BLUEMISSION AA

Building a coordination hub to support the mission implementation in the Atlantic and Arctic Basin

Curriculum of training and transfer activities

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List of Acronyms

Acronym	Meaning
DEP	Dissemination and Exploitation Plan
SER	Society for Ecological Restoration

1. Summary

BlueMissionAA is the coordination hub to support the implementation of the EU Mission Restore our Ocean and Waters by 2030 for the Atlantic and Arctic basins. The specific Mission objective for these basins is to protect and restore marine and freshwater ecosystems and biodiversity[1].

The aim of this specific task and document is to support the linkage of the objectives of BlueMissionAA with the coordination measures needed to achieve the Mission goals, focusing on the connections with several regional or local actors, networks and relevant outputs to the Atlantic and Arctic basins. The *curriculum* basic principles intend to support pertinent governance structures at basin level, which will permit the project to be embedded in a larger context of societal and political transformation to restore ecosystems and biodiversity. Two key instances of coordination will be the continuous cooperation with innovation ecosystems to develop a robust market for restoration solutions as well as stakeholders and citizens to foster co-design, co-deployment and co-monitoring.

Following the Society for Ecological Restoration's (SER)[2] standards and guidelines for carrying out restoration, this *curriculum* identifies the main topics that the specific audiences should be aware of, know or practice in order to be valid interlocutors/actors in the discussion or management of the overall objective of protecting and restoring marine and freshwater ecosystems and their biodiversity.

Educating the target audiences working in ecological restoration about the importance of the coastal environment is essential if they are to become stewards of these valuable ecosystems. This deliverable provides an overview of the process and key considerations involved in preparing *curricula* for coastal ecosystem protection and restoration.

[1] EU Mission Restore our Ocean and Waters Implementation Plan, p. 24

[2] Society for Ecological Restoration - SER E-Learning Course: Overview of the Practice of Ecological Restoration - Society for Ecological Restoration

2. Introduction

Against the backdrop of the 2030 Agenda, the EU Mission "Restore our Ocean and Waters" aims to protect and restore the health of our ocean and waters through research and innovation, citizen engagement and blue investments. The Mission's new approach will address the ocean and waters as one and play a key role in achieving climate neutrality and restoring nature. Crosscutting enabling actions will support this objective, in particular broad public mobilisation and engagement with a water knowledge system and a digital ocean, known as the Digital Twin Ocean[3].

The Mission supports regional engagement and cooperation through area-based "lighthouses" in major sea/river basins: Atlantic-Arctic, Mediterranean Sea, Baltic-North Sea, and Danube-Black Sea. Mission lighthouses are sites to pilot, demonstrate, develop and deploy the Mission activities across EU seas and river basins.

BlueMissionAA aims to have a structuring effect to consolidate and mobilise a wide community of relevant stakeholders and EU citizens towards the achievement of the Mission's objectives at basin level. It will provide an effective governance framework aligned with national, regional and EU level policies, initiatives and actions, a well-coordinated monitoring framework to continuously assess implementation progress, a broad catalogue of supporting services, an attractive innovation ecosystem for ecological restoration, and the opportunity and capacity for EU citizens to engage in the conservation and restoration of oceans and waters through participatory means.

BlueMissionAA focuses on the following specific objectives:

- Establish and mobilise governance frameworks and networks through multidisciplinary and multisectoral cooperation needed to achieve the Mission's objectives in the Atlantic and Arctic Sea basins and inland water systems, building on existing initiatives, in particular those related to ecological restoration.
- Develop and implement a comprehensive monitoring and reporting framework to continuously measure the progress of the implementation of the Mission in the Atlantic and Arctic Sea basins, including the development of a set of indicators in coordination with the Mission's Implementation Platform, the PREP4BLUE[4] project and all other lighthouse projects in the four sea and river basins.
- Develop and maintain a fair catalogue of existing scientific and practical actionable knowledge and innovative solutions and make it available to stakeholders in the Atlantic and Arctic basins and beyond, enabling researchers to make their work available to industry, policy makers and citizens to ensure expertise is readily available for conservation and restoration projects.
- Develop a dynamic entrepreneurial innovation ecosystem in the Atlantic and Arctic basins, building on and aligning with existing initiatives identified in the Catalogue, with the aim of supporting mature technologies and solutions on their way to market and

[3] European Digital Twin of the Ocean (European DTO) (europa.eu)
[4] PREP4BLUE - Preparing the Research & Innovation Core for Mission Ocean, Seas & Waters

productive use by linking them to investments, funders, donors, and public and private customers.

- Engage and empower citizens to contribute to the Mission and boost society uptake of new solutions through a systematic and meaningful involvement of all relevant stakeholders, implementing a holistic evaluation framework, and ensuring a dissemination and exploitation strategy for the whole project, developed and implemented according to Open Science standards and Good Scientific Practices.

The objective of this specific task is to support the linkage of the above objectives with the third level of the BlueMissionAA coordination actions, focusing on the interlinkages between several regional or local actors, networks, and outputs relevant to the Atlantic and Arctic Basins. This curriculum intends to support relevant governance structures at the basin level, which will allow the project to be embedded in a larger context of societal and political transformation to restore ecosystems and biodiversity. Two key instances of coordination will be ongoing: collaboration with innovation ecosystems to develop a robust market for the restoration solutions, and with stakeholders and citizens to promote co-design, co-deployment and co-monitoring.

This means that this Task 3.4 focuses on the development of training and knowledge transfer activities for cross-thematic pilot, test, and demonstration activities, enabling capacity building for stakeholders in the Atlantic and Arctic regions. Curricula activities will focus on the transfer of innovative knowledge from research to industry and/or public stakeholders, and between the Lighthouses.

Generally following the Society for Ecological Restoration (SER)[5] standards and guidelines for carrying out restoration, this document identifies the main topics that the specific audiences should be aware of, know or practice in order to be able to be valid interlocutors/actors in the discussion or management of the overall objective of protecting and restoring marine and freshwater ecosystems and their biodiversity.

Standards-based restoration can help to increase the effectiveness of restoration projects and programs, resulting in better ecological and human well-being outcomes. Standards-based restoration also reduces risk and uncertainty for landowners, regulators, and funders.

2.1 Importance and objectives of knowledge transfer and training activities

"Knowledge Transfer" is a method of sharing information, skills, and ideas across different areas of a productive system. It promotes innovation and increases efficiency. Knowledge transfer systems help users to streamline knowledge, ensuring that everyone in a group has the information they need to keep a particular activity running smoothly.

"Knowledge Transfer" is a practical way of transferring knowledge from one part of a company/organization/country to another. It is both a theory and a practice – which means it is applied to cultural, political or economic systems. However, it is more than just communication. It involves the sharing of information, ideas, tasks, processes, tools,

[5] Society for Ecological Restoration - SER E-Learning Course: Overview of the Practice of Ecological Restoration - Society for Ecological Restoration

documents, and so much more. Knowledge transfer is not the same as "training". Nor is it simply the transfer of information (facts and data). While it includes these items, knowledge transfer is concerned with identifying and harnessing the adaptive skills and abilities of group members to apply information. It is also difficult to transfer tacit knowledge, i.e., personal, experiential knowledge from one person to another. Knowledge transfer combines both the practical and the personal in order to change and structure team/group behaviour and develop their skills.

Training and transfer activities are of significant importance in various fields, especially in education, skills development, and cognitive enhancement. These activities play a crucial role in acquiring knowledge, developing expertise, and applying learned skills in different contexts. Training equips individuals with specific skills and knowledge relevant to their roles and responsibilities. Knowledge transfer activities ensure that these skills are effectively shared and disseminated throughout an organization(s), stakeholders, other groups of interest maximising the collective expertise, and consolidating a best practice. If well-trained individuals perform their tasks more efficiently and effectively, knowledge transfer helps them to apply this acquired knowledge to real-world situations, leading to improved performance and results. Training and knowledge transfer activities promote adaptability by enabling individuals to apply their learning in different situations. This adaptability is crucial in today's rapidly changing political and socio-economic context.

Knowledge transfer allows successful practices and lessons learned to share across teams, departments, organizations and countries. This facilitates a collaborative learning environment and avoids duplication of efforts. Proper training and knowledge transfer processes can help mitigate risks by ensuring that audiences/users are well informed about safety protocols, compliance regulations, and best practices. This preservation of knowledge prevents different actors from duplicating efforts and losing valuable insights, thereby also effectively streamlining the process of knowledge creation and knowledge transfer.

In the end, training and knowledge transfer activities are fundamental for building competent, adaptable, and innovative individuals, organizations, and societies. They facilitate growth, foster cooperation, and position political and socio-economic sectors for success in a rapidly changing world.

In the case of BluemissionAA, the idea is to harness and maximise these potentials/assets/tools of the transfer and training activities, apply them with urgency of protecting and restoring marine and freshwater ecosystems, develop these tools through cross-thematic pilots, testing and demonstration activities, and enable capacity building for stakeholders in the Atlantic and Arctic areas.

These activities will be aligned with the needs identified in WP1 and WP2 and focused on **the Mission objectives**. The planned activities will focus on the transfer of innovative knowledge from research to industry and/or public stakeholders and between the Lighthouses.

3. Training and knowledge transfer *curricula* design

Designing training *curricula* for marine and freshwater ecosystems protection and restoration requires a comprehensive and a multidisciplinary approach that encompasses various subjects and practical skills. A *curriculum* is a general guideline, its specific content and duration may vary depending on the target audience, type of users, available resources, the end purpose, and the depth of knowledge and technology desired. The *curriculum* should be adaptable to various learning formats, including certification training and academic lectures programs, field visits, webinars, e-learning courses, practical exercises, internships, and group discussions. It is essential to incorporate practical/hands-on experiences and encourage active participation to enhance understanding and application of the learned concepts. In addition, guest speakers and experts from relevant fields should be invited to provide real-world insights and share their experiences and technologies.

The presented *curriculum* focuses on the development of scientific knowledge transfer activities for multi-thematic pilot, test and demonstration activities, allowing the strengthening of the capacities of actors in the Atlantic and Arctic areas. The planned activities focus on transfer of innovative scientific knowledge and technology from research to industry and/or public stakeholders, and between the Lighthouses. The target audiences of *curricula*, which includes best practice in knowledge and technology transfer, are based on the audience list established for Milestone 12 and reported in Deliverable D5.1 (Table 1).

Table 1. Audience list/Target group.

***Curriculum* audience**		**Includes**
PUBLIC STAKEHOLDERS	Mission Governance	Mission manager, Mission Secretariat, Mission Board, PREP4BLUE, Mission implementation platform, Mission-funded projects (e.g., other lighthouse CSAs, IAs)
	International Organisations	Multilateral organisations (e.g., UNEP, IOC, IUCN), international partnerships and agreements (e.g., OSPAR, IASC, IASSA, Atlantic Arc commission of CPMR)
	Governmental bodies	Policy and decision-makers operating at different scales (EU, national, regional and local level), funding agencies (e.g., EMFF/EMFAF, LIFE, ERDF, ESF+, JTF, CEF Inland Waterways or Maritime and InvestEU), MPA management authorities, Arctic Council, leaders of existing governance structures, Barents Regional Council, Atlantic Cities
	Civil society and general public	European citizens, NGOs, local community groups, associations, indigenous communities, youth, integrational networks (e.g., All-Atlantic Ocean Youth Ambassadors and the OceanBRIDGES network),

Curriculum audience		Includes
		representatives of specific societal groups (e.g., grass-root organisations, environmental interest groups, minorities)
	Media	Mass media, online news outlets, social media, social media influencers
INDUSTRY	Industry and private sector	Businesses, green businesses, urban and spatial planners, technicians and project managers, other practitioners, innovators, entrepreneurs, start-ups, SMEs, investors, funders, donors, philanthropists, experts in ocean protection and restoration, restoration networks (e.g., SERE), implementation agencies, Arctic Economic Council, AECO, across industries (e.g., fisheries, oil and gas, mineral resources, aquaculture, ports and infrastructure, tourism)

3.1 Scientific knowledge transfer activities

The following appropriate learning topics and technological tools can be used to develop a comprehensive training *curriculum* for protecting and restoring ecosystems (Table 2).

Table 2. Learning topics on academic/scientific transfer of knowledge.

Main topics	Includes/Goal	Transfer tools	Target audience
Introduction to Marine and Freshwater Ecosystems and Biodiversity Conservation	Overview of ecosystems, their components, and functions; Importance of biodiversity conservation for ecosystem health; Threats to ecosystems and the need for protection and restoration	Certification training and academic lectures programs, field visits, webinars, e-learning courses	PUBLIC STAKEHOLDERS
Ecological Principles and Processes	Understanding ecological interactions and interdependencies; Ecological succession and ecosystem dynamics; Introduction to key ecological concepts (e.g., energy flow, nutrient cycles)		PUBLIC STAKEHOLDERS
Ecosystem Assessment and Monitoring	Techniques for assessing ecosystem health and integrity; Key species identification and monitoring methods; Data collection, analysis, and interpretation for ecosystem assessment		PUBLIC STAKEHOLDERS AND INDUSTRY
Ecosystem Restoration Approaches	Principles and strategies for ecosystem restoration; Restoring degraded habitats (e.g., Wetlands, Seagrass); Introduction to		PUBLIC STAKEHOLDERS AND INDUSTRY

Main topics	Includes/Goal	Transfer tools	Target audience
	ecological engineering and restoration techniques		
Conservation Planning and Policy	Conservation planning principles and frameworks; Designing protected areas and habitat corridors; International/European and national policies for ecosystem conservation and restoration		PUBLIC STAKEHOLDERS
Socio-economic Aspects of Ecosystem Protection	Recognizing the social and economic value of ecosystems; Engaging stakeholders in conservation efforts; Sustainable livelihoods and community-based conservation;		INDUSTRY
Case Studies and Best Practices	Examining successful ecosystem restoration projects; Learning from successful examples and experiences; Identifying challenges and lessons learned	Six selected case studies identified in Milestone 1.1 (Annex 1)	INDUSTRY
Practical Innovation Skills Development	Innovation field techniques and technologies for marine habitat assessment and restoration	Practical courses and exercises, internships and group discussions	INDUSTRY

3.2 Technology transfer activities

New technologies have a crucial role to play in the protection and restoration of marine and freshwater ecosystems (Table 3). Technology facilitates knowledge sharing among coastal restoration scientists, researchers, industry and public stakeholders worldwide. Collaboration and the exchange of ideas can be the catalyst for more innovative and effective restoration strategies.

Emerging technologies enable scientists to monitor marine and freshwater ecosystems more effectively and collect detailed data through improved monitoring and data collection (e.g., remote sensing, drones or autonomous underwater vehicles (AUVs)). In addition, geographic information systems (GIS) and high-resolution satellite imagery help in mapping and characterizing marine and freshwater habitats. The real data obtained helps us to understand the ecosystems current condition. It helps to identify critical areas and problems and to develop comprehensive restoration plans. Therefore, advanced technologies enable precise and efficient restoration interventions. For instance, the use of artificial intelligence (AI) and machine learning algorithms can help to optimize the bio-receptive materials, design and placement of artificial reefs (e.g., the 3D Pare project) or wastewater management (ClimaRest project) for maximum impact and success.

Some emerging technologies, like biotechnology and nanotechnology, have the potential to speed up the restoration process. For example, genetically engineered organisms can be used to remove pollutants from water or to restore damaged/sick coral reefs more quickly.

Other technologies can engage the public in ecosystem restoration efforts, named eco-social approaches (e.g., Thames 21 and A-AAGORA (demo site Troms) projects). Citizen science can contribute to data collection through smartphone apps, remote sensing platforms, or web-based monitoring tools, thus expanding the reach and impact of restoration initiatives. Similarly, virtual reality, augmented reality and immersive technologies can be used to raise public awareness about the importance of coastal ecosystem protection and restoration. Such technologies can help people to understand the value of the key ecosystems and encourage them to support restoration efforts. Many emerging technologies are design to address the challenges posed by climate change. Technologies that promote resilience and adaptation are essential for effective restoration as coastal ecosystems face increasing threats from sea level rise, ocean acidification and extreme weather events.

Finally, the integration of new technologies into the protection and restoration of marine and freshwater ecosystems can lead to more efficient data-driven and innovative solutions. This will help us to protect and restore these vital ecosystems for present and future generations. However, it is important to balance the benefits of technology with environmental potential and ethical impacts.

Table 3. Technology training transfer.

	Technology	**Includes**	**Goal**	**Transfer tools**	**Target audience**
Data collection	Remote Sensing and GIS	Introduction to remote sensing technologies (e.g., satellite imagery, aerial photography); Basics of Geographic Information Systems (GIS) and their applications in ecosystem monitoring and analysis	Image interpretation and analysis for sea/land cover mapping, change detection, and habitat assessment	Webinars and virtual workshops; Industry-specific case studies, Expert webcasts, Certification programs, Networking Events and conferences, Collaboration with Industry associations	INDUSTRY
	Drones and Unmanned Aerial Vehicles (UAVs)	Basics of drone technology and regulations; Image processing and analysis techniques for drone data	Applications of UAVs in ecosystem mapping; monitoring, and restoration		INDUSTRY
	Monitoring Technologies	Field data collection techniques using mobile devices (e.g., smartphones, tablets); Tracking data (GPS - Global Positioning System) usage; Introduction to sensor technologies (e.g., water quality sensors, weather	Environmental monitoring (spatial data collection and geo-referencing)	Educational websites, videos, animations, events, talks, workshops, podcasts,	Public stakeholders & Industry

	Technology	Includes	Goal	Transfer tools	Target audience
Data collection		stations, Ocean Observatories)		games and materials distribution; Social media campaigns (inc. influencers); Mobile apps; Public engagement platforms	
	Monitoring Technologies	Citizen Science and Crowdsourcing: Engaging the public through citizen science initiatives; Designing and managing crowdsourcing projects; Quality control and data validation in citizen science programs	Environmental monitoring (spatial data collection and geo-referencing)		Public stakeholders
	Environmental DNA (eDNA) and Metagenomics	Sample collection and DNA extraction techniques; Principles of eDNA and metagenomic analysis; Introduction to bioinformatics tools and databases for data analysis	Biodiversity assessment; Developing efficient indicators of ecosystem function; estimate total biodiversity in the area	Webinars and virtual workshops; Industry-specific case studies, Expert webcasts, Certification programs, Networking Events and conferences, Collaboration with Industry associations	INDUSTRY
Analysis and planning	Data Analysis and Visualization	Data management and analysis using software tools (e.g., R, Python, Excel, ArcGIS); Visualization techniques for presenting and communicating ecological data	Spatial analysis and modelling for ecosystem assessment and planning		INDUSTRY
	Emerging Technologies	Artificial intelligence (AI) and machine learning	Applications of AI for data analysis, species identification, and pattern recognition in ecosystem protection and restoration		INDUSTRY

	Technology	Includes	Goal	Transfer tools	Target audience
	Environmental Monitoring Networks and Sensor Networks – Real time	Design and implementation of environmental monitoring networks; Deployment and maintenance of sensor networks for real-time data collection	Data integration and Management (analysis from multiple sensors and network nodes); Best practices for data management, storage, and sharing		INDUSTRY
		Data integration and interoperability among different technology platforms and datasets; Introduction to open data standards and protocols			
Decision Support	Decision Support Systems and Conservation Planning Tools	Introduction to decision support systems (DSS); Application of DSS tools for prioritization, planning, and decision-making for the protection and restoration of coastal ecosystems; Use of software tools and platforms for conservation planning	Ecosystem management and planning	Educational websites, videos, animations, events, talks, workshops, podcasts, games and materials distribution; Social media campaigns (inc. influencers); Mobile apps; Public engagement platforms	Public stakeholders & Industry

ANNEX 1 - Selected cases WP1 – M1.1

The following cases were selected based on the above criteria:

Case 1:

Title: Large scale RESToration of COASTal ecosystems through rivers to sea connectivity (Atlantic)

Acronym: REST-COAST

Webpage: https://rest-coast.eu/

Goal: Restoration Revolution: overcome present hurdles to upscale coastal restoration interventions through new technical, financial, management and transfer tools, aligned with the needs of coastal vulnerable regions and society.

Study Pilot Highlight: Arcachon Bay, FR and large-scale seagrass restoration (factsheet)

Expected Results: The project is exploring a new restoration approach focusing on hydrodynamics. It aims at reducing hydrodynamics, then increasing sediment deposition, reducing bottom shear stress, and reducing water turbidity. These will contribute to facilitating seagrass anchoring, horizontal and vertical growth from near to far, and large-scale stabilisation and restoration of local seagrass meadows. On a larger scale, it will provide an **"ecological restoration" tool** for local governance that can be used to target both biodiversity enhancement and ecosystem co-benefits (carbon offset, biodiversity offset, erosion protection, and so on) in the Arcachon Basin, replicate that approach, and scale it up to meet both ecological and economic expectations at the regional scale.

Funding mechanism: H2020

Case 2:

Title: Artificial reef 3D printing for Atlantic area (Atlantic)

Acronym: 3DPARE

Webpage: https://www.giteco.unican.es/proyectos/3dpare/index.html

Goal: 3DPARE" develop innovative artificial reefs for sustainable management of the marine ecosystems of the Atlantic Area. Project focuses on 3D printing artificial reefs – particular interest in Santander Bay

Results: Project started in 2017 and concluded in 2021, lessons learnt in terms of 3D printing low-impact and bio-receptive materials based on natural and renewable raw materials. 3DPARE demonstrate that the material developed and the innovative techniques utilized in this project, not only are suitable to manufacture artificial reefs, but also are better that the ones currently used.

Funding mechanism: Interreg Atlantic Area - EAPA_174/2016

Case 3:

Title: Nature-based tools to protect and restore biodiversity (Atlantic)

Acronym: Restoreseas

Webpage: https://www.restoreseas.net/

Goal: RESTORESEAS aims to improve resilience of restoration of marine forest habitats in the Atlantic coasts, by applying novel nature-based solutions.

Expected Results: Restoration of corals, seagrasses, and seaweeds. Offers insights into stakeholder engagement, and policy making. Project partners across Atlantic and Arctic. Project started in 2022.

Funding mechanism: Public funding

Case 4:

Title: Thames 21 (Atlantic) – UK focus

Acronym: Thames 21

Webpage:e https://www.thames21.org.uk/improving-rivers/creating-urbanwetlands/

Goal: Creating urban wetlands on the river Thames in London boroughs. Created in 2019 and ongoing private-public partnership

Funding mechanism: Private-public funding mechanism

Case 5:

Title: Coastal Climate Resilience and Marine Restoration Tools for the Arctic Atlantic basin (Atlantic) - demo site Svalbard (Arctic)

Acronym: CLIMAREST

Webpage: https://climarest.eu/ focus on: Demo site 1 – Arctic fjords – Climarest

Goal: Increasing the resilience of coastal ecosystems in Arctic Fjords through mitigation of land-based pollution discharge and nature-based solutions against coastal erosion. Demo site is part of the Mission Ocean Innovation Action project «Climarest», project started in 2022.

Funding mechanism: Horizon Europe

Case 6:

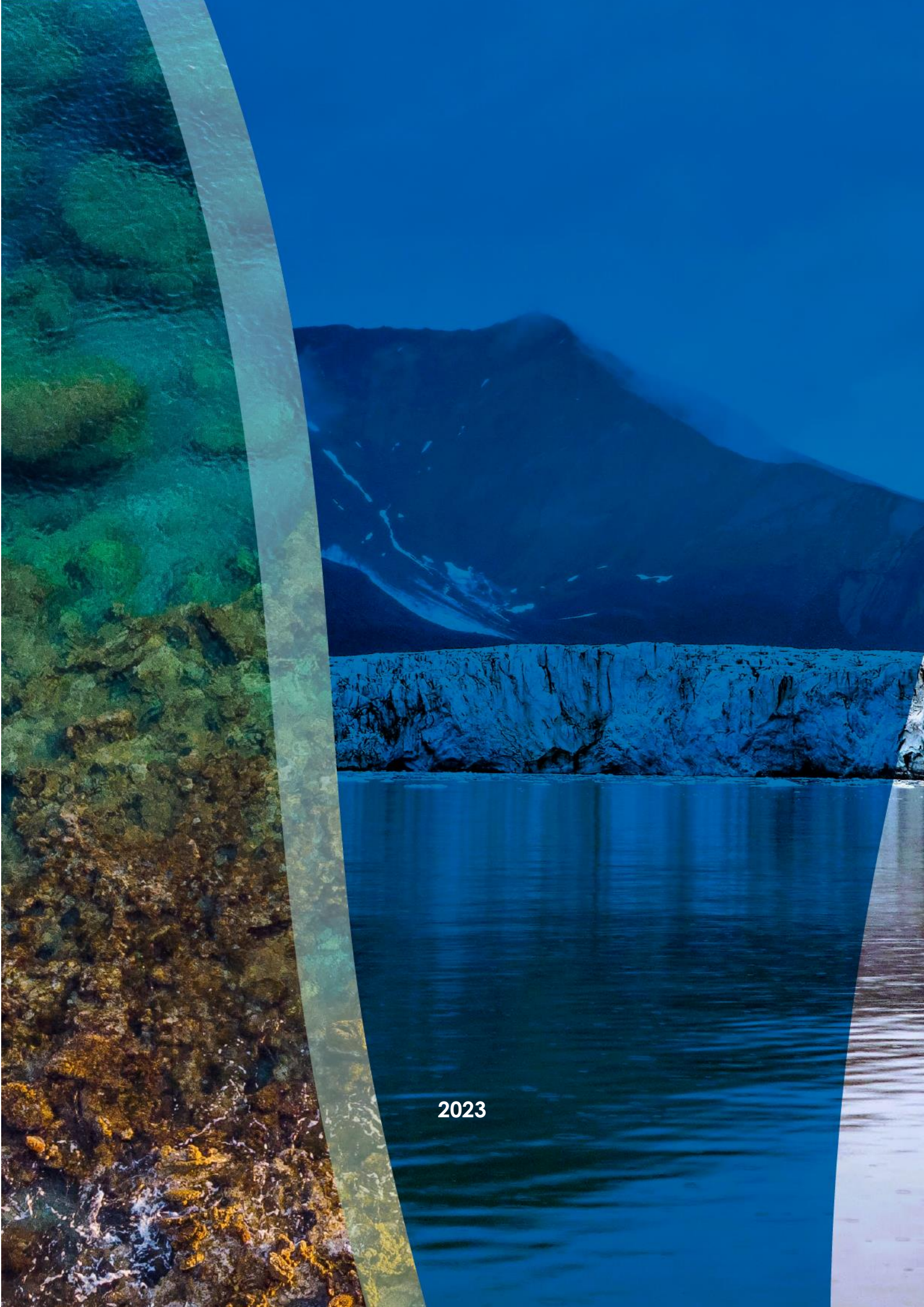
Title: Blueprint for Atlantic-Arctic Agora on cross-sectoral cooperation for restoration of marine and coastal ecosystems and increased climate resilience through transformative innovation

Acronym: A-AAgora

Webpage: https://a-aagora.eu/ & https://a-aagora.eu/demos/demonstration-troms/ & https://storymaps.arcgis.com/stories/71b25e6cbaf84cf3a641e35631b4f2fb

Goal: focus on Troms Arctic Archipelago in Norway - kelp forests (Arctic): Restoration of kelp forest that has been razed by sea urchins ("sea urchin barren") through the removal of sea urchins. Started in 2022, the project implements a living lab approach and can provide insights on how local communities and ecotourism schemes can be engaged in marine restoration activities. The demo site is part of the Mission Ocean Innovation Action

Funding mechanism: Horizon Europe



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