SOLSTICE

Implementation Plan

Version 4

26 March 2018

Emerging fishery of the North Kenyan Bank:

The next frontier for food security of the coastal population

(Kenyan Case Study)

Contents

Document Purpose

The purpose of the SOLSTICE Implementation Plan is to identify key contributions of SOLSTICE partners to research, capacity development and communication objectives of the project and their associated timescales, milestones and deliverables.

This document underpins Institutional Agreements between the Lead Organisation (National Oceanography Centre, UK) and the partner institutions. This document also underpins SOLSTICE Monitoring and Evaluation Plan.

The document is available to project partners and the project Advisory Panel.

SOLSTICE Implementation Plan is an evolving document and subject to regular reviews by the SOLSTICE Leadership Team. Any changes to this document must be approved by the Leadership Team and communicated to all project participants. The latest version of this document can be found on the password-protected SOLSTICE website.

Text shown in red requires updating.

SOLSTICE project outputs

SOLSTICE Logical Framework v1 (as submitted with the project proposal in May 2017) identifies the following key project outputs:

Output1: Strong and self-sustaining **scientific transdisciplinary WIO-UK network** producing high quality intensive body of knowledge on ecosystems dynamics, human dependence on them, their future trends and human responses

Output 2: **Capacity developed in WIO** to conduct interdisciplinary ecosystem research that meets the needs of ecosystem approach to fisheries (EAF), policy, industry and markets. **Capacity developed in UK** to meet the needs of official development assistance (ODA) compliant research.

Output 3: **Strong body of evidence** produced by the network in each Case Study addressing societal challenges and providing strategy options co-created with stakeholders and based on ecosystem approach

Output 4: **Transfer of cost saving technologies** underpinning ecosystem research to overcome limited investment into research infrastructure in WIO.

SOLSTICE Logical Framework and Theory of Change are evolving documents and will be revised regularly by the SOLSTIE Monitoring and Evaluation team. All changes to either of the documents (including proposed Outputs above) are subject to approval by the Project Leadership Team (appointment and Terms of Reference for the Project Leadership Team are expected by the end of January 2018).

1. Resource summary

Participant short name	KMFRI	NOC-OBE	NOC-MPOC-PHY	NOC-MPOC-RS	NOC-MSM	PML-RS	PML-SE	SA-NMU
Person/ mon	36	12	2	18	24	6	7	6

The table above lists all SOLSTICE project partners contributing to the Kenyan Case study with the number of months funded by SOLSTICE for this Case Study. The table includes only directly funded contributions. Contributions "in kind" and studentships aligned with the project are not included into this table and are listed below. Due to the size and complexity of NOC contribution, NOC departments and groups are listed separately.

KMFRI – Kenyan Marine Fisheries Research Institute

WIOMSA – Western Indian Ocean Marine Science Association

NOC – National Oceanography Centre, UK

NOC-OBE – Ocean Biogeochemistry and Ecosystems (NOC, UK)

NOC-MSM – Marine System modelling (NOC, UK)

NOC-RS – Remote Sensing (NOC, UK)

NOC-MPOC – Marine Physics and Ocean Climate (NOC, UK)

NOC-OTE – Ocean Technology and Engineering (NOC, UK)

NOC-MG – Marine Geoscience (NOC, UK)

PML – Plymouth Marine Laboratory (UK)

PML-RS – Remote Sensing (PML, UK)

PML-SE – Socio-Economics (PML, UK)

HWU – Heriot-Watt University (UK)

SAEON – South African Environmental Observation Network (SA)

Rhodes – Rhodes University (SA)

NMU – Nelson Mandela University (NMU)

CORDIO - Coastal Oceans Research and Development – Indian Ocean (Kenya)

KMFRI proposes to align the following PhD students with SOLSTICE:

Fridah Munyi: "Exploring livelihoods and dependency on the fishery resources and their implications as a strategy for improving food security and resilience to climate change within the North Kenya Bank fishery zone." Supervisors: Start date: End date: S.Aswani and E.Papathanasopoulou are happy to co-supervise if required.

Pascal Thoya: "Spatial temporal modeling of satellite imagery to map productivity zones: A case study of the North Kenya Banks". Supervisors: Start date: End date:

Pascal Thoya will participate in KMFRI cruise and will be offered training/exchange visits to UK for biogeochemical measurements. He will lead a SI paper on biogeochemical processes at the North Kenyan Bank. Pascal Thoya will use satellite imagery to determine productivity trends linking the same to the long term fishery catches from NKB. The information obtained will help to assess the effect of climate change and inform on the resilience of the system.

Amon K. Kimeli: "Plume dynamics and the historical sedimentation of the Tana River sediments–A Combination of Field studies and Satellite Imagery Processing." Supervisors: Start date: End date:

Amon K. Kimeli will participate in KMFRI cruise as part of the planned fieldwork on sediment coring and bathymetry mapping of NKB. Any offer of training/exchange for satellite imagery processing and modelling of plume dynamics will be appreciated.

Amon Kimeli Will use remote sensing to determine current and historical sediment plume dispersion directions and extent. He will also employ in situ measurements to model the influence of oceanographic parameters (currents and waves) while using satellite imagery to validate.

Amon Kimeli is keen to be trained on hands-on modelling he has a modelling component in his PhD study. Amon Kimeli will participate in KMFRI cruise and needs training/exchange visits to UK for plume dynamics modelling and remote sensing. He will lead a SI paper on current and historical Tana River plume dynamics.

Athman Salim Hussein (BSc graduate with a Physics and Mathematics major): MSc student his study to be focused on aspects of Biogeochemical modelling

KMFRI proposes to align the following researchers with SOLSTICE to participate in training/exchange visits:

Mr. Noah Ngisiange: will participate in KMFRI cruise and will be offered training/exchange visits to UK for ADCP measurements and marine robotics. Mr. Ngisiange will lead a SI paper on physical processes at the North Kenyan Bank.

2. Case Study background (J. Kamau, KMFRI)

In Kenya, marine fishery is predominantly conducted on a small scale and is artisanal (Sanders et al, 1990; FAO, 2016). Small-scale fisheries generally constitute the pillar of coastal livelihoods and in the provision of coastal food security (Barnes-Mauthe et al. 2013; A review conducted by UNEP (1998) on Marine Fisheries Resources for Kenya estimated that the marine fishery supports about 60,000 people. Annual production from artisanal coastal fisheries average 9,928 MT (FAO 2016). While, Le Manach et al., 2015 reported an annual marine fish landing from artisanal fisheries to be 8,406 tons.

The productivity of the Kenyan marine fishery is constrained by a number of biophysical factors including the narrow continental shelf (estimated at 19,120 km^2), low productivity waters and seasonality. This, combined with increasing fishing pressure, has led to overexploitation in many areas. The pelagic fishery conducted by small-scale fleet (motorized boats) is increasingly gaining importance due to the decline of reef fish (Maina 2012).

In the last three years the North Kenya Bank has emerged as a new frontier for food security. The bank is expansive (approximately 4325 km^2) and presumed to be highly productive. According to a recent hydro-acoustic survey study by Kenya Marine Fisheries Research Institute (KMFRI) it was estimated that the North Kenya Banks has a pelagic fish density of about 21Mt per sq Km, which translates to 401,520 Mt (KMFRI, 2016).

It is presumed that the productivity of the North Kenya bank is driven by wind driven upwelling systems. The northward and southward flow of the monsoonal and local winds drive the surface flows off the Kenyan coast causing localized upwellings. The alongshore stress of the equatorward winds induces an acceleration of the surface currents, which drift offshore under the influence of the Coriolis force. Johnson et al (1982) postulated that the deflection of the EACC seaward at its point of convergence with the Somali Current is mainly due to topographic forcing in the North Kenyan Banks.

Problem statement/Justification

The North Kenya Bank is an important emerging fishery that is expected to spur economic growth for the local fishing communities. The sustainability of this resource requires formulation of informed management interventions. Effective resource utilization will also require informed research on the spatial and temporal distribution of the pelagic fishery by employing tracer proxies (Chl-a, upwelling cells). There however, exists only scanty information on the ecological status, physical environment and drivers of this important emerging fishery resource. If well managed, the fisheries can be a window of opportunities for achieving national development goals including poverty eradication and wealth creation. Moreover, this huge potential is a critical vehicle for the achievement of the Kenya Vision 2030 development plan (Aloo, 2009).

The productivity of the North Kenya Bank is deemed to be driven by the Tana river sediments and nutrients input (both dissolved and particulate). Tana river provides high nutrients that flow over the North Kenya Banks at the convergence of the East African Coastal and Somali currents resulting in a highly productive environment (Wakwabi et al., 2003).

Research questions

1. What is the potential of the North Kenya bank marine fisheries resource
2. What are the Ecosystem processes; identify and understand key ecosystem processes related to productivity/resilience of ecosystems (biogeochemical process), to sustain fisheries productivity and ecosystem health.
3. What are the relative impacts of the productivity drivers: upwelling and Tana river input,
4. Is Climate variability and change affecting the productivity of the North Kenya bank
5. How to optimize the use of the resources, integrating ecological and socioeconomic aspects, to provide long-term benefits to society.
6. Is the North Kenya Banks a depositional sink of the Tana River sediments

References and further reading material

Aloo, P.A (2009). The Fisheries Industry in Kenya: a window of opportunity for Development. In: Amutabi, M. (Ed). Kenya's Economic History.Pp 394-411

Barnes-Mauthe M, Oleson KLL and Zafindrasilivonona B (2013) The total economic value of small-scale fisheries with a characterization of post-landing trends: An application in Madagascar with global relevance. Fisheries Research 147(0): 175–185.

FAO, 2016 [KENYA] National Report to the Scientific Committee of the Indian Ocean Tuna Commission, 2016 IOTC–2016–SC19–NR13

IOTC, 2011, Indian Ocean Tuna Commission National Report of Kenya (2011) IOTC-2011-SC14-NR13

Le Manach F, Abunge CA, McClanahan TR and Pauly D (2015) Tentative reconstruction of Kenya's marine fisheries catch, 1950–2010. Pp. 37–51 In Le Manach F and Pauly D (eds.) Fisheries catch reconstructions in the Western Indian Ocean, 1950–2010. Fisheries Centre Research Reports 23(2). Fisheries Centre, University of British Columbia [ISSN 1198–6727].

Maina GW (2012) A baseline report for the Kenyan small and medium marine pelagic fishery. Ministry of fisheries development, South West Indian Ocean Fisheries Project (SWIOFP) and EAF-Nansen Project. 74 p.

M Manyilizu, P Penven & CJC Reason (2016). Annual cycle of the upper-ocean circulation and properties in the tropical western Indian Ocean. African Journal of Marine Science 2016, 38(1): 81–99

Peter B.O. Ochumba MSc thesis (1983) Oceanographic Features Along the Kenyan Coast: Implications for Fisheries Management and Development. Marine Resource Management Program; School of Oceanography, Oregon State University, Corvallis, Oregon 97331

Renison K. Ruwa (2004) Coastal And Offshore Marine Fisheries Of Kenya:Status And Opportunities. KMFRI Technical Report/2004/FP/1

3. Description of work

3.1 Synthesis

3.1.1. End-to-end literature review and formulation of key hypotheses

Deliverable: Internal project report (Month 12)

Milestone: M8 all contributors identified and agreed

Participating institutions: KMFRI, all participants.

PIs responsible for delivery: J.Kamau (KMFRI), K.Popova (NOC)

We will produce a comprehensive interdisciplinary literature review for the case study following the structure of the SOLSTICE WPs including main challenges and formulation of the key hypotheses. This review will underpin WP contributions to the case study. It is anticipated that this review will form one of the SI papers. Preliminary hypothesis testing is anticipated by WP1a,b (Remote sensing and modelling).

3.1.2. Special Issue (Kenyan and Tanzanian Case Studies)

Deliverable: Collection of peer-reviewed papers (Month 36)

PIs responsible for delivery: SOLSTICE directors (Roberts, Popova), J.Kamau (KMFRI)

Milestones:

M12: Full list of potential papers identified, journal agreed, guest editors assigned

M24: Full list of papers finalised

M30: All papers reviewed at the Science Progress Workshop

Participating institutions: Directors, IMS, KMFRI, all participants.

As a main deliverable for Output 3 ("Strong body of evidence") we will produce a Special Issue (SI) of DSR or a similar journal with socio-economic component. ***This is a combined Kenya-Tanzania deliverable.***

3.1.3. Synthesis paper(s)

Deliverable: Peer-reviewed papers (post-SI effort, Month 42)

PIs responsible for delivery: SOLSTICE directors (Roberts, Popova) and two guest editors (one from each case study, to be identified by M12)

Milestones:

8

M30: List of papers identified

M36: List of papers finalised and lead authors assigned.

M42: Papers submitted

Participating institutions: <u>Directors, KMFRI,</u> all participants.

Key end-to-end synthesis paper(s) with strong links to policy recommendations will be based on the SI collection and submitted by Month 42.

3.1.4. *Final project Report for Kenyan Case Study*
Deliverable: External Project Report (Month 48)

PIs responsible for delivery: SOLSTICE directors (Roberts, Popova), J.Kamau (KMFRI)

Milestones:

M31: Decision if to proceed with the report, its content and alignment with the final project reporting

Participating institutions: all participants.

This report is likely to provide key end-to-end synthesis of the project findings with strong links to policy recommendations. At this stage there is no consensus if such a report is needed/useful. This will be decided by the Project Leadership Team in April 2020, M31). No reporting guidelines have yet been received from the UK project funder (GCRF).

3.2.   WP1a Remote Sensing

3.2.1.   *Synthesis of the satellite-derived information to identify <u>large scale drivers of ecosystem variability</u>*
Deliverables:

- Contribution to the CS review (Month 12)
- SI paper or contribution to WP1b-led SI paper (Month 24)
- Contribution to MOOC (M30)
- Contribution to synthesis paper(s) (M40)

PIs responsible for delivery: M.Srokosz (NOC), B.Kuguru (KMFRI), Y.Shaghude (IMS), S.Mahongo (TAFIRI)

Milestones:

M12 Preliminary results presented as internal project report (underpinning model verification)

Participating Institutions: <u>NOC-RS</u>, NOC-MSM, PML-RS, IMS, TAFIRI, KMFRI

Description:

Analysis of temporal and spatial variability of parameters influencing ecosystem dynamics in the Northwest Indian Ocean (chl-a, primary production, PFTs, ocean currents, coastal altimetry), working with WP1b to support model validation and hypothesis testing and to identify further research questions for investigation in joint African/UK postgraduate research projects. In addition, consider effects of Indian Ocean Dipole (IOD) and monsoon on ecosystem. ***This is a combined Kenya-Tanzania study.***

3.2.2. *Synthesis of the satellite-derived information to identify <u>local drivers</u> of the North Kenyan Bank ecosystem variability*

Deliverables:

- Contribution to the CS review (Month 12)
- SI paper (Month 24)
- Contribution to MOOC (M30)
- Contribution to synthesis paper(s) (M40)

PIs responsible for delivery: B.Kuguru (KMFRI), D.Raitsos (PML)

Participating Institutions: <u>PML-RS</u>, NOC-RS, KMFRI

Description:

Study of chl-a, SST, water quality with a focus on the river plume (complementary to the work of the KMFRI PhD student on Sentinel-2 optical data) ultimately, linking remote sensing to available *in situ* observations. Some satellite altimeter tracks intersect the North Kenya Bank so coastal altimetry data will be used too. This study cannot take advantage of 1/12˚ NEMO model as the scale is too small and NEMO does not have riverine input of nutrients, however a lagrangian modelling study of the riverine input will be conducted as a part of the modelling package.

3.2.3. *Real-time support of the fieldwork and optimisation of the cruise strategy*

Deliverable: online data base and contribution to the cruise plan (Months 6-20)

Participating Institutions: PML-RS (PI: B.Taylor, NEODAAS)

This work will provide the consortium with near-real-time daily ocean colour and SST products at 1km resolution from MODIS and VIIRS satellite sensors to support field campaigns in the North Kenyan Bank case study region - to cover the cruise duration + 1 month before fieldwork start and 1 month after field-work finish.

On-line / off-line data access: altimetry, chl-a, SST

Deliverable: on-line /off-line database and data discovery tools (Month 12 and on-going)

Participating Institutions: NOC-IT (PI V.Byfield), NOC-RS, PML-RS

IT group at NOC will develop a web based system. NOC-MPOC and PML-RS will provide relevant data to populate system. Initially, this could be large-scale data (e.g. ESA CCI altimetry, chl-a, SST) on a ¼° grid and monthly for the whole WIO over the satellite era (1990s onwards). WP4 (Capacity development) will engage with the WIO partners to identify requirements for remotely sensed data and WP 1a will populate the database accordingly. Any remotely sensed data used in SOLSTICE studies could be added to the database (e.g. 1km high resolution chl-a, SST).

In addition, given that internet links for researchers in WIO countries are limited in bandwidth, an off-line version of the database could be made available to those researchers to ease access. We note that this request is strongly supported by WIO partners and an M&E indicator will be developed to reflect availability of the offline data.

3.2.4. Training/capacity development for WP1a (Remote sensing)
Milestones:

- Student co-supervision and exchange visits identified (M4)
- See additional milestones related to the training courses in Section 3.7.

PIs responsible for delivery: V.Byfiled (NOC)

A 2-week remote sensing training course will be run at IMS.

Exchange/training visits dedicated to the remote sensing applications for the Kenyan case study up to one month duration to NOC and PML (UK) are possible if prioritised by WIO institutions (see Note on exchange Visits).

Co-supervision of the WIO students working on remote sensing data by UK partners is possible if requested.

3.3. WP1b Modelling

3.3.1. Model skill assessment
Deliverables:

Internal project report (M6)

Participating institution: NOC-MSM (PI E.Popova)

We will assess NEMO-MEDUSA model skills in all three case study areas, establish model limitations, identify most promising model applications, and range of possible projects and their costs.

3.3.2. Biogeochemical modelling
Deliverables:

- Contribution to the CS review (Month 12)
- SI paper or contribution (Month 24)
- Contribution to MOOC (M30)

- Contribution to synthesis paper(s) (M40)

PI responsible for delivery: K.Popova (NOC)

Participating institutions: NOC-MSM, NOC-RS, NOC-OBE, PML-RS, KMFRI, IMS, TAFIRI, CORDIO

Description:

We will use NEMO-MEDUSA coupled physical and biogeochemical model at 1/12o (hindcast) and 1/4o (climate change projections for RCP8.5 to year 2099) to constrain the key large-scale drivers of the ecosystem variability at seasonal (monsoon), decadal (ENSO, Indian Ocean Dipole) and climatically driven (RCP8.5) variability along the Kenya-Northern Tanzania shelf. Note that resolution and boundary conditions in the model will not allow addressing impacts of Tana deposition of nutrients (these will be addressed in the lagrangian studies). We will focus on the mechanisms of the marine nutrient supply and in particular dynamics and potential changes of the upwelling. The model will be validated using available climatological data, ARGO floats, remote sensing observations and IMS and KMFRI in-situ observations. The modelling package will assist with optimisation of the fieldwork and synthesis of the observational information. ***This is a combined Kenya-Tanzania study.***

3.3.3. *Lagrangian modelling*

Deliverables:

- SI paper (M36);
- Contribution to synthesis paper(s) (M40)
- Internal report on numerical runs conducted for a number of studies co-designed with WIO participants (M30)
- Contribution to MOOC (M30)

PI responsible for delivery: K.Popova (NOC)

Milestones:

M12 potential studies of interest and Kenyan collaborators identified

Participating institutions: <u>NOC-MSM </u>(PI E.Popova), NOC-RS, KMFRI

Description:

A collaborative KMFRI-NOC study will use lagrangian tracer approach to constrain key advective pathways, their variability, potential modifications under the impact of climate change and applications to the issues such as marine pollution (micro-plastics, potential oil spills), design of the MPA, pathways of Tana river, invasive and non-native species, and connectivity with upstream areas. Specific list of applications will be identified in collaboration with KMFRI. A substantial input from local researchers will be required.

3.3.4. *Climate change stressors and their uncertainty*

Deliverables:

- SI paper (month 36)
- Contribution to synthesis paper(s) (M40)
- Contribution to MOOC (M30)

PI responsible for delivery: K.Popova (NOC)

Participating institutions: NOC-MSM (PI E.Popova), NOC-RS, IMS, TAFIRI, KMFRI

We will analyse CMIP5 and CMIP6 model ensembles for the WIO, identify their predictive skills and evaluate key drivers of uncertainty in future projections of the WIO ecosystem dynamics. We will use the forward run of NEMO-MEDUSA ($1/4^o$ resolution or $1/12^0$ if available by M30) to focus on the future projections of upwelling. ***This is a combined Kenya-Tanzania study.***

3.3.5. *NEMO-MEDUSA data access server*

Deliverable: online data access and user manual (months 18)

Participating institution: NOC (PI H.Snaith)

We will develop a server proving access to the model output with area-extraction capability suitable for low bandwidth. This server will be essential for the wide use of the model by WIO researchers and will underpin Modelling training course.

3.3.6. *Training/capacity development for WP1b (Modelling)*

Milestones:

- Student co-supervision and exchange visits identified (M4)
- Opportunities fro wider training of KMFRI researchers identified (M6)
- See additional milestones related to the training courses in Section 3.7

PIs responsible for delivery: V.Byfiled (NOC)

A 2-week remote modelling training course will be run at IMS.

Training in the use of available model output at any level will be provided during the North Kenyan Bank workshops for a wide range of KMFRI scientists (to be discussed and confirmed with KMFRI by M6).

Exchange/training visits dedicated to the modelling applications for the Kenyan case study up to one month duration to NOC (UK) are possible if prioritised by WIO institutions (see note on exchange visits).

Co-supervision of the WIO students working on modelling by UK partners is possible if requested.

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We note KMFRI specific request for training in Modelling, relationship between fisheries and climate change , future changes in fisheries, Species Shifts, and Abundance.

3.4. WP1d Fieldwork

3.4.1. North Kenyan Bank biogeochemical survey (RV Mtafiti)

Deliverables:

- Fieldwork Plan (Internal Report; M8) including capacity development needs and agreement on data archiving
- Workshop at KMFRI on historical data and cruise planning (M13).
- Contribution to CS review (M12)
- Fieldwork (Feb-Mar (M17) and June-July 2019, M22)
- Fieldwork Report (External Report; M28, January 2020)
- Data (archived via BODC M28)
- Papers for SI (M36):
- Contribution to final case study report (External Report M36)

Participating institutions: KMFRI (PI J.Kamau), NMU (M.Roberts only, but note the clash with Tanzanian fieldwork – participation TBC)

Description:

KMFRI will conduct two biogeochemical surveys of 10 days duration each in Feb-Mar and June-July 2019. KMFRI will perform CTD casts, acquire ADCP cruise readings, conduct hydroacoustic measurements, bong net tow, sample phytoplankton and obtain sediment cores using a piston corer.
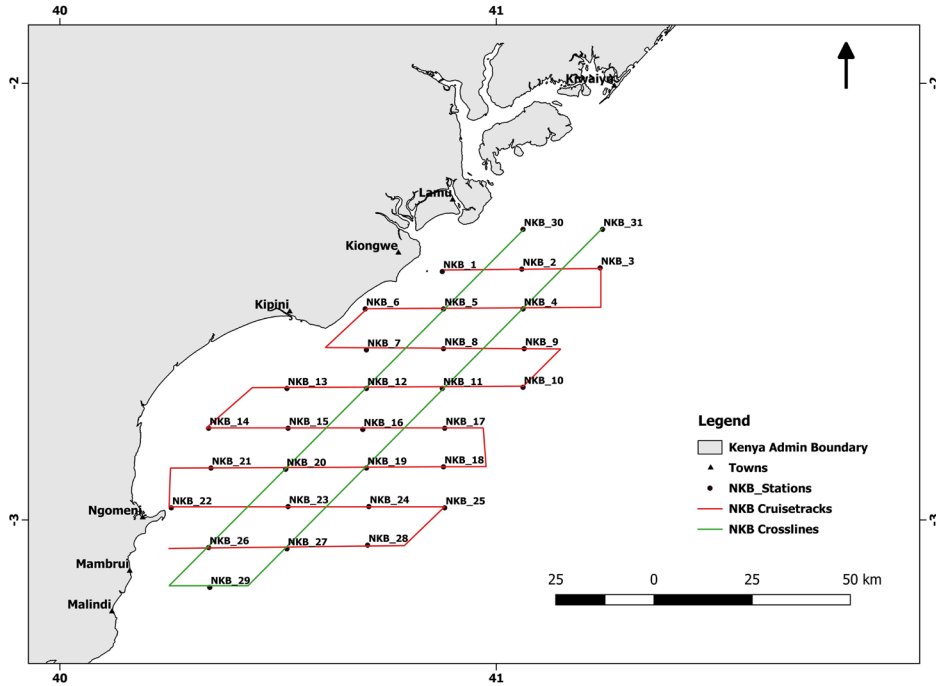
Figure 1. The Kenya coastline showing the tentative North Kenya banks sampling locations

North Kenya bank/Kiwayu tentative Stations					
Station	Long	Latitude	Station	Long	Latitude
NKB_1	40.87628917	-2.431126834	NKB_17	40.88181038	-2.790005501
NKB_2	41.05848911	-2.425605624	NKB_18	40.87904977	-2.878344866
NKB_3	41.23792844	-2.422845019	NKB_19	40.70237105	-2.881105471
NKB_4	41.06124971	-2.516705593	NKB_20	40.5174105	-2.883866076
NKB_5	40.87904977	-2.516705593	NKB_21	40.34625298	-2.881105471
NKB_6	40.69961044	-2.516705593	NKB_22	40.25515301	-2.97220544
NKB_7	40.70237105	-2.610566168	NKB_23	40.52293171	-2.969444835
NKB_8	40.87904977	-2.607805563	NKB_24	40.70789226	-2.969444835
NKB_9	41.06401032	-2.607805563	NKB_25	40.88181038	-2.97220544
NKB_10	41.06124971	-2.696144927	NKB_26	40.34073177	-3.06330541
NKB_11	40.87628917	-2.698905532	NKB_27	40.52017111	-3.066066015
NKB_12	40.70237105	-2.698905532	NKB_28	40.70513165	-3.0577842

NKB_13	40.52017111	-2.698905532	NKB_29	40.34349238	-3.154405379
NKB_14	40.34073177	-2.790005501	NKB_30	41.06124971	-2.334505654
NKB_15	40.52293171	-2.790005501	NKB_31	41.24344965	-2.334505654
NKB_16	40.69408923	-2.792766107			

Note that according to SOLSTICE Terms and Conditions regarding risks, health and safety, no SOLSTICE researchers other than researchers from KMFRI will be allowed to participate in the fieldwork in the north Kenyan waters. Mike Roberts is the only exception from this rule due to his dual contract between UK and SA.

3.4.2. *North Kenyan Bank survey support*

Deliverables:

- Fieldwork Plan (Internal Report; M8) including capacity development needs and agreement on data archiving
- Contribution to CS review (M12)
- Fieldwork (Feb-Mar (M17) and June-July 2019, M22)
- Fieldwork Report (External Report; M28, January 2020)
- Data (archived via BODC M28)
- Papers for SI (M36):
- Contribution to final case study report (External Report M36)

Milestones:
- Training exchange visits identified (M4)

Participating institutions: NOC, KMFRI

PIs responsible for delivery: S.Painter, J.Kamau

Description:

SOLSTICE will offer support of the cruise in form of equipment rental, analytical sample training of Kenyan researchers in Kenya in UK, cruise planning and synthesis workshops, assistance with data archiving, interpretation and throughput to peer reviewed publications in SOLSTICE Special Issue.

Workshop 1. Cruise planning (KMFRI, Mombasa, November 2018 - TBC):

Review of the past observational data, design and planning of the survey, synthesis of modelling and satellite information to assist with the cruise planning and data interpretation; instrument cross-

calibration and testing. This workshop can include additional training by UK researchers in analytical methods.

Workshop 2. Data analysis and synthesis (KMFRI, Mombasa, March 2020 - TBC):

Data analysis and interpretation, preparation for publications, synthesis of modelling and satellite information; data archiving.

Training/capacity development:
SOLSTICE will provide hands-on training for KMFRI in the areas which will be identified by M6. SOLSTICE will provide post-cruise assistance in delivering the results of this fieldwork into peer-reviewed literature.

SOLSTICE proposes to fund 1 month training visits to Liverpool for a physical scientist during 2018. Visits will be designed to overlap with planned glider deployments in AlterEco to enable hands-on seagoing training. Additional 1 month visits to UK in 2019 can be provided for data processing and analysis leading to a SI publication. Exchange visits will be funded from SOLSTICE central budget if prioritised by WIO institutions (see note on Exchange Visits).

SOLSTICE proposes to fund 1 month training visits to Southampton for a biogeochemistry-focused researcher during 2018 including one day training cruise on Calisto. Additional 1 month visits to UK in 2019 can be provided for data processing and analysis leading to a SI publication. Exchange visits will be funded from SOLSTICE central budget if prioritised by WIO institutions (see note on Exchange Visits) .

3.5. WP2 Socio-economic studies

3.5.1. Multi-species fish modelling
Deliverables:

- Contribution to the CS review (Month 12). Dependant on collected data regarding fish and fisheries.
- SI paper (Month 24 paper identified and content finalised; Month 36 paper submitted to SI)
- Contribution to synthesis paper(s) (Month 30 paper(s) identified and finalised; Month 42 paper submitted)
- Fish model outputs (Month 15-18) made available to partners along with short description of the outputs and how to use them. Plus delivery of model outputs for further work within WP2 (specific data type and format).
- Report on the model outputs (Month 24) with case study specific aspects highlighted. Plus comparison to available data.

Milestones:

M6 Lead contacts for fish related enquiries identified by KMFRI.

M6 NEMO-MEDUSA data received from NOC

M7 list of main fish species of interest for the case study agreed on by case study partners.

M8 Additional data (where needed) for model parameterisation provided by partners or gathered from literature

M10-15 Data on fish catch to validate the model output

Participating institutions: PML (PI: Sévrine Sailley), NOC, KMFRI

PI responsible for delivery: Sévrine Sailley, PML

Description:

The fish modelling will make use of the SS-DBEM model to obtain projections regarding possible changes of fish species distribution and potential catch within the century. The model projections will target key fish species for the case study (both in term of subsistence and economic value) and make use of NEMO-MEDUSA model outputs to look at changes of distribution and abundance due to change in climate. There will also be additional run(s) to look at effect of fishing and different management approaches (whether the fishing is at or above the Maximum Sustainable Fishing Yield, MSFY). Model outputs will be made available to project partners, and a report will be produced to highlight the major findings regarding the sustainability of current targeted fishes and possible alternatives.

Although the model and report deliverables will be specific to this case study, the model domain and some of the fish species will overlap across all three SOLSTICE case studies (Kenya, Tanzania, and, South Africa).

KMFRI researcher Dr. Gladys Okemwa will be a lead contact for queries regarding fishing (e.g. main fish species, landing data).

3.5.2. Emergent Fisheries of the North Kenyan Bank

Participating institutions: KMFRI, all participants

PI responsible for delivery: J.Kamau (KMFRI), SOLSTICE directors (Popova, Roberts)

Deliverables:

- Key contribution to the CS literature review (M12)
- SI paper (M 36)

Description:

KMFRI will lead the key "foundation" study demonstrating what we know about the fishery, why its sustainable management is critically dependent on understanding of the marine environment

and biophysical drivers. This study should result in the SI "setting the scene" paper (a compulsory requirement of the SI).

3.5.3. Wider engagement with fisheries: Importance of skip jack tuna along the east African coast

Participating institutions: <u>Rhodes</u>, NOC, PML

Deliverables:

- Detailed research plan presented including sampling program (M12)
- Project progress report (M24)
- SI paper (Month 36)

Milestones:

- Rhodes student identified (M6)
- Timing of the exchange visit agreed (M6)
- Deliverables agreed (M12)
- Input into policy identified (M24)

Description:

The project will address importance of skip jack tuna along the east African coast – synthesis of current biological knowledge, understanding population structure, and potential impacts of climate change. This project was created on request of the DSFA and is aligned with projects in the University of Aberystwyth (UK, Prof. P. Shaw) and Rhodes. The project will include synthesise available biological info (desk top), understand population structure, lagrangian modelling of the ocean circulation related to tuna movement with emphasis on climate change, and provide management advice. The project will include field trips to collect genetic samples - South Africa, Tanzania (mainland, Zanzibar and Pemba Island), Kenya; collection of genetic samples across the area.

Capacity development:

The following exchange visit will be offered to the Rhodes student (funded from NMU budget): Visit to the UK for 4 months, 2 months to NOC (Ocean circulation models and lagrangian analysis), Genetic analysis: - 2 month Aberystwyth (funded by Aberystwyth).

3.5.4. Input-output tables
Deliverables:

- Contribution to the CS literature review (Month 12)
- SI paper (Month 12, 24 paper identified and finalised; Month 36 paper submitted to SI)
- Contribution to MOOC (M30). Regionalising input-output tables and its application to fisheries under climate change scenarios
- Contribution to synthesis paper(s) (Month 30, 36 paper(s) identified and finalised; Month 42 paper(s) submitted)
- Regional input-output data table and user document made available to partners and wider community (Month 24)

Milestones:

M6: Data required for regional input-output tables identified and agreed with UDSM, TAFIRI, IMS

M21: Data collated for regional input-output table in collaboration with KMFRI, CORDIO

M18: Fish model outputs received from PML-fisheries

M30: Results of economic assessment produced and used in writing SI and synthesis papers

Participating institutions: PML (PI: E. Papathanasopoulou), KMFRI, CORDIO

Description:

Regionalised input-output (RIO) tables will be produced for the case study areas. These will be developed using earlier productions of the table at a national level and scaled down by regional data available through statistical records and collected by local partners. The RIO tables will be used to estimate the direct and indirect economic impact on the local economies from changes in fisheries due to climate change. The direct and indirect impacts provide insight into the wider economic impact of the reliance on natural resources and can prove useful for structural regional development that aims to ensure resilience and adaptive capacity. These impacts will be estimated in revenue and employment units.

Training/Capacity development:

Two visits to PML, UK, will be offered to Fridah Munyi. One visit in the first year of her PhD to work with Eleni to identify primary data requirements and its translation into macroeconomic analysis and Sustainable Development Goal monitoring. The second visit will be organised for the last year of her PhD research, where results from her research will be presented at PML and written publications progressed.

3.5.5. Considering climate change as part of resilient Spatial Planning& Ecosystem Based Management for the North Kenyan Bank

Participating institutions: PML (PI: A. Queirós), KMFRI, CORDIO & others (potentially Kenya Wildlife Service)

Note: this study will go ahead if the associated Milestone at M9 (data scoping) has a positive outcome.

Deliverables:

- Contribution to the CS review (Month 12)
- SI paper (Month 36 paper submitted to SI)
- Report geared towards policy communicating main findings of spatial analysis providing advice for resilient use of different gear fisheries & other wild capture

resources, as well as conservation resources based activities in the NKB, within the context of climate change and ecosystem based management. (Month 42).

- Contribution to synthesis paper(s) (Month 42 paper submitted)

Milestones:

M6: Spatial data on relevant marine sectors required co-mapping identified with KMFRI, CORDIO & others

M9: Data scoping: feasibility assessment of the Marine Spatial Planning study

M12: Spatial data delivered or holder identified with KMFRI, CORDIO & others.
M18: Climate modelling projections for physics, biogeochemistry and fish models received from PML-fisheries and NOC-modelling, ready for use in spatial meta-analysis.
M36: Results of spatial meta-analysis data finalised and delivered as manuscript to SI
M42: Report summarising results in less technical language and geared towards policy delivered, with input from partners.

Description:

The main outcome of this task will be to:1) highlight potential opportunities for growth and resilience for fisheries in the NKB that may result from potential changes in the distribution of resources, and/or of key areas that may support their productivity, as climate change unfolds in the region; 2) anticipate potential conflicts and opportunities for other sectors using the marine space of the NKB, given those changes.

The contribution of local institutes will consist of: the provision of GIS data; support in the liaison with other local partners that may hold available data (pending data availability); co-development of the work through advice in the understanding of the local blue economy context; and participation in publications & dissemination as appropriate.

We will assess the resilience (and vulnerability) of current economic sectors dependant on living resources to climate change, in the NKB and encompassing waters, as well as their distribution. The analysis will take into account the current distribution of activities (gear specific fishing grounds) and co-located economic sectors (e.g. spatial data tourism, MPAs or other), as well as projected changes to their associated environment and target resources (species specific), based on modelling projections to the end of the 21st century undertaken by PML and NOC (NEMO-MEDUSA and SS-DBEM).

The completion of this activity will be dependent on the availability of spatial data for co-mapping (local partner engagement) and model projection availability.

Capacity building for this task will be achieved through the collaboration in all aspects of the work, co-design of the study and one-to-one/small team coaching on the methodology and result interpretation. The main capacity building outcome is the analysis as a product for use by the local partners in their marine management engagement and advice to government in Kenya.

3.6   WP3. Science into policy and wider stakeholder engagement

3.6.1. Stakeholder engagement Action Plan

Deliverable: Project Report (Month 9)

Participating institutions: KMFRI (J.Kamau), CORDIO, NOC, PML

Description:

We will produce a report identifying key stakeholders in the following groups: policy, industry, communities, and academia. The report will contain a detailed engagement plan including plans for profiling (M&E indicators, surveys and interviews), identification of stakeholder capacity development needs, stakeholder engagement events, and links with MOOC and MOOC-light.

KMFRI plans to engage the resource managers of the five riparian counties from the onset so that they associate with the project and provide their thoughts on what they require the project to inform them as concerns the resource. KMFRI will also engage the various relevant NGO's, institutions, BMUs, and county development bodies as well as the state department of fisheries. We will require planned visits to the county Governors office to initiate the process.

3.6.2. Policy and practice notes

Deliverable: Policy and practice information pack (M42)

Participating institutions: KMFRI, NOC, PML

Milestones:

M9: Science into policy framework and action plan developed; Examples of Policy and practice notes from previous project reviewed.

M36: Full list and layout of Policy and practice notes identified

Description:

We will produce policy and practice notes aiming at key groups of stakeholders

3.6.3. Final stakeholder engagement event

Deliverable: Workshop with stakeholders (~July 2021)

Participating institutions: KMFRI, NOC, PML

We will run three stakeholder engagement workshops (beginning, mid-term and the end of the project).

Final workshop: a targeted stakeholder information event on the key deliverables of the project, and its legacy. We will present Policy and Practice information pack. We will use this event for the final stakeholder related indicators for M&E profiling (interviews, surveys).

3.7. WP4. Capacity Development

3.7.1. Full capacity development plan for Kenya

Deliverable: Project report and outcome/impact indicators (M9)

Participating institutions: NOC (Byfield), WP leaders 1a,b,c and 2, KMFRI,

We will produce a project report outlining the following:

- Institutional capacity baseline, including overview of facilities and expertise
- All project MSc/PhD studentships including UK-WIO supervisors, training needs, participation in the project events and exchange visits and contribution to the key deliverables.
- Institutional capacity development requirements in technologies (modelling, remote sensing) and field work, key outcome indicators, baseline assessment of these indicators, and capacity development plan.
- Stakeholder capacity development needs
- NOC/PML capacity development needs in application of core expertise in ODA arena
- GCRF might require additional activities on baselining of institutional capacity (TBC).

3.7.2. Training courses

Deliverable: Training courses and associated material (M12, M18, M30)

Description:

We will run three 2-week training courses: Applications of remote sensing, Applications of ocean modelling, and Science communication. This will be available to junior staff and post-graduate students at participating institutions, including at least one person from each of the supporting partners in the wider WIO.

Course 1: Applications of marine remote sensing (M12)

Deliverables: Training course brochure (M8), delivery (M12); course report (M13); course lectures and tutorials available on line (M13).

Participating: <u>NOC-RS (PI V.Byfield), IMS</u>, KMFRI, PML-RS, CORDIO, SAEON, Rhodes

Milestones (main milestones for wider distribution in bold)

M8: Course brochure for publication to partner institutions,

M12: Delivery of the training course

M13: Course report with analysis of student feedback

Course 2: Modelling training course (M24)

Deliverables: Training course brochure (M20), delivery (M24); course report (M25); course lectures and tutorials available on line (M25).

Participating: NOC-MSM (PI E.Popova), NMU, PML

Milestones:

M20: Course brochure for publication to partner institutions,

M24: Delivery of the training course

M25: Course report with analysis of student feedback

M28: On-line availability of course material (lectures and tutorials) on SOLSTICE web site

Course 3: Science communication& MOOC production workshop (M30)

The aim of this training workshop is to develop skills for communicating science to different audiences through participatory training exercises and produce SOLSTICE MOOC material based on the case studies.

Deliverables: Training course brochure (M25), delivery (M30); course report (M19); course lectures and tutorials available on line (M21), additional outreach resources on line (M24).

Participating: NOC-MPOC (PI V.Byfield), IMS, Imperative Space, NOC Coms, all partners

Milestones (main milestones for wider distribution in bold)

M30: Delivery of the training course;

M31: Course report with analysis of student feedback

M23: On-line availability of communication material developed during the course and refined by participants in the following months.

3.7.3. Training in analytical methods at KMFRI and analysis of historical data

Deliverables:

M14 (Nov 2018): Cruise planning and data analysis workshop (at KMFRI)

M26 (Nov 2019): Cruise data analysis workshop

Milestones:

M4: Exchange visits identified

M6 Workshop dates, scope and format confirmed and development needs identified

24

PI responsible for delivery: S.Painter (NOC), V.Byfield

We will organise two training workshops at KMFRI: the first one will be dedicated to the analysis of historical data, cruise planning and data archiving. The second workshop will be dedicated to the analysis of the North Kenyan Bank cruise data.

In addition, a number of exchange visits dedicated to the training in analytical methods will be carried out between KMFRI and NOC.

Additional deliverables

M16, M30 Report on the effectiveness of the fieldwork capacity development activities based on feedback from participating mentors and 'trainees', as contribution to an M&E report.

3.7.4. MOOC

Deliverables: course content (M36) and screening (Months 37, 42, 48)

Provisional title: "Sustainable use of living marine resources: case studies from the Western Indian Ocean"

PI: V.Byfield

Description:

The MOOC will run on the Future Learn (Open University) platform. Following its first screening, an offline version will be made available for use by the partners, and other organisations in the WIO in their course activities. The MOOC will build on research activities in WPs 1, 2 and capacity development resources developed in 4.2, using examples from each of the three case studies, and from SOLSTICE stakeholder engagement activities. The content will address selected capacity development needs of partner institutions and stakeholders, as identified in the capacity development plan. It will run over 6 weeks, each week covering a major theme in SOLSTICE research and stakeholder engagement. Content related to Kenya will include:

- interviews with experts and selected stakeholders, transcript of interviews,
- video from research activities collected during training courses and workshops
- model and satellite animations,
- brief background text and figures with references to further information on the SOLSTICE web site and elsewhere on-line,
- short Q/A exercises to test student understanding,
- forum where students can discuss the topic, ask questions, and share information.

All Co-Is in the UK and WIO are expected to contribute in areas of their expertise, and encourage their students and junior scientists to engage with the MOOC development. Contributors are expected to:

- give interviews about their work and area of expertise,
- facilitate filming of research and other project activities
- provide background text and references, figures, images and/or animations for the MOOC content, related to their research and area of expertise
- follow the MOOC on-line while it runs to answer questions related to their area of expertise.

Milestones:

M9: MOOC outline agreed, all contributors identified,

M12: detailed MOOC outline developed, presenter/interviewer identified for each country (Kenya, Tanzania, South Africa, UK) KMFRI will engage Ms Jane Kiguta as a key MOOC liaison person, she is in charge of public relations at the Institute.

M13: MOOC promotional video produced (NOC, IMS)

M13: MOOC sample lecture produced (NOC)

M18: MOOC CS1 &2 layout finalised (following fieldwork completion)

M24: MOOC CS3 layout finalised (following fieldwork completion)

M34: MOOC outline completed and advertised on Future Learn

M35: Full MOOC content compiled

M36 – Published on FutureLearn platform

M37: MOOC Run 1 (Oct 2020)

M40: Off-line version of MOOC available on SOLSTICE web site (Jan 2021)

M42: Off-line version on Ocean Teacher

M42: MOOC Run 2 (Apr 2021)

M48: MOOC Run 3 (Sep 2021)

M39,M44, M50 Short reports with statistics on MOOC uptake and user profiles for inclusion in M&E reports

3.7.5.   MOOC Light
Deliverables: M39 MOOC Light; M48 report on community testing

PI: V.Byfield

Description:

The MOOC Light will be designed for use in schools and as informal education tool to promote ocean literacy. Covering the main themes addressed by the MOOC, it comprises video, informative brochures and a selection of guided education activities to promote understanding of local habitats, the global interconnectedness of the oceans, and of the productivity that supports larger marine animals, including species important to local fisheries. It will be available in English and Swahili.

Milestones:

M12: recommendation from Science-to-policy WGs on MOOC content received

M30: MOOC Light layout agreed (following CS 1, 2 and 3 fieldwork) and

M39: Content compiled in English and Swahili

M45: MOOC light tested with local fishing communities (KMFRI, IMS, NMU, SAEON,SASMIA, WWF, other participants involved in community engagement activities)

3.8. WP5 Communication

3.8.1. Regular channels of communication:
- Project website (external): Fully operational by 15th December 2017
- Project website (internal): Fully operational by 1st march 2018
- Project newsletter (internal): every 3 months starting 1st December 2017
- Project newsletter (external, summary for stakeholders): every 6 months, starting 1st April 2018
- Project newsletter (external, impact summary for funders): every 6 months, starting 1st April 2018

3.8.2. One-off communication material:
- SOLSTICE banners (M1)
- SOLSTICE brochure (M1)
- SOLSTICE promotional video: M9
- SOLSTICE MOOC promotional video: M13
- SOLSTICE MOOC sample lecture (video): M13
- Training course leaflets (M8, M14, M25)
- MOOC leaflets (M32)
- Infographics for the Case Studies (M42)
- Policy and practice notes for the Case Studies (M42)
- SOLSTICE: summary of outcomes and impacts leaflet

4. Monitoring and evaluation

4.1. Network profiling
Deliverables: survey and basic analysis tools **(M6)**

Participating institutions: NOC (Popova, Alexiou), PML, all partners

Milestones:

M5 questionnaire finalised

M6 survey returned

M6 methodology and indicators finalised

We will use a modified GULLS survey (social network analysis) to profile the network strength and growth parameters (baseline, midterm and end term). International transdisciplinary network is the key delivery of the GCRF Grow call, thus this survey is of extreme importance and should clearly reflect our key success indicators.

4.2. M&E strategy
Participating institutions: NOC (Popova), PML

Deliverables: Project Report (M6)

In consultation with GCRF we will produce a strategy document detailing a complete M&E approach including logframe, theory of change, profiling surveys and methods of qualitative information collection.

4.3. Monitoring and evaluation reports
Participating institutions: NOC, PML

Deliverables: Project Report (M12, M30, M51, long term impact TBD)

Milestones: M&E indicators will be collected every six months

M&E will consider four evaluation categories: i) impact of capacity development both in WIO and UK; ii) benefits, costs and practicalities of employing the new technologies and recommendations; iii) societal impact of case study outcomes; and iv) strength and impact of UK-WIO transdisciplinary networks.

Towards the end of the project we will secure additional funding for the post-project M&E when the highest impacts are expected to be achieved (GCRF additional funding, NC, national and public good are the most obvious routes).

5. Alignment with key regional programs

5.1. PEACC

Acronym: PEACC (Productivity in the EACC under Climate Change)

[Pronounced 'peace' – calling for mankind to be at peace with the environment]

Duration: 24 months (1 July 2016 – 30 June 2018)

Project Reference: MASMA/OP/2016/02

Budget: US$ 252 753

Engagement: We will engage with PEACC via partners in the project e.g. in synthesis: Dr Issufo Halo and Majuto Manyilizu (modelling, Dodoma University and Cape Peninsular University of Technology), Dr Rose Mwaipopo (socio-economics, UDSM) and Dr Albogast Kamukuru (fisheries, UDSM)

5.2. IIOE-II

IIOE-II (Second International Indian Ocean Expedition (IIOE-2)

Engagement: We will engage with Mika Odido from IOC sub-commission for Africa and the adjacent island states and with Ben Milligan (via SOLSTICE Advisory Panel).

5.3. The Western Indian Ocean Upwelling Research Initiative (WIOURI)

WIOURI (Western Indian Ocean Upwelling Research Initiative)

Engagement via WIOURI PI Mike Roberts

5.4. ACCORD

ACCORD (Addressing Challenges of Coastal Communities through Ocean Research for Developing Economies) is a four year UK National Capability Program …

Engagement via K.Popova involved into both project.

5.5 SAPPHIRE:

SAPPHIRE (The Western Indian Ocean Large Marine Ecosystems Strategic Action Programme Policy Harmonisation and Institutional Reforms). Engagement routes to be established by Science into Policy WGs.

5.6   WIOSAP

WIOSAP (Strategic Action Programme for the protection of the Western Indian Ocean from land-based sources and activities (WIO-SAP)

6. Key events and workshops

April 2018, London (TBC)

- Annual Leadership team meeting
- Annual Advisory Panel meeting

April 2018, Mombasa

- Science into policy working group (or in June 2018)

September 2018, Zanzibar

- Remote Sensing training course

November, 2018, Mombasa

- Cruise planning workshop

February-March, 2019

- First North Kenyan Bank cruise

April 2019, Mombasa (TBC)

- Annual Leadership team meeting
- Annual Advisory Panel meeting

June-July, 2019

- Second North Kenyan Bank cruise

June-July 2019, Zanzibar

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- Operations room and stakeholder engagement event during robotics mission (2 weeks). This event might be of interest to KMFRI to see the robotics in action and discuss future funding opportunities in this area

September 2019, Zanzibar (preliminary date)

- Modelling training course

November 2019, Location?
- 11th WIOMSA symposium
- SOLSTICE exhibition and special session (if WIOMSA is run in one of the SOLSTICE countries)

October 2019, Mombasa

- Cruise synthesis workshop
- Second stakeholder engagement workshop

April 2020, Zanzibar (TBC)

- Annual Leadership team meeting
- Annual Advisory Panel meeting

December 2020, Mombasa
- Science into policy WG

February 2020, Zanzibar (preliminary date)
- Communication training course

March 2020, Zanzibar (preliminary date)

- Science progress workshop in preparation to SI submission (combined Kenya and Tanzania event)

April 2021, Port Elizabeth (TBC)

- Annual Leadership team meeting
- Annual Advisory Panel meeting

October 2021, Location?

- 12th WIOMSA symposium
- SOLSTICE exhibition and special session (if WIOMSA is run in one of the SOLSTICE countries)
- SOLSTICE science-into-policy workshop with stakeholders

July 2021, Mombasa

- Synthesis, evaluation and science into policy workshop. Final stakeholder engagement workshop for Kenyan Case Study

7. Institutional Contributions to the Case Study

7.1. KMFRI

KMFRI will lead the North Kenyan Bank Case Study. In particular KMFRI will coordinate the Case Study literature review and the North Kenyan Bank foundation paper for the Special Issue (UK contribution for the literature review will be coordinated by K.Popova).

KMFRI will assist with validation of the physical and biogeochemical model output using historical data and knowledge of the region and contribute to the modelling publication.

KMFRI will conduct two biogeochemical surveys of 10 days duration in February-March and June-July 2019.

KMFRI will aim to produce lead author publications (SOLSTICE Special Issue) in the following areas:

- North Kenyan Bank foundation paper
- Physical processes driving ecosystem dynamics at the NKB (observations)
- Biogeochemical processes (observations)
- Current and historical Plume dynamics from satellite imagery
- Radiocarbon dating and historical sedimentation rates

KMFRI will lead Science into policy work package coordinating stakeholder engagement and production of science into policy material (reports, infographics, policy and practice notes). A substantial contribution of UK researchers (in particular WP2) will be provided to support this activity.

KMFRI researchers will contribute to the MOOC and participate in filming of the material dedicated to the case study; a local contact person will be identified to act as liaison for MOOC development.

KMFRI will facilitate making the off-line version of the MOOC available via Ocean Teacher Global Academy (OTGA) Mr. Harrison Onganda will facilitate this activity.

KMFRI will provide meeting facilities for the SOLSTICE project meeting and workshops run in Kenya.

Dr.J.Kamau will serve as members of the SOLSTICE Leadership Team reporting annually to the Advisory Panel.

7.2. CORDIO

- CORDIO suggests a Beach Management Unit fisheries training course on fisheries information for improved artisanal fisheries co-management (building on a course already prepared and run by CORDIO in 2012 – under SmartFish (IOC)). This will reinforce catch monitoring for at least one year - June 2018 to July 2019 - by BMUs operating in North Kenya Banks.

7.3. NMU

Dr M. Noyon will lead a training session on plankton ecology at IMS in June 2018 with a special focus on plankton collection, identification and measurements in collaboration with HWU and KMFRI (Dr James Mwaluma). The workshop will include looking at samples that have been collected or will be collected during various cruises (Nansen program and IIOE2).

Prof M.Roberts will participate in the North Kenyan Ban cruise if there is no overlap with eth South African and Tanzanian fieldwork.

7.4. Rhodes

Prof. W Sauer will lead on SOLSTICE wider engagement with the WIO fisheries and DSFA (with links to tuna) in particular.

Prof. W Sauer will strongly contribute to the Science into Policy working group activities and in particular to the production of final Science into Policy briefings and material.

Prof. Sauer will serve as a member of the SOLSTICE Leadership Team reporting annually to the Advisory Panel.

7.5. PML

PML will take the lead on WP2 (Socio Economics, PI: E. Papathanasopoulou) and contribute to: the Remote Sensing component of WP1 (Remote Sensing, PI: D. Raitsos), WP3 (Science to Policy), WP4 (Capacity Development) and M&E.

PML will take a lead on the following WP2 tasks: Fish modelling; Input-Output tables; and Marine Spatial Planning. It will also strongly contribute/lead WP1 tasks: synthesis of satellite information to identify large scale drivers, local drivers, real-time support of fieldwork, on-line/off-line remote sensing access; WP3: all relevant activities; WP4: 2-week remote sensing training course and MOOCs.

PML will be involved in co-supervising master and PhD students aligned with the Kenyan case study, particularly through the WP2 Input-output task (E. Papathanasopoulou).

E. Papathanasopoulou will serve as a member of the SOLSTICE Leadership Team reporting annually to the Advisory Panel.

7.6. NOC

NOC as a lead organisation has overall responsibility for delivering the project. NOC PI is identified in every WP.

8. List of abbreviations

AUV - Autonomous Underwater Vehicle

BGC - Biogeochemistry

CS – Case Study

EAF - ecosystem approach to fisheries

GCRF – Global Challenges Research Fund, UK (Project Funder)

MOOC – Massive Online Open Course

M&E – Monitoring and Evaluation

ODA - official development assistance

ROV - (Remotely Operated Vehicle)

RS – Remote Sensiong

SI – Special Issue

WG – Working Group

WP – Work Package