SOLSTICE

Monitoring & Evaluation Plan

Version 2.0

26 September 2018

Contents

Acronyms

SOLSTICE - WIO	Sustainable Oceans, Livelihoods and food Security Through Increased Capacity in Ecosystem research in the Western Indian Ocean, www.solstice-wio.org
RCUK	Research Council United Kingdom, www.rcuk.ac.uk
GCRF	Global Challenges Research Fund, www.rcuk.ac.uk/funding/gcrf/
M&E	Monitoring and Evaluation
ToC	Theory of Change
WIO	Western Indian Ocean

1 Introduction

SOLSTICE-WIO (www.solstice-wio.org) is a four-year collaborative project funded by the UK Global Challenges Research Fund (GCRF) RCUK Collective Fund. Launched in October 2017, SOLSTICE-WIO brings together local knowledge, international research expertise and state-of-the-art technologies to address challenges facing the Western Indian Ocean (WIO) region in a cost-effective way. The total budget for SOLSTICE is £8,000,000 covering the four year project duration which ends on 31 December 2021. The SOLSTICE team comprises researchers from the United Kingdom, South Africa, Tanzania and Kenya with "in-kind" support from the wider Western Indian Ocean community.

1.1 Purpose of this plan

Purpose of this plan is to streamline and coordinate Monitoring and Evaluation (M&E) effort of the SOLSTICE project. In particular, the M&E Plan aims to assist with the following:

- Identifying evidence needs to ensure proposed project outputs are leading to measurable outcomes and impacts
- Identifying the stakeholders and user groups which need to be engaged to maximise project impacts
- Strengthening program design: clear indicators of success allow Leadership Team to optimise project activities and sharpen research questions
- Enabling clear communication: Leadership Team and project PIs are able to communicate based on shared understanding of the different levels of outputs, outcomes and impacts.
- Maximising collaboration with existing networks and projects with shared vision and objectives

The M&E Plan was created by the SOLSTICE M&E team (see Roles and Responsibilities) and includes SOLSTICE Theory of Change, Logical Framework and the Key Performance Indicators. **The M&E Plan is a living and evolving document and is subject to change. All proposed changes to the M&E Plan must be discussed with the M&E Team and approved by SOLSTICE Leadership Team. All versions of the M&E Plan including the latest one can be found on the project website www.solstice-wio.org**

1.2 Version updates

Version	Milestone	Key changes/additions
M&E Plan v1	Created for 6 months GCRF review (March 2018)	Theory of Change Log Frame KPIs
M&E Plan v2	Revised for the Stage Gate Review reporting (September 2018) after receiving GCRF reporting requirements	The following new elements added: Assessing equitability Assessing interdisciplinarity Developing and monitoring SOLSTICE network Preliminary results of social network analysis Capacity assessment matrices Equitable partnership survey Network profiling survey Institutional Capacity KPIs (preliminary)

1.3 Project summary

Title	SOLSTICE
Starting Date	01.10.2017
Duration	31.12.2021

Partners	1. National Oceanography Centre (NOC), UK 2. Nelson Mandela University (NMU), South Africa 3. Plymouth Marine Laboratory (PML), UK 4. Institute of Marine Sciences (IMS), Tanzania 5. Tanzania Fisheries Research Institute (TAFIRI), Tanzania 6. Western Indian Ocean Marine Science Association (WIOMSA), Tanzania 7. Kenya Marine and Fisheries Institute (KMFRI), Kenya 8. Coastal Oceans Research and Development – Indian Ocean, East Africa (CORDIO-EA), Kenya 9. Bayworld Centre for Research and Education (BCRE), South Africa 10. Rhodes University, Department of Ichthyology & Fisheries Science, South Africa 11. South African Environmental Observation Network (SAEON), South Africa 12. University of Cape Town (UCT), School of Economics, South Africa 13. Environment for Development (EfDT), Tanzania 14. Heriot-Watt University (HW), UK 15. The Scottish Association for Marine Science (SAMS), UK 16. South African Squid Management Industrial Association (SASMIA), South Africa
Target Area	World leading research in Sustainable Living Marine Resources
Beneficiaries	The primary beneficiaries are policy makers and resource managers tasked with delivering sustainable management of marine living resources and climate adaptation options. Ultimate beneficiaries include: - Commercial and artisanal fishers and their families will benefit from better yields and greater stability of sustainably managed fisheries or from guidance on alternatives where existing practices are unsustainable. - Enterprises engaged in processing, marketing, distributing and exporting seafood will benefit from higher yields and greater stability of optimally managed fisheries due to improvements in fishing practices arising from research recommendations. - The tourism sector, dependent on attractive, ecologically sound natural environments and a culinary culture where seafood figures prominently, will benefit from their continued availability. - Fishers, their families and the general public will benefit from a better understanding of the marine environment and the services provided by healthy marine ecosystems. The primary academic beneficiaries of SOLSTICE-WIO will be international research scientists working in the Western Indian Ocean on a wide range of marine topics, including physical oceanography, marine ecology, fisheries science and economics, ocean governance, socio-anthropology, climate change impacts, climate change adaptation and mitigation.

Cost	£8,000,000
Funding Source	Global Challenges Research Fund, UK
Goals	The overall aim of SOLSTICE-WIO is to strengthen capacity in the WIO to address challenges of food security and the sustainability of livelihoods of the 60 million people dependent on the region's marine ecosystems. This is reflected in the main objectives of the project: 1. To grow marine environmental research capability to address challenges facing the WIO region in a cost-effective way via state-of-the-art technology transfer, collaborative environmental and socio-economic research and hands-on training; 2. To strengthen the capacity of UK marine scientists to apply leading-edge technologies in developing countries, and work with regional and local experts to ensure that their research addresses local and regional needs. 3. To strengthen the ability of WIO scientists to effectively deliver evidence-based environmental and socio-economic information to support policy development and implementation at national and regional levels. 4. To ensure future sustainability of marine research capability in the region by training and mentoring early career scientists and post-graduate students from the WIO and by developing on-line resources for use in distance learning and hands-on training of marine scientists outside the partner organisations and beyond the duration of the project. 5. To ensure on-going support for an Ecosystem Approach to Fisheries in the WIO by building lasting strategic research partnerships between UK marine science and regional centres of excellence, between these centres and other WIO research organisations, and between marine scientist and government agencies and NGOs mandated to deliver sustainable development and exploitation of marine living resources in the WIO.

2 SOLSTICE Theory of Change

2.1 General approach

SOLSTICE is an international multi-disciplinary research project. Its goal to produce world-class research, capacity development in the world-class research and evidence-based applications to support the sustainable management of the living marine resources.

SOLSTICE Theory of Change present a conceptual view of the changes that SOLSTICE research and capacity development must influence if it is to successfully contribute to development impacts for people and ecosystems. It shows how and why SOLSTICE research is planned to help influencing thinking, attitudes and behaviours amongst its user communities, so that long term improvements can be brought about. SOLSTICE Theory of Change also draws attention to assumptions which are made to allow this conceptual progression. All development initiatives are only as sound as its assumptions which must be met for the goals to become achievable.

The Theory of Change recognises the SOLSTICE is located within a wider set of international, national and local initiatives in the area of sustainable use of living marine resources, environmental issues and impacts of climate change. These all offer opportunities for collaboration and co-production of outputs.

It is important to remember that SOLSTICE Theory of Change is a conceptual model, not a literal representation of a linear process. Its main purpose is to provide an analytical framework for understanding the design of the planned research and the main type of changes the project must achieve for long-term success.

The schematic of the SOLSTICE Theory of Change is presented in Figure 1. It describes a hierarchy of changes starting at the lower level with Program Outputs achieving a number of Program Outcomes leading to short-to-medium term changes. At this level ToC acknowledges that SOLSTICE is not the only initiative working in the area of living marine resources and cutting edge technologies. Thus attribution of the Outcomes and, further down the line, the Impacts to SOLSTICE outputs becomes challenging.

It is important to remember that SOLSTICE is only a four-year project with a substantial component dedicated to the world-leading primary research in marine environment and ecosystems. The process of generating and publishing primary research results to act as evidence in the decision-making process takes time comparable with the project lifespan. Thus the project Leadership Team and GCRF as the project funding agency need to be prepared to evaluate the success of the project at the level of the Outcomes rather than the Impacts. Furthermore, GCRF as a funding agency and NOC as a leading organisation must find the way of carrying on Monitoring and Evaluation efforts beyond the end of the project with the necessary budgetary implications.

2.2 Full Narrative

At the core of the SOLSTICE project design is the notion that insufficient research capacity, inadequate monitoring programs and poor integration of science into fisheries and management practices are the key roadblocks for the ecosystems approach to fisheries (EAF) in the Western Indian Ocean, or put simply "You cannot manage what you don't understand".

Following requirements of the GCRF "Grow" call, SOLSTICE focuses its effort on producing four key outputs:

Output1: Strong and self-sustaining scientific transdisciplinary WIO-UK networks 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 EAF, policy, industry and markets. Capacity developed in UK to meet the needs of ODA 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.

The first three outputs should be common to all projects funded by this call, while the fourth one (technology transfer) is unique to SOLSTICE.

One important assumption will have to prove sound for the Output 1 and 2 to lead to desirable outcomes, namely that upskilled researchers remain in employment either in their institutions or in general area of management of the marine environment. If successful, we expect to achieve Outcome 1: Networks grow, involve newly trained researches and stakeholder participation and begin to attract new funding. It is important to recognise that attracting new funding is a critical feature for a sustainable network and long lasting legacy of the project.

SOLSTICE recognises four key groups of players it must influence to realise its impacts: research (academia and NGOs), private sector industry, policy makers and communities. Through its engagement activities, SOLSTICE aims to overcome a wide spread resistance to employment of new technologies and to achieve its Outcome 2: Key players become aware, receptive and show intention to invest into new technologies and adopt ecosystem approach.

In providing a strong body of research evidence in each of the case studies and ensuring the optimal pathways for communication between science and policy, SOLSTICE will achieve its Outcome 3: Case studies provide strong body of evidence for action with a measurable outcome.

At this level ToC acknowledges that SOLSTICE is not the only initiative working in the area of living marine resources and cutting edge technologies. Thus attribution of the Outcomes and, further down the line, the Impacts to SOLSTICE outputs becomes challenging. However SOLSTICE recognises that synergies with other activities in this area present excellent opportunities for achieving the long term legacy and sustainability of the results.

It is important to remember that SOLSTICE is only a four-year project with a substantial component dedicated to the world-leading primary research in marine environment and ecosystems. SOLSTICE research underpins all four Outputs. The process of generating and publishing primary research results to act as evidence in the decision-making process takes time comparable with the project lifespan. Thus the project Leadership Team and GCRF as the project funding agency need to be prepared to evaluate the success of the project at the level of the Outcomes rather than the Impacts. Furthermore, GCRF as a funding agency and NOC as a leading organisation must find the way of carrying on Monitoring and Evaluation efforts beyond the end of the project with the necessary budgetary implications.

Nonetheless, the project Theory of Change and its Log Frame recognises achievable and measurable impacts, albeit put them into the longer term category, potentially beyond the end of the project.

These are:

Impact 1: Sustainable networked centres of excellence established in South Africa and Tanzania

Impact 2: Institutional uptake of new technologies has a measurable impact on management of living marine resources

Impact 3: Strengthened fisheries management

Impact 4: Uptake of research-based evidence in policy

Here again, we need to recognise critical assumptions which are a prerequisite to the project achieving its impact and providing the long term legacy. SOLTICE recognises three such assumptions at the level of Impacts:

1. Network is successful in leveraging additional funding.

2. Case studies move rapidly along impact pathways and become flagship examples

3. Key influential stakeholders endorse technology-based approach.

Each of these assumptions is only partially based on the success of SOLSTICE effort and is under influence of the factors outside of SOLSTICE control. For instance, success in securing funding requires both: scientific excellence of the applicant (SOLSTICE objective) but also availability of private or governmental funds to bid for (mostly outside of SOLSTICE area of influence).

ToC aspires to contribute to further Impacts which are next to impossible to attribute to SOLSTICE or any other individual program:

1. Further underpinning of the blue economy and creation of alternative livelihoods

2. Sustainably managed marine ecosystems, economic grows, and food security.

It must be recognised, that SOLSTICE ToC is a generic framework designed to cover simultaneously SOSLTICE general approaches and three very different Case Studies set in three countries with diverse economic, scientific, social and cultural conditions. As the Case Studies progress, each of them is expected to develop their own, much more specific Theory of Change.

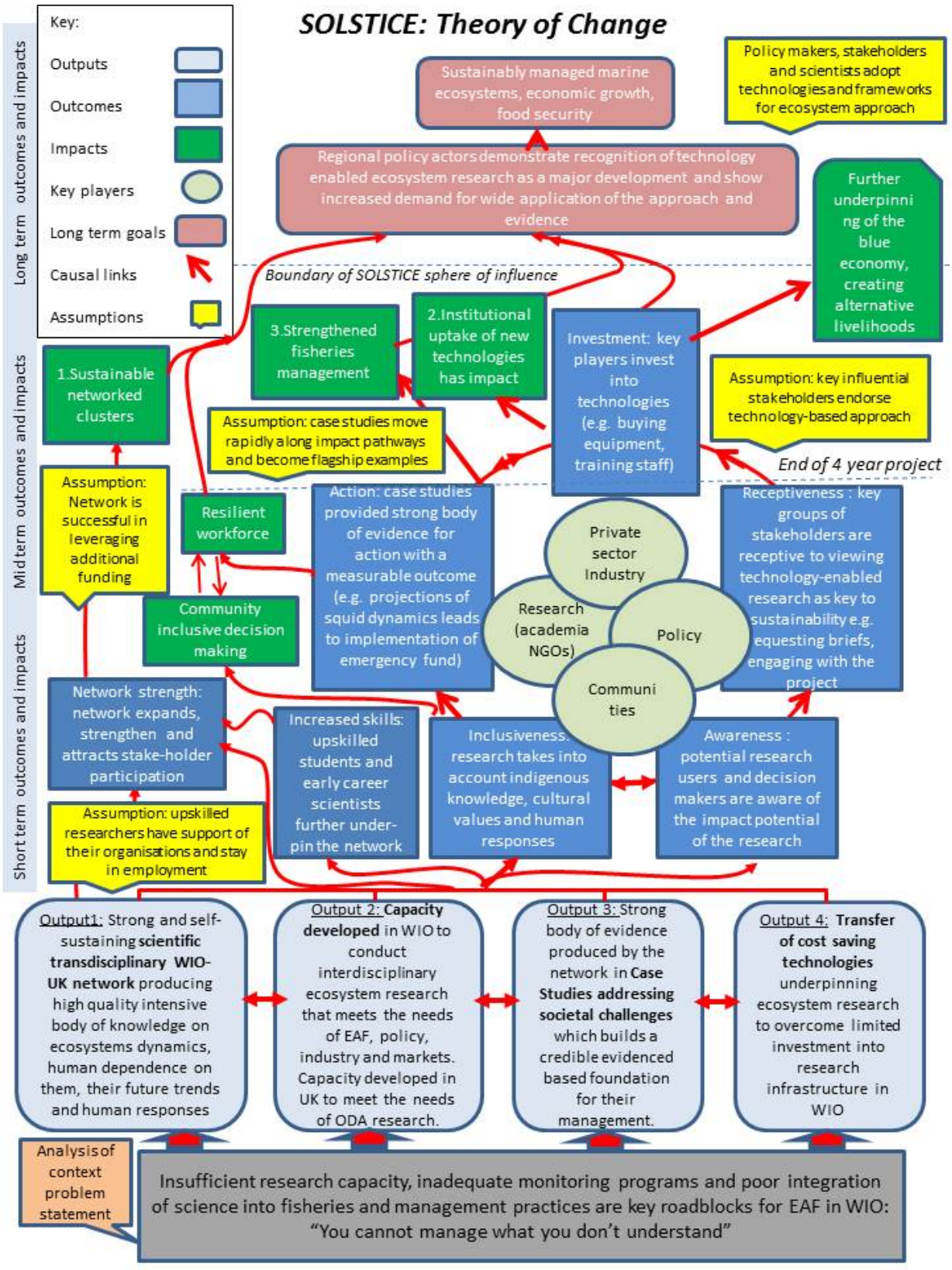


Figure 1. SOLSTICE-WIO Theory of Change diagram, to be read from the bottom up, following flow arrows and touch-points.

3 Logical Framework

	Summary of quantified SMART targets for each level in the log-frame	Indicators (quantitative and qualitative)	Means of Verification	Assumptions
Inputs	Pre-SOLSTICE: NOC/PML leading expertise in marine technologies: Robotics, Modelling, Remote Sensing and Environmental Economics; Existing model outputs, data sets, software tools and socio-economic frameworks; NMU-NOC Innovation Bridge, Newton Chair and new institutional building at NMU to work as a hub for technology transfer. SOLSTICE: Man-hours and face-to-face interactions (meetings, training, collaboration activities) as detailed in the budget; Local interest and involvement from 9 WIO partners			
Activities	Stakeholder engagement workshops; collaborative research (“learning by doing”); co-supervision of students; training courses; MOOC; filed work and associated training; exchange visits			

	Summary of quantified SMART targets for each level in the log-frame	Indicators (quantitative and qualitative)	Means of Verification	Assumptions
Outputs	**<u>Output 1:</u>** Strong and self-sustaining **scientific transdisciplinary WIO-UK networks** producing high quality intensive body of knowledge on ecosystems dynamics, human dependence on them, their future trends and human responses	• Number of collaborative cross-country interdisciplinary papers • Number of co-supervised (WIO-UK) MSc & PhD students actively using technologies as part of projects • Number of collaborative workshops • Number of exchange visits • Number and bidding amount of further funding applications (successful and unsuccesful)	• Web of Knowledge (WoK), internal project manuscript tracker • Project descriptions incl. use of technologies, supervisors and progress available on project website; 6 month project reviews • Statistics submitted by project PIs; surveys of visiting scientists and workshop participants • Statistics of participation in other program's workshops, SOLSTICE invited speakers, presence on advisory boards	WIO partners have incentive to produce high quality peer-reviewed publications. Additional requirements for PhDs agreed by partners aligning projects with SOLSTICE: publications, use of technologies

	Summary of quantified SMART targets for each level in the log-frame	Indicators (quantitative and qualitative)	Means of Verification	Assumptions
	<u>Output 2:</u> Capacity developed in WIO to conduct interdisciplinary ecosystem research that meets the needs of EAF, policy, industry and markets. **Capacity developed in UK** to meet the needs of ODA research.	• Number of training courses and publications resulted from them • Number of users of SOLSTICE-based MOOC and MOOC-l • Number of SOLSTICE-aligned PhD and MSc co-supervised and degrees awarded • Number of exchange visits and collaborative publications and funding applications resulting from them • Number of success stories on use of infrastructure provided to WIO • Number of success stories for upgrading UK technologies to meet ODA requirements • Number of responses in director-level consultation on research funding • Number of briefs with recommendations on increased capacity of WIO institutions and early career scientists to generate research funding in EAF • Number of funding organisations receiving SOLSTICE recommendations	• Questionnaires before and after training sessions measuring change in knowledge • Statistics on MOOC attendance and use of off-line version for local training • Reports and feedback on use of MOOC light in community management initiatives • Submission and successful defence of doctoral and master theses • Peer reviewed publications • Policy reports • Presentations at conferences, departmental seminars, association meetings	Importance and potential of remote sensing data and modelling is appreciated and strong demand exist Importance of economic analyses in integrated management acknowledged and adopted

	Summary of quantified SMART targets for each level in the log-frame	Indicators (quantitative and qualitative)	Means of Verification	Assumptions
	<u>Output 3:</u> 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	• Number of refs to case study reports and data bases • Number of stakeholder workshops • Number of participants representing stakeholders • Number of peer-review publications • Number of case study synthesis papers • Number of translational products: (e.g. Policy Briefing Notes, infographics) co-developed with stakeholders • Number of reports on economic/management strategies by case study (minimum in one case study)	• References to project webpage and YouTube videos • Number of workshops and participants • WoK, internal project manuscript tracker • Meetings with relevant stakeholders to review final reports • Citations of reports and peer reviewed papers in policy and management documents	Meaningful indicators for the case studies will be co-created with stakeholders during the kick-off meetings.
	<u>Output 4:</u> Transfer of cost saving technologies underpinning ecosystem research to overcome limited investment into research infrastructure in WIO.	• Number of MSc & PhD students actively using technologies as part of projects • N of cross-discipline papers using support of technologies • Cost-benefit analysis employing technologies • N of technical demonstrations in Tanzania and SA	• 6 months student project reviews • Review of publication by M&E group • Project report on cost-benefit analysis employing technologies	Project and publication reviews are carried out by M&E group

	Summary of quantified SMART targets for each level in the log-frame	Indicators (quantitative and qualitative)	Means of Verification	Assumptions
Outcomes	**Outcome 1:** Networks grow, involve newly trained researches and stakeholder participation and begin to attract new funding	1. Strength, extent and other key parameters of network as measured by social network analysis	1. Regular network analysis survey carried out by M&E team for all network members (baseline, mid-project, end-project)	SOLSTICE delivers convincing demonstration of the technologies in case studies
	Outcome 2: Key players become aware, receptive and show intention to invest into new technologies and adopt ecosystem approach	2. number of requests for briefs, demonstrations, cost estimates of employing new technologies; number of requests for training and participation in case studies; number of additional researchers and managers becoming involved into case studies and demonstrations	2. Interviews with key players; surveys capturing changing attitudes to technologies carried out by M&E team	Number of locally relevant applications of technologies developed in collaboration with WIO experts are growing
	Outcome 3: Case studies provide strong body of evidence for action with a measurable outcome	3. Number of papers, conference presentations, reports presenting analysis of underpinning ecosystem dynamics and recommended management or policy actions.	3. Publication records, conference papers, desktop reviews	There is sufficient capacity in the region to successfully use modelling, remote sensing and economic decision frameworks

	Summary of quantified SMART targets for each level in the log-frame	Indicators (quantitative and qualitative)	Means of Verification	Assumptions
Impacts	**Impact 1:** Sustainable networked centres of excellence established in South Africa and Tanzania	**1.** Number of new funding applications with the use of technologies and addressing aspects of food security Number of new PhD/MSc students using technologies Number of developing country researchers that contribute to production of high quality multidisciplinary research publications on the link between ecosystem dynamics and food security	**1.** Regular survey of project participants and partner institutions carried out by M&E panel (baseline, mid-project, end-project)	Network is successful in leveraging additional funding Case studies moved rapidly along impact pathways and became flagship examples
	Impact 2: Institutional uptake of new technologies has a measurable impact on management of living marine resources	**2.** Number of organisations directly and indirectly using data products generated by technologies (i.e. measured through data portal metrics, publications, funding applications, MOOC participation) and use the results as evidence in decision-making process	**2.** Interviews with partner institutions and key stakeholders; statistics of data use, expression of interest and requests for evidence. References from non-academic publications (reports and briefs)	Key influential stakeholders endorsed technology-based approach
	Impact 3: Strengthened fisheries management	**3.** Number and type of cases where case study outcomes were evident in management decisions (mention in reports and strategy documents). Number of managers trained in MOOC and MOOC-light. Number of UK REF impact stories built of case studies.	**3&4**. Continuous collection of data on the direct and indirect use of project outcomes in management and policy. Surveys of MOOC participants.	Upskilled researchers have support of their institutions and remain in employment
	Impact 4: Uptake of research-based evidence in policy	**4.** Number and type of interventions where case study outcomes were considered in policy relevant activities (mention in policy documents and climate adaptation plans). Number of REF impact stories built of case studies.	Altmetrics to capture exposure and reach of project outputs.	

4 Indicators

Log-frame reference	Output 1: Strong and self-sustaining interdisciplinary network
Indicators	1. Number of collaborative cross-country interdisciplinary papers (including UK and at least one WIO partner) 2. Number of co-supervised (WIO-UK) MSc&Phd students actively using technologies as part of projects 3. Number of collaborative workshops (including UK and at least one WIO partner) 4. Number of exchange visits 5. Number and bidding amount of further funding applications
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3. 4. 5.
Target	Target refers to the end of four year project period 1. 30 2. 15 3. 10 4. 10 5. 10
Data Collection	Questionnaire sent to institutional leads
Tool	Excel
Frequency	6 monthly
Responsible	Sofia Alexiou
Reporting	Details will be submitted by institutional leads to S. Alexiou every six months for the reporting period.
Quality Control	This group of indicators is straightforward and easily verifiable as workshops, supervision and exchange visits are organised centrally. The questionnaire needs to recognise that peer-reviewed publications have the following stages: submitted; under revision; resubmitted; accepted; in press; published.

Log-frame reference	**Output 2: Capacity developed in WIO to conduct interdisciplinary ecosystem research that meets the needs of EAF, policy, industry and markets**
Indicators	1. Number of training courses delivered 2. Number of publications resulted from training courses 3. Number of users of SOLSTICE-based MOOC (including off-line version) 4. Number of users of SOLSTICE-based MOOC-light for fishers and public 5. Number of PhD and MSc degrees awarded with SOLTICE co-supervision 6. Number of exchange visits resulting in collaborative publications and funding applications 7. Number of success stories on use of infrastructure provided to WIO 8. Number of users of the data bases 9. Number of responses in director-level consultation on research funding 10. Number of briefs with recommendations on increased capacity of WIO institutions and early career scientists to generate research funding in EAF 11. Number of funding organisations receiving SOLSTICE recommendations
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3. 4. 5. 6. 7. 8.
Target	Target refers to the end of four year project period 1. 4 2. 10 3. 300 4. 50 5. 10 6. 10 7. 10; *user stories (qualitative, interview-based)* 8. 100
Data Collection	1. Reports by PIs delivering training 2. Reports by PIs delivering training 3. Statistics on MOOC attendance (web-based) 4. Report by institutional PIs on use of off-line version for local training 5. Report by institutional PI on state of PhDs and MScs 6. Questionnaires before/after training; reports by PIs 7. Interviews with users (as identified by institutional leads) 8. Web site statistics
Frequency	6 monthly
Responsible	S. Alexiou
Reporting	Details will be submitted by institutional leads to S. Alexiou every six months
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable. Project members collecting qualitative indicators will attend M&E training including approaches to collection of qualitative indicators.

Log-frame reference	Output 2: Capacity developed in UK to meet the needs of ODA research
Indicators	1. Number of success stories for upgrading UK technologies to meet ODA requirements (conference abstracts, interviews) 2. Number of training courses attended by UK team members leading to step change in ODA research capacity 3. Number of young career scientists applications for ODA funding as Co-I or PI 4. Number and amount of ODA-type funding applications
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3. 4.
Target	Target refers to the end of four year project period 1. 5; *user stories (qualitative, interview-based)* 2. 5; *user stories (qualitative, interview-based)* 3. 3 4.10
Data Collection	1. Interviews with technology WP PIs, conference abstracts 2. Interviews with attendees (questionnaires) 3. Reports by PIs 4. Reports by PIs
Tool	Excel
Frequency	6 monthly
Responsible	S. Alexiou
Reporting	Details will be submitted by UK WP leads to S. Alexiou every six months for the reporting period.
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable. All data are expected to be held either at NOC or at PML and thus easily obtainable. Project members collecting qualitative indicators will attend M&E training including approaches to collection of qualitative indicators.

Log-frame reference	Output 3: Strong body of evidence produced by the network in each Case Study addressing societal challenges
Indicators	1. Number of references to case study reports and data bases 2. Number of stakeholder workshops 3. Number of participants representing stakeholders 4. Number of peer-review publications addressing the case study issues 5. Number of case study synthesis papers 6. Number of translational products: (e.g. Policy Briefing Notes, infographics) co-developed with stakeholders 7. Number of reports on economic/management strategies by case study (minimum in one case study)
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3. 4. 5. 6. 7.
Target	Target refers to the end of four year project period 1. 20 2. 10 3. 100 4. 30 5. 3 6. 9 7. 2
Data Collection	1. Altmetrics, data submitted by institutional leads, website statistics 2. Project workshop reports 3. Project workshop reports 4. Project manuscript tracker, WoK (likely after the end of the project) 5. Project manuscript tracker, WoK (likely after the end of the project) 6. Report by project PIs 7. Report by project PIs
Tool	Excel
Frequency	6 monthly
Responsible	S. Alexiou
Reporting	Details will be submitted by workshop organisers and institutional leads to S. Alexiou on ongoing basis
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable. Project members collecting qualitative indicators will attend M&E training including approaches to collection of qualitative indicators.

Log-frame reference	**Output 4: Transfer of cost saving technologies underpinning ecosystem research to overcome limited investment into research infrastructure in WIO.**
Indicators	1. N of MSc & PhD students actively using technologies as part of projects 2. N of cross-discipline papers using support of technologies 3. Cost-benefit analysis employing technologies (indicator: costs saved) 4. N of technical demonstrations in Tanzania and SA 5. N of stakeholders attending technical demonstrations 6. Number of presentations on use of technologies in key partner and stakeholder institutions delivered by SOLSTICE researchers
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3. 4. 5. 6.
Target	Target refers to the end of four year project period 1. 10 2. 10 3. £1,000,000 4. 2 5. 50 6.30
Data Collection	1. Internal project tracker 2. Internal project tracker and WoK 3. Cost-benefit analysis 4. Technical demonstration report 5. Technical demonstration report
Tool	Excel
Frequency	6 monthly
Responsible	S. Alexiou SOLSTICE socio-economist (cost-benefit analysis)
Reporting	Details will be submitted by workshop organisers and institutional leads to S. Alexiou on ongoing basis
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable.

Log-frame reference	**Outcome 1: Network grow, involve newly trained researches and stakeholder participation and begin to attract new funding**
Indicators	1. Strength, extent, centricity and other key parameters of network as measured by social network analysis Selection of network parameters for monitoring and their targets to be identified after baselining exercise in April 2018 Note that social network analysis is an area of science rather than a monitoring exercise. Ongoing development of the methodology is expected.
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3. 4. 5.
Target	Target refers to the end of four year project period 1. 2. 3. 4. 5.
Data Collection	A survey with the network profiling indicators will be completed by all project partners, in-kind contributors and associated PhD students. The questionnaire will cover: co-authored publications, co-supervised students, co-organised workshops and co-developed funding applications.
Tool	Social Network Analysis package, Matlab
Frequency	Baseline (April 2018, backdated to 1st Oct 2017) Mid-term assessment (March 2020) End of project assessment (December 2021) Long-term impact assessment (TBD)
Responsible	K. Popova (analysis), S. Alexiou (data collection)
Reporting	A project report on the results of the network analysis will be produced by K. Popova and S. Alexiou
Quality Control	The methodology was tested in the framework of international GULLS project. If required, a professional advice on network analysis will be requested from Dr. Ingrid van Putten, CSIRO who performed the analysis for GULLS.

Log-frame reference	**Outcome 2: Key players become aware, receptive and show intention to invest into new technologies and adopt ecosystem approach**
Indicators	1. Number of requests for briefs and demonstrations from stakeholders 2. Number of requests for cost estimates of employing new technologies; 3. Number of requests for training and participation in case studies; 4. Number of additional researchers and managers becoming involved into case studies and demonstrations 5. Number of instances of WIO media coverage 6. Interviews with key players; surveys capturing changing attitudes to technologies carried out by M&E team
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3. 4. 5.
Target	Target refers to the end of four year project period 1. 20 2. 20 3. 50 4. 100 5. 20 6. qualitative
Data Collection	1. requests via website or project PIs 2. requests via website or project PIs 3. requests via website or PMO 4. 6-monthly reports by institutional leads
Tool	Excel
Frequency	6-monthsly
Responsible	S. Alexiou
Reporting	6 monthly reports by institutional leads Ongoing recording of all requests via website
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable. M&E panel may consider qualitative indicators in form of “Success stories” if a particularly far-reaching event occurs. Project members collecting qualitative indicators will attend M&E training including approaches to collection of qualitative indicators.

Log-frame reference	**Outcome 3: Case studies provide strong body of evidence for action with a measurable outcome (e.g. projections of the squid dynamics leads to a proposal of pension fund)**
Indicators	1. Number of papers, conference presentations, reports presenting analysis of underpinning ecosystem dynamics and recommended management or policy actions. 2. Success stories dedicated to each of the proposed actions (qualitative measure)
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1.
Target	Target refers to the end of four year project period 1. 10 2. 5
Data Collection	6-monthly reports by institutional leads Interviews; desktop reviews
Tool	Excel
Frequency	6-monthsly
Responsible	S. Alexiou
Reporting	6 monthly reports by institutional leads
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable. Coverage of the success stories will be decided on the case-by-case basis

Log-frame reference	Impact 1: Sustainable networked clusters established in South Africa and Tanzania
Indicators	1. Number and bidding amount of new funding applications with the use of technologies and addressing aspects of food security 2. Number of new PhD/MSc students using technologies 3. Number of developing country researchers that contribute to production of high quality (journal IF>1) multidisciplinary research publications on the link between ecosystem dynamics and food security (SOLSTICE network researchers only, post-SOLSTICE Special Issue only)
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3.
Target	Target refers to the end of four year project period 1. 10 2. 10 3. 30
Data Collection	1-3. Data submitted by institutional leads Regular survey of project participants and partner institutions carried out by M&E panel (baseline, mid-project, end-project)
Tool	Excel
Frequency	6 monthly
Responsible	S. Alexiou SOLSTICE socio-economist (cost-benefit analysis)
Reporting	Details will be submitted by UK WP leads to S. Alexiou every six months for the reporting period.
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable. The questionnaire needs to recognise that peer-reviewed publications have the following stages: submitted; under revision; resubmitted; accepted; in press; published.

Log-frame reference	**Impact 2: Institutional uptake of new technologies has a measurable impact on management of living marine resources**
Indicators	1. Number of organisations directly and indirectly using data products generated by technologies 2. Number of cases where data products generated by technologies are used as evidence in decision-making process (each accompanied by a "success story")
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2.
Target	Target refers to the end of four year project period 1. 20 2. 10
Data Collection	Data submitted by institutional leads Desktop reviews Altmetrics (references from non-academic publications e.g. briefs) RCUK REF impact stories
Tool	Excel
Frequency	6 monthly
Responsible	S. Alexiou SOLSTICE socio-economist (cost-benefit analysis)
Reporting	Details will be submitted by UK WP leads to S. Alexiou every six months for the reporting period.
Quality Control	Quantitative indicators in this group are straightforward and easily verifiable.

Log-frame reference	Impact 3: Strengthened fisheries management
Indicators	1. Number and type of cases where case study outcomes were evident in management decisions (mention in reports and strategy documents), accompanied by success stories. 2. Number of managers trained in MOOC and MOOC-light. 3. Number of UK REF impact stories built of case studies.
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2. 3.
Target	Target refers to the end of four year project period 1. 20 (Most likely to happen after the end of the project). 2. 100 3. 2 (Most likely to happen after the end of the project).
Data Collection	Data submitted by institutional leads Desktop reviews Altmetrics (references from non-academic publications e.g. briefs) RCUK REF impact stories MOOC statistics; Surveys of MOOC participants.
Tool	Excel
Frequency	6 monthly
Responsible	S. Alexiou SOLSTICE socio-economist (analysis of management plans)
Reporting	Details will be submitted by WP leads to S. Alexiou every six months for the reporting period.
Quality Control	A professional M&E advice/bought-in service might be though at this stage for the Indicator 1.

Log-frame reference	Impact 4: Uptake of research-based evidence in policy
Indicators	1. Number and type of interventions where case study outcomes were considered in policy relevant activities (mention in policy documents and climate adaptation plans), accompanied by success stories. 2. Number of REF impact stories built of case studies.
Baseline	Baseline refers to the 5 year period prior to 1st October 2017 1. 2.
Target	Target refers to the end of four year project period 1. 20 (Most likely to happen after the end of the project). 2. 2 (Most likely to happen after the end of the project).
Data Collection	Data submitted by institutional leads Desktop reviews Altmetrics (references from non-academic publications e.g. briefs) RCUK REF impact stories Survey of MOOC participants
Tool	Excel
Frequency	6 monthly
Responsible	S. Alexiou SOLSTICE socio-economist (analysis of policies)
Reporting	Details will be submitted by WP leads to S. Alexiou every six months for the reporting period.
Quality Control	A professional M&E advice/bought-in service might be though at this stage for the Indicator 1.

5 SOLSTICE as an equitable partnership

General approach

Creating an equitable partnership is one of the key objectives of the project. We follow general recommendations from (1) ESPA Brief "*Research for development impact: The role of equitable partnerships*", and the (2) UKCDS report "*Building Partnerships of Equals"*, and (3) personal experience of Directors and PIs from ESPA and BELMONT projects in the ODA setting.

Measures used in SOLSTICE to facilitate and continue Equitable Partnerships

- Project partnership development and co-design meetings were run in WIO before official start of the project (four workshops, NOC investment)
- Annual Advisory & Leadership (A&LP) panel meeting (April 2018) dedicated ½ day session (2-day meeting) to discuss equitable partnerships giving voices to both WIO and UK institutions
- An Equitable Partnership Survey (EPS) (anonymous) was developed in May and then executed in July 2018 (Full survey can be found in **Appendix 2**). This will be repeated at 24 and 36 months. It is the main mechanism that SOLSTICE uses to demonstrate equity between its partners.
- Survey indicators and interim responses from the teams on challenges and benefits of SOLSTICE partnerships are reviewed by the A&LP on annual basis.
- The survey aims to evaluate and provide evidence for the following characteristics of equitable partnerships (as defined by GCRF):

1. Transparency (joint decision-making and clarity of communication)
2. Joint Ownership (capacity to co-design, co-produce and co-benefit from the research results and project activities)
3. Mutual Responsibility (capacity of partnership to express and facilitate sharing of skills, creativity, results, knowledge and promote the advancement of Case Studies to benefit of all partners)

Pros and Cons of working in ODA partnership (overall assessment of equitable partnerships)

Although the above characteristics provide a good foundation to build equitable partnerships, further steps are needed to ensure that equitable partnership actually works.

In ODA-style research, balancing the interests of Northern and Southern researchers, institutions, disciplines, network members in different career stages, political agendas, and cultural differences is not easy. And yet an equitable partnership can be defined as a partnership where each member's benefits outweighs the challenges such a partnership brings.

Hence key benefits and challenges were identified for WIO (by WIO partners) and for UK (by UK partners) independent of each other during the first Annual Advisory/Leadership Panel meeting. These benefits and challenges were then rated by each member of the partnership via the online EPS (**Appendix 2**). Survey aims to assess if benefits outweigh challenges both for UK and WIO team members.

SOLSTICE will continue to use the results from the EPS (questionnaire) as equitable partnership indicators.

6 Evidencing Interdisciplinarity

Conducting Interdisciplinary Research (IDR) is a hotly debated topic articulated in a growing volume of dedicated literature (including *Nature*). While there is varying consensus on what IDR is, there is less clarity on (1) what constitutes quality in IDR, (2) how to evaluate and report on IDR. Of course, once a project produces peer-reviewed publications, interdisciplinarity can be evaluated more readily via cited bibliography. Until then, project interdisciplinarity can only be reported using an IDR framework. Although many theoretical frameworks of IDR exist, we have not come across any which seem appropriate in an ODA research setting.

We therefore developed our own pragmatic framework of interdisciplinarity based on the PIs experience with similar ODA projects. This utilises recommendations in the ESPA policy brief — *Interdisciplinary research for development impact: How can funders walk the talk?*, and in Tang et al. (2014) (*The relationship between interdisciplinarity and impact*, UKESRC report).

OPTIMUM (Objective-Practice-Team-Integration-Management-Uniqueness-Motivation) – A pragmatic framework for designing, managing and evidencing interdisciplinarity in large projects.

Objectives

Most IDR aims to develop responses to social and economic problems. Narrow objectives are likely to have solutions. Broader objectives less so with the generated knowledge only partly addressing them.

> ***SOLSTICE*** *mostly belongs to the first category of solution-oriented objectives driven by the case studies, but they are set within the wider GCRF challenges.*

Practice

Method of deploying human resources, i.e. deployment of a large number of part-time senior researchers vs. a small number of full-time junior researchers. The former maximises number of disciplines in the project, outputs and ability to expand by attracting additional funding but introduces challenges of coordinating and integrating the network. The latter simplifies coordination, integration but minimises spread of disciplines and potential for expansion and maximises the risk of relying on a few key individuals.

> ***SOLSTICE*** *is predominantly the former category, employing 33 senior scientists working part-time and 7 full-time early career scientists. The larger number of senior scientists has been advantageous attracting more than 20 MSc/PhD students into the SOLSTICE team.*

Team

Refers to composition of team and cognitive distance between disciplines. IDR requires a combination of single discipline experts as well as T-people (generalists). Warning: assembling single discipline experts does not guarantee the interdisciplinarity (hence "I" – Integration).

> **SOLSTICE** team comprises (from network profiling survey, **Appendix 3**):
>
> - Geosciences 33%
> - Technologies 13%
> - Fisheries 23%
> - Socio-economics, governance 16%
> - T-shaped scientists 15%

Integration

Integration of single disciplines into a multidisciplinary effort is expensive, time consuming, requires face-to-face interactions, and occurs at expense of advancement of single disciplines (which are most likely to produce highest ranking peer-reviewed publications; their advancement is also critical to the project).

SOLSTICE from an interdisciplinary perspective, integrates 3 key outputs: (1) Selection of case studies (achieved), (2) "Foundation study" to identify gaps and set hypothesis (achieved first draft), and (3) "Synthesis study" at end of the project to synthesize disciplinary efforts and interdisciplinary connections and recommendations into a policy output.

We are also monitoring the growing number and strength of emerging interdisciplinary connections using network profiling method (see Category 6) and graphical Social Network Analysis (M&E v2).

Management

This refers to how strongly, and by what methods, integration is driven. Management of integration is expensive both in time and budget.

SOLSTICE drives integration strongly for a small set of clearly identified outputs from an early stage of the project. We use a combination of a small number of actual interdisciplinary workshops with regular virtual *Webex* meetings with coordinators identified both in WIO and UK. Connections between specialised studies (projects) are constantly promoted.

Uniqueness

What are you doing to make it interdisciplinary? Uniqueness of your project is most likely to be its bestselling feature for securing future funding. It is worth considering it as a special case worth extra effort.

SOLSTICE's unique feature is marine robotics. An interdisciplinary study linking progress of marine robotics in the region (ocean technology) to how marine robotics is perceived by local fishermen communities (social science) has already emerged and is underway.

Motivation

Interdisciplinarity is often perceived to be bad for early career scientists (ECS) and takes more time to produce output. Also, evidence suggests interdisciplinary papers are cited less than specialised. Single discipline researchers are strongly motivated by advancement of their own disciplines.

SOLSTICE uses well defined Case Studies with strong societal significance and leveraging of funding in similar interdisciplinary areas as key motivations

7 Developing and monitoring SOLSTICE network

General approach

Scientific networks are at the center of all international programs, especially those concentrated around “wicked problems” such as food security. Well-organised networks harness capacity to solve shared but complex problems by unifying scarce resources, create Capacity Development opportunities, and hasten the development of a common knowledge and understanding. A growing volume of literature is now dedicated to scientific network analysis and theoretical frameworks. And yet, what constitutes a research network and how a network becomes a network remains obscure in many cases.

SOLSTICE aspires to developing a research network which is (1) international, (2) interdisciplinary and (3) focused around the challenge of food security and sustainable use of living marine resources. Desirable characteristics include research excellence, sustainability (ability to secure future funding) and potential to address complex problems (research capability). The ultimate ambition is for this to evolving into a global network.

SOLSTICE is not starting from scratch. Rather it combines several partnerships already in existence to form an effective, well-focused research network. These include (1) a BELMONT Forum GULLS and ESPA program GLORIA projects between the UK, South Africa, Madagascar, India, Brazil and Australia, (2) the well-established and connected Western Indian Ocean Marine Science Association (WIOMSA), and (3) links between national and inter-governmental institutions. Consequently, core institutions in the SOLSTICE Food Security UK-WIO wide network are NOC, PML, NMU, WIOMSA, TAFIRI, KMFRI, IMS and CORDIO.

Defining SOLSTICE network

The term “Network” is highly subjective, and so is a notion of what constitutes “network strength”. Given the opacities of the issue, we have developed a new, simple but quantitative method that allows us to objectively assess the building of the SOLSTICE output-based network and its effectiveness. It also allows comparisons with other networks. In our method, connection strengths between two researchers (in a network) is identified by the following:

1. Number of co-authored peer-reviewed papers
2. Number of co-authored reports commissioned by a regional or global NGO, World Bank or regional/national government (Must be publicly available online and list main and contributing authors)
3. Number of co-supervised PhD and M students (including connections between students and supervisors)
4. Number of co-organised international workshops (defined: minimum of two countries participating with formal record publicly available online listing organisers and participants).
5. Number of co-applicants for a funding grant (PIs, Co-Is) (includes successful and unsuccessful applications)

Evaluating the SOLSTICE network

Baselining of the SOLSTICE network has been completed via a SOLSTICE Network Survey (Appendix 2). After baselining, development of the network will be monitored using 6-monthly project KPIs which contain the five criteria identified above for all the network participants. If the network expands substantially beyond its original size, we may only be able to track two out of five parameters (peer-reviewed publications and commissioned reports).

We employ Social Network Analysis (preliminary graphical analysis of baselining is shown below) which demonstrates the following characteristics of the network: (1) expansion of the original (baselined) network, (2) strength (efficiency), (3) interdisciplinary and (4) international spread (including strength of the links between UK and developing countries). Social Network Analysis is best reported via graphics but ResearchFish doesn't allow this. Therefore, we simply using a set network development indicators:

- Number of individuals involved into the network (67)
- Number of countries (4)
- Number of UK-WIO connections (39)
- Degree of interdisciplinarity (see Category 5)
- Averaged strength of WIO-UK (1.9) and interdisciplinary connections (effectiveness) (4.2, preliminary estimate)

We may adjust the above indicators and/or method of their calculations as our network theory develops.

Facilitating and promoting the SOLSTICE network

SOLSTICE is firmly focused on deliverables including peer-reviewed publications, production of policy-relevant material, facilitation of collaborative workshops involving stakeholders and further funding applications. These facilitate and develop the network strength and expansion.

As it develops, the SOLSTICE network will be promoted at WIO regional and international conferences. We intend to publish the network development method, results and practical recommendations in a peer-reviewed journal (Popova et al in prep).

Preliminary results of the SOLSTICE network profiling using Social Network Analysis

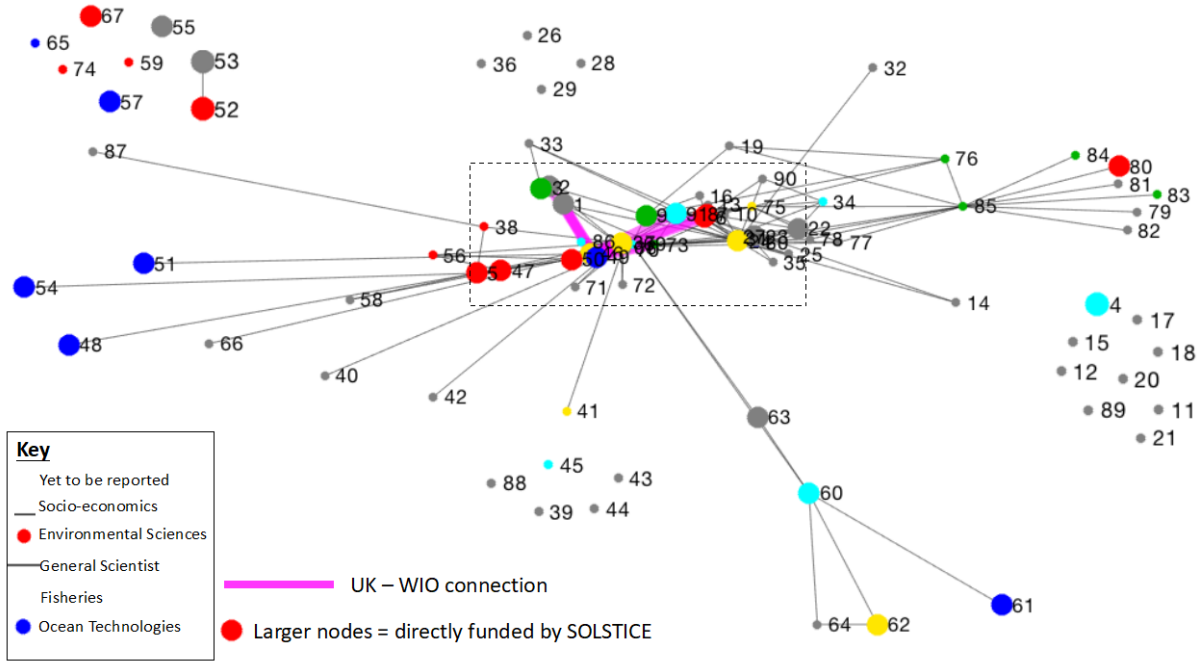


Figure 1. Preliminary results of SOLSTICE network baselining via Social Network Analysis. Dots represent network members (individual scientists). Lines represent connections between members (measured via co-authored publications, reports, etc. See full criteria in the text). Members are coloured by disciplines showing that interdisciplinary connections already exist in SOLSTICE.

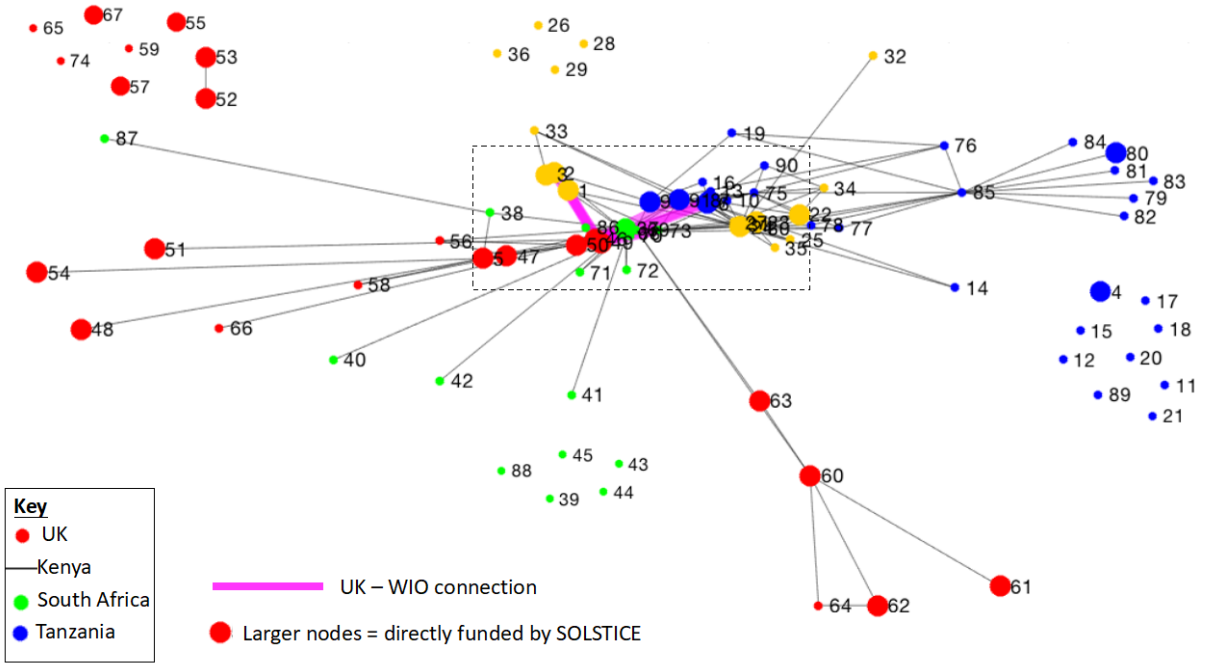


Figure 2. Preliminary results of SOLSTICE network baselining via Social Network Analysis. Dots represent network members (individual scientists). Lines represent connections between members (measured via co-authored publications, reports, etc. See full criteria in the text). Members are coloured by countries showing strong clustering within countries and weak international connections.

Preliminary network statistics

Number of connected nodes: 67

Number of unconnected nodes: 24

Total connections: 574

UK-WIO connections

Number of connections: 19 (solely from nodes 46 (Katya) and 49 (Val))

- Tanzania: 3
- Kenya: 3
- South Africa: 13

Average weight of connections: 1.99

- Tanzania: 1.67
- Kenya: 1
- South Africa: 3.31

Minimum weight: 1

- Tanzania: 1
- Kenya: 1
- South Africa: 1

Maximum weight: 23

- Tanzania: 4
- Kenya: 2
- South Africa: 23

Interdisciplinary connections

Number of connections:

Discipline	**ES**	**OT**	**F**	**SE**	**GS**
ES	-	5	3	2	12
OT	5	-	3	2	4
F	3	3	-	7	10
SE	2	2	7	-	8
GS	12	4	10	8	-

Average weight of connections:

Discipline	**ES**	**OT**	**F**	**SE**	**GS**
ES	-	3.4	2.67	6	3.58
OT	3.4	-	3.67	1.5	5.75
F	2.67	3.67	-	5.14	7.2
SE	6	1.5	5.14	-	2.5
GS	3.58	5.75	7.2	2.5	-

ES – Earth Sciences
OT – Ocean Technologies
F - Fisheries
SE - Socio-economics, governance
GS – Generalists or T-shaped scientists

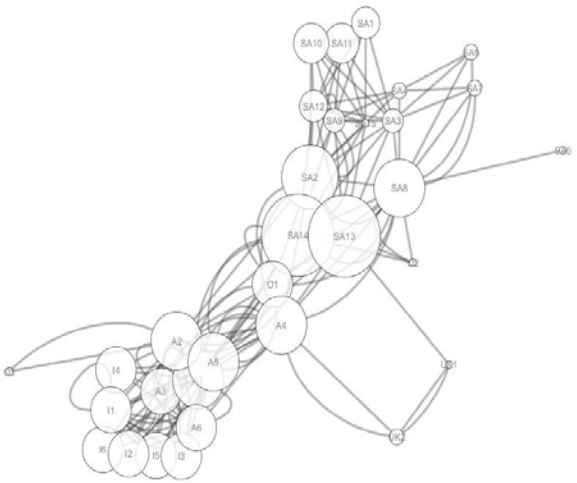


Figure 3. An example of a network profiled for GULLS project (a project similar in its size, objectives and disciplines to SOLSTICE) and connections between the project partners (courtesy of Dr.I.VanPutten, CSIRO).

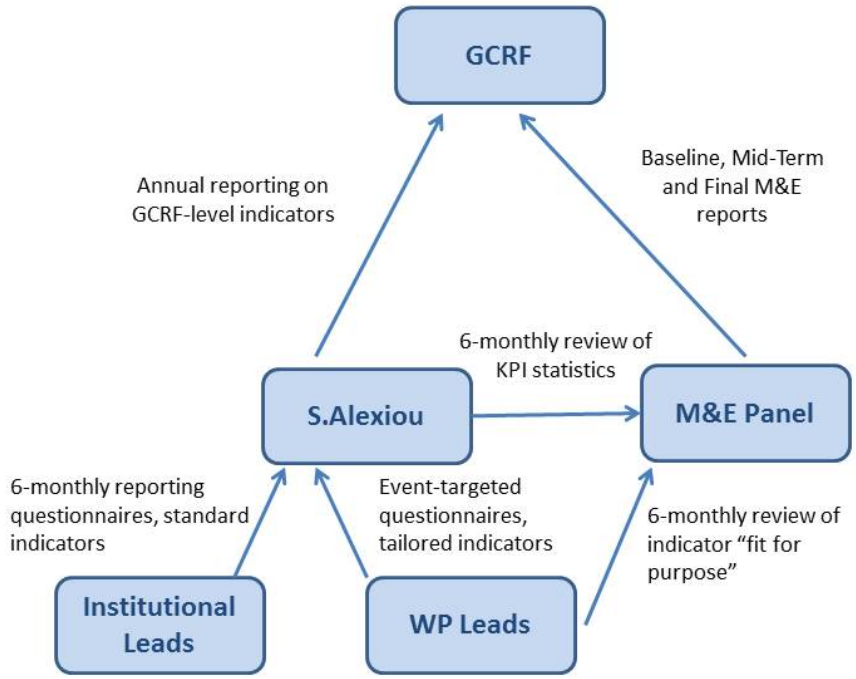
8 Roles & Responsibilities

Role	Responsibilities
K. Popova **NOC**	SOLSTICE Co-Director Chair of the M&E panel • M&E data analysis • Applications of the social network analysis methods to impact evidence • Regular reviews of ToC and log-frame • Overall responsibility for M&E assessment and reports
S. Alexiou **NOC**	SOLSTICE Project Coordinator M&E officer • Data collection, flow and archiving • Coordination of reporting from WIO • Preliminary analysis of data • Collation of reporting material for baselining, mid term and final M&E reports; • Annual reporting to GCRF
M. Roberts **NOC/NMU**	SOLSTICE Co-Director • 6-monthly review of indicators and their suitability for evidencing project outcomes and impacts in the area of Science into Policy and Governance • 6-monthly review of indicators and their suitability for evidencing of the impact in the SA and TAN network clusters • Production of the “Success Stories”
V. Byfield **NOC**	SOLSTICE WP4,5 Lead (Capacity Development and Communication) • 6-monthly review of indicators and their suitability for evidencing project outcomes and impacts in the area of Capacity Development. • Ensuring that the project web resources have adequate automated user reporting systems. • Ensuring that project data bases have adequate automated user reporting systems. • Ensuring that MOOC user statistics is fit for purpose. MOOC reporting. • Capacity development questionnaires. • Training course evaluations. • Institutional capacity baselining • Production of the “Success Stories”
E. Papathanasopoulou **PML**	SOLSTICE WP2 Lead (Socio-Economics) • 6-monthly review of indicators and their suitability for evidencing project socio-economic outcomes and impacts in the Case Studies • Contribution to the baselining, mid term and final M&E reports

SOLSTICE M&E Panel will meet every 6 months (October and April) for reviews of data over the reporting period and review of ToC, Log-Frame and formulation of the Key Performance Indicators.

M&E Panel will report annually to the Leadership Team and the Advisory Panel.

9 Data Flow



10 Data Management

10.1 Storage

Data collected during M&E process will be mainly stored in Excel spreadsheet where it can be analysed. Some data will be collected through automated analytics, ie: number of downloads from our website etc, which will then be exported to Excel and PDFs for analysis, interpretation and reporting. All data will be stored on the NOC secure server, behind encryption firewalls. Files are stored digitally on the NOC shared storage system, which is only accessible by NOC users and each drive having its own permissions locking them down to specific users. These drives are backed up nightly and held off site for up to a year.

10.2 Analysis

Majority of the data will be analysed in Excel. For the social network analysis Matlab tool box will be used.

The interface between Excel network data base and Matlab will be streamlined to ensure smooth operation of the analytical tools and clarified by October 2018.

The interface between Excel and data base usage statistics will be clarified by October 2018.

The interface between Excel and model output usage statistics will be clarified by April 2019.

The interface between Excel and MOOC usage statistics will be clarified by October 2020.

10.3 Privacy

SOLSTICE and its participant partners will abide by and comply with the EU's General Data Protection Regulation (GDPR), ec.europa.eu/info/law/law-topic/data-protection_en. Any personal data that may be collected during M&E will processed lawfully, transparently, and for a specific purpose. Once that purpose is fulfilled and the data is no longer required, it will be deleted.

11 Appendices

Appendix 1. Capacity development matrices

GCRF anticipate for the Capacity Development to happen at three levels:

Individual: involving the development of researchers and teams via training and scholarships, to design and undertake research, write up and publish research findings, influence policy makers, etc.

Organisational: developing the capacity of research departments in universities, thinks tanks and so on, to fund, manage and sustain themselves.

Institutional: changing, over time, the 'rules of the game' and addressing the incentive structures, the political and the regulatory context and the resource base in which research is undertaken and used by policy makers.

We use Research Capacity Assessment Matrices (RCAMs) as the main framework and operational tool to assess CD at the individual, organisational and (partially) institutional level. The matrices follow the general structure:

- Levels of skills of individuals
- Access to infrastructure
- Access/Involvement to international expertise and networks
- Support at organisational Level
- Support at Institutional Level

These focus on:

- Remote sensing for marine ecosystems and climate change impact
- Ocean Model Analysis
- Marine robotics
- Biogeochemical monitoring
- Conducting interdisciplinary projects in EAF and sustainable use of living marine resources
- Conducting ODA research (UK)

No	Category	Please indicate the present status of your institution for each of the categories listed. Your responses should be specifically related to: **Use of autonomous marine robotic systems to monitor marine ecosystems and climate change impact**					
		1	2	3	4	5	Simple test question for Level 3
1	Skills to undertake processing and analysis of data collected from marine robotic platforms	No skills available to work with data obtained by robotic systems.	Some basic skills available, but core training in data processing and analysis is required. Basic oceanographic data interpretation skills are not available.	Some data processing skills are available from one or two individuals but further training in processing and analysis specific to marine robotics is required. Basic oceanographic data interpretation skills are available.	Good understanding of oceanographic data processing techniques, analysis and interpretation. Further training or assistance is required to develop interpretation into peer reviewed publications. Some mentorship is available from senior colleagues.	Broad skillset available, competent skills are available in processing, analysis and interpretation of new observations with the ability to lead on peer reviewed publication in international journals. Expertise is being continuously broadened and brought up to date via regular training.	If provided with raw binary file, multi-variable data from ocean gliders could you produce a processed and quality controlled dataset and produce plots demonstrating changing mixed layer depth and relative location of the chlorophyll maximum throughout the deployment?
2	Infrastructure of marine robotic systems and ability to manage datasets to international standards.	No access to marine robotic systems or technical support. No access to data collected from marine robotic systems.	No access to robotic platforms and technical support but limited access to data collected by partner institutes. Limited skills or infrastructure to manage observational data collected using robotic platforms.	Able to participate in experiments with marine robotic platforms undertaken by partner institutes. Sufficient skills available to manage (e.g. provide quality assurance and control) and securely store data collected.	Access to marine robotic systems and relevant technical support from partners. Able to direct the use of robotic systems to meet own science and technical objectives. Every effort is made to ensure high data quality following "best practice" guidelines.	Direct access to Marine robotic systems either by ownership or via a national facility, including access to technical support. Data quality protocols follow internationally recognised standards. Proven track record of reports/peer-reviewed literature presenting data gathered using marine robotic platforms. Research into future development of robotic systems is planned/ or undertaken.	If requested, could you plan the deployment of an ocean glider to provide 1 month of repeat transects between two fixed stations in the West Indian Ocean, and deliver the resulting multivariable data at a suitable quality for use in a peer reviewed publication?
3	Access to international expertise / networks	No contacts/collaborations with marine robotics international community or identified partnerships with other institutions using marine robotics.	Limited contact or collaboration with marine robotics international community (scientists and technologists). Attendance of relevant personnel at international meetings or workshops that include emerging users of marine robotics.	Working in collaboration with international groups to address scientific or technical questions in the marine environment using robotic systems. Have developed suitable contacts within the marine robotics international community to provide training and assistance in operation and data analysis.	Working in collaboration with international partners addressing scientific and technical questions in the marine environment using robotic systems. Able to request assistance and training as required. Representation on international groups associated with marine robotics. Co-authoring papers with international partners.	Taking a leading role in international groups that coordinate or develop oceanographic research proposals associated with marine robotics. Provide lead authorship of peer reviewed papers in international journals regarding operation and application of marine robotic systems. Providing assistance and training to international partners.	Can you host a workshop to provide training for local scientists and technologists on the deployment and recovery of ocean gliders using internationally recognised expertise?
4	Recognition and support at organisational level	Use of marine robotic systems for ocean research is not considered a valuable undertaking for policy and business development.	There is some appreciation of the benefits of using robotic systems for oceanic research but it is insufficient for significant investment.	Use of robotics to conduct oceanic research is perceived as a valuable activity and opportunities for local development have been identified.	Some investment has been made into facilities and training of personnel to help deliver local objectives with marine robotics to deliver policy needs and business development with the	The use of marine robotics to conduct ocean research is highly valued by management and receives sufficient funding to enable outputs to feed into policy needs and to support business developments without the need for partner	Can you produce a cost-benefit analysis of the use of marine robotic systems for use in a future marine monitoring programme?

					assistance of external partners.	contribution.	
5	Recognition and funding by National /African/ Global Institutions, policy making and funding bodies	The use of robotic systems to investigate marine ecosystem function or climate change impacts does not appear in funding calls and national marine programmes.	The use of robotic systems to investigate marine ecosystem function or climate change impacts does appear in funding calls and national marine programmes, but is identified as one of the areas where capacity development is needed.	Use of robotic systems appears in funding calls and national marine programmes. Use of robotic systems is identified as one of the priority areas in capacity development by national and international African bodies.	Use of robotic systems and the impact of climate change on the ocean are a regular subject of funding calls or a required component of funding calls. Strong national and/or international capacity development efforts exist in this area.	A national facility or coordination programme exists that enables open access to marine robotics and technical support that is actively encouraged to be accessed through targeted funding calls.	Can you identify two current nationally funded projects in the last year, where marine robotic systems form a critical component of the research programme?

No	Category	Please indicate the present status of your own skills (1-3) and your institution/country (4,5) for each of the categories listed. Your responses should be specifically related to: **Ocean Model Analysis* for marine ecosystems and climate change impact** *Please note that this area refers only to analysis of existing models rather than new model development					
		1	2	3	4	5	Simple test question for Level 3
1	Computing facilities and data processing skills	Limited or no skills or available to work with model outputs	Some basic skills are available but core training in data processing and visualisation is required	Some data processing skills are available but up-to-date and advanced training in data analysis and visualisation is required	Adequate skills in data analysis and visualisation are available	Adequate skills in data analysis and visualisation are available and expertise is being continuously brought up to date	If provided with a web link to a 100Mb netcdf file containing 3D monthly mean fields of Chl-a, would you be able to plot surface field, a crossection and extract annual cycle in contrasting locations?
2	Access to model data relevant to the region and analytical skills to interpret the data	No guidance material or training on access to models available	Some relevant material and/or training is available but not enough expertise to implement it	Relevant material and access skills are available but scientific expertise is insufficient to interpret and use the models effectively	Relevant material and access skills are available. Models are used effectively to guide policy and blue industry	Models are used effectively to guide policy and blue economy. Quality of the models for the given region is assessed and user feedback is regularly given to international model developers.	Given a 1 month notice, can you get an access to suitable model output and produce a visualisation of a surface field of primary production in your area and its future projections under a variety of climate scenarios?
3	Access to international expertise / networks	Don't have any contacts/collaborations with ocean (physical and/or biological) modellers in other countries and/or institutions	Have some contacts with modellers (physical and/or biological) in other countries and/or institutions and aware of their effort and progress.	Work in collaboration with groups in other countries doing ecosystem model development and analysis.	Work in close collaboration with groups in other countries doing model development and analysis. Co-author papers with these groups and can request assistance/training in access and analysis of their model output if required.	Work in close collaboration with groups in other countries doing model development and analysis. Co-author papers with these groups and can request assistance/training in access and analysis of their model output if required. Write funding proposals in collaboration with these groups.	Do you have an ecosystem modelling component in your current project even if done by another institution?
4	Recognition and support at organisational level	Modelling is not perceived as a valuable tool for policy and business development	There is some appreciation of potential value of modelling but it is insufficient for investment	Modelling is perceived as a valuable asset and it is seen as being worth the investment	Modelling is valued by management, its use is encouraged but funding is insufficient	Modelling is valued by management, its use is encouraged and institutional funding is allocated	Can you name three institutional projects or project proposals in the last year where ecosystem modelling was a component?

5	Recognition and funding by National /African/ Global Institutions, policy making and funding bodies	Ecosystem modelling and analysis of climate change projections for marine environment do not appear in funding calls and national marine programs.	Ecosystem modelling and analysis of climate change projections for marine environment occasionally appear in funding calls and national marine programs.	Ecosystem modelling and analysis of climate change projections for marine environment occasionally appear in funding calls. Modelling is identified as one of the areas where capacity development is needed	Ecosystem modelling and climate change projections for marine environment appear in funding calls. Modelling is identified as one of the priority areas in capacity development by national and international African bodies.	Ecosystem modelling and climate change projections are a regular subject of funding calls or a required component of funding calls. Strong national and/or international capacity development efforts exist in this area	Can you name three current national programs or national funding calls issued in the last year where ecosystem modelling was a component?

No	Category	Please indicate the present status of your own skills (1-3) and your institution/country (4,5) for each of the categories listed. Your responses should be specifically related to: **Satellite remote sensing* for marine ecosystems and climate change impact** *Please consider all the main satellite technologies and data types used for marine applications (ocean colour, SST, altimetry, SAR) when assessing status					
		1	2	3	4	5	Simple test question for Level 3
1	Computing facilities and data processing skills	Limited or no skills or available to work with satellite data	Some basic skills are available but core training in the use of marine data form different satellite technologies is needed	Ability to use visualise and process some types of satellite data is available, but up-to-date and advanced training in the full range of relevant marine data types is needed	Adequate ability to process and visualise marine data from most satellite technologies is available, and the techniques can be applied in synergy when required	Adequate skills in satellite data analysis and visualisation are available for all the main satellite technologies, these are frequently used in synergy to improve available information, and expertise is being continuously brought up to date	If provided with NetCDF data of SST, chlorophyll-a, SAR, gridded SSH and SSHA, and along-track altimetry, would you be able to process and visualise at least 3 of these data types to reveal features of interest?
2	Access to satellite data relevant to the region and analytical skills to interpret the different data types	No access to satellite data or information on how to analyse and interpret different data types.	Some relevant data is available not enough expertise to use analyse and interpret it in relevant contexts	Data access and analysis skills are available for some satellite technologies, but scientific expertise is insufficient to identify, access and interpret all the different types of data relevant to marine ecosystem dynamics	Relevant material and access skills are available for all the main satellite technologies for marine monitoring. Data from a range of sensors are used to guide policy and blue industry. Algorithms are adapted to improve accuracy of some data products.	Earth observation is used effectively in synergy with other information to guide policy and blue economy. Data from different sensors is used in synergy, to increase accuracy of information, and feedback from users guides development of new or improved algorithms.	Given a 1 month notice, can you get access to suitable satellite data to undertake a study of some of the environmental factors influencing ecosystem variability in your region
3	Access to international expertise / networks	Don't have any contacts/collaborations with marine remote sensing scientists in other countries and/or institutions	Have some contacts with marine remote sensing scientists in other countries and/or institutions and aware of their effort and progress.	Work in collaboration with groups in other countries doing who are involved in marine remote sensing	Work in close collaboration with groups in other countries doing marine remote sensing. Co-author papers with them and can request assistance/training in accessing, analysing and interpreting data products where local expertise is lacking	Work in close collaboration with groups in other countries working with satellite data. Co-author papers with these groups can request assistance/training if required. Write funding proposals in collaboration with these groups.	Do you include satellite data in your work, even if the expertise to analyse some of the required data sets used come from another group?

4	Recognition and support at organisational level	Satellite remote sensing is not perceived as a valuable tool for research, or for policy and business development	There is some appreciation of potential value of using remote sensing data, but it is insufficient for investment in adequate infrastructure and support for skills development	Remote sensing is perceived as a valuable tool that is worth the investment needed to access and analyse relevant data in the future	Satellite remote sensing is valued by management, its use is encouraged but funding is insufficient to fully take advantage of available data	Remote sensing is valued by management, its use is encouraged and institutional funding is allocated to ensure that relevant facilities and expertise are available	Can you name three institutional projects or project proposals in the last year where remote sensing was a component?
5	Recognition and funding by National /African/ Global Institutions, policy making and funding bodies	Satellite remote sensing for marine applications does not appear in funding calls and national marine programs.	Satellite remote sensing for marine applications occasionally appear in funding calls and national marine programs.	Satellite remote sensing for marine applications occasionally appear in funding calls, and is identified as one of the areas where capacity development is needed	Satellite remote sensing for marine applications appear in funding calls. Developing capacity to take advantage of global data archives is identified as a priority by national and international African bodies.	Analysis and interpretation of marine satellite data are regular subject of funding calls or a required component of funding calls. Strong national and/or international capacity development efforts exist	Can you name three current national programs or national funding calls issued in the last year where the use of marine satellite data was a component?

No	Category	Please indicate the present status of your own skills (1-3) and your institution/country (4,5) for each of the categories listed. Your responses should be specifically related to: **Biogeochemical monitoring of marine ecosystems and climate change impact**					
		1	2	3	4	5	Simple test question for Level 3
1	Capability and skillsets to undertake multidisciplinary science	Limited or no skills available to organise and implement fieldwork or collect and process samples	Some basic skills are available but restricted to single disciplinary science (i.e. chemistry or biology not both)	Narrow multidisciplinary skillset available, some appreciation of multidisciplinary science but up-to-date and advanced training in methodologies is required	Broad skillset available, good understanding of multidisciplinary science, can analyse and interpret diverse datasets but recognises training is required	Broad skillset available, competent analysis and interpretational skills, expertise is being continuously broadened and brought up to date via regular training	If asked to conduct regular monthly sampling would you be able to plan, implement, analyse and interpret multiple parameters to produce an annual cycle of the upper ocean?
2	Analytical infrastructure and ability to produce datasets	No analytical infrastructure available. No ability to analyse samples or produce final datasets. No ability to conduct fieldwork (sample collection)	Some analytical equipment exists but range of measurable parameters is limited. Limited expertise available to use instruments efficiently.	Relevant equipment available but scientific expertise is limited. Instruments not used effectively or data quality is unknown.	Relevant equipment available. Instruments are used regularly and effectively to address scientific problems following "best practice" guidelines (if available).	Analytical instruments are used regularly and effectively across multidisciplinary projects. Data methodologies follow "best practice" guidelines (if available), data quality is assessed to an internationally recognised standard with appropriate reference materials	If a visitor asked to run water or water derived samples through all of your existing instruments would you be able to do so quickly and efficiently providing the visitor with datasets?
3	Access to international expertise / networks	No contacts/collaborations with observational/analytical oceanographers in other countries and/or institutions	Have some contact with relevant scientists in other countries and/or institutions and are aware of their effort and progress.	Work in collaboration with groups in other countries doing marine ecosystem research, pelagic marine biogeochemistry and climate change impact on the ocean.	Work in close collaboration with groups in other countries doing marine ecosystem research and pelagic marine biogeochemistry. Co-author papers with these groups and can request assistance/training if required.	Work in close collaboration with groups in other countries doing marine ecosystem research and pelagic marine biogeochemistry. Co-author papers with these groups and can request assistance/training if required. Write funding proposals in collaboration with these groups.	Are you able to draw in outside expertise to help inform fieldwork planning, sample analysis or data interpretation? For measurements your home institute cannot yet perform could you call upon your contacts to facilitate this?

4	Recognition and support at organisational level	Regular or routine sampling of coastal waters is not perceived as a valuable undertaking for policy and business development	There is some appreciation of the benefits of routine monitoring but it is insufficient for investment	Regular monitoring is perceived as a valuable activity and it is seen as being worth the investment	Routine sampling is valued by management and government but funding is insufficient	Routine sampling is valued by management, it feeds into policy and institutional funding is allocated	Have high level discussions /reports produced a plan for a routine sampling strategy for national coastal waters?
5	Recognition and funding by National /African/ Global Institutions, policy making and funding bodies	Biogeochemical sampling to investigate the impacts of climate change or anthropogenic activities does not appear in funding calls and national marine programs.	Biogeochemical sampling to investigate the impacts of climate change or anthropogenic activities occasionally appear in funding calls and national marine programs.	Biogeochemical sampling to investigate the impacts of climate change or anthropogenic activities occasionally appears in funding calls. Routine sampling is identified as one of the areas where capacity development is needed	Biogeochemical sampling appears in funding calls. Routine sampling is identified as one of the priority areas in capacity development by national and international African bodies.	Biogeochemical sampling and the changing ocean are a regular subject of funding calls or a required component of funding calls. Strong national and/or international capacity development efforts exist in this area	Can you name three current national programs or national funding calls issued in the last year where biogeochemical sampling was involved? Did they involve more than nutrients and chlorophyll measurements?

No	Category	Please indicate the present status of your institution for each of the categories listed. Your responses should be specifically related to: **Conducting interdisciplinary projects in Ecosystem Approaches to Fisheries and sustainable use of living marine resources** **For a score of 2 and above, evidence (e.g. proposals, publications) and budget estimates must exist where appropriate**					
		1	2	3	4	5	Simple test question for Level 3
1	Scientific Project Design (defined here as a proposal developed for an internal or external funding body)	Does not have capacity for scientific project design	Has sufficient expertise to design a single discipline project addressing issues relevant to the marine ecosystems and fisheries	Has sufficient expertise to design an interdisciplinary project covering three or more of the following areas: physical oceanography, marine ecosystems, fisheries, climate change impacts, socio-economics, governance	Has sufficient expertise to design an interdisciplinary project covering areas from physical oceanography through marine ecosystems to fisheries, taking account of climate change impacts, socio-economics and governance to address pressing societal issues	Has sufficient expertise to design an interdisciplinary project covering areas from physical oceanography through marine ecosystems to fisheries, taking account of climate change impacts, socio-economics and governance to address pressing societal issues involving latest technologies	Over the last three years, have you submitted an interdisciplinary funding proposal covering three or more of the following areas: physical oceanography, marine ecosystems, fisheries, climate change impacts, socio-economics, governance
2	Funding generation (defined here as a successfully funded proposal by an internal or external body)	Does not have evidence of generating funds for a project	Has evidence of successful funding generation for a project as described above	Has evidence of successful funding generation for a project as described above	Has evidence of successful funding generation for a multi-institutional, multi-national project which includes all of the above	Has a capacity and expertise to generate funding for a multi-institutional, multi-national project which includes all of the above	Over the last three years, have you won any competitive funding for a proposal as described above?
3	Executing a research project	Has no evidence of project completion	Has evidence of successful completion of a project as described above	Has evidence of successful completion of a project as described above	Has evidence of successful completion of a multi-institutional, multi-national project which includes all of the above	Has evidence of successful completion of a multi-institutional, multi-national project which includes all of the above	Over the last three years, have you successfully completed a project as described above?
4	Publishing results of research projects	Has no track record of publications	Has a track record of peer-reviewed publications describing research findings of the above	Has a track record of peer-reviewed publications describing research findings of the above	Has a track record of peer-reviewed publications describing research findings of the above	Has a track record of peer-reviewed publications describing research findings of the above	Do you have peer-reviewed publications describing research findings of a project as described above?
5	Work with stakeholders	Has no experience of communicating with	Can identified key non-academic stakeholders of the	Has an experience of effective communication of the research	Has an experience of involving stakeholders in the design of	Has an experience of involving stakeholders in the design of projects and	Have you run a stakeholder information event or similar?

		non-academic stakeholders	project outputs	results to the non-academic stakeholders	projects	obtaining their support as cash or in-kind investment	
6	Informing policy/governance	Does not conducts research of potential relevance to policy	Conducts research of potential relevance to policy	Has evidence of producing policy-relevant material	Has a track record of the use of some scientific results in policy/governance	Has a track record of the use of scientific results of interdisciplinary projects in policy/governance	Have you produced a policy brief or a stakeholder report?

No	Category	Please indicate the present status of your institution/country (4,5) for each of the categories listed. Your responses should be specifically related to: **Capacity to carry out international development research addressing the SDGs (UK only)**					
		1	2	3	4	5	Simple test question for Level 3
1	Skills at individual level	No experience/skills of working in ODA projects.	Some PIs have experience of conducting research in ODA context. No skills of M&E in the organisation.	Some PIs have experience of conducting research in ODA context. Some limited ability of M&E in the organisation.	A range of PIs has previous experience of conducting research and delivering projects in ODA context. Early career researchers have opportunities to contribute to ODA research and understand additional challenges of ODA. Organisation has some M&E expertise but can get access to M&E skills via external contractors.	A range of PIs has previous experience of conducting research, delivering projects and securing funding in ODA and SDG context and publishing synthesis results in peer reviewed literature. Early career researchers have opportunities to contribute to ODA research and understand additional challenges of ODA. Organisation has M&E experts and stakeholder engagement experts for ODA context.	In the last three years, have the organisation submitted a funding proposal for ODA-compliant research with strong M&E plan, log frame, theory of change including partners from ODA countries?
2	Tools, data sets, instruments are adapted to ODA conditions	No capacity or recognition of the need to adapt to ODA challenges	The organisation has a capacity (if the need arises) for adapting the large data sets to low broadband environment and data processing tools for unskilled users and adapting instruments and analytical capabilities for small boats/shore deployment and lack of research infrastructure.	Recognition that the effort is needed towards adapting the large data sets to low broadband environment; developing data processing and visualisation tools for unskilled users. Recognition for the need of adapting instruments and analytical capabilities or small boats/shore deployment and lack of research infrastructure.	Organisation is working towards adapting the large data sets to low broadband environment; developing data processing and visualisation tools for unskilled users. Some work underway for adapting instruments and analytical capabilities for small boats/shore deployment and lack of research infrastructure.	Large data sets are adapted to low broadband environment. Data processing and visualisation tools are developed for unskilled users. Instruments and analytical capabilities are adapted for small boats/shore deployment and lack of research infrastructure.	Does the organisation have examples of quick adaptation of research tools and methods for work in ODA context?
3	Access to international expertise / networks	No North-South links exist	PIs have some contacts in ODA countries	PIs have existing national and international collaborations and track record of publications with ODA country researchers	PIs have existing trans-disciplinary national and international North-South networks which have some track record of publishing ODA research in SDG context and some joint North-South funding applications	PIs have strong existing trans-disciplinary national and international North-South networks which are active in publishing ODA research and pursuing new funding opportunities with projects in excess of £1M	In the last three years, has the organisation been able to respond to an ODA funding call at a short notice using existing networks with ODA countries and ODA experts in UK?

4	ODA research capacity at organisational level	ODA work is discouraged.	Organisation accepts that ODA work should be a part of the research portfolio	ODA context is valued by the organisation. PIs are recognised for their work in ODA/STG context.	ODA context is highly valued by the organisation. PIs are recognised for their work in ODA/STG context and output expectations are adjusted accordingly. Organisation has ODA experienced PMOs, coms and other science support functions.	Organisation has a strong track record of delivering large ODA projects. ODA context is highly valued by the organisation. PIs are recognised for their work in ODA/STG context and output expectations are adjusted accordingly. Organisation has ODA experienced PMOs, comms and other science support functions.	Can leading PIs get involved into ODA research without damaging/slowing their career progression?
5	ODA research capacity at institutional (national and international funding and regulatory bodies) level	There are no funding opportunities	There are some funding opportunities for leading western research organisations to become involved into research with ODA countries.	There are funding opportunities for leading western research organisations to become involved into research with ODA countries. Policy-making bodies are aware of ODA projects.	Complexities of research in ODA/SDG context are recognised by national and international funding bodies. There are funding opportunities for leading western research organisations to become involved into research with ODA countries. Policy-making bodies are aware and receptive of science into policy process with ODA projects.	Complexities of research in ODA/SDG context are clearly recognised by national and international funding bodies. Clear evaluation frameworks of North-South collaborations exist. There are funding opportunities and evaluation incentives for leading western research organisations to become involved into research with ODA countries. There are appropriate journals, conferences and reports for dissemination of such research. Policy-making bodies are aware and receptive of science into policy process and actively collaborate with ODA projects.	Does the organisation have any ODA-compliant research funded by external bodies?

Appendix 2. Equitable partnership survey (PDF)

Appendix 3. Network profiling questionnaire to be used in social network analysis (PDF)