

## Article

# Overview of Marine Protected Areas and Sites of Particular Biodiversity Value in the Adriatic—Ionian Region (EUSAIR)

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**Abstract:** Marine protected areas (MPAs) are an important tool for conserving biodiversity and ensuring the sustainable use of marine ecosystem services. This study examines the extent of MPAs in the Adriatic-Ionian region (EUSAIR). The analysis focuses on nationally designated marine protected areas and Natura 2000 sites (their marine parts), as well as areas of biodiversity importance that are not officially protected. With a marine area of 484,017 km<sup>2</sup>, the EUSAIR region has 46 nationally designated marine protected areas and 348 Natura 2000 marine protected areas as of 2021, which together represent a protected area of 16,347 km<sup>2</sup> or 3.4% of the region's total marine area. However, strictly protected areas of IUCN categories I and II account for only 0.07% of the region's marine area, highlighting a significant gap in achieving global and EU biodiversity targets. In addition, around 30.75% of the marine area is classified as important for biodiversity based on various conservation instruments, but is not legally protected. These findings underline the urgent need for enhanced protection, improved management and stricter conservation measures to achieve the targets of the Kunming and Montreal Global Biodiversity Frameworks and the EU Biodiversity Strategy 2030, which aims to have 30% of marine areas protected and 10% under strict protection by 2030. Achieving the EU biodiversity targets by 2030 will require a significant expansion of MPAs in the EUSAIR region and intensified efforts to designate new MPAs, integrate existing areas of high biodiversity and ensure effective management consistent with biodiversity conservation objectives.



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**Keywords:** marine protected areas; adriatic-ionician region; eusair; biodiversity conservation; natura 2000; iucn categories; strict protection; conservation tools

## 1. Introduction

Protected areas (PA) are considered as one of the most important tools for protection and long-term safeguarding of biodiversity and ecosystem services [1]. In the year 2024, the extent of the Earth's land surface included in the network of PAs covers 17.3% and 8.3% of the Earth's sea surface is also protected [2]. The International Union for Conservation of Nature (IUCN) has developed a set of guidelines which define a protected area and categorizes a protected area through six management categories. A site, including marine areas, must meet the IUCN protected area definition to qualify for its categories. "A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" [3].

A protected area, designated on land or at sea, describes a precise set of management approaches with limits, must have nature conservation as a primary rather than a secondary

aim, must be mapped and have boundaries that are clearly defined. A degree of area-based protection is already in place in European countries. The specificity of this system is that it consists of nationally designated terrestrial and marine areas classified under the IUCN protected area category system and network of Natura 2000 sites established under the EU Birds and Habitats Directives (in the EU-member states) and their equivalent in the non-EU countries (the EMERALD network).

The IUCN system of protected areas comprises six different categories and is based on the definition of the primary and other management objectives [3]. It is believed that “strict protection” could be applied to completely natural ecosystems where no or very limited human activities are allowed (Strict Nature Reserves—IUCN I a, Wilderness Areas—IUCN I b, National Parks—IUCN II). In IUCN categories I a and I b, the removal of species or the modification, extraction, or collection of resources (e.g., fishing, harvesting, dredging) is not permitted, anchoring is prohibited in category I a protected areas, and in category II protected areas, extractive use (e.g., all types of fishing, including recreational) is inconsistent with the objectives, except for approved research [4].

IUCN protected area categories I and II correspond to the concept of ‘strict protection’, and MPAs in these categories are purely natural ecosystems in which the exploitation of natural resources is not allowed. In the European Union, however, in addition to the system of protected areas established by national or local legislation, there is a system of biodiversity hotspots based on EU legislation, called Natura 2000 (replaced in non-EU countries by the EMERALD network). The Natura 2000 (and EMERALD) network does not divide itself into different categories that would a priori distinguish between strictly and less strictly protected areas, but it does require the establishment of a management regime that will ensure that target species and habitats are in a favourable conservation status. Whether the management of a Natura 2000 site is similar to the requirements for ‘strict protection’ can therefore only be inferred from the conservation objectives that are set for each Natura 2000 site individually.

For the purpose of this analysis, both nationally protected areas and areas designated within the Natura 2000/EMERALD network (which comprise also marine territories), are considered as »marine protected areas« (MPA). The analysis focuses on MPAs in one of the European macro-regions, the EUSAIR region, and also attempts to identify other areas of particular importance for the biodiversity of the Adriatic-Ionian Sea, which currently do not yet have protected area status or any other form of spatial protection that contributes to the achievement of the objectives of marine biodiversity protection. MPAs often also contain parts of land or coastline. Compared to some other protected area databases, the present analysis is based on the creation of an entirely new database for the EUSAIR area, based exclusively on data on the extent of marine area in marine and coastal protected areas. In many ‘marine’ protected areas, land, rather than the sea, is the dominant part of the area. The database is available from the authors of the paper.

#### *Geographical Scope and Aim of the Analysis*

The EU Strategy for the Adriatic and Ionian Region [5] is one of four macro-regional strategies adopted by the European Commission and supported by the European Council.

The policy process aims to improve the quality of coastal life through agreements and ecosystem-based management in the Adriatic-Ionian region and includes Albania, Bosnia and Herzegovina, Croatia, Greece, Italy, Montenegro, Slovenia, as well as North Macedonia and Serbia (which have no marine areas).

The analysis covered MPAs and other areas of nature conservation importance in the Adriatic and Ionian Seas, with the establishment of georeferenced boundaries at the western, southern and eastern maritime boundaries of the EUSAIR as part of the present analysis.

The aim of the analysis is to: digitally draw the offshore boundaries of the EUSAIR region and estimate the area of sea it covers; identify which Marine Protected Areas (MPAs) lie within the EUSAIR region; evaluate the proportions of marine areas within these MPAs; assess how much of the MPAs in the EUSAIR region are classified as strictly protected areas, based on IUCN guidelines on protected area categories and show and estimate the size of areas that qualify as biodiversity important areas in the Adriatic-Ionian Sea but do not yet have official MPA status.

## 2. Materials and Methods

### 2.1. Data Sources and Verification

The digital basis for defining the areas and estimating the boundary of the EUSAIR region relied on multiple data sources from the European Environmental Agency (EEA): the Marine Strategy Framework Directive (MSFD), Marine regions—Exclusive Economic Zone (EEZ), and the International Hydrographic Organization (IHO) sea areas [6]. Additionally, boundaries of the territorial waters at 12 and 24 nautical miles were extracted from these databases. Consistency of EEZ layers was verified using the Sea Around Us database [7]. For land shapefiles, the “Land 10m” dataset (version 4.1.0) from Natural Earth (2009–2021), released in April 2021 by Florida State University, was utilized [8].

The tabular data were cross-referenced with the World Database on Protected Areas (WDPA), managed by UNEP-WCMC [2], to identify and resolve discrepancies. Common issues included inconsistent designations of coastal protected areas as marine (MPA), terrestrial (TPA), or both. These discrepancies were resolved by reviewing mapping layers and database entries for coastal areas designated as both marine and terrestrial. Following the EEA [9], we found that discrepancies can occur due to different criteria. The designation was an important factor for further analysis and the inclusion of exclusively marine areas. Coastal areas designated as terrestrial but still occupying a significant proportion of the sea were treated separately, with only the marine portions considered. The data on marine protected areas by country was verified using the Marine Protection Atlas [10], a portal managed by the Marine Conservation Institute. The data was processed using Microsoft Excel (2021) and QGIS (3.10).

### 2.2. Mapping and Visualization

Using QGIS (3.10), which provides access to freely available global maps, the ESRI Physical was utilized as a base map for visualization. Databases in shp-format were used to precisely define the maritime boundaries of the EUSAIR region, which includes the Adriatic and Ionian Seas and extends partly into the central part of the Mediterranean Sea. A combination of IHO, MSFD and EEZ layers was used to define the boundary, as no single layer provided adequate geo-cartographic coverage. The IHO layer defined the Mediterranean Sea and its subregions, including the Adriatic, Ionian, and Eastern Mediterranean Seas. For the definition of the EUSAIR area, it was important to include, in addition to the Adriatic and Ionian Seas, the entire eastern and southern coasts of Italy, including Sicily and the associated islands, and the western part of Greece, which necessitated the inclusion of the MSFD and EEZ layers.

The MPA analysis covered the countries of Albania, Croatia, western Greece, eastern Italy, Montenegro, Bosnia and Herzegovina and Slovenia. Data on protected and Natura 2000 areas and their cartographic representation were obtained from the MAPAMED database [11], part of the MedPAN network. MAPAMED provided the most up-to-date shapefile layers and tabular data, which included key attributes such as country, protected area name and IUCN category, Natura 2000 designation, protection level (regional, national, international), year of designation, and spatial data.

QGIS tools processed larger polygon layer, enabling the identification and delineation of individual sites by country and conservation category. These polygons were stored as separate layers allowing further analysis, area calculations and easier data management for individual sites.

### 2.3. Area Calculation

The analysis began with displaying marine Natura 2000 sites and nationally protected marine areas in different colors on a base map of the EUSAIR region for visual clarity. Key steps included calculating areas using attribute tables in QGIS, addressing missing size data, and removing overlapping areas between MPA and Natura 2000 layers and terrestrial sites. Terrestrial areas were excluded by cutting along the MSFD boundary. Layers were merged into one to accurately calculate the total area without overlaps. The layer attribute tables were further exported to Excel for refinement and a final format that met the objectives of the analysis.

### 2.4. Identification of Potential Marine Conservation Areas

Following the analysis of the area of existing protected areas, other nature conservation tools operating in the Adriatic-Ionian Sea were included, representing the potential for new MPAs in places. These tools included Cetaceans Critical Habitat (CCH), Specially Protected Area of Mediterranean Importance (SPAMI), Ecologically or Biologically Significant Marine Area (EBSA), Protection of Essential Fish Habitats and Fisheries Restricted Area (EFH), Important Marine Mammal Areas (IMMA), Key Biodiversity Areas (KBA) and Important Bird and Biodiversity Areas (IBA).

Overlapping areas were excluded to focus on unprotected sites with conservation potential. As with the initial analysis, layers were merged to calculate the total area. Additionally, 12- and 24-mile marine zones were added to the cartographic display for an overview of potential protected areas within these boundary zones.

The databases processed as part of this work are available (upon request) for professional and application use.

## 3. Results

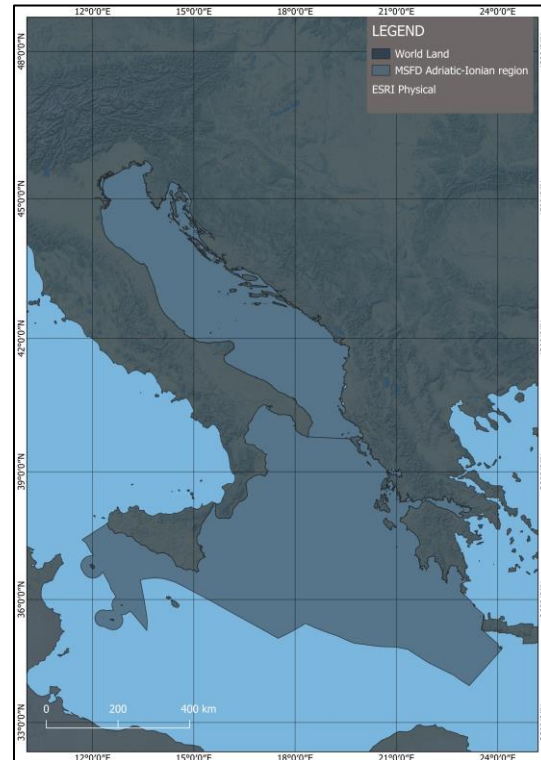
### 3.1. Delimitation of the Maritime Boundaries of the EUSAIR Region

The boundaries of the terrestrial EUSAIR area, as well as the northern boundaries of the marine territory were obtained from the macro-regional strategy website and are shown in Figure 1 below.



**Figure 1.** Boundaries of the EUSAIR terrestrial area [12].

The northern border of the EUSAIR maritime territory follows the Adriatic Sea coastline. The western, southern, and eastern borders are defined at sea, including only parts of Italy's and Greece's maritime areas. MSFD maps were used to define the EUSAIR marine region, excluding the central/eastern Ionian area. The EUSAIR marine boundaries are shown in Figure 2.



**Figure 2.** Boundaries of marine area in the EUSAIR region (with ESRI Physical base map which adds 3D appearance and world land overlay).

The EUSAIR sea area covers 484,017 km<sup>2</sup>. Italy (Tyrrhenian Sea) and Greece (Aegean Sea) have larger marine areas but are outside the Adriatic-Ionian subregion. Table 1 shows the detailed seascape distribution [13].

**Table 1.** Extent of the marine space in the EUSAIR region by country.

Country	Total Sea Area [km <sup>2</sup> ]	Sea Area EUSAIR [km <sup>2</sup> ]
Italy	541,915	222,671
Greece	493,708	180,608
Croatia	59,032	59,032
Albania	13,691	13,691
Montenegro	7745	7745
Slovenia	220	220
Bosnia and Herzegovina	50	50
Total:	1,113,361.00 km <sup>2</sup>	484,017.00 km <sup>2</sup>

### 3.2. Number, Extent and Average Size of MPA in the EUSAIR Region

The total number of MPAs in the EUSAIR region and their scope is shown in Table 2 (nationally protected areas) [13], Table 3 (Natura 2000 sites) and Table 4 (nationally protected areas and Natura 2000 sites combined). These tables contain data on the exclusive marine

share of these areas, as they have been evaluated (and merged into a new database) specifically for the purposes of this paper.

**Table 2.** Nationally protected MPAs.

Country [Adriatic & Ionian Region]	Number of MPAs	Extent of Marine Area Inside Protected Areas [km <sup>2</sup> ]	Percentage of the Marine Area Protected Regarding the Total Sea Area of Each Country	Percentage of the Marine Area Protected Regarding the Total EUSAIR Sea Area of Each Country
Albania	2	132.32	0.97%	0.97%
Bosnia and Herzegovina	0	0	0.00%	0.00%
Croatia	19	616.35	1.04%	1.04%
Greece	6	458.93	0.09%	0.25%
Italy	13	469.86	0.09%	0.21%
Montenegro	0	0.428	0.01%	0.01%
Slovenia	6	1.69	0.77%	0.77%
TOTAL	46	1679.58		

**Table 3.** Natura 2000 marine areas. Marked with X are countries that do not have the Natura 2000 network.

Country [Adriatic & Ionian Region]	Number of Natura 2000 Marine Sites	Extent of Marine Area Inside Natura 2000 Sites [km <sup>2</sup> ]	Percentage of Each Country's Sea Area Protected Within Natura 2000 Sites	Percentage of the Marine Area Protected Inside Natura 2000 Sites Regarding the Total EUSAIR Sea Area of Each Country
Albania	X	X	X	X
Bosnia and Herzegovina	X	X	X	X
Croatia	225	4984.47	8.44%	8.44%
Greece	38	4049.33	0.82%	2.24%
Italy	80	6835.39	1.26%	3.07%
Montenegro	X	X	X	X
Slovenia	5	3.67	1.67%	1.67%
TOTAL	348	15,872.86		

As of the year 2021, in the EUSAIR region there were 46 nationally designated marine protected areas. The marine surface area in these areas covers almost 1680 km<sup>2</sup>. Additionally, Figure 3 presents a map of nationally protected areas, while Figure 4 illustrates Natura 2000 marine sites in the EUSAIR region.

The EUSAIR marine region has 348 Natura 2000 sites across four EU countries, covering 15,872.86 km<sup>2</sup>. The total marine area within nationally protected sites, including Natura 2000, is:

- 5889 km<sup>2</sup> in Croatia (or 9.98% of the total area of the sea within Croatia's maritime boundaries),
- 5710 km<sup>2</sup> in Greece (or 1.16% of the total area of the sea within Greece's maritime boundaries),

- 7059 km<sup>2</sup> in Italy (or 1.30% of the total area of the sea within Italy's maritime boundaries), and
- 4.18 km<sup>2</sup> in Slovenia (or 1.90% of the total area of the sea within Slovenia's maritime boundaries).

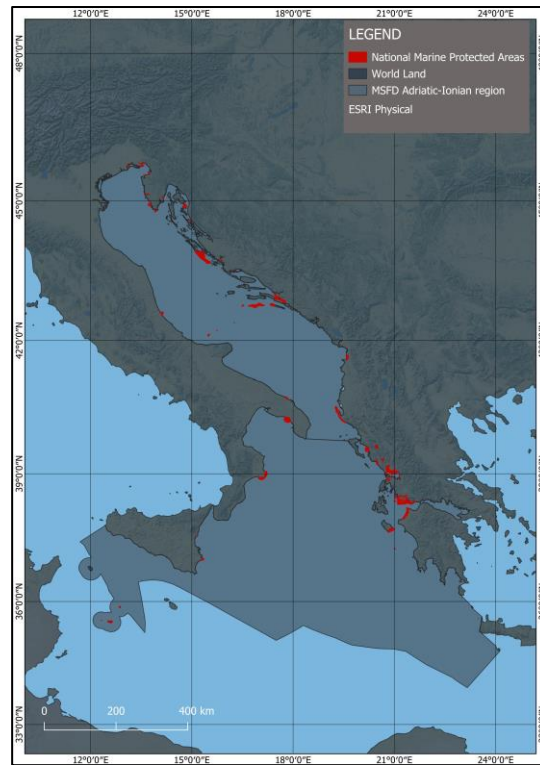


Figure 3. The map of nationally protected areas in the EUSAIR region.

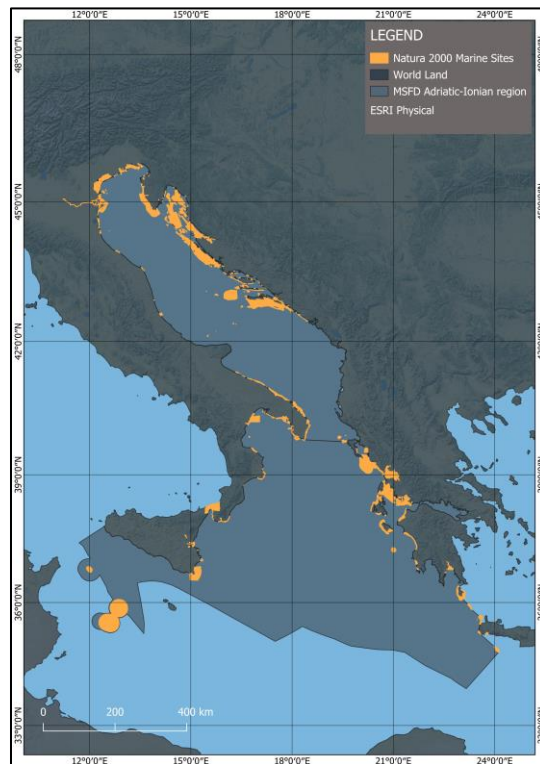
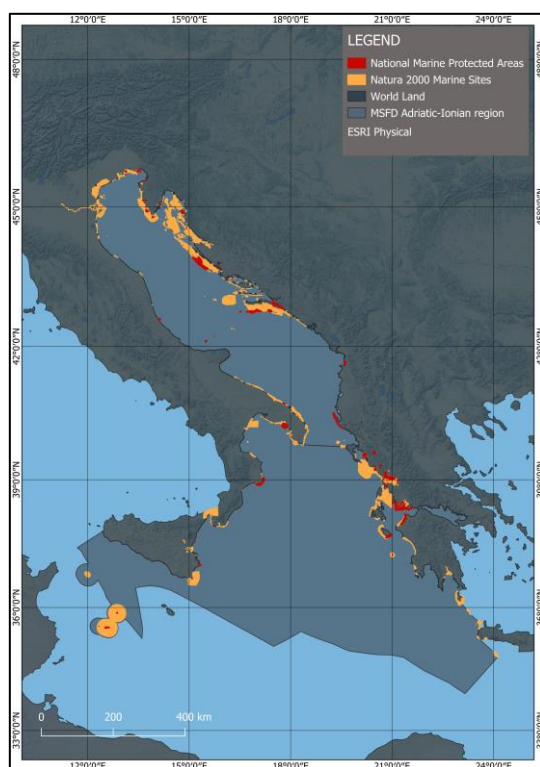


Figure 4. The map of Natura 2000 marine sites in the EUSAIR region.

**Table 4.** Nationally protected areas and marine Natura 2000 sites combined. Marked with X are countries that do not have maritime area.

Country [Adriatic & Ionian Region]	Percentage of Each Country's EUSAIR Sea Area Protected Under National and Natura 2000 Sites
Albania	0.97%
Bosnia and Herzegovina	X
Croatia	8.53%
Greece	2.27%
Italy	3.18%
Montenegro	X
Slovenia	1.86%

Figure 5 displays the combined extent of nationally protected areas and marine Natura 2000 sites within the EUSAIR region.



**Figure 5.** Nationally protected areas and marine Natura 2000 sites combined.

The total protected marine area in the EUSAIR region, consisting of nationally designated marine protected areas and the network of marine Natura 2000 sites corresponds to 16,347.38 km<sup>2</sup> respectively or 3.4% of the total marine area of the EUSAIR region. Nationally protected areas and marine Natura 2000 sites are largely made up of terrestrial parts and marine areas; some of them are also only maritime areas. Table 5 refers to the EUSAIR region and shows the average size of a nationally protected marine area, a Natura 2000 area and the average size of a protected area, taking into account both nationally protected areas and Natura 2000 sites in the calculation; the right-hand column shows how much of the maritime area is covered in each of the three examples of protected territories [13].

**Table 5.** Average size of the MPA in the EUSAIR region; first line presents only nationally protected areas, second line Natura 2000 sites and third line both nationally protected areas and Natura 2000 sites; The first column shows the total designated area, the second the protected marine area.

	Average Size of the Total Area (Land and Sea; km <sup>2</sup> )	Average Size of the Marine Area (km <sup>2</sup> )
Nationally protected areas	60.32	33.68
Natura 2000 sites	73.40	44.63
Combined (Nationally protected areas + Natura 2000 sites)	71.70	43.62

Marine Natura 2000 sites in the EUSAIR region cover on average 73.40 km<sup>2</sup> and are slightly larger than nationally protected areas (which measure on average 60.32 km<sup>2</sup>). In both spatial designations, the proportion of marine area is more than half of the total protected area boundary (44.63 km<sup>2</sup> or 60.8% for Natura 2000 sites and 33.68 km<sup>2</sup> or 55.8% for nationally protected areas). When considering both nationally protected areas and Natura 2000 sites as marine protected areas, the average size of MPAs in the EUSAIR region is 71.70 km<sup>2</sup>, of which 60.8% of MPAs are covered by marine area (average 43.62 km<sup>2</sup>).

### 3.3. Proportion of Strictly Protected MPAs in the EUSAIR Region

Strictly protected areas can only be recognized for nationally protected areas, as only the IUCN classification defines what strictly protected areas are. For Natura 2000 sites, there is no such division, or it depends on the conservation objectives for each Natura 2000 site. Only five EUSAIR marine areas meet IUCN I and II criteria, with just 0.07% (348.76 km<sup>2</sup>) under strict protection.

### 3.4. Important Areas for Biodiversity in the Adriatic-Ionian Sea That Currently Have No Legal Protection Status

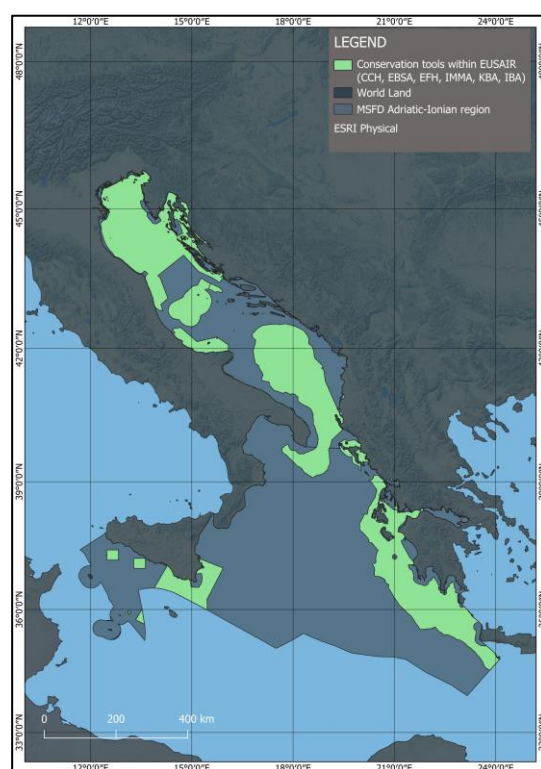
There are several spatial designations in marine areas that indicate areas of particular biodiversity value, including CCH, EBSA, EFH, IMMA, KBA/IBA. Data of these areas are shown in Table 6 and Figure 6 below, summarized for the EUSAIR region as well as indicating their extent within the marine boundaries of individual countries. These areas do not have protected area status.

**Table 6.** Size and percentage of important marine biodiversity areas (CCH, EBSA, EFH, IMMA, KBA/IBA) in the Adriatic—Ionian region by type of the designation and their extent within the marine areas of particular countries; the last column presents the total percentage of each of the designations in the marine EUSAIR waters.

Countries	Conservation Tools That Overlap All Others	Abbreviation	Area of Each Conservation Tool in EUSAIR Region (Without N2k and MPA Surface) [km <sup>2</sup> ] N2k and MPA Surface) [km <sup>2</sup> ]	Percentage of Conservation Tools Regarding the EUSAIR Region
Greece; Croatia, Italy	Cetaceans Critical Habitats	CCH	45,269.72	9.35%
Greece; Croatia, Italy; Slovenia; Albania	Ecologically or Biologically Significant Marine Areas	EBSA	106,883.04	22.08%
Italy; Croatia	Protection of Essential Fish Habitats	EFH	5233.5	1.08%

Table 6. Cont.

Countries	Conservation Tools That Overlap All Others	Abbreviation	Area of Each Conservation Tool in EUSAIR Region (Without N2k and MPA Surface) [km <sup>2</sup> ] N2k and MPA Surface) [km <sup>2</sup> ]	Percentage of Conservation Tools Regarding the EUSAIR Region
Albania, Greece; Croatia, Italy, Slovenia	Important Marine Mammal Areas	IMMA	37,381.13	7.72%
Albania, Greece; Croatia, Italy, Montenegro, Slovenia	Key Biodiversity Areas/Important Bird and Biodiversity Areas	KBA/IBA	8205.757	1.70%
Total (with no overlap)			148,816.352	30.75%



**Figure 6.** Important marine biodiversity areas (CCH, EBSA, EFH, IMMA, KBA/IBA) in the EUSAIR region.

The marine area in the EUSAIR region covered by the different conservation tools (CCH, EBSA, EFH, IMMA and KBA/IBA) comprises 30.75% of the total marine area in the region or 148,816 km<sup>2</sup>. Where the areas of the conservation tools overlapped with nationally protected areas or Natura 2000 sites, these have been excluded from the total area indicated. If two or more conservation tools extend across a part of the sea area, care was taken to avoid duplication when calculating the total area of the sea included in the conservation tools. For this reason, only the total area of conservation tools (not protected areas or Natura 2000 sites) is shown in Figure 6.

## 4. Discussion

Protected areas are widely recognized as the most effective tool for biodiversity conservation, and this applies to both land and sea. Various studies [14] highlight that the global network of marine protected areas is too underdeveloped to effectively protect marine biodiversity.

### 4.1. Regional Comparisons

By the end of 2016, 10.8% of the surface of Europe's seas had been designated as MPAs; during this period, marine protected areas in the Mediterranean Sea accounted for 11.7%, the Black Sea for 14.2%, the Baltic Sea for 16.5% and the North-East Atlantic for 9.9% [15]. While it is possible that the total area of marine protected areas has increased slightly in recent years, there is a markedly low proportion of MPAs in the EUSAIR region, which is particularly worrying given that the regional seas (Adriatic and Ionian) are considered biodiversity-rich areas [16].

### 4.2. Policy Implications

The global community, meeting at the Convention on Biological Diversity in 2023, decided that 30% of the world's land and sea should be protected or managed with biodiversity conservation objectives in mind by 2030 [17]. The EU Biodiversity Strategy 2030 [18] went even a step forward: the Strategy aims to create a cohesive Trans-European Nature Network, legally protecting 30% of EU land and sea, with 10% under strict protection. These objectives are to be achieved by completing the Natura 2000 network and by including other nationally protected areas, as well as other areas managed in such a way that the protection of biodiversity in these areas is aligned with other management objectives [18]. The share of MPAs in EUSAIR would therefore need to increase more than eightfold if we are to meet the EU's biodiversity targets by 2030.

At the same time, 30.75% (or 148,816 km<sup>2</sup>) of the EUSAIR region's sea is identified as a biodiversity important area according to the criteria listed by the various conservation tools (CCH, EBSA, EFH, IMMA, KBA/IBA). These areas do not have any conservation status, and some of them are located close to or even within areas of intensive marine traffic, within areas of intensive fishing, or along coastlines that are heavily impacted by mass tourism.

Such sites, in which certain activities, such as the use of natural resources (fishing) or establishment of maritime traffic corridors are allowed and are also managed with the aim of biodiversity conservation and have monitoring mechanisms in place, qualify as OECMs [19]. Such sites are considered relevant for the 30 × 30 CBD target [18]. However, while such multiple-use marine areas can offer some conservation advantages, fully protected MPAs are generally more successful in achieving comprehensive biodiversity conservation objectives [20]. Negative impacts of fishing such as habitat destruction, the reduction of fish stocks or the trophic cascade [21,22] or maritime traffic [23] are already extremely high in the current situation in the Adriatic and Ionian Seas, and the scale of these activities does not leave much room for the establishment of new, particularly large MPAs in the EUSAIR [13].

### 4.3. Effective Management Essential

The establishment of MPAs sets out the management objectives, the means of achieving these objectives and the boundaries of such areas. In order to achieve the objectives for which the MPAs were set up, they also need to be managed effectively. However, there are a number of gaps in this area, as the management effectiveness of MPAs is generally extremely low. Pike et al. [24] found that only a third of the world's largest MPAs implement

meaningful conservation measures, while the rest allow activities such as mining and industrial fishing that are incompatible with conservation goals. Over 80% of the European Union's MPAs are failing to meet conservation targets, providing only marginal protection against activities like dredging, mining, and bottom trawling [25].

The IUCN has developed global standards for achieving successful conservation outcomes for protected areas through effective and equitable governance and management, called the IUCN Green List of Protected and Conserved Areas [26]. As a first step to verify the effectiveness of the MPAs in EUSAIR, it would be useful to carry out a verification of the achievement of the targets and indicators for these standards.

#### 4.4. Proposals to Expanding MPAs in EUSAIR

Sovinc [13] suggests that the expansion and enhancement of the MPAs network within the EUSAIR region should focus on several key actions at the national level. First, existing MPAs should be assessed against IUCN standards and category objectives to ensure their effectiveness and alignment with conservation goals. Second, efforts should prioritize the establishment of additional MPAs, particularly those designated as fully protected or no-take areas. Third, the boundaries of existing MPAs should be expanded to increase their conservation impact. In cases where the creation of large MPAs is not feasible, alternative approaches should be pursued, such as establishing "blue corridors", multiple-use marine resource areas, and interconnected MPA networks. Additionally, EU countries should complete the network of marine Natura 2000 sites, while non-EU countries should identify potential sites for inclusion in this network. Furthermore, new MPAs should be established, and existing ones expanded beyond territorial waters to ensure the protection of offshore ecosystems. Lastly, the potential for establishing marine OECMs (Other Area-based Effective Conservation Measures) should also be considered as a complementary approach to biodiversity conservation in the region.

## 5. Conclusions

Based on the analysis carried out and the database on sea surface area in the MPAs in EUSAIR, the following conclusions can be drawn:

1. The status of marine protected areas (consisting of nationally protected areas and Natura 2000 sites) in the EUSAIR region is worryingly poor.
2. In the EUSAIR region, which covers 484,017 km<sup>2</sup>, there are 46 nationally designated marine protected areas (with an area of 1680 km<sup>2</sup>) and 348 marine Natura 2000 sites (with an area of 15,872.86 km<sup>2</sup>) in 2021.
3. The EUSAIR region has 16,347 km<sup>2</sup> of protected marine areas, covering 3.4% of its total sea area. Marine protected areas in the EUSAIR region cover less than a third of European seas (10.8%) and under 30% of the Mediterranean. The average MPA in the EUSAIR region is 71.7 km<sup>2</sup>, with 60.8% (43.6 km<sup>2</sup>) marine. Strictly protected MPAs in the EUSAIR region cover just 0.07% (348.76 km<sup>2</sup>), meeting IUCN I and II criteria.
4. Achieving the EU biodiversity targets by 2030 will require a significant expansion of MPAs in the EUSAIR region and intensified efforts to designate new MPAs, integrate existing areas of high biodiversity and ensure effective management consistent with biodiversity conservation objectives.
5. The high intensity of fishing, maritime traffic and coastal tourism in the Adriatic and Ionian Seas poses significant challenges to the establishment of large, fully protected MPAs, requiring a strategic and regionally coordinated approach to marine conservation planning.
6. The effectiveness of MPAs in achieving conservation objectives remains extremely low, as most of them do not implement adequate management measures and many MPAs

continue to allow activities that are detrimental to biodiversity conservation and undermine their conservation objectives, highlighting the urgent need for stronger management and enforcement mechanisms.

7. Assessing and improving MPA management in the EUSAIR region requires the application of standardized assessment frameworks, such as the IUCN Green List of Protected and Conserved Areas. Conducting a review process against these global standards would be a valuable first step in ensuring that MPAs in the region are actually contributing to biodiversity conservation.
8. The expansion of Marine Protected Areas (MPAs) in the EUSAIR region needs to be addressed strategically by assessing the effectiveness of existing MPAs, prioritizing the establishment of fully protected areas, and expanding current MPA boundaries to increase their protective impact.
9. Where the establishment of large MPAs is not possible, alternative conservation strategies such as blue corridors, multiple-use marine resource areas, interconnected MPA networks and Other Effective Area-based Conservation Measures (OECMs) should be pursued, however fully protected MPAs remain the most effective means of protecting marine biodiversity.

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## Abbreviations

The following abbreviations are used in this manuscript:

MPA	Marine Protected Area
EUSAIR	EU Strategy for the Adriatic and Ionian Region
IUCN	International Union for Conservation of Nature
PA	Protected Area
UNEP-WCMC	United Nations Environment Programme—World Conservation Monitoring Centre
EEA	European Environmental Agency
MSFD	Marine Strategy Framework Directive
EEZ	Exclusive Economic Zone
IHO	International Hydrographic Organization
ESRI	Environmental Systems Research Institute
WDPA	World Database on Protected Areas
MAPAMED	Marine Protected Areas in the Mediterranean
SPAs	Special Protection Areas
SACs	Special Areas of Conservation
EMERALD	Network equivalent to Natura 2000 in non-EU countries

CCH	Cetaceans Critical Habitat
SPAMI	Specially Protected Area of Mediterranean Importance
EBSA	Ecologically or Biologically Significant Marine Area
EFH	Essential Fish Habitats
IMMA	Important Marine Mammal Areas
KBA	Key Biodiversity Areas
IBA	Important Bird and Biodiversity Areas
VME	Vulnerable Marine Ecosystem

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