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International
Conference
2014

Sustainable use of marine and coastal resources in Kenya:

from research to societal benefits

Kikambala, Kilifi County, Kenya
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Sustainable use of marine and coastal resources in Kenya:

from research to societal benefits

Kilifi, Kenya, October 2014

VLIZ SPECIAL PUBLICATION 72

VLIR-UOS International Conference 2014:

'Sustainable use of marine and coastal resources in Kenya: from research to societal benefits'.

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DEDICATED TO THE MEMORY OF PROFESSOR PHILIP POLK

MARINE BIOLOGIST

(19 OCTOBER 1932 – 11 MAY 2014)

AN INSPIRATION AND A FRIEND TO MANY IN KENYA AND BELGIUM

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LIST OF ACRONYMS

ASCLME	Agulhas Somali Current Large Marine Ecosystems
BMU	Beach Management Unit
CORDIO	Coral Reef Degradation in the Indian Ocean
CTD	Conductivity Temperature and Depth
EACC	East Africa Coastal Currents
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ICT	Information and Communication Technology
IUU	Illegal Unregulated and Unreported fishing
KBP	Kenya-Belgium Project in marine sciences
KCDP	Kenya Coastal Development Project
KMFRI	Kenya Marine and Fisheries Research Institute
MCS	Monitoring Control and Surveillance
RDA	Roundtable Diagnostic Analysis
MDG	Millennium Development Goals
MOU	Memorandum of Understanding
NGO	Non-Governmental Organization
NKB	Northern Kenya Banks
NMK	National Museums of Kenya
ORI	Oceanographic Research Institute, South Africa
PPP	Public Private Partnership
RMRSCC	Regional Maritime Rescue and Security Coordination Centre
SDF	State Department of Fisheries
SWIOFC	South West Indian Ocean Fisheries Committee
SWIOFP	South West Indian Ocean Fisheries Project
TBI	Turkana Basin Institute
MTP	Medium Term Plan
VLIZ	Flanders Marine Institute
WIO	West Indian Ocean
WIOMSA	West Indian Ocean Marine Science Association
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

This document summarizes the outcomes of the International Conference on sustainable use of coastal and marine resources in Kenya, held in Mombasa between 27 and 29 October 2014. The conference was convened by KMFRI, VLIZ, UGent and VUB and brought together local, national, regional and international scientists and other stakeholders to share experiences and discuss the future of marine research and education in Kenya and the WIO region. As a middle-income economy, Kenya aspires to sustainably use her natural resources including the ocean, which includes approximately 600km of coastline, an area of 142,000km^2 within the 200nm Exclusive Economic Zone (EEZ), and 103,000 km^2 within the 150nm extension of the continental shelf. Research data and information is key for sustainable use and management of marine resources. During the conference, the Kenya-Belgium collaboration in marine sciences, the status of the coastal and marine resources, the existing scientific information, the capacity needs in research, the existing opportunities for KMFRI-VLIZ collaboration and their marine and coastal science networks, and infrastructure needs were reviewed.

Whereas the conference recognised that plenty of research has been done in Kenya and the region, there was limited information on the deep water and the EEZ, which is much needed for sustainable utilization of the marine resources. Also capacity in open ocean research including physical and biological oceanography, deep sea as well as shallow water biodiversity (incl. taxonomy), marine geology, pollution and environmental impact assessment, mariculture, natural resource valuation and blue carbon technology were found to be inadequate in the national institutions, while the technical support for research particularly on instrumentation and sea navigation also needs to be advanced. Established training and research institutions, strong networks of specialized qualified personnel in Kenya, Belgium and other collaborating countries, established regional organisations and the presence of RV Mtafiti provide good opportunities to advance marine science and collaboration nationally, regionally and internationally. The assessment of research capacity needs, establishment of targeted capacity development programs, individual scholarships, exchange programs and the development of a regular EEZ annual cruise program for RV Mtafiti were identified as the points of immediate action to jumpstart the advancement of marine science in the region. Specifically, to advance and build the mariculture industry, the need for a mariculture research and training centre was identified as an urgent need at the coast.

Generally, it was concluded that the conference was a major milestone in the advancement of marine science research in Kenya and the region. The action points, if implemented, would lead to a wider network of professionals required to increase the significance of research on ecosystem management as well as enhance livelihood improvement, raising the profile of participating institutions to attract recognition and scientific impact, increasing the resource base to complement existing regional marine research capacity as well as the capacity of marine research to benefit the communities and the nation at large.

1. INTRODUCTION

The Kenya Marine and Fisheries Research Institute

The Kenya Marine and Fisheries Research Institute (KMFRI) is a government institution in the Republic of Kenya, which was established in 1979 by the Science and Technology Act CAP 250 of the laws of Kenya. KMFRI's mission is to contribute to the management and sustainable exploitation of aquatic resources therefore alleviating poverty, enhancing employment creation and food security through multidisciplinary and collaborative research in both marine and freshwater aquatic systems. KMFRI is ISO Certified (ISO 9001:2008) and has been recognized as a centre of excellence in marine science in the East African region.

KMFRI is structured and strategically located to undertake multidisciplinary research in marine and freshwater fisheries, aquaculture, marine environment and ecology (including physical, chemical and geological oceanography) and inland waters, limnology, fish post-harvest handling and natural products, socio-economics and information and data management. The institute has three research centres: at Mombasa for marine and coastal research, at Kisumu for inland fisheries research and at Sagana for aquaculture research; and ten research stations located countrywide.

Contribution of the marine sector to national development

Kenya has approximately 600km of coastline, an area of 142,000km^2 within the 200nm Exclusive Economic Zone (EEZ) and 103,000 km^2 within the 150nm extension of the continental shelf (Fig. 1).

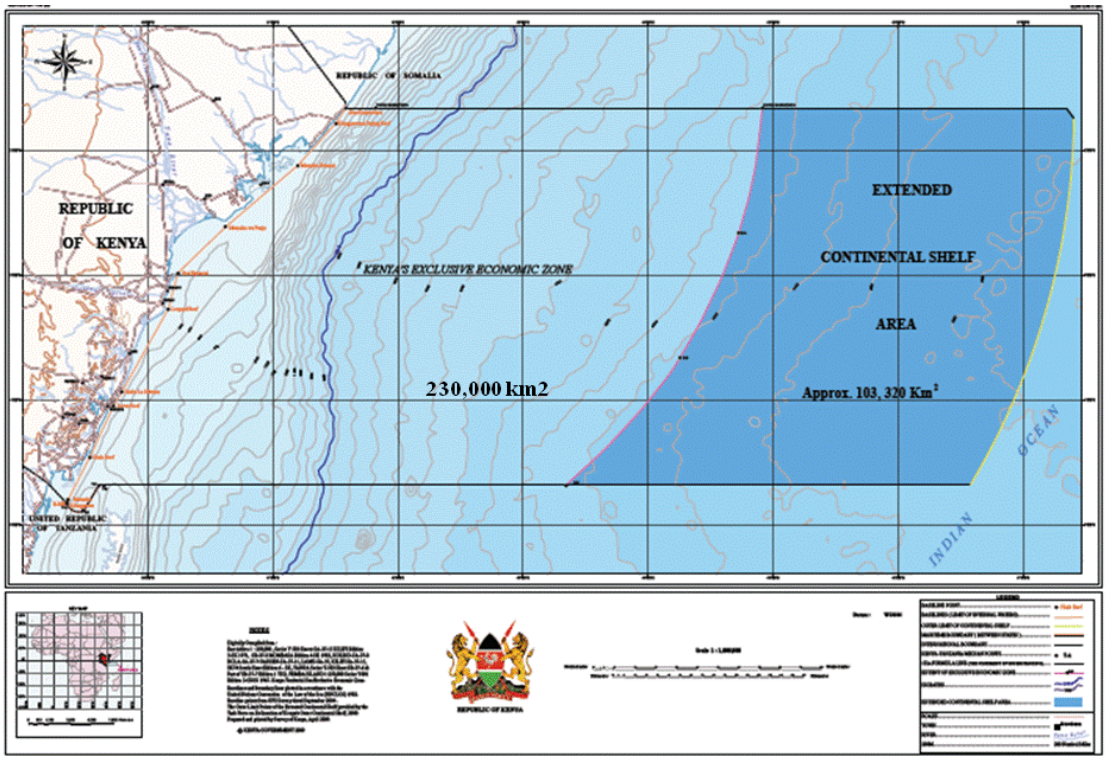

Figure 1. The Kenya coastline, Exclusive Economic Zone and the Continental shelf

Under the national development blue print, Vision 2030 and MTEF/P 2013-17, the country aims to achieve sustainable fisheries development through "innovative and commercially oriented fisheries sector, and improving the value gained in the production and supply chain" in order to improve food security for human wellbeing and attain mid-income economic status by the year 2030. The National Oceans and Fisheries Policy (2008), identifies low utilization of the EEZ for the exploitation of marine living resources as a challenge in the development and management of the fisheries sector. Fisheries

development is, therefore, one of the projects and programs to be undertaken by the government agencies as a foundation for national economic transformation by (1) increasing fish production from capture and culture fisheries (2), reducing postharvest losses and (3) development of the EEZ marine fisheries.

KMFRI conducts fisheries and aquatic research to provide data and information to guide and support the management of aquatic resources in Kenya. KMFRI has been pivotal in the Western Indian Ocean (WIO) region where it has played a leading role in regional research projects and programs including the Fridtjof Nansen Research surveys in the 1980s, the Tyro Expedition (1990s), the SWIOFP and ASCLME programs (2008 – 2013) and more recently the KCDP that runs from 2010-2016. As a centre of excellence for marine research in the WIO region, KMFRI will continue leading marine research in the region and enhance the contribution to the national development agenda. Equally, KMFRI needs to re-direct its energies towards building research infrastructure and human capacity and networks to fully contribute to the national and regional research agenda.

National Marine Research and Information Needs

With increasing demand for natural resources, continuing population growth, and budgetary declines, coastal communities face numerous challenges to the health and sustainability of their marine and coastal resources and habitats that include pollution, habitat loss, invasive species, shoreline change, and biodiversity loss. Given the size, complexity and interconnected nature of the ecosystems, more integrated approaches to conserving and managing our marine and coastal systems are needed. Such an ecosystem-based approach must be based on science and greater knowledge of coastal and marine ecosystems, including how they are affected by human activities. Comprehensive information is needed to answer environmental, economic, and social questions in a way that is site specific, considers the entirety of the ecosystem, and provides a strong scientific basis for decision makers. Effective policy and management depend upon information, research, and outreach coordinated at both local and national levels.

National Oceans and Fisheries Policy (2008) as well as ICZM policy (2014) emphasize the importance of ecosystem based management approaches as a cornerstone of sustainable coastal development. They call for enhanced scientific efforts at the national level to provide essential information for managing ocean and coastal ecosystems for human well-being.

For decades, KMFRI has worked with other partners to conduct scientific research, education, training, and extension projects designed to foster science-based decisions about the use and management of aquatic resources in Kenya. The KMFRI strategic document (2010-2015) identified four broad information needs: 1) research; 2) data collection, monitoring, and observations; 3) useful information products; and 4) outreach, education, training and technical assistance for decision makers.

Kenya – Belgium collaboration in marine sciences

A number of programs have been developed through the collaboration to help achieve the set of objectives and priorities which include:

- Cooperation in the field of Marine Ecology and Management of the Coastal Zone that invested in provision of research equipment and education.
- Higher Institute for Marine Sciences that supported studies in planktons, reef ecology, water chemistry, coastal oceanography and modelling, fisheries, algae, pollution and library resources.
- Implementation of two successive EC-funded projects on dynamics of mangrove ecosystems and the link between mangroves, seagrass beds and coral reefs.
- TYRO expedition-Volunteered by the Netherlands that looked into the effects of the monsoonal regime on coastal marine systems.
- RECOSCIX-WIO, which was Regional Cooperation in Scientific Information Exchange in the Western Indian Ocean.

- Research towards sustainable exploitation of natural resources in mangrove forests.
- Over the years continuous scholarships have been provided to provide capacity building for Kenya students
- Over a period of five years aquaculture research on *Artemia* production in salt ponds has been implemented
- Recently a research vessel (RV Mtafiti) has been donated to aid in offshore research activities and information exchange through maintenance of a digital library is in place

Overall, these collaborations and partnerships have led to the enhancement of human capacity and equipment support.

Regional and National Collaboration in Marine Sciences

KMFRI is empowered by its mandate to address various regional, international, and trans-boundary issues besides national ones in which the Kenyan Government has committed itself through regional and international agreements and conventions. KMFRI therefore collaborates with various national, regional and international institutions to build up various multi-skilled and multidisciplinary research teams to undertake demand-driven research; addressing issues of national and global concerns.

At international level, KMFRI signed memoranda of understanding (MoUs) for collaboration with VLIZ of Belgium, Nagasaki University of Japan, Scripps Institution of Oceanography in the US, Lake Turkana Basin Institute (TBI) and the Centre for Ecological Research of Kyoto University in the period 2011-2012. KMFRI also collaborates with other regional and international institutions under the Western Indian Ocean Marine Science Association (WIOMSA), the South West Indian Ocean Fisheries Project (SWIOFP), the Agulhas and Somali Current Large Marine Ecosystem Project (ASCLME) and the Lake Victoria Fisheries Organization.

At national level, KMFRI has MoUs with national universities and agencies, including; Universities of Maseno, Nairobi, Kisii, Pwani and Mombasa Technical, Eldoret, Kenyatta, Jomo-Kenyatta; as well as with Kenya Forestry Research Institute and the Kenya Wildlife Service. In addition, KMFRI has continued collaboration with other Government Agencies on issues relating to coastal and marine resources.

Partnership with Flanders Marine Institute (VLIZ)

One of the key collaborative research agreements signed in the recent past has been between KMFRI and the Flanders Marine Institute (VLIZ) of Belgium. The agreement seeks to promote partnership in the areas of:

i. Development and execution of collaborative research projects between (1) KMFRI and its marine and coastal science network in Kenya, and (2) VLIZ and its marine and coastal science network in Flanders, Belgium.
ii. Exchange of expertise and exchange of (1) faculty, research and academic staff, (2) technical experts (ICT specialists, data and information managers, marine technicians, nautical experts, communication specialists, etc.) and (3) students
iii. Capacity building for research, technology development (including research vessels and navigational and sampling equipment), data management and education.
iv. Exchange of data and information
v. Jointly producing derived products from research, data and information (e.g. joint scientific publications, communication and outreach products like websites, books, posters, multimedia etc.

The recently concluded VLIR-UOS mission to KMFRI while identifying the country strategy for Kenya emphasized the pivotal role KMFRI plays in advancing marine sciences for national development. The global nature of the VLIR-UOS collaboration strategy further enhances the existing partnership between KMFRI and the network of Belgian institutions and universities.

Research Vessel RV Mtafiti

The RV Mtafiti, which was donated to KMFRI by the government of Belgium, was one of the immediate action points of the MoU between KMFRI and VLIZ. RV Mtafiti was commissioned by HE Hon. Uhuru Kenyatta, the President of the Republic of Kenya, on 27 January 2014 where he gave a directive for the immediate operationalization of the vessel. The vessel opens a wide array of avenues for collaborative research at the global, regional and national level. The research themes are geared towards addressing issues pertaining to ocean resources and ocean health. The RV Mtafiti brings along the much needed capacity to enhance marine sciences in the WIO region while promoting sustainable fisheries resource use, and ocean environmental integrity. The kind of scientific research achievable with RV Mtafiti is global in nature and as such addresses research objectives beyond the national and regional Western Indian Ocean (WIO) region. As such the vessel provides a unique opportunity for collaboration with national, regional and international partners through joint projects. Some of the activities targeted under RV Mtafiti are to:

i. undertake fisheries stock assessment in territorial waters and the entire EEZ
ii. map out the seasonal distribution of the demersal and pelagic fish species
iii. map out the existing coastal fishing grounds, and new offshore fishing grounds
iv. map out the bottom sea bed to determine all the trawl able and untrawlable areas for advice on fishing gear use
v. map out the physical, chemical and biological oceanographic features that determine the productivity in territorial waters and the EEZ
vi. undertake offshore Environmental Assessment and EIA

About the conference on 'Sustainable use of marine and coastal resources in Kenya: from research to societal benefits'

The conference was one of the action points of the MoU between KMFRI and VLIZ and aimed to host professionals from the two institutions and the network of partner universities and institutions to discuss the sustainable use and management of marine and coastal resources in Kenya. The objectives of the conference were:

i. to provide a forum for professionals and stakeholders to discuss pertinent issues pertaining to the sustainable use of Kenya's marine and coastal resources;
ii. to map out strategies for enhancing societal and economic benefits from Kenya's coastal and marine resources;
iii. to provide a forum of exchange for ideas with international partners on sustainable use of Kenya's newly acquired Research Vessel RV Mtafiti;
iv. to develop a framework for long-term development cooperation between Kenya and its regional and northern partners with respect to sustainable management of its coastal and marine resources.

The conference provided strategic orientations and recommendations based on the status of marine science research and contribution to management in Kenya and the region and the role of KMFRI in a rapidly changing scientific world with high economic potential. It identified priorities and options for research, policy adjustments, catalytic investments, and entry points for other investors to foster environmental friendly marine resource exploitation, wealth-creating, and sustainable mariculture.

2. THEMATIC PRESENTATIONS

OPENING SESSION

Welcome remarks by Dr. Renison Ruwa, *Director KMFRI*

Aims and objectives of the conference by Prof. Jan Mees, *Director VLIZ*

Welcome speech by Lou Dierick, *Honorary Consul, Mombasa*

Welcome speech by Roxane de Bilderling, *Belgian Ambassador to Kenya*

Welcome speech by Prof. Japhet Micheni Ntiba, PS, Ministry of Agriculture, Livestock and Fisheries

Opening address by Chief Guest, Felix Koske, Cabinet Secretary, Ministry of Agriculture, Livestock and Fisheries

Opening Session

Dr. Renison Ruwa opened the conference by welcoming all participants and speakers.

While welcoming the Honorary Belgian Consul, **Prof. Jan Mees** paid tribute to the late Prof. Emeritus Philip Polk as an introduction of what the Honorary Consular was to present. He further made reference to the past and present Kenya – Belgium collaboration and the joint activities undertaken between KMFRI and the Flanders Marine Institute (VLIZ), touching on the development and subsequent signing of the Memorandum of Understanding (MoU), under which this conference was conceived and organised. Prof. Jan Mees outlined the aims and objectives of the conference.

The Honorary Consular, **Lou Dierick**, paid full tribute to the person and deeds of the late Prof. Emeritus Philip Polk, confirming the talk and letter on this great scientist and founding father of the Kenya – Belgian Project (KBP) in Marine Sciences, which brought together the Belgian Universities (among them, the Free University of Brussels, State University of Ghent and the Catholic University of Leuven) with KMFRI and some Kenyan universities (principally, University of Nairobi and Moi University), trained hundreds of scientists in Kenya and Belgium, and generated a lot of data with hundreds of publications and university theses.

Her Excellency the Ambassador of Belgium in Kenya, **Roxane de Bilderling** on her side, presented the new promising Kenya – Belgium collaboration.

The Principal Secretary for the Ministry for Fisheries Development, **Prof. Japhet Micheni Ntiba**, focused his speech largely on fisheries matters and scored the sub-sector to play a significant role in the national economy. That though the sub sector contributes 4-6 % to GDP each year, this can increase tremendously when value addition is considered at the various stages of the supply / value chain and post-harvest losses are minimized. The paper further pointed out that the sub-sector supports about 100,000 people directly and another 900,000 people indirectly. These economic figures are, however, based on traditional fishing areas and practices. Further improvement is anticipated once the level of investment in the sub-sector towards the Exclusive Economic Zone (EEZ) is engaged. The Government of Kenya has, therefore, made deliberate shift in focus and attention to the open deep ocean waters to spur this fishery development.

The minister further noted that through strategic research undertaken by KMFRI, it has been shown that fish stocks have declined in the shallow waters, traditionally fished by artisanal fishermen, the need to explore the feasibility of up-scaling production from Kenya's territorial waters on the Indian Ocean and the Exclusive Economic Zone (EEZ). This will be achieved if research is undertaken in the territorial waters and the EEZ, and should witness increase fish production from the current 7,000 tons to 20,000 tons per year, in the immediate future and grow industrial fish production from nil at the moment to over 50,000 tons per year, in the medium term. This Kenya – Belgium collaboration will get better when the two partners, Kenya and Belgium, undertake cooperative expeditions into the Indian Ocean.

The Kenyan coast is located within the tuna belt of the South West Indian Ocean, yet production from the offshore waters is not established. Most of the distant waters fishing nations (DWFN) fleets which operate in these waters do not land, trans-ship or declare their catch in the country. In addition, the Kenyan fishermen have not been able to exploit the EEZ due to various incapacities and lack of sea fare culture in the country. However, with support from funding from the World Bank, the Government of Kenya has set up a Monitoring, Control and Surveillance (MCS) system for the EEZ to enforce compliance with fishing regulations. We are also constructing an Offshore Patrol Vessel (OPV) to strengthen the capacity to patrol the EEZ as well as control and eradicate IUU fishing.

The Cabinet Secretary, **Felix Koske**, whose speech was read by Prof. Japhet Micheni Ntiba went further to say, "I understand that the successful research in seaweed mariculture and working together with coastal communities in the experimental seaweed farms in South Coast, is empowering the coastal communities, especially women folk, to the extent that they can now produce about 20,000 – 40,000 tons of dry seaweed per village group of about 100-200 persons annually. The potential for seaweed and off-shore farming is, indeed, very significant. Therefore, as Kenya ventures into the open sea, it will be imperative that new partners come on board to help develop the capacity for deep sea research. To this end, I want to once again thank the Government of Belgium for donating RV Mtafiti for the much needed ocean research work. I am also informed that the Government of Belgium is in the process of developing a new phase of cooperation in marine sciences through the Flemish Interuniversity Council for development cooperation (VLIR-OUS). VLIR-OUS have just concluded a one week mission in Kenya to consult with 15 participating Universities and the Kenya Marine and Fisheries Research Institute. KMFRI has strongly participated in this process from inception, through the institutional review and into the consultative sessions. My Ministry will support this initiative and ensure that potential enterprises develop from this cooperation for the benefit of the coastal communities as well as our national economy. Besides, I shall be working with my colleague Cabinet Secretary of Education, Science and Technology to forge greater cooperation in the teaching of marine sciences in Kenya through our Universities and Kenya Marine and Fisheries Research Institute".

SESSION 1: SETTING THE SCENE

SESSION CHAIRS:

Renison Ruwa (KMFRI)

Jan Mees (VLIZ)

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KEYNOTE SPEECH: IMPORTANCE OF MARINE SCIENCES IN DEVELOPING COUNTRIES

The opening keynote speech of **Prof. em. Mohamed Hyder (Kenya)** set the mood for the conference and emphasized the need to link research, science and technology to national policies. Among the Kenya policy guiding documents in this direction are the National Constitution 2010 and the Kenya Vision 2030. Other notable guiding policy documents include the National Oceans and Fisheries Policy 2008 (currently under review), the Agricultural Policy Framework, the KMFRI Research and Intellectual Property Rights Policy, the National Research, Innovation and Technology Policy (under the National Commission for Science, Technology and Innovation), the KMFRI Research Mandate as provided in CAP 250 of the National Science and Technology Council (1979), and lately, the Jubilee Manifesto (2013).

According to Prof. em. Hyder, meaningful marine sciences for sustainable development must go along with supportive research and development (R&D) governance policies that will allow implementation of the appropriate research and development discoveries made to spur industrial growth especially in a Private – Public – Partnership Program (PPP) approach. Such an approach must include capacity building both for human skills and infrastructure development, staff retention and correct placement and an environment to promote excellence for enhancement of productivity and motivation.

In a joyful mood and living true to his style, Prof. Hyder kept the conference in smile and laughter as he declared that in the last 34 years of KMFRI's existence, we have witnessed how successful international and bilateral partnerships, with special reference to the Kenya – Belgium Project (KBP) in marine sciences (1985-1995) has transformed a national institution to a regionally and internationally recognized marine science research institute. Access to data and information was almost a global nightmare in the past, but thanks to internet technology we can now relatively talk of cautioning ourselves against being drowned with information and data, almost at real time, and therefore be very critical on how we chose and do quality control of the information and data to use.

To make meaningful marine policies, there must be significant investments in multidisciplinary ocean health and human well-being programs which is presently an emerging integrative field. In this regard, there is a need for effective maritime and public health policies as an integral part of the socio-economic aspect for the human well-being. Being a new approach in developing countries, there is a significant gap in our knowledge to make sufficient account of human and ocean health aspects in maritime policy making.

The meeting was seen to be strategic in the sense that it brought together representation from policy makers, the international community, private sector, marine scientists, the public that use marine information, and other relevant stakeholders to share and exchange views and chart the way forward on best practices to sustainably increase ocean productivity and improve on the livelihoods of coastal communities through increased access to ocean resources, improved technology transfer, capacity building and development, and enhanced north-south and south-south cooperation in ocean research. Therefore, the forum presented an excellent opportunity for Kenya to learn and cross-fertilize research ideas, ocean management skills and conservation practices with the developed world and regional partners in the Western Indian Ocean (WIO) region. The Indian Ocean is the third largest ocean in the world, covering about 30% of the global ocean and is rich with a variety of both unique living and non-living resources.

KEYNOTE SPEECH: SHORT HISTORY OF KENYA-BELGIUM COLLABORATIONS AND THE MARINE SCIENCE LANDSCAPE IN BELGIUM

Prof. Jan Mees (Flanders Marine Institute, Belgium) presented the long and successful history of collaboration in marine sciences between Belgium and Kenya. Prof. Mees gave an overview of the current research groups in Flanders – Belgium conducting marine, coastal and/or estuarine research with an emphasis on those research groups with an interest in collaborations with Kenya such as the Laboratory of Aquaculture and Artemia Reference Center (UGent), Laboratory of Environmental Toxicology and Aquatic Ecology (UGent), Marine Biology Research group (UGent), Plant Biology and Nature Management Laboratory (VUB), Research group Analytical and Environmental Chemistry (VUB), Laboratory of Systems Ecology and Resource Management (ULB), and the Laboratory for Toxicology and Food Chemistry (KULeuven).

Prof. Mees further explained how this tradition of collaboration and the available expertise and interest in Flanders – Belgium offers the strongest possible foundation to build new collaborations upon. In view of this, the renewed VLIZ-KMFRI collaboration can provide an umbrella under which ongoing and new Kenya-Belgium collaborations can be clustered.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

MARINE SCIENCES IN THE WESTERN INDIAN OCEAN REGION: THE STORY OF WIOMSA

Dr. Jacqueline Uku (Kenya Marine and Fisheries Research Institute, Kenya), the president of WIOMSA, explained how WIOMSA, established in 1993, and facing a myriad of challenges grew out to be a regional centre of excellence in the WIO region.

Dr. Uku gave an overview of the main activities of WIOMSA, which currently involve:

- linking science to governance processes
- capacity and professional development to conduct quality research and for improved management
- enhancing access to relevant knowledge and information
- strengthening networks and partnerships
- outreach and resource mobilization
- institutional strengthening of WIOMSA

Dr. Uku ended here presentation with some priorities for future actions aimed at sustaining the achievements made in marine sciences in the region:

- **consultation**: national, regional and Africa wide processes such as NEPAD for selecting priority areas of research for commissioned research;
- **long-term sustainability**: WIOMSA is working hard to identify alternative funding sources and revenue generating mechanisms to support WIOMSA program of activities in the long-term;
- **increasing engagement** of regional institutions/experts in regional initiatives;
- **regional "Research Council"**;
- **Going beyond research outputs**: from just recommendations to piloting potential solutions.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

THE KENYA COASTAL DEVELOPMENT PROJECT (KCDP): MATCHING SCIENCE WITH DEVELOPMENT

Dr. Jacqueline Uku (Kenya Marine and Fisheries Research Institute, Kenya), as the coordinator of KCDP, presented the KCDP, a project funded by the International Development Association (IDA) and the Global Environment Facility (GEF) and aimed at improving management effectiveness and enhancing revenue generation of Kenya's coastal and marine resources.

Dr. Uku explained that the KCDP provides support for interventions in fisheries, natural resource management, alternative livelihoods, capacity building and provision of small grants for community development. She highlighted the achievements made in each of the core project areas and ended the presentation with a list of opportunities that the project offers the coastal counties:

- matching community needs with technical support from the Government Agencies;
- matching research interventions with livelihoods;
- opportunities for capacity building at the community level, especially under the Hazina Ya Maendeleo Ya Pwani granting process;
- opportunities to grow confident entrepreneurs;
- opportunities to leverage and up-scale good practices in environmental conservation;
- opportunities to enhance media outreach & communication & policy interventions – looking for opportunities to tell the stories of the Kenyan coast.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

MARINE SCIENCES IN THE AGULHAS AND SOMALI CURRENT LARGE MARINE ECOSYSTEMS (ASCLME) PROJECT

Ms. Lucy Scott (ASCLME House, South Africa), previously Data and Science Coordinator of the ASCLME project, presented the UNDP/GEF financed ASCLME Project (2008 – 2014) that has been concerned with the improved transboundary, ecosystem-based management of the threatened and interdependent coastal and marine regions in nine countries of the Western Indian Ocean (WIO), including Kenya.

The ASCLME project set out to gather new and important information about ocean currents and how they interact with and influence the climate, biodiversity and economies of the western Indian Ocean region. In parallel, it sought to strengthen scientific and management expertise, with a view to introducing an ecosystem approach to managing the living marine resources of the western Indian Ocean region.

The countries of the WIO have agreed on an overarching Strategic Action Program (SAP) for the WIO. The next GEF-funded activity will be a follow-up project building on the ASCLME, but aimed at implementing elements of the SAP. The objectives of this SAP implementation should aim to deliver and execute the agreed management reforms and policy realignments for effective long-term ecosystem management in the Western Indian Ocean LMEs.

The countries have endorsed the new project, named the Strategic Action Program Policy Harmonisation and Institutional Reforms (**SAPPHIRE**) Project. The project has five components:

1. Executing Management and Policy Reforms through a Knowledge-Based Governance Mechanism
2. Stress Reduction within the LMEs through Community-Level Stakeholder Engagement and Empowerment in SAP Implementation
3. Stress Reduction in Marine Pollution within the WIO LMEs through Private Sector/Industry Commitment to transformations in their Operations and Management Practices
4. Innovative Management Mechanisms for Extended Continental Shelf and High Seas Areas with the LMEs
5. Capacity Building and Training for Effective SAP Implementation and Long-term Ecosystem Monitoring

Project implementation is likely in the first half of 2015.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Marine science in a global context and the Second International Indian Ocean Expedition

Mr. Mika Odido (IOC Sub Commission for Africa and the Adjacent Island States, Kenya), spoke about the importance of the oceans as an economic and cultural resource and the role of IOC of UNESCO to promote international cooperation and coordinate programs in research, services and capacity building, in order to learn more about the nature and resources of the ocean and coastal areas; and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making processes of its Member States.

Mr. Odido then presented on the first International Indian Ocean Expedition (IIOE 1959-1965) that became the first major program of IOC in 1962. The IIOE involved more than 40 research vessels from 25 different countries and generated a wealth of knowledge on the Indian Ocean.

Mr. Odido further announced that IOC and SCOR are planning the second International Indian Ocean Expedition, which will provide an opportunity to:

- enhance our understanding of the Indian Ocean and address knowledge gaps, especially in the Western Indian Ocean region;
- address the issue of science to governance, knowledge transfer to government structure, and societal benefits of research results;
- to create public awareness and public advocacy related to ocean issues;
- to develop capacity at all levels.

Mr. Odido advised that a structured approach should be developed to ensure optimal use of these opportunities and that experts/institutions in the region need to be actively involved in the cruises and other observation systems implemented in the region, including contributing to their planning. This will ensure better use of the opportunities provided by the expedition. IOCAFRICA and WIOMSA will be responsible for the planning and coordination of the IIOE.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

KENYA IN THE WESTERN INDO-PACIFIC REALM - ITS CORAL REEFS IN SPACE AND TIME

Dr. David Obura (CORDIO East Africa, Kenya) spoke about Kenya's position in the diversity and evolutionary origins of Western Indian Ocean corals. He elaborated on the current status of Kenya's coral reefs and discussed the future prospects.

Dr. Obura explained that increased exploitation of marine resources, increasing coastal development, the likely expansion of economic activity driven by Kenya's emerging economy and the development of the LAPSETT corridor in the north, and climate change and ocean acidification impacts will place increasing pressures on Kenyan marine systems. Concurrently, changes in these same factors in other parts of the WIO will influence the fate of Kenya's marine resources, and in particular, massive development driven by fossil fuel extraction in the Mozambique Channel may be an important factor in the future wellbeing of Kenya's marine resources.

Dr. Obura highlighted that an understanding of the regional dynamics and dependencies, and of the resilience and ability of local systems to sustain extraction and recover from disturbances will be critical to rational management of Kenya's EEZ and coastal resources and ecosystems.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

SESSION 2: SUSTAINABLE USE OF MARINE RESOURCES

SESSION CHAIRS:
RENISON RUWA (KMFRI)
JAN MEES (VLIZ)

Mrs. Susan Imende (Ministry of Fisheries Development, Kenya) presented the importance of fisheries and aquaculture in promoting health, eliminating hunger, poverty reduction and employment and livelihoods to the people. Mrs. Imende outlined the policy priorities in fisheries according to the Country's development agenda as follows: (1) increase production and productivity by the sustainable development of the EEZ fisheries and mariculture, (2) value addition and new products, (3) enhance market access for fish and fisheries products, (4) enable policies and legal framework and (5) research.

Towards the purpose of the conference, Mrs. Imende summarized the opportunities for fisheries and aquaculture research:

- support in policy and legal framework to support technology and innovation
- support in capacity building for offshore research – new products found in the areas beyond national jurisdiction,
- urgent need for data to support policy decisions, resource rent& access framework
- support for mariculture- proposed marine hatchery development at the coast
- investors willing to venture into production and processing
- county governments' willingness to support innovations to improve the lives of their people
- climate change
- trade regimes at national and international markets

Furthermore, she suggested the establishment of linkages that will increase information flow and synergies between research institutions and society.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Dr. Renison Ruwa (Kenya Marine and Fisheries Research Institute, Kenya) spoke about the importance of using appropriate scientific processes and models to ensure an integration of the three pillars (economic, social, and political governance) anchored in the Kenya Vision 2030 in terms of marine science research for societal benefits.

Dr. Ruwa emphasized that the nature of these scientific processes/models must have abilities to integrate ecological systems, socio-economics for human well-being and governance/policy. These scientific processes/models are: Ecosystem-Based Management (EBM), Integrated Coastal Zone Management (ICZM) and Ecosystem Approach to Fisheries (EAF). These three fundamental processes (EBM, ICZM and EAF) include the three pillars of vision 2030 and are therefore suitable to address the vision 2030 objectives. Besides these three processes, also food security, environmental health and wealth creation to support human well-being provide a further advantage of providing ecological values which are additional values addressing Kenya's Vision 2030.

Dr. Renison Ruwa outlined the way forward where research undertakings should focus on integrated assessments for managing not only the human well-being aspects but also environmental health and sustainable use of natural resources, their conservation and management. It is therefore important to create long-term multidisciplinary databases for integrated assessments needs at national, regional and international levels. As a developing country, Kenya has benefited from partner projects e.g. the KBP, SWIOFP, ASCLME, FAO-EAF Nansen to obtain data which can be used in an integrated assessment.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

MARINE POLLUTION ALONG THE EAST AFRICAN COAST: PROBLEMS AND CHALLENGES

Prof. Colin Janssen (Ghent University, Belgium) presented the problematics of marine pollution threatening the marine and coastal resources in East Africa, with emphasis on the situation in Kenya.

Prof. Janssen explained that only a very limited number of papers on coastal water pollution in Kenya are currently available in open literature. There is a general scarcity of information on the type and distribution of contaminants (exposure), their effects and their potential risks to man and the environment. A literature review reveals fragmented research and the absence of sustained monitoring of chemical substances (and others) in Kenyan waters. To better understand and manage the marine resources in the context of an integrated management of coastal and marine (offshore) resources, Prof. Janssen stated that there is a clear need to develop and implement research and sustained monitoring capacity of marine pollution (e.g. PCB's, Cadmium, mictoplastics,…) and other environmental stressors (e.g. toxic algal blooms) in Kenyan waters.

Prof. Janssen suggested several types of routine monitoring:

- Analytical methods: UHPLC-MS, ELISA, ...
- Phytoplankton monitoring: skilled experts, automated systems
- Satellite imagery: Chl A, surface t°, …

Prof. Janssen concluded that sustained fundamental and applied research will lead to improved assessment, monitoring and prediction of potential risks and sustainable management of coastal and marine resources for the benefits of man and the environment.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

THE IMPORTANCE OF OCEANOGRAPHY AND HYDROGRAPHY IN KENYA

Dr. Charles Magori (Kenya Marine and Fisheries Research Institute, Kenya) presented the activities of the oceanography and hydrography department of KMFRI.

Dr. Magori explained the main challenges the department is facing:

- high cost of marine observation platform and equipment (e.g. Research Vessel, CTD, ADCP, etc.);
- inadequate scientific and technical capacity in the areas of physical oceanography and coastal hydrology;
- develop capacity to make our own survey charts;
- piracy in the WIO region.

Dr. Magori suggested potential areas for collaboration and research opportunities:

- joint oceanographic (physical, chemical, biological and geological) cruises between KMFRI and VLIZ teams on-board RV Mtafiti;
- topographic and bathymetric mapping (MBES) – bathymetric charts;
- hydrographic surveys for the inshore areas (creeks, bays, lagoons, and nearshore and some parts of the outer shelf in order to add to the GEBCO data, improve navigation and for model development to mitigate erosion, pollution (oil/sewage), tsunami inundation and early warning, maritime transportation in, into/out of harbours;
- enhanced ocean surface, sub-surface and atmospheric observations to further understand these processes to improve the ocean forecasting;
- deployment of drifting buoys and Argo floats for integrated observations;
- capacity building in oceanography (internships, MSc and PhD courses for young scientists);
- satellite oceanography and climate change (SST, SSS, Sea state, altimeter, etc.)

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

MARINE FISHERIES RESEARCH IN KENYA

Dr. Edward Kimani (Kenya Marine and Fisheries Research Institute, Kenya) gave an overview of the marine fisheries (research) in Kenya, the resulting management plans and the role fisheries takes up in the Kenya Vision 2030 (National Economic Development Plan for Kenya) with regards to food security and economic development.

Dr. Kimani further outlined future opportunities and priorities for fisheries research, also using the newly acquired RV Mtafiti:

- monitoring control and surveillance (RV Mtafiti)
- acoustics pelagic species surveys
- fishing gear trials
- ocean environment research

Opportunities for collaboration:

- joint national/regional oceanography and fisheries research cruises
- university studentships for higher degrees in marine science: collection of research data and samples
- sharing laboratories facilities and equipment with local and foreign universities, and other research institutions
- national/regional annual research review and planning forum

RESEARCH VESSELS AS AN ESSENTIAL TOOL FOR OCEAN EXPLORATION AND DATA ACQUISITION

Dr. André Cattrijsse (Flanders Marine Institute, Belgium) explained how research ships and the associated equipment are essential to marine sciences and crucial to gather the data and knowledge needed to manage and to secure marine resources for future generations. Dr. Cattrijsse focused especially on the RV Mtafiti, as he outlined the technological capabilities and limits of the ship and how to operate a research vessel in terms of financial costs, scientific desires, cruise planning and setting up a sailing schedule. Further, Dr. Cattrijsse outlined the value of the RV Mtafiti as a research platform for the Kenyan inshore and offshore waters against the societal and scientific needs and the technological capabilities.

Finally, Dr. Cattrijsse suggested some societal relevant research topics for the WIO region that can be tackled using the newly acquired RV Mtafiti:

- Pollution control
- Declining fish stocks and development aquaculture
- Climate change and the role oceans play in it
- Ecosystem health and sustainability
- Management of natural resources
- Marine impacts on human health (HAB)
- Predictability of marine hazards & maritime safety

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RV MTAFITI SCIENTIFIC STRATEGY FOR SUSTAINABLE RESEARCH IN THE KENYAN AND WIO WATERS

Dr. Enock Wakwabi (Kenya Marine and Fisheries Research Institute, Kenya) presented the scientific strategy KMFRI has laid out for sustainable research using the new RV Mtafiti. The global research objective for RV Mtafiti is "to enhance marine science while promoting sustainable economic development, food security and marine environmental health."

Dr. Wakwabi further listed the global research thematic areas being fisheries, chemical and physical oceanography, ocean productivity, marine geology together with their specific objectives and expected outcomes. Potential participation of RV Mtafiti in collaborative research projects in the WIO might involve the IIOE-2 project of IOC-UNESCO (1 year) and the GEF UNDP SAPPHIRE project (5 years). While next to collaborative research, the objective for RV Mtafiti also includes capacity building and the development of collaborative training modules with other national, regional and international institutions in marine sciences.

Dr. Wakwabi finished the presentation by sending an open invitation to all parties interested in using RV Mtafiti to plan and budget the use of Mtafiti jointly and in a way to provide smart solutions for resource use and management.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Fisheries governance in coastal and marine Kenya under the Kenya Coastal Development Project

Mr. Kennedy Shikami (Kenya Marine and Fisheries Research Institute, Kenya), manager of the first component of the KCDP (sustainable management of fisheries resources), presented the objectives, achievements and challenges of this component.

Specific objectives are to (1) improve marine fisheries governance through increased marine fisheries management capacity, by implementing a cost-effective monitoring, control and surveillance (MCS) of the fisheries in the EEZ, (2) advance research on coastal and nearshore fish stocks, promoting alternative fishing technologies and supporting linkages between fishermen, processors and fish mongers and (3) increase fish production through aquaculture.

The major achievements so far were the (1) development of action plans, strategies and management plans for pelagic fisheries, ring nets, the MCS…, (2) the establishment of MCS training and (3) the trials of different fishing gear.

Two main challenges are the high expectations the communities and stakeholders hold and the resources available to the project. However, law enforcement remains the key challenge in fisheries management. Periodic inshore patrols in collaboration with Beach Management Units (BMUs) and development of Management Plans for Priority Fisheries are possible alternatives.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

LEGACY AND LESSONS FROM SWIOFP – 2 YEARS ON

Prof. Johan Groeneveld (Oceanographic Research Institute, South Africa) spoke about the South West Indian Ocean Fisheries Project (SWIOFP) which formed part of the Global Environment Facility (GEF) Large Marine Ecosystems Program in the Western Indian Ocean between 2008 and 2013. SWIOFP aimed to assess existing and potential offshore fisheries; provide scientific information for developing fisheries management plans; strengthen institutional capacity; and foster collaborative networks across the region.

Prof. Groeneveld focused on the lessons learnt from SWIOFP and provided advice for future WIO projects:

- The **participatory process** in project design and implementation, which ensured stakeholder buy-in and relevance of project objectives proved better than using consultants and resulted in the development of a strong regional collaborative network.
- An extensive **Master's degree** program proved efficient in achieving 2 objectives simultaneously, at relatively low cost: contributing to SWIOFP scientific outputs through analysis of survey data and capacity development to an MSc level.
- Linking fisheries research projects with RFMO's (such as the **SWIO Fisheries Commission**) provided significant benefits, and enhanced post-SWIOFP continuity.
- The **project design was over-optimistic**, given existing infrastructure limitations. Parts of SWIOFP (i.e. integrated region-wide fisheries observer program) could therefore not be implemented satisfactorily, and placed a heavy burden on project resources.
- Not enough attention was given to **data analysis** for use in fisheries management.
- The complexity of SWIOFP (multiple countries, languages, needs) required **a long run-up time** to render project management structures efficient. Science (conceptualization, data collection, analysis, reporting, write-up) is a multi-year process, so that many SWIOFP outputs have only been achieved after project conclusion.
- An **exit strategy** providing for continuity is crucial.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

DEMERSAL FISH STOCK ASSESSMENT IN THE KENYAN EEZ: CURRENT STATUS AND OPPORTUNITIES

Prof. Boaz Kaunda-Arara (University of Eldoret, Kenya) presented the problematics of overexploitation of nearshore fish stocks based on the results of a demersal fisheries resources survey and deep slope species.

Prof. Kaunda-Arara explained that the deep slope fisheries resources, that remain largely unassessed, could form an alternative source of livelihood and economic income to the artisanal fishers.

The South West Indian Ocean Fisheries Project (SWIOFP) that concluded in 2013 surveyed the demersal fisheries resources on the Kenyan coast over a bathymetric scale that ranged from shallow (10-50m) to deep slopes (> 100km) on the continental shelf during the NEM season of 2012. These datasets show the potential of an offshore demersal fishery in coastal Kenya. The major observations during the surveys were:

- New unknown stocks were not located following historical surveys (Ujuzi; Dr. F. Nansen).
- Very high species diversity (147 species, 19 families) with interesting deep water fish species was found.
- The shallow water fish species are already known to shrimp trawlers exploiting the MUB.
- Investments In trawl fishery in deep water seems not feasible.

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Gladys Okemwa (Kenya Marine and Fisheries Research Institute, Kenya) presented the work being done within the Fisheries subcomponent of the KCDP regarding the need to explore alternative strategies to relieve the fishing pressure in inshore areas. The KCDP research sub-component invests in research towards promoting sustainable exploitation of fisheries resources and achieving greater economic benefits to fishermen. The key objectives are to advance research on coastal and nearshore fish stocks and to promote alternative fishing technologies

Mrs. Okemwa listed 6 objectives accompanied by the progress/plans made to reach each objective:

1. to assess the status of priority fisheries stocks and impacts of fishing on the stocks;

Progress: indicator species and pilot study sites were identified, data collection was standardized and community consultative meetings, field surveys and biological samplings were held.

2. to develop management strategies based on stock assessments;

Progress: fishery management plans are revised for prawn fishery, ringnet fishery, small and medium pelagic fishery and aquarium and lobster fisheries

3. to build capacity for conducting fisheries stock assessment;

Progress: mentoring of interns, supporting MSc students, providing short trainings, scientific diving skills regarding stock assessments and fisheries surveys

4. to develop fish aggregation devices (FADs) and assess their effect in enhancing artisanal pelagic fisheries production;

Progress: participatory mapping with fishers near FAD areas and fabrication and deployment of deep water and subsurface FADs in Mtwapa

5. to develop alternative environment friendly fishing technologies;

Progress: promoting the use of gears that reduce by-catch and new fishing methods to better access deep water demersal fish

6. to develop resource use maps of key fishing grounds.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Activities of Quality Control and Value addition sub-component in KCDP Component 1: Fisheries

Peter Oduor-Odote (Kenya Marine and Fisheries Institute, Kenya) gave a presentation on the work being done within the Quality control and value addition sub-component in KCDP.

The aim of this component is to improve the socio-economic benefits from fisheries through the development of enhanced value chains and reduced post-harvest losses. The specific objectives are (1) to contribute to food security through reduced post-harvest losses by proper fish handling and (2) to enhance fish quality assurance, value addition and marketing for improved livelihood.

Mr. Oduor-Odote elaborated on the achievements made in fresh, dry, smoked and fried fish value chain enhancement and marketing.

For the fresh fish cold chain an improved fish banda with icemaker and cold room is being introduced in Shimoni to carter for Kibuyuni fish banda as well in the fresh fish cold chain. Other infrastructure includes introduction of insulated containers for artisanal fishermen to carry ice up-stream, insulated containers at the fish banda, a fishing boat and fish collection boat with insulated containers. For the dry fish chain thirteen improved fish drying racks have been introduced in the pilot site of Jasini-Vanga to avoid contamination of fish by sand particles during drying. Seventeen more are to be introduced to include Jimbo area. For the smoked fish chain eight double door improved fish smoking ovens have been introduced in Mpeketoni that use 60% less wood fuel, smoke more fish per unit time and produce better quality fish. For the fried fish chain three prototype improved fish display shelves have been introduced on trial basis in Kilifi Central of Kilifi county with eco-friendly and chargeable lamps replacing the 'Korobois'. This ensures no contamination of fish and no smoke emission with concomitant reduction in carbon footprint.

With regards to the product development, packaging and marketing, capacity was built among the KMFRI scientists and technologists for the development of value added product. Technology transfer of product development is being implemented with local communities. Product packaging and marketing is being done together with local consultants.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

SESSION 3: COASTAL RESOURCE MANAGEMENT

SESSION CHAIRS:
JAMES KAIRO (KMFRI)
ANN VANREUSEL (UGENT)

Prof. Nico Koedam (Vrije Universiteit Brussel, Belgium) presented the view of his team on how to insert scientific work into a general strategy of effective coastal zone planning.

Integrated coastal zonal planning and implementation are issues of policy and governance, so what is the role of science? This contribution stems from the team's original interest in contributing to a better and sustainable coastal management. Since this original idea, Kenya has evidently not waited. Based on its considerable domestic expertise and in view of environmental and economic challenges for the country much has been done to elaborate an integrated coastal zone planning. This resets and should redefine the role of science in the complexity of global and local stakeholders' interests in the coastal zone. Often, data gaps, lack of baselines, lack of integrative insights weaken the effectiveness of such planning. Also, the valuation discourse appears to direct disproportionately conservation and management priorities and must be assessed critically by science. Scientists are keen not only to deliver commissioned and/or applied policy-support research but also to generate an 'overhead' of fundamental understanding, thus looking ahead to future questions and allowing for the transfer of insights to other locations. Indeed lessons learnt elsewhere must accelerate progress in a science-based conservation and management, moving beyond mere empiricism or trial and error.

BLUE CARBON STORAGE AND CLIMATE CHANGE MITIGATIONS

Dr. James Kairo (Kenya Marine and Fisheries Research Institute, Kenya) presented on the status of blue carbon research in Kenya and the opportunities therein.

Dr. James Kairo explains how tidal marshes, mangroves and seagrass meadows sequester and store large quantities of blue carbon and how the degradation or destruction of these ecosystems releases all the stored carbon back into the atmosphere as CO2 emissions. These emissions are now being recognized by the IPCC and UNFCCC as significant sources of GHGs. This being said, Dr. James Kairo stressed that effective management and conservation of coastal wetlands are now a critical priority. He further explained the work being done by a global program called The Blue Carbon Initiative, with focus on Sub-Saharan Africa.

The Blue Carbon Initiative is an integrated program focused on mitigating climate change by conserving and restoring coastal marine ecosystems globally. The Working Group consists of experts in coastal carbon science, carbon assessment, remote sensing and international climate change policy. The group has identified sub-Saharan Africa as a critical priority for:

- Assessment of coastal wetlands for carbon storage and other ecosystem services, including field surveys, mapping, threat analysis
- Support for building capacity on science, conservation and management of coastal wetlands
- Building awareness of the importance of coastal wetlands
- Inclusion in global analyses

South African estuaries: natural and anthropogenic drivers of ecosystem state

Dr. Anusha Rajkaran (Rhodes University, South Africa) summarised the role of natural and anthropogenic drivers on estuarine health, with a focus on South Africa. Dr. Rajkaran explained how estuaries provide a number of ecosystem services and how the value of these services is influenced by many factors. Healthy estuaries are more likely to support habitats that may be more resilient to climate change.

South Africa has approximately 300 functional estuaries classified into five types namely: permanently open, temporarily open closed, estuarine bays, estuarine lakes and river mouths. The main driver of ecosystem health is related to the quality and quantity of inputs from the riverine and marine environments into the estuarine body which influences the physical and chemical properties and in turn productivity in the water column and adjacent habitats. The mouth of an estuary links the marine environment to the estuary and allows for the movement of organic and inorganic components, this movement is important for both ecosystems.

In her presentation, Dr. Anusha Rajkaran evaluated the management tools that are in place in South Africa to protect the integrity of these important estuaries. There is the National Estuary Biodiversity Plan (SANBI, Department of Environmental Affairs) which has identified 133 priority estuaries to be assigned protection status in order to meet defined biodiversity targets. Although legislation is in place (National Water Act), effective estuary management must take place across different government departments which can represent a complex challenge. The Integrated Coastal Management Act strives to achieve this through cooperative governance and the development of estuary management plans which include all stakeholders.

Prof. Mohammed Ali Sheikh (State University of Zanzibar, Tanzania) presented on the effects and consequences of anthropogenic activities and pollution on coastal coastal and marine ecosystems. He focused on levels, behaviour and effects of toxic chemicals such as TBT, diuron and Irgarol 1051 on coastal areas including coral reefs ecosystems.

Prof. Sheikh concluded that to date, very little is known on the adverse effects of antifouling compounds in coral reefs ecosystems. While the levels reported in various regions have reached the threshold levels for survival of corals over a short term exposure, the consequences that might be caused by chronic exposure of the environmental relevance concentrations of these chemicals in coral reef ecosystems remains uncertain.

BIODIVERSITY AND HEALTH OF MARINE AND COASTAL ECOSYSTEMS IN KENYA

Jelvas Mwaura (Kenya Marine and Fisheries Institute, Kenya) presented the major accomplishments that were achieved under the KCDP component concerned with the biodiversity and health of the marine and coastal ecosystems in Kenya. Mr. Mwaura informed that dedicated scientific field studies had been undertaken on biodiversity and health status of coral reefs, mangroves and seagrass beds, in the south coast-Shimoni-Vanga, Kilifi-Malindi, and Lamu regions. An important major delivery of this work has been the production of both scientific and technical reports highlighting the current biodiversity and health status of marine ecosystems, major issues and recommended actions for their sustainable management and conservation. A second delivery is the development of a database for monitoring, evaluation and reporting. The scientific biodiversity studies also led to implementation of pilot projects in some regions such as (1) strengthening locally managed marine areas, (2) restoration of deteriorated marine habitats, particularly near-shore reef systems, (3) strengthening of mangrove management and governance and (4) environmental and economic impact assessment of gated-basket trap.

THE RESTORATION AND REHABILITATION OF DAMAGED OR DEGRADED MANGROVE ECOSYSTEMS IN KENYA

Dr. Jared Bosire (WWF Kenya, Kenya) presented a review of the functionality of restored mangrove ecosystems using functional indicators ranging from vegetation structure, natural regeneration, productivity, nutrient recycling to conservation of inherent biodiversity and socio-economic valuation.

Dr. Bosire finished his presentation by discussing the constraints and opportunities for successful mangrove restoration.

MANGROVES FACING CLIMATE CHANGE: LANDWARD MIGRATION POTENTIAL IN RESPONSE TO PROJECTED SCENARIOS OF SEA LEVEL RISE

Prof. Nico Koedam (Vrije Universiteit Brussel, Belgium) presented the findings of two specific research programs that dealt with the adaptation of species and populations to environmental change on a shorter than evolutionary time scale.

The first study in East Africa (Gazi Bay, Kenya) addressed the question whether or not mangroves can be resilient to a rise in sea level by focusing on their potential to migrate towards landward areas. The combinatory analysis between remote sensing, DGPS-based ground truth and digital terrain models (DTM) unveiled how real vegetation assemblages can shift under different projected (minimum (+9cm), relative (+20cm), average (+48cm) and maximum (+88cm)) scenarios of sea level rise (SLR).

The second study addressed the question whether or species will dynamically adapt to local climatic and environmental conditions. Therefore the team investigated the behaviour of the water transport tissues of mangrove species (as key to their ecological success) upon such changes both in their natural environment and experimentally. Their findings suggest that freshwater availability (rather than tidal inundation) affected radial increment, either in a concentric or patchy pattern in *Avicennia*, and that shrinking and swelling followed but shortly after the onset of changes in salinity in the other two species.

Prof. Koedam concluded that such findings are indicative of rapid changes in mangrove individuals in the highly dynamic environment that mangrove forests are, but demand integration in order to understand eventual success or failure to survive.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Dr. Gabriel Grimsditch (International Union for Conservation of Nature, Maldives) spoke about Blue Carbon science, the research needs and policies with an emphasis on the WIO region.

After providing a global overview of the current state of blue carbon scientific knowledge, Dr. Gabriel Grimsditch summarised the research needs in the field, as follows:

- Habitat cover from remote sensing data needs to be validated in order to improve its accuracy
- Change analysis to calculate loss rates needs to be conducted
- Carbon data is growing in WIO but more is needed, especially for soil
- A network of projects in the region
- Communicate results to government and stakeholders
- Submit results to IPCC

Dr. Grimsditch then focused on case studies relevant to the Western Indian Ocean, exploring the various policy and financing mechanisms that are being developed for blue carbon communities around the world and presented the largest comprehensive blue carbon project in the Western Indian Ocean; the GEF/UNEP/GRID-Arendal Blue Forests project, which involves a large network of partnerships in the region and other international efforts (http://bluecarbonportal.org).

Dr. Grimsditch concluded that in the WIO (and in Kenya) there are few Blue carbon research initiatives. Although Kenya, in particular KMFRI and Napier University, are occupied with this, most research is done on mangroves, little on seagrasses.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Dr. Virginia Wang'ondu (University of Nairobi, Kenya) spoke about the threats to the coastal ecosystems of Kenya, in particular the mangrove forests and the coastal fisheries. She emphasized the need for sustainable management of these ecosystems and discussed the several efforts in Kenya directed towards conservation and sustainable use of coastal ecosystems.

Efforts include the reforestation of degraded mangrove forests, the creation of marine protected areas, the payment for ecosystem services and carbon markets programs, the Economic Stimulus Program by the Kenyan Government. Despite these efforts, human activities remain the enormous threat to coastal ecosystems on the global, regional and local scale.

Dr. Wang'ondu concluded that the development of a strategic management plan for coastal ecosystems in Kenya through the Kenya Coastal Development Program will guide and oversee the effective and sustainable management of coastal ecosystems for sustainable utilization, productivity and conservation for future generations. This will reduce poverty, improve livelihoods and increase societal benefits from coastal ecosystems.

Dr. Agnes Muthumbi (University of Nairobi, Kenya) spoke about the Kenyan benthic fauna, the acquired knowledge and the remaining gaps in knowledge.

She provided an overview of the types of studies that have been conducted in the different locations (mainly Gazi and Mida Creek) and habitats (mainly mangroves) and summarized what is currently known about Kenyan benthos. She identified that the topics of interest in the Kenyan benthic studies were trophic interactions between endobenthos and epibenthos. Also studies relating to mangrove ecosystem recovery and function where benthic fauna were used as bio-indicators were common.

Dr. Agnes Muthumbi emphasised that there are few studies that relate to the impacts of human activity such as organic pollution, seed collection for mariculture, bait collection to benthic biodiversity and how these impacts are likely to affect the whole ecosystem.

Dr. Muthumbi also listed following research activities needed that are needed in the future:

- Data and information archiving: centralized system which is accessible to all stakeholders
- Integration of available data and information on mangroves benthos in order to inform mangrove management strategies
- More studies on other less studied coastal biotopes like seagrass beds, sandy beaches (species distribution /interactions, taxonomy/diversity)
- More studies on the continental shelf/slope
- Studies on inter connectivity between coastal and offshore populations

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

SOCIETAL AND ECONOMIC BENEFITS OF MARINE RESEARCH

Mr. Jacob Ochiewo (Kenya Marine and Fisheries Research Institute, Kenya) explained how marine and fisheries research information can positively result into societal and economic benefits, particularly when the research information is effectively disseminated to communities and other stakeholders.

The traditional exploitation of the natural resources at the coastal zone of Kenya has resulted in a 'natural resources trap' with poverty levels remaining extremely high among the local communities. In fact, the exploitation of some of the natural resources has been characterized by serious use conflicts.

Mr. Ochiewo shed light on the importance of understanding the socio-cultural and economic setting of the coast, the needs of the local communities, and applying scientific information to address these needs within the existing socio-cultural contexts.

Mr. Ochiewo finished his presentation by making suggestions on a way forward for achieving sustainability in the face of extreme poverty:

- There is a need for (more) social science studies on the management of marine and coastal resources.
- Identification of economically viable alternative & supplementary livelihoods
- Resource and socio-economic challenges
- Understanding the value of natural resources to influence policy & resource allocation decisions
- Understanding the role of institutions in development
- Understanding coastal socio-economic dynamics

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

SESSION 4: SUSTAINABLE AQUACULTURE DEVELOPMENT: CHALLENGES FOR KENYA

SESSION CHAIRS:
BETTY NYONJE (KMFRI)
GILBERT VAN STAPPEN (UGENT)

CHALLENGES FOR AQUACULTURE DEVELOPMENT IN EASTERN AFRICA

Prof. Gilbert Van Stappen (Ghent University, Belgium) presented the current status of aquaculture development in Africa, with an emphasis on East Africa.

Prof. Van Stappen explained that fast population growth and uncertain yields from traditional agriculture and terrestrial husbandry, aggravated by climatic change, currently press governments to explore diversification of food resources. Although initiatives for aquaculture production are increasing, the pace of aquaculture development has been slower in Africa than on other continents.

Prof. Van Stappen outlined the key points favouring growth of aquaculture in Africa:

- important water resources (e.g. inland lakes and reservoirs)
- agriculture in broad sense plays a dominant role in most African economies as an important source of livelihood
- opportunities for integrated production, production combined with mangrove reforestation....
- growing awareness at governmental level ('National Fisheries and Aquaculture Development Plans') alongside terrestrial crops –but further consolidation of the idea that aquaculture can create wealth
- establishment of networks (e.g. SARNISSA)
- substantial economic growth in a number of countries; growing foreign investments

As main bottlenecks for aquaculture development, Prof. Van Stappen identified the lack of appropriate 'seed' and 'feed'; i.e. resp. the production of sufficient numbers of good quality fish/shellfish larvae for stocking, and the availability of affordable high quality feeds for grow-out. Prof. Van Stappen concluded that various macro- and micro-economic, social and cultural factors can be held responsible for the present status of African aquaculture.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

AQUACULTURE RESEARCH AND DEVELOPMENT IN KENYA: AN OVERVIEW

Dr. Betty Nyonje (Kenya Marine and Fisheries Research Institute, Kenya) presented the strategic research and development issues identified for Kenya to exploit her largely unutilized aquaculture potential.

Dr. Nyonje explained that the marine aquaculture sector has had no major government intervention so far. But as Kenya endeavours to pursue a science-based aquaculture development, efforts in research are therefore demand driven.

Dr. Nyonje highlighted the research efforts that KMFRI and several universities have undertaken to address some of the strategic research issues, including diversification of aquaculture species base, improved culture systems, improvement of bio-security and fish disease surveillance as well as environmental research. Dr. Nyonje demonstrated how these issues also present opportunities for research collaboration.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

RECENT ADVANCES IN MARINE AQUACULTURE RESEARCH – IMPLICATIONS FOR KENYA AND THE REGION

Dr. Nigel Preston (Commonwealth Scientific and Industrial Research Organisation, Australia) presented the advances made in Australia regarding coastal aquaculture and demonstrated how some of these achievements are directly transferable to the Kenyan coast.

Dr. Preston explained how the challenge for Kenya, and other countries in the region, is to develop and gain the economic benefits from coastal aquaculture enterprises, whilst conserving the ecosystem health of adjacent environments. In this context, recent advances in environmental management, selective breeding and aquafeeds have dramatically increased the production efficiency and sustainability of Australian aquaculture enterprises. These achievements are proven solutions to the concerns about the negative impacts that aquaculture can have.

Dr. Preston concluded that the transfer and application of these recent advances from Australia could significantly enhance the viability of new aquaculture enterprises in the coastal areas of Kenya, and other countries in the region.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

COMMUNITY BASED AQUACULTURE INITIATIVES IN COASTAL KENYA

Dr. James Mwaluma (Kenya Marine and Fisheries Research Institute, Kenya) discussed the successes, challenges and constraints in community based aquaculture at the coast and gave an overview of the few pilot projects running in Kenya on mariculture.

Despite the huge mariculture potential in Kenya only a few community-based pilot projects and isolated trials have been done which have largely remained at experimental/demonstration stages. A few initiatives have started realizing some profits albeit at subsistence levels. The few successes include the crab farming in Dabaso, seaweed farming in the South coast, the *Artemia* pond production, milkfish farming in Makongeni, and the milkfish and prawn farming in Kibokoni.

Dr. Mwaluma listed the challenges that mariculture is facing in Kenya:

- Lack of technical knowhow (pond siting & construction)
- Lack of seeds and feeds
- Lack of financing (pond construction)
- Low scale production (understocking of seeds)
- Lack of sustainability (group dynamics, business skills, perception)
- Low markets (low market prices)
- Lack of guidelines
- Disputes among group members

Finally, Dr. Mwaluma discussed the interventions needed to enhance the viability of new aquaculture initiatives:

- Establishment of a marine hatchery (seed and feed production)
- Community training in mariculture production
- Private partnership in marketing, value addition and semi processing
- Need for partnership in upscaling, research, packaging and marketing artemia cysts
- Training in business skills
- Development of an aquaculture policy
- Development of mariculture guidelines
- Aquaculture master plan - guide development of aquaculture interventions and investment
- Diversification of aquaculture species (marine tilapia, siganids) and technology (cage culture offshore)
- Training in leadership roles (women)

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

GOVERNMENT INTERVENTION FOR AQUACULTURE DEVELOPMENT IN KENYA

Dr. Harrison Charo-Karisa (State Department of Fisheries, Kenya) talked about the unprecedented growth in aquaculture in Kenya over the past five years through government intervention such as initiating programs, awareness campaigns, product value addition and diversification, changing policy formulations, development of the National Aquaculture Development Strategy and Plan, direct investments in the sector through the Economic Stimulus Program funded Fish Farming Enterprise Productivity Program (ESP-FFEPP) and quality assurance efforts to ensure that aquaculture fish and fish products continue to access traditional and emerging markets.

Dr. Charo-Karisa also addressed some points of improvement such as the low production and some challenges the aquaculture sector is facing such as sustaining inputs and equipment, market development and market information flow, the weak research support and the threats to ecosystems and biodiversity.

Dr. Charo-Karisa finished his presentation by suggesting a way forward through various points of action:

- Get the market right: a value chain development approach and focus on end-product
- Well-funded research for development
- Enhanced public-private partnerships
- Standards: facilities, processes and products
- Diversification of culture systems
- Diversification of culture species
- Develop Centres of Excellence

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

MICROBIAL BIODIVERSITY IN BOHAI BAY SALTWORKS AND THEIR BIOTECHNOLOGICAL UTILIZATION

Dr. Sui Liying (Tianjin University of Science and Technology, China) presented the results from a study of the microbial biodiversity of brine water with different salinities and seasons in the Bohai Bay saltworks, the main salt production site in China.

Dr. Liying put emphasis on the biotechnological use (in medicine, food industry, environmental protection) of certain active compounds that the halophilic bacteria and archaea in the saltworks contain. Dr. Liying explained how the study of the biotechnological compounds produced by bacterial and archaeal strains can provide useful information on the potential utilization of microbial resources in saltern ponds.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Mr. Patrick Gwada (Kenya Marine and Fisheries Research Institute, Kenya) spoke about the historical evolution and improvements in the environmental management tools that Kenya uses in environmental governance.

Mr. Gwada explained that, within the national ocean policy and strategy, the potential of twining the availability of RV Mtafiti to the need to develop new national and regional monitoring or observer stations to inform the development or improvements of existing environmental management tools are explored as well as including new opportunities to exploit the resources of the EEZ.

Mr. Gwada highlighted the challenges in environmental management and governance within the oceanographic and coastal perspectives to improve the economic, political, and social well-being of its people. Examples of existing interventions in improving coastal livelihoods were discussed for a number of aquaculture interventions and for few natural resource management initiatives within the Kenyan coast and near-shore marine environments.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

THE STATUS AND OUTLOOK OF MARINE AQUACULTURE DEVELOPMENT IN SOUTH AFRICA

Prof. Daniel Brink (Stellenbosch University, South Africa) presented on the status of the mariculture development (mainly abalone, mussels, oysters and finfish) in South Africa.

Prof. Brink identified the particular challenges the sector faced to be a high energy coastline with limited sheltered bays for offshore aquaculture, the long distance from the world markets which increases the costs of logistics, the escalating costs of energy and labour and the cost of capital and high internal rate of inflation (>6 percent per annum).

On the other hand, Prof. Brink also addressed the development advantages the sector enjoys in South Africa, being:

- well-developed infrastructure (transport, processing facilities, marine infrastructure)
- reputation as a high quality seafood supplier
- diversified marine species resource base
- abalone subsector success
- pristine marine environment
- new growth priority and strategy

Finally, Prof. Brink concluded that the marine aquaculture sector in South Africa has made good progress over the past decade and is well positioned for future growth, supported competitive technologies and market demand. Specific development goals are to increase the production of abalone and marine finfish within the next five years and to drive up the total production to 20.000 tons within 5-10 years.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

SUSTAINABLE *ARTEMIA* POND PRODUCTION IN COASTAL SALTWORKS AS A TOOL TO SOLVE AQUACULTURE CHALLENGES

Assoc. Prof. Dr. Nguyen Van Hoa (Can Tho University, Vietnam) told the successful story of *Artemia* farming in Vinh Chau (Vietnam) from introduction, adaptation of the original *Artemia* species (i.e. *Artemia franciscana* from solar saltworks in San Francisco, USA) to the new habitat (Vinh Chau), pond culture techniques and technology transfer to open out the possibility of fulfilling the need of *Artemia* cysts for local aquaculture development.

Assoc. Prof. Nguyen Van Hoa explained how nowadays, more than 80% of *Artemia* cysts are being used for marine shrimp hatcheries, but that the main cyst source comes from the wild (e.g. collected from salt lakes in USA, Russia, China) which are usually expensive and thus become bottlenecks to poor and developing countries. *The Artemia* farming in Vinh Chau has proved to be a new approach to generate a higher income for poor salt-farmers (i.e. salt-farmers could increase their profit 3-5 fold compared to traditional salt production).

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

REVIEW OF COASTAL AQUACULTURE DEVELOPMENT IN MOZAMBIQUE

Mr. Rafael Miguel Rafael (National Fisheries Research Institute, Mozambique) presented on the history and current coastal aquaculture activities in Mozambique which includes the culture of crustaceans, finfish, bivalves and seaweeds. Mr. Rafael concluded that despite the fact that a favourable political environment for investment as well as climatic conditions and identified suitable coastal areas for aquaculture are accessible, the potential of coastal aquaculture in Mozambique has to date not been meaningfully exploited.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

THE POTENTIAL OF INTEGRATING MARINE BIOTECHNOLOGY WITH AQUACULTURE FOR HUMAN HEALTH IN KENYA

Dr. Charles Gatune (Karatina University, Kenya) spoke about the integration of biotechnology with aquaculture development in Kenya.

The application of biotechnology for the development of aquaculture has been emphasized as a thematic area in:

1. improving fish breeds through selective breeding, fish strain comparison, identification and introduction of candidate local fish species
2. identification and introduction of highly nutritious natural, live and formulated fish food with minimal residue
3. introduction of fish production systems with potential to conserve water, stabilize favourable water quality, integrate with other agriculture systems and bio-accumulate macro- and micro-nutrients in fish tissue for improved human health and nutrition.

Dr. Gatune explained that the sustainable use of coastal and marine resources in Kenya can be greatly enhanced by utilizing its biotechnology opportunities to develop aquaculture. For instance: 1) culturing, bio-accumulating and bio-encapsulating macronutrients in marine live feeds such as *Artemia*, fresh and brackish water *Caridina*, zooplankton, micro-algae, biofilms and bioflocs and, 2) extracting and incorporating gelatine and agar, from marine fish and sea weed, in formulating fish food can promote introduction of fish food which is ecologically clean, water stable and has potential to upgrade the nutritive value of fish tissue for improved human health and nutrition.

In the light of the above observations, Dr. Gatune mentioned that Karatina University has introduced an academic and research program for Aquaculture and Fisheries Technology to build capacity and undertake innovative research to continuously improve aquaculture development in Kenya.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

An overview of the current status of Kenyan fish feed industry and feed management practices, challenges and opportunities

Dr. Jonathan Munguti (Kenya Marine & Fisheries Research Institute, Kenya) talked about the current status of the fish feed industry in Kenya and the challenges the industry is facing.

In light of the challenges, Dr. Munguti defined a whole series of opportunities for joint research between KMFRI and the marine research institutes in Belgium and other countries:

- Capacity building
    - Training on feed processing and production technologies
    - Development of adaptable technology and equipment for fish feed processing & production suitable for the local conditions
    - Exchange program between Belgium and KMFRI Researchers for practical experience in feed production
- Infrastructure
    - Development of a state of the art nutrition laboratory for feed analysis, formulation and quality control
- Improvement of feed quality & reduction of cost
    - Development of live feeds - *Artemia*, rotifers
    - Research on alternative feed resources- plant based, non-conventional
    - Improvement of the feed conversion ratio (FCR)
    - Feed development for different stages of development
    - Starter diets specifically formulated for the mariculture
    - Development of ornamental feeds (Koi carp)
- Development of efficient marketing linkages and a communication platform
- Research on nutrition related conditions, deformities, diseases and the quality of the farmed flesh
- Research on anti-nutritional factors, toxins in fish feed ingredients and safe removal mechanisms
- Nutrient loading from fish feeds in culture systems, effects on water quality, treatment and safe disposal
- Development of a certification system for accrediting for feed manufacturers
- Opportunities for development partners to invest in the feed industry in Kenya

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

A GAP BETWEEN SMALL-SCALE COMMUNITY MARICULTURE AND MARICULTURE AS A BUSINESS: CAN KCDP BRIDGE THE GAP?

Mr. David Mirera (Kenya Marine and Fisheries Research Institute, Kenya) talked about the evolution of community based small-scale mariculture, the experimental and research interventions on commercial productions and the development of the aquaculture strategy (2010), policy (2011) and a mariculture forum (2005) by WIOMSA.

Mr. Mirera explained that mariculture in Kenya is dependent on wild seed supply, is underdeveloped and can be traced back to the earlier 1980s. Community based small-scale mariculture was initiated about two decades ago along the coast of Kenya and organised community groups (OCGs) formed the entry point for the interventions. Unfortunately, mariculture has been characterised with low and inconsistent annual production regimes that has been associated to a number of factors. However, the fish culture and seaweed farming areas have doubled with more communities being introduced into mariculture through effective KCDP intervention over the last one and a half years.

Mr. Mirera indicated that collaborative partnerships in mariculture development will be important in the future to respond to issues on income, production and sustainability and listed following opportunities for collaboration:

1. Development of marine hatchery will open-up a variety of species for aquaculture
2. Production of quality and affordable feed for marine fish
3. Undertaking research that address industry needs
4. Diversification of culture technologies and species for culture
5. Understanding market dynamics for the different mariculture products and using them as opportunities in development of the sector
6. The need for coordinated mariculture development

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

SESSION 5: CAPACITY BUILDING AND EDUCATION

SESSION CHAIRS:
BOAZ KAUNDA-ARARA (UNIVERSITY OF ELDORET)
ANN VANREUSEL (UGENT)

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An overview of the institutions and education programs of higher learning in aquaculture development in Kenya

Dr. John Radull (Maseno University, Kenya) presented the current status of aquaculture training available in Kenya and outlined possible ways to actualize the training of aquaculture practitioners and managers for sustainable aquaculture in Kenya.

Dr. Radull explained how the development of a sustainable aquaculture industry is largely dependent on the principals of good management practices, themselves a culmination of purposeful training, both formal and informal. In Kenya, aquaculture training can be said to be at its infancy, making it a high priority development target. Reviewing the existing training programs in Kenya, Dr. Radull found that (1) there are not enough qualified personnel to manage the aquaculture industry in Kenya, (2) the Kenyan universities have neither the appropriate curriculum nor the technical capacities to handle meaningful aquaculture training and (3) there is urgent need to formulate and actualize meaningful programs for aquaculture training in Kenya

Dr. Radull therefore suggested that a framework for appropriate aquaculture training in Kenya should be developed and the framework should (1) involve all the players in the aquaculture value chain, (2) use the bottom-up demand oriented process in curriculum development, (3) develop adequate infrastructure, demonstration farms, pilot recirculation hatchery systems, laboratories, etc. and (4) engage experts, international partners and local entrepreneurs in curriculum development.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

Approach of Stellenbosch University in promoting aquaculture education in Africa

Prof. Daniel Brink (Stellenbosch University, South Africa) gave a general overview of the evolution of aquaculture education in South Africa and the different courses available at Stellenbosch University.

Prof. Brink explained how a first formal training program in aquaculture was introduced in 1990 and over the years grew out to MSc and PhD postgraduate courses as from 1996. The lack of training opportunities on subsidiary levels has led to the introduction of a Certificate Program in 1997 as well as regular short courses in order to develop required capacities. The certificate program expanded onto a distance learning platform in 1998 in an effort to improve accessibility throughout the region. The latest addition was a Post Graduate Diploma in Aquaculture Production and Management introduced in 2012 to further enhance accessibility through acknowledgement of prior learning at other institutions. Prof. Brink also emphasized the importance of establishing international networks.

The curriculum of Stellenbosch University now incorporates the main components along the value chain, including water ecology, breeding, nutrition, husbandry, health management and post-harvest technology. Production and financial management, together with marketing are incorporated in subsequent modules. A wide range of both freshwater (e.g. trout, tilapia, catfish) and marine species (seaweed, shellfish, molluscs, finfish) are reflected.

Prof. Brink concluded his presentation by identifying the key challenges with regard to aquaculture education and training which are accessibility, affordability and student compatibility as well as continental career opportunities for postgraduate students in particular. Stellenbosch University is currently embarking on an information communication technology strategy (SU 2014) to enhance future teaching and learning opportunities that could address some of these challenges. Complementary teaching and learning networks throughout Africa, and beyond, will also play a key role in meeting the training needs of the continent in relation to aquaculture development.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

BUILDING A REGIONAL TRAINING NETWORK OF COASTAL, MARINE AND CONTINENTAL WATER BODY SCIENTISTS IN THE WIO REGION

Dr. Karolien Van Puyvelde (Vrije Universiteit Brussel, Belgium) presented a new project which will provide the opportunity to build a regional and international South-South scientific network, named InteGRADE: the South Initiative 'INternational inTEnsive Southern training proGRAm and network DEvelopment for marine and lacustrine scientists.

Dr. Van Puyvelde explained how Flanders has built capacity in relevant fields, often created nuclei, but how regional and international South-South scientific networking remain an underutilised resource for valorization.

Therefore InteGRADE is intending to (1) build a regional training network of coastal, marine and continental water body scientists in the Western Indian Ocean region (WIO) and to (2) organise a pilot event in the South on basis of the network initiating the establishment of an international intensive southern training program (on research capacity, new scientific developments, governance and policy,...) within the disciplines of marine and continental water body research and management. The concept is to involve lecturers, academic scientists, managers, NGO collaborators and students at an international, intensive training program in the South. There is an emphasis on valorizing alumnus involvement.

Dr. Van Puvelde further elaborated on the opportunities this program presents for future close collaborations with (1)VLIR -UOS listed regional partners, such as South Africa and Kenya (since 2015), (2) non listed countries such as Mozambique, (3) land locked countries which are part of the regional network in the aquatic science and management (African lakes) such as Malawi, Uganda and (4) countries which are as yet beyond reach but must be integrated into operational scientist networks, because of their basin linkage (South Sudan – Nile basin) or coastal continuity (Somalia) .

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

How to convey a complex message to a wide audience: avoiding the ocean divide between science and public understanding?

Prof. Nico Koedam (Vrije Universiteit Brussel, Belgium) presented an initiative 'Green Dyke' conducted in Sri Lanka set out to convey a complex message to a wide audience.

Communicating scientific findings to the public is a challenge as it is often not the primary aim of research and the messages are increasingly complex and cannot be reduced easily to simple statements. Yet, society has a right to call upon scientists. Therefore, Prof. Koedam explained, a Coastal Resources Awareness Centre was developed in the framework of the VLIR-UOS funded project 'Green Dyke' in Sri Lanka (2008-2014). He presented the approach of his team to serve as a source of inspiration elsewhere, also in Kenya.

Dr. Koedam concluded with the lessons learnt from this project, such as the importance of diversification in the use of media, the teams involved and the language of expression and how the geographical and cultural context are crucial elements throughout the entire process.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

IOC-UNESCO Regional Training Centre for the OceanTeacher Global Academy

Mr. Harrison Ong'anda (Kenya Marine and Fisheries Research Institute, Kenya) outlined the role of KMFRI to host a Regional Training Centre (RTC) for the OceanTeacher Global Academy Project of IOC-UNESCO.

Mr. Ong'anda explained how this project is aimed at developing a global training centre network and utilizing this network to increase national capacity in coastal and marine knowledge and management. It does so by promoting the establishment of Regional Training Centres (RTCs) as well as their close collaboration through advanced information technology. The Project will target staff of marine research institutions and related facilities, staff of Government departments involved with marine science and services, marine related practitioners (Government and Private Sector), university students (marine science and related disciplines).

The OceanTeacher Global Academy (OTGA) Project is an extension of the achievements of the OceanTeacher Academy (OTA) project which developed a Learning Management System and teaching program that has successfully organised 42 courses on ocean data and information management, involving over 1800 participants, at the IOC Project Office for IODE in Oostende, Belgium. The Enhancements in this second phase include (i) OceanTeacher Global Classroom, which will involve the establishment, by Member States, of regional training centres (of Excellence) and their interconnection through advanced video conferencing services; and (ii) the development of a wide range of courses responding the needs in ocean science, ocean observation, tsunami warning and mitigation, integrated coastal area management, marine spatial planning, etc.

Mr. Ong'anda also emphasized that special attention will be given to North-South as well as South-South interaction of students, as well as to gender balance in terms of students and resource persons (lecturers and teaching assistants). The project is in fulfilment of the IOC-UNESCO partnership with the Global Ocean Forum on a commitment at the Rio+20 conference on 'Building Global Capacity for Marine Sciences, Observation and Transfer of Marine Technology'.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

LINKING SCIENCE AND COMMUNITY DEVELOPMENT: THE COMMUNITY DRIVEN DEVELOPMENT (CCD) APPROACH

Ms. Farida Hassan (Kenya Marine and Fisheries Research Institute, Kenya) presented the conceptual framework of KCDP fund 'Hazina Ya Maendeleo Ya Pwani' (HMP) that seeks to address the gap between research findings on management of natural resources in areas such as coral reefs, mangroves, fisheries, aquaculture, seagrasses, seaweeds, etc. and the adoption of these findings for improved management of natural resources and community development.

Ms. Hassan explained how the HMP fund has adopted a comprehensive approach of engaging coastal communities in the sustainable management of natural resources and community development. The approach is known as the Community Driven Development (CDD) where control of the development process, investment resources and planning decisions are directly handed over to community. The approach comprises building the capacity of Community Based Organisations through training, technical backstopping and provision of small grants for implementation of priority projects within their locality.

Ms. Hassan concluded that the CDD approach has stimulated the interest of coastal communities in participating in the HMP program. The community trainings, technical backstopping and small grants provided to communities has given them the confidence of wanting to be part of stakeholders that are critical in the management of natural resources and community development.

The PDF of the presentation can be consulted at http://www.vliz.be/kenya/conference-output

SUMMARY OF THEMATIC PRESENTATIONS

Most of the presentations made were either on the coastal land based or near shore resources with minimal work being presented on the offshore resources (Table 1). This indicates that capacity development in Kenya and the region on offshore research is needed to be able to tap into the huge unexploited resources in the EEZ. The number of Kenyan scientists who presented in the various thematic areas indicates the diversity and significance of the collaborative trainings that have been spearheaded by VLIZ and other partners over the years. However, the presentations on policy were minimal in the conference, an aspect that is limiting in uptake of scientific information (Figure 2).

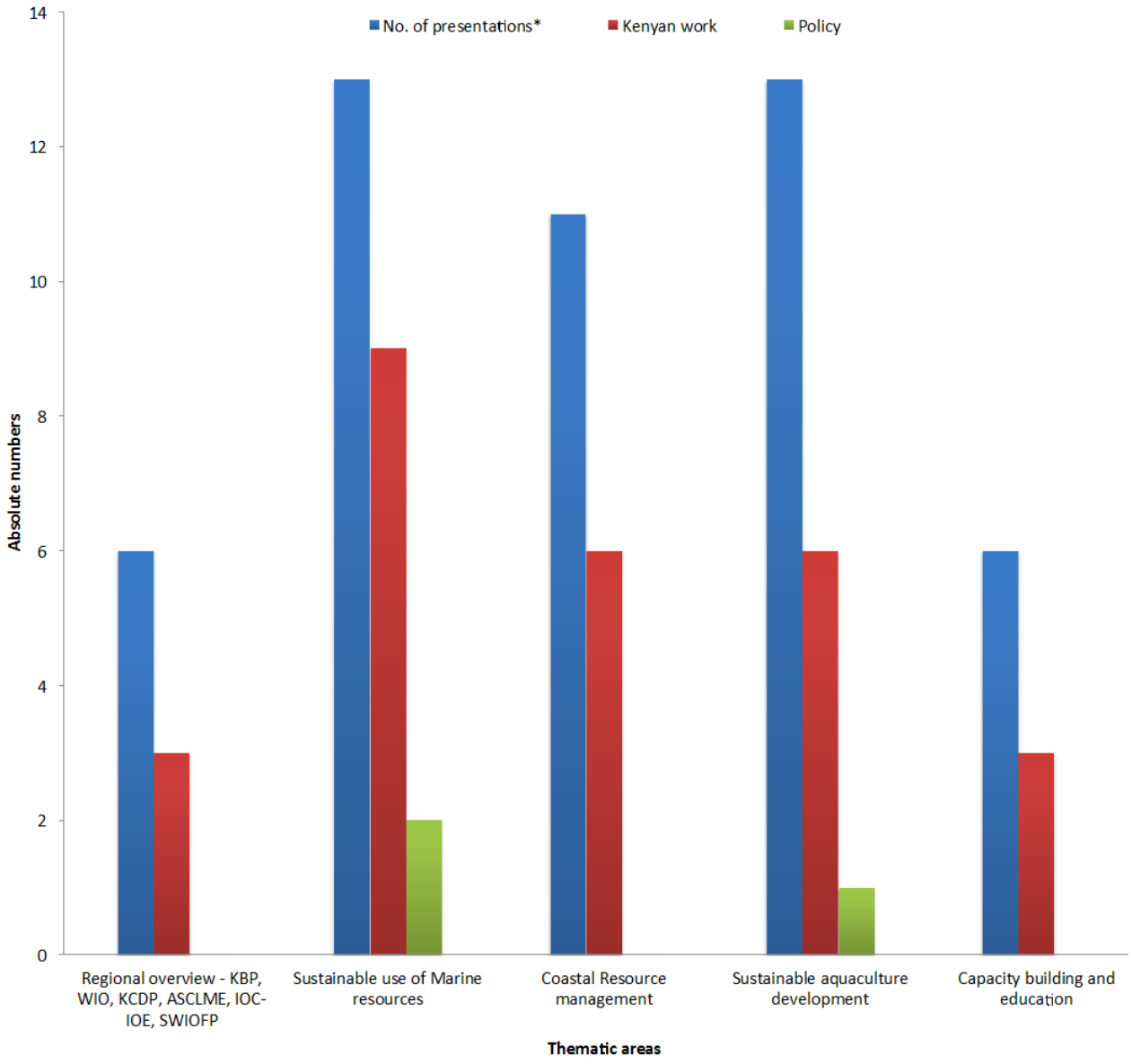


Figure 2: Summary of the number of oral presentations made for each thematic area during the conference.

Table 1: Overview of the oral presentations made during the conference for each thematic area.

Thematic area	No. presentations	Coastal/land-based	Near-shore	Offshore deep sea	Challenges	Way forward
Regional overview: **KBP, WIO, KCDP, ASCLME, IOC, SWIOFP**	6	1: KCDP	2: KCDP, KBP	5: WIO, KCDP, ASCLME, IOC-IOE, SWIOFP	▪ Overexploitation of stocks ▪ poor transboundary management ▪ inadequate enforcement ▪ ABNJs/High Seas not properly managed ▪ intersectoral conflicts not addressed ▪ few international commitments to adopt ecosystem-based management methods	▪ develop common priorities ▪ advance capacity building for marine research and observations ▪ bridge the gap between science and policy ▪ participate in agreed regional strategic action programs ▪ participate in implementation frameworks to deliver and execute actions
Sustainable use of marine resources	13	2: Quality Control (QC), Catch Assessment Surveys (CAS)	13: ▪ marine fisheries ▪ marine sciences ▪ marine pollution ▪ oceanography ▪ research vessels ▪ fisheries ▪ governance ▪ SWIOFP legacy ▪ stock assessment ▪ QC ▪ CAS		▪ Fishing, overfishing and destructive fishing ▪ climate change impacts ▪ critical habitat loss (coral reefs, seagrasses and mangroves) ▪ other ecosystems (LME, upwelling zones, climatic) ▪ pollution ▪ future development ▪ population growth ▪ global/market changes	▪ develop common priorities (e.g. national and regional fisheries management plans) ▪ advance capacity building for marine fishery database, research and observation ▪ bridge the gap between science and policy ▪ participate in agreed regional strategic fishery action programs, e.g. stock assessment, EAF, etc. (incorporating standards such as FAO guidelines) ▪ data analysis for fisheries management to be prioritized and linked to sustainability, societal benefits and economic growth ▪ phytoplankton monitoring (skilled experts, automated systems, satellite imagery for chl a, surface T, etc.)

Thematic area	No. presentations	Coastal/land-based	Near-shore	Offshore deep sea	Challenges	Way forward
Coastal resource management	11	1: ICAM (Integrated Coastal Area Management)	10: ▪ ICAM ▪ Blue technology ▪ estuary dynamics (ZA) ▪ mangroves (Sri Lanka, Malaysia, Kenya) ▪ biodiversity assessments ▪ restoration research ▪ sea-level rise ▪ macrobenthos ▪ socio-economic benefits		▪ Water quality degradation ▪ habitat and community modification (coral reefs, seagrasses and mangroves) ▪ declines in living marine resources ▪ unpredictable environmental variability and extreme events ▪ current and future development ▪ population growth ▪ global/market changes	▪ develop common priorities (e.g. sustained fundamental and applied research that will lead to improved assessment, modelling, monitoring and prediction of potential risks and sustainable management of coastal and marine resources) ▪ advance capacity building for marine resource database, research and observations (including health status, fluxes, connectivity, drivers, pressures and responses, case study scenarios) ▪ bridge the gap between science and policy (ocean without borders) ▪ participate in agreed regional strategic action programs (e.g. the ICAM framework, the spatial planning framework, MEDA, root-cause analysis, resource valuation, valuation of ecosystem services, PES, promoting blue-carbon technologies, EBM, continuous monitoring) ▪ data analysis for resource management to inform management interventions, etc., pollution and invasive species monitoring

Thematic area	No. presentations	Coastal/land-based	Near-shore	Offshore deep sea	Challenges	Way forward
Sustainable aquaculture development	13	ICAM	▪ ICAM ▪ research, development (Ke, Mozambique, Za) ▪ fish aquaculture seaweed aquaculture, *Artemia* aquaculture, feeds and seeds, aquaculture challenges ▪ recent advances ▪ community aquaculture ▪ GOK – interventions ▪ biotechnology in aquaculture (China) ▪ scaling-up ▪ environmental safeguards		▪ Technical and infrastructure constraints (site selection, zoning and weak research support: culture biology, diversification of accepted species, culture systems, fish health issues, inputs and equipment, seed and feed improvement programs, breeding programs, quality certifications, disease control, domestication) ▪ institutional/legal framework to support aquaculture development (sometimes dispersed nature of initiatives within and across national boundaries, devolution of governance and control and oversight responsibilities, bias on some freshwater fish species, pond production) ▪ inadequate capacity building and educational framework ▪ uncertainty on land ownership and/or use ▪ competition for (fresh)water resources or space ▪ social constraints: limited social acceptation of fish culture/consumption? ▪ market development and market information flow ▪ ecosystem threat and conservation of biodiversity	▪ Get the sites right (processes and supporting tools and mechanisms) ▪ get the technology right (culture biology, diversification, culture systems, disease control, inputs and equipment, seed and feeds, domestication, centres of excellence) ▪ get the regulations right (standards - facilities, processes and products) ▪ Markets and trade - value chain development, approach and focus on end-product ▪ enhanced public private partnerships ▪ get the social linkages right (needs of producing and consumer communities, food security, additional social benefits) ▪ get the environmental regulations right (maintaining environmental integrity and sustainability, threats to biodiversity, pollution, invasive species, water quality, production standards - facilities, processes and people, changing environments - climate change, etc.) ▪ get the institutional capacity building and technology transfer right.

Thematic area	No. of presentations	Coastal/land-based	near-shore	offshore/ deep sea	Challenges	way forward
Capacity building and education	6	institutions, policies, sectors (fisheries, aquaculture, oceanography, ocean divide, HMP)				

3. POSTER AND EXHIBITION SESSION

KENYA COASTAL DEVELOPMENT PROJECT (KCDP)

The Kenya Coastal Development Project (KCDP) is a World Bank funded initiative with a program component that provides community funds for coastal development. The program is locally known in Kiswahili language as HMP - *Hazina ya Maendeleo ya* and has engaged 127 local groups in all the 6 coastal counties of Kenya. The purpose of this engagement is to create opportunities for the local communities to compose their own indigenous projects that either contribute towards the sustainable management of coastal natural resources or provide possible solutions for providing services to the community. HMP provides 90% of the financial support in form of grants, while the community contributes the rest.

During the International Conference on 'Sustainable use of coastal and marine resources in Kenya' held in Kilifi, Kenya in October, 2014 the community groups were invited to present emerging results from their projects. It turned out that most of their results presented demonstrably contribute to the benefit of the coastal communities, in line with the theme of the conference – "from research to societal benefits". Pictures of the posters presented by the community projects are attached in Annex I.

Communities from Lamu County presented results on community service through three projects on street paving, enhanced poultry production and improved access to water. From Kilifi, one project demonstrated how vulnerable youth (injectable drug users and teenage mothers) convert domestic waste into useful products. In another project, a group has constructed a community resource centre inside a mangrove creek for archiving educational materials. Projects from Taita Taveta County include the construction of dormitories and kitchens for use by young mentally handicapped students and improved access of water in a boarding school to reduce resource -use conflicts and another project aims to sensitise communities on nutritional and medicinal values of forest products. Tana River County showcases a project on pest control through the construction of a livestock treatment facility, a water project and a public sanitation project. Additional projects were presented from Mombasa County on rehabilitation of a public beach and mangrove forests, and construction of an ecotourism board walk. In Kwale County community groups demonstrated how they manage mangroves to attract carbon credit and how they promote sustenance of indigenous cultural knowledge and traditions of the coastal people.

In general, the posters highlighted the background of each community group, the intended intervention of each project including the main activities, the project cost, expected benefits and how each project will sustain itself beyond the support provided by HMP once KCDP term ends.

4. ROUNDTABLE DISCUSSIONS FOR THEMATIC AREAS

The specific impacts, changes and challenges experienced in marine and coastal research within the coastal areas of the Western Indian Ocean countries were well articulated during the oral and poster presentations in the four thematic areas of the conference i.e. sustainable use of marine resources, coastal resource management, sustainable aquaculture development and capacity building and education.

Consequently, the joint roundtable diagnostic analysis (RDA) identified key gaps of concern for the people of Kenya and the Western Indian Ocean region under each thematic area that could be most appropriate and desirable to be addressed as research, policy of management targets/interventions. A summary of the priority issues as identified and analysed during the RDA is discussed in following sections.

REPORT OF ROUNDTABLE DISCUSSION 1: SUSTAINABLE USE OF MARINE RESOURCES

MODERATORS:
RENISON RUWA (KMFRI)
JAN MEES (VLIZ)

RAPPORTEURS:
JACOB OCHIEWO (KMFRI)
KAROLIEN VAN PUYVELDE (VUB)

The potential of offshore resources and inshore marine resources in Kenya and the WIO region was underscored based on the expansive coastline and the EEZ. However, only a negligible part of all the scientific work in the Western Indian Ocean region provides reliable information on the offshore resources. Therefore, the need for a clear framework, structured to facilitate research on offshore resources, taking advantage of the RV Mtafiti, in addition to well programmed and coordinated data collection for inshore fisheries and other marine resources is evident. The research will facilitate investments in the exploitation of the deep sea and EEZ fisheries resources as well as guide the management and policy development. The research envisioned could include biological productivity and oceanographic dynamics, river discharge and linkages with the distribution patterns and productivity of fisheries resources.

Limited data and information on the marine resources was a major concern in most of the presentations. There is now an opportunity provided by RV Mtafiti undertaking joint regular multidisciplinary research expeditions that are needed to improve the data and information on the status of marine resources in the WIO region. In addition, such expeditions also provide a good opportunity for building offshore research capacity by training young scientists and technical staff. The planning of such expeditions should involve universities and other institutions in the region so that the RV Mtafiti will be optimally utilized and opportunities for co-founding will be created. The data collected will be significant in management of marine resources and in attracting investments.

From the results of previous regional surveys including SWIOFP, the need to harmonize studies, surveys and long term fisheries dependent data collection was noted to enable extensive comparison of results and methodologies. The cruise plans, data collection and storage protocols and platforms and research teams for RV Mtafiti need to be developed. More studies to establish which methods are suitable for the exploitation of stocks associated with the rocky sea bottom in Kenya are needed. Experimental studies need to engage the local people and diverse fisheries expertise. In particular, the absence of taxonomy expertise and reference materials especially on offshore and deep water fisheries in the WIO is evident. In addition, taxonomic skills are also required to improve the quality of small scale fisheries data collected by the Beach Management Units (BMUs) and fish cooperatives down to the county level. The need to increase taxonomic skills, reference guides, inventories was noted as a cross cutting need.

To increase catches and the benefits to the local communities, fisheries research should look at stock enhancement technologies as short/medium term strategies. This may also lead to development of suitable candidates for aquaculture and stock enhancement based on results of biological studies of key species making aquaculture and fisheries research complimentary.

Research on marine ornamental fish was found to be limited. More studies in this area could be needed including building capacity in the same area. Areas to be explored include level of exploitation of species, alternative ways of producing the fish e.g. aquaculture and other information necessary to initiate effective management of the industry i.e. biology of species and habitat characteristics.

REPORT OF ROUNDTABLE DISCUSSION 2: COASTAL RESOURCE MANAGEMENT

MODERATORS:
JAMES KAIRO (KMFRI)
ANN VANREUSEL (UGENT)

RAPPORTEURS:
PATRICK GWADA (KMFRI)
KAROLIEN VAN PUYVELDE (VUB)

Coastal resource management in Kenya has been a challenge due to inadequate management guidelines. However, in recent years, specific programs and guidelines for conservation and sustainable utilization of some coastal resources have been formulated. The Government has demonstrated continued commitments towards sustainable management of coastal resources in Kenya through development of an Integrated Coastal Zone Management (ICZM) framework. The ICZM identifies various measures and strategies that need to be implemented in order to reverse environmental degradation and promote sustainable utilization of coastal and marine resources, including the development of a mangrove management plan.

The National Oceans and Fisheries Policy (2008), identifies low utilization of Kenya's EEZ for the exploitation of marine living resources as a challenge in the development and management of the fisheries resources. The ICZM policy (2014) emphasizes the importance of ecosystem based management approaches as a cornerstone of sustainable coastal development. They call for enhanced scientific efforts at the national level to provide essential information for managing ocean and coastal ecosystems for human wellbeing.

In Kenya, inshore marine areas including estuaries and bays have been relatively studied and assisted efforts to develop and manage nearshore coastal resources. However, offshore marine environment is barely known. Mapping of offshore resources and biodiversity assessment to guide management has been a challenge due to the lack of a vessel. The RV Mtafiti brings along the much-needed capacity to enhance marine science in the WIO region while promoting sustainable fisheries resource use, and ocean environmental integrity. The ship will provide a platform for observations, monitoring and mapping of offshore resources to generate data and information to guide and support the management of those resources.

Pollution is an issue of concern in the marine environment. The ocean is without any physical boundaries as such the pollutants are transboundary and require concerted international effort to regulate. The Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region was signed in 1985 and came into force in 1996, to address some of these issues. Plastic materials are an emerging pollutant and comprise one of the most persistent macroscopic pollutants in oceanic waters and beaches in the world. Ingestion of microplastics by marine species at the base of the food web is an issue of concern as little is known about its effects. It remains unknown if microplastics may be transferred across trophic levels. The presence of RV Mtafiti will therefore allow for offshore studies of monitoring marine environment and mapping pollution 'hotspots'.

Biological research specifically aimed at studying both primary and secondary production amongst Kenyan marine ecosystems has been limited to the Tyro Expedition 1992 - 1995. This lack of adequate information creates a knowledge gap that inhibits a more clear understanding of the Kenyan marine ecosystems and the associated fisheries for effective management of those resources. Research with RV Mtafiti will be geared towards understanding planktonic ecosystems in nearshore and offshore areas of our EEZ with special emphasis to fishing zones using an ecosystem approach.

During the roundtable discussions, it was observed that there is a gap in translation of research findings in natural resource management into socio-economic benefits of the community. This makes it difficult for resource users to draw boundaries between research, conservation and livelihoods. Equally important was the aspect of communities not being able to understand the causes of coral bleaching and what impacts such will have on the fisheries. Consequently, there is a limitation on how research is integrated into decision making processes so that the community should benefit. More studies on how the communities and decision makers could be engaged were recommended.

It was observed that whereas carbon trading could be a noble idea, there is need to address teething issues within the new sector i.e. zoning of mangrove forests to justify which communities could be able to benefit from what zone, development of benefit sharing guidelines and criteria for selecting

beneficiaries. It was further observed that carbon trading was skewed only to Kwale County, thus communities felt that such noble approach needs to be expanded to cover other coastal counties.

There is need for more research to establish to what extend carbon credit could be applied i.e. in mangrove plantations, natural mangrove stands, etc. Also the need for more research to advance the field of carbon credits and climate change through the use of RV Mtafiti was seen as an opportunity for Kenya and the region.

The discussions settled on the fact that there was limited research linking the different ecosystems. Therefore, a multi-disciplinary research between different institutions addressing various ecosystems and in relation to climate change, ecosystem services, blue technologies, poverty, etc. could be developed. Such research could also include aspects of ICZM to bring about connectivity between catchment areas and the marine environment, aspects of spatial planning and spatial and temporal coverage of ecosystems.

Other emerging issues that currently need significant data include; like mining, water abstraction and damming. This may be initiated by carrying out independent validations of the situation. There is need to develop new research products through e.g. bio prospecting to be considered as a way of ensuring sustainability of research.

It is recognized that the public-private sector may also have specific maritime related needs involving use of the research vessel and therefore yielding to potential partnership programs. This includes collaborative programs for discovery of new fishery resources and fishing grounds with the existing semi-industrial fishing companies. Offshore oil and gas exploration in Kenya has been ongoing. Potential collaborative programs with the oil companies include marine environmental assessment and monitoring before, during and after the drilling of oil and gas.

The new constitution gives an opportunity for KMFRI to engage with the coastal counties to provide technical expertise in spatial planning for utilization of marine resources, to provide data that will inform counties to develop policies of natural resource management. In addition KMFRI can provide the required information for investors in natural resources exploitation and management i.e. create interest in industry to support research. To achieve this, it is important to network with other partners such as universities, NGOs (e.g. WWF, CORDIO), the industry, county governments, etc.

REPORT OF ROUNDTABLE DISCUSSION 3: SUSTAINABLE AQUACULTURE DEVELOPMENT IN KENYA

MODERATORS:
BETTY NYONJE (KMFRI)
GILBERT VAN STAPPEN (UGENT)

RAPPORTEURS:
DAVID MIRERA (KMFRI)
COLIN JANSSEN (UGENT)

Over the years, mariculture production in Kenya and the WIO region has been low due to low investment, uncoordinated development and technological limitations. The presentations during the conference showed that a large potential exists for development of the industry. However, to realise this potential several gaps were identified and possible interventions proposed for action.

The Roundtable Diagnosis Analysis (RDA) identified availability of production data and research information as a challenge. Existence of production and economic data are key indicators for investors in the industry for tracking changes over time, and coupled with an indicators program, measure change against predefined criteria. Key interventions could be in development of extension capacity and provision of policy direction. Policy tools related to collection and flow of mariculture (aquaculture) data could facilitate collection and use of similar information to provide policy and management decisions.

According to Kenya's vision of knowledge-based economy inclined in the 2nd Medium Term Plan (MTP), information is a critical tool for expanding human skills that in turn plays a great role in driving productivity and economic prosperity. The conference identified gaps in communication at all levels, which greatly impact mariculture information disseminations. This involved among others dissemination of research information to farmers, investors and policy makers. Through research more strategies should be developed to enable information flow like development of mariculture manuals, flyers, fact sheets and other ICT tools. For investors, developments of a mariculture master plan and clear guidelines on investor engagement could be useful tools that may be hosted at the KMFRI website and other relevant departments based in policy direction. This will also involve outlines on engagements with investors, county government and other national government agencies.

Under the Millennium Development Goals (MDGs) and as an economic pillar in Kenya's 2nd MTP, expansion of aquaculture could be promoted for economic development, poverty alleviation, wealth creation, employment, food security and trade. Consequently, conference participants underscored research on economic viability and break-even level in mariculture investment during the RDA as a way of interesting investors in different fields of mariculture. This information could interest funding support for mariculture development in addition to increasing production to levels that could ensure sustainability of the interventions. Therefore, focus on mariculture research should focus on upscaling current production to attain profits in the medium and long term (seaweeds, *Artemia*, milkfish, mud crabs). However, the research needs to integrate both community level productions like in Southeast Asia and commercial aquaculture productions as in the case of South Africa and Australia while promoting PPPs as stipulated in the 2nd MTP and Vision 2030. Such undertaking could be effectively advanced using the different weaknesses and strengths of each system as presented by different countries in the Western Indian Ocean.

Kenya's vision 2030 underscores the significance of science, technology and innovation in accelerating economic development. Also, according to a World Bank report on agriculture and rural development (2006), aquaculture is a knowledge-based industry. Therefore, a modern fish farm is an intensive knowledge-based enterprise, serviced by dedicated commercial scientific institutions devising new technologies and innovations for corporate clients that move to ever more productive and intensive farming practices. In due respect, the RDA exclusively identified the need for dedicated mariculture research on diverse culture methods and systems applicable to Kenya and the region. Currently, most aquaculture is done in the mangrove systems and intertidal beach flats for seaweeds. The research could expand to encompass offshore fish cages and land based mariculture especially for shrimp and finfish.

In line with development of culture systems, research is also required to undertake selective breeding programs e.g. marine tilapia and identify priority marine carnivorous species for high end and local markets since currently most of the species are low in the food chain (herbivores) and marine plants (seaweeds). This will consequently require viable technologies in nutrition and quality feed formulation for increased production for the different fish species identified and developed. Consequently,

significant resources will be required to develop hatcheries for production of marine fish seed to ensure timely seed for mariculture farmers to enable planning for profitability. Indeed, effective management of mariculture depends not only on our knowledge of the culture systems and current status of the investments/interventions, but also on the different policies impacting on investments like land ownership systems, policy guidelines on licensing and environmental aspects.

Responsible mariculture can provide environmental benefits, while unbridled and irresponsible aquaculture can cause a range of adverse environmental impacts. The negative impacts include but are not limited to the loss or degradation of habitats such as mangrove systems, salinization of soil and water, coastal and freshwater pollution, alteration of local food webs and ecology, depletion of wild resources and biodiversity for seed or broodstock, spread of parasites and diseases to wild stocks and impacts of introduction of exotics (deliberate or inadvertent). According to the RDA, currently, KMFRI has limited capacity on offshore environmental monitoring, an aspect that is key for the development of the mariculture sector. However, in the presence of RV Mtafiti, the infrastructure capacity is attained if well supported by developing a pool of environmental experts to backstop aquaculture development. The information obtained through these research studies will be used to provide advise on pollution and possible interventions to ensure environmental friendly mariculture. It's under these auspices that development of multi-disciplinary research projects addressing ICZM in Kenya could be addressed. Further collaborations could be drawn from local and regional universities, other regional organizations and VLIR-UOS. Consequently, KMFRI needs to spearhead a range of necessary regulatory measures, including zoning, EIAs, monitoring of farms, and inclusion of environmental stewardship obligations in the conditions of farm licenses.

In principle, networking and collaborations (south-south and south-north) across the aquaculture sector was seen as vital to leverage the required resources needed to improve the quality of research being undertaken whereas refocusing on the needs of the industry. Further, the collaborations add to the much needed expertise required to undertake site selection, zoning of suitable mariculture sites and development of aquaculture master plans while working with County and National government to expand coastal aquaculture. Such collaborations could be significant strides in the development of the industry.

Evident in the MDGs and Kenya's 2nd MTP is equity in access, control and participation in resource distribution for improved livelihoods of women, youth and vulnerable groups. In recognition of these, the RDA made cognizance of the current mariculture interventions which principally targeted women, youth and marginalized coastal communities. However, to improve the interventions, further research on community dynamics is necessary to identify the entry points. In addition, the multi-disciplinary studies should cover aspects of profitability and sustainability of the mariculture activities while addressing the roles of the different stakeholders in the whole mariculture spectrum.

REPORT OF ROUNDTABLE DISCUSSION 4: CAPACITY BUILDING AND EDUCATION

MODERATORS:
BOAZ KAUNDA-ARARA (UNIVERSITY OF ELDORET)
ANN VANREUSEL (UGENT)

RAPPORTEURS:
PATRICK GWADA (KMFRI)
NICO KOEDAM (VUB)

Presentations on capacity building revolved around the need for a steady availability of competent staff and infrastructure for research in different areas of marine science and extended particularly in marine aquaculture. These presentations generated a lot of discussions with the following main issues coming out distinctly:

- Assessment of the capacity needed for aquaculture development in Kenya should be carried out. This should involve a survey of all institutions in order to understand what is being offered and determine the way forward for aquaculture development, infrastructure and research capacity in terms of personnel and stakeholders needed to improve aquaculture.
- The universities are offering courses which are not adequately addressing the needs of aquaculture development in the country. Thus, there are gaps that may be addressed through the development of a marine aquaculture research and training centre which is similar to the National Aquaculture Research and Training Centre at Sagana in Central Kenya. It was proposed that this centre would be established at the coast to provide practical experience to trainees. Establishment of this centre requires development of infrastructural capacity.
- There is need for personnel training targeting both researchers and extension staff. Therefore, the development of practical short courses to address extension in aquaculture in collaboration with the universities will be critical. KMFRI may need to introduce a training and communication section to fast track the short courses. Training should be based on skills needs assessments that should be carried out from time to time to ensure that staff training addresses the objectives of marine research and development.
- The courses offered by local universities need to be developed to ensure different institutional strengths at tapped through networking.
- There is no university in Kenya that provides specialized training on physical oceanography and marine geology. Thus, there is need for collaboration between Belgium and the region to develop this expertise. Capacity building in biological oceanography also needs to be developed to meet the needs for offshore research taking advantage of RV Mtafiti.
- There is lack of manpower with appropriate training for work offshore (particularly on physical oceanography, taxonomy, marine geophysics and geology), beyond the reef. Capacity on taxonomy should encompass all areas of fisheries, crustaceans etc. Most of the scientists who are available have been trained for work in the shallow water areas. Capacity on marine geophysics and geology is not developed yet oil and gas is coming up very rapidly.
- Technicians and technologists should also be trained so that they are able to work in the deep sea with the scientists who would be trained. Use RV Mtafiti to build capacity by carrying out joint research with universities in Kenya and Belgium and the region. Also training of personnel including the crew, technicians and researchers. Also collaboration between Belgian institutions and Kenya and the region. There is also need for observer programs (Observatories) to ensure an ecosystem approach to marine resource management.
- Capacity is lacking in research on blue technologies e.g. carbon in the deep sea.
- There is lack of capacity on economic valuation of marine ecosystems and cost-benefit analysis. In addition, there is need for developing capacity in environmental assessments and impact valuation. This will involve trainings in environmental economics and EIA in collaboration with universities in Kenya and Belgium. This can be mixed with short courses (US and Belgium, etc.).
- There is lack of capacity in socio-economic research that can link ocean and human wellbeing. It may be necessary to collaborate with universities that offer degree courses in social sciences and economics to provide the necessary training to build capacity for socio-economics research.
- Undergraduate programs on marine science are developed so that capacity is built before the young people start specializing.

To steer forward marine research in the region and enhance the contribution to the national development agenda, KMFRI needs to build research infrastructure, human capacity and networks to fully contribute to the national, regional and global research agenda. The above issues should be addressed through enhanced collaboration between research institutions in Belgium, and their wider networks within EU on one hand, and KMFRI as the national focal point in Kenya and her national, regional and international networks on the other hand in order to achieve the following outcomes:

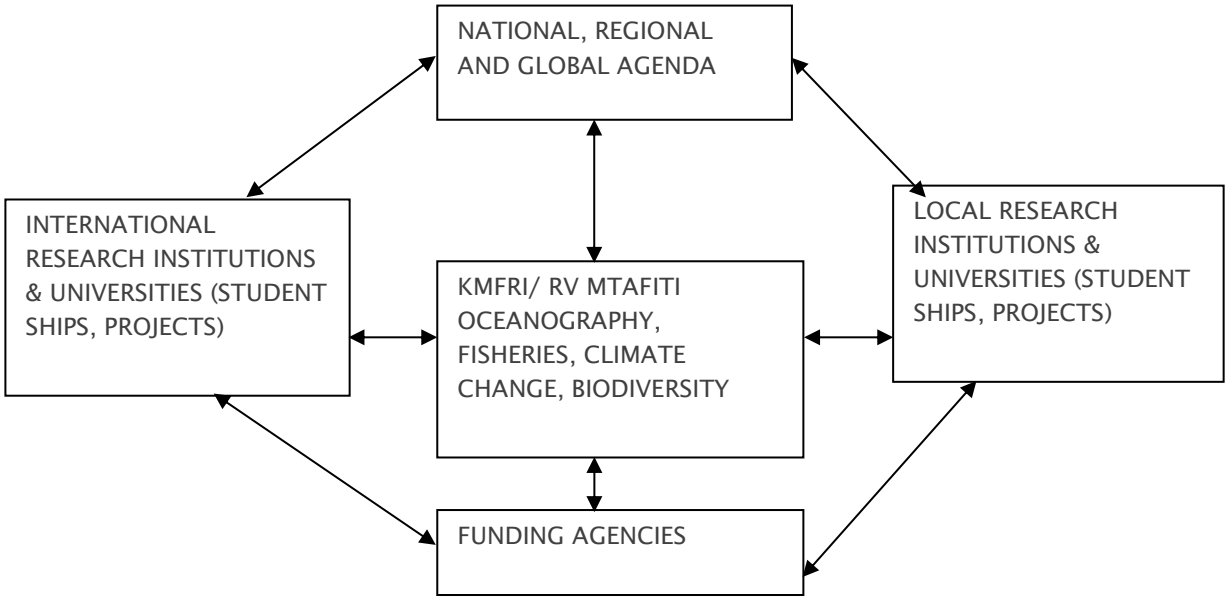
i. A wider network of professionals required to increase the impact of research on ecosystem services as well as enhance livelihoods.
ii. Raise the institutional profile of participating institutions to attract recognition and scientific impact.
iii. Increase resource base to complement existing regional marine research capacity.
iv. Increase opportunities for marine research through capacity building and training.

5. NEEDS, OPPORTUNITIES AND ACTION POINTS

Following the discussions during the conference and further formal and informal consultations, the following were identified as the key needs for research development, the opportunities that exist in Kenya and the WIO on one hand and in Belgium and other countries that collaborate in research in the Indian Ocean and the immediate action that may address the identified needs.

Needs	Opportunities	Action points
Scientific research capacity: mainly for physical and biological oceanography, marine geology, taxonomy, EIA, mariculture, natural resource valuation, blue carbon technology, ICZM/spatial planning, human health, pollution/toxicology, socio-economic research	Established training institutions, networks of specialised qualified personnel in Kenya, Belgium and other collaborating countries and regional organisations (e.g. WIOMSA, SWIOFC)	▪ Capacity needs assessment and development of targeted capacity development programs ▪ Individual scholarships and exchange programs ▪ Get funding for joint multi-interdisciplinary research projects with international partners
Technical research capacity: instrumentation, taxonomy, ship crew	RV Mtafiti, MoU with VLIZ, Local maritime college (Bandari)	▪ Assessment of training needs, Technical training ▪ Get co-funding to operationalize RV Mtafiti
Limited data and information on offshore and deep water resources in Kenya and the WIO, bioprospecting, oil and gas exploration	Research Institutions, scientists, PPP, RV Mtafiti	Joint national and regional multidisciplinary cruises and research/monitoring programs
Aquaculture infrastructure capacity: seed and feed research, value addition,	Existing water resources, conducive climate, existing trained mariculture scientists, experience, network of aquaculture specialists, ready market	Mariculture research, training and development centre
Networking and collaborations (need for diplomatic policies for close border scientific collaborative studies)	Existence of MoUs, long-term collaboration in research and strong scientific institutes and universities	Development of policy framework to facilitate capacity building and exchange of technical professionals to other labs/countries

The model of collaboration between KMFRI, local and international universities and research institutions with funding from governments and funding agencies is suggested in the figure below. In the model, KMFRI will continue to provide scientific and logistic support in capacity building in collaboration with local and international universities through research programs and cruises, lectureships and supervision of graduate and postgraduate students. The figure below shows the suggested model of interaction to build synergies and increase benefits from collaborations in future.



6. CONCLUSIONS

The conference presentations and discussions clearly demonstrated the existing volume of scientific knowledge on marine resources, research disciplines, infrastructure capacity, data and information gaps and opportunities within Kenya and the WIO region. The key institutions in the WIO including research organisations, universities, NGOs and funding agencies demonstrated their areas of interest and avenues of communication and collaboration. Complementarities and synergies between different research disciplines in Kenya were discussed and the need for further cooperation was recognized. The research institutions in Belgium indicated that their current programs in marine science include funding plans for marine research in Kenya.

As a centre of excellence in the region, KMFRI was able to demonstrate its leadership position in marine research in the WIO, having housed many important regional and national programs, and its capacity and readiness to continue supporting regional research programs as well as new and emerging areas including environmental health, climate change and new types of pollution.

The conference concluded that deliberate efforts involving multi-disciplinary and interdisciplinary approaches to marine science will need to be upheld involving the natural scientists and social scientists including economics in collaborative research in order to achieve the desired outcomes as discussed during the conference. Continued capacity building in all these areas will be essential for this to work. Words on Belgium perspective of the conference: “The conference was a great success and there is need to foster collaboration between the coastal and marine science network in Belgium and KMFRI in the future”.

Although the need for further cooperation was recognized, the conference was too short to identify concrete and realistic research initiatives and draw detailed action plans for the future. Ideally, there should be a smaller follow-up meeting to work this out, based on the VLIR Country Strategy for Kenya and on other strategies developed by other donors.

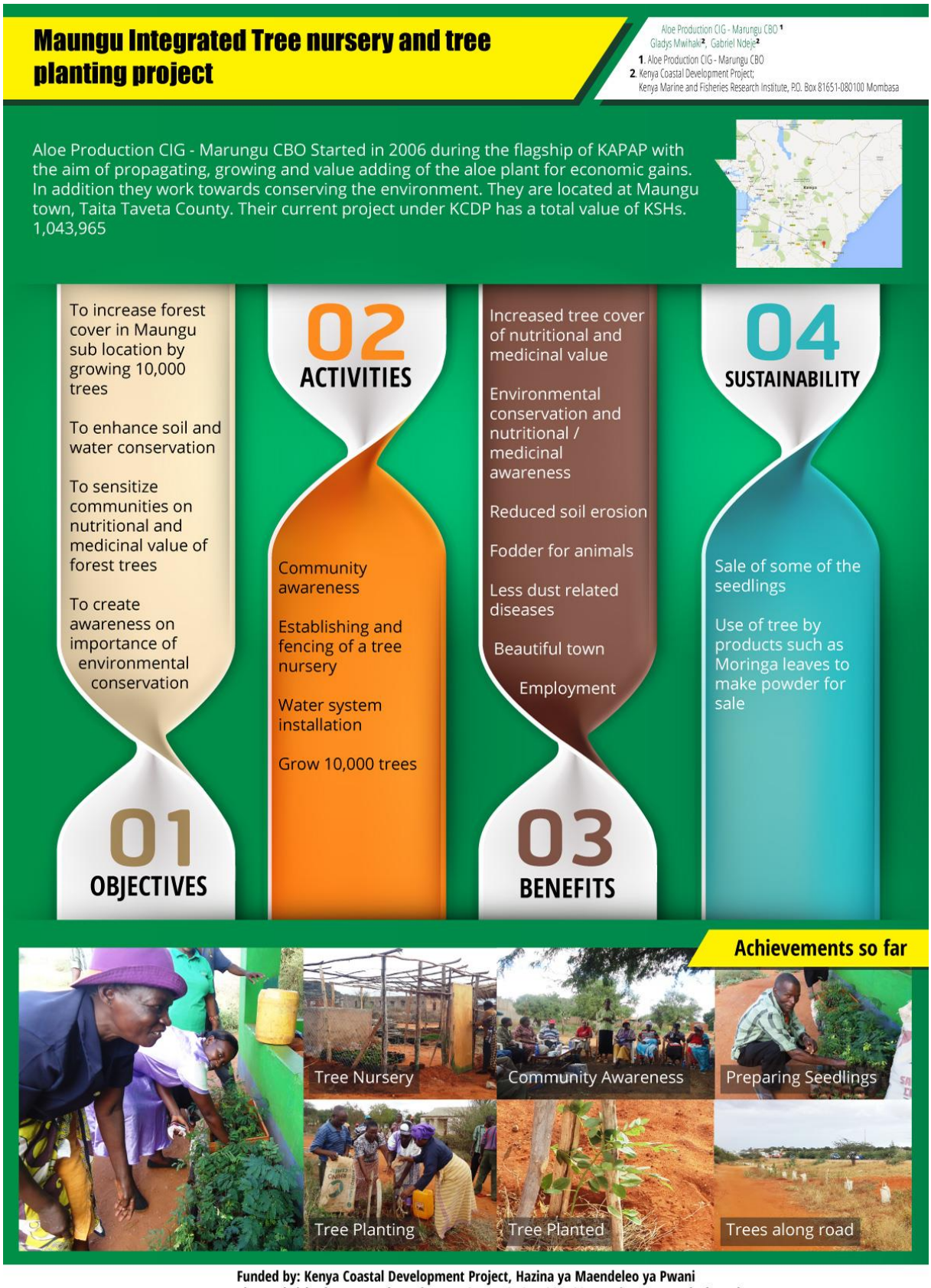
Building upon a history of long-standing and successful bilateral cooperation between on the one hand KMFRI or individual universities in Kenya, and on the other hand individual partners in Belgium (VLIZ, universities, …), the conference participants a) recognize the need, b) will explore possibilities for funding and c) aim to enter jointly into activities of multilateral cooperation, involving various Kenyan and Belgian partners. Therefore, in parallel with continued and even intensified bilateral cooperation, this conference could be the start to bring cooperation between Kenya and Flanders to a next level.

ACKNOWLEDGEMENTS

We are grateful for the support by organizations that funded the conference VLIR-UOS, KMFRI, KCDP, NACOSTI, IORA and individual speakers who funded their trips to the conference. It was the hard work of the members of the organizing and scientific committee, the team that developed the proposal including scientists from KMFRI, VLIZ, UGENT and VUB. The organisers would also wish to give special thanks to the speakers of the conference sessions. All the participants drawn from different stakeholders (including county government officials, community members, researchers, NGOs and people from the industry) who showed interest and participated actively in the different sessions made the conference a resounding success. Finally, the dedication of the secretariat and the logistics team who did the behind the scenes organization is sincerely appreciated.

ANNEXES

ANNEX I. POSTERS – KENYA COASTAL DEVELOPMENT PROJECT



KCDP

Mangrove Rehabilitation along the Junda area of Tudor Creek

Brain Youth Group

Mbarak Abdalla [1] , Angela Mbelase[2] , David Kalama [2]
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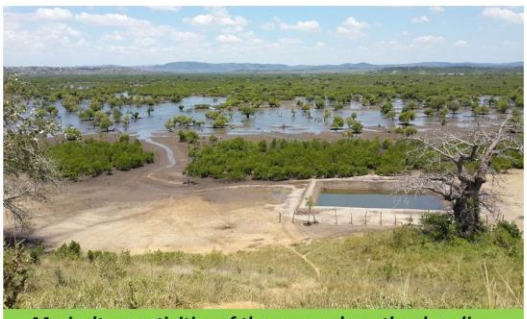
[2] Kenya Coastal Development Project; Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

Background:

- Registered as a CBO in 2011
- Membership of 20 pax (Female 9)
- Previous activities
  - Conserving the marine ecosystem
  - HIV/AIDS awareness
  - Income generating projects
- Groups partnered with KMFRI, PSI, KFS, MoH and Kwetu Training Center.
- Mission: To work for the sustainable development of Junda mission by providing alternative sources of income while preserving the environment.
- Problem
  - Loss of different species of mangroves
  - Degradation of breeding grounds for fish.
  - Shoreline erosion

GPS Coordinates: S 03°58'00.0" E 039 °43'23.6"

A degraded section of the mangrove forest along the shoreline



Mariculture activities of the group along the shoreline.

Involving community in mangrove planting.

KCDP-HMP Project Interventions

- Rehabilitation of degraded mangrove forest along the Junda area of Tudor creek
- Improve safety in times of natural calamities and disasters due to unpredictable climate change and reduced shoreline erosion.

Activities to be undertaken

Trainings on; Seed selection, Nursery preparation, Variety of species, Mangrove diseases, Tides notification

↓

Sourcing for Seeds and Nursery preparation

↓

Planting

↓

Security for Nursery and planted trees

Project Cost

Total Project Costs	Grant Size	Community Contribution
Ksh. 541,680	Ksh. 449,980	Ksh. 91,700

Mangrove nursery ready for planting

Implementation preparation

- Community awareness
- Nursery preparation

What the community must overcome

- Low survival rate of the planted mangrove
- Tree and nursery security

Expected benefits

- Increased mangrove cover along the creek especially in the deforested area.
- Improved breeding grounds of fish thereby increasing fish population leading to improved livelihoods.
- Increased awareness on the importance of mangrove to livelihood by the community in Junda area

Sustainability

Community awareness, mariculture activities of the group will ensure sustainability of the project.

KCDP

DEVELOPMENT OF A COMMUNITY RESOURCE CENTRE & LEARNING GROUNDS

Dabaso Creek Conservation Group, S. Mulili and R. Ruwa
Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

DABASO CREEK CONSERVATION GROUP

Background Information

- **DCCG** is self help group officially registered with the Kenyan Ministry of Gender and Social Development services in 2000.
- The CBO enjoys support from the community and stakeholders in all its conservation activities along the Mida Creek and its environs.
- The group is made up of a diverse membership drawn from the youth and the elderly, male and female, literate and illiterate, farmers and fishermen.
- The group's goal is conserving the mangrove forest and promote a sustainable usage of the resources in Mida Creek and its environs.

Mangrove planted in a degraded area

Boardwalk in mangrove forest

Objectives

The group aim is to enlighten the community on the importance of conserving the marine ecosystem and encourage sustainable use of the resources.

DCCG training organised by KWS

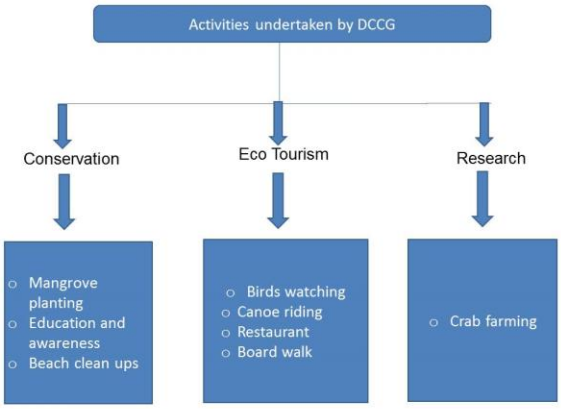
Crab farming going on

Strengths

DCCG has enjoyed immense support and collaboration from the community and government agencies in its continuing efforts of conservation where the community would be mobilised in mangrove planting activities and Kenya marine and fisheries research institute (KMFRI) as a government agency, has in the past used our venue to carry out research on crab farming. Other agencies are:- Kenya Forest Service, Kenya Wildlife Service and Department of Fisheries.

Activities undertaken by DCCG

- The group is involved in three major categories of activities as shown in the figure below



Rehabilitation of degraded areas

Mangrove nurseries in Dabaso

Challenges

The main problems that DCCG aims to address are:-

- Mangrove deforestation
- Illegal fishing methods
- Over fishing

Expected Impacts

- Degraded areas rehabilitated
- Level of ignorance on marine ecosystem reduced
- Intact breeding sites for marine organisms
- Creation of job opportunities among community members
- A conducive site for marine research that yields beneficial information for the local community

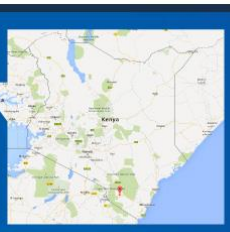
Birds flying in beautiful Mida Creek

Community member in taking guests on a boat riding experience

Water harvesting From Roof tops project at Dr. Aggrey High School

PTA Dr. Aggrey High School[1]
Gladys Mwihaki[2], Gabriel Ndeje[2]
1. PTA Dr. Aggrey High School, P. O. Box Number 1011 – 80304, Wundanyi
2. Kenya Coastal Development Project;
Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

Dr. Aggrey is a provincial secondary school in Wundanyi, Taita Taveta County; 2km from Wundanyi town. It was established in the 60s and currently has a population of 681 Student and 51 staff. The school vision, mission and motto is: To attain academic excellence; To equip students with knowledge and skills to become innovative and self reliant; and Elimu na Maendeleo respectively. Their current project under KCDP has a total value of KSHs. 2,190,738



01 OBJECTIVES

To increase access to water for students at Dr. Aggrey High School

Reduce erosion and siltation of river Voi

Reduce conflict between students and community over natural resource

Reduce pressure on natural resource

02 ACTIVITIES

Procurement of project materials

Fixing of gutters on the fisher boards

Construction of tank bases and tanks installation

Plumbing

Tree planting

03 BENEFITS

Reduced costs in accessing water

Reduced students - community conflicts

Enhanced health of the students

Better school performance

Enhanced school management in running other projects

Environmental conservation

04 SUSTAINABILITY

The school has a repair and maintenance kitty

1. Water Shortage necessitating purchase of water

2. Dr. Aggrey students washing at the river

3. Soil erosion at the school

Achievements so far

A. Gutters fixed and Installed 4 water tanks

B. Constructed 7 tank bases awaiting tank installation

C. Planted 150 trees in the school

Funded by: Kenya Coastal Development Project, Hazina ya Maendeleo ya Pwani
Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa, www.kcdp.co.ke

KCDP

Galana Maro Community Water Project

Galana Maro Women Group, P. Kazungu and R. Machaku
Galana Maro Women Group, P.O. Box 103, Hola

About Galana Maro Women Group

- Registered in 2010
- Membership: 20 (F: 13)
- Physical address: Hola, Tana River
- Goal: Economic empowerment

Project location


A resident of Wachakone fetches water in the crocodile infested River Tana.


Current source of water for the Kerengende community

- **Project Title: Community Water Project**
- **Project Objective: Improving access to clean water at Wachakone and Kerengende villages, Hola.**
- **Project Cost: Kshs 924,500/=**
- **Type of Project: Community Service**

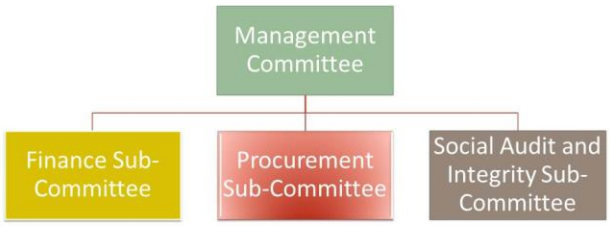
Expected Impacts

- Enhanced access to clean water for 2000 community members from 400 households
- Distance to water point reduced from 3km to 300 metres

Project Status

- Hydro-geological and Geophysical Investigations have already been conducted on the two villages
- Digging of the shallow wells has commenced

Galana Maro W/G Organogram



Statement of the Problem

- Wachakone and Kerengende villages have a combined 400 households.
- Wachakone residents rely on River Tana for its water needs.
- However, the river is heavily infested with crocodiles, occasioning up to 6 attacks on humans and up to 50 attacks on livestock every year.
- Kerengende residents meanwhile rely on a shallow well located 2 kilometres away from the village. The well cannot sufficiently sustain the community's water needs.

Implementation Approach

- The group is sinking two shallow wells in the two villages.
- The wells shall be fitted with hand pumps for ease of water access.
- The wells' apron shall be raised, and reinforced with concrete to protect the wells from contamination from flood waters.
- Village water committees shall manage the wells on behalf of the beneficiaries.


Shallow well digging in progress

Acknowledgement

Funding for the project has been provided by Kenya Coastal Development Project through the Hazina ya Maendeleo ya Pwani – HMP

Promoting Mangrove Conservation Through Eco-tourism Activities

Tima Matano [1] , Amina Ali[1] , Noel Mbaru[2] , Gladys Muiti [2]

[1] Gazi Women Group ; P.O. Box 3 Msambweni.

[2] Kenya Coastal Development Project; Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

KCDP

Introduction

Registered in 2004 ; the group has a goal geared towards enhancing community income through mangrove ecotourism activities amongst households in Gazi village, Kinondo location. Ongoing group activities include ecotourism , apiculture , catering and reforestation. The group received K.C.D.P/HMP funds, which will unable them to address challenges such as limited catering amenities and services, poor marketing strategies which translates to Low visitor turn out and cash flows. Further, there is high degradation of mangrove forests through illegal overharvesting and encroachment at Gazi bay and even within the eco-tourism designated areas.

Gazi Mangrove Boardwalk

Project Objectives

1. To develop an eco -restaurant within the forested boardwalk facility.
2. To market the mangrove eco-tourism products to hotels, schools and colleges
3. To equip the group members with good entrepreneurial, project management and leadership skills.
4. To diversify non-consumptive activities in mangrove areas

Degraded mangrove stand

Activities

1. Re designing and establishing a restaurant in the existing boardwalk facility to include catering related infrastructure .
2. Value addition and support to their apiculture activities
3. Marketing and Branding of the Boardwalk with regard to mangrove eco-tourism
4. Strengthening the capacity in eco- entrepreneurship through training of community members.

Improving on infrastructure, catering activities and marketing

Support to Apiculture

Value Addition to Apiculture

Expected Benefits

1. 10% Increase in community members participating in Mangrove conservation (Increase to the membership of the group).
2. 2 %Increase in number of tourists to the project (which is approximately 800-1000 per year)
3. 2000 mangrove trees planted.
4. 3 % increase on the net returns per year on catering) currently Gazi the initiative is making an average of 200,000 per year but hope to increase the income to 500,000 per year.
5. Increase support for *Madrassa* PTA teacher from 2 to 4.

Acknowledgement

This poster is produced through the support from the Kenya Coastal Development Project under the Hazina Ya Maendeleo Ya Pwani (HMP)

Project Size : Ksh 1,500 000

Conservation and Promotion of Cultural Knowledge for Sustainable Livelihoods

KCDP

Gerald Gambo [1] , Noel Mbaru[2] , Gladys Muiti [2]

[1] Kaya Muhaka Community Based Organisation P.O. Box 86 Ukunda .

[2] Kenya Coastal Development Project; Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

KARIBU CAMP KAYA

Background

Registered in 2000, Kaya Muhaka Forest Organization is a community initiative whose major objective is to involve local community around Kaya Muhaka Sacred Forest in biodiversity Conservation while promoting socio-economic benefits in order to improve their livelihood.

Endangered Columbus monkey

Kaya Muhaka Sacred forest view

Situated just outside Muhaka village, on the slopes of Shimba Hills in Kwale county Kaya Muhaka is home to a variety of wildlife;

- Vervet monkeys,
- Sykes monkeys,
- Bush babies,
- Yellow baboons,
- Suni antelopes,
- Endangered species such as Angolan black, white Columbus monkeys , golden ramped elephant shrew and ground thrush

Existing Tourism Facilities & Activities

- Camping site
- forest and village tours
- Information center
- Tree nursery for indigenous and exotic trees
- Jatropha farm and processing unit
- Bee keeping.

Challenges and Opportunities

- Partial research and data on existing and endangered biodiversity species
- Undocumented information/curricula for education programs
- Inadequate business strategies and tourism marketing

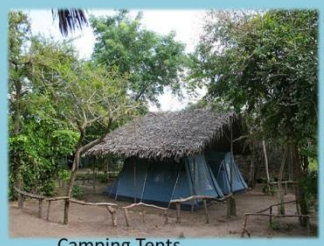
Project Objectives

- To enhance biodiversity conservation and cultural activities of Kaya Muhaka Sacred forest
- To diversify and promote ecotourism and other eco-friendly economic enterprises
- To increase awareness to the local community and the users on the values of the Kaya forest through participation and education programs

Project Activities

New Eco-Shades & Power Grid installation

Improving water source



Camping Tents

Tree planting

Expected Benefits

- Increased biodiversity through the planting of 1600 indigenous trees around Kaya Sacred Forest
- Community managed camp site with Increased number of local and international visitors from 170 pax to 1440 pax and hence increased income
- Farm produce market for about 50 farmers
- Promotion of local talents and arts for over 100 youths
- Shared project benefits with the local community (water, education & infrastructure)

Acknowledgement

This poster is produced through the support from the Kenya Coastal Development Project under the Hazina Ya Maendeleo Ya Pwani (HMP)

Project size : Ksh. 1,798,470

KCDP

Kipao Livestock Dipping and Treatment Facility Project

Kipao Noor Women Group, P. Kazungu and R. Machaku
P.O. Box 136, Garsen

About Kipao Noor Women Group

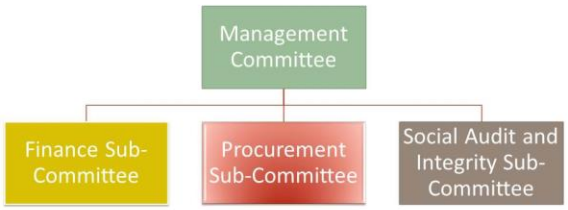
- Registered in 2002
- Membership: 28 (F: 23)
- Physical address: Kipao Village, Tana Delta
- Goal: Economic empowerment

Location of the group

- **Project Title: Kipao Livestock Dipping and Treatment Facility**
- **Project Objective: Mitigating Livestock Mortality for Improved Livelihoods at Kipao village**
- **Project Cost: Kshs 1,870,920/=**
- **Type of Project: Community Service**

Some of the Kipao Noor Women Group Members during proposal development

Kipao Noor W/G Organogram



Implementation Approach

- The group will construct a cattle dip 200 metres from the village.
- Water from the river will be pumped to the dip
- Waste water will be treated before being disposed
- Youth from the village will be trained on animal health
- The veterinary office will offer technical assistance to the group.
- Livestock owners will be charged a small fee for dipping and treatment of their animals

Cattle at Kipao village

Statement of the Problem

- Kipao village has over 20,000 heads of cattle, sheep and goats.
- Kipao Village has no functional cattle dip, exposing animals to tick borne and tsetse fly infestation related diseases
- ~150 animals die annually from these diseases

Expected Impacts

- Reduction in ecto-parasite infections at Kipao hence reduced cattle mortality rates
- Reduced spending on animal health
- Improved economic livelihood for the community
- Safer environment as a result of controlled disposal of chemical waste

Acknowledgement

Funding for the project has been provided by Kenya Coastal Development Project through the Hazina ya Maendeleo ya Pwani -HMP

Majaoni Community Board Walk Eco-Tourism Project

By Majaoni Youth Development Group

Lucas Cosmas Fondo [1], Angela Mbelase [2], David Kalama [2]

[1]Majaoni Youth Development Group-MYDG P.O. Box 88643-80100 Mombasa. Cell Phone No.0721-327-144

[2]Kenya Coastal Development Project; Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

KCDP

Majaoni Youth Development Group

Conserve to Sustain

Background:

- Registered as a CBO in 2003
- Membership of 20 pax. (Female 12)
- **Vision**: Empowered and developed youths who are able to exercise their rights, sustainably exploiting local resources for their own benefits and the community

Majaoni project

- **Location:** North of Mombasa mainland behind Shanzu Village on the Old Mombasa Malindi road. GPS Coordinates: S 03°57' 58.9" E 039°43' 23.0"
- Destruction or degradation of breeding grounds for fish and other marine fauna due to indiscriminate cutting/harvesting of mangrove
- Inadequate access to tourism market for community products and artistry due to absence of a suitable avenue to showcase these products
- Unemployed and idle youth within the community

KCDP-HMP Project Interventions

- Enhance efforts by group in conserving mangroves along Mtwapa creek.
- Initiate a community managed board walk eco-tourism aimed at increasing benefits to members of the community.
- Enhance tourism market accessibility for community made artifacts

Project Activities

- Access Road construction
- Construction of a community eco-tourism Boardwalk
- Construction of community Resting/ exhibition Bandas
- Construction of a toilet
- Training of Guides

Project Costs

Total Project Costs	Grant Size	Community Contribution
Ksh. 1,655,390	Ksh. 1,471,400	Ksh. 183,990

Income Generating activities for the group

Conservation efforts: Mangrove Planting

A section of the completed boardwalk: Before and after

Access road & Banda

Expected Benefits

- Conserved mangroves forest of about 5km^2
- Enhanced community ecotourism project. With approximately 3000 people benefitting from the ecotourism
- Employment opportunities created for 20 community members as guides.
- Increased access to ecotourism market

Implementation Status

- Currently the group has received the final tranche disbursement which is to be utilized to complete the bandas, construct a toilet and train tour guides in readiness for the official opening of the project.

Anticipated Challenges

- Resistance from some community members to pay
- Low season of foreign tourists
- High maintenance costs of the structures and boardwalk

Sustainability

- Liaise with stakeholders in developing a business and marketing plan for the project
- Charging visitors a fee to cater for maintenance and running costs.

KCDP

Tarasaa Public Sanitation Project

Mapato Community Based Organization (CBO), R. Machaku and P. Kazungu
P.O. Box 123-80203, Garsen

About Mapato CBO

- Registered in 2006
- Membership: 22 (F: 9)
- Physical address: Tarasaa, Tana Delta
- Goal: Economic empowerment

- **Type of Project: Community Service**
- **Project Objective: Improving access to sanitation at Ngao and Oda Trading Centres, Tana Delta.**
- **Project Cost: Kshs 1,984,640/=**

Location of the group

Statement of the problem

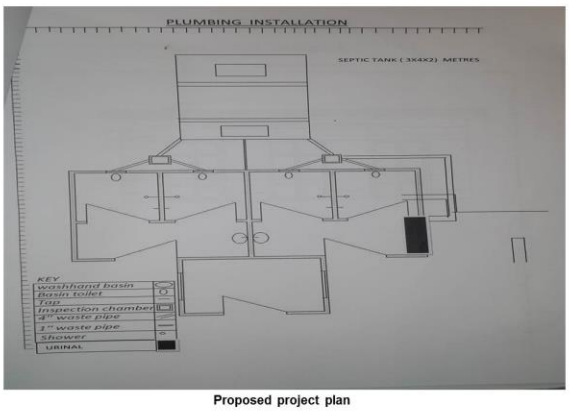
- Lack of access to sanitation facilities for ~1000 people in Ngao and ~3000 people in Oda
- Pollution of the environment due to open disposal of human waste
- Increased risk of outbreak of water borne diseases
- 200 cases of diseases related to poor sanitation are reported monthly in the project area
- Limited awareness on the need and importance of using sanitation facilities

Some CBO Members during proposal development

Mapato CBO Organogram

Implementation approach

- The group proposes to construct two modern eco-toilet facilities at Oda and Ngao Trading Centres.
- A third facility will be constructed at Tarasaa Trading Centre
- The group will charge a small access fee for maintenance of the facilities



Proposed project plan

Expected Impacts

- Cleaner environment in the trading centres
- 2946 and 920 people operating within Oda and Ngao towns respectively will have access to sanitation services
- Reduced cases of disease outbreaks in and around the trading centres
- Communities in and around the trading centres adopting the use of toilets.

Project Status

The project is awaiting Eco-Sanitation consultancy recommended by KCDP as well as an Environmental Impact Report to commence.

Acknowledgement
Funding for the project has been provided by Kenya Coastal Development Project through Hazina ya Maendeleo ya Pwani - HMP

KCDP

Managing Mangroves for Improved Community Livelihood

Salim Abdhala [1] , Noel Mbaru[2] , Gladys Muiti [2]

[1] *Mikoko Pamoja Community Based Organisation ; P.O. Box 178 Msambweni.*

[2] *Kenya Coastal Development Project; Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa*

Background

The Mikoko Pamoja Community Based Organization is aimed at enhancing mangrove productivity by carrying out activities that benefit local communities and are eligible for attracting carbon investment. During its Project Development stage, technical feasibility studies were undertaken in the mangroves of Gazi bay hence it provided Plan Vivo certified carbon accreditation and benefits that attracted investors in the sale of its first offsets in 2014 . The group has been approved to received financing from K.C.D.P to address issues which include the following; Degradation of mangrove forests due to illegal harvesting and encroachment ; Inadequate capacity on mangrove reforestation and management amongst community members ; Lack of tailor made carbon forest monitoring tools that could be used by communities to track mangrove carbon in their areas and lastly Poor understanding of the value and benefits of mangrove goods and services.

Project Objectives

1. Improve surveillance of mangrove areas through construction of a watch tower at Makongeni pilot area
2. Build local capacity on mangrove reforestation and management
3. Develop forest carbon monitoring tools for use in the monitoring of mangrove carbon
4. To inform, educate and make aware to the community the non-consumptive uses of mangroves

Activities

1. Forest monitoring, patrols, policing, mapping and data collection of Gazi mangroves
2. Site selection and establishment of mangrove nurseries for the *Sonneratia alba sp.*
3. Planting of approximate 4000 *Sonneratia alba sp.* of mangroves at the degraded Gazi beach
4. Construction of the watch tower

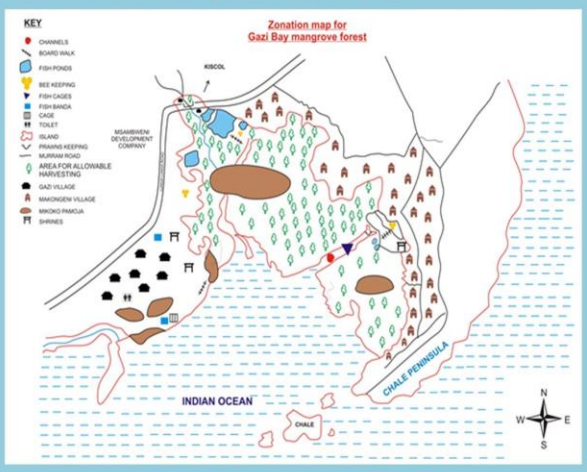
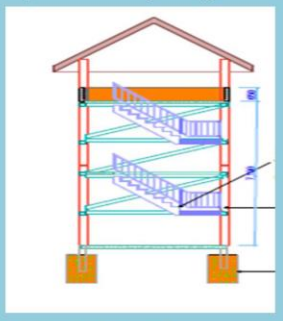


Fig 1 - Zonation map for Gazi Bay mangrove

Forest rehabilitation

Establish *Soneratia alba* stand

Fig 2 - Proposed watch tower design to be used for mangrove protection



Expected Results

1. Improved forest cover as a result of reduced mangrove poaching and rehabilitation of degraded areas
2. Enhanced capacity on mangrove reforestation and management
3. Improved tools to monitor mangrove carbon for sale in the international carbon markets
4. Increased capacity on participatory mangrove management
5. Increased income from sale of carbon credits generated from managed mangroves
6. Better managed mangroves through this project will lead to increased fisheries and shoreline protection

Acknowledgement

This poster is produced through the support from the Kenya Coastal Development Project under the Hazina Ya Maendeleo Ya Pwani (HMP)
Project Size: Ksh. 499,950

Mentally Impaired/Disabled school dormitory project at Voi Primary

Mwangea Hills Green Belt[1], Voi Primary[1], Gladys Mwihaki[2], Gabriel Ndeje[2]
1. Voi Primary School, P. O. Box 16 - 80300, Voi
2. Kenya Coastal Development Project;
Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

Mwangea Hills Green Belt in Voi, Taita Taveta County was registered in July 2007 and has 20 members (Female: 13). They have previously been involved in Farming; Planting trees; Soil conservation; and Cleaning the village. The project they will be implementing under KCDP has a total value of KSHs. 2,065,079 and is expected to commence soon.

01 OBJECTIVES

To accommodate 24 students who are mentally impaired and thus keep them safe from sexual abuse, forced drug abuse and ridicule

To reduce the time mentally challenged pupils at Voi primary take to get to and from school

Reduce the risk of being involved in a road accidents

02 ACTIVITIES

Procurement of project materials

Construction of the school dormitory with an extension of a kitchen and a dinning area

03 BENEFITS

24 mentally challenged children accommodated in a safe environment

Increased school enrolment of mentally challenged children

Reduced sexual harassment and forced drug abuse

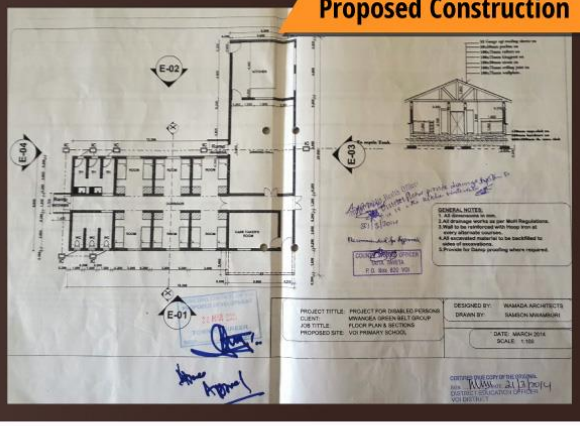
Parents to have more time in farming and other income generating activities

04 SUSTAINABILITY

The boarding pupils will be charged a fee of KShs. 5,715 per term

Current Situation

Proposed Construction



Funded by: Kenya Coastal Development Project, Hazina ya Maendeleo ya Pwani
Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa, www.kcdp.co.ke

KCDP

Rehabilitation of Newport Beach Area – Likoni

Mahmood Karama Hamtoot [1] , Angela Mbelase[2] , David Kalama [2]

Newport Self Help Group P.O. Box 81651-080100 Mombasa, Mobile: 0723 291 949

[2] Kenya Coastal Development Project; Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

Newport Self Help Group

Background:

- Started in 2005 and registered as a CBO in 2010
- Membership of 44 pax. (Female 4)
- Groups goal: Offering surveillance on the beach to avoid misuse of the shoreline.
- Previous activities:
  - Managing the beach area
  - Constructing an office in the area

Newport Beach

- The fishermen use the Newport beach as a landing site and the youth use the beach for recreation i.e. mainly swimming and sunbath.
- Massive pollution along the Newport beach shoreline that threatens to choke the sea leading to Loss of aesthetic value of the shoreline stretch
- Death of fish along the shoreline caused by the fishing feeding on nonorganic waste swept by the sea during high tides
- GPS Coordinates: S 04 °04'39.2'' E 039°39'20.8''

Dumpsite along the Newport beach

Effects of Litter on the marine organisms

Expected benefits of the project to fishermen and the youth.

KCDP-HMP Project interventions

- To have a clean rehabilitated Newport beach.
- To start a waste management mechanism for the community.

Activities to be undertaken

Project Cost

Total Project Costs	Grant Size	Community Contribution
Ksh. 511,250	Ksh. 449,950	Ksh. 61,300

Efforts of the group to control irresponsible dumping

Expected Benefits

- The clean shoreline will open it up again for recreational purposes including swimming and enhanced aesthetic value
- Organised solid waste disposal program to the community living along the landing site by provision waste collecting bins to 100 households
- Protected fish life thus increase in fish catch.

Readiness for Implementation

- Community awareness
- Putting posters discouraging irresponsible dumping.

Anticipated Challenges

- Resistance from community some members
- Delay by county government in picking the litter from the transfer centre.

Sustainability

- The domestic garbage collection will provide an alternative to dumping along the shoreline.
- Income generated from the garbage collection project will be sued to sustain the cleanliness activities in the area.

KCDP

Improving Access To Domestic Water For Ndau Village

By Al-Fattah Self Help Group

Contact person : Abdul-Fatah Hassan Ali, Chair Person
P.O. Box 45 – 80500 Lamu, Tel: +254(0)723237113, Email: abdulfatahhassan60@yahoo.com

Background:

- Registered as CBO in 2011.
- Membership of 20 pax (10 Females)
- Previous Activities:
  - HIV and AIDS awareness
  - Planting trees (2000 seedlings)
  - Rain water harvesting using underground storage tanks (*Djabia*)

Ndau Village

- Remote village part of the 65 islands of the Lamu Archipelago
- Has a population of approx. 854 pax
- The village experiences acute shortage of drinking water
- The high cost of fresh water ranges between KSh. 30 and 50 per 20 litre.
- Residents spend several hours in queuing for water.

Dilapidated *Djabia* for rain water harvesting

Long queues and time spent in drawing water

KCDP-HMP Project Interventions

- Construction of *Djabia*
- Community engagement in management of the water project
- Provide water at affordable price

Main Activities

- Construction of *Djabia*
- Community engagement in management of the water project
- Selling of water at affordable price

Project Cost

Total Project Costs (KSh.)	917,800
HMP Grant (KSh.)	812,800 (89%)
Community In-Kind Contribution (KSh.)	55,000 (6%)
Community Cash Contribution (KSh.)	50,000 (5%)

Extension of the outer wall of the water tank in progress

Construction work on the new water holding tank in progress

Expected benefits

- Reduced time spent in search and queuing for water
- Reduced price volatility of water in Ndau village
- Improved access to water for 854 community members in Ndau village

Sustainability

Revenue will be raised to cater for operation and maintenance as the community pays for drawing water from the *Djabia*.

KCDP

Bomani Community Poultry Production Improvement Project

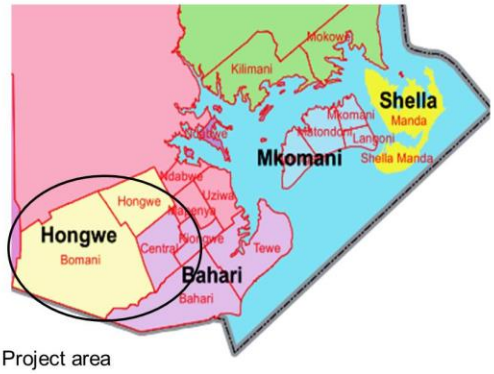
By Mega Vision Youth Bunge
Contact Person: John Mutie Njuguna, Chair Person
P.O. Box 41 – 80503 Mpeketoni, Tel: +254(0)734750051 or +254(0)726801216
Email: johnliver2013@gmail.com

Background:

- Registered as CBO in 2011
- Location: Bomani Village, Hongwe Ward
- 20 members (8 Female)
- Previous activities
  - Poultry farming,
  - Youth empowerment
  - Environmental school clubs
  - HIV/AID Campaigns

Major Problems:

- High costs of using a Hatchery for poultry production currently at Ksh. 30 per egg
- Low productivity from poultry farmers due to inadequate extension services



Project area

Current hatchery

Present poultry structure

Egg laying area

KCDP-HMP Project Interventions

- Construct a modern poultry hatchery
- Train more than 100 farmers
- Provide free poultry vaccines to more than 100 farmers utilizing the hatchery services
- Brood young hatchlings for two weeks

Main Activities

- Construct a poultry hatchery
- Install a solar system.
- Fence the project plot
- Training, educating and creating awareness to more than 100 farmers in Bomani

Project Cost (KSh.)

Total Project Costs	2,613,250
HMP Grant	1,800,000 (90%)
Community Contribution In Kind:	106,200 (5%)
Community Contribution Cash	155,125 (5%)

The proposed hatchery

Proposed hatchlings brooding area

Expected Benefits

- Reduced price in hatching services to Ksh. 10
- Easy access to hatchery machine by 1 Km
- Increase the survival rates of brooders
- Improved housing, disease control and feeding for poultry leading to better returns

Sustainability

The group will easily sustain the project from the funds generated through the hatching services to the farmers.

SABAKI GREEN COMMUNITY PROJECT

KCDP

By Veterinary Community Environmental Conservation Group, R. Ruwa and S. Mulili
c/o Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

Background:

- Veterinary Community Environmental Conservation group is a Community Based Organization which was formed in 2012 as a self help group. In June 2013 the group joined other groups from the area to form a community based organization focusing on environmental conservation activities.
- The group has 34 members (16 Female).
- The group activities are sited at Sabaki Bridge, Magarini Sub County of Kilifi County where the group uses 4 acres of land which belongs to the Ministry of Agriculture.

Onions ready for at group's farm

Problems being addressed

- Lack of awareness on environmental conservation.
- Indiscriminative tree cutting in the area and the existing mangrove forests.
- High Poverty levels of the community members leading to misuse or over use of the available natural resources.
- Open quarries.

A degraded area forest to be rehabilitated

A degraded mangrove forest to be rehabilitated

KCDP-HMP proposed interventions

- Rehabilitate the degraded areas and conserve the existing marine ecosystem by promoting the use the resources sustainably.
- Enlighten the community on the importance of conservation of the environment.
- Reclaim the sand quarries to their original state.
- Create jobs for youths and women through farming activities.
- Promote tourism activities in the area.

Planned activities

- Awareness creation on environmental conservation
- Rehabilitation of quarries
- Seedlings production
- Aquaculture
- Rehabilitation of sand quarries
- Poultry keeping
- Tour guiding
- Apiculture
- Mushroom farming

Tree seedlings to be planted in degraded areas

Tomatoes harvested from group's farm

Expected Impacts

- Bigger coverage of mangrove forest providing better breeding grounds for marine life.
- Increased forest cover.
- More income generating activities for the community especially unemployed youth and women.
- Improved living standards of the local community members.
- Members embracing modern technologies in farming.

KCDP

Okoa Maisha Project: Empowering IDUs and Teenage Mothers Through Waste Management

By Where Talent Lives, R. Ruwa and S. Muilili

c/o Kenya Marine and Fisheries Research Institute, P.O. Box 81651-080100 Mombasa

Background:

- WTLStarted in 2007 and was officially registered 2011
- Membership of 20 pax. (10 Females) in Gold, Silver and Bronze categories.
- Previous activities
  - Mentoring,
  - Empowering and engaging injecting drug users, commercial sex workers and teenage mothers
  - Alternative to livelihood Income Generating Activities
  - Creating job opportunities
- Goal is to emphasizing efforts to realize a healthier and sound environment for development.

Problems Statement

- Pollution due to lack of proper liquid and solid waste management systems.
- High rate of unemployment among youth
- Increasing number of injectable drug users in society
- Increasing number of young (teenage) mothers in society.

Teenage mothers trained on basketry with materials from recycled waste

Raphael a recovered IDU giving a

Khamisi a Recovered IDU giving a catching

Youth engaged in environmental conservation efforts through WTL's Okoa Maisha project

Objectives

- To involve the community in Environmental conservation
- To ensure effective and sustainable Waste management criteria in Kilifi county
- Integration of IDUs and teenage mothers into the society.

Activities undertaken by WTL

- Environment Conservation
- Garbage Collection
- Recycling the Plastics containers and bags
- Preparing compost manure from the waste products

WTL/ HMP Okoa Maisha Team

Group clearing undesignated dumpsite close to Mnarani beach

Tree planted on cleared undesignated dumpsite

Expected Impacts

- Improved environmental health
- Recycling of waste materials into useful products
- Proper disposal of waste products with over 500 homes participating in community based waste management
- At least 40 teenage mothers will be will be actively engaged in economic activities and equipped with skills
- The engagement of 100 IDUs in waste management as well as their rehabilitation within a year

ANNEX II. CONFERENCE FUNDING

The entire budget to host KMFRI-VLIZ conference was Kshs 6,014,275.00. The contribution in comparison to total budget was VLIR-UOS 33.25%, KMFRI 32.43%, KCDP 23.92%, National Council for Science Technology and Innovation (NACOSTI) 3.32% and Indian Ocean Ream Association (IORA) 7.07% (Table 2). Other indirect/in-kind contributions were received from speakers and participants who funded their trips to the conference in payment of air tickets and accommodation.

Table 2: Summary of funding contribution towards organisation of the conference

ORGANIZATION/INDIVIDUALS	CONTRIBUTION	
	KES	EUROS / USD
VLIR-UOS	2,000,000.00	20,000.00 € / 23,529.41 USD
KMFRI	1,950,275.00	19,502.75 € / 22,944.41 USD
KCDP	1,439,000.00	14,390.00 € / 16,929.41 USD
NACOSTI	200,000.00	2,000.00 € / 2,352.94 USD
IORA	425,000.00	4,250.00 € / 5,000.00 USD
TOTAL	**6,014,275.00**	**60,142.75 € / 70,756.18 USD**

ANNEX III. FINAL ADJUSTED PROGRAM

INTERNATIONAL WORKSHOP

27 – 29 OCTOBER, 2014

NORTH COAST BEACH HOTEL, KILIFI COUNTY, KENYA

SUSTAINABLE USE OF COASTAL AND MARINE RESOURCES IN KENYA:
FROM RESEARCH TO SOCIETAL BENEFITS

PROGRAM

DEDICATED TO THE MEMORY OF PROFESSOR PHILIP POLK, MARINE BIOLOGIST

(19 OCTOBER 1932 – 11 MAY 2014)

an inspiration and a friend to many in Kenya and Belgium

Monday 27 October 2014

OPENING SESSION

8:00 – 8:30 **Registration**

8:30 – 10:00 **OPENING SESSION**

Welcome remarks, Dr. Renison Ruwa, *Director KMFRI*
Aims and objectives of the workshop, Prof. Jan Mees, *Director VLIZ*
Welcome speech, Lou Dierick, *Honorary Consul, Mombasa*
Welcome speech, Roxane de Bilderling, *Belgian Ambassador to Kenya*
Welcome speech, Prof. Micheni Ntiba, *PS, State Department of Fisheries*
Opening address by Chief Guest, Felix Koske – *Cabinet Secretary, Ministry of Agriculture, Livestock and Fisheries*

SESSION 1: SETTING THE SCENE

(Chair: Renison Ruwa)

KEYNOTE SPEECH

10:00 – 10:30 **Importance of marine science in developing countries**
Prof. em. Mohammed Hyder, *Kenya*

10:30 – 11:00 **Break**

SESSION 1: SETTING THE SCENE (CONTINUED)

(Chair: Renison Ruwa and Jan Mees)

KEYNOTE SPEECH

11.00 – 11:30 **Short history of Kenya-Belgium collaborations and the marine science landscape in Belgium**
Prof. Jan Mees, *General Director, Flanders Marine Institute (VLIZ), Belgium*

11:30 – 11:45 **1. Marine sciences in the West Indian Ocean Region: the story of WIOMSA**
2. The Kenya Coastal Development Project: Matching Science with Development
Dr. Jackline Uku, *KCDP coordinator, President of WIOMSA and Senior Research Scientist, KMFRI, Kenya*

11:45 – 12:00 **Marine sciences in the Agulhas and Somali Current Large Marine Ecosystems (ASCLME) project**
Ms. Lucy Scott, previously Data and Science Coordinator, *UNDP/GEF financed ASCLME Project, South Africa*

Monday 27 October 2014

12.00 – 12:15 **Marine science in a global context and the Second International Indian Ocean Expedition**
Mr. Mika Odido, *Coordinator, Intergovernmental Oceanographic Commission (IOC) of UNESCO in Africa, UNESCO/IOC Sub Commission for Africa and the Adjacent Island States, Kenya*

12:15 – 12:30 **Kenya in the Western Indo-Pacific Realm - its coral reefs in space and time**
Dr. David Obura, Director, *Coastal Oceans Research and Development in the Indian Ocean (CORDIO East Africa), Kenya*

12:30 – 14:00	**LUNCH**

SESSION 2: SUSTAINABLE USE OF MARINE RESOURCES

(Chair: Renison Ruwa and Jan Mees)

14:00 – 14:15 **Sustainable coastal and marine fisheries resources in Kenya: forging linkages between research and policy for societal benefits**
Susan Imende, *Director, Fisheries Policy, Research and Regulation, Kenya*
Prof. Micheni Ntiba, *Principal Secretary, Ministry of Fisheries Development, Kenya*

14:15 – 14:30 **Marine Sciences: state of the art in Kenya**
Dr. Renison Ruwa, Director Kenya Marine and Fisheries Research Institute (KMFRI), Kenya

14:30 – 14:45 **Marine sciences: state of the art in Tanzania**
Dr. Magnus Ngoile, Policy and Governance Coordinator, United Nations Development Programme (UNDP)/*Global Environment Facility* (GEF) Agulhas Somali Current Large Marine Ecosystems (ASCLME), Tanzania

CANCELED

14:45 – 15:00 **Marine pollution along the East African coast: problems and challenges**
Prof. Colin Janssen, Faculty of Bioscience Engineering, *Ghent University, Belgium*

15:00 – 15:15 **The importance of oceanography and hydrography in Kenya**
Dr. Charles Magori, *Assistant Director, Oceanography and Hydrography, KMFRI, Kenya*

15:15 – 15:30 **Marine Fisheries research in Kenya**
Dr. Edward Kimani, *Assistant Director, Fisheries Division, KMFRI, Kenya*

15:30 – 16:00	**Break**

Monday 27 October 2014

SESSION 2: SUSTAINABLE USE OF MARINE RESOURCES (CONTINUED)

(Chair: Renison Ruwa and Jan Mees)

16:00 – 16:15 **Research vessels as an essential tool for ocean exploration and data acquisition**
Dr. André Cattrijsse, *Manager, Research Infrastructure division, Flanders Marine Institute (VLIZ), Belgium*

16:15 – 16:30 **RV Mtafiti scientific strategy for sustainable research in the Kenyan and WIO waters**
Dr. Enock Wakwabi, *Deputy Director, Kenya Marine and Fisheries Research Institute (KMFRI), Kenya*

16:30 – 16:45 **RV Fridtjof Nansen: experiences from the WIO Region** CANCELED
Dr. Kwame Koranteng, *coordinator of the EAF (Ecosystem Approach to Fisheries) - Nansen project, Fisheries Management and Conservation Service (FIMF), Food and Agriculture Organization (FAO) of the United Nations (UN), Italy*

16:45 – 17:00 **Fisheries governance in coastal and marine Kenya under the Kenya Coastal Development Project**
Mr. Kennedy Shikami, *Manager, Fisheries component, KCDP/KMFRI, Kenya*

17:00 – 17:15 **Legacy and lessons from SWIOFP – 2 years on**
Prof. Johan Groeneveld, *Oceanographic Research Institute (ORI), South Africa*

17:15 – 17:30 **Fish stock assessment in the Kenyan EEZ: current status**
Prof. Boaz Kaunda Arara, *Department of Fisheries and Aquatic Sciences, University of Eldoret, Kenya*

17:30 – 17:45 **KCDP fisheries research: progress update for the year 2013-2014**
Gladys Okemwa, *Research scientist, Fisheries Division, KMFRI Kenya*

17:45 – 18:00 **Quality control and value addition sub-component in KCDP Component 1: Fisheries**
Peter Oduor- Odote, *Senior Research Scientist, Fisheries Division KMFRI, Kenya*

18:00 – 19:30 RECEPTION

Tuesday 28 October 2014

SESSION 3.	COASTAL RESOURCE MANAGEMENT

(Chair: James Kairo and Ann Vanreusel)

8:30 – 8:45 **Integrated coastal zone planning and implementation**
Prof. Nico Koedam, *Plant Biology and Nature Management (APNA), Free University of Brussels (VUB), Belgium*

8:45 – 9:00 **Blue carbon storage and climate change mitigations**
Dr. James Kairo, *Principal Scientist, KMFRI, Kenya*

9:00 – 9:15 **South African estuaries: natural and anthropogenic drivers of ecosystem state**
Dr. Anusha Rajkaran, *Lecturer, Faculty of Science, Rhodes University, South Africa*

9:15 – 9:30 **A comparative survey of mangrove dynamics in India, Sri Lanka, Malaysia and Kenya**
Ass. Prof. Dr. Behara Satyanarayana, *Institute of Oceanography and Environment (INOS),* Universiti Malaysia Terengganu, *Malaysia*

CANCELED

9:30 – 9:45 **Eco-toxicology in coastal and marine systems**
Prof. Mohammed Ali Sheikh, *CEO of Zanzibar Business and Academic Consultancy (ZABACCO), Tanzania*

9:45 – 10:00 **Biodiversity and health of marine and coastal ecosystems in Kenya**
Jelvas Mwaura, *Research Scientist, Kenya Marine and Fisheries Research Institute, Kenya*

10:00 – 10:30	Break

(Chair: James Kairo and Ann Vanreusel)

10:30 – 10:45 **The restoration and rehabilitation of damaged or degraded mangrove ecosystems in Kenya**
Dr. Jared Bosire, *World Wide Fund for Nature (WWF), Kenya*

10:45 – 11:00 **Mangroves facing climate change: landward migration potential in response to projected scenarios of sea level rise**
Prof. Nico Koedam, *Plant Biology and Nature Management (APNA), Free University of Brussels (VUB), Belgium*
Prof. Farid Dahdouh-Guebas, *Systems Ecology and Resource Management, Free University of Brussels (ULB/VUB), Belgium*

Tuesday 28 October 2014

11:00 – 11:15 **Blue Carbon in the Western Indian Ocean**
Dr. Gabriel Grimsditch, *Senior Project Officer, International Union for the Conservation of Nature (IUCN), Maldives*

11:15 – 11:30 **Coastal ecosystems, coastal forestry and fisheries**
Dr. Virginia Wang'ondu, *Lecturer, School of Biological sciences, University of Nairobi, Kenya*

11:30 – 11:45 **Macrobenthos from Kenyan marine sediments: a review**
Dr. Agnes Muthumbi, *School of Biological Sciences, University of Nairobi, Kenya*

11:45 – 12:00 **Societal and economic benefits of research**
Mr. Jacob Ochiewo, *Assistant Director, Socio-economics and Planning, KMFRI, Kenya*

12:00 – 14:00 LUNCH

SESSION 4 . ROUND TABLE DISCUSSION: SUSTAINABLE USE OF MARINE RESOURCES

14:00 – 15:15 **Round table discussion**
Led by Dr. Renison Ruwa (KMFRI, Kenya) and Prof. Jan Mees (VLIZ, Belgium)

15:15 – 15:30 **Round up**
Rapporteurs Mr. Jacob Ochiewo (KMFRI, Kenya) and Dr. Delphine Vanhaecke (VLIZ, Belgium)

15:30 – 16:00 **Break**

SESSION 5 . ROUND TABLE DISCUSSION: COASTAL RESOURCE MANAGEMENT

16:00 – 17:15 **Round table discussion**
Led by Dr. James Kairo (KMFRI, Kenya) and Prof. Ann Vanreusel (UGent, Belgium)

17:15 – 17:30 **Round up**
Rapporteurs Mr. Patrick Gwada (KMFRI, Kenya) and Dr. Karolien Van Puyvelde (VUB, Belgium)

SESSION 6. KENYA COASTAL DEVELOPMENT PROJECT (KCDP)

17:30 – 18:30 **Poster and exhibition session (KCDP)**

Wednesday 29 October 2014

SESSION 7.	SUSTAINABLE AQUACULTURE DEVELOPMENT: CHALLENGES FOR KENYA

(Chair: Betty Nyonje and Gilbert Van Stappen)

8:00 – 8:15 **Integrated water resource management and aquaculture for equitable and sustainable livelihoods in East-Africa** CANCELED
Prof. em. Patrick Sorgeloos, *Laboratory of Aquaculture & Artemia Reference Center (ARC), Ghent University (UGent), Belgium*

8:15 – 8:30 **Challenges for aquaculture development in eastern Africa**
Prof. Gilbert Van Stappen, *Laboratory of Aquaculture & Artemia Reference Center (ARC), Ghent University (UGent), Belgium*

8:30 – 8:45 **Aquaculture research and development in Kenya: an overview**
Dr. Betty Nyonje, *Assistant Director, Mariculture, KMFRI, Kenya*

8:45 – 9:00 **Recent advances in marine aquaculture research – implications for Kenya and the region**
Dr. Nigel Preston, *Research Director, Integrated Sustainable Aquaculture Production, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia*

9:00 – 9:15 **Community based aquaculture initiatives in coastal Kenya**
Dr. James Mwaluma, *Senior Research Scientist, KMFRI, Kenya*

9:15 – 9:30 **Government intervention in aquaculture development in Kenya**
Dr. Harrison Charo Karisa, *Deputy Director of Fisheries, Ministry of Fisheries Development and Acting Director at the National Aquaculture Research Development and Training Centre (NARDTC), Kenya*

9:30 – 9:45 **Microbial biodiversity in Bohai Bay Saltworks and their biotechnological utilization**
Dr. Sui Liying, *Salt Research Institute of China National Salt Industry Corporation, China*

9:45– 10:00 **Environmental safeguards in Kenya – oceanographic and coastal perspectives**
Mr. Patrick Gwada, *Senior Research Scientist, KMFRI, Kenya*

10:00 – 10:30	Break

10:30 – 10:45 **The status and outlook of marine aquaculture development in South Africa**
Prof. Daniel Brink, *Vice Dean & Associate Professor, Faculty of AgriSciences, Stellenbosch University, South Africa*

Wednesday 29 October 2014

10:45 – 11:00 **Sustainable *Artemia* pond production in coastal saltworks as a tool to solve aquaculture challenges**
Assoc. Prof. Dr. Nguyen Van Hoa, *Head of Department of Coastal Aquaculture, College of Aquaculture and Fisheries, Can Tho University (CTU), Vietnam*

11:00 – 11:15 **Coastal aquaculture developments in Mozambique**
Mr. Rafael Miguel Rafael, *National Fisheries Research Institute (IIP), Mozambique*

11:15 – 11:30 **The potential of integrating marine biotechnology with aquaculture for human health in Kenya**
Dr. Charles Gatune, *co-ordinator Aquaculture department, Karatina University, Kenya*

11:30 – 11:45 **Aquaculture development in Tanzania: status, trends and perspectives** CANCELED
Dr. Charles Mahika, *Director, Aquaculture development division, Ministry of Livestock Develoment and Fisheries, Tanzania*

11:45 – 12:00 **Improvement of the living standard of rural communities in Kenya through Artemia production in coastal saltworks** CANCELED
Morine Mukami, *PhD, KMFRI, Kenya*

12:00 – 12:15 **An overview of current status of Kenyan fish feed industry and feed management practices, challenges and opportunities**
Dr. Jonathan Munguti, *Assistant Director, Aquaculture - Inland division, KMFRI, Kenya*

12:15 – 12:30 **A gap between small-scale community mariculture and mariculture as a business: can KCDP bridge the gap?**
David Mirera, *Research Scientist, Aquaculture Division, KMFRI, Kenya*

12:30 – 14:00	**LUNCH**

SESSION 8. ROUND TABLE DISCUSSION: SUSTAINABLE AQUACULTURE DEVELOPMENT IN KENYA

14:00 – 15:00 **Round table discussion**
Led by Dr. Betty Nyonje (KMFRI, Kenya) and Prof. em. Patrick Sorgeloos (UGent, Belgium)

15:00 – 15:15 **Round up**
Rapporteurs Mr. David Mirera (KMFRI, Kenya) and Prof. Colin Janssen (UGent, Belgium)

15:15 – 15:45	**Break**

Wednesday 29 October 2014

SESSION 9. CAPACITY BUILDING AND EDUCATION

(CHAIR: ANN VANREUSEL)

15:45 – 16:00 An overview of the institutions and education programs of higher learning in aquaculture development in Kenya
Dr. John Radull, *lecturer at Maseno University, Kenya*

16:00 – 16:15 Policy of Stellenbosch University in promoting aquaculture education in Africa
Prof. Daniel Brink, *Vice Dean & Associate Professor, Faculty of AgriSciences, Stellenbosch University, South Africa*

16:15 – 16:30 Capacity building in fisheries in Kenya CANCELED
Prof. Boaz Kaunda Arara, *Department of Fisheries and Aquatic Sciences, University of Eldoret, Kenya*

16:30 – 16:45 Building a regional training network of coastal, marine and continental water body scientists in the WIO region
Dr. Karolien Van Puyvelde, *coordinator MSc Marine and Lacustrine Science and Management (Oceans & Lakes), Free University of Brussels, Belgium*

16:45 – 17:00 How to convey a complex message to a wide audience: avoiding the ocean divide between science and public understanding ?
Prof. Nico Koedam, *Plant Biology and Nature Management (APNA), Free University of Brussels (VUB), Belgium*

17:00 – 17:15 IOC Regional Training Centre for the OceanTeacher Global Academy
Mr. Harrison Ong'anda, *Head of Kenya National Oceanographic Data Centre and Head of the department of Information and Data Management, KMFRI, Kenya*

17:15 – 17:30 Linking science and community development: the Community Driven Development Approach
Faridah Hassan, *HMP Manager, KCDP, Kenya*

SESSION 10. ROUND TABLE DISCUSSION: EDUCATION AND CAPACITY BUILDING

17:30 – 18:30 Round table discussion
Led by Prof. Boaz Kaunda Arara (University of Eldoret, Kenya) and Prof. Ann Vanreusel (UGent, Belgium)

18:30 – 18:45 **Round up**
Rapporteurs Mr. Patrick Gwada (KMFRI, Kenya) and Prof. Nico Koedam (VUB, Belgium)

18:45 **Closing address**
Dr. Renison Ruwa (KMFRI, Kenya) and Prof. Jan Mees (VLIZ, Belgium)

End of conference day three

Thursday 30 October 2014

OPTIONAL FIELD TRIP: VISIT TO SOME OF THE NATURAL RESOURCE MANAGEMENT AND AQUACULTURE PROJECTS AROUND KILIFI COUNTY.

ANNEX IV. LIST OF PARTICIPANTS

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Last name	First name	Email	Affiliation	Country
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Annex V. Conference brochure

INTERNATIONAL WORKSHOP

SUSTAINABLE USE OF COASTAL AND MARINE RESOURCES IN KENYA: FROM RESEARCH TO SOCIETAL BENEFITS

October 27-29, 2014, North Coast Beach Hotel, Kilifi County, Kenya

- dedicated to the memory of Professor Philip Polk – (19/10/1932 – 11/05/2014)

Kenya aims to be a middle-income - rapidly industrializing - nation by 2030 (Kenya Vision 2030). For a country whose development is largely contingent upon the environment, this vision creates many challenges not only for the sustainability of the ecosystems and the natural resources they provide, but also for mitigating the effects of climate change starting to appear around the country.

This workshop intends to bring together researchers, university teachers and students, policy makers/advisors and other key stakeholders involved in marine science activities with sustainable development relevance for Kenya.

Objectives:

* to provide insight in some of the most important marine research and education projects and initiatives in Kenya, and in the available Belgian, Kenyan and regional expertise in the various research fields,
* to discuss needs, challenges and generate ideas, strategies for the sustainable development of Kenya's coast and ocean, concentrating on topics such as overexploitation of fisheries resources, pollution, mangrove degradation, climate change, sustainable aquaculture development and the management of marine protected areas,
* to identify opportunities for future collaborations.

Output:

* a roadmap that defines the future research and education priorities in Kenya needed to achieve the sustainable use and management of the coastal and marine resources of Kenya, in line with the nation's development strategies.

"You cannot protect the environment unless you empower people, you inform them, and you help them understand that these resources are their own, that they must protect them."

- Wangari Maathai -

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Organizing institutes:
Kenya Marine and Fisheries Research Institute (KMFRI), Kenya
Flanders Marine Institute (VLIZ), Belgium

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