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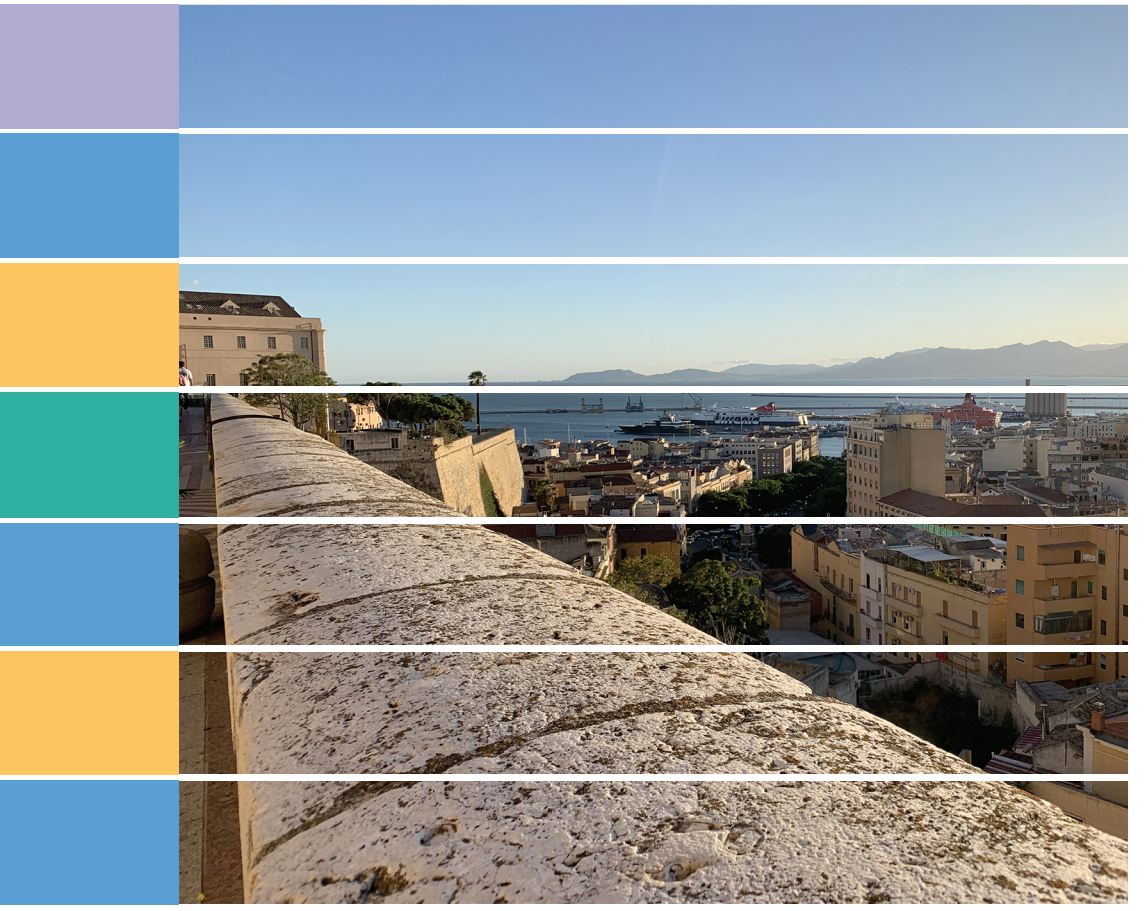

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ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6
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Carmela Gargiulo Corrado Zoppi

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Planning, Nature and Ecosystem Services

INPUT aCAdemy 2019

Conference proceedings

Federico II Open Access University Press

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La cooperazione al cuore del Mediterraneo

Planning, nature and ecosystem services / editors Carmela Gargiulo, Corrado Zoppi - Napoli: FedOAPress. 2019 - (Smart City, Urban Planning for a Sustainable Future. 5).

Web link:
http://www.tema.unina.it/index.php/tema/Monographs

ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6

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Università degli Studi di Napoli Federico II
Centro di Ateneo per le Biblioteche "Roberto Pettorino"
Piazza Bellini 59-60 - 80138 Napoli, Italy
http://www.fedoapress.unina.it

Published in Italy
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Cover and graphic project: TeMA*Lab*

This book collects the papers presented at INPUT aCAdemy 2019, a special edition of the INPUT Conference hosted by the Department of Civil and Environmental Engineering, and Architecture (DICAAR) of the University of Cagliari.

INPUT aCAdemy Conference will focus on contemporary planning issues with particular attention to ecosystem services, green and blue infrastructure and governance and management of Natura 2000 sites and coastal marine areas.

INPUT aCAdemy 2019 is organized within the GIREPAM Project (Integrated Management of Ecological Networks through Parks and Marine Areas), co-funded by the European Regional Development Fund (ERDF) in relation to the 2014-2020 Interreg Italy – France (Maritime) Programme.

INPUT aCAdemy 2019 is supported by Società Italiana degli Urbanisti (SIU, the Italian Society of Spatial Planners), Istituto Nazionale di Urbanistica (INU, the Italian National Institute of Urban Planning), UrbIng Ricerca Scientifica (the Association of Spatial Planning Scholars of the Italian Schools of Engineering) and Ordine degli Ingegneri di Cagliari (OIC, Professional Association of Engineers of Cagliari).

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This book is the most recent scientific contribution of the "Smart City, Urban Planning for a Sustainable Future" Book Series, dedicated to the collection of research e-books, published by FedOAPress - Federico II Open Access University Press. The volume contains the scientific contributions presented at the INPUT aCAdemy 2019 Conference. In detail, this publication, including 92 papers grouped in 11 sessions, for a total of 1056 pages, has been edited by some members of the Editorial Staff of "TeMA Journal", here listed in alphabetical order:

- Rosaria Battarra;
- Gerardo Carpentieri;
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- Rosa Morosini;
- Floriana Zucaro.

The most heartfelt thanks go to these young and more experienced colleagues for the hard work done in these months. A final word of thanks goes to Professor Roberto Delle Donne, Director of the CAB - Center for Libraries "Roberto Pettorino" of the University of Naples Federico II, for his active availability and the constant support also shown in this last publication.

Rocco Papa
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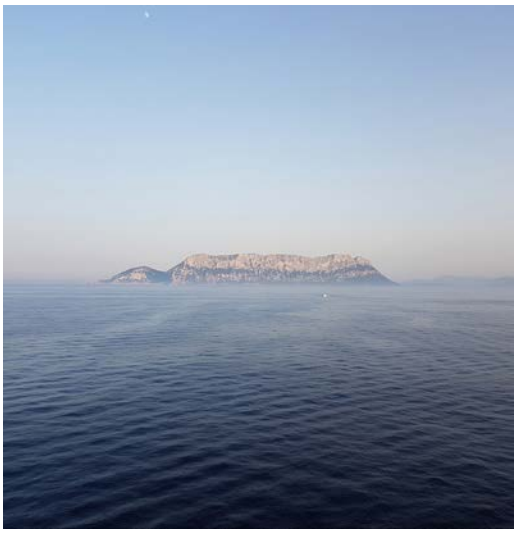

A METHODOLOGICAL APPROACH TO BUILD A PLANNING ENVIRONMENTAL ASSESSMENT FRAMEWORK IN THE CONTEXT OF MARINE PROTECTED AREAS

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How to cite item in APA format:
Cannas, I. & Ruggeri, D. (2019). A methodological approach to build a planning environmental assessment framework in the context of marine protected areas. In C. Gargiulo & C. Zoppi (Eds.), *Planning, nature and ecosystem services* (pp. 152-164). Naples: FedOAPress. ISBN: 978-88-6887-054-6, doi: 10.6093/978-88-6887-054.6

ABSTRACT

In the last years, issues concerning the environmental protection of marine-coastal protected areas have become a crucial part in policies related to coasts and sea. In Italy, marine protected areas are established by the laws n. 979 of 1982 and n. 394 of 1991, through a ministerial decree where the areas to be protected are named and defined, and objectives and protection disciplines for marine ecosystems are declared. Marine protected areas need to be managed through regulations based on institutional goals aiming at preserving the biodiversity of the marine ecosystem, and promoting the use of natural resources, also through experiences based on sustainable development. The regulation of marine protected areas often overlaps with additional levels of protection coming from planning and management tools referring to different regulatory tools (e.g. the overlap of marine protected areas with the sites of the Natura 2000 network) and, sometimes, to different territorial contexts. This overlap requires a holistic system to integrate all planning issues of the environment and the territory. This condition entails the creation of a cognitive level taking into account relations of the marine-coastal context with the surrounding territorial systems, with particular regard to transition boundaries. Approaches should be able to support territorial policies concerning interactions between human and nature dimensions. This paper proposes a study concerning the definition of a methodology structure to build an analytical-cognitive environmental framework to be integrated into planning processes related to marine protected areas.

KEYWORDS
Environmental Assessment; Protected Areas; Spatial Planning

1 INTRODUCTION

In coastal landscape, high-value areas are often affected by high anthropic pressure (Benoit & Comeau, 2005). The implementation of systemic approaches to improve the development and practice of territorial policies, aimed at the peaceful coexistence of human and nature dimensions, is crucial in planning. In marine-coastal contexts, the need for socio-economic development and environmental protection requires to balance conservation and development practices, taking into account natural and cultural factors.

Since the year 1960, critical processes causing the degradation of natural capital in marine-coastal contexts were already known: the persistent extension of coastal urbanization, the pollution of coastal marine waters, the artificialization of beach areas and wetlands, and the consumption of land agriculture, the abandonment of rural areas and settled inland areas (Salizzoni, 2012).

The marine environment constitutes a precious heritage that can support marine ecosystem services demand (Rosales, 2018). The preservation of marine ecosystems should be supported by the implementation of thematic strategies.

The Marine Strategy Framework Directive (Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy) suggests implementing in protected areas ecosystem-based approaches to manage human activities that may induce impact on the marine environment. In order to guarantee the sustainable use of marine goods and services for future generations, pressures caused by human activities should be contained within compatible levels of "good environmental conditions" and the ability of marine ecosystems to cope with human-induced changes.

In this paper, the authors suggest the definition of a methodology aimed at implementing an environmental cognitive framework as a crucial point to integrate planning processes in marine-coastal areas with particular reference to marine protected areas. Currently, this methodology has been implemented in the context of the definition of the regulation of the Marine Protected Area of "Tavolara-Punta Coda Cavallo", in Sardinia (Italy), characterised by the overlapping of some Natura 2000 sites.

This cognitive framework enables to include environmental, cultural and socio-economic aspects, by implementing an environmental assessment aimed at defining environmental sustainability objectives oriented both to the protection and the conservation of natural heritage, and cultural, social and scientific development. This conceptual scheme can effectively and dynamically address a holistic planning process characterized by management paradigms towards responsible uses of resources.

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DOI: 10.6093/978-88-6887-054-6
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2 THE METHODOLOGICAL APPROACH TO DEFINE AN ENVIRONMENTAL ASSESSMENT FRAMEWORK

The safeguard of marine protected areas is an important issue in several scientific types of research (Douvere & Ehler, 2009; Garmendia et al., 2017; Hogg et al., 2018; Paltriguera et al., 2018) and policies to protect coasts and sea.

Rules of protected areas often overlap with additional planning and management tools established by different regulations set defined by different protection levels and objectives (e.g. marine protected areas may overlap with sites of the Natura 2000 network and/or regional or national parks). Therefore, this overlapping determines that a holistic system is required to integrate environmental issues into spatial planning, through a knowledge framework taking into account the interaction between the marine context and the coastal context, with particular regards to the transition boundaries, combining, in turn, the local protection with widespread protection. In these contexts, integrated management should be designed to simple logic of protection and conservation, in order to assume a complex structure where the implementation of all phases activates a set of competencies, requiring moments of continuous control and arrangements in the definition of the methods to implement strategies (Addis et al., 2011).

In order to support the governance in this integration of overlapping rules in spatial planning, a framework of the environmental state, aimed at defining environmental sustainability objectives, is strictly required. The methodological proposal concerns the implementation of a framework where the environmental dimension is disaggregated and expressed by the knowledge of a detailed environmental assessment analysis, that consists in examining, qualitatively and/or quantitatively, a set of environmental elements representing a series of information on the state of natural resources and pressures exerted by anthropic and/or productive factors. In this way, environmental criticalities may be detected, and peculiarities of the context can be highlighted.

2.1 THE STRUCTURE OF THE ENVIRONMENTAL ANALYSIS

The environmental analysis proposed in this paper consists of a hierarchical structure (Fig. 1): the environmental elements are identified in the context to be analysed; in turn, the complexity of these elements is divided into specific themes; further, these themes are subdivided into quantifiable or qualifiable specific aspects to be evaluated by proper indicators.

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DOI: 10.6093/978-88-6887-054-6
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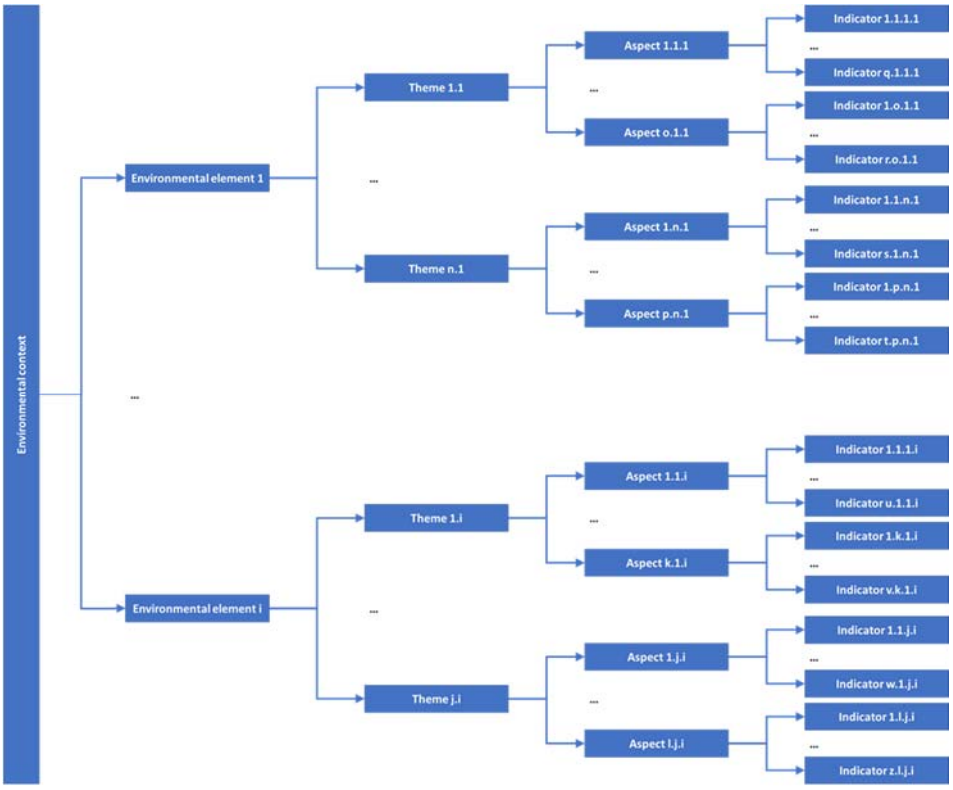

Fig. 1 The hierarchical structure of the environmental analysis. Source: elaboration of the authors

The environmental analysis, therefore, represents a tool able to make understandable complex phenomena not immediately perceptible. It can be structured by specific analysis forms, one for each environmental element of the context.

These analysis forms provide a synoptic framework of the environmental state, by reading the environment through a rational analysis of the context (SWOT[1] analysis), in order to address the definition of objectives concerning the environmental sustainability by including key sustainability criteria[2].

[1] Acronym of: Strengths, Weaknesses, Opportunities, Threats.

[2] For example, the key sustainability criteria as defined in "A Handbook on Environmental Assessment of Regional Development Plans and EU Structural Funds programmes" of the European Commission, available at: http://ec.europa.eu/environment/archives/eia/sea-guidelines/handbook.htm.

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The declination of the environmental elements

A given environmental dimension may be subdivided into several environmental elements which are specifically chosen by analysing the complex system of the context. ISPRA (2017a, 2017b) suggests useful ways to implement a proper environmental analysis by using specific set of environmental elements and their indicators in spatial planning fields.
Specifically, in a marine protected area, significative environmental elements, that should involve all main terrestrial and marine characteristics of the complex context, can be resumed as following: air; water; flora, fauna and biodiversity; soil and marine geomorphology; landscape; settlement structure; waste; touristic, recreational and educational activities; fishing and other productive activities; marine and terrestrial mobility and accessibility; energy and noise. In turn, the environmental elements can be characterized in a more detailed analytical framework, as shown in Tab.1.

Environmental elements	Themes	Aspects	Indicators
Air	Air quality	Pollution sources	Pollutant value (e.g. NO_x, CO_x, So_x, O_3, …)
	Weather and climate conditions	Temperature	Average temperature trends
			Air temperature
			Solar radiation
			Isohyets
			Relative humidity
			Atmospheric pressure
		Wind	Main directions
			Intensity
Water	Marine waters	Hygienic and bathing conditions	Bathing quality sampling
			Transparency
			Temperature
			Salinity
			Levels of dissolved contaminants (e.g. P, PO_4^{3-}, N, NO_x, NH_3, SiO_4, …)
			Main directions of waves
			Average wave height
			Sea conditions
			Colifecal bacteria
	Surface waters and groundwaters	Natural sources	Sources number
		Physical, chemical and	Quality parameters (ph, O_2, turbidity, conductivity, ...)

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Environmental elements	Themes	Aspects	Indicators
		hygienic conditions	Chlorophyll and phytoplankton
			Levels of dissolved contaminants (e.g. P, PO_4^{3-}, N, NO_x, NH_3, SiO_4, …)
			Colifecal bacteria
	Water supply network	Physical and chemical conditions of drinking water	Quality parameters (ph, O_2, turbidity, conductivity, ...)
		Wastewater treatments	Purification plant (number and general characteristics)
Flora, fauna and biodiversity	Habitats of community interest	Marine and transition habitats and submerged caves	Number of marine and transition habitat and submerged caves
			Total surface of marine and transition habitat and submerged caves
			Number of priority marine and transition habitat and submerged caves
			Total surface of priority marine and transition habitat and submerged caves
			Maps of marine habitat
			Maps of marine-benthic biocenosis
		Terrestrial habitats	Number of terrestrial habitats
			Total surface of terrestrial habitats
			Number of priority terrestrial habitats
			Total surface of priority terrestrial habitats
			Maps of terrestrial habitats
	Species of community and conservation interest	Flora of community interest	Number of species
			Number of priority species
		Other floristic species	Number of other floristic species
			Number of other floristic endemic species
		Fauna of community interest	Number of species
			Number of priority species
		Other faunistic species	Number of other fauna species
			Number of other fauna endemic species
Soil and marine geomorphology	Geologic and geomorphologic characterization	Terrestrial geology and geomorphology	Geological and geomorphological maps
		Marine geology and geomorphology	Geological and geomorphological maps
		Active and potential	Coastal erosion
			Hydraulic hazard and risk

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Environmental elements	Themes	Aspects	Indicators
		phenomena of coastal erosion and hydrogeological instability	Landslide hazard and risk
		Bathymetry	Maps
	Land use and cover	Land use and land cover inventory	Maps and surface of land use and land cover
Landscape	Characterization of identity and landscape heritage	Identity heritage	Maps and numbers of elements
		Landscape heritage	Maps and numbers of landscape elements
			Maps and numbers of cultural elements
	Characterization of environmental landscape heritage	Natural areas	Maps and surface
		Seminatural areas	Maps and surface
		Areas for agroforestry use	Maps and surface
		Environmental landscape heritage	Maps, surface and number of punctual elements
	Submarine landscape	Natural elements	Maps and number
		Historic-cultural elements	Maps and number
Settlement structure	Administrative-territorial characterization	Buildings and administrative characterisation	Maps of building distribution
		Zoning of the marine protected area	Zoning maps
		Forecast of the coastal plan	Maps of littoral activities
		Properties and concessions	Maps and surface of permissions
	Socio-economic characterization	Demography	Population density
			Resident population
			Population trend
		Economy	Income
			Employment rate
			Unemployment rate
			Youth unemployment rate
Waste	Production	Produced waste	Total undifferentiated waste produced
			Total urban waste produced
		Abandoned waste	Typology

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Environmental elements	Themes	Aspects	Indicators
	Collection	Management of the marine context	Collection plant and their services
			Number and distribution of eco-centres
			Boating services
		Management of the terrestrial context	Number and distribution of eco-centres
			Services typology
Touristic, recreational and educational activities	Hospitality	Hospitality activities	Number and typology of hospitality activities
		Touristic flow	Touristic flow trend
	Attractiveness	Services	Number and typology of tourist services (e.g. diving, …)
			Number of hygienic services in the beaches
			Areas equipped for dogs
		Organisation of cultural, educational and sport events	Number of InfoPoint
			Number, typology and period
Fishing and other productive activities	Fishing activities	Local fishing	Typology of fish caught
			Number of boats used for fishing activities
			Linked industry (e.g. business volume, number of employees, …)
			Catch distribution in the supply chain
			Distribution and typology of fishing pressure
		Sport and recreational fishing	Number of sport and recreational events
			Typology of sport and recreational events
			Typology and number authorisations
			Distribution and typology of fishing pressure
	Other productive activities	Agriculture and breeding	Characterization of land units by agricultural use
			Characterization of agricultural units by type of farming
		Other sectors	Characterization by sectors and employees in local units
Marine and terrestrial mobility and accessibility	Terrestrial mobility and accessibility	Vehicle presence	Quantity and typology
		Paths	Distribution, type and characteristics of footpaths and driveways
		Accessibility services	Distribution, typology and characteristics
	Marine mobility and accessibility	Vehicle presence	Quantity and typology
		Sailing routes	Distribution, typology and characteristics of allowed routes
		Boating and accessibility services	Distribution, typology and characteristics

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DOI: 10.6093/978-88-6887-054-6
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Environmental elements	Themes	Aspects	Indicators
		Passenger transport	Number of access
Energy and noise	Energy	Energy supply and consumption	Production
			Consumption
	Noise	Noise sources	Emissions localisation and intensity

Tab. 1 The environmental elements of the context in marine protected areas declined in themes, aspects and indicators. Source: elaboration of the authors

2.2 THE ANALYSIS FORMS

An analysis form for each environmental element is filled in a proper way (as shown in Tab. 2). The purpose of the analysis form is to recapitulate in a schematic way all information found in the environmental context, in order to refer a SWOT analysis. The integration of key sustainability criteria addresses the definition of environmental sustainability objectives with proper reference to the analysed environmental element. The analysis form is organised into sections as specified as following. The introductory section qualitatively describes the environmental element, declaring all themes to be analysed in the complexity of the context. Afterward, for each theme, specific aspects are identified in reference to the environmental element; they quantify or qualify the analysis through proper indicators. These indicators can be useful tools communicating environmental issues. They have the function to simplify complex environmental issues and to make measurable environmental and policy progress (Stanners et al., 2007). These identified indicators can be used, subsequently, also as an analytical basis for the definition of a further environmental monitoring plan.

2.3 THE DEFINITION OF ENVIRONMENTAL SUSTAINABILITY OBJECTIVES

Effective and positive integration of environmental issues into planning processes, promoting the environment as a vehicle for development, provides a declination of sustainability according to its three "fundamental pillars" (Karrer & Fidanza, 2010). The model of sustainability that predominates thinking is composed of the social, economic, and environmental pillars (Stanners et al., 2007). The objectives of environmental sustainability are the key to the integration of environmental sustainability issues into the planning processes. The definition of the objectives for each environmental element follows the flow chart of Fig. 2. Firstly, once the framework of the environmental analysis is completed, the context is characterised by the SWOT analysis, that means that the context can be read

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DOI: 10.6093/978-88-6887-054-6
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through its criticalities, endogenous and exogenous (weaknesses and threats), and its peculiarities, also endogenous and exogenous (strengths and opportunities). In this way, a preliminary strategy which, by mitigating the risks, through strengths and opportunities, can solve any weaknesses.

Environmental element h
[This is a general section where the environmental element is qualitatively described with reference to the planning context; the themes of the environmental element are declared, and, for each theme, specific aspects and their proper indicators are shown]
Theme i
[This is the specific section to describe each theme related to the environmental element]
Aspect j
[This is the section to describe each aspect of the theme of the environmental element]
Indicator k
[This is the section where the indicators describe, in a qualitative and/or quantitative way, each aspect of the theme of the environmental element, specifying source and reference period of data]

SWOT analysis	
Strengths • … • …	Weaknesses • … • …
Opportunities • … • …	Threats • … • …

Environmental sustainability objectives	Key sustainability criteria
ES_Ob_1 - … … ES_Ob_n - …	• … • …

Tab. 2 The structure of the environmental analysis form of the environmental elements.

Source: elaboration of the authors

However, this strategy is contextualised by the concepts of sustainability by using the key sustainability criteria; the strategy is stated through one or more sustainability objectives. These defined objectives can address the decision-making process towards sustainable and effective planning.

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DOI: 10.6093/978-88-6887-054-6
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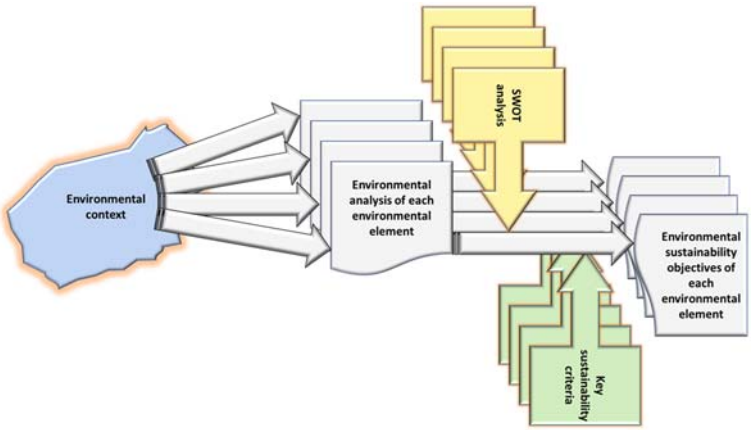

Fig. 2 The flow diagram for the definition of environmental sustainability objectives.
Source: elaboration of the authors

3 CONCLUSIONS

The presence of marine protected areas brings, in the territory, benefits from the socio-economic point of view (Rosales, 2018). However, in the world, biodiversity in the marine-coastal systems is in continuous decline as a result of uncoordinated and unsustainable human activities (Douvere & Ehler, 2009). Planning approaches of marine-coastal contexts, characterised by overlapping government tools and different levels of protection, have to be effectively addressed towards environmental sustainability objectives, through operative paradigms, characterising decision-making processes and integrating it with management aimed at the responsible use of resources. In this paper, the crucial importance of the environmental analysis framework is highlighted, including the physical, chemical, ecological, cultural, socio-economic and development aspects, and aimed at the contextual formulation of environmental sustainability objectives. In particular, the proposed methodology to assess a marine context is proposed by the implementation of a knowledge framework declined in environmental elements, themes, aspects and indicators.

This implementation of basic knowledge, organised in an environmental analysis framework, in addition of a preliminary planning phase, supports the assessment of the environmental effects, eventually determined by the implementation of the planning system, by defining environmental sustainability objectives.

The proposed evaluation scheme aims to ensure that human activities are compatible with sustainable development, respecting the regenerative capacities of ecosystems and resources, safeguarding biodiversity and a socio-economic growth perspective.

ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6
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ACKNOWLEDGEMENTS

The study is proposed in the research project under the Convention between the DICAAR and the Autonomous Region of Sardinia, Department of Defense of the Environment, aimed at achieving the objectives of the project "GIREPAM Integrated Management of Ecological Networks through Parks and Protected Marine Areas" funded under the INTERREG Maritime Program Italy-France Maritime 2014-2020, Axis II, Scientific coordinator: Corrado Zoppi.
This paper is the result of the research of the authors, who have jointly collaborated in its conception and drafting.

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ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6
© 2019, FedoaPress

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ISBN: 978-88-6887-054-6
DOI: 10.6093/978-88-6887-054-6
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ISBN:978-88-6887-054-6
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