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## **Community based aquaculture in the Western Indian Ocean: Challenges faced and lessons learned**

**9 -11 December 2013, Zanzibar, Tanzania.**

**Workshop report**

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beyond conservation

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**Keywords:** Community, aquaculture, community-based management, marine conservation, local governance, learning-network.

This work was supported by the Marine Science for Management (MASMA) Grant, under Grant No. MASMA/Workshop/2013/02. The views expressed herein are those of the author(s) and do not necessarily reflect the views of WIOMSA. WIOMSA is authorized to produce and distribute reprints for educational purposes notwithstanding any copyright notation that may appear hereon.

**Acknowledgements:** This workshop would not have been possible without the generous support of WIOMSA. Special thanks go to the WIOMSA staff, as well as to the 40 community aquaculture practitioners who attended from 10 countries including Kenya, Madagascar, Tanzania, Mozambique, Seychelles and South Africa.

We are also deeply indebted to our facilitating partner, IMS of the University of Dar es Salaam for their tireless contributions to the planning of the workshop between June and December 2013.

We would also like to thank the following people for reviewing abstracts: Dr. David Obura, Dr. Tim McClanahan, Dr. Christina Hicks, Ms. Charlie Gough, Ms. Frances Humber, Dr. Nick Graham, Dr. Joshua Cinner, Dr. D. Tesfamichael, Dr. Melita Samoily.

**Recommended citation:** Ateweberhan, M., Hudson, J., Rougier, A., Harris, A., Jiddawi, N., and Msuya, F.E. 2014. Community based aquaculture in the Western Indian Ocean: Challenges faced and lessons learned. Zanzibar, December 9-11, 2013. Blue Ventures Conservation, London.

**Front page:** [Community seaweed farm in southwest Madagascar, Photo credit: Antoine Rougier, 2013]

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## 1. Executive Summary

Community based aquaculture (CBA) is seen as an important Alternative Income Generating Activity (AIGA) for marine resource dependent coastal communities, and has attracted considerable attention from governments, international donors, and social entrepreneurs as well as conservation and development agencies. As a result, CBA projects have undergone global expansion, and their rapid growth throughout the Western Indian Ocean (WIO) is attracting considerable donor and private-sector investment.

Despite a proliferation of CBA approaches throughout the WIO region in recent decades, little is known about the degree to which these activities have resulted in favorable conservation and community development outcomes. The challenges faced and lessons learned during production are often poorly documented, and in many cases the environmental and socio-economic impacts of CBA activities remain unknown.

A workshop titled '*Community based aquaculture in the western Indian Ocean: Challenges faced and lessons learned*' was held in Zanzibar on December 9-11, 2013, to address the key issues faced by CBA practitioners in the WIO region. The main goal of the workshop was to provide a platform for scientists, technicians, entrepreneurs and community leaders involved in CBA to enable broader understanding of common challenges and generate recommendations for best practice. Specific aims of the workshop were to:

- a) *Identify key issues influencing successful implementation of CBA projects.*
- b) *Analyze the effectiveness of CBA programmes as economic incentive mechanisms to promote conservation.*
- c) *Initiate a regional CBA network to enable broader understanding of common challenges and discuss possible solutions.*

Workshop participants came from all across the WIO: Kenya, Tanzania, Mozambique, South Africa, Madagascar and Seychelles, as well as the UK, Germany and Sweden. Participants were composed of researchers, technicians and extension workers, commercial partners, farmers, fishers and students; with the most common CBA activities practiced in the region being finfish, invertebrate (shellfish) and seaweed farming.

The workshop was held over three days and gave an in-depth overview of CBA in the WIO through participant presentations, as well as three individual workshops aimed at evaluating different areas of CBA.

Presentations covered diverse subjects and outlined the main issues affecting CBA: biophysical conditions related to unsuitable environmental surroundings, shortage of seed supplies, low levels of knowledge and skills, negative attitudes and behavior, weak organizational and governance, poor participatory approach, unclear terms of agreement and regulations in project and business partnerships between communities and external players such as government, local and international NGOs and donors. The focus on production with little consideration for value-chain approaches was

also seen as a main challenge for CBA projects in successfully achieving their goals and reaching their potential.

#### *Workshop I: Analyzing the CBA experience in WIO*

Workshop I identified the main challenges faced by the common CBA activities practiced in the region. To gain an in-depth understanding of the CBA experience in the WIO, this session built on the discussion points raised during the presentations session, as well as information acquired from the questionnaire ([Appendix I](#)) sent prior to the start of the event. Participants were divided into smaller groups based on the focus of their CBA activity: finfish, invertebrates and seaweed. It was recognized that while generally there is a good environment for finfish and shellfish production in the WIO, many accessible shallow locations were hostile to those seaweed species in high demand, *cottonii*, due to high temperatures and epiphyte infection. The main biophysical challenge faced by finfish, shellfish and invertebrate production was the lack of seed supplies. Presence of unclear policy frameworks often with contradictory messages, absence of procedures to streamline developments and lack of harmonization among government departments was stressed as an impediment to the development of CBA programmes in the region. It was also recognized that the donor model is too short term resulting in a lack of continuity at the end of programmes which is seen as a pre-requisite to enabling proper transition from fisheries to farming by communities. This was emphasized as a major challenge to long term financial sustainability and independence.

#### *Workshop II: Evaluation of effectiveness of CBA programmes in promoting biodiversity conservation*

Workshop II examined the relationship between CBA and biodiversity conservation; to see if CBA can work in conjunction with conservation activities as well as improving coastal livelihoods. Looking at key questions, the participants worked in groups to identify the effects of CBA, both positive and negative, that CBA has had on the environment. The primary reason given for the failure of CBA projects in promoting conservation was that either conservation was not a main objective of CBA project or there was a lack of coordination and integration between activities where the main aim of CBA was to promote conservation.

#### *Workshop III: Formation of a regional CBA network*

One of the objectives of the workshop was to create a regional network for CBA in the WIO so that stakeholders can share information and experiences in order to develop best practices. Participants unanimously expressed that there is a need for a regional CBA network of which the purpose would be to share information, increase capacity and mobilize resources. Participants elected representatives from Kenya, Tanzania, Mozambique, South Africa, Madagascar and Seychelles to be the focal contacts for each country and to be responsible for developing the action plan of the network.

## **Recommendations**

The following recommendations are made synthesizing information and feedback from the workshop:

- Develop community capacity and improve national and local governance in order for communities to effectively participate in decision-making business partnerships and so forth.

- Increase community awareness and promote participatory approaches to enable more effective implementation of CBA activities.
- Build hatcheries and feed processing plants, and develop the necessary technical skills in representative sites to curb shortage in seed and feed supplies.
- Create new no-take zones nearby to CBA sites in order to increase source of seed and juveniles of farmed organisms.
- Develop techniques for growing '*cottonii*' in deeper, cooler areas to combat low production due to effects of high temperatures and the associated increase in epiphyte and disease infection.
- Improve marketing of existing products through value addition and introduce high value species.
- Improve policies towards supporting communities and their local partners in gaining access to external markets in order to reduce the reliance on donor funding.
- Develop sound business partnerships between communities, commercial partners and research institutes for seed supplies, production, value addition and marketing of CBA products.
- Develop guidelines to minimize ecological and social impacts of CBA projects.
- Promote integration of CBA projects into conservation and development programmes where biodiversity conservation is the main objective.

## 2. Background

Global fisheries have been characterized by significant declines in important finfish and shellfish populations in recent decades with 75% of global fish stocks classed as either fully or partially exploited; whilst aquaculture production has increased steadily throughout this time and in 2011 contributed 40.1% to total fish production globally (FAO 2012). The coastal communities of the WIO are some of the poorest in the world and many rely heavily on healthy marine resources for food, income and cultural identity (Cinner *et al.* 2009, 2012). Marine resources in the WIO have shown signs of significant overexploitation and suffered from habitat degradation from direct human activities including pollution, coastal development and destructive fishing practices as well as stresses associated with recent extreme thermal events (Burke *et al.* 2011; Conand and Muthiga 2008; Maina *et al.* 2013). Considering that many future models predict the population of the WIO to double by 2050, as well as increases in the frequency of extreme climatic events, this trend is most likely to continue (Christensen *et al.* 2007; Maina *et al.* 2008; McClanahan *et al.* 2007).

Alternative income generating activities (AIGA) can help reduce dependence on natural resources, and may in turn promote biodiversity conservation by reducing the anthropogenic pressures put on marine ecosystems (Little *et al.* 2012). Community based aquaculture (CBA) can play a key role in diversifying coastal livelihoods by stimulating new local employment and in doing so improve local economies and promote food security. CBA activities have expanded throughout much of the tropical and subtropical coastal developing world in recent years, with diverse product species being cultured, while also employing a wide range of techniques and investment models. It has been suggested that CBA can play a dual role in improving the socio-economic conditions of communities whilst also contributing to the conservation of biodiversity. By stimulating coastal economies and providing new skills to communities, CBA also boosts the socio-adaptive capacity of communities to manage climate change associated environmental threats.

The proliferation of CBA activities in the WIO during the last two decades has resulted in a dynamic and crosscutting sector, bringing together communities, research institutions, investors, NGOs and businesses in a broad range of scientific, technical and business disciplines relating to CBA (Troell *et al.* 2011). These actors have accumulated rich experiences in the underlying components of CBA, including production biology and ecology, environmental and socio-economic impacts, and investment and management models.

Despite the expansion of CBA in the WIO, little is known about the environmental and socioeconomic impacts of these programmes (Bryceson 2002; Bryceson *et al.* 2005; Hecht 2006; Troell *et al.* 2011). Unlike conservation and fisheries management sectors, within which stakeholders generally seek to monitor and communicate progress and findings, the profit-oriented and private sector nature of many aquaculture enterprises mean that results and developments are often not publicized, and experiences are rarely shared at local, national or regional levels. In addition, many CBA initiatives are implemented at geographically isolated sites, where information sharing with other communities and stakeholders may not be practical. Given these factors, there is a critical need to consolidate best practice to overcome negative environmental and socio-economic impacts, in addition to sharing lessons learned in order that opportunities are not missed or investment resources wasted. The broad spectrum of environmental, cultural and socioeconomic situations in

the WIO, and the presence of CBA initiatives at a range of stages of development and investment, presents a unique opportunity to share experiences.

## Workshop objectives

The main objectives of the three-day workshop organized by Blue Ventures Conservation and the Institute of Marine Sciences (IMS) (University of Dar-Es-Salaam), were to provide a platform for scientists, technical experts, social entrepreneurs and community leaders engaged in CBA aquaculture projects in the WIO to share experiences, discuss the main opportunities and challenges faced, outline lessons learned and formulate recommendations on best practice.

Identifying successful initiatives that can act as models for expanding CBA in the region whilst also promoting the diversification of coastal livelihoods towards sustainable alternatives to fishing is vitally important. Pinpointing the scientific, technical, financial and institutional challenges faced and advantages and drawbacks documented would help develop practical techniques, ultimately improving the efficiency, sustainability and profitability of CBA programmes. Results would be useful not only for stakeholders working in the same sector (e.g. two distinct sea cucumber mariculture initiatives in different geographies) but also across sectors (e.g. sea cucumber versus seaweed farming in the same or different areas). In addition, the workshop provides an opportunity for WIO-wide networking that will also play a role in standardizing protocols and methodologies used in data collection, monitoring and evaluation across the region.

### *Specific objective 1: Evaluation of socioeconomic and environmental impacts of CBA programmes*

Workshop participants will develop a series of criteria for evaluating existing CBA programmes in the region. Evaluation criteria will be based on the main objectives set out during project inception. The two most commonly cited global objectives of CBA programmes, socio-economic advancement and ecological restoration, will form the main benchmarks for analyzing projects. Other factors that will need to be considered include set-up costs and barriers to entry, market challenges and commercial and operational risks.

### *Specific objective 2: Identification of main practice challenges faced by existing CBA projects, identification of causes and possible solutions to these drawbacks*

Objective 1 will help identify the CBA initiatives that have succeeded or failed in meeting their initial goals. As a follow up, workshop participants will identify the preconditions for success in those projects that achieved favorable outcomes. Participants will discuss what factors were behind the successful implementation of some projects and the failure of others, looking at ecological, technical, socio-economic and organizational factors influencing the success and failure of projects.

### *Specific objective 3: Analysis of business and investment approaches to CBA*

Participants will discuss the financial context of existing aquaculture approaches, comparing investment models and the commercial basis upon which CBA initiatives are established and operated throughout the WIO region. Discussion will focus on key themes including: (i) models for community ownership and profit distribution; (ii) seeking investment; (iii) CBA business management challenges and opportunities; (iv) cost-benefit analysis of different aquaculture approaches.



*Specific objective 4: Outline lessons learned and formulate recommendations on good practice*

Workshop participants will develop an agreed set of variables (indicators) determining successes and failures of CBA projects, as well as key capacity development and investment needs in the WIO region.

**Expected outcomes**

The expected outcomes of the workshop are as follows:

- Identify key factors influencing successes and failures of CBA projects in the region and those influencing effectiveness of CBA in promoting biodiversity conservation
- Recommendations for best practice
  - Key issues influencing successes and failures of CBA projects in the region
  - Recommendations will be made for introducing interventions
- A vision for the future scenarios of CBA in the WIO
  - Develop ideas and achieve consensus on what actions are needed to develop successful CBA in the region
  - Future development options (e.g. how will CBA look in 2030?)
- Formation of regional CBA network
  - Define the mission of the network (e.g. to promote effective and responsible regional CBA projects for healthy coastal and marine ecosystems and communities)

### 3. Workshop Proceedings

The *Community based aquaculture in the western Indian Ocean: Challenges face and lessons learned* workshop consisted of four main sessions:

1. Presentations by two keynote speakers and participants
2. Workshop I: *Analyzing the CBA experience in the WIO*
3. Workshop II: *Evaluation of effectiveness of CBA programmes in promoting biodiversity conservation*
4. Workshop III: *Formation of regional CBA network*

The event was opened by Mrs Fatima Gharib Bilal, the Principal Secretary for Women and Children Affairs, Office of the President of Zanzibar. The workshop programme included 26 presentations by keynote speakers, participants and organizers, and three workshops addressing the main objectives.



**Figure 1. The participants of the workshop with Mrs Fatima Bilal (middle, seated)**

#### Summary of workshop presentations

In the opening presentation, Dr Ateweberhan highlighted the declining trends in global fisheries and the decreasing biomass in finfish and invertebrate populations in the WIO that is accompanied with destructive practices (e.g. bottom trawling or dynamite fishing), whilst stressing that climate change will intensify the negative effects of anthropogenic pressures on the marine environment. The global demand for fish and the need to generate income for poor communities in the region is expected to result in a further increase in the uptake of aquaculture activities, both community-based and private. Finally, he emphasized the need for improved CBA practice underpinned by environmental and social sustainability.



**Figure 2. Professor Selina Stead gives the first keynote speech of the workshop**

The presentation by the first keynote speaker, Prof. Selina Stead, Newcastle University, UK, demonstrated that despite the clear increase in demand for aquaculture products, the benefit is not clearly understood by communities. Based on the *Belief Network Analysis* that her team conducted in coastal Tanzania, she highlighted that coastal communities preferred to continue fishing despite decreasing catch levels and the high promises aquaculture can provide in regards to income generation and nutrition. Even in Europe where there is better governance, aquaculture development faces serious challenges and she recommended that aquaculture practitioners need to disseminate their findings and experiences, as this information is key in improving project development. .

The second keynote presenter, Prof. Peter Britz, Rhodes University, South Africa, highlighted that CBA projects are often limited to primary production operations and recommended for the introduction of value-added approaches through sound community-private sector business partnerships that are supported by clearly defined agreements and good governance. He also recommended that adequate time needs to be given for mutual trust to develop among partners.

Presentations by other participants indicated both positive and negative social changes associated with CBA projects, with positive impacts including changes in attitude and behavior, increased participation and the empowerment of women. Negative effects focused on the lack of cooperation and commitment, particularly in cooperatives, and the theft of products and corruption among community leaders. Increased income was the main positive economic outcome while ecological impacts of CBA activities were less addressed in the presentations. Presentations indicated that the main challenges faced by CBA projects were:

- Unsuitable physio-chemical conditions
- Low level of knowledge and skills by community members
- Negative attitudes and behavior of community members

- Weak organization and governance of communities and local authorities
- Lack of participatory approach with communities during planning and implementation
- Unclear terms of agreement and regulations in project and business partnerships between communities and external players such as government, local and international nongovernmental organizations (NGO) and donors
- Lack of capacity within communities to manage activities
- Limited access to hatcheries stemming from poor infrastructure and planning during project development
- Heavy reliance on donor funding

## Summary of workshop sessions

### Workshop I – Analyzing the CBA experience in the WIO

In Workshop I, participants identified and discussed key issues influencing CBA projects ([Appendix I & II](#)). Three groups were formed, based on the CBA activities the participants had most experience in: a) finfish farming, b) shellfish and invertebrate farming and c) seaweed farming. Participants were asked to consider the schematic model of relationships presented in Figure 3 to brainstorm and identify the main factors limiting CBA projects and assign ranks to the factors, and propose recommendations.

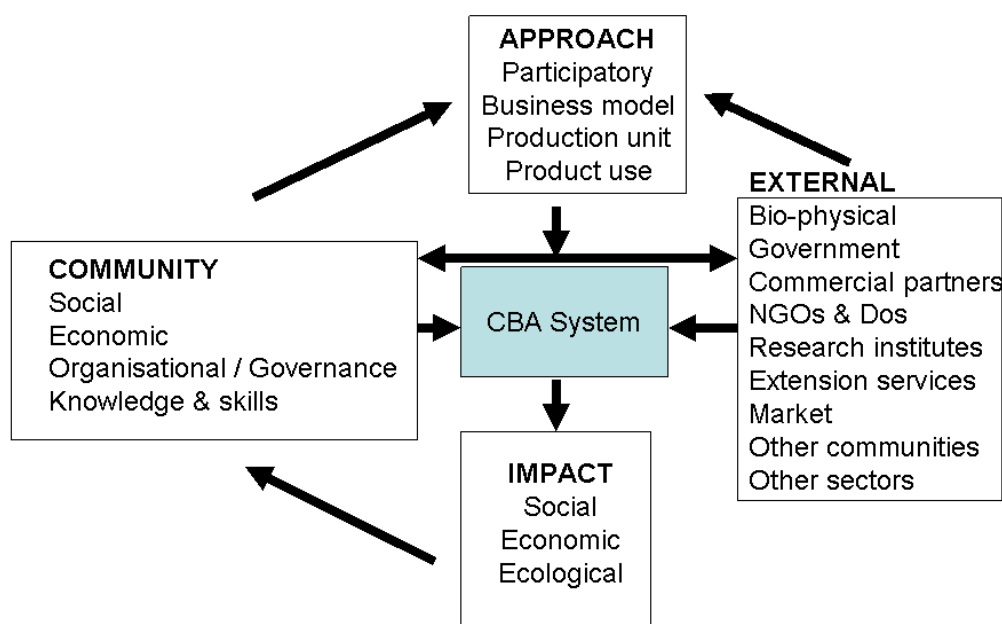


Figure 3. Framework of key players and relationships in a CBA system

**Table 1. Factors affecting CBA in the WIO**

Issue	Recommended management intervention
<b>1. Biophysical factors</b>	
<p><i>Unsuitable habitat</i></p> <p>a) Many areas in the region are suitable for finfish and invertebrate production.</p> <p>b) Many shallow locations are less suitable for the production of <i>cottonii</i>, the highly sought-after seaweed species, due to the effects of high surface seawater temperature and irradiation, and associated epiphyte infection. Climate change is expected to compound these negative effects.</p>	<ul style="list-style-type: none"> <li>• Increase research efforts to select more resistant varieties and increase production.</li> <li>• Intensify research on epiphyte and disease biology and prevention.</li> <li>• Improve seaweed growing techniques, for example, deep water growing to minimize negative effects of temperature and epiphytes.</li> <li>• Further educate and train farmers to understand the main environmental issues and improve production.</li> </ul>
<p><i>Shortage of seed and feed</i></p> <p>a) There is often a shortage of seed and feed material, particularly in finfish, shellfish and invertebrate farming.</p> <p>b) For some species, e.g. milkfish and shellfish, seed supply is based on capture fisheries resulting in a decrease in wild populations.</p>	<ul style="list-style-type: none"> <li>• Develop hatcheries and technical skills to increase supply of seeds.</li> <li>• Promote creation of new no take zones (NTZs) or increase the size of existing ones to increase seed supply from wild populations.</li> <li>• Promote sound community-private commercial partnerships to fill gaps in the supply chain of seed and feed.</li> </ul>
<b>2. Organizational / governance</b>	
<p><i>Suitable site availability</i></p> <p>a) Site availability is an issue especially in inland systems and finfish farming where there could be a shortage in water and substrate and where ownership of land and water is not clearly identified.</p> <p>b) Use of suitable sites can be problematic as obtaining permits can be difficult on the developer, and involve several different government bodies, e.g. district councils in Tanzania and involving three different ministries in Kenya.</p> <p>c) Unequal access to resources and marginalization of some community members, e.g. land ownership predominantly favors male members.</p> <p>d) Absence of clear policy frameworks resulting in contradictory messages, e.g. acquisition of land and mangrove management, lack of procedures to streamline developments or harmonize among levels of government and government departments.</p>	<ul style="list-style-type: none"> <li>• Improve understanding of land tenure and ownership in order to understand the extent to which these relationships represent major constraints or opportunities and to resolve potential resource use conflicts.</li> <li>• Improve coordination to ensure good resource governance that benefits whole communities.</li> <li>• Improve governance structure by identifying and describing the roles of each stakeholder.</li> <li>• Improve harmonization among government agencies and departments in implementing policies.</li> </ul>
<b>3. Business and partnership</b>	
<p><i>Reliance on donor funding</i></p> <p>a) Donor model is often too short-term with poor continuity at the end of programmes, resulting in weak transitions from fisheries to farming.</p> <p>b) Beneficiaries tend to look to donors as a source of</p>	<ul style="list-style-type: none"> <li>• Donor or government support should be long enough to ensure smooth transition from fisheries to farming.</li> <li>• Projects should clearly stipulate that donor</li> </ul>

<p>income as opposed to facilitators to improve their livelihoods.</p>	<p>support is short-term and include clear exit strategies (for donors) during planning. Viable community-private commercial partnership also ensures that projects do not become donor dependent.</p>
<p><i>Participation</i></p> <ul style="list-style-type: none"> <li>a) Often poor group cohesion and a lack of commitment in larger community groups.</li> <li>b) Gender difference in profit returns - returns are often too distant time wise for men while women are more patient.</li> <li>c) Communities are often disjointed and their members isolated to have a united voice and a better bargaining power.</li> </ul>	<ul style="list-style-type: none"> <li>• Emphasize small group sizes, as groups with a larger number of members are more difficult to manage and often their returns become unrealistically low.</li> <li>• Consider gender differences in planning and project implementation.</li> <li>• Farmer associations need to be promoted and empowered through training, promoting their purchasing power, and their skills in processing, packaging and marketing.</li> </ul>
<p><b>4. Market</b></p>	
<p><i>Access and products value</i></p> <ul style="list-style-type: none"> <li>a) Lack of access to the global market.</li> <li>b) The most widely cultured species, e.g. milkfish, are of low value. The seaweed <i>Spinosum</i> is easy to grow but it has very low global demand and its price is too low to be profitable. These low value species are currently working on low input – low output systems.</li> <li>c) Often there is too little consideration of the value chains even for high value species. There is also too much focus on introducing production technologies rather than on value addition.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop sound business partnerships between community and commercial partners to promote access to global market.</li> <li>• Projects should be more market oriented and there should be more focus on value addition.</li> <li>• There is a need to improve processing, e.g. milkfish value could be increased by drying fish and selling inland.</li> <li>• Introduce higher value species, e.g. pompano, groupers and siganids.</li> <li>• Encourage full processing and partial value addition to increase price of seaweed products.</li> </ul>
<p><i>Support and governance</i></p> <ul style="list-style-type: none"> <li>a) Lack of support by governments, e.g. Tanzanian seaweed farmers are required to pay tax (through prices paid by exporters) which places them in a disadvantaged position in comparison to their counterparts in SE Asia that are tax exempt.</li> <li>b) There are often unclear business partnerships among communities, local and international business partners and governments.</li> <li>c) There is constant breach of contracts and agreements by community members and commercial partners.</li> <li>d) Weak enforcement of agreements by governments.</li> <li>e) Local business partners have low profit margins in comparison to international buyers who don't invest in the production process and are not bound by agreements.</li> <li>f) Communities are too weakly organized to be able to negotiate on prices and other issues.</li> </ul>	<ul style="list-style-type: none"> <li>• Look for alternative sources of revenue, e.g. tourist fee for visits to farm sites, use of seaweed sap in agriculture, etc.</li> <li>• Develop a multi-regional bargaining platform, e.g. auctions, to counteract price fixing in the global market.</li> <li>• Help local communities to organize and become more empowered in order to understand the terms of business agreements and bargain on prices and other issues.</li> <li>• Promote the business approach to farming by encouraging value addition to products.</li> <li>• Promote mutual trust among partners so that rules and agreements are respected.</li> </ul>

## Workshop II – Evaluation of effectiveness of CBA programmes in promoting biodiversity conservation

In Workshop II, participants identified the positive and negative impacts that CBA projects are having on the environment, and described the underlying causes behind any successes or failures of CBA activities in promoting biodiversity conservation ([Appendix III](#)). Participants were randomly put into three groups; the members of each group were asked to suggest one positive and one negative effect that CBA has on biodiversity. Group members were then asked to rank the positive and negative impacts in order of importance (

Table 2) and further information was provided during open discussions (Table 3). They were also asked to provide evidence where CBA has been used effectively to promote conservation, and to propose ideas and mechanisms whereby CBA can be used to promote conservation (Table 3).

**Table 2 Summary of positive and negative ecological impacts of CBA projects arising from group sessions in Workshop II, ranked in order of importance**

	Positive	Negative
<b>Group 1</b>	1. Stock enhancement <sup>1</sup>	1. Extractive use
	2. Reduced pressure on resources & biodiversity	2. Loss of biodiversity and biomass
	3. Conservation mangrove wildlife	
<b>Group 2</b>	1. Local area sustainable management incentives <sup>2</sup>	1. Habitat destruction <sup>3</sup>
	2. Alternative income leads to reduction in natural resource harvest	2. Resource depletion
	3. Enhanced wild fishery <sup>1</sup> recruitment	3. Alien species and new diseases introduced
<b>Group 3</b>	1. Reduction in pressure on natural resources	1. Habitat destruction <sup>3</sup>
	2. Create new habitat	2. Decreased intertidal biodiversity
	3. Increase in mangrove cover <sup>3</sup>	3. Decreased wild populations (extraction for feed and as source for farmed animals)

<sup>1</sup> Farmed species can trigger an increase in local wild populations by causing breeding events e.g. farmed oysters can cause spawning in wild oysters by seeding outside the farmed area.

<sup>2</sup> CBA can also induce MPAs and NTZs to protect the farm and surrounding area leading to an increase in recruitment, improvement in the surrounding marine habitat etc.

<sup>3</sup> Different projects/countries have different experiences in terms of mangroves - some replant while some remove for aquaculture

**Table 3. Detailed description of positive and negative impacts of aquaculture on biodiversity raised during Workshop II group discussions**

1. Positive impacts	Detailed description
<i>Ecological</i>	<ul style="list-style-type: none"> <li>• Creation of NTZ reserves, for the purpose of increasing source of seed for finfish and shellfish aquaculture, increases biodiversity and biomass of overexploited fish and invertebrate species.</li> <li>• Many CBA programmes in intertidal zones require planting of mangrove trees in dykes and pond surroundings. Many of these areas were deforested mangrove habitats initially and CBA associated afforestation has resulted in increased mangrove forest cover, diversity of mangrove trees and other species, including birds and overall habitat restoration and creation of new habitat (Tanzania and Kenya).</li> <li>• Stock enhancement in nearby areas due to accidental release of larvae from farming areas leading to an increase in wild populations.</li> <li>• Creation of spawning habitat, e.g. squids on farmed seaweed.</li> <li>• Seaweed lines and other structures act as fish aggregating devices (FAD) resulting in increased catches of wild populations in farming areas.</li> </ul>
<i>Socio-economic</i>	<ul style="list-style-type: none"> <li>• Increased income.</li> <li>• Diversification of livelihoods and reduced reliance on wild fisheries for income.</li> <li>• Increased availability of protein and income resulting in better health conditions and improved social relations.</li> <li>• Empowerment of women resulting in greater independence and involvement within the community.</li> <li>• Increased community awareness and motivation towards environmental protection.</li> <li>• Enhancement of skills and improved local capacity.</li> </ul>
2. Negative impacts	Detailed description
<i>Ecological</i>	<ul style="list-style-type: none"> <li>• Depletion of wild stocks due to overharvesting of juveniles and adults for use in farms e.g. crabs, spat, oysters.</li> <li>• Mangrove clearance for CBA pond construction.</li> <li>• Destruction of terrestrial land through pond construction and salinization.</li> <li>• Introduction of alien or invasive species.</li> <li>• Introduction of alien diseases (e.g. white syndrome in wild shrimp populations).</li> <li>• Depleted populations in the wild due to over-collection for feed and seed of farmed organisms.</li> <li>• Reduced diversity in CBA farming areas and nearby habitats due to dominance by farmed species.</li> <li>• Negative effect on food chain and trophic relations, e.g. due to over-predation by mud crab.</li> <li>• Habitat destruction by off-bottom seaweed farming in shallow areas due to trampling by farmers on seagrass, other macrophytes, corals and other shallow macrobenthic and possibly microbenthic communities, e.g. Kenya, Tanzania, Madagascar.</li> <li>• Physical pollution through introduction of plastic bottles that are used as floats in seaweed long-lines and rafts.</li> <li>• Obstruction of water movement due to construction of ponds, dykes, cages and other structures.</li> </ul>
<i>Socio-economic</i>	<ul style="list-style-type: none"> <li>• The delayed gratification of most CBA activities leading to continuance of</li> </ul>



	<p>unsustainable livelihood practices.</p> <ul style="list-style-type: none"> <li>• Privatization of common reserves and other areas reducing available fishing areas.</li> <li>• Farming plots hinder access to open fishing areas by fishers.</li> <li>• Decreased security and mutual trust due to increased theft or poaching of farmed organisms by farmers.</li> </ul>
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### Workshop III – Formation of a regional CBA network

Participants formed three groups and discussed the potential need for creating a regional CBA network and formulating its objectives ([Appendix IV](#)). Participants unanimously agreed on the need and importance of having a regional CBA network. They identified the main challenges and ways to addressing these. The following objectives and activities were suggested: documenting and exchange of information, developing and improving capacity and skills through regional training including establishing community exchange programme for CBA practitioners, promoting integration of CBA into conservation and development and promoting value addition and improving business partnerships. Table 4 summarizes anticipated challenges and interventions for addressing those suggested.

**Table 4. Challenges facing the creation of a regional CBA network in the WIO and recommended actions to address them**

Challenge	Action for addressing challenge
Different policies in different countries and language difference could be communication barrier.	Focus on commonalities; key information should be distributed using the four key languages: English, Kiswahili, French and Portuguese.
Identifying best platform for communication.	Online communication is preferred. Create a highly interactive website, with access to online databases and maps, that is integrated with social media pages (e.g. Facebook, Twitter, etc.).
Coordinating and managing the network.	A permanent coordinator must be assigned.
Identifying a willing and capable host institution.	Liaise with potential host institutions, e.g. WIOMSA, Live with the Sea, Blue Ventures Conservation, SARNISSA, etc. to host the network.
Cost of running the network.	Propose a budget for developing and running the network, apply for appropriate funding.

Participants elected one representative from each of the six countries in the region to be the contact person and responsible for developing the strategy and action plan of the network, which will be coordinated by Mr. Antoine Rougier.

1. Kenya: Dr. Betty Nyonje
2. Tanzania: Dr. Narriman Jiddawi
3. Mozambique: Mr. Rafael Rafael
4. South Africa Prof. Peter Britz
5. Madagascar: Mr. Gaetan Tsiresy
6. Seychelles & Indian Ocean Islands: Mr. Aubrey Lesperance

## 4. Conclusions, recommendations and next steps

### Conclusions

Community based aquaculture is emerging as an effective solution to some of the challenges faced by coastal communities in the WIO. It has shown promise as a means to safeguard food security, address coastal poverty and alleviate the pressure on marine resources. However, aquaculture initiatives, especially small-scale community-run projects, have suffered from poor information sharing, leading to a lack of knowledge in regards to the environmental and socioeconomic impacts of these programmes. CBA also suffers from a number of challenges, including inadequate funding and poor governance, lack of capacity and access to markets. The main focus of CBA has been increasing income for poor coastal communities, with little focus on preventing or minimizing negative environmental and social impacts.

Overcoming these challenges may best be achieved by building on the spirit of regional and international exchange forged during this forum. The formation of a network following the workshop will enable CBA practitioners in the WIO to share experiences and best practice, and offer training, exchange visits, and an online information clearing house. The network will also aim to promote CBA in other areas and establish regional funds to support CBA development in the long-term.



**Figure 4. Group discussions were an integral part of the workshop**

The workshop identified key biophysical factors, local community characteristics and the role of external players in influencing the successful implementation of CBA projects. The following recommendations were suggested in order to improve community capacity for ensuring environmental and social sustainability through improved production, value addition and minimizing the negative environmental and social impacts.

## Recommendations

### Developing community capacity and improving governance

One of the major factors limiting the productivity of CBA activities is the lack of capacity within local communities to maximize production and effectively oversee the management of such initiatives. The often low level of education within coastal communities in the WIO levels stems from poverty, and is a key hurdle to overcome when planning and implementing CBA projects. A lack of education teamed with a shortage of technical knowledge means that communities are habitually ill equipped to be able to achieve maximum production, access public services or participate effectively in business partnerships and decision making. In addition to investing money for improved production, future strategies should be developed and investment dedicated towards the enhancement of decision-making by local communities in order to improve their participation within national government frameworks and business partnerships. Community based aquaculture development and its integration with conservation and development will mean new tenure regimes and responsibilities. Thus, capacity building of communities through education and technical skills development should be a high priority for communities themselves, as well as governments, donors and civic society groups in order to empower these communities to develop avenues and institutions for active participation at all levels.

The presentations and workshop discussions highlighted the short-term nature of donor support. It is recommended that longer-term support by donors is important to enable both a smooth transition from fishing to aquatic farming as a livelihood, in addition to planning the timeframe needed for communities to build the capacity needed to manage CBA initiatives in the long term. This also allows for the shift from production to a value-addition and the development of a market oriented approach, which also enhances the sustainability of projects.

### Increasing seed and feed supply in finfish, shellfish and invertebrate farming

Shortage of seed was one of the main issues in finfish and invertebrate farming. Building of hatcheries and the development of necessary technical skills in representative areas is seen as crucial for resolving this problem. This should also be accompanied with a sustainable supply of feed for larvae, juveniles and adults. Development of sound business partnerships between community, commercial partners and research institutes is seen as key for promoting research in the development of hatcheries and feed processing plants.

### Improving growth conditions in 'cottonii' farming

Despite seaweed farming being a low input system, the more commercially sought-after species *Kappaphycus alvarezii* (*cottonii*), is harder to cultivate than the less popular *Eucheuma denticulatum* (*spinosum*). Many shallow sites are unsuitable for *cottonii* farming due to high surface water temperatures and associated epiphyte and disease infection. These impacts are expected to become more intense with climate change. Development of techniques for growing *cottonii* in deeper waters where it is cooler and conditions are more stable is recommended.

### Improving marketing of products

Some of the taxa that are comparatively easy to grow have lower market values, e.g. milkfish and *spinosum*. Value addition to these and other products will not only result in increased price and

income for communities but it will also increase participation by communities, their understanding of the market and their bargaining power. Introduction of higher value species, development of multi-regional bargaining platforms to counter price fixing in the global market and revision of existing import-export and tax policies by governments were some of the recommendations put forward. Development of sound business partnerships between community and commercial partners, while being supported by clearly stipulated agreements and regulations is also seen as key for promoting value addition, developing research on introduction of high value species and accessing wider markets.

### **Minimizing negative environmental and social impacts of CBA**

Habitat destruction, disease and species introductions, over-collection of juveniles and adults from the wild and increased pollution were the main negative ecological impacts of CBA. Some of the negative social impacts were introduction of unsustainable practices and privatization of common coastal areas. Recommendations and suggestions for best practice were reducing these impacts through stringent regulatory guidelines addressing environmental and social issues, including conducting proper social-ecological impact assessments before the commencement of projects. Aquaculture development must also adapt to the needs and capacities of the communities concerned, and models need to be developed to clearly predict whether the socio-economic benefits of aquaculture are worth any predicted environmental degradation.

### **Integrating CBA into conservation programmes**

While some CBA projects in the WIO have been established as AIGAs in order to support biodiversity conservation efforts, their effectiveness in promoting conservation has not been properly analyzed. It is recommended that CBA projects should be properly integrated into conservation and development programmes at all stages from planning to implementation, while also being monitored and evaluated through participatory methods that involve local communities and other key partners. Legal policy frameworks developed to ensure transparency and accountability should support this. There is also a need for institutional coordination to avoid conflicting messages coming from different government departments.

### **Formation of a regional CBA network**

All participants agreed that a network can be a powerful tool for sharing information, and there is a need for such a platform in the WIO region. However, the biggest challenge to networks in the WIO is long term sustainability; securing funding, effective organization and leadership, and finding appropriate hosting platforms. Thus securing sufficient funding to enable the network to be established formally and operate in the long term is a critical need, as well as promoting the network as widely as possible within the region to ensure maximum outreach and information dissemination. In this vein, the creation of an open access platform, involving as many stakeholders as possible, including government agencies and private sector organizations is recommended.

### **Next steps and follow up activities**

The need to supply the growing world population and its increasing demand for marine products, and the declining wild finfish and shellfish populations in the region will mean that the fast growing

trend in aquaculture and community based aquaculture will continue. The high rate of population growth and intensified urbanization in the region is expected to result in an increasing demand for existing and new marine products. Experience from other regions in the world shows that such demographic and socio-economic changes can lead to the commercialization of aquaculture and an introduction of semi-intensive and intensive practices. Analysis of business models and partnerships, while developing a 'CBA vision' for the future, are some of the key suggestions for follow-up to the workshop. The regional CBA network can be used as a vehicle for addressing these and other issues.

### Next steps

#### *i. Capacity building*

- Establish new regional centers of excellence and strengthen existing training and extension institutes for knowledge and skills development, including technical, marketing and business management.

#### *ii. Marketing and value-addition*

- Develop research on existing and alternative high value species that could be cultured in the region.

#### *iii. CBA and conservation*

- Develop tools for integrating CBA into conservation, including participatory approaches in planning and implementation and monitoring of environmental and socio-economic sustainability.

#### *iv. Regional network*

- Developing a proposal and budget estimation for the formal creation of a regional CBA network, to be submitted to relevant funding bodies to ensure continuation of the network.
- Develop and strengthen the newly established regional CBA network towards recognition as an official body.
- The creation of an open access online platform where members can upload and download reports, share experiences, as well as communicate with each other freely. A social media presence could be one of the follow ups to this step.
- Organize a visionaries meeting (within two years) in coordination with the regional CBA network in order to develop a future vision for CBA in the region towards improving research, development and innovation.
- Identifying anchor institutions for hosting the regional CBA network and developing further the CBA map.

#### *v. CBA regional map*

- Develop further the regional CBA map by gathering additional and detailed information on existing and new sites and projects to be able to analyze data and conduct evaluation through standardized methods.

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## 6. Appendices

### Appendix I Questionnaire: Issues and factors affecting community based aquaculture projects in the Western Indian Ocean

The workshop has two discussion sessions: 1) factors influencing success and failure of CBA projects in the region and 2) assessing effectiveness of CBA in promoting biodiversity conservation. The main objective of the exercise is not only to identify key factors but also come up with recommendations for improvement. This semi-structured questionnaire-based interview is meant to draw a general picture of CBA and provide different perspectives of CBA based on the views of the various stakeholders involved.

As the information derived from the questionnaire will form the main platform for the workshop discussions and follow-up analysis, it is important that respondents provide accurate and detailed answers as much as possible.

#### A. General information

1. Name:
2. Name your organization (*or affiliation*):
3. Name of CBA project:
  - a. Project start date:
  - b. Country where project is based:
  - c. Location of CBA farm in country:
  - d. Name of locality (*if relevant*):
  - e. Geographic position (*coordinates if possible*):
4. Your role in CBA project(s):
5. Farmed organism(s) (please provide species name if possible):
6. Community size (overall):
  - a. Number of families involved:
  - b. Number of villages involved:
  - c. Size of area occupied by community:
  - d. Distance from nearest town / city:
  - e. How many community members were there in the project initially?
  - f. Reasons for quitting, if any:
7. Main source of income of community members (*please circle/indicate*)
  - a. Fishing
  - b. Crop production
  - c. Livestock keeping
  - d. Tourism
  - e. Small businesses (*if so please say what kind of business*):

- f. Other (please describe):
  
8. Level of education of community members (*please circle/indicate*):
  - a. Primary school attendance
  - b. Secondary school attendance
  - c. Adult literacy rate (*if known*)
  
9. Marine reserve (if your project is within a MPA - if not please go to question 11)
  - a. Presence of marine management area, MMA (including no-take area):
  - b. Size of MMA:
  - c. Size of NTA:
  - d. Level of management enforcement:
  
10. Protected species and habitats in the MMA / NTA
  - a. Particular species (e.g. green turtle nursery area):
  - b. Particular habitat/ecosystem (e.g. coral reef, natural heritage site, sanctuary site, etc.):
  
11. Known direct environmental problem(s) (*please circle/indicate*):
  - a. Inadequate fish and marine resources
  - b. Inadequate crop land
  - c. Inadequate pastures
  - d. Inadequate drinking water
  - e. Animal and crop diseases
  - f. Other (please expand):
  
12. Who are the main project stake-holders? (*please circle/indicate*):
  - a. Local community
  - b. Local NGOs and its function
  - c. International NGOs and development agencies and their functions
  - d. Local Government and its functions
  - e. Others (please describe) and their functions
  
13. Estimated project costs
  - a. Estimated costs of planning, start-up and running so far:
  
14. Main CBA project funder (%) (please circle and indicate what % for each funder):
  - a. Local community
  - b. Government
  - c. International NGO
  - d. International government
  
15. Income from CBA project
  - a. Anticipated income (whole community, USD per annum):
  - b. Anticipated income (per fisher):
  - c. Realized income (whole community):



- d. Realized income (per fisher):
- e. Comparison of income to that from main activity (e.g. fisheries (%)):

16. Final product from CBA is used for (*please circle/indicate*):

- a. Direct use (local)
  - i. Source of food
  - ii. Source of feed
  - iii. Source of chemicals
  - iv. Source of other substances (please describe)
- b. Direct use (export)
  - i. Source of food
  - ii. Source of feed
  - iii. Source of chemicals
  - iv. Source of other substances (please describe)
- c. Indirect use
  - i. Cultural services (e.g. amenities, recreational activities, etc.)
  - ii. Regulating services (e.g. climate regulation, waste processing, etc.)

17. Main objectives of CBA project (*please circle/indicate*):

- a. Income generation
- b. Climate change adaptation
- c. Compensation for lost opportunity associated with conservation (e.g. creation of MPA)
- d. Compensation for other lost opportunity due to (e.g. displacement from use area)
- e. Other (please expand):

18. Is the CBA project an integral part of regional development programme? (*please circle/indicate*):

- a. Yes
- b. No
- c. If yes, what other development sectors are included?

19. Is the CBA project an integral part of regional conservation programme? (*please circle/indicate*):

- a. Yes
- b. No
- c. If yes, what conservation programmes are included?

20. Community participation (*please circle/indicate*):

- a. Needs assessment
  - i. Not conducted
  - ii. Included community members
  - iii. Didn't include community members
  - iv. I don't know
  - v. Main acting stakeholder

- b. Project planning
  - i. Not conducted
  - ii. Included community members
  - iii. Didn't include community members
  - iv. I don't know
  - v. Main acting stakeholder
    - c. Project management
      - i. Not conducted
      - ii. Includes community members
      - iii. Doesn't include community members
      - iv. I don't know
      - v. Main acting stakeholder
        - d. Monitoring and evaluation
          - i. Not conducted
          - ii. Includes community members
          - iii. Doesn't include community members
          - iv. I don't know
          - v. Main acting stakeholder
            - e. Level of trust and commitment between community and other stakeholders
              - i. very low
              - ii. low
              - iii. moderate
              - iv. high very high
            - f. Level of trust and commitment among other stakeholders (without community)
              - i. very low
              - ii. low
              - iii. moderate
              - iv. high very high

21. Is there a project monitoring programme in place?

- a. Yes
- b. No
- c. If yes, how frequently is monitoring conducted?
- d. What aspects of project are monitored?
  - i. project activities
  - ii. finances
  - iii. human resources
  - iv. physical and social welfare of members

22. Is there a project monitoring programme in place?

- a. Yes
- b. No

- c. How frequently is evaluation conducted?
  - d. What aspects of project are evaluated?
    - i. project activities
    - ii. finances
    - iii. human resources
    - iv. physical and social welfare of members
  - e. Who conducts monitoring and evaluation?
    - i. The community itself
    - ii. NGO
    - iii. Government
    - iv. all stakeholders together
    - v. all stakeholders but separately
23. Do you think your CBA project has been successful in achieving its main goals (*please circle/indicate*):)
- a. Conserving biodiversity
  - b. Managing natural resources
  - c. Meeting social needs, such as maintaining local culture, increasing opportunities for income generation, and improving health and well-being
  - d. Lowering management costs
  - e. Sustaining outcomes over time
24. Known positive impact of CBA project (*please circle/indicate*):
- a. Socio-economic (e.g. increased income, positive change in attitude and behavior, etc.)
  - b. Environmental (e.g. establishment of MPA, increased abundance of endangered species)
25. Known negative impacts of CBA project (*please circle/indicate*):
- a. Socio-economic (e.g. lowered income, reduced health condition, increased conflict among different resource users, etc)
  - b. Environmental (e.g. increased pollution, negative effect of introduced species)
26. Existing CBA projects in your area
- a. Do you know CBA projects running in your region but whose members are not in this workshop?
    - i. Yes
    - ii. No
    - iii. If yes, please mention them.
  - b. Do you think they have been successful?
    - i. Yes
    - ii. No
    - iii. If yes, then why?
27. CBA projects in your area that have terminated

- a. Do you know of such CBA projects that are not active any more?
  - i. Yes
  - ii. No
  - iii. If yes, please mention them.
- b. Reasons for their closure:

## B. Factors and issues affecting successes and failures of CBA projects

Main factors influencing success and failure of CBA project(s) in your area. Think why your CBA has successful or why it be as successful as it should (*please circle/indicate*):

- a. Attitudes and beliefs (e.g. superstitions, social stigma, influence of religion and traditional beliefs, negative views toward innovation and change, etc.).
  - b. Social (e.g. inequality in resource ownership, access, control, decision making, division of labor, etc.).
  - c. Socio-economic (low level of knowledge, education and skills, high level of poverty, weak infrastructure, etc.).
  - d. Organizational (weak community leadership, organization and governance, low level of community participation, etc.).
  - e. Regional and national (e.g. weak regional and national institutions of governance and infrastructure to support communities, lack of guiding policies and poor implementation of government strategies, etc)
  - f. NGOs and Development Organisations (mismatch in objectives with community needs, do not ensure community participation)
  - g. Financial management (low level of skills in financial controls and management;
  - h. Managerial (low level of managerial knowledge and skills)
  - i. Technical (low level of technical knowledge and skills)
  - j. Ecological (low level of ecological knowledge and skills)
  - k. Marketing approach (low level of marketing knowledge and skills, unclear business models and partnerships)
  - l. Environmental (less suitable bio-physical conditions)
- Other factors

## C. Factors influencing effectiveness of CBA projects in promoting biodiversity conservation.

*Please circle/indicate which factors you think are most important:*

- a. Attitudes and beliefs (e.g. superstitions, social stigma, influence of religion and traditional beliefs, negative views toward innovation and change, etc.).
- b. Social (e.g. inequality in resource ownership, access, control, decision making, division of labor, etc.).
- c. Socio-economic (low level of knowledge, education and skills, high level of poverty, weak infrastructure, etc.).
- d. Organizational (weak community leadership, organization and governance, low level of community participation, etc.).
- e. Regional and national (e.g. weak regional and national institutions of governance and infrastructure to support communities, lack of guiding policies and poor implementation of government strategies, etc)
- f. NGOs and Development Organisations (mismatch in objectives with community needs, do not ensure community participation)
- g. Financial management (low level of skills in financial controls and management;
- h. Managerial (low level of managerial knowledge and skills)
- i. Technical (low level of technical knowledge and skills)

- j. Ecological (low level of ecological knowledge and skills)
- k. Marketing approach (low level of marketing knowledge and skills, unclear business models and partnerships)
- l. Environmental (less suitable bio-physical conditions)
- m. Other factors (please expand):

## Appendix II. Guideline to Workshop 1. Issues and factors affecting community based aquaculture projects in the Western Indian Ocean

### Practical work – workshop 1 (Issues and factors affecting community based aquaculture projects in the Western Indian Ocean)

In the briefing document that you received, it is indicated that one of the main goals of the three-day workshop is to discuss the main opportunities and challenges faced, outline lessons learned and formulate recommendations on best practice. The first workshop has the following specific objectives:

- A. Identify key factors influencing successes and failures of CBA projects in the region and those influencing effectiveness of CBA in promoting biodiversity conservation.
- B. Come up with recommendations for best practice
  - Key issues influencing successes and failures of CBA projects in the region will be identified.
  - Recommendations will be made for introducing interventions at different stages and components of CBA projects.
- C. Develop a vision for the future scenarios of CBA in the WIO
  - Develop ideas and achieve consensus on what actions are needed to develop successful CBA in the region
  - Evaluate future development options (e.g. how will CBA look in 2030?)

The main tasks in this workshop are for you to have a closer look at the different components of your own CBA system, identify the key factors and players, and review its effectiveness in meeting the objectives set during project inception. Figure 1 shows a general framework for reviewing a fisheries / aquaculture system which can be modified according to your own needs.

#### Before the workshop

You are provided with a questionnaire on the background of your project and on the main issues affecting it to be successful or not. The answers you provide to the questions will be useful in facilitating this activity.

1. Make a logic model of your own CBA system by focusing at the 'community' as the main beneficiary of the project. Figure 2 provides a good example of a logic model that you can easily modify for your purpose.
2. Outline the main goals of the project (e.g. improvement of the socio-economic conditions of the community). You can modify the initial project goal(s) by considering recent socio-economic and environmental changes. For example, older projects rarely considered climate change adaptation whilst this is one of the main goals in recent projects.

*Project goals (please add more if needed)*

- 1.
- 2.
- 3.

1. Identify and prioritize factors affecting ability to achieve project goals. e.g. socioeconomics of the community, organization and governance, governmental and institutional support, external factors (such as market, climate, donors etc.). Please rank each factors according to their importance levels: 0) no importance, 1) low importance, 2) medium importance, 3) high importance. You may use additional paper if needed.

	Importance (0, 1, 2, 3)	Remarks and examples (if any)
<b>Bio physical Factors</b>		
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
<b>Socio-economics of community</b>		
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
<b>Organizational / governance</b>		
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
<b>External players (e.g. donors, market)</b>		
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

9.		
10.		
<b>External factors (e.g. climate)</b>		
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

- Analyze the approach and process followed at different stages, decide whether it was participatory at all levels of the project cycle, from planning to implementation, during monitoring and evaluation, whether the agenda considers needs and rights of the community or it was donor or government driven, etc. Please rank each step according to their importance levels: 0) no importance, 1) low importance, 2) medium importance, 3) high importance. You may use additional paper if needed.

<b>Steps followed</b>	<b>Participatory (0, 1, 2, 3)</b>
<b>Needs assessment</b>	
<b>Planning</b>	
<b>Implementation</b>	
<b>Implementation</b>	
<b>Evaluation</b>	



3. Conduct basic cost-benefit analysis by considering changes in social (e.g. attitude, behavior), economic (financial, material, infrastructure, services, etc), environmental (e.g. ecology, animal welfare). You may use additional paper if the space provided is not enough. Impact or change: -2: negative and very high; -1: negative and high; 0: no change or no impact; +1: positive and high; +2: positive and very high.

Factor	Level of change (-2, -1, 0, 1, 2)
<b>Socio-economics of community</b>	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
<b>Economic</b>	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
<b>Environmental</b>	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

**During the workshop**

Participants will form three groups based on the main CBA activity they are involved in: 1) finfish, 2) shellfish and 3) marine plants and other organisms and conduct SWOT (strength-weakness-opportunity-threat) analysis.

- Consider the situation, priorities and intended outcomes of the project
- Inputs in terms of investment (money, labor, research, equipment, etc)
- Output (your target and things that you do to achieve it)



**After the workshop**

Revise your initial CBA system model by considering the project objectives and exercise on prioritization of issues that were identified during the SWOT analysis and suggestions for intervention and management response (30 min).

Propose a CBA system model for your specific field area (e.g. fin fish, shellfish, seaweed) and your community for 2030.

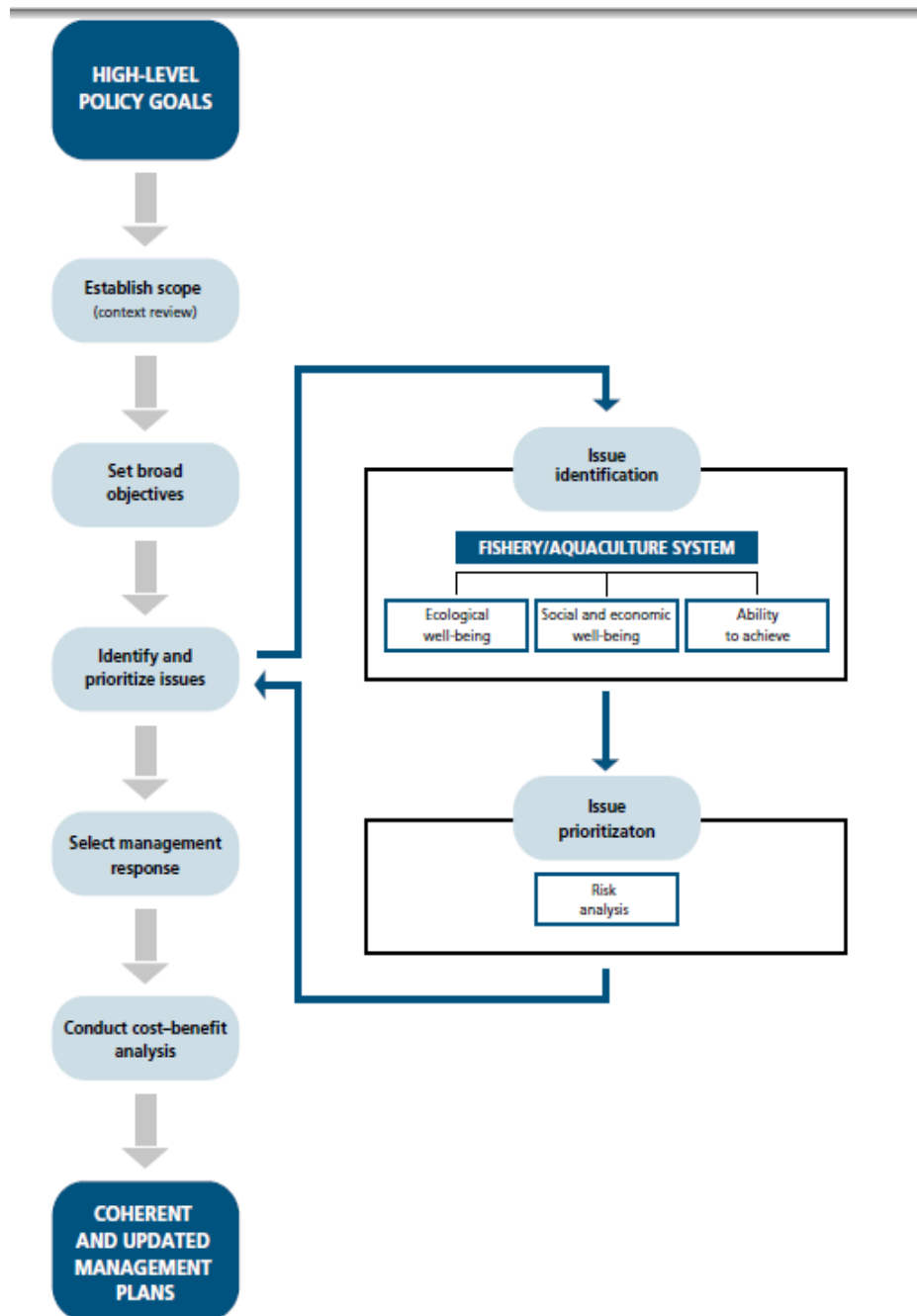


Figure 1. Basic framework for fisheries / aquaculture management (FAO 2012)

## Appendix III. Guidelines to Workshop II - Role of Community Based Aquaculture (CBA) in Promoting Conservation Biodiversity

### Questions this session aims to address:

1. Is there any evidence community based aquaculture (CBA) can promote conservation where the goal is to improve biodiversity?
2. Can CBA if adopted as an alternative or supplementary livelihood mitigate unsustainable marine (freshwater) resource use?
3. Is there a relationship between impacts of CBA on socio-economic demographic variables and support for conservation measures, e.g. MPAs?

Time (mins)	Activity	Lead	Materials
	3 working groups, <i>Split so each group has members from different countries</i>	Selina	
09:00  15 mins  End 09:15	<p>Introduction to workshop session</p> <p>Workshop aims:</p> <p>1) Encourage participants to consider the broad range of drivers impacting links between CBA and biodiversity conservation;</p> <p>2) Identify and share experiences in which participants have successfully improved or negatively impacted biodiversity with CBA or where there is potential for CBA to improve biodiversity.</p> <p><i>Aim is to share experiences with participants working in different countries in the WIO region.</i></p> <p><i>Split in to 3 groups.</i></p>	Selina	Powerpoint ppt
09:15  5 mins  20 mins	<p><b>Q1. Is there any unequivocal evidence community based aquaculture (CBA) can promote conservation where the goal is to improve biodiversity?</b></p> <p>Each <b>individual</b> – quiet 5 minutes <b>to identify the key drivers in eggs from your country in WIO where CBA positively and/or negatively impacts biodiversity conservation (give named eggs).</b></p> <p>Identify the top three for you, if you can.</p> <p>Write top 3 drivers for their countries on cards (5mins) write on cards participant name with country name.</p> <p>Then discuss in <b>group</b> – identify top three for group (WIO region) (table facilitators collect unselected cards).</p> <p><b>Q2. Can CBA if adopted as an alternative or supplementary livelihood mitigate unsustainable marine resource use?</b></p>	<p>All</p> <p>Individual</p> <p>Group</p> <p>Facilitators Selina wall</p>	<p>Each of three tables as coloured post-its</p> <p>Coloured paper annotated for country</p> <p>Coloured paper annotated for</p>

20 mins	Brainstorm key drivers that led to or prevented unsustainable marine resource use for above three in each <b>group</b> (write on paper) from that and prepare one person to summarise table discussion to plenary.		WIO region  Coloured paper annotated for WIO region
30 mins     End 10.30	<p>SS: <i>Facilitator to stick on wall under Q1/Q2 categories, by group:</i></p> <p>Q1 +ve/-ve impacts of CBA on biodiversity conservation    Q2 +ve/-ve resource use</p> <p>Gp 1 Gp 2 Gp 3</p> <p>Each <b>group present to plenary</b> (10 mins each) – One participant from each group</p> <p><b>Discussion</b> – whatever time remains before coffee.... invite people to look at wall we have constructed for all groups...</p>	Selina lead with JH as helper  Facilitator on tables	
	<b>11.00-11.15 Coffee break</b>		
11.15   10   15   5   10  End 11.55	<p>Q3. <i>Is there a relationship between impacts of CBA on socio-economic demographic variables and support for conservation measures, eg MPAs?</i></p> <p>Group discussions: What are the main governance constraints to the implementation of CBA to promote improved biodiversity conservation in each country? (focus on local, national and regional challenges).</p> <p>Free <b>brainstorm of constraints by table</b> – facilitator writing them down per table – annotated by country – colour by table...</p> <p>SS: <i>Facilitator to categorise on wall under governance themes (structure, process, management).</i></p> <p><b>Vote</b> – Which are most problematic constraints for WIO regionally?</p> <p><b>Highlight/discuss the top three in plenary.</b> If time discuss egs where governance constraints have been overcome? What helped? What was a hindrance? Any good practice in achieving conservation biodiversity relevant for WIO? Wrap up and links with previous session</p>	<p>SS lead with JH as helper</p> <p>Facilitators on tables</p> <p>SS Lead</p>	Coloured paper annotated for WIO region

## Appendix IV. Questionnaire: Formation of a regional CBA network (CBA-N) - What, Why, How?

**Name :**

**Organization :**

### *The general concept of a CBA Network for the Western Indian Ocean*

1. Do you think a Community Based Aquaculture Network for the Western Indian Ocean Region would be a good idea?

- Yes  No

2. Your interests for a Community Based Aquaculture Network for the Western Indian Ocean Region?

- |  |  |
|--|--|
| <input type="checkbox"/> Sharing results | <input type="checkbox"/> Find information/guidance |
| <input type="checkbox"/> Connect people  | <input type="checkbox"/> Seek for contacts         |
| <input type="checkbox"/> Find jobs       | <input type="checkbox"/> Increase visibility       |

Others: .....

3. The limits for such network?

- |  |   |
|--|---|
| <input type="checkbox"/> Language barriers               | <input type="checkbox"/> Confidentiality                              |
| <input type="checkbox"/> Leadership and responsibilities | <input type="checkbox"/> Difficulties of integrating multiple sectors |
| <input type="checkbox"/> Funding                         | <input type="checkbox"/> Long term sustainability                     |

Others: .....

### *Defining a strategy for a CBA Network*

1. What are the key players in the region such network wants to include?

- |  |  |
|--|--|
| <input type="checkbox"/> Farmers/beneficiaries | <input type="checkbox"/> Politics            |
| <input type="checkbox"/> Researchers           | <input type="checkbox"/> Donors              |
| <input type="checkbox"/> Students              | <input type="checkbox"/> Anybody interested? |
| <input type="checkbox"/> NGOs                  |  |

Others: .....

2. What should be the audience of such network?

- Open access/ external communication
- Internal communication tools
- Limited access for outsiders

Others: .....

3. Type of information to be shared?

- |  |  |
|--|--|
| <input type="checkbox"/> Project results and updates | <input type="checkbox"/> Contacts                        |
| <input type="checkbox"/> Publications                | <input type="checkbox"/> Pictures                        |
| <input type="checkbox"/> Handbooks                   | <input type="checkbox"/> Calls for proposal / Job offers |

Others: .....

4. Media you are familiar with?

- Emails
- Website
- Facebook
- Blogs
- Youtube
- Papers/magazine

Others: .....

5. What type of activities would you see as part of this network?

- Online bases
- Newsletters
- Regular meetings
- Exchanges visits
- Papers/magazine

Others: .....

6. Are you familiar with other network?

- SARNISSA
- NACA
- DLIST
- Coralreef.noaa.gov
- ANAF

Others: .....

What do you appreciate/dislike with this/these network(s)?

.....

.....

.....

.....

.....

.....

## Appendix V. Workshop programme

<b>Workshop day 1 - 09 December 2013</b>			
<b>Presentation topic</b>	<b>Presenter's name</b>	<b>Start</b>	<b>Finish</b>
Registration at Zanzibar Grand Palace Hotel		09:00	09:30
Welcome and opening address	Guest of honour	09:30	09:45
Objectives and expectations of the workshop	Workshop organizers	09:45	10:15
<b>COFFEE BREAK</b>		<b>10:15</b>	<b>10:30</b>
<i>Keynote presentation 1: The socio-economics of community based aquaculture (CBA)</i>	Prof. Selina Stead	10:30	11:00
<b>Presentations session I – Chair: Dr. Tim Andrew</b>			
Success and Failure of community-based aquaculture ventures in coastal Kenya	Amina Juma Hamza	11:00	11:15
Experiences, challenges and lessons learned from different CBA projects that IH.SM was involved during the last decade	Thierry Lavitra	11:15	11:30
Community based mariculture development in Tanzania	Aviti Mmochi	11:30	11:45
Small-scale innovations and women empowerment	Lasse Lindstrom	12:00	12:15
Deep water seaweed farming in Pemba, Tanzania	Flower Msuya	12:15	12:30
The role of communities in successful implementation of mariculture initiatives; opportunities and challenges. A case of Ihaleni and Kidundu Community groups in Kilifi, Kenya	Brendan Muli	12:30	12:45
Jozani fish farming project - JFPP	Hassan Hassan	12:45	13:00
<b>LUNCH BREAK</b>		<b>13:00</b>	<b>14:00</b>
<b>Presentations session II – Chair: Dr. Lasse Lindstrom</b>			
The feasibility and potentiality of villager's aquaculture (seaweed, sea cucumber) in the southwest region of Madagascar with improvement for some major points.	Gaetan Tsiresy	14:15	14:30
Social dimension of the CBA in Kenya. A Student's perspective	Anne Wanjiru	14:30	14:45
Recent developments in the establishment of commercial seaweed farming in coastal communities in Kenya	Betty Nyonje	14:45	15:00
Culture of <i>Artemia (Artemia franciscana)</i> in salt work farm in Mozambique	Rafael Rafael	15:15	15:30
<b>COFFEE BREAK</b>		<b>15:30</b>	<b>15:45</b>
Development of an automatic and self sustaining aquaculture unit for limited water supply space and system suitable for urban fish farming.	Stanley Mwalembe	15:45	16:00
CBA of mud crab in Zanzibar: a case study of determining an alternative source of sustainable feeds for mud crabs <i>Scylla serrata</i> farming in Zanzibar.	Muumin Iddi Hamad	16:00	16:15
A farmer's perspective to CBA projects. A Case study of Gazi village	Hamisi Kirauni	16:15	16:30



CBA research activities at Sokoine University of Agriculture	Sebastian Chenyambuga	16:30	16:45
<b>Networking &amp; Social event at Mercury's Bar (next to Zanzibar Grand Palace Hotel)</b>		<b>16:45</b>	<b>18:30</b>

<b>Workshop Day 2 - 10th December 2013</b>			
<i>Keynote presentation 2: Challenges in moving from a production driven, value chain approach to CBA development</i>	Prof. Peter Britz	08:30	09:00
<b>Presentations session III – Chair: Dr. Betty Nyonje</b>			
Women involvement in coastal activities and community based mariculture in Zanzibar	Narriman Jiddawi	09:00	09:15
Livelihood transitions triggered through community based conservation initiatives and implication to poverty alleviation in Bagamoyo, Tanzania	Jairos Mahenge	09:15	09:30
Public-private partnership on seaweed and sea cucumber community aquaculture in SW Madagascar: an overview of the success, challenges and next steps	Antoine Rougier	09:30	09:45
Betty Njonje presentation	Betty Njonje	09:45	10:00
<b>COFFEE BREAK</b>		<b>09:45</b>	<b>10:00</b>
Environmental challenges in seaweed farming in south-western Madagascar: ecological and socio-economic implications	Mebrahtu Ateweberhan	10:00	10:15
Economic modelling of community-based half-pearl culture in Tanzania	Ismail Saidi	10:15	10:30
Workshops: Analysing the CBA experience in WIO, Sectorial SWOT Analysis  <i>Aim: Sector by sector SWOT analysis of successes, failures and challenges in the 3 main areas of work in CBA. Preparations will be made towards identifying key issues affecting CBA projects (Dr. Ateweberhan, Dr. Jiddawi and Dr. Msuya)</i>  Group 1: Finfish aquaculture (Dr. Aviti Mmochi and Dr. Tom Shipton) Group 2: Invertebrate aquaculture (Dr. Narriman Jiddawi) Group 3: Seaweed farming and others (Dr. Flower Msuya and Dr. Mebrahtu Ateweberhan)		10:30	13:00
<b>LUNCH BREAK</b>		<b>13:00</b>	<b>14:00</b>
Presentation and discussion from Group 1		14:00	14:25
Presentation and discussion from Group 2		14:25	14:50
Presentation and discussion from Group 3		14:50	15:15
<b>COFFEE BREAK</b>		<b>15:15</b>	<b>15:30</b>
Synthesis of presentations  <i>Formation of breakout groups to further develop issues discussed during SWOT analysis and presentations. They will record specific challenges and issues their projects face, and develop plans of action for addressing them.</i>		15:30	16:00
<b>Group visit to local CBA projects</b>		<b>16:00</b>	<b>18:30</b>
<b>Workshop dinner at the Zanzibar Grand Palace Hotel</b>		<b>18:45</b>	<b>20:30</b>

<b>Workshop day 3 - 11th December 2013</b>			
Evaluation of effectiveness of CBA programmes in promoting biodiversity conservation <i>Three country/region based groups will assess if CBA in their areas have effectively promoted biodiversity conservation. Preparations will be made towards identifying key issues affecting the success of CBA projects.</i>	Prof. Selina Stead and Jo Hudson	09:00	11:00
<b>COFFEE BREAK</b>		<b>11.00</b>	<b>11.15</b>
Group presentations, discussions and recommendations from morning group sessions	Prof. Selina Stead and Jo Hudson	11:15	13:00
<b>LUNCH BREAK</b>		<b>13:00</b>	<b>14:00</b>
Formation of a regional CBA network (CBA-N) - What, Why, How? <i>Participants will brainstorm on and discuss the importance of a regional CBA-Network, how it can be formed and maintained. Is there a need to formalise the network?</i>	Antoine Rougier and Dr. Thierry Lavitra	14:00	15:00
Group discussion: defining priority issues and develop objectives for creating a successful CBA-N	Antoine Rougier and Dr. Thierry Lavitra	15:00	15:45
<b>COFFEE BREAK</b>		<b>15:45</b>	<b>16:00</b>
Forming the regional CBA-network: Establishment of a steering committee to follow up with workshop participants and promote actionable ideas.	Antoine Rougier and Dr. Thierry Lavitra	16:00	17:30
<b>End of workshop (Closing remarks by organizers)</b>		<b>17:30</b>	<b>18:00</b>

## Appendix VI. List of workshop participants

Name	Organisation	Country	Email
Abdulrahman Ali	Pwani Project, WIOMSA	Zanzibar, Tanzania	<a href="mailto:abdul@wiomsa.org">abdul@wiomsa.org</a>
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## Appendix VII. Workshop evaluation form

### *Overall Evaluation Questionnaire*

**1. Which part of the workshop did you find the most useful and why?**

**2. What changes would you make to the workshop and why?**

**3. What topics/areas, if any, would you add or give more time to?**

**4. How relevant was the workshop to your work? (please mark)**

Not at all relevant  Barely relevant  Relevant  Very relevant

**5. Overall, how worthwhile was it to for you to attend the workshop? (please mark)**

Not at all worthwhile  Barely worthwhile  Worthwhile  Very worthwhile

**6. Circle up to three words below that best sum up your overall opinion of this learning experience:**

interesting    challenging    exciting    revealing    fascinating

entertaining    boring    confusing    difficult basic    clear easy

realistic practical    theoretical    irrelevant    waste of time

new    innovative    complicated    enjoyable    valuable

inspiring    unfocused    rushed    thorough    stimulating

exhausting    nothing new    useful    comprehensive

over-ambitious    changed my life    thought-provoking

Add your own words:

---

---

**7. Do you feel the workshop achieved its overall objectives? *Please elaborate if the answer is no.***

- A. Specific objective 1: Evaluation of socioeconomic and environmental impacts of CBA programmes
- B. Specific objective 2: Identification of main practice challenges faced by existing CBA projects, identification of causes and possible solutions to these drawbacks
- C. Specific objective 3: Analysis of business and investment approaches to CBA
- D. Specific objective 4: Outline lessons learned and formulate recommendations on good practice

**8. Do you feel the workshop achieved the expected outcomes? *Please elaborate if the answer is no.***

- A. Identify key factors influencing successes and failures of CBA projects in the region and those influencing effectiveness of CBA in promoting biodiversity conservation
- B. Come up with recommendations for best practice
  - i. Key issues influencing successes and failures of CBA projects in the region will be identified.*
  - ii. Recommendations will be made for introducing interventions at different stages and components of CBA projects.*
- C. Develop a vision for the future scenarios of CBA in the WIO
  - i. Develop ideas and achieve consensus on what actions are needed to develop successful CBA in the region*
  - ii. Evaluate future development options (e.g. how will CBA look in 2030?)*
- D. Formation of regional CBA network
  - i. Define the mission of the network (e.g. to promote effective and responsible regional CBA projects for healthy coastal and marine ecosystems and communities).*

**9. How would you rate the overall delivery of the workshop? (please mark)**

Very poor       Poor       Average       Good       Very good

*If you would like to add any comments about the delivery please do so here:*

**10. How would you rate the overall structure of the workshop? (please mark)**

Very poor       Poor       Average       Good       Very good

*If you would like to add any comments about the structure please do so here:*

**11. How would you rate the overall organisation of the workshop? (please mark)**

Very poor       Poor       Average       Good       Very good

*If there were areas which could be improved upon with the organisation please comment here:*

**12. Any other comments:**

## Appendix VIII. Field Visit

Participants visited the Chaza Cooperative Society and the Bweleo-based members of the Zanzibar Seaweed Cluster Initiative in the afternoon of 10 December, 2013. The main aims of these initiatives, of whose members are predominantly women, are to promote coastal management, environmentally friendly livelihoods, value addition, and small business enterprise development. Activities include pearl farming, jewelry making, no-take zone conservation, and seaweed value addition. After a welcome address by the community leader (*Sheha*), the female members and a male pearl farmer explained the main activities of the groups and gave practical demonstrations on the creation of value added seaweed products as well as the steps involved in pearl farming; seeding, harvesting and the creation of pearl jewelry. The Chaza Cooperative Society is part of the wider Pwani Project which supports local women, families and entrepreneurs while the Seaweed Cluster is part of the Pan African Competitiveness Forum (PACF), the clusters programme in Africa. Drs. Narriman Jiddawi and Flower Msuya, who were also the leaders of the activities, organized the field trip for the participants.



**Figure 5. Members of the Chaza Cooperative Society demonstrate how to create jewelry from harvested shells**