Joint Meeting of the Grantees for MASMA Programme and Cities & Coasts Project

PROGRAMME & ABSTRACTS

Mombasa, Kenya, 14-15 November 2019

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Prof Pius Yanda
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PROVISIONAL PROGRAMME

Thursday, 14th November 2019		
OPENING SESSION		
Chairperson: Lena Gipperth		
09:00 – 09:10	Welcoming remarks & announcements	WIOMSA
09:10 – 09:20	Opening remarks	
09:20 – 09:30	Introduction	
PROJECTS PRESENTATIONS		
MASMA-2018		
Chairperson: Ian Bryceson		
09:30 – 10:00	Larval fish production and dispersal in critical habitats of coastal East Africa" (FLAPSEA)	J. Mwaluma, L. Daudi, N. Ngisiange & G. Rushingisha
10:00 – 10:10	Remarks & Discussion	All
10:10 – 10:40	Assessment of the Ecological Aspects of Microplastic Pollution in Dar Es Salaam, Zanzibar and Mombasa Coastal Marine Environments (MICROMARE)	D Shilla, C. Kosore & Nancy Oduor
10:40 – 10:50	Remarks & Discussion	All
10:50 – 11:20	Coffee Break	
11:20 – 11:50	Enabling Sustainable Exploitation of the Coastal Tuna Species (Kawakawa and Skipjack) in the Western Indian Ocean	W. Sauer & G. Okemwa
11:50 – 12:00	Remarks & Discussion	All
12:00 – 12:30	Ecosystem based protection of the coastal zone: the effectiveness of seagrass meadows in coastal erosion management	J. Hollander & B. Lugendo
12:30 – 12:40	Remarks & Discussion	All
12:40 – 14:00	Lunch Break	
Cities & Coasts – 2018		
Chairperson: Lena Gipperth		
14:00 – 14:30	Cities and Climate Change in Coastal Western Indian Ocean A Grand Challenge (CICLICO)	S. Rosendo
14:30– 14:40	Remarks & Discussion	
14:40 – 15:10	Smart and sustainable transitioning for coastal cities in the face of global environmental change: Prototyping transdisciplinary networks for peer-to-peer learning for Mombasa (Kenya) and eThekwini/Durban (South Africa)	J. Kithiia, S. O'donoghue G. Nato & I. Wanyonyi
15:10 – 15:20	Remarks & Discussion	
MASMA-2019		
Chairperson: Ian Bryceson		
15:20 – 15:50	Billfish Interactions, Livelihoods, and Linkages for Fisheries sustainability in the Western Indian Ocean	I. Kadagi, N. Wambiji & J.

	(BILLFISH - WIO)	Halafo
15:50 – 16:00	Remarks & Discussion	
16:00 – 16:30	Coffee Break	
16:30 - 17:00	Slippery resource in peril: Ecology of Western Indian Ocean Anguillid eels and their contribution to sustainable fisheries and livelihood along the East Coast of Africa	G. O'brien, C. Kihia & C. Hanzen
17:00 – 17:20	Remarks & Discussion	
17:20 – 17:30	General discussions	
17:30	End of the Day	
1900	**Cocktail**	

Friday, 15th November 2019			
09:00 – 09:10	Recap of the first day		
MASMA-2019 (contd)			
Chairperson: Ian Bryceson			
09:10 – 09:40	WIO-BENTH - Identification, characterization and vulnerability assessment of benthic ecosystems in the WIO		S. Fennessy, B. Everett & J. Okondo
09:40 – 09:50	Remarks & Discussion		All
Cities & Coasts – 2019			
Chairperson: Lena Gipperth			
09:50 – 10:20	Building Climate Change Resilient Coastal Cities through Anticipatory Integrated Land Use Planning		M. Mdemu, J. Kihila & N. Kiketelo
10:20 – 10:30	Remarks & Discussion		All
10:30 – 11:00	Coffee Break		
11:00 – 11:30	Impacts of large-scale infrastructure developments on coastal biodiversity: A case of LAPSSET infrastructure project in Lamu		Z. Maritim, R. Ogalo & J. Kamula
11:30 – 11:40	Remarks & Discussion		All
11:40 – 12:30	Joint Meeting of PCs	Group discussions by grantees	
12:30 – 14:00	**Lunch Break**		
14:00 – 15:00	MASMA PC	Cities & Coasts PC	Group discussions by grantees
15:00 – 15:30	Feedback by Grantees		
15:30 – 16:00	Coffee break		
16:00 – 17:30	Feedback to MASMA Grantees	Feedback to Cities & Coasts Grantees	
17:30	Closure of the Meeting		**Chairperson: Ian Bryceson**

Saturday, 16th November 2019
Cities& Coasts Programme Committee visit to the Miji Bora project sites

ABSTRACTS

MASMA PROJECTS

Larval fish production and dispersal in critical habitats of coastal East Africa" (FLAPSEA)

Investigators: James Mwaluma, Melckzedeck Osore, Jacob Ochiewo, Lillian Daudi, Noah Ngi'siange, (Kenya Fisheries Marine Research Institute (KMFRI)), Margret Kyewalyanga, Mwanahija Shalli & Barnabas Tarimo (Institute of Marine Sciences (IMS)), George Rushingisha (Tanzania Fisheries Research Institute (TAFIRI)), Monika Winder, Maricela de la torre Castro & Martin Gullstrom (Stockholm University (SU)).

The "Larval fish production and dispersal in critical habitats of coastal East Africa" (FLAPSEA project) is a MASMA funded project by Western Indian Ocean Marine Science Association (WIOMSA) in 2018-2020 to study fish larvae in seagrass habitats and adjacent zones. The goal of this project is to investigate how food-provisioning services in the form of fish production are threatened by coastal habitat degradation and how production of this natural resource is related to climate change and coastal development in East Africa. The project will identify sensitive seagrass habitats that need to be protected and threshold values for healthy productive seagrass habitats, and estimate the socio-economic costs of seagrass beds loss to fisheries. Specifically, this will be done by addressing the following objectives including identification of habitat conditions critical for fish recruitment and key drivers for fish larvae production, Identification of dispersal potential of fish larvae from the seagrass habitats to where adult fish spawn, prediction of future economic impacts and the most vulnerable coastal areas, and provision of scientific information that can lead to improved management and protection strategies in coastal East Africa.

Study sites for the FLAPSEA project in Kenya and Tanzania were identified. Progress has been made in implementation of activities including, inception meetings, site surveys, stakeholders meeting, sampling and data analysis workshops in both Kenya and Tanzania. Sampling commenced in June and extended to August 2019 covering the SEM season. A few results are presented in plankton analysis, seagrass surveys, beach seining, modeling and current measurements. Potential papers to be produced are presented, potential students and plans to disseminate project information are discussed.

Assessment of the Ecological Aspects of MICROplastic Pollution in Dar Es Salaam, Zanzibar and Mombasa Coastal MARINE Environments (MICROMARINE)

Investigators: Daniel Shilla (University of Dar es Salaam (UDSM)), Dativa Joseph (UDSM), Yvonne Shashoua (National Museum of Denmark), Farhan Khan (Roskilde University), Nancy Oduor & Charles Kosore (Kenya Marine and Fisheries Research Institute (KMFRI), Bahati Mayoma & Moses Shimba (University of Dodoma)

The MICROMARINE is one of the MASMA projects approved by WIOMSA in 2018 that concentrates on microplastics (MPs) research in marine environment. MICROMARINE deals with the ecological aspects of MPs in marine ecosystems and is made up of a consortium of three partners from three countries (Tanzania, Kenya and Denmark) to. Inception workshop for the project was successfully carried on 15 - 17 May 2019 at Ledger Plaza Bahari Beach Hotel, Dar Es Salaam, Tanzania to deliberate on the implementation of the project objectives. The project has already implemented a collaborative field effort of unprecedented dimensions in Kenyan marine environment; with one manuscript on the abundance and distribution of microplastics in water being prepared for publication on a joint effort between the partners. Microplastic in Kenyan waters were assessed in July, August and September, and the results presented in abundance (MPs m^{-3}), sorted according to colors, types, sizes and polymer types. Dissemination, awareness and education have also been carried out with scientific community, opinion leaders and local communities in Mombasa, Kenya in October. The project works closely with a MASMA project titled, *"Larval fish production and dispersal in critical habitats of coastal East Africa"*, especially in the identification of the zooplankton and fish larvae, which are potentially exposed to microplastics through ingestion. Two PhD and one MSc students have been engaged to pursue their studies along the project objectives. The project's activities are now focused on the ecotoxicological part of the studies and microplastics assessments in Tanzanian waters and sediments from December 2019. Set up and study designs for ecotoxicological experiments have already been completed. Additionally, fostering the development of a diverse scientifically trained workforce through coastal and ocean education programs as well as raising public awareness of the risks that microplastics pose to marine ecosystems and, eventually, human health will also commence on December 2019.

Enabling Sustainable Exploitation of the Coastal Tuna Species (Kawakawa and Skipjack) in the Western Indian Ocean

Investigators: Warwick Sauer (Rhodes University); Johnson Grayson (Sokoine University of Agriculture); Gladys Okemwa & Joseph Kamau (Kenya Marine and Fisheries Research Institute (KMFRI)); José Halafo (Instituto Nacional de Investigação Pesqueira (IIP)); Paul Shaw (Plymouth Marine Laboratory)

The Western Indian Ocean (WIO) region provides a diversified habitat for small migratory tuna fishes including Kawakawa *Euthynnus affinis* and Skipjack tuna *Katsuwomis pelamis*. Skipjack fisheries are known to make up the majority of canned tuna in world markets, and kawakawa also make up a significant catch of landed tuna in the territorial waters of the region. Thus, the two fish species are important for local fisheries (artisanal and small purse seiners), national economies and for food security of coastal communities throughout the WIO region. Tuna species managed under the auspices of the Indian Ocean Tuna Commission (IOTC) have generally been assumed (explicitly or implicitly) to be highly mobile and consist of a single panmictic spawning population for the purposes of stock assessment and management. However, empirical data on population structure are lacking and the occurrence of distinct populations, as recently reported for yellowfin tuna, will fundamentally compromise current management approaches aimed at both sustainable and optimal economic exploitation. Thus the project investigates what levels of genetic biodiversity exist within Kawakawa and Skipjack populations within the WIO, concentrating on South Africa, Mozambique, Tanzania and Kenya, and how these levels relate to other populations and species; whether this diversity is distributed evenly across the participating countries or are there discrete genetic stocks of Kawakawa and Skipjack tuna in the WIO region. Basic information on catch and effort and the biology and reproductive patterns of kawakawa and skipjack in the WIO region is also being collected to understand exploitation patterns and reproductive seasonality. Furthermore, the project also investigates how oceanographic factors influence distribution, genetic structure, spawning pattern and abundance of Kawakawa and Skipjack in the WIO region, and how we can optimize economic and societal benefit of the Kawakawa and Skipjack tuna fisheries in the WIO in general, and Tanzania, Kenya, Mozambique and South Africa in particular.

Progress made so far includes an inception meeting which was held on the 10 and 11th of July 2019 in Zanzibar. The workshop brought together all project partners to discuss the research, logistics and financial issues. Common data collection tools (for the catch assessment and value-chain analysis) were developed and finalized. Potential PhD candidates were also identified, and Ms Fatuma Mzingirwa from Kenya was selected. Ms Mzingirwa is currently completing her literature survey, and finalizing the framework of her PhD. Data collection plans for the countries have been finalized, and sample sites identified, and some initial catch and effort and biological sampling has taken place. Initial genetic samples of both species from all countries have been collected, and analysis is planned over the next few months. Furthermore, genetic samples have also been collected from Sri Lanka and the Seychelles for comparison purposes.

Linkages with other projects have also been forged. An initial meeting was held with the IOTC scientific working group in Spain in October 2019, and we plan to work closely with them

during this project. The Deep Sea Fishing Authority (DSFA) will be conducting a project on tuna stocks within the territorial waters of Tanzania, and we will liaise with this project also. In terms of the oceanographic and social and economic data we will be working closely with the SOLSTICE project, funded through GCRF. These aspects will be tackled in close association with researchers involved in the project.

Ecosystem based protection of the coastal zone: the effectiveness of seagrass meadows in coastal erosion management

Investigators: Blandina R. Lugendo (University of Dar es Salaam); Johan Hollander (Lund University); Salomao Bandeira (Eduardo Mondlane University); Yohana W. Shaghude & Mwanahija Shalli (Institute of Marine Sciences (IMS); Olof Linden (World Maritime University)

Increased human activities of the coastal zone has led to worldwide degradation of marine coastal ecosystems and loss of ecosystem services. In combination with global climate change, such as stronger and more frequent storms, and heavier rainfalls, today we see an increase in eroding coasts. Since hard solutions (grey infrastructure) should be considered as last resort for coastal management as they provide additional problems for the coast, soft solutions (green infrastructure) should be favoured due to the plethora of ecosystem services they provide. For that reason, this project explores the efficiency and sustainability of ecosystem-based protection measures, particularly, the effectiveness of seagrass meadows in retaining sediments and reducing wave energy to protecting shorelines. We are here providing an interdisciplinary approach, for a multifunctional motivation, to better understand; status and conditions of the region's seagrass beds, best practise of seagrass restoration techniques, and how such incentives can reduce hydrodynamic force and mitigate erosion. Since seagrass beds provide such important nursing grounds for various fish and shellfish species, biodiversity both in the marine and on adjacent terrestrial environment is also considered – all in a context of social science with coastal inhabitants. The project comprises seven work packages (WPs), and we intend to discuss the progress made so far and the road forward for all the WPs.

Billfish Interactions, Livelihoods, and Linkages for Fisheries Sustainability in the Western Indian Ocean (BILLFISH-WIO)

Investigators: Nelly Isigi Kadagi African Billfish Foundation (ABF); Nina Wambiji, Kenya Marine and Fisheries Research Institute (KMFRI); Lydia Kanyairita (University of Dar es Salaam); Emmanuel Andrew Sweke (Deep Sea Fishing Authority); Mwaka Barabara Said (Kenya Fisheries Services); Sean Fennessy & Dr. Bruce Mann (Oceanographic Research Institute (ORI)); Chris Poonian (Community Centred Conservation (C3)); José Halafo (Instituto Nacional de Investigação Pesqueira (IIP)): Joseph Maina Mbui (Macquire University); Sumaila Rashid (University of British Colombia); Julian Pepperrell (Pepperell Research & Consulting); Sam Williams (University of Queensland); Robert Ahrens (University of Florida); Sarah Glaser (Secure Fisheries)

Funded by the Western Indian Ocean Marine Science Association (WIOMSA), the overall goal of the BILLFISH-WIO project 2019-2022 is to provide a comprehensive understanding of billfish species in the Indian Ocean to support efforts on ensuring their sustainability. Specifically, the project will focus on four thematic areas by (i) examining the historical and present status of billfish species; (ii) evaluating the socio-economic contribution and governance of billfish; (iii) evaluating the genetic structure of key species; and (iv) determining the spatial and temporal distribution of billfish species. The BILLFISH-WIO project will have case-studies in Kenya, Tanzania, Mozambique, Madagascar, Somalia and South Africa. To achieve the overall goal, the project has diverse implementing institutions within the Western Indian Ocean (WIO) including the African Billfish Foundation (Kenya), Kenya Marine and Fisheries Research Institute (Kenya), University of Dar es Salaam (Tanzania), One Earth Future, Secure Fisheries (Somalia), Community Centered Conservation (Madagascar), Oceanographic Research Institute (South Africa). The project also brings together an interdisciplinary team of experts and researchers including a Post-doctoral position, 1 Ph.D. and 4 MSc. studentships.

We provide an overview of the progress made in refining the project objectives, research questions and methodologies, selection of study sites, defining the role of implementing institutions and collaborators, and the expected outputs. We also highlight the progress in addressing the programme committee's comments, identification of students, and the development of a road-map for data collection, reporting and dissemination of results to multi-stakeholders through working papers, publications and policy documents among others.

Ultimately, the project findings will provide a framework for further investigations, support policy changes at national and regional scale, and complement on-going work by the Indian Ocean Tuna Commission (IOTC), National Fisheries Institutions, and regional projects to improve the management of vulnerable Indian Ocean billfish stocks.

Slippery resource in peril: Ecology of Western Indian Ocean Anguillid eels and their contribution to sustainable fisheries and livelihood long the East Coast of Africa

Investigators: Gordon O'Brien (University of Mpumalanga); Céline Hanzen (University of KwaZulu Natal); Charles Kihia (Egerton University); Emmanuel Mbaru (Kenya Marine Fisheries Research Institute (KMFRI))

The Western Indian Ocean (WIO) Anguillid eels (Anguilla spp.) are long distance catadromous migratory fishes that use both marine and inland/coastal ecosystems along the WIO region to complete their life cycles. In the region, four Anguillid eel species occur, representing 25% of the global diversity for these unique, socio-ecologically important and charismatic fishes. Because they occupy both freshwater and marine environment, eels are particularly vulnerable to threats (e.g., damming, pollution, overfishing) derived from both ecosystems. Globally, Anguillid eels have a high socio-economic value and are targeted for commercial and subsistence fisheries. They have the highest economic value per weight of any fish and, represent an important part of the biodiversity of tropical, sub-tropical and temperate regions of the world's oceans. Eels also act as ecological indicators of the integrity of riverine, estuarine and oceanic environments. Several WIO countries have recently entered the global eel trade, but commercial fisheries is in its infancy and may be constrained by variation in eel populations and multiple anthropogenic stressors. Very little is known of the contribution of eels to subsistence fisheries along the WIO coastal region, and consequently contribution of these migratory fishes to community livelihoods remains undescribed. Secondly the emerging commercial interest in this poorly known resource that may already be endangered. Knowledge pertaining to their vulnerable migratory ecology as well as fisheries demand and supply, is therefore urgently needed. Here, we propose to elucidate eel migratory ecology and the associated environmental drivers and risks to the recruitment of glass eel entering estuarine ecosystems and escapement of silver eels back into the WIO to breed. Our objectives include: (1) a review of existing knowledge regarding their ecology, use and threats, (2) characterise the recruitment and escapement ecology in selected estuaries, (3) evaluate their contribution to local fisheries and livelihood and, (4) undertake a regional scale ecological risk assessment to finally produce recommendations for conservation and sustainable management. We will adopt a multi-disciplinary (bio-ecological, socio-economic and socio-cultural surveys and case studies) and multi-country approach, in selected estuaries in South Africa (Thukela), Mozambique (Inkomati, Limpopo) and Kenya (Tana, Ramisi). Expected outputs from this 3 year study include reviewed publications, postgraduate student training and thesis and management policy brief.

WIO-BENTH - Identification, characterization and vulnerability assessment of benthic ecosystems in the WIO

Investigators: *Sean Fennessy, Bernadine Everett & Fiona MacKay (Oceanographic Research Institute (ORI)); Jean-Jacques Bé Centre d'Etudes et du Développement des Pêches (CEDP)); Julius Okondo (Kenya Marine and Fisheries Research Institute (KMFRI)); Martin Ohldieck (Institute of Marine Research (IMR)); Mary Kishe-Machumu (Tanzania Fisheries Research Institute (TAFIRI); Rui Mutombene (Instituto Nacional de Investigação Pesqueira (IIP))*

Details of the nature of sea floor habitats and their associated communities are unknown for most of the Western Indian Ocean (WIO) – attention has traditionally been focussed on habitats such as coral reefs and mangroves. Nevertheless, there is increasing interest in exploiting offshore marine areas, and decision-makers are ill-equipped to decide on trade-offs between a variety of usage options, including conservation. Our project will make use of extensive existing survey data, hitherto only superficially analysed or not all, to produce the first regional spatial analysis and interpretation of benthic habitats and communities to assist with marine spatial planning. The focus will be on the continental shelf and upper slope to approximately 500m depth, in the western part of the WIO, where most of these data were collected. There are project participants from five countries, with a range of experience, skills and disciplines. We will undertake data analysis and species-habitat modelling independently and jointly at numerous workshops, in the process mentoring junior scientists and training students. We will produce formal scientific publications and, more importantly, an atlas depicting the spatial extent of habitats and their associated communities, which will be available to the public, scientists, managers and decision-makers. The project will integrate well with other current regional research initiatives and is particularly pertinent to Blue Economy initiatives, providing information to assist WIO countries in achieving their Sustainable Development Goals, and to planning future surveys in the region. Regarding how the proposal was amended to meet the reviewers' comments: (a) Permission to use their respective country's RV *Dr Fridjtof Nansen* survey data have been received from all the WIO-BENTH project country partners, but there are still some challenges regarding the involvement of the EAF-Nansen Programme and IMR. (b) Improved knowledge of seabed habitats and their benthic communities will be important for spatial planning - the WIO-BENTH project aims to increase the knowledge of habitats (deeper soft sediments) which are poorly known relative to coral reefs. In the process it will also start to build knowledge of their functioning, and provide capacity development of people to enable analysis and interpretation of the data underpinning the knowledge.

CITIES & COASTS PROJECTS

Investigators: Bernadette Snow, Mandy Lombard & Nina Rivers (Nelson Mandela University (NMU)); Louis Celliers & María Máñez (German Climate Service Center (GERICS)); Sérgio Rosendo (NOVA FSCH)

Background. The diversity of coastal and marine ecosystems and resources of the Western Indian Ocean (WIO) provide a wide range of ecosystems that form the basis for the growing Blue Economy. Coastal cities present enormous opportunities for development and are the nodes through which the benefits of the Blue Economy are channelled to and through. However, they are faced with multiple pressures, including resource degradation, poverty and increasing demands on social services. Climate change adds another layer of complexity to the challenges faced by coastal cities, threatening their sustainable development. These challenges form the backdrop to CICICLO and will be explored as a case study in the medium-sized coastal city of Port Elizabeth in the Nelson Mandela Bay municipality on the shores of Algoa Bay, South Africa.

Research aims, objectives and methods. The overall aim of CICLICO is to explore and plan, with decision-makers and society in the Algoa Bay and the city of Port Elizabeth, how diverse, often uncoordinated, objectives of coastal and marine planning can be implemented to enable better adaptation to climate change through the use of climate services for city planning tools.

The project focuses on the opportunities and constraints presented by the use of Area Based Management (ABM) tools, namely Marine Spatial Planning (MSP), Integrated Coastal Management (ICM) and Marine Protected Areas (MPAs) and climate services to support adaptation planning by the city.

The specific objectives and the methods to address them are:

1) P*articipatory mapping* of the coastal and marine planning systems (tools, institutions, stakeholders) of the Nelson Mandela Bay municipality in Algoa Bay to understand the system, including the interaction between the different ABM approaches; how they relate to key city planning tools, in particular the IDP; the stakeholder networks created by them; key climate impacts; climate information available; and ability of the governance framework to address

climate impacts across the land-sea interface. Key methods used will include desktop reviews (i.e. review of the legal and policy frameworks and stakeholder analysis) and a modified application of the Capitals Approach Framework (CAF) combined with Fuzzy Cognitive Mapping (FCM).

2) Build a *system dynamics model* with stakeholders in order to build a shared understanding of the Algoa Bay system and key drivers of change and identify and test possible policy interventions enabled by ABM tools, including what data, information and knowledge are needed to inform management. This will involve engagement with managers and other stakeholders, informed by the work developed in Objective 1 and will provide the basis for development of climate services in Objective 3. Key methods used include participatory group modelling and other stakeholder engagement tools.

3) *Co-create climate services* adapted to the needs and policy objectives identified by stakeholders in Algoa Bay, using system dynamic models as proof of concept. This objective will explore the type and nature of climate services required to inform ABM planning processes and implementation in ways that enhance the capability of the city to address climate risks and opportunities. The methods used to achieve this objective will include design workshops, consultations and demonstrations. Ultimately, this objective will develop a generic model for climate services co-development linking ABM and city planning tools that can be applied more widely.

Addressing comments from the PC

One of the key aspects was meeting the brief of the funding call, focussing on a coastal city, particularly building resilience in cities to climate change. Therefore the project is addressing this through co-creation of knowledge and development of climate services that will benefit and promote city resilience using the AMB tools. However, to do this the disparities and complexity of the different tools need to be understood. Not only from a scientific perspective but inclusive of capacities and knowledge of the implementing agencies within the cities (local scale).

With regards to budget comments, the team was tasked to reduce partners and the focus was then placed on one case study, namely Algoa Bay, Port Elizabeth. The focus will be on Nelson Mandela May Municipality (the city). Main budgets are managed by two partners only i.e. NMU and GERICS with the CORDIO budget subsumed by GERICS and NOVA FCSH subcontracted by NMU to increase capacity for the CAF component of the project as written into the original proposal.

Progress in project implementation

Signing contracts between the leading institutions (NMU and GERICS) and WIOMSA was concluded in mid-2019. NMU sub-contracted NOVA FCSH to undertake aspects of the project and this contract was finalised late 2019. A two day inception meeting involving NMU, GERICS and NOVA FCSH was held in Port Elizabeth in July, 2019. This meeting resulted in a draft work plan with detailed activities for 2019-2020. A project launch meeting is planned for March 2020 and will include the advisory board. The meeting will be used to present the project to stakeholders, get their feedback on the project objectives and assumptions, and potentially to apply the CAF. The meeting plan has been drafted and will be further refined. The advisory board is currently being set up. The team is also in the process of obtaining ethics approval from NMU, which is essential to undertake any research activities with stakeholders.

Scientific results

Only desktop research was planned for 2019 (Objective 1). Research engaging stakeholders will be initiated in 2020 (Objective 2 & 3). The desktop research includes: (1) Review of the legal and policy frameworks impacting on the management of resources in Algoa Bay; (2) Focussed review of environmental and climate hazards, vulnerabilities and risks related to the city of Port Elizabeth and its location in Algoa Bay; (3) Stakeholder and network "mapping" pertaining to ICM, MSP, MPAs and city planning tools (i.e. IDP). The stakeholder and network "mapping" will be completed by end of February 2020 and the other two reviews by March 2020.

Publications produced or in preparation

Recent papers from previous MASMA project in support of CICLICO:

- Celliers, L., Rosendo, S., Costa, M.M., Ojwang, L., Carmona, M., Obura, D., 2019. A capital approach for assessing local coastal governance. Ocean Coast. Manag. 104996. https://doi.org/https://doi.org/10.1016/j.ocecoaman.2019.104996
- Williams, D., et al. (submitted) Integrating climate change adaptation into recommendations for policy formulation in Small Island States. Climate Policy
- Williams, Celliers et al (in prep) Identifying leverage points for enhancing local governance in responding to climate change. Earth's Future

Students involved in the project

NMU has involved Post Doc (Nina Rivers), PhD (Estee Vermeulen) and a student assistant (currently being recruited). GERICS has appointed a PhD student (Lena Rölfer) with the intention of aligning her studies with aspects of the project. Her involvement is contingent on an

agreement on scientific content between GERICS and NMU. Similarly, GERICS appointed Gundula Winter in a Post-Doctoral position which is intended to support CICLICO.

Strategies to package information

A brochure with information about the project aimed at stakeholders is being prepared and will be released at the March 2020 meeting. How best to package and disseminate the findings to maximise their impact will be discussed with the Advisory Board and stakeholders at the March meeting. Their insights will form the basis for the project dissemination strategy. There are also existing engagement platforms e.g. the Algoa Bay website, Facebook page and GEONODE which will be used to disseminate CICLICO information.

Links to on-going projects

In addition to links to the Algoa Bay Project (https://algoabaydata.wixsite.com/website) there are other links, in particular the One Ocean Hub Project, the completed Algoa Bay Community of Practice project (Phase 1) and potentially Phase 2 of the CoP, should funding become available. The links are to the stakeholders in particular and understanding the social-ecological system. The unique contribution from CICLICO is the focus on the ABM tools and developing climate resilience, particularly with managers and users of the coastal city's natural assets. Conceptually, CICLICO is also closely linked to activities relating to the development of coastal climate services in an European project funded by HZG and entitled Coastal Climate Services @ GERICS. There is potential to link with a NOVA FCSH Marie Curie Research Fellow working on the integration of socio-ecological systems research in MSP.

Smart & sustainable transitioning for coastal cities in the face of global environmental change (''*Miji Bora* Project'')

Investigators: Justus Kithiia & Innocent Wanyonyi (Coastal and Marine Resources Development (COMRED)); Sean O'Donoghue (Thekwini Municipality/Durban & University of KwaZulu-Natal); Daniel Irurah (University of Witwatersrand); Joseph Maina (Macquarie University); Godfrey Nato (County Government of Mombasa); James Kairo (Kenya Marine and Fisheries Institute)

The *Miji Bora* project will examine city systems and co-design practical pathways towards a sustainable port city of Mombasa. This aim will be achieved by addressing three broad objectives; namely, to conduct a situational analysis of the key drivers of urban form, to predict future trajectories based on business as usual scenarios and to envision, prototype and mainstream smart and sustainable future pathways.

An updated proposal, incorporating feedback received from the Programme Committee at the Johannesburg meeting in Nov. 2018, has been shared with WIOMSA. Included in the proposal are research questions and revised the methodology. We have also divided the project activities into several components for ease of implementation and follow up.

AS major activity which has been ongoing since July 2019 is information gap analyses. The aim of this activity is to establish the status of different data and information at the county. We sought to determine if key data exists, what is available and in what condition and format. Not surprisingly, we have established that the county doesn't have an existing data sharing and management policy. Consequently, the *Miji Bora* project, in collaboration with the county government, has embarked on drafting a data policy for the county. Outputs from the gap analyses will inform the acquisition of new data.

The first learning exchange is planned for Mombasa from 11 – 13th November 2019. The exchange will focus on solid waste, waste water, storm water, transport, energy and biodiversity. A city-to-city learning exchange framework is in place and this will be critically evaluated as part of the MSc associated with this project component. The Smart Cities & Futures-Thinking component has developed an in-principle MoU agreement with iLabAfrica (Innovation Hub at Strathmore University, Nairobi). The MOU has now been finalised and highlighted collaboration opportunities are being conceptualised under the Smart City Mombasa theme.

The following students are participating in the *Miji Bora* project. Ms Lynne Farrah will complete a master's degree on the learning exchange component. Lynne works for the county government, placing her perfectly to action her science. Ms Irene Ngunjiri is a PhD student at University of Witwatersrand, and a lecturer at Strathmore University in Nairobi. Her PhD study is on water-

services governance in informal settlements with case study informal settlements in Nairobi and Johannesburg, with Prof Daniel Irurah as one of her supervisors. She is working on the *Miji Bora* Mombasa Project as a Research Assistant to Prof Irurah on the Smart Cities and Futures-Thinking component of the project which Prof Irurah is leading.

At this stage, there are no publications as implementation only began in May of this year. Project info is being packaged and communicated on the *Miji Bora* website which is up and running (www.mijibora.org).

The Miji Bora project has a number of links to regional projects and partnerships. The project is working with the CGM to document the decommissioning of the former Kibarani dumpsite and to institute a continuous monitoring process for the greening project. Specific activities will include monitoring methane gas emissions/accumulation, survival rate of trees and soil toxicity levels. As a first step, the project intends to procure a base satellite imagery of the area prior to the closure of the dump. Subsequent imageries would be taken periodically using UAVs to monitor progress. The UN-HABITAT, WWF and COMRED (*Miji Bora*) are holding discussions to develop a tripartite agreement, outlining the scope of collaboration on some common/complementary activities between the three organisations. These discussions are at an at an advanced stage.

Other regional links include a link with the Urban Climate Change Research Network Knowledge Network - the *Miji Bora* project is closely aligned with the Durban Adaptation Charter Hub and Compact Implementation programme and with the Urban Climate Change Network's Knowledge Hub. Project activities are reported in the Durban Research Action Partnership's quarterly steering committees.

As part of the collaboration with iLabAfrica/Strathmore University, we are jointly developing a proposal in response to a UK Research Innovation Office call on Digital Innovation for Development in Africa (DIDA). The proposal will be submitted along the theme of 'Smart Communities', which is one of the three themes for the call, the other two being Digital Rights and Digital Health

Building climate change resilient Coastal Cities through anticipatory integrated land use planning

Investigators: *Makarius Mdemu, Jacob Kihila, Tatu Limbumba, Elinorata Mbuya, Yohannes Kachenje, Albert Nyiti, Neema Munuo, Lazaro Mngumi & Mariam Genes (Ardhi University); Neema Kiketelo & Antelius Anglibert (Tanga City Council)*

Coastal cities in East Africa are more affected by the impacts of climate change such as flooding, heat islands effects, inundation or erosion of coastal land and salt intrusion of underground water systems because of their location. The impacts are exacerbated by rapid urbanization under informal land use changes. These impacts consequently reduce cities resilience to climate change. This research will address a gap in knowledge on the relevant processes and strategies for anticipatory land use planning to adapt coastal cities to climate change and enhance their resilience. Modalities for developing strategies and options of anticipatory and integrated land use planning to enhance climate change resilience of coastal cities will be explored. Using Tanga City as a case study, existing institutional frameworks for climate change resilience will be analysed, local climate change resilient features and activities mapped and relevant policy options for climate change resilient coastal cities developed. The research will adopt a case study strategy which allows application of a combination of methods. It will engage a multi-stakeholders participation in the design, collection of data, analysis and dissemination of results. Reconnaissance survey and site observations, key informant interviews, focus group discussions, household surveys, in-depth interviews, spatial analysis of citywide land use changes based on remote sensing techniques will be employed to collect and analyse data. Workshops with stakeholders will be used as a platform for co-planning the implementation and dissemination of the research. In the long term, the research will contribute to improved resilience to climate change in coastal cities.

Impacts of large-scale infrastructure developments on coastal biodiversity: A case of LAPSSET infrastructure project in Lamu

Investigators: *Zachary Maritim (WWF-Kenya)); Raymond Ogalo (LAPSSET Corridor Development Authority); James Kamula (National Environment Management Authority)*

Lamu County coastal and marine environment is endowed with a variety of natural resources ranging from Fish and Livestock, Minerals, Wildlife, Sandy Beaches, Marine Ecosystem and conducive weather greatly contributing to the social and economic livelihood of a rapidly growing population through crop production, livestock production, fisheries, tourism and mining. These natural resources together with a capable human resource form the basic ingredients of the Country's economic growth by facilitating Kenya's socio-economic development agenda.

The Lamu Port South-Sudan Ethiopia Transport (LAPSSET) Corridor Program is a regional multimodal infrastructure program integrating roads, railway and oil pipeline components in Kenya, South Sudan and Ethiopia. The Program is the single largest project of its nature in Eastern Africa and is intended to provide seamless connectivity, enhance trade and logistics within the region by providing an alternative and strategic corridor to serve the landlocked neighboring countries of Ethiopia and South Sudan. The corridor covers over half of the country with a planned investment resource of about US$25 Billion, equivalent to half of Kenya's GDP for the core investment alone. It is anticipated that the project will inject between 2% to 3% of GDP into the economy and it is expected to contribute 8% to 10% when generated and attracted investments finally come on board.

As designed and aligned, the entire LAPSSET Corridor in Kenya spans over 2,000 Km in length from Lamu – Isiolo – Moyale and Isiolo – Lodwar – Nakodok and comprises an international class highway, a Standard Gauge Railway (SGR), and oil pipelines connecting hinterlands in Kenya, Ethiopia and South Sudan to a planned 32 Berth sea port at Lamu in Kenya's North Coast. Other components entail development of three airports and resort cities at Lamu, Isiolo and growth areas targeting Special Economic Zones and value addition centers to allow for integration of the local economies within the area it traverses.

The research is aimed at addressing the following anticipated impacts and policy gaps as a result of the LAPSSET Corridor Program: -

1. Loss of critical biodiversity assets through dredging of the sea bed and degradation of marine environment (mangroves, sea grass, coral reefs etc.) and terrestrial environment (forest, wildlife, grasslands, *dhuris* (shrines), etc.)
2. High cost of LAPSSET infrastructure maintenance due to sedimentation (as result of sea wave action and land use related activities)
3. Population growth and demand for associated social and physical infrastructure (housing, water, sanitation, roads, etc.)
4. Community access to land resources and livelihoods
5. Inadequate institutional capacity

The research will be undertaken jointly by WWF – Kenya, National Environment Management Authority (NEMA) and LAPSSET Corridor Development Authority (LCDA). It will be based on robust scientific methodologies to inform policies on sustainable investments. WWF-K will engage two graduate students to assist in undertaking field-based research.