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ORIGINAL PAPER

Ten years of co-management in Greek protected areas: an evaluation

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Abstract The present study attempts an evaluation of the first co-management framework that has been adopted and implemented in Greece over the last 10 years for the management of its protected areas. To get insight as to how efficient it has been, we evaluate the performance and outcomes of the 28 management authorities of the protected areas of the country that

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substantiate it and the conditions under which they have been operating. The study involved a large part of the Greek conservation community. It was conducted via a questionnaire dealing with issues of financing and administration, environmental management and guarding, and connection with the local community. For co-management, it is essential that the actors involved undertake their share of responsibility, which should be clearly defined and delimited; this was not usually the case. Decentralization of the power of management requires capacity building locally and active involvement of the local community; these have been addressed and achieved only to a limited degree. Most importantly, the support and commitment to conservation of state actors were often missing. Funding discontinuities, delays in responding to needs associated with biodiversity monitoring and protection and inefficient guarding were the major problems resulting from the inadequacies detected. Despite its weaknesses, the co-management framework contributed considerably to the conservation of environmental values of Greece. We propose improvements and measures that can substantially increase its overall effectiveness towards nature conservation. However, under the severe crisis that the country has been facing, its future is currently unknown.

Keywords Biodiversity · Conservation policy · Governance · Management Authorities · Natura 2000 network

Introduction

Protection of areas with high biodiversity value is a priority in the European environmental policy agenda, with the Habitats (92/43/EEC) and Birds (2009/147/EC) directives being the most important legal instruments to substantiate this aim. At a larger scale, the Convention on Biological Diversity (1992), the Ramsar Convention (1971) and the IUCN programmes have major contribution in setting the rules and enabling biodiversity protection. The governance framework, under which policies for the management of protected areas (PAs) are to be implemented at the local scale, can be distinguished into four major types (Borrini-Feyerabend 2003): (i) government management, where management is the responsibility of state actors, (ii) co-management, where it is distributed among different state- and non-state actors, (iii) management by private actors, and (iv) community management, where management is the responsibility of local communities.

The co-management framework is the substantiation of a pluralist approach aiming to decentralize the power of management (Berkes 2009; Plummer and FitzGibbon 2004a). Enhanced equity and efficiency of decision-making, broader based legitimization for actions and increased capacity at a local scale have been pointed as its potential main outcomes (Plummer and Armitage 2007). This framework draws from shifts in management theory and practice, whereby rights previously exerted by state actors are conceded to non-state stakeholders (Kapoor 2001; Plummer and FitzGibbon 2004b). Active involvement of communities and other local stakeholders in the environmental management of a PA (Maliao et al. 2009) is believed to assist in increasing environmental awareness, minimizing social conflicts and reducing state costs during policy implementation (Hind et al. 2010; Jones et al. 2012a; Vasconcelos et al. 2013). These seem to be the reasons why co-management has been

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increasingly applied in PAs around the globe (Horigue et al. 2012; Moreno-Sanchez and Maldonado 2010; Nursey-Bray and Rist 2009; Rodriguez-Martinez 2008). Despite this rapid development, evaluation of co-management schemes still remains a challenging task (Plummer and Armitage 2007).

The present study aims to evaluate the first such framework for PAs that has been adopted and applied in Greece. Assessment of conditions and limitations and identification of specific areas needing improvement can increase conservation efficiency at the local/regional scale so as to meet global biodiversity targets. Several studies have been published analysing evaluation methods that focus on socio-economic, ecological and management effectiveness issues (Leverington et al. 2008; Plummer and Armitage 2007; Stoll-Kleemann 2010). Focusing on the same issues, we implemented an empirical study that was initiated and endorsed by the national 'Natura 2000' Committee[1] (Vokou 2011), which is the main scientific advisory body of the State on biodiversity and PAs issues. It is an in-depth investigation of the operation of the Management Authorities (MAs) of PAs in Greece that exemplify this new framework over the past decade.

The evaluation of management effectiveness and concomitant identification of associated barriers and deficiencies can also serve direction setting. It is a prerequisite for policy recommendations that will act in support of the shift towards co-management of natural resources. It can also contribute into creating a precedent for similar initiatives to be undertaken and applied in other environmental-policy areas in Greece and in other countries, where environmental management is traditionally conducted by state actors.

The management of protected areas in Greece

Greece has numerous areas of high biodiversity value (Papageorgiou and Vogiatzakis 2006; Troumbis and Dimitrakopoulos 1998). PAs were first proclaimed in the country in 1937 (law 856/1937). Their management was the responsibility of local forest services and their funding derived solely from state sources (Papageorgiou and Vogiatzakis 2006). Major changes to this scheme were introduced half a century later (law 1650/1986); these concerned the designation processes, the distribution of responsibilities and the categories of PAs. Major responsibilities like for planning and designing policies and measures were transferred to the Ministry of Environment, Physical Planning and Public Works, but their implementation remained the responsibility of the local forest services that belonged to the Ministry of Agriculture. The two ministries failed to develop a viable collaboration scheme. Additionally, the absence of any provision for involving local communities in the decision-making and the actual management of PAs raised several problems (Papageorgiou and Vogiatzakis 2006).

The regulatory framework for the PAs was repeatedly revised between 1999 and 2011. A number of factors dictated changes. Human pressures, mainly from agricultural and recreational activities, increased, while social conflicts in the designated PAs were far from resolved (Dimitrakopoulos et al. 2010; Hovardas and Poirazidis 2007; Jones et al. 2012b; Karamanlidis et al. 2004; Kleftoyanni et al. 2011; Oglethorpe and Miliadou 2000; Oikonomou et al. 2011; Oikonomou and Dikou 2008; Papageorgiou and Brotherton 1999; Trakolis 2001a, b). In addition, although state actors were responsible for the management of PAs,

[1] The 'Natura 2000' Committee is primarily responsible for coordinating, monitoring and evaluating policies and measures for the implementation of the Habitats directive (92/43/EEC) and the protection of biodiversity in Greece (law 3937/2011). Of the Committee (2000-2013) full and deputy members, 13 were Faculty or Research Institute members representing different environmental disciplines, 4 represented NGOs with country-wide operation and another 12 represented various ministries.

several non-state actors came to be highly involved through tourism and other activities (Hovardas and Poirazidis 2007; Machairas and Hovardas 2005). Most importantly, Greece had to incorporate new European regulations in national laws, primarily the Habitats Directive, which together with the Birds Directive forms the legal basis for the pan-European Natura 2000 network of nature conservation. The new regulations that were introduced (laws 2742/1999, 3044/2002 and 3937/2011) contributed to the gradual formation of a new management framework for PAs incorporating principles of co-management (Papageorgiou and Vogiatzakis 2006). Changes were also introduced to the PA categories[2] with a new important category added, the 'Habitat/Species Management Areas' to accommodate those Natura 2000 sites in the Greek territory that were not already part of existing PAs. Several entities are eligible (law 2742/1999) to undertake the management of PAs: specifically created autonomous bodies, public services, local or regional authorities, entities of the broader public sector like state universities or research institutes or of the private sector like NGOs with proven relevant capacity. However, the centrally favoured option during the last 10 years had been that of the autonomous legal authorities.

At the time of the study, there were 28 MAs of PAs in Greece; these have under their jurisdiction <30 % of the sites making the Greek part of the Natura 2000 network (Fig. 1; see Appendix 1 in Table 5). This network in Greece includes 202 Special Protection Areas (SPAs), defined after the Birds Directive, and 241 Special Areas for Conservation (SACs), defined after the Habitats Directive. These protected sites account for 4,294,960 ha corresponding to 27.3 % of the national territory and 6.1 % of territorial waters. The list of sites to be included in the network was the product of many scientists working together under the coordination of the Greek Biotope/Wetland Centre (Dafis et al. 1996). There was no procedure involving public consultation for the list to become accepted and finalised. Before the Natura 2000 network was established, the most important PAs in the country were its National Parks (forested areas, primarily) and its Ramsar wetlands. Parts of these old PAs were later also assigned as Natura 2000 sites. Under the current law, MAs were established primarily for these PAs and only in a few cases for the newer ones.

MAs are responsible for the administration and management of PAs, for observing and evaluating the implementation of related regulations, for providing expert opinion to state actors, also for research, planning and implementing environmental education and awareness programs, undertaking and promoting eco-tourism activities, and fostering sustainable development activities (law 2742/1999). However, MAs are not authorized to enforce the law. This remains the responsibility of other authorities (forest service, police, port police, etc.) that are empowered by the state and have the necessary control mechanisms. For instance, the guarding personnel of MAs can only exert supervision of PAs and notify accordingly the authorities that are responsible to enforce the law (Papageorgiou and Kassioumis 2005; Papageorgiou and Vogiatzakis 2006).

MAs are governed by powerful Administration Boards (ABs). In compliance with the law, ABs have a three-year term and consist of 7–11 non-paid members who represent major stakeholders in the area, both public and private. More specifically, ABs consist of members representing the central government (specific ministries), members representing local authorities (mayors, prefects or their deputies), members elected to represent locally active private-interest groups (like agricultural cooperatives, fishermen associations, etc.), and members representing NGOs that operate in the area. In addition, there are environmental

[2] The other categories of protected areas of the country are the strict nature reserves, the nature reserves, the natural parks (national and regional), and the protected landscapes/seascapes or protected natural formations.

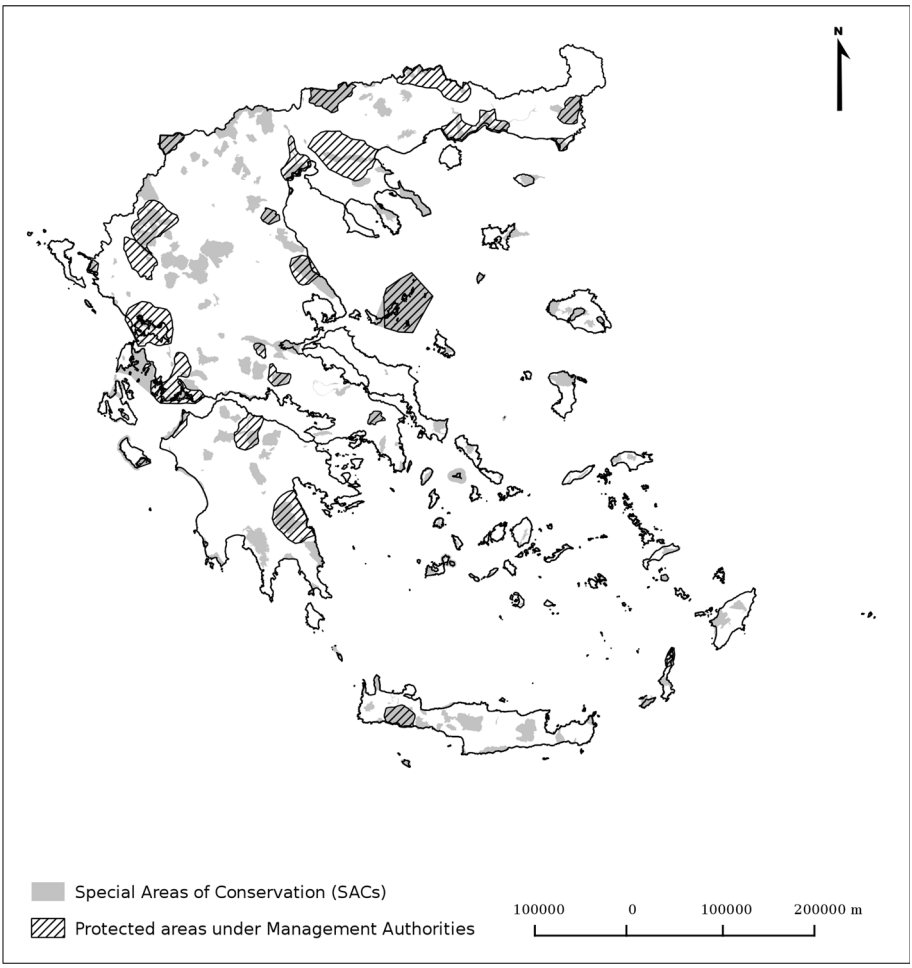

Fig. 1 Special areas of conservation of the Natura 2000 network in Greece and protected areas of the country under the jurisdiction of management authorities

scientists specialized on issues of the PAs who do not represent anybody, but are there to offer their scientific expertise. AB presidents are selected directly by the Minister of the Environment, whereas the other members are first appointed by the actors represented in the ABs (law 2742/1999). The necessary personnel for the functioning of the MAs (scientific, administrative, guards and guides) are hired by the ABs after open calls, through processes and with criteria established by the State. These criteria are not purely educational or professional; social ones are also included.

Methods

A comprehensive baseline against which to assess the outcomes of evaluation and detect positive or negative changes brought about by co-management does not exist. To get insight as to how efficient the co-management framework was, we chose to evaluate the

performance and outcomes of the 28 MAs of the country that substantiate this framework and assess the conditions under which they operate so as to examine if these facilitated or not its implementation.

To this aim, we explored a number of issues pertaining to financing and administration of the MAs, environmental management and guarding of the PAs, and connection of the two entities with the local communities. In doing so, we engaged a large part of the conservation community of the country, from the academia, administration and environmental NGOs, and primarily from the MAs themselves. We also took into consideration deficiencies already identified in the literature (Papageorgiou and Vogiatzakis 2006; Apostolopoulou and Pantis 2009).

Collection of data

A questionnaire was created and forwarded to all MAs on February 2011. Their presidents were advised to communicate the questionnaire to all members of their ABs and to the staff and return answers within 2 months. To capture the whole spectrum of diverse opinions and perceptions of those directly involved in the management of PAs, in case of different opinions, more than one questionnaire per MA could be returned. There were in total 30 filled in questionnaires. Only for two MAs, more questionnaires were returned (three from the one, two from the other) differing in some of the views expressed. In the few cases that there were differences of quantitative character, the final score for the specific MA was the average value. One MA did not participate in the survey.

The questionnaire and data processing

The questionnaire focused on the following issues: (i) functioning of the AB, (ii) functioning of the MA (infrastructure, staff, funding), (iii) monitoring and management of the PA, (iv) guarding and control mechanisms, and (v) local-community related issues. Both quantitative and qualitative aspects were explored. To produce the questionnaire, we took into consideration the relevant literature on evaluating the management of PAs (Leverington et al. 2010; Stoll-Kleemann 2010; Stolton et al. 2007, and references therein) and the views of conservation scientists in Greece. Before finalizing the questionnaire, a pilot study involving six persons from different MAs was conducted. As our goal was not to evaluate each specific MA and its efficiency to protect the area under its jurisdiction, but of the framework within which MAs operate, we did not use answers to score the performance of each MA. We focused instead onto bringing into light dominant practices and perceptions, major problems and their sources, key players and requirements for their solution.

After data analysis, a draft report was prepared and sent to selected individuals associated with various environmental players in the country, such as major NGOs and services of the public sector or of the local/regional administration, in order for them to express their own opinions and recommendations.

Administration Board

The first set of questions investigated the functioning of the ABs. Specifically, it focused on the frequency of meetings both under the current and previous compositions and on the performance of their members. More specifically, MAs were asked (i) if there are board

members systematically absent from these meetings and who these are, (ii) how many members, other than the president, participate in various activities as in the formulation of recommendations for the PA or undertaking initiatives for new projects and actions or representing the MA in various events, and how they perform their role, (iii) if MAs consider that the ABs, as composed, are appropriate to serve the function envisaged, and (iv) whether they see the need for a preparation process, before board members undertake their tasks (see Appendix 2a in Table 6).

Infrastructure, staff, funding

The second set of questions investigated the material capacity of MAs to play their role in terms of personnel, facilities, equipment available, and financial support. MAs were asked about the number of their employees, the type of employment offered and the disciplines represented, and whether they prepare staff members to cope with their tasks (see Appendix 2b in Table 6).

Regarding financing, MAs were asked whether they face any problems in funding their activities and meeting their needs; they were also asked about the funding sources during the current (2010–2015) and the previous (2003–2009) periods (see Appendix 2c in Table 6).

Concerning infrastructure and equipment, it was examined whether the facilities that MAs currently use are rented or owned and whether the available infrastructure in terms of office, monitoring, and guarding equipment is considered adequate to satisfy their needs (see Appendix 2d in Table 6).

Environmental Management

A set of questions dealt with management issues. In particular, MAs were asked whether there exists a valid regulatory framework protecting the area under their jurisdiction, if they have an integrated management plan that is approved by the Ministry of the Environment, as required (law 3937/2011), if they conduct monitoring of habitats and species, if threats and pressures in the PA have been evaluated, and if the latter were taken into consideration for planning and implementing species and habitat monitoring. They were also asked about the response of permit-issuing authorities to the expert opinion that they have to provide (law 2742/1999) regarding proposed works and activities in the PA. Additionally, they were asked how they organize and store the data that they collect, and whether data repositories are in a form that can be used in combination with other available datasets (see Appendix 2e in Table 6).

Guarding

MAs were asked if they have developed a guarding plan and if they consider that its implementation can safeguard the area's protection. They were also asked whether they have developed effective cooperation with the authorized control authorities for supervising the PA and observing the implementation of regulations for the area (see Appendix 2f in Table 6).

Local community

The final part of the questionnaire deals with issues related with local communities. More specifically, MAs were asked how often they organize specific events to inform the local

community on the various issues of the PA, how aware is the local community of the role that they play, and how well PAs are accepted locally (see Appendix 2g in Table 6).

For each of the above issues, MAs were invited to submit comments and/or proposals for improvement.

Results

Functioning of the Administration Board

The vast majority of ABs meet on a regular basis, monthly (52 %, $n = 14$) or bimonthly (41 %, $n = 11$), at a higher frequency than during the first years of MAs' operation. Although there is generally no problem with quorum, there are board members who are consistently absent from board meetings for all but two MAs. These are primarily representatives of the central administration with first in the list those from the Ministry of Finance (in 85 % of the MAs). Representatives of the supervising Ministry of Environment were also named as systematically absent by 44 % of the MAs. Systematic absences of members representing local authorities were less frequent, whereas they were never the case for representatives of NGOs and scientific experts.

Except for the president, there is a limited involvement of the other board members in MAs' activities; only two MAs (7.4 %) agreed that that there are 'several' members who have an active role in introducing issues in the board meetings or take initiatives for new actions and projects, and only one (3.7 %) that 'several' members participate in events connected with the PA (Table 1). Interestingly, only seven MAs (26 %) were of the opinion that 'several' of the AB members realize that they represent a MA and act accordingly (Table 1).

Over 70 % ($n = 19$) of the MAs regard the composition of ABs little or not at all appropriate in representing the major stakeholders of the area and in responding to the purpose that they were created, and all but one believe that there should be some preparation mechanism to enable board members perform effectively their responsibilities and duties.

Staff issues

At the time of the survey, 276 persons were employed, 3 persons at minimum, 32 at maximum[3] per MA. These are both regular (3–28 persons per MA) and seasonal personnel (7–27 persons per MA). Guards make the largest category of employees (39 %), followed by scientists of various disciplines related to aspects of the natural environment (Fig. 2). About half of the respondents (48 %, $n = 13$) answered that training to prepare the staff for the tasks and responsibilities to be undertaken was 'rarely' or 'never' offered.

Infrastructure

Two MAs (7.4 %) use facilities that they own, another 18 (67 %) use public buildings without charge and only seven pay rent (26 %). The vast majority of respondents (74 %) feel that these facilities inadequately meet their needs (Table 4). Regarding equipment, the most positive response was given for the office one: 67 % of the MAs stated that it 'totally'

[3] At that time, one MA had not hired personnel yet.

Table 1 Management Authorities' (MAs) estimations regarding the involvement of Board members, other than the president, in the activities of the MAs and judgement of their performance by those who have filled in the questionnaires (presidents or staff coordinators) if in accordance with their representing an organization of nature protection; N stands for the number of MAs having given the specific answer

Number of members	Formulating recommendations		Taking initiatives for new projects and actions		Participating in events		Understanding their role	
	N	%	N	%	N	%	N	%
Everyone	0	0	0	0	0	0	1	3.7
Several	2	7.4	2	7.4	1	3.7	7	25.9
Few	19	70.4	21	77.8	18	66.7	18	66.7
None	6	22.2	4	14.8	8	29.6	1	3.7

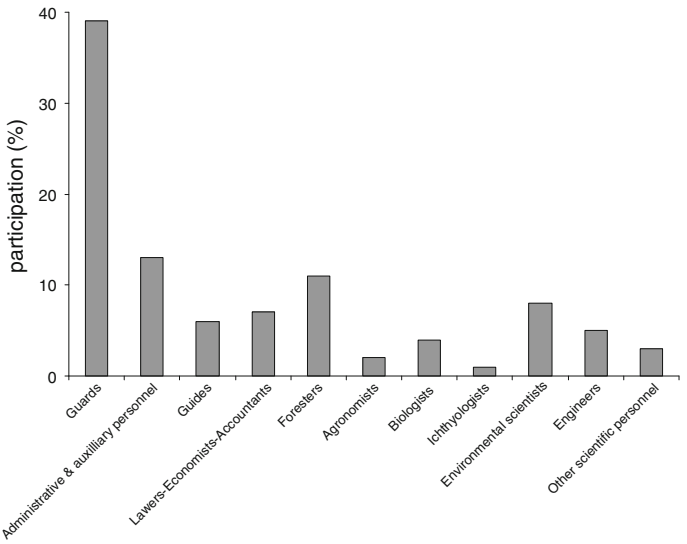

Fig. 2 Distribution of personnel (as percentages) employed in the Management Authorities of the protected areas of Greece according to occupation and/or specialization

or 'quite' covers their needs (Table 2). Guarding equipment is considered 'totally' or 'quite' sufficient by 41 %. Dissatisfaction is highest for monitoring equipment: 81 % of the MAs answered that it meets their needs 'little' or 'not at all'.

Funding

From their answers, it became evident that MAs face serious problems in funding their activities and paying their personnel (more than 70 % stated so). The funding sources are primarily European money (Fig. 3), in particular the Cohesion Fund and the Regional Development Fund (specifically, the Greek Environment and Sustainable Development Operational Program and the Regional Operational Program). Many MAs (78 %, $n = 21$)

Table 2 Management Authorities' (MAs) estimations regarding the adequacy of their facilities and equipment to serve their needs; N stands for the number of MAs having given the specific answer

Adequacy	Infrastructure (buildings)		Office equipment		Monitoring equipment		Guarding equipment	
	N	%	N	%	N	%	N	%
Totally	1	3.7	2	7.4	0	0	1	3.7
Quite	6	22.2	16	59.3	5	18.5	10	37.0
Little	16	59.3	8	29.6	12	44.4	13	48.1
Not at all	4	14.8	1	3.7	10	37.0	3	11.1

made attempts to access funding from other European programmes and 30 % achieved to be granted such. Little funding comes from national sources, mostly from the 'National Fund for the Implementation of Urban and City Planning' (known as ETERPS) and its descendant, the current 'Green Fund'; even less comes from other sources.

Environmental management of the protected area

Only three MAs manage PAs designated as such by a presidential decree, which is the first in order legal instrument offering protection status. These are the only PAs with a clearly defined legal framework of protection, well delineated zones and fully described land uses and activities. For all other PAs, other legal instruments have been used or applied; these may be old, incomplete or in litigation. Also, only one has an integrated management plan, approved by the Minister, as required. The majority of MAs do not monitor species (63 %, $n = 17$) or habitats (81.5 %, $n = 22$). A large number of respondents (63 %, $n = 17$) stated that they evaluated the threats and pressures that the PA faces and that some related measures were taken. But less than these (48 %, $n = 13$) made use of the identified threats and pressures in planning and/or implementing monitoring of species or habitats.

A positive finding was that the expert opinion that MAs provide for proposed constructions and activities in the PA is always (33 %) or often (41 %) accepted by the permit-issuing authorities (Table 3).

Regarding record-keeping and data storage, more than half of MAs (59 %, $n = 16$) stated that they have an electronic archiving system or that they keep GIS files (52 %, $n = 14$); only 30 % ($n = 8$) stated that they follow a specific protocol for organizing their data.

Guarding of the protected area

According to this survey, 74 % ($n = 20$) of the MAs developed a specific guarding plan for the PAs under their jurisdiction. This is implemented to a large extent (55 %) with the cooperation of other authorities (Table 3). Among the latter, the forest authority was mentioned by 74 % ($n = 20$), the coast guard, the police and the fire department, all together, by 67 % ($n = 18$), and the local authorities by 30 % ($n = 8$). Similarly, for the enforcement of existing regulations in the area, 52 % stated that they cooperate ('totally' and 'quite') with the relevant authorities (Table 3). Despite these collaborations, the majority of MAs believe that guarding of the PAs is not sufficient ('little' 59 %, 'not at all' 30 %).

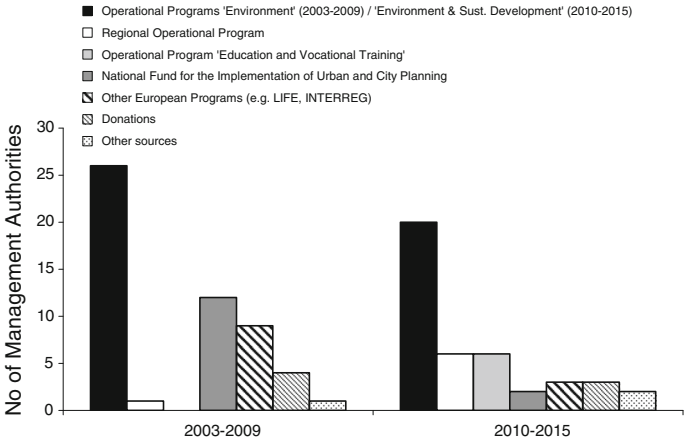

Fig. 3 Funding sources of the Management Authorities of the protected areas of Greece during two different periods (2003–2009 and 2010–2015)

Table 3 Management Authorities' (MAs) estimations regarding the level of their cooperation with other authorities and of the frequency at which their recommendations regarding permissions for works and activities in the protected area are accepted by the relevant authorities; N stands for the number of MAs having given the specific answer

Cooperation/acceptance	For guarding the area		For implementing regulations		In issuing permissions for works and activities	
	N	%	N[a]	%	N[b]	%
Totally/always	4	14.8	3	11.1	9	33.3
Quite/often	11	40.7	11	40.7	11	40.7
Little/rarely	9	33.3	8	29.6	2	7.4
Not at all/never	3	11.1	4	14.8	1	3.7

[a] Four MAs answered that they have not provided expert opinion yet

[b] One MA did not answer to this question

Relations with the local community

Only one MA believes that the local community has understood its role and only two MAs that the local community has accepted the PA (Table 4). It is not a surprise then that many MAs organize events to inform the local community on issues concerning the PA and the MA; it is a surprise, though, that a large part of them (44 %) only rarely undertake such activities.

Discussion

It is widely accepted that efficient governance of the actors involved in the management of PAs is an essential step towards the effective management of PAs themselves (Leverington et al. 2010). Having this in mind, we examine our results.

Table 4 Management Authorities' (MAs) estimations regarding the degree to which the local community understands their role and accepts both the MA and the PA; N stands for the number of MAs having given the specific answer

Degree (of)	Understanding the role of the MA		Accepting the PA and the MA	
	N	%	N	%
Totally	0	0	0	0
Quite	1	3.7	2	7.4
Little	22	81.5	25	92.6
Not at all	4	14.8	0	0

One of the aims of co-management is decentralization (Pomeroy and Berkes 1997). This does not mean that state support is not essential (Cao et al. 2014). Representatives of ministries are expected to act as links between central authorities and MAs providing locally the necessary information on centrally decided policy issues and transmitting back to central authorities information regarding the specific problems encountered by each MA. Their role at the local level is important for one additional reason: they personify the commitment and willingness of central authorities to support the MAs and their activities. Thus, it becomes a serious problem if representatives of the Ministry of Environment, which is the supervising state authority, are systematically absent.

Administrative Boards are designed in accordance with co-management principles, giving the opportunity to major stakeholders to interact directly among themselves and with scientists having expertise on environmental issues of the PA. Optimally, they can function as fair representations of the local societies and their administrative and scientific environments. However, to become efficient and play their role, it is essential that the really important local players participate in the ABs, and there should be provision for this requirement to be met at all times. The players that we are referring to are primarily locally active legal entities representing different groups of people and their interests. This is because AB members, with the exception of environmental experts, do not participate as individuals but as delegates: of the central government, the local authorities, private-interest groups and NGOs. Which exactly of the locally active actors are to be included in the AB of each MA is decided by the Minister of Environment. As Papageorgiou and Vogiatzakis (2006) also note, the issue of ABs' composition is a critical one as it affects the representation of various voices in the management of each protected site. If NGOs with a very minor presence are chosen, if the farmers are not selected to be represented in the AB of a park surrounded by an agricultural area or the fishermen in that of a marine park or a lake, if the president appointed is not a scientist related to environmental issues, as required by the law, mistrust will be the result, particularly from the excluded actors, and the role and importance of this administrative structure will be jeopardized. In a wider context, given that many actors are involved in the management of PAs, it is essential that the responsibilities of each one become clearly defined and delimited rather than diffuse and overlapping.

The qualifications of the AB members and how prepared they are to undertake their responsibilities is an issue raised by many MAs. If AB members promote strictly the interests of the actors that they represent, if they are not well qualified to interact in a co-management framework, if they underestimate the need for species and habitat conservation and the ecological importance of specific biodiversity features (in controlling the

microclimate, preventing floods, resisting to exotic species invasions, etc.) they will fail to perform their role. Specialized seminars to increase the Board members' knowledge-base on ecological, social and management issues of the PAs and to assist them in improving their understanding of the situation and acquiring necessary administrative skills could be an answer. The presidents of ABs play a crucial role and, therefore, they should be specifically targeted. Because of legislation gaps, apart from theirs, they also play the role of Chief Executive Officers (CEOs). Their qualifications usually satisfy one of the requirements for such a position: most often, they are esteemed members of the academia, thus satisfying the criterion of scientific expertise on environmental issues, or they are elected representatives of the local people (mayors, prefects, etc.), thus satisfying the criterion of administrative and/or managerial capacity. Very seldom they satisfy both criteria. Their position is also political: presidents are selected directly by the Minister of Environment from the pool of those having expressed an interest. This implies that in exerting their duties, they will have the support of the supervising state authority. In practice, this is rarely the case. As AB presidents are not paid but volunteer in offering their time and expertise, gaps in legislation should be filled and CEOs be appointed. A background on conservation planning and experience in achieving communication between scientists, policy makers and land managers (Knight et al. 2006) are very important qualifications for CEOs to have.

For the majority of MAs, the current size of the personnel employed is considered adequate. But, adequacy in numbers is not synonymous to a high level of efficiency (Cao et al. 2014). There are many committed, highly qualified and very efficient staff members that are hired for their specific skills; there are also others who are employed after social criteria. Improvement in the hiring process is required in line with what has already been proposed for those working in PAs (Nielsen 2012; Porej et al. 2009). Considering that new tools and models are constantly developed, while new challenges, gaps in knowledge and conservation issues are raised (Rands et al. 2010; Sutherland et al. 2014), state funding should be allocated for the needs of training and technical education at various periods during personnel employment.

Species and habitats monitoring is a main responsibility of MAs. Such a monitoring requires skills that only experts have. However, after the exploratory and initial assessment phases, alternative monitoring frameworks could be investigated and applied: clearly described protocols could be developed that, in conjunction with specialized seminars, would allow volunteers to take part. A recent survey on biodiversity-monitoring practices across Europe showed that volunteer-based schemes are important tools for monitoring and conservation, and that the quality of volunteering data is more likely determined by survey design, analytical methodology, and communication skills (Schmeller et al. 2009). Therefore, training should also aim at increasing the ability of MAs personnel to contact and attract volunteers and further design appropriate schemes, where to involve them.

Funding is always an important issue in nature conservation (Cao et al. 2014; Oestreicher et al. 2009; Reid-Grant and Bhat 2009; Schmeller et al. 2008; Struhsaker et al. 2005). Inadequate funding would be disastrous for critically endangered species (IUCN Red Data List/assessed 12/3/2014), among which the monk seal *Monachus monachus*, one of the most endangered mammals of the world, and the steno-endemic *Saponaria jagelii*, one of the top 50 Mediterranean island plants (Montmollin and Strahm 2005), and would seriously affect conservation of the habitats of other priority species that utilise Greek sites as their breeding (e.g. the loggerhead sea turtle *Caretta caretta*) or overwintering (e.g. the lesser white-fronted goose *Anser erythropus*) grounds. Although lack of funding was mentioned by all MAs, the expressed primary concern was more the continuity and origin

rather than the size of funds. MAs have been covering their needs almost exclusively with European money; this was not their choice, but a centrally made one. The consequence of this choice is that their operation pertains more to a project of a European programme rather than to an entity of the broader public sector. This had major impacts on their efficiency, associated primarily with discontinuities of their operation between European-programme periods and with a heavy administrative load to satisfy the requirements and comply with the limitations of either state. Diversification of sources, wherefrom to get funding, is very important for PAs: entrance fees, tourism and recreational activities, purchase of local products, etc. (Dimitrakopoulos et al. 2010; Eagles et al. 2002; Jones et al. 2012a, b; Nolte et al. 2010; Reid-Grant and Bhat 2009) are some of the options needing to be explored. State actors have an important role to play in facilitating such efforts. Taking advantage of existing instruments, MAs should also explore the possibility of collaboration schemes with the research and development sectors so as to reach new funding sources while gaining in knowledge, support and experience.

Disappointing findings of our study that constitute adverse conditions for MAs' operation are (i) that the legal framework for the large majority of PAs in Greece is old, incomplete, currently in litigation or it does not exist at all, and (ii) that only one MA has an approved (by the Minister of Environment) management plan. There are conservation activities and measures, but these do not make part of a structured and coherent plan, and they do not result from clearly defined priorities and objectives. Evidently, under such conditions, the co-management framework cannot be evaluated as to its efficiency, because basic prior requirements are not met. In order to ensure effective conservation planning, it is important that information gained from the past be assembled and used to drive future decisions (Grantham et al. 2010). To this end, we suggest fast-track procedures for improving legislation and development of specific, clear and applicable guidelines from the central authorities for flexible and realistic management solutions (Arponen et al. 2013).

Guarding of PAs is essential for the effective protection of biodiversity (Bruner et al. 2001). With its 6,600 plant taxa (Dimopoulos et al. 2013) and 23,130 animal taxa (Legakis and Maragou 2009), among which numerous endemic (1,278 plant and 3,956 animal species) and threatened, Greece is a biodiversity hotspot, part of the Mediterranean hotspot (Mittermeier et al. 2005; Myers et al. 2000). Ineffective guarding may have serious impacts on biodiversity, particularly because numerous human activities take place within PAs (Tsiafouli et al. 2013). The guarding system of the Greek PAs is co-management in practice. This is because the guarding personnel of MAs are not authorized to enforce the law, and therefore, different authorities are obliged to collaborate. However, collaboration among them is not always as close as required and immediacy in responding, when illegal and harmful activities are detected, is not always achieved. To this we should add that environmental crime is not always taken and punished as seriously as it should in the country. The guarding system should be revised and the guarding personnel of the MAs be given the authority to enforce the law. This in turn will require selection criteria different to those currently used for the recruitment of the guarding personnel and additional training of the current one to be able to face the new tasks. In a revised guarding system, the role of all involved actors and the terms of their operation should become clearly defined, but also respond to an additional requirement: to protect biodiversity not only within but also outside PAs. Apart from that, the conservation community should become more active and seek alliances that would make the environmental crime far less acceptable by the Greek society.

The last issue concerns the interaction of MAs with local communities. These consist of residents who live in the area on a long-term basis, permanently or even as second home

owners (Petrova et al. 2011). According to the majority of MAs, there is a rather low level of acceptance of PAs by the locals and a limited understanding of MAs' role. Local people differ in many aspects: in gender, age, education, occupation, economic status, but also in other characteristics like how strongly they feel attached to the place. All these proved important, at least in some of the cases examined, in shaping local people's attitudes (Anthony and Moldovan 2008; Jones et al. 2012b; Kleftoyanni et al. 2011; Pavlikakis and Tsihrintzis 2006; Petrova et al. 2011; Trakolis 2001a, b). The lack of public participation in the planning and decision-making has been identified as a major factor towards developing negative perceptions in the case of Greek PAs (Papageorgiou and Vogiatzakis 2006) and is related to the fact that the national conservation policy is perceived in Greece as a top–down response to horizontal European directives (Apostolopoulou and Pantis 2009). Benefits from incorporating the locals' knowledge, expertise and needs into conservation planning have been widely acknowledged and ways of how to achieve it also discussed in the context of biodiversity conservation and conflict management (Berkes 2004; Wells and Bradon 1992; Young et al. 2012), but weaknesses regarding public participation are still very common in the management of PAs (Cao et al. 2014; Ervin 2003). Even if the ABs of the Greek MAs are properly composed, decision making will largely remain a compromise only among those participant interests that are included; other stakeholders may find themselves having no influence on the negotiation process (Papageorgiou and Vogiatzakis 2006). As the success of MAs is linked with local communities' perceptions and attitudes, communicating the reasons why a PA has been established, the perspectives and the new opportunities that the protection status offers, following practices that reduce suspicions and smoothen conflicts, and adopting processes through which the local community participates actively and finds a role in the management of PAs should be consistently pursued by all MAs. Whether MAs can respond to the increasing pressures for appropriate representation of a matrix of different interests between national-local level as well as between socioeconomic-environmental dilemmas (Papageorgiou and Vogiatzakis 2006) is still an unanswered question.

It is widely perceived that the co-management framework, which has been applied in Greece, though incomplete in its implementation and heavily relying on volunteerism, had an overall positive impact and contributed considerably to the conservation of environmental values of the country. However, this does not apply for the all the national Natura 2000 sites. Although this network represents the basic instrument for applying and promoting conservation of the Europe's critical biodiversity features, only part of this network is under appropriate management schemes (Apostolopoulou and Pantis 2009; Beunen and de Vries 2011; Iojă et al. 2010). In Greece, in particular, more than 70 % of the national Natura 2000 sites are without responsible authorities for their management; there are no clearly defined objectives, priorities and measures for the species and habitats included in them, either. It is important to know how much this situation has affected conservation efficiency in these sites compared to that in PAs under the jurisdiction of MAs. Unfortunately, this cannot be currently assessed, as nationwide monitoring of species and habitats and evaluation of their conservation status has started only recently.

The Greek co-management framework for PAs has a specific structure, in the sense that only representatives of stakeholders (including state actors, local authorities and NGOs) and scientists with expertise on environmental issues of the PA participate in the ABs of MAs. At present, there is no official framework promoting a wider participation of the public beyond representation of the major stakeholders in the decision-taking bodies. As a result, we based the design of this study on current methodological tools for evaluating management of PAs (e.g. Leverington et al. 2010; Stoll-Kleemann 2010; Stolton et al.

2007) that focus on the perceptions of management actors. To have some understanding of the interaction of MAs with the local communities, some questions regarding the citizens' perceptions were also included in our survey, but our evaluation is clearly based on MAs perspective. To complete the picture, further research is needed that will focus on the local communities, which are the ones directly affected by the establishment of PAs. However, if the social and institutional context within which MAs operate and the external and internal constraints of this operation are not well understood, it may be difficult to interpret the views of local people. Therefore, researches like the one that we have undertaken should precede those exploring the responses of the local communities.

As a final remark, we note that at the time of preparing this paper, a new Bill passed (law 4109/2013), which changes the system's structure. After merging many, abolishing several, and maintaining a few, there will be 14 MAs, in total. These changes took place against the opinion of the conservation community of the country, assumingly in response to the demands of the country's lenders for a smaller public sector. Given these unnecessary changes, it is to be seen how much of the co-management framework will remain in the years to come.

Conclusions

The present study aimed to evaluate the performance of a co-management governance framework that has been implemented in Greece in the field of environmental management over the last decade. There were signs of satisfactory implementation of co-management in some areas, but several deficiencies were also identified.

As stated by Plummer and Armitage (2007), amassing empirical evidence which is ground in practice not only contributes to the collective understanding of adaptive co-management in theory, but it also permits articulation of arguments to policy makers, international development organizations, and resource agencies. In this context, the major issues that emerged from the evaluation of the Greek system, on which attention should be drawn, are primarily related with the responsibilities of all involved actors, both state and non-state. It is essential that they undertake their share of responsibility, which should be clearly defined and delimited.

MAs will be unable to execute their essential responsibilities without local support. Therefore, improving their local acceptability should become a priority. To this aim, structuring of ABs so that they correspond to the really important stakeholders of the area, adoption of bottom-up-approaches for a number of management issues and widening the scope of co-management so as to include the wider public should be pursued.

Despite the decentralization of the power of management in the Greek system, the central government remains the major player. Co-management of PAs cannot be achieved without its commitment to support MAs and their operation at all levels. New or revised legal instruments are urgently needed to secure the protection status and improve guarding efficiency. For the conservation goals to be achieved, operation discontinuities of MAs should be avoided and sufficient funding guaranteed. For the latter, diversification of funding sources should be sought by MAs so that they are able to perform their primary conservation tasks, at least. Because of the European dimension of the Natura 2000 network, European money must remain a main source for its operation and implementation of associated goals, but state funding should be allocated to improve the qualifications of administrators, satisfy the needs of training and technical education of the employed personnel, and cover the needs of everyday operation.

Despite its weaknesses, the co-management framework that has been implemented in Greece contributed considerably to the conservation of the environmental values of the country. We expect the measures and improvements that we propose to substantially increase its overall effectiveness towards nature conservation, but under the severe crisis that the country has been facing, its future is currently unknown.

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Appendices

Appendix 1

See Table 5.

Table 5 Protected areas in Greece having management authorities and the year the latter were formed

Protected areas having responsible authorities to manage them		Year
1	National Marine Park of Zakynthos	2000
2	Schinias-Marathonas National Park	2002
3	Pamvotis Lake Eco-development area	2002
4	National Marine Park of Alonissos-Northern Sporades	2002
5	National Park of the Koroneia-Volvi Lakes	2002
6	Northern Pindos National Park	2002
7	Karla-Mavrovounio-Kefalovrysso-Velestino Eco-development area	2002
8	Eco-development area of Mt Parnon and Moustos Wetland	2002
9	Dadia-Lefkimi-Soufli Forest National Park	2002
10	Mesologgi Lagoon National Park	2002
11	Axios-Loudias-Aliakmonas Estuaries National Park	2002
12	Kerkini Lake National Park	2002
13	Evros Delta National Park	2002
14	Prespes National Park[a]	2002
15	National Park of Kotychi-Strofylia Wetlands	2002
16	National Park of Eastern Macedonia and Thrace (Delta Nestou and Vistonida-Ismarida Lakes)	2002
17	Amvrakikos Wetlands National Park	2002
18	North Karpathos-Saria Eco-development area	2002
19	Helmos-Vouraikos National Park	2002
20	Ainos National Park	2002
21	Acheron and Kalamas Rivers Nature Reserve	2002
22	Oiti National Park	2002
23	Parnassos National Park	2002

Table 5 continued

Protected areas having responsible authorities to manage them		Year
24	Rhodope Mountain Range National Park	2002
25	Olympus National Park	2002
26	Samaria National Park	2002
27	Parnitha National Park	2002
28	Tzoumerka-Peristeri-Arachthos Gorge National Park	2009
29	Kastoria Lake Nature Reserve[b]	2012

[a] It was the only Management Authority that did not answer the questionnaire

[b] It was established in 2012, after the end of the survey, never had any administration board or staff, and was abolished soon after

Appendix 2

See Table 6.

Table 6 Major issues, questions per issue, and specifications for answering the questionnaire distributed to the Management Authorities of protected areas of Greece; AB stands for Administration Board, MA for Management Authority, PA for protected area

Issue examined	Questions	Type of question/answer options
a. Functioning of the AB	How often do AB meetings take place currently?	Open question
	How often did AB meetings take place in the past?	Open question
	Do all AB members usually participate in the AB meetings?	Yes/No
	Are there members that are systematically absent?	Yes/No
	If so, which actors do they represent the members that are often absent?	Open question
	How many of the AB members are involved in formulating recommendations for the PA?	Everyone, several, few, none
	How many of the AB members undertake initiatives for new projects and actions in the PA?	
	How many of the AB members participate actively in representing the MA and are present in events connected with the PA?	
	How many of the AB members realize that they represent a MA of a protected area and act in a respective manner?	
	Do you regard that the AB composition fulfils the aims that it was created for?	Totally, quite, little, not at all
	Do you regard that a preparation mechanism is needed for the AB members before they undertake their responsibilities in the MA?	Yes/no
	If you have any comments and/or improvement proposals for this issue, please write them down	Open question

Table 6 continued

Issue examined	Questions	Type of question/ answer options
b. Staff of the Management Authority	Does the MA employ personnel?	Yes/no
	How many people are employed on (a) regular, (b) temporary base?	Open questions
	Which disciplines do staff members represent and which are their responsibilities in the MA?	Open question
	Are the new staff members trained concerning the PA, and the responsibilities that they will undertake?	Always, often, rarely, never
	If you have any comments and/or improvement proposals for this issue, please write them down	Open question
c. Funding of the MA	Are there serious problems with funding of the MA?	Yes/no
	Are there serious problems with staff payments?	Yes/no
	What are/were the sources of funding of the MA during the periods (a) 2005–2009, (b) 2010–2015?	Open question
	Have you tried to access funding through other sources?	Yes/no
	If so, did you have any success with these efforts?	Yes/no
	If you have any comments and/or improvement proposals for this issue, please write them down	Open question
d. Facilities and equipment	Do the current facilities meet the needs of the MA?	Totally, quite, little, not at all
	Does the current office equipment meet the needs of the MA?	
	Does the current monitoring equipment meet the needs of the MA?	
	Does the current guarding equipment meet the needs of the MA?	
	Do you rent/own the facilities that you currently use?	Open question
	If you have any comments and/or improvement proposals for this issue, please write them down	Open question
e. Environmental management	Has the management plan of the area been completed and approved by the Ministry of Environment?	Yes/no
	Do you implement a scientific monitoring scheme for species (collecting, sorting and analysing data)?	
	Do you implement a scientific monitoring scheme for habitats (collecting, sorting and analysing data)?	
	Have you evaluated the threats and pressures that the PA faces?	
	If so, have you taken into consideration these threats and pressures in planning and implementing species and habitat monitoring?	
	Are the data that you collect in a format that allows connection with data from other areas so as to arrive at conclusions at different spatial scales? In particular,	
	Do you keep electronic files? (e.g. excel)	
	Do you keep spatial data? (e.g. GIS)	
	Do you follow a specific protocol for systematically organizing data?	

Table 6 continued

Issue examined	Questions	Type of question/ answer options
	When you give expert opinion, as required by the law, about proposed works and activities in the protected area, are your recommendations accepted by the relevant authorities?	Always, often, rarely, never
	If you have any comments and/or improvement proposals for this issue, please write them down	Open question
f. Guarding of the PA	Do you implement a specific guarding plan in the PA?	Yes/no
	Does the MA cooperate with other authorities (e.g. forest services, police) for the guarding of the PA?	Totally, quite, little, not at all
	Does the MA cooperate with relevant services (e.g. urban planning office) for the implementation of the relevant regulations in the PA?	
	Is the guarding of the PA sufficient?	
	If you have any comments and/or improvement proposals for this issue, please write them down	Open question
g. Local community issues	Do you inform the local community for the PA and the MA?	Always, often, rarely, never
	Do you regard that the local community has understood the role of the MA?	Totally, quite, little, not at all
	Do you regard that the local community has accepted the PA?	
	If you have any comments and/or improvement proposals for this issue, please write them down	Open question

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