EUROPEAN COMMISSION
Research Executive Agency

The Director

ANNEX 1 (part A)

Research and Innovation action

NUMBER — 862428 — MISSION ATLANTIC

Table of Contents

1.1. The project summary

Project Number [1]	862428	Project Acronym [2]	MISSION ATLANTIC

One form per project	
General information	
Project title [3]	Towards the Sustainable Development of the Atlantic Ocean: Mapping and Assessing the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation
Starting date [4]	01/09/2020
Duration in months [5]	60
Call (part) identifier [6]	H2020-BG-2019-2
Topic	BG-08-2018-2019 All Atlantic Ocean Research Alliance Flagship
Fixed EC Keywords	Latin America, Marine ecosystems and processes, Africa, Marine biodiversity conservation, Environmental monitoring systems, Aquaculture, fisheries
Free keywords	

Abstract [7]

MISSION ATLANTIC develops and systematically applies Atlantic Integrated Ecosystem Assessments (IEAs). IEAs enable identification of ecosystem components most at risk from natural hazards and the consequences of human activities. The project employs all available information on those sources, the pressures they impose and the ecosystem components are affected, to identify the most important risk factors influencing sustainable development. IEAs are developed at basin and regional scales, using a nested approach with key case study (CS) areas including sub-Arctic and Tropical regions in the Atlantic Ocean. To support IEAs we map, model and assess Atlantic Ocean ecosystems including resilience and responses to cumulative pressures. Regional indicators are provided for both pelagic and benthic components, using existing and new data from monitoring programs, including information from new glider technology.

Coupled end-to-end physical-biological models are developed and validated at the basin scale to simulate ecosystem dynamics, defining new biogeographical regions and resolving connectivity between CSs. Ecosystem state indicators are then evaluated under four future climate projections of the models, to identify future risks of crossing identified tipping points into undesirable ecosystem states.

In support of the Bélem Statement, the project brings together scientists, managers and stakeholders from Brazil, S.Africa and the EU as well as US & Canada. Regional stakeholder platforms are established to support the IEAs and the interactions between researchers, industries, policy makers and authorities across the Atlantic. The platforms are delivered via partners with recognized experience in “science to governance” interfacing. Training and professional development opportunities across the Atlantic are provided via mobility, PhD and MsC programmes building around IEA theory and using an adaptive e-learning platform and examples to ensure program legacy.

1.2. List of Beneficiaries

Project Number [1]	862428	Project Acronym [2]	MISSION ATLANTIC

List of Beneficiaries

No	Name	Short name	Country	Project entry month[8]	Project exit month
1	DANMARKS TEKNISKE UNIVERSITET	DTU	Denmark	1	60
2	UNIVERSITAET HAMBURG	UHAM	Germany	1	60
3	FUNDACION AZTI - AZTI FUNDAZIOA	AZTI	Spain	1	60
4	HAVFORSKNINGSINSTITUTTET	IMR	Norway	1	60
5	MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM	MBA	United Kingdom	1	60
6	VLAAMS INSTITUUT VOOR DE ZEE VZW	VLIZ	Belgium	1	60
7	PLYMOUTH MARINE LABORATORY LIMITED	PML	United Kingdom	1	60
8	UNIVERSIDADE DO PORTO	UPO	Portugal	1	60
9	COLLECTE LOCALISATION SATELLITES	CLS	France	1	60
10	STOCKHOLMS UNIVERSITET	SU	Sweden	1	60
11	UNIVERSITY OF STRATHCLYDE	STRATH	United Kingdom	1	60
12	THE UNIVERSITY COURT OF THE UNIVERSITY OF ST ANDREWS	USTAN	United Kingdom	1	60
13	NATIONAL OCEANOGRAPHY CENTRE	NOC	United Kingdom	1	60
14	INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	IFREMER	France	1	60
15	CONSORCIO PARA EL DISENO, CONSTRUCCION, EQUIPAMIENTO Y EXPLOTACION DE LA PLATAFORMA OCEANICA DE CANARIAS	PLOCAN	Spain	1	60
16	IMAR - INSTITUTO DO MAR	IMAR	Portugal	1	60
17	UNIVERSITY OF CAPE TOWN	UCT	South Africa	1	60
18	UNIVERSIDADE FEDERAL DE SANTA CATARINA.	UFSC	Brazil	1	60
19	HAFRANNSOKNASTOFNUN, RANNSOKNA- OG RADGJAFARSTOFNUN HAFS OG VATNA	MFRI	Iceland	1	60
20	MARINE INSTITUTE	MI	Ireland	1	60
21	INSTITUTO ESPANOL DE OCEANOGRAFIA	IEO	Spain	1	60
22	SEASCAPE BELGIUM	SSBE	Belgium	1	60
23	UNIVERSIDADE DE SAO PAULO	USP	Brazil	1	60
24	INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA	ICES	Denmark	1	60

1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry month[8]	Project exit month
25	UNIVERSITY OF PLYMOUTH	UPL	United Kingdom	1	60
26	SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE	SANBI	South Africa	1	60
27	MEMORIAL UNIVERSITY OF NEWFOUNDLAND	MUN	Canada	1	60
28	ASSOCIACAO PARA O DESENVOLVIMENTO DO ATLANTIC INTERNATIONAL RESEARCH CENTRE	AIRC	Portugal	1	60
29	MARITIME ROBOTICS AS	MROB	Norway	1	60
30	UNIVERSITAET BREMEN	UBH	Germany	1	60
31	WORLD MARITIME UNIVERSITY	WMU	Sweden	1	60
32	INTRIGO LIMITED	INTRIGO	Ireland	1	60

1.3. Workplan Tables - Detailed implementation

1.3.1. WT1 List of work packages

WP Number[9]	WP Title	Lead beneficiary[10]	Person-months[11]	Start month[12]	End month[13]
WP1	Atlantic Ocean Integrated Ecosystem Assessment	4 - IMR	136.00	1	48
WP2	Data technology and management for IEA	6 - VLIZ	176.00	1	48
WP3	Pelagic Mapping: ecosystem, resources & pressures	3 - AZTI	297.00	1	36
WP4	Benthic Mapping: ecosyst., resources and pressures	20 - MI	194.00	1	44
WP5	Assessing state, drivers and tipping points	1 - DTU	239.00	1	30
WP6	Dynamics of ecosystem state and resources	7 - PML	173.00	1	42
WP7	Risk Assessment and uncertainties	10 - SU	192.00	1	46
WP8	Building Capacity for the IEA	31 - WMU	52.00	1	52
WP9	Societal Engagement & Communication	8 - UPO	131.00	1	60
WP10	Project Coordination	1 - DTU	77.00	1	60
WP11	Ethics requirements	1 - DTU	N/A	1	60
		Total	1 667.00		

1.3.2. WT2 list of deliverables

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Regional and pan-Atlantic management objectives	WP1	4 - IMR	Report	Public	8
D1.2	Present status assessment of the Atlantic Ocean ecosystem	WP1	4 - IMR	Report	Public	30
D1.3	Ecosystem vulnerabilities under future scenarios	WP1	20 - MI	Report	Public	48
D1.4	TOR and stakehodelr activities in all CS areas	WP1	4 - IMR	Other	Confidential, only for members of the consortium (including the Commission Services)	6
D2.1	Data Management Plan and guidelines for FAIR outputs	WP2	6 - VLIZ	ORDP: Open Research Data Pilot	Public	10
D2.2	Review of available data & gaps for regional Case Studies	WP2	14 - IFREMER	Report	Public	15
D2.3	New technologies for big data collection, analyses and storage (R; PU)	WP2	12 - USTAN	Report	Public	42
D2.4	Data Management for IEA incl. recommendations to D9.1 Dissemination & Exploitaiton Plan	WP2	6 - VLIZ	Report	Public	48
D3.1	3D maps of pelagic physical and chemical components and ecosystem attributes	WP3	5 - MBA	Websites, patents filling, etc.	Public	22
D3.2	Maps of present ecosystem pressures (fishing, shipping, pollution)	WP3	3 - AZTI	Report	Public	18
D3.3	New biomes boundaries of pelagic ecosystem	WP3	12 - USTAN	Report	Public	34
D3.4	Mapping fish distribution of target species	WP3	3 - AZTI	Report	Public	36

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D4.1	Framework for future Atlantic cooperation on seafloor mapping efforts & prioritisation of seabed targets for IEA	WP4	20 - MI	Report	Public	18
D4.2	Seafloor characteristics and benthic communities across the Atlantic	WP4	25 - UPL	Report	Public	26
D4.3	Changes in distribution of VME communities as a result of climate change and ocean-acidification	WP4	4 - IMR	Report	Public	44
D5.1	State, drivers, cumulative impacts and tipping points indicators	WP5	1 - DTU	Report	Public	22
D5.2	Attributes of resilience and early warning indicators	WP5	2 - UHAM	Report	Public	24
D5.3	Key indicators & threshold for risk assessment	WP5	1 - DTU	Report	Public	28
D6.1	Validated hindcast simulations 1980-2019 (NEMO-ERSEM & SEAPODYM)	WP6	7 - PML	Report	Public	26
D6.2	2020-2070 Future Projections (NEMO-ERSEM & SEAPODYM)	WP6	7 - PML	Report	Public	36
D6.3	Drivers, connectivity and extreme events at different scales	WP6	13 - NOC	Report	Public	42
D7.1	Qualitative vulnerability assessment of important ecosystem components for each case study	WP7	2 - UHAM	Report	Public	12
D7.2	Semi-quantitative vulnerability assessments	WP7	10 - SU	Report	Public	22
D7.3	Vulnerability analyses of Atlantic ecosystems under climate change and anthropogenic impacts	WP7	1 - DTU	Report	Public	46

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D7.4	Management option evaluations under climate change and anthropogenic impacts	WP7	11 - STRATH	Report	Public	42
D8.1	Learning Objectives for training on IEA	WP8	24 - ICES	Report	Public	18
D8.2	Online IEA Training Course and teaching material	WP8	24 - ICES	Websites, patents filling, etc.	Public	52
D9.1	Dissemination & Exploitation Plan	WP9	8 - UPO	Report	Public	6
D9.2	Full Communications Toolkit	WP9	32 - INTRIGO	Websites, patents filling, etc.	Public	18
D9.3	Risk management protocol for IEA for policy advice	WP9	31 - WMU	Report	Public	36
D9.4	Knowledge Transfer Pathways per main project output (R, PU)	WP9	32 - INTRIGO	Report	Public	48
D9.5	Documented Added Value for Env. Managers of IEA tools	WP9	1 - DTU	Report	Public	60
D10.1	Internal IT communication infrastructure	WP10	1 - DTU	Websites, patents filling, etc.	Confidential, only for members of the consortium (including the Commission Services)	3
D11.1	POPD - Requirement No. 1	WP11	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.2	A - Requirement No. 2	WP11	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.3	NEC - Requirement No. 3	WP11	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D11.4	EPQ - Requirement No. 4	WP11	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	4
D11.5	H - Requirement No. 5	WP11	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	1

1.3.3. WT3 Work package descriptions

Work package number [9]	WP1	**Lead beneficiary** [10]	4 - IMR
Work package title	Atlantic Ocean Integrated Ecosystem Assessment		
Start month	1	**End month**	48

Objectives

WP will advance the Operational Readiness Level of Integrated Ecosystem Assessments in the Atlantic Ocean: in seven regional case studies (CSs) and at the Atlantic basin scale. Specific Objectives:
1. Implement coherent IEA frameworks in the CSs and across the Atlantic Ocean
2. Enable discussions and analyses of IEA results with regional stakeholders
3. Assess ecosystem status, providing a whole Atlantic synthesis of IEAs results

LEADS: Mette Skerne-Mauritzen (IMR) & D. Reid (MI)

Description of work and role of partners

WP1 - Atlantic Ocean Integrated Ecosystem Assessment [Months: 1-48]
IMR, DTU, AZTI, UPO, SU, NOC, PLOCAN, IMAR, UCT, UFSC, MFRI, MI, IEO, USP, SANBI
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 1.1 Coordinate and advance the Operational Readiness Level of IEAs in all case studies and at the pan-Atlantic scale

Subtask 1.1.1 Establish and coordinate the CS network and regional stakeholder platforms.
Each CS will carry out its own IEA process, but will be as closely harmonised with the other CS IEAs as possible. This task coordinates and facilitates interactions between the CSs and the interactions with WPs 2-7. Additionally, it will organize stakeholder meetings for the review process in the IEA. This iterative activity will advance ORL in each CS moving towards an operational IEA at the Atlantic basin scale. A Term of Reference (ToR) for the network of CS leaders will be set up and updated regularly, including protocols for interactions, a calendar of joint activities and a calendar for stakeholder interactions to reduce stakeholder fatigue. Plenary CS meetings, specific conference calls, calendar of events, etc. will be part of the ToR. The ToR will be a living document and will be reviewed regularly to adapt to new findings and tools in the project to ensure a mirroring of activities within Case Studies across the WPs (D1.4)., as well as regular update of KPIs 1 & 5 in the Dissemination & Exploitation Strategy, Section 2.2.1. (Milestones MS1.1, MS1.2, MS1.3, MS1.4).

Lead: IMR, Partners: CS Leaders, Duration: M1-48

Subtask 1.1.2 Review existing IEA frameworks.
This subtask will provide a review of existing IEA frameworks and tools from different sources (e.g., ICES, NOAA, ODEMM, OHI) to develop IEA best practices and to implement comparable frameworks across CSs. The frameworks will be tailored to regional knowledge and data availability, operational readiness of the IEA, as well as to the relevant human activities, pressures and impacts identified through the scoping process. This task contributes to D1.1 informing activities in T1.2 and WP7.

Lead: MI, Partners: IMR, IEO Duration: M1-6

Task 1.2 Identify regional objectives and societal development

Subtask 1.2.1 Scoping: identify targets and objectives of the IEA.
For each CS, this task will organize workshops to perform an initial, participatory scoping process with the regional expert and stakeholder communities to i) identify the main impacting human activities, associated pressures, and the ecosystem components affected by these, ii) explore regional outlooks for impacts associated with emerging issues and/or future climate, and finally iii) to identify management objectives related to regional and national policies, such as e.g. MSFD, CFP etc. Stakeholders will include Advisory Councils and their equivalents outside the EU, as well as national organizations and international groups such as OSPAR, NOAA, DFO, and the relevant Regional Fisheries Management Organizations to cover the pan-Atlantic scale (with WP9). This task will produce conceptual models of present and future multiple impacts on the ecosystems, by linking current and emerging pressures to ecosystem

components through to ecosystem services using approaches such as ODEMM and versatile collaborative modelling software. As part of the scoping, we will also include the likely pressures coming from climate change and described via the basin scale modelling, e.g. sea temperature, pH, etc. (from WP5,6). The links between human activities and these pressures are evaluated early in the project, and used, in combination with climate change influence on these pressures, to evaluate future scenarios. This task delivers D1.1 to be used in WPs5-9, as well as regular update of KPIs 1 & 5 in the Dissemination & Exploitation Strategy, Section 2.2.1.

Lead: IMR, Partners: CS Leaders, SANBI Duration: M1-12

Subtask 1.2.2 Atlantic socioeconomic pathways.
In this task, a characterization of the Shared Socioeconomic Pathways (SSP) for the CS is performed to inform modelling (WP6,7). The approach will be cross-sectorial mapping human activities and will benefit from output of concurrent project (e.g. CERES). For open ocean regions dedicated semi-structured interviews (subject to informed consent) are conducted with national/regional organizations and international advisory/management bodies, and additional ocean thought leaders and science/policy analysts with responsibilities for providing science advice to decision-makers. Fishery efforts and landings, fuel cost, energy demand, nutrient release, and recreational and tourism activities are examples of the derived variables. Results contributes to D1.3.

Lead: USP, Partners: UCT, SU, IMAR, SANB, PLOC, IEO Duration: M1-12

Task 1.3 All Atlantic Ocean Ecosystem Assessment

Subtask 1.3.1 Atlantic basin IEA.
This undertakes a whole Atlantic IEA, along similar lines to those used in the CSs, but independent of them and simplified to focus on activities, drivers, pressures and ecosystem components that have large scale effects. This will mainly be driven by the pressures that can be inferred from the basin scale modelling including fishing, warming, eutrophication, pH change, etc. It will be informed by the IEAs in each CS for other relevant human activities that might contribute to these pressures. The pressures will then be mapped through to ecosystem goods and services, and the scale of risk to provision of those services. Output of this task contributes to D1.2 and D1.3.

Lead: MI, Partners: NOC , DTU, SANBI Duration: M12-48

Subtask 1.3.2 Synthesis of the Atlantic ecosystem assessments. Individual regional IEAs will differ in terms of methods, data availability, and in the ecosystems themselves. This task will provide a synthesis of the results using a comparative approach across the CSs and integrating the basin scale information (e.g. biogeography, connectivity, trait distributions, pressures) to provide synthetic whole Atlantic basin assessments of: (D1.2) Present ecosystem status and risks to ecosystem components from human activities; (D1.3) Ecosystem vulnerabilities under future scenarios. The synthesis will look for commonalities and specificities in the high-risk activities, pressures, and ecosystem components implicated. We expect that fishing, warming and acidification will be important (high risk) in most CSs, and that pressures caused and ecosystem components affected would broadly be the same. In contrast, the role of, e.g., shipping, may be very different across CS, depending on the scale of traffic. Where appropriate, the synthesis will also show where increases in a particular activity are likely possible without increasing risk to any of the ecosystem components. Synthesising the future scenarios will also likely highlight the common major emergent vulnerabilities, and whether these would be at the basin scale or CS specific, and whether they would be complicated by climate change pressures and at what scale. This task will also contribute to co-design guidelines (with stakeholder in WP9, D9.5) on how to establish operational IEA frameworks incorporating resilience and non-linear dynamics concepts; methods to combine multiple pressures; models to identify critical present and future drivers; and methods to forecast likely future changes. The task delivers D1.2 and D1.3 with table of contents co-developed with WP9 (MS1.4), to maximize end-users uptake , and update of KPI's 1 & 5 in the Dissemination & Exploitation Strategy, Section 2.2.1.

Lead: MI, Partners: CS Leaders, UPO, SU, MFRI, SANB, DTU, PLOC, IEO, MFRI Duration: M12-48

Participation per Partner

Partner number and short name	WP1 effort
1 - DTU	3.00
3 - AZTI	3.00
4 - IMR	7.00

Partner number and short name	WP1 effort
8 - UPO	1.00
10 - SU	5.00
13 - NOC	5.00
15 - PLOCAN	1.00
16 - IMAR	3.00
17 - UCT	6.00
18 - UFSC	36.00
19 - MFRI	1.00
20 - MI	30.00
21 - IEO	6.00
23 - USP	24.00
26 - SANBI	5.00
Total	136.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Regional and pan-Atlantic management objectives	4 - IMR	Report	Public	8
D1.2	Present status assessment of the Atlantic Ocean ecosystem	4 - IMR	Report	Public	30
D1.3	Ecosystem vulnerabilities under future scenarios	20 - MI	Report	Public	48
D1.4	TOR and stakehodelr activities in all CS areas	4 - IMR	Other	Confidential, only for members of the consortium (including the Commission Services)	6

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D1.1 : Regional and pan-Atlantic management objectives [8]

This includes the review of existing IEA frameworks (T1.1.2), the initial scoping with conceptual models presented (T1.2.1) with a qualitative risk assessment (T7.1).

D1.2 : Present status assessment of the Atlantic Ocean ecosystem [30]

This includes an initial IEA at the atlantic scale (T1.3.1) and the synthesis of all assessments in each CS (T1.3.2) for the present state. For all CS areas results from WP7 are included and all deliverables and results from WP3, WP4, WP5, WP6 considered.

D1.3 : Ecosystem vulnerabilities under future scenarios [48]

Full Integrated Assessment in all CS areas and at the Atlantic Basin scale (T1.3). All results from WP2,3,4,5,6,7 are considered in the report, including progress on Operational Readiness Levels (ORL) per case study (contribution to KPI1 in Exploitation & Dissemination Plan D9.1

D1.4 : TOR and stakehodelr activities in all CS areas [6]

TOR to be updated Months 6, 18, 20, 42; ensure that stakeholder activities take into account KPI's ourlined in Section 2.2.1 Dissemination & Exploitation, and Deliverble D9.1 Dissemination & Exploitation Plan.

Schedule of relevant Milestones

Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS1	MS1.1. Establish TOR for CS network	4 - IMR	3	Communication to CS Leaders
MS2	MS1.2. Analyses completed for all CS areas for present state assessment	17 - UCT	24	Workshops held, D1.1 Scoping Synthesis
MS3	MS1.3. All workshops for Management options evaluation completed	4 - IMR	36	Ecosystem resilience assessed in all CS regions
MS4	MS1.4. D1.3 Table of Content agreed with WP9	20 - MI	42	Synthesis shapes T9.3 activities

Work package number [9]	WP2	**Lead beneficiary** [10]	6 - VLIZ
Work package title	Data technology and management for IEA		
Start month	1	**End month**	48

Objectives

The goal in WP2 is to identify historical environmental data as well as the storage of Mission Atlantic data and processing in support of the IEAs. Specific objectives are:
1. Define and implement a coordinated data management approach to ensure that data generated and collected are well documented, archived, interoperable and made accessible for use in other WPs.
2. Provide demonstrations (software and infrastructure) of cost-effective methods for processing a large quantity of ecosystem and pressure data.
3. Ensure the long-term storage of data produced in the project, by processing them into interoperable (spatial) data formats and agreed standards in collaboration with EMODnet and GEOSS.

LEADS: Lene Vandepitte (VLIZ) & Erwann Quimbert (IFREMER)

Description of work and role of partners

WP2 - Data technology and management for IEA [Months: 1-48]
VLIZ, DTU, AZTI, MBA, USTAN, IFREMER, PLOCAN, IMAR, UCT, UFSC, MI, IEO, SSBE, USP, ICES, UPL, SANBI, MROB, UBH
Task 2.1 Scanning the seascape: meta-inventory of available Atlantic data resources
Performing a survey of available data, products, models, tools and classifications for major Atlantic Ocean Regions and more in particular for the CSs (MS2.1). We will identify relevant existing resources, as well as creating a meta-database of sources of all data needed in WP1-7. This activity will be done in collaboration with CS leaders in T1.1 to Scope Regional IEAs where, for each regional IEA, we will scan the availability of data sources. This task cooperates with WP3 & 4 on spatial and temporal dynamics of ecosystem drivers and stressors. We will start our survey by looking into Atlantic data sources from, e.g.,:

(1) EMODnet including data on Bathymetry, Geology, Chemistry, Seabed habitats, Biology, Physics and Human activities & Inventory performed under the EMODnet Atlantic Sea-basin Checkpoint Challenge.,

(2) ICES including data on Vulnerable Marine Ecosystem (VME) indicators and habitats and data on Acoustic and Trawl surveys in the North Atlantic as well as fisheries distributions, efforts and catches,

(3) The Ocean Biogeographic Information System (OBIS) and Long Term Ecological Station (LTER) Project in the upwelling system of Cabo Frio (Since 1994),

(4) the Atlantic Continuous Plankton Recorder program, 60 years of plankton data across the North Atlantic,

(5) Ocean colour and physical parameters from the Copernicus Marine environment monitoring service,

(6) Physical, chemical and biological parameters from the World Ocean Atlas,

(7) Atlantic Seabed Mapping International Working Group data resources,

(8) National Data sources: covering relevant high impact maritime activities, such as aquaculture, energy production, geological resource extraction and shipping,

(9) Benthic species/habitats in the Bay of Biscay,

(10) Vulnerable Marine Ecosystems database for the (North - and South Atlantic) and

(11) EU Atlas Horizon 2020 Project: Science, Policy and Blue Growth: an Atlantic Assessment.
This contributes to D2.1 and delivers D2.2.

Lead: IFRE, Partners: SANB, MBA, MI, ICES, USTAN , VLIZ, SSBE, UCT, UFSC, IEO Duration: M1-15

Task 2.2 Make Data FAIR
Development of a cost-effective approach for data management and data access enhancement, including cost-effective solutions for data management and quality control & data access, ensuring project data being FAIR - Findable, Accessible, Interoperable, and Re-usable. This task will deliver a Data Management Plan (DMP, D2.1, D2.4) outlining

how the data will be managed throughout the project lifecycle describing the data to be collected, the estimated size and formats, details on how and where the data will be stored, with whom they will be shared and will contain information on the legal and ethical aspects. This should also cover how newly generated data will be processed and archived with assigned responsibilities. Where possible, this will build on DMPs from previous and ongoing relevant projects, e.g. H2020 ATLAS and others. Next to the DMP, this task will also develop guidelines for the data generators, which will contain detailed information on how to make their data FAIR and how to make them available as project output where relevant and feasible, in open access targeted e-infrastructures e.g. GIS-platform & long-term storage in EMODnet. This will include procedures on the assignment of DOI's, how to apply tools specifically developed to make marine data FAIR and how to process new data using international standards and formats. Tools and standards will include - but are not limited to: IMIS, Marine Data Archive, AphiaID (WoRMS), IPT, EMODnet formats, OBIS, SDN, Marine Regions geography & MRGID, BODC Parameter dictionary.

Lead: VLIZ, Partners: SANB, IFRE, AZTI, ICES, MI, MBA, IMAR, SSBE Duration: M1-48

Task 2.3 Demonstration of big data acquisition, storage and analyses
This task will progress beyond the state of the art by additional data preparation, integration and analysis for big environmental dataset. Integrated data will play a large role in the development of big-data techniques to map the benthic (WP4) and pelagic (WP3) ecosystems and related stressors as well as to identify indicators, ecosystem state and thresholds (WP5). Whilst 'novel data' types, such as community vertical depth structure and dynamics, will fill data gaps in models (WP6 and WP7). To identify new data technologies in support of IEA (D2.3), this Task will work on 8 demonstrators (leading partners in parentheses):

Demo I: Application of artificial Intelligence system to benthic image analysis. A system for autonomous detection and identification of animals in seafloor images is developed and demonstrated in association with T4.2 and T4.3 to supporting species distribution modelling.
(Lead UPL)

Demo II: Application assessment of convoluted network models and/or other novel techniques for automated processing of mapping data: Seabed bathymetry and water column data and associated ancillary data will be acquired both opportunistically, and during a collective EU/US/Canadian 2019-2025 effort to cohesively map a pilot area in the Atlantic, as an output of the ASMIWG collaboration. Data will be processed, assimilated and uploaded to existing data archives, and incorporated via Task 2.2. Artificial intelligence will be used for interpretation of seafloor image data and a user friendly interface will be further developed
(Lead MI).

Demo III: Automatic processing of acoustic data for key marine ecological features. Collated active-acoustic data (single frequency and broadband echosounder data) will be processed and biological features (e.g. schools and layers) will be extracted and summarised by a number of key metrics, describing the vertical structure, composition and dynamics (DVM behaviour) of water-column communities. Metrics will be stored and made publicly available
(Lead USTAN).

Demo IV. Smart seafloor imaging for seafloor characterization and ground truthing. A new ultra-low power imaging system combined with an adaptive energy optimized image collection method suitable for underwater gliders is developed and demonstrated in WP4. The system will exploit recent increases in efficiencies in LED based lighting solutions and the availability of higher resolution low-light imaging sensors. The objective is to build, test and evaluate an external strap-on imaging payload suitable for underwater gliders. The adaptive imaging altimetry data to derive backscatter information of the surrounding water as well as distance information from the bottom will guide the adaptive sampling protocol of the glider. In WP4 the system is used to provide the means to ground truth existing ship-based acoustic seafloor characterizations. This demonstration will provide inside into the potential and feasibility of long-endurance (weeks to months) glider-based seafloor image acquisition.
(Lead UBH, PLOC, MROB).

Demo V. Image analyses of 40 years of biodiversity data from LTER station. Cold Cape (Cabo Frio upwelling system) has an harmonic seasonal rhythm in plankton phenology. Using a set of well-preserved samples (1µm to 50mm meshes) a biodiversity/biomass record is derived developing new technologies combining cytometry, micro-imagery, and artificial intelligence to provide high-quality data for WP5 to assess ecosystem status, trends and disruption in ecosystem resilience, linked to local and general circulation processes
(Lead: UFSC, DTU).

Demo VI: Machine learning toolbox for ecosystem assessment. An R-TOOLBOX will comprise a hands-on tutorial in the software R which will include an example data set, as well as all the code needed to run the various statistical tools and methods applied in WP5. As part of the European Research Infrastructure LifeWatch, VLIZ set up a Collaborative

Platform hosting an RStudio server. Using this RStudio server, WP5 can perform additional analyses on the data, by writing and using their own custom R scripts.
(Lead DTU)

Demo VII: Advancing the European Tracking Network Database (ETN), by targeting data-storage and satellite telemetry. ETN for aquatic animals was set up in the framework of AtlantOS, with the objective to ensure the transition from loosely-coordinated set of existing regional telemetry initiatives, to an integrated Pan-European biotelemetry network which so far has focussed its integration efforts on acoustic telemetry
(Lead VLIZ, IMAR).

Demo VIII: Vulnerable Marine Ecosystem (VME) database for the South and North Atlantic: based on the North Atlantic version developed by the ICES Working Group on Deepwater Ecology (WGDEC) and managed by the ICES Secretariat - on to the South Atlantic. ICES have developed tools and guidance for use of the North Atlantic VME database that can directly be transferred to the South Atlantic. Specifically, WGDEC has developed a spatial mapping and weighting system that uses data on the distribution of VME indicator species in recommending areas for fisheries closures. In this sub-task, these tools and the database will be extended to include the South Atlantic.
(Lead ICES, UPL)

Lead: USTAN , Partners: MI, VLIZ, IMAR, MBA, AZTI, IEO Duration: M6-42

Participation per Partner

Partner number and short name	WP2 effort
1 - DTU	6.00
3 - AZTI	8.00
5 - MBA	18.00
6 - VLIZ	24.00
12 - USTAN	4.00
14 - IFREMER	22.00
15 - PLOCAN	1.00
16 - IMAR	5.00
17 - UCT	2.00
18 - UFSC	40.00
20 - MI	1.00
21 - IEO	7.00
22 - SSBE	3.00
23 - USP	4.00
24 - ICES	6.00
25 - UPL	6.00
26 - SANBI	8.00
29 - MROB	6.00
30 - UBH	5.00
Total	176.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D2.1	Data Management Plan and guidelines for FAIR outputs	6 - VLIZ	ORDP: Open Research Data Pilot	Public	10
D2.2	Review of available data & gaps for regional Case Studies	14 - IFREMER	Report	Public	15
D2.3	New technologies for big data collection, analyses and storage (R; PU)	12 - USTAN	Report	Public	42
D2.4	Data Management for IEA incl. recommendations to D9.1 Dissemination & Exploitaiton Plan	6 - VLIZ	Report	Public	48

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D2.1 : Data Management Plan and guidelines for FAIR outputs [10]

DMP draft will be delivered in Month 10, however DMP will be a living document updated by VLIZ and output owners at every General Assembly, to better support End-User Advisory Group, Knowledge Transfer Pathways (KTP) development and D9.1 Dissemination & Exploitation Plan.

D2.2 : Review of available data & gaps for regional Case Studies [15]

This provide an advanced catalogue of data using activities in T2.1 and T2.2.

D2.3 : New technologies for big data collection, analyses and storage (R; PU) [42]

This reports on all demonstrators under T2.3 providing guidelines on future technologies supporting IEA

D2.4 : Data Management for IEA incl. recommendations to D9.1 Dissemination & Exploitaiton Plan [48]

Report on data collection and storage activities and Identifies opportunity for knowledge transfer in data management for IEA (Based on all activities in WP2). Where relevant take into account KPI's ourlined in Section 2.2.1 Dissemination & Exploitation, and Deliverable D9.1 Dissemination & Exploitation Plan.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS5	MS2.1. Compilation of a meta-database, based on EMODnet standards	14 - IFREMER	14	Accessible via Zenodo project collection
MS6	MS2.2. Atlantic Geospatial Data Visualization Platform linked to EMODnet	22 - SSBE	40	www in Newsletter
MS7	MS2.3. All relevant Open Access data submitted to	6 - VLIZ	44	www in Newsletter

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
	Marine Data Archive and EMODnet			

Work package number [9]	WP3	Lead beneficiary [10]	3 - AZTI
Work package title	Pelagic Mapping: ecosystem, resources & pressures		
Start month	1	End month	36

Objectives

The goal of WP is to generate 3D information on essential ocean variables (physical, chemical and biological) over the whole water column, as well as to map biodiversity, food provision and pressures over the Atlantic Ocean. Specific objectives are:

- To acquire sufficient spatial and temporal data coverage to enable 3D-mapping of the water column from the surface to deep ocean of key ecosystem components;
- To identify the main Atlantic vertical ecosystem domains, from the surface to the mesopelagic, and linkages between them via diel vertical migration;
- To map the main source of human food provision from the Atlantic and the human pressures on the overall pelagic ecosystem such as fishing, shipping and pollution.

LEADS: Guillem Chust (AZTI) & Andrew Brierly (USTAN)

Description of work and role of partners

WP3 - Pelagic Mapping: ecosystem, resources & pressures [Months: 1-36]
AZTI, DTU, MBA, VLIZ, PML, CLS, USTAN, NOC, IMAR, UCT, UFSC, MI, IEO, USP, SANBI, MROB
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 3.1 Data collection & mapping physical, chemical and biological variables

Subtask 3.1.1 Mapping ecosystem attributes.
Physical and chemical variables compiled in T2.1 are processed to deliver 3D maps over the entire Atlantic Ocean. This will include both (1) low to mid-trophic level biomass distribution (e.g. phytoplankton, zooplankton, squid and fish larvae) from different sources (e.g., satellite-derived products, backscatter from broadband echosounders, ships-of-opportunity) (2) Predator distributions: estimated using remote underwater video (BRUV) and passive acoustic (for cetaceans) surveys, as well as from tagged tuna (data from which will inform habitat use). Decadal habitat maps for trophic, functional (e.g. size spectra), and taxonomic groups, are produced using CPR data for the North Atlantic and combined with LTER data in the South Atlantic (T2.3 Demo V). Data from T3.1.3 are collated and analysed to detect seasonal patterns in DVM over large latitudinal gradients. The task will produce 3D maps of pelagic variables (D3.1) to be used in Tasks 3.2, 3.3 and 3.4.

Lead: MBA, Partners: AZTI, CLS, PML, USTAN , IMAR, VLIZ, UFSC, IEO, UCT; Duration: M1-22

Subtask 3.1.2 Oceanographic surveys. This task will support collection of acoustic and size spectra data from the dedicated oceanographic expedition in Brazil (MS3.2) and from ships-of-opportunity (as compiled in T10.4). The dedicated oceanographic cruise will include pelagic and benthic components (e.g., hydrography, echosounder sampling, benthic imaging) on the shelf and up to the shelf break in CS SBS. New technology including, LOKI, LIDAR systems and AUV/ROV missions with autonomous feature classification and mosaicking will be used. In particular size spectra distributions in the pelagic, and benthic community at the shelf break will be mapped and used for model validation (T6.1.3). The AMT ship of opportunity will be used to collect size-spectra data using machine learning technology and integrated with reanalysis of historical samples (Task 3.1.1) to provide decadal and basin scale maps of variability for validating models (WP6) and providing context for CSs. This task contributes to D3.3.

Lead: UFSC, Partners: IEO, MI, NOC , DTU, IMAR, M6-36

Subtask 3.1.3 WaveGlider™ missions. This task will manage the WaveGlider™ missions including integration of sensors into a custom payload, deployment and recovery operations, piloting, and data storage (with WP2) as well as near real time visualisation services (MS3.4). This latter will be used in combination with WP9 activities for outreach and dissemination. The glider is equipped with a SIMRAD WBT Mini fisheries echosounder and a towed hydrophone. Acoustic data for fish (38 kHz) and zooplankton (333 kHz) are collected with ping rate adapted to local conditions and optimized for disk storage over long-term missions. Two missions are conducted: (A) From the Azores to Ascension Island, following the mid Atlantic Ridge; and (B) From Florianopolis, to Cabo Frio and on to Ascension Island, covering

the South Brazilian Shelf and near offshore areas. Data will contribute to D3.3 and support SEAPODYM validation in WP6.

Lead: MROB, Partners: USTAN , DTU, UFSC, IMAR. M12-36

Task 3.2 Mapping anthropogenic pressures in space and time
In collaboration with WP4 (MS3.2), this task will generate maps of the main anthropogenic pressures in relation to: (A) fishing, shipping, and aquaculture at the overall Atlantic basin scale, and (B) pollution (plastics, river discharges) for North Atlantic and, when possible, South Atlantic. We will use machine learning algorithms for automatic mapping of fishing pressure, breaking impact down to different gear types, and shipping intensity over the Atlantic Ocean based on massive AIS (automatic identification system) data in comparison with official effort data when available. This work will build on ongoing collaborations with EC, FAO, UNs and the NGO Global Fishing Watch. For plastic pollution we will map the distribution of plastics collected in CPR surveys in the North Atlantic and identify source areas and hotspots for these pollutants. For aquaculture pressure, we will collect and map the location and production of aquaculture facilities. For river discharges, we will identify and collect available river discharges data (flow rate and nutrient loads) across the basin (WP3). As part of that, we will work with CS Leaders to ensure we identify and quantify major nutrient inputs from rivers in each CS area (WP1). This task delivers D3.2 (with WP4) and input WP2 to assemble meta-databases and WP6 to enable projection of future state.

Lead: AZTI, Partners: MBA, MI, SANB, IEO, UCT Duration: M1-18

Task 3.3 New biogeography of pelagic biomes
A key element of this WP will be to evaluate the spatial and temporal variability in biome boundaries (MS3.1). Under this Task, we will (1) draw on previous surveys (e.g. CPR, LTER) and on new data (including from WP2 and Tasks 3.1) to create new pelagic biome boundaries and resolve a coherent, 3D bioregionalization of the Atlantic that takes vertical linkages into account (e.g. downward mediation of C flux via diel vertical migration). These new ecoregions will be analysed over a multi-decadal scale to ascertain the sensitivity of these regions to anthropogenic drivers such as climate warming in Task 3.4. We will (2) examine connectedness among key ecosystem communities (plankton and micronekton) through the Atlantic biomes and between 3D ecoregions based on RV Malaspina survey data and oceanographic current modelling, LTER time series, H202 ATLANTOS and T3.1 results. The task will produce new ecoregions for IEA in WP1 (D3.3) and deliver content for WP8, WP9 (MS3.5).

Lead: USTAN , Partners: AZTI, CLS, IMAR, MBA, UFSC, IEO Duration: M6-36

Task 3.4 Fish species distribution and abundance of key species
This task will generate present-day habitat maps for the 30 main commercial Atlantic fish communities (D3.4): 25 small pelagics, coastal and demersal species according to total catch weight in 2017 (FAO, 2019), and main 5 tuna species indicated below. It will also calibrate dynamic population models for projecting distribution and abundance of these fishes under climate change scenarios (in WP6). First, we will use ecological niche-based modelling to map present-state distribution of species. The niche models are based on a statistical tool that will use oceano-climatological data produced in WP6 at the present period to infer the habitat preferences of each species, and hence predict their abundance distribution. Second, modelled distributions will be used as input parameters for implementing a dynamic bioclimate envelope model with a size#based trophic restriction (SS-DBEM). SS-DBEM will be calibrated in this task to simulate the effects of future climate change in WP6. We will also examine 3D movement for specific migratory species (tuna, mackerel, eels) through Atlantic ecoregions and generate explicit 3D habitats including present nursery areas. The task delivers D3.4 to be used in WP6, WP1 and WP7.

Lead: AZTI, Partners: PML, IMAR, VLIZ, IEO, CLS, UCT Duration: M1-38

Fish / Species names
Tuna species / Albacore, Atlantic bluefin, southern bluefin, bigeye skipjack, yellowfin
Small pelagics and demersal* / Atlantic herring, Blue whiting, Atlantic cod, European pilchard, Atlantic mackerel, Sardinellas, Sandeels, Gulf menhaden, Atlantic chub mackerel, European sprat, Cape horse mackerel, Bonga shad, Argentine hake, Round sardinella, Haddock, Saithe, Capelin, Cape hakes, Southern African anchovy, Atlantic menhaden, Madeiran sardinella, European anchovy, European hake, Atlantic horse mackerel, Greenland halibut

*Main 25 commercial fish species according to total catch weight in 2017 (FAO - Fisheries and Aquaculture Information and Statistics Branch, 2019).

Partner number and short name	WP3 effort
1 - DTU	3.00
3 - AZTI	42.00
5 - MBA	20.00
6 - VLIZ	5.00
7 - PML	6.00
9 - CLS	10.00
12 - USTAN	18.00
13 - NOC	20.00
16 - IMAR	10.00
17 - UCT	2.00
18 - UFSC	81.00
20 - MI	5.00
21 - IEO	10.00
23 - USP	48.00
26 - SANBI	2.00
29 - MROB	15.00
Total	297.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D3.1	3D maps of pelagic physical and chemical components and ecosystem attributes	5 - MBA	Websites, patents filling, etc.	Public	22
D3.2	Maps of present ecosystem pressures (fishing, shipping, pollution)	3 - AZTI	Report	Public	18
D3.3	New biomes boundaries of pelagic ecosystem	12 - USTAN	Report	Public	34
D3.4	Mapping fish distribution of target species	3 - AZTI	Report	Public	36

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D3.1 : 3D maps of pelagic physical and chemical components and ecosystem attributes [22]

Maps in includes data from WP2 and all activities in WP3 (T3.1)

D3.2 : Maps of present ecosystem pressures (fishing, shipping, pollution) [18]

Based on the results of T3.2 and T4.2.4 to be provided to WP6 and WP7, 1 and stored under WP2.

D3.3 : New biomes boundaries of pelagic ecosystem [34]
Report on activities in T3.3 and T3.1.2 and T3.1.3

D3.4 : Mapping fish distribution of target species [36]
Output from task T3.4 to be included and stored under WP2.

Schedule of relevant Milestones

Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS8	MS3.1. Protocols established for mapping procedures	12 - USTAN	10	Common protocol agreed
MS9	MS3.2. WP3-WP4 workshop on ecosystem pressures	3 - AZTI	12	Minutes of the meeting available
MS10	MS3.3. Oceanographic cruise in Brazil completed	18 - UFSC	18	Cruise hold news distributed
MS11	MS3.4. WaveGlider missions NS transect and Brazil completed	29 - MROB	24	Data available to WP6
MS12	MS3.5. Training Tutorial content agreed with Task 8.2 Training Programme in IEA	3 - AZTI	38	published in Newsletter/www

Work package number [9]	WP4	Lead beneficiary [10]	20 - MI
Work package title	Benthic Mapping: ecosyst., resources and pressures		
Start month	1	End month	44

Objectives

The goal of this WP is to generate new maps of seafloor characteristics, benthic communities, and VMEs to enable IEAs in CS areas and at the Atlantic basin scale. Specific objectives are:
● Develop a cohesive strategic mapping approach to support IEA through multidisciplinary seafloor bathymetry and benthic habitat data acquisition and dissemination, particularly in data poor regions;
● Describe and characterise the seafloor and benthic communities in specific CS areas;
● Identify key natural environmental drivers and anthropogenic pressures and their impact on the spatial distribution of benthic communities and VMEs;
● Model spatial distribution of benthic communities and VMEs under present and future environmental regimes to underpin Atlantic basin scale and CS IEAs.

LEADS: Thomas Furey (MI) & Paal Mortensen (IMR)

Description of work and role of partners

WP4 - Benthic Mapping: ecosyst., resources and pressures [Months: 1-44]
MI, DTU, IMR, PLOCAN, UFSC, MFRI, IEO, USP, UPL, SANBI, MUN, UBH
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 4.1 Strategic framework for Atlantic Bathymetry & Benthic Habitat Mapping for IEA

Through collaboration with ongoing international seabed mapping networks and initiatives including the All AtlaNtic Cooperation for Ocean Research and innovation (AANChOR), ASMIWG, Seabed 2030, EurofleetsPlus, ASPIRE, and seagoing campaigns within concurrent Horizon 2020 Blue Growth projects, this task will assess and share Atlantic survey operational activities, strategies and plans, and develop an all Atlantic mapping strategy to guide and accelerate future seabed bathymetry and benthic habitat mapping activity, and associated data sharing. The strategy will maximise leveraging of new data in support of IEA, connecting and underpinning regional CS areas. This task delivers D4.1 to be used in T4.2.

Lead: MI, Partners: IMR, UPL, IEO Duration: M1-24

Task 4.2 Seafloor characteristics, benthic communities and their pressures

Subtask 4.2.1 Mapping and modelling benthic communities and seafloor.
This task will create maps of seabed bathymetry, benthic habitat, selected VME species and characteristics of benthic species assemblages, to underpin IEA and ecological modelling (Task 4.3, WPs 5, 6, 7). The development of novel species distribution and habitat suitability models involves collation of existing bathymetric and species / habitats datasets (undertaken in T2.1) as well as spatial environmental data derived from oceanographic models at basin scales for pan-Atlantic scale models (MS4.1) and regional scales, implemented in WP6, for case study areas (South Brazilian shelf, Benguela Current, Mid Atlantic Ridges and Celtic Sea, MS4.2). T4.2 outputs will be strengthened and augmented by novel data acquired from the application of AI to interpret archived seafloor image data as part of DEMO I under T2.3. This task delivers D4.2 to be used in T1.3.

Lead: UPL, Partners: IMR, MI, MFRI, USP, UNH, MUN, SANBI Duration: M1-30

Subtask 4.2.2 Deep glider data collection.
This task manages three deep-glider missions in Azores, Canary and Brazil and provides integration of sensors into a custom strap-on payload, deployment and recovery operations, mission planning, and data storage (with WP2). The underwater glider is equipped with standard oceanographic sensors and an ultra-low power imaging system (DEMO IV). Three two-four week missions at depths between 600 m - 1000 m depth in selected VMEs and hotspot biodiversity areas are envisioned to collect ground truthing data for model validations and new independent data for model evaluation. This task delivers data in T4.2.1 contributing to D4.2 and contribute to the capacity building activity in WP8 and dissemination in WP9.

Lead: UBH, Partners: PLOC, DTU, UPL, SANBI, USP, Duration: M12-48

Subtask 4.2.3 Reef community of Atlantic open ocean islands.
Standardized baseline data of reef fish community structure and benthic cover for all tropical oceanic islands of the South Atlantic (namely Rocas Atoll, Fernando de Noronha, St Peter and St Paul's Archipelago, Trindade, Ascension, São Tomé and Príncipe) will be expanded including data from St Helena. This will contribute to (i) determine spatial heterogeneity of reef communities (ii) quantify variations in functional redundancy and connectivity, as well as vulnerability of fish assemblages to pressures; (iii) modelling scenarios for predicting future states of functional diversity in coral reef fish considering climate change. This task delivers information to be included in D4.2 and D5.2.

Lead: UFSC, Participants: DTU, UPL, USP Duration: 12-36

Subtask 4.2.4 Maps of pressures on bottom communities:
This task will generate maps of pressures on benthic communities and VMEs due to bottom fishing, oil exploitation, seabed litter, telecommunication, scientific exploration, and seabed minerals in selected CS areas. This activity will engage with stakeholders to communicate data requirements for quantifying anthropogenic pressures, establish methodologies and protocols for data sharing, and centralize relevant information and data, and identify gaps. A GIS based assessment will determine the extent of anthropogenic pressures mentioned above, including high seas mineral exploration licensing. Mapping outputs will contribute to WP2 and augment existing international resources and portals on anthropogenic pressures, including EMODnet Human Activities. This task delivers information to be included in D3.2 (M4.3).

Lead: SANB, Partners: UPL, IMR, MI, MFRI, UFSC, UNH, MUN, Duration: M1-30

Task 4.3 Future distribution of benthic communities and biodiversity
T4.3 will use broad-scale benthic habitat models developed in T4.2 (using contemporary oceanographic data), to predict spatial distributions of selected species and assemblages under different climate change scenarios by forcing benthic habitat models (developed in T4.2) onto future environmental conditions using scenarios from WP6 for climate change and ocean-acidification. This will include predicted changes in temperature, salinity, dissolved oxygen concentration, POC flux, and aragonite saturation depth, and will result in the production of maps of future habitat suitability. Spatial outputs of both contemporary and future models will be overlain to quantify and map potential range shifts for species, assemblage and biodiversity (MS4.4). This task delivers D4.3 to inform WP1 and WP7 for incorporation into IEA assessment and development of management options.

Lead: IMR, Partners: MFRI, UPL, SANBI Duration: M20-44

Participation per Partner

Partner number and short name	WP4 effort
1 - DTU	2.00
4 - IMR	22.00
15 - PLOCAN	4.00
18 - UFSC	25.00
19 - MFRI	8.00
20 - MI	18.00
21 - IEO	6.00
23 - USP	46.00
25 - UPL	22.00
26 - SANBI	19.00
27 - MUN	8.00
30 - UBH	14.00
Total	194.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D4.1	Framework for future Atlantic cooperation on seafloor mapping efforts & prioritisation of seabed targets for IEA	20 - MI	Report	Public	18
D4.2	Seafloor characteristics and benthic communities across the Atlantic	25 - UPL	Report	Public	26
D4.3	Changes in distribution of VME communities as a result of climate change and ocean-acidification	4 - IMR	Report	Public	44

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D4.1 : Framework for future Atlantic cooperation on seafloor mapping efforts & prioritisation of seabed targets for IEA [18]

Report from Task 4.1 including input from the All Atlantic Panel and consodering T10.4 activities under the clustering task

D4.2 : Seafloor characteristics and benthic communities across the Atlantic [26]

This includes activity reports under T4.2.1, T4.2.2, T4.2.3 and be included in WP2 catalogue

D4.3 : Changes in distribution of VME communities as a result of climate change and ocean-acidification [44]

Based on T4.3 to be used in WP6 and WP7

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS13	MS4.1. Broad basin scale resolution (≥1km grid cell size) habitat suitability models and output layers to WP2	25 - UPL	24	Output is FAIR on Zenodo project collection
MS14	MS4.2. High resolution (<200m grid cell size) habitat suitability models and output layers to WP2 in selected CS areas	25 - UPL	24	Output is FAIR on Zenodo project collection
MS15	MS4.3. Joint WP3-WP4 workshop Maps of pressures	20 - MI	26	Maps of pressures
MS16	MS4.4. Low resolution (≥1km grid cell size) basin scale validated ensemble HSM of	4 - IMR	40	Output is FAIR on Zenodo project collection

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
	distribution of species under predicted climate change			
MS17	MS4.5. Training Tutorial content agreed with T8.2 Training Programme for IEA	20 - MI	42	Summary in Newsletter

Work package number [9]	WP5	Lead beneficiary [10]	1 - DTU
Work package title	Assessing state, drivers and tipping points		
Start month	1	End month	30

Objectives

The goal of WP5 assess and compare the status, trends and response dynamics of Atlantic marine ecosystems to cumulative impacts from local, regional and basin-wide drivers and pressures (e.g., climate change, fishing, extreme events).

Specific objectives are:
● To assess and compare the present status, long-term trends and occurrence of potential abrupt transitions in and across Atlantic ecosystems (input to WP1);
● To identify key drivers, characterize their pressure-state relationships, as well as quantify tipping points and main attributes of ecosystem resilience;
● To evaluate and provide key ecosystem indicators and threshold values as input to scenario modeling (WP6) and vulnerability assessment (WP7);
● To provide educational tutorials for analyses of large quantities of environmental data, assessment of ecosystem status, trends, drivers and abrupt transitions (input to WP2 and WP9).

LEADS: Martin Lindegren (DTU) & Saskia Otto (UHAM)

Description of work and role of partners

WP5 - Assessing state, drivers and tipping points [Months: 1-30]
DTU, UHAM, IMR, SU, IMAR, UCT, UFSC, MI, IEO, USP, SANBI, WMU
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 5.1 Assessing ecosystem status, trends and abrupt transitions

This task will assess and compare the status, trends and occurrence of abrupt transitions in Atlantic ecosystems based on the available data on key ecological variables in each CS area (MS5.1). Multivariate statistics (e.g., Dynamic Factor Analysis, Product Tensor Decomposition) will be applied to extract the dominant modes of variability (i.e., the first dimensions), here considered as aggregate "ecosystem state" variables. We will then compare the status and trends in these ecosystem state variables, as well individual biotic variables across regions. Finally, we will identify and compare abrupt transitions in these variables across CS, using a suit of breakpoint detection algorithms and deliver information to WP7 for risk analyses (MS5.2).

Lead: DTU, Partners: UHAM, CS Leaders Duration: M1-12

Task 5.2 Identifying key ecosystem drivers, cumulative impacts, tipping points

This task will identify and compare the key drivers of ecosystem state and dynamics (e.g., fishing from, warming, acidification, eutrophication and pollution) at Atlantic basin scale and in each CS based on available simulated and observational data reflecting local, regional and basin-wide pressures in each CS areas and the entire Atlantic. These pressures are identified and compiled at the Atlantic scale and in each CS using ecological model results from WP6 (warming, eutrophication, acidification), fishing pressure compilation in WP3 and WP4, and available observations in CS areas on pollution compiled in WP1, WP2. Using indicators of ecosystem state (from T5.1 and simulated in WP6) we will develop and apply (A) multi-model statistical inference approaches to investigate cumulative impacts of multiple drivers (i.e., additive, synergistic or antagonistic) and characterize the resulting driver-response relationships (i.e., linear, abrupt or discontinuous). In case a discontinuous response is detected, we will identify tipping points and compare the estimated threshold values across drivers, response variables and case study areas (MS5.3); (B) develop and apply supervised Artificial Neural Networks (ANNs) to establish the ability of simulated and observed drivers of ecosystem state indicators for predicting ecosystem stability tipping points for the whole Atlantic. These will deliver D5.1 and inform risk assessment in WP.

Lead: DTU, Partners: UHAM, SU, SANBI, CS Leaders Duration: M10-22

Task 5.3 Assessing resilience attributes and early-warning signals of regime shifts

This task will assess and compare the key attributes promoting ecological resilience in each case study area, using a trait-based approach. Specifically, the available data on species abundances and traits are used (provided by WP2-4) to quantify the degree of functional redundancy (i.e., the number of species per functional group) and response diversity (i.e., the variation in responses to environmental change by species within a functional group) across trophic levels. The primary focus is on fish communities across the Atlantic basin including open ocean islands (from T4.2.3). Spatio-temporal scales at which functional trait attributes operate and overlap are identified using discontinuity analysis, while early-warning indicators of critical transitions are identified (e.g. using variance and autocorrelation analyses) in the overall abundances/biomass of the functional groups previously identified. This delivers D5.2 contributing to D1.2 in WP1 and risk assessment in WP7.

Lead: DTU, Partners: UFSC, WMU, IEO, SANB, UHAM Duration: M1-24

Task 5.4 Developing suites of ecosystem indicators and threshold levels for ecosystem-based management
This task will make use of the results from previous tasks to identify core ecosystem indicators and thresholds (D5.3) to be used within the following steps of the IEA (in WP6 and WP7). Focus will be given to selecting a suite of indicators that are sensitive to stressors, have known and specific response to a given disturbance, and are easy to measure and are applicable across CS areas. A standard method for testing indicators will be applied and extended with Signal Detection Theory, as well as probabilistic sensitivity analysis to quantify the level of uncertainty associated with the indicator-based prediction (i.e. using Monte Carlo Simulations). To enhance the management applicability, threshold levels will be established for each core indicator based on approaches applied in Task 5.2. Such threshold levels help interpreting changes in the intensities of human and environmental pressures and making more informed assessments of when and under what conditions intervention, preparation, and mitigation may enhance progress toward ecosystem-based management goals. The tools of the multimodal inference approach will be added to the tutorial and will be implemented into a new and open-source indicator evaluation software (R package 'INDperform') integrated in EMODNET (DEMO VI).

Lead: UHAM, Partners: CS Leaders, DTU, SU, SANBI Duration: M16-30

Participation per Partner

Partner number and short name	WP5 effort
1 - DTU	24.00
2 - UHAM	16.00
4 - IMR	12.00
10 - SU	5.00
16 - IMAR	16.00
17 - UCT	2.00
18 - UFSC	74.00
20 - MI	4.00
21 - IEO	16.00
23 - USP	46.00
26 - SANBI	23.00
31 - WMU	1.00
Total	239.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D5.1	State, drivers, cumulative impacts and tipping points indicators	1 - DTU	Report	Public	22
D5.2	Attributes of resilience and early warning indicators	2 - UHAM	Report	Public	24
D5.3	Key indicators & threshold for risk assessment	1 - DTU	Report	Public	28

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D5.1 : State, drivers, cumulative impacts and tipping points indicators [22]

Reporting on results and activities under T5.1 and T5.2

D5.2 : Attributes of resilience and early warning indicators [24]

Report on results generated under T5.3 with input from T4.2.3

D5.3 : Key indicators & threshold for risk assessment [28]

Results from T5.4

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS18	MS5.1. CS Hand-on workshop on data analysis & methods used in WP5.1	1 - DTU	6	Summary in Newsletter
MS19	MS5.2. State, trends & transitions delivered to Task 5.2, WP1, 7	1 - DTU	12	Summary in Newsletter
MS20	MS5.3. CS Hand-on workshop on data analysis & methods used in Task 5.2	26 - SANBI	14	Summary in Newsletter
MS21	MS5.4. Training Tutorial content agreed with T8.2 Training Programme for IEA	1 - DTU	30	Summary in Newsletter

Work package number [9]	WP6	**Lead beneficiary** [10]	7 - PML
Work package title	Dynamics of ecosystem state and resources		
Start month	1	**End month**	42

Objectives

The goal of WP6 is to simulate the past and project the future of physical, chemical and living components of the Atlantic ecosystem to inform IEA activities. Specific objectives are:

- To characterize the hydrodynamics, biogeochemistry and distributions of plankton, benthos and mesopelagic functional guilds, and selected key species across the entire Atlantic basin between 1980 and 2019;
- To project the state of the Atlantic ecosystem until 2070 under different scenarios for socioeconomic development and climate change;
- To deliver food web models for management strategy evaluation in case study regions.

LEADS: Jorn Bruggeman (PML) & Inna Senina (CLS)

Description of work and role of partners

WP6 - Dynamics of ecosystem state and resources [Months: 1-42]
PML, DTU, AZTI, CLS, STRATH, NOC, UFSC, MI
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 6.1 Atlantic ecosystem state and dynamics 1980 - 2019

Subtask 6.1.1 Hydrodynamics and biogeochemistry simulations.
This task will use NEMO-ERSEM to simulate hydrodynamics (NEMO), biogeochemistry, benthos, plankton (ERSEM) at ¼ deg. and 75 depth levels between 1980 and 2019. We will use the ocean component (NEMO) of HADGEM3-GC3.1 (the physical core of the CMIP6 UK Earth System Model), coupled to ERSEM and developed for improved coastal-ocean processes (including tides and riverine nutrients). ERSEM will be coupled to an existing size spectrum representation of higher trophic levels to allow it to respond dynamically to fisheries pressure. The models forced by reanalysis of atmospheric data and pressure maps produced by WPs 1-4.

Lead: PML, Partners: NOC , STRATH Duration: M1-26

Subtask 6.1.2 Simulations of key migratory fish species.
This task will use the basin scale SEAPODYM model to simulate the spatial population dynamics of Atlantic tunas and mackerel species. SEAPODYM will use outputs from NEMO-ERSEM to drive integrated models of mesopelagic prey and the age-structured demography of each target fish species. The species model represents migration, reproduction, growth and mortality due to predation and fishing.

Lead: CLS, Partners: PML, NOC Duration: M1-26

Subtask 6.1.3 Model validation.
Results from T6.1.1 and T6.1.2 will be validated against mapped observational products for a range of physical and biogeochemical variables in the pelagic and benthos (from WPs 2, 3 and 4). Based on validation results, we will implement bias corrections of the hindcasts and future projections (T6.2). This task will deliver D6.1 used in WP1-7. In particular, model results will be used to compute a range of key indicators (WP5) of ecosystem state and sensitivity contributing to T6.4 and T7.3 and present state assessment in WP1.

Lead: PML, Partners: CLS, NOC Duration: M1-26

Task 6.2 Future projections of ecosystem state until 2070
This task will simulate the future states (up to 2070) of the Atlantic ecosystem and migratory fish species under scenarios of societal development (with T1.2.2) and climate change. We will use four scenarios based on contrasting Shared Socioeconomic Pathways (SSPs), translated into specific trajectories for the state of the atmosphere (using existing HADGEM3-GC3.1 outputs for different SSPs) and human pressures, including fisheries and riverine nutrient inputs (T1.2 and T3.2). These scenarios will drive NEMO-ERSEM, resulting in four potential future hydrodynamic and biogeochemical states. These, augmented by scenarios of fisheries management objectives specific to Atlantic tuna and

mackerel, will drive the species specific SEAPODYM model set up in T6.1.2. This task delivers D6.2 to be used in risk assessment (T7.2, T7.3, T7.4) and T1.3 in WP1.

Lead: PML, Partners: CLS, NOC Duration: M12-36

Task 6.3 Management option evaluation framework
This task delivers the model advances and configurations needed to run management option evaluation (MOE) simulations in each of the CS areas (MS6.1). MOE will use the StrathE2E model, which is a coarse spatial and taxonomic representation of end-to-end food web dynamics (nitrogen-nutrients and functional guilds spanning microbes to megafauna) at the scale of each case study region. The initial model is fully documented and available as an R-package, and any developments in the project will be similarly published as open-source, plus an online version as an R-Shiny application (T9.1). The boundary condition data needed for each CS implementation of StrathE2E will be extracted from the hindcast and future projection outputs from NEMO-ERSEM (T6.1, T6.2), plus additional driving data on e.g. anthropogenic nutrient inputs and fishing gear activity rates from other sources (WP2, 3). Each CS implementation will be fitted to observational data assembled in WP 2-4 by computational parameter optimisation, and validated against independent data not used in the optimisation process. Configuration files for each of the CS models will be published as open source for plug-in to the StrathE2E R-package, and available from a drop-down list in the Shiny-app. This task contributes to T7.3; T7.4 and WP9 webtools.

Lead: STRATH, Partners: CS Leaders; Duration: M6-36

Task 6.4 Variability, trends and connectivity at different scales

Subtask 6.4.1 Cross-scale pressure analyses. This task will analyse outputs from NEMO-ERSEM to assess how ecosystem drivers (e.g. temperature, stratification, circulation, oxygen, primary production and pH) vary at scales from CS areas, through biogeochemical provinces defined in WP3, to basin scale out to 2070. The role of the Atlantic upwelling systems (e.g., Brazil, Benguela, Canary) in driving productivity export and community structure over the shelf is investigated here. Climatic variations and trends will be set in the context of natural variability and related to global scale atmospheric and oceanic drivers to inform the whole Atlantic IEA in T1.3, thus delivering D6.3.

Lead: PML, Partners: NOC, UFSC Duration: M30-42

Subtask 6.4.2 Basin-scale connectivity. This task will determine connectivity between all CS areas and biogeochemical provinces due to ocean currents and propagule dispersion. It will employ a Lagrangian approach driven by NEMO currents from T6.1 and T6.2 to track the fate of particles entering the Atlantic basin at the mouths of major rivers as well as from known areas of higher trophic level significance (e.g. spawning areas). It will characterize migration dynamics of charismatic species across the Atlantic (e.g., whales, tunas) from a combination of SEAPODYM outputs (T6.1 and T6.2) and ETN data (Task 2.3.2). This task contributes to D6.3 and provides far-field effects in CS area to inform IEA analysis under T1.3.

Lead: DTU, Partners: PML, CLS, UFSC, MI Duration: M12-42

Subtask 6.4.3 Climate extremes and early warning systems. Climate extremes (e.g. marine heatwaves, sudden changes in ocean circulation) have major impacts on marine ecosystems and human communities. Specific predictive tools (for ecosystem and climate services) will be co-designed with relevant stakeholders (from WP1,9) and developed using existing seasonal-to-decadal forecast systems (e.g. Copernicus Climate Change Service, WCRP Decadal Prediction Project) and products from WP3, WP4, WP6 and via clustering with other projects funded in H2020. The aim is to support adaptation, mitigation and disaster risk-management at the pan-Atlantic scale, contributing to D6.3 and the IEAs synthesis in T1.3.

Lead: DTU, Partners: AZTI, PML Duration: M12-42,

Participation per Partner

Partner number and short name	WP6 effort
1 - DTU	30.00
3 - AZTI	3.00
7 - PML	48.00
9 - CLS	24.00

Partner number and short name	WP6 effort
11 - STRATH	17.00
13 - NOC	20.00
18 - UFSC	22.00
20 - MI	9.00
Total	173.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D6.1	Validated hindcast simulations 1980-2019 (NEMO-ERSEM & SEAPODYM)	7 - PML	Report	Public	26
D6.2	2020-2070 Future Projections (NEMO-ERSEM & SEAPODYM)	7 - PML	Report	Public	36
D6.3	Drivers, connectivity and extreme events at different scales	13 - NOC	Report	Public	42

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D6.1 : Validated hindcast simulations 1980-2019 (NEMO-ERSEM & SEAPODYM) [26]

Present state run with all models and validation (Task T6.1)

D6.2 : 2020-2070 Future Projections (NEMO-ERSEM & SEAPODYM) [36]

Follow up from T6.1 including 4 future climate scenarios.

D6.3 : Drivers, connectivity and extreme events at different scales [42]

Critical analyses of model results under Task T6.4

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS22	MS6.1. End-to-end model configurations per Case Study (StrathE2E)	11 - STRATH	36	Models available to run Management Option Evaluations
MS23	MS6.2. Training Tutorial content agreed with T8.2 Training Programme for IEA	7 - PML	42	Summary in Newsletter

Work package number [9]	WP7	**Lead beneficiary** [10]	10 - SU
Work package title	Risk Assessment and uncertainties		
Start month	1	**End month**	46

Objectives

WP7 will assess the vulnerability of Atlantic Ocean ecosystems to human activities, climate, and natural hazards using a hierarchical risk assessment framework. The specific objectives are:
- To conduct a holistic qualitative scoping of ecosystem vulnerabilities in all CS;
- To identify the key vulnerabilities and pressure-impact linkage in all CS;
- To conduct in-depth quantitative risk and vulnerability analysis on the key pressure-impact linkage chains in all CS and determine uncertainties and sensitivity of the assessments;
- To conduct management option evaluations under different climate conditions and anthropogenic pressures.

LEADS: Susa Niiranen, (SU) & Mike Heath, (STRATH)

Description of work and role of partners

WP7 - Risk Assessment and uncertainties [Months: 1-46]
SU, DTU, UHAM, AZTI, IMR, PML, STRATH, IMAR, UCT, UFSC, MI, IEO, USP, SANBI
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 7.1 Qualitative risk assessment

Subtask 7.1.1. Preliminary evaluation of existing knowledge.
This task will evaluate existing qualitative data, using literature review, to perform a preliminary screening of the ecosystem pressures caused by climate and anthropogenic activities. Based on these analyses it will be identified where these pressures are likely to result in a risk to ecosystem components and key ecosystem services in all CS. Focus will be given to pressure-impact chains that are closely linked to known ecosystem indicators (including MSFD). This task will also cluster human activities, pressures and ecosystem components to facilitate across case study comparisons and develop a general Atlantic synthesis (T1.3). Critical knowledge and data gaps will be identified. This task contributes to D1.1 with supports and benefits from the scoping in Task 1.2 and Subtask 7.1.2.

Lead: SU, Participants: UHAM, CS Leaders, SANB, Duration: M1-6

Subtask 7.1.2 Identification of regional vulnerabilities.
This task will establish potential linkages between activities, pressures, ecosystem components and ecosystem services to produce a holistic understanding of linkage chains present at each CS. This presence-absence analysis, is the first stage of the risk analysis and will be done, mainly by experts in collaboration with Task 1.2.1. The specific protocol used will be defined in WP1. This task delivers D7.1 including the socio-ecological networks defining linkages that contribute to total ecosystem risk under Task 7.3.

Lead: UHAM, Participants: SU, CS Leaders, SANB, Duration: M3-12

Task 7.2 Semi-quantitative risk assessment

Subtask 7.2.1 Prioritization of regional vulnerabilities. This task scores the linkage chains defined in T7.1 to identify the most significant risks to ecosystems. Experts will be consulted to evaluate the role of risk attributes, which depend on the approach chosen in WP1, but can include (i) Degree of pressure/impact – from small to population to ecosystem level effects (ii) Spatial scale of pressure/impact- from point to global (iii) Temporal scale of pressure/impact- from rare to continuous (iv) Persistence – how long the pressure/impact continues after the activity stops (v) Resilience – how quickly the system recovers after the pressure is removed. The scorings will be analysed to identify regional vulnerability scores and the strengths and interactions of the main regional drivers of change, climate exposure factors as well as quantifying expert certainty in scoring. Based on the results of these analyses narratives of vulnerability of Atlantic ecosystems to climate change and anthropogenic impact will be developed to inform WP5 and 6, as well as tasks in T7.2 and T7.4. This task delivers D7.2.

Lead: SU, Participants: UHAM, SU, CS Leaders, SANB, Duration: M6-22

Subtask 7.2.2 Structure and sensitivity of the socio-ecological networks. This task will build socio-ecological networks based on nodes (actors e.g., economic sectors, groups of species, services) and links (interactions e.g., feeding interactions, information exchange, impacts) identified in 7.1.2. Then centred around the ecosystem service of interest (e.g., climate regulation, food provision, etc.) network metrics will be used to describe critical dependencies and to define direct and indirect effects linking human activities and services. The topological analyses of the networks will provide baseline information on functional redundancy in delivering ecosystem services, thus assessing network resilience to pressures and contributing to D7.2 and D7.3.

Lead: DTU, Partners: SU, STRA, UHAM. Duration: M12-46

Task 7.3 Quantitative risk assessment and uncertainties

Subtask 7.3.1 Risk assessment on key vulnerabilities. This subtask will perform in-depth risk assessments for the main vulnerabilities identified in each CS in T7.2. Information produced in WPs 2-6 will be combined using a mixture of quantitative analyses (from WP5), experts' knowledge (WP1, WP9) as well as monitoring data (WP2-WP4) and modelling including future scenarios (WP6). Depending on data available in each CS, tools could include multi-risk analyses, Bayesian belief networks (BBNs), metrics of system dynamics and the further development of supervised and unsupervised Machine Learning tools (e.g. ANN, from WP5). Output from this task will update the regional vulnerability scores (T7.1) delivering D7.3 and contributing to the whole Atlantic assessment in T1.3 and the training (MS7.4).

Lead: SU, Partners: UHAM, DTU, CS Leaders, SANB, PML Duration: M12-36

Subtask 7.3.2 Ensemble modelling and sources of uncertainty. The different models in WP6 and 7.4 produce different outcomes in response to the same driving conditions due to differences in their detail, structure and formulation. This task will create an ensemble of these models using supervised ANNs to deduce the most probable trajectory and uncertainty in predictions to contribute to D7.3. Different ensemble schemes will be developed to assess ecosystem service responses to pressures. Depending on availability in each CS, the output of other regional models (e.g., EwE, Atlantis, NORWECOM) will be included in the analyses. Comparison of ANN predictive capacity by these approaches will allow the development of pressure response envelopes for ecosystem services in each CS relative to individual and multiple stressors.

Lead: DTU, Partners: SU, PML Duration: M24-46

Task 7.4 Management option evaluation
The key purpose of the task is to quantify not only the direct responses of ecosystem components to pressures, but also the indirect responses due to cascading trophic effects (D7.4). Dynamic simulations with the StrathE2E models configured for each CS (delivered by T6.3) will be performed to quantify the magnitude of responses of ecosystem indicators (derived from the model state variables and fluxes e.g. biomasses, diet compositions, fisheries landings and discards) given based on prescribed scenarios of multiple simultaneous anthropogenic pressures (fishing gear activities, seabed disturbance, nutrient inputs, T3.2). Responses will be measured relative to baseline state simulations (e.g. 2010-2020 climate and human activity, or 2050-2060 climate and present-day activity). Anthropogenic pressure scenarios will reflect options for future management of key human activities arising from the IEA task (WP1, T1.2.2). Monte-Carlo-based simulations with the model will be used to provide credible intervals for the simulated ecosystem responses given parameter uncertainty.

Lead: STRATH, Participants: SU, AZTI, CS Leaders, Duration: M18-42

Participation per Partner

Partner number and short name	WP7 effort
1 - DTU	17.00
2 - UHAM	17.00
3 - AZTI	3.00
4 - IMR	12.00
7 - PML	11.00
10 - SU	21.00

Partner number and short name	WP7 effort
11 - STRATH	21.00
16 - IMAR	2.00
17 - UCT	9.00
18 - UFSC	20.00
20 - MI	10.00
21 - IEO	16.00
23 - USP	24.00
26 - SANBI	9.00
Total	192.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D7.1	Qualitative vulnerability assessment of important ecosystem components for each case study	2 - UHAM	Report	Public	12
D7.2	Semi-quantitative vulnerability assessments	10 - SU	Report	Public	22
D7.3	Vulnerability analyses of Atlantic ecosystems under climate change and anthropogenic impacts	1 - DTU	Report	Public	46
D7.4	Management option evaluations under climate change and anthropogenic impacts	11 - STRATH	Report	Public	42

Description of deliverables

D7.1 : Qualitative vulnerability assessment of important ecosystem components for each case study [12]
Report on activities under T7.1.2 integrating knowldge generated in WPs 1,2,3,4,5,6

D7.2 : Semi-quantitative vulnerability assessments [22]
Results generated under all (sub)tasks in T7.2

D7.3 : Vulnerability analyses of Atlantic ecosystems under climate change and anthropogenic impacts [46]
Results generated under all (sub)tasks in T7.3

D7.4 : Management option evaluations under climate change and anthropogenic impacts [42]
Results generated under T7.4

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS24	MS7.1. Literature review completed	10 - SU	6	Deliverable 7.1
MS25	MS7.2. Social-ecological network structures ready	1 - DTU	24	Results ready for T7.2 activities
MS26	MS7.3. Workshop for ensemble modelling assessment with CS leaders	1 - DTU	40	Workshop minutes on website
MS27	MS7.4. Training Tutorial content agreed with T8.2 Training Programme for IEA	10 - SU	46	Summary in newsletter

Work package number [9]	WP8	Lead beneficiary [10]	31 - WMU
Work package title	Building Capacity for the IEA		
Start month	1	End month	52

Objectives

WP8 will improve professional skills and competences across the Atlantic in support of an integrated ecosystem approach to ocean resource management and supporting the implementation of SDGs at regional scale. Specific objectives are:

- Deliver demand driven training and capacity building based on a survey of industry, scientists, managers, practitioners, ocean governance professionals from the Atlantic region;
- Develop training and professional development opportunities for future blue economy practitioners via e.g., PhD school, mobility program, e-learning platform on IEA;
- Enhance the provision of IEA training in MSC programmes across the Atlantic.

LEADS: Mary Gasalla (USP) & Mary Wisz (WMU)

Description of work and role of partners

WP8 - Building Capacity for the IEA [Months: 1-52]
WMU, DTU, UHAM, IMR, PML, UPO, IFREMER, PLOCAN, IMAR, UFSC, MI, IEO, USP, ICES, AIRC, MROB, UBH
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 8.1 Future human capacity & Learning Objectives for IEA

ICES will hold a dedicated workshop convening ocean stakeholders from industry, policy makers and academia to identify IEA training needs and learning objectives relevant for maritime and ocean practitioners. This will be supplemented by stakeholder interviews (with T9.2.2) and interviews carried out during WP1 regional CS stakeholder workshops. This task works closely to AANCHOR's WP3 on capacity development, including the results of the assessments on capacity development needs. This process will inform the providers of teaching output in WP1-7 about end-user needs needs and will deliver Learning Objectives for each of the key IEA target audiences: researchers, marine resource managers and policy/decision makers (D8.1). The Learning Objectives will structure the on-line training programme in Task 8.2 based on key project outputs.

Lead: WMU, Partners: ICES, DTU, IMR, USP, UBH, UPO Duration: M1-18

Task 8.2 Training Program in IEA

Subtask 8.2.1 Online training course (e-learning) on IEA.
Each WP Leader will provide training content in agreement with WP8. Based on Learning Objectives delivered in T8.1 and the WP Leader-generated content (video, tutorial, quiz, software, dataset), the online training package will be made publically available and will be focused on key WP deliverables and lessons learned on IEA operationalisation. training material from partners, will be disseminated via online distribution platforms (e.g COURSERA). Target groups for learning materials are: MPA managers, MS Planners, Marine Resource Managers, Conservationists, local, national and regional Policy Makers, Industrial groups on biotech, marine technologies, fisheries and aquaculture. Key learning materials produced will include a e.g.: (a) Integrated assessment approaches in the Atlantic (from D1.2) (b) Big data analyses from EMODnet Geoportal (from D2.3) (c) Data collection with wavegliders (d) Habitat mapping and Identification of biomes (based on D3.3 & D4.2) (e) Seabed Mapping for IEA (based on D4.1) (f) Scenarios Modelling of Management Relevance (from D6.3) (g) Ecosystem Risks & Vulnerabilities (from D7.2).

Lead: ICES, Partners: DTU, UHAM, IMR, PML, UPO, IFRE, PLOC, IMAR, UFSC, MI, IEO, USP, MROB, UBH, WMU Duration: M18-58

Subtask 8.2.2 All Atlantic master program on IEA. A special training line "Mission Atlantic scholarship" will be established at the World Maritime University (WMU, Partner 33). Notably this program will be for MSC students and recent graduates from the countries bordering the Atlantic (especially non-Mission Atlantic developing countries) which could be supported by our mobility programme (T8.3.1). The MSC program will be part of the existing WMU master

training courses, and will serve as a platform to deliver the latest IEA research and lessons learned to potential long-term end-users and practitioners.

The pool of past/current WMU MSC students who currently hold high-impact positions in African and Caribbean countries will be contacted to promote the application of IEA in their countries. Interactions with the AANCHOR's All-Atlantic Ocean Youth Ambassadors Programme (a network of early career researchers and professionals engaged in Atlantic science-policy efforts) will be explored. Students involved via the PhD school (T8.3.2) will contribute to this task via IEA mentoring together with their supervisors.
Results from these tasks will contribute to impact measure in D9.5 (MS8.6)

Lead: WMU, Partners: DTU, USP, AIRC, UPO, IEO Duration: M12-58

Task 8.3 Mobility & PhD Network to enable IEA

Subtask 8.3.1 Mobility programme. Two Mobility Calls (MS8.2, MS8.5) will be open to students, researchers, technicians and marine environment and resource management professionals across the Atlantic states.

Awardees will be hosted at MISSION ATLANTIC partner institutes for approx. 6 weeks, with a special focus on supporting "Mission Atlantic scholarship" in T8.2. and the All-Atlantic Ocean Youth Ambassadors Programme (launched at the All Atlantic Ocean Research FORUM, 6-7 Feb 2020).

Selection Criteria will be outlined by Exec. Board, and selection of applicants performed based on best complimentarity of CVs and research/learning objectives & personal motivation to MISSION ATLANTIC key deliverables and end-user outputs, as well as supporting capacity building and knowledge transfer to the Global South on the topic of Integrated Ecosystem Assessment (IEA) implementation.

Funding for the Mobility Programme (160.000 EUR) is held by P8 UPO. The cost model of the mobility program will be based on the US Fulbright Specialist Program (https://fulbrightspecialist.worldlearning.org/eligibility-host-institutions/), supporting applicants with direct costs at MISSION ATLANTIC hosting partner institutions (travel,accommodation costs, sustainance costs, but except personnel salary costs) for approx. 6 week mobility period, to engage with and be hosted by, MISSION ATLANTIC partners in the EU. Individual grants are estimated at +/- 500 EUR for flights, and 3.000-3.500 EUR for 6 weeks accommodation & sustenance costs.

Outcome of the task will be to strengthen MISSION ATLANTIC collaboration with Global South on IEA research, and inform Dissemination & Exploitation Strategy (D9.1) with respect to specific end-users that can assist with MISSION ATLANTIC Exploitation Phase (Months 48-60) in transforming project knowledge to "fit for purpose" outputs for practicing professionals (Subtask 9.3.2 Adaptive exploitation measures).

Lead: DTU, Partners: UPO, USP, AIRC, WMU Duration: M12-52

Subtask 8.3.2 PhD programme. This task will manage the North-East-West-South (NEWS) Doctoral Programme to cluster and co-fund PhD fellowships hosted at Project partner Graduate Schools on MISSION ATLANTIC research priorities. The task will be used to strengthen collaboration and transfer know-how along north-south Atlantic (Belém Statement), east-west (Galway Statement) and research-public sector axis.

MISSION ATLANTIC will internally fund joint PhD fellowships based on funding to Partners UFSC (144MM), USP (36MM), SANBI (24MM) , UHAM (36MM) , AZTI (11MM) , IMAR (12MM), DTU (12MM) and linking with the recently launched All-Atlantic Ocean Youth Ambassadors Programme, supported by both CSAs: AORA (Galway Statement; GA 652677; 2015-2020) and AANCHOR (Belem Statement; GA 818395; 2018-2022).

In addition, MISSION ATLANTIC partners confirm a small nucleus of potential co-funded fellowships with international collaborators:
(1) Bottom Mapping, Supervised by UNH(USA)-MI-SANBI (Cullen Fellowship, Hosted by MI, Ireland)
(2) Autonomous observation technology, Supervised by NOC - MUN(Canada) - DTU (Hosted by DTU)
(3) IEA, Supervised by UnFlorida(USA)-STRA-UFSC(Brasil) (Hosted by STRATH).

To capitalise on these co-funded fellowships by MISSION ATLANTIC beneficiaries' Graduate Schools, the Project sets up a Reserve Fund of 200.000 EUR held by the Coordinator DTU. The Reserve Fund will be used to match the co-financing of the fellowships above (and seek additional opportunities for co-financing with Graduate Schools in the consortium) to outline research projects aligned with MISSION ATLANTIC research objectives. The Reserve Fund of 200.000 EUR can only be used to compliment EU-based Graduate School fellowship (that correspond to the selection criteria below), and strictly for complementing personnel salary costs of the selected fellows, and travel to MISSION ATLANTIC workshops and project meetings (no other cost categories are eligible).

Selection process (MS8.1, 8.2, 8.5) is performed by the project's Executive Board with priority on:
(1) research relevance to project objectives,
(2) high-potential of co-financing by beneficiaries' Graduate Schools, and
(3) strong co-supervision by EU-N.America-S.Atlantic research team triplets.
Research output will feed directly into and strengthen WP1,3,4,5,6,7 deliverables underpinning IEA operationalisation in WP1 and WP9.

Lead: UPO, Partners: DTU, USP, AIRC, WMU Duration: M12-52

Participation per Partner

Partner number and short name	WP8 effort
1 - DTU	4.00
2 - UHAM	1.00
4 - IMR	1.00
7 - PML	1.00
8 - UPO	2.00
14 - IFREMER	2.00
15 - PLOCAN	1.00
16 - IMAR	2.00
18 - UFSC	4.00
20 - MI	1.00
21 - IEO	2.00
23 - USP	8.00
24 - ICES	8.00
28 - AIRC	4.00
29 - MROB	3.00
30 - UBH	2.00
31 - WMU	6.00
Total	52.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D8.1	Learning Objectives for training on IEA	24 - ICES	Report	Public	18
D8.2	Online IEA Training Course and teaching material	24 - ICES	Websites, patents filling, etc.	Public	52

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D8.1 : Learning Objectives for training on IEA [18]

From Task T8.1 to be used in WP9

D8.2 : Online IEA Training Course and teaching material [52]

All material available on the website

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS28	MS8.1. PhD Fellowships Call for co-funded Atlantic fellowships	1 - DTU	10	published in Newsletter, website, social media
MS29	MS8.2. Mobility Call I (10 fellows)	8 - UPO	18	published in Newsletter; ensure that Mobility Call Selection Criteria is aligned with indicative KPI's outlined in 2.2.1 Dissemination & Exploitaiton Strategy, and D9.1 Dissemination & Exploitation Plan
MS30	MS8.3. ICES workshop on Learning Objectives	24 - ICES	14	Workshop minutes on website
MS31	MS8.4. Training Program content approved by WP10, 11 & Exec. Board	24 - ICES	36	Minutes of EB meeting
MS32	MS8.5. Mobility Call II (10 fellows)	8 - UPO	36	published in Newsletter; ensure that Mobility Call Selection Criteria is aligned with indicative KPI's outlined in 2.2.1 Dissemination & Exploitaiton Strategy, and D9.1 Dissemination & Exploitation Plan
MS33	MS8.6. Metrics of impacts provided to D9.5	31 - WMU	58	Data available on the website; ; ensure that input is aligned with indicative KPI's outlined in 2.2.1 Dissemination & Exploitaiton Strategy, and D9.1 Dissemination & Exploitation Plan

Work package number [9]	WP9	**Lead beneficiary** [10]	8 - UPO
Work package title	Societal Engagement & Communication		
Start month	1	**End month**	60

Objectives

WP will ensure results, activities and knowledge generated in the project are effectively communicated, disseminated and transferred to end-users leading to effective exploitation for maximum impact. Specific objectives are to:
● Implement, integrate and evolve the Dissemination and Exploitation Plan to facilitate effective communication and knowledge transfer;
● Increase ocean awareness and ensure alignment of project results to the needs of key target users;
● Establish a multidisciplinary international stakeholder platform on IEA to empower co-design of research output products;
● Strengthen science-diplomacy in ocean governance mechanisms across the Atlantic, focusing on the implementation of the targets of the Sustainable Development Goals (SDGs);
● Exploit project results to integrate Mission Atlantic into the wider landscape of Atlantic and international projects, policy and ocean governance.

LEADS: Isabel Sousa-Pinto (UPO) & David Murphy (INTRIGO)

Description of work and role of partners

WP9 - Societal Engagement & Communication [Months: 1-60]
UPO, DTU, UHAM, AZTI, IMR, MBA, PML, CLS, STRATH, NOC, IFREMER, PLOCAN, IMAR, UCT, UFSC, MI, IEO, SSBE, USP, ICES, SANBI, AIRC, WMU, INTRIGO
CS Leader partners: IMR (P4), IMAR (P16), UCT (P17), UFSC (P18), MI (P20), IEO (P21), USP (P23).
In agreement with Table 1.1 Case Study overview

Task 9.1 Communication and Dissemination

Subtask 9.1.1 Dissemination and exploitation plan.
The Dissemination and Exploitation Plan (DEP) and the communication strategy are delivered in this task (D9.1) and revised at regular periods (MS9.1). Project communication will encompass a range of ongoing actions engaging the full partnership throughout the duration of the project (draft plan in section 2.2). Strong branding will be established early in the project and will form the basis of a robust communications toolkit including logo, style guidelines, website, factsheets, posters, infographics, and a slide deck. Short videos and animations on the technical outputs will also be developed and disseminated; production of the videos will be closely linked with the e-learning & training developed in WP8. Broad spectrum outreach activities across a range of platforms including e-newsletters (e.g., three per year), social and traditional media, science blogs, and participation at events will be complemented by proactive strategic communication of specific knowledge outputs to targeted end-users. An effort will be made to integrate the work of the project with UN Decade of Ocean Science and with established ocean literacy projects and platforms. Close linkages with the UNESCO IOC and its Ocean Literacy Portal and initiatives that already exist with members of the consortium will be exploited. Project communication will be in accordance with EC best practice communication guidelines. The portfolio of communication assets will be transferred to CS leaders who will act as ambassadors of MISSION ATLANTIC at regional level (D9.2).

Lead partner: UPO, Partners: CS leaders, DTU, INTRIGO, UHAM, AZTI, PML, IMR, CLS, STRATH, IFREMER, SANBI, ICES, NOC Duration: M1-60

Subtask 9.1.2 Website.
A project website is established and maintained in this task to help IEAs operations. The website is designed to support the scoping and risk analyses drawing from experiences from other regions (e.g. https://www.integratedecosystemassessment.noaa.gov). Project website will be the primarily platform for interactions of CS leaders with stakeholders and will then include features (e.g. javascript) to run models developed in the project, producing dynamic outputs (T9.1.3). The statistical toolbox developed in WP5 (INDperform) for ecosystem assessment will be linked to EMODnet (WP2) and the output dynamically accessible from the project website. Partner SSBE will contribute to have relevant tools embedded in the EMODnet for an Atlantic Stakeholders Section.

Lead: INTRIGO, Partners: CS leaders, DTU, SSBE, SANBI, Duration: M1-60

Subtask 9.1.3 Web tools:
This task will deliver the MISSION ATLANTIC version of StrathE2E as a web-service so that any user, anywhere with internet access, can run and perform experiments with models for a set of geographic areas. For each geographic domain the app will be configured to deliver a standard baseline model run for a given period of years. The user can then vary the driving parameters of the model to create their own scenario of, e.g. fishing pressures, nutrient inputs. The new model is then run on a server and returns results to the user as datafiles that they can analyse and visualise in their own way, or use plotting tools available in the app.

Lead partner: STRATH, Partners: CS leaders, INTRIGO, DTU, ICES, Duration: M1-60

Task 9.2 Cooperation and Science Diplomacy

Subtask 9.2.1 All Atlantic FORUM. A multi-actor Science-Policy Forum (FORUM) focussing the identified trans-Atlantic research priorities (Galway and Belem statements) will be established at the outset of the project, thorough mapping and engagement processes across the Atlantic basin and at regional scales, in direct collaboration with the BG8A AANCHOR (MS9.1, MS9.3). The main aim of this FORUM will be to tailor the products of MISSION ATLANTIC to the needs of policy development and implementation, especially at the regional, European and International levels. It will target relevant initiatives as the EU Environmental Program and Directives, Regional fora as OSPAR and HELCOM and international as the CBD, IPBES, and others. Results of these interactions will inform T9.1 and the DEP. Members of FORUM will include a range of national authorities and policy makers, trans-Atlantic intergovernmental organizations, experts involved in Galway and Belem Statements implementation, NGOs, scientists from other key projects etc. from different Atlantic regions: Europe, Africa, and the Americas. Early engagement will be made with other H2020 projects to ensure clustering (with T10.3) and minimise duplication of effort and policy-maker's fatigue. Where logistically practical, FORUM will meet back to back with GA and with the End-User Focus group, and further communication will take place virtually, to ensure the engagement of the participants, the appropriate integration of their knowledge in the development of products and the transparency of the process. This Science-policy platform will also be consulted in the development of some tailored products (e.g. policy briefs to contribute to T9.1)

Lead partner: UPO, Partners: WMU, INTRIGO, PLOC, DTU, IFREMER, SSBE, SANBI, ICES, AIRC, CS Leaders. Duration: M1-60

Subtask 9.2.2 Science Diplomacy. This task analyzes the different approaches for science-diplomacy to inform ocean governance on a basin scale for the Atlantic, with a view towards developing recommendations for embedding safeguards in the IEA process that will minimise uncertainties typically arising in the decision making process. Information from different stakeholders will be collected participating in various Atlantic scale stakeholder fora, such as All Atlantic Research Forum in Brussels (2020), South Africa (2021) and Brazil (2022), the Decade of Ocean Science for Sustainable Development general and regionally focussed meetings for the Atlantic (expected 2022), and 2 BBNJ, and AANCHOR expert workshops. The task will evaluate options for the co-creation of IEA decision making tools and indicators through the collaboration of scientists, stakeholders and decisions makers. It will also deliver recommendations for communicating the results of the IEA research back to decision makers and society (T9.3). This task will address issues concerning BBNJ, SDGs and international scientific programmes, such as the ones conducted by the IOC. Additionally, it will analyze the science-policy interface at the national and regional level, where SDG target's implementation is taking place and in interaction with WP1 and WP7 and by delivering information to T8.1 in terms of mobility and training, and user interactions. Finally, this task will deliver D9.3 a risk management protocol for embedding science diplomacy into the IEA process. Task 9.2.2 requires specialized "Text Mining " and "Text Content Analysis " software to convert stakeholder interviews into quantitative datasets. The software is purchase is specific to the Project and the Task.

Lead partner: WMU, Partners: UPO, ICES, AIRC, CS Leaders. Duration: M1-60

Task 9.3 Knowledge Transfer and Impact Measure

Subtask 9.3.1 End-User FOCUS group (EUG). This task will establish an expert group in the project by subcontracting 8 to 10 experts covering industry (e.g. fisheries, aquaculture, insurance), ecosystem managers, advisory groups, NGOs concerned with the Atlantic Ocean. The EUG members will be invited to take part on own resources where possible. Where time/resources are an issue for commitment, high priority EUG members will be contracted (in accordance with GA Article 10 "Purchase of Good & Services") as a Lump Sum service contract of up to 5.000 EUR to offset EUG members time commitment to MISSION ATLANTIC, for 12 full working days (2 days per year in yr1-4, plus 4 days in yr5) to directly advise WP9 on Knowledge Transfer Pathways (KTP) in Task 9.3 Knowledge Transfer and Impact Measure.

EUG will meet once a year and will provide feedback on projects' outputs to achieve "fit-for-purpose" ready for uptake end-products. MISSION ATLANTIC has a memorandum of understanding with several organizations including Marine Stewardship Council, Benguela Current Commission, OSPAR, Ocean Data Alliance (Table 2.1) (cf. Appendix A, Letter of commitment).

A fund of 50.000 EUR held by Coordinator DTU will be used to assist up to 10 EUG members with Lump Sum GA Article 10 contracts. Prioritization of EUG selection will be responsibility of Exec. Board based on candidates capacity and experience with transferring and translating IEA research into policy and management by local/regional end-users.

Outcome of the task is informed steering of Subtask 9.3.2 Adaptive exploitation measures, for "fit for purpose" project outcomes, and optimal end-used uptake and re-use beyond project lifetime.

Lead: DTU, Partners: INTRIGO, WMU, AIRC, UPO, ICES. Duration: M1-M60.

Subtask 9.3.2 Adaptive exploitation measures. Based on the initial DEP (M.6) and its revisions (updated at each reporting period), this task will pool information gathered in all stakeholder engagement workshops (WP1), stakeholder needs mapping on training (T8.1) and the FORUM (T9.2) in order to define Knowledge Transfer Pathways (KTP) of the project's outputs (D9.4), to reach specific end-users among the key target audience groups: scientists, marine resource managers, policy makers, industry. This task requires flexibility and adaptation in the exploitation plan, which contractually will be based on Grant Agreement Article 4.2 'Budget transfers ': The article flexibility for diversion of resources between tasks and partners (in agreement with EC Project Officer).

The Task is lead by the Coordinator, and GA Article 4.2 will be activated by the Exec. Board , EUG (Subtask 9.3.1 End-User FOCUS group) and EC PO of the project in order to allocate reserve funds 100.000 EUR with the objectives, to:
(1) optimize clustering of effort & resources with concurrent Blue Growth projects (Task 10.3),
(2) boost exploitation and uptake of outputs by targeted end-users,
(3) react to emerging stakeholder & end-user needs in 2024 and act on their advice for optimal output transfer into "fit for purpose", operational products.

EUG End-USer Group (cf Letters of Commitment; Task 9.3.1) will advise WP9, Exec.Board and Case Study Leads on implementing FORUM recommendations (Task 9.2) and prioritising tasks & activities for months 48-60 best suited for transforming project outputs and Deliverable D1.2 and D1.3 into "fit-for-purpose" products for end-users.
Reserve Funds of 100.000 EUR are held with the Coordinator DTU, intended to be allocated to full range of cost categories: project beneficiary salaries, travel, other direct costs (according to GA Article 4.2), external service contracts (according to GA Article 10) and subcontracts (GA Article 13) provided that:

• Exec. Board prioritise stakeholder recommendation for "fit for purpose" transformation of outputs, and
• EC PO & FO approve the eligibility of the costs.

A final deliverable (D9.5) will document impact and added value for marine resource managers and decision makers. The precise format and means for capturing and measuring this impact in the 12 months "exploitation phase" of the project will be informed by and ultimately feed into key performance indicator KPI5 (cf. Section 2.2).

Lead partner: DTU, Partners: INTRIGO, ICES, WMU, MI, UPO, SANBI, CS Leaders, Duration: M12-60

Participation per Partner

Partner number and short name	WP9 effort
1 - DTU	4.00
2 - UHAM	1.00
3 - AZTI	3.00
4 - IMR	1.00
5 - MBA	2.00
7 - PML	3.00
8 - UPO	26.00
9 - CLS	1.00

Partner number and short name	WP9 effort
11 - STRATH	7.00
13 - NOC	3.00
14 - IFREMER	2.00
15 - PLOCAN	1.00
16 - IMAR	3.00
17 - UCT	1.00
18 - UFSC	5.00
20 - MI	1.00
21 - IEO	2.00
22 - SSBE	3.00
23 - USP	4.00
24 - ICES	6.00
26 - SANBI	11.00
28 - AIRC	3.00
31 - WMU	23.00
32 - INTRIGO	15.00
Total	131.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D9.1	Dissemination & Exploitation Plan	8 - UPO	Report	Public	6
D9.2	Full Communications Toolkit	32 - INTRIGO	Websites, patents filling, etc.	Public	18
D9.3	Risk management protocol for IEA for policy advice	31 - WMU	Report	Public	36
D9.4	Knowledge Transfer Pathways per main project output (R, PU)	32 - INTRIGO	Report	Public	48
D9.5	Documented Added Value for Env. Managers of IEA tools	1 - DTU	Report	Public	60

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D9.1 : Dissemination & Exploitation Plan [6]

PEDR, Plan for Exploitation & Dissemination of Results, a living document updated for Exec.Board at General Assemblies (Milestones 10.2-10.5). The PEDR will take into account KPI's outlined in Section 2.2.1 Dissemination & Exploitation, and in collaboration with CS break them down to "leading KPI measures" that are actionable and empower CS and Task Leads to implement their activities while gathering direct evidence, data, narratives for Deliverable D9.5.

D9.2 : Full Communications Toolkit [18]

Full Communications Toolkit

D9.3 : Risk management protocol for IEA for policy advice [36]

From T9.2.2 including a draft policy brief to be used under T9.4

D9.4 : Knowledge Transfer Pathways per main project output (R, PU) [48]

KTPs will directly support Steering Committee to prioritise 100k EUR resource distribution in Task 10.3.2 in the remaining 12 months of the project (Exploitation Phase)

D9.5 : Documented Added Value for Env. Managers of IEA tools [60]

Short Executive Summary report to EC, based on measurable impact & added value for specific end-users. Synthesis of progress on all KPIs, stakeholder/end-user testimonials, to be delivered & disseminated in suitable format for Project Communication to non-experts (e.g. "EC Project Highlights") and stakeholder engagement.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS34	MS9.1. DEP revised	8 - UPO	16	DEP drafts updates will be delivered Months 16, 36, 48. Final draft approved by the EB Month 48.
MS35	MS9.2. First FORUM meeteing	8 - UPO	12	Event agenda on www, D10.1
MS36	MS9.3. Webapp for End-to-end simulation	8 - UPO	24	Available on the website
MS37	MS9.4. Second FORUM meeting	1 - DTU	30	Event agenda on www, D10.1
MS38	MS9.5. Exec. Board approval of T9.3 exploitation plan for M48-M60	1 - DTU	45	Minutes of EB meeting

Work package number [9]	WP10	Lead beneficiary [10]	1 - DTU
Work package title	Project Coordination		
Start month	1	End month	60

Objectives

The aim of WP is to facilitate an efficient and timely implementation of the project by establishing proper management procedures, address and handle, project and Consortium issues including effective communication between partners and timely reporting to the Commission. This aim is reached through the following specific objectives:

- Ensure that objectives, tasks, deliverables and milestones are done timely and within the budget;
- Ensure effective communication between the Coordinator, partners and the Commission;
- Ensure timely financial and contractual management;
- Ensure that all challenges and potential conflicts are identified and mitigated in a timely manner;
- Oversee and monitor all ethical issues.

Description of work and role of partners

WP10 - Project Coordination [Months: 1-60]
DTU, AZTI, IMR, VLIZ, PML, UPO, CLS, SU, UCT, UFSC, MI, IEO, UPL, SANBI
Task 10.1 Implementation of management structures
To sustain scientific coordination of the project The Coordinator and the Management Team will work jointly on day-to-day business and currently monitor the progress of activities, task, milestones and deliverables. They will also monitor the expenditures of person months and funds in connection with the financial reporting. The Executive Board, which is composed of the Coordinator and all WP leaders, will meet to assess progress and mitigate any deviation of work plan. In connection with the Executive Board meetings, the WP Leaders will provide the updated reporting on the status of their respective Work Packages. If any deviation of Workplan emerge or any risks are identified, the Executive Board will immediately take adequate measure to mitigate and solve the situation. If necessary, the Coordinator will jointly with the Executive Board make updated of Work plan to be agreed at the Project Board if necessary. The Coordinator will also work with the Advisory Board and Executive Board on the overall scientific implementation and adjust the project to incorporate new relevant policy measures during the course of the project. General issues will be raised at the annual Project Board where the scientific development in each work package will be presented and discussed to ensure communication across these aspects of the project.

Lead partner: DTU. Duration: M1-60

Task 10.2 Communication with partners and the Commission
The Coordinator will currently be in direct contact with all WP leaders to ensure a proper implementation of the project. The management structure will be used to sustain this effort and meetings with the Executive Board (every two month) and Project Board will be the main platform of internal communication. The project intranet establishment and will serve as a platform for communication and upload of data, draft publications etc. The Coordinator will be the sole communication point between the project and the Commission and the Project officer will be invited to attend the annual meeting and other relevant activities. Regular physical and virtual project meetings as well as impromptu meetings will be organized and convened by the Coordinator (see Section 3.2.2). A kick-off meeting will be organized in Gran Canaria at the start of the project to initiate activities and collaboration between all partners. Other three project meetings (with General Assemblies), will occur in M18 (UCT, South Africa), M30 (Brazil), M42 (Lisbon) and M54 (Brussels).

Lead partner: DTU. Duration: M1-60

Task 10.3 Implementation of financial and contractual management
With the assistance of the Management Team, the Coordinator will timely instruct all partners to edit and sign financial statements including keeping an overview of the effort allocated in the reporting periods. The Coordinator will oversee the use of resources measure up with the progress and timing of responsibilities of each partner in the project to ensure that resources are being used in accordance to timing of work plan and allocation of effort. The Coordinator will oversee the financial plan and will be responsible for distributing the funds allocated according to the provisions of the Grant Agreement. The Coordinator will also communicate efficiently and timely concerning financial matters with project partners.

Lead partner: DTU. Duration: M1-60

Task 10.4 Clustering Activities with Concurrent Programs
This task supports synergies across concurrent Atlantic projects to: reduce stakeholder fatigue, coordinate ship of opportunity; enhance dissemination and exploitation activities; align science priorities. In coordination with BG-08-2018 AANCHOR CSA (Coord. Sofia Cordeiro, FCT) and Partners PLOCAN as (WP lead for in AANCHOR CSA) and AIRC, Coordinator will create a All-Atlantic Panel (role and ToR detailed in Section 3.2) made up of project beneficiaries, volunteer experts from the 6 concurrent projects MEESO and SUMMER and BG-08-2018 AORA supporting projects, and concurrent Belmont Forum funded projects (namely SEAVIEW Project through partners UCT and IFREMER), which have strongly overlapping objectives on All Atlantic ecosystem management.

DTU & WP5 Lead Martin Lindegren (DTU) will cluster with H2020 SC5 Climate Mitigation on concurrent funded project ECOTIP with focus on "tipping points".

Additionally, the coordination team and WP11 will engage concurrent projects Leads on Dissemination & Exploitation to join the project key Stakeholder Scoping Workshops in WP2, and the project's annual meetings (T11.2) to align DEP and exploitation strategies, and pool effort and resources to optimize achieving common Expected Impact on end-users of common interest. Partners MI, VLIZ, IEO, DTU, IFREMER as partners in concurrent EUROFLEETS+ infrastructure project, will assist coordinator in optimising on Ships of Opportunity where relevant to the project research objectives (cf Section 1.3.8 Activities at sea ship of opportunity), as well as DFO (Canada) and NOAA (USA) concurrent initiatives to be funded on shared priorities (cf Letter of Support for detailed concurrent initiatives).

Key Performance Indicator (KPI) for the task will be number of joint communication & exploitation products and activities, targeting end-users of common interest. Outcomes of all "clustering" activities will inform the Steering Committee and refine WP9's exploitation strategy.

Lead: DTU, Partners: AZTI, IMR, MI, VLIZ, PML, CLS, SU, IEO, UFSC, UPO, UCT; Duration: M1-60

Task 10.5 Handle conflicts
The Coordinator will carefully observe all potential conflicts both related to partners contractual obligations including scientific delivery. Conflicts will be addressed immediately. Initially they will be addressed on a bilateral basis but if this proves insufficient, an extra Executive Board meeting may be convened to solve the problem. The Executive Board has subsequently the opportunity to present the issue at the Project Board if necessary. The Coordinator will formulate and negotiate a Consortium Agreement with the assistance of the legal office at the DTU describing these measures. This Consortium Agreement will describe all rights and obligations of the partners of the project in detail and also take into account handling of intellectual property rights and managing of innovation issues. All partners will sign the Consortium Agreement before the start of the project.

Lead: DTU. Duration: M1-60

Task 10.6 Ethics requirements
The Coordinator will with the assistance of the Management team oversee that all ethical issues are handled according to national and EU legislation. This includes: 1) detailed information on the procedures for data collection, storage, protection, retention, and destruction. 2) identify consent procedures for the participation of humans, covering the voluntary participation and data protection issues.

Lead: DTU. Duration: M1-60

Participation per Partner

Partner number and short name	WP10 effort
1 - DTU	60.00
3 - AZTI	1.00
4 - IMR	1.00
6 - VLIZ	1.00
7 - PML	1.00
8 - UPO	1.00

Partner number and short name	WP10 effort
9 - CLS	1.00
10 - SU	1.00
17 - UCT	1.00
18 - UFSC	1.00
20 - MI	3.00
21 - IEO	1.00
25 - UPL	3.00
26 - SANBI	1.00
Total	77.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D10.1	Internal IT communication infrastructure	1 - DTU	Websites, patents filling, etc.	Confidential, only for members of the consortium (including the Commission Services)	3

Description of deliverables

All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

D10.1 : Internal IT communication infrastructure [3]

The project intranet establishment and will serve as a platform for communication and upload of data, draft publications etc.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS39	MS10.1. Kick-Off Meeting in Gran Canaria	1 - DTU	2	Event agenda on website
MS40	MS10.2. GA Meeting 1 (South Africa)	1 - DTU	12	Event agenda on website
MS41	MS10.3. GA Meeting 2 (Brasil)	1 - DTU	24	Event agenda on website
MS42	MS10.4. GA Meeting 2 (Lisbon)	1 - DTU	36	Event agenda on website
MS43	MS10.5. GA Meeting 4 (Brussels)	1 - DTU	48	Event agenda on website

Work package number [9]	WP11	Lead beneficiary [10]	1 - DTU
Work package title	Ethics requirements		
Start month	1	End month	60

Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description of work and role of partners

WP11 - Ethics requirements [Months: 1-60]
DTU
This work package sets out the 'ethics requirements' that the project must comply with.

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D11.1	POPD - Requirement No. 1	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.2	A - Requirement No. 2	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.3	NEC - Requirement No. 3	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.4	EPQ - Requirement No. 4	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	4
D11.5	H - Requirement No. 5	1 - DTU	Ethics	Confidential, only for members of the consortium (including the Commission Services)	1

Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D11.1 : POPD - Requirement No. 1 [3]

- The beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO

under the General Data Protection Regulation (GDPR) a detailed data protection policy for the project must be kept on file (to be specified in the grant agreement) and submitted to the Agency upon request. The confirmation for each beneficiary must be submitted as a deliverable. - The beneficiary must explain how all of the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimisation 'principle). This must be submitted as a deliverable. - A description of the technical and organisational measures that will be implemented to safeguard the rights and freedoms of the data subjects/research participants must be submitted as a deliverable. - A description of the security measures that will be implemented to prevent unauthorised access to personal data or the equipment used for processing must be submitted as a deliverable. - Description of the anonymysation/pseudonymisation techniques that will be implemented must be submitted as a deliverable. - In case personal data are transferred from the EU to a non-EU country or international organisation, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be submitted as a deliverable. - In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be submitted as a deliverable. - In case the research involves profiling, the beneficiary must provide explanation how the data subjects will be informed of the existence of the profiling, its possible consequences and how their fundamental rights will be safeguarded. This must be submitted as a deliverable.

D11.2 : A - Requirement No. 2 [3]

- Copies of relevant authorisations for animal experiments (covering also the work with genetically modified animals, if applicable) must be kept on file (to be specified in the grant agreement) and submitted to the Agency upon request. - General information on the nature of the experiments, and the procedures to ensure animal welfare and adherence to the Three Rs principle must be submitted as a deliverable. - If applicable, copies of training certificates/personal licenses of the staff involved in animal experiments must be kept on file (to be specified in the grant agreement) and submitted to the Agency upon request.

D11.3 : NEC - Requirement No. 3 [3]

- Detailed information to demonstrate that fair benefit-sharing arrangements with stakeholders from low and lower-middle income countries are ensured must be submitted as a deliverable. - Details on the materials which will be imported to/exported from the EU must be submitted as a deliverable. - Copies of import/export authorisations, as required by national/EU legislation must be kept on file (to be specified in the grant agreement) and submitted to the Agency upon request. - Detailed information on the measures to minimise the risks to research participants and staff involved in this project must be submitted as a deliverable.

D11.4 : EPQ - Requirement No. 4 [4]

- The applicant must demonstrate that appropriate health and safety procedures conforming to relevant local/ national guidelines/legislation are followed for staff involved in this project. This information must be submitted as a deliverable. - Details on the endangered species and/or protected areas involved in the research, and the measures to minimise the impact of the activities must be submitted as a deliverable.

D11.5 : H - Requirement No. 5 [1]

- The procedures and criteria that will be used to identify/recruit research participants must be submitted as a deliverable. - The informed consent procedures that will be implemented for the participation of humans and in regard to data processing must be submitted as a deliverable. - Templates of the informed consent/assent forms and information sheets covering the voluntary participation and data protection issues (in language and terms intelligible to the participants) must be kept on file (to be specified in the grant agreement) and the English version must be submitted as a deliverable.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

1.3.4. WT4 List of milestones

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS1	MS1.1. Establish TOR for CS network	WP1	4 - IMR	3	Communication to CS Leaders
MS2	MS1.2. Analyses completed for all CS areas for present state assessment	WP1	17 - UCT	24	Workshops held, D1.1 Scoping Synthesis
MS3	MS1.3. All workshops for Management options evaluation completed	WP1	4 - IMR	36	Ecosystem resilience assessed in all CS regions
MS4	MS1.4. D1.3 Table of Content agreed with WP9	WP1	20 - MI	42	Synthesis shapes T9.3 activities
MS5	MS2.1. Compilation of a meta-database, based on EMODnet standards	WP2	14 - IFREMER	14	Accessible via Zenodo project collection
MS6	MS2.2. Atlantic Geospatial Data Visualization Platform linked to EMODnet	WP2	22 - SSBE	40	www in Newsletter
MS7	MS2.3. All relevant Open Access data submitted to Marine Data Archive and EMODnet	WP2	6 - VLIZ	44	www in Newsletter
MS8	MS3.1. Protocols established for mapping procedures	WP3	12 - USTAN	10	Common protocol agreed
MS9	MS3.2. WP3-WP4 workshop on ecosystem pressures	WP3	3 - AZTI	12	Minutes of the meeting available
MS10	MS3.3. Oceanographic cruise in Brazil completed	WP3	18 - UFSC	18	Cruise hold news distributed
MS11	MS3.4. WaveGlider missions NS transect and Brazil completed	WP3	29 - MROB	24	Data available to WP6
MS12	MS3.5. Training Tutorial content agreed with Task 8.2 Training Programme in IEA	WP3	3 - AZTI	38	published in Newsletter/www
MS13	MS4.1. Broad basin scale resolution (≥1km grid cell size) habitat	WP4	25 - UPL	24	Output is FAIR on Zenodo project collection

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
	suitability models and output layers to WP2				
MS14	MS4.2. High resolution (<200m grid cell size) habitat suitability models and output layers to WP2 in selected CS areas	WP4	25 - UPL	24	Output is FAIR on Zenodo project collection
MS15	MS4.3. Joint WP3-WP4 workshop Maps of pressures	WP4	20 - MI	26	Maps of pressures
MS16	MS4.4. Low resolution (≥1km grid cell size) basin scale validated ensemble HSM of distribution of species under predicted climate change	WP4	4 - IMR	40	Output is FAIR on Zenodo project collection
MS17	MS4.5. Training Tutorial content agreed with T8.2 Training Programme for IEA	WP4	20 - MI	42	Summary in Newsletter
MS18	MS5.1. CS Hand-on workshop on data analysis & methods used in WP5.1	WP5	1 - DTU	6	Summary in Newsletter
MS19	MS5.2. State, trends & transitions delivered to Task 5.2, WP1, 7	WP5	1 - DTU	12	Summary in Newsletter
MS20	MS5.3. CS Hand-on workshop on data analysis & methods used in Task 5.2	WP5	26 - SANBI	14	Summary in Newsletter
MS21	MS5.4. Training Tutorial content agreed with T8.2 Training Programme for IEA	WP5	1 - DTU	30	Summary in Newsletter
MS22	MS6.1. End-to-end model configurations per Case Study (StrathE2E)	WP6	11 - STRATH	36	Models available to run Management Option Evaluations
MS23	MS6.2. Training Tutorial content agreed with T8.2 Training Programme for IEA	WP6	7 - PML	42	Summary in Newsletter
MS24	MS7.1. Literature review completed	WP7	10 - SU	6	Deliverable 7.1

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS25	MS7.2. Social-ecological network structures ready	WP7	1 - DTU	24	Results ready for T7.2 activities
MS26	MS7.3. Workshop for ensemble modelling assessment with CS leaders	WP7	1 - DTU	40	Workshop minutes on website
MS27	MS7.4. Training Tutorial content agreed with T8.2 Training Programme for IEA	WP7	10 - SU	46	Summary in newsletter
MS28	MS8.1. PhD Fellowships Call for co-funded Atlantic fellowships	WP8	1 - DTU	10	published in Newsletter, website, social media
MS29	MS8.2. Mobility Call I (10 fellows)	WP8	8 - UPO	18	published in Newsletter; ensure that Mobility Call Selection Criteria is aligned with indicative KPI's outlined in 2.2.1 Dissemination & Exploitaiton Strategy, and D9.1 Dissemination & Exploitation Plan
MS30	MS8.3. ICES workshop on Learning Objectives	WP8	24 - ICES	14	Workshop minutes on website
MS31	MS8.4. Training Program content approved by WP10, 11 & Exec. Board	WP8	24 - ICES	36	Minutes of EB meeting
MS32	MS8.5. Mobility Call II (10 fellows)	WP8	8 - UPO	36	published in Newsletter; ensure that Mobility Call Selection Criteria is aligned with indicative KPI's outlined in 2.2.1 Dissemination & Exploitaiton Strategy, and D9.1 Dissemination & Exploitation Plan
MS33	MS8.6. Metrics of impacts provided to D9.5	WP8	31 - WMU	58	Data available on the website; ; ensure that input is aligned with indicative KPI's outlined in 2.2.1 Dissemination & Exploitaiton Strategy, and D9.1 Dissemination & Exploitation Plan
MS34	MS9.1. DEP revised	WP9	8 - UPO	16	DEP drafts updates will be delivered Months 16, 36, 48. Final draft approved by the EB Month 48.

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS35	MS9.2. First FORUM meeteing	WP9	8 - UPO	12	Event agenda on www, D10.1
MS36	MS9.3. Webapp for End-to-end simulation	WP9	8 - UPO	24	Available on the website
MS37	MS9.4. Second FORUM meeting	WP9	1 - DTU	30	Event agenda on www, D10.1
MS38	MS9.5. Exec. Board approval of T9.3 exploitation plan for M48-M60	WP9	1 - DTU	45	Minutes of EB meeting
MS39	MS10.1. Kick-Off Meeting in Gran Canaria	WP10	1 - DTU	2	Event agenda on website
MS40	MS10.2. GA Meeting 1 (South Africa)	WP10	1 - DTU	12	Event agenda on website
MS41	MS10.3. GA Meeting 2 (Brasil)	WP10	1 - DTU	24	Event agenda on website
MS42	MS10.4. GA Meeting 2 (Lisbon)	WP10	1 - DTU	36	Event agenda on website
MS43	MS10.5. GA Meeting 4 (Brussels)	WP10	1 - DTU	48	Event agenda on website

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	Limited ship-of-opportunity available. Risk level: Medium. Risk magnitude: Medium	WP2, WP3, WP4, WP6	Coordination via EUROFLEET+, and other funded projects under H2020 BG08-B-2018-2020. Several cruises are already planned in iAtlantic and AtlantEco and coordination with them via AANCHOOR will be activated. DTU owns a large scale vessels (e.g., RV Dana, Havfisken, etc.) which could be used to support MA activities in gliders deployment and recovery operations and size spectra analyses.
2	Application for ship in Brazil not successful or delayed. Risk level: Medium. Risk magnitude: Low.	WP2, WP3, WP4, WP6	Application for ship time in Brazil will be managed in Task 3.1. A dedicated subcontract is defined to support data collection in the area. The process requires substantial effort and there is a risk (medium) of delays and a risk (low) of cancellation. Mitigation measurements are the same as for the risk above and the EB will decide on budget relocation to support data collection by other platforms (e.g. extension waveglider missions) and/or activities in other CS areas. Impact on the project is low as other activities at sea are planned in the area (e.g. waveglider mission in WP3, historical data collection in WP2).
3	IEA risk: Definition of conceptual models for pressures, ecosystem components and impacts are delayed in some CS. Risk level: Low. Risk magnitude: High.	WP1, WP5, WP7	WP1 coordinators will support the activities in the problematic CSs and submit modifications to the workplan to the EB
4	IEA risk: Data compilation will be delayed. Risk level: Low. Risk magnitude: Medium	WP1, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Initial analyses start as planned based on data availability. The IEA cycle in some CS could be adapted, by the CS lead, based on the expected finalization of data compilation.
5	IEA risk: Stakeholders show no interest in IEA. Risk level: Medium. Risk magnitude: High.	WP1, WP7, WP8, WP9	AP will coordinate activities with other H2020 projects to develop a revised communication plan in WP8,9 and WP10. CS lead will act regionally to communicate the project, its scope and objectives. Eventually a better alignment of project deliverables and milestones to stakeholder needs is discussed by the EB.
6	IEA risk: Time series analyse prevented because of lack of quality data. Risk level: Medium. Risk magnitude: High.	WP1, WP5, WP6, WP7	Time series analysis can be done with different levels of quality in the data. Approaches using only qualitative (expert judgement) or analytical methods will be used that can work with e.g. missing year – for example Dynamic Factor Analysis
7	IEA risk: 3D hindcast models and forecast end-to-end models are delayed.	WP1, WP6, WP8, WP9	The four scenarios are based on extensive High Performance Computing simulations (CPU-Time). PML infrastructure will be used and the

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
	Risk level: Medium. Risk magnitude: Medium.		project will financially support the effort. An unforeseen event might delay scenario output. EB is responsible to adjust the workplan, to reduce the impact on expected results.
8	IEA risk: Risk and vulnerability assessment delayed. Risk level: Medium. Risk magnitude: Medium.	WP1, WP7, WP9	A set of methods are used ranging from qualitative to fully quantitative. Some of the models (e.g. based on ANN) are entirely new for such analyses and delays in the development might occur. Periodic formal and informal reports on the status of assessment models will be provided by WP7 lead. EB will act timely in case of predicted delays in some of the methods.
9	Technology demonstrators delayed. Risk level: Medium. Risk level: Low.	WP1, WP2, WP3, WP4, WP5, WP9	This will impact schedule of the activities at sea and model validation. Lead of the Demo propose a contingency plan to the EB.
10	Glider missions delayed. Risk level: Low. Risk magnitude: Medium.	WP2, WP3, WP5, WP7, WP8	Lead of Task 3.1.3 (waveglider delayed) and/ or T4.2.2 (deep sea glider delayed) submit a contingency plan for approval of the EB. Workplan modified based on EB decisions and resource re-distributed accordingly.
11	Underestimation of WP costs. Risk level: High. Risk magnitude: Medium.	WP1, WP10, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Participants are experienced in carrying out this type of project and resources have been estimated to deliver the specified objectives. If issues arise, the Coordinator will either reconsider the research plan or seek complementary funding.
12	Delays in deliverables. Risk level: Medium. Risk magnitude: Medium.	WP1, WP10, WP11, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	WP leaders will coordinate and account for all activities via WP specific video conferences and use milestones to assess progress and to ensure that the deliverables are completed according to the project timeline.
13	Lack of impact of project outcomes on achievement of industrial and policy targets. Risk level: Medium. Risk magnitude: Medium.	WP8, WP9	Stakeholder and dissemination activities will be focussed on the identified industry and policy targets as outlined in the Dissemination and Exploitation Plan (Table 2.1). MB members and key stakeholder participants within MISSION ATLANTIC will participate and disseminate project outcomes at industrial and policy relevant meetings and forums.
14	Dissemination and communication activities have a lower impact than expected. Risk level: Low. Risk magnitude: Medium.	WP9	Continuously monitor impact of WP9 activities including CS lead communication tasks. EB acting if needed. T:9.3.2 Knowledge Transfer Pathways (KTP)16 will ensure project's outputs, reach specific end-users in target audience groups: scientists, marine resource managers, policy makers, industry.
15	Lack of overall coordination. Risk level: Low. Risk magnitude: High.	WP1, WP10, WP11, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Effective coordination is ensured by the managerial structure (Section 3.2) and through the project work plan. The Coordination Team has experience in coordinating large EU and national projects.

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
16	Lack of WP coordination. Risk level: Low. Risk magnitude: Medium.	WP1, WP10, WP11, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Primary WP leads have coordination experience in large projects with deputy WP leads for identified in all WPs. In case of unforeseen events impacting the WP coordinator the deputy will take over coordination tasks.
17	Conflicts in the consortium. Risk level: Low. Risk magnitude: High.	WP1, WP10, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	The Executive Board will operate according to section 3.2.4 to solve conflicts, and initiate the action (Task 10.5).
18	Withdrawal of case study prior to or during the project. Risk level: Low. Risk magnitude: Medium.		Since the continuous interactions in WP1 this risk is considered unlikely. Alternatively WP1 lead will identify solutions to carry on the work in the problematic CS and EB will redistribute effort and budget accordingly.

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	Total Person/Months per Participant
1 - DTU	3	6	3	2	24	30	17	4	4	60	✓	153
2 - UHAM	0	0	0	0	16	0	17	1	1	0		35
3 - AZTI	3	8	42	0	0	3	3	0	3	1		63
4 - IMR	7	0	0	22	12	0	12	1	1	1		56
5 - MBA	0	18	20	0	0	0	0	0	2	0		40
6 - VLIZ	0	24	5	0	0	0	0	0	0	1		30
7 - PML	0	0	6	0	0	48	11	1	3	1		70
8 - UPO	1	0	0	0	0	0	0	2	26	1		30
9 - CLS	0	0	10	0	0	24	0	0	1	1		36
10 - SU	5	0	0	0	5	0	21	0	0	1		32
11 - STRATH	0	0	0	0	0	17	21	0	7	0		45
12 - USTAN	0	4	18	0	0	0	0	0	0	0		22
13 - NOC	5	0	20	0	0	20	0	0	3	0		48
14 - IFREMER	0	22	0	0	0	0	0	2	2	0		26
15 - PLOCAN	1	1	0	4	0	0	0	1	1	0		8
16 - IMAR	3	5	10	0	16	0	2	2	3	0		41
17 - UCT	6	2	2	0	2	0	9	0	1	1		23
18 - UFSC	36	40	81	25	74	22	20	4	5	1		308
19 - MFRI	1	0	0	8	0	0	0	0	0	0		9
20 - MI	30	1	5	18	4	9	10	1	1	3		82
21 - IEO	6	7	10	6	16	0	16	2	2	1		66
22 - SSBE	0	3	0	0	0	0	0	0	3	0		6
23 - USP	24	4	48	46	46	0	24	8	4	0		204

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	Total Person/Months per Participant
24 - ICES	0	6	0	0	0	0	0	8	6	0		20
25 - UPL	0	6	0	22	0	0	0	0	0	3		31
26 - SANBI	5	8	2	19	23	0	9	0	11	1		78
27 - MUN	0	0	0	8	0	0	0	0	0	0		8
28 - AIRC	0	0	0	0	0	0	0	4	3	0		7
29 - MROB	0	6	15	0	0	0	0	3	0	0		24
30 - UBH	0	5	0	14	0	0	0	2	0	0		21
31 - WMU	0	0	0	0	1	0	0	6	23	0		30
32 - INTRIGO	0	0	0	0	0	0	0	0	15	0		15
Total Person/Months	136	176	297	194	239	173	192	52	131	77		1667

1.3.7. WT7 Tentative schedule of project reviews

Review number [19]	Tentative timing	Planned venue of review	Comments, if any
RV1	18	To be decided	PLEASE CONTACT YOUR PO 2 MONTHS IN ADVANCE
RV2	36	To be decided	PLEASE CONTACT YOUR PO 2 MONTHS IN ADVANCE
RV3	48	To be decided	PLEASE CONTACT YOUR PO 2 MONTHS IN ADVANCE
RV4	60	To be decided	PLEASE CONTACT YOUR PO 2 MONTHS IN ADVANCE

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Agency). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent fillings, videos, etc.
OTHER	
ETHICS	Ethics requirement
ORDP	Open Research Data Pilot
DATA	data sets, microdata, etc.

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

PU	Public
CO	Confidential, only for members of the consortium (including the Commission Services)
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
EU-CON	Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
EU-SEC	Classified Information: SECRET UE (Commission Decision 2005/444/EC)

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number:MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

VA	if virtual access,
TA-uc	if trans-national access with access costs declared on the basis of unit cost,
TA-ac	if trans-national access with access costs declared as actual costs, and
TA-cb	if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

HISTORY OF CHANGES
to DoA 862 428
Negotiation phase 9 Dec 2019 – 15 April 2020

History of Changes		
Version	**Date**	**Updates**
v1.0	9/12/19	• Original proposal text
v1.1	7/4/2020	Part A: • Partner updates: UKRI replaced by NOC; UNH (USA) changed to "International Collaborator" by own request Part B: • Section 1.3.5.1 Atlantic seagoing missions (age 10-11): activities at sea clarified (as requested in ESR) • Section 2.1.5 (page24) Paragraph added to clarification on technology development (as requested in ESR) • Section 3.1 Fig.8 Gantt Chart includes EC approved Reporting Periods (18,18,12,12M) WP1: included a deliverable for stakeholder activities overview (D1.4) and modified text in T1.1 accordingly (as requested in ESR) WP5: Task 5.2 modified to clarify source of data on the "pressures" (as requested in ESR) WP10, Task 10.6 Ethics requirements (page 52): "1) details on the experiments to be conducted and information on the procedures to ensure animal welfare and adherence to the Three Rs principle" has been deleted as no animals experiments included in proposal • Section 3, Table 3.2b (page 62), risk table, updated (as requested in ESR); Table 3.4b inconsistencies corrected. • Section 3.4.2.1, and Table 3.4a (Page 69, Page74) clarification of effort per CS (as requested in ESR) and allocation effort in WP1, WP3, WP5, WP7 • Section 4.1 Participants: UKRI replaced by NOC, and throughout Sections 1-5 • Section 4.1 Beneficiaries' acronyms and employees names updated (GAP request); • Section 4.2 Third Parties: Article 11 clarification for all Brazilian Beneficiaries and their Third Party Foundations; • Section 5.1 Personal data collection, • Section 5.2 Third Countries have been updates to match GAP • Section 5.4 Environmental Protection & Saftey added • Section 5.5 Working with Animals added Figures: all enlarged for clarity
v1.2	15/4/2020	• Partner 20 MD (Brazil): Excluded from GA due to LEAR Validation issues; • Page 27, Demonstrator V data analyses "*40 yrs of biodiversity image analyses*" replaces with "*time-series of several years*" to accommodate for uncertainty with new subcontract; • Section 4.1 Partner 20 MD deleted, responsibilities transferred to P1 DTU and P18 UFSC, as well as a new subcontract of 50.000 EUR in Section 4.2; • Section 4.2 Third Parties: new subcontract described for P18 UFSC to compensate for exclusion of Partner 20 MD in support of Task 3.1;

Table of Contents

1. EXCELLENCE

MISSION ATLANTIC takes a fully holistic and integrative approach to assess the state of the whole Atlantic: no pressure or ecosystem component is excluded. The scope of pressures includes human activities, variability, and natural hazards. The integrated ecosystem assessments (IEA) link these explicitly to relevant ecosystem components. This provides a framework for a risk-based prioritization of links between pressures and ecosystem components, and for targeting research activities. Links between pressures and ecosystem state are evaluated in the context of multiple pressures. Expert judgment, time series analysis, statistical inference, process-based models and network analyses are used to quantitatively score the importance of those links. Resilience is quantified as a key attribute of the socio-ecological networks. This approach enables us to determine ecosystem responses to management actions which will contribute to the sustainable management and protection of Atlantic marine and coastal ecosystems and resources.

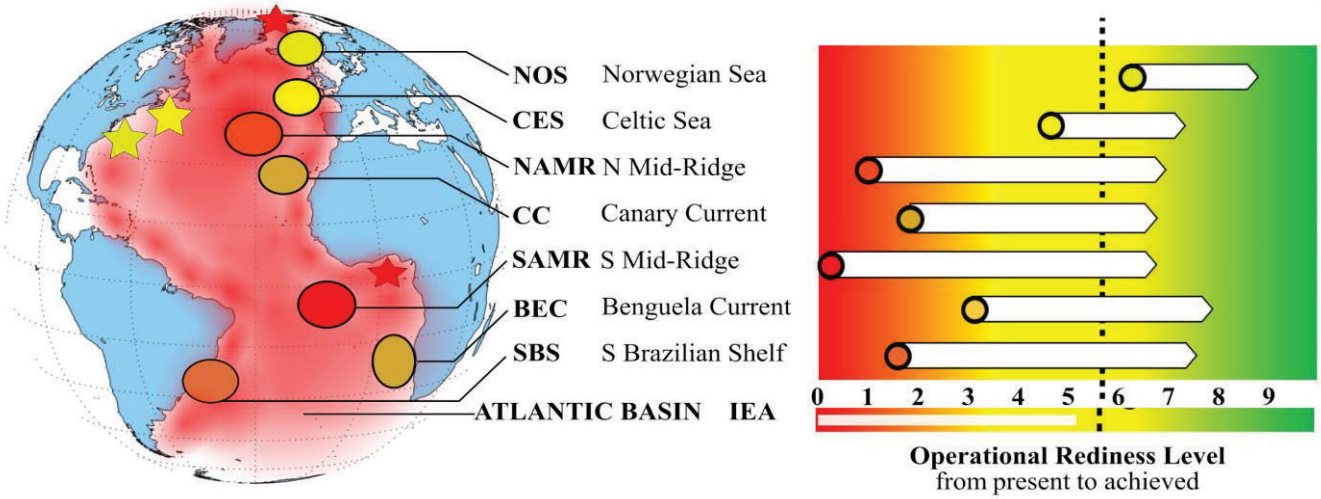

Figure 1. *Case Study locations (circles), Atlantic Basin area and four associated IEAs areas (stars) considered in MISSION ATLANTIC. Estimated Operational Readiness Level (ORL) is coloured based on "present state" and indication of what is realistically achievable during the project. Modelling and data collection activities are across the entire Atlantic basin. The project is expected to increase the overall Atlantic basin IEA to ORL 5-6.*

1.1 OBJECTIVES

To establish the risks posed by pressures from human activities, climate change and natural hazards, to sustainable use of the Atlantic ecosystem at a global and regional scale, we have defined five distinct and measurable objectives in terms of Scientific and Technical excellence (**ST**) and Educational and Outreach excellence (**EO**):

- **ST1:** *Assess ecosystems status and resilience in the whole Atlantic Ocean* to cumulative and cross-scale impact of pressures, and consequences for food provision, climate regulation and cultural services.

- **ST2:** *Map the present and establish the future 3D distributions of Atlantic biomes and their pressures with respect to physical, biological, chemical and seafloor attributes* to support the sustainable use of marine resources.

- **ST3:** *Develop new indicators, tools (process-based and statistical models) and technologies (information fusion, big data processing, machine learning) to identify risks and vulnerabilities* of the Atlantic Ocean under different climate conditions and management scenarios.

- **EO1:** *Formulate and transfer assessment guidelines, data and modelling tools into ecosystem-based management procedures,* to support sustainable governance of marine resources and the development of the

Blue Economy through dissemination, co-creation of management recommendations, and more general ocean-awareness activities involving regional stakeholders (e.g., NGOs, industry, ecosystem managers).

- **EO2:** *Educate ocean resource managers and researchers in application of a systemic approach to ecosystem management (e.g. IEA),* providing professional development opportunities and educational programmes with/in countries bordering the North, South and Tropical Atlantic Ocean.

1.2 RELATION TO THE WORK PROGRAMME

MISSION ATLANTIC addresses EU Horizon 2020 topic BG-08-2018-2019 B: "*Assessing the status of Atlantic marine ecosystems*". Structure and objectives in the project are designed to clearly address all the elements requested in the *Specific Challenges*, the *Scope* and *Sub-topic B* of the call text:

Specific Challenges	**MISSION ATLANTIC addressing challenges**
To take a systemic approach to tackle the scientific and socio-economic challenges and to move towards a basin-wide cooperation	**ST1** requires a systemic (holistic) approach with new methods (e.g. coupled models, evaluation of indicators, artificial intelligence, broadband acoustics) to fill data gaps, and new knowledge at the Atlantic scale on: ecosystem resilience and risks, distributions and biodiversity of pelagic/benthic biomes; climate variability; socio-ecological networks; ecosystem based management.
Scope	**MISSION ATLANTIC addressing scope**
Understanding and sustainably managing the Atlantic Ocean as a whole	Case study areas in the project are nested in **a basin-scale approach** sharing data, knowledge and models. A synthesis of IEAs at the scale of the entire Atlantic Ocean is delivered to achieve an Atlantic basin IEA (*Fig. 1*).
Upscale cooperation along and across the Atlantic Ocean and the creation of long-term partnerships building on on-going initiatives such as the All Atlantic Ocean Research Alliance (AORA)	We support the formation of an **All Atlantic Research Platform** developing on AORA and in close collaboration with AANCHOR CSA and the AIR Centre (partner in the project). The four WGs established under AORA include (1) Ecosystem approach to ocean health and stressors and (2) Seabed mapping. MISSION ATLANTIC advances these platforms by providing the science framework for IEA, thus directly augmenting both *Galway and Belém Statement* Atlantic cooperation, and associated WG activities.
Challenges in subtopic B	**MISSION ATLANTIC addressing challenges in subtopic B**
Enhance the knowledge on the status and dynamics of Atlantic marine ecosystems	**ST2 and ST3 activities enhance knowledge of system state, dynamics and resilience by: (1)** mapping and assessing ecosystems state and resilience in both pelagic and benthic components, **(2)** quantifying the main drivers of change and their interactions at the relevant scales, **(3)** extending climate & ecosystem scenarios to provide evaluation of risks and vulnerabilities of ecosystem functioning and associated services at the whole Atlantic basin.
Contribute to improve the sustainability of the exploitation of the marine resources	**ST1 and ST2 directly addresses this point by: (1)** Identifying ecosystem indicators and tipping points relative to different pressures for use in management advice; **(2)** Extending climate scenarios to simulate ecosystem functioning and associated services in the future.
3D–mapping of the water column and high-resolution seafloor mapping of selected large areas	**ST2 activities provide: (1)** 3D maps of physical, biological and chemical parameters, including their evolution over time; **(2)** Maps of habitats including high resolution seafloor characterization. Those are produced using models and observations, with ground-truthing using WaveGlider™ and other data collection activities.
Demonstration of cost-effective approaches to management and processing of the large quantities of data, better coordinated data sharing and operability	**The project exploits machine learning** methods to deliver a step change in our ability to extract and process large quantities of ecosystem data, to deliver indicators, to map ocean risks, and to autonomously identify seafloor characteristics. We plan a set of demonstrators to integrate these new tools into EMODnet following FAIR principles (Findable, Accessible, Interoperable, and Reusable) for data sharing.

Development of improved forecasting capabilities of stressors, tipping points, recovery and changes in ecosystem state	**ST3 will include: (1)** Projections linking stressors and management scenarios to future ecosystem services, and **(2)** A statistical toolbox linking impacts and ecosystem state for the identification of non-linear ecosystem dynamics, future tipping points and characterization of ecosystem resilience. Fishing, acidification and warming are specifically considered as pressures acting at the Atlantic scale, while in selected areas all relevant pressures are considered (e.g., nutrient loading, contaminants, pollution, mineral extraction, …).
Participation of industrial and regional stakeholders to help define ecosystem-requirements	**IEA has at its very core the involvement of regional stakeholders** in *scoping* for management objectives, discussion on IEA results, *co-design* of IEA output products and management plans, and *co-creation* of future scenarios. **EO1** will formalize and implement a strategy for direct involvement of stakeholders in this transdisciplinary process. Web, machine learning, and other decision tools will be used for data summary and scenario exploration.
Open access of all data collected (including in international waters) by the end of the project	All data collected (including in international waters) will be made open access by the end of the project, by interacting and contributing to EMODnet, WoRMS taxonomy, Marine biogeography, Seabed 2030, and the BODC Parameter dictionary. The project will allocate a dedicated task to conform to agreed international standards and formats.
Capacity building and training with/in countries bordering the South and Tropical Atlantic Ocean should be considered	**EO2** builds on several activities i.e. e-learning, PhD school, ship-board training and a mobility programme. This will provide long-lasting educational training and professional development opportunities for sustainable management of Atlantic Ocean resources in collaboration with International Council for Exploration of the Sea (ICES) and World Maritime University (WMU) which are both partners in the project.
Proposals shall include a task to cluster with other projects	MISSION ATLANTIC has a specific task to operate the "Belém AORA Panel" established in the project, to ensure clustering and cooperation with other H2020 projects. At proposal stage discussions on alignment of research activities have started with BG08 2019 projects AANCHOR, AQUAVITAE and iATLANTIC.

1.3 CONCEPTS AND METHODS

1.3.1 Background: Integrated ecosystem assessments

Modern environmental assessments are cornerstones for implementing ecosystem-based management approaches (EBM) required for achieving a sustainable use of ecosystem services as called for by, for example, the UN Sustainable Development Goals. Integrated Ecosystem Assessments (IEAs) represent the best strategy towards implementing marine EBM [1,2]. IEAs go beyond observing system states (*Fig. 2*). They are means towards evaluating the status of knowledge on complex problems relevant to society. Prominent examples of such comprehensive assessments of environmental problems include the reports of the Intergovernmental Panel on Climate Change and the Millennium Ecosystem Assessment. These assessments are experts review of evidence needed for decision-making, including consideration of trade-offs between different uses and ecosystem services. Such analyses require a suite of methods that range from qualitative (e.g. in data poor situations) to quantitative complex modelling approaches to fully account for the many sectors and components comprising ecosystems and to assess them in combination and not in isolation.

1.3.2 Background: Resilience and tipping points

To understand, predict and adapt to global changes we need to resolve ecosystem resilience by unravelling the hidden connections in ecological and social systems [3]. Ecosystems, the services they provide, and the people who use and manage them, comprise complex adaptive systems which may exist in different alternative states, differing markedly in terms of their structure and functioning. Abrupt transition between such states, often termed regime shifts, are typically characterized as either linear, nonlinear or discontinuous, resembling fundamentally different types of ecosystem responses to external drivers [4]. While all three types of responses can give rise to abrupt changes in the biota, only the latter involves hysteresis which indicates that irreversible changes in the

structure and functioning of ecosystems may occur. The underlying mechanisms behind such shifts are such that while some drivers primarily serve to weaken the resilience of the system [5], sudden perturbations from other drivers may trigger the actual shift, once passing beyond a tipping point [4]. Despite a strong theoretical foundation of non-linear system responses to cumulative impacts, and our ability to map and identify abrupt ecosystem state changes from historical data [6], our understanding of the underlying mechanisms and drivers of regime shifts, their interactions and cumulative impacts on the status and resilience of ecosystems is largely lacking.

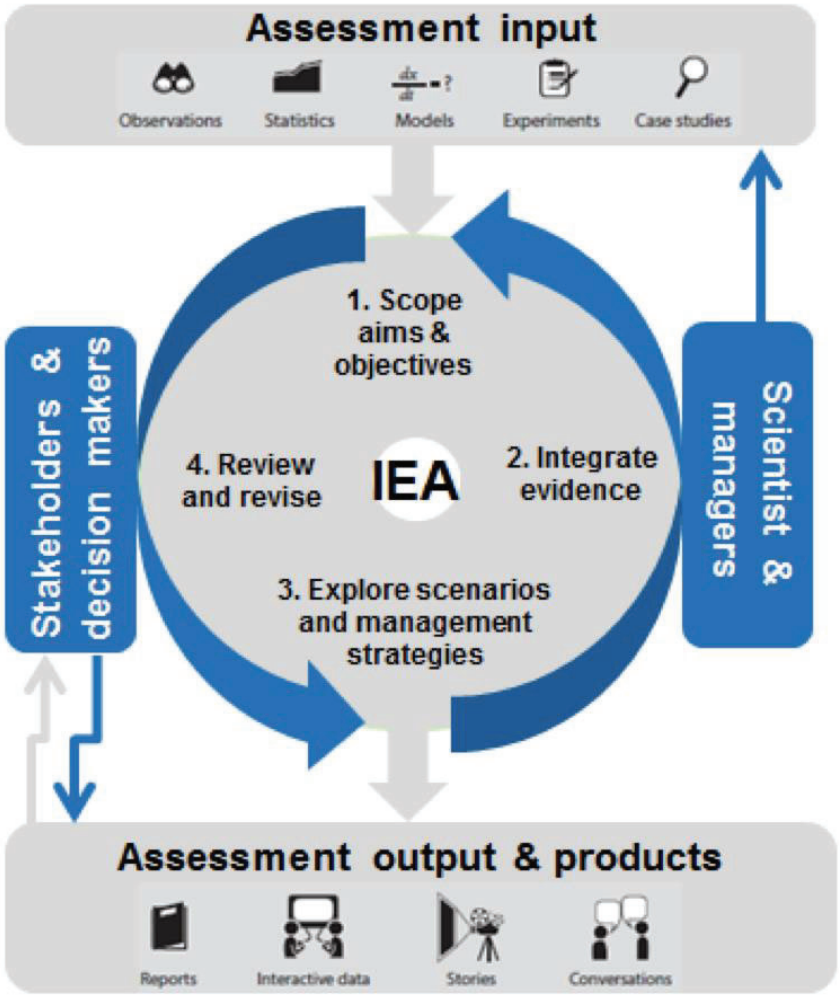

Figure 2. *A schematic representation of modern integrated assessment frameworks: an iterative process where experts together with a broad range of stakeholders assess the status of ecosystems by integrating the best available knowledge and associate uncertainties through a combination of qualitative and quantitative approaches.*

1.3.3 MISSION ATLANTIC Concept

Atlantic Ocean resources are shared between different regions, and regional ecosystems import and export services to the wider Atlantic. The MISSION ATLANTIC approach is to assess both the whole Atlantic and the regional ecosystems, as well as their interconnectivity. The core concept is to develop such assessments based on a holistic evaluation of ecosystems and following a homogeneous approach at both basin and regional scales, using a common-IEA framework, common-ecosystem models and common-statistical tools (*Fig. 3*). This translates into developing IEAs for a range of case study (**CS**) areas in the Atlantic Ocean, and identify both the specificities and commonalities across regions to provide an Atlantic wide assessment. The purpose in MISSION ATLANTIC is to enhance the scientific basis for management advice on relevant spatial and temporal scales (up to 2070). The novel framework developed in the project has the potential to be useful well beyond the end of the project, and can provide the context for future IEAs of the Atlantic Ocean, linking North, South, East, West Atlantic and aligning research and management programmes.

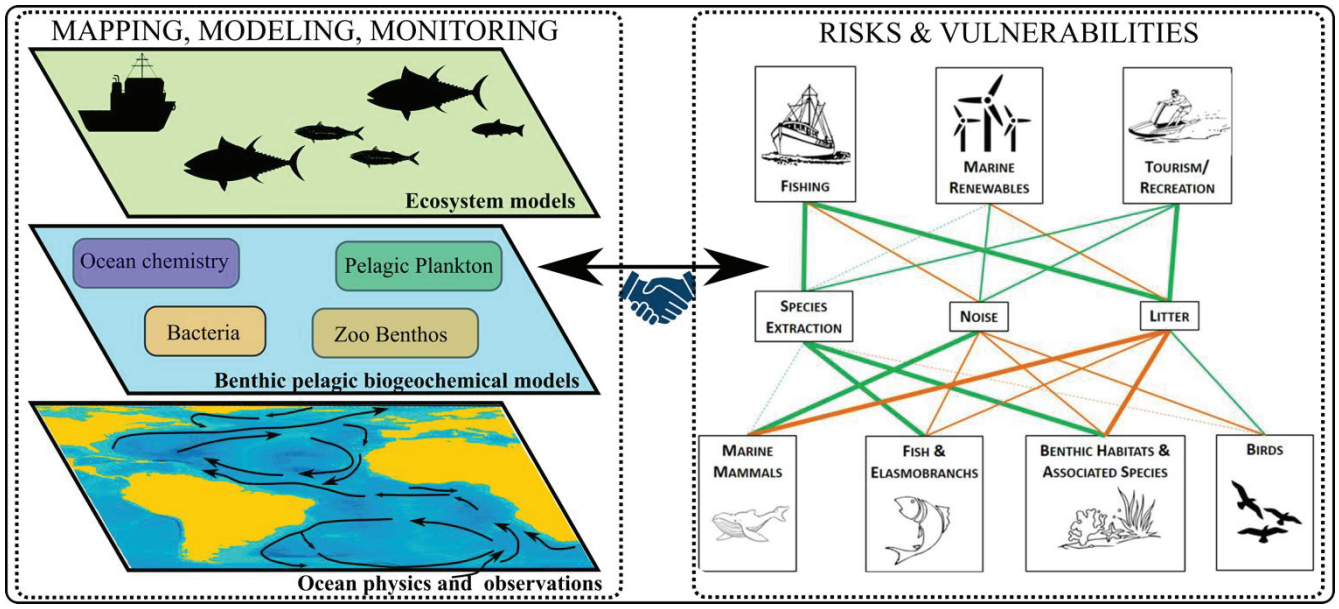

***Figure 3**. Schematic of the approach followed in MISSION ATLANTIC. Observations and model data for the entire ecosystem, including benthic and pelagic components, are combined with temporal dynamics of relevant ecosystem state indicators to inform the risk assessment methodology. In the illustration pressures (species extraction, noise, litter) are generated from different human activities and impacting several ecosystem components. The thickness of the link is proportional to the importance of the impact (e.g. top risk) dotted lines are potential risks that are never realised, and orange or green colours indicate data availability, which contributes to the assessment of confidence and uncertainties. Links in this socio-ecological network are discussed with stakeholders and updated as new knowledge is available.*

1.3.3.1 IEAs cycle from case study to the Atlantic assessment. The ecosystem assessments of present and future status of the Atlantic is delivered in the project by integrating, at the basin scale, the new knowledge produced in MISSION ATLANTIC: a dedicated IEA cycle for the whole Atlantic Ocean; a synthesis of CS results to detect specificities and commonalities across regions; basin scale patterns and vulnerabilities. The operationalization of IEA frameworks has been extensively debated [7] but a formal implementation in management routines has not yet been achieved. IEAs as conceptualised by Levin et al. (2009) [1] comprise five steps: scoping and defining goals; developing ecosystem indicators and reference values; risk assessment; management strategy evaluation; and, monitoring and evaluation. MISSION ATLANTIC develops operational IEAs to evaluate "*how ecosystems respond to cumulative pressures that affect their resilience*" and systematically perform, in each identified CS, the following steps (*Fig. 4*):

(1) **Scoping** the key management objectives, human activities and the ecosystem components affected by these through a formal process of stakeholder involvement;

(2) **Develop a suit of indicators** and reference levels for assessing status, drivers and resilience of ecosystems, as well as the occurrence of tipping points;

(4) **Simulate ecosystems state and dynamics** under various scenarios of climate change, resource exploitation and social development using end-to-end ecosystem models;

(3) **Assess risks and vulnerabilities** of ecosystems to present impacts and future changes through a suit of qualitative and quantitative approaches;

(5) **Evaluate management options** for achieving desired outcomes reflecting the needs and trade-offs between ecological, economic and social objectives.

The scoping phase identifies all human activities likely to exert any pressure on any component of the ecosystem. This will make the IEA truly inclusive and holistic, delivering conceptual models of the socio-ecological interactions. End-to-end models, biogeography of pelagic and benthic biomes, analyses of trait distributions, functional redundancy and connectivity, and identification of future risks and vulnerabilities (including extreme events) will all be provided at the whole Atlantic basin scale.

1.3.3.2 Analyses of risks and vulnerabilities. Proper ecosystem assessment (as asked for by the call) can only be delivered when risk and vulnerability analyses are performed. MISSION ATLANTIC will develop a set of qualitative, semi-quantitative, and quantitative tools to evaluate the importance of the links in the socio-ecological networks, i.e., human activities to pressure, pressure to ecosystem component, and components to ecosystem services. The pressure-component links will be evaluated and categorised into five attributes: (a) *Degree of pressure/impact* – from small to population level effects; (b) *Spatial scale of pressure/impact*- from point to global; (c) *Temporal scale of pressure/impact*- from rare to continuous; (d) *Persistence* – how long the pressure/impact continues after the activity stops; (e) *Resilience* – how quickly the system recovers after the pressure is removed. These attributes will be divided into categories ranging from minor to major. The attribute categories will be scored and agreed with stakeholders, to reflect their objectives, then associated to a "confidence" level, ranging from expert judgement to full analytical data. This semi-quantitative procedure will help to prioritize linkages prior to full quantitative analyses and the evaluation of the management options. As new knowledge is generated in the project (new maps, indicators, present state, future scenarios) those linkages will be updated with an increasing confidence, making the IEA framework adaptive.

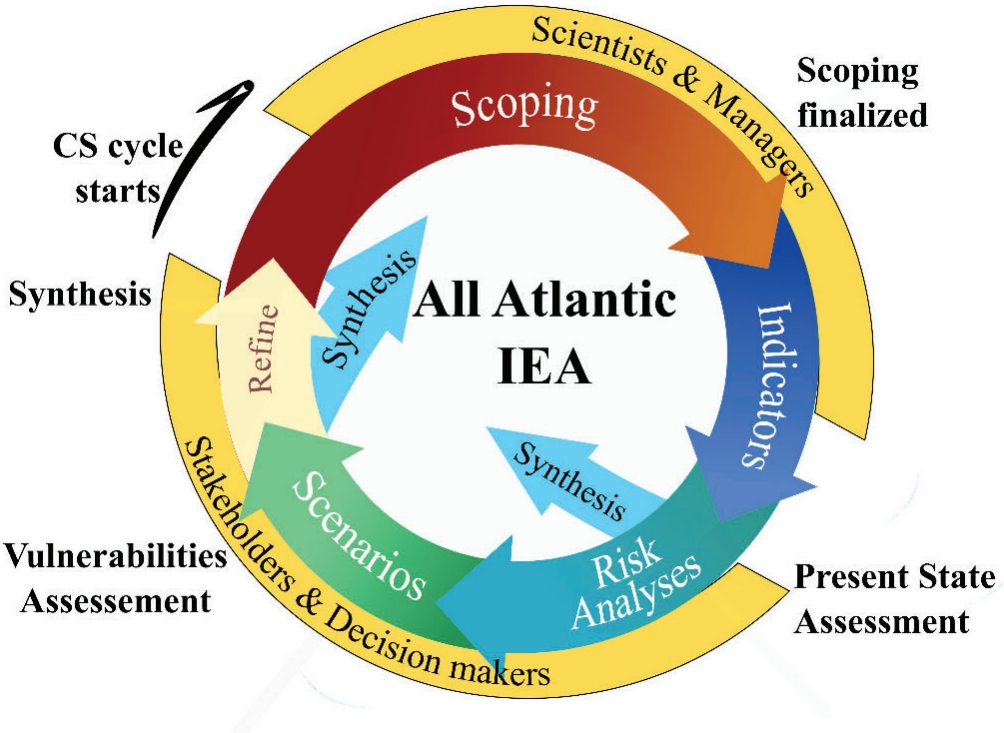

Figure 4. *Schematic of the main activities of the Case Study cycle and Atlantic basin assessment of the IEAs.*

1.3.3.3 Interactions between pressures. Until now pressures have been evaluated individually, or as simply "cumulative" and on single or few species. MISSION ATLANTIC goes beyond this by developing approaches to evaluate interactions between pressures and identifying whether they are *additive, synergistic or antagonistic*. Together, this gained knowledge enables a much more nuanced evaluation of resilience, and pressure-state relationships, and provides insight on how to handle multiple different pressures for forecasting future ecosystem changes. Modelling is the instrument to bind all these elements together. We have therefore identified a group of **process based models** for the whole Atlantic (and global) for coalescing this knowledge and providing broad scale relationships for use in ecosystem state projection. **Adaptive modeling tools** based on machine learning, including new Artificial Neural Network (ANN) approaches [8], are developed to identify indicators of ecosystem state that are responsive to cumulative pressures. This common modeling approach enables - for the first time - direct comparisons between CSs while linking directly to the needs of regional management authorities.

1.3.3.4 Assessment of the Atlantic Ocean ecosystems. Beside IEAs in each CSs, a whole Atlantic Ocean IEA is carried out according to the cycle above (*Fig. 4*), but on a set of activities, pressures and components that have large scale effects and can be informed from models. This is the first time this systemic, integrative approach is operated over the entire Atlantic Ocean. The assessment involves species habitat modelling and trait based distributions analysis, both considered at the basin scale. Warming, acidification, deoxygenation, fishing, changes in ocean circulation and connectivity patterns are some of the stressors explicitly resolved over the entire basin. Process based end-to-end models from primary producers to fish are developed for the entire basin adequately resolving the benthic-pelagic coupling and the links to fish production and carbon sequestration for present conditions and future scenarios. This specific Atlantic IEA will be integrated in a synthesis of CS results to detect similarities and differences across regions and identify those linkages which are high risk in many regions. Using this synthesis two assessments are delivered in the project (*Fig. 4*): present ecosystem status, and ecosystem vulnerabilities over the whole Atlantic Ocean.

1.3.3.5 Mapping. MISSION ATLANTIC delivers a new pan-Atlantic biogeography accounting for both benthic and pelagic biomes in both coastal and open ocean regions and using advanced habitat modelling tools for present state and future scenarios (niche-based modelling [9], dynamic bioclimate envelope model [10]). Dedicated oceanographic expeditions and WaveGlider™ missions are used to collect new data from North to South to validate models and elucidate processes (e.g., trait interactions, migrations, carbon sequestration). Deep sea glider missions will explore the deep sea in key biodiversity areas (e.g. VMEs), collecting new data on species distribution across the Atlantic, inside and outside CS regions. New knowledge and new observations provide the information to assess attributes of ecosystem resilience at the Atlantic scale as well as to derive risk and vulnerabilities over the entire basin. Additionally, the impacts of extreme events (e.g., marine heat waves, changes in large scale circulation) are resolved over the entire Atlantic and from seasonal to decadal time scales. This will deliver the first baseline for the Atlantic Ocean IEA.

1.3.3.6 Case study approach. MISSION ATLANTIC includes seven regional CSs in the North, South and Tropical Atlantic (*Fig. 1*). They range from shelf seas to the mid-Atlantic Ridge, and from high to low latitudes. CSs are large biomes representing a number of contrasting and complementary regions with distinct bathymetry, hydrography, productivity and biota, climate change impacts and human use (Table 1.1). Additionally, four further regions where IEA activities are being developed are associated and lead by partners in MISSION ATLANTIC from UK (Gulf of Guinea, P11), US (NW Atlantic Shelf, P29), CANADA (Newfoundland Shelf, P28) and ICES (Central Arctic Ocean, P25). As such, these areas are not directly funded by the project, but still contribute in exchanging knowledge and experiences by directly participating in specific activities, including PhD school, mobility program and e-learning. CSs and associated IEA areas (total of 11) are representative of major Atlantic ecosystems where globally relevant socio-ecological concerns are present. Regional stakeholder platforms are organized in each CS with activities (i.e. *Fig. 4*) coordinated in a common work-package (WP1) to optimize knowledge transfer across CSs, harmonize methods for engagement and reduce stakeholder fatigue.

Table 1.1 Case Study Overview including estimated ORL.

CS1 Norwegian Sea (NOS) **Lead:** Mette Skerne-Mauritzen IMR (P4), **Estimated ORL: 6**		
Data availability	***Supposed Drivers***	***Management & advisory bodies***
High, indicators compiled	Fishing and Climate, Petroleum	NEAFC, Iceland, Norway, the Faroe Islands, ICES and OSPAR
Present State: The ocean temperature in the Norwegian Sea is presently above long-term mean. The biomass of planktivorous fish in the Norwegian Sea seems to have been close to or above the carrying capacity for some time, and there is much focus on the interplay between zooplankton production and fish biomass and predation. Petroleum and transport are important human activities, and associated risks are related to accidental spills. Relevant management & advisory bodies include national management authorities.		
CS2 Celtic Sea (CS) **Lead:** David Reid MI (P20), **Estimated ORL: 5**		
Data availability	***Supposed Drivers***	***Management & advisory bodies***
High, indicators compiled	Fishing, Waste Water, Land-based Industry, Shipping	ICES, EC (MSFD, CFP), OSPAR, Regional and National Governments
Present State**:** First analysis reveals fishing as the key sector, through several pressures (species removal, abrasion, bycatch & litter). Other main sectors are shipping and terrestrial origin pollution. Ocean temperatures appears higher than the mean in the eastern Celtic Sea and Irish Sea, also to the NW of Ireland. But not on the SW shelf areas. The winter North Atlantic Oscillation (NAO) index (2016) was positive (+1.47) for the fourth consecutive winter, the first such positive run since 1992–1995. For 2017 the NAO was weakening, close to neutral, possibly indicating changes in 2018-2019.		
CS3 Canary current system (CC) **Lead:** Marcos Llope IEO (P21), **Estimated ORL: 2**		
Data availability	***Supposed Drivers***	***Management & advisory bodies***
Medium	Acidification, Hypoxia, Climate, Airborne dust, Fishing	CECAF (FAO), Spain, African Governments (Morocco, Senegal, Mauritania, Guinea Bissau)
Present State**:** While an increase of upwelling-favourable winds has been reported, no significant upwelling trend was found from SST-based upwelling indices, probably as a result of changes in the internal structure of the upper ocean due to warming. Primary productivity negative trends have weakened in recent years, except in the extreme ends of the CCLME (Guinea and northern Morocco). Surface seawater pH has declined at rates of -0.0013 yr^{-1} to -0.0025 yr^{-1} and hypoxia is increasing in the oxygen minimum zone. Oscillation in sardine abundance and distributions have been documented in the past as well as triggerfish and octopus outbursts linked to changes in upwelling, poleward undercurrent intensities and other processes. The reported drop in primary production is not yet reflected in pelagic fish catches.		
CS4 North Mid Atlantic Ridge (NAMAR) **Lead:** Pedro Afonso, IMAR (P16), **Estimated ORL: 1**		
Data availability	***Supposed Drivers***	***Management & advisory bodies***
High, indicators compiled	Fishing, climate, (potential) mineral extraction, pollution (chemical, noise, debris)	ICCAT, ICES, ISA, IWC, NEAFC, NAFO, Iceland, Portugal/Azores, (EEZs),
Present State**:** Similar to CS6, this is a very large area of high biome diversity, covering the deep-sea (including numerous hydrothermal fields, seamounts, ridges and fracture zones), the open ocean (including fronts) and oceanic islands; mostly ABNJ managed by RFMOs/international agreements, but also by local/National Authorities (Iceland, Portugal), with numerous national/ABNJ MPAs; subject to intense industrial high-seas fisheries and the growing interest in exploitation of deep-sea minerals (especially massive sulphides). Interest and involvement of international and national NGOs on main topics (e.g. conservation of deepsea VMEs and large migratory species, MPAs, plastic pollution) is also growing. Indicators fairly available and ongoing for deep-sea and coastal/island environments but less for the open ocean. Some ecosystem models already developed but need to broaden the scope and data coverage.		

CS5 South Mid Atlantic Ridge (SAMAR) **Lead:** Mary Gasalla, USP (P23)**, Estimated ORL: 0**		
Data availability	***Supposed Drivers***	***Management & advisory bodies***
Very Low	Climate, fishing, pollution, connectivity	Brazilian Navy; Conservation and Park Authority, ICMBio, TAMAR, UK, ICCAT, FAO
Present State**:** Similar to CS4 in profile (large complex of oceanic islands, deepsea and open ocean biomes) but generally data-poorer and little explored for ecosystem based management approaches. Data are available from different public database (e.g. SISBIOTA-Mar network of Brazilian marine scientists, the Research and long-term ecological monitoring (LTER), PELD - Brazilian oceanic islands) and other team-based research programs in the Oceanic islands (St Peter & St Paul's, Ascension, St Helena, Rocas Atoll, Fernando de Noronha, Trindade). Available key indicators are mostly subtidal and circalittoral but efforts are underway to ensure broad-scale data for deep-sea and open-ocean areas. Because of the very large scale and isolated biomes, the role of ocean connectivity is expected to be key, as in the CS4.		
CS6 Benguela Current (BC) **Lead:** Lynne Shannon, UCT (P17), **Estimated ORL: 3**		
Data availability	***Supposed Drivers***	***Management & advisory bodies***
High	Fishing and climate	Dep. Env. Affairs (South Africa), Benguela Current Comm. (BCC), South East Atlantic Fisheries Organisation (SEAFO)
Present State**:** Anchovy was the dominant small pelagic fish in the 1980s but declined by the 1990s and stocks of sardine, redeye, horse mackerel and Cape hake increased, as well as a rapid increase of several jellyfish species. The "high pelagic fish biomass" situation of the early 2000s was short-lived, stocks of both anchovy and sardine again declining, with the sardine fishery currently in dire straits. Cape hakes are the most valuable commercial species in the Southern Benguela but there is little room for expansion of the hake fishery above present levels. Line fish stocks were considered to have been overexploited and a moratorium on catches was implemented in 2002. Recent stock assessments indicate that some line fish stocks are recovering. Fish biomass is higher now than in the 1980s and 1990s, whereas landings have fluctuated but are lower in the late 2000s compared to two decades before. Holistic analyses of ecological indicators related to fishing suggest that the ecosystem state is currently not improving. The environment has been shown to be an important driver of ecosystem change in the system.		
CS7 South Brazilian Shelf (SBS) **Lead**: Marinez Scherer, UFSC (P18), **Estimated ORL: 2**		
Data availability	***Supposed Drivers***	***Management & advisory bodies***
Medium	Tourism, Oil & Gas, and Fishing	Brazilian Navy, Ministry of Environment
Description Present State: Spatial planning process started in 2011 but with little improvements. Of the 145 descriptors needed for MSP, only five are available via the Brazilian National Spatial Data Infrastructure while other databases (e.g., BNDO) are difficult to access. Oil and gas industry is fast scaling up, with all impacts on marine (e.g. oil spills) and coastal areas. Coastal tourism is one of the main drivers for urban development leading to marine pollution and ecosystem loss. Fishing is seemingly out of control and no statistics on catch are collected or available. USP will collaborate in this CS and coordinate with CS SAMR for stakeholder interactions.		

1.3.4 Operational Readiness Level

We defined an **Operational Readiness Level (ORL)** measured by: availability of data, existence of identified key ecosystem indicators, available end-to-end ecosystem model outputs, inclusion and awareness of stakeholders and their management objectives, presence of methods to perform management strategy evaluation (MSE), and presence of IEA activities (Table 1.1). Based on the ORL, CS areas rank from cases where IEA and associated research is reasonably well developed (ORL 5 & 6, *Fig. 1*), to those where it is in the very early stages (ORL 0 & 2). **The pan-Atlantic IEA is estimated at ORL 1 and we aim at progressing to at least ORL 5 by the end of the project**. The IEA framework can be established both in data-poor as well as in data-rich regions as long as the stakeholders and/or governance bodies can be identified. A very basic IEA could solely consider for example expert knowledge (ORL 0) when models and data are not available. This would not be a substitute for empirical data, but would provide important guidance as to which data would be a priority to start collecting. MISSION ATLANTIC will provide models and data for the entire Atlantic including low ORL cases and regions not directly addressed by specific CSs, providing baselines and advancing IEA at the Atlantic Ocean scale. For higher ORL cases, the aim is to reach ORL 7 or 8, and to use the skills learned in those CSs to help kick start the development

in the lower ORL cases. Methods and approaches developed within the project are applied in all CSs, recognizing that analyses will have to be fitted to the regional specifics and requirements. CS areas represent biomes currently identified as biogeochemical provinces [11, 12]. However, MISSION ATLANTIC aims to re-evaluate present biogeography using new methods and tools which combines data from pelagic and benthic habitats. Similarity between CSs (e.g. North and South Mid Atlantic Ridge) will be capitalized upon in the project, with common stakeholder meetings and analyses. Governance structures in these data-poor areas are mainly represented by national/regional organizations and international advisory/management bodies, e.g., fisheries agencies. While answering to the recent call for urgent actions to improve management in Areas Beyond National Jurisdiction (ABNJ), MISSION ATLANTIC will actively seek out and engage the participation of these bodies, such as Regional Fisheries Management Organizations (RFMOs), and treaty organizations such as OSPAR, IMO, ISA, etc. Many of them have already expressed full support to the project (please see attached Letter of Supports).

1.3.5 Data poor and data rich regions

The operability, confidence and uncertainty of IEAs is influenced by the availability of quality data across different ecosystem components. MISSION ATLANTIC will include an Atlantic-wide assessment of available data, data products, models and tools as well as dedicated data collection activities.

1.3.5.1 Atlantic seagoing missions. MISSION ATLANTIC partners have a detailed schedule of field work activities and a list of ship-of-opportunity is already compiled. Additional surveys and opportunities in development will be managed by the **Executive Board and the All Atlantic Panel** of the project, to maximising associated partnership, shared infrastructure access, outreach, capacity building and on-board training opportunities. Available long-term time series and/or highly resolved spatial data will support evaluation of ecosystem indicators and validate model output. Data from the LTER station in Brazil will be augmented in the project by processing biodiversity and size distribution data from more than 20 years of stored samples. Dedicated field work in Brazil and South Mid Atlantic Ridge will be funded to collect '**environmental'** and '**pressures'** data in the epipelagic (0-200 m depth), mesopelagic (200–1000 m depth), bathypelagic (water column > 1000 m depth) and seabed zones. Priority will be given to estimates of trophic transfer efficiency from trait based (e.g. size) measurements in data-poor regions and across different trophic levels. **The project will co-finance activities on the Atlantic Meridional Transect (AMT) programme** to collect data on trait distributions. The Brazilian Navy, under the governance of Ministry of Defence, operates in South Atlantic and Southern Ocean using key oceanographic ships (e.g. NHOc Vital de Oliveira, NOc Cruzeiro do Sul), collecting information about physical, chemical, and biological properties of the ocean. Partners USP & UFSC are seeking to deploy their vessel "Alpha Crucis" through São Paulo Funding Agency support (FAPESP) on seabed mapping and deep water cold water coral studies. These Brazilian partner data contributions will support IEA in the South Atlantic CS. New sensors will be applied to obtain required information including: wideband acoustic, range-gated laser camera, hyperspectral methods, LOKI plankton system, and other size-spectra acquisition methods. Dedicated sampling at St. Helena will expand present knowledge on trait distribution and connectivity between open ocean tropical island communities. Two WaveGlider™ equipped with wideband acoustic and water quality sensors will be used for long North-South and East-West transects for a total of ca. 160 days at sea. Three long endurance Deep sea (up to 1000m depth) glider missions (Canary, Azores, Brazil) are planned, with a newly developed imaging and lighting system specifically designed for ultra-low energy operations with underwater gliders. This will require technical developments to optimize acoustic data storage for ground thruthing benthic habitat models. Extensive multi-frequency acoustic data acquisition and seabed ground-truthing will be undertaken in the Celtic Sea CS ca. 90 days annually, contributing to habitat characterisation research and ecosystem assessment. Additionally, further new data to support IEA will be delivered through partnership and opportunistic international cruises in the Atlantic and through coordination with ongoing Atlantic research projects such as SUMMER and ASPIRE. High priority will be given to acoustic surveys, and size-based observations across different plankton and fish groups to support a global database of acoustic survey data (Partner USTA) and model validation. We have already reached agreements on the use of ship time with coordinators of MEESO and SUMMER projects and have a strong partnership with EUROFLEETS members.

Box 1. Data gathering and activities at sea.

In the figure shown the geographical distribution of data collection activities.

Data gathering activities (in WP2) from different sources will focus on all case study areas (**dark shade**) and associated areas (**light shade**) covering as much as possible all ecosystem components.

Data collection at sea will include:
(A) oceanographic cruises (in WP3) supporting Atlantic Meridional Transect cruise in 2021 (**black line**)
(B) Benguela Current cruise (**white lines**, in WP4), contributed by OneOceanHub project
(C) Brazilian shelf ocean cruise (**white lines**, in WP3) with ship-time applied via P18 UFSC
(D) wave glider transect (in WP3) from Ascension Island to the Azores (**green line**)
(E) wave glider mission (in WP3) from Florianopolis to Cabo Frio and shelf break (**green line**)
(F) three deep sea glider missions (in WP4) offshore the Canary current system (**orange diamond**), to test and demonstrate the complete system
(G) benthic surveys (in WP4) in St. Helena (**red square**), to support the analyses of open ocean island trait connectivity (in WP5).

Further details on these activities are contained in the table below.

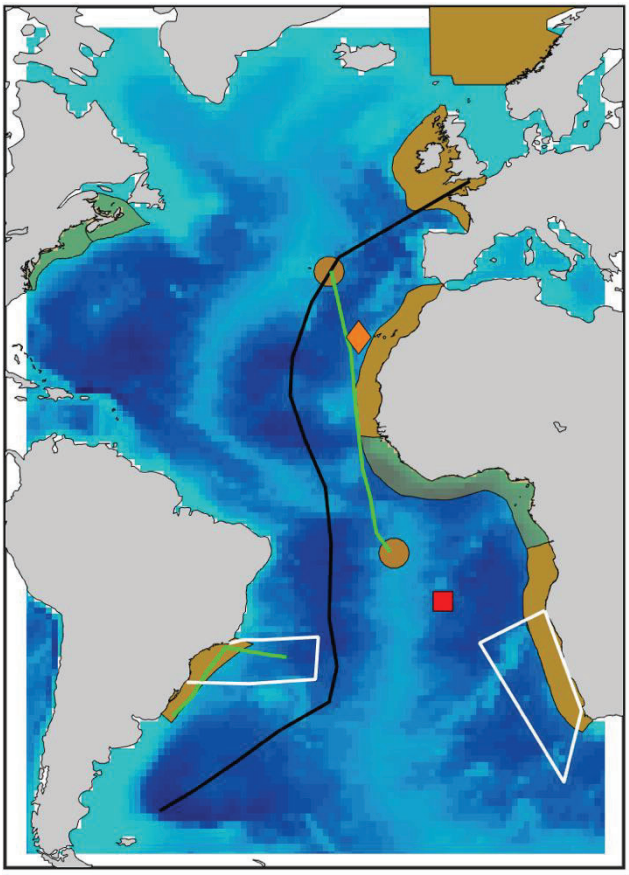

Table 1.2 Major activities at sea relevant to MISSION ATLANTIC

Region	Lead	Description	Period	Notes	CS
(C) Brazilian Shelf	UFSC	Oceanographic cruise benthic pelagic (CTD, plankton net, size spectra, fish acoustic surveys, bottom acoustic survey, benthic surveys with gliders and ROVs)	*2 week* Spring 2021 or 2022	Person Months and logistic funded in Mission Atlantic, ship-time application via Partner (18) UFSC (in kind value ca. 250k €)	SBS, SAMR
(G) St. Helena	UFSC	Survey (fish community, diversity, benthic traits)	*16 days* Feb 2021	Fully funded 7-person expedition boat renting and scuba equipment	SAMR
(D) Atlantic Transect	MROB	WaveGlider™ with CTD, acoustic survey: two frequencies 333 KHz (ES333-7CDK-Split 7º x 7º for Zooplankton), 38KHz (split beam for fish)	*100 days* March-May 2021	Fully Funded Deploy and recovery contributed by local partners (AIRC, IMAR) (in kind value ca. 30k €)	NAMR, SAMR
(E) Brazilian Shelf break	MROB	WaveGlider™ with CTD, acoustic survey: two frequencies 333 KHz (ES333-7CDK-Split 7º x 7º for Zooplankton), 38KHz (split beam for fish)	*40 days* Jan2022	Fully Funded, deploy and recovery contributed by local partners (UFSC, USP) (in kind value ca. 30k €)	SBS

(F) Canary, (Azores, Brazil)	UBH /PLOCAN	Deep sea gliders (CTD, bottom images, backscatter)	*10 days* 2022	Three long endurance missions fully funded deployment recovery PLOCAN (optionally opportunities in Brazil and Azores through UFSC and IMAR partners) Recovery deployment at PLOCAN contributed (in kind value ca. 50k €)	CC NAMR, SBS
(A) Atlantic Meridional Transect	NOC	Oceanographic (pelagic, acoustic)	*48 hours* 2021	Partially Funded 54k € from Mission Atlantic, (in kind value 1,4M EUR)	CES, CC, NAMR, SAMR
(B) Benguela Current region	UPL	Benthic survey, seafloor mapping, basic oceanography (physical and biological).	*2 weeks* 2021-22	Opportunity via UK-funded "OneOceanHub" Project (in kind value ca. 600k €)	BEC
Azores	IMAR	Oceanographic (pelagic, acoustic)	Summer 2021-2022	Opportunity	NAMR
Canary Islands	UPLGC	Oceanographic (pelagic, acoustic)	Spring 2020-2021	Opportunity	CC
Porcupine bight	NOC	Oceanographic (pelagic, acoustic)	Spring 2020-2021	Opportunity	CES
Norway to Azores	SINTEF	Oceanographic (pelagic, acoustic)	Summer 2020	Opportunity from SUMMER project	NOS, NAMR
Celtic Sea	MI	INFOMAR: Seabed Mapping	300 days Approx. 75 p.a. 2020 – 2023 inclusive	Opportunity: Fully INFOMAR funded bathymetry surveys (circa 4M EUR), with additional opportunistic groundtruthing & Atlantic Transect surveys anticipated.	CES

1.3.5.2 Mapping Social systems. The *scoping* phase will use the stakeholder platforms from each CS to help identify relevant ecosystem services, and sort their importance in the specific area (participatory approach), with fishing and climate change adaptation opportunities likely being a common priority. Review of selected scientific literature and policy documents are performed to map links between drivers, pressures and state and to support the *scoping* phase. This will include the characterization for the Atlantic Ocean of the Shared Socioeconomic Pathways used by IPCC. The approach will be cross sectorial and will map human activities. For selected data poor regions (SAMR, and partially NAMR) we will conduct dedicated semi-structured interviews with national/regional organizations and international advisory/management bodies, and additional ocean leaders and science/policy analysts with responsibilities for providing science advice to decision-makers. To support coming assessments IPBES (via its Multidisciplinary Expert Panel) will be consulted in the *scoping* phase to see to what degree their key priorities can be integrated in the work of Mission Atlantic. Knowledge generated in data-rich CS (as part of projects like VECTORS, MFISH, DEVOTES) will help in providing solid baselines in data-poor regions.

1.3.6 National and international programmes linked to MISSION ATLANTIC

MISSION ATLANTIC is a timely initiative building upon previous EU programmes: EURO BASIN, DEVOTES, MEECE, VECTORS, and strong collaborations with ongoing activities. The CSA **AORA** has initiated collaborations on mapping, ecosystem, aquaculture, and ocean literacy research including an Atlantic Seabed Mapping International Working Group, whose activities are directly supported in MISSION ATLANTIC. Strategic research alliance on seabed mapping is also established with, EuroFleets+, and ASPIRE (Atlantic Seafloor Partnership for Integrated Research & Exploration). The project will benefit from **H2020 AANCHOR** and the **AIR Centre** initiatives (partner in the project), to identify and manage regional Atlantic stakeholders for

IEA. The **EAF-Nansen Programme and PANDORA** will support the project for the management of marine fisheries. Links with H2020 **MEESO** and **SUMMER** projects are established on mesopelagic community and links with other BG08-B and BG08-C projects (e.g. **iATLANTIC**, **TRIATLAS**, **AQUAVITAE**) will be established to ensure data interoperability and standardization within and beyond the project (in WP2), to harmonize modelling approaches and field work, and reduce stakeholder fatigue across the Atlantic. MISSION ATLANTIC **will fill present major gaps in BG08 research activities** by developing IEAs for the whole Atlantic including coastal and high seas as well as pelagic and benthic components under multiple pressures and several climate scenarios. MISSION ATLANTIC will benefit from the recently funded EU climate project **COMFORT** to test for tipping-points driven by global scale ocean circulation and biogeochemistry. **ICES working groups on** IEA approaches are engaged in the project. Several national and EU initiatives are present in all CS regions and a specific task will ensure clustering and cooperation with those. The **Brazilian government** is starting a Marine Spatial Planning initiative and has explicitly requested MISSION ATLANTIC support to working groups on shared uses (**UCAM**); **ProOcean** is a Brazilian National Program for monitoring local and regional ecosystem resilience on the Brazilian shelf since 2010 and MISSION ATLANTIC aligns goals and targets to the benefit of both projects. Partners in the project are collaborating in the UK **One Ocean Hub**[1] project with research cruises in 2021 in the BEC and SAMR CS, a contributed case study in the Gulf of Guinea and a dedicated stakeholder group that will inform the project (geographical focus Africa and the Caribbean, see Letter of Support). The Belmont Forum project **GULLS** will provide socio-ecological outcomes linked to climate change projections. Finally, MISSION ATLANTIC will support the EU backed Intergovernmental Platform for Biodiversity and Ecosystem Services (**IPBES**) mission, by delivering new insights into the state of the planet's biodiversity, ecosystems and the benefits they provide to people, as well as the tools to manage them sustainably.

1.3.7 Methods and work-package structure

MISSION ATLANTIC includes ten Work Packages (WPs, *Fig. 5*) with research activities on: big data technology and management (WP2), mapping pelagic and benthic habitats (WP3, 4), ecosystem state indicators and future scenarios (WP5, 6) and assessment of ecosystem risks and vulnerabilities in associated ecosystem services (WP7). Two WPs (WP8, WP9) are dedicated to training and building future capacity, and legacy designed to engage society on IEA topics, respectively. WP10 is devoted to Project Management. A matrix structure is used with the IEAs in 7 CS coordinated in WP1 with interactions with all the other WPs. The matrix structure will ensure the integration of the scientific work both **within and between** the WPs and CS, guiding the exchange of knowledge between experts and regions, and **best enabling a basin-wide Atlantic ecosystem assessment**. Moreover, acknowledging the different levels of maturity of IEA process across the Atlantic, this approach will guarantee the flexibility to advance present knowledge, monitoring, modelling and mapping capacities in all regions. Stakeholder engagements during the scoping and review processes in each CS are all organized in WP1.

WP1: Atlantic Ocean Integrated Ecosystem Assessment will: **(Task 1.1)** Coordinate all regional stakeholder platforms meetings and advance the ORL of IEA in all CSs and at the whole Atlantic scale **(Task 1.2)** Identify regional objectives and basin scale social systems (***scoping***) **(Task 1.3)** Assess the whole Atlantic Ocean ecosystem, including a synthesis of basin scale and regional findings, identifying commonalities and specifics across CSs. WP1 will coordinate stakeholder interactions within CSs, and interactions among and between CS and WPs by extending existing assessment frameworks and tools used by project partners and developed by NOAA and ICES. The *scoping* will provide the framework, conceptual models and scenarios for assessing indicators of states and drivers (WP5), and future scenarios and risks (WPs 6,7) using inputs from data and information provisioning activities (WPs 2,3,4). WP1 harmonizes the timing of these activities in each CS ensuring advancing ORLs and to deliver - over the entire Atlantic Ocean – two assessments: present ecosystem status; ecosystem vulnerabilities.

[1] One Ocean HUB, UK https://www.ukri.org/news/new-global-research-hubs-to-tackle-complex-development-challenges/

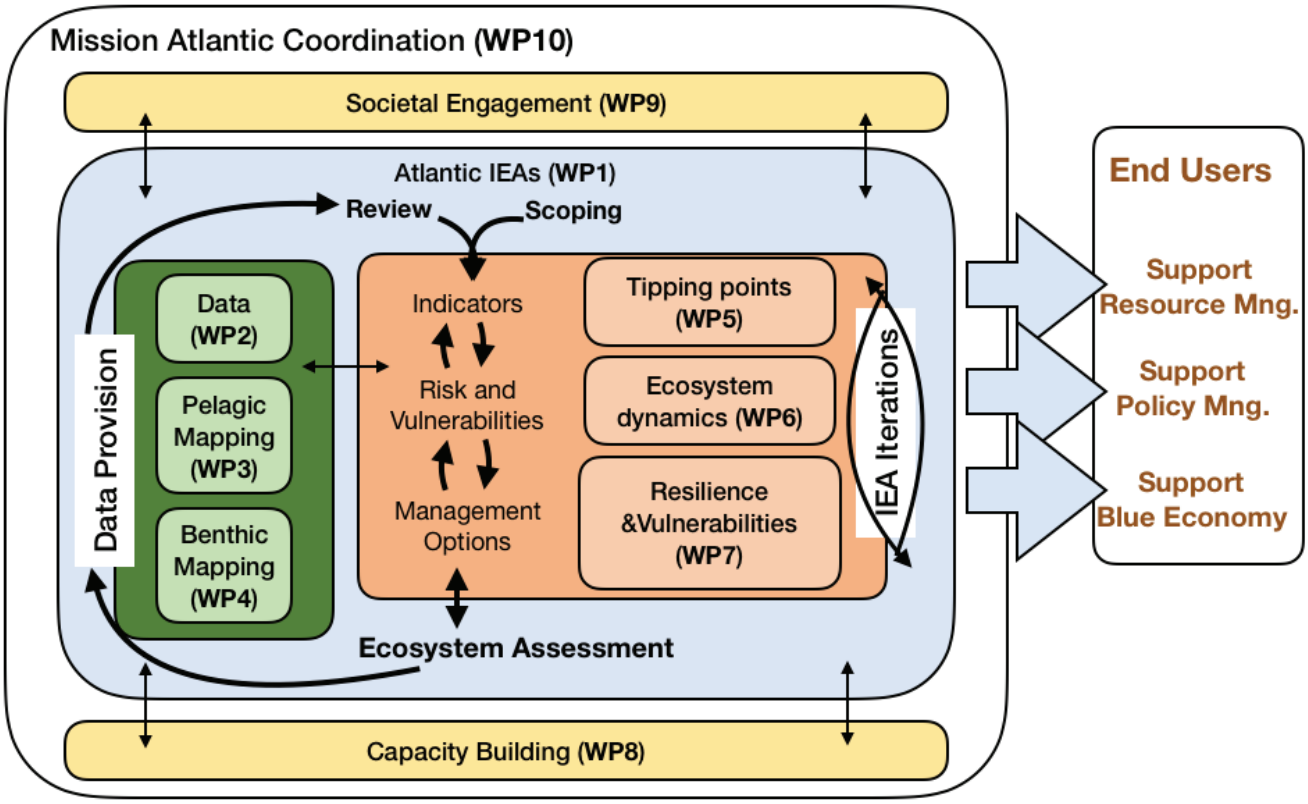

***Figure 5**. Work-packages and their main interdependencies and flow of information to support the IEAs. Specific activities are highlighted to demonstrate the iterative nature of the Atlantic IEA framework in its interaction with technical & scientific WPs. Scoping and review processes are performed with stakeholders. Blue arrows indicate the information flow and major outputs to benefit society. CSs are coordinated in WP1 and operate across all WPs with variable effort depending on their specific ORLs.*

WP2: Data technology and management for IEA will implement a coordinated data management approach that operates from the start until the end of the project to ensure that data produced during the project are well documented and archived, made accessible and interoperable. This WP will **(Task 2.1)** map the data availability by addressing the IEA needs (WP1); **(Task 2.2)** manage all project outputs (data, software, and other outputs) according to FAIR requirements into targeted e-infrastructures (e.g. EMODnet for data products from seabed mapping, biological, chemical, physical, observations and models), adding value using geospatial data management techniques e.g. GIS, where relevant and to ensure a link with developments in related projects; **(Task 2.3)** establish technology demonstrators on big data storage and analyses, to observe and map benthic and pelagic biomes and to fill data gaps in existing models by delivering systems supporting blue bio-economy.

WP3: Pelagic Mapping: Ecosystems, Resources and Pressures will produce 3D maps of physical, hydrological, biological and chemical parameters as well as pressures such as fisheries at basin and regional scales to inform WP1 and the basin scale analyses (WP5-7). **Task 3.1** generates maps of ecosystem attributes based on historic data and partner archives in WP2 as well as from field work in the all Atlantic regions. **Task 3.2** delivers a new bio-regionalisation for the Atlantic horizontal and vertical domains for defined climate and socio-ecological scenarios accounting for spatially-explicit human pressures (from **Task 3.3**), basin circulation (e.g. AMOC), multi decadal oscillation anomalies (e.g. ENSO), coupled habitat (niche-based) models [11] and dynamic bioclimatic envelope model for data-rich and data-poor regions [12] (with WP6).

WP4: Benthic Mapping: Ecosystem, Resources and Pressures will (**Task 4.1**) develop a strategic framework for Atlantic bathymetry and benthic habitat mapping for IEA, leveraging key Partner roles in the AORA, Atlantic Seabed Mapping International WG, EuroFleets+, and ASPIRE. New and existing data integration will enable

(**Task 4.2**) mapping of seabed bathymetry, benthic habitat, selected vulnerable marine ecosystem species (VMEs) and characteristics of benthic species assemblages, to underpin IEA and ecological dynamics modelling (in WP6). Maps of sectoral pressures on benthic communities and VMEs will be created and shared (e.g. EMODnet Human Activities). Finally, **Task 4.3** will predict spatial distribution of selected species and assemblages under different climate change and ocean acidification scenarios (WP6), creating maps of future habitat suitability.

WP5: Assessing state, drivers and tipping points will: (**Task 5.1**) Assess and compare the status, trends and occurrence of abrupt transitions in Atlantic ecosystems; (**Task 5.2**) Identify the key drivers, response dynamics and tipping points of Atlantic marine ecosystems to *cumulative impacts* arising from changes in multiple local, regional and basin-wide pressures, including climate change, fishing, acidification and pollution; (**Task 5.3**) Assess and compare the key attributes promoting ecological resilience (i.e., the degree of functional redundancy and response diversity) across each CS area; (**Task 5.4**) Identify and test core ecosystem indicators and thresholds to be used in IEA interactions with stakeholders (WP1) and in WP6 and WP7. Focus will be given to indicators that are sensitive to stressors, have known and specific response to a given disturbance, are easy to measure and are applicable across CS areas.

WP6: Dynamics of ecosystem state and resources simulates basin and regional scale ecosystem state indicators in the past, present and future (1980-2070). **(Task 6.1)** a ¼º global hydrodynamic-biogeochemical model (**NEMO-ERSEM**) will be setup and validated. This is a IPCC-class global ocean model adapted for coastal-ocean applications and will be coupled to size-based and species-resolving models of fish stocks. Results are validated and bias-corrected with all available observations (WP2-4). (**Task 6.2**) The models will be used to simulate the change in indicators and ecosystem state until 2070 under four scenarios developed together with WPs 1-4. Then management option evaluations are enabled in WP6 by (**Task 6.3**) setup and validation of StrathE2E [13]. Finally, (**Task 6.4**) seasonal, decadal and climate variability of major drivers of change are analysed including the large-scale connectivity between biogeographic regions and extreme events.

WP7: Risk assessments and uncertainties will assess the vulnerability of Atlantic Ocean ecosystems to human activities, climate, and natural hazards using a hierarchical risk assessment framework: (**Task 7.1**) Qualitative risk assessment, i.e., preliminary evaluation of existing knowledge and qualitative scoping of linkages between activities, pressures, ecosystem components and ecosystem services in each case-study; (**Task 7.2**) Semi-quantitative risk assessment, using expert knowledge and network metrics to set scores on pressure-impact chains and identify key vulnerabilities; (**Task 7.3**) Quantitative risk assessment for the most prominent risks identified using methods, such as multi-risk analyses, Bayesian belief networks (BBNs) and metrics of system dynamics. Supervised and unsupervised machine learning tools are used to analyse model ensembles to deduce the most probable trajectories and uncertainties in scenario projections; (**Task 7.4**) Management option evaluation using dynamic simulations with the StrathE2E models configured for each CS (in WP6) to quantify ecosystem responses given scenarios of multiple simultaneous anthropogenic pressures (fishing gear activities, seabed disturbance, nutrient inputs) and climate conditions (from WP6) and relative to baseline states (e.g. 2010-2020 climate and human activity). Results in this WP are validated and discussed in each CS areas with stakeholders in WP1.

WP8: Building Capacity for the IEA will improve professional skills and competences across the Atlantic in support of IEA approaches to ocean resource management. Activities will: **(Task 8.1)** survey the stakeholder needs at regional level to define learning objectives for IEA training; **(Task 8.2)** deliver adaptive e-learning platform on IEA topics for relevant target users; **(Task 8.3)** establish a PhD doctoral school (~10 PhDs), a large-scale mobility program (6 weeks for ca. 40 scientists) and integration of IEA concepts in existing master programmes of the academic partners in the project (e.g. WMU, DTU).

WP9 Societal engagement and communication will ensure that the knowledge generated by MISSION ATLANTIC is used for optimal benefit to society: **(Task 9.1)** Tailored communication and impact maximization actions, including dedicated web-interfaces for regional models; **(Task 9.2)** multi-actor Atlantic stakeholder engagement and profiling of target users (i.e. High-Level Stakeholder Forum); **(Task 9.3)** adaptive exploitation strategy addressing societal, policy, and industrial needs. Activities will embed this project's outputs within a

framework of international initiatives and sustainability targets relevant for the Atlantic Ocean (e,g. SDGs, IPCC, MSFD, MSP, IPBES).

WP10: Project Coordination (leader DTU) will facilitate progress to achieve the deliverables and facilitate clustering of MISSION ATLANTIC with other projects under BG08 and other H2020 funded projects (e.g. AANCHOR, TRIATLAS, iATLANTIC, AQUAVITAE, SUMMER, MEESO, PANDORA) as well as relevant projects of the Bélmont Forum (e.g. GULLS).

1.3.8 Gender analysis

MISSION ATLANTIC will adhere to the gender mainstreaming strategies that have been adopted by the EU Commission, for the systematic integration of equal opportunities for women and men into all programmes, policies and practices. The planned research and innovation activities in the project will be performed by both women and men without any barriers that could emerge in running those tasks. MISSION ATLANTIC will promote participation of women in science, management and policymakers roles to ensure that women are involved in all aspects of the project by establishing a gender action plan under WP10.

1.4 AMBITION

The ambition is to advance the *Operational Readiness Level (ORL) of the IEA approach in each CS areas and at the whole Atlantic basin-scale*. The project aims at advancing knowledge going beyond the present state of the art on:

(a) Management of human activities to improve sustainable development: MISSION ATLANTIC is the first integrated, holistic approach applied at the scale of the entire Atlantic Ocean for pelagic and benthic habitats and their physical and biological components. Presently, operational IEAs are rare (e.g., California Current, North West Atlantic) with IEAs under development in e.g., North and Arctic Seas. MISSION ATLANTIC will advance the state of the art creating operational IEAs in 7 regions (WP1) and advancing an additional 4 associated with the project, and incorporating new knowledge on ecosystem resilience, thresholds and tipping points that has only been minimally included in any IEA to date (WP 5, 6, 7). This will establish a first assessment of the whole Atlantic basin and will additionally deliver significant knowledge that can *kick-start future new IEAs* in non-CS areas of the Atlantic.

(b) Enhancement of a global model to inform and support regional studies: MISSION ATLANTIC will adapt and extend a state-of-the-art IPCC-class model for the global ocean (the high-resolution, physics-only variant of the CMIP6 UK Earth System Model) with improved capability in coastal and shelf systems. To this end, we will improve the representation of coastal physics (e.g., by adding tides) and couple it to ERSEM, a detailed marine ecosystem model that expands combines the typical open ocean ecosystem representation with several features designed for coastal applications (e.g., variable stoichiometry, an explicit benthic subsystem).l. This enables it to provide information on key local pressures at regional scales while simultaneously capturing climatic and far field effects in a consistent manner across the whole Atlantic.

(c) Adaptive modelling based on Artificial Neural Network (ANN): Machine learning tools for handling of data, pattern and process analysis and prediction of the emergent properties of complex systems have led to significant breakthroughs in disciplines from quantum physics, earthquake prediction to human health. ANN techniques have been proposed for understanding the processes impacting on ecosystem state [8]. MISSION ATLANTIC will advance the field in the prediction of future ecosystem states and the dynamics of key species via the integration of deterministic model predictions (WP6, 7) and historic data (WP2) in supervised and unsupervised ANNs hence creating an adaptive modelling tool that is sensitive to the complex interactions of evolving Atlantic ecosystems and able to quickly respond to specific end-user needs.

(d) Big data management, visualization and analyses in the ocean: Processing of environmental data is demanding and initiatives to pool infrastructures and resources towards a common architecture, functionalities and collaborative tools are initiated under the European Open Science Cloud (EOSC). These developments will

facilitate and improve access to big data in MISSION ATLANTIC which will move beyond the state of the art by advancing machine learning techniques for extracting data from big data archives, and processing large quantities of raw and mapping data and visualizing project data on a GIS platform for long-term ingestion in EMODnet. A toolbox for indicator analyses and ecosystem resilience evaluation is developed in WP5. Additionally, a web interface is provided for management strategy evaluation in each CS. The software will make use of the database produced in the project (estimated ~450 Tb) and the available data for the CSs (from WP2), to interactively run regional end-to-end models from WP7 providing a synthetic graphical information about impacts on different economic sectors.

(e) Detailed maps of Atlantic biomes, their vulnerabilities and drivers of change: Assessing ecosystem state and risks requires knowledge on both the distribution of species and habitats, and the distribution of human activities impacting them. MISSION ATLANTIC will move beyond the state-of-the-art by generating 3D maps of the abiotic and biotic properties of the entire Atlantic, as well as their present and future pressures, providing insight into the main Atlantic biomes and biological connectivity between regions. Maps will be generated based on information from coupled 2D and 3D ecosystem models, long-term data series and new 3D and whole-water-column sampling methods: ARGOS system, WaveGlider™, backscatter data from multi-frequency and broadband echo sounders, CPR, European Telemetry Network (ETN). Dedicated field-work with new (autonomous)sampling technologies will be delivered across the Atlantic.

(f) Linking North and South Atlantic: Long lasting research cooperation program on IEA MISSION ATLANTIC will be a game-changer for the North-to-South, East-to-West collaborations in the Atlantic. It will contribute directly into AIRC, AANCHOR and AORA WGs activities delivering tools, methodologies, and knowledge that will exceed the project life, underpinning long term sustainable management of the Atlantic Ocean. It will establish for the first-time common ecosystem models and cross comparison methods. We will simulate past, present and future IEA indicators in all CS regions based on four climate scenarios filling present modelling gaps in all Atlantic Ocean regions (especially data poor) and contribute to creating a common modelling framework that will last well beyond the end of the project (data storage performed via WP2). It will support professional development and building capacity across the Atlantic on IEA creating a long-term legacy via introduction of a curriculum shaped around professional needs and implementing three tools (i) e-learning (ii) PhD school (iii) mobility programme.

2. IMPACT

MISSION ATLANTIC will run from September **2020 to 2025 (60 Months),** overlapping with major relevant global policy initiatives, in which consortium partners are directly involved, including among others: IPCC 6th Assessment Report, UN World Ocean Assessments (Regular Process), IPBES Assessment on Sustainable Use of Wild Species and Assessment on Invasive species, and Decade of Ocean Science for Sustainable Development. Most of the initiatives above have major milestones in the period 2020-2025, and MISSION ATLANTIC will time activities and milestones with these policy agendas in order to increase impact and uptake of project outputs in policy formulation.

2.1 Expected Impacts

MISSION ATLANTIC will advance the **Operational Readiness Level** (*Fig.1*) of integrated ecosystem assessment in the entire Atlantic including North, South and tropical regions. Sustainable resource exploitation is linked to our ability to assess and predict impacts of human activities on these ecosystems. Ecosystem impacts are extremely variable and both state and drivers are subject to large uncertainties. It is the role of MISSION ATLANTIC to reduce such uncertainties and to inform decision makers about the likely consequences of different management measures and strategies, but doing so with clear mandate from end-users.

To ensure uptake of results and long-term legacy, MISSION ATLANTIC integrates co-creation in its methodology (Section §1.3.7), and has engaged end-users broadly (Table 2.1) to **document clear need and relevance** of project main output to targeted end-user's workflows and mission objectives. The End-user Focus Group (EUG) also

commits to co-deliver "**fit for purpose**" outputs to non-academic end-users (cf. Appendix A, Letters of Commitment).

Uptake will also be optimised by delivering all scientific and technical activities (aka **ST** objects in Section §1.1) by Month 48, dedicating 12 Months (*Fig.8 Gantt Chart*) to transforming mature results to "**fit for purpose**" outputs under the guidance of the EUG, input from Stakeholder FORUM (Task9.2), and 100.000 EUR resources to be prioritised into exploitation activities most pertinent at the time for end-user uptake (Task9.3).

MISSION ATLANTIC will deliver concepts, results and methods relevant for *Belém and Galway Statements* objectives, by leading ***"clustering" effort on IEA-related research*** in the Blue Growth portfolio of projects, as well as (e.g. US-NOAA's ASPIRE, UK's One Ocean HUB and regional initiative explicitly flagged by EUG in Appendix A). Clustering Task10.4 will form an ***All Atlantic Panel*** for direct collaboration with concurrent Coordination & Support Action AANCHOR[2], and concurrently funded iAtlantic, TRIATLAS, AQUAVITAE projects, as well as other *Blue Growth* projects to be prioritised with EC Project Officer.

2.1.1 Demand-Driven & End-User Centered

A core End-User Focus Group (EUG) has been committed to the project (cf. Appendix A) in order to (a) document end-user demand at methodology design, and (b) establish a core group that can guide MISSION ATLANTIC in identifying and mobilising key influencers in relevant Blue Economy and stakeholder sectors.

EUG offers a preliminary documentation for end-user demand of MISSION ATLANTIC outputs, spanning government bodies in both North & South Atlantic, coastal states to small island governments (Table 2.1). EUG have expressed their interest for the IEA activities and the mapping, modelling, risk assessment products, and will guide and optimise co-creation within the research methodology itself (Section §1.3.7, WP1) and uptake of "**fit for purpose**" outputs (Section §1.3.7, WP9) across multiple Blue Economy sectors (Table 3.1b, Task 9.3).

Demand for MISSION ATLANTIC outputs on pelagic & benthic habitat baselines, forecasting scenarios of ecosystem state, changes in commercial species distribution is an explicit need [14] and gap [15] for the insurance sector. In order to ensure all MISSION ATLANTIC data products are "**fit for purpose**" for Ocean Risk Index[3] proposed framework and indicators, Ocean Data Alliance (USA; co-author of the ORI framework) commits to guide the consortium annually. The partnership with Ocean Data Alliance as member of the EUG will ensure project outputs are relevant all Blue Economy activities currently underwritten by the Insurance Sector.

Table 2.1 Committed entities to End-User Focus Group (EUG) in MISSION ATLANTIC

Government Bodies:	BLUE SECTOR:	Case Study Region (Fig.1):	OUTPUTS of explicit interest (cf. Appendix A):
US Dept. Commerce, NOAA-Fisheries (**NOAA**)	Fisheries, Aquaculture, Seabed Mapping	All CS	Pelagic & benthic habitat maps, predictive capabilities of vulnerable habitats, deep-sea connectivity, operational IEA frameworks
Dept. Fisheries & Oceans, Canada (**DFO**)	Maritime Sectors & Fisheries	NW Atlantic	operational IEA frameworks, benthic habitat maps, vulnerability & risk maps
Regional Fund for Science & Techn., Azores (PY)	Marine Resources, Spatial Planning	NAMR CC-Canaries	operational IEA frameworks, collaboration on triple helix stakeholder involvement in IEAs
JSC of SFTAs EU-Morocco, Mauritania, Senegal	Marine Resources, Spatial Planning	CC-Canaries	Pelagic & benthic habitat maps, Vulnerabilities & Risk maps in CC region
St Helena Government	Marine Resources,	SAMR	Pelagic & benthic habitat maps,

[2] BG-08-2018 CSA AANCHOR "Building an All Atlantic Ocean Community" https://www.allatlanticocean.org/

[3] Reducing Risk from a Changing Ocean, Ocean Risk Summit 2018, https://www.oceanrisksummit.com/

	Spatial Planning		Distribution of commercial species,

Regional Commissions:			
OSPAR	Fisheries,	CES, NOS	Pelagic & benthic habitat maps
Benguela Current Commission (**BCC**)	Fisheries, Oil & Gas	BEC	operational IEA frameworks,

Private Sector:			
Ocean Data Alliance (**ODA**)	Insurance of all Blue Economy sectors	All CS	Integration of habitat maps, model scenario forecasts & uncertainty (WP3,4,6,7) in Ocean Risk Index[4]
Gardline Marine Surveys Ltd	Offshore Surveys, Offshore Energy, Communications & Engineering	All CS	Pelagic & benthic habitat maps

IGOs & NGOs:			
Marine Stewardship Council (**MSC**)	Seafood ecolabelling	All CS	new indicators for ecosystem health and resilience,
Under negotiation at submission of the proposal			
World Wildlife Fund (**WWF**), Holland			*Alignment with S. Atlantic & Africa initiatives on biodiversity*
ClientEARTH, UK			
International Seabed Authority, **ISA**	*Seabed Mining & Exploitation*		*Benthic and bathymetry mapping, benthic habitats*
Regional Fisheries Management Organisations: **SEAFO**, **CECAF, NAFO**	*Fisheries, Aquaculture, Marine Resources*		*Habitat maps of commercially exploited species, Operational IEA frameworks and protocols*

2.1.2 Provisions to match end-user demand

Re-use of research results between concurrent research initiatives is ensured by MISSION ATLANTIC leadership on "**clustering**" with concurrent IEA-relevant programs, within Blue Growth portfolio (Table 3.1b, Task 10.4), and funded programs within the circle of influence of the EUG (cf. Appendix A).

The role of science diplomacy to inform ocean governance at the Atlantic basin scale is investigated (T9.2.2) and a roadmap to introduce such tools into IEA framework is delivered (D9.3). All-Atlantic Ocean Research Forum (organized every February by AANCHOR), the Intergovernmental Conference for Biodiversity Beyond National Jurisdiction (BBNJs) and IPBES experts panel meetings, are all considered important platforms to inform stakeholders about IEAs outputs. The adaptive exploitation strategy designed in MISSION ATLANTIC will allow to respond quickly to end user needs (T9.3.2).

Beyond research and policy, the EUG has direct influence over prioritisation of resources and effort dedicated to stakeholder involvement in the methodology (Section §1.3.7, WP9), two "All Atlantic FORUM" events (Task 9.2, Milestones 9.1 & 9.2) and 100.000k EUR of resources for adaptive exploitation initiatives (Task 9.3) that can address end-users needs in the period 2023-2025, taking into consideration progress on external initiatives supporting UN Decade of the Ocean.

[4] F. Niehörster & R.J. Murnane (2018). Ocean Risk and the Insurance Industry. Pub. by XL Catlin Services SE, UK, May 2018, 40pp. ISBN: 978-1-9995922-0-2

Strong South Atlantic presence on the EUG will also have influence on MISSION ATLANTIC education and training activities. Large-scale mobility, MSC and PhD programmes are funded in the project and will be linked to initiatives such as the All-Atlantic Ocean Youth Ambassador Programme[5], and similar programmes from European Marine Board and EUROMARINE. A "MISSION ATLANTIC MSC programme" will be established at WMU on IEA topics with learning objectives co-designed with end-users (T8.1, T8.2, T8.3).

2.1.3 Specific outputs

Although MISSION ATLANTIC follows a demand driven approach to Knowledge Transfer, specific outputs can be already identified as candidate for transfer outside the science community:

Deliverable D1.1 "Scoping Impact, Pressure, Ecosystem State" will include conceptual models of the regional ecosystems, which will be defined in discussion with stakeholders at the regional scoping workshops (*Fig.3*, WP1). These conceptual models will be part of the communication toolbox delivered in WP9 (e.g., making use of brochures and infographics) to allow disseminate regionally-relevant message on progress towards IEA operationalisation, best practices, regional pressures and drivers. The communication toolbox will be provided to the CS leaders who will serve the role of MISSION ATLANTIC ambassadors to disseminate knowledge of integrated ecosystem approaches for the Atlantic Ocean.

Deliverable 2.3 "New technology for big data collection, analyses and storage" will include an analysis of data gaps and how new technologies such as acoustic sensors and autonomous systems can fill present gaps in support of the IEA. This will feed directly into other EU initiatives, e.g., BG-07-2019-2020: The Future of Seas and Oceans Flagship Initiative, [A] 2019 - Blue Cloud services (IA), [B] 2019 - Observations and forecasting (RIA), [C] 2020 - Technologies for observations (RIA), and can be converted into a "how to" guide, describing the use of these advanced technologies in real world ocean monitoring applications, and be also of use in training via WP8.

Deliverable D1.2, D1.3 "Present status assessment" and "Ecosystem vulnerabilities under future scenarios" will include a review of the MISSION ATLANTIC process and identify commonalities and specificities of the IEA in CS areas proposing Atlantic and regional management actions. We plan to transform the new knowledge of the project deliverable into a ***demand-driven*** tool e.g. manual, decision logic tree, best practice guide etc., to empower practicing marine resource managers and policy makers to increase their IEA operational level. This will involve gathering information on end-user workflow to best shape the format for knowledge transfer. This will be followed by specific repackaging into specific guidelines for IEA implementation in specific regions that will fit end-user workflows. Information on end-user needs will come from the regional scoping workshops (*Fig. 4*, WP1, 7), from the Atlantic FORUM and the EUG established in the project (WP9).

2.1.4 Expected impacts mentioned in the work programme

Given the *expected impact* in the call text (**EI**) we describe for the short and medium term, the *main outputs* (**OUT**) of MISSION ATLANTIC which we use to monitor the project:

Expected impact in the short term

EI: Contribute to the implementation of the EU-Brazil-South Africa Belém Statement on Atlantic Ocean Research and Innovation cooperation
OUT: (1) PhD school and mobility program (WP8); (2) Operational IEA and stakeholder fora (WP1).
Advancing the IEAs in all regions and the specific activities under WP8 (Capacity Building) and WP9 (Societal Engagement) will improve scientific and technological cooperation across the entire Atlantic Ocean. MISSION ATLANTIC delivers a new science network addressing IEA in several Atlantic areas for international cross-disciplinary and cross-sectorial collaborations between scientists and policy makers from the EU, Brazil, South Africa, the US and Canada. Activities will clearly address the objectives defined in the *Belém Statement*, linking South and North Atlantic to promote both "*human capital development*" and "*joint activities*"

[5] https://www.youth.ie/articles/atlantic-ocean-youth-ambassadors-programme/

on common area of interest: *"ecosystem approaches", "ocean observations (including seabed mapping)", "forecasting and monitoring", "fisheries management", "effects of emerging pollutants"*, etc.

EI: Contribute to create the right conditions for the development of better and accurate monitoring, modelling, planning, management and prediction capacities in the whole Atlantic

OUT: (1) Vulnerability assessments (WP1,7); (2) Management option evaluations in all CS areas (WP7).

MISSION ATLANTIC develops IEAs which explicitly "create the right conditions for the development of better and accurate monitoring, modelling, planning, management and prediction capacities in the whole Atlantic". It will map human activities to pressures, and pressures to ecosystem components and services, assessing vulnerabilities and risks in consideration of alternative management options and climate scenarios - in seven CS (WP7) and at the Atlantic basin scale (WP1). This is supported by research in: ecosystem functioning and indicators to advance the monitoring of the essential ocean variables; new end-to-end models and model ensembles for the entire Atlantic (and globally) at 0.25 degree resolution and four climate scenarios (WP6) - going beyond IPCC state of the art models.

EI: Develop ecosystem assessments and forecasts as well as a deeper understanding of vulnerabilities and risk including climate change

OUT: Vulnerability assessment for the whole Atlantic under four climate scenarios (WP1, 7).

MISSION ATLANTIC develops models and methods for the identification and evaluation of indicators to assess ecosystem non-linear dynamics, resilience and the risks of crossing tipping points under climatic and multiple anthropogenic pressures at both the regional and basin scale (WP1, 5, 6). Risks and vulnerabilities of the ecosystem are assessed explicitly (WP7) using a hierarchical approach to respond to difference in data and knowledge across the whole Atlantic (North South, East West, coast to high seas).

EI: Increase the competitiveness of EU's Blue Economy, develop new technologies to service societal needs & new value chains

OUT: (a) Tools and methods for big data analysis and storage (WP2); (b) Global high resolution end-to-end models (WP6); (c) Education, training and professional development opportunities (WP8)

IEAs are a tool/ method explicitly considering all Blue Economy sectors. An End-User Focus Group is established in the project to align research outputs to societal needs and to identify new value chains. MISSION ATLANTIC will therefore be able to provide risk evaluations for the development of the Blue Economy (WP7). All models (WP6) and mapping activities for pelagic (WP3) and benthic biomes (including seafloor, WP4) and maritime activities are spatially explicit. New data and technology for monitoring (including those from gliders) will be delivered in Open Access (WP2) to facilitate uptake by industrial sectors. In particular link with global insurance companies are established to provide new data and methods for "Ocean derived Risk Assessment" following recommendations from several Blue Economy sectors [15]. Boundaries for the safe and sustainable development of economic sectors will be identified (WP7) and presented to management authorities (WP9). The benefits of data, spatial planning, education and skills development have already been recognised as key enablers for the blue economy and especially for small and medium enterprises[6].

EI: Contribute to the sustainable management & protection of marine and coastal ecosystems to avoid significant adverse impacts, strengthen resilience, take action for their restoration, in order to achieve healthy and productive oceans (UN SDG 14)

OUT: Integration of ecosystem resilience into IEA

Target 14.2 of SDG14 is about strengthening ecosystem resilience, which is a key theme in MISSION ATLANTIC. Several activities in MISSION ATLANTIC will contribute to sustainable management of Atlantic Ecosystems: WPs 1,5,6,7 will identify suitable indicators, key stressors triggering tipping points using data (WP2) and new pressure and habitat maps (WP3,4). WP6 & 7 will provide scenarios response envelopes and management options to inform resource managers in all CS areas to avoid undesired ecosystem developments including critical transitions of the ecosystem state and deliver tools for future IEAs under changing management

[6] https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/swd-2017-128_en.pdf

objectives and global change. Relations between cumulative pressures and resilience for relevant ecosystem indicators are specifically delivered in WP5 and integrated for the first time in IEAs (WP1,7).

Expected impact in the medium term

EI: Contribute to the development of ecosystem services to ensure the long-term sustainable management of marine resources (UN SDG 14).
OUT: Vulnerability assessment and management option evaluation (WP1, 7) Mapping human activities in the context of each other and delivering a whole Atlantic IEA focussing on ecosystem services (WP1).
Risks and vulnerabilities of present and future human activities and climate conditions are assessed (WP7) indicating the safe operating space for maritime activities. This provides scientific support for sustainable use of marine resources, and also identifies sectors where further economic expansion is possible (WP1). We engage resource and conservation managers, NGOs, relevant industrial and policy stakeholders in the definition of scenarios and management options as well as in reviewing project outputs (WP1, WP9). New maps of resource distribution, services and vulnerabilities can inform marine spatial planning (MSP) and help to develop the blue economy in a sustainable way under different future conditions.
EI: Increase EU leadership in ocean technology developments
OUT: Development of: (1) acoustic sensor systems 2) autonomous systems for seafloor integrity and characterization 3) new generation of surface and Deep sea gliders
MISSION ATLANTIC focuses on: (1) Tools for big data collection, analyses and storage using artificial neural networks; (2) Integration of broadband acoustic sensors on WaveGlider™ for ocean monitoring; (3) Adaptive sampling using Deep sea glider technologies. In WP2,3,4 we demonstrate, for the first time, all these new technologies together, applying them in specific areas and including their output into IEA approaches. We expect these technological solutions to become standard tools in the future for data driven IEAs.
EI: Improve the professional skills and competences of those working and being trained to work within the blue economy
OUT: (a) PhD and graduate schools and mobility program (WP8) (b) e-learning platform (WP8);
WP8 undertakes an assessment of perceived capacity-building needs from government, industry, and civil society decision-makers and their advisors, across the Atlantic (T8.1). This will shape both the content of the e-learning platform (T8.2) and the PhD school and mobility program (T8.3). Learning objectives of the e-learning platform are defined to match the demand from the Blue Economy sectors. Possible topics that could be considered in the e-learning platform and which are further developed in MISSION ATLANTIC are: glider technologies (WP2-4), analyses of big environmental data (WP5), numerical ocean models (WP6), IEA for science and policy development (WP1,3,4,9), advances in risk assessment methods and artificial intelligence based model ensembles (WP7).
EI: Contribute to policy making in research, innovation and technology
OUT: Inform and deliver advice to policy makers and resource managers on the sustainable development of the maritime sectors (WP1, 9)
The ambition of MISSION ATLANTIC is to advance the Operational Readiness Level (ORL) of the IEA in each case study area developing a framework that is routinely implemented to provide management and policy advice in an operational context. Stakeholders at regional level are engaged in the project (WP9) and scenarios co-created (WP1,9) to be used in the risk and vulnerability assessment (WP7) at different levels of complexity, from qualitative to fully quantitative. Each step can provide management advice, with an increasing level of detail and complexity. This will have a direct impact on several policy initiatives, e.g., MSFD, CFP, MSP directive, Blue Growth strategy, and the International ocean governance agenda for the future of our oceans. We have dedicated tasks in WP9 to provide flexible and adaptive knowledge transfer (T9.3) and to deliver a risk management protocol for embedding science diplomacy into the IEA process (T9.2.2).

2.1.5 Other significant expected impacts

(a) **Improve access to oceanography data in Brazil:** Spatial planning process started in 2011 in Brazil but with little improvements. Of the 145 descriptors needed for MSP, only five are available via the Brazilian National Spatial Data Infrastructure while other databases (e.g., BNDO) are difficult to access. BNDO is the national database for oceanography data, so all institutes that perform an oceanographic survey in Brazilian EEZ are supposed to contribute to this database by sharing gathered data. Until now this access and data submission has being either difficult or sluggish. MISSION ATLANTIC will make a step change in the way data is sent to BNDO and shared in Brazil, promptly providing new data, improving accessibility to historical data, and making FAIR all data collected in the project. The ambition is to provide a solid science-based reference and data sharing that highlights the huge potential of historical time series collected in the country.

(b) **Linking South and North Atlantic Ocean Research Strategies:** MISSION ATLANTIC will link research activities and advance science and knowledge to regional research programmes and initiatives for Atlantic scale IEAs. Research activities will directly benefit and further AORA's Working Groups (WGs) on the Ecosystem Approach to Ocean Health and Stressors and the Atlantic Seabed Mapping in particular. Under WP10 a specific panel (**All Atlantic Panel**) will facilitate a close working relationship between researchers in MISSION ATLANTIC and existing WGs across the entire Atlantic in close cooperation with AANCHOR and including the All-Atlantic Ocean Research Forum, (e.g. 6 - 7 February 2020, in Brussels). In particular, the project is clearly expanding to the South Atlantic the vision of EA2OHS WG in AORA which is to promote research to understand the North Atlantic Ocean in support of ecosystem based management (EBM). The operational framework developed in MISSION ATLANTIC will contribute directly to the work of EA2OHS to create a science plan on research directions, priorities, synergies, and complementarities in the North Atlantic, and will expand it including activities performed in the Tropical and South Atlantic Ocean. Specific tasks in WP1 (scoping management objectives and data availability) WP3,4 (habitat mapping for pelagic and benthic communities), WP5,6,7 (modelling future risks and vulnerabilities) will advance our ability to operationalize the ecosystem approach to management, a very much needed global priority for the Oceans including North and South Atlantic, as exemplified by a recent workshop on this topic organized by FAO and AORA[7]. We already have in the project direct participation of NOAA and DFO (see section 3.3) to promote the cross Atlantic dimension of IEA approaches.

(c) Support for The **Intergovernmental Panel on Climate Change**, IPCC, **Intergovernmental Science-Policy Platfrom on Biodiversity and Ecosystem Services** (IPBES), **Marine Strategy Framework Directive** (MSFD), and **Common Fishery Policy** (CFP) implementation: MISSION ATLANTIC data management plan implementation will ensure data are fit for purpose for ingestion by relevant existing data portals, thus supporting relevant IPBES and MSFD reporting and moves towards achieving Good Environmental Status. In particular, WP2, 3 & 4 outputs will be informative in reporting on biological diversity and seafloor integrity descriptors D1 & D6. D1: Biological diversity is maintained D6: Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected. Results from MISSION ATLANTIC will then help structuring monitoring programmes, and determine resilience and restoration measurements. MISSION ATLANTIC will support CFP and contribute to refining reference points for fishery management from an ecosystem point of view. Total allowable catches for commercial fisheries are in most cases derived by applying fisheries reference points, for example the fishing mortality rate that in the long run maximizes fisheries yield at still sustainable stock biomass. To properly expand this concept to account for ecosystem effects of fisheries, as well as for the effects of the ecosystem on fisheries, it is imperative to extend fisheries reference points to include effects of the ecosystem (e.g. changes in the capacity of the system to support the reproduction of a given commercially exploited stock) and effects on the ecosystem (e.g. removing predators or prey). Key processes affecting the interplay between the ecosystem and commercial fisheries, as well as indicators for the status of these processes in relation to desired state (IPCC and partially described in the MSFD) are to the core of IEA. For this reason, IEAs such as those developed in MISSION ATLANTIC are an ideal avenue to channel ecosystem information into reference points.

[7] https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5adc90303&appId=PPGMS

(d) **Ocean literacy:** Stakeholder involvement and co-creation are key to the successful development and legitimization of the IEA. The dissemination and exploitation plan in MISSION ATLANTIC (WP9) will promote the understanding of the ocean's influence on the society and our influence on the ocean. The scholarships, MSC and PhD programmes in WP8 combined with All Atlantic Youth Ambassador from AANCHOR aim at *building an Atlantic Community of a fully engaged young generation to create a movement to support an Ocean aware society, targeting communities living by and from the Atlantic Ocean*. Stakeholder engagement and co-creation of science-to-society products are major activities in the IEA e.g. in WP1, WP7, WP8, WP9. (1) An **Atlantic FORUM and an End-User-Focus-Group (EUG)** are established in WP10 and WP9, respectively, and used to inform the IEA on policy objectives and to profile end users to maximize knowledge transfer. (2) Key scientific findings and new data observation and survey highlights will be synthesised in plain language for public **outreach, engagement, and awareness raising**, both in professional print and video formats. (3) **Open access data policy** is used in the project, with accessible databases and data policies that enable efficient data communication between project partners and with the society at large. (4) **Partner scientists** will directly contribute content and interview material for synthesis and production of outreach materials in WP8-9. (5) **CS leaders** will act as MISSION ATLANTIC ambassadors in each area to optimize communications methods. (6) Specific key educational and public engagement events will be targeted for MISSION ATLANTIC information dissemination, e.g. the annual Irish SeaFest event that has audience in excess of 100,000, and the European Marine Science Educators Association Annual Conference.

(e) **Technology Development**: MISSION ATLANTIC contributes to developing tools for big data collection, analyses and storage using artificial neural networks; Integration of broadband acoustic sensors on WaveGlider™ for ocean monitoring; Adaptive sampling using Deep sea glider technologies. In WP2,3,4 we demonstrate all these new technologies together, applying them in specific areas and including their output into IEA approaches.

Technology development in Mission Atlantic

Lead	***Description***	***TRL [8] from to***	***Development***
Demo I (UPL)	*Application of artificial Intelligence system to benthic image analysis*	3-6	Software available, we will apply to relevant environment and demonstrate use.
Demo II (MI)	*Application assessment of convoluted network models and/or other novel techniques for automated processing of mapping data*	2-3	Software available, we will apply to sample datasets, test in different depth ranges and in areas of differing seabed character
Demo III (USTA)	*Automatic processing of acoustic data for key marine ecological features*	3 - 9	Integration of broadband echosounder to WaveGlider, test system in relevant environment, collection of whole-watercolumn backscatter data on transect from Brazil to Azores, and extract features such as sound scattering layers and schools as per proven and published image processing and machine learning techniques for ship-based observations
Demo IV (UBH)	*Smart seafloor imaging for seafloor characterization and ground truthing*	1 - 7	System design, camera setting and integration on gliders, test in the lab, test in real environment and data collection for deep sea
Demo V UFSC)	*Image analyses of time-series of several years of biodiversity data from LTER station*	4 - 5	Software already available, protocol developed to work on preserved samples

[8] *TRL 1* – Basic principles observed; *TRL 2* – Technology concept formulated; *TRL 3* – Experimental proof of concept; *TRL 4* – Technology validated in lab; *TRL 5* – Technology validated in at sea; TRL 6 – Technology demonstrated at sea in relevant environment; TRL 7 – System prototype demonstration in operational settings; TRL 8 – System complete and qualified; TRL 9 – Actual system proven in operational environment.)

Demo VI (DTU)	*Machine learning toolbox for ecosystem assessment*	2 - 6	Development of software and integration in a collaborative platform allowing big data access and processing for real world use
Demo VII (VLIZ)	*Advancing the European Tracking Network Database*	5-9	Development of software and integration of (meta)data of DST and satellite telemetry in a collaborative platform. Disclosure of datasets to Eurobis and Emodnet.
Demo VIII (ICES)	*Vulnerable Marine Ecosystem (VME) database for the South and North Atlantic*	6-7	Tools for database management and data extraction extended to the South Atlantic Ocean.

2.1.6 Potential barriers and obstacles

IEAs are already providing information and results to fisheries management councils in the US. In Norway, processes related to the cross-sector management plans of the Norwegian sector of the North Sea, Norwegian Sea and the Barents Sea rely on the output from ICES IEA groups (on status and trends in the ocean systems). In ICES there is much communication across IEA and stock assessment groups, with the IEAs providing contextual ecosystem information relevant for fisheries management advice. However, there have been challenges and barriers to IEA implementation. Challenges and barriers in operationalizing IEA have been discussed both in DePiper et al. (2017) [16] and in a dedicated AORA-ICES-FAO workshop[9] and can be summarized as: communication, ability to achieve consensus, effective governance, and complexity of the process. MISSION ATLANTIC will address these challenges and aims to overcome them as follows:

Communication: Communication challenges include clearly defining objectives for the risk assessment, to foster support from manager and political bodies to pursue a risk assessment approach, and making the risk assessment approach administratively achievable. MISSION ATLANTIC managers and scientists will communicate iteratively and early on in the process with managers and stakeholders to define management needs for decision-making. All CS will go through a scoping process very early in the project and establish regional stakeholder platforms to perform and communicate the IEA concept, activities and goals.

Consensus: Clarity of the mission is critical for building consensus. Furthermore trust, inclusivity leads to consensus and are paramount in developing transdisciplinary work necessary for developing IEAs, All project partners will pro-actively work on establishing clarity of mission mutual trust and respect. Time (and money) is needed to build the group rapport critical for transdisciplinary work through repeated personal interactions. The Terms of Reference and coordination of CS activities in WP1 will enable a standardized terminology for clarity as well as the mission across the project so that the process is transparent to all participants, and methodology will be clearly defined (and tested) in advance of the analysis.

Governance: Identification and buy in by management bodies is not always easy ranging from lacking to too supportive. In Table 2.1 an initial list of relevant Mgt. bodies is compiled and we have already received support from several regional management organizations (OSPAR, Benguela Current Commission, St.Helena, etc.) and engaged with several RFMOs. Hence, MISSION Atlantic IEA approach has established buy in from key governance bodies prior to start up.

Complexities: complexity is a recognised characteristic of ecosystems. To understand and predict their dynamics requires describing their present state and the processes impacting upon their dynamics. IEAs due to their inclusion of all key pressures circumvent the problems stemming from risk assessment frameworks developed for single species or a limited number of ecosystem attributes. MISSION ATLANTIC develops a more structured network based cross-disciplinary cross sectoral framework for risk assessments and prediction of future states of these complex systems ranging from qualitative to fully quantitative assessments directly supported by new data and knowledge generated in the project for the whole Atlantic Ocean.

[9] ICES. 2016. AORAC-SA FAO workshop: Making the ecosystem approach operational, 21-22 January, Copenhagen, DK. 55 pp.

2.2. Measures to maximise impact

The general strategy of MISSION ATLANTIC is to effectively cover the three main pillars of societal engagement (*Fig. 6*), with dedicated activities in all work packages. WP9 will implement a strategy for communication, dissemination and exploitation of results, while WP8 will organize training on IEA relevant topics. Workshops and engagement with stakeholders will advance the operationalization of the IEA and will be conducted mainly in WP1, with support from WP2, WP5, WP7, WP9.

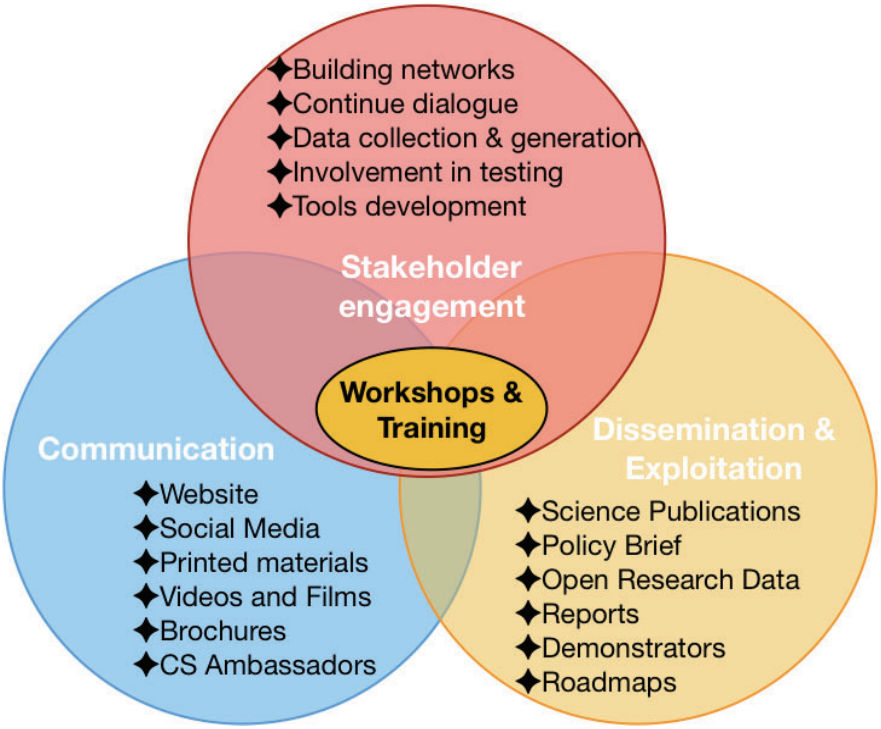

Figure 6. *Illustration of the societal engagement strategy in MISSION ATLANTIC, with connection between the three pillars: Communication, Stakeholder Engagement, Dissemination and Exploitation (as designed in WP9) with central elements (workshops and training) at the interface of these activities. Also listed the main activities chosen to maximize the project's impact on society.*

Primary targeted end-users in the project are IEA **research community** (carrying on the IEA beyond project lifetime), **marine resource and conservation managers (**helping operationalize the knowledge generated in the project), **policy makers** (setting policy terms and incentivize IEA), NGOs as well as **blue economy actors** (e.g. planning and executing fisheries, aquaculture, transport and offshore activities) and the **general public** that may appreciate the cost/benefits of stricter ocean governance policies.

2.2.1 Dissemination & Exploitation Strategy

Co-creation as means for optimizing output relevance and uptake by end-user is a guiding philosophy in MISSION ATLANTIC design for all targeted end-users, from the range of scientific and outreach objectives (cf. Section 1.1) to a highly re-iterative research method (*Fig. 5*) that inherently holds capacity to overcome potential barriers and obstacles (*cf Section 2.1.3*).

The following guiding principles on dissemination and exploitation are used in the project:

- **Be Relevant*:*** Scoping end-user needs (WP1, reiterative Case Study workshops)
- **Co-create & Co-design*:*** involving end-users in output design (WP1, CS workshops & WP9 FORUM, EUG)
- **Build Trust*:*** validate mature outputs with end-users (WP1 workshops & T9.2.2 Science-diplomacy)
- **Adapt*:*** learn the stakeholder vocabulary to customise the message (T9.1 Comms - T9.2 FORUM, T9.3EUG)
- **Demand-driven Transfer**: capitalize on end-user knowledge to define efficient pathways for outputs transfer, and maximize impact in the project (T9.3 Knowledge Transfer and EUG & T10.4 Clustering)
- **Measure Impact:** document added value to end-user workflow (T9.3 & Deliverable 9.5)

These guidelines helped in designing MISSION ATLANTIC and to identify three main **PATHWAYS** for dissemination and exploitation towards target users:

(1) Access & re-use,
(2) Context and legacy,
(3) Co-design for End-users.

Each pathway is established by combining tasks and effort throughout the project lifetime, and exploiting the diversity of experts in the consortium. Five key performance indicators (**KPI**) are also defined to monitor progress towards the objectives (*Fig. 8*). Those indicators are chosen to gauge effective Knowledge Transfer as the project reaches Scientific & Technical maturity. Each KPI is rooted in the original Scientific & Technical (ST1-3) and Education & Outreach (EO1-2) objectives of the project (cf. *Section 1.1*):

KPI 1: Operational Readiness Level (ORL) in each Case Study region has significantly and measurably increased relative to "present level" (*Fig.1*) (related to objectives ST1-3; reported in Deliverable D1.3);

KPI 2: Number of joint initiatives as a direct result of "***clustering***" Dissemination & Exploitation resources and experts with concurrent BG-03-2018, BG-08-2018 and other relevant concurrent projects in the H2020 Work Programme (related to objectives ST1-3 & EO1-EO2; reported in Deliverable D9.1 & D9.5);

KPI 3: Policy and Media citations, statistics on re-use of project outputs as a result of FAIR principles applied to full range of outputs, as tracked by AltMetrics ™ (related to objective EO1; reported in Deliverable D9.1 & D9.5);

KPI 4: Numbers of: (a) marine resource managers trained within project lifetime (Task 8.2), (b) successful, non-EU mobility fellows in support of Belém & Galway Statements, and (c) number of co-funded and co-supervised PhD fellowships (related to objective EO2; reported in Deliverable D9.5);

KPI 5: Number of Impact Narratives[10] across Case Study regions, and sectors, documenting added value to end-user workflows and strategic outlook (related to objectives EO1 & EO2; reported in Deliverable D9.1 & D9.5);

[10] *Impact Narratives following UK Research Excellence Framework (REF) Impact Case Study Template https://impact.ref.ac.uk/casestudies/ , and H2020 COLUMBUS Methodology for tracking end-user impact of research.*

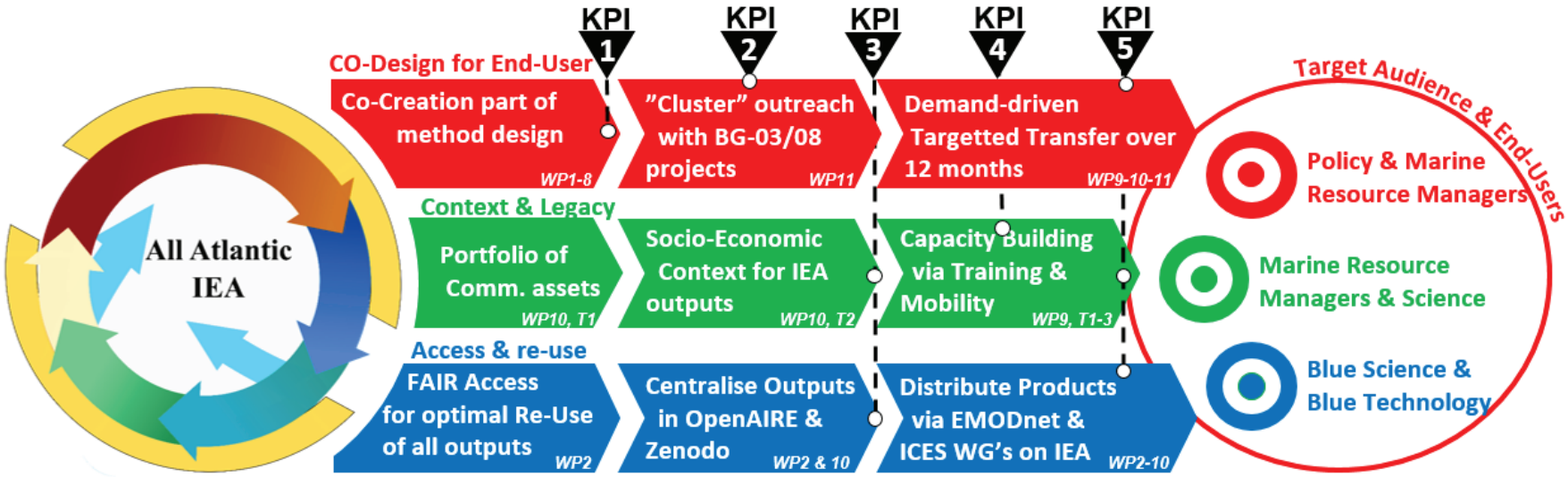

Figure 7. *Strategy for knowledge management, dissemination & exploitation relying on three main pathways: access, context & co-design. Output relevance and re-use, and end-user capacity to access, handle and uptake main outputs in their own workflow is gauged by KPI's (lagging measures) dependent on multiple tasks. Dissemination & Exploitation Strategy (Deliverable D9.1) will translate KPI's into actionable instructions for WP1, Case Study Leads and Task Leads, so that implementation is focused on delivering to End-User needs on regular basis.*

PATHWAY 1*:* Access to & Re-use of Knowledge

Open Science directly benefits Blue Growth. The benefits of making marine observation data interoperable and publicly available adds value of approx. €100 million for Science, €56 million for Public Authorities and €150 million for the Private Sector[11]. Lack of FAIR standards can add up to 25% on the cost of products and services based on marine data[12] and knowledge products. In support of EC's "*Open Science, Open Innovation, Open to the World*" and "*Blue Growth*" agendas, MISSION ATLANTIC commits resources in WP2 and WP9 to applying FAIR principles beyond just data, and to all its research outputs (data, model code, software, publications, educational/training resources). As part of D2.1 and D9.1 all mature project outputs will be issued a Digital Object Identifier via ZENODO.org to enable media and policy citation tracking via AltMetrics ™ , and in turn inform D9.1 Dissemination & Exploitation Strategy. 100% Open Access to publications will be achieved via Green Open Access and manuscript deposit in institutional repositories and by centralizing all outputs in relevant established e-infrastructures (cf *D2.3 Geospatial Data Portal, EMODnet & D9.2 Output Collection on OpenAIRE*). Full open access to all outputs beyond data, is a stepping stone for achieving the maximum impact of the project through more targeted Knowledge Transfer to the main targeted end-users. Progress along the pathway will be monitored by KPI's 3 and 5.

PATHWAY 2*:* Context & Legacy

Although the project commits to full open and free access to its diversity of outputs, marine resource and conservation managers and civil society rarely rely on scientific publications as a source of new knowledge. For marine research results to effectively enter the policy making agenda, intermediate systematic reviews and locally relevant summary mechanisms are needed before research can impact policy. The "*context*" pathway capitalizes on full free access to the research outputs on one hand, and the re-iterative co-creation process with regional marine managers on the other, as part of the project design. The scoping for marine management objectives and validation of mature analyses with end-users (WP1, Case Study workshops), as well as the T9.2 FORUM, will inform the Dissemination & Exploitation Strategy (D9.1). It will also confirm demand-driven means and language for effective repackaging of new knowledge relevant to policy makers (Tasks 9.1-9.2-9.3). Case Study leaders will act as Regional Ambassadors and experts to tune the language and provide regionally relevant means to repackage the new knowledge. To strengthen the "*context*" pathway during and beyond project lifetime, **two calls for 10 mobility fellowships, of 6 weeks duration** (Task 8.3) will target practicing marine resource managers and researchers from the South Atlantic to engage with MISSION ATLANTIC on key research priorities, and exchange knowledge. A co-financing mechanism in T8.3 will ensure that up to 9-12 PhD fellows are co-funded and co-supervised by USA-South Atlantic-EU teams, and form a network of IEA young researchers with keen interest in MISSION ATLANTIC Scientific & Technical objectives. Progress along the pathway will be gauged by KPI's 3,4 and 5.

PATHWAY 3*:* Co-Design for End-User

Demand for MISSION ATLANTIC outputs is documented among Atlantic stakeholders (*cf.* Letters of Support from Gobierno Vasco, Spain & Ministério do Meio Ambiente, Brazil). To refine this demand and to make co-design output fit-for-purpose, the project invests a major part of the budget in Regional Case Studies to ensure IEA operationalization outputs match local needs. Each Case Study has an inherent co-creation loop in its method (*Fig. 4*) and will scope stakeholders needs, validate mid-term results, and perform Management Strategy Evaluation (Deliverable D1.5). The "*co-design*" pathway is mediated by the "clustering" task performed by the Coordinator (T10.4) that will seek to capitalize on Dissemination & Exploitation efforts by concurrent Blue Growth projects, with overlapping policy impact objectives on ecosystem-based approach to marine resource management. Task 9.2 "Atlantic FORUM" will also capitalize on broad marine managers and decision maker stakeholders' knowledge of barriers and obstacles, to co-design detailed *Knowledge Transfer Pathways per main project output* (D9.4). Based on this synthesis of collective knowledge, the Executive Board will approve on a fit-for-purpose basis a spending plan for 100.000 EUR to perform knowledge transfer (task 9.3) in the last 12 months of the project. Progress along the pathway will be gauged by KPIs 1,2 and 5.

[11] *Communication from the Commission: Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth - https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=COM:2014:254:REV1&from=EN*

[12] *Marine Knowledge 2020: Roadmap http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2014:149:FIN*

Table 2.2 Draft Plan for Dissemination & Exploitation of Results

TOOL:	Science	Resource Managers	Policy Makers	Blue Economy	General Public
Int. Conferences and trade shows	**X**	**X**	**X**	**X**	**X**
Scientific publications and attendance to conferences and trade shows will distribute the scientific and technical knowledge generated in MISSION ATLANTIC towards the science and industry communities interested in ecosystem resilience, tipping points, population connectivity, ecosystem state and effects of climate and anthropogenic pressures. New technologies are developed and demonstrated in WP2, 3 and 4 including new sensor technologies for WaveGlider™ and deep sea gliders. All Atlantic FORUM organised annually by CSA AANCHOR will be a starting target.					
TOOL:	**Science**	**Resource Managers**	**Policy Makers**	**Blue Economy**	**General Public**
Open Research Data	**X**	**X**	**X**	**X**	**X**
Data products will be (and all research outputs) will be openly archived and disseminated according to FAR (Findable Accessible Interoperable Reusable) Principles in WP2. Ocean Data Alliance (End-User FOCUS Group) will advise on "**fit for purpose**" data products for Insurance Sector, and integration in the Ocean Risk Index (AXXA Catlin initiative).					
TOOL:	**Science**	**Resource Managers**	**Policy Makers**	**Blue Economy**	**General Public**
Demonstrators	**X**	**X**	**X**	**X**	**X**
In WP2 we present eight demonstrators for big data analysis and storage to release prototype products and services based on interoperable environmental data. These demonstrators include: release of databases for application in underwater autonomous feature recognition; release of a statistical toolbox for evaluation of indicators from large environmental datasets; and a web interface for seafloor image data characterization via artificial intelligence algorithm. Additionally project's website will have a dedicated section for each CS results and data to enable interactions with models for management strategy evaluation via online tools.					
TOOL:	**Science**	**Resource Managers**	**Policy Makers**	**Blue Economy**	**General Public**
Policy brief		**X**	**X**		
Short neutral summaries of the activities and results of MISSION ATLANTIC will be released targeting policy makers and resource managers when: major outputs are produced in the project (e.g. present state assessment of the Atlantic (D1.2), guidelines for IEA operationalization in the Atlantic Ocean (D1.4)) or when major policy events are upcoming. The project actions planned from 2020 to 2025 will be embedded in a framework of international and EU, Brazilian and South African environmental initiatives and sustainability targets relevant for the Atlantic Ocean: e.g. UN SDG 14, UN World Ocean Assessment, IPBES assessments on "Sustainable use of wild species" and program development, the EU's Marine Strategy Framework Directive, Marine Spatial Planning Directive, the revision of the Common Fisheries Policy, the Blue Growth Strategy and the All Atlantic Ocean Research Alliance. Hence, we expect large use of this tool for dissemination. A risk management protocol for embedding science diplomacy into the IEA process is delivered in WP9.					

2.2.2 Communication Activities

Communication activities in MISSION ATLANTIC will foster an ongoing relationship with our target users and engage them in the project as it progresses to ensure they are receptive to our output materials and responsive to our progress. Outreach materials and tools are described in WP9 (task 9.1). A communication toolkit (D9.2) will be provided early in the project to all CS leaders to act as project's ambassadors in each CS regions, tailoring products for the specific local stakeholders and reducing cultural and language barriers. Additional communications tools are synthetically described below:

TOOL:	Science	Resource managers	Policy Makers	Blue Economy	General Public
MISSION ATLANTIC webpage	**X**	**X**	**X**	**X**	**X**

The **MISSION ATLANTIC** webpage will be the main online communication platform, allowing any external public to access updated content at any time. The website will host advanced features to allow CS leaders to interact with data and run models during stakeholders meetings to e.g., show results of the Management Option Evaluations in WP7. A dedicated partner (INTRIGO, P34) will enable us to have professionals developing the website infrastructure, which will be designed in its initial version during the first three months of the project. The website will include a project description together with project schedule, partner information and due acknowledgement to European Commission support. A restricted access section will be used by the partners to exchange technical and management data related to the project. The website will be updated on a regular basis, and include trials results, infographics, video footage, e-learning, news and any other information which may interest the public, the scientific community or the stakeholders.

TOOL:	Science	Resource managers	Policy Makers	Blue Economy	General Public
Social Networks	**X**	**X**	**X**	**X**	**X**

To maximize public access to MISSION ATLANTIC project progress and results, accounts will be open on Facebook, Twitter, Youtube and LinkedIn. These accounts will allow publishing general information, posting videos and trials results, and also receiving comments, questions and expressions of interest from a wide audience worldwide thereby promoting therefore the IEA concept.

TOOL:	Science	Resource managers	Policy Makers	Blue Economy	General Public
Digital Newsletter	**X**	**X**	**X**	**X**	**X**

Periodic distribution of a newsletter (e.g., 3 releases per year) will enable briefly reporting of scientific activities. A synthetic format with images, videos and short text, linked to a more extensive description on the project website, will allow to maximize impact. Examples of topics for the newsletter range from the conceptual models developed in each CS, information coming from stakeholder meetings and research workshops, new technology test results from WP2, cruises and publications. All CS and WP leaders will be responsible for producing input for the periodic newsletter.

TOOL:	Science	Resource managers	Policy Makers	Blue Economy	General Public
Press releases	**X**	**X**	**X**	**X**	**X**

The scientific journals, magazines concerned with oceans and environment, and specific journalists engaged in science communication will be contacted on a regular basis through press releases which shall lead to scientific communication and publications. Targeted press will be typically: Nature, Science, Ocean Science, Ocean News, Ocean Systems, Marine Technology, Sea Technology, Offshore Magazine, etc

TOOL:	Science	Resource managers	Policy Makers	Blue Economy	General Public
Videos	**X**	**X**	**X**	**X**	**X**

Short videos and films will be produced in MISSION ATLANTIC to present the results of ecosystem assessment in the different CS areas. For example, as part of the *Deep Forests Project* Partner SANBI will produce a local documentary showcasing South Africa's iconic deep-water species and ecosystems. Aspects of this project could also feed into that effort and provide additional opportunities to communicate science to a public audience. The Deep Forests Project will undertake targeted science engagement through a diverse team of emerging scientists (covering 6 languages) to build science literacy, an appreciation of marine biodiversity and improved ocean stewardship in South Africa.

TOOL:	Science	Resource managers	Policy Makers	Blue Economy	General Public
Workshops and training	**X**	**X**	**X**	**X**	**X**

We have planned 3 stakeholder workshops in each case study (total 24) with an additional 7 scientific and technical workshops (WP1, 2, 5, 8), where representatives from associated IEA's will be invited. Those events will be publicized openly on social media, newsletters and webpage and open to the entire scientific community interested in MISSION ATLANTIC topics. Additionally an e-learning platform is integrated in the project website and open to the entire world.

3. IMPLEMENTATION

3.1. Work plan – work packages, deliverables

To provide a division of responsibility among partners that ensures detailed monitoring of progress of this ambitious research program, the project has ten work packages (WPs). The inter-dependencies of WPs are shown in *Fig. 5* with a detailed Pert Chart in *Fig. 10* (page 56). These are entirely structured around Integrated Ecosystem Approach principles, with WP1 responsible for the coordination of all CSs, interactions with regional stakeholders and to advance the ORL of the IEA in all regions. The project will have seven CSs to cover major Atlantic ecosystems. CS leaders will work in an operational network with Terms Of Reference (TOR) defined and updated in WP1. WPs on data provision (WP2, 8), habitat mapping (WP3,4) and ecosystem analyses (WP5,6,7) will perform the scientific activities to develop new knowledge to be integrated in the IEA. Finally, two dedicated WPs will benefit of the output (and support the development) of IEA in all regions: capacity building activities (WP8) and interaction with end users (WP9). An iterative approach is chosen, where results from data collection, mapping and analyses, and activities of stakeholder interactions, are integrated in the case studies via the WP1.

Table 3.1a List of Work Packages & Leads

WP	Work Package Title	**Leader** + deputy	Lead and deputy expertise
1	Atlantic Ocean Integrated Ecosystem Assessment	**M. Skerne-Mauritzen** IMR (P4); & D. Reid, MI (P21)	Integrated Ecosystem Assessment; Chair of ICES IEA Steering Group
2	Data technology and management for IEA	**L. Vandepitte**, VLIZ (P6) & E. Quimbert IFREMER (P14)	Data management
3	Pelagic Mapping: ecosyst., resources and pressures	**G. Chust**, AZTI (P3) & A. Brierly, USTAN (P12)	Habitat modelling and data acquisition
4	Benthic Mapping: ecosyst., resources and pressures	**T. Furey**, MI (P21) & P.B. Mortensen, IMR (P4)	Seafloor mapping and characterization
5	Assessing state, drivers and tipping points	**M. Lindegren**, DTU (P1) & S. Otto, UHAM (P2)	Ecosystem assessment, biodiversity, trait based ecology
6	Dynamics of ecosystem state and resources	**J. Bruggeman**, PML (P7) & I. Senina, CLS (P9)	Ecosystem modelling, fish dynamics, climate modeling
7	Risk Assessment and uncertainties	**S. Niiranen,** SU (P10) & M. Heath, STRATH (P11)	Vulnerability assessment in social-ecological systems
8	Building Capacity for the IEA	**M. Gasalla**, USP (P23) & M. Wisz, WMU (P31)	Socioeconomic and governance
9	Societal Engagement & Communication	**I. Sousa-Pinto** , UPO (P8) & D. Murphy, INTRIGO (P32)	Biodiversity, science-policy, knowledge transfer

10	Project Coordination	**P. Mariani** DTU (P1), & Management Team at DTU	Project management, oceanography, marine ecology
11	Ethics	**DTU**	

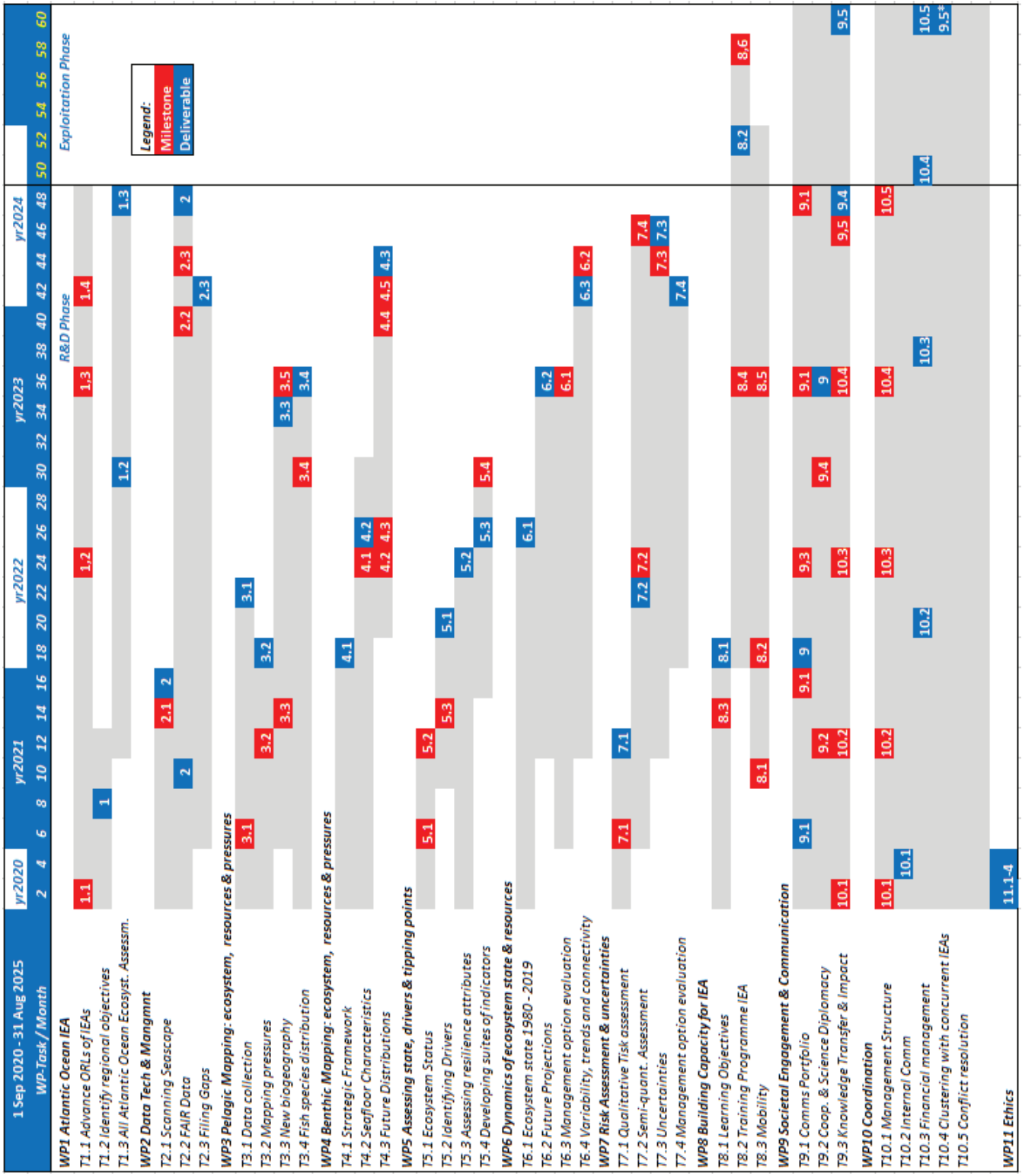

Figure 8. Gantt Chart for MISSION ATLANTIC

3.2 Management Structure, Milestones and Procedures

3.2.1 Structure and decision making.

We adopt a management structure and procedures appropriate to the scale of the project as successfully utilized in several EU projects, e.g., UTOFIA, DISCARDLESS and PANDORA.

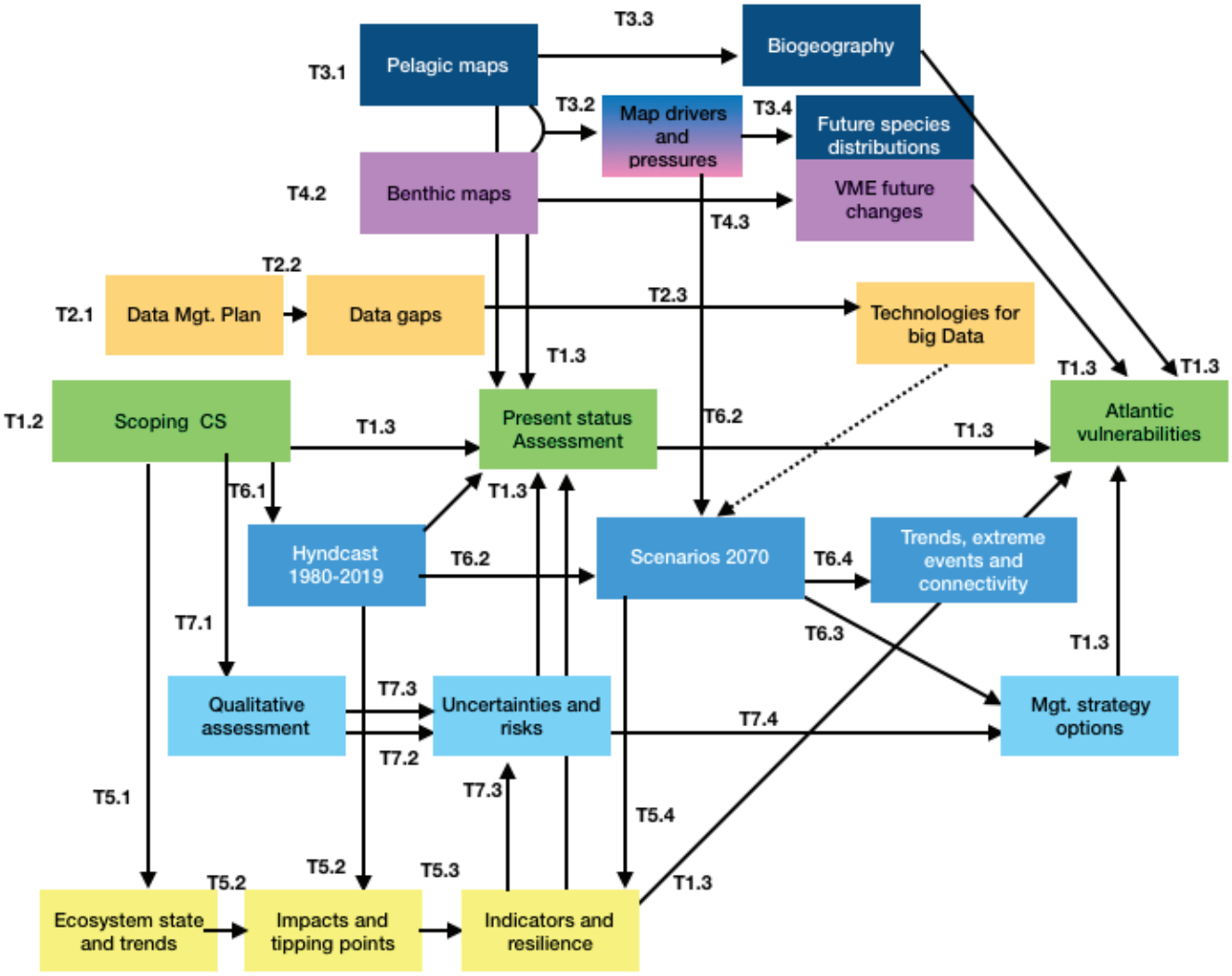

Figure 9. *Pert chart showing specific output in the project (rectangles) linked by tasks (arrows) to be monitored and controlled by the management team. Directional arrows represent tasks that must be completed sequentially; divergent arrow directions indicate possibly concurrent tasks; dotted lines indicate information flow e.g. info from new technologies used to validate models. Different colours indicate different WPs. Note only the science WPs (1 to 7) are shown since capacity building (WP8), societal engagement (WP9) and project management (WP10) will be performed across all activities.*

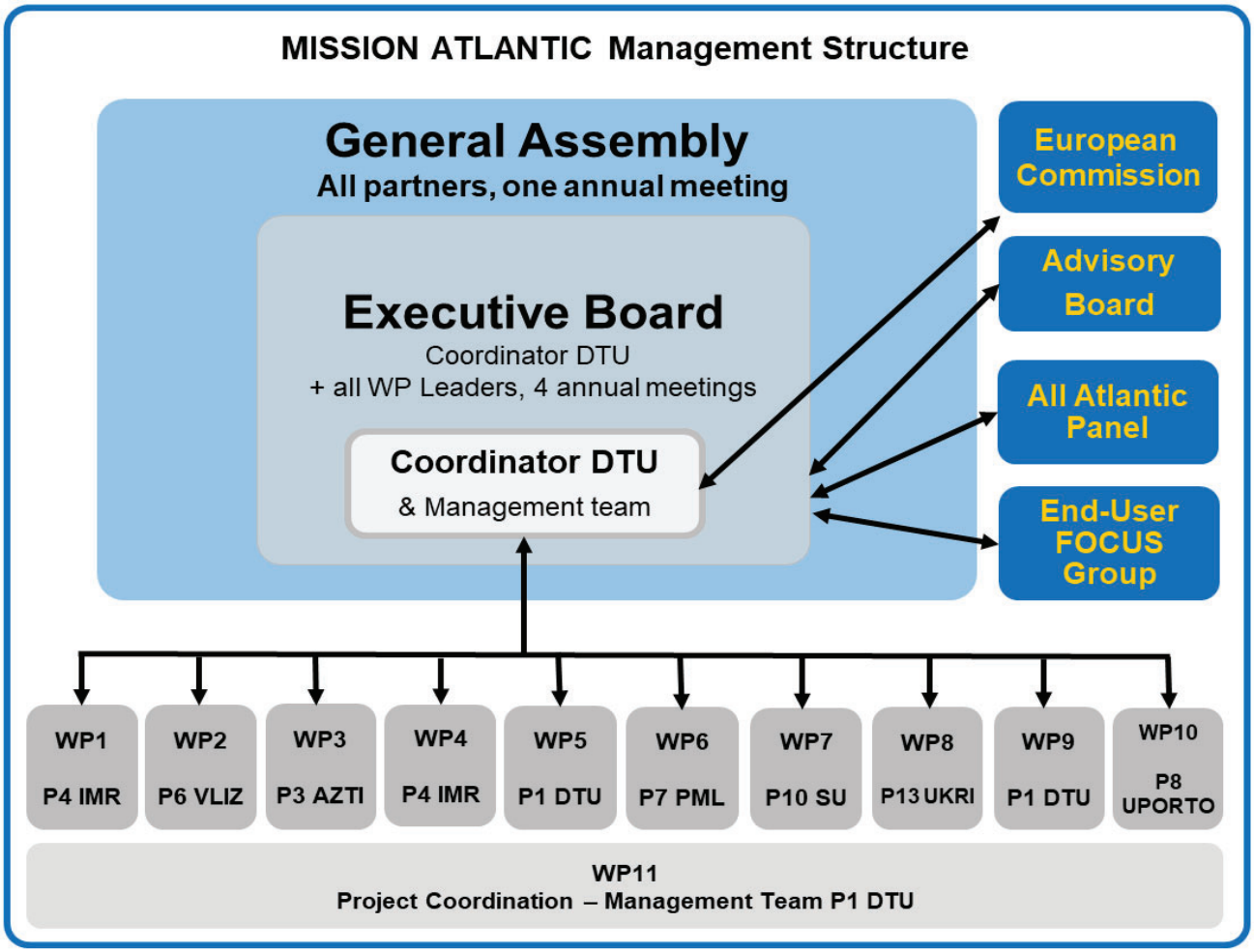

Figure 10. *Governance Structure: Project Management (coordinator: P. Mariani and mgt. team) supported by Executive Board (WP leaders) the All Atlantic Panel and End-User focus group (both formed in the project). All acting under the Genearal Assembly with the assistance of the Mgt. Team. Activities performed in the WPs1-9 are coordinated under WP10. Case Study leaders activities are coordinated in WP1 with interactions with all WPs. An external Advisory Board and the EC will interact with the project through the coordinator.*

The overall governance structure is shown in *Fig. 10*, with roles and responsibilities summarized in Table 3.2a.

Table 3.2a Roles & Responsibilities

LEVEL	Management Body	Composition	Main Responsibilities
Case Study	CS Leader	One person from partner institute leading the CS (Table 1.1)	● Coordinate and report on progress of CS activities ● Timely delivery of CS results to support WPs activities
WP	WP Leader	One person from partner institute leading the WP (Table 3.1a)	● Coordinate and report on progress of WP activities ● Timely delivery of WP results as defined in the work plan
Project as a whole	Executive Board	WP Leaders + Project coordinator	● Make strategic decisions on project coordination, overall scientific management and planning ● Project Risk Management
	Management Team	Project coordinator + Project Manager + support team (DTU Aqua Research Secretariat)	● Implement decisions of the Executive and Genearal Assemblys ● Assist all other management bodies ● Day to day project management
	Genearal Assembly	One representative of each partner	● Strategic decisions on major changes ● Resolution of any major conflicts
	All Atlantic Panel	lead of WP9 & 10 + representatives within WPs1, 3, 4	● Advise on initiatives pertinent to the Belém and Galway Statements (AORA & AANCHOR initiatives) ● Oversee regional science to society interactions ● Liaise with relevant Atlantic activities
	End-user Focus Group	Contracted in the project (GA Article 10)	● Advise on translation of research output into products & co-design activities in different WPs
	Advisory Board	External to the project	● Advise Coordinator, Executive - and Genearal Assemblys

A proper and timely implementation of a large-scale collaborative project like MISSION ATLANTIC requires detailed planning, coordination and a clear management structure. MISSION ATLANTIC is comprised of the **Management Team** at DTU Aqua (4 Members), the **Executive Board (**9 research work package leaders under which there are task leaders and case study leaders, as well as WP10 Project Coordination) and the **Advisory Board** (5 Members). This structure allows the Coordinator to effectively ensure execution of activities by WP, TASK and CS leaders many of whom have led or participated in large projects. The management of the project will be coordinated through tasks of **WP10 Project Management**. Figure 10 gives an overview of the different organizational management's structures, described in detail below:

(a) **DTU will have the role of project coordinator** will have overall responsibility for the management of the project and liaison with the Commission. **Dr. Patrizio Mariani will act as the Mission Atlantic coordinator and WP10 lead**. He will have the overall responsibility for administrative and technical matters**.** Dr. Mariani (PhD) is Senior Researcher DTU and leads the group on Observation Technology at DTU Aqua which focuses on new autonomous systems in support of the next generation of marine integrated ecosystem assessments. He is the elected chair of the Steering Committee of EUROMARINE (European marine science network with 73 European

Member Organizations) and main PI in several H2020 projects. He has >40 peer-reviewed publications and was involved in the writing team of Navigating the Future V (EMB, 2019); he is the Danish representative at the European Marine Board. His extensive experience in EU research project will benefit the coordination of Mission Atlantic. The coordinator is supported by **Prof. Mike St. John (deputy coordinator)** who has a long history of coordination of EU projects e.g. FP7 Project EUROBASIN and WP Leader and Steering committee member of over 10 other EU funded projects. He has served as Co-Chair IGBP IMBER Working Group: Ecosystems End to End and Co-Chair of North Atlantic-Arctic Planning Workshop. April 14-16, 2014 in Arlington, Virginia, USA which generated the Atlantic Arctic science plan. He served as the Chair of Session 2 at the Galway Declaration: The Atlantic a shared resource and was on the SAPEA writing team generating the vision for more food from the oceans.

(b) The **Management Team** comprises **Coordinator** and **deputy coordinator, a full time Project Manager (Ivo Grigorov) and the Finance officer**. The Management Team will take overall responsibility for the management of the project, all reporting (scientific and technical, financial and administrative) to the European Commission as well as preparing the Consortium Agreement. The Coordinator also holds the sole responsibility of contacting and communicating with the Commission. The Management Team will draw on the advice and recommendations of the Advisory Board. The Management Team is well qualified to perform these managerial tasks with extensive experience managing coordination of more than 15 EC-funded projects. The legal unit at DTU will provide assistance with respect to negotiation of the Consortium Agreement and other legal matters, whilst DTU's financial department will monitor and process the accounts as well as payments to project participants.

The Coordination Team (Coordinator and the Management Team) will regularly assess the use of resources and budget expenditures. The Management Team will be responsible for outlining all contractual obligations and procedures, including the Consortium Agreement, detailed financial management and, transferring project payments to the Participants. The Management Team will follow up on the implementation of the Consortium Agreement, and address all questions that might arise in the course of the project. The management team is responsible for: (a) overall administrative and financial management of the project, keeping financial overview of budget, expenditures and effort allocation, (b) manage the distribution of funds to the consortium, (c) management of consortium-level legal and ethical issues, (d) preparation of financial and administrative reporting to the Commission, (e) handling IPR with regards to knowledge and innovation-related activities (f) handling and mitigation of potential conflicts and critical risks (jointly with Coordinator and Executive Board), and (g) monitoring any emerging issues, and establish contingency responses.

(c) **Work Package and Tasks leaders** are identified in each WP. Additionally, for each WP leader we have identified a Deputy Leader in order to share responsibility and reduce management risks. The WP leader is responsible for coordinating the activities of the experts involved in a WP and holding regular WP specific video conferences to discuss WP specific activities and issues. Each Task has one or at maximum two deliverables with a lead partner. WP Leads and Task Leads will ensure partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to the Coordinator and contributing partners no less than 30 days prior to official submission deadline.

The WPs of MISSION ATLANTIC address a diverse range of physical, biological, technological and ecosystem modelling topics. Each WP and Task leader has an outstanding reputation in the field and leadership experience in EU research projects (see *Section 4*). WP, CS and Task leaders are responsible for organizing the practical work and, with the Coordinator, ensure the timely completion of the WP milestones and deliverables. WP leaders will report to the Coordinator on WP progress during meetings organized **four times per year**. The Coordinator will make the status reports available for evaluation by the Executive Board.

(d) **Genearal AssemblyGeneral Assembly** include Principal Investigators (PIs) of all project partners, which meet at the general assembly (GA) meetings, i.e., the major decision-making body in MISSION ATLANTIC. The GA meeting will be the main event for transferring information and stimulating scientific debate between all the partners. It will be the opportunity for the participants to brief and guide the Coordinator and Executive Board in person on scientific and management issues. The Coordinator and the Executive Board will propose major

decisions to the Genearal Assembly. At the Genearal Assembly, each partner will have one vote and simple majority will make decisions. In case of a draw, the Coordinator holds the deciding vote. All rights and obligations of partners in the Genearal Assembly will be described in the Consortium Agreement.

(e) **Executive Board (EB)** is chaired by the Coordinator and every WP leader is member of the EB. (Table 3.2a). Each member of the EB holds one vote, and decisions will be reached by consensus if possible but the Coordinator will have the deciding vote if a consensus is not reached. The responsibilities of the EB include; a) define and update the Work plan, b) monitor WP progress and delivery including preparation of status reports of the Project for the Commission, and c) ensure the timely and quality delivery of Project Deliverables. EB, T. Furey (MI) and All Atlantic Panel will also be responsible for maintaining a calendar of ships-of-opportunity, selection and prioritization of applicants for Mobility and PhD Fellowships Call (T9.3), approving and steering Knowledge Transfer spending plan (Months 48-60). T

(f) **All Atlantic Panel (AP)** will be first established at the kick off meeting (as in task 10.4) and will advise the EB and project Coordinator on any strategic clustering with other EU and non-EU programmes, and with other regional activities in the Atlantic Ocean. Members of the AP are Prof. St John, Prof. Sousa-Pinto, AIR Centre Chair and selected members from the project to be approved by the Genearal Assembly. The panel will meet remotely bi-monthly to ensure rapid response to changes in research and policy development in the Atlantic. It will report to the EB during the EB meetings. AP members will consult with regional authorities and leaders of other BG-08-2018b funded projects to align strategies, research programmes and research activities for the North and South, East and West Atlantic. AP will refer to well established policy frameworks (e.g., Galway Statement, Belém Statement) to support integration of project's results and activities into e.g. AORA Working Group legacy, SDG dialogue, UN Decade of Ocean Science.

(g) **Advisory Board (AB).** This group will comprise independent world-renowned researchers on integrated ecosystem assessment as well as industry representatives, who will provide independent advice and feedback on the application of research to achieve the project's objectives, integration of interdisciplinary research, communication with industry and other stakeholders and dissemination of research findings. **The AB will be composed by 5 members** with their MISSION being to promote create awareness of MISSION ATLANTIC amongst the research and stakeholder communities. The composition of the Advisory Board is flexible and can be modified over the course of MISSION ATLANTIC to meet the project's needs.

Confirmed members of the Advisory Board at the time of submission are:

1. **Cisco Werner**, Director of Scientific Programs and Chief Science Advisor at NOAA (cf. Letter of Commitment, Appendix).
2. **M. Robin Anderson**, Environmental Science Division, Fisheries and Oceans Canada.
3. **Phil Levin,** Professor of Practice, College of the Environment, Un. Washington (USA), and former senior scientist at NOAA-Fisheries, looking at the impacts of ocean acidification on culture, particularly tribes.

The additional Members will be selected in discussion with the Genearal Assembly. The Advisory Board will provide a strong resource of experiences and expertise concerning IEA application and operationalization.

3.2.2 Projects Meetings and monitoring project activities

The Coordinator is responsible for organizing and convening all project meetings, specifically the Genearal Assemblys and the Executive Board meetings (Fig. 11). He will provide the agendas and minutes of meetings according to the provisions set out in the Consortium Agreement and will work when required with local organisers of these events or will ensure the proper technology setting in case of Tele Conferences (TelCo). MISSION ATLANTIC will make extensive use of video conferencing, email, telephone, as well as web-based internal communications software. The kick off meeting is planned for M1 and will be the first meeting of the Genearal Assembly including all partners. This event will launch the project and facilitate contact among partners and the Commission, as well as establish good working relationships. Subsequent project meetings will be scheduled immediately prior to the end of a reporting period and preferably in conjunction with the Commission's review meetings. These major annual project meetings will occur in months M12, M24, M36, M48 with the Final

Conference M56 hosted by the coordinator. Generic agenda items will include the following points: **i.** *review of the progress in the Case study areas and work packages*, **ii.** *discussion and analyses of the results obtained in each WP/Task*, **iii.** *exchange of (technical) expertise and data between partners (see WP2.1, D2.3)*, **iv.** *review of the milestones and deliverables for upcoming phase of MISSION ATLANTIC*, and **v.** *potential adjustment of the work plan* for subsequent phases of the project to best meet MISSION ATLANTIC goals and respond to changing trends and related research to adapt to and capitalize on unforeseen opportunities that may arise under the advise of the Advisory Board.

Executive Board Meetings. During the project, Executive Board meetings will be held ***every three months*** (4 one-hour meetings per year). When convenient, these meetings will be done back to back with the kick-off and the four annual project meetings with remaining meetings held utilizing TelCo specialized software (e.g. Adobe Connect) available at the coordinator's institute. The Executive Board will review and monitor the progress and results of the project during these meetings and a progress report will be prepared based on findings. CS Leaders are invited to attend the EB meetings.

Internal communication. The communication strategy adopted in the project will ensure all partners are fully informed about the status of the different ongoing and upcoming activities. The target is to reach maximum transparency for all parties involved and hence increase synergy. All reports produced (such as meeting notes, intern and external project reports, visit reports, publications, etc.) will be communicated to the Management Team which will be responsible for providing this information to other partners when appropriate. All partners responsible for Deliverables will circulate a "Table of Contents" for the deliverable to Coordinator, relevant WP Lead, Task Lead and participating partners, no less than 30 days prior to official submission deadline.

Similarly, the Coordinator will distribute relevant information obtained from sources outside the project (other H2020 Blue Growth programs, from the Commission, or from various agencies) as well as information from the AB to the partners.

Methods for monitoring and reporting progress. The essence of internal project monitoring is the identification of deviations from the schedule, budget or work plan. All project partners will report on project activities performed, (preliminary) results achieved, issues and deviations (if any) providing **a risk register and risk mitigation plan** and details of use of resources (and deviations, if any) on a bi-annual basis. Each WP leader will compile a WP report to the Management Team who will make it available for assessment and evaluate the project status prior to the EB meetings. It will also include the reports on use of resources. The Management Team will monitor the use of resources of each partner in connection with the periodic reporting and monitor the financial situation (actual vs. planned) carefully. **Milestones:** Due to the highly integrated and iterative project structure and the resulting tight linkages between WPs, most deliverables are also project-scale milestones. Both deliverables and milestones are visible in the Gantt Chart (*Fig.8).*

3.2.3 Innovation & IPR management

The project will develop innovative tools (e.g. risk assessment, decision support, new technologies) for potential use by industry, interest organisations, resource and environmental managers. The main project outputs are not subject to standard IPR protection or licensing as all software development will be open source for optimum re-use and integration in diverse workflows by all end-users (management, industry, policy). The rules and obligation with respect to use and ownership of Intellectual property rights (IPR) will be negotiated and formulated in the Consortium Agreement.

3.2.4 Handling of conflicts and critical risks

Any conflict or issue that may give rise to a risk for a proper implementation of the project will be addressed and resolved immediately. In general, consensus will be sought at all levels in the decision making structure.
Identification of conflicts which arise in the project is the responsibility of all project participants. Any signs of disagreement between project participants should communicated to the work package leader or project coordinator (as appropriate), who should then initiate conflict resolution, involving higher management levels only if necessary:

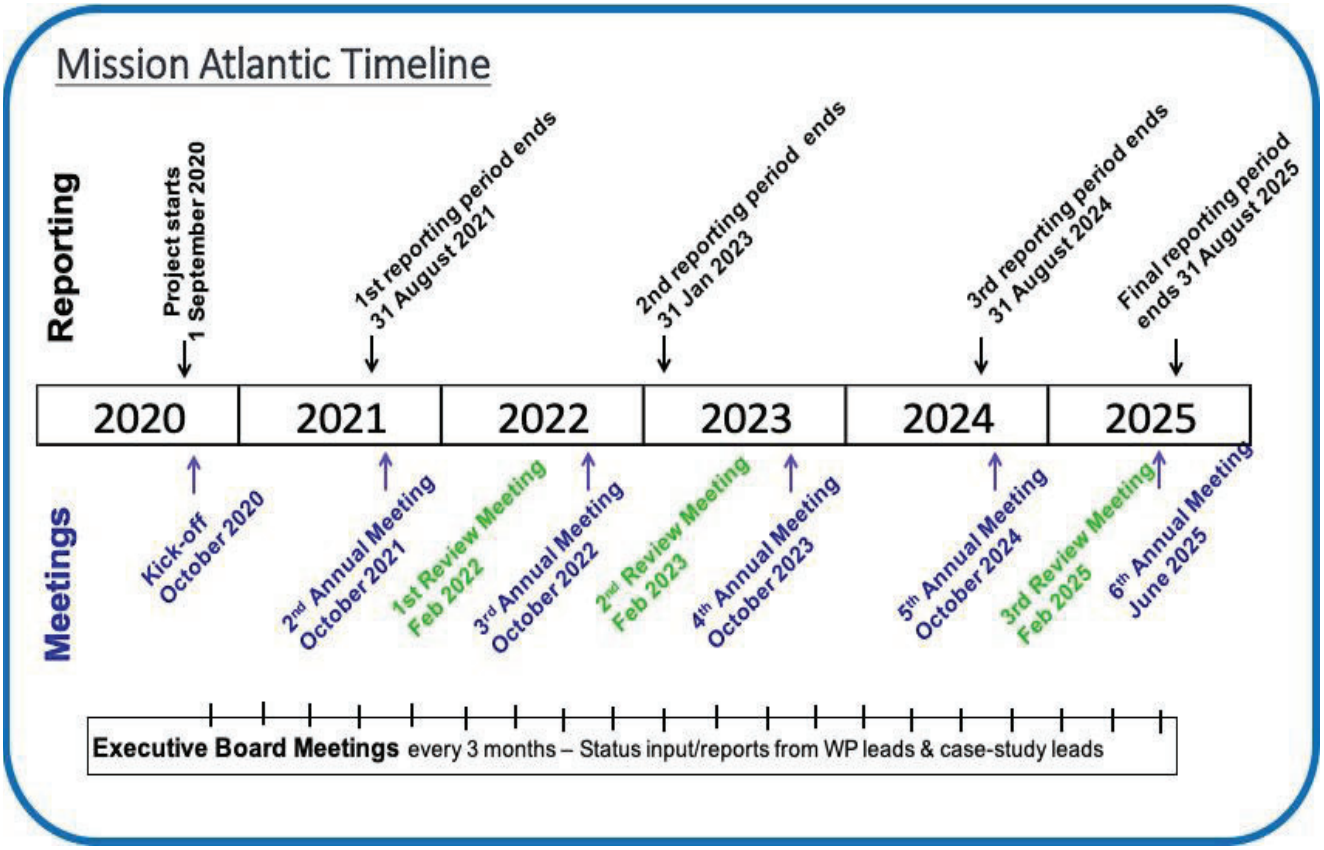

Figure 11. Project meeting and internal reporting overview
(Reporting Perdiods 18M-18M-12M-12M on top; Meeting on bottom of panel)

1. At level 1, the Coordinator should separately contact parties either in person or by telephone or Video conferencing , to identify the different viewpoints. (It is important not to use email: that medium very often leads to a rapid escalation of disagreements). Based on the clarification of viewpoints, the Coordinator should try to propose a solution. If one is achieved, it should be recorded in a short report; if not, no documents should be produced, and the problem referred to the Executive Board.

2. If level 1 fails, the matter should be taken up by the Executive Board (at a special meeting, if need be). At this level, all communication should be in writing. If conflicts relate to matters which would normally be assessed as part of the annual reviews by the Commission, the views of the Commission should be sought.

3. If level 2 fails, a special meeting of the Genearal Assembly should be called. Partner representatives will then require voting on the issue.

To assist and support all decision making bodies, a Consortium Agreement will be negotiated and signed by all partners before the start of the project. The Consortium Agreement will describe all procedures, rights and obligations of the partners involved in the MISSION ATLANTIC Project.

NOTE on Brexit: The project has six partners from the UK whose funding may depend on the conditions agreed by the EU and the UK. The UK government has issued a note stating that all EU approved projects **submitted** before Brexit will be funded by the UK whatsoever the outcome of EU UK Brexit negotiations.

3.3 Consortium as a whole

The MISSION ATLANTIC consortium consists of 32 partners, 27 academic partners, Europe (21), Brazil (2), South Africa (2), and Canada (1), 4 industrial partners (satellite: CLS, robotics: MROB, big data: SSBE, policy: INTRIGO), two intergovernmental science organization (ICES, AIRC). In North America associated government research partners include the U.S. National Oceanic and Atmospheric Administration (NOAA) and Fisheries and Oceans Canada (DFO). The 24 EU partners represent a total of 10 countries: Spain (3), Norway (2), France (2), Belgium (2), United Kingdom (6), Denmark (1), Sweden (2), Germany (2), Portugal (2), Ireland (2) and four international organizations based in Denmark (ICES), Belgium (SSBE), Sweden (WMU) and Portugal (AIRC). This team represents the key players and institutions from around the Atlantic Basin necessary to fulfil the ambitious goals of MISSION ATLANTIC.

The MISSION ATLANTIC consortium has been carefully considered to meet the needs of implementing IEA in the whole Atlantic and making the tools and results available to end users and stakeholders. The consortium is a well-integrated multidisciplinary cross sectoral unit with all members committed to a common purpose. All CS leaders (IMR, MI, IEO, IMAR, USP, UCT, UFSC), associated IEA regions (NW Atlantic: NOAA, Newfoundland: DFO, Arctic: ICES, Gulf of Guinea: STRA) and key partners (PML, NOC , UFSC) have access to time series data, perform relevant ongoing cruise activities (e.g. DTU, AZTI, UFSC, NOC , IMAR, PLOCAN) and/or end-to-end models, and experience in ecosystem state and indicators analyses for the region under their responsibility.
Consortium partners are major contributors to working groups at ICES (e.g., WGIAB, WGINOR, WGEAWESS, WGRMEC), FAO (e.g., CECAF) and other relevant national and international organizations to support the implementation of IEA. Participants are also involved in IPCC: Lead Author for Climate Change 2021: Impacts, Adaptation and Vulnerability, Working Group II of the International Panel for Climate Change (IPCC) Sixth Assessment Report; and IPBES Assessment Reports and management and the World Ocean Assessment (e.g., UHAM, IMR, AZTI, MBA, UPO). Lead Author for the Regional Assessemnt of Biodiversity and Ecosystem Services in Europe and Central Asia - IPBES – Intergovernamental Panel on Biodiversity and Ecosystem Services. The team is comprised of recognised World experts in ecological modelling and indicators analyses (PML, SU, NOC , STRA, CLS, AZTI, UHAM, DTU) that have leading roles in WP5,6,7 and providing tools for the IEA to assess ecosystem status (past, present and future) risks and vulnerabilities as well as the development of tools for providing management advice. The team has experts (e.g. AZTI, DTU) in the application of AI approaches (machine learning and ANN) bringing modern data science techniques to marine resource management catalyzes a leap forward, which would be ground-breaking. Risk assessment activities are coordinated by Stockholm Resilience Centre (SU), a world recognised institute in advancing the understanding of complex social-ecological systems and studies phenomena, such as ecosystem resilience, ecosystem service production, food security and adaptive governance.

Global general ocean coupled-models with advanced biogeochemistry are developed under the coordination of UK Research and Innovation (NOC) and Plymouth Marine Lab (PML) the later developing Marine, Coastal and Fisheries Sectoral Information System for the Copernicus Climate Change Service as well as contributing model out, This globally recognised modelling team ensures, the availability of the large computing infrastructures needed for this ambitious task, the tools and expertise to simulate the future development of IEA indicators.

The project has strong Atlantic partnerships on seabed mapping (IFRE, MI, UPL, SANBI, UFSC, MFRI, MUN, UNH), technology development (MBA, PLOC, DTU), data management (ICES, VLIZ; SSBE) and stakeholder engagement (UPO, SANBI, UNH, DTU). The consortium has key players in the marine socioeconomic community (WMU, USP, SANBI) and in partnership with WMU (a United Nation's graduate training hub for maritime and ocean governance leaders) will deliver an ambitious MSC program to ensure project legacy in capacity building on IEA. Additionally the participation of key stakeholders in the End User Focus group in MISSION ATLANTIC (EUG, see Table 2.1 and Appendix A Letters of Supports) greatly advance the possibility

of the project to deliver long-lasting products to different Blue Economy sectors and ecosystem management organizations. In particular the partnership with Ocean Data Alliance (ODA) enable delivering "fit for purpose" data and forecast products to the Ocean Risk Index framework & indicators directly linking to the global Insurance Sector which has a major interests in the Blue Economy. Hence, the consortium is via expert partners (DTU, WMU, UPO, USP, SANB) is uniquely positioned to provide tangible products serving societal needs as well as possibility of training and professional development to future marine scientists via mobility, Masters and PhD programs. These activities will also take advantage of the newly established All-Atlantic Ocean Youth Ambassadors Programme under AANCHOR in which partners in MISSION ATLANTIC (AIRC, UPO, PLOCAN) have a key role. Responsibilities within the consortium are well balanced, with several partners taking responsibility for case studies, WPs, Tasks, deliverables and milestones, among others and more details can be found in the individual Partner Description.

Taken together, this is probably the strongest team that can be assembled at the Atlantic level in terms of Integrated Ecosystem Assessments, enhanced by experts in a variety of complementary fields (ocean technology, numerical modelling, data management). The overall coordination of the consortium is taken by DTU (DTU Aqua, National Institute for Aquatic Resources) that has a long history in participating and leading large-scale projects on marine and maritime research, presently coordinating linked H2020, PANDORA (fish stock assessment), DISCARDLESS (impacts of discards in European fisheries).

3.3.1 USA & Canada Role and Contribution

MUN (Partner 28) and UNH (USA; International Collaborator) are contributing in-kind research effort in WP4 and WP9 T9.3 Mobility & PhD Network. The U.S. National Oceanic and Atmospheric Administration (NOAA) will cooperate with the consortium under the terms of the 2016 "Implementing Arrangement between the Government of the United States of America and the European Commission for Cooperation between Researchers Funded Separately by the United States and the European Union's Framework Programmes for Research and Innovation" (the Implementing Arrangement[13]). NOAA has identified (see Letter of Support) several linkages with MISSION ATLANTIC activities under WP1,3,4,5,7,8. With respect to WP1, NOAA has established IEAs nationally in several areas (https://www.integratedecosystemassessment.noaa.gov) with a methodology that will inspire MISSION ATLANTIC activities. With respect to WP3 and WP4, NOAA's Office of Ocean Exploration and Research (OER) has conducted numerous expeditions to collect foundational information on biology and geology of the deep sea. If the proposal is selected for funding NOAA will contribute to the coordination of the activities among various vessels and entities to both build on existing baselines and establish new baselines for other poorly known areas. We have a dedicated task under WP4 (T4.1) to address such collaboration also in coordination with ASPIRE. Similarly, Fisheries and Oceans Canada (DFO) will be considered a research partner aligned with the administrative arrangement between Canada and the EU[14] and contributing into: (1) the cross-fertilization of ideas on operationalize IEA framework for the Newfoundland Shelves area (2) liaise with the AORA Implementation Committee Working Group and follow up activities on the Ecosystem Approach to Ocean Health and Stressors (EA2OHS).

3.4 Resources to be committed

All partners have an important role in the project and MISSION ATLANTIC Consortium requests 11.5 M € to ensure that all participants have adequate resources to meet their roles. The consortium proposes an ambitious and detailed work-plan to develop a research network on IEAs over the entire Atlantic Ocean. This requires research activities that are: covering the entire Atlantic; interdisciplinary; involving stakeholders at regional and basin scales; including a range of ocean, habitat, ecosystem, climate and risk assessment models. Particular importance in the project is given to strength technological and observational programmes as well as the capacity of our society to perform integrated ecosystem assessments.

There is a significant amount of resources committed as in-kind contributions from different partners. In particular activities at sea under section 1.3.5 (Table 1.2) indicate contributed cruises for about 7M €. Additionally,

[13] https://ec.europa.eu/research/iscp/pdf/policy/eu-usa_implementing_arrangement_2016.pdf
[14] http://ec.europa.eu/research/iscp/pdf/policy/administrative_arrangement_canada-h2020_062016.pdf#view=fit&pagemode=none

contributed person time (as PhD from DTU, WMU, and PhD program leverage, and as professor time from WMU and SANBI) accounts for ca. 1M. The conservative estimate of in-kind contribution amount at ca. 8M € and we aim at increasing this fraction by for example engaging with INFOMAR (Seabed Mapping, coordinated at Marine Institute – partner in Mission Atlantic) for dissemination and capacity building activities.

All beneficiaries comply with the rules and regulations of the Horizon 2020 GA as requested in the Guidance of Action document with respect to Travel Costs, which also include subsistence costs. Coordinator will also reject Travel Costs not directly supporting the action, prior to submission to EC. Beneficiaries signing the GA agree explicitly to those rules & regulations, and are liable for non-eligible costs. All travel arrangements will comply with the beneficiary's usual accounting practice of the company and best value for money.

All partners purchasing equipment will follow their own depreciation rules as requested in the Guidance of Actions document, and either write off the cost in the same year of purchase, or claim only the proper depreciation share for the individual reporting periods.

All direct costs can be independently directly measured and the usual accounting practice of the beneficiary considers them direct costs. Consumable costs can be independently, directly measured and they are supported by the beneficiary's usual accounting as direct costs.

3.4.1 Personnel costs: 63% of the budget is allocated to personnel costs as summarized in the Table 3.4a (Fig. 12). This accounts for 1692 person-months to perform the science and technology and exploitation, dissemination and management activities throughout the ten WPs. Distribution of effort to the different WPs is proportional to the challenges posed by the specific objectives and the complexity of the tasks. WP1, WP5, WP6 and WP7 together represent 45% of the total PM almost equally distributed between them (WP1: 9%, WP5: 13%, WP6: 12%, WP7: 12%). They represent the core activities to advance ORL of IEAs and include research on indicators, statistical and process based models as well as risk assessment models. WP1 is focussing on regional stakeholder interactions over the entire IEA cycle, this requires organization of stakeholder meetings in each CS area. **CS leaders have a dedicated budget to run three of these meetings (see 3.4.3).** WP3 and WP4 represent together 28% of the total PM and include activities at sea as well as mapping resources and anthropogenic pressures (joint activity in WP3) for the pelagic and benthic habitats: the knowledge needed to support identification of indicators, provide data for model validation and to deliver the whole Atlantic IEA. WP2 accounts for 11% of the total PM to perform data management and demonstrate technologies for (big) environmental data collection, storage and analyses. Resources for a dedicated data centre to store the ca. 450 Tb of model data produced in WP6 have been allocated to PML partner (Table 3.4b), while WP2 is responsible to set the meta-database under FAIR principles. WP8 is 4% of the total PM to manage the e-learning, mobility, MSC and PhD programmes. Although the lowest total PM, WP8 includes substantial budget to setup these ambitious programmes (see T3.4.3). Societal engagement in WP9 counts for 8% of the total PM and has an additional budget (100k €) which will be allocated (as defined in task 9.3) before the year 5 of the project to achieve and effective and adaptive exploitation strategy. This total effort in WP9 is justified given the exploitation and dissemination measures that extend from Europe to Africa and Brazil. Project management in WP10 counts for 4% allowing a dedicated project manager involved in the management team at DTU, justified given the complexity of the program.

3.4.2 Distribution of resources: The share of budget received by each partner is proportional to the costs required to perform the tasks they are involved in, considering both concrete work tasks and tasks within management and coordination such as WP and CS leads (Fig. 13). As coordinator, WP5 lead and task leader in WP6, WP7, WP8 and WP9 DTU has 143 PM allocated. Most partners have been allocated between 20 to 48 PM ensuring sustained contribution to the project over the 5 years. Several partners (11) have substantially more than 48 PM. These partners generally consist of several teams contributing to several different WPs. Brazilian partners (USP, UFSC) are dedicating a large fraction of their budget to PhD scholarships, thus explaining the large PM allocations. Partners SSBE, PLOC, and MFRI have limited budget allocated (6PM, 8PM, 9PM) and are included to provide specific competence and specific role in dedicated tasks (data management, glider deployment, benthic maps).

3.4.2.1 Allocation of effort per Case Study

Partners leading CS IEAs will need to carry major activities in WP1,2,3,4,5,7. All CS will have effort allocated to complete the CS cycle including: scoping (in WP1) data gathering and mapping (WP2, 3, 4), indicator analyses (WP5), risk and vulnerability assessment (WP7). Distribution of efforts within these steps is not equal and reflects the different starting ORL and how far can be advanced, based on availability in data, models and knowledge in the CS area. Additionally, some CS lead might have extra tasks to complete or contribute in, making the effort varying between partners. Finally, since WP1 is focussing on regional stakeholder interactions over the entire IEA cycle, all CS lead have a dedicated budget to run three stakeholder meetings in their CS although synergies for common meetings are also included (e.g. in CS NAMR, SAMR, SBS) (see 3.4.3).

An overview on the efforts per CS is provided in the table below, indicating the effort including the extra activities associated with the specific CS lead partner:

	WP1	***WP2***	***WP3***	***WP4***	***WP5***	***WP7***	***Total CS effort***
NOS: Norwegian Sea (IMR)	**Effort: 7 MM** *Extra*: Leading WP1 + chair of all CS interactions + Overview Scoping			***Note 1***	**Effort: 12 MM**	**Effort 12 MM**	**31 MM**
CES: Celtic Sea (MI)	**Effort: 12 MM** *Extra*: Co-lead WP1 + review all IEAs + Lead Synthesis + Atlantic IEA (see below)	**Effort: 1 MM**	**Effort: 1 MM**	***Note 2***	**Effort: 4 MM**	**Effort 10 MM**	**38 MM**
NAMR: Mid Atlantic North (IMAR)	**Effort: 3MM** *Extra*: Contribute to SSP + Participate to synthesis	**Effort: 5MM**	**Effort: 10 MM**		**Effort: 16 15 MM**	**Effort: 5 MM**	**38 MM**
CC: Canary Current (IEO)	**Effort: 6MM** *Extra*: review IEAs	**Effort: 7MM** Participate in Demo 8	**Effort: 10MM**	**Effort: 6MM** Extra: Task 4.1 EUROFLEET	**Effort: 16MM** Extra: Resilience Atlantic basin	**Effort: 16MM**	**61 MM**

SAMR: Mid Atlantic South (USP)	**Effort: 24MM** *Extra*: Lead SSP	**Effort: 4MM**	**Effort: 48MM**	**Effort: 46MM**	**Effort: 46MM**	**Effort: 24MM**	**192 MM** ***Note 3***
BEC: Benguela Current (UCT)	**Effort: 6MM** *Extra*: review IEAs	**Effort: 2MM**	**Effort: 2MM**		**Effort: 8MM**	**Effort: 9MM**	**27 MM**
SBS: South Brazilian Shelf (UFSC)	**Effort: 36MM**	**Effort: 4MM**	**Effort: 40MM**	**Effort: 25MM**	**Effort: 38MM**	**Effort: 20MM**	**163 MM** ***Note 3***
Atlantic Basin (MI + All)	**Effort: 18 MM**		**Effort: 4MM**	**Effort: 3 MM**			**25 MM**

(1) IMR will contribute with a second research group leading the activities in WP4 which are supporting all Case Studies. These MM are not included in the Table.

(2) MI will contribute with a second research group leading the activities in WP2, and WP4 which are supporting all Case Studies. These MM are not included in the Table.

(3) USP and USC plans to use the budget mainly for PhDs, hence estimated MM is larger than other partners allocating effort to senior staff members.

3.4.3 Building capacity and the All Atlantic Network on IEA: Integrated assessment strongly rely on regional and basin scale stakeholder interactions. 6% of the total budget is allocated to stakeholder workshops under the 7 CS in MISSION ATLANTIC corresponding to 3 meetings per CS. Additional workshops are focussing on IEA activities in WP5 and WP7 as well as in engaging the larger Atlantic community in WP8 and WP9. In WP8 200k € are allocated to provide seed money (approx. 1 year) for shared PhDs between MISSION ATLANTIC partners and associated partners on IEA topics relevant for the project. Additional 160k € are dedicated to mobility for short term stays along the North South Atlantic directions as detailed in T8.3 (budget hold by partner UPO). Together with demand driven definition of learning objectives and the ambitious MSC program on IEA established at WMU, this seed funding can represent a step change in the collaboration across the Atlantic Ocean. Together CS activities and WP9 science to policy and WP8 capacity building, including the organisation of General Assemblies have a budget of 11,5 % of the total budget all contribution to build the All Atlantic research network on IEA.

3.4.4 Observations and new technologies: Several partners have PM allocated in activities at sea. In particular long-endurance WaveGlider™ and Deep sea glider missions (main partners: MRob, PLOCAN, UBH), size-spectra measurements across large latitudinal gradient including co-funding of the Atlantic Meridional Transect (NOC) and dedicated oceanographic cruise in Brazil (lead: UFSC). These accounts for 1.2M € and approx. 10% of the total budget.

3.4.5 Other costs: Several project partners claim costs connected to travel, expensive research consumables, cost for open access publication and computing costs in addition to personnel costs (Table 3.4b). 16% of the budget is divided between travel, other goods and services, and equipment (Fig. 12). To sustain internal communication between partners and interlinkage with other project and related activities in the Atlantic region, each partner has been given sufficient travel budget. Apart from person-month DTU holds the budget (24k EUR travel + 50k EUR salary contracts, Article 10) for the involvement of selected End-Users (EUG in T9.3.1 and full list in Table 3.4a) which are contracted in the project (Section 4.2 Third Parties) to provide input on shaping research products into usable products across different Blue Economy sectors. DTU holds also the flexible budget for targeted exploitation measurements (100k) and the PhD programme (200k) as well as to organize GA meetings (200k) and other clustering activities with other projects (40k).

3.4.6 Additional resources: Partner P27 MUN is not eligible for EC funding, but are providing their own contribution to the project. Their effort is included in the table above. Other Partners in addition to their EC request are providing in kind senior staff contribution to the project (IMR, IFREMER, UFSC, USP, SANBI).

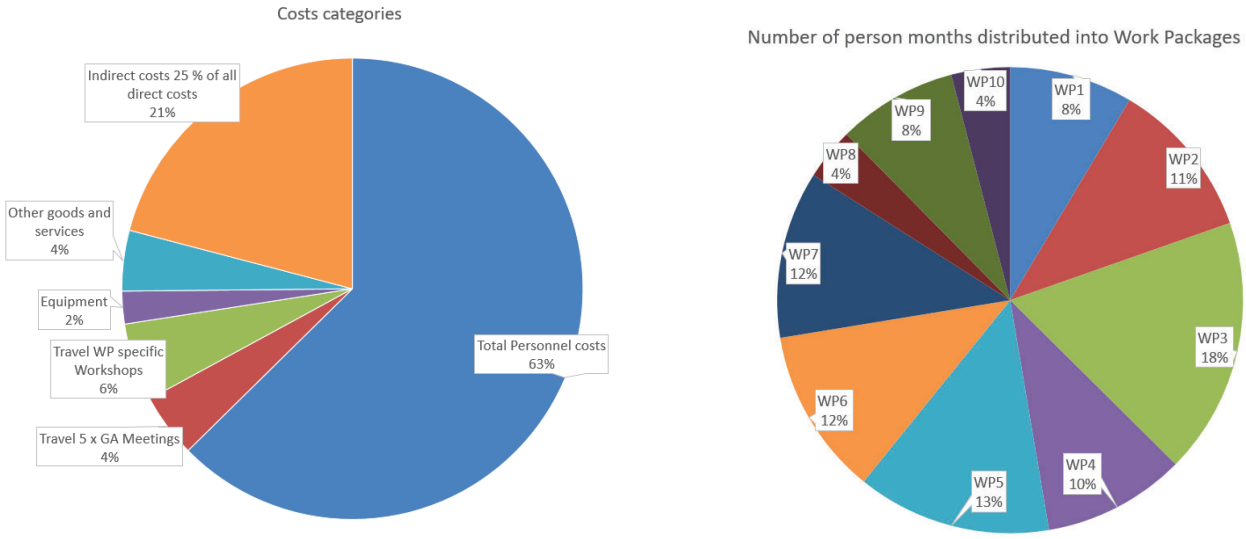

Figure 12. *Distribution of resources (a) per cost item (EUR), and (b) person months per WP*

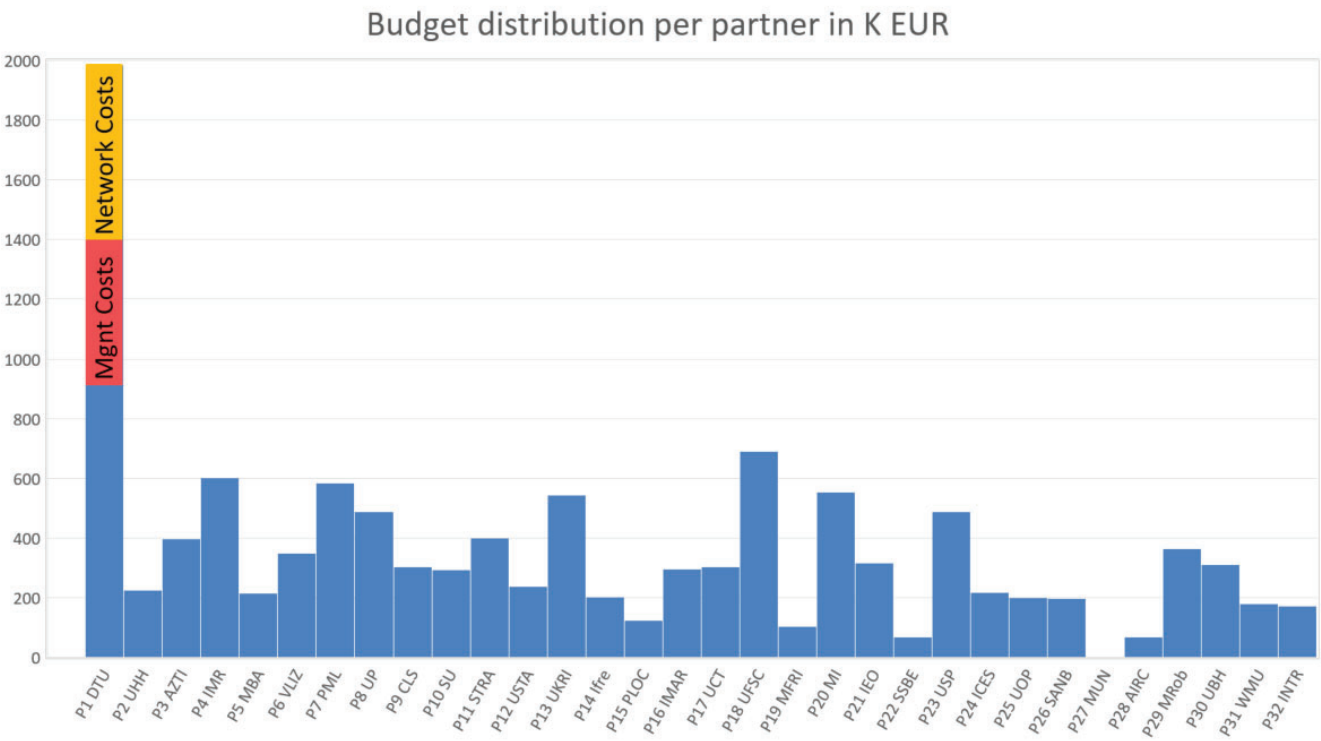

Figure 13. *Budget distribution per partner (DTU's budget includes research in blue, management costs in orange, network costs in yellow).*

Table 3.4b: Detailed description of Other direct costs *(travel, equipment, other goods and services, large research infrastructure, etc.) where these costs exceed 15% of the partners requested funding. Costs can be independently directly measured, and Equipment Depreciation costs will follow internal beneficiary procedure in compliance with GA[§]. Itemisation of all costs in Table 3.4 is indicative only, and all costs are subject to full flexibility according to Article 4.2 'Budget transfers[15]', and subject to eligibility of costs at Project Reporting Periods (GA Article 21 "Payments & Payments Arrangements").*

P1. DTU 60,7%	**Cost (€)**	**Justification**
Travel	**40.000**	5 x GA Meetings 5 PI's x 1400€ per meeting: 35.000 €, 1 PI x 5 AANCHOR / Atlantic Alliance annual meetings x 1000€ : 5000€
Other goods & services	**563.500**	Hosting 1 x WP5 Workshop (travels costs for 10 regional stakeholders at 1200 €): ***12.000 €*** Hosting 2 WP1-WP10 Workshops (travels costs for 10 regional stakeholders at 1200 €): ***24.000 €*** 1 Kick-off & 5 GA meetings logistics (6 general assembly meeting x 25.000 € of venue costs & Service Contracts Art.10): ***150.000 €*** Task 8.3.2 PhD fellowships programme Reserve Fund: ***200.000 €*** (Flexible Reserve Fund based on Article 4.2 "Budget Transfers" at disposal of Executive Board, to be used to match co-financing of fellowships hosted at project Beneficiary Partner Insititutions, for qualifying fellowships aligned with MISSION ATLANTIC research objectives. The Reserve Fund can only be used to compliment EU-based Graduate School fellowship (selection criteria in WP8), and strictly for ***personnel salary costs*** of the selected fellows, and ***travel*** to MISSION ATLANTIC workshops and project meetings, according to GA Article 4.2 "*Budget Transfers*"). Task 9.3 Exploitation activities Reserve Fund ***100.000 €*** (Flexible Reserve Funds of 100.000 € are held with the Coordinator DTU, intended to be allocated to full range of cost categories: project beneficiary salaries, travel, other direct costs (according to GA Article 4.2 "*Budget Transfers*"), external service contracts (according to GA Article 10) as well as potential subcontracts (GA Article 13) provided that Exec. Board & EC PO agree); End User Group (EUG) Lump Sum contracts for 10 members, estimated at 5.000 € per contract for 12 days workload: ***50.000 €*** EUG Travel expenses for 8 members to attend GA meeting, arranged by hosts/coordinator, estimated at 3000€ each: ***24.000 €*** Certificate of Financial Audit : ***3.500 €***
Total	**603.500**	**before indirect costs*
P7 PML 46.1%	**Cost (€)**	**Justification**
Travel	**16.000**	5 x GA Meetings (2PIs x 5 x 1600€): 16.000€.

[15] Horizon 2020 AGA http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

Other goods & services	**131.500**	High Perfromance Computing services hire for WP6 simulations that have to be outsourced due to lack of in-house capacity: 60.000 €. Data Storage service for large simulation output in WP6: 50.000 €. 8 travel costs for attendance of international conferences to present project outputs (5 PI's) @1750 € = 14.000 € Publication Costs: 4.000 €. Certificate of Financial Audit: 3.500€
Total	**147.500**	**before indirect costs*
P8. UPO 157.7%	**Cost (€)**	**Justification**
Travel	**16.000**	5 x GA Meetings x 2 PI's @1600€ : 16.000€.
Other goods & services	**223.500**	Task 9.3 Mobility Calls travel expenses (2 calls of 15-20 fellows @4.000 € travel costs per fellow) : 160.000 € WP specific Workshops: Task 10.2 Atlantic FORUM Cost: 15.000 € (travels costs for 10 regional stakeholders at 1500 €) Task 10.2 Final Event in Brussels (venue, catering, hosting costs): 15.000 € Communication materials & marketing services @ 6.000 € per year: 30.000 € Certificate of Financial Audit: 3.500€
Total	**239.500**	**before indirect costs*
P13 NOC 75.7%	**Cost (€)**	**Justification**
Travel	**35.000** **3.220** **2.800** **7.040**	5 PI's x 5 GA Meetings x 1400 EUR per trip: 35.000€. 2 PI's travel x 2 Atlantic Cruises: 3.220 € 2 PI's attending x 2 WP-specific workshops (700 € in EU): 2.800€ 2 PI's attending x 2 Int. Conferences (1760 € registration, accommodation, travel costs): 7.040€
Other goods & services	**138.753**	Disk Space & Data Storage for global modelling simulation outputs for WP6: 2.185€. Disk Space for FlowCam Data Storage & analysis: 546€. FlowCam Sensor 8 months hire: 67.530€. Consumables for FlowCam analysis: 5.462€. Extra 2 days Research Vessel hire to extend existing Atlantic Meridianal Transect (AMT) Programme (UK) cruise to allow deployment of vertical profiles specific to Action : 54.615€. Freight for 2 cruises, to deliver FlowCam to/from vessel: 1.638€. Publication costs: 3.277€.

		Certificate of Financial Audit: 3.500€
Total	**186.813**	**before indirect costs*
P15 PLOCAN 103.3%	**Cost (€)**	**Justification**
Travel	**19.500**	1 PI attending x 5 GA Meetings, 3 days: 7.500€. WaveGlider™ deployment Brazil x 2 Mission (4 x PI's based on flexible *SeaFarer* flight ticket costs & accomodation costs): 8.000 € WaveGlider™ deployment Azores x1 Missions (4 x PI's based on flexible *SeaFarer* flight ticket & accomodation costs): 4.000 €
Equipment[§]	**39.000**	Batteries + consumables for WaveGlider™. x 3 Missions @13.000 €: 39.000 €[§] (Depreciation costs of 20% over 5 years)
Other goods & services	**5.000**	Freight for WaveGlider™ deployment Azores: 5.000 €
Total	**63.500**	**before indirect costs*
P16 IMAR 57.1%	**Cost (€)**	**Justification**
Travel	**10.000**	1 PI attending x5GA Meetings, 3 days: 10.000€.
Equipment[§]	**16.500**	One multi-sensor telemetric package to deploy on large pelagic predators over the mid-Atlantic ridge (*Equipment Depreciation costs will follow internal beneficiary procedure in compliance with GA*[§]).
Other goods & services	**60.000**	WP specific Workshops 2 x Case Study Lead Workshops, 10 regional stakeholders' travel costs at @1.400 € @14.000 €: 28.000 € Single-use electronic tags[§] for large pelagic predators: 25.000 €[§] Fieldwork consumables, WP3 & 4, @3.500 € per WP: 7.000 €
Total	**86.500**	**before indirect costs*
P17 UCT 23.3%	**Cost (€)**	**Justification**
Travel	**16.000**	2 PIs attenting x5 GA Meetings, 3 days @1.600 €: 16.000 €
Other goods & services	**30.000**	WP specific Workshops 3 x Case Study Lead Workshops in WP1, travel costs for 10 regional stakeholders @1.000 € @10.000 €: 30.000€
Total	**46.000**	**before indirect costs*
P18 UFSC 14.5%	**Cost (€)**	**Justification**
Travel	**16.500**	2 PIs attending x5 GA Meetings, 3 days, @1.650 €: 16.500€
Other goods & services	**45.000** **3.500**	WP specific Workshops (3 x Case Studystakeholder workshops @15.000 €, travel costs for 10 regional stakeholders @1.500 €: 45.000 € Certificate of Financial Audit: 3.500€
Total	**65.000**	**before indirect costs*
P22 SSBE 16.7%	**Cost (€)**	**Justification**
Travel	**8.000**	1 PI attending x 5 GA Meetings, 3 days, @1.600 €: 8.000 €.
Total	**8.000**	**before indirect costs*

P23 USP 22.3%	**Cost (€)**	**Justification**
Travel	**21.500**	2 PI's attending x 5 GA Meetings. 3 days, @1.650 €: 16.500 € 2 PI's attending WP7 Research Workshop, @2500 €: 5.000 €
Other goods & services	**30.000** **3.500**	3 x Case Study specific stakeholder workshops at 10.000 € (travel costs for 10 regional stakeholders @1.000 €): 30.000 € Certificate of Financial Audit: 3.500€
Total	**55.000**	**before indirect costs*
P24 ICES 29.7%	**Cost (€)**	**Justification**
Travel	**20.000**	2 PI's attednig x5 GA Meetings. 3 days, @1.500 €: 15.000 € Task 9.2 Atlantic FORUM travels for 5 PI's: 5.000k €
Other goods & Services	**20.000**	WP specific workshops: Host 2 x WP8 workshops (Milestone 8.3; travel costs for 10 regional stakeholders @1.000 €) @10.000 €: 20.000 €;
Total	**40.000**	**before indirect costs*
P25 UPL 18.9%	**Cost (€)**	**Justification**
Travel	**13.000**	1 PI attending x 5 GA Meetings, 3 days, @1.600 €: 8.000€. 1PI attending x 4 WP specific workshops, @1250 €: 5.000€
Other goods & services	**12.377**	Open access publications 4.240 € HPC High-Performance Computing service for AI/Machine Learning: 2.000 € Data Storage Services beyond in-house capacity: 1.137 € 2 x attendance & travel costs for Int. Conference x 2 PI's @1250 €: 5.000 €
Total	**25.377**	**before indirect costs*
P26 SANBI 33.3%	**Cost (€)**	**Justification**
Travel	**22.200**	5 x GA Meetings (2 person) at 2.220 €: 22.200 €
Other goods & services	**15.000** **2.400**	Host 1 x WP5 Workshop on Tipping Points (travel costs for 10 regional stakeholders @1.500 €): 15.000 € Video Production Services (Article 10) in WP9
Total	**39.600**	**before indirect costs*
P28 AIRC 57.1%	**Cost (€)**	**Justification**
Travel	**20.000**	1 PI attending x 5 GA Meetings, @2.000 €: 10.000 €. Travel costs for attendance of WP1,2,8,9 specific workshops x 2 PI's @1250 €: 10.000€
Total	**20.000**	**before indirect costs*
P29 MRob 183.1%	**Cost (€)**	**Justification**
Travel	15.000	1 PI attending x5 GA Meetings, @2.000 €: 10.000 €. 1 PI attendance of x4 WP specific workshops in WP 3 & 4, @1250 €: 5.000 €

Other goods & services	174.000	WaveGlider™ hire for 132 Days @ 1250 EUR/day: 165.000 € WaveGlider™ consumables (batteries§): 9.000 €§
Total	**189.000**	**before indirect costs*
P30 UBH 27.8%	**Cost (€)**	**Justification**
Travel	**10.000**	1 PI attending x5 GA Meetings, 3 days, @2.000 €
Other goods & services	**50.000**	All costs associated with Task 2.3 Demo IV prototype demonstrator: Freight & shipping material for WaveGlider 2 x missions: 4.000 € Seafloor Imaging Sensor Hire: 13.000 € Mission-specific, pressure-housing components for prototype testing: 12.000 €§ Consumables (single use electrical components, essential for prototype testing): 21.000 €
Total	**60.000**	**before indirect costs*
P31 WMU 81%	**Cost (€)**	**Justification**
Travel	**61.700**	2 PI x 5 GA Meetings, 3 days, @2.740 €: 27.400€[16] WP specific workshops: 2 PI attendance of 10 Case Study Workshops in WP1 as data gathering (Science Diplomacy interviews) for Task 8.1 and Task 9.2 (@17.150 €): 34.300 €
Other goods & services	**2.750**	Interview Processing Software, task-specific to T9.2.2: 2.750 €
Total	**64.450**	**before indirect costs*
P32 INTRIGO 27%	**Cost (€)**	**Justification**
Travel	**14.400**	2 PI attending Kick-Off, 3 days in Oct 2020, @1.500 € 1 PI attending x 4 GA Meetings, 3 days, @2.000 € 1 PI attending x 2 WP specific workshops, @1.700 €:
Other goods & services	**15.000**	1 Service Contract (Article 10) for Graphic Artist, 5.000 € Printing, marketing, branding costs @2.000 € per year
Total	**29.400**	**before indirect costs*

[16] *NB: WMU World Maritime University is an UN Intergovernmental Insitution with specific travel requirement for intercontinental travel. Travel Cost Estimates are performed following UN internal guidelines & procedures.*

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[11] *Longhurst 2010*. Ecological geography of the sea. *Elsevier*.
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[14] *Laffoley & Baxter 2018*. Ocean connections. An introduction to rising risks from a warming, changing ocean. Gland, Switzerland: IUCN. vi+38 pp.
[15] *Niehörster & Murnane, 2018*. Ocean Risk and the Insurance Industry. Pub. by XL Catlin Services SE, UK, May 2018, 40pp. ISBN: 978-1-9995922-0-2.
[16] *DePiper, et al*., 2017. Operationalizing integrated ecosystem assessments within a multidisciplinary team: lessons learned from a worked example. *ICES Journal of Marine Science*, *74*(8), pp.2076-2086.

4. CONSORTIUM MEMBERS

All partners confirm that mentioned personnel is directly under employment contract with the Beneficiary legal entity.

4.1. Participants (applicants)

4.1.1 Partner 1, National Institute of Aquatic Resources, Technical University, Denmark (DTU)

The Technical University of Denmark is a self-governed university that operates at a high international level in a wide array of research areas within science and technology. DTU Aqua provides research, education and advice concerning sustainable exploitation of living marine and fresh water resources and conducts the Danish national monitoring on fish and fisheries for the EU. The institute conducts research across a wide range of marine disciplines, principally focusing on ecosystem interactions, sustainable fisheries production and the underlying processes. The Section for Oceans and Arctic, and Marine Living Resources within DTU Aqua conduct basic research on oceanography, climate, ocean biogeochemistry, plankton and fish production as well as developing process-based and statistical models of the marine environment. DTU Aqua has extensive experience in coordinating and managing scientific projects, including EU framework projects (e.g. PANDORA, UTOFIA, DISCARDLESS, MYFISH, COLUMBUS, MEECE, PROTECT, FACTS). It has on-going activities in applied marine technology, and ecosystem assessment and has a wealth of experience in communicating and engaging with stakeholders and policy makers. The institute has been coordinator (2010 – 2014) of a large North Atlantic Ecosystem EU FP7 project EURO-BASIN and is coordinating (2018-2022) a major Fish Stock Assessment H2020 project PANDORA.

Contribution to the project

DTU Aqua will coordinate the Project (WP10), work package leader of WP5, and responsible for specific deliverables in other work packages with focus on ecosystem state and resilience (WP5), scenarios of fishing effort (WP3), connectivity models (WP6), Artificial Neural Network development and Application (WP7), capacity building (WP9) and societal engagement (WP10), as well as contributing on the technology development and demonstration of gliders (WP2, WP3, WP4) and the whole Atlnatic assessment in WP1.

Profiles of the principal investigators

Dr. Patrizio Mariani (male) is the Project Coordinator. He is Head of the Observation Technology group at DTU Aqua and he has a PhD degree from the University of Naples “Federico II”, Italy. His research focuses on ecological modeling, food-web interactions, spatial ecology and effects of multiple stressors, particularly on the population dynamics and adaptation of plankton and fish. Since 2016 he is elected Chair of the EUROMARINE Steering Committee and main organizer of several events at the science policy interface. He is Danish representative at the European Marine Board and member of different advisory boards including EMBRIC. He is author of >35 peer-reviewed publications. In the past 5 years he has been coordinator of national research project in the field of marine technology and robotics, and coordinator for the European Maritime and Fishery Fund, while PI in several EU projects since FP6 (e.g., EuroBASIN, COCONET, COLUMBUS, UTOFIA) as well as in additional 10 externally-funded national and international projects. Presently involved in H2020 SUMMER and AQUAVITAE.

Prof. Michael St John (male) is a Professor in Marine Ecosystem Dynamics and deputy coordinator in the Project, has extensive experience in Project management inlcluding the coordination of the FP7 Project EuroBASIN. He is an Editor for Frontiers in Marine Science (Marine Ecosystem Ecology) having edited a special Issue on Complexity in Marine Systems: Developing a pragmatic approach to understanding and managing their emergent features as well as Co Chairing a PICES working group on Application of Machine Learning to Ecosystem Change Issues in the North Pacific. He will lead activities realtive to of the All Atlantic Panel to optimize clustering of project impact with concurrent Blue Growth projects.

Dr. Martin Lindegren (male) holds a PhD in marine biology from the University of Copenhagen. He is a Senior Researcher with primary research focus on investigating large-scale patterns, trends and drivers of marine biodiversity. He has >40 peer-reviewed publications, is a chair and active member of several international expert

groups and a PI of the Centre for Ocean Life, as well as a number of EU projects (MARmaED, SUMMER). He is leading WP5 and participate in WP1, WP3, WP7, WP8 and WP9.

Dr Mark R. Payne (male) is a senior researcher in the Centre for Ocean Life who focuses on developing predictive knowledge in marine ecosystems covering time scales from the seasonal and decadal to the climatic. Payne has published 30 peer reviewed publications (h-index 11) and a variety of other publications in journals including Nature, PNAS and Global Change Biology and has substantial experience providing scientific advice regarding the management of fish stocks. He has previously been the leader of WP4 in the EU FP7 project NACLIM, which focused on decadal-scale forecasts of the oceanic environment, and has helped pioneer the application of this knowledge to predict marine ecosystems. He is also the lead editor of a "research topic" in the journal "Frontiers in Marine Science" dedicated to this issue. His previous work has ranged across ecosystems (North Atlantic, North Sea) and trophic levels, including climate change impacts on plankton, small-pelagic fish and top predators. He primarily works with statistical analysis of observational data sets, using inputs from satellite remote sensing and general circulation models to develop new insights into the underlying processes. Mark is contributing to the analyses of extreme events in WP6.

Dr. Kirsten Thomsen (female) and Dr. Ivo Grigorov (male) as part of Research Secretariat, DTU-Aqua, will act as Project Managers. Research Secretariat staff have >10 yrs of experience training researchers in Log Frame Matrix, SMART Objectives (delivered in the framework of Building Stronger Universities, DANIDA Danish Development Agency programme), proposal formulation for Impact on Societal Challenge and MSCA calls. Research Secretariat is a partner in H2020 FOSTER+ (Implementing EC Open Science agenda), H2020 COLUMBUS (Knowledge Transfer) and H2020 SeaCHANGE (Ocean Literacy).

Relevant previous projects

- H2020 CERES (GA 678193): Climate change and European aquatic RESources
- H2020 PANDORA (GA 773713): PAradigm for New Dynamic Ocean Resource Assessments and exploitation
- FP7 EURO-BASIN (GA 264933): Integrated Project on Basin-Scale Analysis, Synthesis and INtegration
- FP7 NACLIM (GA 308299): North Atlantic Climate: Predictability of the climate in the North Atlantic/European sector related to North Atlantic/Arctic sea surface temperature and sea ice variability and change
- NAACOS (Ref. no. 10-093903) North Atlantic - Arctic coupling in a changing climate impacts on ocean circulation, carbon cycling and sea-ice (funded by the Danish Research Council)

Relevant publications and products

- Azaña Schnedler-Meyer, N., **Mariani, P.,** Kiørboe, T. 2016 The global susceptibility of coastal forage fish to competition by large jellyfish Proc. R. Soc. B 2016 283.
- **Mariani P,** Andersen KH, Visser AW, Barton AD & Kiørboe T (2013) Control of plankton seasonal succession by adaptive grazing. Limnol. Oceanogr. 58(1).
- **Lindegren M.,** C. Möllmann, A. Nielsen, and N. C. Stenseth. 2009. Preventing the collapse of the Baltic cod stock through an ecosystem-based management approach. PNAS , 106:14722;
- Palacz, Artur **; St. John, Michael** ; Brevin, R.J.W. ; Hirata, T. ; Gregg, W.W. 2013: Distribution of phytoplankton functional types in high-nitrate low-chlorophyll waters in a new diagnostic ecological indicator model. Biogeosciences Discussions vol: 10, pages: 8103-8157,
- **Lindegren, M.,** Checkley, D.M., Jr., Ohman, M.D., Koslow, A., Goericke, R. 2016. Resilience and Stability of a Pelagic Marine Ecosystem. Proc. R. Soc. B., 283: 20151931.

Research facilities, infrastructures and equipment

DTU Aqua has new (built in 2017) state of the art facilities to conduct research related to the project. The Institute has a dedicated project office with four staff members assisting for the coordination of many national and international projects. Mission Atlantic will have a person dedicated to internal administration of the project. DTU Aqua has modern laboratories for technology development on autonomous systems, and owns and operates the

research vessel Dana, which is a multipurpose vessel capable of worldwide operation. Dana is classified for ice navigation (DNV Ice 1A*) and equipped to carry out a wide range of investigations within arctic research, marine biology research, climate and environment research, geological research and fishery research.

4.1.2 Partner 2, University of Hamburg, Inst. for Marine Ecosystem and Fisheries Science, Germany (UHAM)

The Institute for Marine Ecosystem and Fisheries Science (IMF) at University of Hamburg (UHH) conducts interdisciplinary research in all fields of marine science with a focus of understanding the functioning of marine ecosystems under climate change and fisheries exploitation. IMF is member of the German Science Foundation Cluster of Excellence in Climate System Analysis and Prediction (CLiSAP) and the UHAM Center for Earth System Research and Sustainability (CEN) that unites the expertise of oceanographers, meteorologists, marine biologists, geophysicists, geologists, soil scientists, geographers and biogeochemists, as well as researchers in the business and social sciences. The IMF department on Marine Ecosystem Dynamics and Management lead by Prof. Dr. Christian Möllmann is analysing climate and fisheries effects on the structure and functioning of marine ecosystems with the goal to develop better ecosystem-based management strategies. Members of the working group are significantly involved in Integrated Ecosystem Assessment (IEA) development within the International Council for the Exploration of the Seas (ICES). IFM and its groups has extensive experience in coordinating and participating in scientific EU framework (e.g. CERES, PANDORA, MARMAED, MYFISH, EURO-BASIN, MEECE, PROTECT, FACTS, BECAUSE) and EU Era-Net projects (BLUEWEBS, INSPIRE, AMBER, ECODRIVE).

Contribution to the project

UHH will co-lead work package WP5 on assessing state, drivers and tipping points, and is responsible for specific deliverables in other work packages with focus on risk assessment and uncertainties (WP7), building capacity for the IEA (WP8) and societal engagement (WP9).

Profiles of the principal investigators

Prof. Dr. Christian Möllmann (male). The work of Christian Möllmann focuses on direct and indirect effects of climate and fisheries exploitation on the structure and function of marine foodwebs. He is a leading scientist in the field of marine ecosystem reorganizations (e.g. regime shifts and trophic cascades) and combines statistical analyses of long-term data series, field-based process studies, and modelling techniques. The ultimate goal of his work is the integration of environmental processes into an ecosystem-based management of marine resources. Towards this he is chairing expert groups within the International Council for the Exloration of the Seas (ICES) such as the Working Group on Integrated Assessments of the Baltic Sea (WGIAB), Working Group on Comparative Analyses between European Atlantic and Mediterranean marine ecosystems to move towards an Ecosystem-based Approach to Fisheries (WGCOMEDA), Working Group on Integrated Assessments of the North Sea (WGINOSE). Christian Möllmann holds the ICES Outstanding Achievement Award 2017 and is Lead Author for Climate Change 2021: Impacts, Adaptation and Vulnerability, Working Group II of the International Panel for Climate Change (IPCC) Sixth Assessment Report.

Dr. Saskia Otto (female) is Postdoctoral Researcher specialized in statistical data analysis with a special focus on developing robust indicator systems for Integrated Ecosystem Assessments. She is a present co-chair of the ICES Working Group on Integrated Assessments of the Baltic Sea (WGIAB), a future co-chair of the ICES/PICES joint Working Group on Ecosystems Thresholds and Reference Points, and author of the R package INDperform for evaluating ecological state indicators and assessing the ecological status based on a suite of indicators (https://github.com/saskiaotto/INDperform).

Relevant previous projects

- EU BONUS BLUEWEBS: Blue Growth boundaries in novel Baltic food webs
- EU BONUS INSPIRE: INtegrating SPatIal pRocesses into Ecosystem models for sustainable
- utilization of fish resources
- H2020 MARMAED: MARine MAnagement and Ecosystem Dynamics under climate change
- FP7 EURO-BASIN: Integrated Project on Basin-Scale Analysis, Synthesis and INtegration

- German Ministry for Education and research marEEshift: Marine ecological-economic systems in the Western Baltic Sea and beyond: Shifting the baseline to a regime of sustainability

Relevant publications and products

- **Möllmann C**, Folke C, Edwards M, Conversi A (2015) Marine regime shifts around the globe: theory, drivers and impacts. Philosophical Transactions Royal Society B 370: 20130260
- Conversi A, Dakos V, Gardmark A, Ling S, Folke C, Mumby PJ, Greene C, Edwards M, Blenckner T, Casini M, Pershing A, **Möllmann C** (2015) A holistic view of marine regime shifts. Philosophical Transactions Royal Society B 370: 20130279.
- Levin PS, **Möllmann C** (2015) Marine ecosystem regime shifts: challenges and opportunities for ecosystem-based management. Philosophical Transactions Royal Society B 370: 20130275.
- **Otto SA,** Kadin M, Casini M, Torres MA, Blenckner T (2018) A quantitative framework for selecting and validating food web indicators. Ecological Indicators 84: 619-631.
- Torres MA, Casini M, Huss M, **Otto SA,** Kadin M, Gårdmark A (2017) Food-web indicators accounting for species interactions respond to multiple pressures. Ecological Indicators 77: 67–79.

Research facilities, infrastructures and equipment

UHAM has dedicated human and computing resources for conducting the work planned within Mission Atlantic.

4.1.3 Partner 3, Fundación AZTI - AZTI Fundazioa, Spain (AZTI)

AZTI (www.azti) is a non-profit foundation committed to the social and economic development of the marine environment and the food sector. With 34 years of experience, the organisation has developed more than 2.000 projects with industries and public institutions, including 35 European projects running at present. With a team of 234 professional, as Research and Innovation Centre is structured in two divisions: Marine Research and Food Research. The Marine Research Division, AZTI has extensive experience in scientific projects, including >20 EU projects (e.g. MEECE, EURO-BASIN, DEVOTES, MARS, MYFISH, REPRODUCE, FACTS, MESMA). The institute has been coordinator of two large EU FP7 and H2020 projects: DEVOTES (2012-2016) and SUMMER (2019-2023). AZTI carries out the monitoring of Basque Fisheries since 1997, and oversees the sampling of biological variables (at-the-market and at-sea), recreational fisheries and scientific surveys. Researchers possess wide expertise in modelling of plankton and fisheries data for ecosystem and stock assessment. It has also 10-year experience on Climate Change research, focusing in the impacts on marine ecosystem, fish distribution and reproduction, at both Atlantic and global scales.

Contribution to the project

AZTI will lead WP3 on Mapping Pelagic Ecosystems of the Atlantic, and is responsible for two specific deliverables in this package with focus on mapping fishing effort and shipping for the whole Atlantic using machine learning algorithms and AIS data, mapping fish habitat (Task 3.4) and projecting under climate change scenarios (WP6), and understanding connectedness among communities through the Atlantic biomes (Task 3.3). AZTI will also contribute to: Data Management (WP2), Ecosystem risks and vunerabilitis (WP7) and the Atlantic IEA synthesis (WP1) as well as communication (WP9).

Profiles of the principal investigators

Dr. Guillem Chust (male) is the leader of WP3 and will be also involved in modelling habitat scenarios (WP6) and ecosystem vulnerability (WP7). He is the head of "Climate Change impacts on oceans and coasts" group in AZTI and he has a PhD degree from the University of Paul Sabatier, France. His research focuses on marine macroecology, habitat modelling and climate change impacts in ocean ecosystems. Author of 78 publications in SCI-indexed journals (H index: 28, in Scopus), including high impact international journals (Nature Communications, Global Change Biology). Editor of Frontiers in Marine Science (Marine Ecosystem Ecology, and Global Change and the Future Ocean), and participating as expert reviewer in IPCC reports. Participation in more than 20 research projects and leading competitive national projects and WPs of European projects (MEECE, Euro-Basin). He has co-organized congresses (Uhinak), workshops (Euro-Oceans, Euromarine) and sessions (in ASLO) in climate change and has been invited in 24 seminars and lecturer in international masters.

Dr Haritz Arrizabalaga (male) has chaired the committee of ICCAT, and will be involved in tuna habitat modelling in WP3.

Dr Estibaliz Díaz (female) will be involved in generating future habitats for eel larvae (WP3). Dr Maite Louzao (female) will be involved in 3D habitat mapping (T 3.4). Ms Edier Andonegi (female) will be involved in Regional Integrated Ecosystem Assessment Framework (WP1). Dr Leire Ibaibarriaga (female) will be involved in Data Management, sharing and operability (WP2). **Dr Jose A. Fernandes (male)** will be leading task 3.2 on mapping fishing effort and will be involved in modelling future habitats (WP6). Ms. Irantzu Zubiaur (female) will be involved in communication (WP9).

Mrs. Amaia Barrena (female) is part of the Research Secretariat at AZTI, and will act as AZTI Project Manager.

Relevant previous projects

- H2020 SUMMER (Grant agreement ID: 817806): Sustainable management of mesopelagic resources. Role of AZTI: WP leader.
- H2020 DiscardLess (Grant agreement No: 633680): Strategies for the gradual elimination of discards in European fisheries. (www.discardless.eu). Role of AZTI: WP leader.
- FP7 MARS (603378): Managing multiple stress for multiple benefits in aquatic ecosystems.
- DEVOTES (FP VII ENV.2012.6.2-3 308392): DEVelopment Of innovative Tools for understanding marine biodiversity and assessing good Environmental Status. Role: AZTI coordination, G. Chust task leader.
- FP7 EURO-BASIN (GA 264933): Integrated Project on Basin-Scale Analysis, Synthesis and Integration. Role: G. Chust WP leader.
- FP7 MEECE (Project number: 212085): Marine Ecosystem Evolution in a Changing Environment". Role: G Chust WP leader.

Relevant publications and products

- Villarino E, Watson JR, Jönsson B, Gasol JM, Salazar G, Acinas SG, Estrada M, Massana R, Logares R, Giner CR, Pernice MC, Olivar MP, Citores L, Corell J, Rodríguez-Ezpeleta N, Acuña JL, Molina-Ramírez A, González-Gordillo JI, Cózar A, Martí E, Cuesta JA, Agustí S, Fraile-Nuez E, Duarte CM, Irigoien X, **Chust G** (2018) Large-scale ocean connectivity and planktonic body size. Nature Communications 9:142.
- **Chust G**, Allen JI, Bopp L, Schrum C, Holt J, Tsiaras K, et al. (2014) Biomass changes and trophic amplification of plankton in a warmer ocean. Global Change Biology 20:2124-2139.
- **Fernandes, JA,** WWL Cheung, S Jennings, M Butenschön, L de Mora, et al. 2013. Modelling the effects of climate change on the distribution and production of marine fishes: accounting for trophic interactions in a dynamic bioclimate envelope model. Global Change biology 19, 2596-2607.
- Erauskin-Extramiana, M., **Arrizabalaga, H**., Hobday, A.J., Cabré, A., Ibaibarriaga, L., Arregui, I., Murua, H., **Chust, G**., 2019. Large-scale distribution of tuna species in a warming ocean. Global Change Biology ol. 25, 2043-2060..
- **Arrizabalaga, H**, F Dufour, L Kell, G Merino, L Ibaibarriaga, **G Chust,** et al. 2015. Global habitat preferences of commercially valuable tuna. Deep Sea Research Part II: Topical Studies in Oceanography 113, 102-112.

Research facilities, infrastructures and equipment

AZTI has three buildings in the north of Spain in Bizkaia (Sukarrieta and Derio) and Gipuzkoa (Pasaia) and counts with specialized equipment. Relevant for this proposal is the molecular biology laboratory and computational power for processing big data. For bioinformatics analyses, the molecular biology team counts with two dedicated servers (with 16 processing units and 192Gb of RAM each) and with a shared High Throughput Performance Computing (HPC) grid system with 60 processing units. For processing big data, we have a cluster composed of multiple modules of control, storage, data base, processing and visualization. Each

module is a Lenovo System x3650 M5 with 2 processors Intel Xeon E5-2637 at 3.5 GHz, 284 GB DDR4, 2 SSD of 120, 1 Dual HBA of 8 Gbs and 1 dual 10 Gbs SFP.

4.1.4 Partner 4, Institute of Marine Research, Norway (IMR)

The Institute of Marine Research (IMR, www.imr.no) is the principal governmental institution in Norway conducting monitoring and research on marine living resources, the marine environment, aquaculture and seafood. IMR's activity is primarily focused on the ecosystems of the Barents Sea, the Norwegian Sea, the North Sea, including the coastal zones, in addition to developing countries in Africa and Asia. With around 1000 employees, IMR is the second largest marine research institution in Europe, playing an internationally leading role in several research areas, with extensive experience with multidisciplinary research projects. IMR currently chair the IEA Steering Group in the ICES Scientific Committee, responsible for guiding and supporting expert groups that develop IEAs in European and north Atlantic regions. Also, IMR co-chairs the ICES Working Groups on IEAs for the North Sea, Norwegian Sea, Barents Sea and the Polar Ocean. IMR has partnered with numerous EU projects, including the ongoing CLIMEFISH and CERES focusing on marine systems and resources under climate change. IMR has also leading positions in the Norwegian national seabed mapping programme MAREANO, and participate in the Atlantic Ocean Research Alliance (AORA), ASMIWG (Atlantic Seabed Mapping International Working Group) and ASPIRE (Atlantic Seafloor Partnership for Integrated Research & Exploration). IMR is therefore well positioned to undertake the proposed effort in Mission Atlantic.

Contribution to the project

IMR is a key partner in Mission Atlantic, leading WP1 Atlantic Ocean Integrated Ecosystem Assessment, and coordinating benthic mapping: ecosystem, resources and pressures (WP4), as well as leading two Case Studies (North Sea and Norwegian Sea). IMR has also a significant contribution in the activites at sea (WP3) (including providing a ship of opportunity), and is involved in assessing state, drivers and tipping points (WP5), risk assessment and uncertainties (WP7), building capacity for the IEA (WP 8) and societal engagement & communication (WP9).

Profiles of the principal investigators

Senior scientist, and Head of research, Mette Skern-Mauritzen (female) leads WP1 on the IEA framework. She, and her Ecosystem Processes research group, focus on structure and function of food webs and systems, and impacts, vulnerabilities and risks related to drivers and pressures. Her research group also develop and implement IEAs to support EBM. She is chairing the IEA Steering Group in ICES, coordinating and supporting the development of IEAs across European waters and the North Atlantic. She has authored > 40 peer reviewed publications, and contribute to the 6th IPCC Assessment Report and the World Ocean Assessment.

Dr. Pål Buhl-Mortensen (male) leads WP4 on benthic habitat mapping. His specialty fields cover benthic biodiversity, habitat mapping, and cold-water coral ecology. He has chaired the ICES Working group on Marine Habitat Mapping (WGMHM, 2012-2015), and been a consulting expert for the Norwegian Environment Agency advising on ecology quality objectives for corals and other threatened and/or declining habitats for OSPAR since 2007. He has published 58 peer-reviewed papers, several book chapters and more than 70 Norwegian research reports.

Dr. Jon Egil Skjæraasen (male) leads the North Sea Case Study. He is a member of the ICES IEA group for the North Sea (WGINOSE) and leader of the North Sea project at IMR, focusing on stock assessments and advice to fisheries management. He has authored > 40 peer reviewed publications, including interactions between management strategies and climate on development of marine living resources.

Dr. Per Arneberg (male) leads the Norwegian Sea Case Study. He co-chairs the ICES IEA group for the Norwegian Sea (WGINOR). Dr. Arneberg leads the 'Monitoring group' under the integrated, cross sectoral Norwegian Management Plan, covering the Norwegian sectors of the North, Norwegian and Barents Seas, and has extensive contact with stakeholders. Dr. Arneberg has authored around 30 peered reviewed papers, reports and

book chapters, focusing also on ecosystem assessments and associated methods, marine biodiversity, and scientific advice to ecosystem based management.

Dr. Rebecca Ross (female) has a strong expertise in Atlantic deep-sea benthic ecology predictive habitat modelling and larval dispersal modelling, and will contribute to WP4.

Senior scientist Benjamin Planque (male) has a strong and wide expertise in marine ecology, including food web and system structure and function, as well as in statistical and numerical approaches, including IEA related approaches. Planque will assist in North and Norwegian Seas CSs.

Webjørn Melle (male) is a senior scientist in plankton research, with long experience in monitoring and running scientific surveys as well as research on monitoring techniques and plankton ecology, and will contribute to WP3.

Relevant previous projects

- H2020 CERES (GA 678193): Climate change and European aquatic RESources
- H2020 CLIMEFISH (GA 677039)
- MAREANO - the Norwegian benthic mapping program
- H-2020 project AORAC-CSA (leader of the work package on habitat mapping)

Relevant publications and products

- Kjesbu, O.S., Bogstad, B., Devine, J., Gjøsæter, H., Howell, D., Ingvaldsen, R., Nash, R., **Skjæraasen, J.E**. (2014). Synergies between climate and management for Atlantic cod fisheries at high latitudes. PNAS, DOI: 10.1073/pnas.1316342111.
- **Planque, B.** (2015). Projecting the future state of marine ecosystems, "la grande illusion"?. ICES J Mar Sci, DOI: 10.1093/icesjms/fsv155
- **Buhl-Mortensen P,** Buhl-Mortensen L, Purser A. 2016. Trophic Ecology and Habitat Provision in cold-Water Coral Ecosystems, Chapter 20-1: In: Marine Animal Forests. DOI: 10.1007/978-3-319-17001-5_20-1.
- **Skern-Mauritzen, M.,** Ottersen, G., Handegard, N.O., Huse, G., Dingsør, G.E., Stenseth, N.C, Kjesbu, O.S. 2016. Ecosystem processes are rarely included in tactical fisheries management. Fish and Fisheries, 17, 165-175.
- **Planque, B**., and **Arneberg, P.** (2018). Principal component analyses for integrated ecosystem assessments may primarily reflect methodological artefacts. ICES J Mar Sci, DOI: 10.1093/icesjms/fsx223

Research facilities, infrastructures and equipment

IMRs have dedicated researchers within the core fields of Mission Atlantic. IMR operates 5 ocean class research vessels, used for routine monitoring of the North Sea and Norwegian Sea CS, and provide ample opportunities for data collection and testing of new technology. The data collected are available from the Norwegian Marine Data Center at IMR. Also, data on human activities and impacts are generally available (e.g., catches, fishing gear, catch positions, shipping lanes, seismic surveys, position of constructions). Extensive annual monitoring and mapping surveys provide spatially resolved time series on ocean climate, primary production, zooplankton, benthos, fish, marine mammals and seabirds. Decadal ocean climate predictions and downscaled climate projections following IPCC scenarios extending to 2065 are available for the CS regions. Recent research projects have developed diverse qualitative and quantitative approaches to assess ecosystem state, vulnerability and risks to climate change and other human impacts, which will contribute to Mission Atlantic. Finally, IMR have a longstanding cross sector collaboration among scientists and stakeholders since the establishment of integrated ocean management plans in 2006.

4.1.5 Partner 5, Marine Biological Association, UK (MBA)

The Continuous Plankton Recorder (CPR) Survey is an internationally funded charity that is based at the Marine Biological Association (MBA) in the United Kingdom. The MBA maintains three long-term biodiversity databases in plankton, benthos and fish. The CPR survey is recognised as the longest sustained (operating since 1931) and geographically most extensive marine biological survey in the world. The dataset comprises a uniquely large

record of marine biodiversity covering ~1000 taxa over multi-decadal periods. The survey determines the abundance and distribution of microscopic plants (phytoplankton) and animals (zooplankton including fish larvae) in our oceans and shelf seas using autonomous sampling devices operated from ships of opportunity on ~50 trans-ocean routes. Biological and physical data from ships covering ~20,000 km of the ocean is collected each month, ranging from the Arctic to the Southern Ocean. The survey is an internationally funded charity with a wide consortium of stakeholders. MBA-CPR survey scientists have extensive experience in macroecology, climate change ecology, time-series analysis, regime shifts, habitat mapping, database management, statistical modelling, molecular ecology and developing new image technologies. CPR survey has and is involved in EU Horizons project in AtlantOS, VECTORS, EUROBASIN; MEECE and FP7 project coordinator – SYNRESH (Synchronous Regime Shifts across European Seas). The CPR survey works centres on scientific advice for policy makers including the United Nations and developing indicators of ecosystem health.

Contribution to the project

The CPR survey is involved in data management, data collection, data analysis, spatial mapping under WP2 and WP3. The team leads and is involved in data technology and management for IEA (WP2), pelagic mapping: ecosystem, resources and pressures (WP3) and societal engagement & communication (WP9).

Profiles of the principal investigators

Prof Martin Edwards (male) is Chief Scientist at the CPR survey and Professor of Ocean Ecology at the University of Plymouth. He has over 20 years of experience in research and has participated in and led a number of European proposals. His primary research interest is on climate/environmental change impacts on marine ecosystems. He and his colleagues were some of the first to demonstrate marine biodiversity distributional and phenological changes and whole ecosystem regime shifts in response to climate change. He has written over 150 peer-reviewed publications (H index =48).

Dr Rowena Stern (female) leading plankton molecular ecologist with specialist taxonomy experience in phytoplankton focusing on harmful algae, including genetic analysis of formalin-preserved archival CPR samples and helped lead in several DNA barcoding consortiums. Rowena was been made a Research Fellow of the CPR survey in 2012 and has trained two masters students and a postdoc and currently has 1 PhD student and involved in EU Horizons project AtlantOS. She is chair of the ICES working group in phytoplankton and molecular ecology, leading an initiative in standardised molecular analysis of time-series.

Relevant previous projects and activities

- Participation in multiple EU framework projects with direct thematic relevance to this call, e.g. AtlantOS, VECTORS, EUROBASIN; MEECE.
- FP7 project coordinator – SYNRESH (Synchronous Regime Shifts across European Seas)
- Member of the Global Ocean Observing System (GOOS) Biology and Ecosystem Panel responsible for developing Essential Ocean Variables.
- United Nations 'national expert' for World Ocean Assessment and Global Reporting and Assessment of the State of the Marine Environment - First Assessment Report.
- IPCC 5th Assessment Report contributing author on marine biogeography and Harmful Algal Blooms.

Relevant publications

- Vezzulli, L., Grande, C., Reid, P. C., Hélaouët, P., **Edwards, M.**, Höfle, M. G., Brettar, I., et al. (2016). Climate influence on Vibrio and associated human diseases during the past half-century in the coastal North Atlantic. Proceedings of the National Academy of Sciences, 201609157. DOI: 10.1073/pnas.1609157113
- Thackeray, S. J., Henrys, P. A., Hemming, D., Bell, J. R., Botham, M. S., Burthe, S., Helaouet, P., Johns, D. G., Jones, I. D., Leech, D. I., Mackay, E. B., Massimino, D., Atkinson, S., Bacon, P. J., Brereton, T. M., Carvalho, L., Clutton-Brock, T. H., Duck, C., **Edwards, M.**, Elliott, J. M., Hall, S. J. G., Harrington, R., Pearce-Higgins, J W., Høye, T. T., Kruuk, L. E. B., Pemberton, J. M., Sparks, T. H., Thompson, P. M., White, I., Winfield, I. J. & Wanless, S. (2016) Phenological sensitivity to climate across taxa and trophic levels. Nature 535:241–245

- Beaugrand, G., **Edwards, M**., Raybaud, V., Goberville, E & Kirby, R.R. (2015). Future vulnerability of marine biodiversity compared with contemporary and past changes. Nature Climate Change 5: 695
- **Stern R.F.**, K., A., Bresnan, E., Kooistra, W.H.C.F. Et Al. (2018) Molecular analyses of protists in long-term observation programs- current status and future perspectives. J. Plankton Res., (in review).
- Ostle, C. Johnson, M., Landschutzer P, Schuster, U., Hartman S., and Robinson C. Net community production in the North Atlantic Ocean derived from Volunteer Observing Ship data. Global Biogeochem. Cycles (2015).

4.1.6 Partner 6, Flanders Marine Institute, Belgium (VLIZ)

The Flanders Marine Institute (VLIZ) acts as the coordination and information platform for marine and coastal-related scientific research in Flanders and serves as an international contact point. The VLIZ is a government funded, but autonomous institute with the legal status of a non-profit organization and employs 75 FTE's. VLIZ set up a strong collaborative network through 21 cooperation agreements with Flemish research groups and administrations and integrates its activities in 7 national and 25 international networks. VLIZ has an important international impact by hosting the project office for UNESCO/IOC programme on International Oceanographic Data and Information Exchange (IODE), the Marine Board of the European Science Foundation and the Secretariat of the European Marine Observation and Data Network (EMODnet).

The Data Centre Division of VLIZ represents a core activity and is a world leader in managing marine biodiversity data. It is the National OceanographicContribution to the project Data Centre (NODC) for Flanders, is a World Data Centre and hosts the World Register of Marine Species (WoRMS), the European Ocean Biogeographic Information System (EurOBIS) and the sea level station monitoring facility of the Global Sea Level Observing System (GLOSS). VLIZ also coordinates the Biological European Marine Observation and Data Network (EMODnet) and is responsible for the development of the EMODnet Central Data Portal.

Contribution to the project

VLIZ will coordinate work package WP 2 on Data management, access and interoperability and will lead Task 2.2 Making it FAIR: making project output data findable, accessible, interoperable and reusable. VLIZ will also be involved as partner in WP3 in Task 3.1 Data collection and mapping physical, chemical and biological variables of the pelagic ecosystem, and in task 3.3 on New biogeography of pelagic biomes, in task 3.4 on Fish species distribution and abundance of key species.

Profiles of the principal investigators

Mrs. Leen Vandepitte (female) is a senior scientist and project manager at the datacentre of the Flanders Marine Institute (VLIZ) and has an MSC in Marine Biology. She coordinates the World Register of Marine Species (WoRMS) and the European node of the Ocean Biogeographic Information System (EurOBIS).

Dr. Jan Reubens (male) is senior scientist at the datacentre of the Flanders Marine Institute, he is a postdoctoral research fellow responsible for the acoustic receiver network (http://lifewatch.be/en/fish-acoustic-receiver-network), which allows flexible and cost-efficient spatio-temporal tracking of migratory fish species.

Mr. Klaas Deneudt (male), project manager in the VLIZ data centre, has a MSc in Marine Biology and coordinates the regional component of the Lifewatch ESFRI infrastructure.

Mr Bart Vanhoorne (male), IT specialist and has several years of experience in GIS systems, taxonomic databases and data-warehouses. He is the technical manager of the taxonomical, geographical and biological databases at VLIZ.

Dr. Lennert Tyberghein (male), head of the VLIZ Data Centre, holds MScs in Geography and Marine and Lacustrine Sciences and a PhD in Biology.

Relevant previous projects

- DGMARE (EASME/EMFF/2016/1.3.1.2- Lot 5/SI2.750022 – Biology): Operation, development and maintenance of a European Marine Observation and Data Network – Biology Lot
- H2020 AtlantOS (GA 633211): Optimizing and Enhancing the Integrated Atlantic Ocean Observing System
- H2020 Seadatacloud (GA 730960): SeaDataCloud - Further developing the pan-European infrastructure for marine and ocean data management
- ERIC Lifewatch: e-Science European Infrastructure for Biodiversity and Ecosystem Research,

Relevant publications and products

- Vandepitte, L.; **Vanhoorne, B**.; Decock, W.; Vranken, S.; Lanssens, T.; Dekeyzer, S.; Verfaille, K.; Horton, T.; Kroh, A.; **Hernandez, F.**; Mees, J. (2018). A decade of the World Register of Marine Species – General insights and experiences from the Data Management Team: Where are we, what have we learned and how can we continue? PLoS One 13(4): e0194599. https://doi.org/10.1371/journal.pone.0194599,
- Vandepitte, L.; Bosch, S.; Tyberghein, L.; Waumans, F.; **Vanhoorne, B**.; **Hernandez, F**.; De Clerck, O.; Mees, J. (2015). Fishing for data and sorting the catch: assessing the data quality, completeness and fitness for use of data in marine biogeographic databases. Database 2015: 14 pp
- **Claus, S**.; De Hauwere, N.; **Vanhoorne, B**.; Deckers, P.; Souza Dias, F.; **Hernandez, F**.; Mees, J. (2014). Marine Regions: towards a global standard for georeferenced marine names and boundaries. Mar. Geod. 37(2): 99-125
- **Reubens, J**.; Verhelst, P.; van der Knaap, I; **Deneudt, K**.; Moens, T.; **Hernandez, F**. (2018). Environmental factors influence the detection probability in acoustic telemetry in a marine environment: results from a new setup. Hydrobiologia Online: 1–14.

Research facilities, infrastructures and equipment

One of the core tasks of VLIZ is the development of infrastructures and the promotion of the data flow within and from Flanders to European and international networks. For this purpose, VLIZ has developed several important technologies. Over the course of the years, VLIZ has implemented several systems in numerous projects and activities such as the Marine Data Archive: a secure, online system where researchers can archive their data files in a well-documented manner. The MDA is used as an archive for research groups, to disclose public data files and to manage data files within contexts such as projects; the Aphia taxonomic register contains a list of all known marine species in the world and provides an overview of the accepted taxonomic names. This register is used worldwide as a standard list. It currently serves as a platform for the Belgian, European, arctic and world list of marine species, among others; EurOBIS is an online marine biogeographic data system that centralises biogeographic data on marine species. The EurOBIS system is used in various European projects. The system discloses marine biogeographic data from different European institutes. All data are subject to standard quality control so as to ensure a minimum quality level for the use of the data; LifeWatch VRE is a distributed virtual laboratory and is used for biodiversity research as well as climatological and environmental impact studies. The European research infrastructure integrates several biodiversity observatories, databases, web services and modelling tools.

4.1.7 Partner 7, Plymouth Marine Laboratory, UK (PML)

Plymouth Marine Laboratory (PML) is an International Centre of Excellence in Marine Science & Technology and a Collaborative Centre of the Natural Environment Research Council (NERC) of the UK. The research at PML contributes to the issues of global change, sustainability and pollution, delivering solutions for national and international marine and coastal programmes. PML is an independent, impartial provider of scientific research in the marine environment with a focus on understanding biodiversity and ecosystem function, biogeochemical cycling, pollution and health, and forecasting the role of the oceans in the Earth System. PML has an outstanding international reputation for its capabilities in monitoring and modelling marine ecosystems, across scales from estuarine and coastal environments to shelf seas and the open ocean, and across processes from physics to biogeochemistry and higher trophic levels. The 16-member PML modelling team is at the core of developing and maintaining ERSEM: a community biogeochemical model recognized by NERC as contributing to UK National Capability. PML has a longstanding expertise in downscaling modelled impacts of climate change to regional and

local scales across the marine ecosystem, from biogeochemistry and productivity to fish and fisheries. The PML remote sensing group has a long history of delivering earth observation capability to national, European Commission and European Space Agency projects. This ranges from research and development to reprocessing/reanalysis, and from near real-time data provision to large-scale data distribution and visualisation. PML is recognised by NERC as the major oceanographic remote sensing data processing and analysis centre through their funding of the NERC Earth Observation Data Acquisition and Analysis Service (NEODAAS). PML is a partner in the National Centre for Earth Observation (NCEO), where it contributes remote sensing and ecosystem modelling expertise.

Contribution to the project

PML will lead WP 6 on Dynamics of ecosystem state and resources, and will be responsible for specific deliverables in pelagic mapping: ecosystem, resources and pressures (WP3) with focus on pelagic state reconstruction through remote sensing, risk assessment and uncertainties (WP7), building capacity for the IEA (WP8) and societal engagement & communication (WP9).

Profiles of the principal investigators

Dr. Jorn Bruggeman (male) is senior scientist and will be leading WP6. He has 15 years experience in development and application of marine ecosystem models. His research focuses on size-based models of marine biodiversity and on the design and implementation of integrated 3D modeling platforms for hydrodynamics, biogeochemistry, fish and fisheries. He is a key member of the ERSEM development team, having recently led its complete restructuring and modularization. He has authored 27 peer-reviewed papers with 1291 citations. He is currently leading the ERSEM work package of the UK Marine Ecosystems Research Programme and the development of the Marine, Coastal and Fisheries Sectoral Information System for the Copernicus Climate Change Service. Dr Lee de Mora (male) is a scientist working on global coupled hydrodynamic-biogeochemical models; he was the first to implement and run a global ERSEM model for Earth System applications. Dr James Clark (male) is a scientist with extensive experience in particle tracking; he the author of the PyLag application that will be used to assess connectivity between Atlantic regions.

Dr. Karen Tait (female) will contribute to the eDNA component of WP8. She is a senior microbiologist with 17 years experience in molecular ecology. KT has interests in the complex interactions within benthic communities, with particular expertise in molecular biology techniques such as quantitative PCR and next generation sequencing. KT has published 39 peer-reviewed papers, 13 as first author. Her current research focuses on nutrient cycling: in particular the functions microbes provide in terms of carbon, nitrogen and sulfur cycling within coastal and shelf sea ecosystems. She also has interests in optimization and calibration of eDNA tools for biodiversity assessment. Within the past 5 years KT has been Co-PI on five NERC projects and one BBSRC project.

Shubha Sathyendranath (https://pml.ac.uk/People/Science_Staff/Dr_Shubha_Sathyendranath) (female) will contribute remote sensing expertise to pelagic state reconstruction in WP3. He is a senior scientist focused on the use of satellite data for understanding marine biogeochemistry, from regional to global, and from coast to open ocean. He has spent nearly six months at sea collecting biogeochemical and optical data for validating satellite ocean observations and for developing and testing satellite algorithms for the detection of chlorophyll concentration, phytoplankton functional groups and sea surface temperature. He is co-chair of the international Satellite Phytoplankton Functional Type Intercomparison Project.

Relevant previous projects

- H2020 CERES: Climate change and European aquatic RESources
- H2020 TAPAS: Tools for Assessment and Planning of Aquaculture Sustainability
- FP7 EURO-BASIN: Integrated Project on Basin-Scale Analysis, Synthesis and INtegration
- FAO: Climate change projections of fish biomass by national EEZs 1850-2099
- NERC: MARINeDNA - Calibrating eDNA tools for biodiversity monitoring in the ocean

Relevant Publications and products

- **Bruggeman, J**. & Bolding, K. 2014. A general framework for aquatic biogeochemical models. Env. Mod. & Software, 61: 249–265. https://doi.org/10.1016/j.envsoft.2014.04.002
- Cheung, W.W.L., **Bruggeman, J.**, Butenschön, M. Projected changes in global and national potential marine fisheries catch under climate change scenarios in the twenty-first century. In: The State of World Fisheries and Aquaculture 2018, FAO, Rome. http://www.fao.org/documents/card/en/c/I9540EN
- Kwiatkowski, L., Yool, A., Allen, J. I., Anderson, T. R., Barciela, R., Buitenhuis, E. T., Butenschön, M., Enright, C., Halloran, P. R., Le Quéré, C., de Mora, L., et al. 2014. iMarNet: an ocean biogeochemistry model intercomparison project within a common physical ocean modelling framework, Biogeosciences, 11, 7291-7304, https://doi.org/10.5194/bg-11-7291-2014
- Currie, A.R., **Tait, K.**, et al. 2017. Marine Microbial Gene Abundance and Community Composition in Response to Ocean Acidification and Elevated Temperature in Two Contrasting Coastal Marine Sediments. Frontiers in Microbiology, 8. https://doi.org/10.3389/fmicb.2017.01599
- **Brewin, R.J.W** et al. 2017. Uncertainty in Ocean-Color Estimates of Chlorophyll for Phytoplankton Groups. Frontiers in Mar. Sci., 4. https://doi.org/10.3389/fmars.2017.00104

Research facilities, infrastructures and equipment
PML has access to a large array of computing resources that will be used to perform 3D model simulations for the Atlantic in past, present and future. Facilities include a high performance computer (HPC) with 720 compute cores and a total of 4.8 TB RAM. This HPC is comprised of 36 nodes (dual ten-core Intel Xeon processors and 128 GB RAM per node) which are connected using FDR InfiniBand (56 gbps bandwidth). PML's total disk storage is in the region of 4PB spread across the organisation, of which 600TB is specifically allocated for modelling- related activities

4.1.8 Partner 8, University of Porto - Faculty of Science, Portugal (UPO)

University of Porto is Portugal's second largest university and one of the most prestigious teaching and research institutions in the country. UPO — is a leading research and advanced training institution of the University of Porto, working on the frontier of knowledge and innovation. The centre develops transdisciplinary and transnational research, promotes technological development, and supports public policies and governance in Marine and Environmental Sciences. UPO fields of expertise cover three research domains: GLOBAL CHANGES AND ECOSYSTEM SERVICES, AQUACULTURE AND SEAFOOD QUALITY, and MARINE BIOTECHNOLOGY, addressing important economic and societal challenges. Hosting 10 research groups (with 165 PhD researchers) that cover a wide range of scientific expertise and share a common vision: "Contribute to the Knowledge of the Ocean and coastal areas as a basis for the sustainable management and exploitation of resources", The centre has been actively involved in the integration and development of Marine and Environmental Sciences participating in relevant European and global knowledge and innovation networks (e.g. MARBEF, EUROMARINE, EPBRS, EATIP); it is a member of the European Marine Board. At the national level, UPO is an active member of two relevant actors in the Marine Economy sector: the National Maritime Cluster – Forum Mar, awarded the Bronze Label of the European Cluster Excellence Initiative; and the BLUEBIOALIANCE, a network of research centres, industry and other stakeholders with significant interests in the valorisation of marine bioresources.

Contribution to the project
UPO will lead WP9 Societal Engagement & Communication, and responsible for the project communication and interaction with the FORUM. UPO will participate in case studies for Atlantic Ocean integrated ecosystem assessment (WP1), and in building capacity for the IEA (WP8).

Profiles of the principal investigators
Isabel Sousa Pinto (female). PhD in Marine Biology UCSB, USA, Associate Professor, University of Porto and Director of Coastal Biodiversity Laboratory at (UPO). Research on algal cultivation and use and on ecology and marine biodiversity, and co-chair of MBON - Marine Biodiversity Observation Network from GEO BON. Working with H2020 AtlantOS and on EOOS – European Ocean Observation System to develop the biodiversity component of the Ocean observations and with the European Marine Board to identify gaps in biological observations and produce recommendations to fill them. Member of the POGO working group "Planning the

implementation of a global long-term observing and data sharing strategy for macroalgal communities". Member of the steering committee of Euromarine Consortium. She led or participated in more than 50 research projects (50% European or international). Has published more than 160 papers and book chapters on biodiversity, marine ecology and cultivation and use of seaweeds and on the science policy interface on Biodiversity and Ecosystem Services . Has extensive experience in science-policy-society interfaces: on the Steering Committee of EPBRS (European Platform for Biodiversity Research Strategy 2002-2012), and FWP7 project KNEU - Developing a Knowledge Network for EUropean expertise on biodiversity and ecosystem services to inform policy making and economic sectors, that aimed at building and testing a scientific panel at European scale, and currently H2020 EKLYPSE-- Establishing a European Knowledge and Learning Mechanism to Improve the Policy- Science-Society Interface on Biodiversity and Ecosystem Services.(2016-2020) that aims at building such a platform to support policy and decision making. She was also coordinating Lead Author for the Regional Assessemnt of Biodiversity and Ecosystem Services in Europe and Central Asia - UN IPBES – Intergovernamental Panel on Biodiversity and Ecosystem Services (2015-2018), expert for scoping of its Regional and Global Assessments Portuguese Representative in this platform (2013-2018) and currently member of its MEP – Multidisciplinary Expert Panel.

Zoi Konstantinou (Female). Post-doc whose expertise lies in the development of participatory, social-ecological processes and tools, to support coastal and marine management. She has worked in issues related to transdisciplinary management and science-policy-society interface since 2008, as a researcher, lecturer, science communicator and facilitator. She was the principal researcher for the System Approach Framework (Coastal SAF) implementation in the Greek study site of the FP6 project SPICOSA, while after that she joined EurOcean, the European Centre for Information on Marine Science and Technology, through which she supported the communication of EU projects as RISC-KIT, NetBiome, etc. Since 2014, she co-teaches the course "CMM: Practical applications and challenges" of the Master program Coastal and Marine Management (CMM), of the University Centre of Westfjords, Iceland. At the moment, she is the networking and capacity-building focal point for the H2020 project EKLIPSE. Her current post-doctoral research concerns the development of processes and models to support coastal and marine management, under frameworks of inadequate or over-complex governance.

Relevant previous projects

- H2020 Seachange: Ocean Literacy for Europe (2015-2018)
- H2020 AtlantOS: Optimizing and Enhancing the Integrated Atlantic Ocean Observing System (2015-2019)
- H2020 EKLYPSE - Establishing a European Knowledge and Learning Mechanism to Improve the Policy-Science- Society Interface on Biodiversity and Ecosystem Services. (2016-2019)
- FWP 7 KNEU - Developing a Knowledge Network for EUropean expertise on biodiversity and ecosystem services to inform policy making and economic sectors (2010-2014)
- FWP 7 Euromarine - Integration of European Marine Research Networks of Excellence (2010-2012).

Relevant publications and products

- IPBES (2018): Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Europe and Central Asia of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. M. Fischer, M. Rounsevell, A. Torre-Marin Rando, A. Mader, A. Church, M. Elbakidze, V. Elias, T. Hahn. P.A. Harrison, J. Hauck, B. Martín-López, I. Ring, C. Sandström, **I. Sousa Pinto,** P. Visconti and N.E Zimmermann (eds.). IPBES secretariat, Bonn, Germany. 45p.
- Watt, A.D., Ainsworth, G., … **Konstantinou, Z., Sousa Pinto, I.**, ...Young, J.C. et al 2018. Building a mechanism for evidence-informed European policy on biodiversity and ecosystem services through engagement of knowledge holders. Evidence and Policy.
- Muller-Karger, F., Miloslavich, P., Bax, N., … **Sousa Pinto, I** et al (2018). Advancing Marine Biological Observations using the Essential Ocean Variables (EOVs) and Essential Biodiversity Variables (EBVs) Frameworks. Frontiers in Marine Science.
- Navarro, L. …. **Sousa Pinto, I**., et al 2018. Monitoring biodiversity change through effective global coordination. Current Opinion in Environmental Sustainability 29: 158-169

- **Konstantinou Z.** and Latinopoulos D. 2018. "Investigating stakeholders' priorities for transdisciplinary coastal and marine management: the case of Thermaikos gulf". 14th International Conference for the Protection and Restoration of the Environment (PRE), Thessaloniki, Greece, 3-6 July 2018, pp. 360-369

Research facilities, infrastructures and equipment

With its headquarters at the heart of the maritime industry and services in the Northern region of Portugal (Leixões Harbour), the centre features well equipped facilities for research, training and services, with state-of-the-art equipped laboratories and large cultivation and animal experimental facilities approved by the Portuguese Veterinary Authority. With branches in Lisbon and the Madeira and Azores Archipelagos, the centre is in a unique position to promote research and innovation in the Atlantic Area. UPO further integrates two research infrastructures of national and European relevance: the European Marine Biological Resource Centre – Portugal (EMBRC.PT) and the European Multidisciplinary Seafloor Observatory (EMSO).

4.1.9 Partner 9, Collecte Localisation Satellite, Unit for Sustainable Fisheries Management, France (CLS)

CLS, a subsidiary of CNES (French Space Agency) and IFREMER (French Research Institute for Exploration of the Sea), develops since 1986 satellite services in location and environmental data collection, space oceanography and radar detection. With a staff of more than 600, in France and abroad, CLS offers to a broad range of professionals including: government, industry and the scientific community, services in three major domains: environmental monitoring, maritime security, and management of marine resources. CLS has a solid experience in satellite data processing sea surface temperature, ocean colour and radar imagery as well as in in-situ data processing (ARGO float, drifters, and tide gauges). CLS operates the ARGOS data collection and location system offering a wide range of services for safety, environmental and human activity monitoring and ecological studies (animal tracking). CLS is both involved in research and development activities and in operational oceanography and services for end-users (off-shore industry, ship-routing, fisheries management). It is one among the partners of the COPERNICUS Marine Environment Monitoring Services (CMEMS), being responsible of the sea level TAC (Thematic Assembly center) thanks to 20 years of experiences in processing, validation and disseminating satellite altimetry data.

Since 2006, CLS Unit for Sustainable Fisheries Management has developed a Marine Ecosystems Modeling activity to contribute to a better understanding of how marine ecosystems function, under the influence of both human activities and climate-environmental variability. It also provides useful tools for ecosystem-based management and sustainable exploitation of marine resources, especially the so-called SEAPODYM (Spatial Ecosystem And Population Dynamics Model) software (www.seapodym.eu). This model is coupled (off-line) to physical-biogeochemical model to simulate low and mid-trophic functional groups, and then detailed spatially-explicit population dynamics of fish under the influence of their oceanic environment and the various fisheries exploiting the modelled target species. Once the model parameters have been optimized using available data (e.g., acoustic data, fishing data, tagging data, etc…) it can be used to run projections under climate change scenarios.

Contribution to the project

CLS will coordinate WP6 Dynamics of ecosystem state and resources, and is in charge of modelling mesopelagic functional groups and key pelagic species as Atlantic albacore tuna and mackerel (Task 6.1 and 6.2). The model will provide boundary conditions for regional models in task 6.3. CLS will also contribute to pelagic mapping: ecosystem, resources and pressures (WP3), and societal engagement & communication (WP9).

Profiles of the principal investigators

Dr Inna Senina (female) completed a PhD degree in Mathematical Sciences at the Rostov State University (Russia). Her thesis topic was mathematical modelling, extinction risk assessment and prognosis of harvested fish population dynamics. In April 2004, she became Assistant Researcher for the Pelagic Fisheries Research Programme at the University of Hawaii (USA). She joined CLS in 2007 and contributed to the evolution of SEAPODYM model, including the implementation of a quantitative method to estimate the model parameters from various sources of data.

Dr Olivier Titaud (male) has a background in mathematics, numerical computing and data assimilation. He joined the ecosystem team in CLS in 2012 to assist in the development of the SEAPODYM model, the revision of the code for operational production and increased efficiency and modularity.

Relevant publications and products

- **Lehodey P., Senina I.,** Nicol S., Hampton J. (2015). Modelling the impact of climate change on South Pacific albacore tuna. Deep Sea Research. 113: 246–259.
- **Lehodey, P**., Conchon, A., **Senina, I**., Domokos, R., Calmettes, B., Jouanno, J., Hernandez, O., and Kloser, R. (2015). Optimization of a micronekton model with acoustic data. – ICES Journal of Marine Science, 72(5): 1399-1412
- **Lehodey P., Senina I.,** Murtugudde R. (2008). A Spatial Ecosystem And Populations Dynamics Model (SEAPODYM) - Modelling of tuna and tuna-like populations. Progress in Oceanography, 78: 304-318.
- **Senina I.**, Sibert J., **Lehodey P.** (2008). Parameter estimation for basin-scale ecosystem-linked population models of large pelagic predators: application to skipjack tuna. Progress in Oceanography, 78: 319-335.
- www.mesopp.eu: Website of the Mesopelagic Southern Ocean Prey and Predators project (EU H2020; PI.: P. Lehodey) giving access to standardised acoustic data and model micronekton outputs http://www.mesopp.eu/data/catalogue/

4.1.10 Partner 10, Stockholm resilience Centre, Stockholm University, Sweden (SU)

Stockholm University (SU) is one of Europe's leading centres for research and higher education and is ranked among the world's to 100 universities. The Stockholm Resilience Centre (SRC) at SU is a transdisciplinary centre that advances the understanding of complex social-ecological systems and studies phenomena, such as ecosystem resilience, ecosystem service production, food security and adaptive governance. SRC has its focus on making a difference for sustainable development by building a world-leading research centre that would take the interdisciplinary research on linked ecological and social systems significant steps forward and provide insights and means for the development of sustainable management and governance practices in order to secure ecosystem services. Consequently, the centre applies and further develops the scientific achievements of this research within practice, policy and academic training. SRC is a joint initiative between SU and the Beijer Institute of Ecological Economics at The Royal Swedish Academy Sciences. SRC has been involved in many marine-related EU projects (ELME, KNOWSEAS) and BONUS (ECOSUPPORT, RECOCA, HYPER, INSPIRE, BLUEWEBS) projects and was co-leading NorMER (Nordic Centre for Research on Marine Ecosystems and Resources under Climate Change), a Nordic Centre of Excellence, together with University of Oslo.

Contribution to the project

SU will be a work package leader of WP 7, and contribute significantly for specific deliverables in other work packages with focus on ecosystem state and resilience (WP5), and Integrated Ecosystem Assessment work package (WP 1).

Profiles of the principal investigators

Dr. Susa Niiranen (female) – Principal Investigator. Dr. Niiranen holds a PhD in marine ecology from the Stockholm University, Sweden. Currently, she works as a researcher and Marine research theme co-lead at the SRC. Her research has a focus on how multiple environmental and anthropogenic drivers, including clmate an fishing, affect marine ecosystem function and vulnerability. In particular, she studies food web interactions using different modelling approaches as her research tool. She has participated in several international research projects (ECOSUPPORT, GreenMar, INSPIRE, BLUEWEBS) and is a member of the Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP). She is also a Working Group leader on socioeconomics and governance in EFICA-project working under EU Framework Contract for the provision of Scientific Support to the High Seas Fisheries in the Central Arctic Ocean (CAO). She has an h-index of 15 (google scholar) and has published 21 peer-reviewed articles.

Dr. Thorsten Blenckner (male) Dr Blenckner is an aquatic ecologists and works on system dynamics. In particular, he has been mainly working on the effects of climate and other multiple stressors on food-web dynamics, tipping point dynamics and its resilience and integrated assessments tools (like the Ocean health index).

He had a strong involvement in ICES as he was the co-chair for the working group on integrated assessments of the Baltic Sea (WGIAB). He has been PI of six in international projects (ECOSUPPORT, KNOWSEAS, NORMER, GreenMar, INSPIRE, BLUEWEBS). At SRC he is leading the marine theme. He has an h-index of 36 (google scholar) and has published 62 peer-reviewed articles and 15 book chapters.

Relevant previous projects

- EU BONUS: ECOSUPPORT - Advanced tool for scenarios of the Baltic Sea ECOsystem to SUPPORT decision making, 2009-2011, coordinator Markus Meier, Thorsten Blenckner is PI for Stockholm University,
- EU FP 7: KNOWSEAS – Knowledge-based Sustainable Management for Europe`s Seas, 2009-2012, coordinator Laurence Mee, SAMS Scottland, Thorsten Blenckner is PI for Stockholm University,
- NORDFORSK: NorMer- Nordic Centre for Research on Marine Ecosystems and Resources under Climate, Change, 2011-2015, coordinated by Nils Christian Stenseth, Thorsten Blenckner is PI for Stockholm University and member of the management group, Top Research Initiative.
- NORDFORSK: GreenMar- Green Growth based on Marine Resources: Ecological and Socio-Economic Constraints", coordinated by Nils Christian Stenseth, Thorsten Blenckner is PI for Stockholm University,
- EU BONUS: INSPIRE- INtegrating SPatIal pRocesses into Ecosystem models for sustainable utilization of fish resources, coordinated by Henn Ojaver, Thorsten Blenckner is PI for Stockholm University, 2015-2018

Relevant publications and products

- **Blenckner T**, Llope M, Möllmann C, Voss R, Quaas MF, Casini M, Lindegren M, Folke C, Chr. Stenseth N. 2015 Climate and fishing steer ecosystem regeneration to uncertain economic futures. Proc. R. Soc. B 282: 20142809. http://dx.doi.org/10.1098/rspb.2014.2809
- **Blenckner T**, Österblom H, Larsson P, Andersson A, Elmgren R. 2015. Baltic Sea ecosystem-based management under climate change: Synthesis and future challenges. AMBIO 06/2015; 44 Suppl 3:507-15. DOI:10.1007/s13280-015-0661-9
- **Niiranen, S**, Richter A, **Blenckner T**, Stige LC, Valman M, Eikeset AM (2018) Global connectivity and cross-scale interactions create uncertainty for Blue Growth of Arctic fisheries. Marine Policy 87 321-330.
- Uusitalo L, Korpinen S, Andersen J H, **Niiranen S**, Valanko S, Heiskanen A-S, Dickey-Collas M. 2016. Exploring methdos for predicting multiple pressures on ecosystem recovery: a case study on marine eutrophication and fisheries. Continental Shelf Research, 121:48-60.
- Yletyinen J, Bodin Ö, Weigel B, Nordström MC, Bonsdorff E**, Blenckner T**. 2016. Regime shifts in marine communities: a complex systems perspective on food web dynamics. Proceedings of the Royal Society of London 283, 20152569: Doi:10.1098/rspb.2015.2569

4.1.11 Partner 11, University of Strathclyde, UK (STRATH)

The University of Strathclyde is a Scottish public research university located in Glasgow, United Kingdom. It is a leading international technological university and has a strong reputation not only in teaching and research but also for its strong links with industry and business. The institution was awarded University of the Year 2012 and Entrepreneurial University of the year 2013. The Department of Mathematics and Statistics has 40 academic staff, 15 postdoctoral researchers, and around 50 postgraduates registered for research degrees. Research is focused on applied mathematics with an emphasis on nonlinear systems and solution of problems with industrial relevance. The Department is host to the MASTS marine population modelling group whose staff have extensive experience of working in mathematical and statistical marine ecology, fisheries, and the provision of scientific advice to government on fishery management. The group has worked extensively on ecosystem models of relevance to fisheries and development of fish stock assessment models using discard data. Tasks addressed: Strathclyde University will contribute to Mission Atlantic by extending and applying the StrathE2E end to end food web/ecosystem models to each case study region and generating outputs for each of the climate and human activity scenarios. StrathE2E is a model of simplified biogeochemistry and trophic interactions extending from macrobes to megafauna, coupled to a fishing fleet model. The model was developed at Strathclyde and has been applied to a number of fisheries related issues in different case study regions of the NE Atlantic and sub-Arctic.

Contribution to the project

Strathclyde will contribute to WP6 (Modelling dynamics of the Atlantic Ocean Ecology), WP7 (Ecosystem risks and vulnerabilities) and WP9 (Societal engagement and communication) of Mission Atlantic. In WP6, Strathclyde will work with the team responsible for high resolution spatial modelling of hydrodynamics, biogeochemistry (NEMO-ERSEM) and migratory fish (SEAPODYM), to genrate and bias-correct the driving data required to configure and run the StrathE2E food web model in each of the regional case studies. In WP7, Strathclyde will participate in the stakeholder engagements to produce the narratives describing contrasting worldviews of human activity in each case study, and then use these to provide outputs from the StrathE2E model for each scenario. Strathclyde will lead task 7.3 (Quantitative scenario analyses in model-based management strategy evaluations). In WP9, Strathclyde will develop a web-version of the Mission Atlantic StrathE2E model which will enable anybody, anywhere in the world, to configure and run the model for each of the case-study regions with own configurable scenarios of human activities and climate - early prototype available at http://outreach.mathstat.strath.ac.uk/outreach/e2e/model/index.php

Profiles of the principal investigators

Prof. Michael Heath (male), has 35 years working experience in marine research, originally at Marine Scotland fisheries laboratory in Aberdeen, UK, and since 2010 at the University of Strathclyde, with 190 peer reviewed papers and reports and a track record of participation in EU framework projects (EU-RECLAIM, EURO-BASIN, DISCARDLESS) and UK-NERC Programmes - Sustainable Marine Bioresources, Marine Productivity, Ocean Acidification Programme, Marine Ecosystems Research Programme (MERP), and the UK Changing Arctic Oceans Programme where he leads the MiMeMo project (Microibes to Megafauna Modelling in teh Arctic). His primary scientific contribution in the last 5 years has been the development and implementation of the StrathE2E end-to-end marine food web model for which there are now version for the North Sea, West of Scotland, Irish Sea, Celtic Sea, English Channel and Barents Sea. Strathe2E has been the basis for a series of publications and has been used to scope the ecosystem effects of various aspects of fisheries, with outputs being presented at a public hearing of the European Parliament Fisheries Committee. It has been used to support advice to the EU by ICES on the ecosystem effects of spatial management measures for trawl fisheries in the North Sea, and is one of the main models being used in the NERC-MERP.

Dr. Douglas Speirs (male) is Senior Lecturer in the Department of Mathematics and Statistics. Since 2007 he has been PI/Co-I on grants > £1.3 million, including NERC programmes on Sustainable Marine Bioresources, Ocean Acidification, and Marine Ecosystems Research. His research involves developing computationally efficient population models of fish stocks in which physiological structure and spatial structure are combined: he has a strong publication record in this area (average 26.3 citations per article, top-cited paper >100 citations, H-index 15). His spatial modelling of zooplankton, as part of the NERC MarProd programme, established a new method for modelling the growth and transport by ocean currents of stage-structured populations. He led the development of a new size-structured multispecies model for fish communities, FishSUMS, which has been used to explore a range of multi-species fisheries management scenarios.

Relevant previous projects

- H2020 DISCARDLESS (GA 633680): Strategies for the gradual elimination of discards in European fisheries
- FP7 EURO-BASIN (GA 264933): Integrated Project on Basin-Scale Analysis, Synthesis and INtegration
- FP6 RECLAIM (GA 44133): Resolving Climatic impacts on fish stocks

Relevant publications and products

- **Heath, M.R.** 2012. Ecosystem limits to food web fluxes and fisheries yields in the North Sea simulated with an end-to-end food web model. Progress in Oceanography (Special issue: End-to-end modelling: Towards Comparative Analysis of Marine Ecosystem Organisation) 102, 42-66.
- **Heath, M.R., Speirs, D.C**. and Steele, J.H. 2014. Understanding patterns and processes in models of trophic cascades. Ecology Letters 17, 101-114.

- **Heath, M.R**., Cook, R.M., Cameron, A.I., Morris, D.J. and **Speirs, D.C.** 2014. Cascading ecological effects of eliminating fishery discards. Nature Communications 5:3893 | DOI: 10.1038/ncomms4893.
- **Heath, M.R** and Cook, R.M. 2015. Hindcasting the quantity and composition of discards by demersal fisheries in the North Sea. PLoS One | DOI:10.1371/journal.pone.0117078 March 16 2015.
- St. John, M.A., Borja, A., Chust, G., **Heath, M.**, Grigorov, I., Mariani, P., Martin, A,P., Santos, R.S. (2016). A dark hole in our understanding of marine ecosystems and their services: Perspectives from the mesopelagic community. Frontiers in Marine Science 3:31 doi: 10.3389/fmars.2016.00031

Research facilities, infrastructures and equipment
Strathclyde is regenerating its campus in the centre of Glasgow and has a state of the art new conference and event facilities which will be available to the project. The University also hosts the west of Scotland super- computer facility, and will capitalize on IT support for developing the web-version of StraathE2E.

4.1.12 Partner 12, The University Court of the University of St. Andrews, School of Biology, UK (USTAN)
The University of St Andrews is a world-class, research-intensive university. It has about 10,000 students and 1,000 academic staff, and an annual budget of about £225 million. The University of St Andrews is in the QS Global Top 100 universities, and in May 2018 was ranked by The Guardian newspaper as overall third in the UK (behind Oxford and Cambridge only) and first in the UK for Bioscience. In the most recent UK Research Excellence Framework assessment (2014), Biological Sciences at St Andrews was ranked second for 'Impact', an evaluation of the social, economic and cultural benefits and impacts beyond academia arising from excellent research. Interdisciplinary marine research at St Andrews from across several academic Schools is drawn together collaboratively by the Scottish Oceans Institute (SOI). The SOI, in turn, hosts the Marine Alliance for Science and Technology Scotland (MASTS), which is a consortium of organisations involved in marine science and represents the majority of Scotland's marine research capacity. MASTS was launched in 2009 and by 2017 had a constituency of some 700 researchers with the management of resources consisting of over £66 million annually.

Contribution to the project
USTA School of Biology, with our expertise in acoustic investigation of the mesopelagic zone and exploration of possible mesopelagic biomass, will co-lead WP3 (Mapping Pelagic Ecosystem and Resources of the Atlantic), taking particular responsibility for the watercolumn component. We will also contribute to WP2 (Data management, access and interoperability), hosting Workshop 2 (linking predator behavior with active acoustic observations).

Profiles of the principal investigators
Prof. Andrew Brierley (Male). Brierley is a Professor of Marine Biology in the School of Biology. He leads the Pelagic Ecology Research Group (PERG). His group's research focusses on ecology and behavior of fish and zooplankton in the open ocean, particularly as observable with scientific echosounders. Brierley has a special interest in the mesopelagic, and in sea-ice systems. He has published >115 papers, has an H-index of 41, and has supervised c. 20 PhDs. **Dr. Roland Proud (Male).** Proud is a Post-Doctoral Research Fellow in the School of Biology, and a senior member of PERG. He has a strong background in physics, programming and statistics, and is an expert in the analysis of active-acoustic data. He developed and published an innovative acoustic data-mining method, helped develop the first global mesopelagic biogeography based on acoustic data, and has recently published a global estimate of mesopelagic fish biomass.

Relevant previous projects
- Circum-Antarctic distribution of acoustic deep scattering layers (DSLs), and associated foraging behaviour of deep-diving predators (penguins and seals). Antarctic Circumpolar Expedition (ACE; administered by Swiss Polar Institute). PI Brierley; Co-Is. L. Boehme, N. Ratcliffe, R. Harcourt,C. Cotte et al.
- Linking acoustic observations with models of biomass in the Southern Ocean. CSIRO (Australia) PI Brierley; Co-Is R. Kloser and N.-O. Handegard.
- Mesopelagic Predators and Prey (MESOPP) H2020 Coordination & Support Action (CSA) PI P. Lehodey; Co-Is Brierley, R. Kloser, N.-O. Handegard, C. Cotte, A. Constable et al.

- Broadband echosounders for the UK research vessel community. NERC Equipment. PI Brierley
- Ecosystem of the Mid-Atlantic Ridge at the Sub Polar Front and Charlie Gibbs Fracture Zone (ECO-MAR). NERC Consortium. PI I. Priede; Co-Is D. Billett, Brierley, S. Groom, R. Hoezel, M. Inall, P. Miller, G. Shimmield et al.

Relevant publications and products

- **Proud, R**., Cox, M.J. and **Brierley, A.S.** (2018). Fine-scale depth structure of pelagic communities based on acoustic sound scattering layers. Marine Ecology-Progress Series. In press.
- **Proud, R.**, Cox, M.J., Handegard, N.-O and **Brierley, A.S.** (2018). From siphonophores to deep scattering layers: an estimation of global mesopelagic fish biomass. ICES Journal of Marine Science. In press
- **Proud, R**., Cox, M.A. and **Brierley, A.S.** (2017). Biogeography of the global ocean's mesopelagic zone. Current Biology, 27(1): 113-119.
- **Proud, R**., Cox, M.J., Wotherspoon, S. and **Brierley, A.S.** (2015). A method of defining sound scattering layers and extracting key characteristics. Methods in Ecology and Evolution, 6(10): 1190-1198.
- Boersch-Supan, P.H., Rogers, A.D. and **Brierley, A.S**. (2017). The distribution of pelagic sound scattering layers across the southwest Indian Ocean. Deep-Sea Research Part II, 136: 108-121.

Research facilities, infrastructures and equipment

We have a full suite of EK80 wideband transceivers (WBTs) which we can deploy ourselves on some of the planned cruises, or lend to partners to do so, if existing vessel transducers are compatible (many of the transducers installed for use with the previous generation single frequency EK60 are). We also maintain a very large database of acoustic records from the mesopelagic zone of the global ocean.

4.1.13 Partner 13, National Oceanography Center, Southampton (NOC)

Operating across the whole of the UK with a combined budget of more than £6 billion, UK Research and Innovation brings together the seven Research Councils, Innovate UK and a new organisation, Research England. As part of the Natural Environment Research Council, the National Oceanography Centre (NOC) is the United Kingdom's centre of excellence for oceanographic sciences. It has a remit to provide national capability and leadership for big ocean science. NOC employs around 650 staff. A truly multi-disciplined centre, NOC encompasses Marine Geoscience, Marine Physics and Ocean Climate, Marine Systems Modelling, Ocean Biogeochemistry and Ecosystems, and Ocean Technology and Engineering. NOC is home to the nation's marine data assets; the British Oceanographic Data Centre, the British Ocean Sediment Core Research Facility, the National Marine Equipment Pool, Europe's largest fleet of autonomous and robotic vehicles, and manages two state of the art research ships. In 2015 the Marine Robotics Innovation Centre was opened to provide a vital link between science and business, enabling technology and research to transfer to industry. NOC represent the UK internationally, leading the UK delegation of the Intergovernmental Oceanographic Commission of UNESCO, through membership of the European Marine Board, and through partnerships with other research institutions and organisations worldwide. NOC is a founder memebr of the NEMO modelling consortium which provides world leading global and regional ocean modelling capability for climate, operational and Research oceanography in European and world wide. NEMO models provide the ocean component to UK, French and Itatalian CMIP6 contributions.

Contribution to the project

NOC will be responsible for specific deliverables: providing the physical models underpinning the basin scale modelling (WP6) as well as working with PML to provide model output to facilitate the pan-Atlantic IEA (WP1); providing new observations and analysis at pan-Atlantic scale on plankton size-spectra (WP3).

Profiles of the principal investigators

Dr Daniel Mayor (male) and **Dr Kathryn Cook (female)** will contribute to WP3 by providing expertise on characterizing plankton biomass spectra. Dr. Mayor is a biogeochemist examining the distributions of marine organisms and how their physiology and ecology influence the fate of elements. He leads the Pelagic Ecosystems Group at NOC and is experienced with managing grants and delivering successful project outcomes within nationally- and EU-funded (e.g. RINGO) proposals. Dr Cook has a background in policy-relevant research on

zooplankton communities at national and European levels. She is experienced with a variety of techniques, including traditional microscopy, OPC, Zooscan and FlowCam Macro.

Prof Jason Holt (male) and **Dr James Harle (male)** will contribute to WP1 and WP6. Prof Holt leads the modelling group at NOC and the modelling components in its National Capability programmes. He represents NOC on the NEMO steering committee. He specialises in investigating the impacts of cimate change on the hydrodynamics and biogeochemistry of regional seas and ocean-margins. Dr Harle is a physical oceanographer and numerical modeller. He pioneered global approaches to regional modelling in the QUEST_FISH project. He is part of the NEMO Systems Team and is highly active in the translation of capability from regional to global models in the NEMO framework.

Dr. Adrian Martin (male) will contribute to WPs 1, 3 and 6. He researches physical-biogeochemical interactions. He led a workpackage on the North Atlantic biological carbon pump for the EU FP7 EuroBASIN project and was part of the NASA EXPORTS Science Definition Team.

Relevant previous projects

EU H2020 INFRADEV (2016). Readiness of ICOS for Necessities of integrated Global Observations (RINGO). 730944.
FP7 EURO-BASIN (GA 264933): Integrated Project on Basin-Scale Analysis, Synthesis and INtegration
NERC Directed Grant, Changing Arctic Ocean (2016): Mechanistic understanding of the role of diatoms in the success of the Arctic Calanus complex and implications for a warmer Arctic (DIAPOD). NE/P006280/1
NERC Resolving Climate Impacts on shelf and CoastaL sea Ecosystems (ReCICLE). NE/M003477/1
NERC Predicting the impacts and consequences of climate change on global fish production (2010) (QUEST_FISH) NE/F001525/1

Relevant publications and products

Sanders, R.,…Martin, A. et al. (2014) The Biological Carbon Pump in the North Atlantic. Progress in Oceanography, 129 (B). 200-218, 10.1016/j.pocean.2014.05.005
Mayor, Daniel J., Sommer, Ulf, Cook, Kathryn B., Viant, Mark R.. 2015 The metabolic response of marine copepods to environmental warming and ocean acidification in the absence of food. Scientific Reports, 5. 13690.10.1038/srep13690
Holt, J.,… Harle, J., et al. (2016) Potential impacts of climate change on the primary production of regional seas: A comparative analysis of five European seas. Progress in Oceanography, 140. 91-115.10.1016/j.pocean.2015.11.004
Barange, M., G. Merino, J. L. Blanchard, J. Scholtens, J. Harle, E. H. Allison, J. I. Allen, J. Holt, and S. Jennings (2014), Impacts of climate change on marine ecosystem production in societies dependent on fisheries, Nature Clim. Change, 4(3), 211-216, doi:10.1038/nclimate2119
Holt, J., J. I. Allen, T. R. Anderson, R. Brewin, M. Butenschon, J. Harle, G. Huse, P. Lehodey, C. Lindemann, L. Memery, B. Salihoglu, I. Senina, and A. Yool (2014), Challenges in integrative approaches to modelling the marine ecosystems of the North Atlantic: Physics to Fish and Coasts to Ocean, Progress in Oceanography, doi:10.1016/j.pocean.2014.04.024(129), 285-313.

Research Facilities, Infrastructures and Equipment

High Performance Computing facility for running computationally demanding ocean models.
Netting equipment and expertise for size-spectra characterization.

4.1.14 Partner 14, Ifremer, Research Infrastructures and Information Systems France (IFREMER)

Ifremer, France's national integrated marine science research institute, contributes to the national and European strategy for research and innovation by producing basic knowledge, applied research results in response to questions raised by society, and research and technology that contribute to the economic development of the marine sector. Through a systemic approach and in the context of global change, Ifremer participates in

observing and monitoring the marine environment at all levels and in studying ecosystems, the processes that govern them as well as the services that they provide. To this end, Ifremer designs and builds marine research and monitoring infrastructures, develops tools for observation and scientific investigation and manages databases.

Contribution to the project
Ifremer's ***Research Infrastructures and Information Systems*** will lead the task 2.1 ("scanning the seascape") in WP2 (data management) where, in collaboration with the case studies leaders, they will perform a survey of the available data resources required by the project and publish online a metadata catalog of these ressources. Ifremer will support VLIZ in leading the WP2 by becoming the deputy of this work package and will aslso contribute to the training in WP8 and communication activities in WP9.

Profiles of the principal investigators
Erwann Quimbert (male) has 10 years of experience in data management on issues relating to discovery services (metadata catalogue), viewing services and downloading services. He has been involved in Seadatanet, Emodnet and in the H2020 project ENVRIplus in which he coordinates a task about cataloguing activities. He manages the french Marine Spatial Data Infrastructure called Sextant. He will lead the task 2.1 in WP2 and will be deputy of the WP2.

Research facilities, infrastructures and equipment
Ifremer will make available to the Project its spatial data infrastructure for marine data, namely Sextant. It allows to create interoperable web services for discovery, viewing, and downloading that use standards defined by the Open Geospatial Consortium (OGC), are compliant with ISO 119115 and ISO19139 metadata standards, and fulfill the INSPIRE Directive requirements. Sextant is currently used by several European projects such as some EMODnet lots (Bathymetry, Chemistry, Physics) and checkpoints (Atlantic, Mediterranean and Black Sea), Seadatanet, or the H2020 Project AtlantOS. For the purpose of Mission Atlantic, Sextant will be used in WP2 (task 2.1) to build a catalogue of the available Atlantic data resources required for IEA and other WPs.

4.1.15 Partner 15, Oceanic Platform of the Canary Islands, Spain (PLOCAN)

The Oceanic Platform of the Canary Islands PLOCAN (PLOCAN AN) is a multipurpose service centre with land-based and novel sea-based infrastructures to support research, technology development and innovation in the marine and maritime sectors. Its mission is to promote long-term observation and sustainability of the ocean, providing a cost-effective combination of services, such as an ocean observatory, a marine test site, a base for underwater vehicles, training and an innovation hub. PLOCAN is a joint initiative of the Spanish and the Regional Canary Islands governments, with the contribution of the European Regional Development Fund, and is included in the Spanish Map of Unique Scientific and Technical Infrastructures (ICTS). PLOCAN is also an instrumental resource of the Regional Government and has the role to act as an intermediary infrastructure to link administration, academia and industry.

In addition, PLOCAN is configured as a Test Site where projects focused on testing and demonstrating of all kinds of marine sensors and devices are performed. The Test Site also covers the coastal component of the PLOCAN observatory, which is complemented by:

a. The European Station for Time series in the Ocean, Canary Islands (ESTOC): a multidisciplinary buoy/mooring located in open ocean in the Central Eastern Atlantic at 29º10'N, 15º30'W celebrating in 2019 25 years of nearly continuous surface and mid-water meteorological, physical and biogeochemical monitoring.

b. A mobile observing system comprising a fleet of deep and surface gliders and ROVs able to cover missions for long periods in coastal and open ocean areas.

As for training, PLOCAN organises high specialisation training courses with the aim to provide knowledge and practical skills in the use of facilities and devices for working in and accessing the coastal and deep ocean (see

information about the next glider school taken place 30th September to 4th October 2019 at PLOCAN premises in http://www.gliderschool.eu/).
PLOCAN 's staff and managing team have an extensive experience in the preparation, development and management of large projects in the marine and maritime sectors. Since 2009 they have participated in more than 60 national and EU funded projects both as coordinators and partners.

Contribution to the project
PLOCAN will contribute to WP1 to support partner IEO in the Canary Current case study. It will also contribute to WP4 through availability of deep glider to mission in the Canary Islands, and to WP8 on training activities. In WP9 because it is linked to the AANChOR project as a WP2 leader and to enhance transatlantic cooperation to implement the Belem statement. Finally, in WP10 for coordination activities.

Profiles of the principal investigators
Dr. Octavio Llinás (male) is the Director of PLOCAN . He has dedicated more than 20 years to marine research in the area of physical and chemical oceanography. He has been director of the Canary Islands Institute of Marine Sciences for over a decade, Director of Planning and Development at the Canary Islands Government and General Director of the Spanish Institute of Oceanography. He has also been the main researcher in dozens of national projects and Group Coordinator in several international projects including some of the FP7 and H2020.

Dr. Marimar Villagarcía (female) is Head of the Integrated Observatory of PLOCAN since 2013. She holds a MSc (Canada) and a PhD in Marine Sciences (Spain), and she is a Certified PRINCE2™ Practitioner. She has experience in ocean field research on large research vessels since 1997, mainly related to the ESTOC station. She has worked as researcher and R&D project manager in several international projects in the fields of oceanography, biodiversity and ocean energy granted through the FP and H2020 EC programs (e.g. MERSEA, FIXO3, NETBIOME, BIODIVERSA3, ATLANTOS, AANChOR, OCEANERA-NET, MARINERG-i and MARINET2).

Carlos Barrera (male) is since 2009 the Head of underwater Vehicles, Instruments and MAchineS (VIMAS) at PLOCAN . He is an oceanographer with more than fifteen years experience on marine technology (ocean observing platforms), over a hundred fifty field operations on large research vessels, thirty international projects, seventy publications and two patents related to ocean observing systems,. Technical tasks are time-sharing with desk activities related to R&D projects and services management.

Dr. Silvia Hildebrandt (female) holds a PhD in Marine Sciences. She is Technical Engineer in Computer Sciences and Certified PRINCE2™ Practitioner, as well. After working as a researcher specialized in marine mammal population genetics, she is, since 2009, working as an R&D project manager, first at the University of Las Palmas de Gran Canaria and currently at the Oceanic Platform of the Canary Islands. She is specialized in managing EU funded research projects.

Relevant previous projects
- H2020 BiodivClim (in negotiation): Promoting and implementing joint programming to reinforce transnational research at the crossroad between biodiversity and climate change
- Interreg Atlantic Area JONAS (in negotiation): Joint Framework for Ocean Noise in the Atlantic Seas
- H2020 EUROSEA (in negotiation): Improving and Integrating European Ocean Observing and Forecasting Systems for Sustainable use of the Oceans
- H2020 AANCHOR (GA 818395): All Atlantic Cooperation for Ocean Research and innovation
- Interreg Atlantic Area iFADO: Innovation in the Framework of the Atlantic Deep Ocean
- H2020 SYMBIOSIS (GA 773753): A Holistic Opto-Acoustic System for Monitoring Marine Biodiversities
- H2020 AORA-CSA (GA 652677): Atlantic Ocean Research Alliance Support Action
- H2020 ATLANTOS (GA 633211-2): Optimizing and Enhancing the Integrated Atlantic Ocean Observing System

- ESA Call for Tenders EO-MAMMALS: Earth Observation for Marine Environment: Application for Marine Mammals Environmental Public Management
- FP7 FIXO3 (GA 312463): Fixed Point Open Ocean Observatories Network
- FP7 NEXOS (GA 614102): Next generation, cost-effective, compact, multifunctional web enabled Ocean Sensor Systems Empowering Marine, Maritime and Fisheries Management

Relevant Publications and products

- Pearlman, J. et al. (including A. Cianca & Eric Delory from PLOCAN (2019). Evolving and Sustaining Ocean Best Practices and Standards for the Next Decade. Front. Mar. Sci., 04 June 2019 | https://doi.org/10.3389/fmars.2019.00277.
- Lopez-García P, Gelado-Caballero MD, Collado-Sánchez C, Hernández-Brito JJ (2017) Solubility of aerosol trace elements: Sources and deposition fluxes in the Canary Region. Atmospheric Environment 148: 167-174.
- Montes E, Muller-Karger FE, Cianca A, Lomas MW, Lorenzoni L, Habtes S. (2016) Decadal variability in the oxygen inventory of North Atlantic subtropical underwater captured by sustained, long-term oceanographic time series observations. Global Biogeochemical Cycles 30(3): 460-478.
- Jirka S, Toma D, del Rio J, Delory E (2014). A Sensor Web architecture for sharing oceanographic sensor data. 2014 IEEE Sensor Systems for a Changing Ocean (SSCO) 1-4.

Research facilities, infrastructures and equipment

Oceanic Platform: Dimensions of 38m x 32m x 30m resting on seabed at 30m of depth. Two floors housing laboratories and research areas, a hangar, and an open working area where there is an open test tank, which facilitates sea trials and launching specific underwater vehicles and equipment into the sea.
Marine Test Site: The testing area of 23 km2 (depths 20-600 m.) is located off the East coast of Gran Canaria Island (Spain), at a distance between 2 and 5 km from the coast. PLOCAN also provides a test site in the confined waters of Taliarte harbour nearby.
Vehicles: PLOCAN manages a fleet of Underwater Unmanned Vehicles (UUVs) profiler technologies. The fleet consist of 4 gliders for real-time monitoring up to 1 km depth and several months of continuous mission in different operational scenarios (e.g. ESTOC), 2 USVs able to cover missions for long periods in coastal and open ocean areas and 2 deep water highly capable ROVs (see vehicels missions in http://obsplatforms.PLOCAN .eu/vehicle/all/mission/all/).
ESTOC: Surface buoy and mooring to 3600m deep with meteorological and oceanographic sensors measuring physical and biogeochemical variables. It is maintained twice a year through research cruises (lately IEO ship A. Alvariño) and new technology can be tested (see surface real data at http://siboy.PLOCAN .eu/buoy/ESTOC).
Further details about PLOCAN facilities in https://www.PLOCAN .eu/index.php/en/infrastructure/facilities)

4.1.16 Partner 16, Instituto do Mar, Portugal (IMAR)

IMAR is a not-for-profit private organisation created in 1992 by the top-ranking Portuguese universities in marine research. IMAR is a cross-disciplinary unit with a mission to conduct leading deep-sea and open ocean fundamental and applied research and education to advance the understanding of marine systems in a changing planet, and to promote the sustainable blue economy and management of marine ecosystems for the benefit of the society and the environment. Its scientific activities focus on the ecology, ecosystem functioning and services, and ecosystem based management of open ocean and deep-water ecosystems, including seamounts, hydrothermal vents, mid-ocean ridges, abyssal plains, and the pelagic and mesopelagic realms. Most biology and ecology research have targeted key deep-sea taxa (e.g. benthic invertebrates, soft-bodied animals, fishes) and vulnerable pelagic megafauna (e.g. cetaceans, seabirds, sea turtles and sharks) using a range of molecular, biogeochemical, telemetry and modeling tools. Ecosystem functioning studies have focused in understanding the transfer of energy from chemosynthetic communities to background ecosystems, the main drivers of seamount productivity, and aspects related to the bentho-pelagic coupling and two-way energy transfer between deep-sea and open ocean systems. IMAR has participated in numerous EU (FP6/7, H2020) projects.

Contribution to the project

IMAR will lead the North Mid Atlantic Ridge Case Study and contribute to various WPs, with an emphasis on WP3 and WP4. IMAR will gather and analyze samples, provide historic and new data, and contribute to analytical and modelling activities. IMAR will also contribute to WP3 and WP4 by applying and participating in a nationally-funded cruise and providing new data on pelagic (open ocean) and benthic (deep sea) biodiversity and environment.

Profiles of the principal investigators

Pedro Afonso (male) is a contracted Senior Researcher at IMAR and a visiting scientist at WHOI (USA). Leads the Azorean Marine Protected Area and the Mid-Atlantic ridge Megafauna research groups. Leads the European Animal Tracking Network (ETN) launched within the AtlantOS EU project. His broad expertise on the biodiversity and spatial ecology of reefal, deep-sea and open ocean communities (especially fishes) of mid-Atlantic Ridge Archipelagos and regions and on MPAs/fishing and climate change pressures, are of direct relevance to the project.

Mónica Silva (female) is a contracted Senior Researcher and leader of the Cetacean Ecology group at IMAR. Her main expertise relevant to the project is on cetacean movement, behavioural and feeding ecology, and dynamics of micronekton organisms. She has considerable experience in the application of acoustics, biotelemetry and individual-based models to measure and analyse cetacean behavior.

Christopher K. Pham (male) is a contracted Research Associate working on the ecology of deep-sea ecosystems, especially focused on assessing anthropogenic impacts (e.g. fishing, litter and mining). He is the leader of the Marine Litter group at IMAR and his main expertise relevant to the project is on the spatial distribution of Vulnerable Marine Ecosystems and associated stressors in the Atlantic.

Relevant previous projects

- AtlantOS - Optimizing and Enhancing the Atlantic Ocean Observing System of Systems (EU/H2020)
- DiscardLess – Strategies for the gradual elimination of discards in European fisheries (EU/H2020)
- SponGES - Deep-sea Sponge Grounds Ecosystems of the North Atlantic an integrated approach towards their preservation and sustainable exploitation
- (EU/H20202)
- BIOMETORE - Biodiversity in seamounts: the Madeira-Tore and Great Meteor (EAA grant)
- ETN – European Aquatic Animal Network (Coord.) and OTN - Ocean Tracking Network (NE Atlantic coord.)

Relevant publications and products

- Thorrold S*, **Afonso P*** et al. (2014)(* equal contribution) Extreme diving behavior in devil rays links surface waters and the deep ocean. Nature Communications (DOI: 10.1038/ncomms5274)
- **Afonso P**, Porteiro FM, Fontes J, Morato T, Tempera F, Cardigos F, RS Santos (2013) New and rare coastal fishes in the Azores islands: occasional events or tropicalization process? J Fish Biol 83: 272-294
- **Silva MA**, Prieto R, Jonsen I, Baumgartner MF, Santos RS. 2013. North Atlantic blue and fin whales suspend their spring migration to forage in middle latitudes: building up energy reserves for the journey? PLoS ONE,8(10): e76507.
- **Pham, CK** et al. "Marine litter distribution and density in European seas, from the shelves to deep basins." PloS one9.4 (2014): e95839.
- Morato T, Lemey E, Menezes G, **Pham CK,** Brito J, Soszynski A, Pitcher TJ and Heymans JJ (2016) Food-Web and Ecosystem Structure of the Open-Ocean and Deep-Sea Environments of the Azores, NE Atlantic. Front. Mar. Sci. 3:245. doi: 10.3389/fmars.2016.00245

Research facilities, infrastructures and equipment

Research vessel Arquipélago, coastal vessel Águas Vivas, 3 rigid-hull inflatable boats will support field work on pelagic megafauna; multi-sensor tags to measure feeding rates and bioenergetics; well equipped chemical and

biological labs. IMAR will apply for a nationally funded cruise to the Mid-Atlantic Region and seamounts in the Azores region.

4.1.17 Partner 17, University of Cape Town, South Africa (UCT)

With a ranking among the top 200 universities world-wide (Times Higher Education and Quaquarelli Symonds ranking systems), and ranking first in Africa, the University of Cape Town is an inclusive and engaged research-intensive African university that inspires creativity through outstanding achievements in learning, discovery and citizenship; advancing a more equitable and sustainable social order and influencing the global higher education landscape. UCT has a proud and productive history in marine science as well as in under- and postgraduate education, where interdisciplinary research in the fields of marine ecology and system-based approaches to management of human activities in the ocean, hosted in **UCT's Department of Biological Sciences**, have been key and its outputs and researchers have received prominent global recognition. Marine researchers in this Department actively participate in, and provide leardership to, national and international, research, development and management fora. UCT's Department of Biological Sciences hosts the South African Research Chair in Marine Ecology & Fisheries, whose team has contributed to CEC FPs 6 and 7 in projects such as DARMA, ECOFISH and MEECE.

Contribution to the project

UCT's Department of Biological Sciences will be the Case Study leader for Benguela Current, actively participating in WP1 (Integrated Ecosystem Assessment Framework) and providing inputs in this capacity to other WPs, in particular to WP7 (Ecosystem Risks and Vulnerabilities) but also WPs, 2,3,5,9 and WP10 in connection of CS cycle activities.

Profiles of the principal investigators

Dr Lynne Shannon (female) is the South African Case Study Leader. Dr Shannon has published 120 peer-reviewed publications in the fields of marine ecosystem modelling, ecological indicators and fisheries management. She is recognised among the world's top researchers in her field, and plays strong scientific leadership roles; she has co-chaired the global collaborative EUROCEANS IndiSeas Programme since 2006, and is currently contributing to the IPBES Global Assessment through lead-authorship, and to Future Earth's BioDiscovery Programme as co-chair. Dr Shannon is a senior co-leader of the UCT team under the South African Reseach Chair Initiative: Marine Ecology and Fisheries (ME&F), which is well-established nationally, regionally and internationally, and collaborates closely with the South African Department of Science and Technology, through the National Research Foundation, providing base-funding for a group of MSc and PhD students, as well as Post-Docs, through the Research Chair. Dr Shannon has a proven track record of scientific leadership (both internationally and regionally), and has established an active network of collaborators in the Benguela region across academia, governmental (Department of Environmental Affairs; Department of Agriculture, Forestry and Fisheries), as well as non-governmental organisations (e.g. WWF, BirdLife SA). Her 17-year long work experience at the South African government agencies overseeing fisheries and ocean management stand her in good stead to effectively link science to management in the Benguela region. Dr Shannon served as South African Scientific Lead on the Benguela Current Large Marine Ecosystem (BCLME) Ecosystem Approach to Fisheries Feasibility Study (2004-2006), and chaired the Ecosystem Approaches to Fisheries (EAF) Scientific Working Group at the government department (2003-2008), coordinating the scientific aspects of implementing an EAF in several of South Africa's fishing sectors. This entailed overseeing Ecosystem Risk Assessments for South Africa's key marine fisheries. She was partner researcher and Scientific Co-ordinator of the Benguela Regional Project (2004-2006) of the ECO-UP: Upwelling Ecosystems French-Benguela-Humboldt programme. She served as scientific co-ordinator of the Marine Research in the Benguela and Agulhas Systems for supporting Interdisciplinary Climate-Change Science (Ma-Re BASICS) project at the University of Cape Town (2012 and 2013), and was Acting Director of the Marine Research Institute at UCT (2014/15).

Relevant previous projects

- SEAVIEW, Scenario, fishEry, ecologicAl-economic modelling and VIability nEtWork, Belmont FORUM Project funded by ANR, CSIRO, DFG, FAPESP, NRF, RCN

- EU FP7 project MEECE (Marine Ecosystem Evolution in a Changing Environment), grant agreement no. 212085, 2009-2013.
- IPBES – Gobal Assessment, 2016-2019
- BioDiscovery (Future Earth initiative), 2017-2019
- The "Ecosystem approaches for fisheries management in the Benguela Current Large Marine Ecosystem" project (LMR/EAF/03/01; 2004-2006) and ongoing Benguela Current Commission's research programmes
- The IndiSeas ("Indicators for the Seas") international collaborative project, 2005 til present

Relevant publications and products

- **Shannon, L.J.**, Cury, P.M., Nel, D., van der Lingen, C.D., Leslie, R.W., Brouwer, S.L., Cockcroft, A.C. and Hutchings, L. 2006. How can science contribute to an ecosystem approach to pelagic, demersal and rock lobster fisheries in South Africa? African Journal of Marine Science 28(1): 115-157.
- **Shannon, L.J.**, Coll, M., Yemane, D., Jouffre, D., Neira, S., Bertrand, A., Diaz, E., and Shin, Y.-J. 2010. Comparing data-based indicators across upwelling and comparable systems for communicating ecosystem states and trends. ICES Journal of Marine Science 67: 807-832.
- **Shannon, L.J.**, Jarre, A.C., and Petersen, S.L. 2010. Developing a science base for implementation of the ecosystem approach to fisheries in South Africa. In Perry, R.I., Barange, M., Hofmann, E., Moloney, C., Ottersen, G. and Sakurai, Y. (Editors). GLOBEC Special Issue, Progress in Oceanography 87(1-4): 289-303.
- **Shannon, L.J**., Osman, W., Jarre, A. Communicating changes in state of the southern Benguela ecosystem using trophic, model-derived indicators. 2014. Marine Ecology Progress Series 512: 217–237. doi: 10.3354/meps10879
- **Shannon, L.J.**, and Coll, M. 2018. Assessing the changing biodiversity of exploited marine ecosystems. Current Opinion in Environmental Sustainability 2018, 29:89–97. https://doi.org/10.1016/j.cosust.2018.01.008
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4.1.18 Partner 18, Universidade Federal de Santa Catarina, Departamento de Ecologia e Zoologia – ECZ, Brasil (UFSC)

The Universidade Federal de Santa Catarina (UFSC) is one of the leading research universities in south Brazil. The university is public and free of charge having more than 60,000 people among professors, students, technicians, and staff. **UFSC's Departamento de Ecologia e Zoologia - ECZ** has become internationalized through cooperation agreements (300) with educational institutions all over the world. The Ecology and Zoology Department conducts research in the following programmes: Biogeography and evolution, Connectivity patterns among populations of reef organisms, Reef fish macroecology, Conservation of top predators, Ecology of reef fish interaction with benthic communities, and Invasive marine species. The Oceanography Sector focus on investigating systems, processes and abiotic and biotic phenomenon of the marine environment and their management. Special attention to research related to physical, chemical and geological processes, especially in the coast of Santa Catarina, investigating also oceanographic processes in medium and large scale in the South Atlantic Ocean. Researches are interested to determining structure, function and dynamics of populations, communities and coastal and oceanic ecosystems.

UFSCcannot accept direct funds from EC, and will have Third Party Foundation (in-kind contribution for payment).

Contribution to the project

UFSC wil be responsible for the Case Study South Brazilian Shelf (SBS) and participate in all WPs both dealing with the CS cycle and communication and training (WP1-10). UFSC will be more actively on work packages with focus on ecosystem objectives, human activities, pressures and emerging issues, impacted ecosystem components, and relevant management options (WP1); mapping ecosystems and resources (WP3); distribution of key benthic

epifaunal species and communities (WP4); identify the key drivers and tipping points influencing key species and ecosystem dynamics (WP5); assessing risks and vulnerability (WP7).

Profiles of the principal investigators

Dr. Marinez Scherer (female) is the Coordinator of the CS SBS. Marinez has working with Integrated Coastal and Marine Management at Federal University of Santa Catarina (UFSC) for 8 years, and is the Research Leader of the Integrated Coastal Management Laboratory. Marinez is also visiting professor at the University of Cadiz (UCA)/ Spain for the Coastal Areas Management Master. She has completed supervision of 5 PhDs and 8 MSc at UFSC and UCA. She is the executive secretary of the Brazilian Sea Forum and the Technical Director of the Brazilian Agency for Coastal Management. She is also one of the Brazilian Coordinators of the Ibero American Network on Coastal Management (IBERMAR). Marinez is a member of the IUCN Conservation Strategies Specialist Group, and on the World Commission on Protected Areas (WCPA). She has extensive experience dealing with different stakeholders on Coastal Management issues and Marine Spatial Planning, as she worked as a coordinator of the Coastal Management Plan for Santa Catarina State (Brazil) (2009-2010) and is a trained coach on Blue Planning by Blue Solutions. Main research interests are on integrated coastal and marine management, ecosystem based management, coastal and marine protected areas, and networks.

Dr. Sergio R. Floeter (male) is the Head of the Marine Macroecology and Biogeography Lab and he has a Ph.D. in Environmental Sciences, UENF-Rio de Janeiro, Brazil, Post-Doc at NCEAS (National Center for Ecological Analyses and Synthesis), University of California, Santa Barbara, USA. Associate Professor at Universidade Federal de Santa Catarina (since 2006). Works with reef fish ecology, biogeography, connectivity and evolution with over 80 peer-reviewed publications (over 4300 citations Google Scholar [h-index 33]); Developed several databases on reef fishes. Experience in conducting large scale data analysis. Recently awarded funds (PI or co-PI), and completed supervision of 8 PhDs and 18 MSc.; Currently supervising 2 PhDs, 2 masters candidates and 3 bachelor degrees. Teaching: Vertebrate zoology, Conservation, Community ecology, Reef fish ecology and conservation. Expert IUCN - Brazilian reef fish Red Listing. He will be incvolved in WP4 for the benthic survey at St. Helena and in WP3 and WP5 for the synthesis of the results for trait based mapping and the understanding of attributes of resilience (WP5).

Relevant previous projects

- SISBIOTA-Mar (CNPq 563276/2010-0): Brazilian Marine Biodiversity Network.
- PELD-ILOC (CNPq 403740/2012-6): Research and long-term ecological monitoring (LTER): Brazilian oceanic islands.
- MAArE (Petrobrás): Ecological monitoring of the Arvoredo Marine Reserve, South Brazil.
- Ecosystemic Knowledge for Ecosystem Based Management on coastal and marine areas – UFSC
- Land, Sea and Humankind in Santa Catarina State (CAPES A047_2013)

Relevant publications and products

- Quimbayo, J.P., Dias, M.S., Kulbicki, M., … & *Floeter, S.R.* (2018) Determinants of reef fish assemblages in tropical oceanic islands. Ecography, 41: 1–11. doi: 10.1111/ecog.03506.
- **Floeter, S.R.**, Rocha, L. A., Robertson, D. R., … & Bernardi, G. (2008) Atlantic reef fish biogeography and evolution. Journal of Biogeography, 35: 22–47.
- **Scherer, M.** & Asmus, M.L. (2016) Ecosystem-Based Knowledge and Management as a tool for Integrated Coastal and Ocean Management: A Brazilian Initiative. In: Vila-Concejo, A.; Bruce, E.; Kennedy, D.M., and McCarroll, R.J. (eds.), Proceedings of the 14th International Coastal Symposium (Sydney, Australia). Journal of Coastal Research, Special Issue, No. 75, Volume 1, pp. 690-694. Coconut Creek (Florida), ISSN 0749-0208. doi: 10.2112/SI75-138.1.
- **Scherer, M.**, Andrade, J. Emerim, E.G., … & Veiga Lima, F.A. (2014) Prioritizing actions for coastal management: A methodological proposal. Ocean & Coastal Management, 91 p 17-22. ISSN: 0964-5691 (http://dx.doi.org/10.1016/j.ocecoaman.2014.01.012).

Research facilities, infrastructures and equipment

UFSC has a number of laboratories that can contribute, such as: Coastal Oceanography Laboratory (LOC): marine research and monitoring; Ocean Dynamics Laboratory (DINO): modeling and digital image processing; Marine Macroecology and Biogeography Lab (LBMM): marine biodiversity; Marine Chemistry Laboratory: biogeochemistry; Marine Hidraulic Laboratory: wave prediction and ocean fenomena modeling; Climate and Metereology Laboratory: metereology and climate data, oceano climate modeling; Biodiverstity and Marine Conservation Laboratory: marine bentic ecology; Ficology Laboratory (LAFIC): taxonomy, ecology, ecofisiology and biotechnology of algae; Oil and Gas Geology Laboratory: marine bioindicators and testimonies; Integrated Coastal Zone Management (LAGECI): coastal and marine planning and management; among others. UFSC has a research sailing boat (ECO), prepared to marine expeditions and research.

4.1.19 Partner 19, Marine and Freshwater Research Instutute, Iceland (MFRI)

Marine and Freshwater Research Institute (MFRI) is a government institute under the auspices of the Ministry of Industries and Innovation. The institute employs around 190 staff, operates 2 research vessels and 10 branches around the country, including an aquaculture experimental station. MFRI conducts various marine and freshwater research and provides the Ministry with scientific advice based on its research on marine and freshwater resources and the environment. MFRI is leading in marine and freshwater research in Icelandic territories and the arctic, providing advice on sustainable use and protection of the environment with an ecosystem approach by monitoring marine and freshwater ecosystems. The main research priorities are research on marine and freshwater ecosystems, sustainable exploitation of main stocks, ecosystem approach to fisheries management, research on fishing technology and seafloor and habitat mapping.

Contribution to the project

MFRI main contribution will be focused on WP4 for habitat mapping, as well as support on WP1.

Profiles of the principal investigators

Dr. Julian Mariano Burgos (male) is a senior marine ecologist with the Demersal Division at the Marine and Freshwater Research Institute in Iceland. He holds a PhD degree from the University of Washington (Seattle, WA, USA) and a MSc degree from the University of Charleston (Charleston, SC, USA). His interests and expertise include the identification and mapping of benthic habitats, with focus on Vulnerable Marine Ecosystems, species distribution modeling, interactions between commercial fisheries and benthics ecosystems, risk analysis, hydroacoustics, and spatial statistics. He is a member of the ICES Working Group on Marine Habitat Mapping (WGMHM). He acts as the leading modeler in the Icelandic Seabed Mapping Project at MFRI and the NovasArc project.

Steinunn H. Ólafsdóttir (female) is a senior biologist at Marine and Freshwater Research Institute in Iceland, Demersal Division. She has a Ms degree from the Royal Veterinary and Agriculture University, Copenhagen, Denmark. Her interests and expertise include habitat mapping, video analysis of benthic communities, observations of coral distribution, habitat conservation and advising management authorities regarding Vulnerable Marine Ecosystems. She is a participant in the International Council for the Exploration of the Sea (ICES) as member of the Working Group on Deep-water Ecology (WGDEC). She has been involved and acted as cruse leader in numerous benthic surveys in subarctic and arctic waters around Iceland and in Greenland. She has participated in the following projects: CoralFish EU, Inoman (Initiation of Benthic monitoring in Greenlandic waters), NovasArc (with Norway and the Faroes Islands), LTM Benthos (Long term monitoring of benthos in Pan Arctic region). She initiated the monitoring of benthos during the annual autumn groundfish survey in deep waters around Iceland.

Relevant previous projects

- NovasArc (Nordic project on vulnerable marine ecosystems and anthropogenic activities in Arctic and sub-Arctic waters). Funded by the Nordic Cousel of Ministers, in collaboration with IMR (Norway) and FMRI (Faroes Islands). Participants: JMB, SHO.
- Icelandic Marine Habitat Mapping project. Ongoing MFRI internal project. Participants JMB, SHO.
- -FP7 CoralFISH project (2008-2013). Participants: JMB, SHO).

- Initiating North Atlantic Benthos Monitoring (INAMon). Leaded by GINR (Greenland). Participant: SHO
- Detecting changes in the Arctic Ecosystem – Long-Term Benthos Monitoring network for detecting changes in the Arctic benthic ecosystem (LTM-Benthos) 2017-2020. Participant: SHO

Relevant Publications and products

- Ragnarsson, S.Á. and **Burgos, J.M**., 2018. Associations between fish and cold-water coral habitats on the Icelandic shelf. Marine environmental research, 136, pp.8-15.
- Ragnarsson, S.Á., **Burgos, J.M.,** Kutti, T., van den Beld, I., Egilsdóttir, H., Arnaud-Haond, S. and Grehan, A., 2017. The impact of anthropogenic activity on cold-water corals. Marine Animal Forests: The Ecology of Benthic Biodiversity Hotspots, pp.1-35.
- Davies, J.S., Guillaumont, B., Tempera, F., Vertino, A., Beuck, L., **Ólafsdóttir, S.H.**, Smith, C.J., Fosså, J.H., Van den Beld, I.M.J., Savini, A. and Rengstorf, A., 2017. A new classification scheme of European cold-water coral habitats: implications for ecosystem-based management of the deep sea. Deep Sea Research Part II: Topical Studies in Oceanography, 145, pp.102-109.
- Jørgensen, L.L., Blicher, M., Bluhm, B., Christiansen, J.S., Fredriksen, R., Hammeken, N., Logerwell, L., **Olafsdottir, S.H.**, Roy, V., Strelkova, N.A. and Sørensen, J., 2018. Detecting changes in the Arctic Ecosystem–Long-Term Benthos Monitoring network for detecting changes in the Arctic benthic ecosystem (LTM-Benthos) 2017-2020. Rapport fra havforskningen.
- Buhl-Mortensen, L., **Olafsdottir, S.H.**, Buhl-Mortensen, P., **Burgos, J.M**. and Ragnarsson, S.A., 2015. Distribution of nine cold-water coral species (Scleractinia and Gorgonacea) in the cold temperate North Atlantic: effects of bathymetry and hydrography. Hydrobiologia, 759(1), pp.39-61.

Research facilities, infrastructures and equipment

MFRI owns and operates two research vessels. The research vessels are able to operate a variety of fishing gear. They also provide facilities for many other types of sampling and measurements. Shipboard laboratories allow sample analysis and data processing at sea. The vessels are equipped with scientific echosounders operating at frequencies suitable for fisheries acoustic stock assessments and MFRI has a team of experts, experienced in acoustic measurements and assessment of pelagic fish and other marine organism. Similarly the institute has proper instruments for environmental studies and sampling as well as specialists to operated and analyze the data.

4.1.20 Partner 20, Marine Institute, Policy, Information & Research Support Unit, Ireland (MI)

The Marine Institute (MI) is the national agency for marine research and development in Ireland. The MI has a broad marine remit and is engaged in R&D on a diverse range of areas incl. marine transport, oceanography, fisheries, aquaculture, environment, research vessel operations, climate change and seabed mapping. Fisheries Ecosystem Advisory Services (FEAS) research, and advise on the sustainable exploitation of the marine fisheries. Ocean Science & Information Services (OSIS) provides scientific, operational and analytical support and services to strategic RTDI and statutory monitoring programmes. MI, working with its international partners, conducts a broad range of scientific projects under the EU Framework programmes up to H2020.

Contribution to the project

MI's Policy, Information & Research Support Unit will lead WP4, and contribute to WPs 1, 2, 3, 5, 6, 7, 8, 9 and 10, undertaking data compilation and dissemination, seabed bathymetry and benthic habitat mapping, and developing an integrated ecosystem assessment framework in each case study región. MI is leader for the Celtic Seas case study in WP1. MI has been a leader on the development of IEA in Western Shelf Seas within ICES WGEAWESS (D Reid chair 2011-2015), and the ICES Science Steering Group on IEA from 2012-2016. MI has carried out a full ODEMM analysis for the Celtic Seas and quantified the major drivers, of fisheries, sea floor degradation and litter. MI has strong contacts with industry, and with the government department responsible for MSFD and MSP.

Profiles of the principal investigators

Prof. David G. Reid (male) is the Principle Investigator on Ecosystem Based Fisheries Management within the FEAS. He has worked for 28 years in fisheries management on Fisheries sustainability, fishing capacity and effort, industry collaboration, as well as Integrated Ecosystem Assessment and Risk Analysis. He has a strong involvement with ICES, including chairing the Science Steering Group on Integrated Ecosystem Assessment. He has been involved in over 20 EU funded projects, in two cases as scientific coordinator. He has co-authored over 120 peer reviewed publications, with 4600 citations (1924 since 2014). His h-index is 37 (23 since 2014). He is Adjunct Professor at University College Cork, Ireland.

Thomas Furey (male) is the manager of Advanced Mapping Services in OSIS at the MI. He has an MSc from University of North Wales, Bangor, and has worked for 21 years in seabed mapping. He is joint manager of Ireland's INFOMAR seabed mapping programme (Integrated mapping for the sustainable development of Ireland's marine resource), and he is Co-Chair of the Atlantic Seabed Mapping International Working Group (ASMIWG), setup by the EC, DFO Canada, and NOAA in the U.S. under the Atlantic Ocean Research Alliance (AORA). He is on the External Advisory Board of the H2020 Eurofleets Plus project which is providing access to 27 research vessels, 7 ROVs, 5 AUVs, and a mobile telepresence unit. His areas of expertise include large scale bathymetry and benthic habitat mapping, spatial data integration for multi-sector resource management, industry collaboration, and research coordination. His team were partners in the EMDOnet Seabed Habitats and Atlantic checkpoint ProAtlantic projects, and he coordinates the multi-agency SeaRover project co-funded by the Irish Government and the European Maritime Fisheries Fund, involving an extensive 3 year offshore reef habitat survey and assessment.

Relevant previous projects

- DiscardLess - Strategies for the gradual elimination of discards in European fisheries. National Project Leader and WP leader 2015-2020 EU H2020. €275k
- MYFISH - Broadening the scope of MSY to ecosystems, economics, and social issues. National Project Leader and WP leader 2012-2016 EU-FP7. €241k
- H2020 AORA – The MI led Atlantic Ocean Research Alliance Coordinating and Support Action provides support for the Galway Statement and its Atlantic Ocean Research Alliance
- EMODnet Seabed Habitats – Update and expand broad-scale physical habitat map for all European sea-basins, and provide searchable metadata, a free interactive mapping portal, and downloadable habitat map layers and information.
- SeaChange BG 13 Ocean Literacy-Engaging with Society -- Social Innovation. WP leader 2015-2018 EU-FP7.

Relevant publications and products

- Rindorf, A., Mumford, J., Worsøe Clausen, L., Garcia, D., Hintzen, N., Hoefnagel, E., Holt, J., Kempf, A., Leach, A., Levontin, P., Mace, P., Mackinson, S., Maravelias, C.D., Potter, C., Prellezo, R., Quetglas, A.Tserpes, G. Voss, R. and **Reid, D.G.** (2017). Moving beyond the MSY concept to reflect multidimensional fisheries management objectives. Marine Policy. 85:33-41.
- **Reid, D.** G., Graham, N., Suuronen, P., He, P., and Pol, M. (2016) Implementing balanced harvesting: practical challenges and other implications. – ICES Journal of Marine Science, 73(6): 1690-1696
- Pedreschi, D., Bouch, P., Moriarty, M. Nixon, E., Knights, A.M., & **Reid, D.G.** (2018). "Integrated ecosystem analysis in Irish waters; Providing the context for ecosystem-based fisheries management." Fisheries Research 209: 218-229.
- Trenkel, V. M., Hintzen, N. T., Farnsworth, K., Olesen, C., **Reid, D.G.**, Rindorf, A., Shephard, S., and Dickey-Collas, M. (2015) Identifying marine pelagic ecosystem objectives and indicators for management. Marine Policy. 55, 23-32
- Scott, G., Monteys, X., Hardy, D., McKeon, C., **Furey, T.** (2016), Mapping the Seabed, in Bartlett, D., Celliers, L. (eds), CRC Press 2016. Geoinformatics for Marine and Coastal Management. 17-42 pp. ISBN 9781498731546 - CAT# K26193.

Research facilities, infrastructures and equipment

Marine Institute headquarters is an 11,000 square meter purpose built facility hosting offices, the national marine laboratories, and a 147 seater auditorium. Galway docks is the base for the R.V. Celtic Explorer, the larger of the two state-owned research vessels run by the Marine Institute, and also for the deepwater ROV Holland 1. The multi-purpose research vessel came into service in 2003 and is designed for fisheries acoustic research, oceanographic, hydrographic and geological investigations as well as buoy/deep water mooring and ROV Operations. At 65.5m in length, the vessel can accommodate 35 personnel, including 20-22 scientists.

4.1.21 Partner 21, Instituto Español de Oceanografía, Centre of Cadiz, **Spain (IEO)**

The Spanish Institute of Oceanography (Instituto Español de Oceanografía, IEO) is a public research organization, under the Ministry of Science, Innovation and Universities devoted to marine science research, especially in relation to the scientific knowledge of the oceans, the sustainability of fishing resources and the marine environment. IEO represents Spain in most of the international scientific forums related to the sea and its resources, such as ICES, NAFO, CECAF or OSPAR. IEO is engaged in the following ICES IEA working groups: WGEAWESS (Western European Shelf Seas) & WGCOMEDA (comparative analyses between European Atlantic and Mediterranean). IEO has extensive experience in EU projects (e.g. DiscardLess, SponGES, ATLAS, AtlatOS, MyOcean, CERES). A historical IEO task is fish stock assessment, which requires the compilation of data relating to the Spanish fleet operations, fisheries-independent surveys and on basic biological parameters. This work follows standard procedures established in the data collection framework (DCF) and makes up an impressive database of pelagic and demersal communities in Spanish waters (including the Canaries) and also in areas of the Atlantic were the Spanish fleet operate, such us: Newfoundland (Canada) or the Porcupine bank (Celtic Sea) and some African countries (e.g. Mauritania or Ginea Bissau). IEO is also responsible for the implementation of the Marine Strategy Framework Directive (MSFD) in Spanish Iberian and Canary Islands waters. Through INDEMARES (https://www.indemares.es/en) and the recently-launched INTEMARES, IEO has been studying the deep-sea habitats, pelagic species seabirds and human uses of Spanish marine waters. The aim of these two LIFE projects was to understand the natural and socioeconomic values in order to complete the Natura 2000 Network for marine environments. Another projects of relevance to Mission Atlantic are RADIALES (http://www.seriestemporales-ieo.net/). This long term ecosystem research (LTER) project has been continuously operating since 1991 as an observatory of the pelagic ecosystem in the shelf and nearby oceanic waters of Spain. Oceanographic and plankton variables are measured monthly in 5 transects perpendicular to the coast. As a result of all these activities, IEO holds key databases and ecological knowledge from several regional seas of interest to Mission Atlantic, namely the Cantabrian Sea (south Bay of Biscay), Gulf of Cadiz (south Iberian Coast) and Canary Current (Canary Islands + some African countries), as well as North Atlantic (Newfoundland and Celtic Sea).

Contribution to the project

IEO's Center of Cadiz is Case Study lead the Canary current system. IEO will contribute to the development of an ecosystem assessment framework (WP1), to make its comprehensive time series (hydrography, pollution, plankton, acoustics, biota) and datasets (including recently generated seabed geology, bathymetry and microplastics) accessible and interoperable (WP2), the mapping of the latter (WP3 & WP4), the definition of state, drivers and tipping points (WP5) and the evaluation of risks and vulnerability of the Canary Current case studies (WP7) as well as to build capacity (WP8) and the engagement of society (WP9).

Profiles of the principal investigators

Dr. Marcos Llope (male) joined IEO in 2010 as a research scientist after having carried out postdoctoral studies at the Centre for Ecological and Evolutionary Synthesis (CEES, U. Oslo, Norway) and Sir Alister Hardy Foundation for Ocean Science (SAHFOS, UK). From 2015-2018, he combined this main affiliation with a partial position at CEES (UiO). His main research interests lie in identifying and quantifying the ways in which marine ecosystems respond to climate and fishing and in exploring ecological concepts such as regime shifts and resilience. He develops models of the relationships between trophic levels, climate and fishing. Over the years he has worked on a number of marine systems and he has published 23 relevant publications. At IEO he leads the internal IEO project 'ecosystem management implementation'. His work focuses on the Integrated Assessment of the Gulf of Cadiz-Guadalquivir estuary socio-ecosystem and on the prospect of the implementation of the Ecosystem Approach in the area. He is a member of the ICES Working Group on Ecosystem Assessment of

Western European Shelf Seas (WGEAWESS) since 2013 and co-chair for the 2019-2021 term. He is currently supervising a PhD student on this topic while he maintains collaboration with experts on the subject.

Eva García-Isarch (female) joined IEO in 1999 and is currently the Chief Scientist of IEO's Structural Programme #3 which addresses the Eastern Central Atlantic fisheries, within CECAF area. Eva coordinates IEO research activities carried out in both the Spanish (Canary Islands) and African (Morocco, Mauritania & Guinea-Bissau) waters of the Canary Current LME and is well acquainted with the homologous marine research institutes (INRH-Morocco, CRODT-Senegal, IMROP-Mauritania, CIPA-Guinea Bissau) of the area. She has been a member of the Joint Scientific Committees for the Fisheries Partnership Agreements of Morocco, Mauritania and Guinea-Bissau for the last eight years and has participated as West African fisheries expert at FAO/CECAF and EU scientific working groups. She has published 16 peer-reviewed papers and written more than 120 technical or scientific documents. She has leaded or participated in more than 60 fishing/oceanographic surveys on board commercial and oceanographic vessels, many of them carried out in African waters (Morocco, Western Sahara, Mauritania, Guinea-Bissau, Angola, Namibia and Mozambique).

Relevant previous projects

- 2009-2014 | LIFE+ INDEMARES | Inventory and designation of marine Natura 2000 areas in the Spanish sea | LIFE07/NAT/E/000732 INDEMARES. Funding: 15.4 mill €.
- 2014-2018 | GreenMAR | Green Growth based on Marine Resources: Ecological and Socio-Economic Constraints. http://www.greenmar.uio.no/. Nordic Council of Ministers, NordForsk. Funding: MNOK 27. PI: Anne Maria Eikeset & Nils Chr. Stenseth (U. Oslo).
- H2020 CERES (GA 678193): Climate change and European aquatic RESources

Relevant Publications and products

- **Llope M** (2017) The ecosystem approach in the Gulf of Cadiz. A perspective from the southernmost European Atlantic regional sea. ICES J Mar Sci, 74: 382–390.
- Lynam CP, **Llope M,** Möllmann C, Helaouët P, Bayliss-Brown GA, Stenseth NC (2017) Interaction between top-down and bottom-up control in marine food webs. Proc Natl Acad Sci, 114: 1952-1957.
- **Llope M,** Daskalov GM, Rouyer TA, Mihneva V, Grishin AN, Chan K-S, Stenseth NC (2011) Overfishing of top predators eroded the resilience of the Black Sea system regardless of the climate and anthropogenic conditions. Global Change Biol, 17: 1251–1265.
- **García-Isarch E,** de Matos-Pita SS, Muñoz I, Ramil F (2017) Decapod crustaceans of Mauritanian deep waters. In: Ramos A, Sanz JL, Ramil F (eds.) Deep-sea ecosystems off Mauritania: Research of marine biodiversity and habitats in the Northwest African margin. Springer Netherlands, pp. 355-391.
- Ramos A, Sanz JL, Pelegrí JL, Fernández-Peralta L, Pascual-Alayón P, Ramil F, Castillo S, **García-Isarch E,** Rocha F, Gil M, Calero B (2017) An overview on biodiversity and ecosystems off Mauritanian deep-waters. In: Ramos A, Sanz JL, Ramil F (eds.). Deep-sea ecosystems off Mauritania. Researching marine biodiversity and habitats in West African deep water. Springer Netherlands, pp. 615-659.

Research facilities, infrastructures and equipment

IEO's headquarters are located in Madrid and has nine coastal laboratories along the Spanish coast, 5 on the Iberian Atlantic coast (Vigo, A Coruña, Gijón/Xixón, Santander & Cádiz), 1 on the Canary Islands (Santa Cruz de Tenerife) and 3 in the Mediterrean, 5 aquaculture plants and 5 research vessels. The current staffs include about 600 people, half of which are qualified scientists.

4.1.22, Partner 22, Seascape Belgium (SSBE)

Seascape Belgium comprises a team of marine science, data and policy experts providing research management and communication support, marine data management and GIS support, stakeholder facilitation and high-level advice to the marine and maritime sector. Seascape experts have expertise in the fields of marine biotechnology, oceanography, marine biodiversity, ecosystems and habitat mapping, GIS, marine data and ocean observation, ocean governance and stakeholder engagement. Seascape Belgium is a partner in the Horizon 2020 project SOPHIE on Oceans and Human Health and its staff currently coordinates the European Marine Observation and Data Network (EMODnet).

Contribution to the project
Seascape Belgium will contribute to WP2 (Data Management) Task 2.1. (Inventory of available Atlantic Data Resources), in particular by assisting with the identification of relevant data sources from EMODnet (data portals and Atlantic Checkpoint); and contribute to WP2 Task 2.2. by assisting with feeding selected project outputs to EMODnet for long term stewardship and availability. Seascape Belgium administers the EMODnet Secretariat for DG MARE which inlcudes maintenance and further development of the European Atlas of the Seas. Aside from these specific contributions, Seascape will use the EMODnet communication channels (website, twitter, newsletter) to communicate/disseminate MissionAtlantic news and outputs.

Profiles of the principal investigators
Dr Pascal Derycke (male) (EMODnet Secretariat Technical Coordinator, Seascape Belgium) obtained a PhD in Science at the University of Metz (France) in the field of physics in 1996. After his degree, he pioneered in IT and web design and developed an excellent understanding of all aspects involved in web communication. He was managing a web agency in Metz when he moved to Brussels in 2002 where he was offered a position as IT manager by the NGO GRIP (Group for Research and Information on Peace and security). In 2011, Pascal joined the Marine Department of the Institute for Environment and Sustainability (EC/JRC/IES) as a scientific programmer and data analyst where he expanded his skills to earth observation science and GIS technologies used in the monitoring of climate change and assessment of the environmental status of marine and coastal waters. During these 6 years he was responsible for the maintenance and upgrading of the marine geo-portal EMIS (Environmental Marine Information System) and provided scientific programming support for mapping bio-geophysical products. Alongside this he contributed to the development of INSPIRE services and server applications related to the marine environment and participated in the release of the JRC data catalogue and the MSFD Marine Competence Centre. Pascal brings his expertise in data and GIS to Seascape's EMODnet team in Ostend.

Dr. Nathalie Tonné (female) (EMODnet Project Officer) holds a MSc and a PhD in Biological Sciences from the Free University of Brussels (VUB). She has worked on diverse topics inlcuding loss of landscape features of inferred biological value in Greece and its effect on European migratory bird species, and ecology of the seedlings of Rhizophoraceae mangrove species. In addition to her research, she organized the "Plant Physiology" practical course for bachelor students, and assisted students with their respective thesis. Before joining Seascape as a Project Officer for the EMODnet Secretariat, she co-coordinated the interuniversity MSc programme Marine and Lacustrine Science and Management ('Oceans & Lakes'). She assist with the various EMODnet Secretariat activities, in particular the monitoring and follow up of the thematic and regional EMODnet projects as well as gathering user feedback via user surveys and assessment of user friendliness of EMODnet data portals and services.

Mr Jan-Bart Calewaert Eng (male) (Head of the EMODnet Secretariat and Managing Director Seascape Belgium). Mr Calewaert is currently the Managing Director of Seascape Belgium and Head of the Secretariat of the European Marine Observation and Data Network (EMODnet), a long-term marine data initiative supported by the European Commission Directorate-General for Maritime Affairs and Fisheries. Prior to that Mr Calewaert worked for more than six years at the Marine Board-ESF Secretariat where he coordinated foresight and policy activities in various working areas including marine biotechnology, oceans and human health, climate change impacts on the marine environment and marine pollution. Jan-Bart Calewaert trained as a bio-engineer in cellular and genetic biotechnology at the University of Ghent in 2001 and completed an additional Masters in Marine Environment Management from the Free University of Brussels and University of Antwerp in 2004. Through most of his career, Jan-Bart has worked at the interface between science and policy, combining his broad expertise in marine sciences with knowledge of the marine and maritime policy landscape in Belgium and Europe. Jan-Bart started his career working in Belgium for among other Flanders Marine Institute (VLIZ), the Maritime Institute (UGent) and the Laboratory of Environmental Toxicology and Aquatic Ecology (UGent).

Relevant previous projects
- EMODnet Secretariat (2013-current): the European Marine Observation and Data Network (EMODnet) is a network of European organisations working together to observe the oceans, to make the marine data

collected freely available and interoperable, to create seamless data layers across sea-basins and to distribute the data and data products through the internet. The primary aim of EMODnet is to unlock existing but fragmented and hidden marine data and make them accessible for a wide range of users including private bodies, public authorities and researchers. Seascape Belgium provide the Secretariat for the EMODnet community, funded by the European Commission's Directorate General for Maritime Affairs and Fisheries. Since 2017, the duties of the EMODnet Secretariat also include the management and further development of the European Atlas of the Seas (EAS). For more information, please see www.emodnet.eu and www.european-atlas-of –the-seas.eu.

- H2020 SOPHIE Project: Funded by the European Union's Horizon 2020 programme, the Seas, Oceans and Public Health in Europe project (SOPHIE) is helping to build new research capacity for the emerging scientific discipline of Oceans and Human Health.. Seascape Belgium is responsible for analysing marine environmental data repositories to establish links with public health research to assess usability and gaps to support oceans and human health research in Europe. For more information, please see https://sophie2020.eu/
- H2020 INMARE: Industrial Applications of Marine Enzymes project is focused on the development of innovative screening and expression platforms to discover and use the functional protein diversity from the sea. In this project, Seascape Belgium coordinates the work package on communication and dissemination. For more information please visit www.inmare-h2020.eu

Relevant publications and products

- **Calewaert, J.B.** & McDonough, N. 2011. A new dawn for marine biotechnology in Europe. Biotechnology Advances 29(5):453, 6.
- Lallier LE, McMeel O, Greiber T, Vanagt T, Dobson ADW, Jaspars M (2014), "Access to and Use of Marine Genetic Resources: Understanding the Legal Framework", Nat. Prod. Rep., 31 (5), 612-616
- **Calewaert JB** et al., The European Marine Data and Observation Network (EMODnet): Your Gateway to European Marine and Coastal Data. Quantitative Monitoring of the Underwater Environment (2016). Volume 6 of the series Ocean Engineering & Oceanography (Springer) pp 31-46.
- Marine Data Portals and Repositories and their role in Knowledge Transfer to support Blue Growth (2016) McMeel O, **Calewaert JB**. Deliverable 4.2 H2020 COLUMBUS Project No.652690.
- Hoepffner, N., **Derycke P.** & Dubroca L. 2016. The EMIS-R Marine Analyst – an aid to the monitoring and management of marine areas, including marine protected areas. ICAN Newsletter Nov 2016

Research facilities, infrastructures and equipment

Seascape Belgium is a consultancy service provider and does not own major infrastructures or large equipment. As administrators of the EMODnet Secretariat on behalf of the European Commission Directorate-General for Maritime Affairs and Fisheries (DG MARE), Seascape Belgium plays a central role in coordination of the European Marine Observation and Data Network which can be considered a large distributed marine data infrastructure.

4.1.23 Partner 23, Universidade de São Paulo, Brasil (USP)

The University of Sao Paulo (USP) is the largest university in Brazil, comprising 42 schools in all major fields, 6 specialized institutes, 4 museums and 4 hospitals. The USP academics encompass more than 5,800 faculty members, 30,000 graduate and 59,000 undergraduate students, and are responsible for 22% of the whole qualified science produced in Brazil. During the last 5 years, the USP has repeatedly ranked first in several different global rankings comparing all Ibero-American universities, and among the 100 top universities worldwide (as reported by the Times Higher Education ranking). The **Oceanographic Institute (IO)** and the **Centre for Marine Biology (CEBIMar)** are responsible for the bulk of teaching and research on Marine Sciences within the USP. The School of Arts, Science and Humanities (EACH) and the Institute of Biosciences (IB) also contribute to certain (ocean-related subjects. The enrollment of FUSP in regional and worldwide scientific networks is rapidly increasing, managing resources coming from EU projects (including NERC and INCO), private companies (such as Petrobras, StatOil) and other agencies within Brazil and abroad, with the USP being always the leading Brazilian institution in such partnerships.

Contribution to the project
USP **will coordinate the Case Study (SAMR)** under WP1 and will be active in all WPs related to the CS cycle (WP2,3,4,5,7) as well as in communication and training (WP8, WP9) and task responsible for T1.2.2. USP will contribute to seafloor, benthic and pelagic habitat mapping under WP3 and WP4. Participate to definition of ecosystem state and drivers in WP5 (T5.1, T5.2) and perform Management Strategy Evaluation for CS8 under WP7 (T7.3). USP will also coordinate WP8, contribute to the definition of the learning objectives in WP9 (9.1) and provide content for on-line training in T9.2. Finally will contribute to disseminate (T10.1) and exploit (T10.3) the results of Mission Atlantic acting as regional knowledge transfer ambassador in the project.

Profiles of the principal investigators
Prof. Maria Gasalla (female) holds a PhD in Oceanography, a MSc in Biological Oceanography and a BSc in Biology, and became a fisheries scientist after a 10-year position at a public research body in Brazil and scientific opportunities at international institutions (e.g. Canada, Spain, Denmark, Mexico and Argentina). She is a professor at the University of São Paulo's Oceanographic Institute (IOUSP) and head of the Fisheries Ecosystems Laboratory where interdisciplinary research and capacity building in contemporary fisheries science have been a focus. She is currently a researcher of the Brazilian National Research Council (CNPq) and associate of the Institute of Advanced Studies, and has also been serving as a member of scientific international committees related to the oceans, fisheries and global climate change (IMBER, CLIOTOP, Canada Research Council, UN-FAO) and of the Brazilian delegation in the United Nations Oceans Conference in New York. She participated in several international networks and projects (EU-INCO, Belmont Forum, NERC, ESPA, TBTI, GLOBEC, IUCN) focused on fisheries and marine ecosystems dynamics, and organized several international events, workshops, seminars and special issues in peer-reviews journals.

Dr. Aurea Ciotti (female) is a field optical oceanographer and coastal marine phytoplankton ecologist at the Centre of Marine Biology (CEBIMar – USP), who is interested in ocean color, both in situ and remote sensing, as tools to describe phytoplankton communities and primary production rates in coastal and oceanic waters, as well as benthic-pelagic interactions in nearshore subtropical environments. She is a member of the International Ocean Color Coordinating Group (IOCCG) and of the Scientific Committee on Oceanic Research (SCOR) working group 149 'Changing Ocean Biological Systems' (COBS). In the past 5 years she has coordinated projects funded by CNPq and FAPESP and initiated investigations on plankton fluorescence and metabolism. Dr. Ciotti will collaborate in WPs 3 and 5. Dr. Augusto A. V. Flores (male) is presently the Director of the CEBIMar - USP, and his research interests include (i) crustacean biology, (ii) the ecology of marine invertebrate larvae, and role in connectivity and recruitment strength in coastal habitats, and (iii) the dynamics of benthic communities, especially on rocky reef habitats. Over the past five years he has undertaken experimental research to examine the effects of heat waves on life-history traits of marine invertebrates. In this project, he intends to examine the effects of experimental warming on ecosystem functioning across multiple spatial scales, using the rocky intertidal zone as the focal habitat (WP5).

Dr. Luis Americo Conti (male) is Associate Professor of Geology at School of Arts, Sciences and Humanities (EACH) – University of São Paulo. His research interest includes short and long-term geological processes that have influencing seabed habitats, both in shallow shelf and deep-sea waters using geomatics tools and Geographic Information Systems. He is also involved in several Spatial Data Infrastructures projects, investigating approaches to building usable systems to facilitate and integrate data and metadata access and evaluation, especially for coastal and marine environments. Dr. Conti will collaborate in WP4 "Seabed Bathymetry & Benthic Habitat Mapping".
Relevant previous projects

- INCT-Mar IOC - Integrative oceanography and multiple uses of the continental shelf and the adjacent ocean (Brazilian Ministry of Science and Technology; 2012 to present)
- Global understanding and learning for local solutions (GULLS): reducing the vulnerability of marine-dependent communities (FAPESP/Belmont Forum; 2015 to present)
- Strategic analyses for ecosystem-based fishery management in the South Brazil Shelf Large Marine Ecosystem (CNPq; 2016 to present).

- The future of marine-dependent societies: climate change, inequalities and cooperation in complex socio-ecological systems (USP Provost of Research Office, Institute of Advanced Studies; 2016-2018)
- Mapping, Modelling and Monitoring Key Controls and Processes on cold water coral habitats in Submarine Canyons (MMMonKey_Pro). (Science Foundation Ireland (2018 to present)

Relevant Publications and products

- Vinagre C, Mendonça V, Cereja R, Abreu-Afonso F, Dias M, Mizrahi D, Flores AAV (2018) Ecological traps in shallow coastal waters - Potential effect of heat-waves in tropical and temperate organisms. PLoS One 13: e0192700
- Martins IM, Gasalla MA (2018) Perceptions of climate and ocean change impacting the resources and livelihood of small-scale fishers in the South Brazil Bight. Climatic Chang. 147: 441-456
- Gasalla MA, Rodrigues AR, Duarte LFA, Sumaila UR (2010) A comparative multi-fleet analysis of socio-economic indicators for fishery management in SE Brazil. Prog. Oceanogr. 87: 304-319
- Conti, L.A., Fonseca Filho, H. Turra, A. & Amaral, A.C. 2018 building a Local Spatial Data Infrastructure (SDI) to Collect, Manage and Deliver Coastal Information. Ocean and Coastal Management: DOI 10.1016/j.ocecoaman.2018.01.034
- Ciotti AM, Lewis MR, Cullen JJ (2002) Assessment of the relationships between dominant cell size in natural phytoplankton communities and the spectral shape of the absorption coefficient. Limnol. Oceanogr. 47: 404-417

Research facilities, infrastructures and equipment

Well-equipped operational lab space in virtually all domains of biological, physical, chemical and geological oceanography is available at the IO in its main building in the São Paulo City campus and in the two different coastal research stations (in Cananéia and Ubatuba), accommodating research teams, and providing boating services along the coast. Two research vessels (the Alpha Crucis, a 64 m long vessel for transoceanic operation, with an autonomy of 70 days and capacity for 21 researchers, and the Alpha Delphini, a 27 m long vessel for coastal and open-water operation, with autonomy of 10-15 days and capacity for 12 researchers are managed by the OI. The CEBIMar located by the coast of São Sebastião, hosts resident faculty staff. Two main research buildings are composed by several independent laboratory rooms provided circulating water, compressed air and adequate bench space for different indoor experimental needs. Boating services and specialized technical support for both lab and fieldwork is available. Combined the two units provide complete and real-time monitoring of atmospheric and oceanographic variables in the region, having FUSP as a common administrative service.

4.1.24 Partner 24, International Council for the Exploration of the Sea (ICES)

The International Council for the Exploration of the Sea (ICES) is a global science organization for enhanced ocean sustainability. ICES Science and Advice considers both how human activities affect marine ecosystems and how ecosystems affect human activities. In this way, ICES ensures that best available science is accessible for decision-makers to make informed choices on the sustainable use of the marine environment and ecosystems. ICES is a network of more than 5000 scientists from almost 590 institutes, with 1500 scientists participating in activities annually. ICES has a well-established Data Centre, which manages a number of large dataset collections related to the marine environment. The Data Centre provides marine data services to ICES member countries, expert groups, world data centres, regional seas conventions (HELCOM and OSPAR), the European Environment Agency (EEA), Eurostat, and various other European projects and biodiversity portals.

Contribution to the project

ICES contribution will be in WP2 (**Data and Information**), WP8 and WP9 (**Science Support**). ICES has extensive metadata and data related to the Atlantic area that will form part of the inventory developed in the project. Moreover, ICES shares the same vision as this project to make data available according to FAIR principles, and will fulfil this or ICES managed datasets related to the project, and provide input and guidance to the overall standards used by the Mission Atlantic. More specifically, ICES will work with the MBA and the ICES Working Group on Deepwater Ecology (WGDEC) to extend the current Vulnerable Marine Ecosystem (VME) data portal

into the South Atlantic. ICES in Mission Atlantic is also contributing to capacity building, cooperation and science diplomacy.

Profiles of the principal investigators:
Wojciech Wawrzynski (male), PhD in political economics; science diplomat; Head of **Science Support** at the International Council for the Exploration of the Sea (ICES), Copenhagen. Chair of the LME-LEARN Working Group on Ocean Governance Mechanisms. Serving also as lead support to the Atlantic Ocean Research Alliance Trilateral Aquaculture Working Group**.**
Neil Holdsworth (male) ICES Head of **Data and Information**. Working directly with the EEA and DG Environment on activities leading up to the MSFD implementation and WISE-Marine Partner in a number of large European marine projects related to data infrastructure (EMODnet Biology, EMODnet Chemistry, SeaDataNet, MicroB3). Member of the Marine Observation and Data Expert Group (MODEG) that advises DG-MARE on EMODNet development. Member of the Regional (Fisheries) Database (RDB-FIshFrame) steering group, representing the hosts of the RDB. Responsibility for the biological trawl survey data systems that provide data products to the Fisheries assessments (DATRAS).Neil also serves on a number of advisory boards for projects such as iMarine, EMODnet Atlantic, North Sea and Baltic Checkpoints, Norwegian Marine Data Centre (NMDC) and AquaCross.

Carlos Pinto (male) Carlos Pinto is a computer scientist and works as a lead developer in the ICES Data Centre. His has experience in implementing services for the organization and providing data services to partners like OSPAR, HELCOM, and NEAFC. The current projects he contributes to include Bycatch Database, Impulsive Underwater Noise register, development of stock assessment graphs, biodiversity database, SmartDots: an online international platform for age reading workshops and calibration, stomach database, ICES data portal, ICES library data mining, eggs and larvae data portal.

Alondra Sofia Rodriguez Buelna (female) –ICES Science supporting officer working with ecosystem observation steering groups. These groups deals with optimizing survey designs, evaluating new technologies for observation and the use of resulting data. As a supporting officer she manages the logistics between science groups and ICES secretariat. As a scientist she has participated in numerous surveys and monitoring projects.

Anna Davies (female) ICES events and training coordinator. Anna is in charge of the ICES Training Programme and the Annual Science Conference.

Relevant previous projects

- H2020 AORA-CSA – Atlantic Ocean Research Alliance Coordination and Support Action
- H2020 AtlantOS - Optimizing and Enhancing the Integrated Atlantic Ocean Observing System
- H2020 SeaDataCloud/Net - Further developing the pan-European infrastructure for marine and ocean data management
- H2020 PANDORA - Paradigm for Novel Dynamic Oceanic Resource Assessments
- FP7 EURO-BASIN - Integrated Project on Basin-Scale Analysis, Synthesis and Integration

4.1.25 Partner 25, Plymouth University's School of Biological and Marine Sciences , UK (UPL)

Plymouth University's School of Biological and Marine Sciences includes over 400 academics, research specialists and technical support staff, and has the broadest portfolio of marine expertise in Europe. In the UK's last Research Excellence Framework assessment, 85% of Plymouth's environmental science research submission was classified as world leading or internationally excellent and was in the top 10 for research power. Alongside Southampton, Cambridge and Oxford, PUMI has been the most successful University in the UK in terms of the number of peer-reviewed marine research papers produced. Since 2012 Plymouth University has participated in over 90 EU projects worth over 30m€. Current relevant projects include Pathways for Effective Governance of the English Channel (PEGASEAS), Valuing Ecosystem Services in the Western Channel (VALMAR). Previous relevant projects include the European Lifestyles and Marine Ecosystems (ELME FP6) and Knowledge Based Sustainable Management for Europe's Seas (KnowSeas FP7). The School has a strong track record in working at the science-policy interface of marine research.

Contribution to the project

UPL School of Biological and Marine Sciences will primarily contribute to WP4 conducting habitat suitability modelling and seafloor habitat mapping for specific case study areas. This will include the application of AI to seafloor image analysis. They will also contribute to WP2 developing a novel species image database to support all future AI work.

UPL also sits on the UK's One Ocean HUB Executive Team (concurrent to MISSION ATLANTIC, cf Letter of Support, Appendix) and assist the Executive Board in coordinating research effort (Task 10.3 Clustering) and minimising stakeholder fatigue (WP9) between the two parallel programmes.

Profiles of the principal investigators

Dr. Kerry Howell (female) is head of the Deep-Sea Conservation Research Group. She is a member of the International Council for the Exploration of the Sea's expert Working Group on Deep-Sea Ecology, the Deep Ocean Stewardship Initiative (DOSI) working group on capacity building in developing nations, and co-chair of the DOSI working group on the Decade of Ocean Exploration 2020-2030. Her research is focused on sustainable management of the deep-sea ecosystem, population connectivity, predictive habitat mapping and modelling. She has specialist skills in offshore and deep-sea biology including: species identification and distribution, species diversity, habitat distribution, human impacts and conservation concerns. She has recently been pioneering the use of artificial intelligence in benthic species identification (Piechaud et al., in prep). She is currently Principle Investigator (PI) on a £1.1 million nationally funded project looking at population connectivity in the deep-NE Atlantic, as well as working in the South Atlantic in the UK overseas territories or Ascension, St Helena and Tristan Da Cuhna, as well as an international partner on a South African nationally funded project concerned with management and habitat mapping of the South African EEZ.

Relevant previous projects

- DEEPLINKS - Influence of population connectivity on depth-dependent diversity of deep-sea marine benthic biota NE/KO11855/1 (funded by the UK's Natural Environment Research Council) – PI
- Vulnerable Marine Ecosystems (VMEs) – assessing and predicting their status and function in relation to fishing activities in the North Atlantic (funded by UK Government - DEFRA) – Co-I
- The application of predictive modelling to marine spatial planning associated with deep-sea mining (Funded by industry - UK Seabed Resources Ltd) - PI
- Use of predictive habitat modelling to assess the distribution and extent of selected Vulnerable Marine Ecosystems in the South Atlantic deep sea: (funded by UK Government - Blue Belt project). - PI
- DEEP FORESTS: Foundational Science to Benefits and Management of Deep Coral and Seaweed Habitats in South Africa (funded by National Research Foundation South Africa) – international partner organization

Relevant publications and products

- Dunn, D.C., Van Dover, C.L., Etter, R.J., Smith, C.R., Levin, L.A., Morato, T., Colaço, A., Dale, A.C., Gebruk, A.V., Gjerde, K.M., Halpin, P.N., **Howell, K.L.** et al. 2018 'A strategy for the conservation of biodiversity on mid-ocean ridges from deep-sea mining'. Science Advances, 4(7), p.eaar4313
- Woodall LC, Andradi-Brown, DA, Brierley AS, Clark MR, Connelly D, Hall RA, **Howell KL,** Huvenne VAI, Linse K & Ross RE 2018 'A Multidisciplinary Approach for Generating Globally Consistent Data on Mesophotic, Deep-Pelagic, and Bathyal Biological Communities' Oceanography.
- Ross RE, Nimmo Smith WAM & **Howell KL** 2017 'Towards 'ecological coherence': assessing larval dispersal within a network of existing Marine Protected Areas' Deep-Sea Research Part I.
- **Howell, K.L.**, Piechaud, N.,Downie, A.L., Kenny, A. (2016) The distribution of deep-sea sponge aggregations in the North Atlantic and implications for their effective spatial management. Deep Sea Research Part I, 115: 309–320.
- Ross.,R, **Howell, K.L.** (2013) Use of predictive habitat modelling to assess the distribution and extent of the current protection of 'listed' deep-sea habitats. Diversity and Distributions. 19(4), 433-445.

Research facilities, infrastructures and equipment

UPL has invested heavily in marine science capacity, including a £19M Marine Building, refurbished labs and a new £4M waterside Marine Station. The marine building houses the Coastal, Ocean and Sediment Transport (COAST) laboratory, which has the capability to generate short and long-crested waves in combination with currents at any relative direction, sediment dynamics, tidal effects and wind. UPL own and operate a variety of robotic and autonomous marine vehicles including a 1000m rated ROV, and an autonomous surface vehicle ASV. In addition PUMI houses a High Performance Computing (HPC) facility that is critical in the development of large scale models.

4.1.26 Partner 26, South African National Biodiversity Institute, South Africa (SANBI)

The South African National Biodiversity Institute was established in terms of section 10(1) of the National Biodiversity Management: Biodiversity Act (Act No. 10 of 2004). SANBI's mandate is informed by the Biodiversity Act and its primary purpose is to lead and coordinate research, and monitor and report on the state of biodiversity in South Africa. The institute provides knowledge and information, gives planning and policy advice and pilots best-practice management models in partnership with stakeholders. SANBI must act as an 1) advisory and consultative body on matters relating to biodiversity to organs of state and other biodiversity stakeholders, 2) must co-ordinate and promote the taxonomy of South Africa's biodiversity, 4) must collect, generate, process, co-ordinate and disseminate information about biodiversity and the sustainable use of indigenous biological resources and establish and maintain databases in this regard, 5) must undertake and promote research on indigenous biodiversity and the sustainable use of indigenous biological resources. SANBI must 1) coordinate and implement programmes to 1) rehabilitate ecosystems, 2) involve and engage civil society. SANBI is also expected to act as advisory body when it comes to matters related to the identification of bioregions and contents of bioregional plans and biodiversity planning. The SANBI's programme of work related to the marine environment spans across the science-policy continuum. SANBI currently leads the Deep Forests project (funded by the National Research Foundation's African Coelacanth Ecosystem Programme, NRF-ACEP http://www.saiab.ac.za/deep-forests.htm) which has strong links to the Mission Atlantic Project and will co-fund some of the proposed work. The Deep Forests project focuses on the taxonomy, phylogeny, habitat, ecology and benefits of deep coral habitats in South Africa and includes seafloor mapping and predictive habitat modelling work. The Deep Forests project aims to contribute to knowledge on priority marine ecosystems and habitat forming species with a key contribution to local and international barcoding initiatives. Results from the Deep Forests project will be applied in the South African National Biodiversity Assessment, Marine Spatial Planning (including the delineation of Ecologically and Biologically Significant Areas), and fisheries monitoring and eco-certification.

Contribution to the project

SANBI will contribute National data for fisheries, mining and shipping (Kerry Sink and Megan van der Bank) in Task3.2, and significantly contribute to WP4 with broad scale habitat maps, anthropogenic pressures, and future distribution of selected vulnerable benthic habitats for the CS Benguela Current, in collaboration with nationally-funded Deep Forests programme. SANBI aims to host a WP5 workshop on marine ecosystem assessment and tipping points with a strong focus on formulating guidelines of how to establish thresholds of marine ecosystem condition to inform management and policy. SANBI will also contribute to "*T2.1 Scanning the Seascape*" and contribute to the development of a Vulnerable Marine Ecosystem (VME) database for the South Atlantic in T2.3. As a South African representative SANBI will assist UCT in mobilising stakeholder participation both in WP1's CS Benguela Current, and T10.2 Atlantic FORUM, as well as produce a video targeting the public on complexities of IEA research & operationalisation.

Profiles of the principal investigators

Dr Kerry Sink (female) is the Project Lead within SANBI. Kerry is current programme manager and lead scientist of the SANBI Marine Programme with over 20 years of work experience in the South African marine sector. Kerry is currently the scientific lead on the marine realm for the South African National Biodiversity Assessments which aim to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA is central to SANBI's mandate to monitor and report regularly on the status of the country's biodiversity. The NBA deals with all three components of biodiversity: genes, species and ecosystems; and assesses biodiversity

and ecosystems across terrestrial, freshwater, estuarine and marine environments. Andrew Skowno will be involved in WP1 towards integrated ecosystem assessment as well as WP3, WP4, WP5, WP7 and WP10.

Dr Andrew Skowno (male) is a scientists within SANBI. Andrew has formal training in ecology and systematic conservation planning with over 18 years of work experience in the biodiversity sector. He specializes in the use of GIS in systematic assessment, planning, protected area management and ecology. Andrew is currently the scientific lead for the South African National Biodiversity Assessments which aim to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA is central to SANBI's mandate to monitor and report regularly on the status of the country's biodiversity. The NBA deals with all three components of biodiversity: genes, species and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. Andrew Skowno will be involved in WP1 towards integrated ecosystem assessment as well as WP3, WP4, WP5, WP7 and WP10.

Miss Kaylee Smith (female) is a PhD student at the Nelson Mandela University in South Africa, with a research background in marine ecophysiology and ecology. Since completing her MSc on intertidal coral ecophysiology in KwaZulu-Natal she worked as part of the Reef Rescuers team (Nature Seychelles) in the Seychelles and then completed a year's internship through the NRF-DST program, hosted at the South African Environmental Observation Network (SAEON) in Grahamstown. Her current doctoral research includes identifying and developing indicators to assess ecosystem condition, using rocky reefs as a case study. This will also contribute to the South African National Biodiversity Assessment (NBA) as we aim to ground truth and test current assessments of ecosystem condition at multiple scales. Her role will be to contribute to discussions of the WP1, with focus at fine-scale assessments. More so her role will be to coordinate and participate in the WP5 workshop regarding multi-scale ecosystem condition assessments and tipping points (WP1, WP5.2 & WP5.3).

Dr Jock Currie (male) is a post doctoral researcher in the Marine Programme at SANBI (supervised by KJ Sink). Dr Currie completed a PhD on change in demersal fish communities and holds a Claude Leon Fellowship to build on this work to examine habitat changes linked to demersal trawling. Dr Currie is contributing to the Marine Chapter of South Africa's National Biodiversity Assessment in terms of pressure mapping, ecosystem condition assessment and ecosystem threat status. Dr Currie will be to contribute to discussions of WP1, focused on national and site specific assessment, WP5 (WP5.2 & WP5.3) and WP10. He currently represents SANBI in an International Marine Bioregionalisation project led by CSIRO.

Miss Siyasanga Miza (female) is employed at SANBI as Researcher with more than 7 years' work experience. Over the last few years she has been part of a technical task team that works to provide advice on the proclamation of 22 Marine Protected Areas in South Africa's Exclusive Economic Zone (EEZ) to the National Department of Environmental Affairs; specifically involved in stakeholder engagements. She has been involved in the NRF-FBIP Seakeys Project which aimed to expand our foundational knowledge of marine biodiversity through biodiversity mainstreaming and citizen science projects. Miss Miza is working on a benefits from marine biodiversity project which is linked to the South African Deep Forests Project (Led by Dr Kerry Sink) on the use of marine species for food, traditional medicine and magic in the South African Xhosa and Zulu cultures. Her role in Mission Atlantic will involve public communication, outreach, awareness and working at the science-policy interface (WP 10.1).

Miss Megan van der Bank (female) is employed at SANBI as Marine Biodiversity Coordinator with over 7 years work experience in marine ecology, marine protected area design and management and project management. Her role in the project will involve institutional project coordination and management. She will also be involved in WP3.2, WP4.3 and WP5.

Miss Mari-Lise Franken (female) is employed by the Nelson Mandela University and is based at SANBI as Researcher and Projects Manager with 5 years' work experience in marine ecology, marine ecosystem classification and project management. Ms Franken is starting her Masters which is linked to the South African Deep Forests Project (Led by Dr Kerry Sink) on the identification of vulnerable marine ecosystems in the South Africa's ocean space. Her role in the project will involve development of a Vulnerable Marine Ecosystem (VME) database and an image reference guide to benthic organisms for the South Atlantic (WP2) and model future distribution of selected vulnerable benthic habitats (vulnerable marine ecosystems) (WP4.4). She will also be involved in WP7.

Relevant previous projects

- One Ocean Hub Deepsea Work Package (2019-2024)
- NRF-ACEP Deep Forests Project (2017-2020), is a multi-disciplinary nationally funded project, led by SANBI, and including University Plymouth (UOP). The programme aims to build capacity and the knowledge economy covering priority marine ecosystems and habitat forming species. The concurrent project contains a significant seafloor mapping element complimentary to WP4. The results will be applied in the National Biodiversity Assessment, Marine Spatial Planning (including the delineation of VMEs and Ecologically and Biologically Significant Areas), and fisheries monitoring (Andrew Skowno and Mari-Lise Franken)
- NRF-ACEP, Deep Secrets: The outer shelf and slope ecosystems of the Eastern Cape (2015-2018)
- NRF-FBIP Seakeys Project: Unlocking marine biodiversity knowledge (2014-2018)
- South African National Biodiversity Assessment (2018/2019)

Relevant publications and products

- Sink *et al.* 2019. Chapter 3: Marine Ecosystem Classification and Mapping. In National Biodiversity Assessment 2018 Technical Report Volume 4: Marine Realm. Sink KJ, Majiedt PA, van der Bank MG, Harris L, Atkinson L, Kirkman S, Karenyi N (eds). South African National Biodiversity Institute, Pretoria.
- Skowno, A.L., Poole, C.J., Raimondo, D.C., Sink, K.J., Van Deventer, H., Van Niekerk, L., Harris, L.R., Smith-Adao, L.B., Tolley, K.A., Zengeya, T.A., Foden, W.B., Midgley, G.F. & Driver, A. 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria.
- Botts EA, Pence G, Holness S, Sink K, Skowno A, Driver A, Harris LR, Desmet P, Escott B, Lötter M, Nel J. (2019) Practical actions for applied systematic conservation planning. Conservation Biology. Early view online. doi.org/10.1111/cobi.13321
- Harris, L.R., Holness, S., Finke, G., Kirkman, S., Sink, K. 2019. Chapter 4: Systematic Conservation Planning as a tool to advance Ecologically or Biologically Significant Area and Marine Spatial Planning processes. In: Zaucha, J. & Gee, K. (Eds) Maritime Spatial Planning. Palgrave Macmillan, Cham. Pp 71-96.
- Kirkman, Stephen P., Stephen Holness, Linda R. Harris, Kerry J. Sink, Amanda T. Lombard, Paulus Kainge, Prideel Majiedt, Silvi E. Nsiangango, Kumbi K. Nsingi, and Toufiek Samaai. 2019. Using Systematic Conservation Planning to support Marine Spatial Planning and achieve marine protection targets in the transboundary Benguela Ecosystem." Ocean & Coastal Management 168: 117-129.
- SANBI & UNEP-WCMC (2016) Mapping biodiversity priorities: A practical, science-based approach to national biodiversity assessment and prioritisation to inform strategy and action planning. UNEP-WCMC, Cambridge, UK.
- Skowno A., Holness S., Botts E., Driver A., Sink K., Botha M., Daniels F., Desmet P., Manuel J., Maze M., Nel J, Smith T. (submitted) The development and policy integration of South Africa's Red List of Ecosystems. Submitted to Biological Conservation.
- Botts E, Driver A, Skowno A, Holness S, Sink K, Botha M, Daniels F, Desmet P, Manuel J, Maze M, Nel J, Smith T, Harris L, Lloyd S, Pence G. (submitted) Trends in South African systematic conservation plans over 27 years reveal lessons about implementation. Submitted to Conservation Biology.
- Currie, J. C., Sink, K. J., Attwood, C. G., Atkinson, L. J., & Engelhard, G. H. (2018). Reconstructing the past: design and function of Granton otter trawl gear at the turn of the twentieth century, as used in South Africa's first trawl surveys (1897–1904). ***Maritime Studies***, 1-16. https://doi.org/10.1007/s40152-018-0095-7

4.1.27, Partner 27, Fisheries and Marine Institute of Memorial University, Canada (MUN)

The Fisheries and Marine Institute of the Memorial University of Newfoundland (Marine Institute) is a centre of advanced marine technology, education, and training. Program activities at the Marine Institute (MI) are organized around three schools - the School of Ocean Technology (SOT), the School of Maritime Studies (SMS), and the School of Fisheries (SOF) - and the Department of Ocean Safety, all of which are supported by the Division of Academic and Student Affairs (ASA). The School of Ocean Technology (SOT) promotes the growth of the ocean technology sector through education, training, applied research, technology transfer, and community engagement while supporting Newfoundland and Labrador's burgeoning ocean technology cluster. As new technology continues to shape the ocean industries of the future, SOT and its Centre for Applied Ocean Technology (CTec) continue to play a critical role in educating and training highly qualified people while leading research and development initiatives to support the growth of these industries. The SOT offers graduate programming in technology management, a bachelor's degree in technology, and diploma programs in underwater vehicles, ocean mapping and remotely operated vehicles. CTec collaborates with ocean industries on the development and application of technology for the practical benefit of all sectors of the maritime community. Its overriding goal is to enhance the safety, efficiency, sustainability and profitability of maritime pursuits through the application of technology as a bridge between knowing and doing. As SOT remains current with needs of the ocean technology industry, MI is able to offer the range of programs required to help meet the varying needs of individuals and industry. Programs address the various careers paths required for industry, which is accomplished by being nimble, proactive, innovative and, most importantly, aware of the industry to which we serve.

Contribution to the project

MI/ MUN will coordinate and contribute to the following work packages, particularly WP4: Seabed Bathymetry & Benthic Habitat and Biodiversity Mapping, the school of ocean technology is committed to training HQPs in technical competencies of ocean mapping and will provide undergraduate and graduate students for mobility purposes. By providing paid scholarships to students and giving them opportunities to join international research cruises adds to the capacity building of the next generation ocean data professional. Continuing in this them MI/MUN will collaborate on WP8: Building Capacity supporting an ecosystem-based approach to management of Atlantic resources providing leadership and advisory capacity to cross community collaboration. Provide access to undergraduate and graduate students as future science and technical expertise to the long term viability of IEA. Share doctoral or post-doctoral candidates in collaboration with EU universities. Provide guidance and leadership in case study prioritization and mission panning. Act in an advisory role on technology and feasibility of mission for data collection. Will have students at undergraduate and graduate levels that would participate in student exchange with EU partner universities.

Profiles of the principal investigators

Paul Brett (male) is the Head School of Ocean Technology at the Fisheries and Marine Institute of Memorial University in St. Johns NL Canada. The School of Ocean Technology (SOT) is charged with the responsibility of developing and delivering education and training and applied research and development programs in various aspects of ocean technology. Mr. Brett holds a Master of Science (Geography) from Memorial University of Newfoundland, as well as an undergraduate degrees in Education (post-secondary), Physics, and Geography. Paul is a specialist in Geographic Information Systems (GIS) and remote sensing, he has widespread experience working with synthetic aperture radar (SAR), multispectral imaging, Multi-beam sonar, side scan sonar, and geographic information systems application and development. Most of his career has been involved in ocean related education research and exploration, with particular emphasis on attracting youth to the exciting field. Mr. Brett would like to run as a board member bringing 25 years of educational leadership to the network. He is an active member of AORA Atlantic seabed mapping international working group and would provide insight and leadership to mapping inititives. This will aslso be augmented with his role of Chair of Chair Canadian Ocean Mapping research and education Network. (COMREN)

Richard Rivkin is a University Research Professor in the Department of Ocean Sciences at Memorial University of Newfoundland. His interests and expertise are broadly interdisciplinary with research experience in biological oceanography, aquatic and systems ecology, phytoplankton and microbial physiology and ecology and oceanic biogeochemistry. At one extreme (i.e. the global-scale), Professor Rivkin has characterized the basin-to-

global scale distributions of heterotrophic and autotrophic processes and properties in order to assess and model organic carbon cycling, remineralization and export in the upper water column of the World Ocean. He has been an expert review for many international research programs and has served on the advisory or steering committees for several national and international oceanographic programs (e.g. Canadian JGOFS, GEOTRACES, SOLAS, North Water Polynya, Canadian IPY). He is also currently co-chairs an ICES/PICES Expert Group on ocean carbon sequestration. He will aid in indicator identification in MISSION Atlantic.

Relevant publications and products

- **Brett P.M**. (1996). Remote Sensing and the Use of NOAA AVHRR date; A method for the detection and analysis of wind induced upwelling zones. Honours dissertation, QEII library Memorial University of Newfoundland.
- **Brett, P. M.** (2004) SAR Image Classification of First – Year Ice Types, Bay D'Espoir, Newfoundland and Labrador. Masters Thesis, QEII Library Memorial University of Newfoundland.
- Grant, Scot M. , W. Hiscock, and **P. Brett** (2005) Mitigation of Capture and Survival of Wolffish Captured Incidentally in the Grand Bank Yellowtail Flounder Otter Trawl Fishery. Center for Sustainable Aquatic resources, Fisheries and marine Institute of Memorial University of Newfoundland.P-136
- Sjare, Becky, K. Regular, and **P. Brett** (2008) Monitoring Climate Related Changes in the Availability of Ringed Seal Pupping Habitat in Coastal Labrador.
- Legendre, L. and **Rivkin**, R. B. 2005. Integrating functional biodiversity, food-web processes and biogeochemical carbon fluxes into a conceptual approach for modeling the upper ocean in a high-CO2 world. Journal of Geophysical Research- Oceans. 110, C09S17, doi:10.1029/2004JC002530

4.1.28 Partner 28, AIR Center (AIRC)

The Atlantic International Research Center (AIR Center) is an international distributed research organisation focusing on transatlantic scientific collaboration and innovation, with particular attention to both sides of the tropical and South Atlantic area. Its main purpose is to address the challenges of developing a more integrated and connected sustainable blue-economy in the Atlantic basin. AIR Centre focuses on enhancing scientific and technological collaboration between public and private entities in a wide range of areas related to the marine and maritime environment, based on a network with the capacity to attract scientists and technology-based companies. It aims to accelerate the generation and flow of knowledge of excellence and its valuation in the field of blue economy, including aspects such as climate change, food and energy security, circular economy, maritime technologies and the conservation of marine natural resources. The target is to improve the development of large-scale joint initiatives, projects and integrated actions, taking advantage of synergies of existing and connected distributed infrastructures, institutions and resources in the Atlantic region. The United Nations agenda for 2030 is an important reference for AIR Centre, which works to achieve its objectives, developing effective, viable capacities, knowledge and technologies for the region. It aims to improve the mutual understanding and collaboration of countries, regions and entities connected by the Atlantic Ocean, by strengthening cooperation with the European Union and by harnessing the capabilities of its outermost Atlantic territories. Ultimately, it seeks to materialise the benefits of the blue economy in the Atlantic, promoting the skills, knowledge and technological solutions necessary to address this social and economic challenge. From a geopolitical point of view, the AIR Centre initiative has been led by Portugal with the collaboration of Spain, as well as several other countries involved to varying extent. It intends to be an additional instrument to develop in its greater dimension the transatlantic partnership that will be the agreement of Belem, established by the European Union to counterbalance the framework of cooperation generated from the Galway Statement.

Contribution to the project

AIRC will contribute to WP 8: Building Capacity supporting an ecosystem-based approach to management of Atlantic resources, and to WP9: Societal engagement and communication. AIRC's main effort will be in the field of Cooperation and Science Diplomacy (Task 9.2), which is in the DNA of the organisation. In particular, AIRC will ensure articulation of the All Atlantic Forum with the ongoing governmental-level efforts in AIRC partner countries, as well as proactively seeking to integrate Mission Atlantic in the high-level events organized. In particular, representation in the High-Level Industry-Science-Government Dialogues (HLD) held during the project duration will be ensured. These are the flagship events of the AIR Centre, involving representatives on a

ministerial level from several Atlantic countries. Also solid input to Task 8.1 Future human capacity & Learning Objectives through its strong presence in African countries and Brazilian states, as well as contributing to its content validation will be part of AIRC's role. This includes an effective communication of the project's Training Program (Task 8.2) and Mobility & PhD Network (Task 8.3) within its network.

Profiles of the principal investigators

Jose Luiz Moutinno (male) is the Business Developer of AIR Centre, and has been a key part of the AIR Centre Implementation team of AIR Centre during 2018. Graduated in Biology at the Federal University of Rio de Janeiro in 1981, he obtained the degree of Architect in 1988 from the University of Santa Ursula in Rio de Janeiro. He completed his master's degree in "Engineering Policy and Management of Technology" at IN + Instituto Superior Técnico in 2005 and has extensive experience with technical services in the countries of the Southern Hemisphere, especially Angola where he worked for 5 years in the area of computer security for government entities. In 1995, he created the first Portuguese Internet company, Tinta Invisível, which became one of the market leaders, before merging with other companies that were successively bought by the multinational Cemex. In 2007, he created the company Mirror Neurons, specialized in innovation, research and development in the service area. Until 2017 he has worked in the company Neutrons in Angola, connecting people and relevant know-how.

Dr. Tânia Li Chen (female) is a Project Officer and has been the office coordinator of the AIR Centre Implementation team. Graduated in Applied Biology (Animal Resources, variant: Marine Resources) from the University of Lisbon, Portugal, and holds a PhD in Biochemistry and Molecular Biology from the University of Maine, USA. Her experience as a research assistant (University of Southern Maine, USA) focused on Marine Environmental Toxicology, and was involved in sea expeditions, such as in the Gulf Of Mexico after the Deepwater Horizon Explosion in 2010. She has significant experience in project management and has actively participated in science communication activities.

Relevant publications and products:

- Solubility of aerosol trace elements: Sources and deposition fluxes in the Canary Region, Atmospheric Environment. López-García, P., M. D. Gelado-Caballero, C. Collado-Sánchez, and **J. J. Hernández-Brito** (2017), 148, 167-174.
- Chapter 12-The EU-Project "TROPOS", Papandroulakis, N., C. Thomsen, K. Mintenbeck, P. Mintenbeck, and **J. J. Hernández-Brito** (2017), in Aquaculture Perspective of Multi-Use Sites in the Open Ocean edited by B. H. B. a. R. Langan, Springer International Publishing AG 2017.
- Underwater Electromagnetic Sensor Networks—Part I: Link Characterization. Quintana-Díaz, G., P. Mena-Rodríguez, I. Pérez-Álvarez, E. Jiménez, B.-P. Dorta-Naranjo, S. Zazo, M. Pérez, E. Quevedo, L. Cardona, and **J. J. Hernández-Brito** (2017), Sensors, 17(1), 189.
- Smart and networking underwater robots in cooperation meshes: the swarms. ECSEL: H2020 project, Real-Arce, D. A., T. Morales, C. Barrera, **J. Hernández-Brito**, and O. Llinás (2016), paper presented at Instrumentation viewpoint, SARTI. http://hdl.handle.net/2117/99762
- Global assessment of cadmium concentrations in the skin of free-ranging sperm whales (Physeter macrocephalus), L.C. Savery, **T. Li Chen**, J.T. Wise, S.S. Wise, C. Gianios Jr., J. Buonagurio, C. Perkins, C. Falank,, T. Zheng, C. Zhu, J.P. Wise Sr., Comp Biochem Physiol C Toxicol Pharmacol (2015), 178: 136-144.

Research facilities, infrastructures and equipment

AIR Centre's scientific and technological activities are performed primarily through its network consisting of well-established institutions in the respective fields. Several leading Spanish Research Institutes area articulated with PLOCAN as main representative of the Spanish node of AIR Centre: Instituto Español de Oceanografía - IEO; CSIC - Spanish National Research Council; Barcelona Supercomputing Center - BSC; Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas - CIEMAT; Instituto Astrofísica de Canarias - IAC; Centro para el Desarrollo Tecnológico Industrial - CDTI; EIT Climate-KIC Spain. These provide a wide range of know-how, equipment and research infrastructures - including research vessels, autonomous vehicles, tank facilities, an

offshore research platform and supercomputing facilities.
For Portugal, the Collaborative Laboratories CoLAB +ATLANTIC (Earth Observation and Energy) and CoLAB DTX (Data Science) are the key pillars on National level. These CoLABS have been recently created to join the capacities of industry and academics to build National Competence Clusters focused on Earth Observation and Marine Technology, Energy and Data Science. Significant access to observation equipment and networks is also provided. Further, MoUs with the following institutions have been signed, having in view the mutual use of resources and increasing levels of collaboration: UNOOSA (together with Portuguese Ministry of Science and Technology), INPE (BR), PSU (Pennsylvania State, USA), UFRJ (Rio de Janeiro Federal University, BR), GEO Blue Planet, GEO MBOM, LifeWatch ERIC. In late 2018, a Letter of Intent for Infrastructure Collaboration within AIR Centre was signed between EMBRC-ERIC, EMSO-ERIC, LifeWatch ERIC and Sintef (NO), extending further the large range of AIRC's data and knowledge access options.

4.1.29 Partner 29, Maritime Robotics, Norway (MROB)

Maritime Robotics is a leading provider of innovative unmanned solutions for maritime operations in harsh environments. With technology developed in close collaboration with both civilian, governmental and military partners, Maritime Robotics focuses on delivering high-quality system solutions and products that are cost-efficient, reduce HSE risk exposure and are highly deployable, in any conditions. Our technologies and products operate unmanned in the air and on the surface and can gather data ranging from air to subsea. We believe that the future of maritime operations will enable more unmanned data Acquisition, driving industry standards and continually broadening operational possibilities. Our headquarters is situated in Norway's technology capital, Trondheim, staffed by a highly competent team of engineers and personnel, with a global network of clients and partners. Maritime Robotics is a channel partner for Liquid Robotics and the authorized distributor for Scandinavia.

Contribution to the project

Maritime Robotics expertise is unmanned vehicles for maritime data acquisition and our contribution will be to contribute with 'Wave Glider Unmanned Surface Vehicles (USV) system and operations and to integrate various project relevant data acquisition sensors on to them. Through the Research Council of Norway, DEMO2000, GLIDER project, currently in its third year, Maritime Robotics has extensive experience operating the Wave Glider equipped with a SIMRAD WBT Mini fisheries and towed hydrophones. The MISSION ATLANTIC project would be an opportunity for Maritime Robotics to further develop the
integration of these sensors on the Wave Glider and continue the relevant collaborations that the GLIDER project formulated. Maritime Robotics will provide acquisition services with a Wave Glider, integration of sensors into a custom payload, in field deployment and recovery services, piloting services, Data Storage and Visualization Services – Subcontracted through the GLIDER project organization a Sensor Package (WBT Mini, Transducers, other sensors as requested – Rented through the GLIDER project organization

Profiles of the principal investigators

Joel Pederick (male) Operations Manager for Maritime Robotics, leading a team of Unmanned Surface Vehicle (USV) operators as well as an experienced Project Manager. Joel has degrees in Geomatics (B. Geom) and Environmental Science (B .Sc.) from The University of Melbourne, and a NEBOSH International Diploma in Occupational Health and Safety. He joined Maritime Robotics in 2017 after 18 years working with Schlumberger WesternGeco globally in a number of diverse roles, including in HSQE Advisor, Product Champion for Marine Operations, and Party Manager of Seismic Research Vessels operating in Brazil, USA, Saudi Arabia and Canada. Joel started operating Wave Gliders in 2010 with Schulmberger as Product Champion for a project to use Wave Gliders with towed acoustic arrays for seismic data acquisition. He is a member of IOSH and the Australasian Hydrographic Society.

Dr. Stephanie Kemna (female) is a software engineer and project manager at Maritime Robotics AS. She obtained a B.Sc. and M.Sc. in Artificial Intelligence from the University of Groningen (2008), and a PhD in Computer Science from the University of Southern California (2018), focusing on multi-robot strategies for adaptive informative sampling using autonomous underwater vehicles. This work was applied to algal bloom mapping and monitoring for aquatic ecosystems. From 2009-2012, she worked at the NATO STO Centre for Maritime Research and Experimentation, for the Collaborative ASW (CASW) programme. The CASW

programme was awarded the 2017 NATO STO Scientific Achievement Award for their contributions to "Development and Demonstration of Networked Autonomous ASW". She has 10 years of experience developing adaptive behaviors, autonomy, and mission planning for aquatic robots.

Relevant publications and products

- Fung, N., Rogers, J., Nieto, C., Christensen, H. I., **Kemna, S.**, & Sukhatme, G. (2019). Coordinating multi-robot systems through environment partitioning for adaptive informative sampling. In 2019 International Conference on Robotics and Automation (ICRA), pp. 3231-3237.
- **Kemna, S.**, Heidarsson, H., & Sukhatme, G. S. (2018). On-board Adaptive Informative Sampling for AUVs: a Feasibility Study. In *OCEANS 2018 MTS/IEEE Charleston*: p.1-10.
- **Kemna, S.**, & Sukhatme, G. S. (2018). Surfacing strategies for multi-robot adaptive informative sampling with a surface-based data hub. In *OCEANS 2018 MTS/IEEE Charleston,* pp. 1-10.

4.1.30 Partner 30, University Bremen, MARUM, Germany (UBH)

MARUM is the first research faculty at the University of Bremen also offering a number of technical and scientific services and developing innovative ocean technology in support for scientific operations, including the operation and development of AUV capabilities for deep sea mapping. MARUM also hosts the largest out of three IODP core repositories with >150 km of core from DSDP times to present from the Atlantic and Arctic Ocean, Mediterranean, Black and Baltic Seas, and is partner in the ECORD Science Operator. All mission-specific Onshore Science Parties are hosted at MARUM, and more than 200 visitors annually from all over the world come to the IODP Bremen Core Repository (BCR). Within the last decade MARUM became one of the leading groups in Germany and Europe to develop and operate sophisticated leading edge technologies for marine science applications. A broad spectrum of technological developments ranging from subsea to shore data telemetry (using a combination of underwater acoustics and satellite communication), sensor integration and data processing (optical, acoustic,…) to the development of entire sensor platforms (buoyancy driven vertical profiler, Seafloor drill system MeBo70 and 200, underwater glider, Seafloor crawler, etc.). MARUM hosts specialized workshops for electronic and mechanical development work. Special test facilities like a test basin and a large high-pressure chamber for instrument testing under in-situ pressure are owned by the Department of Geosciences. Two deepsea workclass ROV system with a maximum deployment depth of 4000 m and 2000m respectively are currently available scientific and technology developments. These systems are the core vehicles where additional scientific payload as well a technological prototypes can be tested in order to advance towards achieving the scientific and technological demands of the future. A deep diving Explorer class AUV with a depth rating of 5000 m is equipped with high-resolution sonar mapping systems complements the fleet of seagoing technology. This AUV, together with MARUM's operational expertise is going to be a major resource for the development of a working docking interface. MARUM recently acquired a small coastal vessel, suitable for prototype testing in a coastal setting. MARUM's operational and technological R&D experience with ocean going systems, manned and unmanned, combined with the available above described extensive work class infrastructure makes it an ideal partner to complement the individual strength of the other partners in this proposal.

Contribution to the project

UBH MARUM will lead DEMO IV and contribute to WP4 acquiring seafloor images for ground truthing of seafloor classification for benthic habitat assessment approaches and seafloor habitat including the development of an ultra-low power imaging system operated underwater gliders. We will further contribute to WP2 Data management, sharing and inter-operability (FAIR principle) and to WP8, building new capacities to support ecosystem-based marine resource management.

Profiles of the principal investigators

Prof. Dr. Ralf Bachmayer (male) holds Professorship for Marine Environmental Technologies and Deepsea Engineering at the Center for Marine Environmental Sciences (MARUM) of the University of Bremen, Germany. He also holds an appointment as an adjunct professor in the Faculty of Engineering and Applied Science at Memorial University of Newfoundland in St. John's, Newfoundland, Canada. Prior to leaving Memorial University as an associate Professor he was leading the observational stream (Module O) of the Ocean Frontier Institute (OFI) a collaboration between Dalhousie University, Memorial University of Newfoundland and the University of Prince Edward Island. His main research interests lie in the domain of marine robotics with a focus on autonomous marine

observation systems and autonomous marine vehicles. In particular he is interested in the design, dynamics, control and navigation of autonomous underwater vehicles and gliders. His research activities are targeted towards enabling long-term unmanned operations in harsh environments such as the deep sea and the North West Atlantic. He has a long experience as a researcher at major international research centers and since 2017 he is leading the Innovation Center for Deep-Sea Environmental Monitoring at MARUM.

Relevant Previous Projects

- EU-Projects EUROFLEETS I + II: Transnational Access (TNA) of infrastructure and Joint Research Activities (JRA) focused on hardware/software developments (photo mosaicking, 3D reconstruction, 3D Stereo UW camera systems) amongst project partner.
- MERSEA (Marine Environment and Security for the European Area – IP), ANIMATE (Atlantic Network of Interdisciplinary Moorings and Timeseries for Europe): Focus on multiyear operation of fixed open ocean mooring sites with implemented data transmission (ESTOC, PAP, Denmark Strait).
- Hybrid-ROV: Development of a 6000 m rated battery powered hybrid ROV (H-ROV).

Relevant publications and products

- Zhou, M., **Bachmayer, R**., de Young B. (2019), "Mapping the underside of an iceberg with a modified underwater glider." Journal of Field Robotics. 1–16. https://doi.org/10.1002/rob.21873.
- Zhou, M., **Bachmayer, R**. and DeYoung, B. (2019), "Working towards Adaptive Sensing for Terrain-aided Navigation". In proceedings of the 2019 International Conference on Robotics and Automation (ICRA), 3450-3456, 2019.
- Howatt, T., Palter, J., Matthews, R. J. B.; De Young, B.; **Bachmayer, R**., Claus, B. (2018), "Ekman and Eddy Exchange of Freshwater and Oxygen across the Labrador Shelf Break", Journal of Physical Oceanography, 48, 5, 1015-1031, 2018.
- Crise, A. M., Ribera D'Alcala, M., Mariani, P., Petihakis, G., Robidart, J., Iudicone, **D., Bachmayer**, R., Malfatti, F. (2018), "A conceptual framework for developing the next generation of Marine OBservatories (MOBs) for science and society", Frontiers in Marine Science, 5, 318,2018.
- De Young, Brad; von Oppeln-Bronikowski, N., Matthews, R. B. J. , **Bachmayer, R.** (2018), "GLIDER OPERATIONS IN THE LABRADOR SEA", Journal of Ocean Technology, 13, 1, 2018.
- Zhou, M., **Bachmayer, R**. and DeYoung, B. (2017), "Underwater acoustic-based navigation towards multi-vehicle operation and adaptive oceanographic sampling." In Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

4.1.31 Partner 31, World Maritime University, Sweden (WMU)

World Maritime University (WMU) in Malmö, Sweden is a postgraduate maritime university founded by the International Maritime Organization (IMO), a specialized agency of the United Nations. Established by an IMO Assembly Resolution in 1983, the aim of WMU is to further enhance the objectives and goals of IMO and IMO member states around the world through education, research, and capacity building to ensure safe, secure, and efficient shipping on clean oceans. WMU is a United Nation's graduate training hub for maritime and ocean governance leaders (currently over 4000 MSc alumni from over 166 countries, adding ~200 per year).WMU graduates hold key posts in maritime education, governments, maritime administrations, ports and shipping companies, or represent their governments internationally. In 2017, WMU became home to the WMU-Sasakawa Global Ocean Institute, with a research agenda addressing the interface of science/policy/industry and capacity building in support of Sustainable Development Goal 14, Life Below Water

Contribution to the project

WMU will co-lead WP 8 on capacity building for the All Atlantic Program, and the identification of learning outcomes for IEA, and will deliver research in science diplomacy and research on WP5 IEA of tipping points

Profiles of the principal investigators

Assoc Prof. Mary S. Wisz (female) joined WMU as Associate Professor of Marine Science in 2017. Her research focuses on how climate change and human activities impact marine ecosystems, and tools for decision making and management. She has strong track record of high impact peer-reviewed research (>10000 citations, over 40 peer reviewed articles, 15 papers with >100 citations, h-index of 26, retrieved from google scholar), including work on climate change, invasive species, biodiversity patterns, fisheries, conservation and management, conservation

priority-setting and machine learning methods. She served on the editorial board of the conservation biogeography journal *Diversity and Distributions* from 2012-2017,

Mr. Andrei Polejack (male) currently serves as General Coordinator for Oceans, Antarctica and Geosciences of the Brazilian Ministry of Science, Technology, Innovation and Communications, and is on leave 2019-2022 for PhD studies at WMU. Andrei Polejack has coordinated the Brazilian research endeavors in the Atlantic and Antarctica, providing technical advice on actions of governance, analysis of research projects, the formulation and implementation of public policies, settling international cooperation, managing budget, among other activities. Has negotiated the South-South Framework for Scientific and Technical Cooperation in the South and Tropical Atlantic and Southern Oceans, between Brazil and South Africa, with the participation of Argentina, Uruguay, Namibia and Angola, in order to align research efforts in the South Atlantic. Has also negotiated and took the chair of the Belem Statement, between Brazil, South Africa and European Union, with the ambition to create an All Atlantic Community filling the science gaps of the Atlantic from pole to pole. He represented Brazil in many international fora including UNESCO's Intergovernmental Oceanographic Commission (IOC), the Scientific Committees on Oceanic Research (SCOR) and Antarctic Research (SCAR), the Antarctic Treaty Consultative Meetings (ATCM) and others. Is the national focal point for The United Nations Regular Process of the marine environment and composes the national expert group on matters related to Biodiversity Beyond National Jurisdiction (BBNJ) and for the marine discussions pertaining the Convention on Biodiversity (CBD).

Relevant research projects

- KYSTFISK3- Europeann Maritime and Fisheries Fund €500,000 Euro:Managing coastal areas for juvenile cod and plaice to promote population connectivity of commercial fisheries. PI 2016-2028
- Cod past present and future in Greenland: 2009-2014 Greenland Climate Research Centre, National Research Foundation of Denmark, WP lead on project €1 M
- FISHHAB Europeann Maritime and Fisheries Fund £500,000 : Coastal habitats for commercial fisheries in Denmark. 2016-2018- (project lead J. Støttrup- DTU)
- MEESO Ecologically and economically sustainable mesopelagic fisheries 2019-2023 H2020 Project work package lead, Governance
- GOOSEHUNT- Transboundary adapative management of migratory geese. Norwegian Research Council. 4500000 NOK, 2011-2015

Relevant publications and products

- **Wisz, M.S.,** Broenimann, O., Grønkjær, P., Møller, P. R., , Hedeholm,R. Olsen, S., Swingedouw, D., Nielsen, E. E., Guisan, A., Pellissier, L. 2015. Arctic warming will promote Atlantic-Pacific fish interchange. Nature Climate Change 5 (3), 261-265
- Bonanomi, S., *Pellissier, L., Therkildsen, N.O., Hedeholm, R.B., Retzel, A., Meldrup, D., Olsen, S.M., Nielsen, A., Grønkjær, P., Pampoulie, C., Hemmer-Hansen, J., **Wisz, M.S**., Nielsen, E.E. 2015. Archived fish DNA reveals distinct population responses to fishing and climate change Scientific Reports- 5, 15395
- Pellissier, L.P., Leprieur, F., Paravicini, V., Cowaman, P., Kulbicki, M., Litsios, G., Olsen, S., **Wisz., M.S.,** Bellwood., D. R., and Mouillot, D. 2014. Quaternary coral reef refugia preserved fish diversity. Science 344:1016-1019 (Highlighted in Nature, June 2014)
- Doan, N. X., Vu, M. T., Pham, H. Q., **Wisz, M. S.,** Nielsen, T. G., & Dinh, K. V. (2019). Extreme temperature impairs growth and productivity in a common tropical marine copepod. Scientific reports, 9(1), 4550.
- **Wisz, M. S.,** Pottier, J., Kissling, W. D., Pellissier, L., Lenoir, J., Damgaard, C. F., ... & Heikkinen, R. K. (2013). The role of biotic interactions in shaping distributions and realised assemblages of species: implications for species distribution modelling. Biological reviews, 88(1), 15-30.

4.1.32 Partner 32, INTRIGO, Ireland (INTRIGO)

INTRIGO is a young dynamic Irish SME established in March 2017. It aims to bridge the gap from science to policy, industry and society, through effective knowledge management and transfer. Working with innovative environmental, health and sustainable science projects, INTRIGO specialises in ensuring that new knowledge is effectively transferred to create maximum positive impact. INTRIGO consists of a multidisciplinary team who have an extensive and strong track record in communication and dissemination and are leaders in scientific knowledge management and transfer of research results, building upon a range of professional backgrounds in

scientific research, education, business, industry, and communication. The INTRIGO team have developed specific methodologies to achieve tangible impact from research results through their transfer to industry, policy and decision makers and society. INTRIGO partners with European research consortia to design and contribute to projects that make a difference. The team devises and implements best practice work packages related to dissemination, communication and knowledge transfer to achieve tangible impact from research results. INTRIGO is currently participating in four H2020 projects, and has an excellent understanding of the full life cycle of European funded projects

Contribution to the project

INTRIGO is the deputy WP leader of WP9 – "Societal Engagement & Communication", and contributes to T9.1, being responsible for the project communication toolkit and website and contributing to other communication channels including social media, e-newsletters and traditional press. INTRIGO is also involved in T9.3, bringing its significant track record in Knowledge Transfer activities and will be in charge of generating D9.4 Knowledge Transfer Pathways helping to ensure there is measurable impact from the project results being transferred to end-users.

Profiles of the principal investigators

David Murphy (male). David has 19 years' experience in funding procurement, science communication and research management operating within the European research funding landscape. He is Co-Founder of Intrigo and General Manager of AquaTT. He has overseen the growth strategy of AquaTT to make them a leader in knowledge management activities. He has overseen participation in 17 FP7 projects and currently a portfolio of 18 Horizon 2020 projects. David also provides advice, consultancy and training in funding procurement to universities, pubic bodies and companies across Europe. A well-networked individual with deep familiarity with policy making and funding processes, David is well-suited to provide a steering role for this project.

Annette Wilson (female) has more than 10 years' experience in science communication, teaching and training in the area of oceanography. She holds a PhD in Oceanography and a BSc in Marine Sciences from NUI Galway, Ireland. During her postgraduate studies, Annette gained extensive knowledge on benthic-pelagic coupling in the deep-sea, as well as wide experience with communicating scientific results to a variety of audiences. She also has experience supporting and coordinating international training and capacity building programmes in oceanography and ocean-atmosphere-climate interactions. Annette currently carries out the science communication, knowledge management and transfer activities in two H2020 funded projects; ATLAS and SEAFOOD^{TOMORROW}.

Marieke Reuver (female) has extensive experience with knowledge management and transfer, dissemination, communication and stakeholder engagement. She currently oversees the overall management of over 10 ongoing EU-funded projects and is / has been WP lead for more than 25 EU-funded projects, including coordinating the WP dissemination, knowledge transfer and outreach in ATLAS (A Trans-AtLantic Assessment and deep-water ecosystem-based Spatial management plan for Europe). She is Director and co-founder of INTRIGO and Programme Manager in AquaTT. She has a background in Animal Science (MSc) with an aquaculture specialisation from Wageningen University (the Netherlands).

Relevant previous projects

- RES4BUILD: A H2020 research and innovation action that started in May 2019. Intrigo is leading the communication, dissemination and technology transfer activities. The project is dealing with the development of renewable energy solutions that will contribute in decarbonising the energy use in European buildings.
- SEALIVE: A H2020 innovation action that will start in autumn 2019. Intrigo is leading the communication, dissemination and technology transfer activities for SEALIVE, which aim to demonstrate innovative circular strategies for bio-based plastics in land and sea applications.
- BIOGEARS: Funded through the European Maritime and Fisheries Fund (EMFF) Blue Labs programme, BIOGEARS aims to provide the European aquaculture sector with innovative tools and products

sunstituting the current use of plastics. Intrigo is responsible for maximising the impact and transferability of BIOGEAR's results.

- BIM: Based on the needs of the Irish aquaculture sector, Intrigo is identifying, appraising and transfering technical, scientific or organisational knowledge from Irish and European aquaculture research and development projects. As part of this contract, Intrigo is also providing secretarial support to BIM (www.bim.ie) for the Irish Aquaculture Technology and Innovation Platform (IATiP, www.iatip.ie).
- XRAq: Intrigo was commissioned by the Reference Research Network in Aquaculture of the Generalitat of Catalonia (XRAq) to carry out an analysis of the Knowledge Outputs developed by several research and development teams within the XRAq network. As a result, Intrigo capture the knowledge generated by its members which allowed the prioritisation and efficient transfer to relevant target stakeholders (industry, policy, science and/or wider public).

Relevant publications and products

- Porter, M.K., Bayliss-Brown, G.A., Ní Cheallacháin, C**.** and **Murphy, D.** (2019) *Knowledge Transfer Guidelines and Recommendations for Irish Funding Agencies: How to Embed Knowledge Transfer Principles into Irish Funding Programmes to Help Maximise Measurable Impacts from Public Investments*. EPA: Dublin, Ireland. [html] Available at: https://www.epa.ie/pubs/reports/research/spr/research284b.html
- Porter, M.K., Bayliss-Brown, G.A., Ní Cheallacháin, C. and **Murphy, D.** (2019) *Research to Policy Impact through Effective Knowledge Transfer*. EPA: Dublin, Ireland. [html] Available at: https://www.epa.ie/pubs/reports/research/spr/research284a.html
- Bayliss-Brown, G.A., Ní Cheallacháin, C. et al. (2018) *COLUMBUS Success Stories of Marine and Maritime Knowledge Transfer Activities Volume 0.2*. COLUMBUS Project. [pdf] Available at: http://www.columbusproject.eu/CCV6_FINAL.pdf
- Bayliss-Brown, G.A., Ní Cheallacháin, C., Porter, M.K. and **Murphy, D.** (2018) *COLUMBUS Blue Society Knowledge Transfer Handbook*. COLUMBUS Project. [pdf] Available at: http://www.columbusproject.eu/D8.5%20Handbook_v2_Final.pdf
- **Reuver, M.,** Bayliss-Brown, G.A., Calis, T., Cardillo, P., Ní Cheallacháin, C. and Dornan, N., 2016. Outreach of the Unseen Majority. In: Stal, L.J. and Cretoiu, M.S. (Eds.) *The Marine Microbiome: An Untapped Source of Biodiversity and Biotechnological Potential*. Switzerland: Springer. p.473-498. DOI: 10.1007/978-3-319-33000-6_18

4.2 Third Parties involved in the project

4.2.1 Service Contract (GA Article 10)

Anticipated Article 10 Service Contracts for services that do not cover the implementation of action tasks, but they are necessary to implement action tasks by Beneficiaries are listed in Table 3.4b Other Costs ("Other Goods & Services").

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	NO !
Annex II "*Estimated Budget of the Action*" erroneously includes a 50.000 EUR "Subcontracts" for Partner 1 DTU at time of proposal evaluation, which will be correctly implemented as Article 10 "Service Contracts" LumpSum contracts for external end-user focus group (EUG; see Task 9.3.1 description in Table 3.1b) for external end-users as Exploitation/IPR Consultants, following examples in AMGA Artcle 10. DTU holds 50.000 EUR for End-User FOCUS Group (EUG) contracts where necessary to hire Exploitation & Re-use of Resutrls Consultants (Refer to shortlist of EUG Members presented as *Letters of Commitment* by interested end-users), following examples given in AMGA Artcle10.. Certain legal entities require salary reimbursement for 1-2 days per year committed to the EUG. Such agreements will be honored according to individual contracts with each individual member based on Letters of Support (cf. Appendices), in order to ensure commitment by EUG members. List of EUG members is in Table 2.1 (page 17). Lump Sum Contract are estimated based on up to 12 full working days over the 60 month duration of the Action, plus travel to General Assembly meetings when face-to-face meeting required by Executive Board (EB).	
Does the participant envisage that part of its work is performed by Linked Third Parties (Article 14 of the General Model Grant Agreement)	N
Does the participant envisage the use of contributions in kind provided by Third Parties (Article 11 and 12 of the General Model Grant Agreement)	*N*
Does the participant envisage that part of the work is performed by International Partners (Article 14 of the General Model Grant Agreement)	N

4.2.2 Subcontract (GA Article 13)

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	YES

Sub-contract linked to Task 3.1 (subtask 3.1.1, 3.1.2, 3.1.3) for 50.000 €:

Oceanographic data for model development and validation in the South Brazilian Shelf Case Study.
The SBS is an important Case Study in Mission Atlantic and at the same time covers a large and diverse geographical area. In order to allow cost-efficient gathering of the necessary validation data products that rely on a mix of government proprietary data sets, restricted access time-series datasets and/or new data dependent on regional research vessels beyond access of the consortium partners.

A subcontract of 50,000 EUR will be announced publicly by Partner 18 UFSC to seek bids for Validation Data Products for the South Brazilian Shelf (SBS) Case Study. The data product will summarise key oceanographic & biodiversity parameters (community size structure and traits) across large scale gradients in coastal upwelling regions (e.g. Cabo Frio), both across time and space.

Detailed list of minimum necessary parameters, their quality assurance criteria and analysis requirements, as well as digital format delivery (suitability for ecosystem indicator development), will be specified by SBS Case Study leads and partners after stakeholder workshops in WP1 have allowed the method and objectives "co-creation" process to take place, and include stakeholder needs in the Validation Data Products subcontract.

The Validation Data Product for SBS will also directly add value to actions in WP2, WP3, WP5 and WP6 enabling analyses of ecosystem state indicators.

Does the participant envisage that part of its work is performed by Linked Third Parties (Article 14 of the General Model Grant Agreement)	N
Does the participant envisage the use of contributions in kind provided by Third Parties (Article 11 and 12 of the General Model Grant Agreement)	*N*
Does the participant envisage that part of the work is performed by International Partners (Article 14 of the General Model Grant Agreement)	N

4.2.3 Work performed by Third Parties

Brazilian public sector Beneficiaries P18 UFSC and P23 USP cannot accept direct funds from EC according to national rules. The 3 public sector Beneficiaries will rely on Third Party Foundations that will receive Pre-financing and all follow-up payment as explicitly stated in Consortium Agreement, administer the grants and allow the 3 public sector Beneficiaries to deliver the Action as defined in Table 3.1b.

P18 UFSC will use Third Party foundation: FUNDACAO DE AMPARO A PESQUISA E EXTENSAO UNIVERSITARIA (FAPEU)

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by Linked Third Parties (Article 14 of the General Model Grant Agreement)	N
Does the participant envisage the use of contributions in kind provided by Third Parties (Article 11 and 12 of the General Model Grant Agreement)	*YES*
FAPEU is a non-profit organization with the objective of providing administrative support to UFSC's activities, streamlining support mechanisms to inter-departmental and interdisciplinary research involving different schools and institutes. FAPEU will accept and administer contract financing as explicitly mentioned in Consortium Agreemnt (CA) and according to GA Article 11. FAPEU does not deliver any part of the actions described in the Grant Agrement, and it's services will be invoiced internally with the Beneficiary P18 UFSC.	
Does the participant envisage that part of the work is performed by International Partners (Article 14 of the General Model Grant Agreement)	N

P23 USP will use Third Party Fundacao USP (FUSP)

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by Linked Third Parties (Article 14 of the General Model Grant Agreement)	N
Does the participant envisage the use of contributions in kind provided by Third Parties (Article 11 and 12 of the General Model Grant Agreement)	*YES*

FUSP is a non-profit organization with the objective of providing administrative support to University of São Paulo's activities, streamlining support mechanisms to inter-departmental and interdisciplinary research involving different schools and institutes. FUSP will accept and administer contract financing as explicitly mentioned in Consortium Agreemnt (CA) and according to GA Article 11. FUSP does not deliver any part of the actions described in the Grant Agrement, and it's services will be invoiced internally with the Beneficiary USP.	
Does the participant envisage that part of the work is performed by International Partners (Article 14 of the General Model Grant Agreement)	N

4.2.4 Use of contributions in-kind, free of charge, provided by Third Parties

"*In-kind contributions free of charge*" of human resources by Third Parties (*International Collaborators*, see below) are available to the Action. For reasons stated below, inclusion of detailed budgets per cost category of all in-kind contributions by Article 12 Third Parties, or Article 14a International Partner, is not possible at GA Signature. However, Coordinator and *International Collaborators* commit to detail such costs as actual "in-kind" contributions at Financial Reporting Periods and use Amendments to GA to secure Article 14a *International Partners*, where practical. Article 12 and Article 14a limitations have no impact on delivery of the Action by the Beneficiaries.

4.2.5 International Collaborators

Part of the work in Mission Atlantic will be performed with *International Collaborators* (NB: these are not Article 14a International Partners). *International Collaborators* include three North American Research Organisations (cf *Letters of Support*):

- DFO, Department of Fisheries & Oceans, Canada;
- UNH, Un. New Hampshire, USA;
- NOAA, National Ocean & Atmosphere Administration, USA;
- South African ACEP Deep Forest Project

International Collaborators include 3 Government Agencies and 1 University funded by a Government Agency, neither of which can legally accede to be "Article 14a International Partners", or allow EC Court of Auditors to access any of their records, or legally commit to dissemination obligations part of the EC Contract. This has no impact on implementing the Action, as collaboration will be performed based on bilateral Memorandum of Understanding (MoU) based on attached Letters of Support (cf Appendices), the details of which are already mentioned in Description of Action (DoA), Table 3.1b.

<u>The contributions of International Collaborators are as follows</u>:

DFO (Canada, International Collaborators under the Coordinator, P1 DTU) will align 10 PI's on parallel DFO-funded initiatives, with MISSION ATLANITC WPs 1,3,4,5,6 and 7 (cf. Letter of Support & Section *3.3.1 USA & Canada Role and Contribution*). Robin Anderson will be DFO representative on the Atlantic Panel, and DFO PI's

will assist with stakeholder engagement in WP1, as well as scintific expertise in ecosystem modelling, indicators, bethic habitat identification.

UNH/CCOM (USA; Intenrational Partner attached to P21 MI): will work collaboratively with the MI in the joint supervision of an Irish-based PhD student working on optimizing the information obtainable from the ongoing INFOMAR seabed mapping program. That program is currently addressing one of the identified case specific study areas – CS2: the Celtic Sea. This will be part of WP 4 (Seabed Bathymetry & Benthic Habitat and Biodiversity Mapping). Specifically task 4.2 - Mapping and modelling of seafloor characteristics and benthic communities.The CCOM/UNH contribution will be focused on the manipulation and analysis of the acoustic data.

NOAA (USA) support MISSION ATLANTIC objectives with own-funded parallel initiatives (e.g. ASPIRE Programme *cf. Letters of Support* detailing concurrent planned research; see *Section 3.3.1 USA & Canada Role and Contribution*). NOAA PI's will contribute experetise in local IEA implementation, sensitive habitat characterisation, predictive capabilities for vulnerable habitats, and extending bathymetry coverage (WP4). NOAA cannot declare and commit specific costs to the EU Contract, or respect obligations of GA Article 14a.

South African national-funded ACEP Deep Forests project already closely collaborates with Partner 27 SANBI on MISSION ATLANTIC research objectives and will overlap partly with MISSION ATLANTIC. ACEP partners will be supporting Mission Atlantic with in-kind human resources and equipment contributions free of charge from the Department of Environmental Affairs, the South African Institute for Aquatic Biodiversity (including potential use of the ACEP Remotely Operated Vehicle), scientific contributions from the South African Environmental Observation Network (SAEON) and work towards seabed mapping from the Council for Geoscience. Article 12 requirements to detail "personnel" and "other costs" in-kind free of charge contributions in Partner 27 SANBI budget, are not realistic or credible before implementation of the Action. Detailed and actual costs of "*in-kind contribution for free*" by ACEP will be reported by Partner 27 SANBI at Financial Reporting Periods.

5. ETHICS & SECURITY

The Mission Atlantic consortium has responded to the questionnaire on ethics in the proposal submission forms, and this has resulted in the following issues being flagged: 1) personal data collection, 2) third countries 3) Environmental protection and safety Each of these topics will therefore be considered in turn below. In general terms, all research undertaken within the remits of Mission Atlantic will abide by international and national law and will follow the relevant ethical standards and requirements.

5.1 Personal data collection

With the entry into force of the EU's **General Data Protection Regulation No 2016/679 (GDPR),** in May 2018, the importance of safeguarding personal data and privacy has become even more imminent than previously. Mission Atlantic will of course adhere to the requirements set out by this Regulation, not the least by following the instructions on GDPR provided by the partners' organisations (i.e. at the local level). Mission Atlantic will collect and store personal data (such as names, emails, phone numbers, organizational affiliation) for the purpose of undertaking its research, but will not collect any sensitive personal data (such as health, ethnicity, political opinions). The storage, protection, retention, transfer, destruction or re-use of personal data will be handled by each partner in the consortium in line with the respective organisations' local requirements (based on the GDPR) as well as those from national data protection agencies. Profiling will only be done on basis of public information, and there is therefore no information need on this. All of the Mission Atlantic's partners are long established institutions with a long track record of participating in research projects, and thus also with long standing experience in handling personal data.

The text below will explain the different types of Mission Atlantic activities involving personal data as well as how this data will be handled and protected.

a) Mailing lists and newsletters

Mission Atlantic will create mailing lists in order to communicate internally in the consortium as well as externally with stakeholders and other participants (e.g. people taking part in training activities, networks or people signing up for Mission Atlantic's newsletters). External participants will at any time be able to withdraw their participation in the project and will also be informed that they can request a copy of personal data held about them (data subject access requests) and can always request their personal data to be deleted (the right to be forgotten). Similarly, subscribers to Mission Atlantic's newsletter will be informed of – and given the option to – unsubscribe at any time.

b) Stakeholder workshops

The stakeholders participating in Mission Atlantic will be provided with an information sheet about the work conducted in Mission Atlantic (i.e. the objectives and methods of the project) as well as their expected/suggested role in Mission Atlantic. The information sheet will be prepared in English, but will be translated to necessary languages, should it become relevant. In the information sheet, the stakeholders will be informed of the benefits as well as any potential risks in their participation. The stakeholders will also be informed that their participation at all times is on a voluntary basis and that they thus are free to withdraw at any time. This backdrop should allow the stakeholders to give their full and informed consent to their participation in Mission Atlantic. Mission Atlantic will respect the participants' rights to privacy, and stakeholders may at any time request access to data held about them and requests their personal data to be deleted.

c) Website (cookies)

The project's website is expected to use cookies (small text files stored on the users' computers), as this should help improve the content and services of the website. Cookies provide information about the user (via the IP address) as well as their usage of the site. TIPTOP's website will therefore include a data privacy policy, which will inform the users about the use of cookies and simultaneously also provide information on how to opt-out.

d) Photos and film

With a view to contributing to the communication and dissemination efforts of the project, Mission Atlantic will seek to document its activities with photos (e.g. project meetings, stakeholder workshops, summer schools) and footage (filming during a Mission Atlantic cruise). Participants will be informed of the filming and photography well in advance, in order to allow them to choose whether they wish to be filmed/photographed or not. Mission Atlantic will also seek to minimize the collection of personal data during these activities e.g. by avoiding photographing/filming name tags unless consent has been given to do so.

Interviews/questionnaires/surveys

The project will collect data by circulating questionnaires and interviewing stakeholders face-to-face, and have web based surveys. The recruitment procedures will be determined in the beginning of the project, fully documented and submitted as a deliverable.The data collected will include personal data (such as name, email and organizational affiliation), but will not include any sensitive data. The involved stakeholders will be provided with an information sheet explaining the purpose of the project and their own (suggested) role as stakeholders, as well as any potential risks in participating. The WP and/or task lead will, prior to any data collection, ensure that stakeholders are participating on a voluntary basis and that they have provided informed consent. The collected data will – after processing - be stored in anonymous format, such that the obtained data cannot be linked to a specific participant. Participants will be informed that they are free to withdraw their participation at any time and that they also can request to have their data deleted.

5.2 Third countries

There are ten partners in Mission Atlantic's consortium from non-EU countries, namely from Norway (P4 and P31), Iceland (P19), South Africa (P17 and 27), Brazil (P18, 20 and 24), Canada (P28) and USA (P29).
Norway and Iceland are associated countries in the Horizon2020 programme and both countries are also part of the European Economic Area (EEA). Norway and Iceland therefore have close ties to the EU and cooperate with the EU on a wide range of issues, including data protection and intellectual property rights.

With the general openness of Horizon2020 calls (Open to the World) to non-EU researchers, seven international collaborators - from South Africa, Brazil, Canada and USA – have also joined Mission Atlantic.

The USA and Canada are two of the EU's most strategic partners, and EU's cooperation with them spans the whole spectrum of political, financial, cultural and security issues. Canada and the USA cooperate with EU member states via bilateral agreements and international organizations e.g. via the Transatlantic Economic Council (USA), EU-US Privacy Shield (USA), BILAT-USA 4.0 (USA), Strategic Partnership Agreement (Canada), and Scientific and Technologic Cooperation Agreement (Canada).

The EU also recognizes both Brazil and South Africa as important global partners, and this has e.g. been formalized via Strategic Partnerships (South Africa in 2006 and Brazil in 2007) as well as Agreements on Scientific and Technological Cooperation (South Africa in 1997 and Brazil in 2004). In particular, there is joint interest by all three parties in undertaking research on the Atlantic Ocean, as underscored by the Declaration of Intent on marine research and innovation cooperation signed between the European Commission and Brazil (in 2015) and with South Africa (in 2016). Additionally, the EU, Brazil and South Africa signed the joint Belém Statement on Atlantic Research and Innovation Cooperation in 2017 further emphasizing their common interests in advancing scientific knowledge of marine ecosystems and the link between oceans and climate change.
All four countries are actively participating in the EU's framework programmes, and have been involved in FP7 as well as Horizon 2020. Indeed, Horizon 2020 has had – and will have - specific calls encouraging cooperation with specifically Canada, USA, Brazil and South Africa.
The research conducted outside the EU can be legally carried out in at least one EU Member State.

5.3 Security

The activities and results of Mission Atlantic will not raise any security issues, nor will EU-classified information be used as background or results.

5.4. Environmental protection and safety

Some sampling will be conducted within the research network: Long Term Ecological Research at the Brazilian oceanic islands [http://peldiloc.sites.ufsc.br/].This work will be done in protected areas, but there are already valid permits issued by the Brazilian environmental agency (ICMBio).
All national safety regulations will be followed during fieldwork, and risks in relation to diseases (zika and malaria) will be considered in collaboration with workshop organisers in South Africa and Brazil. The participants will be advised on potential risks, so they can take their own precautions.

5.5 Working with Animals

Experiments and manipulations of vertebrates, including protected species, will be done in accordance with international research standards, by skilled and certified personnel only, and upon renewal of scientific permits for that purpose issued by the Azorean Government and, if applicable, international agencies (eg. CITES). All actions do not involve the killing of animals as they will consist of electronic tagging and small tissue biopsies for stable isotope studies.

APPENDIX A: LETTER OF COMMITMENT OF END-USER FOCUS GROUP

Government Bodies:

- US Dept. Commerce, NOAA-Fisheries
- Regional Fund for Science & Technology, Azores, Portugal
- JSC of SFTAs EU-Morocco, Mauritania, Senegal
- St Helena Government

Regional Commissions:

- OSPAR
- Benguela Current Commission (BCC)

Private Sector:

- Ocean Data Alliance (USA)
- Gardline Marine Surveys Ltd (UK)

IGOs & NGOs:

- Marine Stewardship Council (MSC)

Concurrent Development Programs (UK)

- One Ocean HUB, funded by UK Research and Innovation (NOC) through the Global Challenges Research Fund (GCRF), coordinated by Un Strathclyde (Partner 11 in MISSION ATLANTIC)

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Oceanic and Atmospheric Research
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, Maryland 20910-3283

29 August 2019

Professor Michael St. John
Technical University of Denmark
Section for Marine Living Resources
Kemitorvet, Building 202
2800 Kgs. Lyngby
Denmark

Dear Professor St. John:

It is our pleasure to submit this letter of support for the proposal, *'**Project Mission Atlantic**: Towards the Sustainable Development of the Atlantic Ocean: Mapping and Assessing present and future status of Atlantic Marine Ecosystems under influence of Climate Change and Exploitation'*, which addresses the Atlantic Ocean Research Alliance Flagship (BG-08-2018-2019) action, subtopic [B] 2018-2019 - Assessing the status of Atlantic marine ecosystems. As primary organizations within the U.S. National Oceanic and Atmospheric Administration's (NOAA), the Oceanic of Atmospheric Research (OAR) and the National Marine Fisheries Service (NMFS) include deepwater benthic areas as well as the pelagic ecosystems within their foci. As such, there are numerous linkages between your proposal and our respective Line Office mission objectives in the coming years.

While there are many potential strong links to each of your proposal's Work Packages (WPs), the following WPs are ones with which immediate and direct collaborations can be made:

WP1: Regional Integrated Ecosystem Assessment Framework (IEA)
WP3: Mapping Pelagic Ecosystem and Resources of the Atlantic
WP4: Seabed Bathymetry & Benthic Habitat and Biodiversity Mapping
WP5: Assessing state, drivers and tipping points
WP7: Resilience, vulnerabilities and uncertainties
WP8: Building Capacity supporting an ecosystem-based approach to management of Atlantic resources

With respect to WP1, NOAA has established IEAs nationally in support of NOAA's ocean stewardship responsibilities ((https://www.integratedecosystemassessment.noaa.gov). Specific to the NW Atlantic, a region of particular overlap and interest in your proposal, we support sustained efforts on the Northeast Shelf (http://www.nefsc.noaa.gov/ecosys/ecology/). This ecosystem has sustained high fishing yields for centuries, but in the past half century high fishing pressure has resulted in the depletion of some fish stocks. The value of the fisheries remains an important feature of the region, both economically and socially. The various ocean-uses of this ecosystem reflect the concentration of a high proportion of the United States population being located in this region. Such ocean uses include recreational and commercial fishing,

eco-tourism, shipping and navigation, wind farms and alternate energy exploration, and simple aesthetic enjoyment, among many others.

The NW Atlantic region is recognized as one of the ~60 Large Marine Ecosystems distributed throughout the world's oceans. IEAs provide the scientific underpinning to Ecosystem Based Management (EBM), and include as specific outcomes: (i) better understanding of regional ecosystem function and response to change [WP1], (ii) quantification of ecosystem status, trends and pressures [WPs 2, 3 and 4], and (iii) delivery of advice for management of future ecosystem conditions [WPs 5, 7 and 8]. As such, collaboration with your *"Project: Mission Atlantic"* in establishing the scientific architecture in support of EBM in the NW Atlantic is natural and desirable.

With respect to WP3 and WP4, NOAA's Office of Ocean Exploration and Research (OER) has conducted numerous expeditions to collect foundational information in support of NOAA's deep-sea science and management efforts in the western Atlantic Ocean. Much of this work has focused on sonar-based mapping and deep water remotely operated vehicle-based, characterization of the geology and biology of the canyons and seamounts found in the U.S. Exclusive Economic Zone (EEZ) within the western Atlantic Ocean, thereby enabling efforts to develop a systematic approach to establishing baselines for previously unknown and poorly known areas, which we intend to build upon.

OER is executing work associated with a major Atlantic field campaign, the Atlantic Seafloor Partnership for Integrated Research and Exploration (ASPIRE). ASPIRE is a major multi-year, multi-national collaborative ocean exploration field program focused on raising collective knowledge and understanding of the North Atlantic Ocean. This initiative under the EU-US-Canada Atlantic Ocean Research Alliance will provide data to inform and support research planning and management decisions in the region and currently includes work conducted within the U.S. EEZ as well as the Canadian EEZ, and includes plans for conducting at-sea expeditions along the Mid-Atlantic Ridge in 2020.

Specific goals of ASPIRE are to:

- Improve knowledge of unexplored areas within the U.S. EEZ and in deep-sea areas that have been mapped for the U.S. Extended Continental Shelf Project to inform management needs for sensitive habitats, geological features, maritime heritage sites, and potential resources;
- Locate and characterize deep-sea coral, sponge, and chemosynthetic communities;
- Characterize water column habitats throughout the Atlantic basin using acoustics, visual observations, and emerging technologies;
- Enhance predictive capabilities for vulnerable marine habitats and submarine geohazards;
- Extend bathymetric mapping coverage in the U.S. EEZ and international waters in support of Seabed 2030;
- Increase understanding of deep-sea ecosystem connectivity across the Atlantic basin;

- Improve international collaboration and serve as a major contribution to the Galway Statement on Atlantic Ocean Cooperation and the Atlantic Ocean Research Alliance's deep-sea mapping and exploration efforts; and
- Leverage international partnerships to conduct coordinated exploration and mapping of priority high-seas areas of the North Atlantic, including the Mid-Atlantic Ridge.

The goals of ASPIRE are clearly aligned with the overall concept and objectives of the *Project Mission Atlantic* proposal and OER's planned activities most directly aligned with the projects pelagic ecosystem, seabed bathymetry, benthic habitat, and biodiversity mapping objectives. If your proposal is selected for funding we propose coordination of the activities among various vessels and entities to both build on existing baselines and establish new baselines for other poorly known areas. With appropriate lead-time, and assuming appropriate resources and working agreements[1] exist, we can organize multi-ship operations including complementary mapping and ROV investigations. We are confident our working together will result in additional high-quality data and cost-savings to further our mutual goals and objectives.

We appreciate your proactive efforts to develop partnership opportunities and will look forward to hearing the results of the European H2020 competition. Good luck with the submission!

Sincerely,

Francisco Werner, Ph.D.
National Marine Fisheries Service
Director of Scientific Programs
and Chief Science Advisor

Alan P. Leonardi, Ph.D.
Oceanic & Atmospheric Research
Director of Ocean Exploration
and Research

[1] As in the past, the U.S. National Oceanic and Atmospheric Administration will cooperate with the consortia under the terms of the 2016 "Implementing Arrangement between the Government of the United States of America and the European Commission for Cooperation between Researchers Funded Separately by the United States and the European Union's Framework Programmes for Research and Innovation".

September 5, 2018

P.O. Box 5667
St. John's, NL A1C 5X1

Dr. Michael St. John
Technical University of Denmark

RE: Horizon 2020 MISSION ATLANTIC Proposal,
Towards Sustainable Development of the Atlantic Ocean

Fisheries and Oceans Canada (DFO) is mandated to advance sustainable aquatic ecosystems and support safe and secure Canadian waters while fostering economic prosperity across maritime sectors and fisheries using science based approaches and innovation. Science Branch in Newfoundland Region of DFO is responsible to deliver science advice to advance this mandate for the Newfoundland and Labrador shelves and the eastern Gulf of St. Lawrence. We also contribute to national and international (NAFO, ICES, AORA etc.) initiatives in support of an ecosystem approach to the sustainable management and protection of our oceans.

Fisheries and Oceans Canada's ensure that we sustainably manage fisheries and aquaculture and work with fishers, coastal and Indigenous communities to enable their continued prosperity from fish and seafood and that Canada's oceans and other aquatic ecosystems are protected from negative impacts. In line with the Mission Atlantic proposal, we use scientific evidence, the precautionary principle and taking into account climate change when making decisions affecting fish stocks and ecosystem management.

MISSION ATLANTIC outputs are of the great interest to our organization, especially as they relate to the information, tools and approaches to the application of the ecosystem approach for sustainable management and protection of Canada's Oceans. In particular there is an increasing need for science based ecosystem assessments and the development of a regional approach for the Newfoundland Shelves in the Northwest Atlantic. The opportunity to collaborate with colleagues around the Atlantic Ocean in line with the 2016 Fisheries and Oceans Canada International Science Strategy (http://www.dfo-mpo.gc.ca/science/publications/intss-ssint/index-eng.html) will allow us to take advantage of shared expertise, knowledge and data to enhance the delivery of this complex task.

../3

Canada

These outputs can enhance and improve specific areas of our core mission specifically as they relate to our development of a regional ecosystem assessment process and improved identification of and protection for sensitive benthic habitats. The following researchers will contribute expertise and leadership for matching DFO-NL proposals that will be submitted for internal DFO funding to collaborate with Mission Atlantic.

Name	Expertise/responsibilities	Mission Atlantic WP/ role
Dr. M. Robin Anderson	Aquatic ecology, environmental assessment, Canadian co-lead AORA WG EA2OHS	Belem and AORA Panel, NL Shelves case study WP1, 7
Dr. Pierre Pepin	Aquatic ecology, lead Atlantic Zone Monitoring Program, National co-lead on Implementation of Ecosystem Approach WG, lead Regional WG for Ecosystem Assessment, co-lead AORA ocean monitoring theme, Co-Chair NAFO WGESA	NL Shelves case study, indicator selection, ecosystem modeling WP 1, 5, 6, 7
Dr. Mariano Koen-Alsonso	Aquatic ecology, ecosystem modelling ecosystem approach, sensitive benthic habitats, former co-chair NAFO WGESA (development of ecosystem approach framework)	NL Shelves case study, ecosystem modelling, sensitive benthic habitat identification and modelling WP1, 4, 5, 6, 7
Dr. Robert Gregory	Productive capacity and habitat ecology, co-chair ICES WGNARS	Sensitive benthic habitats, habitat modelling and assessment WP1, 4, 5
Dr. Robyn Jamieson	State of the Environment Reporting	NL Shelves case study WP1, 5
Dr. Corey Morris	Environmental stressors, noise, ocean debris, cumulative effects	Environmental stressors and cumulative effects WP1, 5
Ms. Vonda Wareham	Corals and sponges, taxonomy, ecology, sensitive benthic habitats	Identification and modeling of sensitive benthic habitat WP4
Dr. Bárbara Neves	Cold water coral and sponge ecology	Identification and modeling of sensitive benthic habitat WP4
Dr. Fred Phelan	Fisheries economics	WP1

Canada

The outcome from WP1 and WP 3 will contribute directly to Canada's implementation of an ecosystem approach to management as part of the Sustainable Fisheries Framework Policy (The outcome from WP1 and WP 3 will contribute directly to Canada's implementation of an ecosystem approach to management as part of the Sustainable Fisheries Framework Policy (http://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/ecosys-back-fiche-eng.htm) and the structure derived from WP2 will provide a model to address short-comings of the Canadian system. WP4 will contribute directly to the provision of advice to address the needs dealing with implementation of the Sensitive Benthic Habitats Policy. Work Packages 5 through 7 are directly linked with DFO's initiatives for the implementation of an Ecosystem Based Approach to Management, while WP9 will assist DFO in its ongoing recruitment process.

Yours Sincerely,

Barry McCallum
Regional Director, Science NL

Canada

REGIÃO AUTÓNOMA DOS AÇORES
SECRETARIA REGIONAL DO MAR, CIÊNCIA E TECNOLOGIA
FRCT
Fundo Regional para a Ciência e Tecnologia

Ponta Delgada, 30th August, 2019

Letter of Commitment & Support

Mission Atlantic: *Mapping and assessing the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation.*

The core mission of Regional Fund for Science and Technology (FRCT) is to support and promote science and technology by funding regionally relevant research projects and providing research grants. The FRCT plays an important role in foster national and international cooperation among research institutions and it is a privileged channel for the Regional Government participation in international projects and collaborative activities with external entities to strengthen regional research in all fields of science. FRCT coordinates 3 projects related to mapping and assessment of ecosystem services in EU overseas, monitoring and assessment of marine biodiversity to help implement the European Marine Strategy Framework Directive 2008/56/EC in Macaronesia and also reinforce the implementation of marine spatial planning in Macaronesia.

Specific *Mission Atlantic* ***outputs & products*** closest to our core mission are

- An operational framework to implement Integrated Ecosystem Assessment in coastal and open ocean areas;

- High resolution maps of different ecosystem attributes across the entire Atlantic Ocean including hydrography, plankton and fish species distributions, benthic communities;

- Ocean derived risk maps linked to climate change and anthropogenic impacts;

and our regional interest is especially in ***NAMR-N MID RIDGE*** and ***CC-Canary Current.***

Our current initiatives include the projects MISTICSEAS3, MOVE, MARSP and Aqualit.

MISTIC SEAS3 aims to address the assessment of the Marine Strategy Framework Directive (MSFD) Descriptor 4 (Food webs) at the Macaronesian sub-regional level, following the criteria set up under the new Commission GES Decision 2017/848/EC. Taking advance on the coordinated actions and the cooperation frame established during the previous MISTIC SEAS projects, this project aims to operationalise D4 in the Macaronesian sub-region, to define a common sub-regional approach to the development of this descriptor D4 and also strengthening the cooperation with other sub

regions of the North-east Atlantic Ocean (e.g. Bay of Biscay and the Iberian Coast sub-region).

MOVE- Facilitating Mapping and Assessment of Ecosystem Services (MAES) to support regional policy in OVerseas Europe: mobilizing stakeholders and pooling resources. The main goal is to involve policy makers, researchers and the civil society in the development of methodologies for MAES . Will also explore and test the feasibility of MAES in ORs and OCTs, producing tangible contributions to this purpose on 4 case study regions. A seamless land-coastal-marine spatial coverage of methodological approaches able to cost-effectively map, assess, valuate and monitor ecosystem services will be developed. A second line of contributions will develop, test and set up a mixed and transdisciplinary science-based participative decision-making process able to support the full and cost-effective application and integration of MAES methods and outputs into standard spatial planning procedures (e.g. Land/Coastal Planning and Management, Ecosystem Services-oriented Planning and Management, ICZM – Integrated Coastal Zone Management, and MSP – Marine Spatial Planning).

MarSP -Macaronesian Maritime Spatial Planning. The goal is to reinforce the maritime spatial planning in Macaronesia archipelagos Azores, Madeira and Canary Islands, by assisting the competent authorities from Portugal and Spain, on promoting the development of operatives mechanism of Maritime Spatial Planning (MSP) until 2021.

AQUALIT- Preventive measures for averting the discarding of litter in the marine environment from the aquaculture industry. Equiped the aquaculture sector with a toolbox that can provide existing, upcoming and already implemented tools, case studies, best practices, a database and links between stakeholders for addressing the 3 main components of marine littering: prevention & reduction, monitoring & quantification, and removal & recycling.

Regional Fund for Science and Technology hereby, commits to participate in the End-User FOCUS Group (*Task 9.3 Knowledge Transfer*) and advise *Mission Atlantic's Steering Committee* on ways to co-design & transform research outputs into mature **"*fit-for-purpose*"** operational outputs for optimal uptake and re-use into Regional Fund for Science and Technology (FRCT) core mission activities and our network of stakeholder

Regional Fund for Science and Technology (FRCT) will be available to join *Mission Atlantic* Annual General Assembly in person or via teleconference, as part of the End-User FOCUS Group. It is also our intention to designate a person to the Advisory Board.

Yours sincerely,

Bruno Miguel Correia Pacheco
President of the Administrative Board of FRCT
Regional Fund for Science and Technology (FRCT)

Málaga (Spain), 29 August 2019

Letter of Support

The **Joint Scientific Committees to the EU-Morocco, EU-Mauritania and EU-Senegal fisheries partnership agreements** are composed of scientists from both the EU and the respective African countries. Their overall goal is to ensure a sustainable exploitation of the fisheries resources of Mauritania, Morocco and Senegal, respectively. These Committees provide scientific support to the **EU sustainable fisheries partnership agreements (SFPA)** using the best available knowledge within the context of the ecosystem-based fisheries management.

Through the **SFPAs** the EU gives financial and technical support in exchange for fishing rights with partner countries. SFPAs allow EU vessels to fish for surplus stocks in the countries' exclusive economic zone (EEZ), in a legally regulated environment. These agreements also focus on **resource conservation** and **environmental sustainability**.

We have been informed of the development of a research proposal called **Mission Atlantic** – *Towards the Sustainable Development of the Atlantic Ocean: Mapping and assessing the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation*.

Mission Atlantic aims at better understanding how drivers of change impact Atlantic Ocean ecosystems and alter the distribution and sustainability of services provided to humans through the develop and implement of an Integrated Ecosystem Assessment framework. Apart from the general scientific interest of the project, the following two deliverables have been identified as of specific interest to inform the advice of our Committees:

1) The identification of **new biogeographical regions** within the Eastern Atlantic at regional scales and the **forecast of fish species distribution** for present and future climate conditions.
2) The analyses of **vulnerabilities and risks driven by human activities in the Canary upwelling system** case study.

All things considered we are very supportive of this research initiative and believe that it will contribute and help us provide the best scientific advice, which is the main objective these Committees are tasked with. Additionally we are committed to participate to the regional meetings of the Eastern Atlantic region and be informed about specific activities developed within Mission Atlantic.

Yours sincerely,

Lourdes Fernández Peralta

Full Member of the Joint Scientific Committees (JSC) of the Sustainable Fisheries Partnership Agreements (SFPAs) between the European Union and Morocco, Mauritania and Senegal (2015-2019).

Chair of the JSC of the SFPA EU-Mauritania 2019.

St Helena Government

Essex House
St Helena Island
SAO
STHL1ZZ
Tel: 22270
Email: rhys.hobbs@sainthelena.gov.sh

Date: 29 August 2019

RE: Letter of Commitment and Support, *Mission Atlantic:* *Mapping and assessing the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation*.

This letter is to confirm the support of the Environmental and Natural Resources and Planning Directorate, St Helena Government, for the Mission Atlantic (MA) project. The entire 200nm Exclusive Fisheries Zone (EFZ) of St Helena is designated as an IUCN category VI "protected area with sustainable use of natural resources". The marine management plan for the 444,916km^2 Marine Protected Area (MPA) was formally adopted in September 2016.

The plan identifies the major existing and potential pressures on the marine environment, and sets out management strategies that aim to protect its rich marine biodiversity and natural ecosystems and be preserved whilst ensuring sustainable resource use. St Helena Government has developed a long term monitoring and research plan linked to the marine management plan and the MA project offers the potential to address some of these identified needs.

Specifically, the habitat suitability models developed under WP3 and 4 for the South Mid Atlantic Ridge case study region will have relevance to, and will include St Helena's marine area. These will provide important spatial information that can feed into management plans for St Helena's EEZ. In addition WP4 of the MA will include research on the reef fish communities of St Helena, improving knowledge of these communities, the role they play in St Helena's marine ecosystem, potential impacts of climate change, and the relationship between the communities at St Helena and the wider suite of oceanic islands of the South Atlantic (namely Rocas Atoll, Fernando de Noronha, St Peter and St Paul's Archipelago, Trindade, Ascension, São Tomé and Príncipe). These work packages will complement the existing habitat modelling undertaken for the islands inshore waters, and also help provide valuable information on reef fish communities, something which is currently beyond the capability of the islands Marine Conservation Section to conduct.

WP6 is of particular importance to St Helena as task 6.1 involves using the basin scale SEAPODYM model to simulate the spatial population dynamics of Atlantic tuna species and Atlantic mackerel. Tuna is St Helena's main fishery, and of major importance to the island in terms of both economic

OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

The Aspect
12 Finsbury Square
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United Kingdom

t: +44 (0)20 7430 5200
e: secretariat@ospar.org
www.ospar.org

To:
Mariani Patrizio

23 August 2019

Letter of Support for Mission Atlantic by OSPAR

I am writing to express the support of OSPAR to Mission Atlantic.

OSPAR's vision is of a clean, healthy and biologically diverse North-East Atlantic used sustainably. OSPAR applies the ecosystem based approach to management of human activities. Our specific interest in ***Mission Atlantic*** is better understanding how drivers of change impact Atlantic Ocean ecosystems.

OSPAR expresses support for the project as the outcomes are aligned with the OSPAR Science Agenda in terms of addressing knowledge gaps on cumulative effects and integrated ecosystem assessments. Planned project deliverables of high resolution spatial maps, in particular for the Mid-Atlantic Ridge area is of interst to OSPAR.

The resources required to meet the challenges posed by ecosystem-based management of human activities in the North-East Atlantic far exceed the available capacity and budget of Contracting Parties to OSPAR. Therefore, OSPAR engages with actors that have capacity to contribute to achieving OSPARs goals, such as the MissionAtlantic project. OSPAR can engage in the capacity of stakeholder when it is recognised that transfer of scientific results to OSPAR's work requires additional effort, both from scientists and policy makers.

OSPAR looks forward to engaging with MissionAtlantic in the capacity of stakeholder at relevant project activities planned for the end-user focus groups.

Yours sincerely,

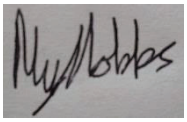
Susana Salvador, Executive Secretary

prosperity and food security. This work will complement, and provide further geographical context to the ongoing Tuna ecology research and resource assessments that have been being undertaken since 2016 as part of the ICCAT and UK Government Blue Belt programmes. The coupled NEMO-ERSEM model in this WP that will be used to characterize the hydrodynamics, biogeochemistry and distributions of plankton, benthos and mesopelagic functional guilds, and selected key species across the entire Atlantic basin will also help inform understanding of St Helena's EEZ. There may also be potential uses and links with St Helena's in-situ oceanographic monitoring data and information by as inputs/calibration of models developed for the project. The management option evaluation (MOE) simulations to be run under this WP for the South Mid Atlantic Ridge case study region, parameterised in collaboration with St Helena Government, will allow us to more holistically assess options for the sustainable use of St Helena's EEZ.

Finally, the research under WP6 assessing connectivity and particularly migration routes for charismatic marine species could also provide important information to St Helena. The whale shark, humpback and dolphin populations are hugely important in the ambition to develop ecotourism on the island, and further knowledge combined with existing research programmes, will only help to further our understanding and management of these megafauna species.

The St Helena Government commits to participate in to Subtask 9.3.1 End-User focus group (EUG).

Yours sincerely,



Rhys Hobbs
Marine Conservation Officer, Environment Natural Resources and Planning Directorate,

Benguela CURRENT CONVENTION SECRETARIAT

REF: BCC/MISSION ATLANTIC/2019 **Data:** 16th August 2019

TO: MISSION ATLANTIC Coordinator, Dr. Patrizio Mariani
Technical University of Denmark

RE: Horizon 2020 MISSION ATLANTIC Proposal,
Towards Sustainable Development of the Atlantic Ocean

Dear Dr. Mariani,

Thank you for contacting the Benguela Current Commission (BCC) and for the information about your initiative called "Mission Atlantic". BCC is a permanent multi-sectoral inter-governmental initiative of South-West Africa countries: Angola, Namibia and South Africa. It promotes the sustainable management and protection of the Benguela Current Large Marine Ecosystem, and it is focused on the management of shared fish stocks; environmental monitoring; biodiversity and ecosystem health; early warnings of extreme oceanographic events; and minimizing the impacts of marine mining and oil and gas production. Of particular importance are also training and capacity building activities with the objectives to promote and coordinate, holistic and regional approach to ecosystem based management.

MISSION ATLANTIC outputs are of the great interest to our organisation, especially concerning the establishment of an operational Integrated Ecosystem Framework (IEA) that can incorporate ecosystem resilience and methods to forecast likely future changes and vulnerabilities to oceanographic extreme events. The large scale capacity building program that is established in the project is also of interest since it entirely resonates with our guiding principle to establishing trans-disciplinary competences to support marine ecosystem based management and ocean governance.

In view of the foregoing, the BCC is fully committed to participate in "Mission Atlantic" taking part in End-User Focus group established in the project, and helping in the IEA activities in our region. We intend to assist you in tailoring specific research outputs to maximise the uptake by our organization.

Sincerely Yours,

Dr. Kumbi Kilongo NSINGI
Acting Executive Secretary of the BCC

BENGUELA CURRENT (BCC) P/Bag 5031 1Strand Street Swakopmund - Namibia 16 AUG 2019 Tel: +264-406 901 CONVENTION

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Benguela CURRENT CONVENTION SECRETARIAT

REF: BCC/MISSION ATLANTIC/2019 **Data:** 16th August 2019

TO: MISSION ATLANTIC Coordinator, Dr. Patrizio Mariani
Technical University of Denmark

RE: Horizon 2020 MISSION ATLANTIC Proposal,
Towards Sustainable Development of the Atlantic Ocean

Dear Dr. Mariani,

On behalf of the Benguela Current Convention (BCC), I have a pleasure to submit to you a proposal for the BCC commitment to participate in "Mission Atlantic", taking part in End-User Focus group established in the project, and helping in the Integrated Ecosystem Framework (IEA) activities in our region.

With the assurance of my highest consideration, I remain, yours sincerely,

Dr. Kumbi Kilongo NSINGI
Acting Executive Secretary of the BCC

BENGUELA CURRENT (BCC) P/Bag 5031 1Strand Street Swakopmund - Namibia 16 AUG 2019 Tel: +264-406 901 CONVENTION

OCEAN DATA ALLIANCE

New York, August, 2019

Letter of Commitment & Support

Mission Atlantic: *Mapping and assessing the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation*.

The ***Ocean Data Alliance (ODA)*** is a multi-stakeholder forum working to solve ocean challenges with business sector. Core ODA initiatives include developing Ocean Risk insurance products, ocean restoration solutions, ocean data monetization, and reporting against UN SDG14 "Life Under Water" targets and indicators.

ODA was a key partner in formulating a ***framework and indicators for the AXXA-Catlin Ocean Risk Index***, and understands the challenges of mobilizing the insurance sector to integrate ocean research data and forecasts in Blue Economy risk assessment and relevant insurance products.

Specific *Mission Atlantic* ***outputs & products*** of potential relevance to Ocean Risk Insurance and related products, are marine ecosystem baseline observations and data, habitat maps of the Atlantic, future scenarios (2020-2070) of species distribution, and distribution maps of commercially important marine species.

ODA hereby, commits to participate in the annual End-User FOCUS Group (*Task 9.3 Knowledge Transfer*) and

- ***advise*** *Mission Atlantic's Steering Committee* on ways to co-design & transform research outputs into mature ***"fit-for-purpose"*** operational data products that would fit the needs and requirements of ***Ocean Risk Index;***

- ***identify & engage*** most likely insurance sector partners with closest strategic interest in Ocean Risk Insurance; and

- ***contribute*** to KPI 5 "Number of Impact Narratives across Case Study regions, and sectors, documenting added value to end-user workflows and strategic outlook.

Where relevant ***ODA*** will join *Mission Atlantic* Annual General Assembly in person or via teleconference, as part of the End-User FOCUS Group.

Yours sincerely,

CEO Steven Adler

GARDLINE LIMITED
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Dr Kerry Howell
Associate Professor (Reader)
School of Biological and Marine Sciences,
Plymouth University,
Drakes Circus,
Plymouth.
PL4 8AA

Wednesday 24th July 2019

RE: MISSION ATLANTIC: Mapping and assessing present and future status of Atlantic marine ecosystems under Climate Change and Exploitation

Dear Dr Howell,

Thank you for making us aware of your Mission Atlantic project.

Gardline, a wholly owned subsidiary of Royal Boskalis Westminster N.V., is a multidisciplinary marine survey company, providing a comprehensive range of marine services including geophysical, geotechnical and environmental surveys. Established in 1969 in Great Yarmouth, Gardline has grown to become one of the world's largest and well reputed marine survey companies. Gardline's services are delivered across industry sectors with an interest in the marine environment, including wind, oil and gas operators, EPIC contractors, governments and public bodies, environmental consultants and telecommunication companies. A truly global company, Gardline operates worldwide, with principal offices in Europe.

Gardline's position as a second to none marine survey company is based on its 50 years of experience, science-based R&D and state of the art equipment. Gardline will continue to invest in R&D, equipment, vessels and employees. Consequently, Gardline are very interesting in supporting this project and are ideally placed to provide valuable input into the End-User focus group (EUG). As such Gardline are willing to contribute their time and experience over the 5 year duration of this project.

We wish you success with your proposal and look forward to working with you further.

Yours Faithfully
For and on behalf of
Gardline Limited

M B Thompson

Michael B Thompson
Client Report Manager - Environmental
Gardline Limited

London, 20 August, 2019

Letter of Commitment & Support

Mission Atlantic: *Mapping and assessing the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation*.

The Marine Stewardship Council ***(MSC)*** is an NGO and ecolabelling Program working with its engaged partners to recognize and incentivize environmentally sustainable wild-capture fishing practices worldwide.

Our specific interest in ***Mission Atlantic*** is better understanding how drivers of change impact Atlantic Ocean ecosystems and alter the distribution of marine resources, with implications for fisheries sustainability.

A better understanding of ecosystem-level tipping points and climate change related risks in Eastern and Central Atlantic marine ecoregions, together with explorations of new indicators for ecosystem health and resilience, will help the MSC engage with the most current scientific advancements, supporting continuous improvement of the Program.

The MSC hereby, commits to participate in the End-User FOCUS Group (Task 9.3 Knowledge Transfer) and assist *Mission Atlantic* to transform key knowledge on Atlantic Marine Ecosystems into mature "*fit-for-purpose*" outputs that can help inform MSC program activities.

The MSC will join Mission Atlantic Annual General Assembly meetings as part of the End-User FOCUS Group

Yours sincerely,

Catherine Longo, PhD

Senior Scientist

Science & Standards

Marine Stewardship Council

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University of Strathclyde
Humanities & Social Sciences

SCHOOL OF LAW

ONE OCEAN HUB

Glasgow, 2 September 2019

Letter of Commitment & Support

To whom it may concern,

***RE: OOH Letter of support to Mission Atlantic: Mapping and assessing the present and future status of Atlantic marine ecosystems under the influence of climate change and exploitation*.**

As the PI/Director and the Deputy-Director of the UKRI GCRF **One Ocean Hub** (OOH) - a £20 million, 5-year global inter- and transdisciplinary research collaboration that aims to transform our response to the urgent challenges facing the world's oceans, we wish to convey the support of the Hub's Executive Team for the Mission Atlantic project application.

The University of Strathclyde coordinates the OOH project (2019-2024). The project is co-directed by its executive team consisting of the leaders of 5 research programmes that make up the OOH project. Briefly, these are as follows: RP1 – Law, RP2 – Arts and Education, RP3 – Fisheries, RP4 – Marine resources, RP5 – Social and Economic Contexts. The overarching objective of ***OOH*** is to predict, harness and share equitably environmental, socioeconomic and cultural benefits from ocean conservation and sustainable use. The Hub will also identify hidden trade-offs between more easily monetized fishing or mining activities and less-understood values of the ocean's deep cultural role, function in the carbon cycle, and potential in medical innovation. The Hub specifically addresses the challenges and opportunities of South Africa, Namibia, Ghana, Fiji and Solomon Islands, and will share knowledge at regional (South Pacific, Africa and Caribbean) and international levels. One of the OOH project's focal areas is the South-east Atlantic where novel research will be conducted across all research programmes.

The Executive Team in its latest deliberation has found that the OOH and Mission Atlantic (MA) projects can complement each other and offer significant added-value to one another, particularly in the Benguela Current, Southern Mid-Atlantic Ridge, and Atlantic Basin case study areas identified in the MA project.

Research programme 3 of the One Ocean Hub project is focused on understanding the fisheries resources of the regional case studies to support productive and resilient ecosystems as well as nutrition, livelihoods, decent work and gender equality.

In this research programme, Dr Lynne Shannon, who is also a co-investigator/partner on both OOH and MA projects and who leads the Benguela Current case study in MA, will develop an Ecospace model for Southern Benguela ecosystem. In addition Dr Mike Heath, who is also on both projects and co-leads MA WP7, will develop and implement StrathE2E fisheries-ecosystem models for the North Benguela system and the northern Gulf of Guinea (Ghana).

These deliverables in the OOH project can contribute to the MA IEA for the Benguela Current region and the Atlantic as a whole, and improve the level of data available. Conversely, the state-of-the-art integrated environmental assessments (IEA) methodology that is developed in MA will be of huge benefit to the OOH, enabling the connections between fisheries-related human activities and social interaction to be mapped through to ecological pressures and responses in a more formal and quantitative way than was originally envisaged by the Hub researchers.

Research programme 4 of the OOH project is led by Dr Kerry Sink and Dr Kerry Howell, both of whom are partners on the MA project. This research programme seeks to understand marine benthic biodiversity and ecosystem services in the stated case study areas (OOH WP4.1), map their distribution and predicted changes in distribution / function as a result of climate change (OOH WP4.3 and 4.4), and explore mechanisms for transboundary, multi-sectoral regional spatial management (OOH WP4.4). There are clear areas of complementary research and shared deliverables with MA WP4. Specifically MA Task 4.2 mapping of seabed bathymetry, benthic habitat, selected vulnerable marine ecosystem species (VMEs) and characteristics of benthic species assemblages, to underpin IEA and ecological dynamics modelling (MA WP6), and mapping of sectoral pressures on benthic communities and VMEs; as well as MA Task 4.3 which aims to predict the spatial distribution of selected species and assemblages under different climate change and ocean acidification scenarios creating maps of future habitat suitability (MA WP6). Models and maps produced under the OOH will be shared with Mission Atlantic for onward use in MA WP6, while models and maps produced under MA WP4 will be shared with OOH for onward use in OOH WP4.4.

In addition OOH research programme 4 includes a funded research cruise to the Benguela Current case study region that will provide the opportunity for novel data collection. Specifically we can offer the collection of multibeam data (pelagic and benthic) and benthic species data to support MA WP3 and 4 objectives. Any processed data products can then be used in OOH WP4.4 improving and expanding the available data for the region.

MA WP8 is focused on building capacity for IEA across the Atlantic by improving professional skills and competences in support of IEA approaches to ocean resource management. Specifically Task 8.2 seeks to deliver adaptive e-learning platform on IEA topics for relevant target users; and Task 8.3 will establish a PhD doctoral school (~10 PhDs), a large-scale mobility program (6 week for ca. 40 scientists) and integration of IEA concepts in existing master programmes of the academic partners in the project. Capacity building is central to the OOH project and OOH research programme 2 has a strong focus on education and marine literacy. The OOH project also has a PhD doctoral school and placement programme. We see opportunities here to coordinate and share materials produced by both projects enabling both to reach a wider audience, as well as possibly share placement / exchange opportunities to maximize benefits to partner nations.

MA WP9 is focused on societal engagement and communication to ensure that the knowledge generated by MA is used for optimal benefit to society. OOH research programme 2 also has a strong focus on societal engagement

particularly through the arts and thus takes a different but complimentary approach to the MA project. There may again be opportunity to explore where activities can be mutually beneficial. Specifically, the high level stakeholder forum that will help steer MA activities under Task 9.2 may also provide input to the OOH project.

Finally MA seeks to develop operational Integrated Ecosystem Assessments to evaluate how ecosystems respond to cumulative pressures that affect their resilience. The first step in the IEA cycle involves scoping the key management objectives, human activities and ecosystem components affected by these activities through a formal process of stakeholder involvement. This scoping phase defines conceptual models of the socio-ecological interactions, mapping links in the ecosystem including human activities within and beyond the CS areas. The OOH project is already fully engaged in this process for the Benguela Current case study region and thus can provide early input to the MA project, particularly on socio-economic aspects which are a key part of OOH research programmes 0 and 5. The two projects can share stakeholder platforms for the identified case study areas in order to minimize 'stakeholder fatigue' and to ensure a fully coordinated approach in the region.

In light of the above, the OOH executive team, is committed to advise *Mission Atlantic's Steering Committee,* as appropriate, on ways to best CLUSTER effort on field campaigns and research, stakeholder engagement, pooling effort on transfer of know-how North-South, as well as joining forces on co-design and transform research outputs into mature **"*fit-for-purpose*"** operational outputs for a range of sectors.

Yours sincerely,

Elisa Morgera

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Daniela Diz

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