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STAKEHOLDERS' PERCEPTIONS OF MOHÉLI MARINE PARK, COMOROS: Lessons learned from five years of co-management



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C3-Comores
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STAKEHOLDERS' PERCEPTIONS OF MOHÉLI MARINE PARK, COMOROS: *Lessons learned from five years of co-management*

*PERCEPTIONS DES ACTEURS DU PARC MARIN DE
MOHELI, COMORES :
Les leçons apprises après cinq années de cogestion*

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Female focus group, Hamavouina

EXECUTIVE SUMMARY

Mohéli Marine Park (*Parc Marin de Mohéli, PMM*) was the first Marine Protected Area (MPA) to be established in the Comoros in 2001. Initially regarded as a model for co-management of marine resources, PMM is now operating at a vastly reduced capacity following an end to external funding sources. An assessment of current perceptions of local stakeholders of PMM was recognized as an essential first step in rebuilding its capacity and effectiveness as an MPA. This study aimed to ascertain stakeholders' current perceptions of PMM, using focus group interviews to evaluate six key parameters: (1) basic awareness, (2) value, (3) effectiveness, (4) environmental threats and solutions, (5) stakeholder roles and responsibilities and (6) future aspirations and expectations. It was apparent that most local communities were aware of the importance of PMM, but felt that it had failed to include their needs or consider their input in its management. Concern was expressed for the lack of sustainability or alternative livelihoods; inequitable distribution of benefits; exclusion of women; continuing environmental threats and a concurrent lack of enforcement of regulations. The key recommendations arising from this work were:

- 1. ensure sustainability through effective financial planning and promotion of low-cost, appropriate management techniques;**
- 2. mobilize local communities to create a truly co-managed PMM;**
- 3. ensure tangible benefits to local communities through realistic alternative livelihood options, particularly for fishers;**
- 4. ensure equitable sharing of benefits and awareness of PMM**
- 5. involve women in the management of PMM as the primary local educators and motivators for future generations;**
- 6. inform law enforcement officials and members of the justice system to ensure understanding, respect and enforcement of PMM regulations.**

RÉSUMÉ EXECUTIVE

En 2001, le Parc Marin de Mohéli (PMM) fut la première aire protégée établie aux Comores. Initialement vu comme un modèle de co-gestion des ressources marines, la gestion du PMM s'avère aujourd'hui déficitaire, notamment en raison de l'arrêt de financement des bailleurs de fonds externes. Pour renforcer les capacités et l'efficacité du PMM comme aire protégée, il fut reconnu que la première étape importante à ce processus était d'effectuer une étude sur la perception des acteurs du PMM. Cette étude avait pour but d'identifier la perception des acteurs du PMM en interviewant des groupes focaux afin de déterminer six paramètres clés : (1) sensibilisation primaire, (2) valeur, (3) efficacité, (4) Dangers environnementaux et solutions, (5) Rôle des acteurs et leurs responsabilités et (6) Aspirations et perspectives futures. Il en résulte que la plupart des communautés locales étaient conscientes de l'importance du PMM, mais ressentaient que lors de sa mise en place, ni leurs besoins, ni leurs recommandations n'avaient été prises en compte. Les problèmes majeurs énoncés par les groupes focaux étaient le manque de durabilité, de mise en place d'activités alternatives pour les communautés, de la distribution inéquitable des bénéfices, de l'exclusion des femmes, de la continuité de problèmes environnementaux, et du manque de renforcement de la législation par les autorités locales. Les recommandations clés basiques de cette étude sont :

1. assurance de la pérennité au travers de l'établissement d'un plan de financement et de la promotion de techniques de gestion peu coûteuses ;
2. mobilisation des communautés locales afin de créer un PMM vraiment cogéré ;
3. assurance de bénéfices tangibles pour les communautés locales au travers de la mise en place d'activités alternatives surtout pour les pêcheurs ;
4. partage équitable des bénéfices et sensibilisation du PMM ;
5. participation des femmes à la gestion du PMM, car elles forment les éducateurs et motivateurs de demain ;
6. informer les autorités locales et membres juridiques sur la législation du PMM afin d'assurer sa bonne compréhension, son respect et sa régulation.

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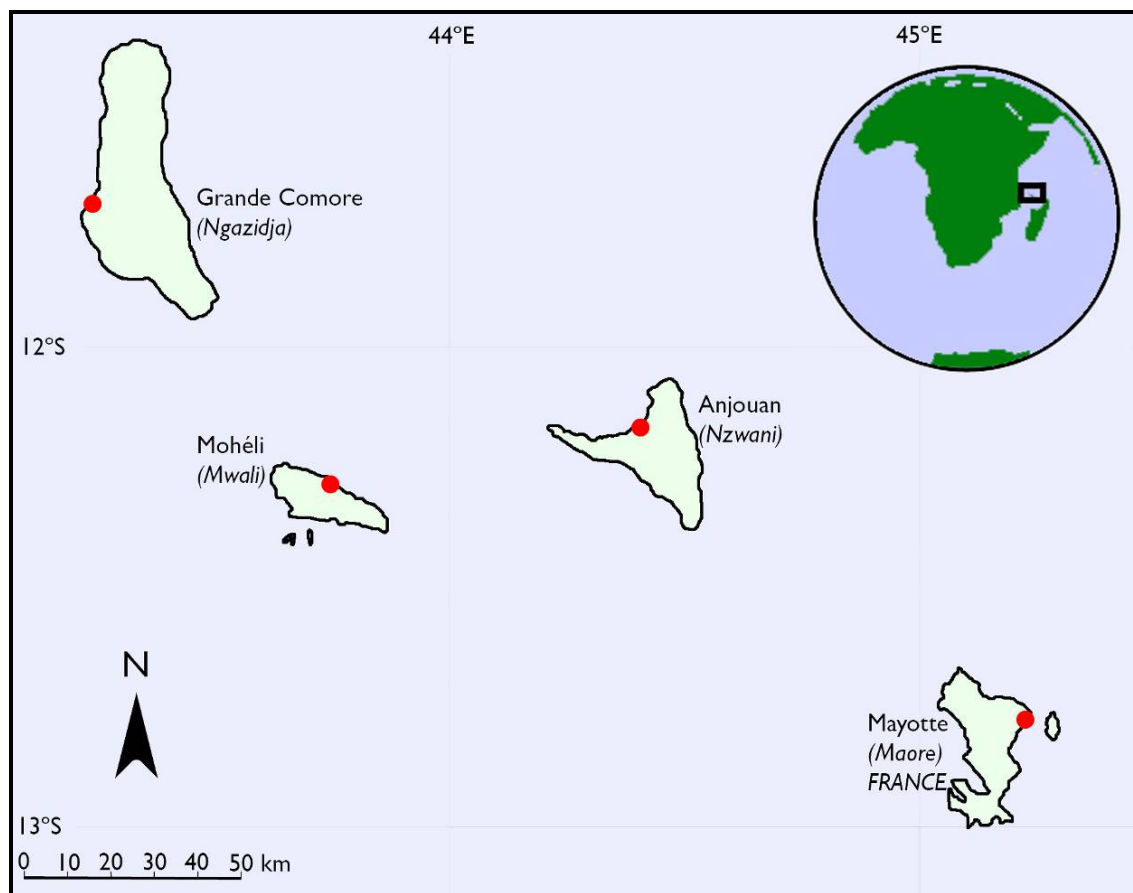


Figure 1: Union of the Comoros and Mayotte

I. INTRODUCTION

The Union of the Comoros is situated at the northern end of the Mozambique Channel, equidistant (approximately 300km) from continental Africa and Madagascar (Figure 1). It comprises three volcanic islands: Grande Comore, Anjouan and Mohéli. Since independence from France in 1975, the Comoros have not achieved firm political stability. The current governmental system, established in 2002, consists of an autonomous government for each island (dealing with internal island affairs), and a Union Government for the country as a whole (dealing with national and international affairs). The Comoros are currently facing extreme demographic pressures, 53% of the population is under 20 years old and the population is predicted to double within the next 33 years (Union des Comores 2005). As an island state, with limited natural resources, these rates of growth are likely to result in serious environmental degradation unless mitigation measures and proactive management of natural resources are initiated immediately. These impacts are most likely to be experienced first in coastal populations, since the majority of the population lives on the coast and artisanal fisheries are of considerable economic importance (Abdoulhalik 1998).

Mohéli, at 290 km², is the smallest of the islands, yet it faces some of the strongest demographic and environmental pressures. In 2003, the population of Mohéli was 35,751, 6.2% of the country's total population of 576,000 (Union des Comores, 2005); however, the population growth rate is the highest of all three islands, at 3.6% (UNEP 2002). In 2005, the registered unemployment rate for Mohéli was 19.8%, compared to the national unemployment rate of 14.3%, with 36.8% of Mohéli's population employed in the primary sector (Union des Comores, 2005).

In contrast to its demographic circumstances, the Union of the Comoros has been identified as one of the 'hottest hotspots' in terms of global conservation priorities (Myers et al. 2000). Thus, this small island developing state is one of the world's critical sites for natural resource-based development and has tremendous potential, not only for ecotourism, but for conservation investment and action. These combined attributes of high marine diversity and intensive anthropogenic pressure underscore the importance of assessing, understanding and monitoring socioeconomic elements to strengthen current and implement further appropriate management and conservation strategies which include local stakeholders and communities.

The three main obstacles to the country in the implementation of effective biodiversity conservation strategies have been identified as: lack of technical and financial resources; demographic pressure and an absence of fair distribution of the benefits arising from natural resources (Union des Comores 2003). In 1998, IUCN and the Comorian government, funded by GEF/UNDP, initiated a 5-year project entitled 'Conservation of Biodiversity and Sustainable Development in the Federal Islamic Republic of the Comoros' (Project Biodiversity). Although successful to some extent, this project was overambitious for the available levels of training, project timeframe and existing infrastructure (Wells 2005) and the final evaluation of the project concluded that the prognosis for its sustainability was poor (IUCN 2004). Although some components of Project Biodiversity were extended for two years as 'The Project for Rehabilitation Activities for the Conservation of Biodiversity', all funded activities concluded in 2005.

One of the most notable achievements of Project Biodiversity was the establishment of the first Marine Protected Area (MPA) in the Comoros, Mohéli Marine Park (*Parc Marin de Mohéli PMM*), on 19th April 2001. The MPA covers 404km² off the southern coast of the island (Figure 2). The establishment of PMM was based on its rich biological diversity and the presence of key coastal habitats and endangered marine species including coral reefs, mangroves, humpback whales, dugong, and the third most important nesting site for green sea turtles in the world. The Management Plan for PMM (Gabrie 2003) anticipated full involvement of local stakeholders through co-management. This approach has proved valuable when tackling fundamental socioeconomic factors influencing

conservation efforts and has been useful in situations where scientific data were limited (Granek and Brown 2005). An elected Management Committee, including a representative from each of the 10 villages involved in PMM was responsible for decision making, a curator was appointed to carry out these decisions and twelve ecoguards were put in charge of day-to-day management and monitoring activities within their villages. The Minister in charge of the environment for the autonomous government of Mohéli was given overall responsibility for PMM.

Initially regarded as a model for co-management of marine resources (IUCN 2002), PMM is now operating at a vastly reduced capacity following the end of Project Biodiversity, and subsequent end in funding (Wells 2005). Beaches are littered with poached turtle carcasses and fishers regularly use gillnets and other banned fishing methods (Abdou Rabi pers. comm. 2006). The sustainability of PMM is intrinsically related to the inclusion of local stakeholders (Gabrie 2003). It is now crucial that the impetus of Project Biodiversity is built upon immediately (Granek and Brown 2005), to ensure that local communities do not become disillusioned and de-motivated. Thus, this work was recognized as essential to ensure integration of the perceptions of these stakeholders into current management decision-making and in the identification of future priorities.

2. AIMS AND OBJECTIVES

This work aimed to ascertain local stakeholders' current perceptions of PMM, using focus group interviews to evaluate six key parameters:

1. Basic awareness
2. Value
3. Effectiveness
4. Environmental threats and solutions
5. Stakeholder roles and responsibilities
6. Future aspirations and expectations

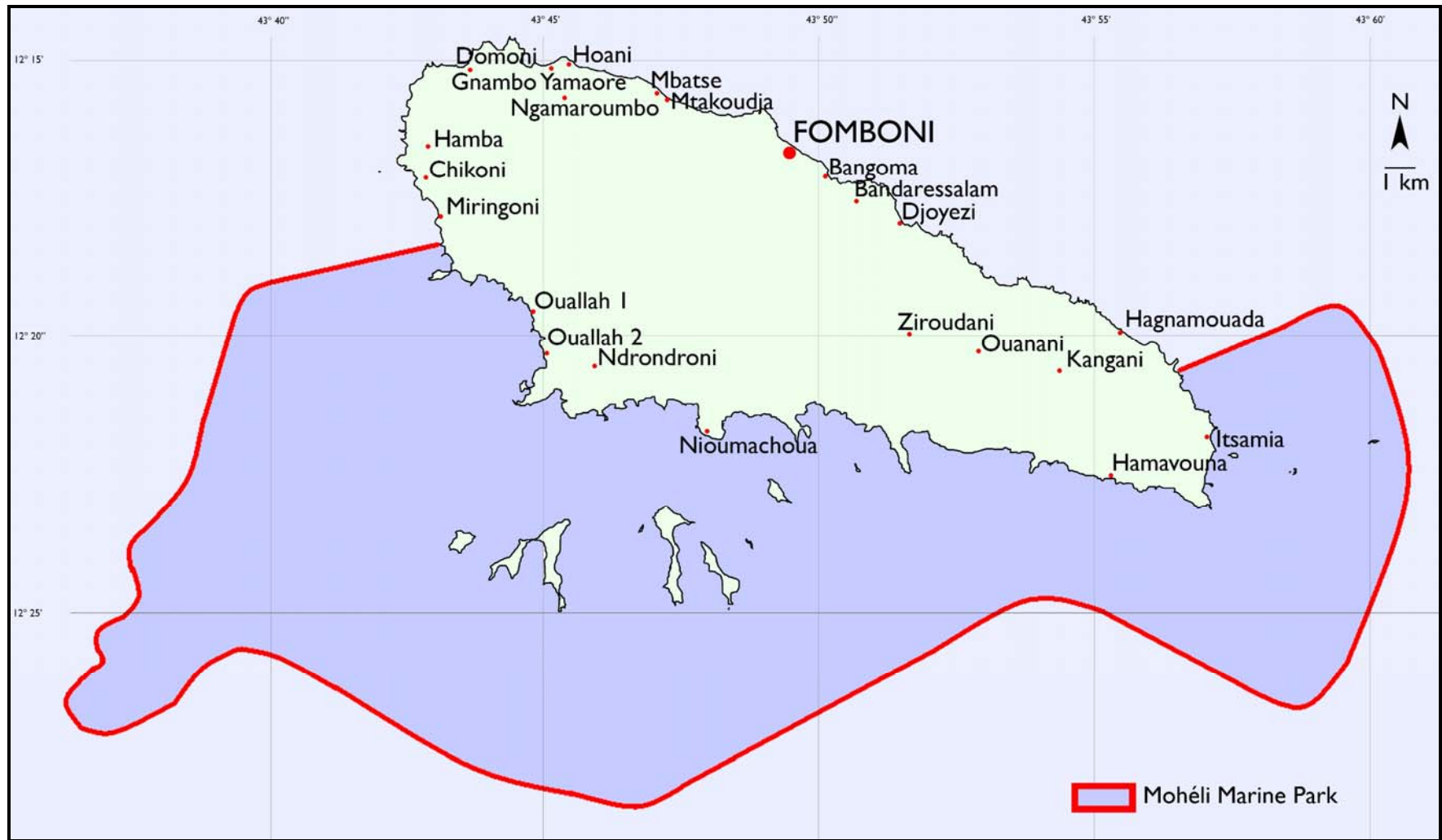


Figure 2: Mohéli showing location of PMM

3. METHODS

Semi-structured interviews (see Appendices), consisting of 12 questions based on the six key parameters were conducted, following guidelines from Bunce et al 2000. The interview was designed to allow for open discussion in a focus group format and further relevant questions were posed during each interview according to participants' responses to the key questions.

The interviews were carried out between 10th July 2006 and 20th August 2006 in the 10 villages of PMM: Miringoni (Mir), Ouallah 1 (Ou1), Ouallah 2 (Ou2), Ndrondroni (Ndr), Nioumachoua (Nio), Ouanani (Oua), Kangani (Kan), Ziroudani (Zir), Hamavouna (Ham), and Itsamia (Its) (Figure 2). The interviews were pre-arranged in each village by asking a community leader to coordinate two focus groups: one consisting of 10 men and one of 10 women of various ages, occupations, and social status (see Appendices for statistics; throughout this report, male focus groups are indicated with an 'M' after the abbreviated village name and female focus groups with an 'F'). Male and female focus groups were strictly held separately to ensure that women would feel at ease in voicing their opinions. Whenever possible, interviews were conducted in private locations to minimize distractions and to ensure effective discussion. Discussion was usually in the local Comorian dialect, *ShiMwali*, with responses translated by a facilitator and recorded in French by the interviewer.

The facilitator was briefed before each interview to ensure their understanding of each question and its purpose and to ensure that they did not make leading comments or prompt responses. The interviewer began by briefing the participants on the purpose and importance of the study. During the interviews, answers were repeated if necessary for clarification and accuracy. The group sat in a circle to ensure inclusion of all participants and each person was actively encouraged to present their opinion. Interviewees were assured that names would remain confidential and that no incriminating information would be communicated to external parties.

The primary investigator and 8 facilitators carried out a total of 20 interviews (see Appendices). In two interviews, all of the participants spoke French there was no need for translation. Facilitators included three ecoguards, one ecoguide, two university students and one ex-personnel from Project Biodiversity. All facilitators were selected based on knowledge of PMM and the issues discussed; French language skills and interpersonal skills.

4. RESULTS

4.1 BASIC AWARENESS

Basic awareness of PMM was categorized and is displayed according to gender in Figure 3. It is clear that female focus groups displayed far lower levels of awareness than male focus groups.

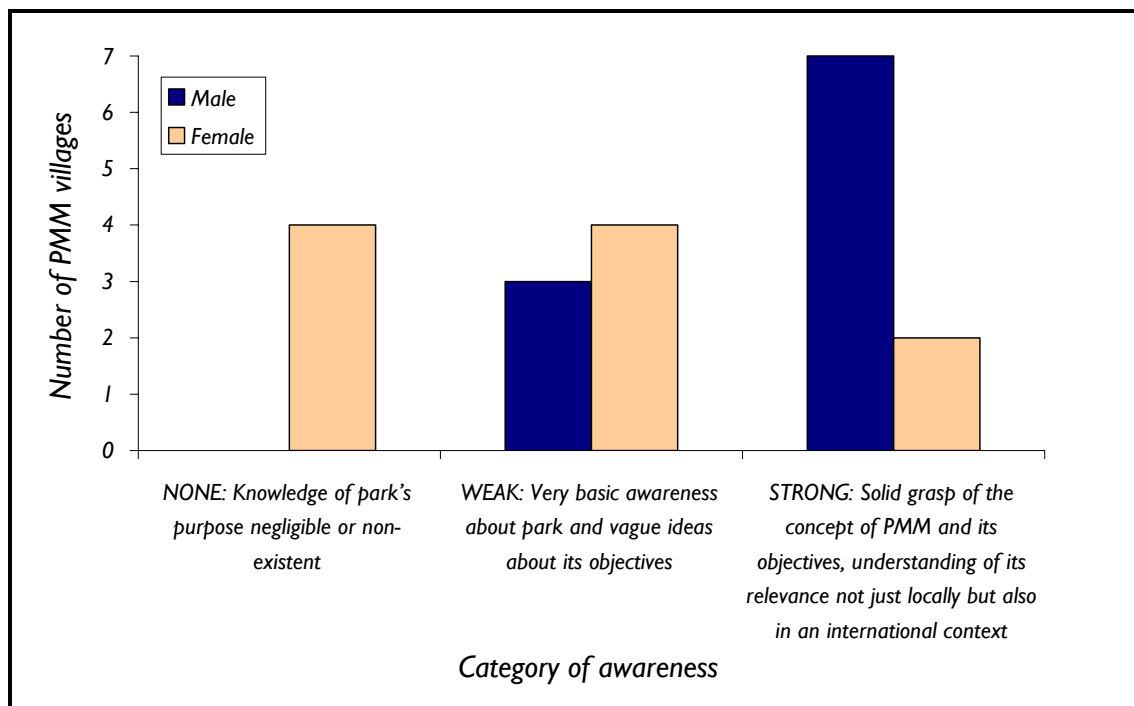


Figure 3: Stakeholder awareness of PMM in male and female focus groups

4.2 VALUE

All focus groups responded that PMM was important, citing the following reasons:

- conservation of natural resources and the rich environment of Mohéli for future generations;
- environmental education and awareness;
- ecotourism development;
- fisheries enhancement and food security;
- protection of endangered species;
- leverage of external funding.

Positive and negative aspects of PMM that were identified are given in Table I, in order of significance according to the number of focus groups that discussed each particular aspect.

Table 1: Positive and negative aspects of PMM identified by focus groups in approximate order of significance

Positive aspects	Negative aspects
1. Environmental protection and a reduction in environmental destruction	1. Lack of sustainability ⁶
2. Increase in fish (size or number)	2. Lack of effective monitoring or enforcement ⁷
3. Prohibitions on fishing gears ¹	3. Lack of respect of PMM personnel for official agreements ⁸
4. Increase in environmental consciousness ²	4. Absence of PMM personnel ⁹
5. Ecotourism	5. Poor management of equipment ¹⁰
6. Increase in coral cover	6. No positive aspects
7. Exchange and increase in information through international interest	7. Prohibition of fishing gears ¹¹
8. Infrastructure development ³	8. Lack of collaboration between PMM, external organizations and villages associations
9. Reduction in unemployment ⁴	9. Insufficient environmental training, education, and awareness-raising
10. Official permission for villages to protect their coastal zone	10. False promises of Project Biodiversity ¹²
11. Presence of ecoguards ⁵	11. Lack of management of forestry activities ¹³
	12. Absence of female participation
	13. Lack of motivation ¹⁴
	14. Lack of benefits
	15. No visible zoning of PMM boundaries ¹⁵
	16. Inequitable distribution of benefits ¹⁶
	17. Environment in a worse state since the creation of PMM
	18. Lack of waste management

¹Fishers now understand that non-destructive fishing methods bring long-term benefits, such as food security through control of marine resource exploitation.

²Now people are aware of what they can and cannot do – if they decide to engage in environmentally destructive activities, then they are fully aware of what they are doing and the consequences' – Male focus group participant, Ou I

³e.g. brick-making factory built in Mir; PMM office in Nio; Tourist bungalows in Ou I, Nio, and Its.

⁴through employment of ecoguards, even if their salary is not reliable

⁵for motivation and enforcement

⁶related to the lack of activities in PMM since funding ran out and irregularity and uncertainty of salaries for ecoguards

⁷A Nio fisher stated: 'the fishers are doing poachers a favour by protecting the turtles so that they can come here to kill and eat them'. i.e. those that respect regulations gain no benefits, while those that do not respect regulations gain increased benefits.

⁸e.g. Chinese were permitted to extract sea cucumbers; military personnel were permitted to fish using spearguns; turtle poachers are not effectively prosecuted

⁹Ham also remarked on the dismissal of their ecoguard.

¹⁰conflicts in the management of boats provided to villages by PMM, lack of boats with which to continue monitoring activities

¹¹regarding reductions in catch, particularly during rough weather; lack of alternative gears and direct impacts on female fishers, who exclusively use the poison *uruva* (*Theophrosia candida*) which is now prohibited

¹²unfulfilled promises include: increased employment and income; boats and equipment; in Mir, the community was told that seagrass would be plentiful after 5 years following the ban on *uruva* and then they could continue making mattresses with seagrass; Fish Aggregating Devices (FADs) for fishers were never put into operation.

¹³especially considering the current impacts of deforestation and subsequent erosion and sedimentation

¹⁴demotivation of PMM personnel since the end of the Project Biodiversity; without finances or activities, villagers no longer respect PMM and its prohibitions; ecoguards poorly equipped, and lack training

¹⁵fishers did not know when they are inside PMM boundaries, creating difficulties for monitoring and enforcement

¹⁶communities felt that benefits are concentrated in PMM headquarters (Nio) or villages such as Its which receive more tourism

4.3 EFFECTIVENESS

There were 18 distinct categories of perceived changes since the creation of PMM identified in this study; these are given in order of significance in Table 2.

Table 2. Perceived changes since the creation of PMM

Perceived change since creation of PMM	Number of PMM villages
1. Increase in species abundance and diversity	7
2. Decline in seagrass ¹	5
3. Reduced environmental threats	4
4. Increase in environmental awareness	3
5. Reduction in species abundance and diversity	3
6. Initial improvement as a result of Project Biodiversity but now deterioration because of PMM inactivity	2
7. Fishing more difficult because of gear restrictions	2
8. Ecoguards neglected	2
9. No changes - PMM does not exist	2
10. Socioeconomic development	1
11. River flow improved	1
12. Improved relations between villages	1
13. Conflicts between villages	1
14. Increase in employment	1
15. Negative impacts on female fishers	1
16. Fishing easier	1
17. Restrictions now in place	1
18. Increased turtle poaching	1

¹Decline in seagrass and increase in sand cover over approximately the last 10 years, not directly related to PMM, but to other natural or anthropogenic phenomena

In addition, changes relating specifically to fishing are given in Table 3. Perceptions of the fishery-enhancement effects of PMM varied greatly, with fishers from different villages reporting decreases in catch and fish size as well as increases.

Table 3. Perceived changes related specifically to fishing since the creation of PMM

Perceived change related to fishing since creation of PMM	Number of PMM villages
1. Change in gear ¹	8
2. Women no longer fish ²	6
3. Supply of fish inconsistent ³	5
4. Increase in nearshore catch ⁴	5
5. Decrease in species diversity	4
6. Increase in species diversity	4
7. Habitat loss	4
8. Decrease in nearshore catch ^{5,6}	3
9. Overall decrease in catch	3
10. Increase in fish size	2
11. Decrease in offshore catch	2
12. Decrease in fish size	2
13. No change in gear	1
14. Fishing not a significant sector because village located inland	1
15. Increase in offshore catch ⁷	1
16. Overall increase in catch	1

¹primarily from gill nets to line fishing

²following prohibition of *uruva*

³especially when sea conditions were poor, necessitating purchase from external parties, storage freezers suggested as a solution (Nio, Oua, Kan, Zir, Ham)

⁴allowing the use of traditional and less expensive fishing methods (OuaM)

⁵related to the loss of seagrass habitat

⁶increasing necessity to travel further to catch fish and resultant increased cost (OuaM, NdrM, and HamM)

⁷particularly tuna

4.4 ENVIRONMENTAL THREATS AND SOLUTIONS

A total of 15 threats were raised during focus group interviews (Table 4). ZirF stated that there were no current human-induced threats in PMM. NioF could not answer the questions; it had no suggestions and said that it was for the ecoguards to answer these questions.

Table 4: Threats identified during focus group interviews at each village

THREAT											No. PMM
	Mir	Ou1	Ou2	Ndr	Nio	Oua	Kan	Zir	Ham	Its	villages
Turtle poaching	X	X	X	X	X	X	X	X	X	X	10
Destruction of coral ¹	X	X	X	X	X	X	X		X		8
Illegal fishing ²		X	X	X	X	X	X	X			7
Octopus fishing ³	X	X	X		X		X		X		6
Deforestation	X	X	X		X				X		5
Lack of waste management	X				X	X			X		4
Outsider threats ⁴	X		X					X	X		4
Egg poaching	X	X	X		X						4
Extraction of sand	X			X		X					3
Erosion	X		X			X					3
Pollution of river or ocean		X				X			X		3
Authorized illegal extraction ⁵			X						X	X	3
Agriculture (erosion)			X			X					2
Increase in sand		X									1
PMM and its prohibitions ⁶				X							1

¹resulting from octopus fishing extraction of coral for building materials (though the latter happens less frequently today).

²gillnetting, spearfishing, dynamiting, poisoning

³every village stated that they practiced octopus fishing

⁴illegal extraction by local (e. g. neighbouring villagers or islanders) or foreign companies

⁵authorization from government or PMM allowing local or international individuals, companies, or organizations to use illegal fishing methods

⁶existence and policies of PMM itself are a threat to the environment

The remaining 18 groups (from 8 villages) proposed 34 solutions to these threats. The five most commonly proposed solutions were:

1. Environmental education, training, and awareness-raising;
2. Expansion of PMM personnel (ecoguards) and building of PMM capacity;
3. Supplies of equipment including boats and communication to patrol turtle nesting beaches;
4. Enforcement of fishing regulations, turtle poaching laws, etc;
5. Reduction of poverty and unemployment.

Other innovative proposed solutions included:

- Effective work programme for the ecoguards;
- Training courses in conflict resolution so that villagers may effectively deal with poachers in their own villages;

- Ditches or reforestation to deal with problems of erosion;
- Environmental education for local authorities and fishers;
- Fuel-efficient wood stoves;
- Exchanges between villages to share ideas on environmental protection;
- Involvement of fishers in nightly surveillance to capture turtle poachers;
- Incentives or alternatives to stop turtle poaching;
- Guard hut in the forest between Ouallah 1 and Ouallah 2 to deal with forest related problems.

4.5 STAKEHOLDER ROLES AND RESPONSIBILITIES

Male focus groups in three villages (Ouallah 1, Ouallah 2 and Ndrondroni), felt that they had not been adequately consulted during the development of PMM. However, most female focus groups felt that they had been excluded; only women in three villages (Miringoni, Ouanani and Kangani) felt that they had any involvement.

All villages responded that they would like to be involved in PMM activities where possible, though Ou2M and HamM stated that this would only be on the condition of a commitment to transparency and effective management practice. Stakeholders were interested in participating through activities such as awareness-raising and education, training opportunities, conducting surveillance, and community clean-ups. They also expressed a wish to be invited to information sessions and workshops.

Percentages of focus groups that reported multiple benefits, no benefits or one benefit from PMM are given in Figure 5; benefits mentioned included the following:

- increased fish catches
- increased tourism
- use of the beach for swimming and picnics
- official rights to guard their species and environment
- PMM itself through protection of the environment
- reduction in unemployment
- fishing gear restrictions
- PMM office— when PMM finally ends, the building will be used by the village!

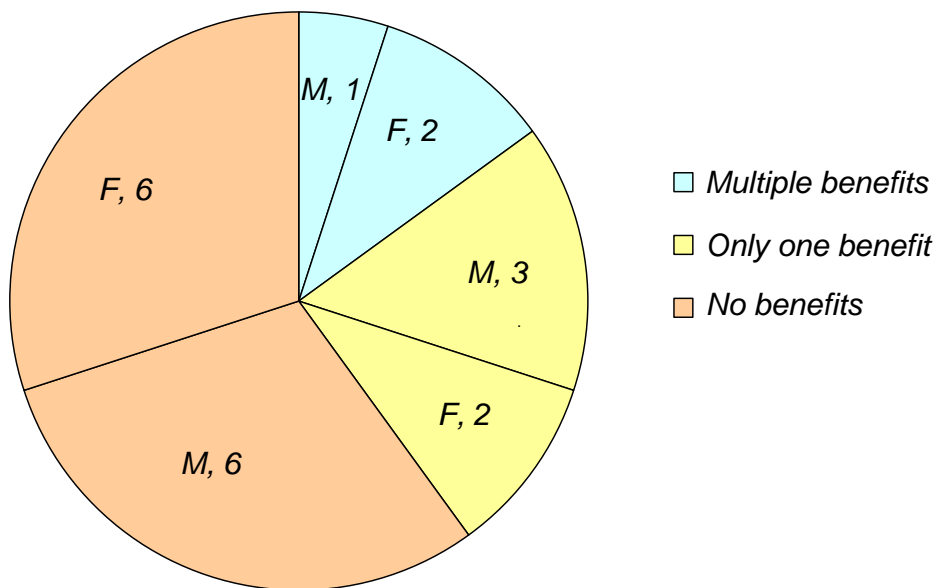


Figure 5: Numbers of male (M) and female (F) focus groups that reported multiple benefits, no benefits and one benefit from PMM

4.6 FUTURE ASPIRATIONS AND EXPECTATIONS

Future visions and aspirations for PMM (see Appendices) were grouped into 5 broader themes:

- Training and education
- Livelihoods
- Administrative management of PMM
- Conservation and protection
- Community participation

Female focus groups identified 12 aspirations and expectations, more than half of which were related to training and education (Figure 6), demonstrating that there was much similarity in ideas and visions amongst women from all PMM villages. ItsF only responded that it hoped that PMM would bring future benefits but that it had no idea what the future held. Male focus group identified 55 specific activities, with far less clustering according to theme (Figure 7).

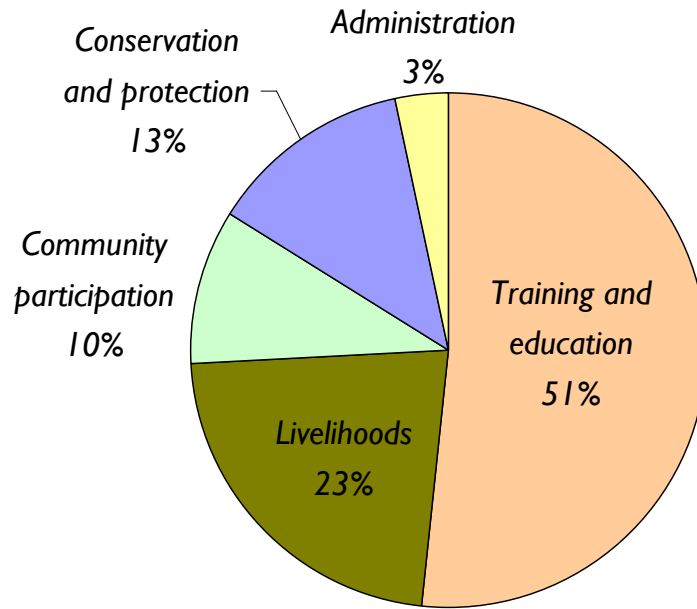


Figure 6: Female focus group aspirations and expectations grouped by theme

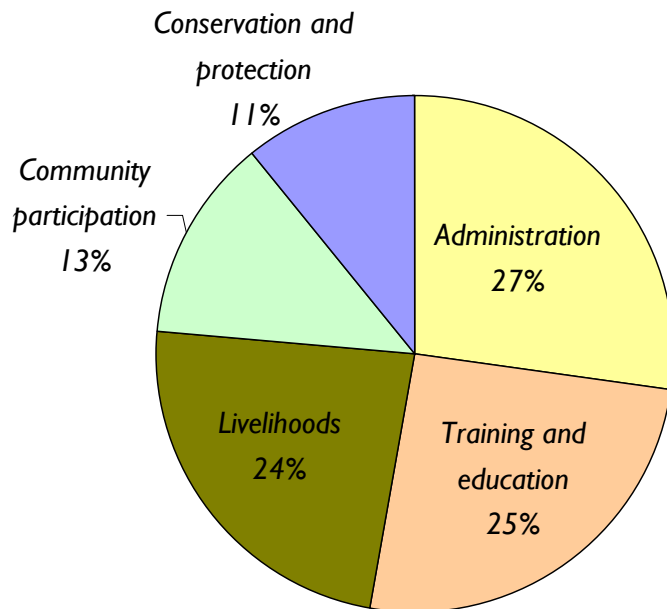


Figure 7: Male focus group aspirations and expectations grouped by theme

5. DISCUSSION

5.1 ACHIEVEMENTS OF PMM

'PMM's objectives are good in terms of conservation but they do not concretely address the issue of how we can both protect and consume resources within PMM.' - Male respondent from Ouanani

'People's attitudes are changing – they have a better understanding of conservation' – Male respondent from Miringoni

All focus groups interviewed believed that PMM was important, and the reasons given were almost identical to the MPA's initial objectives (Gabrie 2003):

1. to ensure the independent function and management of the park and to sustain the management structure;
2. to ensure the conservation of marine and coastal biodiversity, habitats and endangered species;
3. to encourage the development of ecotourism and other income-generating activities;
4. to ensure the sustainable use of marine resources;
5. to reinforce environmental education, training and communication.

Thus, PMM has partially succeeded in creating awareness of its objectives and importance amongst local communities. However, the 18 negative aspects and comments later recounted by PMM villages (Table 1) illustrate that to date it has failed to some extent in successful implementation of these objectives in a co-management context.

5.2 LACK OF SUSTAINABILITY

'Since Project Biodiversity finished, we now say that the word PMM does not exist. There has never been follow-up to anything that was implemented during the project. With the project, we stopped all of the harmful activities that we were told to stop. However, we saw that we gained nothing, and now, bit-by-bit, we have started engaging in harmful activities again. Moreover, the management of the PMM now remains only in the hands of a few individuals – this is the reason that there is more damage occurring now than before – people have lost respect for PMM. To make matters worse, the ecoguards were abandoned as soon as the project finances stopped. They were expected to work hard and were paid very little. For example, they were expected to defend themselves against poachers carrying weapons, without having any weapons themselves or even training in self-defence.' – Male respondent from Ouallah I

Lack of sustainability was identified as the primary negative aspect of PMM, although there were originally plans to address this issue, it seems that none was fully realized. Project Biodiversity laid the groundwork for a Biodiversity Trust Fund for the Comoros, including management of protected areas (Bayon 1999). However, a much longer time-scale was required to set up a Fund (several years, rather than the 4-5 years envisaged in the project document), as well as a much greater level of capitalisation (US\$15 million instead of the US\$2 million proposed in the GEF Project Document) (Wells 2005). The management plan for PMM estimated annual management costs of a minimum of US\$87,000 or an optimum of US\$215,000 (Gabrie 2003). In the absence of the Trust Fund to cover these costs, no contingency plan for sustainable funding and no lower-cost alternative for its management, PMM's financial situation was uncertain following the end of Project Biodiversity. This was clear to local communities who remarked on the reductions in management effectiveness, activity and levels of enforcement after Project Biodiversity was over. The sheer scale and promises of Project Biodiversity overwhelmed the communities of PMM, raising their expectations. Following the end of funding, communities were no longer willing to accept the potential of low-cost, community-motivated conservation initiatives, preferring to leave enforcement to the salaried ecoguards. In this way, community enthusiasm was, in some ways, reduced by the creation of PMM as stakeholders became disillusioned by the lack of activity and realized benefits following Project Biodiversity.

5.3 SUSTAINABLE LIVELIHOODS

'PMM told us that we could no longer use uruva because it was bad, but in our village we saw the opposite happen, now there are less fish since it was banned!' - Female respondent from Miringoni

Most focus groups (85%) believed that they had received no benefits or only one benefit from PMM. Thus, PMM has failed to provide adequate incentives to its stakeholders to ensure their continuing motivation for biodiversity conservation.

5.3.1 Ecotourism

Ecotourism was one of the key objectives of PMM (Gabrie, 2003) and was recognized by communities as a positive aspect. However, tourist arrivals have declined since the creation of PMM and communities complained that they were inadequately trained to host tourists and provide guides, accommodation and other services. Local capacity and infrastructure must be considerably improved for ecotourism to provide a significant alternative income on Mohéli (C3-Comores unpublished data).

5.3.2 Gear alternatives for fishers

Prohibitions on fishing gear (gillnetting, spearfishing, dynamiting and poisoning) were identified as a constraint by several villages. The main concern was the reduction in catch as a result of restrictions, particularly during rough weather; furthermore, no alternative fishing methods were offered by PMM. However, while stakeholders felt that prohibitions caused a significant hindrance, they also identified the positive aspects of conservation and sustainable management of marine resources. Results also showed that while most communities knew that the prohibited fishing methods were destructive to the environment, the reason *why* they were destructive was not well understood. Stakeholders stated that they were led to believe that if they ended the use of destructive gears there would be an abundance of fish, coral, and marine species. For instance, MirF understood that if they stopped using *uruva*, fish populations would soar and seagrass would proliferate within 5 years. However, not only had they not seen these changes and felt that they had been deceived, they also believed that there were more fish and seagrass before PMM when they were using *uruva*. NdrM stated that the use of *uruva* encouraged larger fish that would come to feed on the smaller fish that had been poisoned. Thus, although information regarding prohibited activities in PMM was widely distributed, the restrictions were not linked with marine resource conservation in a way that local communities could effectively understand. As a result, stakeholders felt that they were making a sacrifice by abiding by PMM regulations, particularly those related to their core livelihoods. This situation could be improved through the implementation of community-centred monitoring to provide feedback in terms of changes in resources over time.

Although knowledge of fishing restrictions was widespread throughout PMM, the majority of villages (70%) stated that the use of prohibited fishing gears was a current problem within PMM. These methods were used openly, in hiding, or by fishers from neighbouring villages. Many focus groups were particularly concerned about the damaging effects of gillnetting, such as coral damage and by-catch. The authorization of gillnetting within PMM during the month of Ramadan in 2005 caused conflict and radiated mixed messages; some men stated that they felt that this authorization negated their conservation efforts. Many fishers also remarked that they have never been aware of the location of the PMM no-take zones and that PMM staff do not enforce these zones.

Some villages always respected regulations, despite the lack of enforcement, but felt that their efforts were futile because fishers in other villages continued to use banned methods and benefit from higher catches. As a result, many fishers felt that they had not received adequate compensation to date, e.g. alternative sources of income or alternative fishing methods. This problem was recognized in 2001, when the gillnet and spear fishers of Nioumachoua expressed their dissatisfaction that Nioumachoua's alternative income-generating scheme (ecotourism facilities) had failed to provide them, the 'victims' of PMM, with any benefits (Loupy 2001). There is a clear need to directly address

these issues and provide realistic alternatives for these fishers. All fishers requested training in the use of alternative fishing gears. Women appeared to have been the most inventive in experimenting with new fishing methods (e.g. catching fish in baskets or *shiromanis* (traditional cloths) at low tide or using a hook, bucket, and wooden stick to catch octopus).

A number of projects have already attempted to address these issues through the provision of motorized boats to PMM fishers. However, logistical complications always arose with the sharing of a single motorized boat and these projects have proved inadequate and have caused conflicts in all villages that were involved in them. Some villages decided that the boat would not be exclusively used for fishing but also for tourism, transporting goods and passage to other islands and disputes also occurred if the boat or engine was damaged (Loupy 2001). A lack of follow-up or formal evaluation of these alternative income generation schemes has made it impossible to learn lessons in order to improve such projects in the future (Malleret 2004).



Artisanal fishers, Ndrondroni

There was no consensus on the effects of PMM on fisheries yields. A frame survey of artisanal fisheries is urgently required, not only for Mohéli but for the Union, since the last extensive published survey was in 1995 (reported in UNEP 2002). Without demonstrable fisheries enhancement effects, PMM will be unable to win over fishers who have lost income following gear prohibitions within PMM boundaries. Seagrass was reported to have declined throughout Mohéli, over the last 10 years, and beds are now significantly less dense (C3-Comores unpublished data) than described in the PMM management plan (Gabrie 2003). A reduction in seagrass habitat is certain to have negative effects on nearshore fisheries yields (Connolly et al 1999), and seagrass also provides essential habitat for the endangered green turtle and vulnerable dugong.

5.4 INEQUITABLE DISTRIBUTION OF BENEFITS

A lack of transparency in the management of PMM and an unequal distribution of its benefits were major concerns voiced by local communities. Stakeholders felt that benefits were being concentrated in Niomachoua, the headquarters of PMM or villages such as Itsamia that host more conspicuous marine attractions such as turtles. These views regarding the unequal distribution of benefits were a root cause of the feelings of bitterness towards PMM, common among stakeholders. For example, throughout the interview in Ndrondroni, the men were extremely critical of PMM and its administrative personnel. As a result, some of their answers were exaggerated to provoke hilarity and verged on the absurd as they recounted all of the detrimental effects of PMM. Discussion groups in Hamavouna, Itsamia, Kangani, and Ziroudani also initially mocked PMM, saying that it was dead or non-existent. In Hamavouna, the women pretended for the first 10 minutes of the discussion to have never heard of PMM. The result is that these attitudes of resentment and distrust clearly contribute to stakeholders' non-compliance with PMM regulations and their unwillingness to actively participate in effective co-management. In the past, it appeared that this lack of cooperation from villages resulted in a tendency for PMM to avoid confrontation and in doing so to ignore the problem (Abdou Rabi pers. comm. 2006) leading to further isolation and resentment from these communities. Thus, rather than concentrating efforts in these villages, they were marginalized.



Turtle awareness-raising, Hamavouna

It became evident through focus group interviews and discussion with PMM staff that Ndrondroni and Hamavouna were the most marginalized villages within PMM. Unsurprisingly, Ndrondroni and Hamavouna were also the two PMM villages most notorious for turtle poaching and a lack of compliance with PMM regulations which was blamed on their *Anjoanais* origin (Boinali pers. comm. 2006). Both of these villages were noticeably the poorest villages within PMM as well as the most disassociated from PMM activities and benefits. For example, the ecoguard at Hamavouna had been

dismissed, whereas Nioumachoua and Itsamia both currently have two. It was thus quite discouraging to hear that, subsequent to this study, the ecoguard of Ndrondroni, Rafiki Soilihi Bacar was also dismissed (Mindhiri pers. comm. 2006). Furthermore, as both villages are visibly much less developed than the other eight villages, they are less likely to gain any direct benefits from tourism. As a result, if PMM is to function effectively as a whole, great efforts need to be made to equally include all villages and attempt to share benefits throughout the park. For example, the annual awareness-raising 'Day of the Turtle' could be held in one of these villages rather than always at Itsamia.

It was also expected that there would be a lack of environmental awareness in Hamavouna and Ndrondroni as well as villages far from the coast or PMM headquarters; however, this was not the case. Surprisingly, the female focus groups of Itsamia and Nioumachoua were classified as having no awareness. This was unexpected since PMM headquarters, technical staff and two ecoguards are based in Nioumachoua. Itsamia is the only other village with more than one ecoguard and is known throughout the Comoros as a pioneering village in terms of turtle conservation and for its dynamic village association ADSEI. The lack of awareness in these villages could be because (1) less emphasis was placed on environmental education as it was assumed that information would be automatically disseminated through the physical presence of PMM personnel or (2) because of the strong PMM presence, less effort was made to develop community co-management since PMM personnel were expected to directly take on these responsibilities.

5.5 EXCLUSION OF WOMEN

'We know nothing about PMM except for the activities that are now prohibited and the names of the PMM personnel that work here – we don't even know what these personnel do.'- Female focus group, Nioumachoua.

'The situation is urgent; we need to do something quickly. We must start straight away' – Female focus group, Ndrondroni

On the coast, as in many environments, both men and women play different productive, economic and social roles. There are gender differences in resource use patterns, access to land, natural resources, equipment, labour, capital, outside income, and education, and in the control of these resources (USAID 1998). Participation of women in coastal resource use is rarely fully acknowledged and tends to receive little, if any, economic remuneration (van Ingen et al 2002).

Great disparity in knowledge and awareness of PMM was noted according to gender, with women showing much lower levels of awareness. The vast majority of women (70%) felt that they had not

had a role in the creation of PMM and four women's groups also remarked themselves that they remained uninformed and ignorant of park activities and conservation in general. It should also be noted that after every female discussion group, the interviewer was thanked extensively for having included women in her research – most groups said that it was the first time anyone had asked them about their opinions of PMM and natural resource management. The women who participated in the focus group interviews were motivated and inspired. They were willing to partake in all conservation activities, including nightly surveillance of beaches for turtle poachers.

5.6 ENVIRONMENTAL THREATS

'We would like a respectable park. We want a park that respects its own legislation and its agreements, especially with regard to catching poachers. At this time, everyone simply does as they please. It is very discouraging'. – Male focus group, Itsamia

'Tourists come here to see turtles and all they find are carcasses on the beach.' – Man from Ouallah I



Evidence of turtle poaching, Islets of Nioumachoua

Turtle poaching was the most commonly cited threat within PMM. Communities felt that poaching of endangered species was a serious problem and had a negative impact on the environment and tourism. The motivation behind hunting turtles for meat was for its taste, low cost, and because consuming turtle meat is believed to bestow strength. HamM openly admitted to killing at least 2 turtles each month, and NdrM said that they would not stop unless adequate benefits or replacement sources of meat were provided by PMM. Only 4 of the 10 villages identified poaching of turtle eggs as a current threat, even though it occurs throughout PMM (C3-Comores unpublished data). The effects of egg-poaching are less apparent than the slaughter of adult turtles, however,

awareness-raising is necessary so that the ecological consequences of poaching turtle eggs are also understood.

The destruction of coral was regarded as a continuing problem within PMM by 80% of villages. This was an issue often raised by female focus groups, as it is more common for women to collect octopus or other marine species at low tide (a fishing technique known locally as *mtsohozi*), thus they directly witness impacts on coral. Coral damage was frequently identified as a result of octopus fishing practices; particularly through the use of iron rods (*ntshora*) or rocks to smash coral and extract the octopus. While the use of iron rods was not officially banned under PMM regulations, it has been regarded as an infraction as a form of spearfishing (Loupy, 2001). A number of villages (60%) stated that octopus fishing was a continuing problem within PMM. HamM exclaimed that the destruction caused by octopus fishing was an even greater threat to the environment than the poaching of turtles. In Hamavouna, fishers claimed that they would catch between 50 – 100 octopus each day. Walking on coral at low tide was identified as another cause of destruction. Some groups also noted the collection of coral for construction, though less frequently in recent years. NdrM claimed that before PMM, they mined coral and it grew back quickly; but now it does not return. The source of these perceptions could be the 1998 coral bleaching event which resulted in severe levels of mortality throughout the Indian Ocean (Obura 2001), also affecting Mohélian coral reefs.



Coral destruction, Niomachoua

The villages where deforestation was of greatest concern were Ouallah 1, Ouallah 2, Miringoni, and Niomachoua. Forests near Ouallah 1 and Ouallah 2 are habitat for the endemic Livingstones Fruit Bat (*Pteropterus livingstonii*) and Miringoni relies on hydroelectric power. Deforestation was considered a result of current cultivating practices which involve felling large numbers of trees and

slash-and-burn agriculture. According to the focus groups, erosion was the most damaging result of deforestation, particularly along rivers leading to sedimentation and damage to coastal habitats such as seagrass and coral reefs, particularly during periods of high rainfall. Ou2M suggested that a guard hut be constructed between Ouallah 1 and Ouallah 2 and a terrestrial ecoguard be employed to survey the area for destructive forestry practices. Deforestation of mangroves was not cited as an extensive problem on Mohéli since mangrove wood is not widely used. People also expressed fear of mangrove areas because they are believed to harbour evil spirits.

5.7 MONITORING AND ENFORCEMENT

'The fishermen here are doing poachers a favour by protecting the turtles so that they can come here to kill and eat them' – a Nioumachoua fisher

Lack of effective monitoring or enforcement ranked second for negative aspects of PMM. This issue was raised in 8 villages who stated that the lack of permanent monitoring and enforcement was leading to a continuation of turtle poaching and destructive fishing practices. As a result, local communities have become demotivated. Resentment has arisen from the fact that those that do respect regulations gain no benefits, while those that do not respect regulations gain increased benefits. Lack of enforcement has also led to the perception that PMM no longer exists and thus, people may carry out illegal activities with no fear of incrimination.

6. CONCLUSIONS AND RECOMMENDATIONS

The objectives of PMM were clearly envisaged, although in reality their implementation has not been fully realized. PMM must act urgently in order to realign its management activities and re-establish itself as an effective MPA. The most pressing points of action identified by this report are given below:

(1) Ensure sustainability through effective financial planning and promotion of low-cost, appropriate management techniques:

An effective business plan and trust fund or other means of sustainable finance should be developed and there is a need to move away from external funds, and focus on low-cost, appropriate management that can continue if there are financial problems in the future.

(2) Mobilize local communities to create a truly co-managed PMM:

All decisions are currently being made by one or two people who are not representative of PMM communities; the Management Committee must be fully involved and their power of authority reinforced as representatives of the 10 villages for decision-making in PMM.

(3) Ensure tangible benefits to local communities through realistic alternative livelihood options, particularly for fishers:

A frame survey and socioeconomic assessment of fisheries are essential first steps, followed by research and implementation of alternative gears and livelihoods.

(4) Ensure equitable sharing of benefits and awareness of PMM:

An initial focus on Hamavouna and Ndrondroni is required, involving an intense awareness-raising and education programme to instil a new understanding in these communities for their natural resources, and ecotourism benefits must be equally distributed.

(5) Involve women in the management of PMM as the primary local educators and motivators for future generations:

This may be achieved through targeted awareness raising programmes, training of female ecoguards, ecoguides and community trainers and promotion of sustainable alternative livelihoods for women (from artisanal craft-making to new fishing methods).

(6) Inform law enforcement officials and members of the justice system to ensure understanding, respect and enforcement of PMM regulations:

Targeted training workshops in the ecological and economic importance of natural resources will help to ensure the effective application of environmental regulations, particularly through community reward systems for the reporting of PMM infractions.

'We want youth to be involved with PMM. We want them to become motivated and to forget about all the past negative aspects associated with PMM. We want them to be able to gain the benefits. Our generation has failed, but we should look to improve the situation for the following generations.' – Man from Ndrondroni

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9. APPENDICES

9.1 FOCUS GROUP QUESTIONNAIRE

1. BASIC AWARENESS

Aim: to gain an understanding of communities' knowledge of PMM, its purpose, and the dissemination of information regarding PMM

- i. What do you think is the purpose of PMM?
- ii. Why was PMM created?

2. VALUE

Aim: to gain an understanding of villagers' personal and communal interests in PMM

- i. Do you think that PMM is important? Why?
- ii. What are the negative and positive aspects of PMM?

3. EFFECTIVENESS

Aim: to gain an understanding of communities' awareness of the current conditions of PMM; e.g. biodiversity, habitat protection, fisheries enhancement

- i. What changes, social and environmental, have you noticed since the creation of PMM
- ii. (to fishers) Have there been any changes in your fishing methods, catch numbers, and size of fish since the creation of PMM?

4. ENVIRONMENTAL THREATS AND SOLUTIONS

Aim: to gain an understanding of villagers' knowledge of current threats and their awareness of the impact of their own actions

- i. What human activities do you think are **currently** having a negative effect on PMM or the environment in general?
- ii. What methods can we use to reduce these threats?

5. STAKEHOLDER ROLES AND RESPONSIBILITIES

Aim: to understand the present role of communities (and the possibilities for their role in the future) within PMM

- i. Did you have a role during the creation of PMM?
- ii. How do you think you could participate in the activities of PMM ? Are you interested?
- iii. What benefits (now and future) do you think that you could gain from PMM?

6. FUTURE ASPIRATIONS AND EXPECTATIONS

Aim: to understand how communities would like PMM to develop in the future

- i. What is your future vision for PMM?

9.2 FOCUS GROUP STATISTICS

Table 5. Size and age distribution of focus groups

Focus Group	Number	Mean \pm SE Group Size	Age
MEN	159	16 \pm 2.7	12-76 (mean=34)
WOMEN	107	11 \pm 1.5	15-75 (mean=35)
TOTAL	266		

Table 6. Dates and locations of interviews

	Date	
	Male	Female
Mir	20 th August 2006	20 th August 2006
Ou1	12 th July 2006	12 th July 2006
Ou2	31 st July 2006	31 st July 2006
Ndr	10 th July 2006	10 th July 2006
Nio	28 th July 2006	10 th August 2006
Oua	18 th July 2006	18 th July 2006
Kan	17 th July 2006	17 th July 2006
Zir	6 th August 2006	6 th August 2006
Ham	17 th July 2006	17 th July 2006
Its	27 th July 2006	27 th July 2006

9.3 DETAILED RESULTS

9.3.1 Basic awareness

Table 7. Levels of awareness of PMM determined for each focus group

	Stakeholder awareness	
	Male	Female
Ou1	Strong	Strong
Ou2	Strong	Strong
Ham	Strong	Weak
Ndr	Strong	Weak
Oua	Strong	Weak
Zir	Strong	Weak
Mir	Strong	None
Nio	Weak	None
Kan	Weak	None
Its	Weak	None

9.3.2. Value

Table 8. Positive aspects of PMM identified by focus groups

Aspect	Mir		Oul		Ou2		Ndr		Nio		Oua		Kan		Zir		Ham		Its	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1. Environmental protection and a reduction in environmental destruction	X				X	X			X				X	X	X	X				
2. Increase in fish (size or number)	X			X	X	X					X	X			X	X	X			
3. Prohibitions on fishing gears				X					X		X				X		X			
4. Increase in environmental consciousness			X												X		X			
5. Ecotourism	X					X			X											
6. Increase in coral cover						X									X		X			
7. Exchange and increase in information through international interest				X					X											
8. Infrastructure development									X								X			
9. Reduction in unemployment		X							X											
10. Official permission for villages to protect their coastal zone															X					
11. Presence of ecoguards																	X			

Table 9. Negative aspects of PMM identified by focus groups

Aspect	Mir		Oul		Ou2		Ndr		Nio		Oua		Kan		Zir		Ham		Its		
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
1. Lack of sustainability	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Lack of effective monitoring or enforcement	X				X	X		X	X	X			X	X		X	X				X
3. Lack of respect of PMM personnel for official agreements	X				X				X					X		X	X		X	X	X
4. Absence of PMM personnel													X	X		X	X		X	X	X
5. Poor management of equipment												X	X	X	X	X	X				
6. Absence of PMM personnel												X	X		X	X		X	X	X	X
7. No positive aspects		X					X	X										X	X	X	X
8. Prohibitions on fishing gears		X					X		X	X		X									
9. Lack of collaboration between PMM, external organizations and villages associations									X			X						X	X		
10. Insufficient environmental training, education, and awareness-raising		X			X					X		X									
11. False promises of Project Biodiversity		X		X					X			X									
12. Lack of management of forestry activities				X		X			X	X											
13. Absence of female participation								X	X		X								X		
14. Lack of motivation	X				X									X							
15. Lack of benefits							X	X											X		
16. No visible zoning of PMM boundaries				X					X									X			
17. Inequitable distribution of benefits ¹⁶											X	X		X							
18. Environment in a worse state since the creation of PMM							X														
19. Lack of waste management										X											

9.3.3 Effectiveness

Table 10. Perceived changes since the creation of PMM for each focus group

Change	Mir		Oul		Oua		Ndr		Nio		Oua		Kan		Zir		Ham		Its	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1. Increase in species abundance and diversity	X					X			X		X	X	X	X	X	X	X	X		
2. Decline in seagrass				X	X				X				X					X		
3. Reduced environmental threats		X			X							X								X
4. Increase in environmental awareness	X					X									X					
5. Reduction in species abundance and diversity				X			X											X		
6. Initial improvement as a result of Project Biodiversity but now deterioration because of PMM inactivity			X	X													X	X		
7. Fishing more difficult because of gear restrictions	X						X													
8. Ecoguards neglected			X														X			
9. No changes - PMM does not exist							X													X
10. Socioeconomic development		X																		
11. River flow improved		X																		
12. Improved relations between villages					X															
13. Conflicts between villages													X							
14. Increase in employment						X														
15. Negative impacts on female fishers						X														
16. Fishing easier									X											
17. Restrictions now in place										X										
18. Increased turtle poaching							X													

Table 11. Perceived changes related specifically to fishing since the creation of PMM for each focus group

Change	Mir		Oul		Ou2		Ndr		Nio		Oua		Kan		Zir		Ham		Its		
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
1. Change in gear	X	X	X	X	X		X		X	X	X	X		X						X	
2. Women no longer fish		X				X				X	X				X						X
3. Supply of fish inconsistent									X	X	X	X	X	X	X	X	X	X			
4. Increase in nearshore catch	X			X			X				X							X			
5. Decrease in species diversity	X	X	X			X															X
6. Increase in species diversity				X		X			X		X										
7. Habitat loss			X			X			X				X								
8. Decrease in nearshore catch			X				X											X			
9. Overall decrease in catch			X		X													X			
10. Increase in fish size				X					X	X											
11. Decrease in offshore catch	X		X																		
12. Decrease in fish size			X			X															
13. No change in gear																		X	X		
14. Fishing not a significant sector because village located inland															X	X					
15. Increase in offshore catch													X								
16. Overall increase in catch									X												

9.3.4 Future hopes and expectations

Table 12. Aspirations and visions identified by female focus groups

Vision	Mir	Oul	Ou2	Ndr	Nio	Oua	Kan	Zir	Ham	Its	No. PMM villages
1. Training ¹	X	X	X	X	X	X	X	X	X		9
2. Women's conservation centre ²	X	X	X	X		X			X		6
3. Employment ³		X		X		X		X	X		5
4. Involvement in PMM					X	X		X			3
5. Education opportunities						X					1
6. Food security								X			
7. Marine and tourist infrastructure				X							1
8. Education of youth							X				1
9. Awareness-raising				X							1
10. Transparency of management				X							1

¹training of trainers'; mobilization of women; youth education; conservation training; enforcement training; swimming lessons and English language training for tourism

²a centre to be a place for women to receive training and information on conservation; to display their artisan crafts and an environmental education library

³'All of the threats to the environment here are caused by poverty. If we can create sustainable employment it will reduce poverty.' – Woman from Oua

Table 13. Aspirations and visions identified by male focus groups

Vision	Mir	Ou1	Ou2	Ndr	Nio	Oua	Kan	Zir	Ham	Its	No. PMM villages
1. Tourism development ¹	X			X		X	X	X		X	6
2. Training ²		X	X			X		X	X	X	6
3. Involvement in PMM ³		X	X		X	X				X	5
4. Enhanced fisheries ⁴	X			X		X			X		4
5. Increased visibility of PMM personnel ⁵	X		X					X		X	4
6. Equal distribution of benefits				X		X	X				3
7. Transparency of management			X			X					2
8. Management and enforcement			X			X					2
9. A respectable MPA								X		X	2
10. Equipment		X				X					2
11. Increased surveillance			X					X			2
12. Youth and community centres		X						X			2
13. Education of youth						X			X		2
14. Training and environmental education for fishers						X			X		2
15. Village awareness-raising		X							X		2
16. Better life	X										1
17. Community development				X							1
18. Improved standards for ecoguards							X				1
19. Improved justice system			X								1
20. Expansion of PMM to all of Mohéli						X					1
21. Waste management									X		1
22. Youth participation				X							1
23. Collaboration and empowerment of fishers					X						1
24. Improved collaboration between villages						X					1

¹increased employment and income; the only means through which Mohéli will be able to develop and enhance the standard of living; development of dive tourism; collaboration between villages to develop and share the benefits of tourism

²training of trainers; swim and dive training; self-defence for ecoguards; English language; conservation and environment; ecoguides; alternative fishing techniques

³improved collaboration between PMM and village associations; more participation in the management of the park

⁴perhaps adopting seasonal restrictions