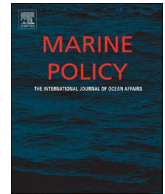




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Lessons from three north-western Mediterranean MPAs: A governance analysis of Port-Cros National Park, Tavolara Punta-Coda Cavallo and Ustica

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ABSTRACT

This paper examines the governance of Port-Cros National Park (PCNP), Tavolara Punto-Coda Cavallo Marine Protected Area (TPCCMPA) and Ustica Island Marine Protected Area (UIMPA), all north-western Mediterranean. The governance approach adopted in PCNP is predominately state-led with increased decentralisation and participation, whilst in TPCCMPA and UIMPA the management responsibility is shared between national and local governments. The use of legal and knowledge incentives has predominated governance of PCNP. Public acceptance has been boosted through increased use of participative incentives, brought about by a reform of French National Parks in 2006 and the creation of the new PCNP between 2012 and 2016. In TPCCMPA and UIMPA both legal and economic incentives are the key mechanisms through which the MPAs are managed and conflicts addressed. In TPCCMPA and UIMPA, where the MPA management authority are faced with a lack of enforcement capacity, greater attention should be given to participative and interpretive incentives to boost stewardship and compliance. The authors conclude that the current governance approaches are effective but do not address all challenges and cross-cutting issues faced. Strengthened political will and leadership from all levels of government is required to improve governance towards more effective and equitable outcomes for all three MPAs, along with increased use of participative and interpretative incentives to generate an increased sense of community stewardship.

1. Introduction

This paper utilises the Marine Protected Area Governance (MPAG) analysis framework [1] to examine and compare the governance structures and cross-cutting issues underpinning the marine sectors of Port-Cros National Park (PCNP), Tavolara Punto-Coda Cavallo Marine Protected Area (TPCCMPA) and Ustica Island Marine Protected Area (UIMPA) (Fig. 1, Table 1). It is one of several papers on recent MPAG case study analyses, all of which are discussed separately in this special section [2][AMEND IN REF LIST JONES LEAD PAPER 2017]. The aim is to examine the incentives applied within the three MPAs, adding a comparative analysis and additional point of reference to the knowledge base of MPAs that have applied the MPAG framework. The work draws upon in-depth interviews with MPA staff and key informants and an extensive literature review conducted between September 2012 and March 2014 as part of a Marie Curie funded project. Following initial interviews, a modified DELPHI technique [3] was employed to validate findings, which involved individual MPA reports being sent to interviewees for verification, for example, providing fact checks for dates, figures and legislation. Additional experts working in these MPAs

further validated a preliminary version of this paper. Still, it must be noted that this analysis is based primarily on the expert views of the respondents to this study, rather than on wider socio-economic studies and their views may not represent the views of other experts or of people who are affected by the MPAs.

2. Context

2.1. Port-cros national park

The Ministry of Environment established PCNP in 1963 (Decree 63–1235), Table 2 outlining the objectives. One of the oldest parks in France, it represents the second European marine and terrestrial national park (preceded by Mljet National Park, Croatia). Originally PCNP included the island of Port-Cros, islets Bagaud, La Gabinière and Le Rascas, the marine and terrestrial areas protected then being 13 km² and 7 km² respectively [4]. A comprehensive reform (law No. 2006-436 of 14 April 2006, Environment Code, Art. L 331-1 to L 331-29) modified the legal status and framework of French national parks [5]. The 2006 reform defined a new and innovative approach to governance and

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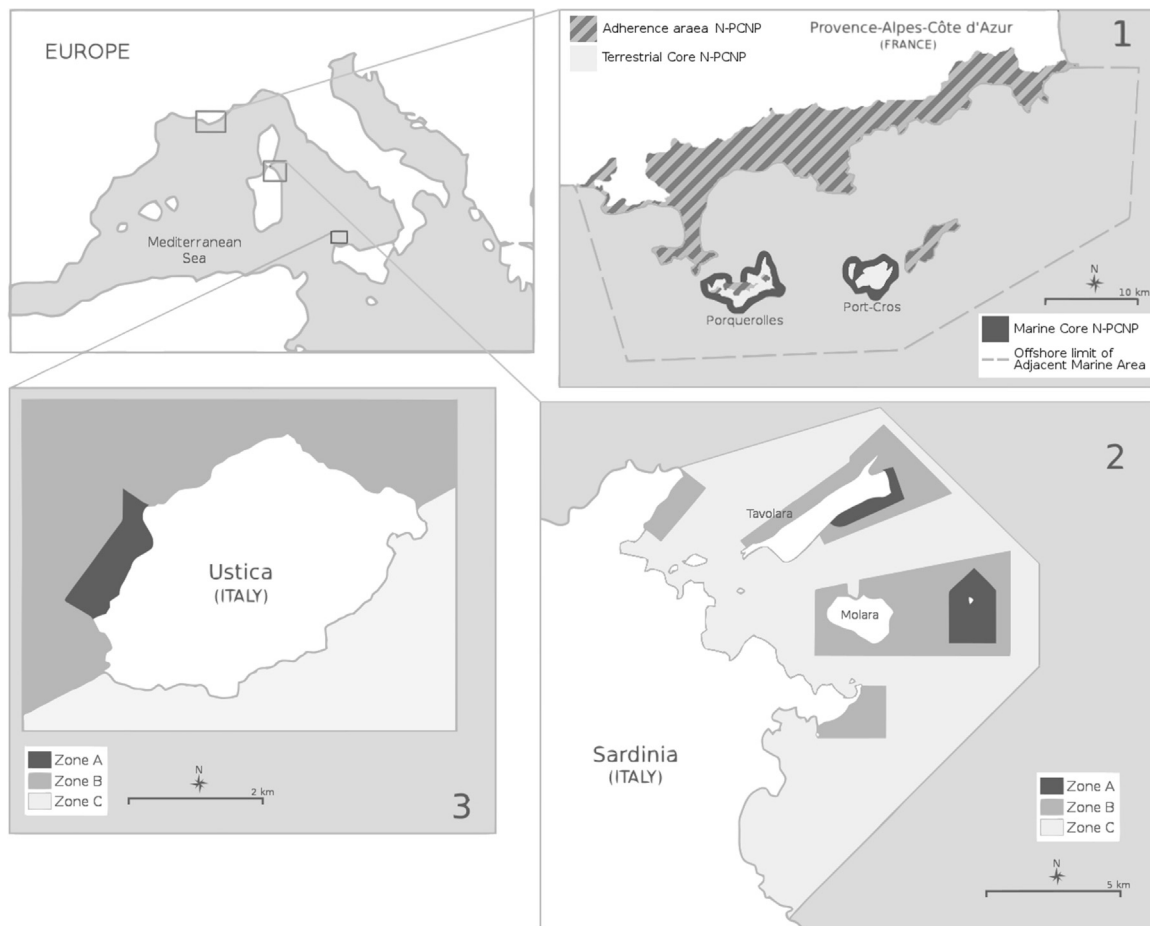


Fig. 1. Location and zoning maps of the case study MPAs: 1) PCNP, 2) TPCCMPA and 3) UIMPA.

Table 1
The three MPA case studies.

	PCNP, Provence-Alpes-Côte d’Azur, France	TPCCMPA, Sardinia, Italy	UIMPA, Sicily, Italy
Area	Terrestrial/coastal 10 km ² , marine 16 km ² , marine adherence area (buffer zone) 123 km ²	154 km ²	159 km ²
Year of designation	1963	1997	1986

Table 2
Objectives and management actions for PCNP.

Conservation	Operational
To protect the unique biodiversity and cultural heritage.	Organisation of public reception and control of visitor numbers
Preservation of the natural heritage	Dissemination of environmental education and transmission of knowledge
Preservation of the landscape and cultural identity of the island	Reinforcement and development of partnerships for sustainable development of the territories

targets of national parks [5]. Key changes introduced were to more effectively balance biodiversity protection with sustainable development objectives, and to specify an increased role for regional and local authorities [5,6]. Since May 2012, the core of PCNP was extended to include two core-protected areas: the Port-Cros Archipelago and the Porquerolles Archipelago (10 km² and 16 km² of terrestrial and marine

Table 3
Main development metrics and ranks where appropriate for France and Italy.

	GDP per capita	GDP Growth Rate	State Capacity	Human Development Index (HDI)	Population below the poverty line
France	US \$35,700 (2013)	0.30%	1.16	0.884	7.90%
Italy	US \$29,600 (2013)	-1.80%	0.50	0.872	29.90%

surface area, respectively); and a vast adjacent marine (adherence) area extending seawards to the edge of the continental shelf (123 km²) (Fig. 1). [4,7]. The newly extended PCNP belongs to the Natura2000 network under the European Habitats Directive (92/43/EEC), has been declared a SPAMI (Specially Protected Area of Mediterranean Importance) under the Barcelona Convention, is included in the MedPan network and since 1999 has played a key role in the coordination of the Pelagos Sanctuary for Mediterranean Marine Mammals [4]. France has a unitary parliament and is well developed (Table 3) [8]. The Provence-Alpes-Côte d’Azur region’s economy is dominated by the service sector and it is the leading touristic region in France welcoming 10 million tourists a year [9]. The core of the park (Port-Cros and Porquerolles) is home to a permanent population of ~350 inhabitants. This figure is elevated substantially in peak season. The islands’ economies are dominated by high-end tourism.

Table 4
Objectives and management actions for TPCCMPA.

Conservation	Operational
Protect the marine environment	Spread and disseminate knowledge of the coastal area
Protect the biological resources and geomorphology of the area	Carry out education programs to improve knowledge of ecology and marine biology Promote socio-economic development compatible with the protected area and supporting artisanal and traditional activities

2.2. Tavolara-Punta Coda Cavallo MPA (TPCCMPA)

TPCCMPA covers 154 km² and is located in Olbia-Tempio Province, North East Sardinia, Italy (Fig. 1). TPCCMPA was identified as a potential MPA by Law no 979 December 31, 1982 and designated in 1997 by Ministerial Decree to meet the objectives outlined in Table 4. Since 2006 TPCCMPA has been declared as a SPAMI, a SCI (Site of Community Interest) as part of the Natura 2000 network and is included in the MedPan network. The protected area includes Tavolara, Molara and Molaretto Islands along with several other small islets. The MPA is zoned (Fig. 1). Zone A is a no-take/no-access zone where all extractive activities are prohibited (certain activities including authorised research and guided visits are permitted); zone B is a buffer zone in which activities such as artisanal fishing, boating and diving are regulated by the management authority; zone C is the peripheral zone, where all activities are allowed including professional and recreational fisheries, but are still regulated by the MPA management authority. Italy also has a predominantly unitary parliament, and is well developed but less economically advantaged in comparison to France (Table 3) [8]. In contrast to the relative wealth of the region containing PCNP, Sardinia is comparatively poor [8].

2.3. Ustica island MPA (UIMPA)

Ustica Island lies 60 km North of Palermo, Sicily, Italy. UIMPA surrounds the island and covers approximately 159 km² (Fig. 1). UIMPA was identified by Law No. 979 of 1982, and was established by Ministerial Decree in 1986. UIMPA along with Miramare MPA in Trieste were the first MPAs designated in Italy. The objectives are defined in Table 5. The MPA is included in the Natura2000 network as a SCI, under the European Habitats Directive for its environmental and biodiversity value, and is included in the MedPan network. UIMPA follows the same zoning system described for TPCCMPA (Fig. 1). The region containing UIMPA is the poorest of our three case studies, and Sicily's economy has been dominated by the agricultural and fisheries sector [8]. The island's economy is dominated by small-scale agriculture and the artisanal fisheries sector, but is constrained by its comparatively isolated location.

Table 5
Objectives and management actions for UIMPA.

Conservation	Operational
Protect the marine environment	Carry out investigation and scientific research in the fields of ecology, marine biology and environmental protection, to ensure systematic knowledge of the site
Protect and enhance biological resources and repopulation of the area	Spread and disseminate knowledge of marine coastal areas Carry out educational programs to improve knowledge of ecology and marine biology

3. Drivers and possible conflicts

The main threats include: fishing, water pollution, coastal development, tourism, diving, other recreational activities, invasive species and the impacts of climate change [10].

3.1. Small-scale artisanal and recreational fishing

Around Port-Cros and Porquerolles Island fishing is restricted in certain areas - mostly in sites that are designated for diving activities. Trawling was banned within the original core with the establishment of PCNP in 1963, and management of artisanal fishing activities around Port-Cros Island has been aided by the development, in 1999, of commercial fishing regulations enshrined in a fishing charter, which bans trawling and recreational fishing. To be authorised to fish inside the area, each fisher has to sign the charter each year and to abide by its rules. In addition, fishers have to communicate details of their catches to the park managers via a fishing logbook [11]. The charter is updated annually, based on scientific monitoring and in consultation with the fishers [11]. Currently, a comparable charter does not extend to Porquerolles Island, where both artisanal and recreational fishing continue to present a management challenge. A no-take zone (NTZ ~0.5 km²) was designated on the southern coast of Porquerolles in collaboration with local users to restrict all recreational fishing, and in other areas recreational fishing is limited seasonally, which aims to enhance the reserve effect. Generally, laws set by *prud'homies des pêcheurs*¹ and national government regulate professional fishing. The main types of fishing gear used are trammel nets and longlines. Two trawlers from Hyeres were reported to operate in the area of adherence (buffer zone), and were perceived as a significant threat to the park's effectiveness. The prohibition of recreational fishing around Port-Cros made the restrictions assigned to commercial fishers more socially acceptable, and the initial desire to ban artisanal fishing in or around Port-Cros has been proven unnecessary [11]. The gear permitted elsewhere in the MPA includes longlines, trolling and spear fishing. Currently there are 700 boats authorised to fish recreationally within the MPA. The high number of recreational fishers questions the balance between sustainable development and conservation.

All forms of fishing are prohibited within zone A (no-take/no-access area) of TPCCMPA and UIMPA. In TPCCMPA and UIMPA small-scale artisanal fishing is limited within zone B and C to those fishers that are formally resident in coastal villages within the MPA. In TPCCMPA the professional fishing fleet is small, with 15 boats fishing regularly in the MPA. The main types of fishing gear used in TPCCMPA are trammel/gill nets and longlines, with fishers alternating between types of gear, depending on the season. Trawl fishing is prohibited within the MPA. The fleet in Ustica is also small (7–8 vessels). The main types of fishing gear used in UIMPA include trammel nets, longlines and fish pots. The use of purse-encircling nets is permitted in zone C. Changes in EU legislation for tuna and swordfish have resulted in larger artisanal boats (12 m) being used for inshore artisanal fishing, rendering the fleet's activities unviable economically as market prices fall in the face of increasing supply. Similarly to PCNP, in TPCCMPA it is recreational fishing that poses the greatest management concern. Recreational fishing is permitted in zone C and gear permitted includes trolling and longlines. Spearfishing is not permitted in the MPA, but is permitted outside the MPA's boundaries. In UIMPA recreational fishing is permitted for authorised residents of the Island in zone B and C. Gear and catch restrictions apply. A study conducted by Di Franco et al. [12] in TPCCMPA showed there to be no difference in fish assemblages between

¹ *Prud'homies des pêcheurs* (fishers' guild) have existed since the 14th century, and enforce EU and national laws as well as specific regulations set out by the institutions themselves. As representative bodies covering clearly defined areas, they have the right to issue sanctions to their own members, but not to members of other *prud'homies*.

zones B and C, and areas outside the MPA, where recreational and professional fishing are regulated in different ways. Biomass of many species was found to be higher in the no-take/no-access zone (zone A). These findings suggest that the threats from recreational and professional fishing are very real, and that both recreational and professional fishing must be quantitatively assessed in order to set up more effective regulations [12]. Indeed, the three MPAs could benefit from a quantitative assessment of fishing pressures to ensure appropriate regulations are applied (e.g. gear restrictions, limiting professional and/or recreational fishers), in order to achieve an appropriate balance between ecological targets and human uses [12].

As in other MPAs, the number of full-time artisanal fishers is in decline in all three, stemming from a lack of generational renewal, lack of institutional support, strict EU regulations and feelings of marginalisation and undervalued position in society. In general, much of the fish caught by the artisanal fleets within the three case studies is destined for local markets, and some for national and European markets. Incoming external fishers are a serious issue in PCNP and TPCCMPA. Since the economic crisis (which began in 2007) and associated budget cuts, staff numbers and vigilance has decreased substantially, increasing opportunities for illegal activity. As seen in other MPAs [13] [PLEASE AMEND IN REF LIST HOGG et al. THIS ISSUE CPH] the crisis is driving recreational fishers to supplement their income or support themselves through the illegal selling of their catch, increasing user group conflicts. The isolation of Ustica may offer the MPA some protection from illegal fishers. However, despite its isolation, there have been episodes of illegal fishing, which were devastating for stocks. In UIMPA retired fishermen continue to fish and sell their catch (illegally) in the local fish market. Strong cultural tradition on the island allows this activity to continue despite the negative consequences for licenced commercial fishermen. New laws are being developed for UIMPA in an attempt to better manage the recreational fishing sector. Not only do these illegal activities deplete stocks for both fishers and divers across all three MPAs, but it also impacts market prices [14].

3.2. Tourism

PCNP is a top tourist destination attracting high-end tourists and large numbers of pleasure boats. Similarly, tourism development in Northern Sardinia started in the 1960's. Olbia, San Teodoro, Golfo Aranci and the Emerald Coast, close to TPCCMPA, are highly developed touristic areas. Local government focus on economic development is resulting in continued tourism development throughout these regions - often in conflict with conservation objectives. Consequential environmental degradation from tourism activities, including diving and snorkelling, anchoring, sedimentation and tourism-related infrastructure development, is increasing in all three MPAs. Tourist numbers are significantly boosted in the three MPAs by tourists in the peak season summer months, which brings additional income but also anthropogenic challenges. Growth in tourism activities in PCNP is a major management challenge, which, to date, has not been adequately addressed [15]. There are no accurate estimates for the number of recreational boats transiting the area around PCNP and TPCCMPA, yet both destinations are popular for pleasure boats. Measures are in place to control anchoring within certain zones of each MPA. For example, anchoring has been banned around the northern coast of Port-Cros Archipelago. An ecological mooring system, designed to cause minimal impact to benthic habitats, has been established in the Bay of Port-Cros. Within the framework of the Natura 2000 zone of 'Rade d'Hyères' and in close consultation with users, ecological mooring and no mooring zones have also been established around Porquerolles Island [16]. These mooring systems provide a good example for other MPAs, but they are expensive to install and maintain, creating an additional financial challenge and burden for the park. Breaches of anchoring regulations remain common in PCNP, which is associated with the transmission of the invasive species *Caulerpa cylindracea*, *Caulerpa taxifolia*

and *Womersleyella setacea*. The first invasion of *C. taxifolia* was discovered in 1994 and park staff actively manage outbreaks through manual uprooting [17].

Other marine tourism activities, including diving, are regulated within each MPA. Specific zones and dive buoys mark areas where diving is permitted and diving is closely monitored, yet official limits/quotas on dive immersions are not in place in these MPAs. To date, the growth of the dive industry has created little conflict between user groups in these MPAs. Fishers and community members in UIMPA and TPCCMPA reported being satisfied with the growth of the dive industry, yet believed that more could be done to respect fishing activities, and encourage profits from the dive industry to remain within the community. PCNP introduced a diving charter in 1994 in collaboration with stakeholders and resource users, to regulate diving and instil good practice guidelines.

4. Governance

4.1. Governance of PCNP

The governance approach adopted in PCNP is 'government-led', though since the National Park Reform and extension of PCNP, the approach has included increased elements of decentralisation and substantial community participation. French national parks are generally established through central government initiatives with political approval at the local level. The government retains overall control of PCNP, with daily management being performed by the government agency, *Parcs Nationaux de France*, supported by a management board (Fig. 2). The management board includes representatives of the central government, the regional government and members chosen for their national or local relevance (e.g., landowners, residents, users, and representatives of environmental NGOs or sectoral trade organisations). The director is appointed by an order of the minister in charge of environmental protection. Since 1964 the management board has been further assisted by scientific councils to ensure decisions are evidence-based and, since 2006, an economic, social and cultural committee. In 2012 a law, considered to be very advantageous to park staff, was passed that grants park staff 'environmental police' status to enforce park regulations and issue sanctions.

The establishment of PCNP in 1963 followed the fashion of the time: top-down in nature, with priority given to biodiversity conservation, though it was reported that the implementation process had more 'bottom-up' elements of governance than was common at that time [21]. The lack of zonation prior to the creation of the MPA reportedly made it more challenging to subsequently limit certain uses and strengthen protective measures in particularly sensitive areas [15]. Similarly to other examples [22], legal incentives alone were insufficient (between 1964 and 2011) to extend the national park because of strong public opposition. A highly participatory process has been undertaken over the last four years (2012 – 2016) to develop the Charter of the National Park (PCNP), with many meetings held in a dozen places to discuss, modify and improve the charter, meetings which residents, users, stakeholders and elected representatives could attend freely. Although the participatory process was state-driven, the drafting process of the Charter was largely bottom-up. The Charter has since been approved by the French *Ministère de l'Environnement, de l'Energie et de la Mer* (decree of December 30, 2015). In June 2016, the Charter of the Park was finally approved, extending the parks boundaries (Fig. 1). The introduction of much greater public participation was reported to have helped resolve many of the existing issues and improve overall public acceptance and support.

4.2. Governance approach TPCCMPA

Although also government-managed, compared to PCNP the governance approach adopted in TPCCMPA involves significantly more

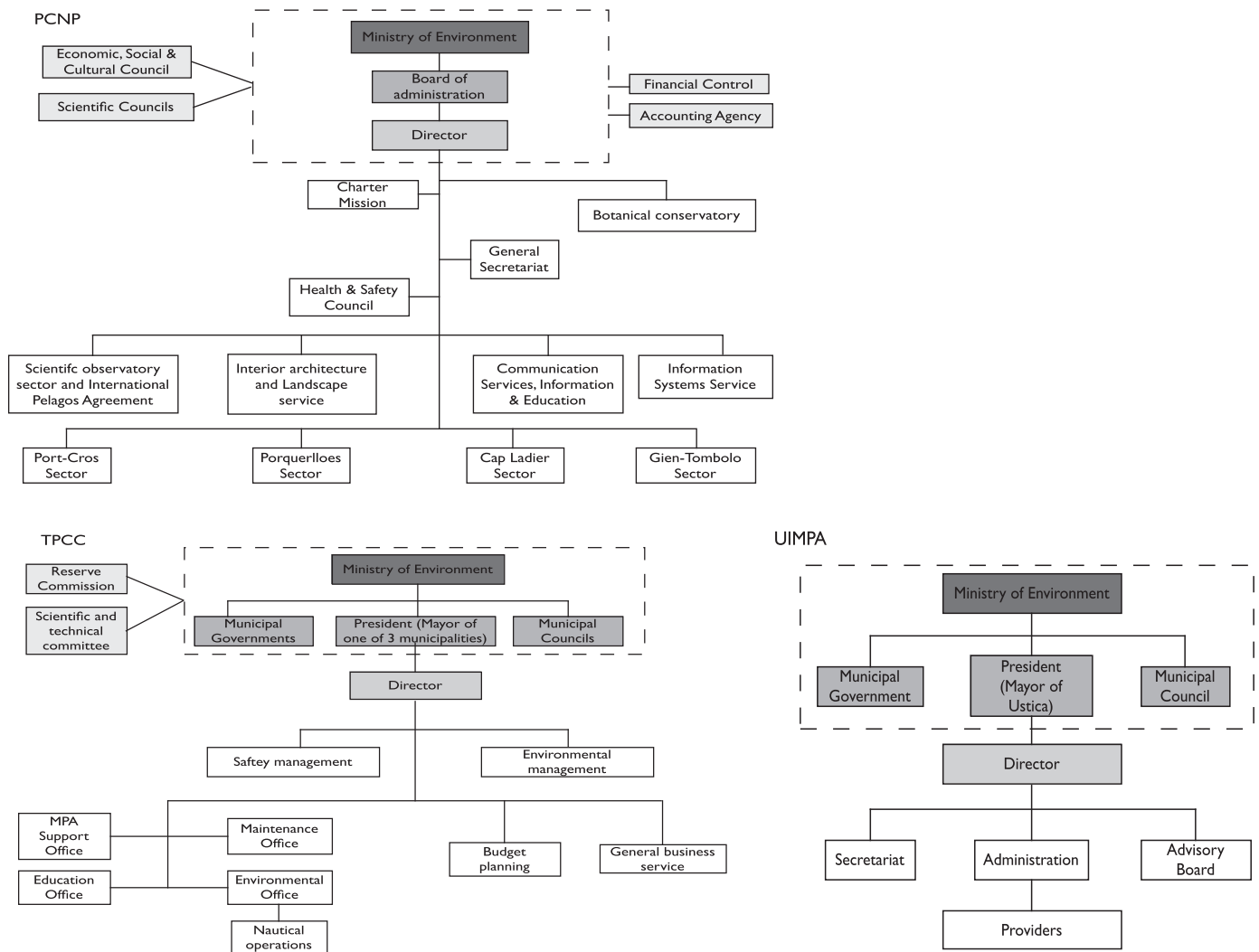


Fig. 2. Governance organogram of: PCNP, TPCCMPA and UIMPA (adapted from [18–20]).

decentralisation. In the last ten years environmental governance in Italy has undergone several decentralisation reforms [23]. The assignment of power over the environment has been evolving with a general trend towards an increased role of local authorities. As such, the role of central government in MPA management has diminished, while local governments are being granted more responsibility for MPAs and their performance [23]. TPCCMPA, in practice, is a good example of this approach, with the management having been entrusted to a consortium of three municipalities: Olbia, Loiri-Porto San Paolo and San Teodoro since 2003 (Fig. 2). Daily management is the responsibility of the TPCCMPA management authority (a municipal department), which works closely with several associated organisations. The MPA is monitored using cameras and enforced by the TPCCMPA management authority and Coastguard. Furthermore, dive centres and long term researchers contribute through ‘self-management practices’, i.e. employing collective action to monitor and report transgressors. The TPCCMPA management authority have limited capacity to enforce the regulations as they do not have the power to issue sanctions to transgressors, and must report transgressions to authoritative bodies with higher enforcement powers. The delegation of day-to day management responsibilities created the opportunity for increased local involvement and participation, but also provides opportunities for local level politics and economic development interests, such as coastal development, land-use planning and fisheries management, to influence the overall effectiveness and management outcomes. Annual MPA funding based

on performance is provided by national government and supplemented by additional project funding secured by the TPCCMPA management authority. Local government provides a large proportion of funds and resources to manage the MPA.

4.3. Governance approach UIMPA

The governance approach adopted in UIMPA currently follows the same pattern of Italian decentralisation described above (Fig. 2). The MPA is the responsibility of Ustica municipality and daily management is the duty of the UIMPA Management Authority, which at the time of study employed a director and 1–2 temporary staff members. As in TPCCMPA, the management authority does not have the power to enforce regulations through the issue of sanctions, and is reliant on the Coastguard. UIMPA has no specific scientific committee, though an advisory committee does support decision-making processes. Between 2003–2013, UIMPA went through a substantial period of ‘government-led’ management, brought about by changes in the way funds were allocated to MPAs. This arrangement is not uncommon though is usually only for short periods, yet UIMPA remained under national government management for 10 years, which is more unusual. During this period the MPA lacked a local manager, scientific monitoring, infrastructure maintenance, financial management and stakeholder involvement. In 2013 the management was, once again, entrusted to Ustica’s municipality. As in TPCCMPA, remote cameras, the Coastguard,

MPA staff, dive centres and local fishers are involved in ‘patrolling’ and monitoring the MPA. However, the amount of money allocated by the state to support the annual management plan is now substantially lower than in the past. Furthermore, the municipality of Ustica also suffers from a shortage of resources and this situation has worsened during the economic crisis, restricting the provision of sufficient funds and resources (such as for staff, office buildings, visitors centre and other facilities) to the MPA. This lack of funding is proving to be a significant management challenge, as local residents are expecting the same economic returns from the MPA achieved in the past.

5. Effectiveness

There has been some disparity between official regulations and what has been enforced on the ground. Law enforcement and compliance with commercial fishing regulations has been relatively effective in all three MPAs. However, the lack of a fishing charter for Porquerolles Island in PCNP has reduced both compliance and enforcement capacity. For other activities (illegal fishing practices, recreational fishing and tourism) enforcement has varied in each MPA. Management of tourism and recreational fishing in PCNP and UIMPA remains ineffective. Following the MPAG effectiveness scale (ranging from 0: no impacts addressed to 5: all impacts completely addressed), the effectiveness of TPCCMPA and UIMPA was reported by experts interviewed to be 2 (‘some impacts from local activities completely addressed, some only partly addressed’). The recent extension of PCNP makes it inappropriate to assess overall effectiveness of the park, and the lack of a management authority and reliable data for UIMPA over the last 10 years means its rating should be considered tentatively.

Numerous studies demonstrate significant improvements in biodiversity richness and population numbers around Port-Cros [24–30]. The dusky grouper population has increased from only 7 individuals recorded in 1973 to over 700 in 2011, fish species richness is high (180+ species), and the size of bream (*Diplodus* spp.) are recorded as being 13 times bigger around Port-Cros than around Levant Island, the latter area only having been part of the park since 2012 [24–30]. Overall, the results demonstrate the original PCNP has benefited substantially from fifty years of protection, and is in a state of recovery. The reform that gives consideration to sustainable development, however, is raising concerns regarding the capacity to balance societal needs and MPA management in the extended PCNP. Current legislation for Porquerolles Island specifies only one small NTZ, and the fishing regulations do not differ significantly from the area external to the MPA, making it highly unlikely that the extended park will yield the same environmental recovery as found around Port-Cros.

Micheli et al. [31] have declared TPCCMPA to be a ‘superperformer’ given findings that show significant ecological success despite high human pressures, and lack of enforcement. A study by Sala et al. [32] found TPCCMPA ranked highest in fish biomass, demonstrating a total biomass 1.3–31 times higher than the 32 Mediterranean MPAs and unprotected locations investigated. TPCCMPA also has low abundances of invasive species and relatively healthy benthic communities [12,32,33]. Overall, despite the lack of sanctioning capacity of MPA staff, research and monitoring indicate that the ecosystem in TPCCMPA has benefited from protection and is in a state of recovery.

In UIMPA the reserve effect and the island’s biology were previously well documented, though in the last 10 years there has been little/no research conducted. Despite improvements in the island’s biology, recovery rates of functionally relevant species, potentially affecting the whole community, were found to be lower than expected [15,34–37]. The accentuated isolation of the island could potentially delay the rate of stock recovery, given the need for larval recruitment from external sources [15,36,37]. Furthermore, isolation could contribute to a deficiency of nursery habitats, which have not been offset by the presence of suitable adjacent habitats [15,36,37]. The MPA authority believes that the 10-year gap in local management has substantially reduced the

MPA’s effectiveness and led to the deterioration of, not only the MPA’s infrastructure, but also the involvement and trust between the MPA, resource users and the community, diminishing the general visibility and efficiency of the MPA. The ecosystem surrounding the island is currently considered to be in a stable state. However, due to isolation, and, most critically, weakened governance, recovery has not been as substantial as expected. Effective protection measures and increased participation, to reduce recreational fishing and control tourism growth, are needed to maintain and restore the condition of the marine ecosystem, though some see UIMPA as a ‘lost cause’, suggesting that fund allocations should be diverted to ‘functioning’ MPAs.

6. Incentives

This analysis has identified key incentives² currently used and particularly needed to support governance. Five kinds of incentives are discussed here and outlined in Table 6 (PCNP), Table 7 (TPCCMPA) and Table 8 (UIMPA): economic; interpretive; knowledge; legal; and participative.

6.1. Economic incentives

Economic incentives remain a key mechanism through which conflict between nature conservation and economic development is being addressed in these MPAs. Potential fisheries benefits of MPAs were promoted during the initial implementation phase of each MPA, and in UIMPA in particular, the protected area was strongly supported by the local fishing community. ‘Green marketing’ of products and tourism services and sustainable development initiatives are being introduced gradually in each MPA. A key focus has been to promote sustainable dive tourism in each MPA. In TPCCMPA the high abundance of large fish and rich benthic communities attract more than 10,000 recreational divers each year, and the total value of the diving sector is estimated to be US\$18 million per year [31,38]. At the heart of the 2006 French national park reform is the promotion of a balance between conservation and sustainable development. PCNP thus has plans to extend green marketing programs to the fisheries sector, promoting the artisanal fishing sector and use of eco-labels to mark sustainably caught products. TPCCMPA has similar plans to introduce eco-labels for sustainably caught seafood. Fishing ‘pesca-tourism’ has been promoted for fishermen in UIMPA as an alternative source of income, but profit margins are not as high as for commercial fishing and the legislation and logistics for taking tourists on fishing boats remains a deterrent.

6.2. Interpretive incentives

Public meetings, volunteer opportunities, websites that feature newsletters and articles, flyers, school programs, guided tours, and conservation signage are all part of PCNP and TPCCMPA’s interpretive incentives. PCNP created the first underwater educational snorkel trail in 1979 and TPCCMPA has an educational cinema that runs during peak season within the MPA, and a team of volunteer tourist guides. In general, awareness of PCNP remains low, particularly in the newer areas of the park [9]. Previous public opposition to the extension of PCNP reportedly calls for a ‘softer’ introduction of interpretive incentives. During the period UIMPA lacked a local manager, interpretive incentives were not utilised and pre-existing MPA infrastructure and education facilities deteriorated. As the MPA enters the new phase of management, focus is being given to interpretive incentives: signage and flyers with strong conservation messages; guided tours; school programs; a visitor centre; website; documentary; and public meetings have been introduced in the last few years. However, funds are insufficient to restore all pre-existing infrastructure. In all

² For a full list of incentives analysed and definitions see Jones et al. [1].

Table 6

PCNP- Incentives applied (Y) including those that are particularly important priorities for strengthening (Y*) and introducing (N*).

	Incentive type	Used	How/Why
Economic	Reducing the leakage of benefits	Y*	Restrictions on incoming commercial fishers should retain related benefits amongst local fishers, but illegal incoming fishers continue to undermine this. The local economy derives major economic benefits from tourism but concerns remain at the leakage of benefits related to incoming tourism operators.
	Promoting profitable and sustainable fishing etc	Y	Promotion of a balance between conservation and sustainable fishing is at the heart of the 2006 French National Park reform.
	Promoting green marketing	N*	Previously a green marketing scheme was piloted with a few fishers, but it was challenging to ensure necessary standards were met. More clearly defined green marketing approaches would be beneficial, but a system ensuring standards are met is required. These schemes are considered to increase the products value and recognize traditional techniques applied.
	Promoting diversified and supplementary livelihoods	N*	Island employment opportunities are limited and younger generations are leaving to seek employment elsewhere. Fishing and tourism are the main sectors of employment, but are associated with environmental impacts that need to be better addressed, and there is considerable leakage of related benefits to incoming fishers and tourism operators - both issues that providing better livelihoods for local people in tourism and sustainable fishing would help address.
	Investing PA Income/funding in facilities for local communities	N*	Acceptance of the park is increasing. Investing some MPA funding in the local infrastructure would further increase public acceptance and potentially increase community stewardship.
	Ensuring sufficient state funding	Y	Support from the government and national park resource in terms of human and financial resource is sufficient, but recent cuts threaten to undermine effectiveness.
	Provision of NGO, Private Sector and user fee funding	N*	State funding cuts are increasingly threatening the ability of the staff to achieve their conservation objectives. Additional funding would be beneficial to reduce impacts - NGO, private sector and/or user fee funding could help address this.
Interpretative	Raising awareness	Y*	Awareness remains low amongst tourists and some locals despite public meetings, volunteer opportunities, websites, school programs, guided tours and conservation signage.
	Promoting recognition of benefits	Y	MPA benefits are communicated through the channels noted above.
	Promoting recognition of regulations and restrictions	Y*	Rules and regulations are communicated through the media channels and other routes to address the local surrounding community and visitors, but more could be done to make tourists aware of regulations and restrictions.
Knowledge	Promoting collective learning	N*	Data presently used is mostly scientific, dominated by the scientific committee. More effort is required to harness local knowledge to build confidence and trust in the data and related knowledge being used to make decisions.
	Independent advice and arbitration	Y	Port Cros has a management board supported by two scientific committees and a more recent cultural and social committee.
Legal	Hierarchical obligations	Y	This MPA is part of the Natura 2000 Network and is declared as a SPAMI as well as being part of the MedPan Network, all of which require set obligations to be delivered.
	Capacity for enforcement	Y*	Park staff are granted Environmental Police status to enforce park regulations and to issue sanctions but there are concerns that state budget cuts will lead to reductions in surveillance and enforcement capacity.
	Penalties for deterrence	Y	Penalties (fines) are provided for in the overall legal framework.
	Protection from incoming users	N*	Concerns exist regarding trawlers permitted to operate in the adherence area. Regulations that are applied to recreational fishing licensing were seen to be inadequate and created a threat to commercial fishers. Tourists regularly fished in restricted areas due to the lack of awareness/knowledge. In Port Cros, a specific fishing charter protects local fishers from incoming users- yet does not extend to Porquerolles (the area of extension), leaving these fishers vulnerable to the impacts of incoming fishers.
	Cross-jurisdictional coordination	Y	A management board consists of representatives from central and local government, landowners, users and representatives of environmental NGOs to enable coordination of activities and actions across different jurisdictional areas, but there is a need for improved coordination and for other authorities to exercise their functions in a way that better addresses conflicts, e.g. to establish limits on tourists and vessel numbers.
	Clear and consistent legal definitions	Y	Legal definitions are created under the Environmental code.
Participative	Legal adjudication platforms	Y	Legal processes are managed by the state. Routes and platforms exist to appeal decisions.
	Rules for Participation	Y	The legislative framework makes providing for stakeholder participation obligatory, including details on which sectors and groups should be represented on the management board and related committees and the need to be open to the public.
	Establishing collaborative platforms	Y	The 'Charter of the National Park' established several such collaborative platforms in various locations with residents, users, electoral representatives, etc.
	Decentralising responsibilities	Y	Many responsibilities are decentralised to the management board and, in turn, to related committees and public meetings.
	Peer enforcement	N*	During peak season, there are a lot of tourists to manage and monitor and insufficient park staff to do so. Additionally, difficulties created by locals vs. tourists 'local privileges' associated to regulation application is an issue that needs addressing. Volunteer warden schemes could overcome these issues, increasing awareness regarding the benefits of regulations and increasing stewardship.
	Building trust and the capacity for cooperation	Y	Involvement of users and locals in the Charter of the National Park helped resolve existing issues and improved the overall acceptance of and support for the park.
	Building linkages between relevant authorities and user representatives	Y	Strategic relationships were built with key user and local representatives to enable the creation and implementation of the Charter of the National Park and the investment in these relationships is ongoing.

three MPAs, interviewees recognised that greater focus should be given to education and interpretive incentives to encourage compliance and decrease the reliance on legal incentives. Interpretive incentives could

also be used to influence the behaviour of local government actors, particularly in TPCCMPA and UIMPA, both of which are affected to a large degree by local politics. Introducing MPA guardian programs

Table 7

TPCCMPA- Incentives applied (Y) including those that are particularly important priorities for strengthening (Y*) and introducing (N*).

	Incentive type	Used	How/Why
Economic	Reducing the leakage of benefits	N*	Income leaks to incoming tour operators and illegal anglers.
	Promoting profitable and sustainable fishing etc	Y	Plans exist to promote the artisanal fishing sector and profitability of its traditional sustainable fishing practices, including through enforcement of the ban on commercial angling by non-professional fishers.
	Promoting green marketing	N*	There are plans to promote the use of eco-labels to mark sustainably caught products - needed to increase the value of the resources and respect local traditions.
	Promoting diversified and supplementary livelihoods	Y	Fishing tourism is promoted as an alternative livelihood to commercial fishing, although lower profit margins and the logistics for taking tourists on fishing boats are a deterrent.
	Ensuring sufficient state funding	Y*	National Government provides annual funding based on performance and the TPCCMPA management authority tries to secure additional project funding. Local government also provides a large proportion of funds and resources. Italian MPAs are funded depending on performance. TPCCMPA is one of the best performing MPAs and quite well funded, yet, each year the budget available is reducing. As the local municipalities provide a majority of the funding they have been hit badly by the economic crisis. MPA staff are 'employed' on 8 month contracts as there is no guarantee of long term funding, creating issues for staff and long-term project planning.
Interpretative	Provision of NGO, Private Sector and user fee funding	N*	Potential to charge user fees, including fees for commercial operators within the MPA and potentially some NGO funding needs to be explored to address funding shortages.
	Raising awareness	Y	An educational cinema runs in peak seasons and there is a team of volunteer tour guides to inform visitors about the MPA.
	Promoting recognition of benefits	Y	All of the benefits of the MPA are communicated through the channels above.
Knowledge	Promoting recognition of regulations and restrictions	Y	As above.
	Promoting collective learning	Y	Artisanal fishers knowledge was drawn on in the design of the MPA and is drawn on in its assessment and management.
	Agreeing approaches for addressing uncertainty	Y	Through collaboration with the university there has been acknowledgment that they do not have answers for everything and therefore use some experimentation which is openly communicated but there is not a formal agreement or process.
	Independent advice and arbitration	Y	Data has been published in high quality international peer-reviewed journals giving confidence in the quality and reliability of the data used in monitoring and applied to decision-making, improving management quality of the MPA. The use of peer review acts as a form of independent advice.
Legal	Hierarchical obligations	Y	The designation as a SPAMI and SCI and inclusion in the MedPan Network requires certain obligations be met.
	Capacity for enforcement	Y*	MPA staff have no jurisdictional power to enforce regulations. Transgressors caught, can only be issued a verbal warning – that it is a protected area and their activities are not permitted. Coast guards enforce the regulations, but the Coast Guards have limited capacity and often cannot respond to reports. MPA staff suggested that they themselves are less influenced by local politics and could enforce the MPA more effectively and equitably. MPA staff were aware of the system in France (where park staff have police status) and saw this as one of the most beneficial potential improvements for their MPA.
	Penalties for deterrence	Y	There are penalties for deterrence in the form of fines and this is written into the government law.
	Protection from incoming users	N*	Increased enforcement is needed to protect local commercial fishers from incoming illegal anglers.
	Cross-jurisdictional coordination	Y*	Coordination is managed across various jurisdictions within the government and local government with a consortium of management from three municipalities, the TPCCMPA management authority and associated organisations. There could be improvements made to increase effectiveness, particularly through improved coordination with the Coast Guard.
	Clear and consistent legal definitions	Y	All legal definitions are contained within the government law and under specific zonation plans regulated by the management authority.
	Legal adjudication platforms	Y	The government manages all adjudication through the traditional legal channels.
Participative	Establishing collaborative platforms	Y	A working group was created to facilitate meetings and workshops related to MPA decision-making and develop strategic partnerships with key community groups, research institutes and key industries.
	Building trust and the capacity for cooperation	N*	Although meetings are held, some consider them infrequent and that effort is needed to bring the different groups together in decision-making processes and to build trust.
	Building linkages between relevant authorities and user representatives	N*	Improved linkages between relevant authorities and user representatives could be established through more regular meetings.

similar to the reef guardian school and local government program created by the Great Barrier Reef management authority, could increase awareness and encourage local government actions that improve the health and resilience of these MPAs [39].

6.3. Knowledge Incentives

PCNP and TPCCMPA make substantial efforts to maximise scientific knowledge to guide/inform decisions. The legislation for each MPA, particularly PCNP, identifies science-based MPA decision-making as a priority. PCNP and TPCCMPA have scientific committees (see Fig. 2) and since 2006 PCNP has had a committee to guide the development of socio-economic, cultural and management principles. Nevertheless, data sources for PCNP are relatively few, leading other researchers to question the quality of the research conducted. The majority of data

available and referenced in this article for PCNP is taken from masters and doctoral theses, technical reports and a local journal. In contrast, data for TPCCMPA has been published in high-quality international peer-reviewed journals, giving those in doubt greater confidence in the quality and reliability of the data collected. For adaptive management to be effective, it was reported that robust data is required to make good choices. The ten-year period of national government-led management and lack of funding allocated to UIMPA has had a negative impact on the scientific studies conducted within the MPA. As a consequence, there is a critical shortage of reliable information upon which to base management decisions. The focus on high quality scientific knowledge in TPCCMPA has improved the quality of management, ensuring that management is adaptive and budgets and conservation missions can be allocated accurately. The promotion of mutual respect and collective learning between different knowledge owners (external to the MPA

Table 8

UIMPA- Incentives applied (Y) including those that are particularly important priorities for strengthening (Y*) and introducing (N*).

	Incentive type	Used	How/Why
Economic	Promoting profitable and sustainable fishing etc	Y*	Only locals fish around the MPA, which is far from mainland Sicily so does not attract outside fishing pressure. Big trawlers are not allowed in the MPA and there is high promotion of good fishing practices with the landing of certain species banned and some fishing gears also restricted, but fishers displaced by new EU restrictions on swordfish and tuna fishing coupled with illegal commercial angling continue to pose challenges.
	Promoting green marketing	N*	Effort needs to be made to promote island produce and respect traditions. Some agricultural producers are promoting the slow food movement through their production of wines and olive oils. These same principles could be applied to the fishing industry in combination with restaurants offering an incentive for retired fishers to be more respectful of the regulations and restaurants more considerate regarding from whom they buy produce.
	Promoting diversified and supplementary livelihoods	Y	Pesca-tourism is promoted as an alternative livelihood to commercial fishing and illegal angling, although low profit margins and logistics of taking tourists on fishing boats are a deterrent.
	Ensuring sufficient state funding	Y	Funds for the MPA are allocated by the state, though this has decreased in recent year with economic decline and related austerity measures.
Interpretative	Raising awareness	Y	Signage and flyers with strong conservation messages are used alongside guided tours, school programs, a visitor centre, website and public meetings.
	Promoting recognition of benefits	Y	MPA benefits are communicated through the channels noted above.
	Promoting recognition of regulations and restrictions	Y	MPA rules and regulations are communicated through the channels noted above.
Knowledge	Promoting collective learning	N*	In the past, the MPA was very well funded and was attractive to researchers. As more MPAs were introduced researchers began to go elsewhere. During the 10 year period when the MPA was under government control, the infrastructure deteriorated and was unused. No studies have been conducted for ~10 years. Researchers and locals are recommended to work together to recreate the history of the MPA and undertake collective research on trends in fish populations, habitats, etc.
	Agreeing approaches for addressing uncertainty	Y	Lack of information is acknowledged, but agreements have been reached to proceed in the face of uncertainty. There is no formal process, but there is awareness of the challenge of uncertainty and this is being built upon continually.
Legal	Hierarchical obligations	Y	This MPA is included in the Natura 2000 Network as a SCI under the Habitats Directive and is also part of the MedPan Network, all of which carry obligations that have to be met.
	Capacity for enforcement	N*	MPA staff have no jurisdictional power to enforce regulations. Only verbal warnings can be issued and they are reliant on the Coast Guards to enforce the regulations and issue sanctions. A request to position cameras in the port was declined by the local Mayor.
	Penalties for deterrence	Y	These are in the form of fines and are documented within the legal framework, but they are not often applied and there is a lack of will to impose the fines.
	Protection from incoming users	Y	This is included within the legal framework which protects from larger boats specifically under the legislation, plus the distance from any other land offers increased protection as it's a long way for smaller boats to travel.
	Cross-jurisdictional coordination	Y*	There needs to be stronger cross-jurisdictional support to improve effectiveness, particularly between the MPA authorities on the island and the Coast Guard.
	Clear and consistent legal definitions	Y	All legal definitions are contained within the government law and under specific zonation plans which is regulated by the management authority.
Participative	Legal adjudication platforms	Y	The judiciary manages all adjudication through recognised legal channels and platforms for appeals.
	Establishing collaborative platforms	Y	A recently established informal advisory committee supports the decision-making process with input from a variety of user and interest groups.
	Independent arbitration panels	N*	Ustica island is small and strongly influenced by 'local' needs, therefore independent advice and arbitration, free from local politics and with the capacity to build participatory decision-making, is required to ensure the plans for the MPA move forward.
	Decentralising responsibilities	Y	The Ustica Municipality is responsible for the MPA and the daily management is undertaken by the UIMPA Management Authority
	Peer enforcement	N*	As a very small Island, peer enforcement systems could be very effective. There is a strong sense of pride in the Island's heritage and culture. This could be promoted through volunteer warden schemes to ensure the Island is respected by locals and tourists. It could also help overcome the issue with retired fishers if they understood the negative impact they were having on legitimate commercial fishers.
	Building trust and the capacity for cooperation	Y	Coast Guards, MPA staff, dive centres and local fishermen are involved in patrolling and monitoring as the management of the MPA was entrusted to the USTICA Municipality, building local trust and cooperation.

organisation) has further guided management decisions and research protocols. However, MPA staff reported that scientific reports are often published in English, exacerbating isolation of certain groups, including the MPA staff themselves. Researchers are therefore responsible for providing wider audience feedback in more appropriate and accessible formats. In each MPA, greater effort is required to encourage consideration of local ecological knowledge through a more inclusive approach, for example through participatory research projects [40]. Transparent and participative approaches to gathering and explaining scientific information, would also overcome isolation of certain groups, improving the credibility of the science and its acceptability by non-scientist participants. In California [41] this was achieved by making science team meetings open to the public with opportunities for public comments and the rationale for all scientific guidance and explicit recognition of uncertainty was made publicly available.

6.4. Legal incentives

The existence of a legal framework for management provides the basis for regulating fishing, tourism and other activities in each MPA. In PCNP, legal incentives are the keystone of the reform and extension of the park and are providing the basis for the participation of scientists and other relevant actors. The creation of a legal charter between 2012 and 2016 provided guidelines as to how conservation and local sustainable development can be supported. However, the ability to satisfy the needs and demands of all actors and to achieve a real balance between sustainable development and conservation objectives remains a major management challenge. Some MPA staff considered legal incentives and regulations underutilised and restrictions and enforcement of regulations require strengthening. In order to achieve a real balance, it is strongly recommended that thorough and high-quality monitoring

of current human activities is conducted, in order to test to what degree they are impacting the ecosystem. Evidently, in each MPA there are still some major gaps in the legal frameworks restricting the ability to enforce regulations on the ground e.g. the lack of jurisdictional power to issue sanctions of TPCCMPA and UIMPA's management authorities. The lack of capacity is seen to weaken the 'importance' of the MPA authority as a management institution. The Coastguard department, which has a specific mandate to enforce MPA regulations, were potentially more influenced by local politics and lack of political will. Effective enforcement of MPA regulations in all three cases requires stronger commitment and cross-jurisdictional coordination from all levels of government, to ensure that local and national level politics are in line with the MPA's conservation objectives, or at least cannot interfere with them. By granting sanctioning powers to the MPA authorities in TPCCMPA and UIMPA it is believed that graduated sanctions would be applied more equitably to transgressors and strengthen the MPA authorities political position.

6.5. Participative Incentives

When initiated in 1963, the views of the community and actors in PCNP directly affected by the MPA were not given the same level of consideration as they are now. A more participative governance approach was introduced through the 2006 legislative reform, and participation is now supported by a strong legal mandate. Transparent participation and decision-making processes are setting the tone for sustained management, and helped, to some extent, overcome local opposition to the park. TPCCMPA has taken a different approach, focusing considerable resources into the development of strategic partnerships with: key community groups (local government councils and schools); research institutes (universities and consultants); and key industries (e.g. dive tourism operators and small scale fishing) to ensure that the MPA management is participative. Although participative incentives are already used in TPCCMPA, and have helped broaden overall support for the MPA, such mechanisms could be strengthened by introducing clear rules regarding the roles of participants and ensuring regular meetings. In contrast to the other case studies, the long period of national government-led management has had a negative impact on the level of social capital and trust between UIMPA and the community. Lack of a local management authority has weakened possible utilisation of participative incentives. Since 2013, attempts are being made to build partnerships with key community groups, research institutes and local industries, in order to build an effective working group. During 2014 UIMPA legislation was rewritten, and various participatory approaches were used to facilitate community involvement in the decision-making process. Yet use of participative incentives is hindered by a lack of experience with such processes at local government level and turnover of MPA staff.

7. Cross cutting issues

7.1. Leadership

A top-down leadership from the national government has driven PCNP and is supported by the dedication and example set by national park staff, yet, no strong local leader has been identified. In TPCCMPA the most marked and positive changes in the management and functioning of the TPCCMPA have occurred under the leadership of the director assigned in 2004 [31]. TPCCMPA's director is a key leader and influential figure: recruiting competent temporary staff; conducting aggressive fund raising; building strong relationships with the local municipalities; and establishing a series of collaborations with social and natural scientists within national and international academic institutions and environmental agencies [31]. TPCCMPA's success has been attributed to this strong leadership and the vision held by the director [31]. However, such strong leadership and networks created by

only one key individual leaves the MPA in a vulnerable position, as when that individual leaves, the future outcomes for the MPA may be affected. In UIMPA there are several local people who have been strong advocates for the MPA and its establishment since the beginning, but are not considered leaders. Given the leadership success in TPCCMPA, there is incentive for leaders or key institutions that can play the role of leaders to be identified in the other MPAs, to contribute towards better MPA awareness, acceptance, facilitation and efficiency [42]. In TPCCMPA itself, plans are required that ensure the MPA would continue to be a 'superperformer' under alternative leadership.

7.2. Role of NGOs

The three MPAs maintain good relationships with national and international NGOs (e.g. WWF, Legambiente, Total Foundation) - who are playing a key role by influencing decisions at a national government level. However, the lack of NGOs at a community level in the three MPAs is a missed opportunity, especially given the current economic climate, which is hindering the governance capacity of all three, and the potential for funding, knowledge, facilitation and guidance that such collaborations could provide [43].

7.3. Equity and stewardship

A weakness in the governance of all three MPAs is the failure to address issues relating to equity and stewardship. In TPCCMPA and UIMPA, the lack of sanctioning power by the MPA authority leaves the management authority reliant on public administrative bodies to issue sanctions and police the MPA. Regulations are influenced by local politics and not always applied impartially. In PCNP and UIMPA, local politics and local traditions are creating inequity issues through failure to apply sanctions and regulations on a consistent basis. Locals expect 'islander privileges' [16]. Illegal sales of 'recreational' catches are common in UIMPA, with the problem rooted in strong cultural traditions and exacerbated by the lack of legal actions against violations of regulations, political influence by local vested interests and an increasing lack of human and financial resources available for law enforcement activities. The seasonality of the tourism industry in all three MPAs is another contributing factor. In low season, certain activities are 'permitted' for locals and in peak season they are restricted (with increased difficulty), whereas for tourists the restrictions are applied year round. Inconsistency and inequity in enforcement is causing the evolution of complex enforcement systems, leading some MPA staff to consider effective regulation an impossible task. Introducing warden schemes as applied elsewhere [44], could offer an opportunity to increase stewardship within the local communities of each MPA. Offering locals greater responsibility for managing the MPA, adding an extra level of vigilance, could overcome issues of public opposition; inequity and eliminate 'islander privilege' attitudes, as locals gain hands on experience of the benefits/necessity of protection.

8. Conclusions

In conclusion, the MPAs have been relatively effective, the challenges faced are similar, but governance structures and the levels of participation, in particular, have been different. A strong, clear governance structure is critical (evidenced by the weaker performance of UIMPA when a local management authority was absent). Legal incentives appear necessary but not sufficient, as in all cases there have been weaknesses in implementation. This is due to lack of local enforcement mandate (i.e. sanctioning power in TPCCMPA and UIMPA) but has also been the case in PCNP where legislation has been enforced inconsistently due to local pressures. Lack of sanctioning power in TPCCMPA appears to have, to some extent, been offset by strong leadership within the local management authority and public participation, suggesting that even without a strong or consistent legal

enforcement capacity, MPAs can deliver effective results if other aspects of governance compensate for this. In particular, public participation is being increasingly recognised in all three cases as being critical to public acceptance (and providing interpretive incentives for improved awareness and compliance). Better cross-jurisdictional coordination, improved political will and greater support from higher levels of government could assist the MPAs to fully exercise their legal authority and further meet their designated objectives. While the focus of this paper was to provide information specifically related to PCNP, TPCCPMA and UIMPA, the strategies applied and lessons learned extend far beyond the north-western Mediterranean.

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References

- [1] P. Jones, *Governing Marine Protected Areas: resilience Through Diversity*, Oxon, 1st ed., Routledge, 2014.
- [2] P. Jones, Recent marine protected area governance (MPAG) case studies: introduction and discussion, *Marine Policy*. 2017.
- [3] J.P. Worsham, Application of the Delphi method, *Vance Bibliographies*; 1980.
- [4] A. Barcelo, C.F. Boudouresque, Rôle de la recherche dans un parc national: 50 ans de recherche dans le parc national de Port-Cros, *Bull. De. La Société Zool. De. Fr.* 137 (2012) 11–24.
- [5] F. Thurel, Port-Cros et son héritage culturel, *Sci. Rep. Port. Cros Natl. Park.* 29 (2015) 237–246.
- [6] A. Guignier, M. Prieur, *Legal Framework for Protected Areas: France, IUCN, Gland Switzerland and Cambridge UK*, 2010.
- [7] C.F. Boudouresque, A. Barcelo, J.-G. Harmelin, G.J. Martin, C. Maurer, F. Médail, et al., The Scientific Council of a national park, the Port-Cros National Park: 50 years of conservation culture, *Scientific Reports of Port Cros National Park.* 27; 2013 pp. 297–317.
- [8] Eurostat Your Key to European Statistics, EUROSTAT, <www.ec.europa.eu>, 2015. <http://www.ec.europa.eu/eurostat/data/database> (accessed 7 March 2015).
- [9] G. Landrieu, L'évaluation de la valeur économique des parcs nationaux, en particulier du Parc national de Port-Cros: un exercice nécessaire mais délicat, *Sci. Rep. Port. Cros Natl. Park* 27 (2013) 377–414.
- [10] M. Coll, C. Piroddi, C. Albouy, F. Ben Rais Lasram, W.W.L. Cheung, V. Christensen, et al., The Mediterranean Sea under siege: spatial overlap between marine biodiversity, cumulative threats and marine reserves, *Glob. Ecol. Biogeogr.* 21 (2011) 465–480, <http://dx.doi.org/10.1111/j.1466-8238.2011.00697.x>.
- [11] G. Cadiou, C.F. Boudouresque, P. Bonhomme, L. Le Direach, The management of artisanal fishing within the Marine Protected Area of the Port-Cros National Park (northwest Mediterranean Sea): a success story? *ICES J. Mar. Sci.* 66 (2009) 41–49, <http://dx.doi.org/10.1093/icesjms/fsn188>.
- [12] A. Di Franco, S. Bussotti, A. Navone, Evaluating effects of total and partial restrictions to fishing on Mediterranean rocky-reef fish assemblages, *Mar. Ecol. Progress. Ser.* 387 (2009) 275–285.
- [13] K. Hogg, M. Semitiel-García, P. Noguera-Méndez, J.A. Garcia-Charton, A governance analysis of Cabo de Palos-Islas Hormigas and Cabo de Gata-Níjar Marine Protected Areas, Spain, *Marine Policy*; 2017.
- [14] L. Perez de Oliveira, Fishers as advocates of marine protected areas: a case study from Galicia (NW Spain), *Mar. Policy* 41 (2013) 95–102.
- [15] P. Francour, J.-G. Harmelin, D. Pollard, S.P. Sartoretto, A review of marine protected areas in the northwestern Mediterranean region: siting, usage, zonation and management, *Aquat. Conserv.: Mar. Freshw. Ecosyst.* 11 (2001) 155–188, <http://dx.doi.org/10.1002/aqc.442>.
- [16] A. Barcelo, J. Canale, G. Cresp, M. Creusefond, G. Crossetti, P. Despinoy, et al., Concertation et mode de gouvernance lors de la mise en place de l'aire marine protégée de Porquerolles (Hyères, France) dans le cadre de Natura 2000 en mer, *Sci. Rep. Port. Cros Natl. Park* 24 (2010) 21–38.
- [17] J.M. Cottalorda, A. Barcelo, M. Barral, H. Bergere, J.Y. Fromentin, E. Pironneau, et al., Résultats de la campagne d'octobre 2010 de recherche et d'éradication de la Chlorobionte envahissante *Caulerpa taxifolia* (Vahl) C. Agardh, *Sci. Rep. Port. Cros Natl. Park* 25 (2011) 199–202.
- [18] PCNP, ed., Parc national de Port-Cros, PCNP, <<http://www.portcrosparcnational.fr>>, 2015.
- [19] UIMPA, ed., Area Marina Protetta Isola di Ustica, UIMPA, <<http://www.ampustica.it/it/index.asp>>, 2015.
- [20] TPCC, ed., Area Marina Protetta di Tavolara Punta Coda Cavallo, TPCC, <<http://www.amptavolara.com/home-page/>>, 2015.
- [21] M. Sorlin, Histoire de Port-Cros. protection et aspects culturels, *La Terre Et La Vie, Rev. D'Ecol. Appl.* 110 (1963) 494–498.
- [22] E.M. De Santo, The Darwin Mounds special area of conservation: implications for offshore marine governance, *Mar. Policy* 41 (2013) 25–32, <http://dx.doi.org/10.1016/j.marpol.2013.01.007>.
- [23] I. Capozza, G. Garrone, Chapter 16: Italy: Towards responsibility-sharing in environmental protection, in: A. Breton, G. Brosio, S. Dalmazzone, G. Garrone (Eds.), *Environmental Governance and Decentralisation*, Edward Elgar Publishing, 2007.
- [24] GEM, Recensement de la population de mérour brun (*Epinephelus marginatus*): Pisces du Parc national de Port-Cros (France, Méditerranée), *Sci. Rep. Port. Cros Natl. Park.* 22 (2005) 39–49.
- [25] J.G. Harmelin, Le mérour brun et le corb: deux Grands Témoins de 50 ans de protection du milieu marin dans le Parc national de Port-Cros (France, Méditerranée), *Sci. Rep. Port. Cros Natl. Park.* 27 (2013) 263–277.
- [26] J.G. Harmelin, S. Ruitton, La population de corb (*Sciaena umbra*: Pisces) du Parc national de Port-Cros (France), état en 2005 et évolution depuis 1990: un indicateur halieutique et biogéographique pertinent, *Sci. Rep. Port. Cros Natl. Park* 22 (2007) 49–65.
- [27] S. Ruitton, J.G. Harmelin, Le compte est très bon. Port-Cros 2011: quand le joyau devient pureté, *Marginatus* 12 (2012) 2.
- [28] J.-G. Harmelin, P. Robert, M. Cantou, Long term changes in the dusky grouper (*Epinephelus marginatus*) population from a NW Mediterranean marine protected area, the national park of Port-Cros (France), *Nice University Publishers, Nice*, 2007.
- [29] S. Ruitton, J.G. Harmelin, Recensement et structure démographique de la population de corbs (*Sciaena umbra*) du Parc national de Port-Cros en 2009–2010, *Parc National De Port-Cros Et GIS Posidonie Publ.*, Marseille, 2010, pp. 1–46.
- [30] J.G. Harmelin, S. Ruitton, GEM, Statut du mérour brun (*Epinephelus marginatus*) dans le Parc national de Port-Cros (France, Méditerranée): état 2008 et évolution en 15 ans, *Sci. Rep. Port. Cros Natl. Park* 24 (2010) 147–159.
- [31] F. Micheli, F. Niccolini, Achieving Success under Pressure in the Conservation of Intensely Used Coastal Areas, *Ecol. Soc.* 18 (2013) 19, <http://dx.doi.org/10.5751/ES-05799-180419>.
- [32] E. Sala, E. Ballesteros, P. Dendrinos, A. Di Franco, F. Ferretti, D. Foley, et al., The structure of Mediterranean Rocky reef ecosystems across environmental and human gradients, and conservation implications (1–13–e32742), *PLoS One* 7 (2012), <http://dx.doi.org/10.1371/journal.pone.0032742>.
- [33] G. Ceccherelli, D. Casu, D. Pala, S. Pinna, N. Sechi, Evaluating the effects of protection on two benthic habitats at Tavolara-Punta Coda Cavallo MPA (North-East Sardinia, Italy), *Mar. Environ. Res.* 61 (2006) 171–185, <http://dx.doi.org/10.1016/j.marenvres.2005.09.002>.
- [34] G. La Mesa, M. Vacchi, An Analysis of the Coastal Fish Assemblage of the Ustica Island Marine Reserve (Mediterranean Sea), *Mar. Ecol.* 20 (1999) 147–165, <http://dx.doi.org/10.1046/j.1439-0485.1999.00067.x>.
- [35] P. Guidetti, Marine Reserves Reestablish Lost Predatory Interactions And Cause Community Changes In Rocky Reefs, *Ecol. Appl.* 16 (2006) 963–976.
- [36] M. Vacchi, S. Bussotti, P. Guidetti, Study of the coastal fish assemblage in the marine reserve of the Ustica Island (southern Tyrrhenian Sea), *Ital. J. Zool.* 65 (1998) 281–286.
- [37] P. Guidetti, M. Milazzo, S. Bussotti, A. Molinari, M. Murenu, A. Pais, et al., Italian marine reserve effectiveness: does enforcement matter? *Biol. Conserv.* 141 (2008) 699–709.
- [38] F. Niccolini, D. Marzo, Turismo naturalistico e sviluppo responsabile. Dal valore delle specie simbolo alla strategia di conservazione sistemica. Il caso della cernia bruna dell'Area Marina Protetta di Tavolara Punta Coda Cavallo, Report for TPCC, 2009.
- [39] J.C. Day, K. Dobbs, Effective governance of a large and complex cross-jurisdictional marine protected area: australia's Great Barrier Reef, *Mar. Policy* 41 (2013) 14–24, <http://dx.doi.org/10.1016/j.marpol.2012.12.020>.
- [40] K. Stange, J. van Tatenhove, J. van Leeuwen, Stakeholder-led knowledge production: development of a long-term management plan for North Sea Nephrops fisheries, *Science and Public Policy*, Oxford University Press, 2014, pp. 1–13.
- [41] E. Saarman, M. Gleason, J. Ugoretz, S. Aïramé, M. Carr, E. Fox, et al., The role of science in supporting marine protected area network planning and design in California, *Ocean Coast. Manag.* 74 (2013) 45–56, <http://dx.doi.org/10.1016/j.ocecoaman.2012.08.021>.
- [42] K. Hogg, P. Noguera-Méndez, M. Semitiel-García, M. Giménez-Casaldruero, Marine protected area governance: prospects for co-management in the European Mediterranean, *Adv. Oceanogr. Limnol.* 4 (2013) 241–259.
- [43] P. Jones, W. Qiu, E.M. De Santo, Governing marine protected areas: socio-ecological resilience through institutional diversity, *Mar. Policy* 41 (2013) 5–13, <http://dx.doi.org/10.1016/j.marpol.2012.12.026>.
- [44] T. Roberts, P. Jones, North East Kent European marine site: overcoming barriers to conservation through community engagement, *Mar. Policy* 41 (2013) 33–40.