

Article

Marine Protected Areas Management in the Mediterranean Sea—The Case of Croatia

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Abstract: Marine protected areas (MPAs) are widely used tools to conserve marine ecosystems and their services. They are complex socio-ecological systems where human activities and nature interact. Croatia has 409 protected areas, of which 19 are coastal-marine. The aim of this paper is to analyze the management model of MPAs in Croatia and to identify their strengths and weaknesses. For this purpose, three MPAs have been chosen: Brijuni National Park, Telašćica Nature Park, and Pakleni Islands Significant Landscape. The methodology used assesses 26 specific indicators to analyze the status of 4 key factors: management body, planning subprocess, public participation, and implementation subprocess. The results of this evaluation are 5 possible scenarios: proactive (1), learning (2), interactive (3), centralized (4), and formal (5) management. The results show that Brijuni presents a proactive scenario (1), Telašćica an interactive scenario (3), and Pakleni Islands a centralized scenario (4). A series of measures are presented, which can improve the score. In general, MPA management in Croatia tends towards a proactive model, where the management body is its greatest strength. There is a shift from a top-down to a bottom-up approach, which implies a greater involvement of the population in decision-making. However, public participation is not yet fully consolidated.

Keywords: assessment; Croatia; management; marine protected area; public participation



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1. Introduction

Marine protected areas (MPAs) are widely used tools to conserve marine ecosystems and their services. They are found worldwide [1] and have proven to be a successful management instrument to conserve biodiversity [2–4], being critical for human well-being [5,6] and providing numerous benefits to society, especially related to recreation and tourism [7,8]. In recent years, they have evolved from a pristine model, where no human presence was allowed, to an ecosystem approach, where the social part is equally important as the physical–natural one [9–15].

Nowadays, MPAs are complex socio-ecological systems in which human activities and nature interact. They are typically found in coastal or coastal-marine areas, which have historically been used by fishermen and indigenous people [16–18]. In fact, only 1.18% of MPAs are found in international waters [19]. This means that their creation and management directly affect the activities and behavior of populations living along the coast, making it necessary to reconcile the use and exploitation of resources with conservation.

MPAs can have different degrees of protection and/or use of sites and their resources. Generally, benefits for local communities and general population, and for biodiversity, tend to be greater as the degree of protection increases [20–22]. However, results are not always obvious or immediate. Sometimes, local people are limited in their access to resources after declaration, and this can lead to conflict or lack of support and respect for regulations [23]. Nonetheless, MPAs are fundamental to the economic and social well-being of the population.

Therefore, conservation of ecosystems and their resources must be addressed together with the communities that use these spaces. In fact, several authors consider social acceptance as the main indicator to measure the success of an MPA [24–27]. Nowadays, not only is the inclusion of the population in the use and enjoyment of resources being contemplated, but there is an increasing trend towards a participatory management model, in which society has the tools to influence decision-making [11,28].

Another notable problem is that many of the current MPAs do not have management plans and are not being adequately managed [9]. Sometimes, the only protection they receive is designation as a protected area, but without appropriate human and financial resources, biodiversity conservation is not ensured. This leads to poor management and, in the worst cases, to so-called “paper parks”, i.e., areas that have been designated as protected, but in practice receive no management at all [29–31]. Appropriate management that is adaptive and ensures the sustainable and equitable use of ecosystems and their services is needed.

For all these reasons, the improvement of management and the development of different tools to help managers to exercise a more participative management and to monitor progress are being promoted. To analyze how management actions and components are doing, and to identify strengths and weaknesses, a management assessment is a very useful element. Numerous frameworks consider this as an integral step because it makes it possible to receive feedback that facilitates decision-making and error correction [32,33]. It does not only mean observing problems but also identifying and analyzing those aspects that are being done well, in order to provide the necessary information for decision-making by area managers [34]. Different methodologies exist to evaluate management [35–43]. However, there is a lack of internal analysis of the management body itself and of the MPA management model.

Croatia is extremely rich in terms of landscape and favorable climate and has a great biological diversity. It has 409 protected areas, of which 19 are coastal-marine. The system of protected areas nationally designated covers approximately 1.04% of the sea, although the Croatian part of the Natura 2000 network includes 8.79% of the marine area [44]. The Nature Protection Act ensures the conservation of the natural environment. It provides for nine categories of protected areas that correspond, as far as possible, to one of the internationally recognized IUCN categories. National and nature parks are designated by the Parliament, strict and special reserves by the Government, and the other categories by the county assemblies and the Zagreb City Assembly. This Act provides for public participation and access to designation acts [45]. Protected areas are managed by Public Institutions, whose main function is the protection, maintenance, and promotion of protected areas, and monitoring compliance with regulations.

The aim of the paper is to analyze the management model of MPAs in Croatia and to identify strengths and weaknesses. For this purpose, three MPAs with different protection statuses have been chosen: Brijuni National Park, Telašćica Nature Park (both managed at national level) and Pakleni Islands (significant landscape managed by Split-Dalmatia County) (Figure 1a). These three cases studies account for 2.48% of Croatia’s protected coastal and marine area.

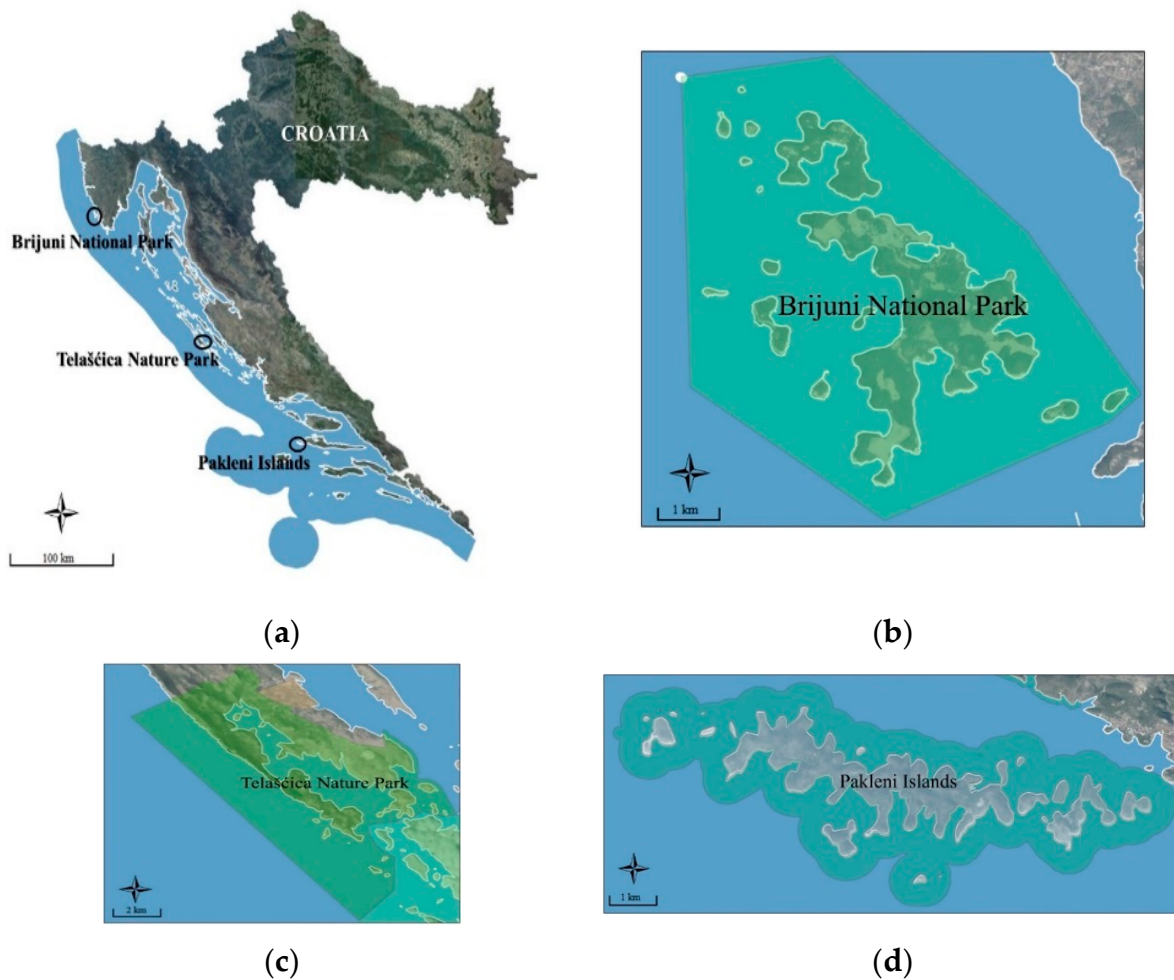


Figure 1. (a) Map of Croatia showing the location of the three study areas; (b) Map of Brijuni National Park; (c) Map of Telašćica Nature Park; (d) Map of Pakleni Islands Significant Landscape.

2. Materials and Methods

2.1. Study Areas

2.1.1. Brijuni National Park

Brijuni National Park (Figure 1b) consists of 14 islands, islets, and cliffs located along the western coast of Istria. It was declared a national park and memorial site on 1 November 1983 by the National Parks Act and the Brijuni Memorial Site. It has almost 47 km of coastline and is 3395.0 ha, of which 2651.7 are marine [46]. It was declared thanks to its geomorphological–hydrological, climatic, and landscape characteristics, together with the flora, fauna, and its unique cultural heritage. In 2021, it was awarded the Blue Park prize for achieving the highest scientific standards of marine life protection and management.

As with all national parks in Croatia, commercial fishing around Brijuni is prohibited. There are no population centers in the national park. As some islands are very close to the mainland and local people have always enjoyed the right to fish, today the Public Institution still issues permit for recreational fishing around two islands. However, there is significant pressure on fish stocks in and beyond the boundaries of the Park, and the establishment of a buffer zone around the current park boundaries is under consideration.

2.1.2. Telašćica Nature Park

Telašćica Nature Park (Figure 1c) was designated as such in 1988 with the separation from Kornati National Park, of which it was a part of from 1980 to 1988. Telašćica obtained the status of a protected area thanks to its fauna and flora, geological and geomorphological phenomena, diverse seabed communities, and archaeological heritage. Three basic units

represent the fundamental characteristics of this area: the bay of Telašćica, the cliffs of Dugi Otok, and the salt lake “Mir”. The total area of the nature park is 70.50 km², with 25.95 km² in Dugi Otok and the islets, and 44.55 km² in the sea [47].

On Long Island there are 2873 inhabitants (according to the Census of Population, Households and Dwellings. Republic of Croatia: Central Bureau of Statistics, 2011). The population works in tourism, agriculture, or fishing, although a survey conducted in 2010 revealed public concern about the state of fish stocks. Respondents pointed out that there have been changes in the community due to the emigration of young people from the island and reduced quality of life due to inability to find employment and insufficient cultural offer [48].

Fishing activities in Nature Parks in Croatia are regulated through the Fisheries Act with no differences in size and type of fishing gear outside and inside protected areas. Only recreational fishing has been regulated since July 2018. Specific (more restricted) regulations are just about to be developed and adopted.

2.1.3. Pakleni Islands Significant Landscape

Pakleni Islands (Figure 1d) are an archipelago of 19 islands and islets declared “significant landscape” in 1968 for their complex geography of 634.38 ha. The underwater environments surrounding the islands are part of the European ecological network Natura 2000 and were chosen with the aim of preserving *Posidonia oceanica* beds, reefs with established algal and coral biocenoses, infralittoral sands, mudflats, and sandflats not covered by seawater at low tide and sea caves. They are managed by the “More i Krš” Institution, under the County of Split-Dalmatia.

On the nearest inhabited island, Hvar, there are 11,077 inhabitants, while on the larger island, Sv. Klement, there are three villages that are only occasionally inhabited [49]. Tourism is one of the main sources of income for the communities. Many are engaged in agriculture, animal husbandry, or fishing.

2.2. Methodology

The methodology used to analyze the management of Pakleni Islands, Telašćica Nature Park, and Brijuni National Park has been applied before in Azores Marine Park [50] and in three national parks of Costa Rica [51]. It has a social perspective that is based on the analysis of two fundamental elements: processes and people involved. The steps to be taken are as follows.

2.2.1. Step 1. Selection of Key Management Aspects

Four management aspects were identified as key. Key aspects are those of a transversal nature that also encompass different elements. These are: management body, planning sub-process, public participation, and implementation sub-process. Based on the methodologies developed by the World Database of Protected Areas (WDPA), these four aspects have been chosen because, in a first approach, we aim to cover the whole process of planning and execution, and the people involved in the management: the managers and stakeholders.

2.2.2. Step 2. Identification of Specific Indicators

A series of specific indicators were selected for each aspect. An indicator is a specific, observable, and measurable characteristic that can be used to show the status of an aspect of management. In this case, indicators are in question format. This resulted in 26 indicators (Table 1), which were chosen based on the literature reviewed and on our expert criteria. Some of them were developed by the authors, while others were adapted from other methodologies. Table 2 shows the general themes that were drawn from these sources.

Table 1. Indicators for MPA management analysis.

Key Management Aspect	Indicator	Evaluation
Management Body	1. Background of the staff	1 Without basic training or education.
		2 Higher education: only natural sciences.
		3 Higher education: multidisciplinary team (natural and social sciences)
	2. Technical training offered to staff	1 No, or sporadically.
		2 Yes.
		3 It also anticipates future needs.
	3. MPA staff participation in the planning processes	1 No.
		2 Sporadic.
		3 In all planning processes.
	4. MPA staff have the necessary procedures to participate in the planning processes	1 No.
		2 It has some procedures, sometimes insufficient.
		3 Yes.
	5. Cooperation with other institutions at the local level	1 No.
		2 Not with all institutions or not on a regular basis.
		3 It exists on a regular basis with all institutions.
	6. Cooperation with other institutions at the regional level	1 No.
		2 Not with all institutions or not on a regular basis.
		3 It exists on a regular basis with all institutions.
	7. Cooperation with other institutions at the international level	1 No.
		2 Not on a regular basis.
		3 It exists on a regular basis, with a large number of institutions.
	8. Collaboration and exchange of knowledge with other international projects/programs	1 No.
		2 Not on a regular basis.
		3 It exists on a regular basis, with a large number of projects/programs.
Planning sub-process	9. Management plan	1 No.
		2 Not implemented, or only partially implemented.
		3 It exists, is updated, is fully implemented, and has an established schedule for regular reviews and updates.
	10. Strategies and management measures identified with the management objectives	1 They do not exist or are not related to the objectives.
		2 They exist partly in relation to the objectives.
		3 They exist and are completely identified with the objectives.
	11. Operational Plan	1 No.
		2 Partially implemented.
		3 Fully implemented.
	12. Ecosystem diagnosis carried out prior to the development of the management plan	1 No.
		2 Not available to interested parties.
		3 Yes, and it is published or available.
13. The MPA integrated into an MPA network	1 No.	
	2 It is in the process of being integrated.	
	3 Yes.	

Table 1. *Cont.*

Key Management Aspect	Indicator	Evaluation
Public Participation	14. Public participation in the process of developing the management plan	1 There was or is no management plan.
		2 Yes.
		3 Yes, at all stages of the development of the management plan and participation is foreseen for the evaluation of the management plan.
	15. Representative public participation in the process of developing the management plan	1 There was no management plan, it was not representative, or there is no management plan.
		2 Only the priority groups were represented.
		3 Both primary and secondary users were represented.
	16. Social actors participation in management decision making or planning processes	1 No.
		2 Through consultation
		3 Interactive participation with a direct impact on decision making
	17. Collegiate body for participation	1 No.
		2 Is not representative and/or does not function properly.
		3 It exists, it is representative, and it works properly.
	18. Communication between stakeholders and managers	1 Very little or none.
		2 Not within an established program.
		3 A communication programs is being implemented to build stakeholder support for the MPA.
	19. Sustainability education activities	1 No.
		2 Sporadically.
		3 On a regular basis and with wide participation.
	20. Volunteer or environmental communication activities	1 No.
		2 Sporadically.
		3 On a regular basis and with wide participation.
21. MPA information available to stakeholders and the general public	1 No.	
	2 Part is available upon request to the park management.	
	3 It is available on the website, available to any interested party.	
Implementation Sub-Process	22. Zoning of the MPA	1 It does not exist for the use or conservation of resources.
		2 It exists for use and conservation, but it is only partially functional or outdated.
		3 It exists updated, with measures and concrete uses for each zone.
	23. Budget allocated for the management of the MPA is adequate	1 This information is not accessible.
		2 The budget guarantees the costs of the administration and surveillance staff and the means necessary for management (vehicles, equipment, fuel, etc.).
		3 The budget also allows for other innovative activities such as: research, development, etc.
	24. Monitoring and evaluation of biophysical, socio-economic and governance indicators	1 No.
		2 It does not follow a strategy or regular collection of results, which are not systematically used for management.
		3 There is a good system of monitoring and evaluation, which is well implemented and used in adaptive management.

Table 1. *Cont.*

Key Management Aspect	Indicator	Evaluation
25. Scientific information integrated into MPA management	1	No.
	2	In some cases.
	3	It serves to evaluate and improve the management of the MPA.
26. The MPA considered a socio-ecosystem	1	No.
	2	The social system is an important factor, but the natural system is a priority.
	3	It is considered and taken into account throughout the process.

Table 2. Topics evaluated with indicators adapted from other methodologies.

Topics	Sources
Trainings	[37,38,52]
Planning tools	[52]
Management plans	[37–39,52]
Operative plans	[37,38]
Public participation	[38,52]
Collegiate bodies	[39]
Communication	[37–39,52]
Environmental education	[38,52]
Volunteer	[38]
Information	[39]
Budget	[38,52]
Monitoring	[38,52]
Scientific knowledge	[37–39]

2.2.3. Step 3. Data Collection and Assessment of Indicators: Score from 1 to 3 Points

Each of the indicators has been rated on a scale of one to three, with one being the most unfavorable situation and three the optimum. Although using these options is a simple representation, it covers the entire spectrum of responses, from a negative assessment of the indicator to an optimal situation, passing through an intermediate state. This system facilitates responses and future proposals for improvement. For each indicator, each of the ranges has been specified to identify what “optimal state” means.

To respond to the indicators, several sources of information have been used, primarily interviews with the managers of the protected areas. One manager was interviewed in Brijuni and Pakleni, and three in Telašćica. Semi-structured face-to-face interviews were conducted with managers at three parks, always by the same person. These were based on a questionnaire with open-ended questions, but the conversation was allowed to bring up new topics or issues of relevance to the interviewee. The information obtained from the interviews and field observations was contrasted with the bibliographic sources to determine the score obtained for each indicator. Specifically, management plans, annual reports, technical documents, project documents, and scientific articles were analyzed. Field observations included visits to the facilities of the park administration and to the most important physical, natural, and cultural sites. Once all sources were analyzed, the score for each indicator was determined.

2.2.4. Step 4. Definition of Five Management Scenarios: Expert Criteria

Once all indicators have a value from 1 to 3, the average is calculated to find out how each of the four key aspects is valued. The different possibilities that can be found are considered, depending on the value from 1 to 3 of each of the aspects. From this combination, we have proposed five models that represent five realities, depending on four variables each (Table 3). They are ordered from the ideal situation to the least favorable as follows:

- Scenario 1: Proactive management. The team that makes up the managing body is multidisciplinary and highly trained. They collaborate and cooperate with other institutions. Participatory management is carried out where all stakeholders are represented. It is planned years ahead and possible problems are anticipated.
- Scenario 2: Learning management. All four elements have the same intermediate value; therefore, they are in a situation where they could be improved. The management body is multidisciplinary. It is planned for the medium term and is managed in response to past mistakes and successes. There is public participation, but it is not fully representative or well consolidated.
- Scenario 3: Interactive management. The management responsibility falls largely on social actors. All stakeholders are well represented and have appropriate participation mechanisms. Planning and implementation subprocesses are carried out transparently by the authorities. Awareness is high among the population.
- Scenario 4: Centralized management. The managing body is sound and multidisciplinary and functions correctly. It can belong to different scales. It has responsibility, determines the management objectives, and develops and executes the management plan. However, public participation is not very common in decision-making.
- Scenario 5: Formal management. Priority is given to short-term management. Planning is extremely static, public participation in decision-making is not carried out, nor are there evaluation mechanisms or strategic medium to long-term objectives.

Table 3. Management Scenarios.

Type of Management	Rating				Figures
	Management Body	Planning Sub-Process	Public Participation	Implementation Sub-Process	
Proactive	3	3	3	3	
Learning	2	2	2	2	

Table 3. Cont.

Type of Management	Rating				Figures
	Management Body	Planning Sub-Process	Public Participation	Implementation Sub-Process	
Interactive *	1, 2, 3	1, 2, 3	3	1, 2, 3	
Centralized	3	1, 2, 3	1, 2	1, 2, 3	
Formal **	1, 2	1, 2	1, 2	1, 2	

* Interactive management is where public participation scores the highest but at least one of the other 3 aspects does not have a score of 3. ** Formal management occurs with any combination of one and two when the total is not two.

A method of analysis and projection of reality through the construction of scenarios was used, by applying alternative (five options) and contrasted (can be compared) scenarios [50]. This is a tool for understanding the potential and limits of management. The factors that define these scenarios can change over time, and thus are images of present, future, and/or desirable situations [53,54]. Therefore, it is a proposal that allows us to understand the evolution of a management model. In addition, it can be seen whether certain specific changes (in any of the indicators) cause significant changes to the general model or not.

3. Results

Brijuni National Park scored 2.9 for the management body, 2.8 for the planning stage, 2.5 for public participation, and 2.6 for the implementation stage. With these results, the park management model is considered to resemble the proactive scenario (Figure 2a).

Telašćica Nature Park scored 2.9 for the management body, 2.6 for the planning stage, 2.5 for public participation, and 2.2 for the implementation stage. With these results, the park management model is included in the interactive scenario (Figure 2b).

Pakleni Islands scored 2.9 for the management body, 2 for the planning stage, 2.1 for public participation, and 2 for the implementation stage. With these results, the park management model falls into the centralized scenario (Figure 2c).

Figure 3 shows the assessment for each of the indicators analyzed in Brijuni National Park, Telašćica Nature Park, and Pakleni Islands Significant Landscape. Table 4 shows some details on the assessment of each of the indicators.

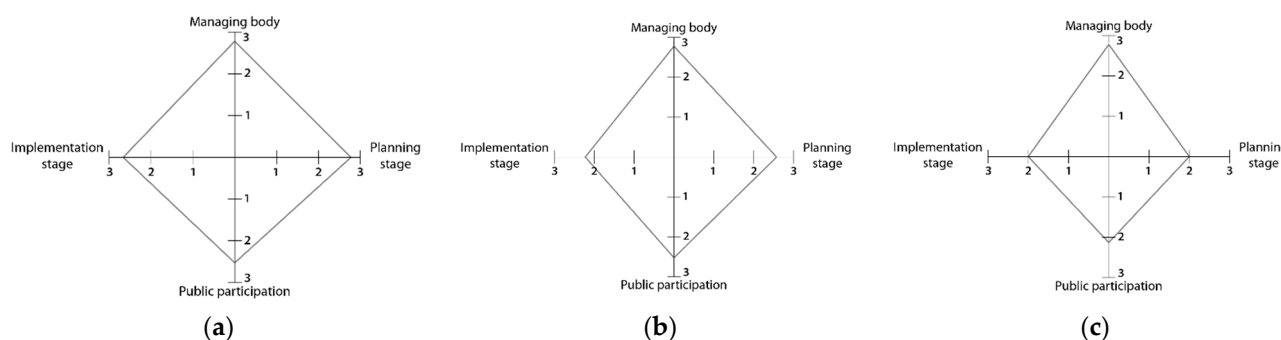


Figure 2. (a) Evaluation of the management of Brijuni National Park; (b) Evaluation of the management of Telašćica Nature Park; (c) Evaluation of the management of Pakleni Islands Significant Landscape.

Table 4. Details of the rating given to each indicator.

Key Management Aspect	Indicator	Details		
		Brijuni	Telašćica	Pakleni Islands
Management Body	1. Background of the staff	Board of 5 members, multidisciplinary, managed by the Brijuni National Park Public Institution	Board of 5 members, multidisciplinary, managed by the Public Institution of the Telašćica Nature Park	Board of 5 members, multidisciplinary, managed by the Institution More i Krš, under the County of Split-Dalmatia
	2. Technical training offered to staff	Budget is set aside, but there is no set program	Budget is set aside, but there is no set program	Budget is set aside, but there is no set program
	3. MPA staff participation in the planning processes	Yes	Yes	Yes
	4. MPA staff have the necessary procedures to participate in the planning processes	Yes	Yes	Yes
	5. Cooperation with other institutions at the local level	Yes	Yes	Yes
	6. Cooperation with other institutions at the regional level	Yes	Yes	Yes

Table 4. Cont.

Key Management Aspect	Indicator	Details		
		Brijuni	Telašćica	Pakleni Islands
	7. Cooperation with other institutions at the international level	Yes	Yes	Yes
	8 Collaboration and exchange of knowledge with other international projects/programmes	Yes, it is involved in many projects	Yes, e.g., FishMPABlue2	Yes
Planning Sub-Process	9. Management plan	Yes, valid for 10 years (2016–2025). Currently under revision. In addition to this plan, the documents that regulate the organization, use, planning, protection, and management of MPAs are the spatial plan and the internal organizational rules	Yes, valid for 10 years (2012–2021). A new one is currently being developed. In addition to this plan, the documents that regulate the organization, use, planning, protection, and management of MPAs are the spatial plan and the internal organizational rules	Under development
	10. Strategies and management measures identified with the management objectives	Yes	Yes	–
	11. Operational Plan	Yes	Yes	Yes, it has exercised the functions of the management plan so far
	12. Ecosystem diagnosis carried out prior to the development of the management plan	No, but an external analysis of the state of ecosystems was developed	No	No, but an ecosystem services assessment was developed
	13. The MPA integrated into an MPA network	Yes, national (CroMPA) and international (MedMPAnet)	Yes, national (CroMPA) and international (MedMPAnet)	Yes, national (CroMPA) and international (MedMPAnet)
	14. Public participation in the process of developing the management plan	Yes, participation was mainly through two workshops, providing phone numbers and emails for enquiries and interviewing visitors. The first was “Objectives and activities of Brijuni National Park management” and the second “Zoning of Brijuni National Park” [46]	Yes, it was the first event that included the population. The implementation of the management plan is carried out in cooperation with the Sunce Association and the MedPAN South Project [47]	Yes

Table 4. Cont.

Key Management Aspect	Indicator	Details		
		Brijuni	Telašćica	Pakleni Islands
	15. Representative public participation in the process of developing the management plan	Yes	Yes	Yes
	16. Social actors participation in management decision making or planning processes	No	Population participates in some monitoring	No
	17. Collegiate body for participation	No	For some specific aspects, such as fishing. A network has been created between fishermen, the government (Directorate of Fisheries), the park management, and WWF Adria to co-manage fisheries. The network is part of the FishMPABlue2 project	No
	18. Communication between stakeholders and managers	Yes, there is an annual marketing plan, and the park is very active on social media	Yes, there is no communication plan in place, but the park is very active on social media	There is no communication plan, but there is a telephone and email available, and annual meetings are held with the population
	19. Sustainability education activities	Yes	Yes	Yes. Some initiatives are mobile applications to identify invasive species or illegal activities
	20. Volunteer or environmental communication activities	Yes	Yes, but there are areas where more information panels and routes are needed. An information point is under construction	Yes
	21. MPA information available to stakeholders and the general public	Yes	Yes	As it is managed at County level, the website and social media are shared with the rest of the More I Krš protected areas, and information about this particular area is more limited to the public, although it is available on request

Table 4. Cont.

Key Management Aspect	Indicator	Details		
		Brijuni	Telašćica	Pakleni Islands
Implementation Sub-Process	22. Zoning of the MPA	Yes, but there is a gap between the management plan and the spatial plan	Yes, but there are no powers to manage it. A new internal regulation is currently being developed that will give authority to the park	No. There is only one habitat map. Zoning is not mandatory for this protection category
	23. Budget allocated for the management of the MPA is adequate	It has sufficient budget for basic management, but not for the full implementation of projects and all the necessary staff. It has attracted attention for its sustainable financing strategy, which includes a concession program for tourism activities that was used to achieve conservation objectives. The SARS-CoV pandemic has significantly affected the Croatian economy	It has sufficient budget for basic management, but not for the full implementation of projects and all the necessary staff. The SARS-CoV pandemic has considerably affected the Croatian economy	It has sufficient budget for basic management, but not for the full implementation of projects and all the necessary staff. The SARS-CoV pandemic has considerably affected the Croatian economy
	24. Monitoring and evaluation of biophysical, socio-economic, and governance indicators	When there are projects. Biophysical and socio-cultural indicators	When there are projects. Biophysical indicators	When there are projects. Biophysical indicators
	25. Scientific information integrated into MPA management	Yes. Several databases have been created, for example one on marine habitats, cultural heritage sites from prehistoric times to the 20th century, and geological–paleontological sites of interest	For example, the analysis of metal concentrations in water is serving as a basis for delimiting the carrying capacity of anchored vessels and is about to be determined on land [47]. A database on the fishing situation in the marine part of the park would be needed, which is planned	Yes
	26. The MPA considered a socio-ecosystem	Yes	In process	In process

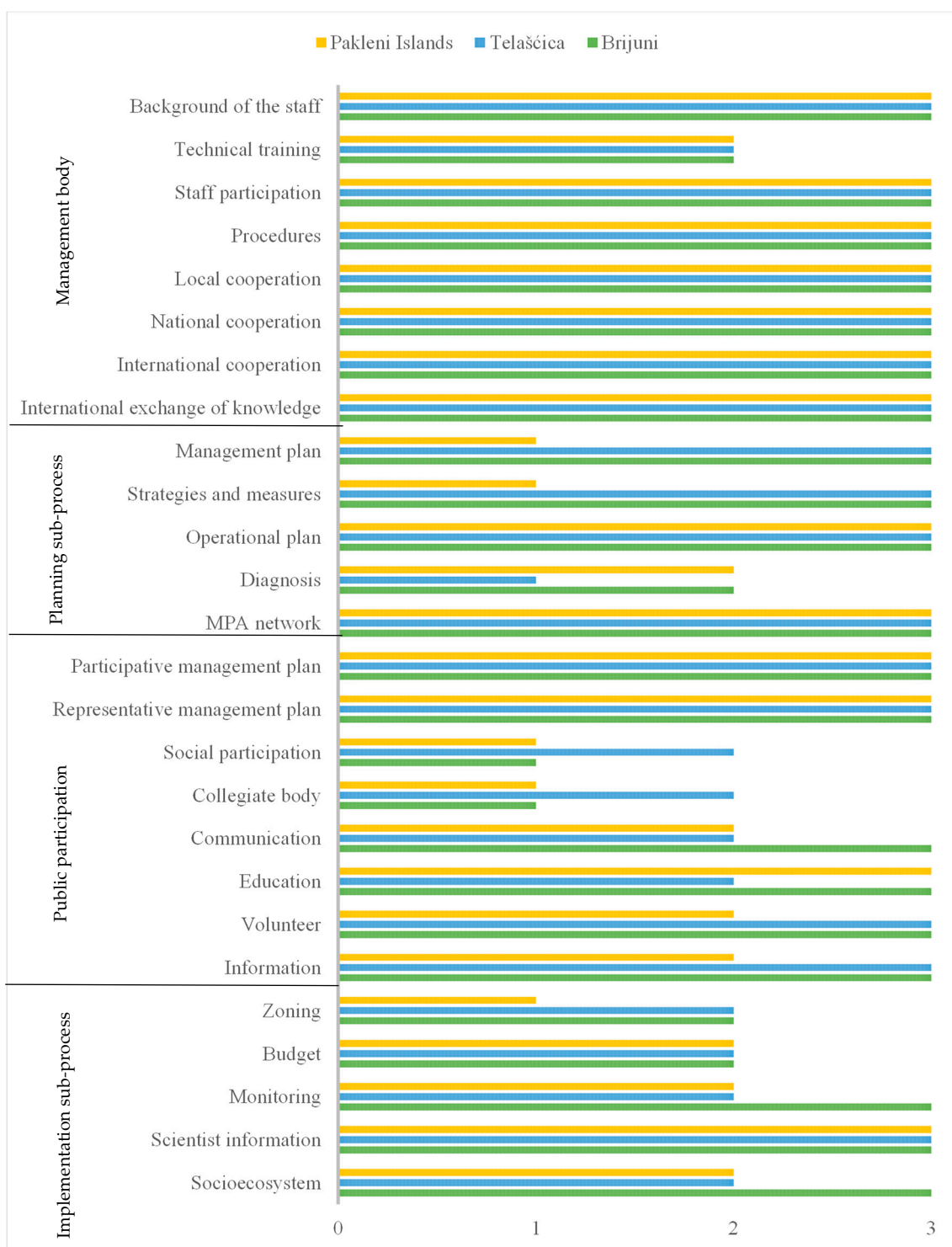


Figure 3. Assessment of indicators.

4. Discussion

All parks have almost the highest score (2.9) for the management body, showing that it is one of the greatest strengths of the Croatian protected area system. This is similar in other European countries, such as France and the UK [55]. Appropriate training of MPA managers or technicians should be multidisciplinary. In Croatia, each park has a Management Board, which is responsible for adopting the management plan and annual plans, drawing up a financial plan and managing the accounts [46]. In addition, it has an

expert service, with specialized university training, which advises the Board in making decisions that have a direct impact on the biophysical systems. Therefore, the parks have a multidisciplinary team that allows them to approach management with an ecosystem approach, which is necessary to reconcile the protection of ecosystems and their services with the economic development of local populations [56,57].

There is no doubt that capacity building is fundamental to successfully addressing management of protected spaces. Van der Molen [58] argues that conflict resolution and working towards a sustainable relationship between environment and society is a multifaceted process that encompasses different forms of capacity building. The three MPAs provide for staff training based on current priorities and specific needs. However, there is no established training plan as such, and the responsibility and initiative lie with the employee himself/herself. Nevertheless, an analysis of the annual reports shows a high level of staff involvement, as many multidisciplinary courses are held each year. At the more operational levels, there is compulsory training to enable them to carry out certain activities. The absence of a regulated training program is a shortcoming observed in other MPAs around the world, such as Costa Rica [51], even though they manage their resources adequately.

In the Mediterranean, MPAs are generally understaffed (Brijuni is an exception) or have staff with no experience in management, conservation, and planning [59], making capacity building programs very useful. Di Carlo et al. [59] identified 250 training opportunities related or applicable to MPA management in the Mediterranean, provided over the past five years by 51 national and international organizations. Of these, only four were extensive courses covering the full range of management topics. Most of them are one-time courses and do not belong to any regular training program. With a few exceptions, only online courses are available on a continuous basis and can be taken at any time. However, MPA staff may change (new staff joining and requiring training) or face emerging problems and needs, so mechanisms need to be put in place to ensure that knowledge remains with the managing body and MPA staff and is continuously updated. Examples of ways to overcome this problem are the creation of learning networks, support teams, or a core group of trainers.

Cooperation with other levels of administration and even with other international agencies and bodies should be highlighted. These include national and international universities to research institutes and local associations. Projects such as MedPan South Project, which supported the creation of Brijuni and Telašćica management plans, stand out. Brijuni, being a national park, is involved in a large number of projects. This broad collaboration is a very positive factor, as it is key to the implementation of marine policies [60] and fosters public awareness and support for protection. Increasingly, MPA management is moving towards interdisciplinarity.

It is clear that good management requires the adoption of clear objectives and governance systems, the allocation of adequate and appropriate resources, and the implementation of management strategies and processes [61]. More effort needs to be devoted to planning for the future and planning and implementing current activities [62]. Benefits derived from MPAs are related to the design, the number of resources, the degree of protection provided through fair governance and effective management, and the scale at which it works [63]. Brijuni scored near the highest score in the planning stage, demonstrating that this protection category (national park) is committed to short-, medium-, and long-term planning for marine environment. The management plans for Brijuni and Telašćica are almost fully complied with. In Pakleni Islands the management plan is in the process of development and, so far, the annual operational plan has exercised the functions of the management plan. However, the implementation of the activities of the three parks has been reduced due to the SARS-CoV pandemic. This has occurred in many countries, including Brazil, Costa Rica, Namibia, Ecuador, Indonesia, Canada, the United States, and South Africa [64–66]. Adapting MPA management to the current situation left by the pandemic is a global challenge. Parks face emerging challenges, such as drastically

decreasing budgets [64,67] or increasing contamination from single-use masks [68], and it is essential to address them in a holistic manner, seeking nature-based solutions [64].

Croatia has a network of MPAs (CroMPA), which was promoted by the Brijuni Public Institution with the objectives of increasing management effectiveness, capacity building, data exchange, implementing a common approach to solving management problems, influencing the future development of a strategic legal framework, and planning, preparing, and implementing common projects. This network provides the opportunity to establish Croatia as a leading country in the protection of the marine environment. In addition, all parks are part of the Mediterranean MPA Network (MedMPAnet), which is indispensable for long-term marine biodiversity monitoring projects [69].

An important part of MPA planning and management is understanding and incorporating the priorities of different groups [70–73]. The design and management of an MPA should be based on knowledge of the physical and ecological systems that affect it, and on human dimensions, including governance, socio-economic, and cultural aspects [74,75]. Management must be adapted to the socio-cultural situation of each place. Furthermore, the design of the decision-making process must be transparent and cover all stages of management.

Until 2004, an effective system was in place to ensure a representative inclusion of stakeholders in management. Boards consisted of representatives of scientific communities, local communities, the Nature Protection Directorate, and political representatives. However, this system was abandoned, and members are now determined solely on political grounds [76]. Despite this, there is a balance between all sectors involved in the Boards of the three parks, which are multidisciplinary. Recent publications suggest that MPA management should evolve towards a bottom-up model, in which local people are involved in planning processes [77], or towards an intermediate model combining both top-down and bottom-up elements [78–80].

In this sense, Croatia is getting closer to this desirable situation. For example, in the case of Telašćica, the development of the management plan was the first event that included the population. Since then, it has collaborated in some monitoring and local fisheries councils have been established. In the framework of the FishMPABlue2 project, for the first time in Croatia, fishermen were involved in the design of the fisheries management plan. They decided to create no-take zone in the MPA themselves and replaced their nets with more selective ones to reduce fishing pressure and catch per unit effort. This is a good example of a management plan developed in a bottom-up approach involving fishermen, scientists, non-governmental organizations, and the government [81].

However, there is still a long way to go. MPAs are only legally obliged to ensure stakeholder participation in relation to the designation of an MPA and in the form of public consultations regarding proposals for management plans and acts of secondary legislation affecting their interests. Nevertheless, an effective system of stakeholder participation in day-to-day management has not been developed [76].

This situation is found in other MPAs around the world, for example in California, where the design and planning of its MPA network was highly participatory. Stakeholders played a key role and were the sole group responsible for proposing MPA configurations and locations [82]. However, without specific structures for this process, maintaining the high level of participation and engagement is challenging, especially with the top-down model that is legally in place [82]. In Thailand, meanwhile, national legislation contains provisions for participation, but ministerial mandates and local managers maintain top-down approaches, leading to conflicts between the community and managers [83]. As can be seen, it is essential that public policies are aligned at all scales, and that the institutions in charge of managing MPAs have the will and the tools to do so in a participatory way, beyond the design of the MPA or the elaboration of the management plan.

There are no population centers in Brijuni National Park, so stakeholders belong to the nearest communities (mainly Fažana). One of the activities carried out during the development of the management plan were interviews with visitors. It was observed that

most of them have concerns related to problems with infrastructure and services, tourism management (hotels and visitors), and conservation of natural and historical-cultural heritage [46]. Some of them have no problems with the current levels of cooperation and expect to continue to do so (in research, education, or volunteering), while others want to increase the level of cooperation and participate more actively in the park's activities [46].

Overall, these findings show that the desires of communities interested in coastal MPAs are context-specific, even when the groups appear to be similar. A similar finding occurs in a Canadian MPA, Basin Head, where strong community support was found [84]. Most interviewees in this park indicated that they were satisfied with just receiving updates and allowing local management and leaders to make management decisions. This was influenced by the fact that the partnership formed by managers and the population generated a high level of trust, allowing other stakeholders to take a hands-off approach. However, in Brijuni, since the creation of the management plan, social actors have not been involved in management processes and relations with the community are not as consolidated, although communication channels are always open for suggestions and consultations.

To avoid conflict, it is imperative that all stakeholders are involved in planning and management processes in a representative manner [85,86], leading to greater transparency and recognition of the views and concerns of different actors. This increases the likelihood of agreements and improves social acceptability, legitimacy, and support for future MPAs. In Croatia, efforts have been made to involve stakeholders in ocean projects and management. However, despite its long experience in creating and implementing park policies, there are obvious difficulties in getting protected areas to play their role through the involvement of local communities [87]. Successful participatory conservation requires a legislative framework, understanding and determination of management, and local willingness to implement conservation programs. One case of an MPA that has significantly improved its public participation is Tubbataha, in the Philippines. Initially, the state did not take community input into consideration during the design of the MPA. However, eight years later, a participatory governance system was established, which has been instrumental in the success of this area. The management plan was subject to extensive consultation, and participatory evaluation is carried out as part of an adaptive planning process. Research, information, and education campaigns are often carried out in collaboration with various organizations [88]. Zeng et al. [89] propose promoting public participation through better advocacy and incentive mechanisms, and the creation of local advisory councils, which allow for more active stakeholder participation and provide opportunities to interact with management agencies.

Both Telašćica and Brijuni have education and volunteer programs and activities, although both were affected due to restrictions caused by the SARS-CoV pandemic. In Brijuni several activities are being developed to better present the park and its heritage [46], and in Telašćica there are various activities on the values of the park. However, there are some problems, especially in the Mir Bay area, which receives more than 100,000 visitors during the tourist season [47].

In order to implement management actions effectively, sufficient human and financial resources are essential. The main sources of income in Croatian parks are EU and national funds, donations, and sponsorships, and those generated through their own activities. The funds for the annual budget of the Brijuni Public Institution come from the income earned by the institution. Until 2014, the park received small financial contributions from the Croatian government for certain staff salaries and capital projects. Since then, the park has been financially independent from the government and is funded through tourism revenues, donations, and EU-sponsored projects. It has attracted attention for its sustainable funding strategy, which includes a concession program for tourism activities that was used to achieve conservation objectives. This, among other reasons, has led to it being awarded the Blue Park Award in 2021.

However, it is relevant to note the impact that the SARS-CoV pandemic has had on the Croatian economy, which is heavily dependent on tourism. In the Plitvice Lakes

National Park (also in Croatia), tourism-related revenues account for approximately 98% of the total, which leads to MPAs being unable to carry out their actions and management plans in the absence of visitors. A paradigm shift is needed, including diversification of funding sources for areas and communities, effective allocation of financial resources, and responsible tourism recovery plans [64].

The meaning of management is none other than to implement the plan and programs that have emerged in the planning stage. In addition to executing the various measures, it is also essential to monitor implementation [90]. Several authorities adopt adaptive management as a central orientation of conservation management [79]. It is the cyclical process of systematically testing assumptions, generating learning by evaluating results, and continuing to correct and improve management practices [33]. This enables the identification of the most effective measures to achieve desired outcomes, and a better understanding of how objectives should be modified in the context of changing conditions [91]. It requires a regular system of monitoring and evaluation. Attention should be paid to the analysis of socio-economic aspects of the MPA and local perceptions [92,93].

Monitoring of indicators is carried out when there is a project that requires it. In Telašćica and Pakleni Islands, only biophysical indicators are considered. In Brijuni they also have visitor monitoring. This aspect could be improved by establishing a regular monitoring system, as its absence can lead to conflicts between managers, fishermen and the scientific community, as has happened in the Sanya Coral Reefs [94]. However, all three parks have a system of annual evaluation, through reporting, which examines the degree of compliance with the operational plan. This evaluation is used to propose changes to the management plan for the following year. This procedure is used in other successful MPAs, such as the Australian Great Barrier Reef [95], although public participation in this park is higher. Monitoring of management activities is well established in Croatia but monitoring of biophysical and socio-economic indicators is not systematic.

Despite this, all parks have a long scientific tradition and results are integrated into management. In the case of Brijuni, biophysical, cultural, and archaeological issues are studied. For example, several databases have been created, such as marine habitats, cultural heritage sites from prehistory to the 20th century, and sites of geological–paleontological interest. In Telašćica, the biophysical part is the most important, although the social part is becoming increasingly important. A database on the fishing situation is planned. The license holders are not obliged to report the amount of their catches to the Public Institution, so it has not been possible to monitor the fishing effort within the park. Considering that almost the whole area is privately owned (95%), its management becomes more complex, and mutual co-operation is of utmost importance. Another example of the use of scientific information in management in this park is the analysis of metal concentrations in the water, which is serving as a basis for delimiting the carrying capacity of anchored vessels [47].

In general, public participation and the implementation stage are the aspects that need to be strengthened the most. These weaknesses have been identified at least since 2014 [96]. At the time, the identified weaknesses were facilitation and conflict resolution, communication with the local community and their participation in management, dissemination of MPA values, issues and rules of behavior with visitors (public participation), and monitoring, evaluation, and management of the project cycle (implementation stage). These elements could serve as a starting point for developing a training program for managers at the national level, strengthening community relations and adaptive management through constant feedback. This happens in many MPAs. Case studies in France, England, and Portugal showed deficiencies in the implementation of their actions, which was present in only 40% of cases, while this percentage was somewhat higher in Spain [55]. This may be due to numerous reasons, such as lack of resources. For example, Gill et al. [97] analyzed the management of 433 MPAs around the world and 65% stated that their budget was inadequate.

The traditional top-down approach to nature protection in Croatia is being replaced by bottom-up conservation, as recommended by recent publications [77]. This approach

considers local communities as key partners in wildlife management and requires their involvement in social development and biodiversity conservation [98]. Telašćica and Pakleni Islands need to start adopting the socio-ecosystem view, a process that has already begun.

5. Conclusions

In general, MPA management in Croatia tends towards a proactive model, where the management body is its greatest strength. There is a shift from a top-down to a bottom-up approach, which implies a greater involvement of the population in decision-making. However, public participation is not yet fully consolidated, as the involvement of stakeholders outside the management plan development process is not always common. However, the surface area of MPAs in Croatia is still low.

It can be observed that those areas that have a higher protection category, in this case Brijuni and Telašćica, also have a higher assessment of their indicators (proactive and interactive scenarios, respectively). Pakleni Islands, however, is in the process of developing its management plan, which makes its management model more similar to a centralized one. There is ample evidence that the management of the marine environment and its resources should move towards a proactive model.

However, it is logical to think that it is not possible to progress from the *centralized* to the *proactive* scenario directly, so some priority actions are recommended in this research, which can improve the score, especially in the indicators that are scored below 2:

- Planning instruments, containing clear objectives and strategies, such as coastal/spatial plans, marine spatial plans, zoning plans, sustainable development and climate change adaptation strategies, sustainable tourism plans, etc., should be developed.
- To develop the zoning of the MPA and establish mechanisms to ensure its implementation and the respect of its rules. Marine spatial planning could help in this regard, which can be seen as a means to compensate for the weakness of MPAs.
- To develop a socio-ecosystem diagnosis of the MPA and update it periodically, always using the best available information.
- To establish a periodic monitoring system, which collects biophysical and socio-economic data, and whose results are integrated into management.

It is recommended that public participation bodies are created and strengthened throughout the country. Stakeholder involvement is crucial at all stages of integrated management: baseline analysis of the situation, goal setting, political commitment, implementation and monitoring of the process, and evaluation and reporting [99]. Finally, as the management body is the greatest strength of Croatian MPAs, it would be of great interest to create a network of managers linked to different MPAs—national and international—to promote the exchange of experience and knowledge. Additionally, to develop an inter-institutional project to train staff working in MPAs in integrated coastal and marine management, including skills such as conflict resolution techniques, negotiation and decision-making, resource economics, etc., would be of interest.

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