Advancing Marine Ecosystem Based Management at the Science Policy Society Interface

Marine Ecosystem Based Management

Science to Policy Workshop Report

22-24 August 2023

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Executive Summary

A three-day science to policy workshop for marine ecosystem based management was held at the South African National Biodiversity Institute (SANBI), Kirstenbosch Botanical Gardens in Cape Town from the 22nd to 24th August 2023. The workshop arose from a Mission Atlantic commitment but for multiple reasons, including suggestions from policy makers, a joint project meeting was developed to share findings and co-develop recommendations across five international projects: Mission Atlantic, iAtlantic, One Ocean Hub, AtlantECO and TRIATLAS. A science meeting was held on days 1 and 2, which sought to share and distil detailed research findings and strengthen collaboration across projects. On Day 3, a broader event with additional scientists and policy makers was planned with the aim of sharing joint results and co-developing recommendations to address key findings across multiple projects. The overall event objectives were to share research progress across international projects in the region, strengthen collaborations across projects, distil common understandings and recommendations, to engage with policymakers to discuss progress, challenges and opportunities to optimize the management of marine ecosystems and to shape future research for science to policy successes.

The methodology sought to distil and summarise a vast amount of knowledge and research in a way that could resonate with policy makers, and co-create key recommendations to address main research findings, involving both researchers and policy makers, for improved policy uptake. In attendance, there were 35 researchers on the first two days and a total of 54 participants in the dedicated science-policy discussion on the last day. The three day workshop saw participation from 14 Early Career Researchers. On Day 3, after a keynote address and panel discussion, a multi-project, multi-disciplinary science team presented just 8 slides that summarised the context and key research findings from across the projects. A world café format with five groups then allowed for in depth discussion with policy makers and each group discussed and jointly developed recommendations to address one of the following five key findings:

- Improved methods and models have generated new knowledge on ocean benefits, connectivity and cumulative impacts under changing climate.
- Emerging novel approaches to improve participation can strengthen implementation and policy coherence.
- The indirect and cumulative impacts of mining and petroleum on the ocean and people are now better understood. However, they are not sufficiently considered in environmental impact assessments (EIAs).
- The lack of an overarching fisheries policy that includes small-scale, commercial *and* recreational fisheries undermines the management of resources and compromises the goal of equitable fisheries.
- Omission of small-scale and recreational fishers from many planning and decision-making processes results in conflict and threatens social and environmental justice.

Jointly developed recommendations in response to Southern African research findings emerged from the workshop including calls for and ideas to improve participation in marine planning, protection and management and the need for approaches to better consider cumulative impacts including climate change in spatial planning, impact assessment and mining decision support and management in particular. Increased effort is needed to work with small-scale and recreational fishers to improve participation, integrated policy and co-management of marine resources. Better mapping of the fishing grounds and efforts for both these sectors is needed to feed into spatial planning with mapping of small-scale fisheries being the priority and with some initial progress in this important area of work. Improved mapping and consideration of mining and petroleum impacts (including cumulative impacts) are further key priority actions and there is a need to better map and plan for the tourism sector with consideration of synergies with other sectors such as conservation and heritage. These co-developed priority actions are useful for South Africa's upcoming National Biodiversity Assessment which draws from research that assesses the state of marine ecosystems, species and genetic diversity and presents recommendations and priority actions to improve the state of marine biodiversity. They are also useful at regional and international scales and can strengthen basin scale research and inform management recommendations.

During the preceding science meeting, active listeners were assigned to key themes and were requested to document key points related to: linkages between projects; knowledge co-production innovation, integration, data sharing; lessons for future research; and capacity development. These different areas of work were curated and added to by participants over the 3 days allowing for the documentation of research linkages between projects, the identification of knowledge gaps and research priorities, the capture of lessons for research co-design and the reporting of capacity strengthening lessons and needs. The workshop highlighted the value of knowledge exchange, identified many synergies that provide opportunities for strengthened collaborations and identified key areas of emerging research and knowledge gaps. The participation of early career researchers in a novel approach to facilitate learning about the science-policy interface through active participation was successful with positive contributions and reflections from emerging and young researchers. Increasing participation within and between sectors and facilitation of dialogue and participatory processes emerged as key elements in improving ecosystem based management and there are opportunities to draw from workshop lessons in the co-design of future research initiatives that can support improved knowledge generation and ecosystem based management across the science-policy-society interface.

1. Background and workshop goals

A three-day science to policy workshop for marine ecosystem based management was held at South African National Biodiversity Institute (SANBI), Kirstenbosch Botanical Gardens, Cape Town, South Africa, from the 22nd to 24th August 2023 (see Appendix 1- workshop invitation). The workshop arose due to a commitment made by the SANBI team as part of their deliverables for the Mission Atlantic project but for multiple reasons, including suggestions from policy makers, a joint project meeting was developed to share findings and co-develop recommendations across multiple projects rather than focus on a single project. This was feasible and desirable because the workshop organising team spanned multiple projects. A science meeting was held on Day 1 and 2, which sought to share research and strengthen collaboration across five international projects including Mission Atlantic, iAtlantic, One Ocean Hub, AtlantECO and TRIATLAS. On Day 3, a broader event with additional scientists and policy makers was planned with the aim of sharing joint results and co-developing recommendations to address key findings across multiple projects (see Annexure 1 for the annotated workshop agenda).

The overall event objectives were:

- To share research progress across international projects in the region.
- To strengthen collaborations across projects.
- To distil common understandings and recommendations.
- To engage with policymakers to discuss progress, challenges and opportunities to optimize the management of marine ecosystems.
- To shape future research for science policy successes.

Overviews of the five international projects can be accessed at the following links:

- iAtlantic: **iAtlantic**: Health Of Deep-Sea And Open-Ocean Ecosystems Research
- Mission Atlantic: Towards the Sustainable Development of the Atlantic Ocean | **Mission Atlantic**
- TRIATLAS: **TRIATLAS** – Tropical and South Atlantic climate-based marine ecosystem prediction for sustainable management (uib.no)
- One Ocean Hub: **One Ocean Hub** | Fair and inclusive decision-making for a healthy ocean
- AtlantECO: Home | **AtlantECO**

2. Workshop approach and overview

The methodology used for the workshop sought to distil and summarise a vast amount of knowledge and research in a way that could resonate with policy makers, and co-create key recommendations to address main research findings, involving both researchers and policy makers, for improved policy uptake (more detailed methods in Annexure 2). Figure 1 gives an overview of the methodology to distil key findings, messages and recommendations and shows other workshop outputs in terms of joint identification of research and capacity development lessons, however further details on the workshop methods are presented below.

The workshop had independent facilitators with combined experience in environmental and organisational learning, policy engagement and development and working at the science to policy interface. The workshop was opened with a round of introductions on all three days to ensure that participants knew who (individuals and organisations) was in the room. The background and objectives were shared with an agreed upon vision of proposed outcomes. At the start of the science meeting, researchers were asked to reflect on two questions on coloured cards which were visually displayed in the venue. The two questions were: 1) What are you listening for? 2) What must we hear?

The feedback received broadly included the following (but see Annexure 3 for more detail):

What are you listening for?

- To learn more about the research being conducted across the different projects.
- How to conduct research that is solution-based, in service of societal and policy needs, and this research can be taken up into policy and implemented effectively.
- New ways of thinking about the connections between people and the ocean.
- Potential for improved collaboration between projects, and between researchers from different disciplines.
- Opportunities for early career researchers to build their capacity.

What must we hear?

- Project proposals need to be co-developed with developing nations so that the operational constraints of developing nations can be taken into account and measures put in place to overcome these constraints (including capacity development, financial, operational support).
- South African researchers are working together towards policy changes, but there is room for improvement.
- There is a need for improved collaboration between research projects, between researchers from different disciplines, between researchers, policy makers and other stakeholders, and between early career researchers and policy makers.
- Coastal communities must be included in the decision-making process, and overall participation in policy processes must be improved.

During Day 1 when each of the five projects shared their key research activities and findings, active listeners were assigned to key themes and were requested to note down any key points related to: linkages between projects; knowledge co-production innovation, integration, data sharing; lessons for future research; and capacity development. These different areas of work (informally referred to as parking lots) were noted by the active listeners and were added to by participants over the three days. The participants had intended to get back to these during the workshop but there was insufficient time for longer discussion on these during the workshop.

Each of the five projects were allocated 45 minutes on Day 1 to share their research activities and findings and each team could decide on the way to use this time. As a guide, projects were requested to include the following elements but a diversity of style and format was encouraged to suit each project and diversify presentations:

- Project overview – aims, objectives, structure, timing
- Project team including connections to other projects
- Progress to date
- Main products (listed explicitly with the main characteristics: e.g. map, model, local/national/regional/global (to map), and so on, to also see how they fit or are complementary with each other and if there are ways to connect those products already finished, but especially those still on-going.
- List the relevant stakeholders that the project has interacted with (incl. policy makers)
- Key challenges
- Key successes
- Priority research and knowledge gaps
- Progress and recommendations for capacity development
- Draft key policy messages
- Other

The five international projects were presented as follows:

- Mission Atlantic – Introductory video by Patrizio Mariani (project lead) and 17 slides were presented by Isabel Sousa, Kerry Sink, Lisa Skein, Lynne Shannon and Kelly Ortega.
- AtlantECO - 20 slides were presented by Natasha Karenyi and Emma Rocke
- TRIATLAS- 42 slides were presented by Hans Sloterdijk
- One Ocean Hub – 33 slides were presented by Elisa Morgera, Taryn Perriera, Luther Adams and Kirsty McQuaid
- iAtlantic – Murray Roberts shared a 45 minute video presentation

The afternoon session of Day 1 was dedicated to try and distil key findings, synergies and differences among projects and develop three to five potential themes for the world café planned for Day 3 with policy makers. On Day 2, working groups were convened around three themes (Ocean Governance, Fisheries and Mining) that emerged at the end of Day 1. Several key findings were formulated around each of the three themes, noting supporting research evidence from across the five projects, and why these findings mattered (the so what) (further detail in Annexure 4). Initial thoughts on what could be done about it (a potential call to action/recommendation) were also discussed. Each group presented their key findings in plenary and based on the information shared it was collectively agreed that the microbiome, deep-sea aspects and microplastics should be highlighted as key emerging research issues that could also be presented to policy makers. The intention here was to make policy makers aware of these as emerging research areas rather than key findings which have emerged from established research across multiple projects. After further distillation, five key findings were identified and refined in five working groups. At the end of Day 2, each group produced a single slide with a key finding, links to multi-project evidence and in some cases a brief summary of the main implications. Further work was undertaken overnight to standardise these slides.

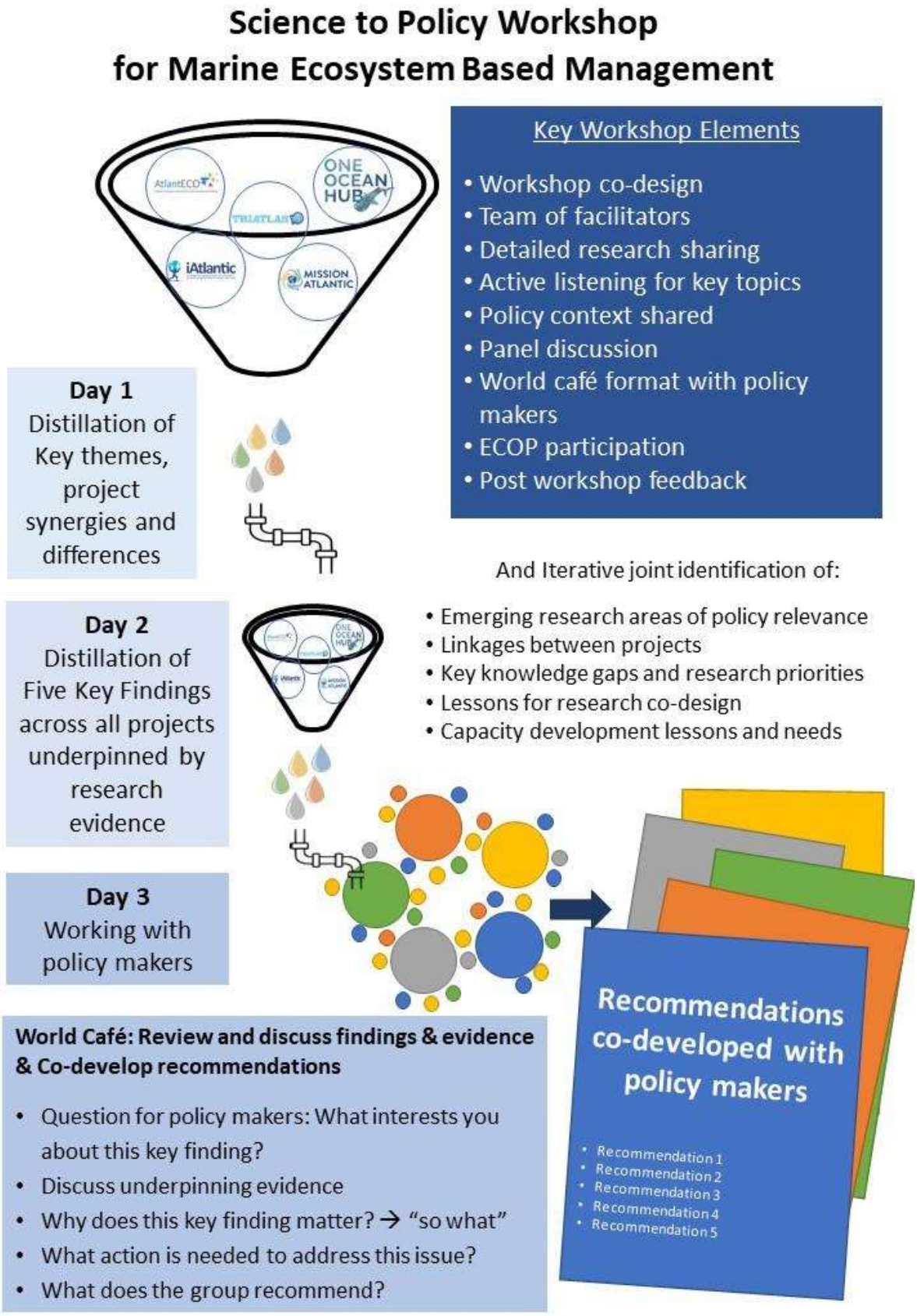


Figure 1. Overview of the workshop methodology and format.

Day 3 included participation from policy makers and additional researchers, working towards ecosystem based management in South Africa. Early career researchers participated in all three days of the workshop. Day 3 started with a keynote address which set the stage for the days' discussions drawing from local, regional and international research and policy. A panel discussion took place, facilitated by Loyiso Dunga, with policy makers and/or individuals working with policy makers (further detail was captured in Annexure 5). Highlights from the panel discussion included the importance of including different disciplines and knowledge forms in research endeavours, and the transformative potential of research for achieving sustainable and positive policy outcomes whilst respecting human rights. Further, embracing the complexity of the ocean space and its users, improving the communication and dissemination of research findings across audiences, and improved collaboration across research silos were highlighted by panellists as approaches that can help to overcome current barriers for policy uptake.

Researchers subsequently presented their key findings and supporting evidence across the five research projects (one speaker for each of the five key findings). A world café format was used for researchers and policy makers to co-create a key message with recommendations per finding. The following three specific questions were posed at each café:
1) What interests you about this finding?
2) Why is this key finding relevant or why does it matter?
3) What action is needed to address this issue and what do you recommend?
The world café involved five breakout groups (one group per key finding) and two different groups visited each table (Annexure 6 has additional notes from these discussions). Originally three rounds were planned to review and refine recommendations, but this was reduced to two rounds due to limited time. In addition, two emerging research groups (deep-sea research, and microbiome and microplastics) were facilitated as part of the world café. By the end of the world café, each group created one slide with the key finding, why it matters and key recommendations drawing from the discussions in the world café groups. These were presented in plenary (one spokesperson per group) with a question-and-answer session held after these presentations (see Annexure 7).

At the end of Day 3, some of the active listeners, policy makers, and early career researchers were asked to reflect on key issues and learning from the day. All participants were asked to reflect on the day and the broader process in terms of what worked and what could be improved on different colour cards (see section 5 and further detail in Annexure 8).

3. Key research findings

The preceding two-day science meeting worked to distil the large volume of information shared by the five projects into 8 slides (pasted below). This included a single slide introducing the five projects and a slide summarising the funding, substantial research investments and the multiple disciplines and research fields represented at the overall science-policy workshop. This was followed by one slide for each of the five key findings and a final slide highlighting emerging areas of research relevant to policy makers. As the workshop was held in South Africa and attended by local policy makers, findings focused on local research results but also included and referenced research findings from other countries, regions and at the basin-scale where applicable.

Five international projects:

AtlantECO — A research & innovation project to evaluate and predict the Atlantic Ocean's health status & better manage the ecosystem services it provides to society.

iAtlantic — Integrated assessment of Atlantic marine ecosystems in space and time.

MISSION ATLANTIC — Towards the sustainable development of the Atlantic Ocean: mapping and assessment the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation.

ONE OCEAN HUB — Towards integrated and Inclusive ocean governance: Connecting knowledge, science and dialogue through integrated research.

TRIATLAS — Tropical and South Atlantic climate-based marine ecosystem prediction for sustainable management.

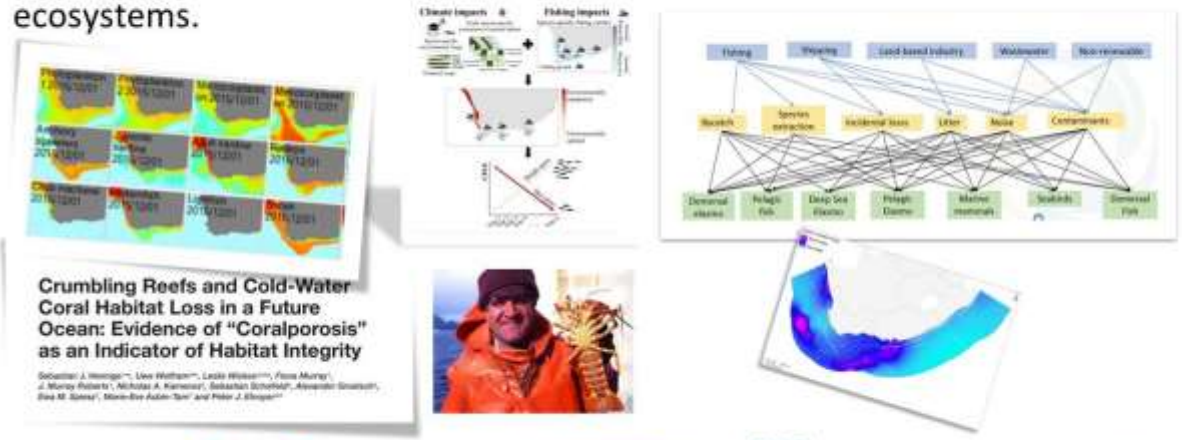
- Four projects funded under Horizon 2020 by the European Commission
- One project funded by the UK Research & Innovation through the Global Challenges Research Fund
- Total overall international budget of R 1.35 billion over 4-5 years
- More than 400 researchers from > 150 institutes from> 30 countries
- All multi-disciplinary, some trans-disciplinary
- Oceanography, Connectivity, Ecology, Climate science, Law, Social sciences, Economics, Arts and more

These 5 projects are all active in South Africa

AtlantECO iAtlantic MISSION ATLANTIC ONE OCEAN HUB TRIATLAS

AtlantECO iAtlantic MISSION ATLANTIC ONE OCEAN HUB TRIATLAS

Key finding 1: Improved methods and models have generated new knowledge on ocean benefits, connectivity and cumulative impacts under changing climate. This can enable integrated management of marine ecosystems.



Key finding 2: Emerging novel approaches to improve participation can strengthen implementation and policy coherence.

Key finding 3: The indirect and cumulative impacts of mining and petroleum on the ocean and people are now better understood. However, they are not sufficiently considered in EIAs.

Key finding 4: The lack of an overarching fisheries policy that includes small-scale, commercial *and* recreational fisheries undermines the management of resources and compromises the goal of equitable fisheries

- The marine recreational fishery is the **largest (694 000 fishers)** and **most valuable (R19 billion pa)** sub-sector of the linefishery (Potts et al. 2022)
- The true number of SSFs is **unknown**, and most remain unrecognised.
- There are **more than 20** recognised commercial fisheries sectors in South Africa

Key finding 5: Omission of small-scale and recreational fishers from many planning and decision-making processes results in conflict and threatens social and environmental justice

This is especially relevant for:

- Marine Spatial Planning
- Marine Protected Areas
- Co-management of Marine Resources

Sunde 2022:

SOUTH AFRICA
BLUE ECONOMY

A Seismic Shift

At the heart of the court papers was the call for an ecosystem-based approach to ocean governance, respecting the human rights of local communities and adopting a precautionary approach

AtlantECO iAtlantic MISSION ATLANTIC ONE OCEAN HUB TRIATLAS

Emerging research areas of policy relevance

Microbiome:
95% of marine microbial function is unknown although they constitute 70% of marine biomass, playing a key role in nutrient recycling and climate regulation.

Microplastics:
The infiltration of microplastics from the world's rivers into the marine food chain accumulate and negatively affects marine and human health. South Africa needs to invest in research to quantifying the impact of microplastics on both ecosystems and people.

Deep sea:
Deep-sea ecosystems provide important societal benefits which are at risk. Novel approaches emerging to advance deep-sea research *and* strengthen capacity in Africa to maintain ecosystem services.

AtlantECO iAtlantic MISSION ATLANTIC ONE OCEAN HUB TRIATLAS

4. Co-developed recommendations

Five key findings with recommendations were co-developed with researchers and policy makers during the world café on Day 3 of the workshop. The workshop slides presented in plenary are pasted below. Some researchers or facilitators took more detailed notes during the world café available in Annexure 6 and 7**.**

Key finding 1: Improved methods and models have generated new knowledge on ocean benefits, connectivity and cumulative impacts under changing climate.

So what: This can enable integrated management of marine ecosystems.

Co-developed Recommendation: Facilitate ongoing dialogue for knowledge generation for policy uptake

- Establish a marine research: policy forum
- Co-design of research
- Span different knowledge forms
- Communicating benefits
- Simplifying science
- Synthesizing science for policy uptake
- Marine legislation requires review, rationalization and alignment
- Re-think Research Metrics

Key finding 2: Emerging novel approaches to improve participation can strengthen implementation and policy coherence.

Co-developed Recommendation: We need to integrate social science-led participatory processes that go beyond the tick box

- Extended engagement / meaningful participation
- Beyond minimum mandate
- Reflect and build on existing (social sciences) evidence base
- Understand cultural-social structural dynamics/context
- Learn to listen (capacity building process for decision-makers)
- Adaptive and responsive (relationship building)
- Social-science led co-design and facilitation
- translation

Key finding 3: The indirect and cumulative impacts of mining and petroleum on the ocean and people are now better understood. However, they are not sufficiently considered in EIAs.

So what: Cumulative impacts must be considered if ocean ecosystem services and benefits are to persist

Multiple scales for assessing cumulative impacts:

1.single operation, (2) multiple operations within a sector, (3) multiple operations across sectors

Co-developed Recommendations:

1.Single operation: Amendment of the EIAs to include the cumulative and indirect impacts (Socio-econo-ecological systems); Guidelines for including cumulative and indirect impacts in EIA for practitioners

2.Multiple operations within a sector: Cumulative impact assessment (includes socio-ecological systems) by biodiversity sector

3.Multiple operations across sectors: SEA (DFFE MSP process underway incl sector plans)

- Inclusion of cultural importance and indirect impacts across all scales
- Will require will, resources and capacity

Key finding 4: The lack of an overarching fisheries policy that includes small-scale, commercial *and* recreational fisheries undermines the management of resources and compromises the goal of equitable fisheries

Recommendation: Improve representation structures, enable increased cooperation with the diverse range of users and amend existing regulatory mechanisms to better cater for sectoral nuance

- Review the MLRA to bring it inline with global standards and current best practices
- Organise the recreational fishery "voice" (e.g. peak body) to achieve consensus and feed it into scientific working groups
- Provide clear, actionable policy reform recommendations compiled in cooperation with stakeholders
- Shift recreational fishery regulations from the act into permit conditions – as it is for other sectors
- Improve our understanding of the heterogeneity of the diverse spectrum of recreational and small-scale sectors
- Provide better estimates of recreational small-scale fishery effort to improve ability to manage this open access fishery

Key finding 5: Omission of small-scale and recreational fishers from many planning and decision-making processes results in conflict and threatens social and environmental justice

Why does this matter?

- It further marginalises and in some cases criminalises SSF
- Misses out on the knowledge and contributions of SSFs to these processes (MSP, MPA planning & management, co-management of resources)

Co-developed Recommendations

1. In the upcoming sector specific engagements for MSP - learn lessons from last year's 'DFFE Road Show' experience - enhance participation through partnerships and facilitation
2. Initiate the demarcation of SSF Community Fishing Areas ! (SSF policy section 5.1.2 - the Minister can declare)
3. Bring together all currently available spatial data on SSF into best available layer, to improve iteratively over time

In summary, 5 key co-developed recommendations in response to Southern African research findings include calls for:

- Improved participation in marine planning, protection and management (especially in reaching the 30x30 global target).
- Better consideration of cumulative impacts including that of climate change in spatial planning and impact assessment.
- Increasing efforts in working with small-scale and recreational fishers to improve participation in decision making, integrated policy and co-management of marine resources and ecosystems.
- Better mapping of the fishing grounds (particularly for small-scale and recreational fisheries), mining activities and tourism opportunities to improve consideration of these sectors in spatial planning.

5. Participant feedback

Before closing participants were requested to answer the following two questions:

- What was most useful for you today?
- What did you find challenging today?

In summary, participants appreciated the following elements as most useful (additional detail available in Annexure 8) :

- The world café format which provided an opportunity for more in depth discussions.
- An emerging consensus of the importance of social science in ocean governance.
- Diversity of participants in terms of discipline, role (scientists, managers, policy makers) and emerging researcher participation and the experience they brought to the discussions.
- Innovation in participation.
- Learning about policymaker tasks, challenges, expectations and needs.
- Co-development of joint recommendations from a diversity of participants.

In terms of the most challenging aspects of the workshop, participant feedback is summarised below with two themes dominating the feedback (time challenges and complexity) and many individual points. In summary these included the following:

- Insufficient time for further in-depth discussion and the volume and depth of information covered.
- The complexity, volume (and pace) of government processes, legislation, implementation and information to govern the use of ocean resources vs the needs of society.
- Idealism of scientists, defensiveness of some participants, a lack of understanding and difficulties in not personalising some feedback in challenging discussions/ multiplicity of views were noted by some participants. Challenges in listening were also expressed.
- The challenges of distilling complex and voluminous research results onto simple messages for policy uptake.
- Trade-offs and the challenge of balancing social needs and economic needs and optimising ecosystem use.
- Uncertainty around how to integrate the different kinds of knowledge systems and sources.
- A lack of clarity in terms of how these discussions can be deepened, taken forward to effect change.
- The need to have more policymaker engagements pre-meeting to ensure more relevant departments attend.
- Challenges of inclusivity (or implications due to the lack thereof) and the absence of stakeholders (including mining and maritime, regulatory and EIA people, local communities and fishers).
- It is important to clearly define terms, so we don't lose the idea behind it. For instance: policy is not defined clearly and is often used interchangeably with words such as legislation, regulations and enforcement. Hence others think policy is not the biggest challenge.
- Connections between projects but the lack of a single champion to hold all projects.

Early Career Ocean Professional (ECOP) and Researcher (ECR) Perspectives

The three day meeting included participation from 14 early career researchers including five MSc students from the University of Cape Town who participated as part of their curriculum. Aimee Cloete was elected by this group to provide feedback at the workshop which is shared below:

"Thank you for meaningfully including us in this exciting, novel process. It speaks directly to key finding 2: meaningful participation is a strength not a weakness. It's powerful and important and can only be a benefit to everyone involved. We have all agreed that we felt our feelings, opinions and questions were HEARD. It is important to feel heard and not just be "allowed to speak". There's a difference because being heard helps us feel that we have the potential to make meaningful contributions NOW - not in 20 years' time when we are well-established scientists.

This experience has taught us way more than we could have ever learnt in a classroom. It's been an extremely stimulating environment that has allowed us to learn so much about translating policy into science. How to do it, who should do it and why it's important. This understanding on how to bridge the gap between science and policy making from the beginning of our careers is going to give us an advantage with policy relevant research in the future.

The last three days have been a huge encouragement and boost of confidence for us knowing that the research community is willing to give us a seat at the table. Allowing future generations to have a seat at the table is so important for the transformative goals we have in South Africa as a whole (and globally) and we would like to encourage all other sectors to follow suit."

There were also other ECRs who participated in the workshop including students and ECRs from all five projects. Ndamononghenda Mateus, a Nambian PhD student studying at the University of Cape Town and AtlantECO also shared written feedback:

"Participating in this workshop was a transformative experience for me, fostering personal growth and inspired a commitment to contribute meaningfully to the realm of science-informed policy that is applicable to the Namibian community in ocean governance. The workshop discussed key findings, research gaps and next steps across the five international projects in marine science in the Benguela region and engaging policy makers in ocean governance. As an emerging researcher, I grasped that being an exceptional scientist extends beyond research and publications. Advising policymakers effectively, requires fluent communication, bravery, and well-informed research findings. This newfound understanding prompts me to train further in conveying my work's significance to diverse audiences."

6. Project linkages, knowledge gaps and lessons

To help meet workshop objectives in terms of supporting collaboration, a variety of beneficial linkages among projects were identified as highlighted below.

Linkages between projects

A variety of beneficial linkages among projects were identified, ranging from socio-ecological aspects of marine management, quantitative scientific outputs that may help to fill knowledge gaps, and complimentary outputs to refine Systematic Conservation Plans (SCP).

Socio-ecological and policy aspects of ecosystem-based marine management:

One Ocean Hub, Mission Atlantic, TRIATLAS and iAtlantic incorporate various social aspects that relate to the overall needs to improve socio-ecological integration in marine planning and management. Collectively, the related outputs from these projects reflect the need to better consider human dimensions within planning and ecosystem based management of the marine realm. Further detail is available in Annexure 1 but some of the key evidence includes:

(a) The Integrated Ecosystem Assessment of the Mission Atlantic project produced networks of linkages among sectors, their associated pressures and how these pressures can

simultaneously affect ecological components (including interactive and potentially cumulative impacts), cultural aspects and related ecosystem services (informed by the One Ocean Hub). How these may be impacted by sectoral activity could be added to an expanded network in iterative improvements of the risk assessments and their accompanying linkage networks in Mission Atlantic to improve the contextualisation of management priorities.

(b) The One Ocean Hub project incorporates art-based communication approaches to emphasize emotional, cultural and religious connections of indigenous and other groups to the sea. References are made specifically to cultural connections to the deep-sea and the need for this to be considered alongside emerging pressures such as deep-sea mining and oil and gas exploration.

(c) Work aimed at quantifying social-ecological priorities with a focus on fishing has been done in the TRIATLAS project by means of Shared Socio-economic Pathways and consideration of several social vulnerability indices. Hotspots of social vulnerability were identified.

(d) The One Ocean Hub has shown by emphasizing the need for improved participation of small-scale and subsistence fishers in marine planning and protection, efforts are adaptable so that they are adequate for the group being consulted to ensure inclusiveness in the consultation and decision-making processes. Combining these results with results from TRIATLAS can guide efforts to plan for avoiding further impacts on the most vulnerable and inform planning for increased resilience of small-scale and subsistence fishers.

(e) Workshops and stakeholder engagements hosted as part of the iAtlantic systematic conservation plan case study in South Africa have yielded key lessons on participation and the needs of knowledge holders, rights holders and other stakeholders with many participants concerned about cumulative impacts and failures to consider ecosystem services in planning.

Other work that was identified that could strengthen planning across projects included:

- The recent benthic classification done for the South Atlantic deep-sea including the South African Exclusive economic zone (EEZ) (One Ocean Hub and Mission Atlantic). This could be used to refine current groupings of ecological components in Mission Atlantic's risk assessment frameworks, as well as inform regional marine spatial planning (MSP) efforts for the deep-sea.
- Ecosystem services delivered by deep-sea habitats (One Ocean Hub) could inform considerations of cumulative impacts in the Mission Atlantic and iAtlantic projects.
- Social vulnerability hotspots (TRIATLAS) can inform marine protected area (MPA planning and MSP.
- Results from plankton movement studies (AtlantECO) could be useful in designing for connectivity in MPA planning.

<u>Other complementary scientific studies:</u>

Other points of overlap among scientific studies undertaken across projects and areas where outputs from one project may help fill knowledge gaps or provide guidance for work undertaken in another project that were identified included:

- The TRIATLAS project is building ecosystem models that will also incorporate predictions under various climate change scenarios for the Southern Benguela ecoregion and this could address gaps in the Mission Atlantic project risk assessments (i.e. the scoping phase of the Integrated Ecosystem Assessment). However it is anticipated that upcoming risk assessments such as Bayesian Belief Networks will incorporate climate change scenarios and investigate the interactive effects thereof in relation to other pressures and resultant impacts on ecological components. As such Mission Atlantic may be able to use model data on ecological indicators under climate change, as will be produced by TRIATLAS.
- In the iAtlantic project, scientific studies are underway to better understand and predict the dynamics and impacts of marine heatwaves, including in South Africa (University of the

Western Cape). This may also be of benefit to the oceanographic modelling components of other projects and could be used to build climate resilience into systematic conservation planning efforts within the iAtlantic project. (There may be scope to consider the influence or impact of heatwaves on the microbiome).

- Processing of visual imagery data using Artificial Intelligence (AI) is currently being used in Mission Atlantic to speed up the analysis of benthic imagery data and build on the occurrence records for deep-water organisms to support more data driven ecosystem mapping and predictive modelling across broader areas. AtlantECO is also utilising existing AI platforms (e.g. EcoTaxa) for analysis of plankton imagery data . It would be useful to have discussions on how useful various methods have been.
- The iAtlantic project developed Species Distribution Models for several deep-sea taxa including cold-water corals. Transferring such models to appropriate areas in the deep-sea of South Africa's EEZ can increase the extent of predicted distributions for such taxa, and thereby delivering more detailed national benthic maps for use in Mission Atlantic. This can, in turn also support the SCP work of iAtlantic, if there is scope to extend planning. AtlantECO is also doing some microbiome species distribution modelling, biodiversity mapping, network analyses, etc, which could assist with pelagic systems.
- In the scoping phase of the Integrated Ecosystem Assessment in Mission Atlantic, several pressures were identified as being data-poor. Litter, and more specifically microplastics, was one such area. AtlantECO is currently investigating the effects of microplastics in the ocean microbiome, which will be valuable for Mission Atlantic with regards to refining perceptions of risk from this pressure. This work can also be used in South Africa's National Biodiversity Assessment.
- In Mission Atlantic and the Integrated Ecosystem Assessment, ecological indicators are being developed that can be used to assess the effectiveness of management measures, with great emphasis on defining good ecological condition/health. Similar work is currently being done in AtlantECO's work focusing on the ecosystem health index. Both projects could feed into SANBI's ecosystem assessments.
- The One Ocean Hub project investigated potential impacts of deep-sea mining in other regions, as well as contributing inputs on related policy advice. With a large focus on the ocean microbiome, AtlantECO is interested in informing predictions on the potential impacts of this emerging sector to microbiological taxa that represent the base on the food chain. Similarly, Mission Atlantic's initial risk assessments also identified deep-sea mining as a sector with substantial potential risk but in need of more studies. Upcoming more quantitative risk assessments like Bayesian Belief Networks (Mission Atlantic) incorporating deep-sea mining may draw from One Ocean Hub study outcomes. iAtlantic has conducted experimental work that indicates that deep-sea corals have little resilience to mining impacts.

Knowledge gaps and research priorities

- Ground-truthed data are needed to validate multiple models that are being developed including predictive models and species distribution models.
- It would also be useful to establish some widely accepted and attainable indicators to regularly monitor broad ecosystem health and condition. The Essential Ocean Variables (EOVs) and Essential Biodiversity Variables (EVB) could be considered for this purpose but should be assessed if these are practical in the South African context and if such data are available and routinely collected.
- Incorporate microbiome monitoring data into ecosystem assessments – need to initiate research on microbiomes through inclusion of this component in broader research projects in the future. This was flagged as an emerging research area about which we know very little

and with limited research effort and capacity. There are very few people working on this and it is an important aspect for future consideration in projects.

- There is a need for ground truthing of ecological condition – this is specifically relevant for validating model outputs. There are many models being developed at large ocean-basin scales which are useful as the whole ocean space cannot be studied quantitatively at fine resolution, however, most models still require measured data to ground-truth them to assess their performance accuracy. Improved data sharing may help with this issue.
- Global shipping and oil and gas impact – data on known impacts of shipping and petroleum exploration and extraction remain elusive and unquantified in the South African context. Improved pathways to sharing data (unconstrained) and expertise and efforts to unlock industry data could also improve knowledge regarding these impacts.

Lessons for research co-design

During the workshop it was emphasised that it is critical that co-production of new knowledge should be included in projects from the very outset i.e. planning stages of future projects. This is relevant to developing country scientists and in terms of broader participation of other knowledge holders, rights holders and stakeholders. If communities are included in the project planning there is greater likelihood of meaningful participation, buy-in and future uptake and this will have more valuable outcomes and success down the line.

Participants recommended that the following elements should be considered when developing future research proposals and projects:

- Projects need to be co-designed to build common understanding from the outset (from pre-proposal stage).
- Improved communication and coordination between researchers and end-users is needed to improve the usefulness of project outputs and outcomes.
- Projects need to include stronger social and economic research, local and traditional knowledge forms, and transdisciplinary research methods.
- Improvement is needed to reframe the connections between people and the ocean (in terms of reliance and vulnerability), and improved consideration of human rights in marine research and ocean spaces is needed.
- Projects should include tailored approaches for capacity development (understanding specific country needs) and actions to develop capacity should enable and empower African researchers to conduct research in their own waters (see additional detail below).
- More support should be provided for non-European country organisations to enable them to navigate the complexity of especially Horizon-2020 grant conditions to maximise the benefits which can potentially be derived from these kinds of projects. Some H2020 project participants were told they are not able to be remunerated for project time. It is important that African researchers can also be remunerated for project time and this should be clarified in project communication during the development phase. Challenges have also encountered when supporting students on some projects as project deliverables pose additional pressures on students to release products and produce outputs beyond the thesis before the post graduate degree is completed.

Capacity strengthening lessons and needs

Across projects several capacity development lessons, concerns, and needs were shared. Participants preferred the term "capacity strengthening" over "building/development" as the latter may imply that no initial capacity exists. In terms of strengthened capacity, several projects had a focus on training Early Career Researchers. Examples included an innovative approach to capacity development piloted through the One Ocean Hub whereby an ECR was empowered to lead a multi-institutional and multi-disciplinary research expedition to support ship-based training of a team of emerging researchers. Another example was found in ship-to-shore training of a group of ECRs through iAtlantic but although those conducting the training published about this important initiative, those who participated in training have not yet contributed to the lesson sharing about this approach. TRIATLAS will have training, summer schools and ship-based learning for ECRs.

Gaps in capacity identified through the projects included a need for expertise to best share scientific results with end-users, including through building communication skills for maximum impact. Needs also included learning to work together across disciplines and learning to engage with different stakeholders, rights holders and knowledge holders. Further needs are identified in a report on challenges and solutions for deep-sea research and management capacity produced through One Ocean Hub. Finally, data gaps were identified as a significant issue limiting decision-making but with the exception of AtlantECO, none of the remaining projects supported scientific exploration (deep or otherwise). This was largely due to the Covid-19 pandemic but pathways to remedy the loss of data collection could have been further explored. Importantly, there was a strong sense that capacity development efforts should be meaningful, including co-designed efforts to address self-identified priorities.

7. Conclusion

This workshop was a unique and successful science-policy event that brought together five large international projects with policy makers and early career researchers to discuss and distil research findings, co-develop recommendations and share learnings to support ecosystem based management of marine ecosystems. The workshop highlighted the value of knowledge exchange, identified many synergies that provide opportunities for strengthened collaborations and identified key areas of emerging research and knowledge gaps. Jointly developed recommendations in response to Southern African research findings emerged from the workshop including calls for and ideas to improve participation in marine planning, protection and management, and the need for approaches to better consider cumulative impacts including climate change in spatial planning, impact assessment, mining decision support and management in particular. Increased effort is needed to work with small-scale and recreational fishers to improve participation, integrated policy and co-management of resources.

Increasing participation within and between sectors and facilitation of dialogue and participatory processes emerged as key elements in improving ecosystem based management and there are opportunities to draw from workshop lessons in the co-design of future research initiatives including those under new Atlantic initiatives, Horizon 2020 and other international, regional and local initiatives. Application of the lessons learned from this workshop could facilitate improved knowledge generation and ecosystem based management across the science-policy-society interface. The co-developed priority actions are useful for South Africa's upcoming National Biodiversity Assessment which draws from research that assesses the state of marine ecosystems, species and genetic diversity and presents recommendations and priority actions to improve the state of marine biodiversity and also have relevance in regional and international contexts. The upcoming All-Atlantic Ocean Research

and Innovation Alliance at the Cape Town International Convention Centre in South Africa on 21-22 November 2023 will provide an opportunity to build on and address the identified linkages, knowledge gaps and joint recommendations.

List of Annexures

Annexure 1: Annotated workshop agenda
Annexure 2: Detailed methods for Science workshop (Day 1 and 2)
Annexure 3: Day 1 feedback
Annexure 4: Key findings discussion on Day 2
Annexure 5: Policy panel discussion on Day 3
Annexure 6: World café discussions on Day 3
Annexure 7: Key findings with co-developed recommendations plenary presentation on Day 3
Annexure 8: Key issues and learnings (participant feedback) on Day 3

Appendix 1: Invitation and Participant register

MISSION ATLANTIC

Science to Policy Workshop for Ecosystem Based Management: Progress across international projects in the region 2023

Event objectives:

1. Share research progress across international projects in the region
2. Strengthen collaborations across projects
3. Distil common understandings and recommendations
4. Engage with policymakers to discuss progress, challenges and opportunities to optimize the management of marine ecosystems
5. Shaping current and future research and dissemination for science policy successes

Date: 22 - 24 August

SANBI Biodiversity for Life

Venue: Kirstenbosch National Botanical Gardens, Cape Town, South Africa

Draft Agenda: Science meeting for international projects		Science to policy workshop
Day 1. Projects: Synergies & strengthened collaborations	**Day 2. Crafting key messages for policymakers**	**Day 3: Policy Interactions**
Presentations focused on marine EBM with main policy relevant results achieved so far by: • Mission Atlantic • iAtlantic • AtlantEco • TriAtlas • One Ocean hub	Discussions to craft key messages to share with policy makers. Potential focus areas : • Progress and challenges in ecosystem mapping and assessment • Availability of data and data inter-operability for use at the national level (EIAs, etc) • Ecosystem based management recommendations (fisheries, mining, climate and social justice) • Climate science-policy linkages • Vulnerable marine ecosystems • Spatial planning and management • Global Biodiversity framework links • Ocean decade links	Opening address Delivery of key messages from international projects
Planning for Day 2 – themes and breakout groups: • Reflection on connecting data and research findings across projects • Discussions on how policy can still tailor research in these projects • Discuss methodologies and approaches for conducting research that aligns with policy needs and priorities	Developing clear, actionable and realistic key messages from science that will be presented to policymakers on Day 3	World cafe discussions (e.g., by topic/theme: Ecosystem Based Management, Marine Spatial Planning Climate Resilience, Ecosystems and People) Debriefing of world cafe discussions and dialogue with policy makers Research, Funding and Dissemination for Policy Uptake in the Region • Key points to pursue under UN Decade for Ocean Science • Key gaps and priorities in the region

MISSION ATLANTIC iAtlantic TRIATLAS AtlantECO ONE OCEAN HUB

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Science to Policy Workshop for Ecosystem Based Management

Date : 22 and 23 August 2023

Venue: Colophon room, CBC, Kirstenbosch

SANBI

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AtlantECO Atlantic Ecosystems Assessment, Forecasting & Sustainability iAtlantic INTEGRATED ASSESSMENT OF ATLANTIC MARINE ECOSYSTEMS IN SPACE AND TIME MISSION ATLANTIC ONE OCEAN HUB TRIATLAS

MISSION ATLANTIC

Science to Policy Workshop 2023: Optimising Ecosystem Management

Date : 24 August 2023

Venue: Colophon room, CBC, Kirstenbosch

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