

Factors shaping implementation of protected area management decisions: a case study of the Zakynthos National Marine Park

ANATOLI TOGRIDOU*, TASOS HOVARDAS AND JOHN D. PANTIS

Department of Ecology, School of Biology, Aristotle University, UPB 119, 541 24, Thessaloniki, Greece

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SUMMARY

Institutional and non-institutional factors for the success of protected area (PA) governance have repeatedly been identified, but their relative weight has not been evaluated. To investigate the implementation of PA management in Zakynthos (Greece), meeting minutes of the local Park Authority for its first four years of operation were reviewed and statistically analysed. The Park Authority's autonomy and management complexity were indicated and with reference to governance, members of the local Park Authority belonged to the 'inner-circle' of decision-making and the Ministry of Environment formed the 'environment', since administrative issues had to be approved by the latter. Implementation of actions referring to administrative issues was less likely than implementation of environmental, social and economic arrangements, where the Park Authority had a higher degree of autonomy. The implementation of arrangements for promoting administrative stability and viability was highly dependent on external actions (annual government funding and approval of by-law governance and implementation). The more sophisticated and complex the governance system became, the more likely it was that Park Authority encountered difficulty when trying to make choices and changes. The methodology proved effective in revealing the management behaviour of the Park Authority, as well as indicating institutional and non-institutional issues that most significantly affected the harnessing of resources and the degree of action implementation; this could offer crucial feedback to managers and governmental representatives on the factors responsible for the success or failure of PA management.

Keywords: effectiveness, institutional and non-institutional factors, management behaviour, protected areas

INTRODUCTION

A prevailing task for policy makers is to evaluate protected area (PA) management. During the last few decades, the empirical

evaluation of PA performance has gained increasing attention and notoriety as a conservation priority (Pomeroy *et al.* 2001, 2005), and a growing body of literature recognizes the effective management of PAs as a crucial step towards sustainable development (Hockings *et al.* 1998; Imperial 1999; Mascia 2000; Scrase & Sheate 2002; Hockings *et al.* 2004; Pullin *et al.* 2004; Beger *et al.* 2005). It is generally assumed that quality of management should improve as the number of PAs increase globally (Crofts 2004) and in Greece, where approximately 300 PAs have been declared following the Natura 2000 Directive.

It has become commonplace to create governance systems for PAs capable of managing multiple uses in an integrated way through the cooperation and coordination of government institutions at different levels of authority (Patrick & White 1997; Ehler 2003). Encouraging the participation of users in PA management is increasingly gaining support, as managers recognize that without cooperation, effective management of resources will be impossible (Hockings 1998; Jameson *et al.* 2002; Beger *et al.* 2005). In 1999, the Greek government established an institutional framework for the National Marine Park of Zakynthos (NMPZ) and, in 2002, they created 25 local park authorities (Greek Law 3044/2002) under the Ministry of Environment to manage Greece's most important PAs. However, despite major protection efforts, there is a substantial lack of Greek literature on the subject of PA management.

Since the mid-1990s, numerous methodologies have been developed to assess the management effectiveness of PAs (Edgar *et al.* 2004; McClanahan *et al.* 2005; Napier *et al.* 2005). Management effectiveness is here defined as the degree to which management actions planned to achieve the goals of the PA are transformed from decisions to implemented actions. However, besides interviews and questionnaires to stakeholders, the decisions recorded in the Park Authority's minutes are a valuable contribution to the understanding of management behaviour. The use of meeting minutes has long been a common methodology in political sciences (see Schwartz-Shea & Yanow 2002 for a discussion), yet it has rarely been employed in conservation policy. Minutes contain consistent records of management actions and planning, and translate individual preferences into collective choices.

A large number of PAs have failed to meet their management objectives (McClanahan 1999; Pauly *et al.* 2002). Management failures range from complete lack of implementation (so called 'paper parks'; Beger *et al.* 2005) to strategic errors. Exogenous (non-institutional) issues (such

* Correspondence: Mrs A. Togridou Tel: +32 31 099 8316/8254 Fax: +32 31 099 8379 e-mail: atogridou@bio.auth.gr

as insufficient finances, lack of government commitment, unclear legislative directions, ineffective power-sharing and decision-making) and endogenous (institutional) issues (such as misunderstanding of the institutional context in which managers make collective choices and insufficient Park Authority actions) have been recorded as key factors in PA failures (Bernauer 1995). Clearly, the mixed success of current PA performance demonstrates an immediate need to build capacity for PA policy makers to proceed with rapid evaluations of both the institutional and non-institutional factors that shape PA management strategies and actions.

In response to the recognition of the need for an applicable approach to management evaluation, we selected the NMPZ in Greece as a case study to investigate non-institutional and institutional procedures associated with the effectiveness of PA governance. We believe that empirical research, guided by a coherent evaluation theory and basic social science methodology, is the most productive way to assess a park authority's governance and arrive at insights that are of practical value for environmental policy makers. Therefore, we based our model on two institutional analysis and management evaluation frameworks, namely the Institutional Analysis and Development Theoretical Framework (see Ostrom 1986, 1990; Ostrom *et al.* 1993, 1994; Crawford & Ostrom 1995; Koontz 1997; Ostrom & Ostrom 2004) and the World Commission on Protected Areas (WCPA) Framework (outlined in Hockings *et al.* 2004). We augmented these frameworks with meeting minutes and their statistical analysis, defined resources available to management and established a criteria system for the evaluation process, and then applied the methodology to the NMPZ.

Three main objectives were considered in this assessment of the NMPZ Park Authority's governance. (1) How is the NMPZ Park Authority structured, how are decisions made and what influences these decisions? (2) What has the management behaviour been in administering the area, i.e. what has the management behaviour been? (3) How have non-institutional and institutional factors shaped implementation of Park Authority policies and actions?

METHODS

The Park history

Physical conditions

Zakynthos has the most important loggerhead sea turtle (*Caretta caretta*) nesting beaches for the Mediterranean. Systematic monitoring has shown that 1000–2000 nests, depending on the year, are recorded on the 3.5 km of sandy beach within the Laganas Bay, located on the south coast of the island (Margaritoulis & Rees 2003). Zakynthos, once a quiet island catering to a few Greek visitors, has recently become a prime tourist resort, experiencing rapid tourism growth over the past 20 years, which is believed to exert significant pressure on turtle nesting beaches.

Table 1 Synopsis of the history of the Zakynthos National Marine Park (NMPZ).

<i>Year</i>	<i>Fact</i>
1983	Establishment of a society for the study and protection of the loggerhead turtles (<i>Caretta caretta</i>), the Sea Turtle Protection Society (STPS)
1987	Ministerial decision to demarcate a Housing Control Zone
1990	Critical point when local indignation turned to violence
1990	WWF established its own presence on the island with programmes for the protection of another marine species, the monk seal (<i>Monachus monachus</i>)
1998	European Commission froze funds earmarked for the development of infrastructure in the protected area
1999	European Commission started an infringement procedure against Greece; the case is pending in the European Council of Justice
1999	Presidential Decree for the establishment of the NMPZ
2000	Establishment of the Park Authority of the NMPZ

Community attributes

In 1987, a ministerial decision demarcated a Housing Control Zone along the nesting beaches in which land use was regulated. This legislation infuriated local landowners who looked to tourist development as an easy enterprise. The government failed to compensate the affected people in the years that followed and hence exacerbated negative attitudes towards measures dealing with sea turtle protection (Dimopoulos 2001). Consequently, illegal construction of bars, restaurants, holiday homes and deployment of beach furniture mushroomed, and parts of the habitat experienced severe development (Table 1).

Rules-in-use

The Presidential Decree for the establishment of the NMPZ Park Authority (1999) established the actions that should be taken to achieve desired outcomes (Dimopoulos 1991; Warren & Antonopoulou 1990). One of the main aims of the NMPZ is to protect the natural heritage of the coastal area of Laganas Bay. The regulation assigned was the establishment of a zoning system that controls land use within the NMPZ. Unfortunately, enforcement of legislation was very poor mainly because there was no specific body to coordinate law enforcement efforts. Furthermore, no appropriate compensation strategies for affected landowners were ever implemented (Theodossopoulos 1997).

Action situations

The European Commission commenced an infringement procedure against Greece in 1999 for the NMPZ, and the case is pending in the European Council of Justice. Following years of delays, the Presidential Decree establishing the NMPZ was finally signed on the 1st December 1999 and published in the



Figure 1 Location and diagrammatic map of the National Marine Park of Zakynthos (Greece).

Government Gazette on 22 December 1999. The recently-established NMPZ (Fig. 1) addresses the problems pertaining to the overall site protection, integrated management and sustainable development.

The major achievement of the Presidential Decree was the establishment of a private, non-profit institution, namely the Park Authority of Zakynthos National Marine Park, to administer the NMPZ under the authority of the Ministry of Environment. The Park Authority comprises the President, representatives from the three ministries involved in PA governance (namely the Ministry of Environment, Ministry of Agriculture and Ministry of Commercial Navigation), one regional representative, two non-governmental organization (NGO) representatives (from the Sea Turtle Protection Society [STPS] and World Wildlife Fund [WWF] Greece), three representatives from local authorities (namely the Prefecture of Zakynthos, Municipality of Zakynthos and Municipality of Laganas) and two representatives of the local economic sector (i.e. the Agricultural Association and Hotel-owner Association). At the administrative councils, the actors make collective choices over the strategic decisions, a fact also indicated by the unanimous nature of all decisions taken. The body has autonomy on decisions referring to environmental and social issues, but decisions referring to administrative

arrangements (by-law governance and operation) have to be approved and signed by the Ministry of Environment.

Data collection

To review the decisions taken by the NMPZ Park Authority, we selected the minutes of the Park Authority's meetings during its first four years of operation (2000–2003). Minutes included all the decisions taken by the Park Authority and reflect the management strategies designed to achieve objectives (planning). The data set comprised 439 decisions. To assess the implementation of actions, we noted whether the decisions recorded in the minutes were wholly or partially implemented, or not implemented at all. For example, in response to one objective to promote environmental awareness (desired outcome), the Park Authority decided to construct ten information kiosks on tourist beaches (action). This action was considered by stakeholders as 'all implemented' when all 10 information kiosks were constructed, 'partially implemented' when less than 10 were constructed, and 'non implemented' when no information kiosk was constructed.

We analysed the content for each decision and categorized it according to the law in force. Furthermore, for each decision we defined available resources that had been mobilized in the decision-making process and governance criteria that had been taken into consideration. Inter-coder reliability amounted to slightly over 80%, which is deemed a satisfactory content analysis reliability measure (Weber 1990; Malloy & Fennell 1998; Bos & Tarnai 1999).

Methodological steps

An institutional framework that identifies the major types of structural variables, present to some extent in all institutional arrangements, is the Institutional Analysis and Development Framework (IAD; Ostrom 1986, 1990; Ostrom *et al.* 1993, 1994; Crawford & Ostrom 1995; Koontz 1997). The IAD has been widely employed to examine the institutional arrangements used to implement ecosystem-based management programmes (Imperial 1999), as well as to analyse fisheries policy (Imperial & Yandle 2005). The starting point of the institutional analysis consists of understanding the environment within which management is operating (context; Imperial & Yandle 2005). This description typically includes the physical conditions, the attributes of the community, the rules-in-use, as well as the action situations and the actors of the action arena.

The methodology included two main steps: the identification of the parameters used in this study and the statistical analysis of the relationships between the parameters. Three parameters were defined in our analysis.

Management objectives and resources

The Presidential Decree for establishment of NMPZ determines the objectives that should be accomplished in management plans and includes rules-in-use. Thus,

Table 2 Institutional and non-institutional criteria used for assessing PA governance.

<i>Criterion</i>		<i>Indicator of output or outcome</i>
Institutional	Accountability	Demand of the civil society and the media for accountability
	Understanding	Understanding of ecological systems and natural resources; data collections and interpretations derived from science
	Considerations	Incorporation of environmental considerations early in policy making and planning
	Coordination	Capacity to coordinate actions of affected stakeholders to implement decisions taken
	Monitoring	Capacity to undertake regular monitoring to assess management plans
	Risk	Risk management; capacity to identify, mitigate and manage key risks and hazards
	Information	Assurance of public access to information and provision of adequate information about its conservation role
	Involvement	Facilitating public involvement in decision making; provision of mechanisms for citizen participation at all levels of management plans' implementation
	Damage	Promoting concerted efforts that will prevent or extenuate environmental damage
	Amenities	Ensuring that unquantified environmental amenities and values are considered during decision making
Non-institutional	Trust	Establishing relations of trust, including reciprocal arrangements, locally developed rules, norms and sanctions
	Decentralization	Appropriate degree of decentralization in decision making
	Legislation	Legislative engagements for the viability of the protected area
	Vision	Existence of a common vision integrating management with environmental goals and economic development
	Collaboration	Use of a collaborative and interdisciplinary approach in decision making involving representatives of all parties
	Productivity	Enhancement of long-term productivity of resources by garnering necessary funds to implement plans

management objectives were defined and categorized by the Presidential Decree. Every decision included in the data set was classified into one of the four following categories: (1) Administrative: actions aimed at the establishment and maturation, i.e. the long-term viability of the NMPZ Park Authority; (2) Environmental: actions aimed at environmental protection and habitat and species conservation; (3) Social: actions aimed at raising stakeholders' environmental awareness; and (4) Economic: actions aimed at the economical viability of the NMPZ.

We classified resources into four main categories: (1) Long-term planning resources: concerned with development of management plans and gaining necessary resources through project implementation; (2) Long-term regulatory resources: including law enforcement, conflict resolution, and land-use arrangement; (3) Short-term spending resources: concerned with the investment of resources gained through project implementation; and (4) Short-term revenue-generating resources: referring to fee establishment, licensing and permit systems, as well as property taxation.

Evaluation of criteria of PA governance

This step involved specifying the evaluation criteria for the decision-making process. We considered identifying the relative weight of various criteria, to enable assessment of more precise options. Evaluation criteria were specified according to Greek Law 1650 (GL1650) and the IUCN (World Conservation Union) Governance Framework (IUCN-GF). The former refers to environmental arrangements at the

national scale, while the latter refers to 'good governance' principles suggested for conservation policy by the United Nations Development Programme (Graham *et al.* 2003).

We combined criteria contained in GL1650 and the IUCN-GF, to determine aspects referring to non-institutional and institutional arrangements (Table 2). Every decision included in the data set could involve more than one criterion.

Statistical analysis

We used cross-tabulations in Statistica to reveal temporal trends for management objectives, resources and criteria, relationships between management objectives and resources, and relationships between decision and degree of implementation. We estimated the effect-strength between variables with the Phi-coefficient.

We used logistic regression (the nonlinear estimation function in Statistica) to estimate the influence of criteria on the probability of management objectives being implemented, the criteria serving as independent variables. We used maximum likelihood as the loss function, and the quasi-Newton estimation procedure because it was the fastest to converge. Positive values of parameter estimates indicated that larger values of the explanatory variable would increase the likelihood of the occurrence of the dependent variable, while negative values indicated that larger values of the explanatory variable would decrease the likelihood. Each logistic equation gave the logit Z of the probability of the outcome described by

Table 3 Time pattern of the management process for decisions referring to management objectives, resources, degree of resource mobilization and criteria. In the case of objectives and degree of resource mobilization, total count percentages amount to 100%. In the case of resources and criteria, total count percentages amount to more than 100%, because each decision could have involved more than one resource and could have referred to more than one criterion. Levels of significance for the chi-square test of independence: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

		2000 (%)	2001 (%)	2002 (%)	2003 (%)	Total (%)
Objectives	Administrative*	53.06	37.16	33.08	29.36	35.76
	Environmental	12.24	23.65	25.56	27.52	23.92
	Social	16.33	25.00	24.81	24.77	23.92
	Economic	18.37	14.19	16.54	18.35	16.40
Resources	Planning	38.78	54.05	50.38	50.46	50.34
	Regulation	48.98	68.24	66.17	57.80	62.87
	Spending*	44.90	40.54	53.38	58.72	49.43
	Revenue-generating	0.00	6.76	3.76	4.59	4.56
Degree of resource mobilization*	1 resource	69.39	43.92	35.34	38.53	42.82
	2 resources	28.57	42.57	55.64	51.38	47.15
	3 resources	2.04	13.51	9.02	10.09	10.02
Institutional criteria	Accountability***	4.08	10.14	0.75	0.00	7.29
	Understanding	14.29	8.11	9.02	14.68	11.16
	Considerations	24.49	29.05	33.08	23.85	29.38
	Coordination*	14.29	10.14	3.01	7.34	8.88
	Monitoring	18.37	29.05	32.33	27.52	30.07
	Risk	2.04	2.70	2.26	4.59	4.78
	Information	24.49	25.00	19.55	20.18	24.15
	Involvement	16.33	27.03	20.30	17.43	23.69
	Damage**	6.12	29.73	27.07	25.69	27.79
	Amenities	4.08	5.41	8.27	11.01	10.25
	Trust***	10.20	43.24	18.05	18.35	29.16
	Non-institutional criteria	Decentralization***	42.86	22.97	14.29	16.51
Legislation*		22.45	29.73	29.32	14.68	28.70
Vision*		22.45	6.76	9.77	9.17	10.25
Collaboration		14.29	8.11	7.52	13.76	11.39
Productivity**		63.27	35.81	39.10	41.28	41.91

the dependent variable, obtained by the following equation:

$$Z = b_1 + b_2x_2 + \dots + b_nx_n$$

where x denotes the explanatory variables of the model, b denotes parameter estimates and n indicates serial numbers for each criterion (Gujarati 1988; Walsh 1990).

In order to reveal significant determinants of the degrees of resource mobilization and of decision implementation, we conducted tree-analysis using S-Plus (Statistical Sciences 1999), where the criteria included served as independent variables. The classification tree was a collection of rules determined by recursive partitioning.

Tree models were constructed by splitting a data set into increasingly homogenous subsets (Breitman *et al.* 1984; Chambers & Hastie 1992), based on a set of ‘stopping rules’, until it was infeasible to continue. We used the available covariates to determine the way the data set was split. At each stage, all covariates were examined, and we selected the one that gave the best split (for example the greatest differences between groups). We validated model fit using the misclassification error rate, which was obtained by dividing

the number of misclassified observations by the total number of observations.

RESULTS

Management behaviour

Time pattern of the management process

During the first year of its establishment, the Park Authority was mainly concerned with arrangements to promote administrative stability (Administrative objective 53.06%, $p < 0.05$; Table 3). Decisions referring to institutional arrangements aimed at protecting the environment (‘Environmental objective’) increased with time. Institutional arrangements aimed at raising public awareness (‘Social’ objective) were steady after the first year (Table 3). Apart from the first year, the decisions referring to economic issues (‘Economic’ objective) had the lowest percentages among management objectives. Overall, total percentages in 2003 were more evenly distributed among management objectives compared to former years (Table 3).

The Park Authority was significantly more likely to invest resources gained through project implementation in 2002

Table 4 Relationships between resources and management objectives. Values refer to total count percentages. Levels of significance for the chi-square test of independence: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, ns = not significant.

Resources		Administrative		Environmental		Social		Economic	
		Absent	Present	Absent	Present	Absent	Present	Absent	Present
Planning**/ns/**/ns	Absent	35.54	14.12	36.45	13.21	35.76	13.90	41.23	8.43
	Present	28.70	21.64	39.64	10.71	40.32	10.02	42.37	7.97
Regulation*/ns/ns/***	Absent	26.65	10.48	29.38	7.74	28.02	9.11	27.33	9.79
	Present	37.59	25.28	46.70	16.17	48.06	14.81	56.26	6.61
Spending***/***/***/ns	Absent	22.55	28.02	42.37	8.20	45.33	5.24	41.46	9.11
	Present	41.69	7.74	33.71	15.72	30.75	18.68	42.14	7.29
Revenue***/***/ns/ns	Absent	59.68	35.76	74.94	20.50	72.44	23.01	79.27	16.17
	Present	4.56	0.00	1.14	3.42	3.64	0.91	4.33	0.23

Table 5 Criteria involved in the decision making process for each management objective. All models were highly significant ($p < 0.001$). Positive values of criteria indicate increasing likelihood of the occurrence of each management objective. Likewise, negative values indicate decreasing the likelihood of the occurrence of each management objective.

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Criteria	Administrative	Environmental	Social	Economic
Model constant	-0.89*	-2.31***	-1.22**	-1.70***
Accountability	2.86**	-0.77	-1.04	-0.59
Understanding	-0.18	1.34**	0.36	-26.18
Considerations	1.65***	-0.28	-2.46***	-0.42
Coordination	0.00	0.06	-1.59*	2.11***
Monitoring	-0.54	0.23	0.13	2.33*
Risk	-2.36*	2.46**	0.46	1.61
Information	-1.65***	-0.67	2.39***	0.33
Involvement	-2.06**	1.01	0.04	-0.94
Damage	-0.85	1.31*	1.15	-3.00**
Amenities	-0.25	-2.76*	-0.35	2.08***
Trust	0.53	0.58	0.65	-2.09**
Decentralization	0.22	-1.59**	-0.95	1.44**
Legislation	0.57	0.07	-1.72**	-0.70
Vision	-0.15	0.64	-0.18	-0.96
Collaboration	-0.01	0.70	0.52	-0.41
Productivity	0.88**	0.63	-0.85*	-0.07
Final loss	199.01	177.42	165.90	144.85
Chi-square	174.46	128.18	151.22	102.12
p level	***	***	***	***
% predicted	76.77	83.14	86.33	87.02

and 2003 than it was in the first two years of its establishment (resource ‘Spending’ criterion 53.38–58.72% and 44.90–40.54%, respectively, $p < 0.05$; Table 3). Percentages of decisions mobilizing two or three resources increased significantly for the years 2001–2003 ($p < 0.05$).

In 2000, the Park Authority activated all the criteria during its decision-making process (Table 3), trying to create a shared common vision between different governance levels (non-institutional ‘Vision’ criterion 22.45%, $p < 0.05$) and gaining the necessary funds to implement various plans during the following years (non-institutional ‘Productivity’ criterion 63.27%, $p < 0.01$). The Park Authority’s need to coordinate actions between affected stakeholders was higher in 2000–2001 than 2002–2003 (‘Coordination’ criterion 14.29–10.14% and 3.01–7.34%, respectively, $p < 0.05$). Moreover, the Park Authority tried to put more weight on preventing activities that caused damage to the environment after its first year of operation (‘Damage’ criterion, $p < 0.01$; Table 3). The Park Authority’s efforts to decentralize the decision-making process decreased with time (non-institutional ‘Decentralization’ criterion, $p < 0.001$). The ‘Accountability’ and ‘Trust’ criteria

peaked in 2001, and showed significantly lower percentages afterwards (10.14% and 43.24%, respectively, $p < 0.001$). Preparation of legislative engagements for the viability of the PA was low in 2003 compared to other years (non-institutional ‘Legislation’ criterion 14.68%, $p < 0.05$; Table 3).

Relationships between resources and management objectives

Decisions referring to administrative issues (‘Administrative’ objective) involved long-term resources that could ensure funds, law enforcement and conflict resolution (‘Planning’ and ‘Regulation’ resources, Phi coefficient = 0.15 and 0.12, respectively; Table 4). Financial resources deriving from the implementation of programmes gave the Park Authority the opportunity to implement environmental and social targets (‘Spending’ resources, Phi coefficient = 0.18 and 0.32, respectively, for environmental and social objectives).

Criteria in the decision-making process

All logistic regression models were highly significant ($p < 0.001$). Seventy-six to 87% of cases were predicted correctly (Table 5). Different patterns of significant predictors were observed for each management objective. Different

Figure 2 Classification tree of the degree to which resources were mobilized. Each split is labelled according to criteria: 0 = absence, 1 = presence of each criterion. Each leaf is labelled according to whether the degree of resources mobilized was low (1 = one resource mobilized), intermediate (2 = two resources mobilized), or high (3 = three resources mobilized). Estimated probabilities for fitted values are given in parentheses.

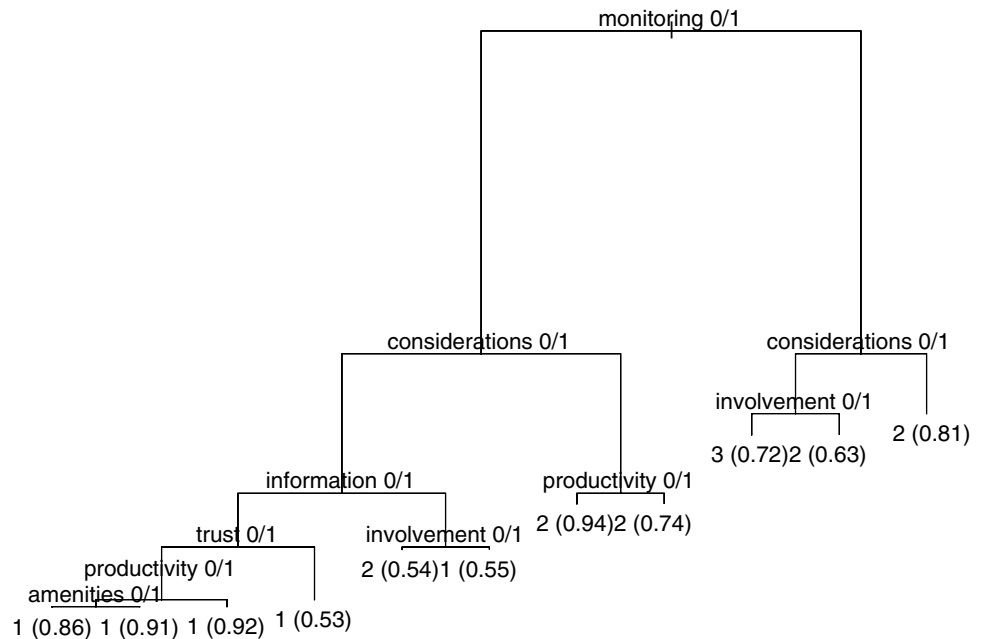


Table 6 Degree to which decisions undertaken by the Park Authority for each management objective were implemented. * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

	Administrative (%)	Environmental (%)	Social (%)	Economy (%)	Total (%)
Non implemented***	43.31	18.10	20.95	19.44	28.02
Partially implemented***	31.21	23.81	29.52	18.06	26.88
All implemented***	25.48	58.10	49.52	62.50	45.10

management objectives were significantly associated with different sets of criteria, and the same criterion could reveal different signs in different models. Finally, non-institutional criteria were significantly involved twice, in the cases of administrative and economic issues.

In the case of strategic choices to attain its establishment ('Administrative' objective), the Park Authority worked on garnering funds by project implementation and annual government funding (non-institutional 'Productivity' criterion, $p < 0.01$). However, accountability and incorporation of environmental considerations into plans proved to be major issues ('Accountability' and 'Considerations' criteria, $p < 0.01$ and $p < 0.001$, respectively; Table 5). In the case of strategic choices for environmental protection ('Environmental' objective), the Park Authority worked on data collection and interpretation to understand the ecology of the region and identify and manage key risks ('Understanding', 'Risk' and 'Damage' criteria, $p < 0.01$, $p < 0.01$ and $p < 0.05$, respectively; Table 5). In the case of strategic choices to promote public awareness ('Social' objective), the Park Authority tried to inform the public about its conservation role ('Information' criterion, $p < 0.001$). Monitoring was the most significant criterion in the case of the 'Economic' objective (Table 5).

Degree to which resources were mobilized and actions implemented

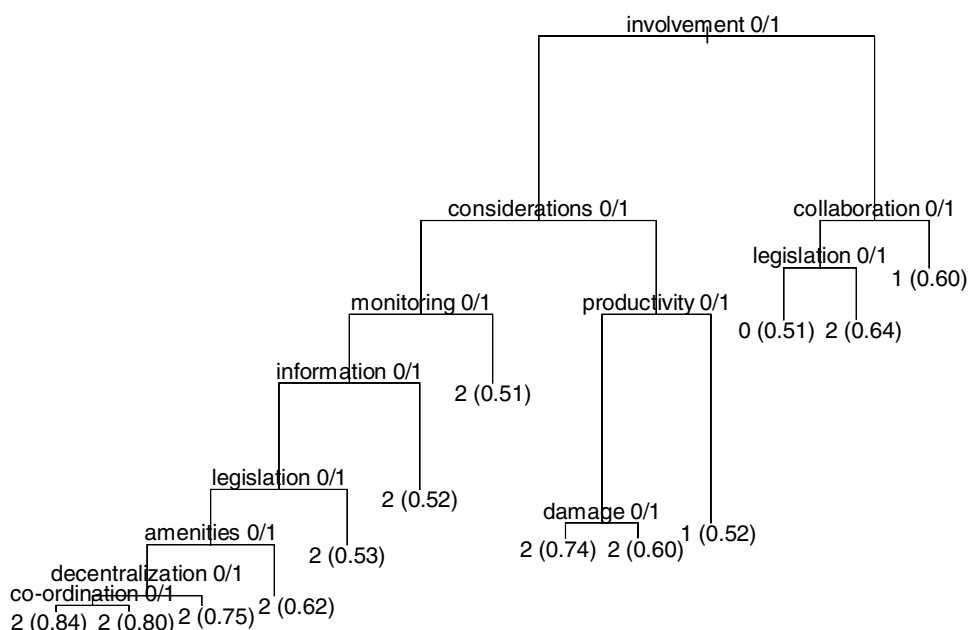
The Park Authority's capacity to undertake regular monitoring to assess management plans ('Monitoring'

criterion) was the most important determinant of the degree to which resources were mobilized (Fig. 2). Incapacity to assess management plans led to low or intermediate degree of resources mobilized (Fig. 2, left part of the tree), while capacity of monitoring led to an intermediate or high degree of resources mobilization (Fig. 2, right part of the tree). The misclassification error rate of the model was 25.74%.

Meeting minutes showed that more than half of decisions undertaken by the Park Authority were implemented (27% partially implemented and 45% wholly implemented; Table 6) while 28% of decisions undertaken were not implemented at all (Table 6). A significant percentage of administrative arrangements were not implemented at all (i.e. 'Administrative' objective 43%, $p < 0.001$). In contrast, significant percentages of environmental, social and economic arrangements were wholly implemented (Table 6).

Another important finding of our study is that as complexity in the decision-making process increased, in terms of involvement of an increasing number of criteria, the probability of an action being implemented decreased (Fig. 3). Facilitating public involvement in decision-making ('Involvement' criterion) led to partial implementation of actions if a collaborative approach in decision-making had been followed (Fig. 3). In the absence of such a collaborative approach, legislative engagements for the viability of the protected area could lead to complete implementation of management actions (non-institutional 'legislation' criterion); if such engagements were not made management actions were

Figure 3 Classification tree of the degree to which actions were implemented. Each split is labelled according to criteria: 0 = absence, 1 = presence of each criterion. Each leaf is labelled according to whether actions were not implemented (0), partially implemented (1), or wholly implemented (2).



not implemented at all. The misclassification error rate of the model was 25.92%.

DISCUSSION

There is a long history of examining the institutional dynamics of marine protected areas, catalysed by Ostrom (1990) and refined in synthesis by Mascia (2000), and McClanahan *et al.* (1997). Our methodology provided valuable insight into the management behaviour of a park authority responsible for PA governance. To our knowledge, this is the first attempt to highlight both institutional and non-institutional factors shaping PA management. Existing data regarding political phenomena are rarely employed yet they are of high potential value for conservation science. Based on institutional meeting minutes and standard statistical analyses, our methodology proved effective in revealing the structure and the management behaviour of the NMPZ Park Authority, as well as indicating institutional and non-institutional issues that most significantly affected the harnessing of resources and degree of action implementation. Furthermore, it provided the information necessary to evaluate management in an integral fashion (Hockings & Phillips 1999). Applicable to a wide range of PAs, its aim is to improve knowledge of the status and development of PAs and the effects of management practices. Taking into account that the lack of statistical analysis of the effects of different parameters on the success of PA management has been reported as a serious deficiency in previous approaches (Agrawal 2001), our methodology could offer crucial feedback and opportunity for adaptive learning by indicating to managers and government representatives the factors responsible for the success or failure of PA management, which is considered a

cornerstone of effective PA decision-making (Hockings *et al.* 2004).

Very few studies have examined PA park authority structure, although this can have considerable influence on decision making (Lowry 1994). The NMPZ Park Authority follows collective-choice arrangements, since most individuals affected by protection rules are members of the Park Authority (Mascia 1999; Anderies *et al.* 2004). Our results indicated that national and local government, local NGOs and resident users were involved in the governance of the Zakynthos PA. With regard to the degree of autonomy from the government, the NMPZ working under the authority of the Ministry of Environment is similar to the arrangements for most PA agencies that are part of a larger government ministry (Mascia 1999; Lovelock 2001; Dearden *et al.* 2005). In other words, the members of the NMPZ Park Authority belong to the ‘inner-circle’ of decision-making and the Ministry of Environment forms its ‘environment’ (Kerremans 1996). Within this frame, bureaucracy-based approaches are likely to have substantially higher administrative costs owing to government’s involvement in administering the programmes (Imperial & Yandle 2005).

Considering management behaviour, varying percentages of different management arrangements, as well as resources mobilized by the Park Authority, produce an image of its evolving efforts to guarantee management effectiveness. More specifically, the increasing evenness among management arrangements in time indicates that the NMPZ Park Authority strived to attach equal weight to each management objective prescribed by the legislation in force. The increasing degree to which resources were garnered to accomplish management objectives also reflects the Park Authority’s efforts to make use of all capabilities available. Long-term resources enhanced objectives that involved long-term actions to achieve NMPZ viability and stability. Conversely, short-term resources

favoured management objectives implying short-term actions. We suggest that the NMPZ's viability depends on long-term planning (existence of a national strategy), while the implementation of the management plans needs short-term review.

Most exogenous aspects evolved significantly in time, though not all in the same manner: garnering necessary funds to implement plans (for example the 'Productivity' criterion), as well as decentralization in decision-making (for example the 'Decentralization' criterion) reached significant levels from the first year of the Park Authority's operation. This stands in contrast to preparing legislative engagements for the viability of the PA (the 'Legislation' criterion), which showed a more homogenous distribution over time. Since the Park Authority was responsible for garnering funds, while it was the central government through the Ministry of Environment that controlled the process of preparing legislative engagements and the decentralization process, our findings show the importance of the interplay between various levels of administration in environmental management (the local versus the national level; Verhoest 2005). Actions implying different degrees of autonomy from the central government evolved differently in time. Our study corroborates the notion that for PA initiatives to be successful, basic issues of government legislation and policy to establish supportive legal rights and authority frameworks must be addressed (Pomeroy & Berkes 1997).

The issue of a park authority's autonomy is also addressed by our study. For instance, in the relationship between management objectives and evaluation criteria, significant determinants were confined to institutional aspects. In the case of degree of action implementation, the administrative objectives, where the Park Authority's dependence in other actors was relatively high, revealed lower levels of all-implemented actions compared to the environmental, social and economic objectives. The most significant determinants of the degree of resource recruitment, where the Park Authority can have much autonomy, pertained to administrative aspects, while the degree of action implementation depended on both institutional and non-institutional aspects, since in this case the initiatives that could be undertaken by the Park Authority were heavily dependent on external actors. One crucial element that significantly mediates this frequently recurrent issue of the Park Authority's autonomy concerns the double role of the Ministry of Environment as both a member within the Park Authority as well as the central authority that retains the power to approve or reject the Park Authority's decisions. The Ministry behaved in a contradictory manner many times, taking part in unanimous decisions as a member of the Park Authority, and simultaneously proving reluctant to support these decisions by legislative prescriptions or adequate funding. This type of decision rule (unanimous consent) creates an opportunity for opportunism at the implementation stages (Sproule-Jones 1999).

Our study further highlighted the inherent complexity of PA management (Feldman & Khademian 2001; Hussey 2002), reflected in the regression models and tree modelling.

More specifically, different patterns of significant predictors in logistic regression models were observed for each management objective and resource mobilized; in addition, the same evaluation criterion could reveal different signs in different models. Tree analysis showed that as complexity in the decision-making process increased, in terms of involvement of an increasing number of evaluation criteria, the probability of objective accomplishment decreased. This should not mean that managers should try to reduce the complexity of the decision-making process by ignoring principles; rather, it should imply that principles should not be treated as a checklist, but as a system to be managed itself. In this context, it has become increasingly apparent that the more sophisticated and complex a rule system becomes, the more likely it is that decision makers will encounter difficulty when trying to make choices and changes (Scrase & Sheate 2002; Imperial & Yandle 2005).

CONCLUSIONS

On a theoretical level, the experience of the NMPZ study suggests that researchers and practitioners must pay closer attention to the important institutional and non-institutional factors that shape PA governance. Decentralization of authority, sufficient funding and time to allow management practices to take root, and long-term government commitment all featured as being tightly correlated with success, supporting the views of McClanahan *et al.* (2005) and Pomeroy and Berkes (1997). Moreover, the scaling-up of local government and site-specific park authority remains a management and policy challenge that will require careful experimentation and evaluation (Christie & White 1997). A lack of understanding of the interactions between different governance levels is likely to result in inappropriate policy recommendations and to decrease the effectiveness of PA management. While the government holds the final authority, it should view PA management as an alternative management strategy to the centralized management system, which in many cases does not work effectively (Pomeroy & Berkes 1997). Local PA institutions are not a quick-fix solution, and adequate finances and realistic time frames are important for success. Zakynthos Park Authority has recently been established and our study suggests that government support is necessary at its early establishment because, according to Napier *et al.* (2005), six years of support are necessary for structure establishment and relationships building. Two specific conditions need attention. First, appropriate compensation strategies for affected landowners need to be implemented because delays undermine faith in any local park authority. Second, collaborative and interdisciplinary approach in decision making is necessary, as the management of PAs usually involves a multitude of authorities (state, regional and local).

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