

Influence of co-management on marine resources sustainability in Shimoni and Wasini areas, Kenya

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Manuscript received: 24 August 2019. Revision accepted: 30 November 2019.

Abstract. Ogada AA, Mwaguni S. 2019. *Influence of co-management on marine resources sustainability in Shimoni and Wasini areas, Kenya. Ocean Life 3: 65-73.* The research investigated the influence of the co-management of marine resources for sustainable development. Co-management is proposed as the ideal tool for sustainable management of marine resources and ensuring stakeholders are involved in decision-making and managing their resources. The study was undertaken to generate knowledge on the influence of co-management on sustainable marine resources; the study area chosen had some background in co-management before. The study was conducted through a survey research design using questionnaires, semi-structured questionnaires, interviews, and focus group discussions, with a sample size of 145 respondents. The collected data was coded using SPSS 19 for analysis, including; presenting simple percentages, frequencies, and cross-tabs. In addition, chi-square was used to test the hypotheses. The study's results focused on co-management variables: institutional design, community participation, and socio-ecological dynamics. The results showed that 95% of the respondents perceived the co-management institutional design as adequate. Community participation is a key factor of co-management, which was proven right with 82.5%. There is the agreement that communities' roles in co-management were clearly defined and involved in the decision-making process. Moreover, 92.5% of the respondents said that IK is valuable and was not only applied in co-management but also effective in its application. In conclusion, the study shows that co-management positively influences conservation and community members' well-being. Therefore the researcher concluded that co-management is an adequate tool for planning and sustainable management of marine resources. However, it was recommended that improved intergovernmental and interagency partnerships are needed to address cross-cutting and emerging issues in co-management.

Keywords: Kenya, Kwale County, marine resources, sustainable management

INTRODUCTION

Worldwide, there are efforts to implement environmental standards and regulate activities in coastal and marine areas to manage development activities, control pollution, and conserve marine resources (UNIDO 2000). At the international level, conventions, protocols, and agreements have provided the basis for cooperation among countries at bilateral, regional, and global levels to achieve this objective. In addition, in some countries, national environmental legislation has provided practical frameworks for achieving the best management approach.

An over-centralized management model, where the artisanal fisherman neither participates nor is represented, brings about an incompatibility between the sustainability objective pursued by States and maximizing fishermen's economic objectives favored by market forces. On the other hand, the experience to date shows how the fishermen's involvement in the co-management of fishery resources and the green economy can be a means to achieve sustainable development in its three dimensions (social, economic, and environmental), together with the eradication of poverty (Gunderson et al. 2002).

Except in the immediate past years, the African region's environmental values and natural resources factors have not always been integrated into national development plans. Moreover, development decisions and social trends appear not to have optimized the value of natural resources

(Akpabli 2000). Many problems and issues facing fisheries can be resolved through developing co-management institutions on a larger scale. Therefore, the co-management approach focused on developing institutional and legal mechanisms to improve fisheries governance through forming BMUs to ensure that these stakeholders, particularly the marginalized poor, can engage in and influence decision-making processes relating to fisheries management. Thus the avenue needed by the government to meet its double obligation of attending to international agreements while sharing decision-making power for fisheries management with communities. Moreover, to maintain scientific validity and achieve wide acceptance, we must identify a management knowledge base acceptable to stakeholders (Berkes 2009a,b).

Co-management systems need to reconcile both formal scientific knowledge and indigenous knowledge. One approach may be to identify science-based indicators of the status of the resource system that also reflect the resource users' observations (Huntington et al. 2004). Management arrangements may require access rights to be limited to some resource users and to exclude others, often resulting in conflicts that can be managed through participatory approaches, which are crucial for successful co-management. In addition, existing institutions need to be reformed to empower local communities to participate in determining management objectives (Ahmed et al. 2004).

In the early 1990s, Kenya's sustainable fisheries management, development, conservation, and utilization mandates had been structured solely under government departments. However, a combination of environmental threats and growing evidence of the resulting negative impacts convinced national authorities that it was time to adopt a new management approach involving communities as partners in management.

As a result, there was a paradigm (policy) shift from a government-centered approach to stakeholders (co-management) based approach since 2004. The new dimension was taken to ensure fisherfolks and other resource users are involved in fisheries management and decision-making. In addition, a consensus is emerging on the need to manage Kenya's coastal and marine resources through an integrated rather than a sectoral approach. Integrated Coastal Zone Management (ICZM) brings all those involved in the development, management, and use of the coastal zone within a framework that facilitates the integration of their interests and responsibilities (McClanahan et al. 2005).

In case of any fisheries depletion, the major stakeholders (fishers, traders, and consumers) will be the biggest losers in their socio-economic status. At the same time, the government will lose revenue and foreign exchange earnings. In this new approach, the good news is that resource users can solve management problems individually and co-operatively, thus ensuring that resources are managed sustainably to realize their full potential contribution to global food security and the well-being of all humankind. However, despite these new policy changes, capacity, strategies, and management tools have not substantially changed. Moreover, stakeholder management groups, such as Beach Management Units (BMUs), in Kenya, have strongly taken up the management of fisheries at beach levels.

In collaboration with stakeholders, the Kenyan government is currently conducting a comprehensive study of the fisheries legislations, institutional framework, and policy guidelines to address the new shift in fisheries management. Various legislatures legally support this participation, most conspicuous being the Environmental Coordination and Management Act (EMCA) 1999, the Forest Act, 2005ICZM, and the Fisheries bill 2012, Legal notice 402.

This study aimed to investigate the influence of co-management of marine resources for sustainable development in Kwale County, Kenya, with Shimoni and Wasini as the case study.

MATERIALS AND METHODS

Research design

The study assessed the influence of co-management in managing marine resources in Shimoni and Wasini, Kenya. The study was conducted through a survey research design. In the study, both areas were familiar with co-management as a management tool for fisheries resources jointly managed by the Beach Management Units and the

Fisheries Department. The principal method of obtaining information was through semi-structured interviews with key stakeholders, whereas questionnaires and focus discussion groups were employed for community groups. Identification of interviewees was purposeful according to their areas of expertise. In addition, stratified sampling was applied to the local community.

Target population

The population targeted is in Shimoni and Wasini areas. The population in Shimoni village is 4,520, according to the administration data from the chief's office, and Wasini Island has a population of 3,600. Therefore, the target population is 8,120, including 396 Shimoni BMU members and 153 Wasini BMU members. The target population already has co-management structures in-place in fisheries management. Community Conserved Areas (CCAs) are also known as Locally Managed Marine Areas (LMMA) in these structures. The Shimoni Community Conserved Area (CCA) is located at the seafront of Shimoni, starting at Waga, and extends to Nyuli and Jironi areas. The Wasini CCA is located at the seafront of the Wasini village, starting at PiliPipa Restaurant (*Domo la Vumba*) in the North and extending westwards through *Masulini* to *Kijiwe Jahazi* in the south.

Sample size and procedure

The following formulae by Bill Godden were identified by the researcher mainly because it is popularly used in descriptive statistics dealing with probability. In these formulae, two calculation processes were applied, the first for the Sample Size for an infinite population (where the population is greater than 50,000) and Sample Size for a Finite Population (where the population is less than 50,000).

$$SS = \frac{Z^2 * (p) * (1-p)}{C^2}$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice expressed as a decimal (0.75 used for sample size needed)

c = confidence interval, expressed as decimal (0.07)

$$SS = \frac{\text{New SS}}{(1 + \frac{SS - 1}{Pop})}$$

Where:

Pop = Population (11,720) (Godden 2004)

Therefore the sample size obtained was 145 people with 14 people as key respondent (Tables 1 and 2).

The sample from the general respondents consisted of any public member selected using stratified sampling to determine if everyone feels the influence of co-management. The key informants mainly included the fisheries personnel, i.e., the area and county fisheries personnel. The other key informants included personnel from Kenya Wildlife Service and, a representative from the tourist hotels in the area, a private tour company representative who will be purposively identified.

Table 1. Number of study respondents

Respondent category	Number in each category	Percentage
Community members	77	53.10%
BMU	61	42.07%
Key informants	7	4.83%
Total	145	100%

Table 2. Number of key respondents

Key informant	No. to be sampled
Fisheries Department	3
KWS	1
Tourist Hotel rep	2
Tour Operators	1
Total	7

Data collection instrument

To obtain the best results, the best way to collect adequate data for the research combined both qualitative and quantitative approaches; some of the data obtained were qualitative in nature and were best obtained through interviews and focus group discussions, while others were qualitative and thus could be gathered through questionnaires and observation schedule.

Questionnaires

Questionnaires are frequently used in quantitative research and social research. They are a valuable method of collecting a wide range of information from many individuals, often referred to as respondents. Adequate questionnaire construction was critical to the success of a survey. The questionnaire was with the general respondents and BMU members. The instruments were pilot tested to ensure they captured the intended information and that the respondents could comprehend the questions asked. Documentary analysis was carried out to draw upon the strengths of the different methods to improve the quality and validity of the data.

Semi-structured interviews

A semi-structured interview was employed because it does not limit respondents to a set of pre-determined answers; it also allows respondents to discuss and raise issues they may not have considered. For this reason, the researcher used this tool with the key informant from the stakeholders in the target area.

Focus group discussion

Focus groups were identified to facilitate discussions that allowed the researcher to see community members' perspectives. Focus groups were employed with the BMU members, including the BMU official.

Desk study review

Desk study will be carried out to examine the global development of marine protected areas, including the growth of community involvement in the management

thereof and the objective of sustainability in resource utilization. That is attained through a review of progress in the global attitude to conservation, looking at the case example of techniques in the field.

Data collection procedures

For an adequate response rate, the researcher submitted official writing to relevant stakeholders (Fisheries Department personnel, Beach Management Unit leaders, Kenya Wildlife Service personnel, and other stakeholders). With the help of trained research assistants, the researcher presents the letters, interview schedules, and questionnaires to the respondents. At the local level, the researcher conducted focus group discussions with an assistant helping in note-taking.

Validity of research instruments

Pre-testing questionnaires helped the researcher increase participants' interest, helped discover question content, wording, and sequencing problems before the actual study, and also helped explore ways of improving the overall quality of the study. To establish the research instrument's validity, the researcher sought experts' opinions in the field of study. That facilitated the necessary revision and modification of the research instrument, thereby enhancing validity. Content validity was obtained by asking for the opinion of the supervisor, lecturers, and other professionals on the adequacy of the questionnaire.

Reliability of research instruments

Reliability was increased by including many similar items on a measure, testing a diverse sample of individuals, and using uniform testing procedures. Several measures were taken to ensure reliability. The themes of the interview questions were based on the objectives stated in the study. Furthermore, to achieve reliability of the questionnaire, the instrument was designed with great care, matching questions with objectives for the study. The questionnaire was tested in the two areas of the study in a small group. The responses from the pilot study revealed ambiguity in some questions within the questionnaire; hence they were also left unanswered, while others appear to have been too difficult for the respondents to understand. The questionnaires were therefore revised to address these issues.

Data analysis and presentation technique

Both qualitative and quantitative data were gathered for the study using questionnaires, interviews, focus group discussions, and documentary sources. After collecting the data from the targeted respondents, the questionnaires were coded and fed into SPSS 19 for analysis to generate a descriptive picture of the data. Simple percentages and frequencies were used to analyze the quantitative data from the questionnaire. In addition, chi-square was used to test the hypotheses. The qualitative data from interviews and focus group discussions were analyzed manually by making summaries of their views and supported with data from documentary sources and the researcher's field observations on the influence of collaborative management

on sustainable development. The analysis was organized under themes from the data and the research questions that guided the entire investigation.

Ethical consideration

Several ethical issues were addressed during the research, including informed consent, access, acceptance, confidentiality, and anonymity. In the conduct of this research, the principle of informed consent was given the required attention by explaining the purpose of the study to participants and making them aware that participation was optional and they could choose to answer any question during the interview. Furthermore, in recognition of the ethical requirements that information obtained from a participant during research was confidential, none of the information provided by interviewees was disclosed to other people.

RESULTS AND DISCUSSION

The study investigated the influence of co-management on the sustainable management of marine resources, using Shimoni and Wasini areas in Kwale County as the case study. The data is presented using frequency distribution tables and percentages; cross-tabulation has also been used to show the relationship of variables. In all instances, the Chi-square statistic was calculated to test the significance of the relationship between variables (Table 3).

Response rate

Table 4 shows the variation in the response rate in each targeted area. Ninety questionnaires were distributed in the two areas considering the population size. Therefore, 60% of the questionnaires were distributed in Shimoni and 40% in Wasini. Response from Shimoni respondents was better, with only three questionnaires not returned, whereas the response from Wasini had seven not returned. Generally, in rating response, 60% is rated as marginal, 70% as reasonable, 80% as good, and 90% would be excellent (Mundy 2002). Therefore the general response was very good, with a response rate of 88%.

Institutional design supporting co-management as a tool for sustainable management of marine resources

The study results show that the respondents believe that the institutional arrangement is currently adequate. According to the response from interviews with FiD and KWS, this is because the transfer of power through the BMU Regulation 2007 Regulation 6, 7, 8 and the by-law were tailor-made by individual BMUs to meet their needs. The interview with KWS personnel revealed that involving community members through co-management is a good move toward sustainable MRM initiatives. In addition, the community has the rights through the BMU to control fisheries' access in their jurisdiction. In that case, the only legal right of access to exploit fisheries resources at gazetted and designated landing sites is through joining a BMU. As a result, 90% of the respondents, as shown in Table 5, agree that co-management has resulted in

improved environmental conditions and conservation measures. The institutional structure of the BMUs was found to be adequate. The adaptability of the by-laws and BMU organizational adequacy were generally satisfactory.

The BMU allows control of access to fisheries resources by limiting the numbers and types of fishing boats and gears. But, most importantly, they set their management rules locally at the beach level through by-laws and ordinances.

Conflict management Structures in co-management for sustainable MRM

The conflict management structures result from the institutional arrangement set in co-management. The data collected show that 95% of the respondents perceive that conflict management structures in co-management are adequate in solving marine resource-based issues, and the BMUs demonstrated the ability to resolve internal conflicts. As represented in Table 6, in co-management, BMUs are expected to develop conflict prevention mechanisms that would lessen the possibility of conflicts arising. The responses indicate that the conflict management mechanisms employed are fruitful.

The common sources of resource use conflicts derived from the study are largely related to gear use, overlapping institutional mandates in the government sector such as Kenya Forest Service and FiD, and inadequate BMU leadership, as shown in Table 7.

The FiD heavily relied on early warning signs and information, such as stakeholder complaints and cases, to anticipate conflict. Table 8 demonstrates results obtained on the most preferred conflict resolution mechanism. Moreover, the respondents said that when conflicts were beyond the reach of the BMU, the FiD took over, which is first addressed in conflict resolution meetings involving a wider audience, including village elders and other agencies (local administration, KWS, etc.). During the focus group discussion, newly established BMU networks within the county can be used as a platform to resolve conflicts of a bigger magnitude, such as shared co-management area-related conflicts. To enhance compliance with the decisions made by the resolution committees, BMUs opted to integrate traditional conflict resolution mechanisms with the newly instituted BMU mechanism.

BMU regulation 2007 has opened an avenue of resource use conflict management by forming the Conflict and Management Committee (CMC) in every BMU. However, the local conflict mechanism is still preferred by 12.5 % of the respondents. In addition, the study showed that there had been cases involving BMU members and external persons, such as some tour operators and hoteliers, who sometimes failed to recognize the BMU's legitimacy. Nevertheless, the general perception is that conflict resolution measures are mostly satisfactory at all levels.

The research sought to test the first research hypothesis as per the results obtained to establish the presence or absence of a relationship between the transfer of power through involvement in conflict management and the definition of roles in co-management for sustainable MRM. The study utilized the chi-square test to test this relationship.

H_0 There is no relationship between the transfer of power and co-management for sustainable marine resources management

H_a There is a relationship between the transfer of power and co-management in the sustainable management of marine resources.

Based on the results of Table 9, the Chi-square value is at 10.679 at a degree of freedom of 1. The chi-square value is higher than the expected value. Therefore the null hypothesis is rejected.

Table 3. Operational definition of variables

Objective	Variable	Indicator	Measurement	Scale	Type of research	Data collection method
1. To examine the institutional design in co-management for sustainable management of marine resources in Shimoni and Wasini.	Institutional design	Conflict management • Definition of roles and responsibilities • Power distribution	How conflict management has been influenced by co-management	Nominal	Survey	Interviews with key informants and questionnaire
2. To determine the extent of community participation in co-management for the sustainable management of marine resources	Community participation	Enforcement • Partnerships and agreements	Community members' magnitude of involvement in decision-making on their resources	Nominal	Survey	Focus group discussion, questionnaire, and interviews
3. To assess the integration of indigenous knowledge in the co-management of marine resource management and utilization	Socio-economic dynamics	Knowledge systems • Diversity	Co-management's effort in incorporating traditional knowledge for better marine resource management	Nominal	Survey	Focus group discussion, questionnaire

Table 4. Questionnaire response rate

Area	Distributed	Returned	Percent %
Shimoni	54	51	94.4
Wasini	36	29	80.6
Total	90	80	100

Table 5. Relationship between Institutional arrangement contribution to resource conservation and its adequacy for Sustainable Development

		Institutional arrangement in co-management is adequate for SD					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
The institutional arrangement has enhanced resource conservation	No	0	2	7	1	0	10
	Yes	1	2	7	42	18	70
Total		1	4	14	43	18	80

Table 6. Comanagement as a solution in resource conflict management

	Frequency	Percent	Valid percent	Cumulative percent
No	4	5.0	5.0	5.0
Yes	76	95.0	95.0	100.0
Total	80	100.0	100.0	

Table 7. Main sources of resource-based conflict

	Freq.	Percent	Valid percent	Cumulative percent
Shared co-management areas	14	17.5	17.5	17.5
Gear use	37	46.3	46.3	63.7
Overlapping institutional mandate	6	7.5	7.5	71.3
Inadequate BMU leadership	23	28.7	28.7	100.0
Total	80	100.0	100.0	

Table 8. Mechanisms to address conflict management

	Frequency	Percent	Valid Percent	Cumulative percent
CMC in BMUs	44	55.0	55.0	55.0
Local conflict resolution mechanisms	10	12.5	12.5	67.5
Report to fisheries dept	26	32.5	32.5	100.0
Total	80	100.0	100.0	

Community participation in decision-making for sustainable MRM

Community members have been given rights to manage the fisheries resources and make decisions on how to manage and control their resources; this includes the right to decide which gear can be used. The study's response shows a strong relationship between respondents' opinions on the clarity of the co-management roles of BMUs and the community's involvement in decision-making on Natural Resource Management (NRM) (Table 10). 82.5% of the respondents agreed that the roles were clearly defined and that community members are involved in community development. The study showed that the communities' sense of ownership of the marine resources had been developed and enhanced due to community consultation and involvement in decision-making, mainly during assembly meetings. Generally, the response on community participation in decision-making was satisfactory.

H₀ There is no relationship between co-management and community participation in the sustainable management of marine resources.

H_a There is a relationship between community participation and co-management in the sustainable management of marine resources

Based on Table 11, the Chi-square value is at 20.851 at a degree of freedom of 1. The chi-square value is higher than the expected value. Therefore the null hypothesis is rejected.

Integration of indigenous knowledge in co-management for sustainable MRM

With the introduction of co-management, the communities are at liberty to use traditional methods. Table 12 shows that 92.5% of the respondents believe that IKS is applied in co-management and is effective in marine resource conservation.

Table 9. Relationship between the transfer of power and co-management in the sustainable management of marine resources

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	10.679 ^a	1	.001		
Continuity Correction ^b	6.618	1	.010		
Likelihood Ratio	7.323	1	.007		
Fisher's Exact Test				.013	.013
Linear-by-Linear Association	10.545	1	.001		
N of Valid Cases	80				

Note: a. 2 cells (50.0%) have an expected count of less than 5. Therefore, the minimum expected count is .65

Table 10. Relationship between defined roles for FiD and BMU and community involvement in decision-making on NRM

		Involvement of community and BMU in decision-making on NRM		Total
		No	Yes	
No Clearly defined roles for FiD and BMU	Count	8	6	14
	% within Involvement of community and BMU in decision making on MR	61.5%	9.0%	17.5%
	Count	5	61	66
	% within Involvement of community and BMU in decision making on MR	38.5%	91.0%	82.5%
Yes	Count	13	67	80
	% within the involvement of community and BMU in decision-making on MR	100.0%	100.0%	100.0%
Total				

Table 11. Research hypothesis testing

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	20.851^a	1	.000		
Continuity Correction	17.368	1	.000		
Likelihood Ratio	16.472	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	20.591	1	.000		
N of Valid Cases	80				

Note: a. 1cells (25.0%) have an expected count of less than 5. Therefore, the minimum expected count is 2.28.

Previously IKS had been left out in marine resource management in favor of scientific knowledge systems which were seen as the panacea to resource degradation; however, it has little impact. The focus group discussion highlighted that management measures of conserved community areas (CCAs) are based on traditional ecological knowledge, including fishing gears, biological monitoring of the area, and seasonal closures.

Furthermore, the Chi-square test was used to test the relationship between the application of IKS in co-management and the perceived effectiveness of this application in marine resource conservation.

H_0 . There is no relationship between the integration of indigenous knowledge and co-management in enhancing the management of marine resources

H_a There is a relationship between the integration of indigenous knowledge and co-management for enhancing sustainability in the management of marine resources.

The Chi-square statistic was computed at the 0.05 level to determine whether there was a correlation between integrating indigenous knowledge in co-management and the effectiveness of sustainable development. The test results, as shown in Table 13, revealed a significant relationship. The null hypothesis is therefore rejected.

Discussion

In this chapter, the researcher summarizes the findings of the study based on the three objectives of the study. In each case, the researcher briefly states the findings and the general implications of co-management toward sustainable development of marine resources in the study area. At the end of the chapter, the researcher states recommendations and highlights areas that need further research.

The study was designed to assess the influence of co-management in the sustainable management of marine resources. Three areas of focus were identified to guide this assessment. That includes the institutional design or arrangement, level of community participation, conflict management, and the socio-economic dynamics due to the application of IK.

Institutional design

An institutional design for co-management ensures that local communities, the primary resource users, are involved in marine resource management. The transfer of power manifests that; this is a shift from the previously employed top-bottom management style to the bottom-up method. However, the study results show that this has developed a sense of ownership; therefore, the community is forced to be cautious and adopt better ways of sustainable resource exploitation.

Conflict management measures in co-management have resulted in a decline in resource use conflict, and when the conflicts arise, the community members have faith in the mechanisms set. The study showed that compliance and validity of the conflict management committees in the BMU were dependent on the incorporation of the local and traditional resolution methods; as a result, the committees are composed of members in the community who are known to address general community conflict. Stakeholders such as FiD, KWS, hoteliers, and Tour operators believe co-management has enhanced resource utilization, making it a good environment for the stakeholders undertaking. For example, tourist handling has improved, cleanliness of the seascape and general order among fishers as they do their business.

Table 12. Relationship between application of IK and effectiveness of IK in resource conservation

		Effectiveness of IK					Total
		Not effective	Little benefit	Average	Good	Very effective	
No Application of IK	Count	1	1	2	2	0	6
	% within the effectiveness of IK	100.0%	33.3%	11.8%	4.8%	0.0%	7.5%
Yes	Count	0	2	15	40	17	74
	% within the effectiveness of IK	0.0%	66.7%	88.2%	95.2%	100.0%	92.5%
Total	Count	1	3	17	42	17	80
	% within the effectiveness of IK	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 13. Relationship between the integration of IK in co-management and effectiveness of IK in resource conservation

	Chi-square tests		Asymp. Sig. (2-sided)
	Value	df	
Pearson Chi-Square	17.497 ^a	4	.002
Likelihood Ratio	10.406	4	.034
Linear-by-Linear Association	10.548	1	.001
N of Valid Cases	80		

Note: a. 7 cells (70.0%) have an expected count of less than 5. Therefore, the minimum expected count is 0.08

Community participation

Comanagement is manifested through the active participation of community members, as was realized in the study. Through involvement and participation, the community members have become enlightened on destructive practices in the sea; as a result, this has increased the level of compliance with the set rules and regulations. In addition, the community members have become conversant with their roles and responsibilities in co-management.

The study also discussed leadership in co-management; it appeared that the community is empowered in picking their leaders. Empowerment is equivalent to "letting the power out" since people already have the power. Kenyan leadership is democratic and has been adopted in co-management structures such as the BMUs. The study showed that leadership in BMU affairs was generally satisfactory. However, leadership challenges within BMUs are numerous; they are constantly addressed according to the set regulations. The regulations are guided by the Fisheries Act and the Kenyan constitution, emphasizing critical leadership issues such as integrity.

Socio-economic dynamics due to the application of IK

There have been several notable socio-economic changes since the establishment of co-management. The study showed that the target BMUs had developed sustainable alternative livelihoods for their members; for example, Wasini has established an ecotourism venture through the CCAs, which is rapidly becoming a tourist hot spot, and Shimoni has attracted private companies dealing with octopus harvesting and aquarium fishery which has created employment to the community members and revenue for the BMU.

Assessment of the effectiveness of the integration of IK in co-management showed that Fishers use traditional local knowledge and skills to perform duties. This knowledge is also used in weather forecasting, which is useful in predicting changes in sea conditions to guide fishers. The social-cultural practices were equally observed and applicable in conflict resolution and conveying messages through well-established community social networks in multi-cultural, multi-religious areas, where BMU.

The first objective was to examine the institutional design for co-management as a tool for sustainable management of marine resources. Three indicators were used to inspect the design's adequacy, including transfer of power, conflict management, and definition of roles and responsibilities. Response from the study showed that there was general acceptance of the institutional design as adequate for sustainable management of marine resources. According to the respondents from Fisheries Department, co-management of fisheries resources has marked changes in the use of destructive practices and a slight increase in government revenue. Reduction in destructive fishing, as discussed earlier, was largely attributed to co-management arrangements, where BMUs enact and enforce by-laws against these practices, thus enhancing cooperation between the community and Fisheries Department. That is in agreement with views from the literature review that

institutional design principles are thought to create conditions conducive to cooperation in common property scenarios (Ostrom 1990) and that high levels of reported conformity are positively related to graduated sanctions designed by co-management partners.

The second objective was to determine the extent of community participation due to co-management for the sustainable management of marine resources. The indicators applied to discuss this include developing a sense of ownership and compliance to set regulations. The results showed that community participation had been enhanced through co-management, creating opportunities for community members to coordinate and collaborate in resource management. Conservation and sustainable development are one of the main goals of BMUs in their activities; they ensure the protection of wildlife hence a boost to tourism. Community members must comply with the set rules on capturing marine mammals and endangered species and not destroying the breeding sites. That has enhanced collaboration with stakeholders such as KWS and hoteliers, who are the most interested parties. That agrees with the literature review that fishing communities can control and properly manage their resources if given exclusive rights and avoid over-exploitation with minimal government intervention. Moreover, Ostrom (1990) suggested that if a community of fishers exhibits a high degree of social, cultural, and economic homogeneity, fishers would be well-prepared to manage the resources successfully.

The last objective was to assess the integration of IK in co-management. Most respondents said indigenous knowledge systems had been heavily employed in co-management, citing examples of its application. For example, an area in Wasini has been successfully closed to fishing to conserve the coral gardens and resident species, generating revenue from tourism; this developed as a result of knowledge passed on through generations. Traditional and scientific knowledge are employed for better management, especially in bio-ecological monitoring of the enclosure. These traditional measures have contributed to improved communities' socio-economic status, especially from tourism and fisheries. The research findings concur with the literature review text from a study on the management of bump head parrot fish in Solomon Island by Aswani and Hamilton (2004), who reported that the integration of traditional knowledge and marine science enabled them to identify species and important associated habitats to develop urgent management needed.

Some perceived challenges of co-management in sustainable MRM were mentioned during the study. Generally, co-management with FiD and KWS has been a relatively easy task. However, conflicts with the Kenya Forest Service arise in mangrove management, especially in licensing of loggers. In addition, some corruption cases have been mentioned where BMU leaders get compromised by illegal fishers.

Similarly, changes in stakeholder income and private sector investments were minimal. However, there was a perception that following the introduction of Locally Marine Managed Areas (LMMAs), stakeholders benefited

directly or indirectly by creating fish reservoirs and tourism. Therefore, a slight improvement in stakeholder income could have been realized. On the other hand, some hoteliers and tour operators do not recognize BMUs; thus, they do not comply with the regulations set, which is common, especially with access to CCAs.

The study aimed to assess co-management influence on sustainable management of marine resources. The main co-management structure employed in the study was the BMUs. In conclusion, the study showed a high appreciation of BMUs as management structures in co-management. Due to the perception that community rights over the management of resources have improved since the inception of the BMU/CCA model. There is effectively outlined in the institutional arrangement for co-management, highlighting an improved government-community relation as management is decentralized. In addition, there has been increased compliance to the set marine resource management, thus reducing the use of destructive gears and general degradation of the environment.

Community participation has been enhanced further with the support from stakeholders that have contributed to the success of co-management; The government policy (Fisheries Policy) recognizes co-management is a global phenomenon that covers a range of resources beyond fisheries and is a way to go; therefore providing an effective institutional policy and legal framework for co-management. In co-management, communities have the right to develop mechanisms to resolve internal conflicts. The BMUs have a Conflict Management Committee Conflicts are set up through the by-laws, mainly composed of community members who handle conflicts. That integrates traditional conflict resolution mechanisms with the newly instituted BMU mechanism.

Finally, the study shows that co-management has a lot of positive influences on conservation and community members' well-being. However, indigenous knowledge

systems must be incorporated for the ongoing tool to function effectively. Therefore, the researcher believes co-management is an adequate planning and management tool for the sustainable management of marine resources.

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