS3 region by means of a weighted sum. Since no specific weights were defined for the individual indicator, the same weight was used for all of them. Therefore, the result is equal to the mean of the values. Results show the cumulative pressure by NUTS3 areas classified into five categories:

- **Very low:** 0 to 1.00.
- **Low:** 1.01 to 2.00.
- **Moderate:** 2.01 to 3.00.
- **High:** 3.01 to 4.00.
- **Very high:** 4.01 to 5.00.

3.5.2. Sea cumulative tourism pressure indicator

Indicators on density of passenger vessels and sailing vessels and pleasure crafts were integrated with a sum to calculate the total maritime traffic per 1 km pixel. Since the data comes from the same source and is expressed with the same units, this process can be done directly without any additional steps.

The resulting layer was reclassified in five categories, from very low to very high, according to the traffic intensity, measured in number of hours with vessel presence in each cell. The pressure categories are based on the total time accumulated over a year, so that the interpretation of the result is comprehensive:

- **Very low:** presence of vessels is less than 1 hour per day.
- **Low:** presence of vessels is between 1 hour per day and 4 months.
- **Moderate:** presence of vessels is between 4 and 8 months.
- **High:** presence of vessels is between 8 months and 1 year.
- **Very high**: presence of vessels exceeds one year, being locations of very high traffic intensity with many vessels.

Because maritime traffic is concentrated in areas close to the coast, especially around ports, marinas or anchorage sites, most of the Mediterranean is classified with very low pressure. The rest of the categories are reduced to a small number of pixels at specific points in the region. To improve the interpretation and visualization of the results, a layer of points was generated with the location of cells corresponding

to the low, moderate, high, and very high pressure classes. The resulting point layer of pressure hotspots was considered the final cumulative indicator for mapping and further analysis.

3.6. Important areas for biodiversity and protected areas layers

Important areas for biodiversity (IABs) are defined as those locations with recognised natural, ecological or cultural values associated with biodiversity. For this assessment, IABs include the following designations: Key Biodiversity Areas (KBAs), Ecologically or Biologically Significant Marine Areas (EBSAs), Particularly Sensitive Sea Areas (PSSAs), Proposed Sites of Community Importance, World Heritage Sites, Important Shark and Ray Areas (ISRAs), Important Marine Mammal Areas (IMMAs), Critical areas for the orca population of the Gibraltar Strait and Gulf of Cadiz, Biosphere Reserves and Cetaceans Critical Habitat.

Protected areas (PAs) are a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values[4]. Human presence, or the exploitation of natural resources, may be limited in PAs. In this assessment two sources were used to define PA surface: the World Database on Protected Areas (WDPA), for land areas, and MAPAMED, the database of Marine Protected Areas in the Mediterranean, for marine regions. This distinction is made because MAPAMED carries out an exhaustive validation of the effective levels of protection and management of PAs, which provides a more realistic vision regarding the protection of biodiversity in the Mediterranean Sea. In the case of land areas, only those PAs from the WDPA reported as 'Adopted', 'Inscribed' and 'Designated' were included; that is, those that are legally established. Proposed PAs were excluded from the assessment.

For mapping purposes, all geometries overlapping the study area were preserved unaltered to show full coverage of the protected areas and IABs both inside and outside the Mediterranean region. For GIS analysis, data were clipped according to the reference coverage of NUTS3 regions and the Mediterranean Sea.

3.7. Vulnerability analysis

Due to the unequal spatial unit of land and marine data (NUTS3 vs pixels), the different sources for the PAs and the fact that in land areas the only IABs to consider are KBAs (as the rest of the categories are exclusively marine), the methodology of the vulnerability analysis differs between terrestrial and marine regions.

3.7.1. Land vulnerability analysis

Land vulnerability was calculated using the cumulative tourism pressure indicator and the surface percentage of IABs (equal to KBAs in the case of land areas) that *is not protected* inside each NUTS3, following the logic that unprotected IABs are more sensitive to tourism pressures as there is not any specific regulation to protect biodiversity. This non protection percentage was classified into five numerical classes, from 1 to 5 (very low to very high), based on the following thresholds: 1) lower than 10%; 2) from 10 to 17%; 3) from 17 to 30%; 4) from 30 to 50%; and 5) higher than 50%. Vulnerability was calculated by the mean value of cumulative tourism pressure and protected areas percentage classes, assuming that those areas with greater pressure and not protected IABs are more vulnerable. The resulting values represent the ecological vulnerability of terrestrial areas in five categories based on a regular interval: very low (1.00 to 1.50), low (1.51 to 2.00), moderate (2.01 to 2.50), high (2.51 to 3.00) and very high (3.01 to 3.5).

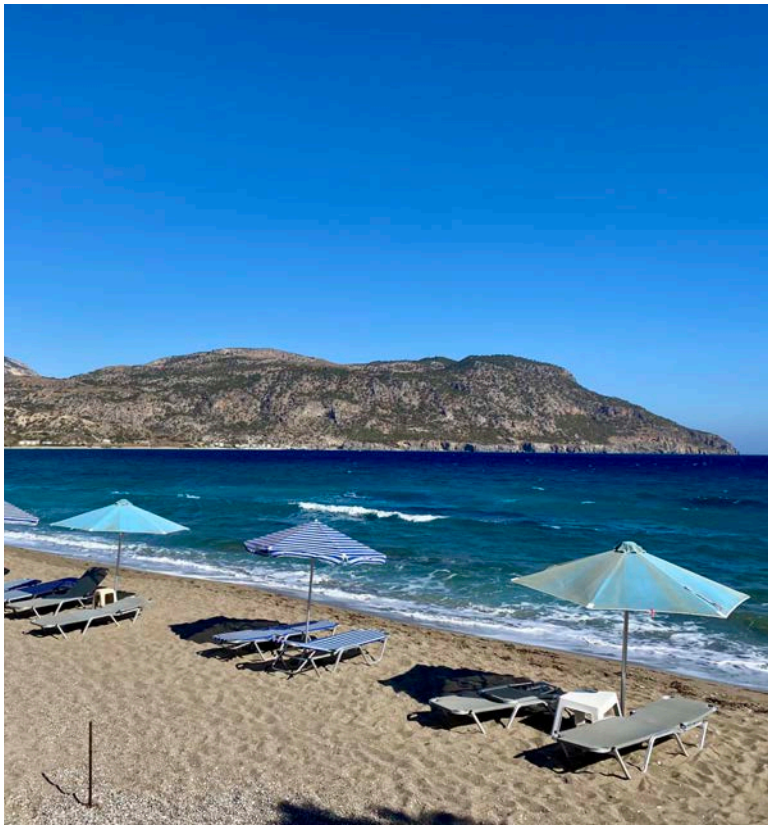
3.7.2. Sea vulnerability analysis

Vulnerability in marine areas was based on the cumulative pressure hotspots extracted from the cumulative traffic indicator and the coverage of PAs and IABs.

Pressure points are overlaid with the IAB polygons. If they fell within an IAB polygon they were ranked in vulnerability classes from very high to low. Each area belonging to one of the vulnerability classes was finally identified according to whether it fell in a PA or not. Accordingly, areas outside IABs and PAs are considered to have little environmental value and were excluded from the assessment, and the vulnerability can be considered very low or negligible.

The resulting point layer represents the ecological vulnerability in marine areas in five categories from very low to very high with a distinction between whether they fall inside or outside of a PA.

Photo 4. **Beach on Karpathos Island, Greece**



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4 IUCN definition of protected areas. This definition is expanded by six management categories.

4. Results

4.1. Individual tourism pressure maps

Based on the methodology presented above, individual tourism pressure maps were processed and delivered, providing an overview of the distribution of individual tourism pressure in the Euro-Mediterranean basin.

The results are presented by category (tourism offer, demand and activities).

4.1.1. Tourism offer

Tourism offer refers to all the products and services that are available to satisfy the needs and wants of tourists including tourist companies, hotel infrastructure, accommodation capacity, quality and diversity of tourist services, transport, restaurants, etc. In our study, we focus on the offer represented by the following indicators:

- Number of bed-places in coastal areas.
- Number of tourism establishments in coastal areas.
- Density of golf courses.

The first two pressure indicators rely on official statistics and represent the actual offer in terms of accommodation capacity and hotel infrastructure. As in most studies on regional scales, second home residences, private tourism apartments (e.g. Airbnb offer) and other types of non-conventional accommodation have not been included due to a lack of consistent and harmonised data. There are already a series of studies considering non-conventional tourism accommodation at the local level, mostly centred in urban areas (e.g. Serrano, Sianes & Ariza-Montes, 2020; Hübscher et al., 2020), but harmonised Mediterranean data are not available yet. Since these accommodation types are becoming increasingly important in the tourism sector across the region, they should be studied in further research if a harmonised way of reporting on them becomes available at large scales.

The study (and the cumulative indicator) uses the tourism offer density of both indicators, i.e., the number of establishments and bed places per km^2 of the NUTS3 territory or equivalent region. Density is a good way of illustrating the territorial importance of hotel infrastructure in reference to the regional context. Since density is linked to the spatial dimension of the region, very small (urban and metropolitan) regions tend to have higher tourism density. Some coastal and mountain regions also have a high tourism density.

The maps of both indicators show very high densities in specific areas of the Mediterranean. The distribution of tourism establishments (**Figure 2**) shows clear territorial differences linked to different models of hotel infrastructure. The Adriatic coastal regions of Italy and Croatia as well as the Western Mediterranean coast of Italy from Genova to Napoli are characterised by high and very high tourism establishment densities. In addition, there are some single regions like Corfu, Rhodes and Malta that also show very high values.

This situation is different to the distribution of the density of bed places (**Figure 3**). Even though the list of very high densities also includes these regions (e.g. Corfu, Malta, Venice, Rimini, Napoli, Tunis and Palestine), there are several

Figure 2. **Estimated number of establishments per km^2**

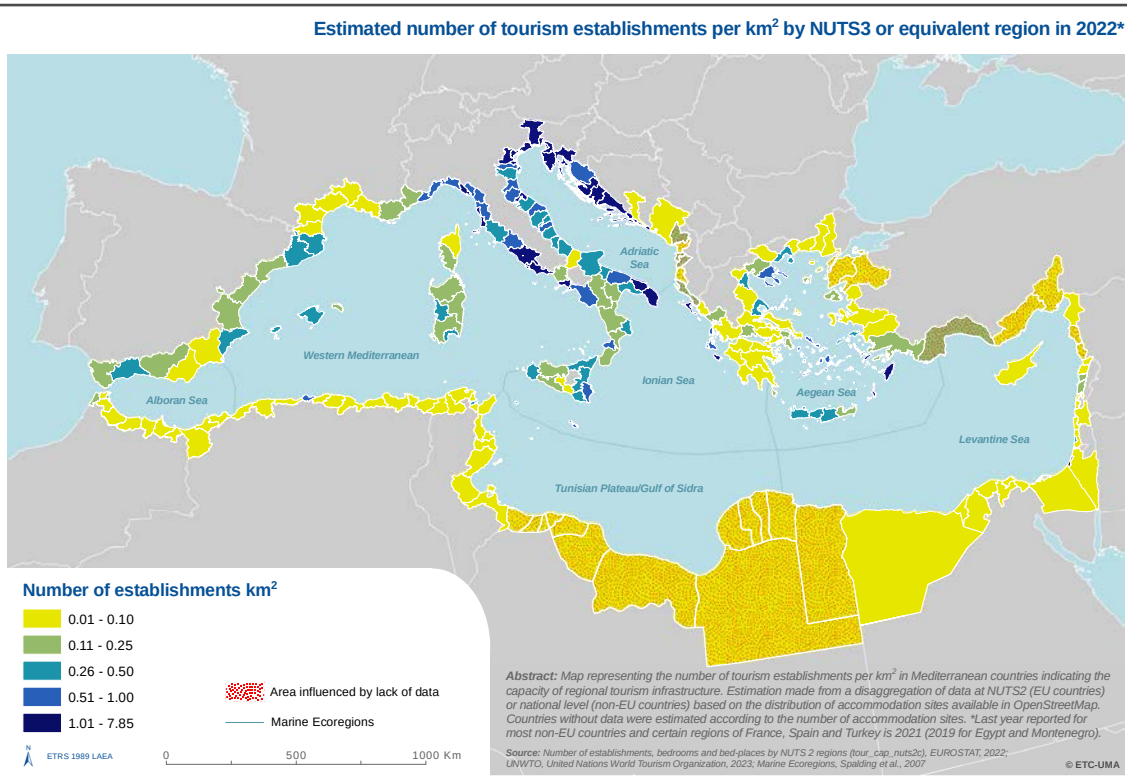
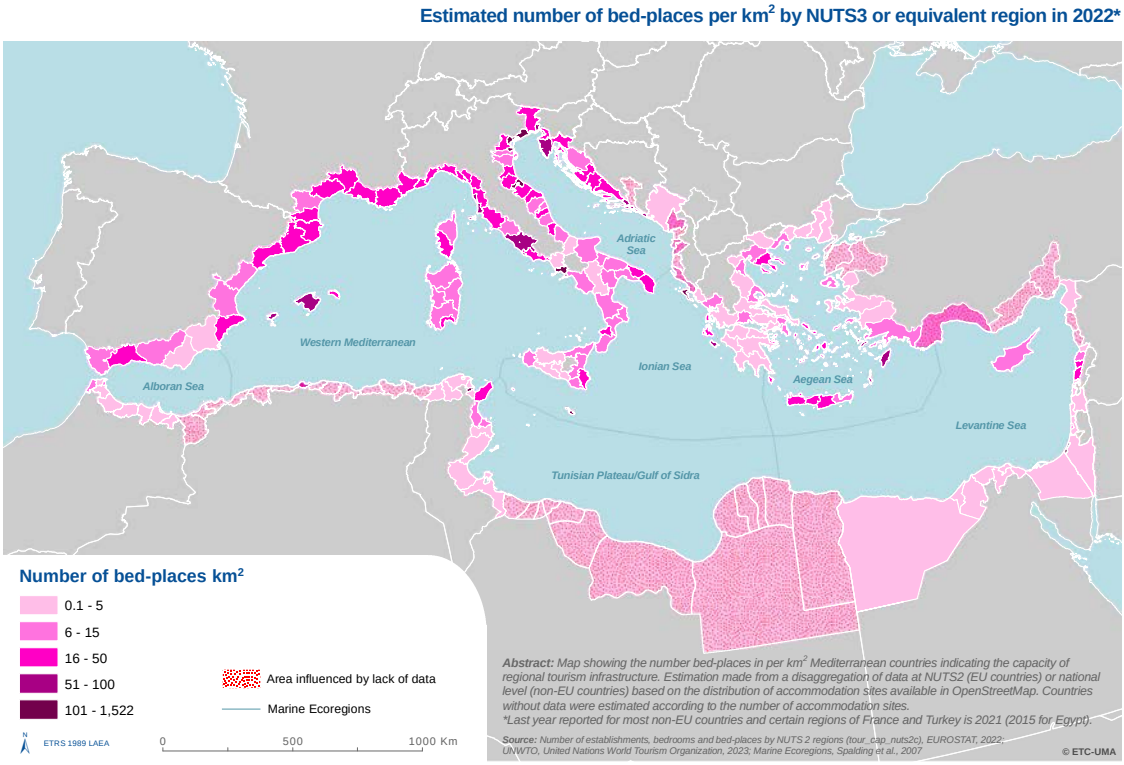


Figure 3. **Estimated number of bed-places per km²**



regions with medium and high densities of bed places where the density of establishments is medium to low, such as on the French Riviera, the Spanish mainland coast and the Balearic Islands. This suggests that these regions have very high bed capacities per establishment.

Golf-related tourism (Figure 4) is a very important sub-sector in terms of spatial extent in the coastal regions of Portugal, Spain, Malta and France, particularly in Cádiz, Málaga, Alicante, Girona, Bouches-du-Rhône and Var, all of which show very high to high levels of nights spent (see section 4.1.2) and tourism offer (Figure 2, Figure 3). Other regions (Italy, Western-Balkan countries, Greece and Cyprus) show moderate to very low coverage, with some exceptions such as Rome, Rimini, Gorizia, Trieste, Malta as well as Tel Aviv, Tunis, Monastir and Tanger. Tunisia, in general, shows a high level of golf course density in its coastal areas.

This spatial distribution of the presence of golf courses in the Mediterranean is alarming given the high water requirements of this type of infrastructure (Salgot et al., 2012) and the increasing urbanisation often linked to golf course developments.

4.1.2. Tourism demand

Tourism demand is well represented by tourism arrivals and number of nights spent. Particularly, the indicator on the number of nights spent is one the most indicative variables to understand the real demand for resources for tourism purposes (Figure 5). Unfortunately, the lack of available data in the Southern and Eastern Mediterranean, as well as in several Western Balkan countries, hampers a full picture of the situation. In any case, major destinations such as Mallorca, Venice, Rimini, Napoli, Istria (Croatia), Corfu and Rhodes could be highlighted as hotspot areas of tourism demand. The pattern reveals, once again, a heavy concentration of tourism demand on the coastal strips of all Mediterranean regions.

The indicator on tourism arrivals completes this picture with some interesting patterns (Figure 6). Türkiye's most touristic region, Antalya (TR), stands out in the **Levantine Sea**. Despite being a large territory, tourism arrival density is very high. On the other side of the Levantine Sea, the metropolitan region of Tel Aviv (ISR) is also among the very high densities. In the **Aegean Sea**, only the Island group of Kalymnos, Karpathos, Kos, Rhodes (GR) has very high densities. The other Islands, including Crete, have high or medium densities. In the **Ionian Sea** the high densities are concentrated on the Greek islands of Zakynthos and Corfu as well as in Malta. The regions with highest values in the **Adriatic Sea** concentrate in the northern part of this regional sea, including Istria in Croatia, and Trieste, Venice, and Rimini in Italy. Finally, in the **Western Mediterranean**, there are a few Italian regions linked to both bigger cities and tourism hotspots, i.e., Napoli and Roma, as well as La Spezia and Livorno, respectively. In addition, the Spanish regions of Girona, Barcelona and the Balearic Islands, as well as the Alboran region spanning coastal areas of Spain and Morocco, are notable for their high densities of tourist arrivals. Tunis, the capital area of Tunisia also stands out in this group of Mediterranean regions with high tourist arrival densities. It is worth noticing that regions in Tunisia, Israel and Lebanon stand out in the context of the Middle East and North Africa (MENA) countries with medium to high densities. The

Figure 4. Density of golf courses as a percentage of total surface area

Density of golf courses by NUTS 3 or equivalent regions in 2023, expressed as surface percentage of the region occupied by golf courses

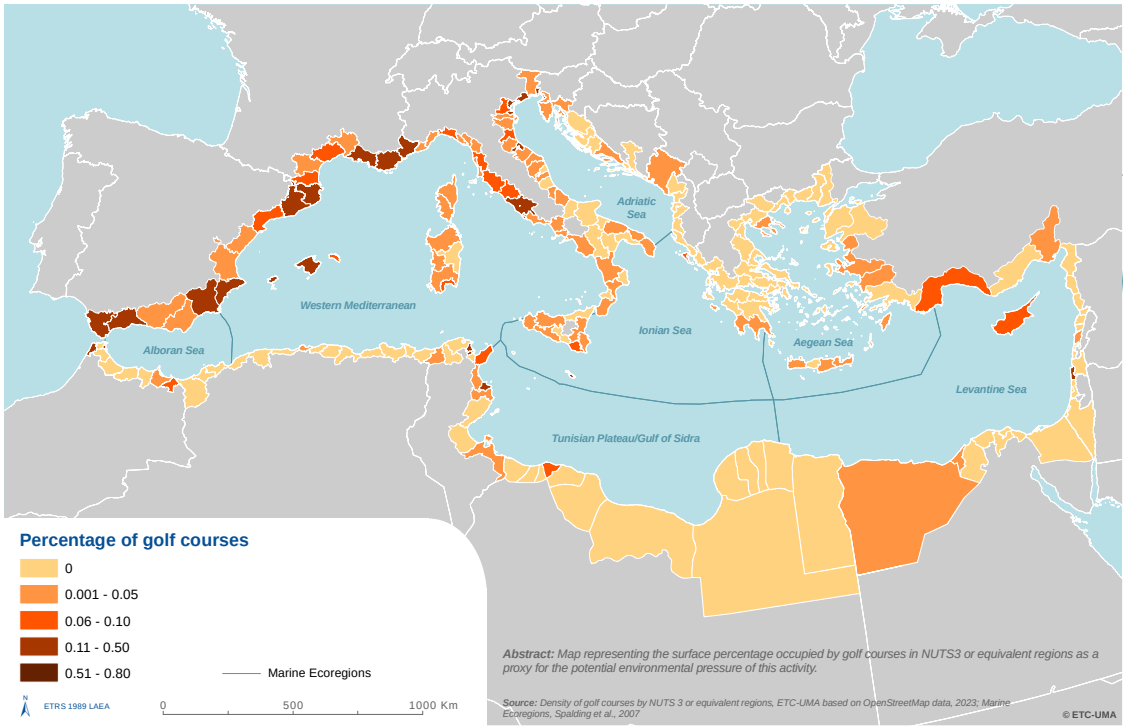


Figure 5. Estimated nights spent at tourist accommodation per km^2

Estimated nights spent at tourist accommodation establishments per km^2 by NUTS3 or equivalent region in 202

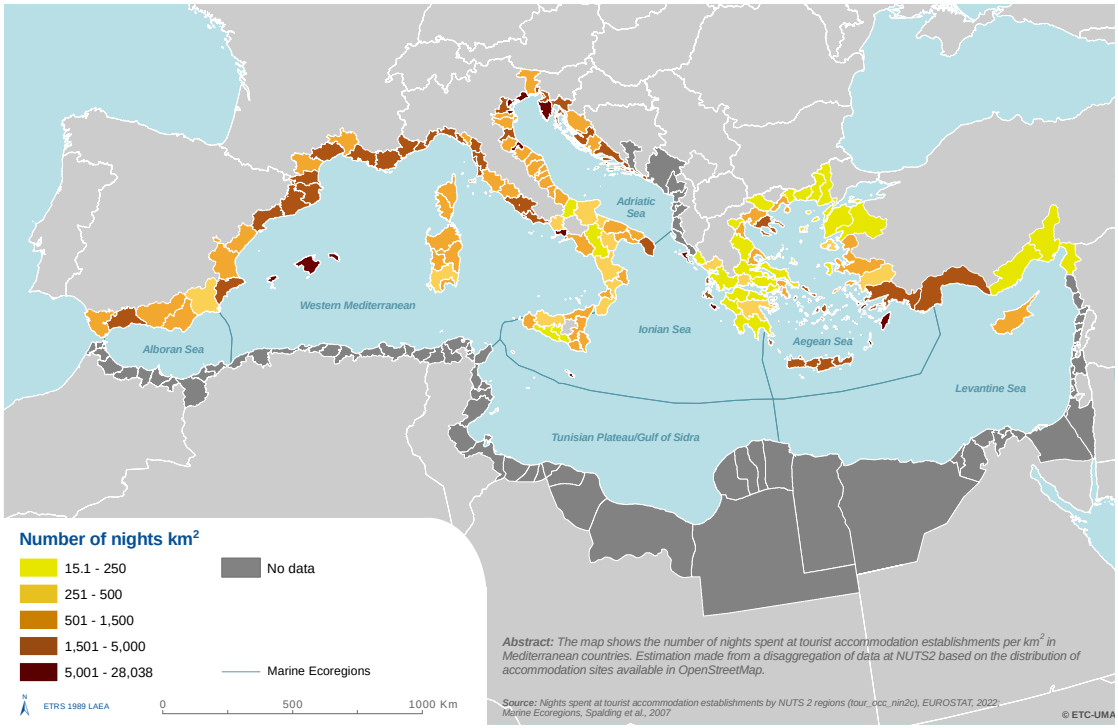
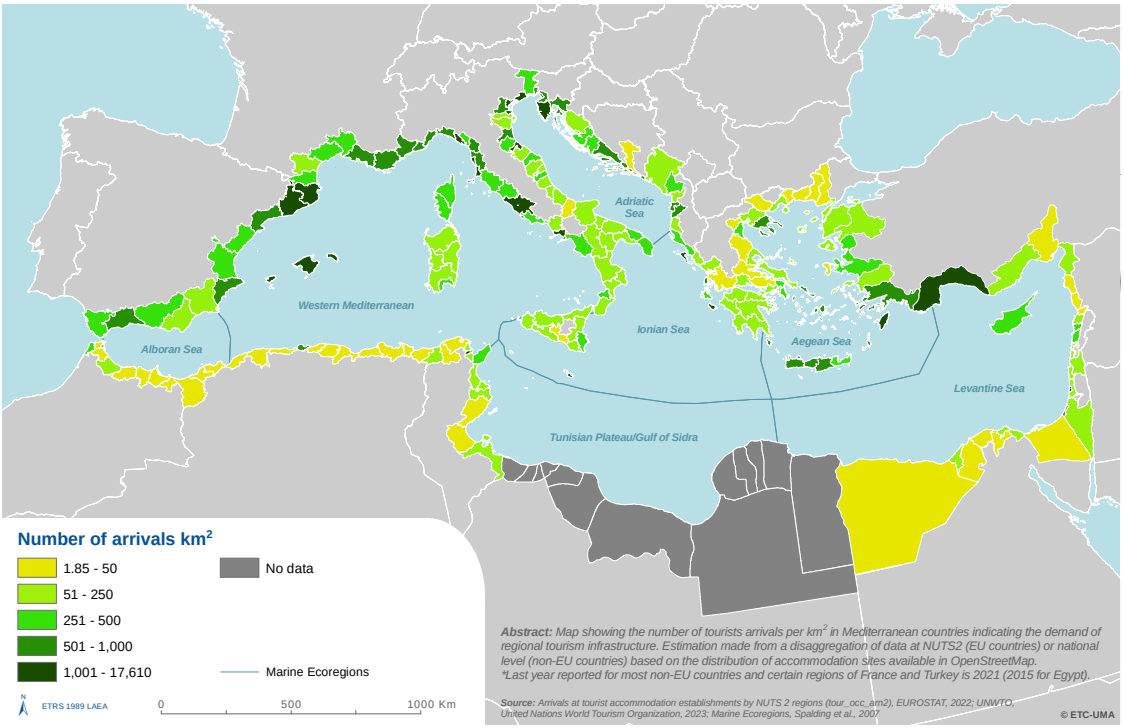


Figure 6. **Estimated arrivals at tourist accommodation per km2**

Estimated arrivals at tourist accommodation establishments per km^2 by NUTS3 or equivalent region in 2022*



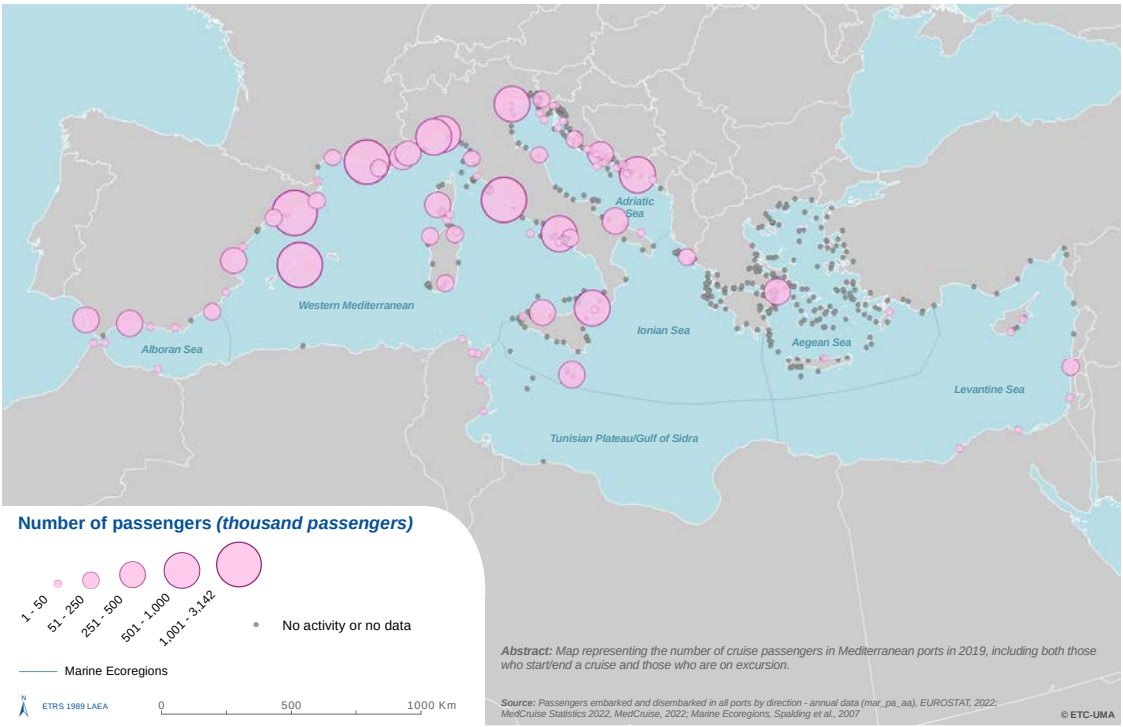
Abstract: *Map showing the number of tourists arrivals per km^2 in Mediterranean countries indicating the demand of regional tourism infrastructure. Estimation made from a disaggregation of data at NUTS2 (EU countries) or national level (non-EU countries) based on the distribution of accommodation sites available in OpenStreetMap. *Last year reported for most non-EU countries and certain regions of France and Turkey is 2021 (2015 for Egypt).*

Source: *Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arm2), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007*

Figure 7. **Number of cruise passengers per port**

Number of cruise passengers* per port in 2019

**Including both those who start/end a cruise and those who are on excursion*



Abstract: *Map representing the number of cruise passengers in Mediterranean ports in 2019, including both those who start/end a cruise and those who are on excursion.*

Source: *Passengers embarked and disembarked in all ports by direction - annual data (mar_pa_aa), EUROSTAT, 2022; MedCruise Statistics 2022, MedCruise, 2022; Marine Ecoregions, Spalding et al., 2007*

whole Southern Adriatic and many Greek regions are among very low and low densities.

Furthermore, a more specific demand indicator at cruise ports (Figure 7), the number of cruise passengers, reveals a high pressure on urban environments in major cruise ports in Mallorca, Barcelona, Valencia, Genova, Civitavecchia, La Spezia, Olbia, Palermo and Messina to name just the major cruise ports. While the number of ports in the Western Mediterranean and the Alboran Sea is relatively limited with a high concentration in major ports, the Adriatic, Ionian and Aegean Seas are characterised by a high number of small ports. The numbers in the Levantine Sea and in North Africa are comparatively low, even though there is an important presence of Tunisian ports in the network.

4.1.3. Tourism activities

The indicators for tourism activities represent very specific tourism-related pressures with localised impacts on resources such as coastal dynamics (marina ports), seabed habitats and species (pleasure crafts) and mammals (passenger vessels).

Marina ports capacity (number of moorings per coastline of NUTS3, Figure 8) highlights a high density in the north-western Mediterranean (from Barcelona until Nice) and in the northern Adriatic. Apart from these marina port hotspot areas, there are only a few other areas with elevated density of moorings, such as in the Berkane Province (Morocco). There are a number of marina ports along the North African and the Levantine coasts, but the density of moorings with reference to the coastlines is low overall.

Marina port developments have major impacts on coastal ecosystems and coastal dynamics, and they generate major impacts on the surrounding waters from leisure boat tourism, including anchoring. These direct pressures are well illustrated by the density of the pleasure craft indicator (Figure 9). This indicator shows very high densities in coastal regions within the area of the Pelagos Sanctuary as well as between the islands Corsica and Sardinia. The Spanish coast, and especially the Balearic Islands, concentrate a lot of sailing and pleasure boat traffic. Furthermore, the Croatian coast as well as the Greek Aegean Islands are other areas of high densities. Finally, there is a stream of traffic flows between the marina ports of Cyprus and those in Israel. Little traffic is reported on the North African coast, with some exceptions in Tunisia.

Photo 5. Catamaran in Kornati National Park, Croatia

© MEET Network (Javier Zapata)

Figure 8. Marina port capacity in moorings per km of coastline

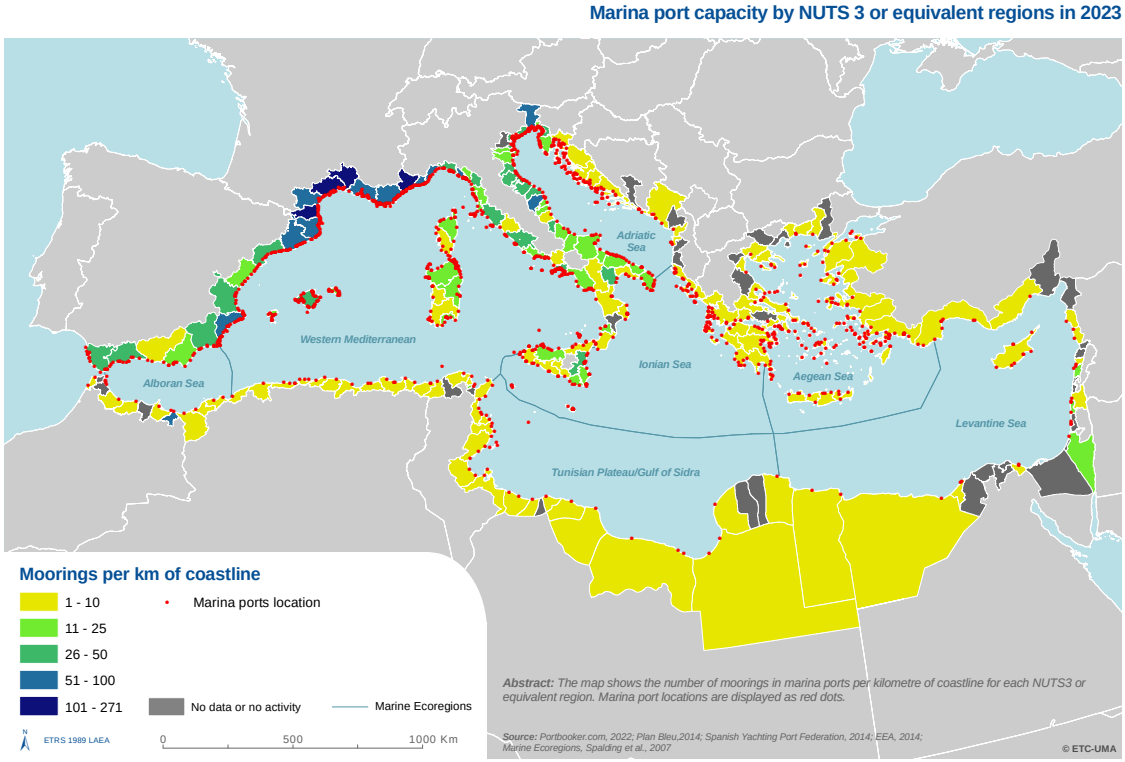
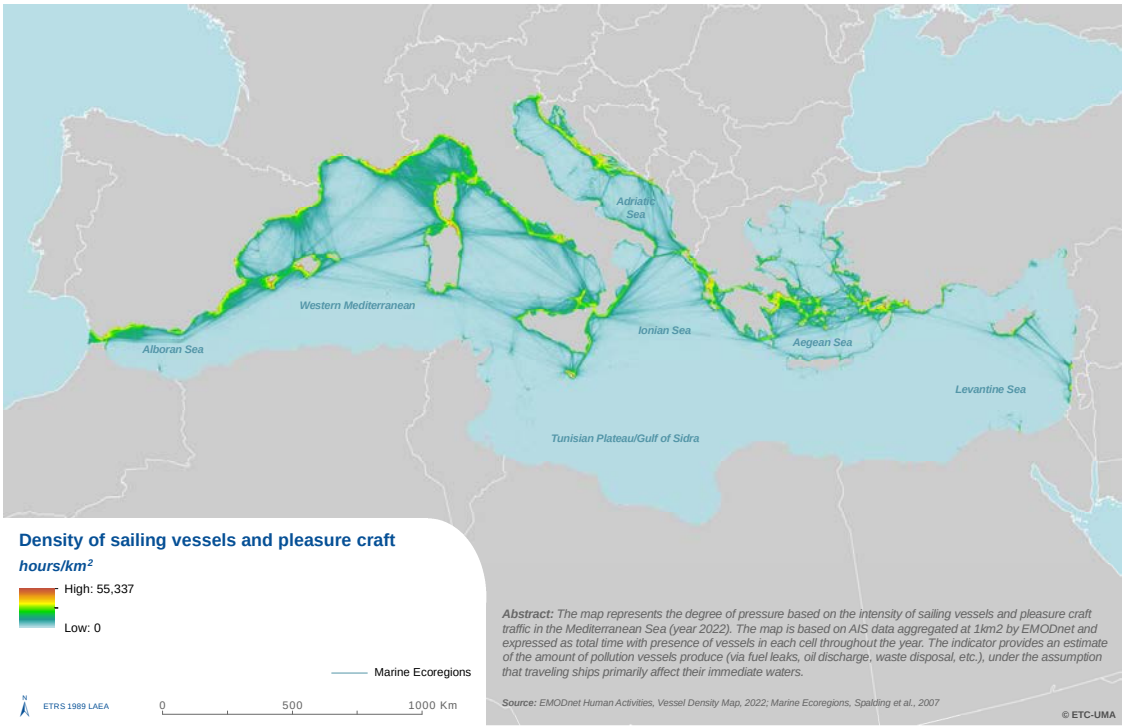


Figure 9. Density of leisure boat activity in hours per km²

Density of sailing vessels and pleasure craft in 2022, expressed as total time of vessels presence throughout the year per pixel (hours/km²)



4.1.4. Tourism induced pressures

The final pressure indicator the study looked at are built-up areas in the coastal buffer area of 1 km. Even though this indicator covers all built-up areas and does not discriminate only tourism-related development, it does provide insights into the state of coastal land take and land degradation that affect coastal habitats that are sensitive to this kind of pressure.

The overview map (Figure 10) shows the percentage of built-up area in the first kilometre of the coastal strip of the Mediterranean region by NUTS3 or equivalent units. As expected, the Spanish, French and Italian coastal strips, linked to the most mature tourism regions in the Mediterranean, are heavily affected by built-up areas. The coastal strip of Lebanon, Israel and Palestine show similar values. Finally, some regions like the Province of Algier, Al Jifarah and Tripoli (Libya) and Al Iskandariyah (Egypt) concentrate a high built-up share. The eastern Adriatic and Ionian Sea, as well as most of the Aegean regions, hove overall medium to low shares of built-up area.

4.2. Cumulative tourism pressure map

Following the methodology described earlier, the different indicators of tourism pressures were combined to come up with a cumulative tourism pressure map and assess its distribution and characteristics.

4.2.1. Terrestrial cumulative tourism pressure map

The terrestrial cumulative tourism pressures (Figure 11) show a clear concentration of high and very high pressures in the European coastal regions of the Western Mediterranean and Alboran Sea as well as the northern Adriatic Sea. The regions of Rome, Napoli and Barcelona are by far the ones with highest pressures, linked largely to tourism offer and demand, particularly arrivals and cruise passengers.

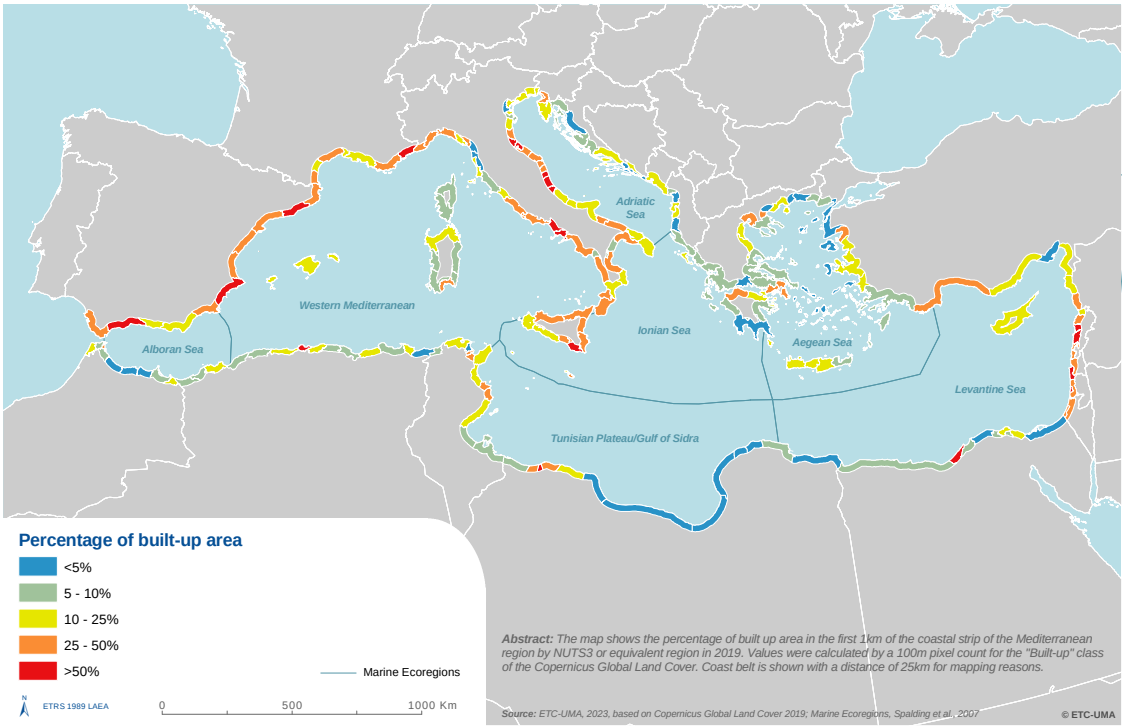
At a second level, the following highly pressured regions can be found in the different regional seas:

Table 2. High pressure regions (cumulative tourism pressure)

Ecoregion	Country and region
Western Mediterranean	**Spain**: Cádiz, Málaga, Alicante, Mallorca, Girona **France**: Bouches-du-Rhône, Var, Alpes-Maritimes **Italy**: Savona, Genova, La Spezia **Tunisia**: Tunis
Adriatic Sea	**Italy**: Venice, Gorizia, Trieste **Slovenia**: Obalno-kraška **Croatia**: Istarska županija
Ionian Sea	**Greece**: Corfu **Malta**

Figure 10. Percentage of coastal built-up area

Percentage of built-up area in the 1km coastal belt by NUTS3 or equivalent region in 2019



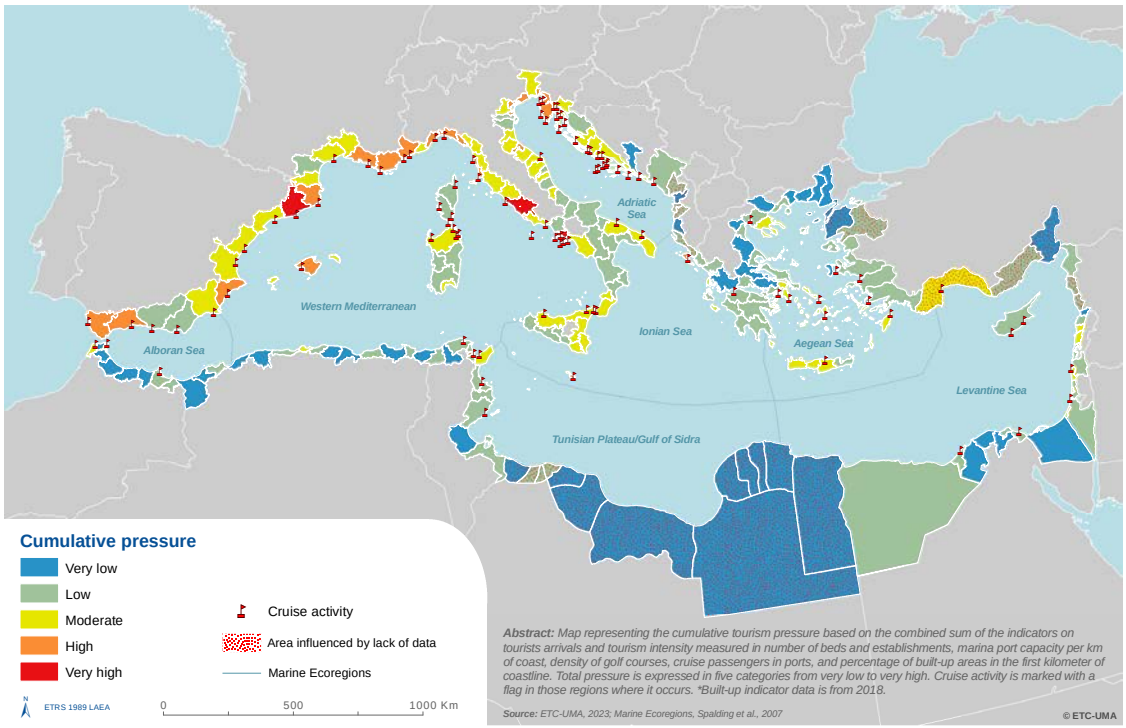
Abstract: The map shows the percentage of built up area in the first 1km of the coastal strip of the Mediterranean region by NUTS3 or equivalent region in 2019. Values were calculated by a 100m pixel count for the "Built-up" class of the Copernicus Global Land Cover. Coast belt is shown with a distance of 25km for mapping reasons.

Source: ETC-UMA, 2023, based on Copernicus Global Land Cover 2019; Marine Ecoregions, Spalding et al., 2007

© ETC-UMA

Figure 11. Cumulative tourism pressure by NUTS3 or equivalent administrative units

Cumulative tourism pressure by NUTS3 or equivalent region in 2022*

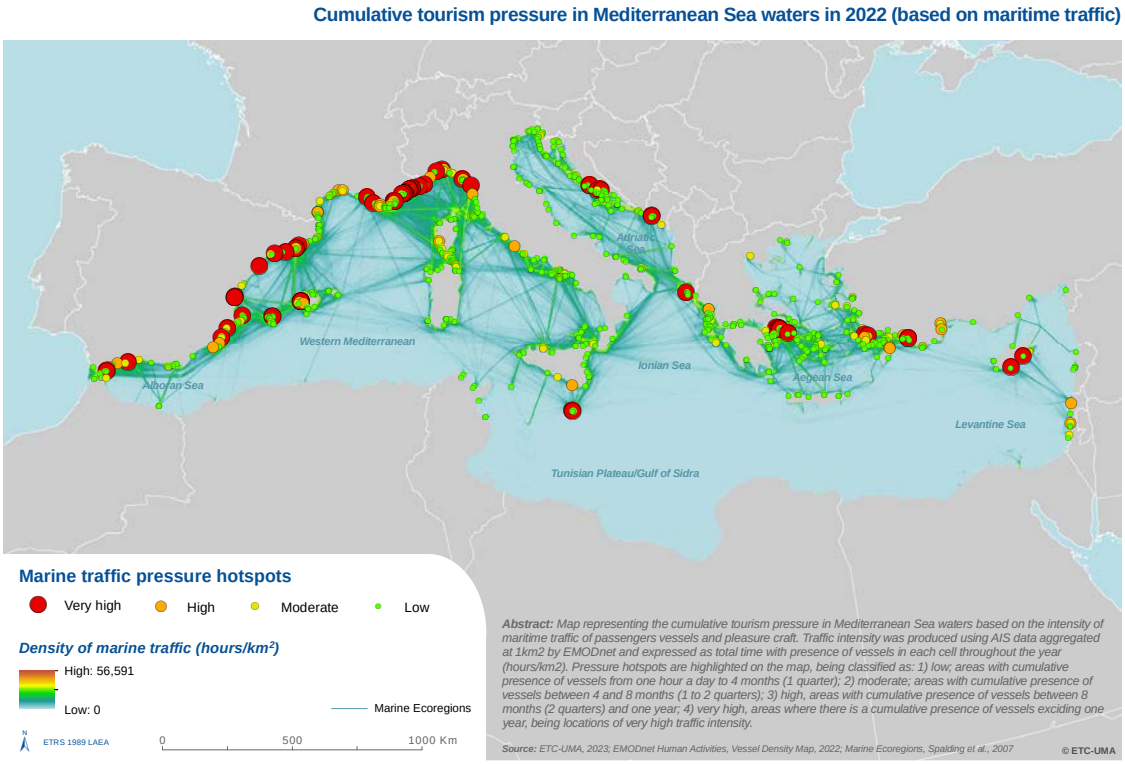


Abstract: Map representing the cumulative tourism pressure based on the combined sum of the indicators on tourists arrivals and tourism intensity measured in number of beds and establishments, marina port capacity per km of coast, density of golf courses, cruise passengers in ports, and percentage of built-up areas in the first kilometer of coastline. Total pressure is expressed in five categories from very low to very high. Cruise activity is marked with a flag in those regions where it occurs. *Built-up indicator data is from 2018.

Source: ETC-UMA, 2023; Marine Ecoregions, Spalding et al., 2007

© ETC-UMA

Figure 12. Cumulative tourism pressure in Mediterranean Sea waters



As can be seen from Table 2, the only region in the non-European countries with high tourism pressures is the Tunisian capital region, Tunis. In the southern and eastern shore of the Mediterranean, the regions with relatively high tourism pressures are Tanger (Morocco), Ceuta, Melilla (Spain) in the Alboran Sea, Algier (Algeria) and Nabeul (Tunisia). In the Western Mediterranean Sea, they are Palestine, Tel-Aviv and Haifa (Israel), Mount Lebanon, Beirut and North (Lebanon) as well as Antalya (Türkiye).

On the European side, the areas with lowest levels of tourism pressures are the Greek and Turkish regions in the northern Aegean Sea, most coastal regions in Central Greece and Thessaly, Aetolia-Acarnania in Western Greece, and the Albanian coastal regions. The low level of major tourism infrastructure, including cruise port capacities or airports, leads to limited tourism arrivals and tourism-related activities.

4.2.2. Marine cumulative tourism pressure map

On the marine side, the hotspot clusters are based on the indicators of density of marina ports and of leisure boating activities. The cumulative pressure of these indicators is clustered in the following areas (Figure 12):

- Southern Aegean, around the Athens region in Greece and including the Greek and Turkish coast in the Aydın Subregion.
- Malta and Corfu (Greece) in the Ionian Sea.
- Central and Southern Adriatic coast of Croatia around Zadar, Split and Dubrovnik.
- The French and Italian Riviera, from Marseille to La Spezia, coinciding with the Pelagos Sanctuary.
- Spanish coast from Barcelona to Cádiz, and the Balearic Islands (Mallorca, Ibiza).
- Cyprus.

While the maritime tourism pressure areas in the Adriatic, Aegean and Levantine Sea do not coincide with the NUTS regions with high or very high terrestrial pressures, this is the case in the marine areas on the French and Spanish coast. Looking at both maps, the combined cumulative maritime and terrestrial tourism pressure in the Western Mediterranean becomes evident, highlighting the need for actions to prevent degradation of both terrestrial and marine ecosystems.

There is not such a coincidence in the Northern Adriatic regions nor in Italian areas around Lazio where terrestrial pressures are much higher than the maritime tourism pressures. On the other hand, in the Southern Aegean or Cyprus, the maritime pressure hotspots do not coincide with terrestrial ones. In the regions and countries on the southern and eastern shore of the Mediterranean, both terrestrial and maritime tourism pressures are generally low with some exceptions for terrestrial pressures as we have seen in the previous section.

4.3. Mediterranean coastal and marine tourism vulnerability map

High levels of tourism pressure alone can be a significant issue for various environmental aspects. Tourism's impact on its territory is manifold such as the increased use of resources (e.g. water, land) and a potential source of air and water pollution and solid waste. This combined potential impact threatens the environment's and people's health in specific regions. The higher the level of pressure, the higher the vulnerability of the territory. This is linked to one of the factors of vulnerability, the exposure. In addition, vulnerability to tourism pressure is also defined by an area´s adaptive capacity and sensitivity, i.e., an ecologically resilient area that is well conserved, with high biodiversity and well connected to its surrounding ecosystems, is less vulnerable than ecologically sensitive areas with inadequate conservation status and high degrees of fragmentation.

Hence, it is crucial to understand where the high levels of coastal and marine tourism pressures overlap with ecologically sensitive areas, both protected and non-protected, to focus management improvements and protection to those areas. Our mapping was set up to do exactly this exercise and provide an evidence-based spatial representation of highly vulnerable areas in the Mediterranean.

4.3.1. Ecological vulnerability to coastal tourism pressure

As described in section 3.7.1, the vulnerability to coastal tourism pressure of coastal ecosystems was calculated using the cumulative tourism pressure indicator and the surface percentage of IABs which *are not protected* inside each NUTS3. Areas with high pressure values and high shares of non-protected IABs are more vulnerable than those with high shares of protection, assuming that unprotected IABs are more sensitive to tourism pressures as there is not any specific regulation to protect biodiversity.

Hence, very high levels of vulnerability are linked to very high cumulative pressure levels and high shares of non-protected IABs in a region. High vulnerability is defined as overlaps of low share of KBAs without protection with very high tourism pressures as well as high shares of KBAs with low protection level and high coastal tourism pressures.

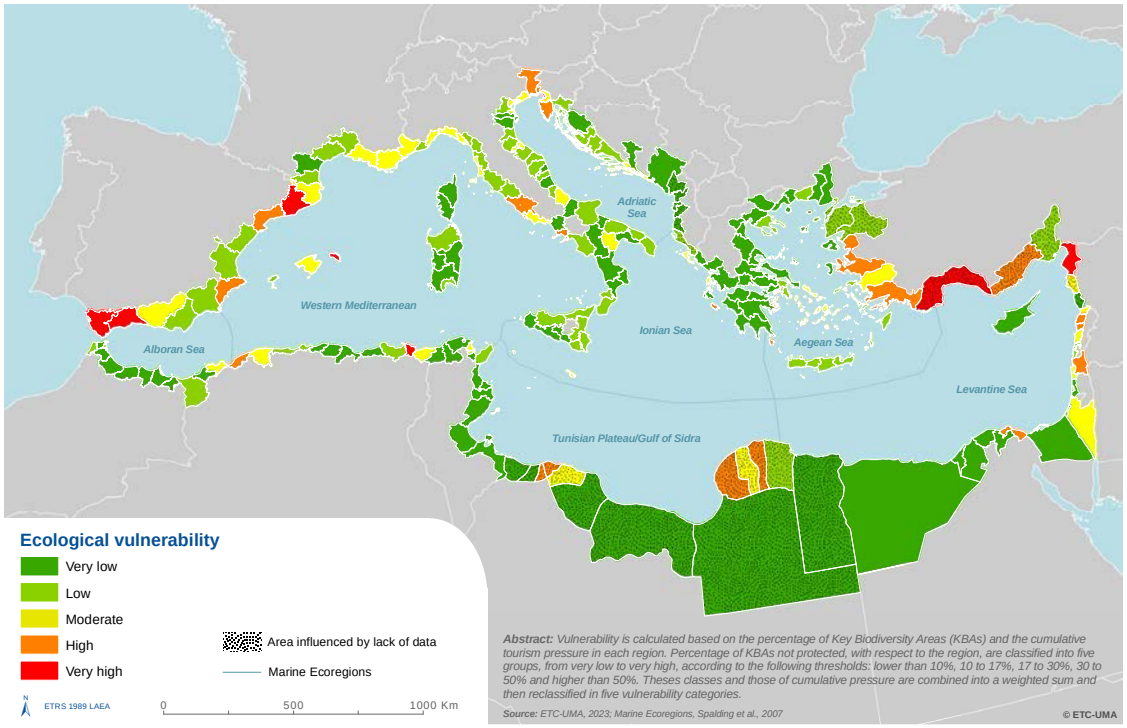
The resulting map (**Figure 13**) provides a very detailed overview of ecological vulnerability to coastal tourism pressures (i.e., terrestrial tourism demand, offer and activities) in Mediterranean regions.

Photo 6. "La Fontanilla" beach in Marbella, Spain

©Turismo Costa del Sol

Figure 13. Ecological vulnerability to tourism (terrestrial)

Ecological vulnerability to tourism by NUTS3 or equivalent region in 2022



Regions with very high levels can be found in both extremes of the Mediterranean basin, i.e., in the Spanish regions of Cádiz and Málaga in the Alboran Sea and in the Turkish provinces of Antalya and Hatay in the Levantine Sea. In addition, very high vulnerabilities are to be found in Girona and Menorca (Spain), the Annaba Province in Algeria and the province of Trieste (Italy). Apart from the high share of non-protected ecologically sensitive areas (KBAs), these regions are characterised by high tourism pressures, namely:

Table 3. Major tourism pressure in regions with very high levels of vulnerability

Region	Major tourism pressure
Cádiz	High % of built-up area Very high concentration of golf courses Very high number of cruise traffic
Málaga	Very high % of built-up area Very high concentration of golf courses High number of arrivals High density of tourism demand (nights spent)
Antalya	High % of built-up area high concentration of golf courses Very high number of arrivals High density of tourism demand (nights spent)
Girona	High % of built-up area Very high concentration of golf courses High density of marina port moorings Very high number of arrivals High density of tourism demand (nights spent)
Menorca	High % of built-up area Very high number of arrivals Very high density of tourism demand (nights spent)
Trieste	High % of built-up area Very high concentration of golf courses High density of marina port moorings Very high number of arrivals High density of tourism offer (bed places, establishments) High density of tourism demand (nights spent)

Several other coastal strips with high shares of KBAs with low protection levels and high to very high levels of tourism pressures are found in the Catalonian coast (Spain), the French Riviera, Italian provinces close to Rome and the northern Adriatic (e.g. Venice), the eastern Algerian province, several provinces in eastern and western Libya and on the Levantine coast from Egypt (with some exceptions) up to north Lebanon. The most striking concentration of highly vulnerable regions is on the Mediterranean coast of Türkiye, from Hatay up to Izmir in the Aegean Sea. This high vulnerability in the Turkish coastal provinces is especially linked to the large number of KBAs in its territories without legal protection. This reflects the very low coverage of protected Turkish land area which is only 6.95% (WDPA)[5], with almost none of these protected areas covering coastal areas.

The general pattern of tourism vulnerability can be summarised as follows: the high vulnerability in EU regions is linked to very high combined tourism pressure values. Even though the protection level is relatively high in most of them, the combined pressure level sets these regions on the list of most vulnerable regions.

On the other hand, the high to very high vulnerabilities in the Eastern and Southern Mediterranean countries is related to the very low protection level in these regions. Even though tourism pressure is not (yet) high, the overall protection level is so low that any additional pressure stemming from tourism activities or others would cause substantial impacts.

The coastal regions in Türkiye are very relevant cases that are highlighted in the map as they show both medium to high levels of cumulative pressures and very low levels of protection of their ecologically sensitive areas.

The analysis of the Turkish regions invites to review the overall performance of Mediterranean countries with regards to both the share of protection of their KBAs and the cumulative pressures and vulnerability mean values in their coastal areas.

To start with, there is a huge difference in the share of protection of Key Biodiversity Areas between countries. **Figure 18** provides this overview. All EU countries plus Albania and Egypt have more than 50% of their KBAs under some type of protection while the remaining non-EU countries do not reach this level of protection, with critical situations of protection levels under 25% such as in Algeria, Israel, Lebanon, Libya, Palestine, Syria and Türkiye.

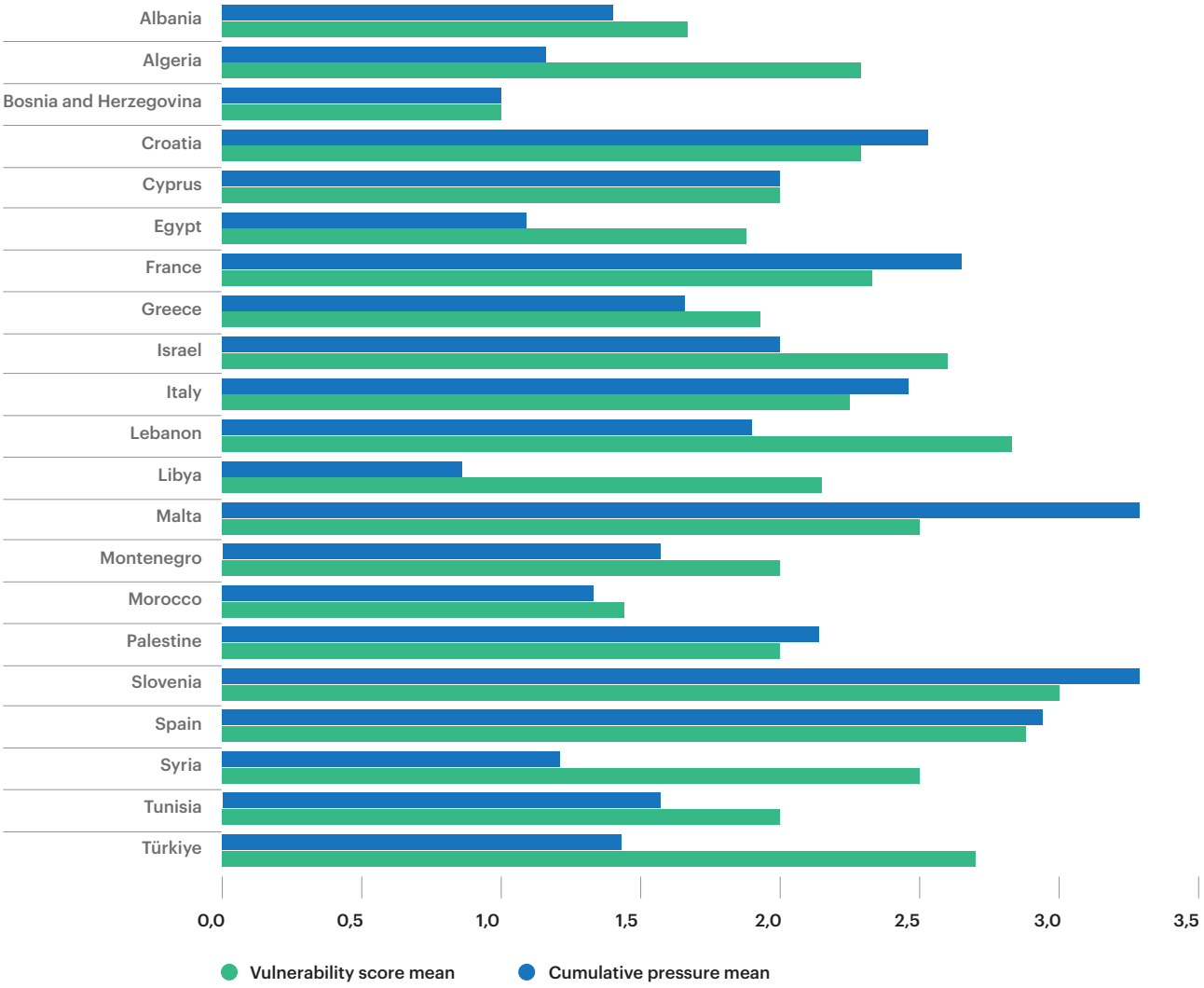
Figure 14 provides an overview of the mean values of cumulative pressures and vulnerability per country. A few key findings can be highlighted:

- Most of the EU countries, except for Greece, have higher mean pressure levels than vulnerability levels, based on the fact that ecologically sensitive areas are usually under protection to a higher degree.
- On the contrary, non-EU countries, including those in the Euro-Mediterranean area, such as Montenegro, Bosnia and Herzegovina and Albania, have higher vulnerability mean values than pressure values, except for Palestine.
- Some countries show very large differences (more than 1 point) between mean pressures and vulnerability values, such as Algeria, Egypt, Libya, Syria and Türkiye, all of them with higher vulnerability than pressure values. Only Malta has much higher pressure than vulnerability values.
- Highest mean vulnerability values (>2.5) are found in Israel, Lebanon, Slovenia[6], Spain and Türkiye.
- Highest mean pressure values are present in: Croatia, France, Malta, Slovenia and Spain.

5 https://www.protectedplanet.net/country/TUR

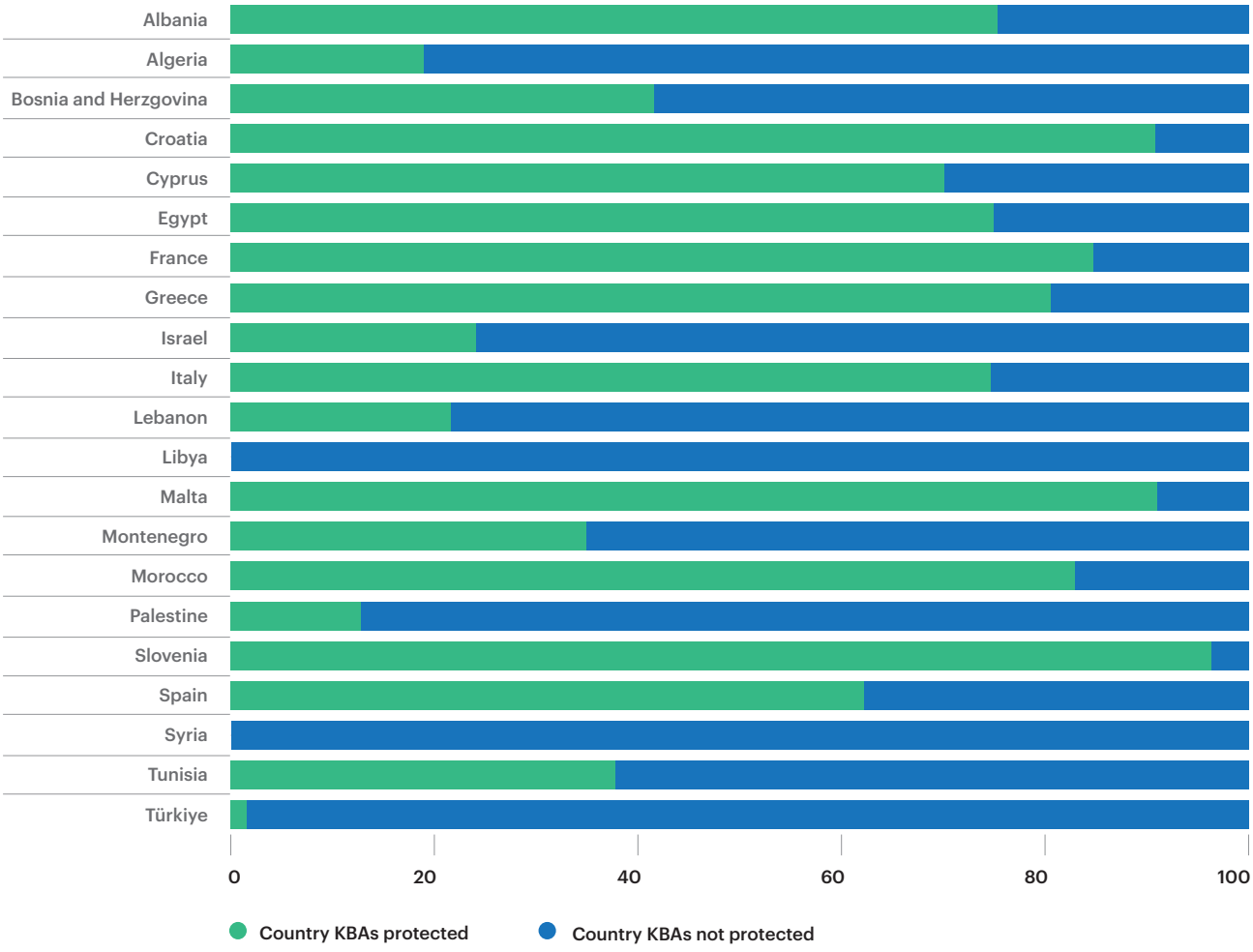
6 For Slovenia, it should be noted that these values only refer to a small coastal strip in one region.

Figure 14. Cumulative mean pressure values versus vulnerability score per country



Source: Authors

Figure 15. **Share of protected and non-protected Key Biodiversity Areas per country**



Source: Authors

4.3.2. Marine vulnerability map

Vulnerability in marine areas was based on the cumulative pressure hotspots extracted from the cumulative traffic indicator and the coverage of PAs and IABs[7]. Pressure points are overlaid with the IAB polygons and if they fall into an IAB polygon they are ranked in vulnerability classes from very high to low. Each area belonging to one of the vulnerability classes is further classified according to whether it falls in a PA or not. Areas outside IABs and PAs are considered to have little environmental value and are excluded from the assessment, and the vulnerability can be considered very low or negligible.

The resulting point layer represents the ecological vulnerability in marine areas in five categories from very low to very high, with the indication whether it is covered by a figure of legal protection or not (**Figure 15**).

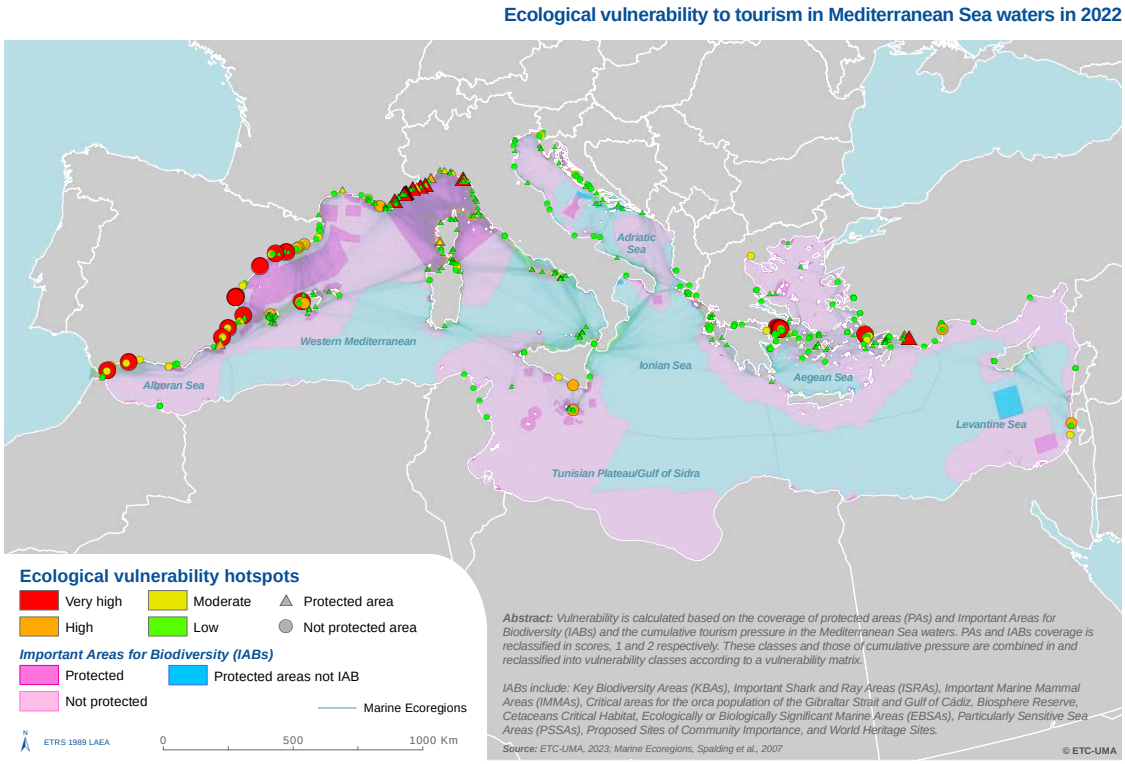
The resulting map (**Figure 16**) shows the hotspots of ecological vulnerability in the marine environment in the Mediterranean.

The hotspots of very high vulnerability are concentrated along the Spanish coastline both in the Alboran Sea (coast of Cádiz and Málaga) and the Western Mediterranean (Alicante, Valencia, Castellón, Tarragona, Mallorca). The second clustering of high vulnerability areas lies in the French and Italian coastal areas around the Ligurian Sea from Toulon to La Spezia. The third cluster of very high vulnerability hotspots can be found in the Aegean Sea with one hotspot in the marine areas around Athens and another hotspot in the marine water of the Muğla Province where some of Türkiye's largest holiday resorts lie, such as Bodrum.

While the Spanish hotspots and most of the hotspots in the Aegean Sea are not covered by protected areas, the hotspot areas in the Ligurian Sea coincide with the Pelagos Sanctuary

7 IABs include: Key Biodiversity Areas (KBAs), Important Shark and Ray Areas (ISRAs), Important Marine Mammal Areas (IMMAs), Critical areas for the orca population of the Gibraltar Strait and Gulf of Cádiz, Biosphere Reserve, Cetaceans Critical Habitat, Ecologically or Biologically Significant Marine Areas (EBSAs), Particularly Sensitive Sea Areas (PSSAs), Proposed Sites of Community Importance, and World Heritage Sites.

Figure 16. Ecological vulnerability to tourism in Mediterranean Sea waters



entirely. In addition, there is one hotspot area of vulnerability on the Turkish coast which is covered by the Special Environmental Protection Area of Patara. This distribution is linked to the fact that most areas with high vulnerability are a consequence of coastal activities such as recreational boating close to urban areas. In most parts, these areas surrounding urban areas do not overlap with legally protected areas.

Furthermore, there are several hotspots of high vulnerability along the Spanish coast (Costa Daurada, Balearic Islands), the French Cote d'Azur, in southern Sicily and Malta as well as in a couple of marine areas in Türkiye, namely Fethiye and Antalya, and a hotspot in Tel Aviv (Israel), most of which do not fall in protected areas.

Interestingly, there are not any significant hotspots in the Adriatic or Ionian Sea nor in the marine areas of North Africa and the Levantine coast (except for Tel Aviv) which mirrors the relatively low intensity of leisure boat activities in these areas.

The regional overview is further discussed with an assessment of the pressure of leisure boat activities on a specific habitat in the Mediterranean, *Posidonia oceanica*, that is discussed under section 4.4.1.

4.4. Specific assessments on the ecological vulnerability of Mediterranean coastal and marine tourism

4.4.1. Vulnerability of *Posidonia oceanica*

A dedicated assessment was done on the vulnerability of *Posidonia oceanica* regarding tourism-related activities such as leisure boating intensity and marine port density. The spatio-temporal patterns of these activities were analysed and overlaid with occurrences of *Posidonia oceanica* meadows to estimate the potential impact on this specific habitat.

Posidonia oceanica is a key habitat due to the multiple ecosystem services it provides, such as carbon sequestration, coastal protection, and habitat provision. Its extent of about 19,482 square kilometres in the Mediterranean Sea has been under pressure over the last decades due to harmful fishing practices and the impact of anchoring/berthing, particularly of leisure boats close to the main tourist centres around the Mediterranean. Our analysis focuses on this latter pressure due to its close relation to Blue Tourism. As part of this analysis, we look both at the *Posidonia oceanica* meadows inside protected areas (approximately 33%) and outside protected areas.

The main source of data comes from Mediterranean-wide maritime traffic information on pleasure crafts (EMODNET), which has been available daily since 2017. These data show clear seasonal and interannual patterns (**Figure 17**). The graphic shows that pleasure craft traffic is a seasonal activity linked to the summer months and that its intensity has been increasing since 2017 with a substantial increase after the pandemic. As data is expressed in units of time per square kilometre, we cannot know if it is due to a higher number of vessels or a longer stay at sea (or both).

The spatial overview of pleasure craft activities across the Mediterranean (**Figure 18**) shows patterns linked to the main touristic areas:

- In the Western Mediterranean: Balearic Islands and coast of Valencia, French and Italian Riviera and Corsica.
- The Croatian coastline in the Adriatic Sea.
- The Greek coast both in the Ionian and Aegean Sea.

Photo 7. **Mediterranean beach with Posidonia seagrass**

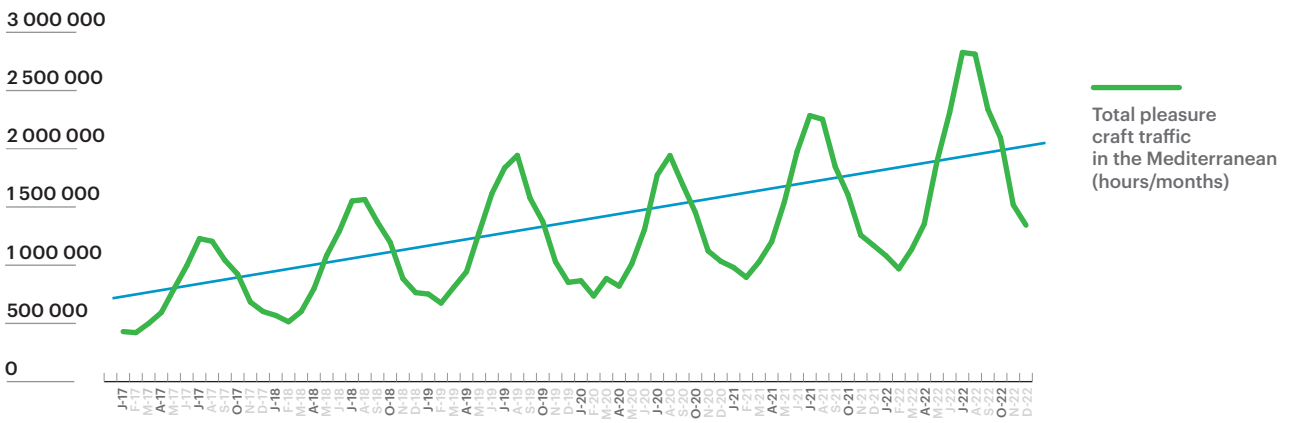
© Dreamstime.com (Visitor Kawa13)

These hotspots of maritime leisure traffic relate strongly with regions with the highest numbers of moorings in marina ports.

The temporal dynamics provide the following patterns:

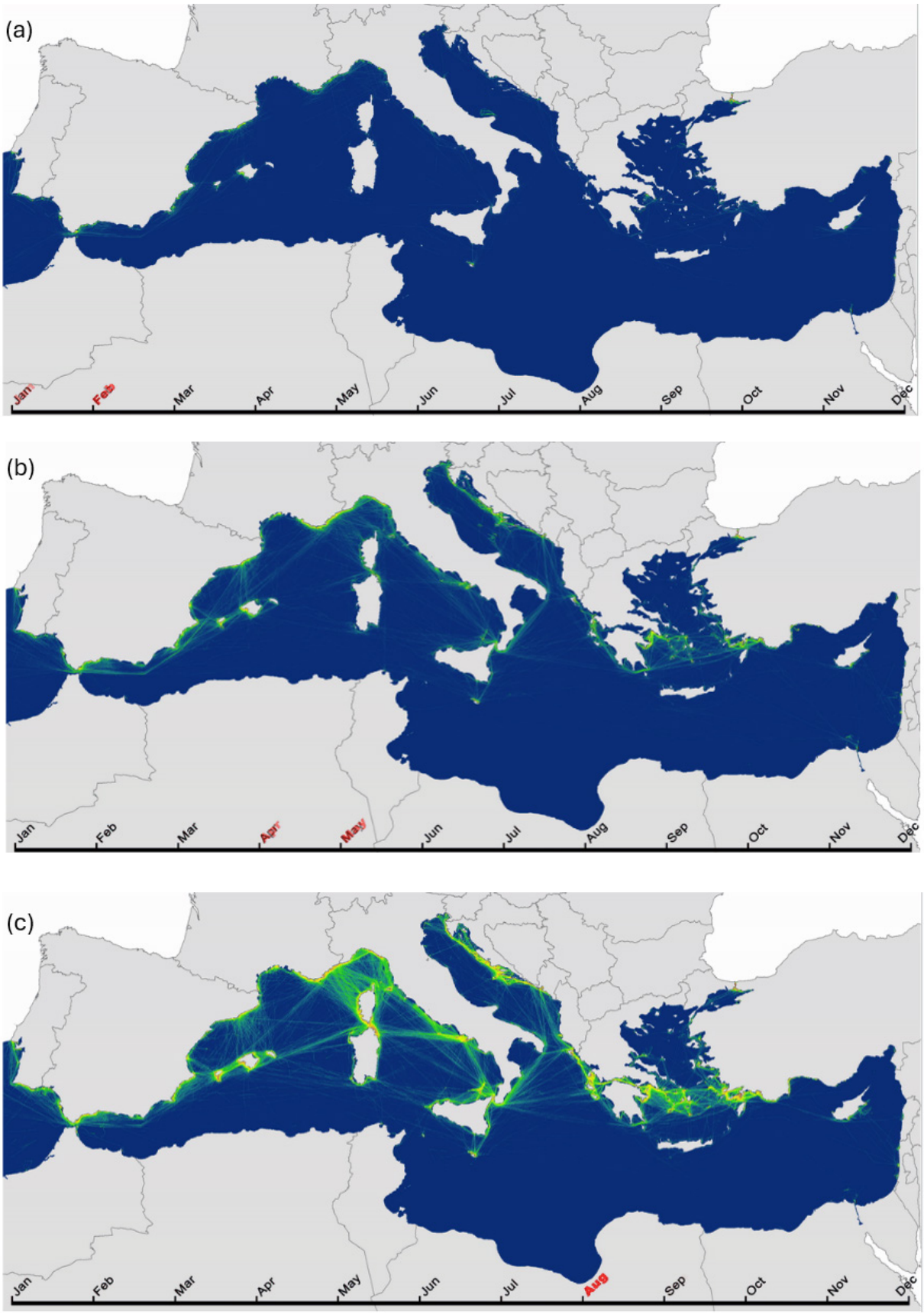
- During the low season, vessels seem to stay close to their ports of origin (higher activity where there is greater capacity of moorings).
- During the high season, vessels spread to other areas of the Mediterranean (activity more linked to the interest of the location, e.g. islands).

Figure 17. **Trend of total pleasure craft traffic in the Mediterranean Sea from 2017-2022**



Source: Authors

Figure 18. **Annual trend of total pleasure craft traffic in the Mediterranean Sea: (a) Winter, (b) Spring, (c) Summer 2022**



The spatial distribution of *Posidonia oceanica* in the Mediterranean was mapped using a GIS dataset provided by the Office Française pour la Biodiversité (OFB) (data from Golder, Université de Corse and Mediterranean Posidonia Network (MPN)). When analysing these spatio-temporal dynamics with respect to the occurrence of *Posidonia oceanica* inside and outside of protected areas in the Mediterranean, we can discover very interesting patterns (**Figure 19**).

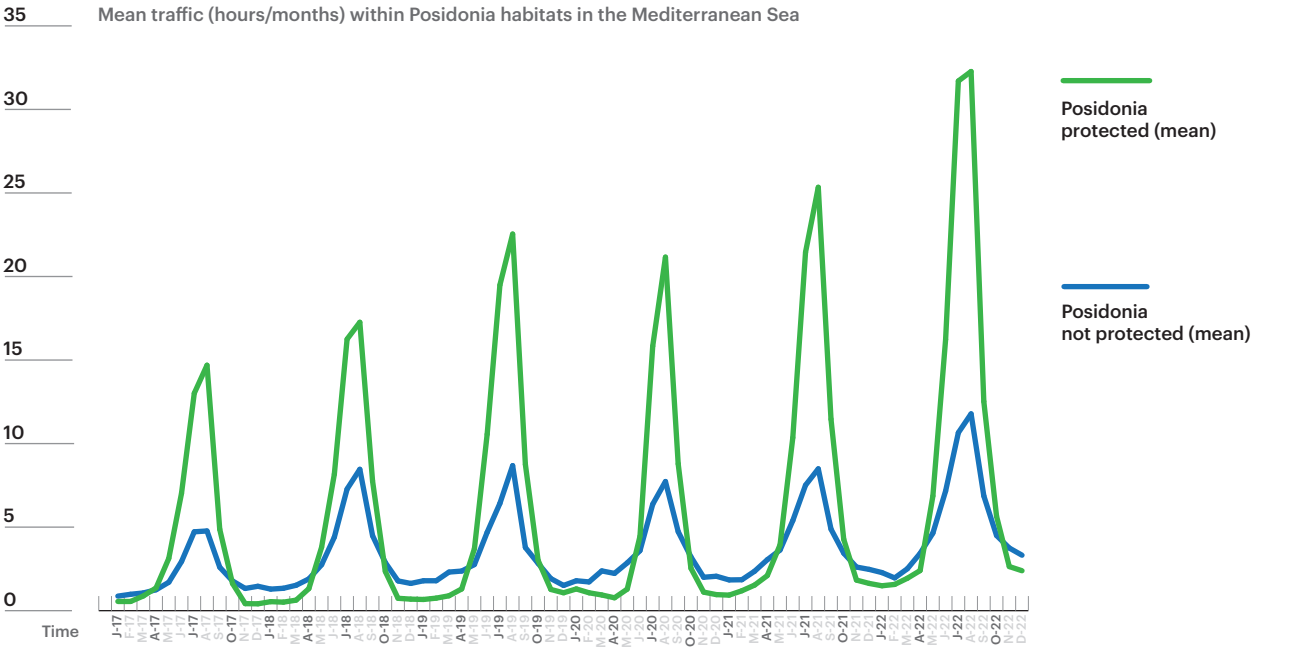
At Mediterranean level, *Posidonia oceanica* meadows in protected areas receive more traffic than those not protected, with substantial increase during the post-pandemic years, especially during summer. Nevertheless, for the Pan-Mediterranean analysis it should be considered that data availability in non-EU countries is relatively low. Results may not be representative of the real situation.

If we take a close look at the data for EU countries (**Figure 20**), we discover that traffic levels are similar in protected and non-protected *Posidonia oceanica* meadows in the high season, but in the low season non-protected *Posidonia oceanica* meadows receive more pressure. This might be related to the fact that leisure boat activities in the winter have a smaller outreach and are more likely to occur close to marina ports and urban areas which are typically not under protection.

If we compare leisure boat activities and their potential impact on *Posidonia oceanica* meadows among Mediterranean countries we can observe a clear grouping of 5 countries (Spain, France, Greece, Italy and Türkiye) with highest numbers of leisure boating activity and strong increase over the past 5 years, with a slight decrease during 2020 (**Figure 21**). On the other hand, the remaining Mediterranean countries have lower degrees of leisure boating activities without significant trends over the observed period. Croatia slightly stands out in this country group as it has experienced a steady increase of these activities.

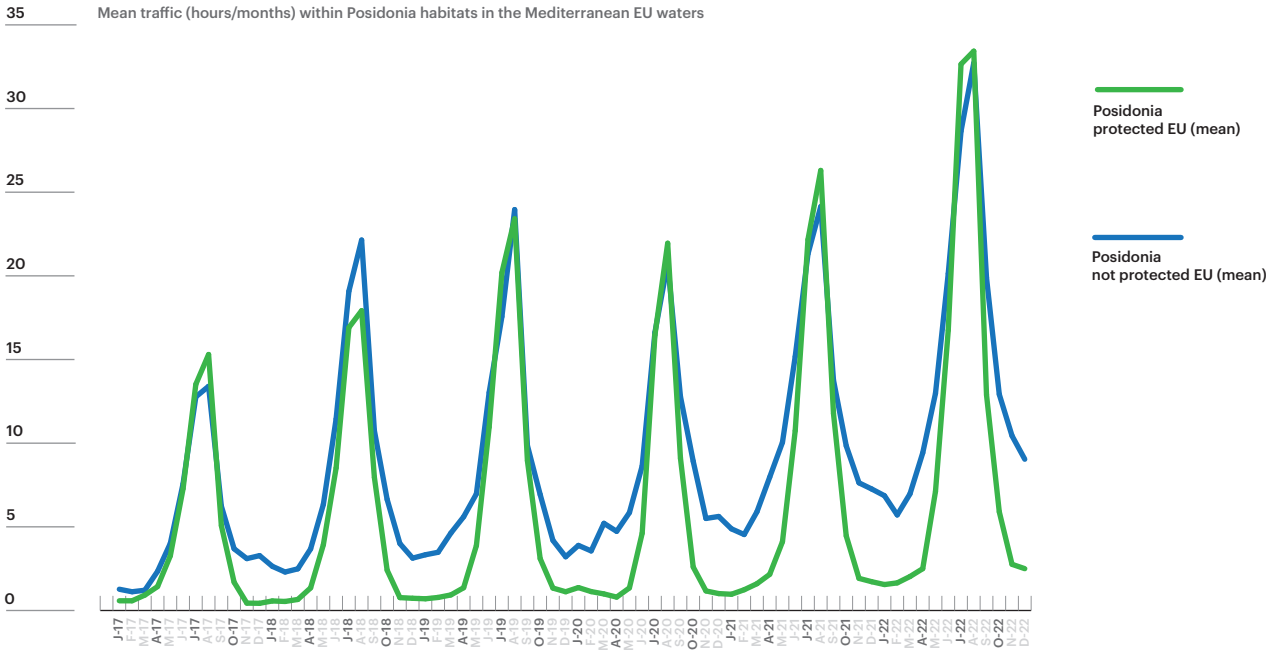
If we finally look at the leisure boat traffic relative to marine area (hours/km^2) and its overlay with protected and non-protected *Posidonia oceanica* meadows, we see that in most countries *Posidonia oceanica* meadows receive proportionally more traffic than the rest of territorial waters (**Table 4**).

Figure 19. Trend of total pleasure craft traffic within protected and non-protected Posidonia meadows (2017-2022)



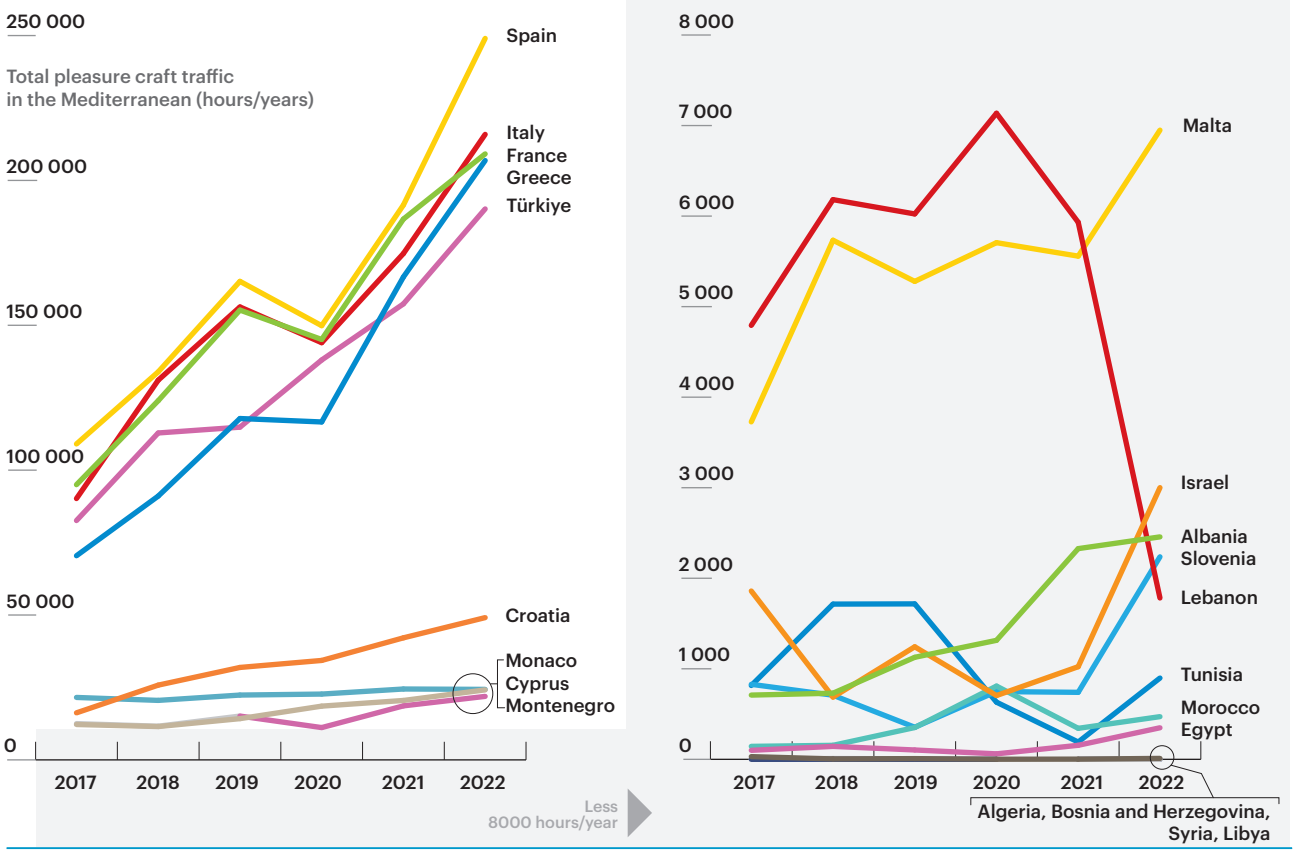
Source: Authors

Figure 20. Trend of total pleasure craft traffic within protected and non-protected Posidonia meadows in the EU (2017-2022)



Source: Authors

Figure 21. Trend of total pleasure craft traffic in hours/year per country (2017-2022)



Source: Authors

Table 4. Traffic relative to marine area (hours/km²)

Country	Territorial waters	*Posidonia oceanica*		
		Total	Protected	Not protected
Albania	0.40	24.16	-	24.16
Algeria	0.00	-	-	-
Bosnia and Herzegovina	0.01	0.01	-	0.01
Croatia	1.55	11.13	5.02	16.34
Cyprus	1.57	1.99	2.47	1.41
Egypt	0.01	-	-	-
France	8.44	25.15	22.36	87.25
Greece	1.83	2.68	2.53	4.15
Israel	0.74	-	-	-
Italy	1.39	6.60	7.50	5.84
Lebanon	0.38	-	-	-
Libya	0.00	-	-	-
Malta	1.72	14.64	14.99	9.91
Monaco	324.48	-	-	-
Montenegro	9.66	-	-	-
Morocco	0.05	-	-	-
Slovenia	10.31	-	-	-
Spain	4.34	25.84	13.57	65.67
Syria	0.00	-	-	-
Tunisia	0.03	0.04	0.00	0.04
Türkiye	3.74	1.30	1.30	-

4.4.2. Vulnerability of marine megafauna

The ecological importance of the North-Western (NW) Mediterranean for fin whales (*Balaenoptera physalus*) is well known. In summer, this area accumulates up to 70% of the whole Mediterranean fin whale population. In addition, two out of three of their known Mediterranean seasonal feeding grounds occur here (Canese et al., 2006; ACCOBAMS, 2022; Panigada V et al., 2022). In summer, this region also hosts about 50% of the whole Mediterranean population of sperm whales (*Physeter macrocephalus*)[8].

Within the Pelagos Sanctuary, the Spanish cetacean migration corridor, and the wider proposed NW Mediterranean Particularly Sensitive Sea Area (PSSA), maritime traffic for goods runs between bigger continental ports, whereas passenger transport occurs mostly between continental and insular ports. This region is also a flourishing cruise tourism area. The proximity to large and tourist islands promotes intense seasonal passenger traffic, as well as widespread recreational boating.

The dynamics of whale ship strikes are still not fully understood. The type of interaction between cetaceans and vessels and the subsequent risk of mortality varies in relation to species' behaviours and shipping features. Some ships can attract small cetaceans (e.g. striped and bottlenose dolphins) that enjoy bow riding or surfing on ship generated waves. However, when it comes to larger cetaceans such as fin whales or sperm whales, this interaction seems to be mostly deadly. In between deep foraging dives, whales spend relatively long periods at the surface recovering, resting still or swimming slowly. These behaviours make them particularly vulnerable to ship strikes. A collision may result in various degrees of injuries for the whales and damage for the boats, depending on the speed and the size of the boat, like pedestrians and vehicles. According to national and international legislation on species protection and conservation, any source of human-induced mortality on protected species needs to be mitigated, including ship strikes.

Impacts of maritime traffic on fin whales in the NW Mediterranean

Collisions between vessels and large whales, in most cases, end with the death of the whale. For some species and in some areas, ship strikes may reach levels that threaten their conservation status. However, the actual impact of mortality caused by shipping at the population level is difficult to assess and quantify. Direct observations are scarce and sparse, as accidents generally happen offshore and are rarely noticed by seafarers, especially by those on large ships. Furthermore, collisions are not always reported, and large whales may sink after the strike and go unnoticed. Because of this, data on long-term monitoring programmes and strandings networks can complement information on these incidents. Based on all these types of accounts, a study showed that between 1971 and 2001, over 80% of reported Mediterranean fin whale ship strikes occurred in the NW Mediterranean (Panigada S. et al., 2006).

Consistent with regional data on species densities and collision events, at its last meeting, the International Whaling Commission (IWC) Scientific Committee stressed that 'action needs to be taken to reduce ship strike risks to

Photo 8. **Sailing near Kornati Islands, Croatia**

© MEET Network (Vicky Brown)

the Mediterranean populations of fin and sperm whales' (IWC, 2022). The Governments of France, Italy, Monaco and Spain submitted a proposal for the "Designation of a Particular Sensitive Sea Area in the North-Western Mediterranean Sea to protect cetaceans". By establishing effective 'associated protective measures' and committing to develop stricter prospective protective measures' mitigating ship-induced mortality, the proposed PSSA will potentially help protecting almost 70% of the whole fin whale population and 50% of the sperm whale's population, both listed as 'Endangered' by the IUCN[9] (Panigada, S., Gauffier, P. & Notarbartolo di Sciara, 2021; Pirotta et al., 2021), increasing their likelihood of survival.

The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) data showed that the highest density of fin whales in the summer of 2018 occurred in a rather large area off the Gulf of Lion west of the Pelagos Sanctuary, which is partially crossed (mostly to the NE) by an intricate web of busy shipping routes (**Figure 22**) connecting many French, Italian and Spanish ports, on both the continent and major and smaller islands. These shipping routes linked mainly to tourism-related traffic are particularly developed within the Eastern (Pelagos Sanctuary) and Western sides (Spanish coast) of the study area. **Figure 23** includes whale density areas, potential risk collision zones, and routes for which whale ship strikes were recorded, showing potentially dangerous routes.

The review of existing information on cetacean ship strike events (Fortuna et al., 2022) yielded 138 records, 123 of which were recorded between 1952 and 2017 in the North-Western Mediterranean only. Of these 123, 16 records were discarded because they were classified as duplicates, unconfirmed events or as events actively caused by whales, 4 were

8 https://www.iucnredlist.org/species/41755/2955634

9 https://www.iucnredlist.org/

Figure 22. **Summer fin whale density vs. summer traffic intensity**

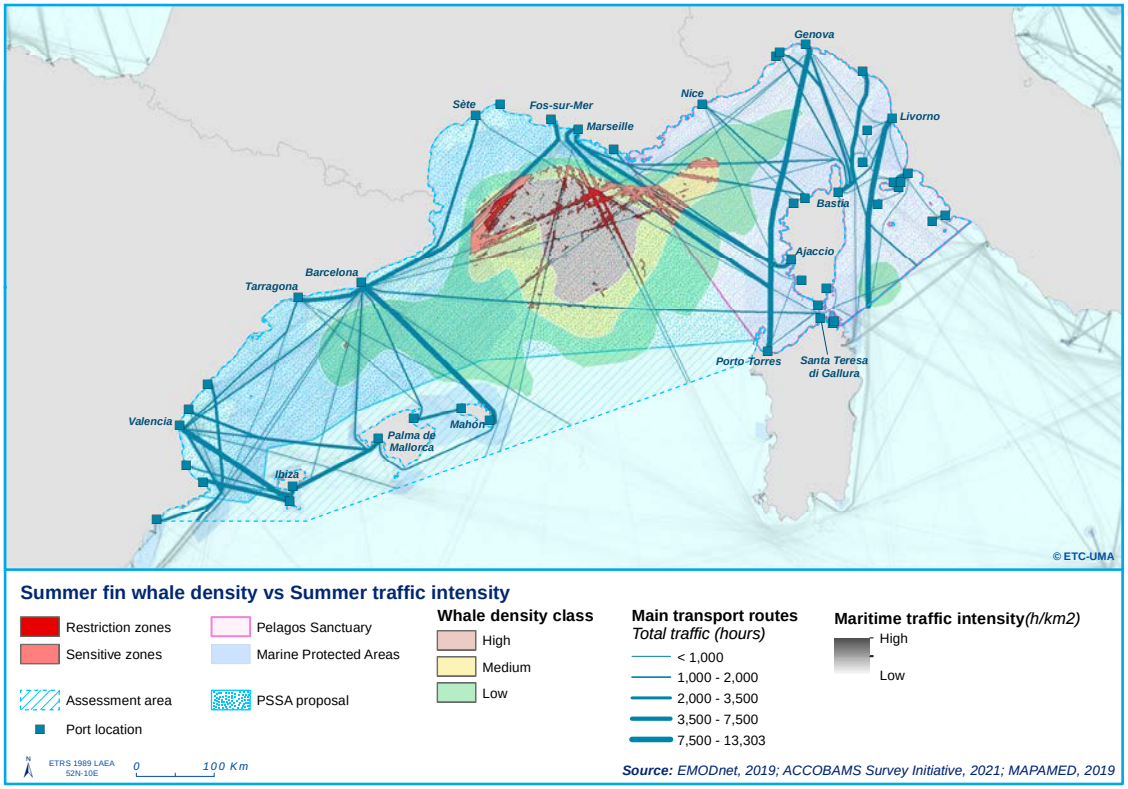
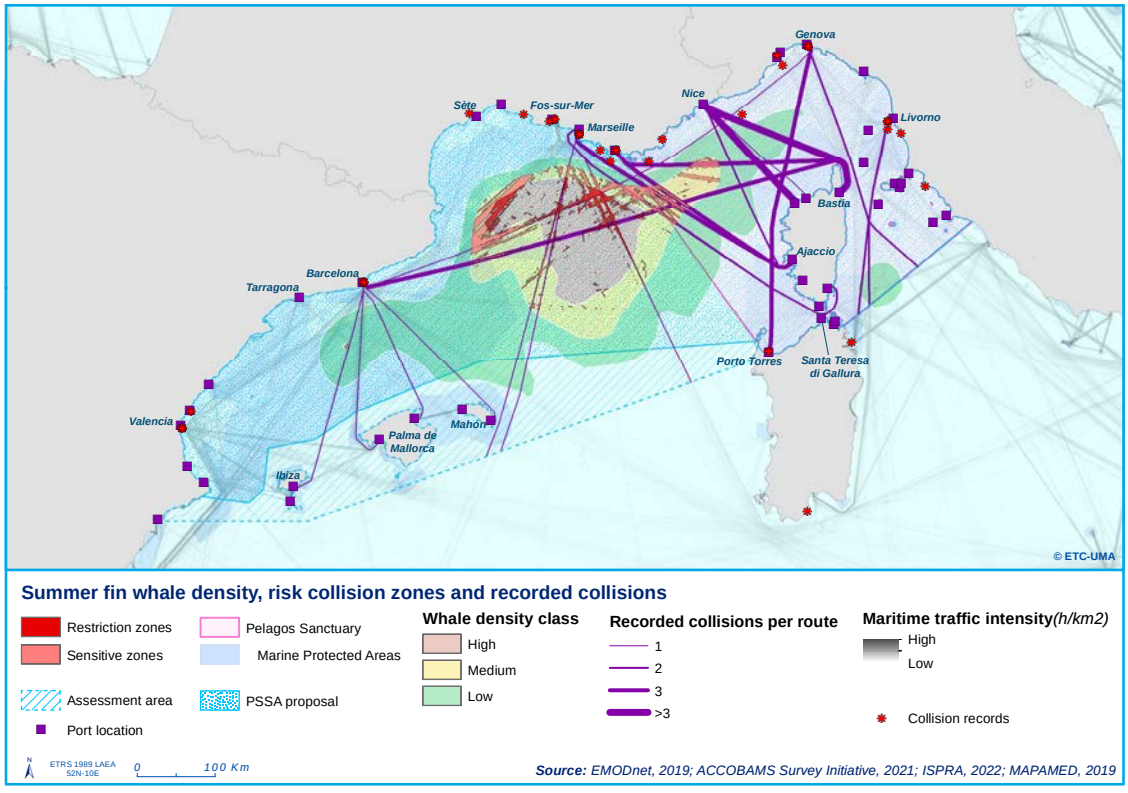


Figure 23. **Summer fin whale density, risk collision zones and recorded collisions**



assessed as animals 'already dead' at the time of collision and 21 were uncertain/unlikely events (some of these are still under evaluation). A total of 58 cases, including 6 of alive fin whales bearing clear marks of collision, were considered 'confirmed' and 24 'highly likely' ship strikes. Within these latter two categories, fin whales represented 69 cases (84%) and sperm whales accounted for 8 cases (10%). It is worth noting that 74% of events were recorded from the 1980s to the 2000s. During this period, they showed a steady increase, with a peak of 38 records (31%) during the 2000s. However, during the 2010s, records dropped at the same level as for the 1970s (11-12 events per decade, equal to 11-12%). This latter trend is not justified by a difference in monitoring intensity.

The level of maritime traffic and the intricacy of the network of shipping routes within the Pelagos Sanctuary and the proposed NW Mediterranean PSSA has the potential to put a major pressure on fin whales, which gather here in spring and summer months to feed. In addition, this region encompasses important habitats for fin whales, sperm whales and beaked whales, including a deep-water corridor.

Many of these shipping routes also cross several MPAs, including large Natura 2000 sites. Such level of shipping intensity brings in several direct and indirect pressures on cetaceans and their ecosystem, which cause direct mortality (whale ship strikes), disruption of communication (increased underwater noise) and potential impacts on the health of cetaceans and their ecosystem (chemical pollution). Unfortunately, these Natura 2000 sites currently lack management measures to mitigate these potential impacts, further exacerbating the threats to marine life and their habitats.

4.4.3. Pre-COVID/Post-COVID patterns of tourism-related pressures

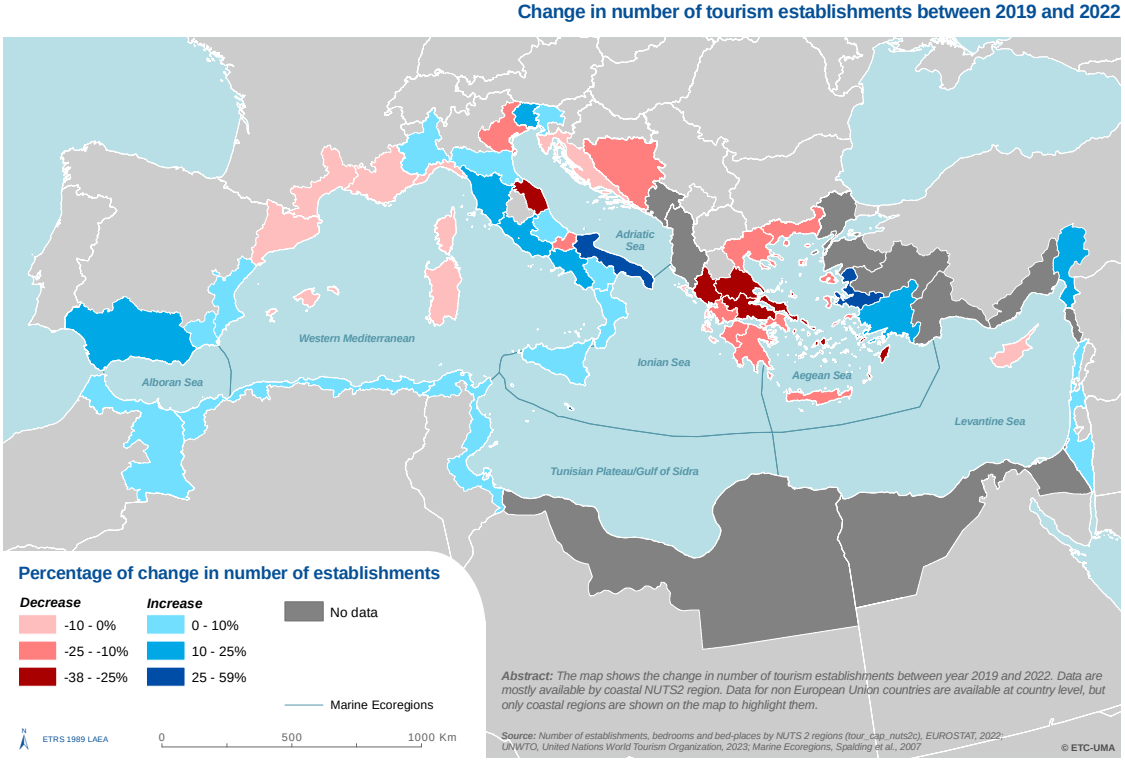
Another focus of this study was to evaluate the different levels of tourism-related pressures before the COVID-19 pandemic (reference year 2019) and in the aftermath of the pandemic (reference year 2022). For this analysis, we only used those indicators for which harmonised data were available for both reference years. This includes:

- **Tourism offer** (Number of bed places; Number of tourism establishments)
- **Tourism demand** (Cruise passengers per port; Number of arrivals; Number of nights spent at tourism accommodations)
- **Tourism activities** (Leisure boating)

In terms of tourism offer, there are clear regional differences in both the number of bed places and tourism establishments in the Mediterranean.

The data (Figure 24) indicate that the tourism accommodation sector maintained or even increased its offer with new establishments during the post-COVID-19 period, highlighting an expected recovery of tourism flows, especially towards the Levantine and Turkish Aegean coast, and the Western Mediterranean on both the European and African side, except for the French regions, Catalonia and the Balearic Islands. On the other side of the story, we see a reduction of accommodation capacities in the coastal Balkan regions on the shores of the Adriatic, Ionian and Adriatic Sea, even some drastic decrease in Central Greece. In addition, the French Mediterranean regions, Catalonia and the Balearic Islands lost accommodation establishments as well as the Italian regions of Genova, Venice, and Sardinia.

Figure 24. Change in the number of tourism establishments (2019-2022)



A similar situation can be seen if we look at the available bed places between 2019 and 2022 (Figure 25). Again, the French coastal regions, Croatia, Cyprus and most Greek regions have reduced their capacities in terms of offered bed places in the period. Nevertheless, there is an increase in some Greek regions such as Crete while the number of establishments decreases, indicating a concentration of the offer in establishments with higher capacities. This is also the case in some Italian regions such as Genova or Sardinia, and in Catalonia. A different situation, of decreasing bed places and increasing number of establishments can be observed in Tunisia as well as in some Italian regions.

Arrivals and nights spent in tourism accommodations represent the key figures of the demand side of tourism as they show the actual short-term recovery of tourism in the regions. With some exceptions, the overall development of tourism arrivals (Figure 26) at NUTS2 regions between 2019 and 2022 is negative with an especially high (>50%) decrease in arrivals. The only regions that have recovered and increased the arrivals are Murcia, Valencia, Balearic Islands, Languedoc-Roussillon, Provence-Alpes-Côte d'Azur, Corsica, Puglia, Marche, Albania, Tekirdağ, Edirne, Kırklareli, Izmir, Aydın, Denizli, Muğla and Antalya, Isparta, Burdur.

When it comes to the nights spent at tourism accommodations (Figure 27), the situation is even more pronounced with only 14 regions showing an increase in nights spent. Hence, even though in cases like Valencia or the Balearic Islands the number of arrivals has increased in this period, the length of stay has decreased, indicating some shifts in tourists' behaviours.

Cruise tourism was also heavily impacted by the COVID-19 pandemic, as it was entirely stopped for 5 months from March 2020 until August 2020. After the lift of this restriction, ports in several countries have recovered or even increased the number of passengers (Figure 28), such as all ports in Tunisia, most of the Italian ports in the Western Mediterranean, the southern Adriatic and Ionian Sea, the Croatian ports of Dubrovnik and Split, Israel, and Valencia and Alicante in Spain.

On the other side, all French, most Spanish, and Croatian ports as well as the ports in Malta and Cyprus in 2022 were still below the numbers of 2019. As mentioned by one of the key reports of the sector (MedCruise, 2023), the last pre-COVID-19 year represented a record year for many of these ports, hence the decrease experienced during the post-COVID-19 years was extremely harsh and increased the difficulty to recover.

Comparing the data for offer and demand, it is interesting to observe that the increase in offer (establishments, beds) in some of the Mediterranean coastal regions, such as the Maghreb countries, and several Spanish and Italian regions, is not in line with the development of the demand: capacities have increased while, at least in the immediate post-COVID-19 situation in 2022, arrivals have not recovered to the pre-COVID situation. This might be related to the finalisation of capacities that were planned or initiated in the pre-COVID-19 situation, or with new investments that advance an expected increase in arrivals soon. On the other hand, there are regions in France that have attracted more arrivals and nights with lower capacities.

The comparison between pre- and post-COVID-19 data for leisure boating was already discussed in section 4.4.1.

Figure 25. Change in the number of bed places (2019-2022)

Change in number of nights spent at tourist accommodation establishments between 2019 and 2022

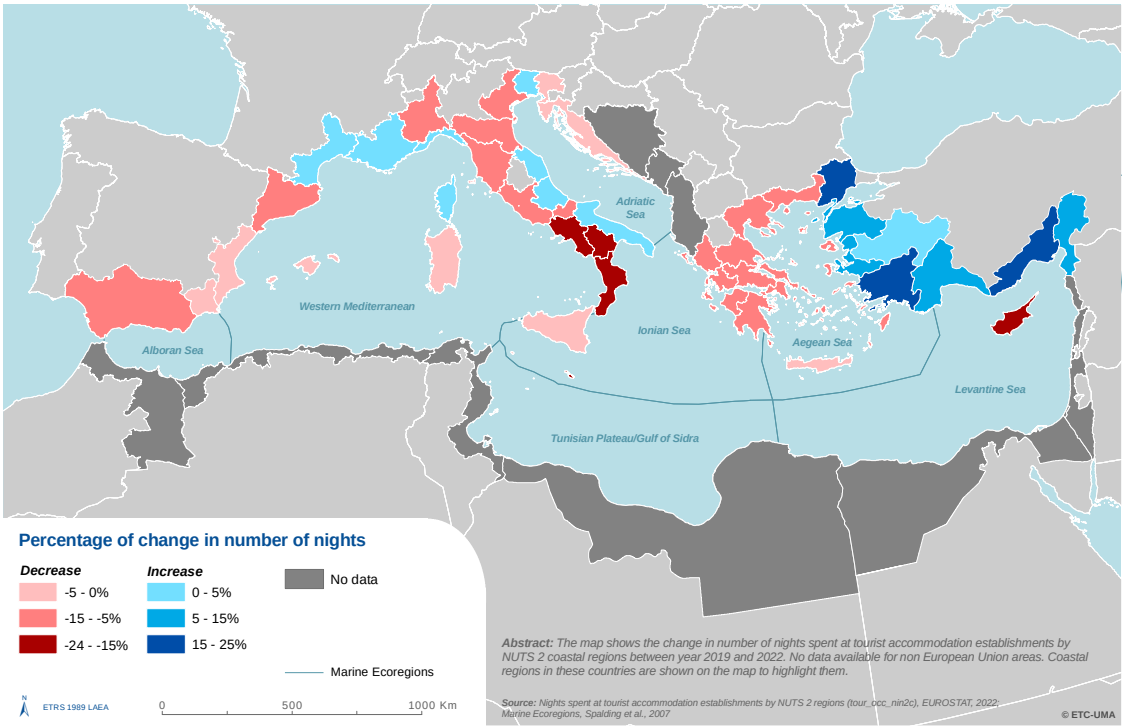


Figure 26. Change in the number of arrivals (2019-2022)

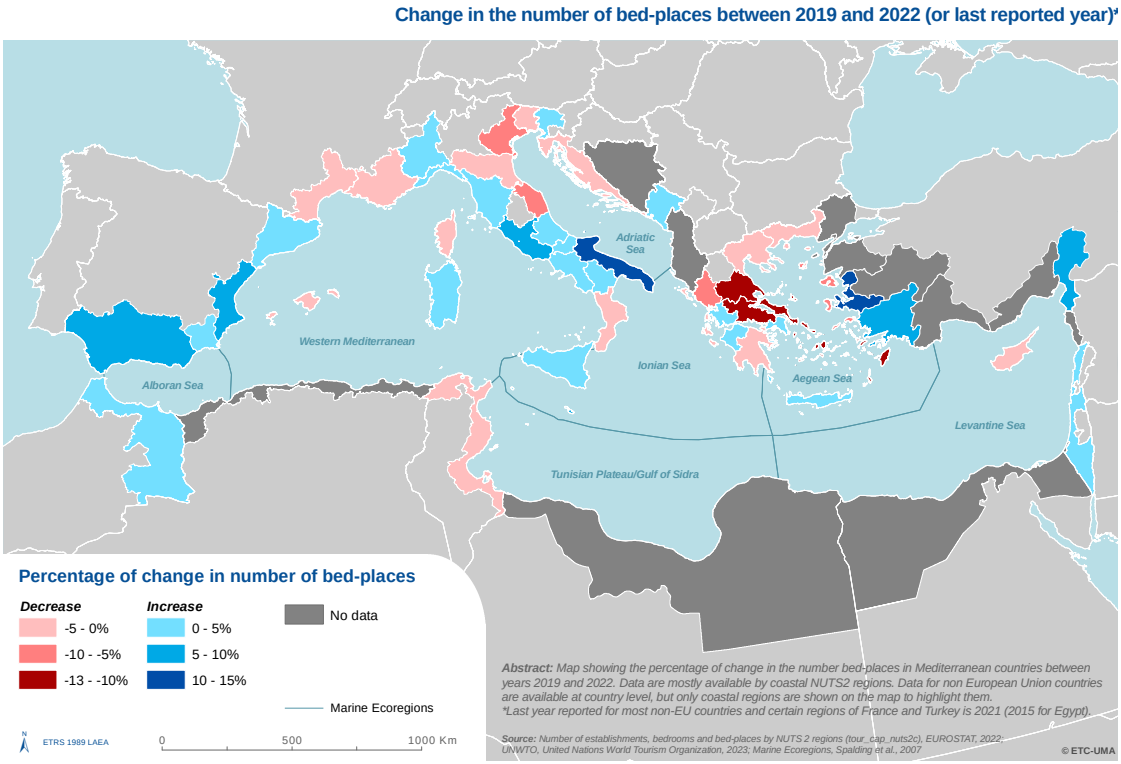


Figure 27. Change in the number of nights spent in tourist accommodation establishments (2019-2022)

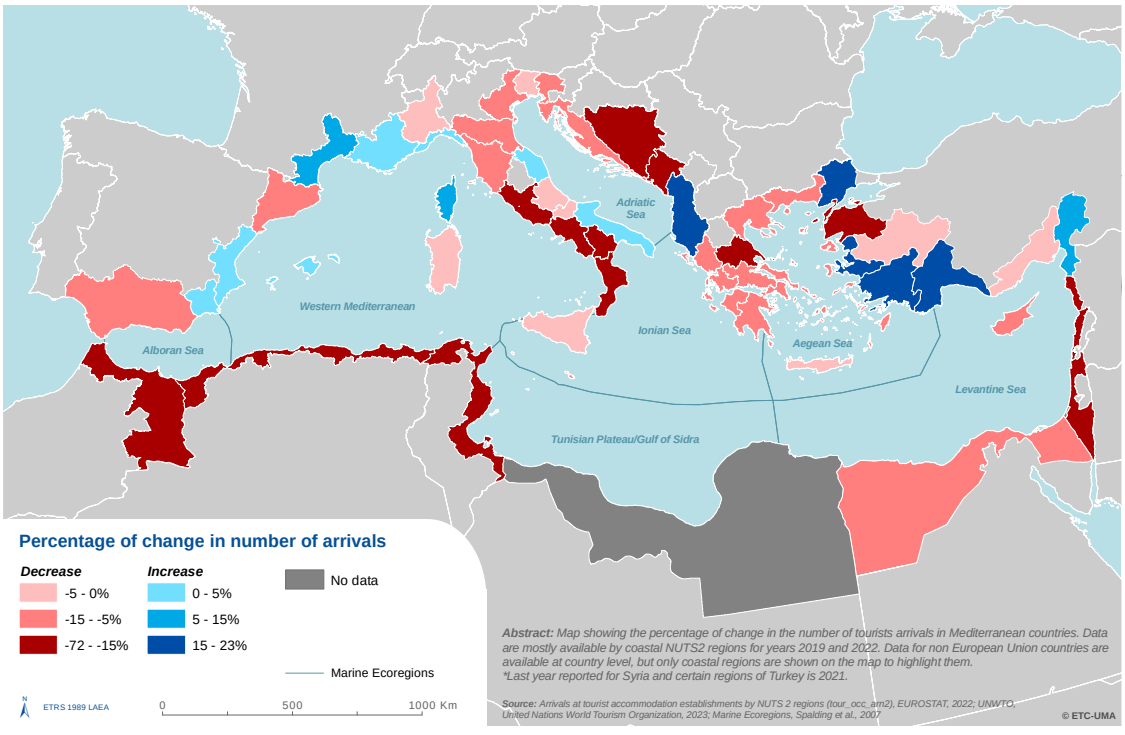
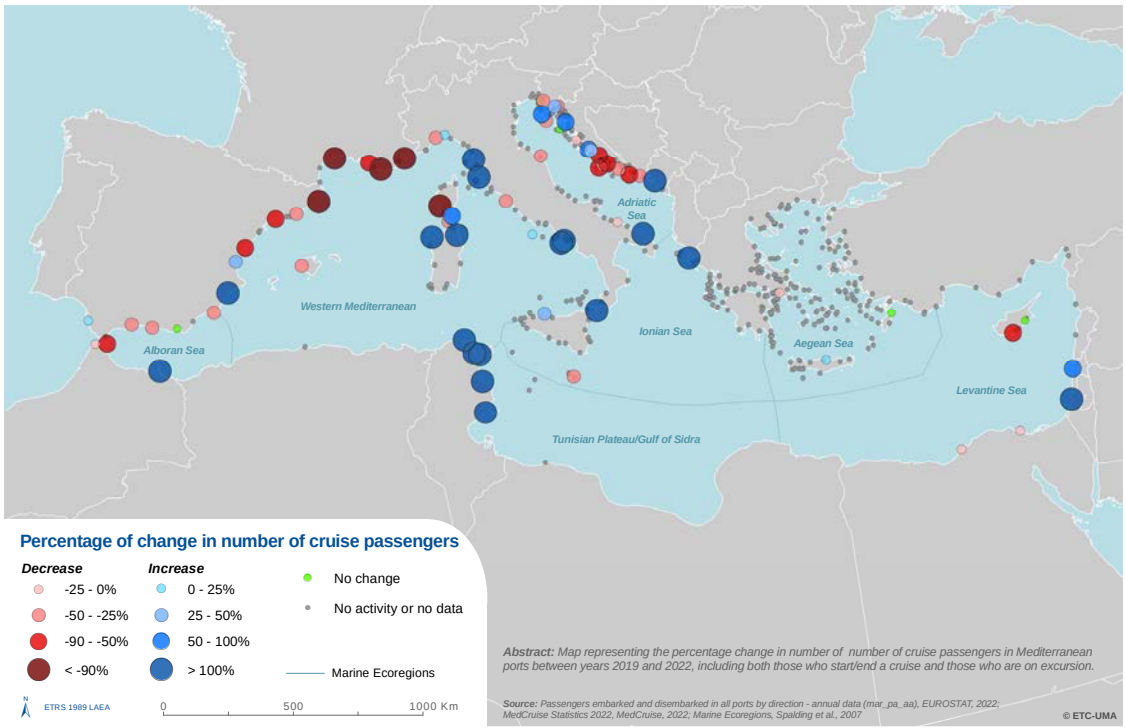


Figure 28. Change in cruise passengers per port (2019-2022)

Change in number of cruise passengers* per port between 2019 and 2022

**Including both those who start/end a cruise and those who are on excursion*



5. Conclusions & recommendations

Going back to the assessment question to analyse the terrestrial and marine ecological vulnerability in the Mediterranean, we focused a large part of the study on the question of how cumulative tourism pressure affects Protected areas and IABs across the Mediterranean. We have seen that, on the one hand, the high vulnerability for the terrestrial part in EU regions is linked to very high combined tourism pressure values. Even though the protection level is relatively high in most EU regions, the combined pressure level sets these regions on the list of most vulnerable regions. On the other hand, the high to very high vulnerabilities in the Eastern and Southern Mediterranean countries are related to the very low protection level in these regions. Even though tourism pressure is not (yet) high compared to the northern and western Mediterranean regions, the overall protection level is remarkably lower. This fact should be assessed in the short to medium term, as any additional pressure stemming from increasing tourism activities or from other sectors would cause substantial impacts. It is worth noticing that data gaps in the southern and eastern Mediterranean countries might underestimate the actual pressure from tourism offer, demand and activities.

Without going into details of single pressures and single regions, the general conclusions and recommendations linked to this assessment's outcomes can be summarised in the following points:

- From a **data point of view**, the assessment
  - has confirmed several findings from the previous assessment work on tourism pressures for the Euro-Mediterranean regions (Schröder & Sánchez, 2022), namely the low quality or lack of spatially explicit data on local tourism activities such as diving and leisure boat anchoring, pesca-tourism, boat rentals or aquatic sports, as well as the lack of consistent and harmonised data for second residences and tourist apartments, and cruise routes. Harmonised data availability for these variables would complement and enrich the existing assessment;
  - has revealed large data gaps for tourism statistics and tourism activity data for non-EU countries, especially in the eastern and southern Mediterranean. These data gaps largely hamper the cumulative pressure analysis and vulnerability assessment;
  - has shown improvements in some indicators such as the downscaling of tourism offer (bed places, establishments) and demand (nights spent) using OpenStreetMap data that has facilitated the spatial-explicit representation of these indicators and overlay with ecologically sensitive areas.
- Regarding **drivers of main pressure and their governance setting**, it is worth mentioning that many pressures are coming from transboundary and transnational activities (e.g. cruises, yachting) that require transboundary and region-wide regulations and governance schemes. Some of them are in place, such as IMO regulations for passenger ships, but transboundary management of leisure boating activities is still lacking in many areas of the Mediterranean. On the other side, IBAs are also spanning different countries with different levels of management enforcement and effectiveness. Therefore, solutions should be also approached from a regional perspective using the existing governance and management settings (e.g. SPA/BD protocol of the Barcelona Convention).
- In terms of **response options**, the conclusions and recommendations differ for the different parts of the Mediterranean:
  - **For EU countries**, new management and policy schemes should focus on the reduction of pressures in combination with more effective management of ecologically sensitive areas. This would lead to a reduction in cumulative pressures while reducing the vulnerability of these areas and avoiding that those pressures translate into actual impacts;
  - **for non-EU countries**, policies must be put into place to increase the surface of protected areas, providing the framework to set up effective management measures before any major tourism developments may cause damage to non-protected ecologically sensitive areas. Furthermore, as highlighted above, there is a need for more data on tourism activities, which would allow to better understand the current level of pressures stemming from the tourism sector.

Photo 9. **Snorkelling near Lošinj Island, Croatia**

© MEET Network (Author - Active Lošinj)

Regarding this last aspect of the conclusion, this involves, for the whole Mediterranean, implementing best practices to ensure the long-term sustainability of these areas. Effective management could include Integrated Coastal Zone Management (IZCM), which emphasises a holistic approach to controlling human activities (such as tourism) that may

harm the environment. This approach ensures biodiversity is maintained, promotes conservation efforts, and monitors environmental health. It also involves engaging local communities, providing education on environmental stewardship, and implementing policies that support conservation goals. By integrating various sectors and stakeholders, ICZM aims to balance environmental, economic, social, cultural, and recreational objectives to achieve sustainable coastal development.

However, if no protected areas are established, the recommendation shifts towards creating a foundation for environmental protection. This would involve identifying critical areas that need protection due to their ecological importance, biodiversity, or vulnerability to human activities. Once identified, appropriate management measures should be put in place. This could involve setting boundaries for new protected areas, creating regulations to limit harmful activities, and designing programs to encourage conservation among local stakeholders.

All of the above relies heavily on improved data availability, both tourism-related and biodiversity-related. Enhanced, harmonised and consistent data flows are not only vital for future assessments of this type but also indispensable for adaptive management and policymaking in response to global change. Global organisations such as UN Tourism are already advocating for standardised measurements of sustainable tourism indicators (UN Tourism, 2024). However, these measurements are often limited to the national level, lacking the detailed, spatially explicit information necessary for more granular analysis. Establishing a more comprehensive and harmonised data collection system for tourism indicators at the regional level, specifically for the Mediterranean, would significantly support future assessment efforts and enable evidence-based policymaking. The targeted assessments focused on specific species and tourism pressures on the marine side, particularly examining marine traffic's impact on *Posidonia oceanica* and marine megafauna. The first assessment evaluated the potential impact of recreational boating activity on *Posidonia oceanica* meadows, analysing the spatio-temporal dynamics of boating activities and their potential effects on Posidonia habitats. The second assessment investigated the potential impact of marine traffic on marine megafauna in one of the key biodiversity areas in the Mediterranean, the Pelagos Sanctuary, also examining the spatio-temporal patterns of pressures and potential impacts.

Again, spatial hotspots of localised vulnerabilities could be identified in both cases and should be translated into local, national and regional actions in terms of improved regulations and conservation measures, as well as prioritising investments at a Mediterranean level. In both cases, there are already Mediterranean initiatives tackling these issues. The Mediterranean Posidonia Network[10] provides recommendations and guidelines for the sector (national regulations, improving anchoring practices, eco-mooring deployment, etc.). Regional key players such as the Regional Activity Centre on Specially Protected Areas (SPA/RAC) have worked on action plans for the conservation of marine vegetation (UNEP/MAP - SPA/RAC, 2019) that will certainly benefit from improved mapping of the habitats and the related pressures.

In the case of marine traffic in the Pelagos Sanctuary, the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) as a legal conservation tool based on cooperation is a main player in the Mediterranean providing an intergovernmental agreement and a set of resolutions to improve the conservation of cetaceans. Again, data availability on marine traffic and how it affects Mediterranean megafauna ensures that the effect of the agreement and the resolutions are well monitored and assessed with the aim of improving and fine-tuning them.

Finally, we examined the different levels of tourism pressure before and after the COVID-19 pandemic, comparing changes in the tourism pressure indicator between 2019 and 2022. This assessment revealed regional disparities in post-COVID trends for several indicators, reflecting different regional strategies to overcome the pandemic-related crisis in the sector. In any case, rather than shifting towards a new paradigm, most indicators suggest that the tourism sector is striving to return to a path of quantitative growth that, in the long run, may jeopardise its material backbone: the Mediterranean landscape and ecosystems.

10 https://medposidonianetwork.com/

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7. Appendices

7.1. Data list

Boundaries

Maritime administrative boundaries

Dataset
Maritime Boundaries v11

Source
Flanders Marine Institute

Format
Vector

Resolution / Spatial unit
Polygon

Temporal coverage
2019

Spatial coverage
World

Link
Link

Data availability
Under request

Details
This geodatabase represents the Maritime Boundaries of the world. The database includes seven global datasets: Exclusive Economic Zones (200NM), version 11 (including the boundary polylines), Territorial Seas (12NM), Contiguous Zones (24NM), Internal Waters, Archipelagic Waters, High Seas, Extended Continental Shelves (including the boundary polylines).

Gaps/Issues
Data considers international agreements but, in some cases, may not be accurate in disputed areas. It is recommended to include some type of disclaimer when using this dataset in maps to avoid conflicts.

Land administrative boundaries

Dataset
GISCO statistical unit dataset

Source
EUROSTAT

Format
Vector

Resolution / Spatial unit
NUTS0 to NUTS3
1:1.000.000

Temporal coverage
2021

Spatial coverage
EU27

Link
Link

Data availability
Public access

Details
The GISCO statistical unit dataset represents the NUTS (Nomenclature of territorial units for statistics) and Statistical regions by means of multipart polygon, polyline and point topology. The NUTS geographical information is completed by attribute tables and a set of cartographic help lines to better visualise multipart polygonal regions.

Gaps/Issues
Data considers international agreements but, in some cases, may not be accurate in disputed areas. It is recommended to include some type of disclaimer when using this dataset in maps to avoid conflicts.

Land administrative boundaries

Dataset
GADM, the Database of Global Administrative Areas, v. 4.1

Source
GADM

Format
Vector

Resolution / Spatial unit
Admin. Units

Temporal coverage
2022

Spatial coverage
World

Link
Link

Data availability
Public access

Gaps/Issues
GADM aims to map the administrative areas of all countries, at all levels of sub-division. It provides data at high spatial resolutions that includes an extensive set of attributes.

Land administrative boundaries

Dataset
GADM, the Database of Global Administrative Areas, v. 4.1

Source
GADM

Format
Vector

Resolution / Spatial unit
Admin. units

Temporal coverage
2022

Spatial coverage
World

Link
Link

Data availability
Public access

Details
GADM aims to map the administrative areas of all countries, at all levels of sub-division. It provides data at high spatial resolutions that includes an extensive set of attributes.

Tourism offer

Number of bed places (per km^2, per habitants, coastal)

Dataset
Occupancy of tourist accommodation establishments (tour_occ) - Establishments, bedrooms and bed-places in tourist accommodation, by degree of urbanisation and coastal/ non-coastal area and NUTS 2 regions (tour_cap_nuts2dc)

Source
Eurostat

Format
Tabular

Resolution / Spatial unit
NUTS2

Temporal coverage
1990 - present

Spatial coverage
EU27

Link
Link

Data availability
Public access

Details
Yearly data on capacity of tourist accommodation establishments (number of establishments, bedrooms

and bed places) collected by the competent national authorities of the Member States at NUTS2 level.

Gaps/Issues
Data based on NUTS2 regions. Only cover certain types of tourist establishments. It is not indicative of the actual occupation. Only EU27 countries.

Number of tourism establishments (per km2, per habitants, coastal), including food facilities

Dataset
Occupancy of tourist accommodation establishments (tour_occ) - Establishments, bedrooms and bed-places in tourist accommodation, by degree of urbanisation and coastal/non-coastal area and NUTS 2 regions (tour_cap_nuts2dc)

Source
Eurostat

Format
Tabular

Resolution / Spatial unit
NUTS2

Temporal coverage
1990 - present

Spatial coverage
EU27

Link
Link

Data availability
Public access

Details
Yearly data on capacity of tourist accommodation establishments (number of establishments, bedrooms and bed places) collected by the competent national authorities of the Member States.

Gaps/Issues
Data based on NUTS2 regions. Only cover certain types of tourist establishments. It is not indicative of the actual occupation. Only EU27 countries.

STRs/Vacation homes

Dataset
OpenStreetMap -> Tourism Key and Tags

Source
OpenStreetMap

Format
GeoJSON, KML

Resolution / Spatial unit
Point

Temporal coverage
Present

Spatial coverage
World

Link
Link

Data availability
Public access

Details
Tourism Key includes location of places and things of specific interest to tourists including places to see, places to stay, things and places providing information and support to tourists. Data includes among others: hotels, guest houses, hotels, motels, caravan sites, apartments, camp sites, attractions...

Gaps/Issues
Coverage depends on the effort of users to map different geographic areas. Some regions may have more data than others.

Density of golf courses

Dataset
OpenStreetMap -> Tag golf course

Source
OpenStreetMap

Format
GeoJSON, KML

Resolution / Spatial unit
Polygon

Temporal coverage
Present

Spatial coverage
World

Link
Link

Data availability
Public access

Details
Location and delineation of golf courses.

Gaps/Issues
Coverage depends on the effort of users to map different geographic areas. Some regions may have more data than others.

Tourism demand

Number of nights spent at tourist accommodation (in coastal regions) by month

Dataset
Occupancy of tourist accommodation establishments (tour_occ) - Nights spent at tourist accommodation establishments by degree of urbanisation and coastal/non-coastal area and NUTS 2 regions (tour_occ_nin2dc)

Source
Eurostat

Format
Tabular

Resolution / Spatial unit
NUTS2

Temporal coverage
1990 - present

Spatial coverage
EU27

Link
Link

Data availability
Public access

Details
Yearly data on occupancy of tourist accommodation establishments (nights spent by residents and non-residents) collected by the competent national authorities of the Member States at NUTS2 level. Monthly data available at NUTS0. Since reference year 2020, monthly and yearly data are also available at NUTS 2 and NUTS3 level respectively.

Gaps/Issues
Data based on NUTS2 or NUTS0 regions. Monthly NUTS2 data and yearly NUTS3 data have an insufficient time series which also corresponds to the COVID19 pandemic period. Only EU27 countries.

Number of cruise passengers per port

Dataset
Maritime transport (mar) - Passengers embarked and disembarked in all ports by direction - annual data (mar_pa_aa)

Source
Eurostat

Format
Tabular

Resolution / Spatial unit
Point

Temporal coverage
1997 - present

Spatial coverage
EU27

Link
Link

Data availability
Public access

Details
Maritime transport data refer to gross weight of goods (in tonnes), passenger movements (in number of passengers), including or excluding cruise passengers, as well as for vessel traffic (in number of vessels and in gross

tonnage of vessels). Data for transport of goods transported on Ro-Ro units or in containers are also expressed in number of units or number of TEUs (20-foot equivalent units). The maritime transport domain contains quarterly and annual data.

Gaps/Issues
Quarterly data do not include cruise passengers. Only EU27 countries.

Number of cruise passengers per port

Dataset
MedCruise Statistic Report
Source
MedCruise
Format
Tabular
Resolution / Spatial unit
Point
Temporal coverage
2015 - present
Spatial coverage
Med Sea
Link
Link
Data availability
Public access
Details
Cruise activity data for all the MedCruise partnership ports. Includes number of passengers and cruises for all partner ports. 2022 report includes analysis of changes in pre- and post-pandemic activity.
Gaps/Issues
Some minor data might by missing.

Number of arrivals, including daily visitors by month

Dataset
Occupancy of tourist accommodation establishments (tour_occ) - Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arn2)
Source
Eurostat
Format
Tabular
Resolution / Spatial unit
NUTS2
Temporal coverage
1990 - present
Spatial coverage
EU27
Link
Link
Data availability
Public access
Details
Yearly data on occupancy of tourist accommodation establishments (arrivals of residents and non-residents) collected by the competent national authorities of the Member States at NUTS2 level. Monthly data available at NUTS0.
Gaps/Issues
Data based on NUTS2 or NUTS0 regions. Only EU27 countries.

Tourism activities

Marina port capacity

Dataset
Current marinas location and capacity
Source
Portbooker
Format
Tabular
Resolution / Spatial unit
Point
Temporal coverage
2023
Spatial coverage
World
Link
Link
Data availability
Public access
Details
Portbooker is a search and booking portal for marinas with a worldwide database on the location (coordinates) and capacity (number of moorings). This information can be digitised as it is a publicly accessible source.
Gaps/Issues
The location and capacity reported are assumed to be updated to the most recent date, so it is not possible to extract a time series on changes in the number of moorings or the construction of new marinas.

Marina port capacity

Dataset
Med-IAMER Marinas location and capacity
Source
ETC-UMA based on Portbooker, Plan Bleu and Spanish Yachting Port Federation
Format
Shapefile
Resolution / Spatial unit
Point
Temporal coverage
2014
Spatial coverage
EU
Med waters
Link
Link
Data availability
Under request
Details
Location and capacity (number of moorings) of marinas for North Mediterranean countries.
Gaps/Issues
Outdated, but data can be compared with Portbooker to study changes in capacity.

Marina port capacity

Dataset
Location of marinas in EU Mediterranean countries, plus Montenegro, Albania, Bosnia and Herzegovina
Source
IFREMER revised by WWF France
Format
Shapefile
Resolution / Spatial unit
Point
Temporal coverage
2019
Spatial coverage
EU
Med waters
Link
Link
Data availability
Public access
Details
Location of marinas for EU Mediterranean countries, plus Montenegro, Albania, Bosnia and Herzegovina
Gaps/Issues
Only location data.

Passengers transport and leisure boat activity

Dataset
Vessel Density Map
Source
EMODnet
Format
Raster
Resolution / Spatial unit
1km
Temporal coverage
2017 - present

Spatial coverage
European seas

Link
Link

Data availability
Public access

Details
The maps are based on AIS data yearly purchased from Collecte Localisation Satellites (CLS) and ORBCOMM. The maps, GeoTIFF format, show shipping density in 1x1km cells of a grid covering all EU waters and some neighbouring areas. Density is expressed as hours per square kilometre per month.

Gaps/Issues
Data expressed in time units. No information on the number of vessels per pixel. Data in areas outside the EU waters may have gaps or show a lower traffic density than the actual one due to lack of data.

Tourism-induced pressures

Built-up areas in the coastal buffer

Dataset
Copernicus Dynamic Land Cover (or Global Land Cover)

Source
Copernicus Land Monitoring Service

Format
Raster

Resolution / Spatial unit
100m

Temporal coverage
2015-2019

Spatial coverage
World

Link
Link

Data availability
Public access

Details
Provides at global level spatial information on different types (classes) of physical coverage of the Earth's surface, e.g. urban areas, forests, grasslands, croplands, lakes, wetlands, etc. Data are updated annually and are available for the 2015-2019 years.

Biodiversity protection

Protected Areas and ecological interest sites

Dataset
MAPAMED - MArine Protected Areas in the MEDiterranean

Source
UNEP/MAP-SPA/RAC, MedPAN Association

Format
Shapefile

Resolution / Spatial unit
Polygon

Temporal coverage
2019

Spatial coverage
Med Sea

Link
Link

Data availability
Under request

Details
MAPAMED is a cartographic database of key information on Mediterranean Marine Protected Areas (MPAs), Other Effective area-based Conservation Measure (OECMs), and more broadly on sites of interest for marine conservation.

Protected Areas and ecological interest sites

Dataset
World Database on Protected Areas (WDPA)

Source
UNEP-WCMC, IUCN

Format
Shapefile

Resolution / Spatial unit
Polygon

Temporal coverage
2023

Spatial coverage
World

Link
Link

Data availability
Public access

Details
Database is the most up to date and complete source of data on protected areas and other effective area-based conservation measures (OECMs), updated monthly with submissions from governments, non-governmental organisations, landowners and communities.

Gaps/Issues
Includes designation types considered ineffective or of dubious usefulness by conservation experts. Therefore, it must be used with care so as not to give a wrong idea of the level of real protection.

Protected Areas and ecological interest sites

Dataset
Key Biodiversity Areas

Source
BirdLife International

Resolution / Spatial unit
Shapefile
Polygon

Temporal coverage
2023

Spatial coverage
World

Link
Link

Data availability
Under request

Details
Location and delineation of Key Biodiversity Areas (KBAs)

Protected Areas and ecological interest sites

Dataset
Important Shark and Ray Areas (ISRAs)

Source
IUCN SSC

Format
Shapefile, Kml

Resolution / Spatial unit
Polygon

Temporal coverage
2023

Spatial coverage
World

Link
Link

Data availability
Under request

Details
Location and delineation of Important Shark and Ray Areas (ISRAs)

Protected Areas and ecological interest sites

Dataset
Important Marine Mammal Areas (IMMAs)

Source
IUCN SSC, WCPA

Format
Shapefile, Kml

Resolution / Spatial unit
Polygon

Temporal coverage
2023

Spatial coverage
World

Link
Link

Data availability
Under request

Details
Location and delineation of Important Marine Mammal Areas (IMMAs)

Posidonia vulnerability

Posidonia meadows distribution

Dataset
Mediterranean *Posidonia oceanica* distribution map

Source
Mediterranean Posidonia Network

Format
Shapefile

Resolution / Spatial unit
Polygon

Temporal coverage
2023

Spatial coverage
Med Sea

Link
-

Data availability
Under request

Details
Distribution of *Posidonia oceanica* of Mediterranean region countries, mainly based on national and subnational studies.

Gaps/Issues
Countries with little or no data or areas presenting gaps.

Megafauna vulnerability

Distribution of marine megafauna

Dataset
Estimates of abundance and distribution of cetaceans, marine mega fauna and marine litter in the Mediterranean Sea from 2018-2019 surveys

Source
ACCOBAMS

Format
Shapefile

Resolution / Spatial unit
Point

Temporal coverage
2021

Spatial coverage
Med Sea

Link
Link

Data availability
Under request

Details
Maps showing predicted abundance of animals in the Mediterranean Sea per 100km^2 cells.

Gaps/Issues
Raw data based on observations, but predictions are modelled, so a certain degree of uncertainty is to be expected.

Collisions reports

Dataset
Fin whales ship strike events

Source
ISPRA

Format
Tabulate

Resolution / Spatial unit
Shipping route

Temporal coverage
2022

Spatial coverage
North Western Med PSSA

Link
–

Data availability
Under request

Details
List of collisions between fin whales and ships with record of date, location or approximate route where it occurred.

Gaps/Issues
Some collisions are recorded in ports since the specific route or location where the incident took place is unknown.

7.2. Indicator cards

Indicator cards template

Indicator name	
Driver	Type of driver that produces the pressure.
Description	Variable measured by the indicator.
Data source	The data to be used to measure the indicator.
Updating	Scientific or technical recommended time interval for the regular measurement of the indicator based on available data.
Valuation scale	Type of scale used to interpret the indicator's intensity values.
Calculation and interpretation	Methodological details on the calculation of the indicator and how the resulting data should be interpreted.
Explanatory notes	Additional, descriptive information on the indicator's terms or concepts for the precise replication of its measurement.
Trend	Details on how progress in the indicator should be measured.
Gaps and limitations	Description of limitations of the indicator due to lack of data coverage or data quality, or due to the methodology itself.

Number of bed-places in coastal areas (per NUTS2, NUTS3 and km²)	
Driver	Tourism offer
Description	The indicator measures the number of bed-places in NUTS2 regions or NUTS3 and km², indicating the local intensity of tourism capacity.
Data source	Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2023. Database on tourism offer and demand, UNWTO, 2023. Distribution of tourist attractions and accommodation sites available in OpenStreetMap (December 2023).
Updating	Yearly
Valuation scale	Data can be represented as categories or as continuous values. Five categories from very low to very high are suggested for NUTS2 regions: • Very Low: 0 – 50,000 • Low: 50,001 – 100,000 • Moderate: 100,001 – 250,000 • High: 250,001 – 500,000 • Very high: > 500,000 Another five categories from very low to very high are proposed for the indicator per NUTS3 and km²: • Very Low: < 10,000 • Low: 10,001 – 50,000 • Moderate: 50,001 – 100,000 • High: 100,001 – 250,000 • Very high: > 250,000
Calculation and interpretation	No calculation required for the indicator per NUTS2 (country level in the case of UNWTO data). Raw data is represented according to the suggested classes from low to high intensive tourism demand. Indicator per NUTS3 and km² is calculated through disaggregation of OpenStreetMap data on the location of accommodation places. These coordinates were aggregated and counted at 1 km² in order to calculate the percentage of sites with respect to the total of the corresponding NUTS3 region in each pixel. The percentage of sites per km was used to disaggregate NUTS2 (EUROSTAT) and country data (UNWTO) at 1 km², and then aggregated at NUTS3. The results of these estimates were divided by the total area (km²) of each region and represented with the proposed classes.
Explanatory notes	All available establishment types are included. Countries without data are estimated according to the number of accommodation sites available in OpenStreetMap and the average number of bed-places per establishment in the Mediterranean region.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	This indicator is based on the disaggregation of data at NUTS2 and country level with its corresponding uncertainty.

Number of tourism establishments in coastal areas (per NUTS2, NUTS3 and km²)	
Driver	Tourism offer
Description	The indicator measures the number of establishments in NUTS2 regions or NUTS3 and km², as an indicator of the local intensity of tourism capacity.
Data source	Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2023. Database on tourism offer and demand, UNWTO, 2023. Distribution of tourist attractions and accommodation sites available in OpenStreetMap (December 2023).
Updating	Yearly
Valuation scale	Data can be represented as categories or as continuous values. Five categories from very low to very high are suggested for NUTS2 regions: • *Very Low: 0 – 5,000* • *Low: 5,001 – 10,000* • *Moderate: 10,001 – 25,000* • *High: 25,001 – 50,000* • *Very high: > 50,000* Another five categories from very low to very high are proposed for the indicator per NUTS3 and km²: • Very Low: < 500 • Low: 501 – 1,500 • Moderate: 1,501 – 5,000 • High: 5,001 – 10,000 • Very high: > 10,000
Calculation and interpretation	No calculation required for the indicator per NUTS2 (country level in the case of UNWTO data). Raw data is represented according to the suggested classes from low to high intensive tourism demand. Indicator per NUTS3 and km² is calculated through disaggregation of OpenStreetMap data on the location of accommodation places. These coordinates were aggregated and counted at 1 km² in order to calculate the percentage of sites with respect to the total of the corresponding NUTS3 region in each pixel. The percentage of sites per km was used to disaggregate NUTS2 (EUROSTAT) and country data (UNWTO) at 1 km², and then aggregated at NUTS3. The results of these estimates were divided by the total area (km²) of each region and represented with the proposed classes.
Explanatory notes	All available establishment types are included. Countries without data are estimated according to the number of accommodation sites available in OpenStreetMap.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	This indicator is based on the disaggregation of data at NUTS2 and country level with its corresponding uncertainty.

Number of nights spent at tourist accommodation establishments in coastal areas (per NUTS2, NUTS3 and km²)	
Driver	Tourism demand
Description	The indicator measures the nights spent at tourist accommodation establishments in NUTS2 regions or NUTS3 and km², as an indicator of the local intensity of tourism demand.
Data source	Nights spent at tourist accommodation establishments by NUTS 2 regions (tour_occ_nin2c), EUROSTAT, 2023. Distribution of tourist attractions and accommodation sites available in OpenStreetMap (December 2023).
Updating	Yearly
Valuation scale	Data can be represented as categories or as continuous values in thousand nights. Five categories from very low to very high are suggested for NUTS2 regions: • Very Low: 0 – 5,000 • Low: 5,001 – 10,000 • Moderate: 10,001 – 25,000 • High: 25,001 – 50,000 • Very high: > 50,000 Another five categories from very low to very high are proposed for the indicator per NUTS3 and km²: • Very Low: < 2,500 • Low: 2,501 – 5,000 • Moderate: 5,001 – 15,000 • High: 15,001 – 50,000 • Very high: > 50,000
Calculation and interpretation	No calculation required for the indicator per NUTS2 (country level in the case of UNWTO data). Raw data is represented according to the suggested classes from low to high intensive tourism demand. Indicator per NUTS3 and km² is calculated through disaggregation of OpenStreetMap data on the location of accommodation places. These coordinates were aggregated and counted at 1 km² in order to calculate the percentage of sites with respect to the total of the corresponding NUTS3 region in each pixel. The percentage of sites per km was used to disaggregate NUTS2 data at 1 km², and then aggregated at NUTS3. The results of these estimates were divided by the total area (km²) of each region and represented with the proposed classes.
Explanatory notes	All available establishment types are included.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	This indicator is based on the disaggregation of data at NUTS2 with its corresponding uncertainty.

Number of cruise passengers per port	
Driver	Tourism demand
Description	The indicator measures the number of cruise passengers in Mediterranean ports, as an indicator of the local intensity of tourism demand.
Data source	Passengers embarked and disembarked in all ports by direction - annual data (mar_pa_aa), EUROSTAT, 2023. MedCruise Statistics 2022, MedCruise 2023.
Updating	Yearly
Valuation scale	Data are represented as thousand passengers. Five categories from very low to very high are suggested: • Very Low: 1 – 50 • Low: 51 – 250 • Moderate: 251 – 500 • High: 501 – 1,000 • Very high: > 1,000
Calculation and interpretation	No calculation required. Raw data is represented by port. Results are showing low to high intensive tourism demand and pressure in port surrounding areas.
Explanatory notes	Indicator includes both those who start/end a cruise and those who are on excursion.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	This indicator is based on port location data. The pressure of tourism can occur in areas far from the disembarkation area of the cruise passengers. It does not into account the type of cruise ships or the management and maintenance tasks carried out in the ports, which can be a source of environmental pressure.

Number of arrivals (per NUTS2, NUTS3 and km²)	
Driver	Tourism demand
Description	The indicator measures the number of tourists arriving in NUTS2 regions or NUTS3 and km², indicating the demand of regional tourism infrastructure.
Data source	Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arn2), EUROSTAT, 2023. Database on tourism offer and demand, UNWTO, 2023. Distribution of tourist attractions and accommodation sites available in OpenStreetMap (December 2023).
Updating	Yearly
Valuation scale	Data are represented as thousand arrivals. Five categories from very low to very high are suggested for NUTS2 regions: • Very Low: < 1,000 • Low: 1,001 – 2,500 • Moderate: 2,501 – 5,000 • High: 5,001 – 10,000 • Very high: > 10,000 Another five categories from very low to very high are proposed for the indicator per NUTS3 and km²: • Very Low: < 50 • Low: 51 – 250 • Moderate: 251 – 500 • High: 501 – 1,000 • Very high: > 1,000
Calculation and interpretation	No calculation required for the indicator per NUTS2 (country level in the case of UNWTO data). Raw data is represented according to the suggested classes from low to high intensive tourism demand. Indicator per NUTS3 and km² is calculated through disaggregation of OpenStreetMap data on the location of accommodation places. These coordinates were aggregated and counted at 1 km² in order to calculate the percentage of sites with respect to the total of the corresponding NUTS3 region in each pixel. The percentage of sites per km was used to disaggregate NUTS2 (EUROSTAT) and country data (UNWTO) at 1 km², and then aggregated at NUTS3. The results of these estimates were divided by the total area (km²) of each region and represented with the proposed classes.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	This indicator is based on the disaggregation of data at NUTS2 and country level with its corresponding uncertainty.

Marina port capacity (per NUTS3 and km of coast)	
Driver	Tourism activities
Description	The indicator measures the number of moorings in marina ports per kilometre of coastline for each NUTS3 region.
Data source	Portbooker.com, 2022; Plan Bleu, 2014; Spanish Yachting Port Federation, 2014; EEA, 2014.
Updating	Yearly
Valuation scale	Mooring per km of coastline is represented as five categories from very low to very high: • Very Low: 1 – 10 • Low: 11 – 25 • Moderate: 26 – 50 • High: 51 – 100 • Very high: > 100
Calculation and interpretation	Number of moorings in marina ports are added per each NUTS3 region and divided by the total km of coast. The indicator is an estimate of the potential pressure of this activity on the coastal strip.
Explanatory notes	The location of marina ports is included as ancillary data.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	Data used are not actual pollution data but an estimate of the potential pressure based on the number of moorings. The demand is not assessed. The indicator sources present gaps for ports in the Balkans, North Africa and Middle East due to lack of data.

Density of sailing vessels and pleasure craft (per 1km pixel)	
Driver	Tourism activities
Description	The indicator measures the intensity of pleasure craft traffic in the study area.
Data source	EMODnet Human Activities, Vessel Density Map, 2023.
Updating	Yearly
Valuation scale	Data are represented as continuous values from 0 to the maximum value. Units are hours/year per km^2.
Calculation and interpretation	Not required. Indicator is a representation of raw data. Indicator represents the degree of pressure based on the intensity of sailing vessels and pleasure craft traffic. Data AIS data aggregated at 1 km^2 and expressed as total time with presence of vessels in each cell throughout the year. The indicator provides an estimate of the amount of pollution vessels produce (via fuel leaks, oil discharge, waste disposal, etc.), under the assumption that traveling ships primarily affect their immediate waters.
Explanatory notes	Traffic data only include vessels with AIS. Rest of maritime traffic is not considered.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	Data used are not actual pollution data but an estimate of the potential pressure based on the traffic intensity.

Density of passengers' vessels (per 1 km pixel)	
Driver	Tourism activities
Description	The indicator measures the intensity of passengers traffic in the study area.
Data source	EMODnet Human Activities, Vessel Density Map, 2023.
Updating	Yearly
Valuation scale	Data are represented as continuous values from 0 to the maximum value. Units are hours/year per km^2.
Calculation and interpretation	Not required. Indicator is a representation of raw data. Indicator represents the degree of pressure based on the intensity of passengers traffic. Data AIS data aggregated at $1km^2$ and expressed as total time with presence of vessels in each cell throughout the year. The indicator provides an estimate of the amount of pollution vessels produce (via fuel leaks, oil discharge, waste disposal, etc.), under the assumption that traveling ships primarily affect their immediate waters.
Explanatory notes	Traffic data only include vessels with AIS. Rest of maritime traffic is not considered.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	Data used are not actual pollution data but an estimate of the potential pressure based on the traffic intensity.
Density of golf courses (per NUTS3)	
Driver	Tourism activities.
Description	The indicator measures the density of golf courses expressed as the surface percentage of the region occupied by golf courses.
Data source	Distribution of golf courses available in OpenStreetMap (December 2023). GISCO statistical unit dataset containing NUTS regions and territorial land boundaries. GADM, the Database of Global Administrative Areas, providing spatial data for non-EU countries administrative subdivisions.
Updating	Yearly.
Valuation scale	Data are represented as five categories from very low to very high: • Very Low: 0% • Low: 0.01 – 0.05% • Moderate: 0.06 – 0.10% • High: 0.11 – 0.5% • Very high: > 0.51%
Calculation and interpretation	Total extent per region was calculated using OpenStreetMap data including the location and delimitation of golf courses. This spatial information was overlaid with the administrative regions to assign the corresponding NUTS3 code to golf areas. The indicator is then calculated by summing the coverage dedicated to golf within each region and dividing it by the total area, thus obtaining the percentage of golf courses in each NUTS3 or equivalent region.
Trend	Progress in the indicator's values (x). It is considered positive if x is smaller than in the previous evaluation, stable if x is similar to the previous evaluation, and negative if x is greater than in the previous evaluation.
Data gaps and limitations	Data used are not actual data on pollution or water footprint but an estimate of the potential environmental pressure based on the extent of golf courses.

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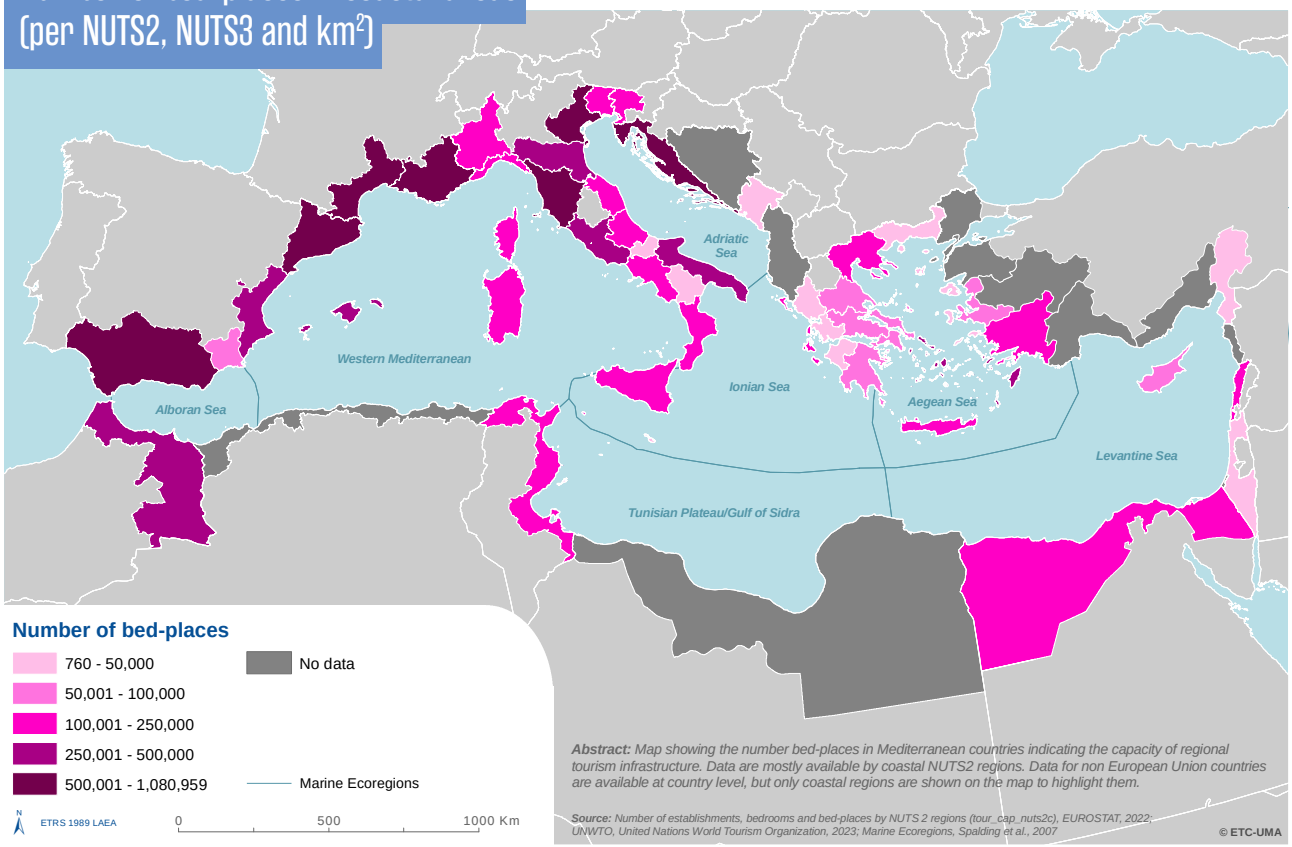
7.3. Large driver and pressure maps

Number of bed-places in coastal areas (per NUTS2, NUTS3 and km²)

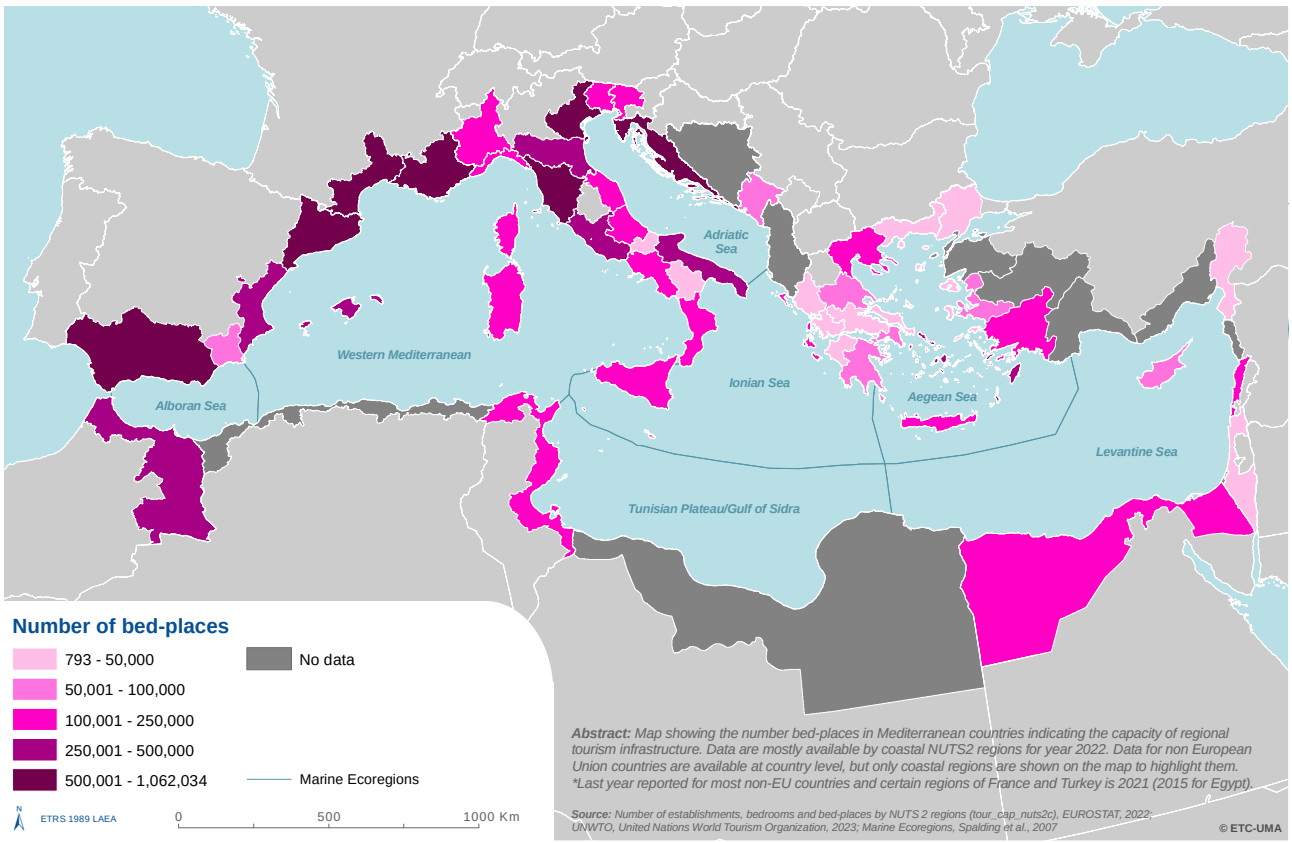
Number of bed-places in 2019*



Abstract: *Map showing the number bed-places in Mediterranean countries indicating the capacity of regional tourism infrastructure. Data are mostly available by coastal NUTS2 regions. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them.*

Source: *Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007*

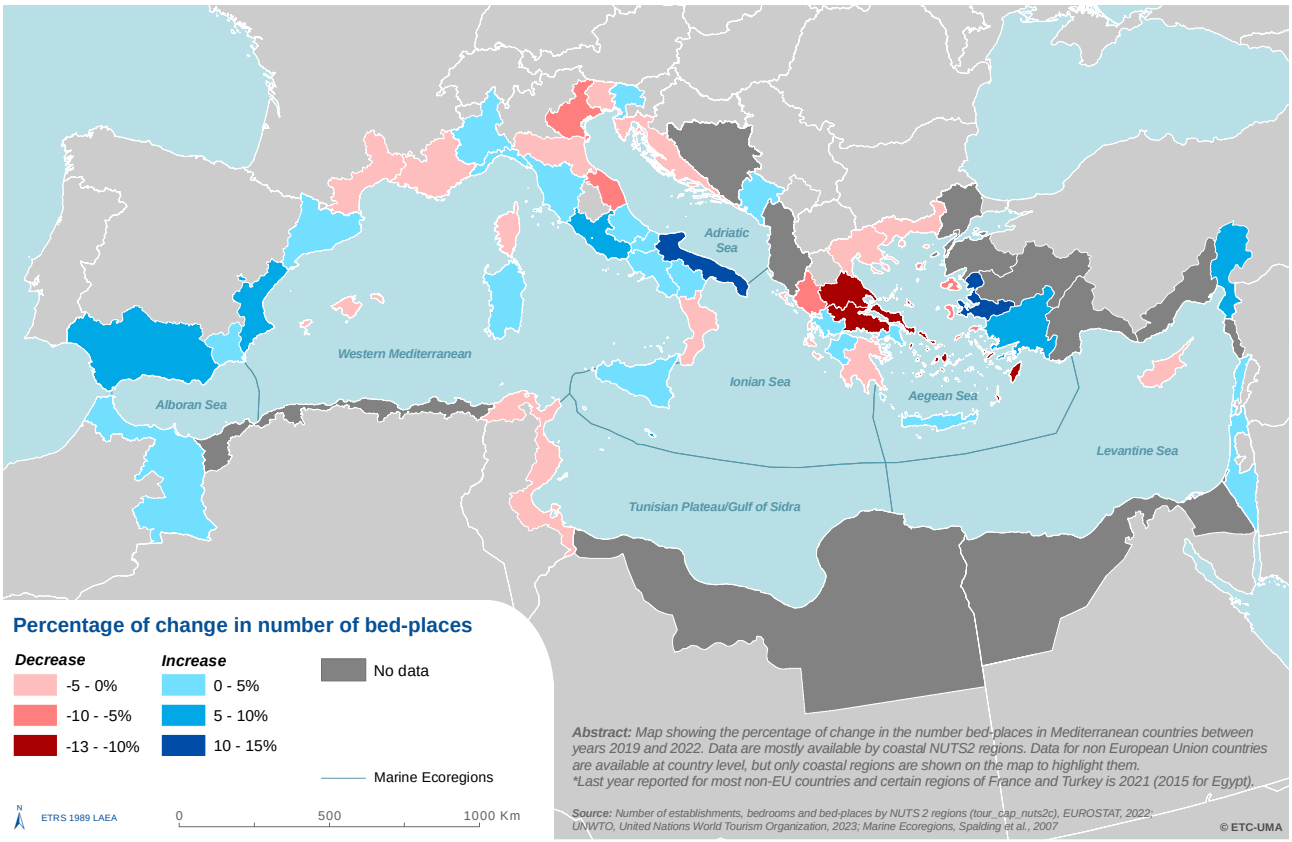
Number of bed-places in 2022 (or last year reported)*



Abstract: *Map showing the number bed-places in Mediterranean countries indicating the capacity of regional tourism infrastructure. Data are mostly available by coastal NUTS2 regions for year 2022. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them. *Last year reported for most non-EU countries and certain regions of France and Turkey is 2021 (2015 for Egypt).*

Source: *Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007*

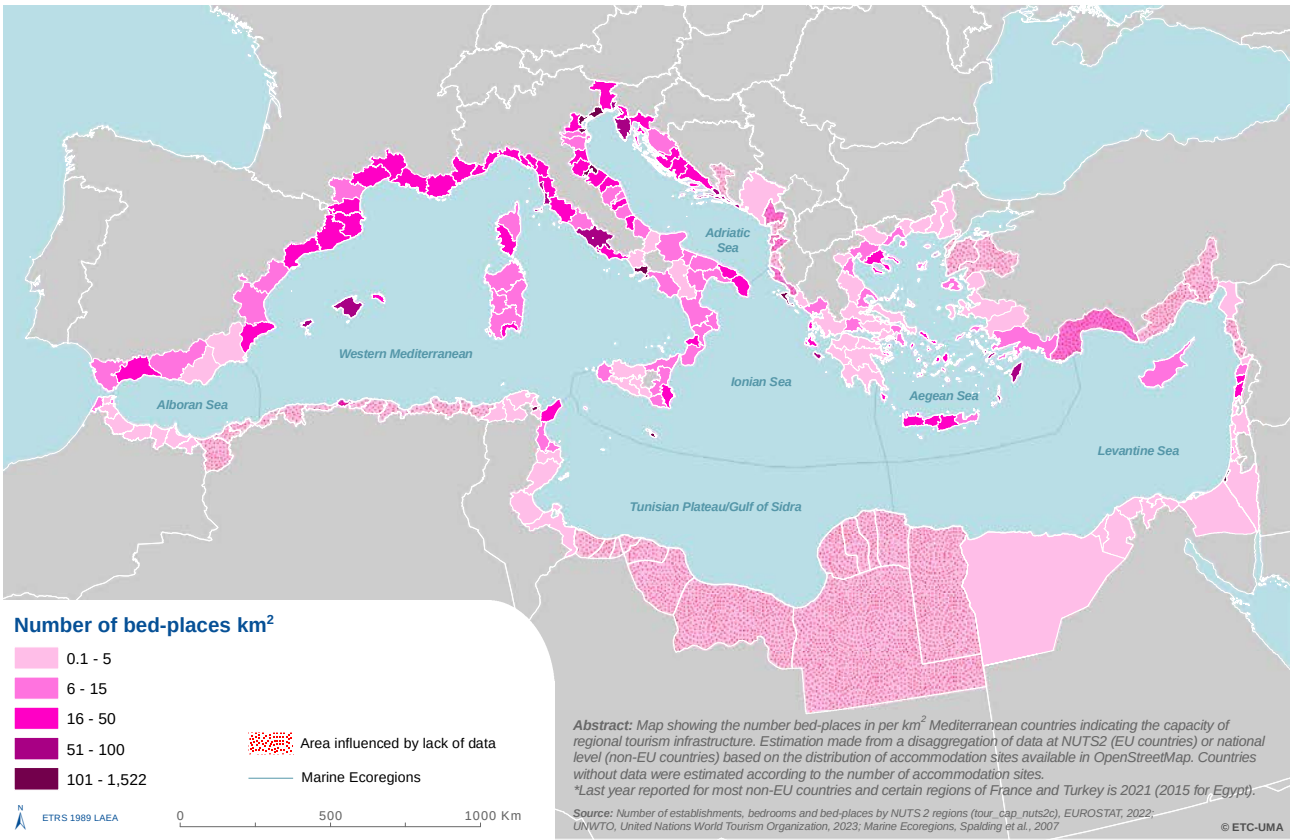
Change in the number of bed-places between 2019 and 2022 (or last reported year)*



Abstract: *Map showing the percentage of change in the number bed-places in Mediterranean countries between years 2019 and 2022. Data are mostly available by coastal NUTS2 regions. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them.*
**Last year reported for most non-EU countries and certain regions of France and Turkey is 2021 (2015 for Egypt).*

Source: Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007

Estimated number of bed-places per km^2 by NUTS3 or equivalent region in 2022*

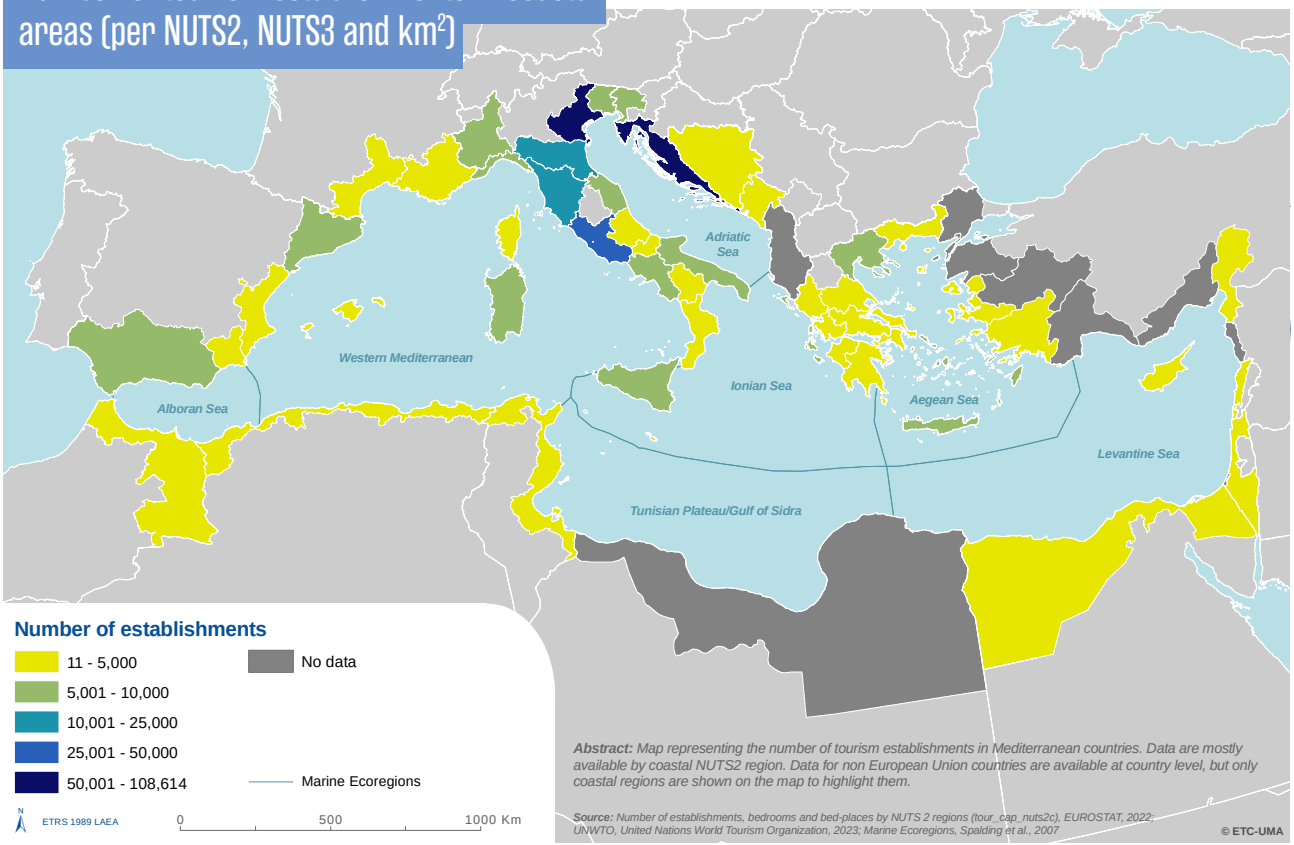


Abstract: *Map showing the number bed-places in per km^2 Mediterranean countries indicating the capacity of regional tourism infrastructure. Estimation made from a disaggregation of data at NUTS2 (EU countries) or national level (non-EU countries) based on the distribution of accommodation sites available in OpenStreetMap. Countries without data were estimated according to the number of accommodation sites.*
**Last year reported for most non-EU countries and certain regions of France and Turkey is 2021 (2015 for Egypt).*

Source: Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007

Number of tourism establishments in coastal areas (per NUTS2, NUTS3 and km²)

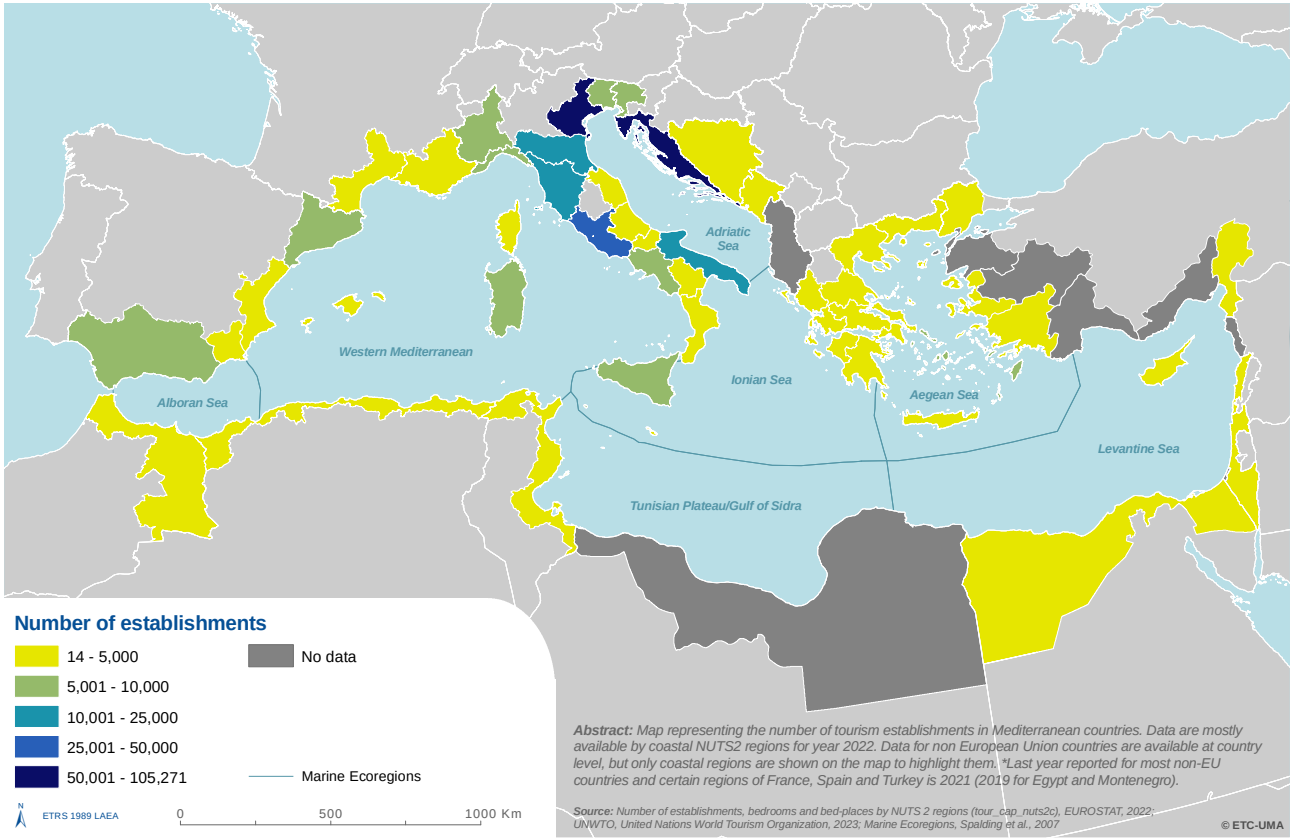
Number of tourism establishments in 2019



Abstract: *Map representing the number of tourism establishments in Mediterranean countries. Data are mostly available by coastal NUTS2 region. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them.*

Source: *Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007*

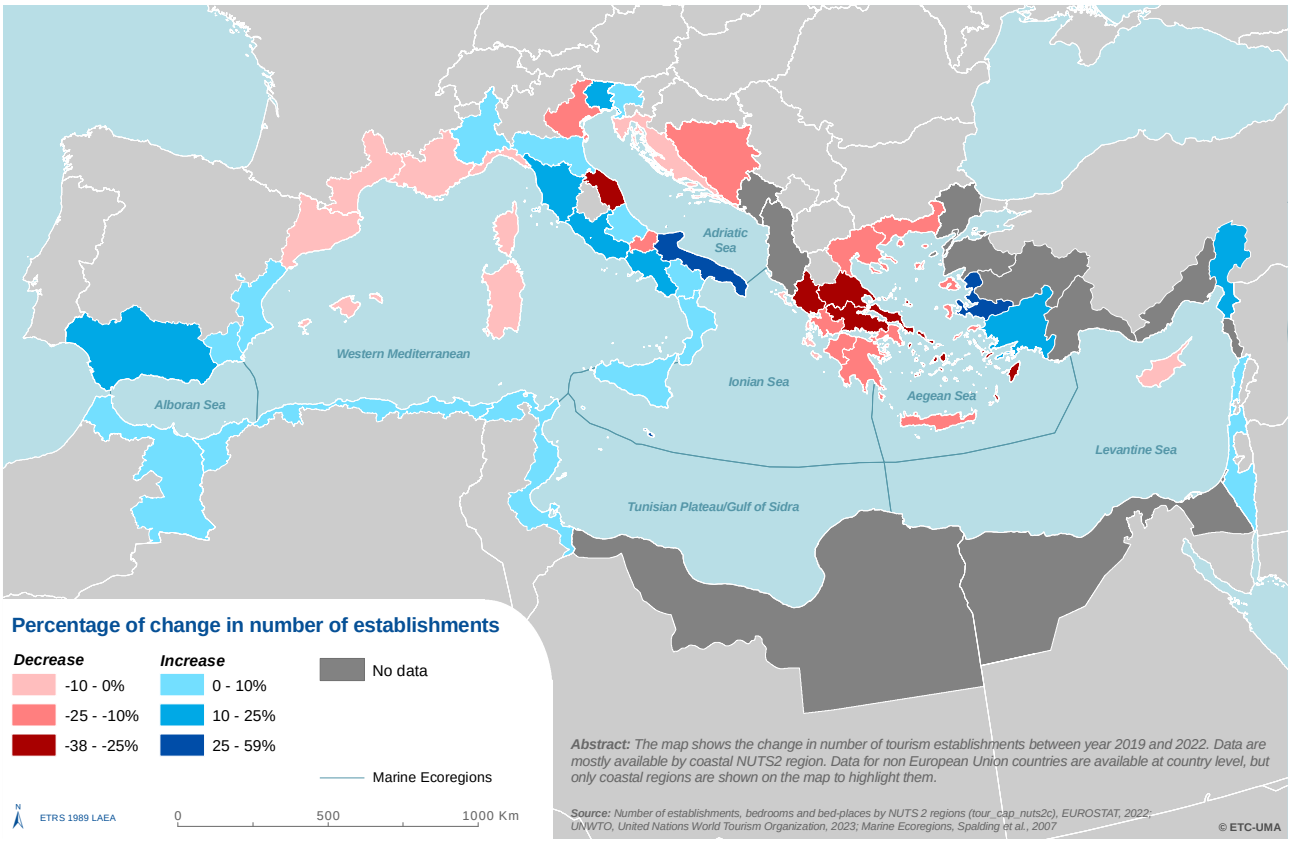
Number of tourism establishments in 2022 (or last year reported)*



Abstract: *Map representing the number of tourism establishments in Mediterranean countries. Data are mostly available by coastal NUTS2 regions for year 2022. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them. *Last year reported for most non-EU countries and certain regions of France, Spain and Turkey is 2021 (2019 for Egypt and Montenegro).*

Source: *Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007*

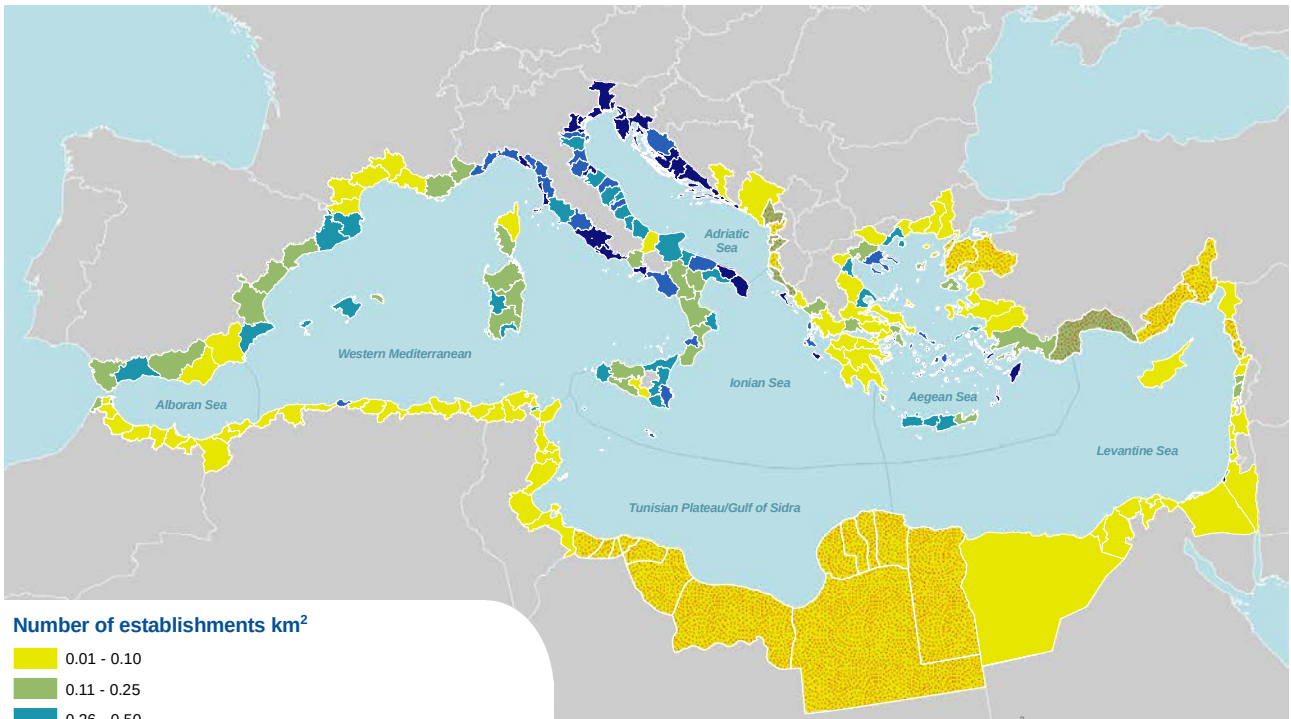
Change in number of tourism establishments between 2019 and 2022



Abstract: *The map shows the change in number of tourism establishments between year 2019 and 2022. Data are mostly available by coastal NUTS2 region. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them.*

Source: Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007

Estimated number of tourism establishments per km^2 by NUTS3 or equivalent region in 2022*

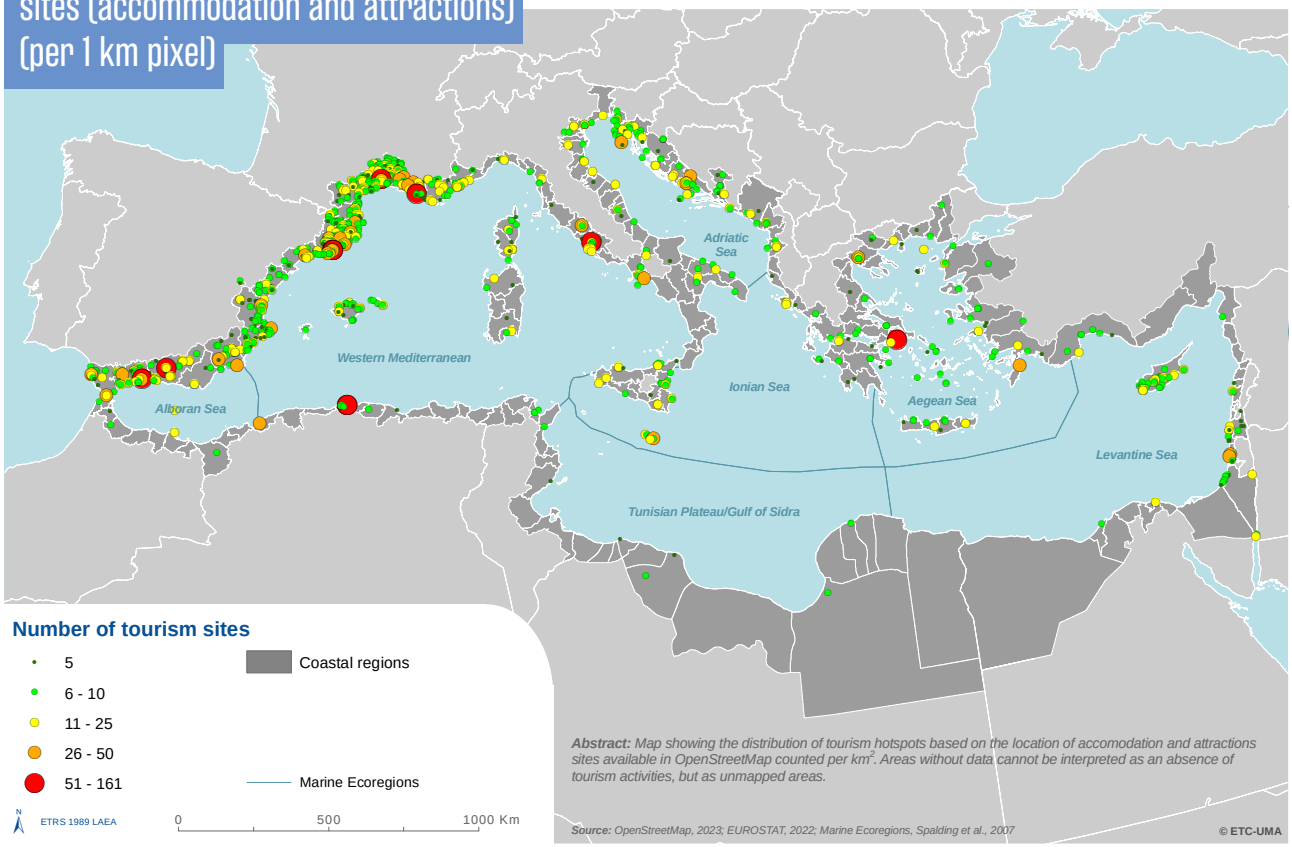


Abstract: *Map representing the number of tourism establishments per km^2 in Mediterranean countries indicating the capacity of regional tourism infrastructure. Estimation made from a disaggregation of data at NUTS2 (EU countries) or national level (non-EU countries) based on the distribution of accommodation sites available in OpenStreetMap. Countries without data were estimated according to the number of accommodation sites. *Last year reported for most non-EU countries and certain regions of France, Spain and Turkey is 2021 (2019 for Egypt and Montenegro).*

Source: Number of establishments, bedrooms and bed-places by NUTS 2 regions (tour_cap_nuts2c), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007

Number of tourism interest sites (accommodation and attractions) (per 1 km pixel)

Distribution of coastal tourism activity hotspots, based on number of tourism sites (accommodations and attractions) in areas of 1 km^2

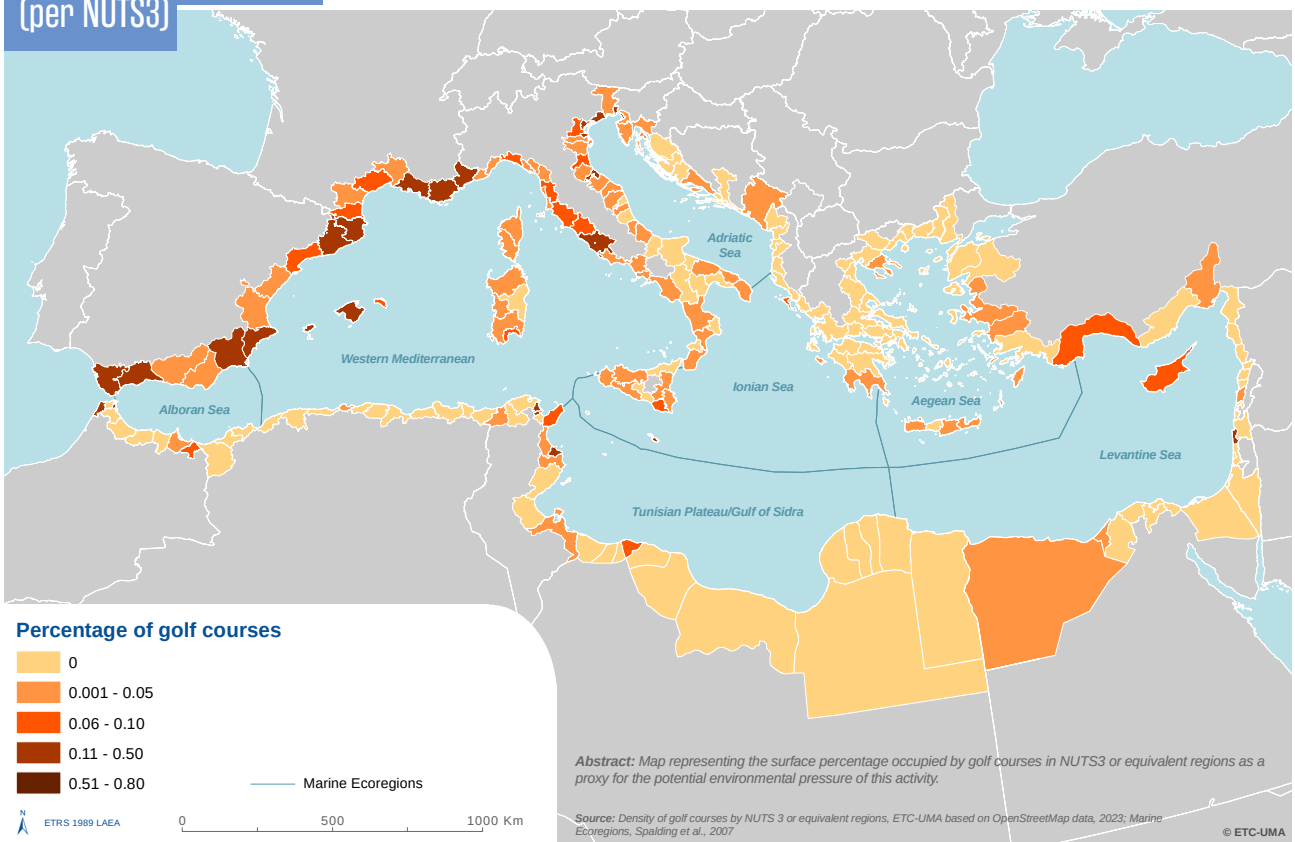


Abstract: *Map showing the distribution of tourism hotspots based on the location of accomodation and attractions sites available in OpenStreetMap counted per km^2. Areas without data cannot be interpreted as an absence of tourism activities, but as unmapped areas.*

Source: *OpenStreetMap, 2023; EUROSTAT, 2022; Marine Ecoregions, Spalding et al., 2007*

Density of golf courses (per NUTS3)

Density of golf courses by NUTS 3 or equivalent regions in 2023, expressed as surface percentage of the region occupied by golf courses

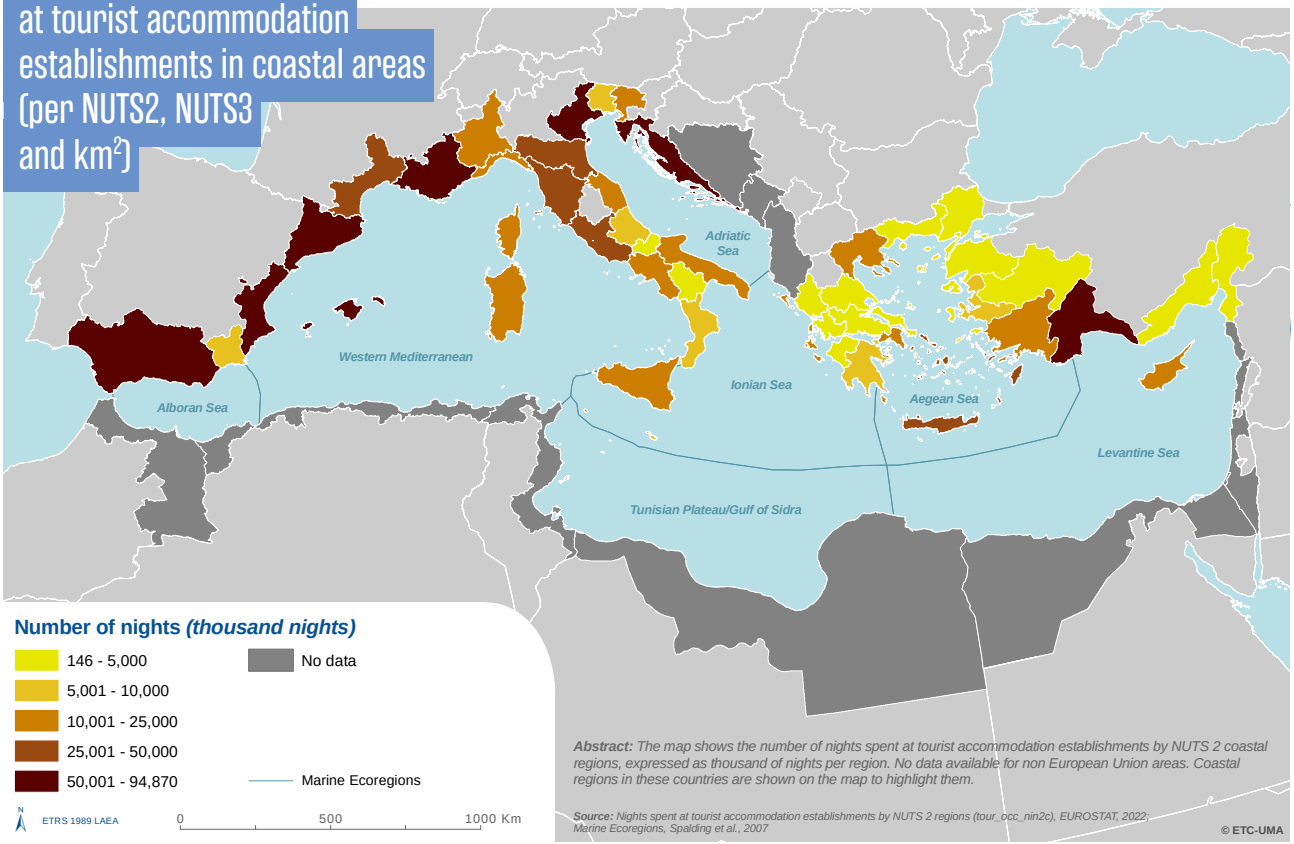


Abstract: *Map representing the surface percentage occupied by golf courses in NUTS3 or equivalent regions as a proxy for the potential environmental pressure of this activity.*

Source: *Density of golf courses by NUTS 3 or equivalent regions, ETC-UMA based on OpenStreetMap data, 2023; Marine Ecoregions, Spalding et al., 2007*

Number of nights spent at tourist accommodation establishments in coastal areas (per NUTS2, NUTS3 and km²)

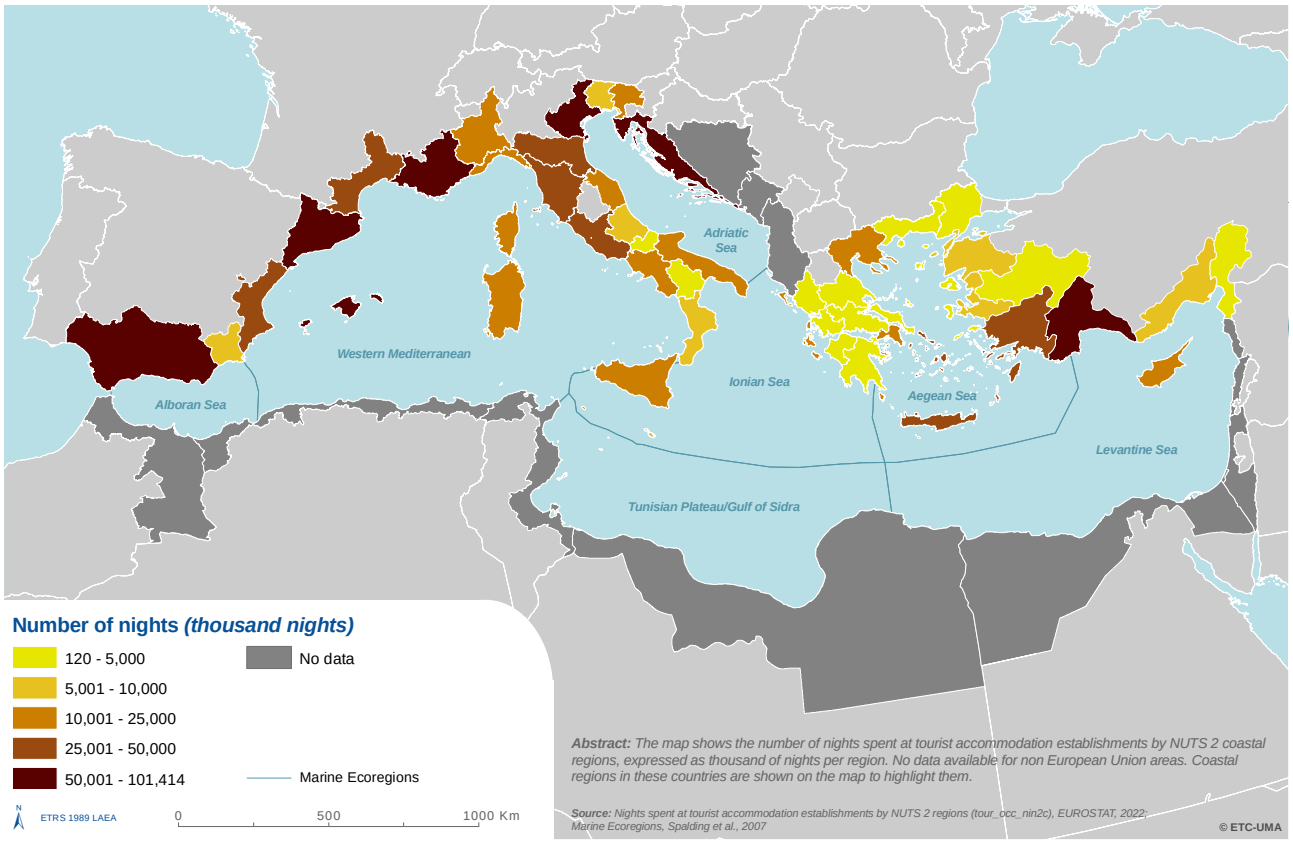
Number of nights spent at tourist accommodation establishments in 2019



Abstract: *The map shows the number of nights spent at tourist accommodation establishments by NUTS 2 coastal regions, expressed as thousand of nights per region. No data available for non European Union areas. Coastal regions in these countries are shown on the map to highlight them.*

Source: Nights spent at tourist accommodation establishments by NUTS 2 regions (tour_occ_nin2c), EUROSTAT, 2022; Marine Ecoregions, Spalding et al., 2007

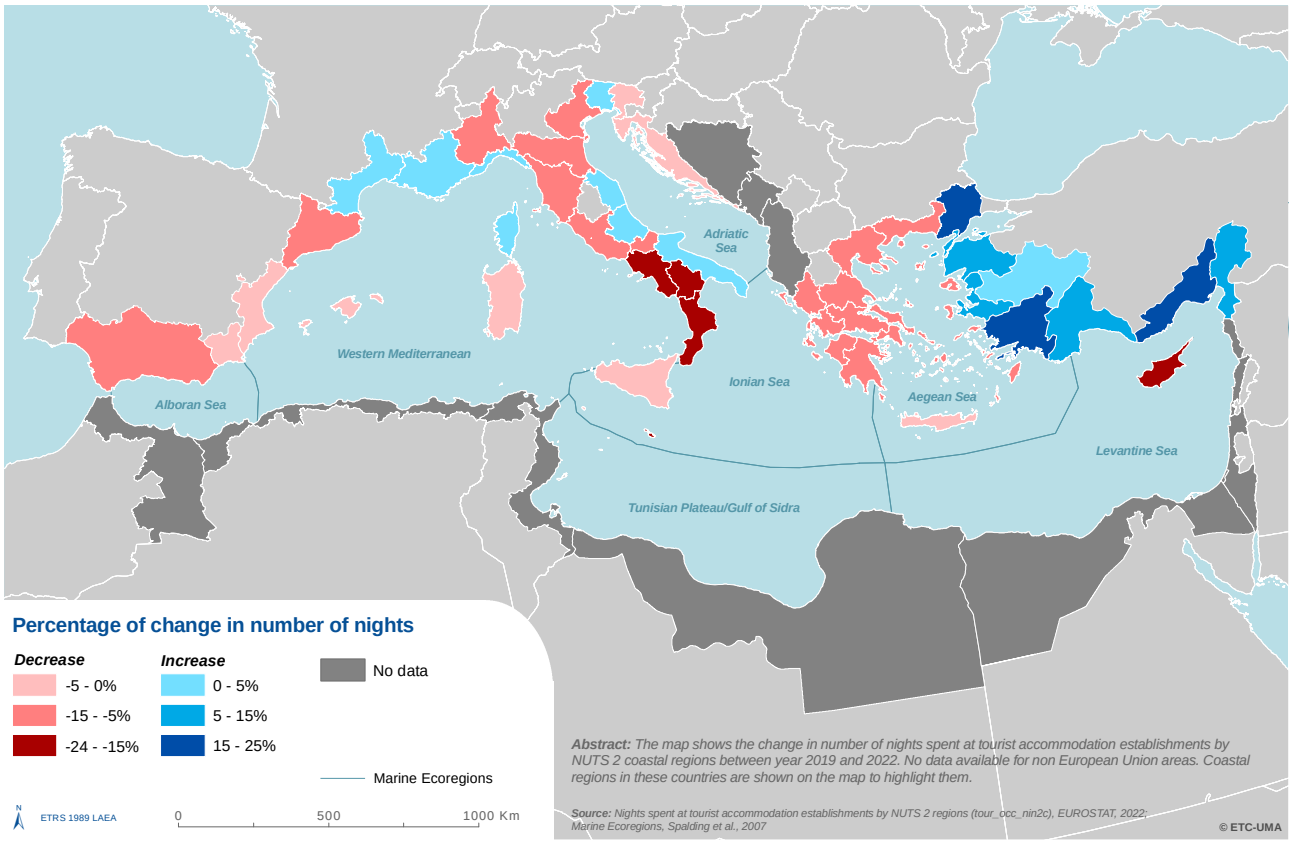
Number of nights spent at tourist accommodation establishments in 2022



Abstract: *The map shows the number of nights spent at tourist accommodation establishments by NUTS 2 coastal regions, expressed as thousand of nights per region. No data available for non European Union areas. Coastal regions in these countries are shown on the map to highlight them.*

Source: Nights spent at tourist accommodation establishments by NUTS 2 regions (tour_occ_nin2c), EUROSTAT, 2022; Marine Ecoregions, Spalding et al., 2007

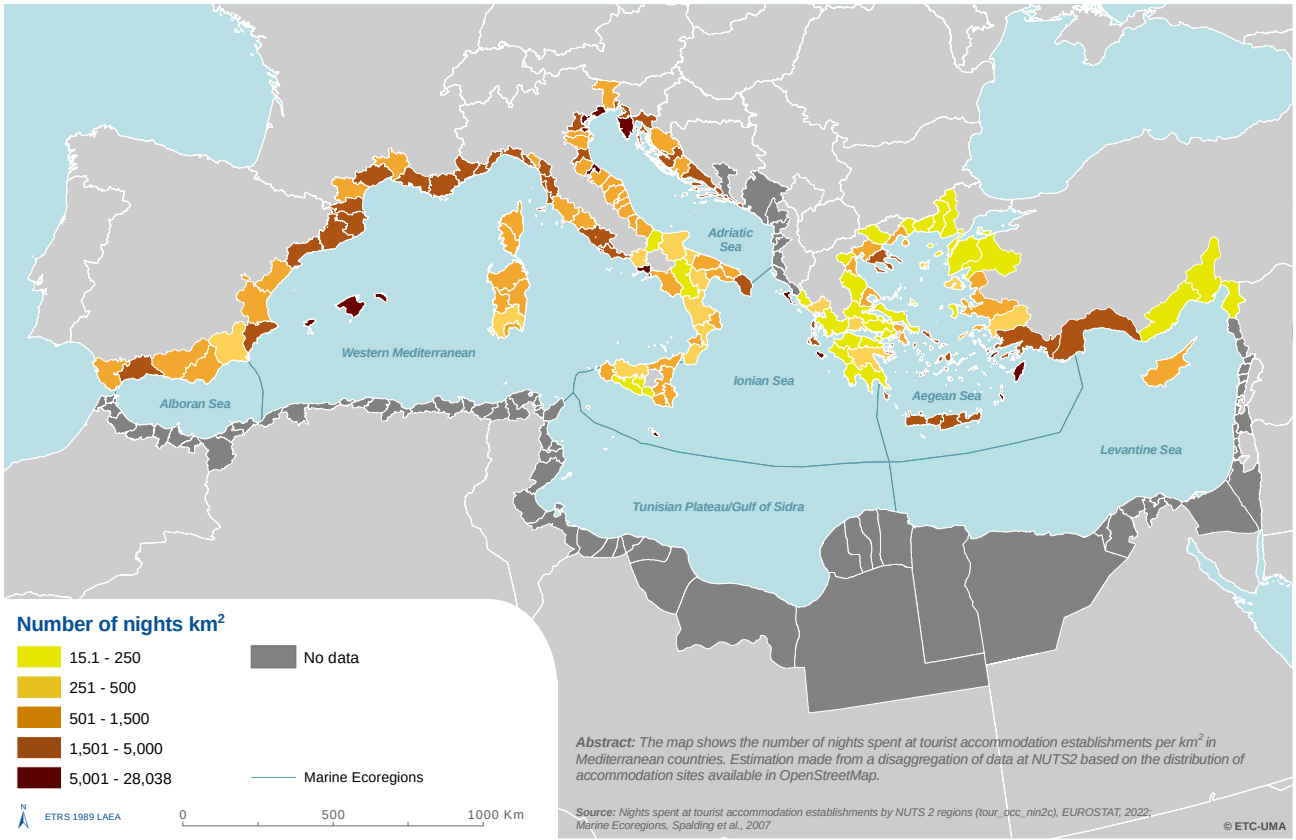
Change in number of nights spent at tourist accommodation establishments between 2019 and 2022



Abstract: *The map shows the change in number of nights spent at tourist accommodation establishments by NUTS 2 coastal regions between year 2019 and 2022. No data available for non European Union areas. Coastal regions in these countries are shown on the map to highlight them.*

Source: Nights spent at tourist accommodation establishments by NUTS 2 regions (tour_occ_nin2c), EUROSTAT, 2022; Marine Ecoregions, Spalding et al., 2007

Estimated nights spent at tourist accommodation establishments per km^2 by NUTS3 or equivalent region in 2022



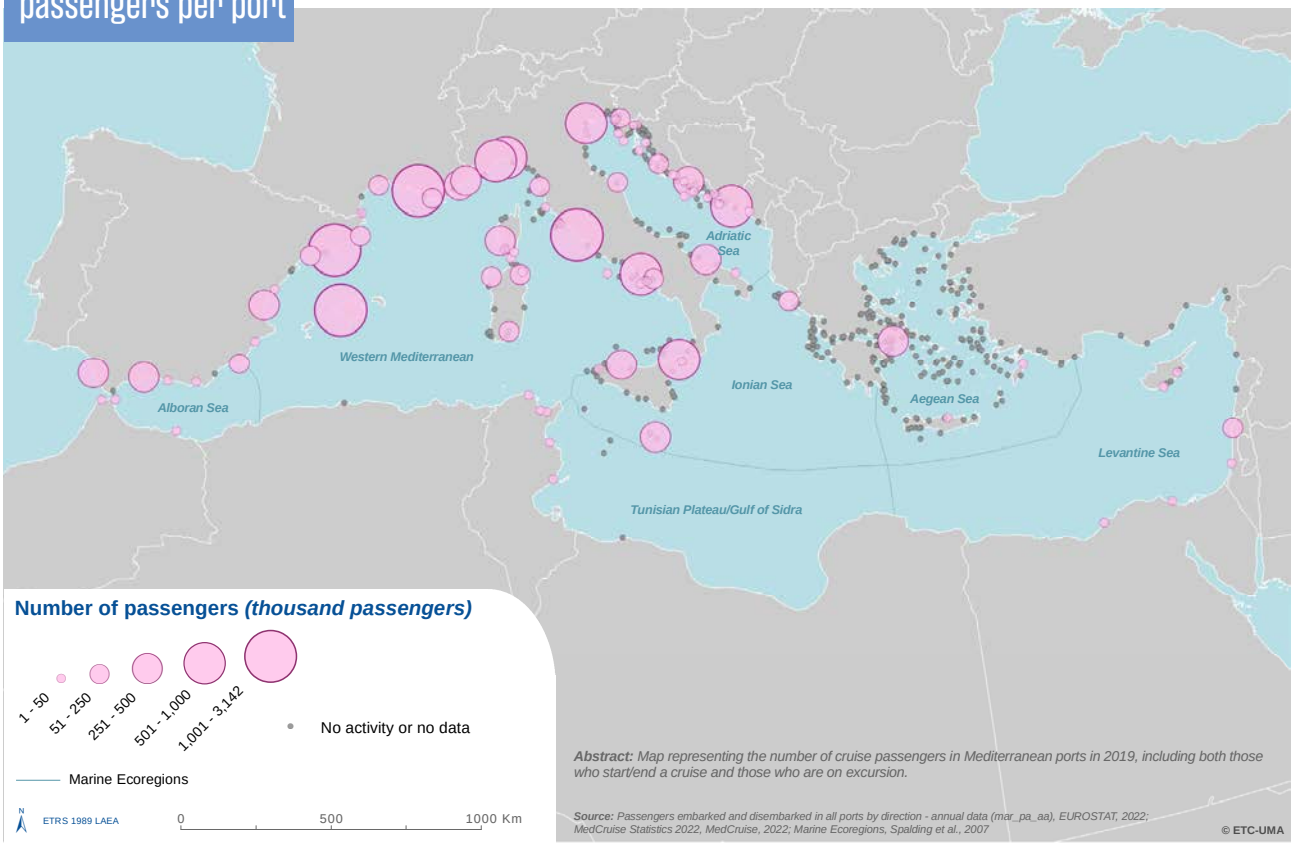
Abstract: *The map shows the number of nights spent at tourist accommodation establishments per km^2 in Mediterranean countries. Estimation made from a disaggregation of data at NUTS2 based on the distribution of accommodation sites available in OpenStreetMap.*

Source: Nights spent at tourist accommodation establishments by NUTS 2 regions (tour_occ_nin2c), EUROSTAT, 2022; Marine Ecoregions, Spalding et al., 2007

Number of cruise passengers per port

Number of cruise passengers* per port in 2019

**Including both those who start/end a cruise and those who are on excursion*

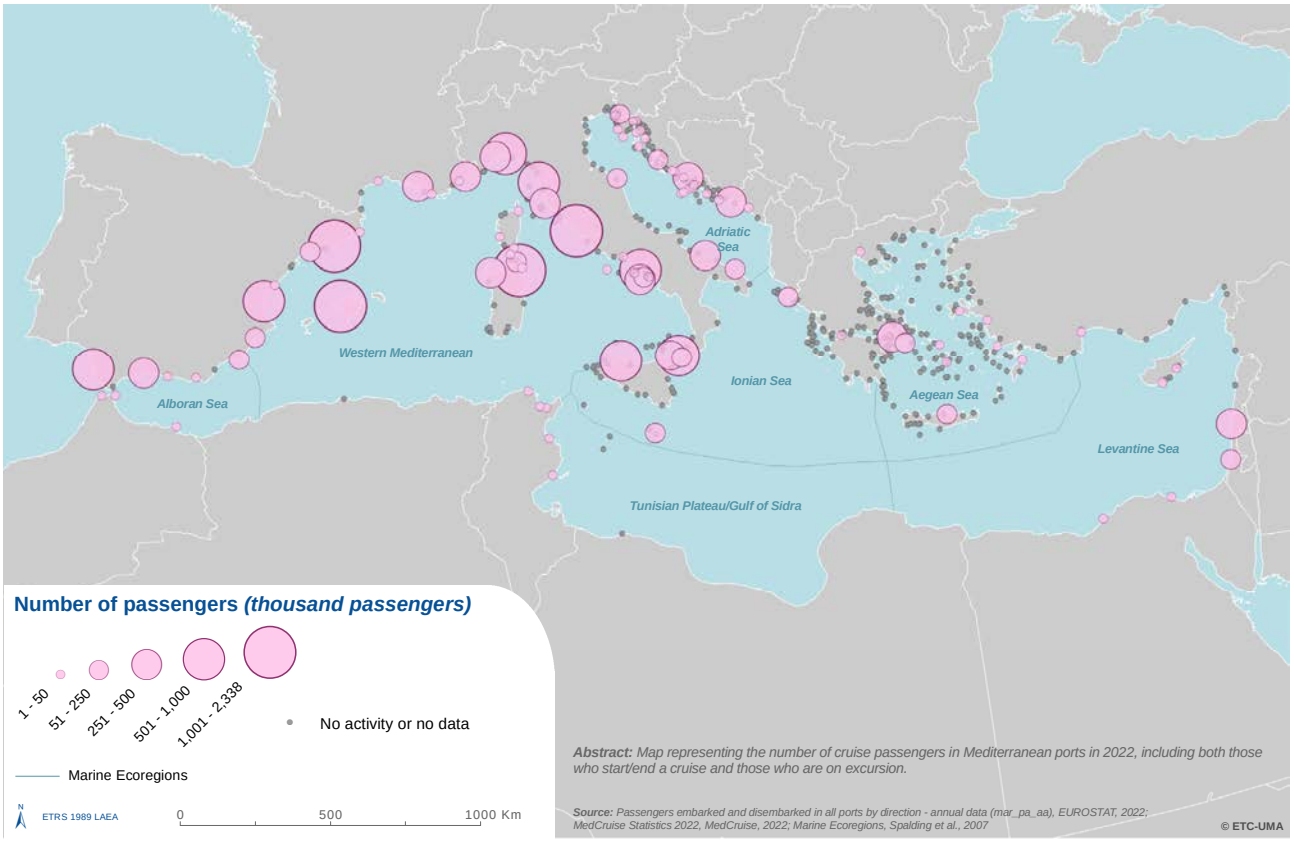


Abstract: *Map representing the number of cruise passengers in Mediterranean ports in 2019, including both those who start/end a cruise and those who are on excursion.*

Source: Passengers embarked and disembarked in all ports by direction - annual data (mar_pa_aa), EUROSTAT, 2022; MedCruise Statistics 2022, MedCruise, 2022; Marine Ecoregions, Spalding et al., 2007

Number of cruise passengers* per port in 2022

**Including both those who start/end a cruise and those who are on excursion*

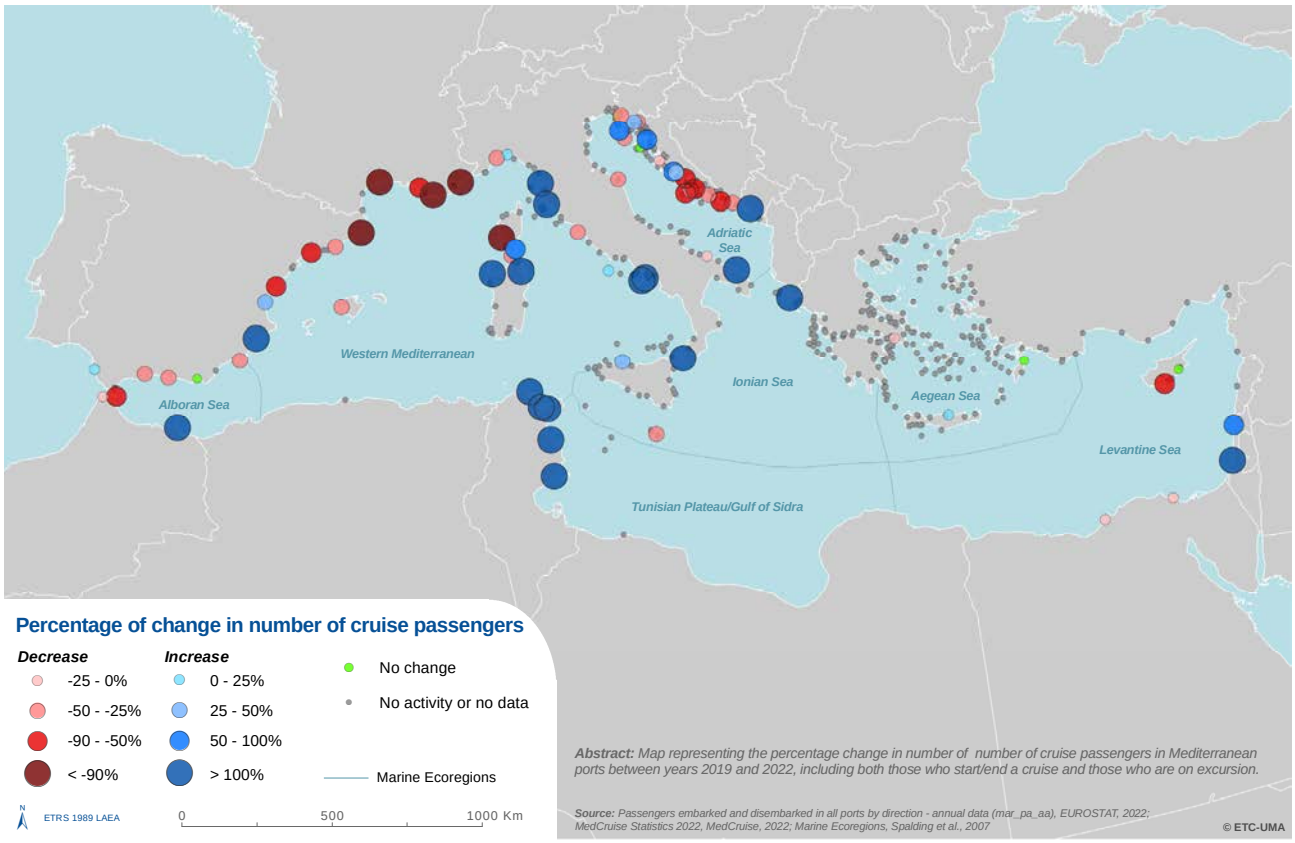


Abstract: *Map representing the number of cruise passengers in Mediterranean ports in 2022, including both those who start/end a cruise and those who are on excursion.*

Source: Passengers embarked and disembarked in all ports by direction - annual data (mar_pa_aa), EUROSTAT, 2022; MedCruise Statistics 2022, MedCruise, 2022; Marine Ecoregions, Spalding et al., 2007

Change in number of cruise passengers* per port between 2019 and 2022

**Including both those who start/end a cruise and those who are on excursion*

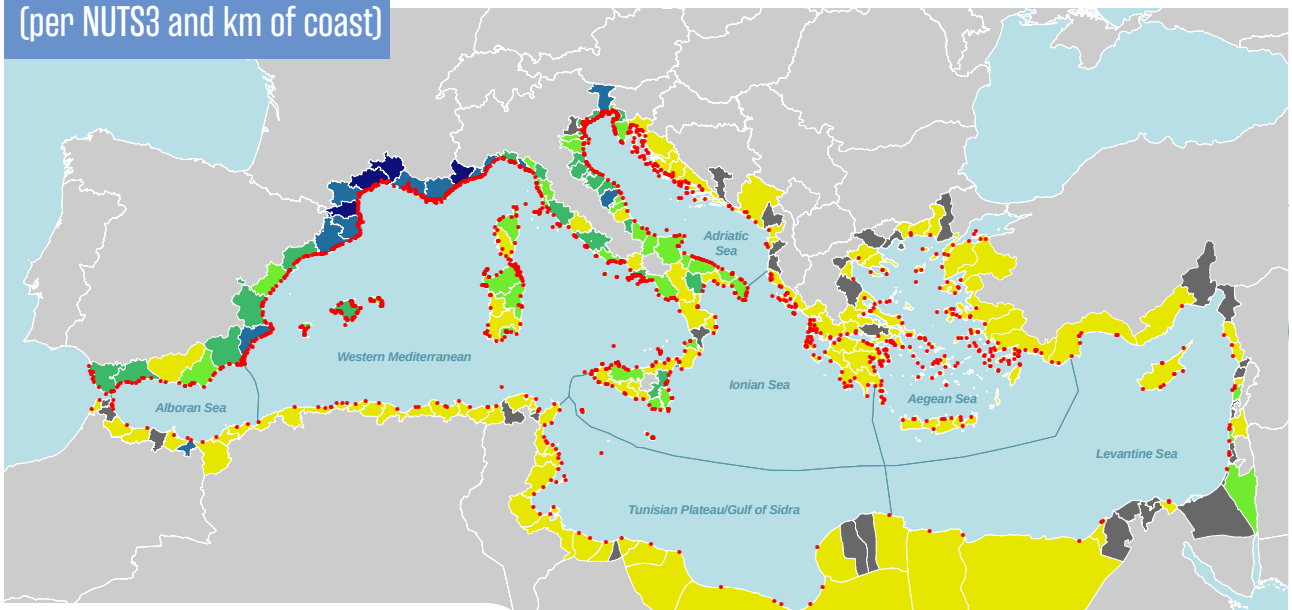


Abstract: *Map representing the percentage change in number of number of cruise passengers in Mediterranean ports between years 2019 and 2022, including both those who start/end a cruise and those who are on excursion.*

Source: *Passengers embarked and disembarked in all ports by direction - annual data (mar_pa_aa), EUROSTAT, 2022; MedCruise Statistics 2022, MedCruise, 2022; Marine Ecoregions, Spalding et al., 2007*

Marina port capacity (per NUTS3 and km of coast)

Marina port capacity by NUTS 3 or equivalent regions in 2023

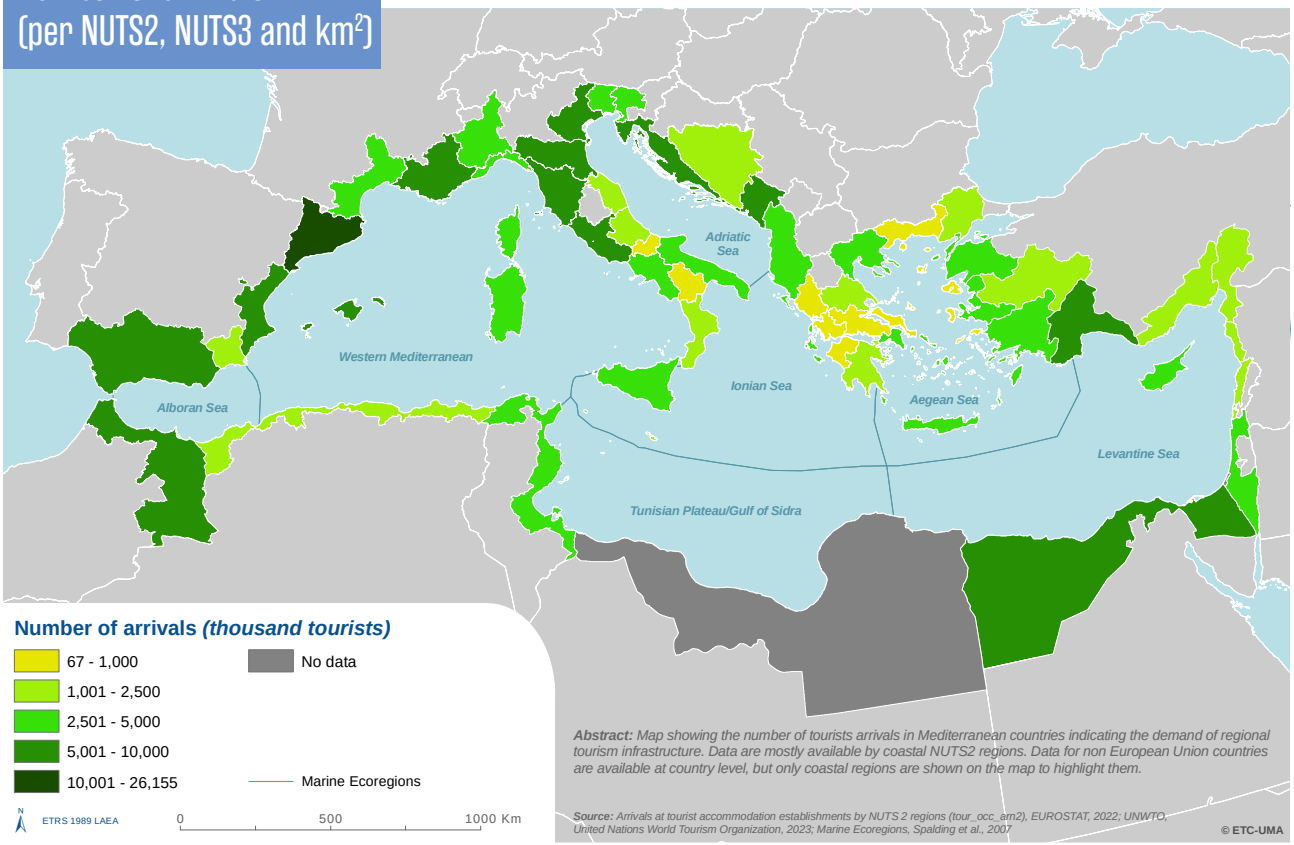


Abstract: *The map shows the number of moorings in marina ports per kilometre of coastline for each NUTS3 or equivalent region. Marina port locations are displayed as red dots.*

Source: *Portbooker.com, 2022; Plan Bleu,2014; Spanish Yachting Port Federation, 2014; EEA, 2014; Marine Ecoregions, Spalding et al., 2007*

Number of arrivals (per NUTS2, NUTS3 and km²)

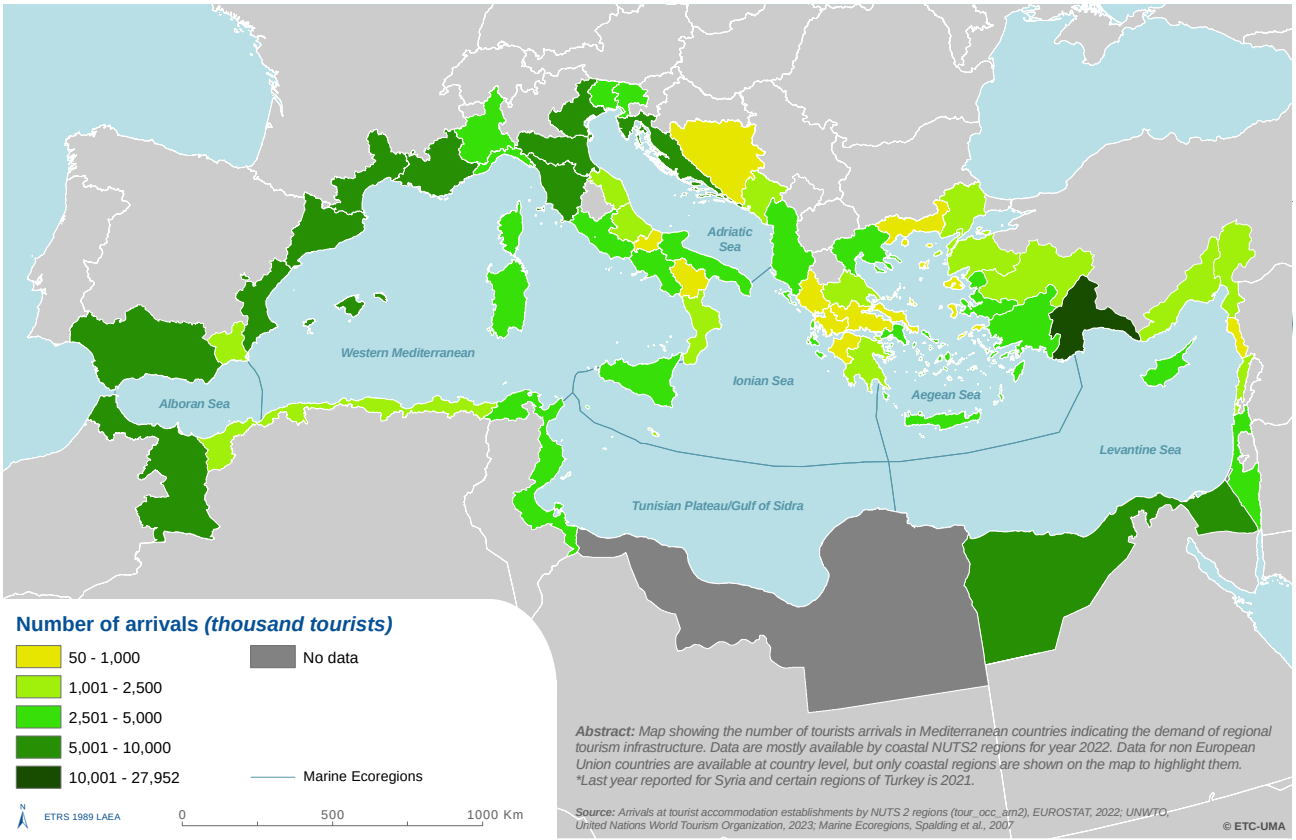
Arrivals at tourist accommodation establishments in 2019



Abstract: *Map showing the number of tourists arrivals in Mediterranean countries indicating the demand of regional tourism infrastructure. Data are mostly available by coastal NUTS2 regions. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them.*

Source: Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arn2), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007

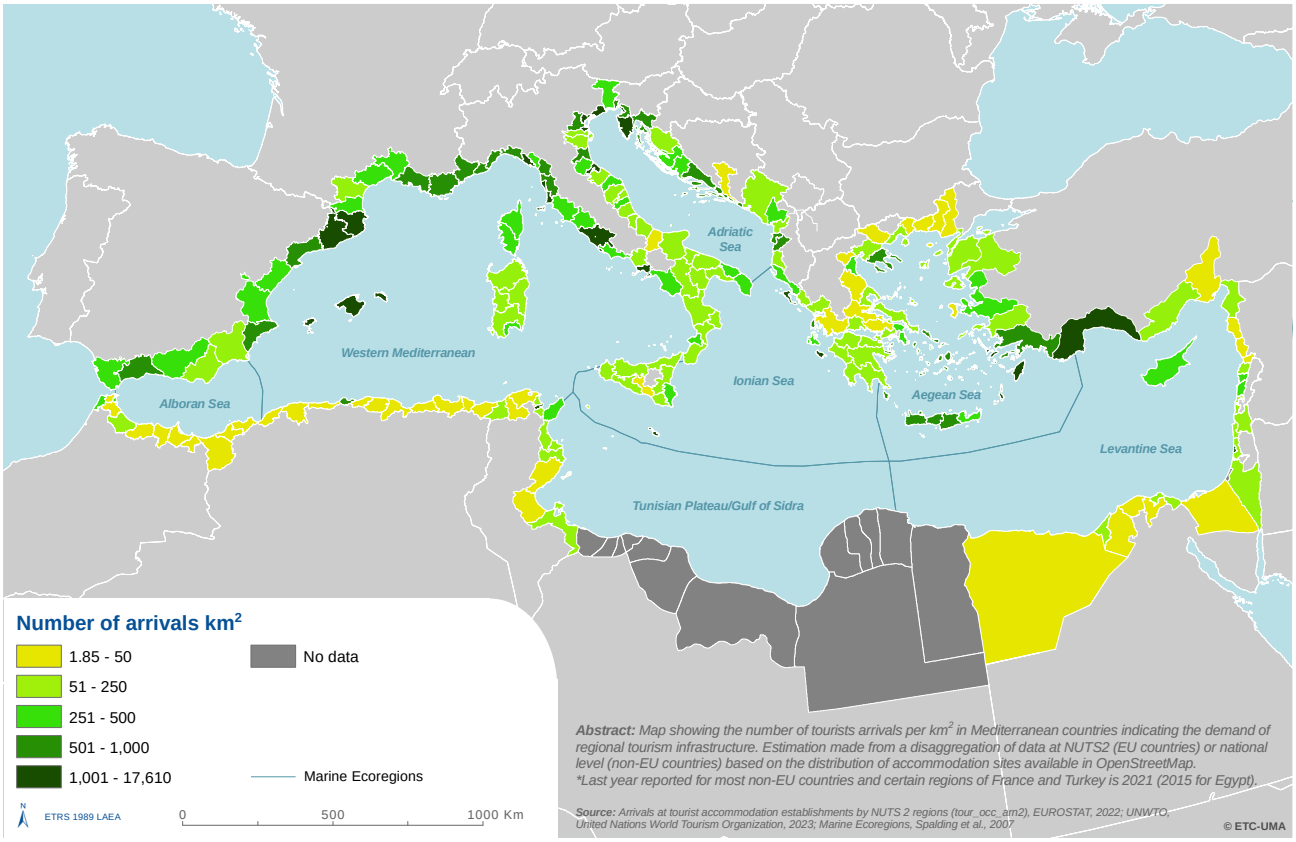
Arrivals at tourist accommodation establishments in 2022 (or last reported year)*



Abstract: *Map showing the number of tourists arrivals in Mediterranean countries indicating the demand of regional tourism infrastructure. Data are mostly available by coastal NUTS2 regions for year 2022. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them. *Last year reported for Syria and certain regions of Turkey is 2021.*

Source: Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arn2), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007

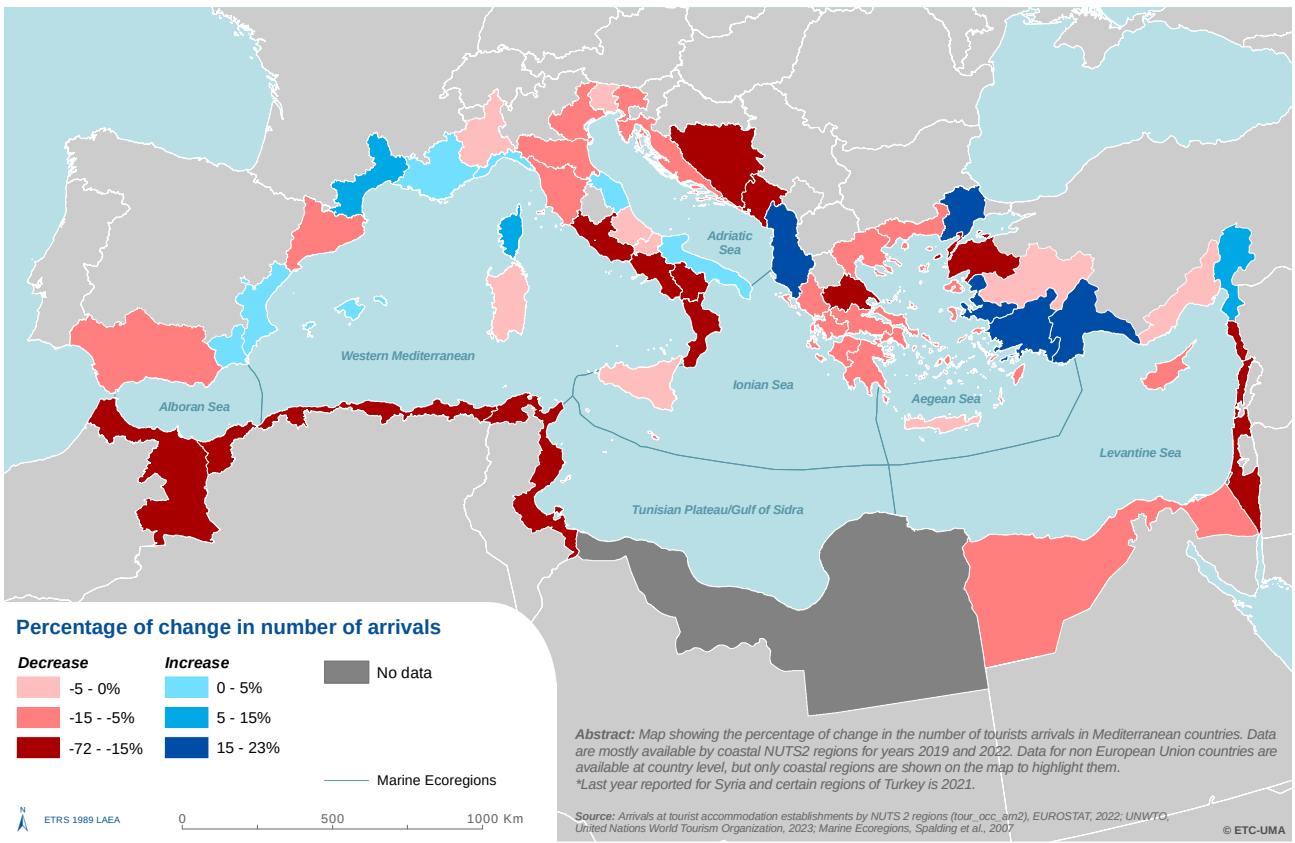
Estimated arrivals at tourist accommodation establishments per km^2 by NUTS3 or equivalent region in 2022*



Abstract: *Map showing the number of tourists arrivals per km^2 in Mediterranean countries indicating the demand of regional tourism infrastructure. Estimation made from a disaggregation of data at NUTS2 (EU countries) or national level (non-EU countries) based on the distribution of accommodation sites available in OpenStreetMap.*
**Last year reported for most non-EU countries and certain regions of France and Turkey is 2021 (2015 for Egypt).*

Source: *Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arn2), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007.*

Change in arrivals at tourist accommodation establishments between 2019 and 2022 (or last reported year)*

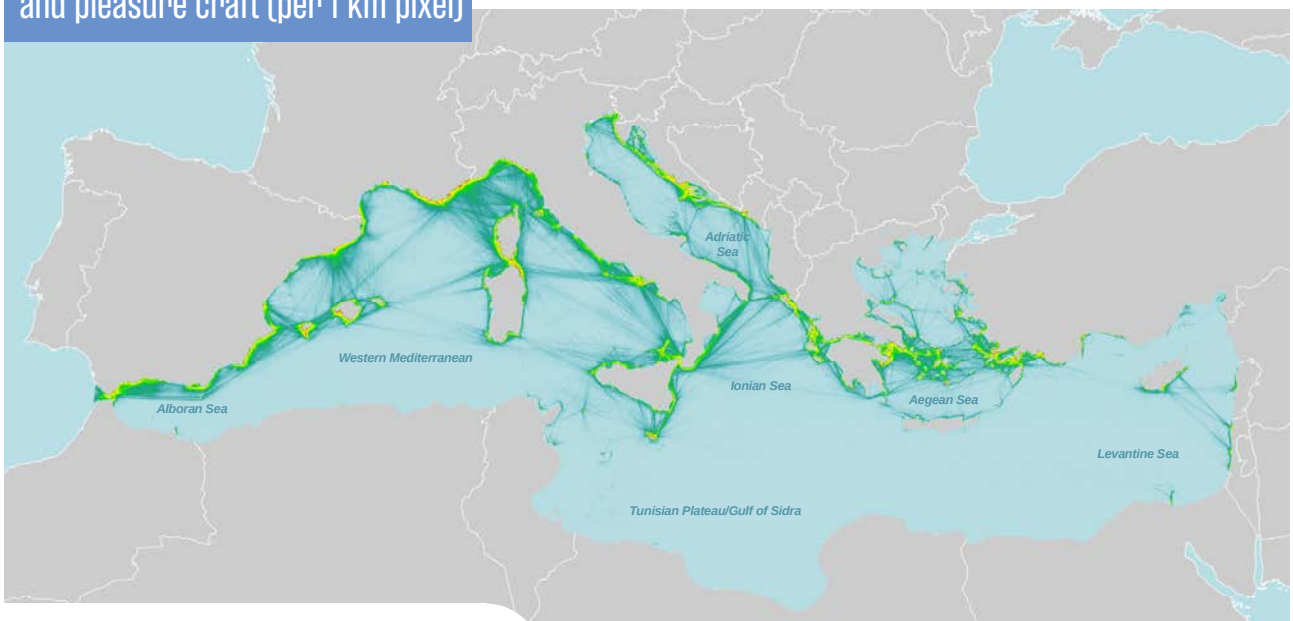


Abstract: *Map showing the percentage of change in the number of tourists arrivals in Mediterranean countries. Data are mostly available by coastal NUTS2 regions for years 2019 and 2022. Data for non European Union countries are available at country level, but only coastal regions are shown on the map to highlight them.*
**Last year reported for Syria and certain regions of Turkey is 2021.*

Source: *Arrivals at tourist accommodation establishments by NUTS 2 regions (tour_occ_arn2), EUROSTAT, 2022; UNWTO, United Nations World Tourism Organization, 2023; Marine Ecoregions, Spalding et al., 2007.*

Density of sailing vessels and pleasure craft (per 1 km pixel)

Density of sailing vessels and pleasure craft in 2019, expressed as total time of vessels presence throughout the year per pixel (hours/km^2)



Density of sailing vessels and pleasure craft

hours/km²

High: 48,277

Low: 0

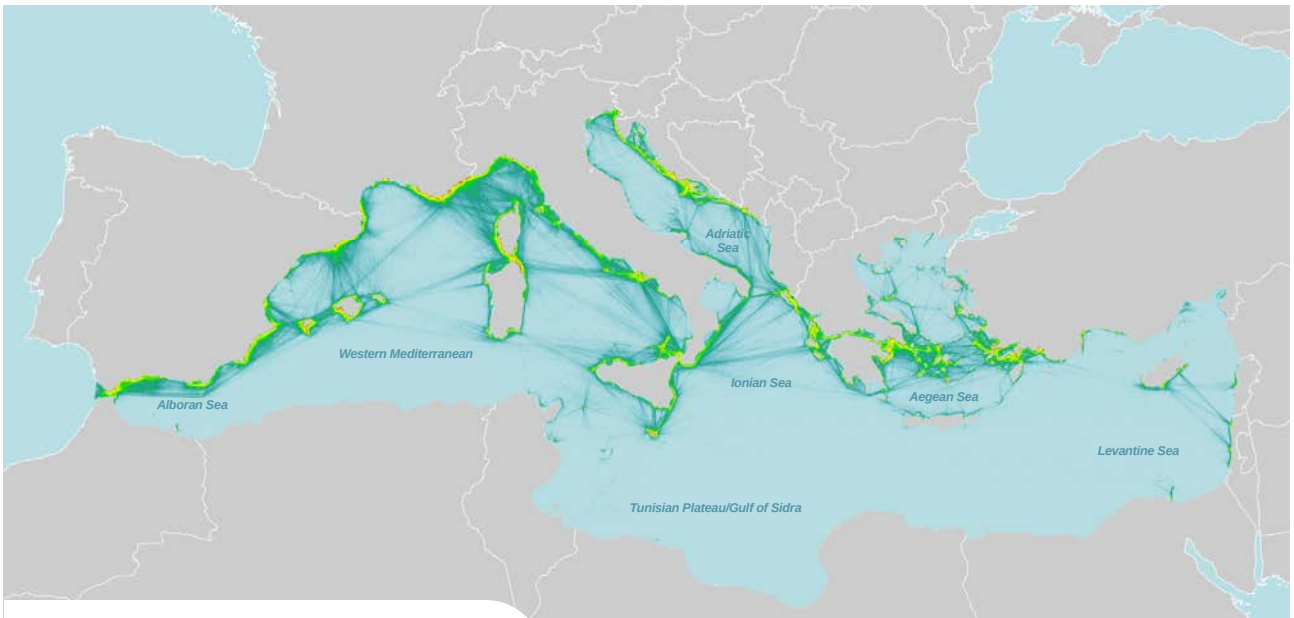
Marine Ecoregions

ETRS 1989 LAEA 0 500 1000 Km

Abstract: *The map represents the degree of pressure based on the intensity of sailing vessels and pleasure craft traffic in the Mediterranean Sea (year 2019). The map is based on AIS data aggregated at 1km2 by EMODnet and expressed as total time with presence of vessels in each cell throughout the year. The indicator provides an estimate of the amount of pollution vessels produce (via fuel leaks, oil discharge, waste disposal, etc.), under the assumption that traveling ships primarily affect their immediate waters.*

Source: *EMODnet Human Activities, Vessel Density Map, 2022; Marine Ecoregions, Spalding et al., 2007*

Density of sailing vessels and pleasure craft in 2019, expressed as total time of vessels presence throughout the year per pixel (hours/km^2)



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Source: *EMODnet Human Activities, Vessel Density Map, 2022; Marine Ecoregions, Spalding et al., 2007*

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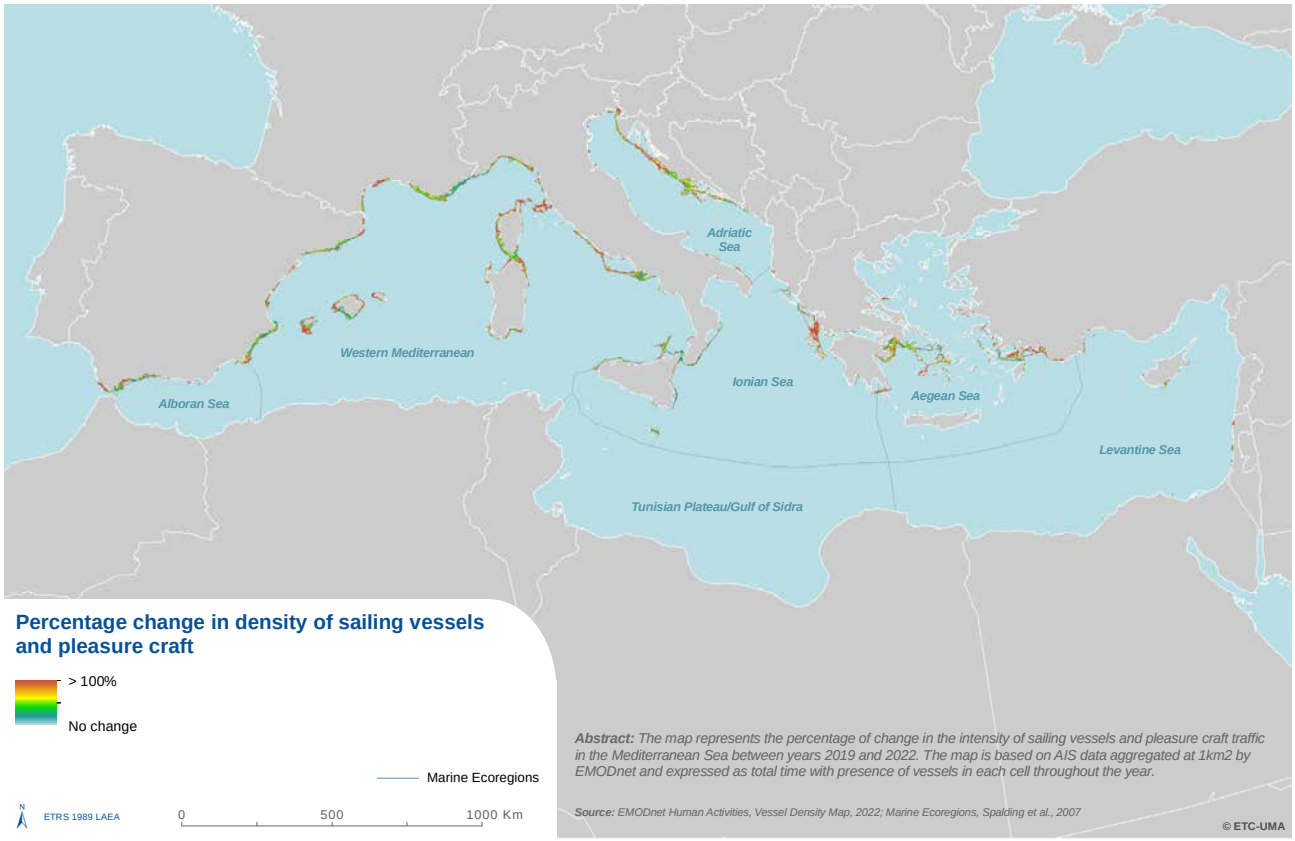
Change in density of sailing vessels and pleasure craft between 2019 and 2022

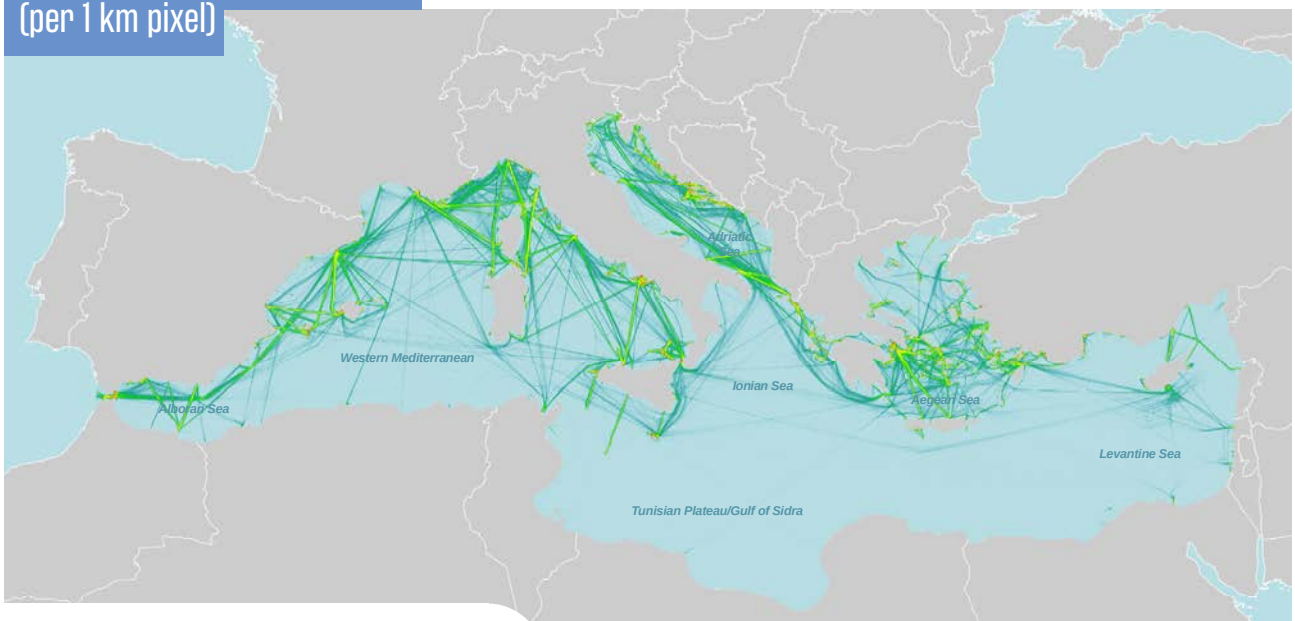


Abstract: *The map represents the percentage of change in the intensity of sailing vessels and pleasure craft traffic in the Mediterranean Sea between years 2019 and 2022. The map is based on AIS data aggregated at 1km2 by EMODnet and expressed as total time with presence of vessels in each cell throughout the year.*

Source: *EMODnet Human Activities, Vessel Density Map, 2022; Marine Ecoregions, Spalding et al., 2007*

Density of passengers' vessels (per 1 km pixel)

Density of passengers vessels in 2022, expressed as total time of vessels presence throughout the year per pixel (hours/km^2)

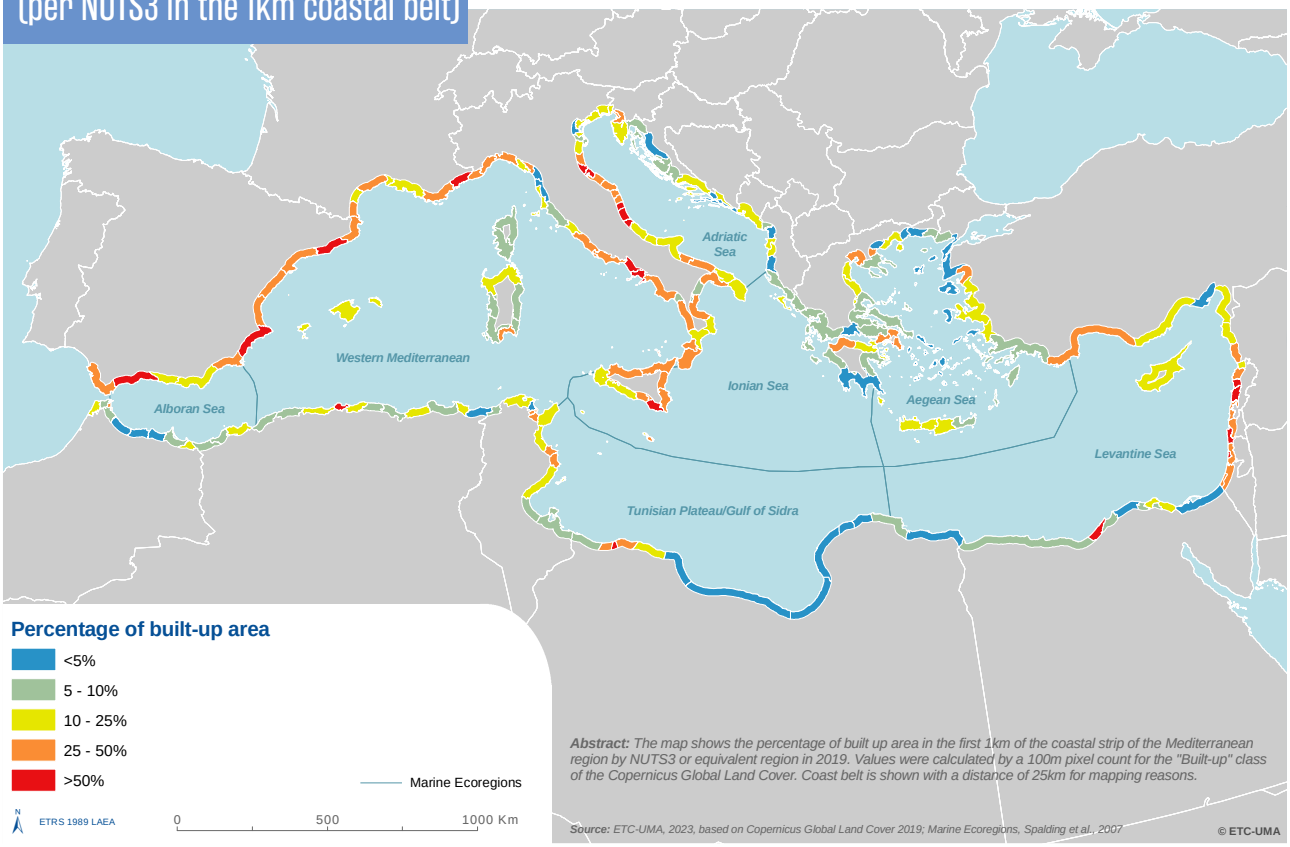


Abstract: *The map represents the degree of pressure based on the intensity of passengers vessels, including high speed craft, in the Mediterranean Sea (year 2022). The map is based on AIS data aggregated at 1km2 by EMODnet and expressed as total time with presence of vessels in each cell throughout the year. The indicator provides an estimate of the amount of pollution vessels produce (via fuel leaks, oil discharge, waste disposal, etc.), under the assumption that traveling ships primarily affect their immediate waters.*

Source: *EMODnet Human Activities, Vessel Density Map, 2022; Marine Ecoregions, Spalding et al., 2007*

Built-up areas in the coastal buffer (per NUTS3 in the 1km coastal belt)

Percentage of built-up area in the 1km coastal belt by NUTS3 or equivalent region in 2019

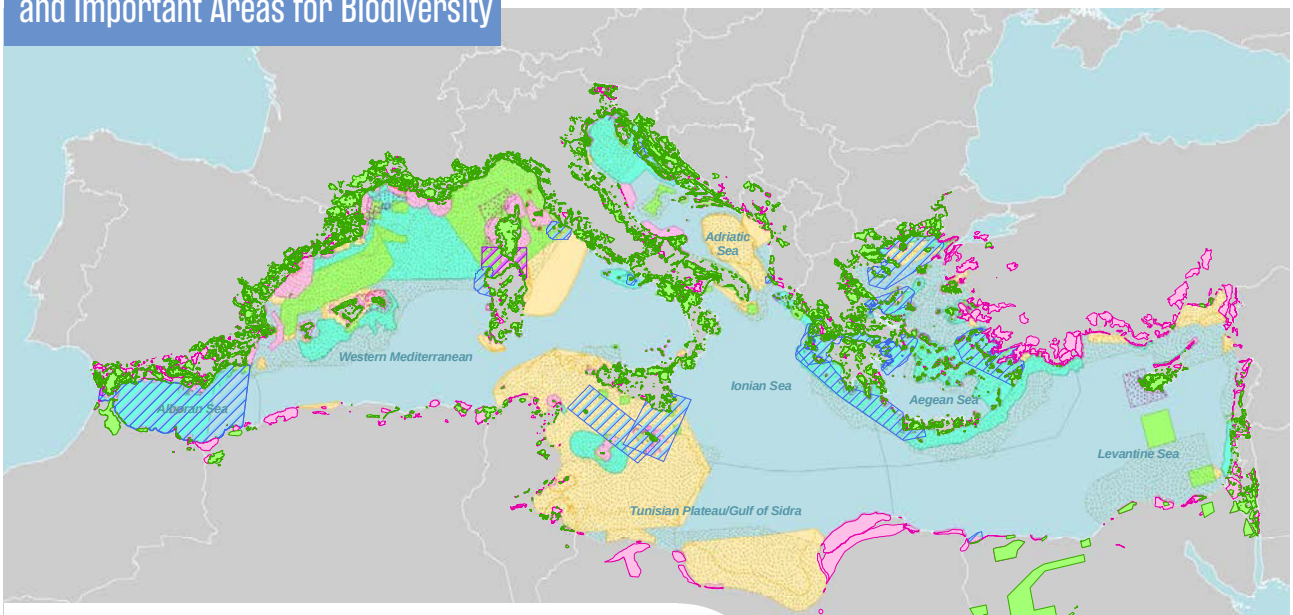


Abstract: *The map shows the percentage of built up area in the first 1km of the coastal strip of the Mediterranean region by NUTS3 or equivalent region in 2019. Values were calculated by a 100m pixel count for the "Built-up" class of the Copernicus Global Land Cover. Coast belt is shown with a distance of 25km for mapping reasons.*

Source: *ETC-UMA, 2023, based on Copernicus Global Land Cover 2019; Marine Ecoregions, Spalding et al., 2007*

Distribution of Protected Areas and Important Areas for Biodiversity

Distribution of Protected Areas (PAs) and Important Areas for Biodiversity (IABs) in Mediterranean Sea waters and coastal regions

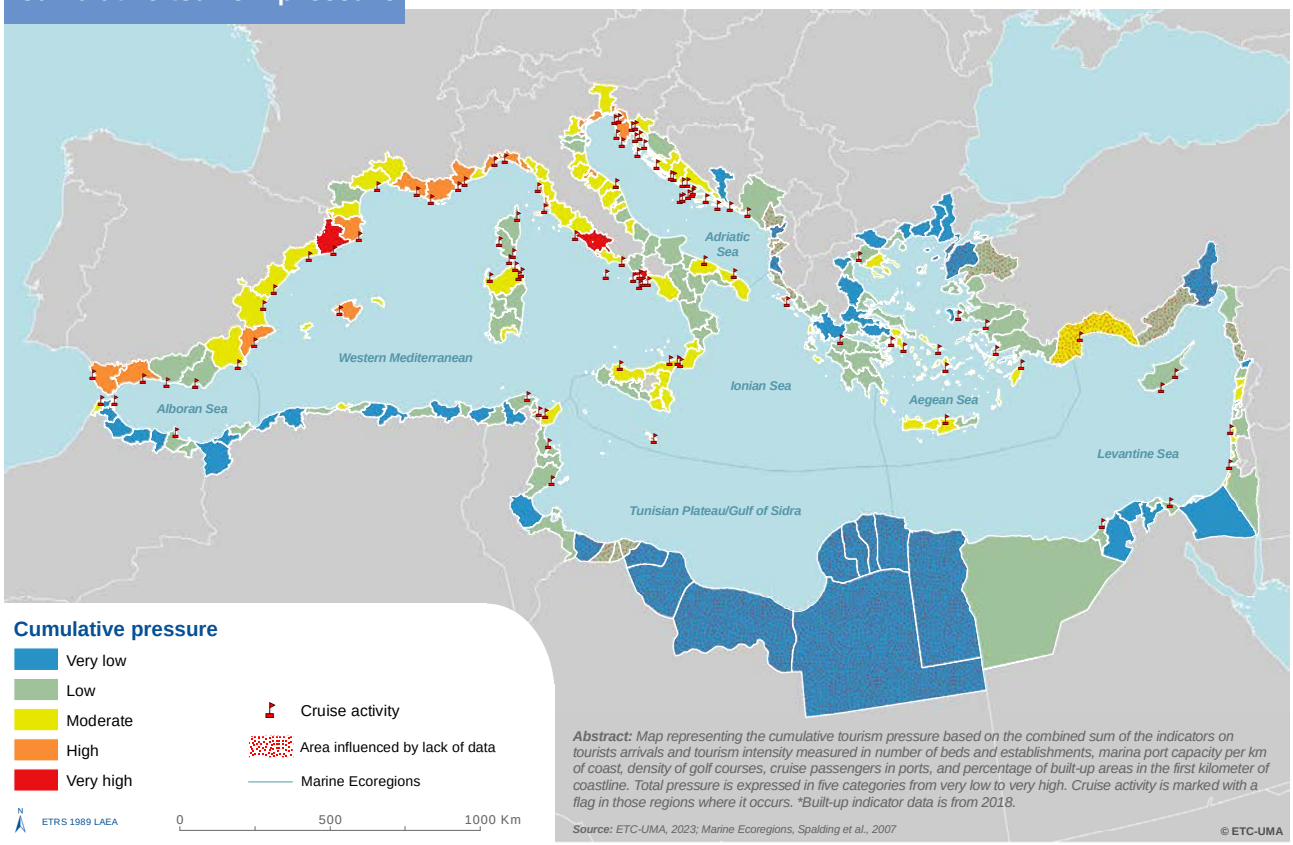


Abstract: *Map representing the distribution of Protected Areas and Important Areas for Biodiversity, both land and marine, in the Mediterranean Sea coastal and marine regions.*

Source: *MAPAMED, the database of MArine Protected Areas in the MEDiterranean. 2019 edition, version 2; World Database on Protected Areas (WDPA), UNEP-WCMC and IUCN (May 2022); World Database of Key Biodiversity Areas, BirdLife International (2022); Marine Ecoregions. Spalding et al., 2007; IUCN, 2023; Marine Ecoregions, Spalding et al., 2007*

Cumulative tourism pressure

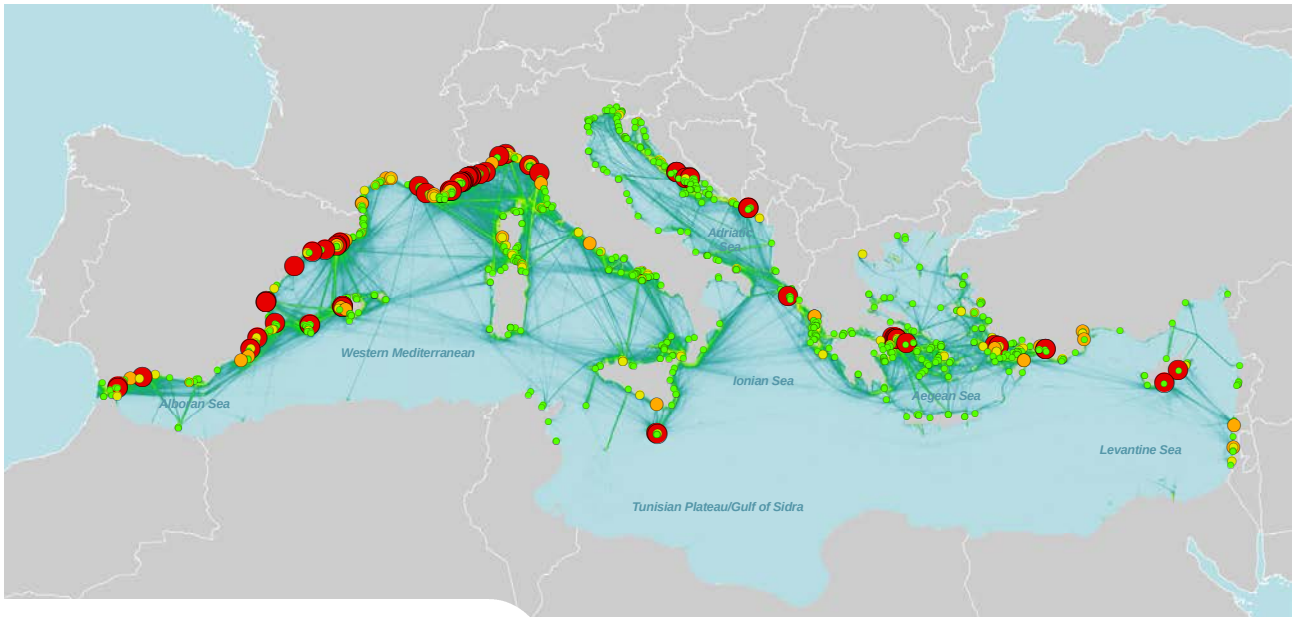
Cumulative tourism pressure by NUTS3 or equivalent region in 2022*



Abstract: *Map representing the cumulative tourism pressure based on the combined sum of the indicators on tourists arrivals and tourism intensity measured in number of beds and establishments, marina port capacity per km of coast, density of golf courses, cruise passengers in ports, and percentage of built-up areas in the first kilometer of coastline. Total pressure is expressed in five categories from very low to very high. Cruise activity is marked with a flag in those regions where it occurs. *Built-up indicator data is from 2018.*

Source: *ETC-UMA, 2023; Marine Ecoregions, Spalding et al., 2007*

Cumulative tourism pressure in Mediterranean Sea waters in 2022 (based on maritime traffic)

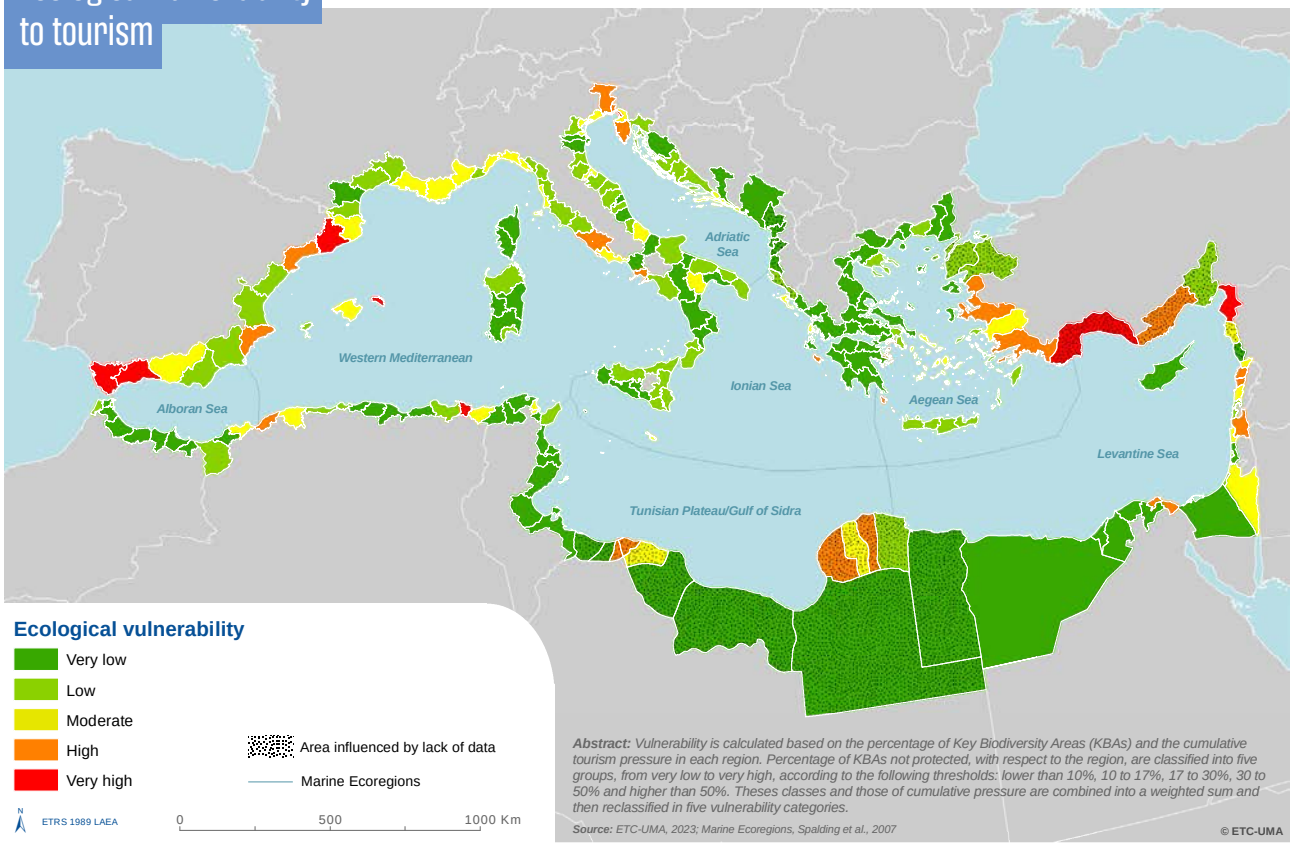


Abstract: *Map representing the cumulative tourism pressure in Mediterranean Sea waters based on the intensity of maritime traffic of passengers vessels and pleasure craft. Traffic intensity was produced using AIS data aggregated at 1km2 by EMODnet and expressed as total time with presence of vessels in each cell throughout the year (hours/km2). Pressure hotspots are highlighted on the map, being classified as: 1) low; areas with cumulative presence of vessels from one hour a day to 4 months (1 quarter); 2) moderate; areas with cumulative presence of vessels between 4 and 8 months (1 to 2 quarters); 3) high, areas with cumulative presence of vessels between 8 months (2 quarters) and one year; 4) very high, areas where there is a cumulative presence of vessels exciding one year, being locations of very high traffic intensity.*

Source: *ETC-UMA, 2023; EMODnet Human Activities, Vessel Density Map, 2022; Marine Ecoregions, Spalding et al., 2007*

Ecological vulnerability to tourism

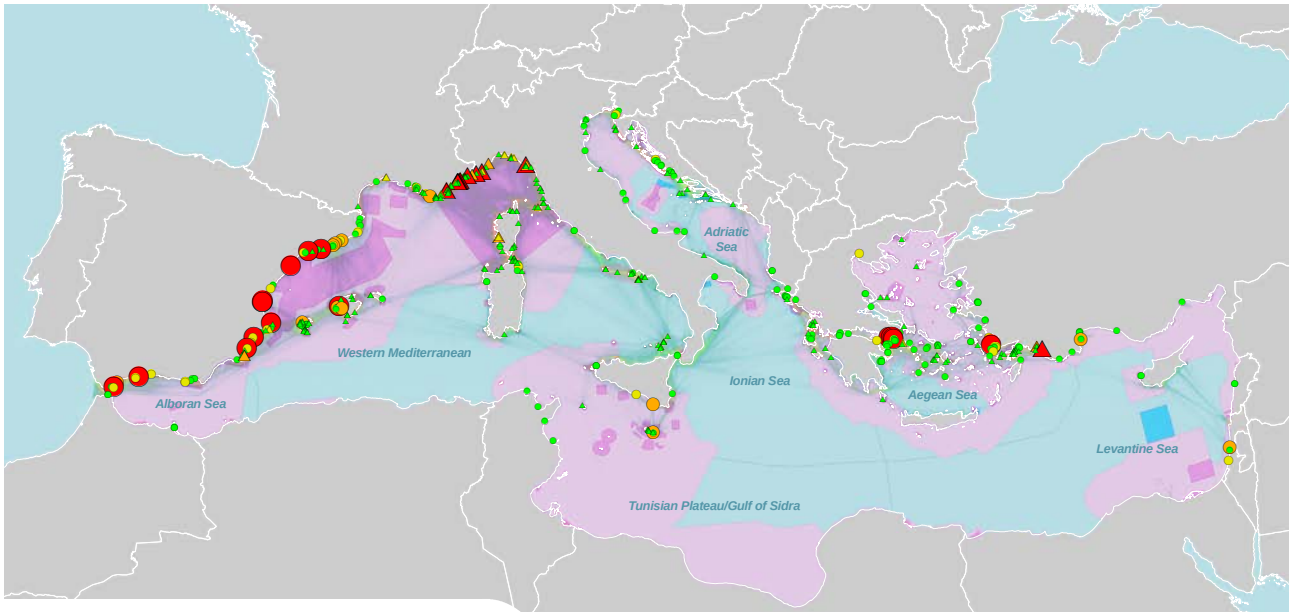
Ecological vulnerability to tourism by NUTS3 or equivalent region in 2022



Abstract: *Vulnerability is calculated based on the percentage of Key Biodiversity Areas (KBAs) and the cumulative tourism pressure in each region. Percentage of KBAs not protected, with respect to the region, are classified into five groups, from very low to very high, according to the following thresholds: lower than 10%, 10 to 17%, 17 to 30%, 30 to 50% and higher than 50%. Theses classes and those of cumulative pressure are combined into a weighted sum and then reclassified in five vulnerability categories.*

Source: *ETC-UMA, 2023; Marine Ecoregions, Spalding et al., 2007*

Ecological vulnerability to tourism in Mediterranean Sea waters in 2022



Abstract: *Vulnerability is calculated based on the coverage of protected areas (PAs) and Important Areas for Biodiversity (IABs) and the cumulative tourism pressure in the Mediterranean Sea waters. PAs and IABs coverage is reclassified in scores, 1 and 2 respectively. These classes and those of cumulative pressure are combined in and reclassified into vulnerability classes according to a vulnerability matrix.*

IABs include: Key Biodiversity Areas (KBAs), Important Shark and Ray Areas (ISRAs), Important Marine Mammal Areas (IMMAs), Critical areas for the orca population of the Gibraltar Strait and Gulf of Cádiz, Biosphere Reserve, Cetaceans Critical Habitat, Ecologically or Biologically Significant Marine Areas (EBSAs), Particularly Sensitive Sea Areas (PSSAs), Proposed Sites of Community Importance, and World Heritage Sites.

Source: *ETC-UMA, 2023; Marine Ecoregions, Spalding et al., 2007*

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