Natural Resources Conservation and Research 2025, 8(1), 11556.
https://doi.org/10.24294/nrcr11556

Article

Natura 2000 network sites in Calabria coastal regions (southern Italy): The case study of Crati River

Nicola Cantasano

Institute for Agricultural and Forestry Systems in the Mediterranean, Secondary Station of Rende 87036, Italy; cantasano@tiscali.it

CITATION

Cantasano N. Natura 2000 network sites in Calabria coastal regions (southern Italy): The case study of Crati River. Natural Resources Conservation and Research. 2025; 8(1): 11556. https://doi.org/10.24294/nrcr11556

ARTICLE INFO

Received: 27 February 2025
Accepted: 2 April 2025
Available online: 14 April 2025

Abstract: The Natura 2000 network is the main tool established by the European Union for biodiversity conservation. The cornerstones of this natural infrastructure are, actually, represented by the Special Areas of Conservation (SAC) and the Zones of Special Protection (ZPS). In the Calabria coastal region, this network is formed by 44 ZSCs widespread along the regional coastline. In this way, most of the Natura 2000 sites are located in continental areas, as 75% of the whole, and every key area includes some natural habitat types. In particular, the greater number of habitats is concentrated in transitional environments, as the case study located in the mouth of the Crati River, including 17 habitat types. However, the geographic distribution of Natura 2000 sites is quite unbalanced because most of the SACs are located in continental landscapes, 75% of the whole, while only 25% are concentrated in coastal regions. This irregular distribution of the network leads to a loss of biodiversity levels from continental to coastal areas. So, the implementation of the Natura 2000 network could be the main tool to connect terrestrial and coastal regions not only for biodiversity conservation but also to improve the social and economic conditions of local people.

Keywords: Natura 2000; Calabria; coastal regions; Crati River; habitats; biodiversity

1. Introduction

The impact of mankind on natural ecosystems is one of the main threats affecting biodiversity in terrestrial and marine biospheres [1–5]. In these last decades, increasing human pressure on natural environments is causing the greatest mass extinction of the Earth [6–10]. One of the problems affecting biodiversity levels is the break-up of natural ecosystems within fragmentation processes caused by a growing anthropic loading on natural resources [11–13]. In the last century, many protective measures were based on the establishment of protected areas, conceived as “natural sanctuaries” where it could be possible to exclude the human presence [14–17]. This traditional approach to biodiversity vision, like a dot, was regarded as inadequate for species conservation [18], and it was overcome by a new kind of global approach according to the principle of “wide areas” [19,20]. In such a context, it appeared the issue of ecological networks was a landscape pattern able to improve the scattering of faunal and plant species for natural conservation [21–23]. So, it was established by the European Union, a Natura 2000 network formed by Sites of Community Interest (SIC), later on named Special Areas of Conservation (hereafter SAC) and Zones of Special Protection (hereafter ZPS), respectively, as a consequence of Habitats and Birds directives (**Figure 1**). However, the realization of the Natura 2000 network and its implementation in European countries ran into many obstacles and conflicts, producing a lot of flaws in the sharing of conservation targets by local people.

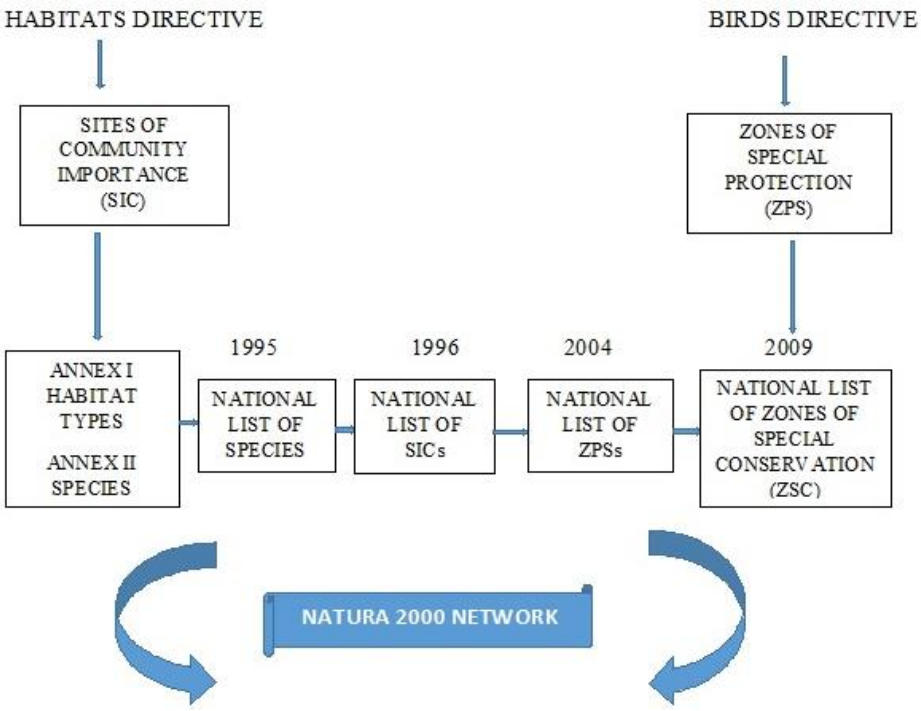

Figure 1. The progress of the Natura 2000 network in Italy.

Also, in Italy, the Natura 2000 network represents the main tool for biodiversity conservation [24]. This European project aims to realize a widespread ecological network formed by priority habitats and target species, respectively, established by the Habitats Directive (92/43/CEE) and the Birds Directive (79/409/CEE). The integration of the Natura 2000 network was realized in 1995 through a Life project named "BioItaly", partly funded by the European Union and coordinated by a close relationship between the Italian Botanical Society and the National Ministry of Environment [25]. The national version of the Natura 2000 network, according to a novel approach "at wide areas" [26] in the landward and seaward sides of coastal regions, is the main strategy for biodiversity conservation through the establishment of Natura 2000 sites [27]. In Italy, the cornerstones of this planning scheme are actually formed, in continental and marine habitats, by 2.302 SAC and by 842 ZPS.

Finally, the Calabria region adopted in 2006, according to the Operative Regional Program (POR), a Strategic and Integrated Process (PIS) aimed to realize a Regional Ecological Network (REN) whose cornerstones were recognized in 180 ZSC and 6 ZPS. In this way, the assessment of the Natura 2000 network was perceived, by the regional policy, as a natural infrastructure able to connect continental and coastal regions in the same landscape unit. This new kind of integrated approach, in the management of coastal regions, recognizes in the Natura 2000 network the ideal tool to merge seaward and landward sides of seaboard areas, supporting, also, a close relationship between local people and natural resources.

The present study aims to deepen the tight connections between the Natura 2000 network and habitat types in the Calabria coastal regions, according to a new kind of integrated management of seaboard areas.

2. Material, methods and study area

In this study, it is necessary to analyze the connections between the core areas of the Natura 2000 network, represented by SAC and ZPS of the regional coastline. This effort aims to develop an integrated approach towards the improvement of natural ecosystems. All the data regarding the Natura 2000 network and the surface areas of each SAC have been drawn from standard data forms released by the European Natural Information System (EUNIS). Indeed, the locations of SACs have been stated through topographic maps edited by the Calabria Region in the year 2016. All the data have been processed, overlapping the cartographic elements with digital images derived from Google Earth Maps in the year 2024. The research was conducted along Calabria's coastal regions for a coastline of 789 km, about 1/10 of the whole national marine boundary (**Figure 2**). Within this kind of regional approach, special attention has been reserved for the wetland corresponding to the outlet of the Crati River, characterized by high levels of biodiversity.

Figure 2. Location of the Calabria region as a study area (drawn by internet at: https://britannica.com/place/Calabria-region-Italy).

The geological pattern of the regional coastline is characterized by rocky coasts, as 55% of the whole, and sandy beaches, as 45% of the regional seaboard [28]. In particular, the Calabria region, in the southern tip of the Italian peninsula, is washed by three coastal districts that are, proceeding from the northwestern side to the northeastern one, the Tyrrhenian Sea (242 km), the Strait of Messina (33 km), and the Ionian Sea (514 km).

3. Results

The resulting data highlight the presence of 44 SACs in Calabria coastal regions, of which fifteen are located along the Tyrrhenian coastline, just two in the coastal stretch of the Messina Strait and twenty-seven on the Ionian Sea (**Figure 3**).

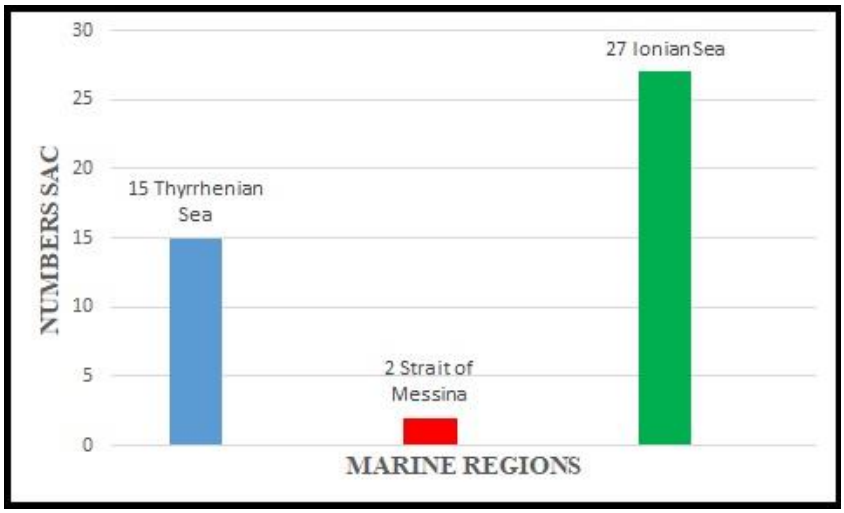

Figure 3. The distribution of SAC in Calabria coastal regions.

These Natura 2000 sites are characterized by specific code numbers, and each one is connected to detailed geographic locations and to habitat types regularly classified by EUNIS (**Table 1**). In the research, the sites have been numbered in a growing order, according to an anticlockwise direction, from the northern limit of the western coastline to the northern end of the eastern one.

Table 1. Natura 2000 sites and their habitat types in Calabria coastal regions.

N.	SITE CODES	SITE NAMES	SITE LOCATIONS	SEAS	AREAS	HABITAT TYPES
1	IT9310034	Isola di Dino	Long. 15.774167 Lat. 39.873333	Tyrrhenian Sea	Terrestrial 35 ha.	1240, 5330, 6220, 6210, 9320, 9340
2	IT9310035	Fondali Isola di Dino-Capo Scalea	Long. 15.785556 Lat. 39.861111	Tyrrhenian Sea	Marine 399 ha.	1120, 1170, 8330
3	IT9310037	Isola di Cirella	Long. 15.801667 Lat. 39.698889	Tyrrhenian Sea	Terrestrial 7 ha.	1240, 5330, 8210
4	IT9310033	Fondali di Capo Tirone	Long. 15.844444 Lat. 39.602778	Tyrrhenian Sea	Marine 80 ha.	1120, 1170, 8330
5	IT9310038	Scogliera dei Rizzi	Long. 15.900556 Lat. 39.538056	Tyrrhenian Sea	Terrestrial 12 ha.	1210, 1240, 5210, 5320, 5330, 8210
6	IT9310039	Fondali Scogli di Isca	Long. 15.055833 Lat. 39.1475	Tyrrhenian Sea	Marine 72 ha.	1120, 1170

Table 1. (*Continued*).

N.	SITE CODES	SITE NAMES	SITE LOCATIONS	SEAS	AREAS	HABITAT TYPES
7	IT9330087	Lago La Vota	Long.16.1894 Lat. 38.9397	Tyrrhenian Sea	Lacustrine 297 ha.	1150, 1210, 1410, 2110, 2120, 2210, 2230, 2240, 2270
8	IT9330088	Palude di Imbutillo	Long. 16.223612 Lat. 38.830114	Tyrrhenian Sea	Lacustrine 33 ha.	2270, 3170, 6420
9	IT9330089	Dune di Angitola	Long. 16.2175 Lat. 36.815278	Tyrrhenian Sea	Terrestrial 383 ha.	1210, 2110, 2120, 2210, 2230, 2240, 2250, 2260, 2270
10	IT9340091	Zona costiera Briatico-Nicotera	Long. 15.828056 Lat. 38.626863	Tyrrhenian Sea	Terrestrial 327 ha. Marine 452 ha.	1110, 1120, 1170, 1240, 2110, 2210, 2230, 5320, 5330, 6220, 8220
11	IT9340092	Fondali di Pizzo Calabro	Long. 15.159167 Lat. 38.745278	Tyrrhenian Sea	Marine 1.216 ha.	1120, 1170
12	IT9340093	Fondali di Capo Vaticano	Long. 15.821667 Lat. 38.620278	Tyrrhenian Sea	Marine 802 ha.	1120, 1170
13	IT9340094	Fondali di Capo Cozzo-S. Irene	Long. 15.978056 Lat. 38.723889	Tyrrhenian Sea	Marine 375 ha.	1110, 1120, 1170
14	IT9350158	Costa Viola e Monte S. Elia	Long. 15.834167 Lat. 38.339722	Tyrrhenian Sea	Terrestrial 339 ha Marine 107 ha.	1120, 1170, 1210, 1240, 5330, 8210, 8330, 9340
15	IT9350173	Fondali di Scilla	Long. 15.713889 Lat. 38.259167	Tyrrhenian Sea	Marine 375 ha.	1120, 1170
16	IT9350183	Spiaggia di Catona	Long. 15.635254 Lat. 38.185890	Strait of Messina	Terrestrial 7 ha.	1210, 2110, 2120, 2210, 2230
17	IT9350171	Spiaggia di Pilati	Long. 15.801389 Lat. 37.918889	Strait of Messina	Terrestrial 8 ha.	1210, 2120, 2210, 2230
18	IT9350172	Fondali da Punta Pezzo a Capo dell'Armi	Long. 15.631389 Lat. 38.075556	Ionian Sea	Marine 1812 ha.	1110, 1120, 1170
19	IT9350140	Capo dell'Armi	Long. 15.682222 Lat. 37.955556	Ionian Sea	Terrestrial 69 ha.	1210 1240, 5330, 6220, 8210
20	IT93500143	Saline Ioniche	Long. 15.717778 Lat. 37.934722	Ionian Sea	Terrestrial 30 ha.	1150, 1310, 1410, 1420
21	IT9350144	Calanchi di Palizzi Marina	Long. 16.0075 Lat. 37.921667	Ionian Sea	Terrestrial 222 ha. Marine 887 ha.	1110, 1120, 1210, 2110, 2230, 5330, 6220
22	IT9350141	Capo S. Giovanni	Long. 15.936111 Lat. 37.925556	Ionian Sea	Terrestrial 55 ha. Marine 286 ha.	1110, 1120, 1210, 2110, 2210, 2230, 5330, 6220
23	IT9350142	Capo Spartivento	Long. 16.058889 Lat. 37.928056	Ionian Sea	Terrestrial 109 ha. Marine 256 ha.	1110, 1120, 1210, 2110, 2230, 5330, 6220
24	IT9350160	Spiaggia di Brancaleone	Long. 16.0892 Lat. 37.9475	Ionian Sea	Terrestrial 174 ha. Marine 1.411 ha.	1110, 1120, 1170, 2110, 2110, 2210, 2230, 2260, 5130
25	IT9330107	Dune di Isca	Long. 15.566111 Lat. 38.601111	Ionian sea	Terrestrial 18 ha.	2110,2120, 22210, 2230, 2240
26	IT9330108	Dune di Guardavalle	Long. 16.579444 Lat. 38.492778	Ionian Sea	Terrestrial 34 ha.	1210, 2120, 2210, 2230, 2240, 2260
27	IT9310051	Dune di Camigliano	Long. 16.828611 Lat. 39.565	Ionian Sea	Terrestrial 88 ha.	1210, 2110, 2120, 2210, 2230, 2240, 2260

Table 1. (*Continued*).

N.	SITE CODES	SITE NAMES	SITE LOCATIONS	SEAS	AREAS	HABITAT TYPES
28	IT9330184	Scogliera di Staletti	Long. 16.570833 Lat. 38.760278	Ionian Sea	Terrestrial 21 ha.	1210, 1240, 5330, 6220, 8210
29	IT9320185	Fondali di Staletti	Long. 16.572222 Lat. 38.757778	Ionian Sea	Marine 46 ha.	1110, 1120, 1170
30	IT9330098	Oasi di Scolacium	Long. 16.585278 Lat. 38.788611	Ionian Sea	Terrestrial 75 ha.	1210, 2120, 2210, 2240, 2270
31	IT9330105	Foce del Crocchio-Cropani	Long. 16.825278 Lat. 38.912778	Ionian Sea	Terrestrial 37 ha.	1210, 1410, 2120, 2210, 2230, 2240, 2260, 92A0, 92D0
32	IT9320102	Dune di Sovereto	Long. 17.059144 Lat. 38.921667	Ionian Sea	Terrestrial 104 ha.	1210. 1240, 1430, 2110, 2120, 2210, 2230, 2240, 2250, 2260, 2270, 6220
33	IT9320103	Capo Rizzuto	Long. 17.096944 Lat. 38.896389	Ionian Sea	Terrestrial 12 ha.	1210, 1240, 1430, 5210, 6220, 9320
34	IT9320106	Steccato di Cutro e Costa del Turchese	Long. 16.886667 Lat. 38.93	Ionian Sea	Terrestrial 258 ha.	1210, 2110, 2120, 2210, 2230, 2240, 2260, 2270, 92D0, 3150
35	IT9320097	Fondali da Crotone a Le Castella	Long. 17.179724 Lat. 38.982222	Ionian Sea	Marine 5.209 ha.	1120
36	IT9320100	Dune di Marinella	Long. 17.068657 Lat. 39.424422	Ionian Sea	Terrestrial 81 ha.	1210, 2110, 2120, 2210, 2230, 2240, 2260, 2270, 5330, 9320
37	IT9320101	Capo Colonne	Long. 17.205556 Lat. 39.025278	Ionian Sea	Terrestrial 29 ha.	1210, 1240, 1310, 1430
38	IT9320096	Fondali di Gabella Grande	Long. 17.126389 Lat. 39.129167	Ionian Sea	Marine 484 ha.	1120
39	IT9320095	Foce Neto	Long. 17.142778 Lat. 39.200278	Ionian Sea	Terrestrial 583 ha.	1130, 1210, 1410, 1420, 2110, 2120, 2210, 2230, 2240, 2250, 2260, 2270, 92A0, 92D0, 91F0
40	IT9310048	Fondali di Crosia-Pietrapaola-Cariati	Long. 16.871389 Lat. 39.566111	Ionian Sea	Marine 4.395 ha.	1120
41	IT9310044	Foce del Fiume Crati	Long. 16.523056 Lat. 39.715278	Ionian Sea	Terrestrial 226 ha.	1130, 1210, 1310, 1410, 1420, 1430, 2110, 2120, 2210, 2230, 2240, 2270, 3150, 3280, 6420, 92A0, 92D0
42	IT9310052	Casoni di Sibari	Long. 16.484444 Lat. 39.734167	Ionian Sea	Terrestrial 504 ha.	1150, 1210, 1410, 2110, 2210, 2230, 2260, 2270
43	IT9310053	Secca di Amendolara	Long. 16.732074 Lat. 39.866265	Ionian Sea	Marine 611 ha.	1110, 1120
44	IT9310040	Montegiordano Marina	Long. 16.605788 Lat. 40.027778	Ionian Sea	Terrestrial 8 ha.	1210, 5420

Most of the Natura 2000 sites in Calabria's coastal regions are located in the marine domain, covering a surface area of 19.279 ha, or 82.0% of the whole. The residual part of ZSC is distributed on the landward side of coastal regions (3.889 ha.) and in lacustrine environments (330 ha.), with respective percentages of 16.5% and 1.5% (**Figure 4**).

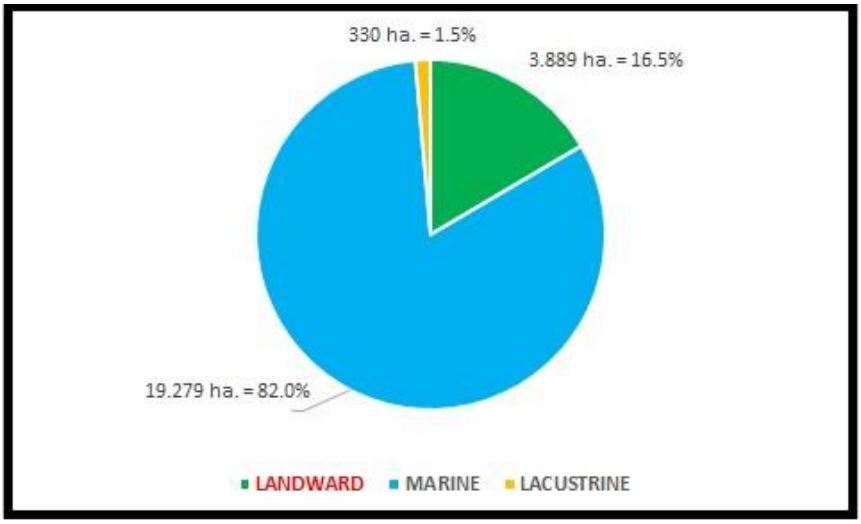

Figure 4. The surface areas of regional ZSC and their percentages in different environments.

There are a lot of habitat types distributed in the ZSC of Calabria coastal regions, and every code number corresponds to a natural ecosystem established by EUNIS (**Table 2**).

Table 2. List of natural habitat types and their code numbers in Calabria coastal regions.

CODE NUMBERS	NATURAL HABITAT TYPES
1110	Sandbanks which are slightly covered by seawater all the time
1120	Posidonia beds (Posidonion oceanicae)
1130	Estuaries
1150	Coastal lagoons
1170	Reefs
1210	Annual vegetation of drift lines
1240	Vegetation sea cliffs of the Mediterranean coasts with endemic Limonium spp
1310	Salicornia and other annuals colonizing mud and sand
1410	Mediterranean salt meadows (Juncetalia maritimi)
1420	Mediterranean and Thermo-Atlantic halophilous scubs (Sarcometea fruticosi)
1430	Halo-nitrophilous scrubs (Pegano-Salsoletea)
2110	Embryonic shifting dunes
2120	Shifting dunes among the shorelines with Ammophyla arenaria (“white dunes”)
2210	Crucianellion maritimae fixed beach dunes
2230	Malcolmietalia dune grasslands
2240	Brachypodietalia dune grasslands with annuals
2250	Coastal dunes with Juniperus spp
2260	Cisto-Lavenduletalia dune sclerophyllus scrubs
2270	Wooded dunes with Pinus pinea and/or Pinus pinaster
3150	Natural autrophic lakes with Magnopotamion or Hydrocharition-type vegetation
3170	Mediterranean temporary ponds
3280	Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba

Table 2. (*Continued*).

CODE NUMBERS	NATURAL HABITAT TYPES
5210	Arborescent matorral with Juniperus spp
5320	Low formations of Euphorbia close to cliffs
5330	Thermo-Mediterranean and pre-desert scrub
5420	Sarcopoterium spinosum phryganas
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea)
6420	Mediterranean tall humid grasslands of the Molinion-Holoschoenion
8210	Calcareous rocky slopes with chasmophytic vegetation
8220	Siliceous rocky slopes with chasmophytic vegetation
8330	Submerged or partially submerged sea caves
91F0	Riparian mixed forets of Quecus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers
92A0	Salix alba and Populus alba galleries
92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)
9320	Olea and Ceratonia forests
9340	Quercus ilex and Quercus rotundifolia forests

So, Calabria is characterized by many natural habitats, but many of these are concentrated in transitional environments, as, for instance, the outlet of the Crati River (Site Code 9310044) contains 17 natural habitat types (**Figure 5**).

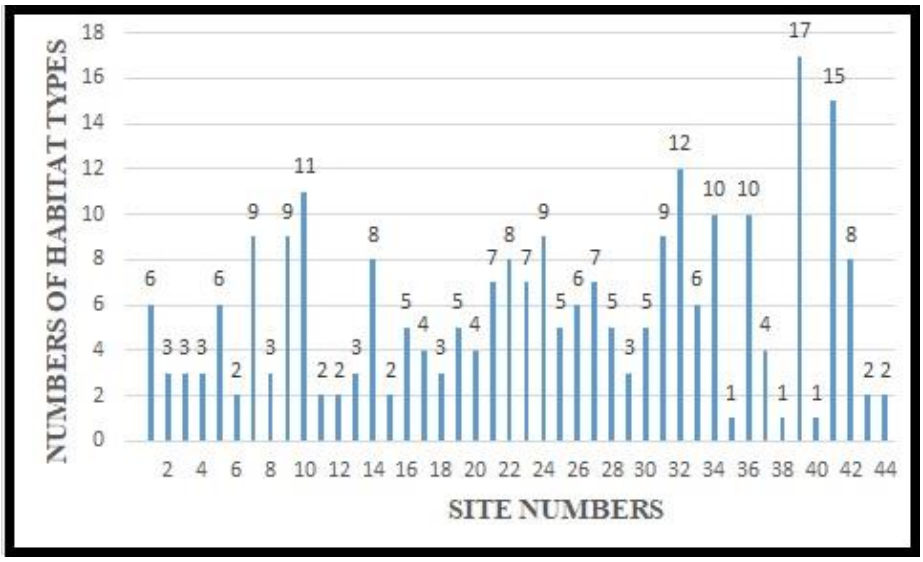

Figure 5. Site numbers of Calabria SAC and the numbers of habitat types.

A case study: The outlet of the Crati River (IT9310044)

The Crati River is the longest river in Calabria, with a length of about 91 km and a catchment area of 2447.79 km^2. It rises at the slopes of Timpone Bruno mountain (1742 m a.s.l.) in the Sila Plateau, with the nickname of Craticello. In the first stretch, it goes down from the supply area, close to Aprigliano country (Cosenza, Italy), where

it receives the waters of the Zumpo stream, taking up the final name of Crati, which covers a steep slope of about 1500 m in ten km until Cosenza town [29]. Afterwards, it goes on along the Crati Valley and, after the dam of Tarsia, it outflows in the Sibari plain until its outlet to the Ionian Sea, close to Schiavonea village (Cosenza, Italy) (**Figure 6**). The mouth of the Crati River represents the most important fluvial ecosystem of the Calabria region, where it was established in 1990 as a Natural Regional Reserve named "Lake of Tarsia and Mouth of Crati".

Figure 6. The geographic map and the outlet of the Crati River.

Generally speaking, most estuaries are special areas for biodiversity conservation because in these transitional environments, at the border between land and sea, sweet and salt waters mix together giving rise to different habitats such as cane-brakes, ponds, coastal lagoons, and riparian woods [30]. So, also in the mouth of the Crati River still exists a great variety of marine and lacustrine environments, keeping a rich biodiversity to protect and value. So, the Natura 2000 network recognized in this coastal area an important ZSC, numbered IT9310044, actually characterized by 17 habitat types, representing the maximum value amongst Natura 2000 sites in Calabrian coastal regions (**Figure 7**).

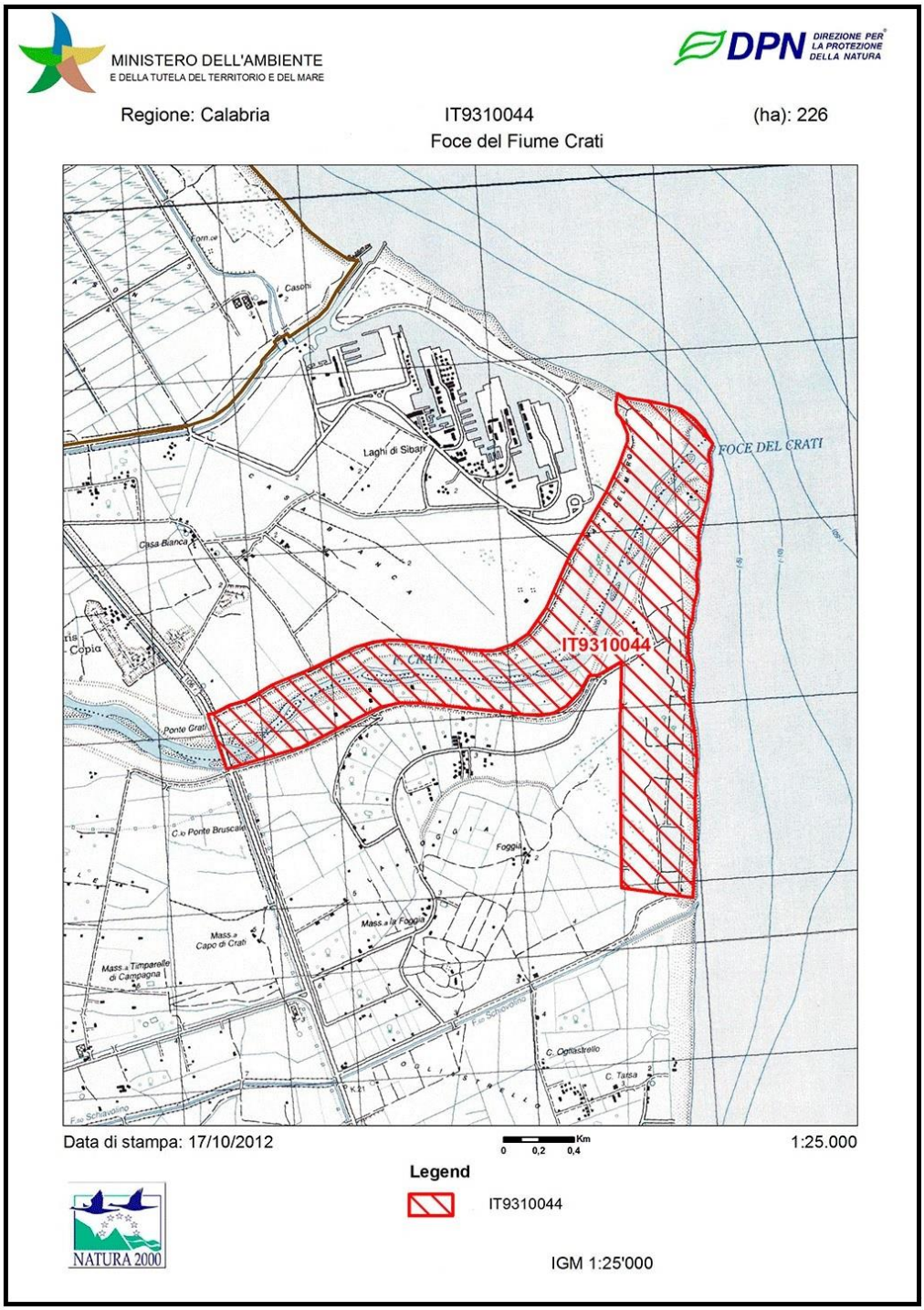

Figure 7. The form of IT931004 "mouth of Crati River" scheduled by the department of nature protection of the Italian ministry of environment.

This case study confirms the great biological and ecological importance of wetlands for biodiversity conservation, as stated in the Ramsar Convention on Wetlands in 1971 [31]. Also, in Calabria coastal regions, the most important Natura 2000 sites are located in some transition environments, such as the mouths of the Crati River (IT9310094) and the Neto River (IT9320095), holding respectively seventeen and fifteen natural habitat types.

4. Discussions

The resulting data derived from the research show the presence of 180 SAC in the whole Calabria region. However, the geographic distribution of Natura 2000 sites is very unbalanced between continental and coastal regions. In fact, 135 SAC are widespread in continental areas, as 75% of the whole, while only 25% are located in coastal regions (**Figure 8**).

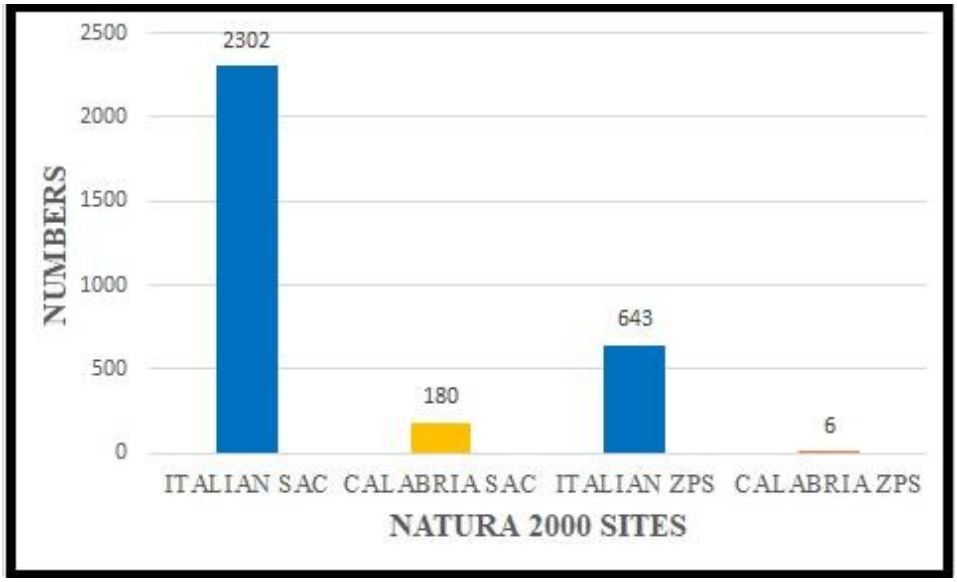

Figure 8. Natura 2000 sites distributed in different environments of the Calabria region.

In this way, the Natura 2000 network covers a lot of the Apennine ridge, but in some southern coastal zones, there is a clear lack of protected areas. In this regional landscape, between land and sea, it is possible to observe local processes of territorial fragmentation, as for instance, the continental landward between Coastal Chain and marine areas along the western seaside of the region, where it is necessary to realize a tight plot of core areas and ecological corridors. In this way, it could be possible to ensure conditions of territorial connection between the landward and seaward sides of coastal regions. However, along Calabria's coastline, marine and terrestrial ZSCs, although sharing the same principles, are still managed separately, as in other littoral areas worldwide [32]. Instead, marine ZSCs, being located in coastal regions [33], are remarkably affected by human pressures deriving from continental environments [34]. To solve these constraints, the Natura 2000 network should be, in view of its implementation, a natural infrastructure able to connect different environments from mountain to coastal areas. Finally, the right functioning of the network should be funded by financial means and policy options integrating investments with effective actions of environmental protection [35]. In this way, it is possible to maximize the benefits deriving from the implementation of the network, reducing the costs of its management [36] through a greater involvement of regional and national stakeholders for the sustainable development of coastal regions [37].

5. Conclusions

Worldwide, fragmentation is considered one of the main causes for biodiversity loss. The breaking up of natural areas occurs when they are separated into a lot of smaller patches, isolated from each other by physical barriers [38]. This process is caused by several anthropic impacts, such as the uncontrolled growth of infrastructures, industrial development, the cementation of the coastal landscape, and a huge urbanization of seaboard areas [39], leading to negative consequences on natural ecosystems [40]. Also, in Italian coastal landscapes, fragmentation can have severe effects on biodiversity levels and may lead to a growing geographical insulation of plant and faunal species, causing a lower resistance of natural habitats against human pressures [41]. So, animal and plant populations are, actually, exposed to the risk of extinction and to an increasing process of biodiversity loss [42].

The Natura 2000 network, in Calabria coastal regions, is characterized by core areas as 44 Special Areas of Conservation for the presence of some priority and natural habitats, most of which are located in coastal seawaters. Among Natura 2000 sites, there are 37 natural habitat types distributed along Tyrrhenian, Strait of Messina, and Ionian coasts. Amongst these core areas, the most representative is the outlet of the Crati River, enriched by the presence of 17 priority habitats. However, in the Calabria regional landscape, 75% of Natura 2000 sites are located in continental areas, while just 25% are concentrated in coastal regions.

In conclusion, it is hoped a new kind of integrated approach in the territorial management of the region, identifying in the Natura 2000 network the ideal tool to connect mountain and coastal regions in the same landscape unit. This innovative planning should value the interactions between mankind and terrestrial and marine resources, favoring at the same time the social and economic development of coastal people.

Acknowledgments: The author thanks Raffaele Greco, Director of the Calabria Regional Board of Marine Regional Parks (MRP) and Antonino Mancuso, as official member of MRP, for the digital images of Natura 2000 sites released by Calabria Region.

Conflict of interest: The author declares no conflict of interest.

References

1. Millenium Ecosystem Assessment. Ecosystems and human well-being: Biodiversity synthesis. Word Resources Institute; 2005.
2. Ellis EC, Gauthier N, Goldewijk KK. et al. People have shaped most of terrestrial nature for at least 12,000 years. PNAS 2021; 118(17): e2023483118.
3. Tong S, Bambrick H, Beggs PJ. Current and future threats to human health in the Anthropocene. Environment International 2022; 158: 106892.
4. Kleidon A. Sustaining the Terrestrial Biosphere in the Anthropocene: A thermodynamic Earth System Perspective. Ecology, Economy and Society-the INSEE Journal. 2023; 6(1): 53–80.
5. Yang L, Xu H, Pan S. et al. Identifying the impact of global human activities expansion on natural habitats. Journal of Cleaner Production. 2024; 484: 140247.
6. Wilson EO. The diversity of Life. Penguin Books; 1992.
7. Algeo TJ, Shen J. Theory and classification of mass extinction causation. Natural Science Review. 2024; 11(1): mwad237.

8. Barnosky A, Matzke N, Tomiya S. et al. Has the Earth's sixth mass extinction already arrived? Nature. 2011; 471: 51–57.
9. Ceballos G, Ehrlich PR, Barnosky A. Accelerated modern-induced species loss: Entering he sixth mass extinction. Science Advances. 2015; 1: e1400253.
10. Carlett RT. The ecology of plant extinction. Trends in Ecology and Evolution .2025; 40(3): 286–295.
11. Soulè ME. Conservation: Tactics for a constant crisis. Science. 1991; 253: 744–750.
12. Simberloff D. Do species-area curves predict extinction in fragmented forests? In: Whitmore TC, Sayer JA (editors). Tropical Deforestation and Species Extinction. Chapman and Hall Publishing; 1992.
13. Li W, Kang J, Wang Y. Effects of habitat fragmentation on ecosystem services and their trade-offs in Southwest China: A multi-perspective analysis. Ecological Indicators. 2024; 167: 112699.
14. Dinerstein E, Wikramanayake ED. Beyond "hotspots": How to prioritize investments to conserve biodiversity in the Indo-Pacific region. Conservation Biology. 1993; 7: 53–65.
15. Myers NR, Mittermeier C, Mittermeier G, et al. Biodiversity hotspots for conservation priorities. Nature. 2000; 403: 853–858.
16. Bennett AF. Habitat corridors at the conservation of small mammals in a fragmented forest environment. Landscape Ecology. 1990; 4; 109–122.
17. Gambino R. The dimension of the large area in land-use planning practice. In: Proceedings of town planning, Dossier 6/96, Lecce, 10–12 Ottobre 1996, Lecce, Italy, pp. 82-90.
18. Beunen R, Hagens JE. The use of the Concept of Ecological Networks in Nature Conservation policies and Planning Practices. Landscape Research. 2009; 34(5): 563–580.
19. Hilthy J, Worboys GL, Keeley A. et al. Guidelines for conserving connectivity through ecological networks and corridors. Best Practice Protected Area, IUCN Guidelines Series. 2020.
20. Hebblewhite M, Hilthy JA, Williams S et al. Can a large-landscape conservation vision contribute to acheving biodiversity targets? Conservation Science and Practice. 2021; 22(4): e588.
21. Biondi E, Casavecchia S, Pesaresi S. Habitats Directive and Conservation of Forest Biodiversity. Proceedings of the Third National Congress of Silviculture for the Improvement and Conservation of Italian Forests (Italian). In: Proceedings of the Terzo Congresso Nazionale di Selvicoltura; 16–18 October 2008; Taormina, Messina, Italy.
22. Blasi C. Bioitaly: Nature 2000 in Italy. Environmental Science, Biology. 1996; 54: 31–38.
23. Fan S, Axmacher JC, Shu H, et al. Ecological network design based on optimizing ecosystem services: Case study in the Huang-Huai region, China. Ecological Indicators. 2023; 150: 110264.
24. Gambino, R. Conservation and planning of wide area systems (Italian). In: Edicomprint (editor). Atti Convegno Nazionale WWF Italia ONG ONLUS. Ecoregioni e reti ecologiche, Roma, 27–28 Maggio. 2004; pp. 24–36.
25. Blasi C, Carranza M, Frondoni R, et al. Ecosystem classification and mapping: A proposal for Italian landscapes. Applied Vegetation Science; 2000; 4: 233–242.
26. Coastal studies. Coastal dynamics and defense, integrated coastal zone management. N. 10 (Italian). In: Nuova Grafica Fiorentina (editor). lo stato dei litorali italiani. 2006; pp. 113.
27. Caloiero D. Hydrology of the Crati Basin (Italian). In: Consiglio Nazionale delle Ricerche, IRPI, Geodata 4, Cosenza, Italia. 1975.
28. Bulgarini F. Ferroni F, Petrella S, Teofili C. Identifying strategic areas for biodiversity conservation: Application of the ecoregional methodology (Italia). Biogeographia. 2006; 27; 255–273.
29. Ramsar Convention on Wetlands. Global Wetland Outlook: State of the World's Wetlands and their Services to People. Ramsar Convention Secretariat; 2018.
30. Beck MW. The sea around: Conservation planning in marine regions. In: Groves C (editor). Drafting a Conservation Blueprint: A Practitioner's Guide for Biodiversity. Island Press; 2003; pp. 319–344.
31. Wood LJ, Fish L, Laughren J, et al. Assessing progress towards global marine protection targets: Shortfalls in information and action. Oryx. 2008; 42: 340–351.
32. Stoms DM, Davis FW, Andelman SJ, et al. Integrated coastal reserve planning: Making the land-sea connection. Frontiers in Ecology and the Environment. 2005; 3(8): 429–436.
33. Gantioler S, Rayment M, ten Brink P, et al. The costs and socio-economic benefits associated with the Natura 2000 network. International Journal Sustainable Society. 2014; 6(1/2): 135–157.

34. Alvarez-Romero J, Pressey RL, Ban NC, et al. Integrated Land-Sea Conservation Planning: The Missing Links. Annual Review of Ecology Evolution and Systematics. 2011; 42: 381–409.
35. Lukambagire I, Matovu B, Manianga A, et al. Towards a collabrative stakeholder engagement pathway to increase ocean sustainability related to marine spatial planning in developing coastal states. Environmental Challenges. 2024; 15: 100954.
36. Wilson KA, Auerbach NA, Sam K, et al. Conservation Research Is Not Happening Where It is Most Needed. PLoS Biology. 2016; 14(3): e1002413.
37. Wilson MC, Chen XY, Corlett RT, et al. Habitat fragmentation and biodiversity conservation: Key findings and future challenges. Landscape Ecology. 2016; 31: 219–227.
38. Fahrig L. Effects of habitat fragmentation on biodiversity. Annual Review of Ecology Evolution and Systematics. 2003; 34: 487–515.
39. Mullu D. A Review on the Effect of Habitat Fragmentation on Ecosystem. Journal of Natural Sciences Research. 2016; 6(15): 1–15.
40. Tomaselli G, Russo P, Ruccio L, et al. Assessment of landscape regeneration of a Natura 2000 site hosting greenhouse farming by using a dashboard of indicators. A case in Sicily through the territorial implementation of a “pilot project” at farm level. Land Use Policy. 2020; 92: 104444.
41. Cardinale B, Duffy J, Gonzalez A, et al. Biodiversity loss and its impact on humanity. Nature. 2012; 486(401): 59–67.
42. Elisha OD, Felix MJ. The loss of biodiversity and ecosystems: A threat to the functioning of our planet, economy and human society. International Journal of Economics, Environmental Development and Society. 2020; 1(1): 30–44.