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Integration of Conservation Measures Concerning Natura 2000 Sites into Marine Protected Areas Regulations: A Study Related to Sardinia

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Abstract: This study defines and discusses a spatial planning approach, which can be integrated into conservation measures, regarding the sites of the Natura 2000 Network—established under the provisions of Directive No. 92/43/EEC (the “Habitats” Directive), and Directive No. 2009/147/EC (the “Birds” Directive)—into the regulations of marine protected areas. The protected marine area of the Island of Tavolara and Cape Coda Cavallo, located in North-Eastern Sardinia (which is overlapped by a Natura 2000 Site) is the spatial context for the implementation of the proposed methodology. The comprehensive outcome of this study, that is, the implementation of the proposed spatial planning approach into regulations regarding the previously mentioned protected marine areas, is particularly relevant for the scientific and technical debate on spatial planning. This debate is related to protection of nature and natural resources, since the issue of integration of the conservation measures related to Natura 2000 Network, into regulations of protected areas, is an open question, which needs further consideration and insights.

Keywords: marine protected areas regulations; Natura 2000 Sites conservation measures; integrated coastal zone management (ICZM)

1. Introduction

Marine protected areas (MPAs) represent a fundamental point of reference regarding environmental protection-related spatial planning policies [1]. These policies are set to conserve [2,3], or re-establish [4], the integrity of ecosystems and biodiversity.

The Convention on Biological Diversity states that a protected area “means a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives” (article 2). The Strategic Plan for Biodiversity 2011–2020 [5] establishes that a minimum of 10% of marine and coastal areas should be protected under the provisions of an MPA status, and other protection rules, by 2020. Nevertheless, it has been reported that biodiversity is even declining within protected areas [6]. Indeed, this is due to direct and indirect impacts on protected areas, generated by land use transitions, which occur inside and outside their borders [2]. These changes are caused by human activity, which often entails intensive artificial uses not forbidden within protected areas [1]. Land-use transitions can often imply habitats degradation and fragmentation as a consequence of urbanization, abandonment or expansion of agricultural land, and deforestation, and, in so doing, they are one of the most dangerous factors of decrease in biodiversity [7]. Land-use changes may eventually generate a decrease in native species [8], and a parallel increase in the presence of non-native species [9]. As a consequence, MPAs should be considered social and ecological landscape elements [10], which are included into an ecosystem featured by social and ecological connections between MPAs, and their bordering areas [11].

Under this perspective, the appraisal of MPAs ability to protect biodiversity can be conceived as a core theme in scientific and technical debates [12], even because measuring the ecological effectiveness of protected areas is considered a means to enhance efficiency and strength of protection policies and to implement and facilitate appropriate measures related to MPAs management [3].

Natura 2000 Network (N2N) is a system of areas belonging to the European Union (EU) countries, which presently comprises more than 27,000 sites [13]. Natura 2000 is the core spatial system of EU policies aimed at increasing biodiversity and nature protection. Sites included in N2N (N2Ss) are selected in order to grant the conservation, in a suitable status, of valuable and/or threatened species and habitats, which may distinctively characterize the landscapes of the EU regions. These sites can be classified in two sets: (i) Sites of Community Interest (SCIs), and (ii) Special Areas of Conservation (SACs), designated under the provisions of the Habitats Directive, and Special Protection Areas (SPAs), identified with reference to the Birds Directive. The process, which leads to the establishment of N2Ss, depends on the kind of site: EU countries have to designate a sufficient number of N2Ss in order to contribute to N2N, whether these are SPAs or candidate SCIs, proposed to the European Commission (EC). The EC decides if a candidate SCI is to be included in the list of the approved SCIs, under the provision that the list is periodically updated. Finally, after six years from their designation, SCIs must get the status of SACs, once appropriate conservation measures are defined.

In order to protect habitats and species located in the N2Ss, EU Countries have to establish suitable conservation measures. These measures can be identified and coordinated in Management Plans (MPs), which can be either defined as plans not connected to others, or they can be studied as components integrated into more general regional strategies concerning spatial planning. Moreover, conservation measures may entail specific norms, which take account of ecological demand of species and habitats, related to land uses, management of sites and compromises acknowledged by public and private parties [14].

The EC does not provide systematic guidelines on the definition of MPs, but only general indications [15]. Therefore, the MPs of the N2Ss are not rigidly conservative, and rather flexible. Their planning approach is incremental and aimed at building a spatial network of N2Ss based on economic and ecological sustainability. In regards to Italy, the Decree of the President of the Republic No. 1997/357 states that the regions have to identify and to establish conservation measures, and that they can define and implement MPs as well. As a consequence, since common procedures and rules are not available, the Italian regions are taking different approaches with regard to the identification of the public administrations in charge for MPs preparation and approval.

Moreover, a relevant theoretical and technical issue, strictly related to the implementation of the methodology proposed in this study and to the outcomes concerning the regulations of the MPAs, is the multilevel governance question. Multilevel governance is an interpretive framework concerning intertwined relationships between different governmental levels (international, national, regional, local), non-governmental organizations and private enterprises and stakeholders, whose interactions need cooperation and participation, which should be preferably based on horizontal and vertical subsidiarity [16,17]. Multilevel governance processes are particularly important, regarding the European Union, and its policies concerning economic and social cohesion, nature conservation and agriculture, since they are intrinsically connected to mutual relationships between municipalities, provinces, regions and national states [18]. The integration of conservation measures concerning Natura 2000 sites into regulations of MPAs entails multilevel governance policies related to protection of nature and natural resources in the EU countries at different governance levels: At the European level, since Natura 2000 is a network established and governed by the European Commission; at the national and regional levels, since MPAs are established and governed by states and regional administrations; at the local level, since the governance of spatial planning regarding MPAs and Natura 2000 sites involves local governments (municipalities) as well [19].

The article is organized as follows. The second section describes the theoretical foundations of the proposed methodology. In the third section the methodological approach is explained and the

spatial context where it is applied is synthetically described. The fourth section shows the results of the implementation of the methodology in the spatial context of the MPA of the Island of Tavolara and Cape Coda Cavallo (MPA Tavolara), located in North-Eastern Sardinia, which is overlapped by the SCI of Islands of Tavolara, Molara and Molarotto (SCITMM). In the concluding section, the outcomes and lines for future research are discussed.

2. Theoretical Foundations

In the so-called “Brundtland Report” [20], the concepts of sustainable development and sustainability were described as a Copernican revolution for the definition and implementation of public policies, and in particular for those concerning spatial planning. Under this perspective, a crucial issue is represented by the implementation of these theoretical categories into spatial planning, or by the need to recognize their utility in effectively addressing real problems, and, in so doing, improving the quality of life related to the urban and rural settlements, and wild environments [21].

According to Zamagni [22], sustainable development is based on the defense of the right of future generations to maintain and possibly enhance their life quality as compared to the present generation's, which entails a holistic perspective which integrates environmental, economic and social profiles. The comprehensive, general narrative of sustainability, implemented into spatial planning-related sciences and disciplines, takes a specific, technical meaning, which implies its use on a case-by-case basis, as a general criterion to be taken into consideration in decision-making and policy implementation processes, and, as a consequence, in the governance of spatial planning [23].

In this conceptual framework, sustainability-oriented assessment can be identified as a general and structured approach to the definition and implementation of spatial policies, which aims at detecting and mitigating negative environmental impacts while granting a high level of local economic and social development, by means of an incremental, inclusive and participatory process [24]. From this standpoint, not only sustainability-oriented assessment is a simple and sectoral analysis, which describes the environmental impacts, due to a set of plan actions, but also, and above all, a process which goes together, and even identifies itself, with the planning decision-making and implementation process [25,26]. Moreover, sustainability assessment in spatial planning processes is not related to the appraisal of the environmental impacts of planning decisions. From this point of view, the quality and effectiveness of the decision-making processes are much more relevant. Sustainability objectives and social development-related aspects have to be integrated into spatial planning policies since the very first moments [26].

Therefore, sustainability-oriented assessment in spatial planning is intrinsically connected to the core principle that sustainability objectives have to be considered a fundamental part of the set of the planning objectives and treated as such. This implies that the assessment process identifies itself with, and is entirely integrated into, the spatial planning process. For instance, the sustainability-oriented assessment of an Regulation of the MPA (RMPA) entails, during the decision-making and planning implementation process, a continuous feedback concerning the compliance of the plan with the sustainability objectives. Such objectives are integrated into the set of the planning objectives, and should not be treated as different from the other (economic, social, etc.) goals. In other words, sustainability should not be conceived as a brake on economic and social development, or as an unfortunately-necessary and boring bad. Under this perspective, sustainability-oriented assessment and planning are based upon a kind of social critical conscience strongly related to the compliance of the plan actions with a subset of the plan objectives.

Under the provisions of the EU normative framework described in the introduction, Italy stated that the selection of SPAs and candidate SCIs is a competence of the 19 regional administrations and of the two autonomous provinces [27]. After this, a process, running over 17 years, in the Sardinian region 124 N2Ss was established, of which: (i) Ninety-three SCIs, 56 of which have recently received the status of SACs; (ii) thirty-seven SPAs [28,29].

The rules related to Italian MPAs are stated in the Regulation of the MPA (RMPA), which establishes what is allowed and forbidden in terms of uses and activities, and waivers implied by the level of environmental protection deemed necessary by the public authority [30].

A number of Sardinian N2Ss partially or totally overlap MPAs, as it occurs in other Italian and European coastal and marine regions, and, as a consequence, an important spatial and environmental planning issue arises, that is, how to make the rules concerning land and marine uses and activities related to MPAs consistent with conservation measures for habitats and species in force in the N2Ss.

This is a core question concerning environmental protection in coastal and marine areas all over the world, which is particularly relevant whenever habitats and species are threatened by human activities. The approach proposed in this study can be easily exported to other coastal and marine contexts, since the issue at stake is general and inclusive.

The approval procedure of an RMPA, which integrates conservation measures, related to the N2Ss, which overlap the MPA and rules concerning the management of the MPA (RINTMPA, from now on), is based on three consultative participatory steps. In the first step, all the public administrations and bodies involved in the RINTMPA planning process are called to a meeting by the authority responsible for the MPA management, on the basis of a preliminary scoping document. In the second step, an advanced version of the document is produced on the basis of the meeting discussion and the collection of the observations and comments proposed by the participants, after a period of time considered appropriate by the participants and agreed upon during the meeting. Finally, a draft RINTMPA is produced by the managing authority, which is proposed to the involved public authorities and the local communities. Observations and comments are collected and implemented, if possible, into the RINTMPA, which is transmitted to the Ministry of the Environment and of the Defense of the Territory and of the Sea for the final approval.

The draft versions of the RINTMPA are incrementally defined by improving the initial version through a progressive refinement of the sustainability-oriented assessment of the planning process. That being so, sustainability-oriented assessment identifies itself with the planning process, and planning and assessment are integrated into a unique course where the assessment of the plan aims almost exclusively at improving the quality of the process and its spatial governance [31,32]. Under this perspective, a fundamental and systemic technical discussion related to the methodology proposed in this study is offered by [33], who put in evidence, with reference to case studies concerning several European Countries, that sustainability-oriented assessment takes its full meaning when implemented into the decision-making phases of the planning process.

3. Methodology and Spatial Context

This section is organized as follows. In the first subsection the methodology is presented in the context of the case study discussed in the study. The methodological approach is based on the theoretical foundations discussed in the previous section. This approach implies the definition of a planning process whose backbone is represented by the sustainability objectives.

Secondly, the MPA Tavolara is synthetically described. This is the MPA targeted for the implementation of the proposed methodological approach.

3.1. Methodology

Our methodology is based on a process which entails a continuous and intertwining planning and assessment activity founded on a logical framework (LF), which identifies conceptual connections between sustainability objectives related to the spatial contexts at stake and the operational planning actions concerning the integration of conservation measures related to N2Ss into the RMPAs.

The comprehensive outcome of the implementation of our methodological approach is the definition of an RINTMPA. As shown in Figure 1, the objectives related to sustainability identified, in regards to the integration of conservation measures, N2Ss into RMPAs, should be addressed by the specific objectives and plan actions of RINTMPAs. The effectiveness of the process is based on

the quality of the information available for the assessment (see Figure 1). The objectives related to sustainability are identified regarding environmental components, which is identified with reference to the Guidelines issued by the Sardinian Region (GLs from now on) [34].

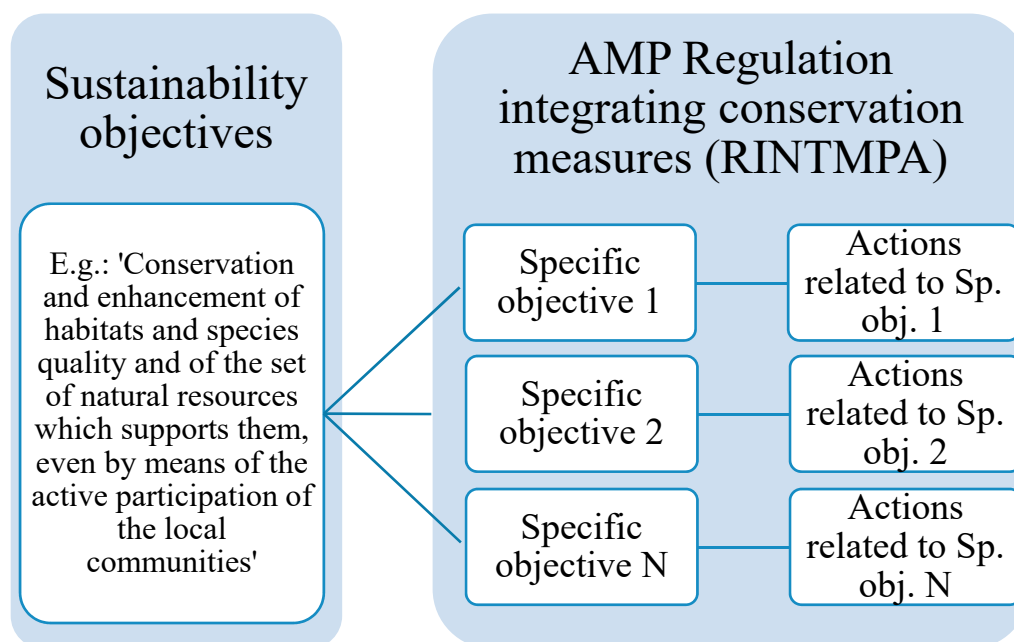


Figure 1. A scheme of the rules concerning the management of the marine protected areas (RINTMPAs) related to the process of integration [35].

In the LF proposed in Figure 1 [35], a sustainability objective concerning the RINTMPA is “Conservation and enhancement of habitats and species quality and of the set of natural resources which supports them, even by means of the active participation of the local communities.” On the basis of this objective of sustainability, the LF of Figure 1 is developed through the identification of the RINTMPA measures related to specific objectives. In order to identify actions and objectives, the LF is implemented into the definition of the RINTMPA of a Sardinian MPA.

The definition and implementation of an RINTMPA implies the integration of conservation measures related to N2Ss into the rules of an MPA. In other words, this entails the assessment of the potentially-negative impacts of plan actions concerning the specific objectives (RINTMPA) on sustainability objectives, and the consequential identification of mitigation measures.

Sustainability objectives are related to the environmental components identified on the basis of the list proposed by the GLs, adapted to the RINTMPA. The adapted list includes the following: (i) Air (quality); (ii) water resources; (iii) waste collection and recycling; (iv) soil and marine geomorphology; (v) floristic and faunistic resources, and biodiversity; (vi) landscape; (vii) settlement pattern; (viii) tourist, recreational and leisure-related activities; (ix) fishery and productive activities; (x) marine and terrestrial mobility and accessibility; (xi) sound pressure and energy.

A sustainability objective is identified on the basis of the analysis concerning an environmental component. The analysis consists of two steps. In the first place, the environmental status of the component is described by gathering and structuring the available information. Secondly, a SWOT analysis is implemented, in order to put in evidence positive and critical issues related to the environmental health of the component [36].

SWOT analysis portrays the set of relevant themes related to a spatial context by identifying, according to a systematic order, positive factors and critical conditions. As Helms and Nixon [37] and Guerel [38] put in evidence in their comprehensive reviews on SWOT analysis, there are two connected reasons to use SWOT analysis in the definition of planning strategies. On the one hand, SWOT makes

the planners' analysis transparent and, by doing so, it improves the quality of participation through a substantial increase of the public's awareness. On the other hand, it enhances the power and effectiveness of planning strategies, since public administrations and bodies can use the SWOT analysis as a dashboard to monitor the implementation of public policies and, if needed, to redefine them. The adjustment processes would be transparent, participated and traceable. According to Vonk et al. [39], knowledge sharing, identification of common needs, and public-private participatory processes are fundamental tools to implement effective policies based on opportunities at stake, regarding planning support systems.

There is a widespread and consistent literature concerning the use of SWOT analysis in the field of spatial planning oriented to conservation of nature and natural resources. Among many, it is worth quoting Comino's and Ferretti's study [40], which proposes a discussion on SWOT analysis applied to planning in spatial contexts characterized by the presence of SCIs and small villages, and Öztürk's work [41], which applies SWOT analysis to spatial planning related to the Turkish Sarikum Nature Protection Area.

Critical aspects are the points of reference to identify questions to be addressed and improved in terms of sustainability objectives, whereas strengths and opportunities are resources helpful to implement measures to pursue sustainability objectives. A set of sustainability criteria, originally designated by the EC [42], are used to better focus the objectives identified through the SWOT analysis on the sustainability paradigm [35]. These criteria are assumed as points of reference for environmental assessment by the GLs as well [43].

The ten sustainability criteria are the following: (i) minimization of the use of non-renewable resources; (ii) use of renewable resources within limits of capacity for regeneration; (iii) environmentally sound use and management of hazardous/polluting substances and wastes; (iv) conservation and enhancement of the status of wildlife, habitats and landscapes; (v) maintenance and improvement of the quality of soils and water resources; (vi) maintenance and improvement of the quality of historic and cultural resources; (vii) maintenance and improvement of the local environmental quality; (viii) protection of the atmosphere (global warming); (ix) development of environmental awareness, education and training; (x) promotion of public participation in decisions involving sustainable development.

The identified sustainability objectives are the backbone of the RINTMPA, since the integration of conservation measures related to the N2Ss, which overlap the MPAs and rules concerning the management of MPAs is implemented on fundamentals represented by the sustainability objectives.

As shown in Figure 1, there are two major steps which follow, namely the identification of specific goals which pursue the sustainability objectives, and of the actions, which must be embedded into the provisions of the RINTMPA, defined in order to achieve the specific goals.

The key issue of the LF is to identify specific objectives (first step) and related measures and policies ("plan actions" in Figure 1, second step), which are consistent with both the present RMPAs and the MPs of N2Ss, and with conservation measures entailed thereof. Our methodology addresses the two steps by analyzing the existing documents, that is RMPAs and MPs, by integrating them into a unique set of objectives (first step), and by selecting plan actions suitable to pursue such objectives (second step).

The implementation of the LF starts with the definition of a set of sustainability objectives based on information related to marine and coastal environments, habitats and species, which builds on existing studies related to RMPAs and MPs. The studies concerning the status of the environmental components have to be collected and analyzed so as to organize and systematize the knowledge thereof, and achieve suitable SWOT schemas for each environmental component, in order to define sound foundations to identify sustainability objectives [44].

Secondly, a set of specific goals, which make the objectives of RMPAs and MPs consistent with each other, has to be identified. Since RAMPs and MPs do not state their goals in terms of sustainability,

the links of their objectives to the sustainability objectives should be retrieved and made explicit through the analysis of the related documents.

Finally, a set of plan actions, which address the specific goals, made explicit through the rules of the RINTMPA, are identified, which finalize the implementation of the LF.

3.2. *The Spatial Context: The Marine Protected Area of the Island of Tavolara and Cape Coda Cavallo*

The MPA Tavolara is located in North-Eastern Sardinia, in the territory of the Province of Sassari, close to the town of Olbia, and stretches, along the coastal line, from Cape Ceraso, in the municipal area of Olbia, to Finocchi Cove and Cape Coda Cavallo, in the municipal area of San Teodoro. The MPA was established in 1997 by the a law that enacted by decree of the Ministry of the Environment on 12 December. The MPA was then amended by another law, enacted by decree of the Ministry of the Environment on 28 November 2001, to include a marine area of about 15,000 hectares and coastal strips belonging to the towns of Olbia, Loiri Porto San Paolo and San Teodoro. The three towns have constituted the Management Consortium, which obtained the EMAS certification in 2005. In 2007, the MPA Tavolara was rewarded the inclusion in the list of the Specially Protected Areas of Mediterranean Importance (SPAMI) under the provisions of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean [45], due to the endowment of natural resources.

Faunistic and floristic resources make the MPA notably interesting and attractive. In particular, half of the total number of vertebrate species present in Sardinia are represented in the MPA Tavolara, and, among them, several amphibian and reptilian species. The terrestrial area of the MPA is diversified from the geomorphological point of view, and characterized by pink granites, quartzose-feldspathic sandy beaches and karstic-dolomitic hills in Tavolara Island. Botanic resources are extraordinary as well, in terms of habitats, endemisms and flourishing Mediterranean scrub [46].

Conservation measures related to SCITMM are defined within the provisions of its MP, which was set up by the MPA Tavolara Consortium in 2014 and approved by the Decree of the Alderman of the Environment protection of the Region of Sardinia of 4 May 2016 [47].

The RMPA was approved by the Ministry of the Environment, and of the Protection of the Territory and of the Sea in 2014, through a law, enacted by decree on 3 December. The RMPA regulates all the activities and uses which are either allowed or forbidden in the three zones of the MPA Tavolara. In particular, A Zone is made subject to a strict ruling regime and the most part of public uses and activities are forbidden, whereas in the B and C Zones the ruling regime becomes gradually more flexible, with reference to: Bathing, diving, sea-watching, tourist shipping, mooring, anchoring, tourist transport and guided tours, boat renting, whale-watching, commercial, recreational and sport fishing, and rules concerning authorization procedures. The issue of biodiversity protection is addressed in article 4, but the MP of SCITMM is not mentioned, so the integration of conservation measures into the RMPA is a core question to address in order to provide the MPA with a powerful managing and planning tool, not only aiming at enhancing the rules in force to control uses and activities, but also, and above all, to implement a detailed conservation-oriented system of measures into the RMPA in order to improve biodiversity conditions through proactive protection of habitats and species.

Figure 2 shows the location of MPA Tavolara in the spatial context of Sardinia and an overlay map of the MPA and SCITMM.

4. Results

In this section the implementation of the methodology proposed above is described in order to define the RINTMPA of MPA Tavolara. The methodology unfolds in three steps, as shown in Figure 1. First, sustainability objectives are identified regarding each environmental component through SWOT analysis supported by the ten sustainability criteria. Secondly, specific objectives related to each sustainability objective are designated, which must be consistent with both the RMPA and the MP of SCITMM. This implies a careful consideration of the contents of the RMPA and the MP, since the

specific objectives are to be addressed through planning actions, which have to be made into a system of rules, which will substitute the new RINTMPA for the present RMPA (third step).

The RINTMPA is the outcome of the implementation of the three steps for each environmental component. This section discusses the three steps with reference to the fifth environmental component of the list reported in Section 3.1, that is floristic and faunistic resources, and biodiversity (FFB from now on).

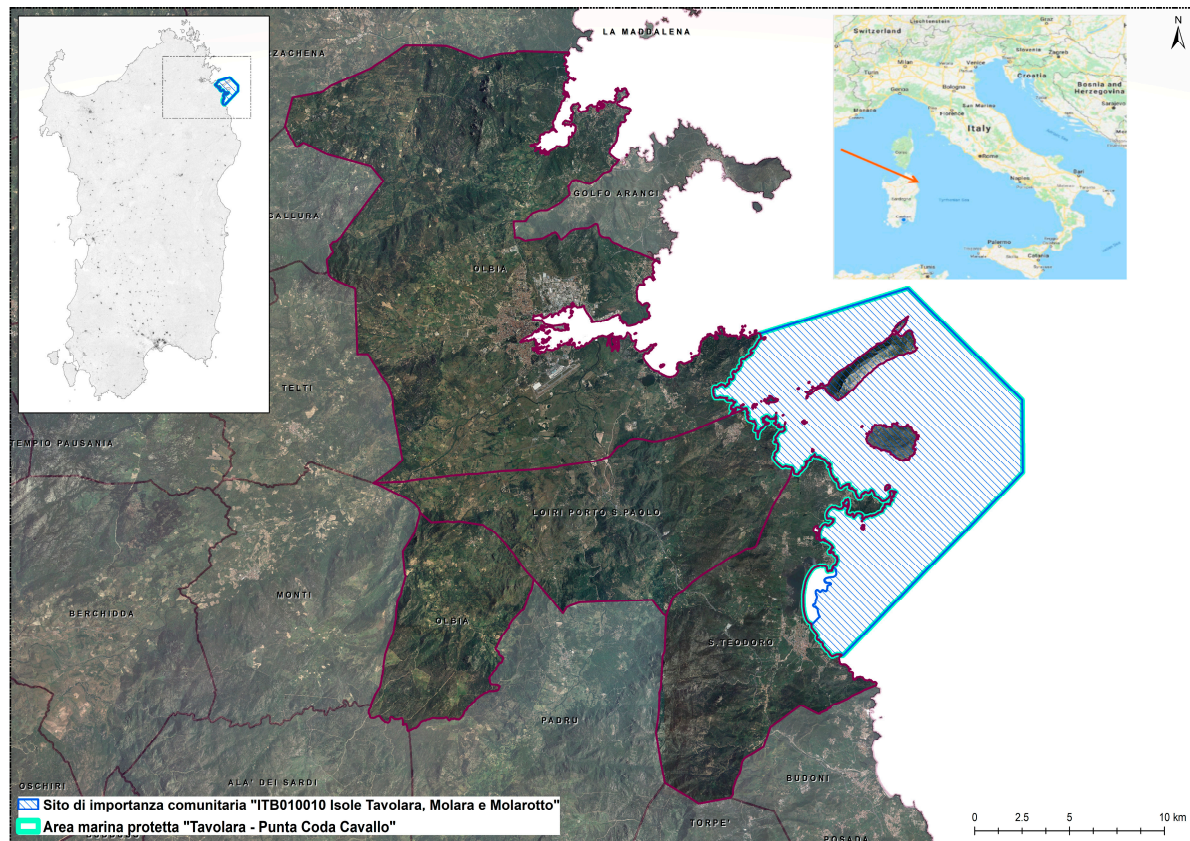


Figure 2. Overlay map of MPA Tavolara and of the Sites of Community Interest (SCI) of Tavolara, Molarra and Molarotto Islands: The boundary of MPA Tavolara is cyan colored; the blue-painted background represents the area of the SCI [48]. The arrow in the upper right image shows the location of MPA Tavolara in the spatial context of Sardinia and Italy [49].

4.1. Sustainability Objectives

Sustainability objectives are identified on the basis of a SWOT analysis implemented by means of an environmental appraisal related to a set of indicators, which characterize each environmental component. In case of FFB, it is important to put in evidence that MPA Tavolara is almost totally included into the SCITMM, which is a marine-coastal site endowed with a set of habitats of community importance and a few priority habitats. The SCI hosts a lot of internationally-relevant faunistic species protected under the provisions of the Habitats and Birds Directives. MPA Tavolara, which stretches from Cape Ceraso, in the municipal area of Olbia, to Cape Coda Cavallo, in the municipal area of San Teodoro, includes a small marine area outside the SCI and all the small islands located in front of the coastal line: Among many, Isolotto Rosso (Small Red Island), Isola Piana (Plain Island) and Isola dei Cavalli (Horses Island).

The environmental indicators characterize the following features: Habitats of community importance, on the basis of the Natura 2000 Standard Data Form (SDF) [50]; the ongoing and potential impacts generated by pressures on the habitats located in the MP; marine and transition habitats, and undersea caves, described in the SDF; the maps of marine and

transition habitats, and undersea caves, of benthic biocenoses, and of terrestrial habitats, reported in the MP; the ongoing and potential impacts generated by pressures on species of community and conservation importance, identified in the MP; and, the lists of floristic and faunistic species of community importance and other floristic and faunistic species, as reported in the SDF.

The SWOT analysis concerning FFB is proposed in Table 1, and open the way for the definition of sustainability objectives (Table 2).

Table 1. SWOT Analysis concerning the floristic and faunistic resources, and biodiversity environmental components [51].

SWOT Analysis	
Strengths	Weaknesses
<ul style="list-style-type: none"> - Presence of habitats of community and conservation importance - Presence of priority habitats - Presence of species of community and conservation importance - Presence of priority species and endemisms 	<ul style="list-style-type: none"> - Anthropic activities, which may possibly generate negative impacts on habitats - Environmental disturbances generated by anthropic activities, which cause negative impacts of different size and nature on floristic and faunistic species - Presence of antagonist species; - Presence of untamed and feral animals; - Poor awareness of biodiversity importance and of related proper behavior
Opportunities	Threats
<ul style="list-style-type: none"> - Future improvement of habitats, species, and of their conservation status - Public investment in campaigns to eliminate antagonist species - Public investment in education concerning conservation of nature and awareness-building 	<ul style="list-style-type: none"> - Negative impacts generated by climate changes - Fires - Collisions between marine species and boats - Poor awareness of the presence of habitats and species of community importance, which entails peculiar critical issues

Table 2. Sustainability objectives concerning the floristic and faunistic resources, and biodiversity environmental component [51].

Sustainability Objectives
Conservation and improvement of habitats, species, and of the supporting natural resources, even though the promotion of proactive participation of the local communities
Mitigation of the impacts on habitats and species generated by anthropic activities and monitoring of environmental pollution coming from different sources.

As shown in Table 2, the sustainability objectives implied by the SWOT analysis concerning FFB are related to two aspects. The first sustainability objective entails protection of habitats and species and, if possible, future improvement of their conservation status, which are consistent with the fourth, fifth and seventh criteria reported in Section 3.1 (iv. conservation and enhancement of the status of wildlife, habitats and landscapes; v. maintenance and improvement of the quality of soils and water resources; vii. maintenance and improvement of the local environmental quality). Under this perspective, participation and involvement of the local societies into environmental management processes take an important role, which is consistent with the ninth and tenth sustainability criteria indicated in Section 3.1 (development of environmental awareness, education and training and promotion of public participation in decisions involving sustainable development). The second sustainability objective reported in Table 2 concerns environmental impacts caused by human activities, and the identification of suitable mitigation measures. This question is strictly related to energy saving and increased production from renewable energy sources, which are consistent with the first and second sustainability criteria, and with the third criterion (environmentally sound use and management of hazardous/polluting substances and wastes). In conclusion, six out of ten sustainability criteria

support the two sustainability objectives. This highlights that the holistic approach to sustainability, proposed by the EC, through the ten criteria [42], which are considerably represented by the identified sustainability objectives.

Indeed, the identified sustainability objectives are the backbone of the sustainability-oriented assessment of the planning process of the RINTMPA, which unfolds in the second step, that is the specific objectives.

4.2. Specific Objectives

The identification of specific objectives is based on the analysis of the planning instruments whose provisions are integrated into the RINTMPA, namely the RMPA of MPA Tavolara and the MP of SCITMM. Moreover, two important protocols are taken into account as sources of specific objectives which, either directly or indirectly, add substantially to the LF, that is the ICZM (integrated coastal zone management) Protocol and the standardized management plan, defined in the context of the ISEA Project (ISEAMP) [45,52,53]. ICZM states objectives, which should be considered in setting coastal zone management policies regardless of the location of coastal areas, whereas ISEAMP was specifically related to the area of MPA Tavolara. A sample of specific objectives of the RINTMPA related to FFB is reported in Table 3.

Table 3. A sample of the RINTMPA specific objectives related to FFB (floristic and faunistic resources, and biodiversity), based on the integration of RMPA, MP of SCITMM (SCI of Islands of Tavolara, Molarà and Molarotto), ISEAMP (ISEA management plan), and ICZM (integrated coastal zone management) [51].

Specific Objectives
1. Protection and conservation of habitats of community importance and of terrestrial and marine faunistic and floristic species
2. Integration of environmental protection needs into the MPA management rules and into uses allowed in the public maritime domain
3. Effective and sustainable implementation of tourist and recreational activities under the provisions of the rules in force in each Zone of MPA Tavolara and related code of conduct

The first objective embeds and integrates the strategies of RMPA, MP, ICZM and ISEAMP: By contributing to the monitoring activity concerning habitats and species of community importance under the provisions of the Habitats Directive (RMPA); by preserving the dunal habitats and species along the sandy seashores the coralligenous habitat n. 1170 and, in particular, the facies named “coralligenous”, and by promoting long-run conservation of the SCITMM integrity, in terms of habitats and species (MP); by protecting wetlands and estuaries, marine habitats, coastal forests and dunes (ICZM and ISEAMP).

The second objective entails the integration of: The RMPA strategy concerning biodiversity of the coastal and marine ecosystems, treatment of the *Posidonia oceanica* plants deposited on the beaches, and protection of biochemical characteristics of air and marine waters; the MP and ICZM strategies related to habitats and species of community importance; the ISEAMP strategy aimed at preserving dunal ecosystems and restoring damaged fences protecting dunal areas. Finally, the third objective implies the integration of: The RMPA and ICZM strategies related to the management of tourism and tourist activities, which take place along the seashore and in the maritime public domain, and the cooperation with local municipalities, which participate in the MPA Tavolara Consortium; the MP’s long-run conservation strategy of the SCITMM concerning the integrity of habitats and species, which entails an adequately-ruled tourist activity and proper use of natural resources; the ISEAMP-supported definition and implementation of a general plan and regulation concerning mooring and anchoring of tourist boats.

The integration of objectives related to different instruments aims at gathering approaches concerning several planning issues and points of view, which may eventually result in management operations and rules inconsistent with each other in the absence of proper coordination.

In the case of MPA Tavolara, four instruments are considered, whose aim and scope are quite different from each other. The RMPA is essentially a set of rules, which establish what is permitted or forbidden with reference to the three types of zones identified in the MPA, whereas the MP concerns the protection of habitats and species under the provisions of the Habitats and Birds Directives. The only regulatory profile of the MP is that it is the environment-related basis to implement the appropriate assessment of plans and projects. In other words, MPs do not state any directly binding rules, whereas the RMPA and the future RINTMPA are, intrinsically, systems of rules. Indeed, the Habitats Directive establishes that “[a]ny plan or project not directly connected with or necessary to the management of the site, but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives” (article 6, paragraph 3). Furthermore, it states that “[t]he competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.”

Nevertheless, in the short, medium and long run, the future of the MPA depends heavily on the adequate implementation of the RMPA and MP, and their mutual consistency should be ensured in order to maximize their positive impacts, not only in terms of environmental quality, but also with reference to local economic and social development and, ultimately, to quality of life. Once the RMPA and MP goals are made consistent with each other and integrated into common specific objectives, it is quite straightforward to identify goals related to ICZM and ISEAMP, which match such objectives. For example, specific objective 1 of Table 3 (Protection and conservation of habitats of community importance and of terrestrial and marine faunistic and floristic species) is generated on the basis of an objective of the RMPA and four objectives of the MP; two objectives coming from the ICZM and the ISEAMP help to better focus the integration of the RMPA- and MP-derived objectives into the definition of the first objective reported in Table 3. The same procedure is used to identify objectives 2 and 3.

4.3. Actions of the RINTMPA

The actions are the operations identified in the RMPA, in the MP and in the ISEAMP (the ICZM states issues to be addressed rather than rules or operations) supporting the specific objectives of the RINTMPA, which are eventually used to set up the system of rules of the RINTMPA.

In general, the actions of the RINTMPA can be related to five categories: Regulation; environmental monitoring; awareness raising/information/education; coastal and marine surveillance; and inter-institutional coordination. The operations entailed by the first category are related to RMPA and MP, whereas the actions concerning the second and third categories address specific objectives of RMPA, MP and ISEAMP; the issue of inter-institutional coordination is mainly connected to the provisions of ICZM.

The RINTMPA will translate into a set of rules the operations, which address the specific objectives. As a consequence, the strategic project defined by the integration of the objectives of RMPA, MP, ISEAMP and ICZM will be implemented into a unique and consistent planning and ruling instrument.

The following paragraphs discuss the most outstanding operations related to the specific objectives described in Section 4.2.

4.3.1. Operations Related to Protection and Conservation of Habitats of Community Importance and of Terrestrial and Marine Faunistic and Floristic Species

Protection, conservation and enhancement of terrestrial habitats of community importance and species imply the continuous conservation and enhancement of dunal systems, where the terrestrial habitats of community importance of MPA Tavolara are identified [54]. The spatial planning operations related to dunal systems consist of building and maintenance of protection fences and barriers, maintenance and improvement of the local network of footpaths and cycle tracks, and setting-up and organization of the beach access points and pathways. From this point of view, particular attention is needed by the treatment of *Posidonia oceanica* marine plants deposited on the sandy beaches. These deposits should be stored at selected locations and brought back to the sea once the tourist season has ended, since the life-cycle of *P. oceanica* is very important for the quality of the marine and coastal ecosystems.

Another very important operation of the RINTMPA to achieve the first specific objective regards the eradication of invasive alien plants and animals, which threaten habitats of community importance and the survival of protected native species. The MPA Tavolara Consortium has recently implemented a campaign to uproot the black rat, which ravages the nests of the shearwater puffinus, a protected marine bird species, and devours the nestlings.

Moreover, proper land cover is needed to conserve and protect terrestrial habitats, especially in the retrodunal areas. Important renaturalization campaigns implemented by the MPA Tavolara Consortium are ongoing in order to substitute alien vegetable species for native species. An important and longlasting campaign aims at substituting *Carpobrotus acinaciformis* (Hottentot fig) for *Rouya polygama*, *Brassica insularis*, *Centaurea horrida* and *Linaria flava* [55], which are typical and protected native plant species of the dunal and retrodunal environments of MPA Tavolara.

Finally, it has to be highlighted the importance of awareness-building campaigns to collect abandoned wastes and to claim polluted areas within the MPA, with particular reference to the seashore and the dunal areas.

4.3.2. Operations Related to Integration of Environmental Protection Needs into the MPA Management Rules and into Uses Allowed in the Public Maritime Domain

The central issue related to this specific objective is the definition of a zoning layout to regulate maritime concessions along the seashores. Control of pathways to access and of the number of people who are allowed to access the seashore and the dunal areas is fundamental in order to protect habitats of community importance, and animals and plants targeted for conservation under the rules of the Natura 2000 Network. Pathways and dunal and retrodunal areas, especially along the seashore of the municipalities of Olbia, Loiri Porto San Paolo and San Teodoro, are managed by private enterprises under the provisions of concessions released by the MPA Tavolara Consortium. The concessions state rules concerning the accessibility and the maintenance of the seashore and of dunal and retrodunal areas and related pathways and parking lots. Moreover, they define how the enterprises entitled to concessions have to implement control on the number of people who access the areas. The identification of parking lots, gateways and accessible parts of the seashore, dunal and retrodunal areas, is strictly related to the assessment of the carrying capacity of the protected coastal habitats, animals and plants, that is, of the coastal and marine ecosystems. In other words, the zoning layout of the RINTMPA is based on the carrying capacity assessment of the coastal spatial context.

4.3.3. Operations Related to the Effective and Sustainable Implementation of Tourist and Recreational Activities under the Provisions of the Rules in Force in Each Zone of the MPA Tavolara and Related Code of Conduct

The third specific objective focuses on the management of the marine context of MPA Tavolara, with specific reference to management of tourism and tourist activities. The RINTMPA defines a zoning layout of the marine context, which is organized in three zones (A, B and C, see Section 3.2). The only

areas accessible to tourists are located in the B and C zones. The marine spatial context is directly managed by the MPA Tavolara Consortium. The administrative staff of the MPA operationalizes the rules of the RINTMPA by assessing the seawater and seabed quality and by implementing the RINTMPA into the organization and control of bathing and diving activities, guided tours, sea-watching and fishing activities.

5. Discussion and Conclusions

The study of spatial governance processes concerning the integration of conservation measures of MPs into regulations of MPAs, which is being implemented in the Sardinian region, puts in evidence that the sustainability paradigm can be effectively included into the processes only through a systemic approach related to the definition of RINTMPAs objectives. In this framework, sustainability objectives are the leading references, as it has been discussed regarding the RINTMPA of MPA Tavolara. Indeed, a sustainability-related LF is used to improve the quality of the process concerning the definition of the RINTMPA of MPA Tavolara, which is based on a detailed and analytical dialectic comparison between sustainability objectives and other goals expressed by public and private stakeholders and planning instruments in force, which may possibly relate to social and economic expectations concerning local and regional development. The LF proposed in this study is opposed to planning approaches, which are based on widespread bonds on land uses, possibly extending over large spatial districts, which may eventually prevent the local societies from projecting new spatial organizations aiming at catalyzing urban and regional economic and social development.

Under this perspective, sustainability objectives are the backbone of the RINTMPAs strategic framework and of the rules generated thereof. These rules represent the outcome of an innovative planning process based on dialectic comparison and integration of heterogeneous expectations and goals coming from different stakeholders, e.g., public and private agencies, institutions and bodies, rather than generated by spatially-undifferentiated bonds.

Three general issues have to be addressed in order to operationalize the LF proposed in this study into the processes concerning the definition and implementation of RINTMPAs. Firstly, it has to be noticed that a weak inter-institutional cooperation characterizes the ongoing processes of definition of new regulations (RINTMPAs), which integrate conservation measures of N2Ss into the present RMPAs. The RINTMPA is approved by the Ministry of the Environment and of the Defense of the Territory and of the Sea, whereas conservation measures are stated by the regional administrations, and, in case of Sardinia, they are established within the MPs of the N2Ss.

Moreover, as stressed above, MPs are implemented through a set of conservation rules and policies, specifically related to habitats and species, which are not directly prescriptive. The integration of conservation measures into RMPAs, which would generate RINTMPAs, would need a strong cooperative effort on behalf of the Sardinian regional administration and the national Ministry of the Environment, which is far from being implemented in the proper way. The methodological and technical approach applied to the case study of MPA Tavolara is helpful and effective in identifying virtuous cooperative practices, based on the sustainability paradigm implemented into the planning process of the RINTMPA through the LF.

Secondly, our study puts in evidence that normative guidelines are needed, which should state the formal definition and implementation of the planning process related to the RINTMPA, which should be based on an LF whose backbone is represented by a set of sustainability objectives identified through the environmental and SWOT analyses proposed in the fourth section. Planning processes, which develop within sustainability-based environmental assessment procedures, are entirely consistent with a consolidated theoretical and technical literature on strategic environmental assessment [25,33]. Planning processes based on environmental assessment are participatory procedures, which imply cooperation of the involved public bodies (e.g., the Sardinian regional administration and the national Ministry of the Environment), and, by doing so, they improve the quality of the plans and the quality of the governance of the implementation of sustainability-oriented public policies.

A third important issue concerns the territorial scale of planning processes related to RINTMPAs. Indeed, there are questions, such as road infrastructure and protection of ecological corridors belonging to the regional Natura 2000 network, which involve, at the same time, municipalities managing building permits related to the municipal land, the MPA Consortium and the Sardinian regional administration, which is responsible for the implementation of the conservation measures within N2Ss. This observation shows that, particularly in case of MPAs, which overlap areas belonging to small municipalities, such as the MPA Tavolara, processes aimed at defining RINTMPAs must be implemented at the subregional or regional levels, rather than at the local (municipal) level. Indeed, the involvement of several municipal administrations and local communities would imply economies of scale in terms of reduced costs of environmental studies and the chance to spread public participation and awareness on the issues of sustainability and protection of environmental resources over a larger set of potential stakeholders [56].

A major value added entailed by the implementation of the methodology proposed in this study is represented by the learning processes generated by participation in policy-making related to the involvement of a number of public administrations in a vertically-integrated virtuous planning cooperative governance.

The learning process, which entails planning cooperation, is strictly related to the issue of multilevel governance mentioned in the Introduction. Under this perspective, a contribution quite relevant to interpret the outcomes proposed in this study is offered by Homsy et al. [57], who identify five factors characterizing virtuous multilevel governance processes. First, a coordinating authority should be established, whose ruling role should be recognized by all the participating stakeholders. Secondly, each stakeholder should be endowed with the operational capacity necessary to pursue his objectives and tasks in the context of the multilevel governance process at stake. Moreover, each actor should cooperate so as to produce shared knowledge-building processes, which each stakeholder takes advantage from. Finally, the local societies are called to participate in the multilevel governance processes, not only because the outcomes are likely to generate important impacts on them, but also since participation is likely to improve significantly the quality of the processes. The five factors can be straightforwardly identified in the outcomes of this study. First, the current legislation establishes that the RINTMPA planning process has to be coordinated by the MPA Tavolara Consortium, whose director is designated by the National Ministry of the Environment and of the Protection of the Territory and of the Sea [30]. The integration of conservation measures of Natura 2000 sites into the MPA regulations implies a relevant coordination effort from the involved public administrations and bodies, which complies with the second factor. Consistently with the third and fourth factors, the quality of the resulting governance system depends on the effectiveness of this effort, which involves, as described in the Introduction, the European Commission, national and regional governments, and municipalities, as in the case of the MPA Tavolara Consortium, which is managed by three municipalities (Olbia, Loiri Porto San Paolo and San Teodoro). Indeed, each stakeholder contributes to and takes advantage from, the multilevel planning process related to the RINTMPA.

Consistently with the Homsy et al.'s theoretical framework [57], the national Ministry of the Environment and of the Defense of the Territory and of the Sea, regional administrations, provinces, municipalities and the involved local societies learn, by doing, how to integrate their planning efforts to maximize the final product, that is, the RINTMPA. Learning processes can be traced back from the preliminary scoping meetings and related draft documents to the final version of a RINTMPA. Continuous enhancements in the quality of planning proposals, of public participation and of cooperative expertise characterize the progressive development of the RINTMPA drafts, and the experience learned by the involvement in the process governance remains forever as a permanent asset of local societies, and public administrations and bodies.

The strength of the process, which includes and integrates a strategic environmental stepwise assessment approach, is based on the implementation of the sustainability paradigm into each step of the planning/assessment procedure, and on the progressive improvement of the involvement and

participation of public administrations and bodies, and of stakeholders of the local communities, which can be recognized through the planning achievements.

This community-learning-oriented, progressive and maieutic feature is based on an LF, which can be easily exported to other national and international coastal and marine contexts, characterized by the simultaneous presence of MPAs and other protected areas, e.g., N2Ss, whose administrations decide to cooperate in order to integrate provisions and rules concerning different protected areas into a unique planning and regulatory instrument, such as an RINTMPA. The LF builds upon the sustainability objectives, the leading references of the planning process, which develops through a progressive assessment of specific objectives, which are deemed to effectively address the sustainability objectives through appropriate plan actions. In other words, the specific objectives are appraised in accordance with the sustainability-based backbone of the LF and plan actions are assessed with reference to specific objectives, and, ultimately, regarding the sustainability objectives connected thereof.

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