‘Annual State of the Coast Report

SEA-EU

(Task 5.2)

November 2024

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Preface

In stark contrast to the prevailing mindset in antiquity, right up to a few centuries ago, when the coast was perceived as a foreboding place which was susceptible to incursions and pillaging of all forms, the coastal zone is nowadays coveted by many. So much so that two-thirds of the world's megapolis are centred along the coast and, according to the UN, at least 40% of the global human population lives within a day's walk of the sea. The inevitable consequence of such popularity is clutter, in the form of coastal urbanisation, with the diverse array of coastal habitats regressing at an alarming pace. The Mediterranean Sea, for instance, is reputed to have lost at least 75% of its coastal dune extent.

The coastal urbanisation drive is compounded by other insidious pressures, including the one arising from coastal armouring in response to Sea Level Rise (SLR), which in turn are placing the same coastal habitats between a rock and a hard place, the so-called 'coastal squeeze' phenomenon. These are the same habitats which are known to provide human societies with a plethora of ecosystems goods and services, not least carbon sequestration, storm attenuation, water purification and nutrient cycling. To cap it all, coastal zones are known for their productivity and rich biodiversity, courtesy of their 'ecotone' or transitional zone status, further underscoring the need for the adoption of sound Integrated Coastal Zone Management (ICZM) approaches when managing coastal systems.

Concurrently, the momentum in favour of Blue Growth is unrelenting, putting a premium on what is essentially already a highly-crowded coastal and marine space. Foresight and the consideration of future possible scenarios become essential in the struggle to maintain Blue Growth as sustainable as possible. The SEA-EU Alliance spans, through its nine member Universities, an extensive coastal stretch approximating 110,000km, within different European sea basins – the Mediterranean, the Baltic, the north-east Atlantic and the North Sea, extending from the Arctic approaches all the way south to the waters off northern Africa. This in itself presents a unique opportunity to conduct a pan-Alliance comparative exercise to assess the state of the coast within each respective participating country/institution. This is what this exercise is all about. The hope is that the same exercise allows the identification of commonalities and peculiarities within the coastal zones under scrutiny, pursuant to promoting the formulation of common management strategies through the sharing of knowledge and experiences.

Kudos to the catalysts behind this exercise – Dr. Lisa Pace, from the Edward de Bono Institute for Creative Thinking and Innovation at the University of Malta and Ms. Isabella Bianco from the UM's SEA-EU Office – as well as to all the academic and administrative staff within the nine SEA-EU participating Universities for investing time and energy to contribute to this interesting comparative study, which definitely warrants a meaningful follow-up.

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Malta's Ocean Governance Ambassador

SWOT Task Team

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Terms of Reference:

The SEA-EU alliance aims to identify sustainable development strategies in the coastal area using an ecosystem-based approach (Task 5.2). As a first step to assess the state of the coast, SEA-EU partners conducted an analysis of the Strengths, Weaknesses, Opportunities and Threats (SWOT) in the following four domains:

- **Circular blue economy** maximizes the use of materials through circular flow (Martínez-Vázquez et al., 2021), and reducing the need for new resources and materials (EU Blue Economy Report 2023).
- **Marine renewable energies**, including ocean energy, floating solar energy and offshore hydrogen generation
- **Marine ecosystem services** comprise various goods, services and cultural or other benefits derived from marine habitats and ecosystems (Barbier, 2017; EU Blue Economy Report, 2023).
- **Spatial planning of socio-economic activities** refers to the practices and policies implemented to manage and organise the use of the coastal areas and ocean space, as well as the interactions among uses and between uses and the marine environment, including socio-economic and environmental pressures/tensions on coastal territories.

This study defines the **coastal region** according to Eurostat's criteria: a region with a coastline, or where more than half the population lives within 50 km of the coast, based on 1 km² grid cell population data, or a region with a strong maritime influence. The **coastal region level** is delineated at NUTS II level which is the basic unit for the application of European regional policy, strategic planning and is often an institutionalised administrative level.

The present report reflects the progress achieved by the SEA-EU partners with some partners having completed the analysis, while others were in the stage of data collection upon completion of the present report.

Data and Methodology

The SWOT exercise was conducted between March and September 2024. The SWOT Team met in March to define key tasks and requirements for data collection and subsequently in April to monitor progress. An outlook on the SWOTs was presented by the SEA-EU partners at the 'Being SEA-EU' Conference held at the University of Malta, Valletta campus on the 12th June 2024.

The SEA-EU partners agreed that data would be collected through interviews conducted with at least one expert from each of government, university/academia and a non-governmental organisation and from published documents (national and regional strategies, expert reports etc.,) to obtain diverse perspectives on the state of the coast in the four domains. However, recognizing the significant influence of the private sector as a key stakeholder in the region, for some regions interviews were also conducted with representatives from these entities.

The SWOT (Strengths, Weaknesses, Opportunities and Threats) is a well-established tool used in decision-support systems and policy development. This study adopted a SETs framework that considers the interactions of coupled social, ecological, and technological dimensions of coastal and marine systems in the SWOT. These dynamics change with time and the relative contribution of the social, ecological and technological dimensions to sustainability differ in complex systems (McPhearson et al., 2022) – Table 1.

Table 1: Dimensions used to investigate SWOT factors

Dimension	Description
Socio-economic	Economic, institutions, regulatory frameworks, education, science and innovation capacity
Ecological-biophysical-climate	Biophysical and climate system including biodiversity, green infrastructures, ecosystem management practices
Technological-engineering infrastructural	Engineering infrastructures, technology solutions and developments or technology improvements and innovations

ANALYSIS OF STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS (SWOT)

SWOT– Algarve, Portugal

CIRCULAR BLUE ECONOMY:

The Algarve region has extensively addressed Blue Growth in its strategic documents, starting with the Algarve Regional Development Strategy 2030, followed by the RIS3, and culminating in a specific intelligent specialization strategy for Blue Growth. This vision, validated by the 2023 Atlazul Project, promotes an economy that sustainably and innovatively uses marine resources, focusing on waste reduction, material reuse, and fostering sustainability across sectors. Priorities include transitioning ports to renewable energy, optimizing consumption, and supporting electric vehicle infrastructure.

STRENGTHS	**WEAKNESSES**
Portugal's strengths for sustainable development include qualified human resources, high fish consumption, and a strong maritime tradition. The country emphasizes intellectual capital and has advanced circular economy measures since 2017. (*socio-economic*) Emerging technologies support renewable energies and sustainable aquaculture, with several ports along the coast. The Blue Hub in Olhão is developing, and initiatives like the Blue Circular Economy focus on recycling marine plastic waste in Portugal. (*technological)*	Main challenges include limited stakeholder integration, insufficient funding for sustainable projects, overreliance on tourism, and complex licensing systems. Outdated legislation and inadequate training for government personnel also pose obstacles, while the economy remains largely dependent on tourism. (*socio - economic*) Development and tourism pressures can harm marine ecosystems if not managed properly. Investment in the blue economy faces obstacles, high licensing costs, and outdated policies. Excessive tourism threatens coastal areas, while habitat loss and pollution challenge biodiversity conservation. (*ecological - biophysical)* Infrastructure needs updating for the blue economy, with an aging fishing fleet and a lack of waste transformation industry. The region is often overlooked in public investments, and associationism is weak. (*technological)*
OPPORTUNITIES	**THREATS**
Key actions include developing blue economy policies, simplifying licensing, and implementing a community support framework. There's	Challenges include resistance to change, strict regulations, and an aging workforce. Outdated legislation and reliance on tourism

potential for aquaculture growth, stakeholder engagement, and modernizing the legal framework for circularity. (*socio-cultural*) Restoring marine ecosystems can enhance ecotourism and sustainable aquaculture, while community awareness can reduce inland litter. Green projects like wetland restoration improve biodiversity, and marine protected areas, along with alternative uses for invasive species, can help ease pressure on overexploited species. (*ecological - biophysical*) Key initiatives focus on sustainable marine management technologies, supporting algae biomass production, and enhancing digital tools. Investments in eco-friendly ports and aquaculture promote circular economy practices, while public transportation connects key hubs and "industrial" parks for aquaculture are being established. (*technological*)	hinder progress, while reluctance from traditional industries to adopt circular practices limits economic diversification. (*socio-cultural*) Current territory reservations hinder progress, emphasizing the need for a legal framework for ecosystem services. (*ecological - biophysical)* Challenges include inadequate infrastructure for circular economy practices, limited technological readiness, and difficulty attracting talent outside major urban areas. Establishing aquaculture "industrial" parks is restricted by regulations. Existing infrastructures are hindered by dependence on a single economic activity. (*technological)*

MARINE RENEWABLE ENERGY:

Marine renewable energy represents a significant untapped resource, with the potential to provide 20% of Europe's electricity by 2050 and avoid 279 million tonnes of CO2 emissions annually. Despite the potential to generate over 1.8 GW in European waters by 2030, industry challenges include high costs and engineering uncertainties that deter investment. Portugal has been a pioneer in testing marine energy converters, notably the Evopod tidal energy device at Ria Formosa. This project generated valuable data for developers and raised the region's profile in EU funding opportunities, such as Interreg Atlantic Area and H2020. It also initiated discussions about creating a pilot sustainable energy island on Culatra Island, with broad support from key stakeholders. Culatra is now one of six EU pilot islands receiving European Commission backing for clean energy initiatives, strengthening the region's role in Portugal's energy transition.

STRENGTHS	**WEAKNESSES**
The Algarve region's leadership in marine renewable energy testing signals strong innovation potential, job creation, and economic diversification. Support from the European Commission and commitments to the Blue Economy promote sustainable growth. Portugal's continental shelf extension enhances investment opportunities, while establishing an island as a living laboratory for energy transition	The Algarve faces challenges in attracting marine renewable infrastructures and sustaining commercial interest and there is a high reliance on external funding. Conflicts with local fishing and tourism necessitate stakeholder management. Delays in licensing and poor coordination hinder investment and decentralized energy market growth.

allows for testing renewable technologies and serves as a model for coastal communities. (*socio-economic*) The Algarve's coastal areas, like the Ria Formosa lagoon, are well-suited for marine renewable energy technologies with minimal environmental impact. Its potential for tidal and offshore wind energy aligns with EU sustainability goals. The region supports marine energy projects, promoting the transition to clean energy. As a living lab for sustainable energy, the Algarve fosters innovation and ongoing research at UALG's centers aims to enhance ecosystem management while addressing climate resilience, economic preservation, and self-sufficiency, boosting blue economy revenues and job creation. (*ecological - biophysical*) The Algarve showcases technological readiness in marine renewable energy with prototypes like the Evopod tidal energy converter. Its infrastructure supports projects like Windfloat, establishing the region as a European leader in this field. The development of offshore hybrid energy projects further enhances energy source diversification and production optimization. (*technological*)	Current energy frameworks limit decarbonization and optimal use of renewable resources by relying on conventional generation. (*socio-economic*) Environmental concerns about tidal energy converters involve impacts on tidal patterns, sediment transport, and marine habitats, necessitating careful management. Insufficient data on environmental interactions can impede technology acceptance, while research highlights potential negative effects on marine ecosystems. Additionally, the Algarve lacks a clear vision for its climate agenda, with the Algarve2030 Agenda failing to effectively outline steps for a sustainable energy action plan. (*ecological - biophysical*) Marine renewable energy technologies are still developing and not fully economically viable. More research is needed to address environmental concerns and enhance performance.The industry struggles with uncertainties in engineering design, making investments risky. Although the University of Algarve is working on smart energy solutions under the Culatra2030 initiative, these technologies are not yet established in the region. (*technological*)
OPPORTUNITIES	**THREATS**
Supportive regulatory frameworks will encourage investment and innovation, while integrating these initiatives into sustainable development strategies will maximize benefits. The Ria Formosa system is ideal for testing prototypes, representing coastal areas where energy-generating devices can support small communities. (*socio - economic*) Ecosystem-based approaches in marine renewable energy minimize ecological impacts, and installations can serve as artificial reefs to boost biodiversity. Environmental monitoring and climate change adaptation are crucial for energy planning. The region's favorable climate and collaboration between academia and	Economic barriers, high costs, and complex permits impede marine renewable energy projects. Public resistance and competition with industries like fishing and tourism create conflicts. Despite Portugal's potential, interest in marine renewable devices has declined. (*socio-economic*) Marine renewable energy infrastructure can cause habitat loss and species displacement, while installation may disrupt migration routes. Long-term impacts are uncertain, particularly concerning cumulative effects from climate change. Extracting marine energy may reduce tidal amplitude, alter

industry support these initiatives. (*ecological - biophysical*) Technological advancements enhance the efficiency of marine renewable energy systems, while innovative energy storage and grid solutions optimize production. Smart grid digitalization improves project management. Culatra 2030 serves as a living laboratory for energy transition, showcasing smart grid technologies. (*technological*)	flow patterns, and affect water quality and sediment transport. (*ecological - biophysical*) Tourism harms marine habitats, while emerging renewable energy technologies face technical challenges that lead to delays and costs. Additionally, insufficient investment in renewable energy education at the University of Algarve limits expertise development. (*technological*)

SPATIAL PLANNING OF SOCIO-ECONOMIC ACTIVITIES

The future vision for spatial planning in the Algarve emphasizes sustainable development, environmental protection, and economic growth. Key initiatives include managing coastal areas for activities like aquaculture and tourism while ensuring resource sustainability. Portugal aims to combat climate change through investments in science and technology, promoting an Integrated Maritime Policy for effective governance. Specific plans, such as the Algarve Aquaculture Development Plan, support sustainable practices. Overall, the vision seeks to balance economic development with environmental conservation through collaboration and efficient governance.

STRENGTHS	**WEAKNESSES**
The Algarve focuses on spatial planning for sustainable development, enhancing attractiveness, diversifying the economy, and promoting innovation. Its rich cultural heritage includes UNESCO recognition of the Mediterranean diet. The presence of universities and research centres supports scientific research, while quality-certified tourist information centres improve visitor experiences. Recognized excellence in beaches, golf, and gastronomy contributes to its appeal, alongside a strong sense of safety for tourists. (*socio-economic)* The Algarve boasts a rich natural heritage with diverse ecosystems, including forests, wetlands and coastal areas, attracting nature-loving tourists. Its favourable Mediterranean climate supports year-round outdoor activities and offers various routes and itineraries for different tourist preferences. Protected areas like Ria Formosa Natural Park aid in conservation efforts, while the region's climate	The region's heavy reliance on tourism makes it vulnerable to economic shocks and leads to challenges in balancing stakeholder interests, including those of fisheries and local communities. Accessibility for people with reduced mobility is also a concern. Additionally, the seasonal nature of tourism results in fluctuating economic activity and difficulties in coordination among various tourism sectors. (*socio - economic*) Public awareness about conservation is low, and workforce specialization is insufficient. Inadequate regulations fail to balance conservation with tourism, while coastal ecosystems are vulnerable to climate change impacts, threatening both ecosystems and tourism. (*ecological- biophysical*) Limited innovation among businesses hampers sustainability efforts, and there is a need for more investment in technology and

also provides resources for agriculture and tourism. (*ecological-biophysical*) The Algarve's international airport boosts tourist accessibility, while locals' language skills enhance communication. Well-coordinated transport systems connect urban coastal areas with amenities, and a developed road network facilitates efficient movement of goods and people. (*technological*)	infrastructure to manage marine ecosystem services effectively. (*technological*)
OPPORTUNITIES	**THREATS**
Portugal is increasingly recognized as a trendy destination, attracting tourists and investors. Niche tourism is growing, supported by political acknowledgment of tourism's economic value. Sustainable regulations and collaboration with local communities promote responsible practices and preserve cultural heritage. (*socio-economic)* There is potential for diversifying local resources to promote sustainable development. A significant part of the territory is protected for biodiversity conservation. Awareness of climate change encourages proactive measures, while efforts to address water scarcity and manage invasive species reflect a commitment to preserving native ecosystems. (*ecological - biophysical*) There is a focus on eco-sustainable entrepreneurship, funding for green technologies, and collaboration with research institutions to drive innovation. This includes integrating smart technologies and sustainable practices to enhance resilience and resource optimization. (*technological*)	The tourism industry is challenged by a slowing European economy, Brexit uncertainties, and political instability, which may deter investment. A shortage of skilled workers affects service quality, and low environmental literacy limits sustainable practices. Short-term funding focus also hinders long-term sustainability efforts. (*socio- economic*) Limited resources for conservation and a need for better stakeholder coordination underscore the importance of raising public awareness about these issues. (*ecological - biophysical*) Economic slowdowns and Brexit uncertainties challenge tourism growth. Political instability may reduce investor confidence, and a lack of skilled professionals affects service quality. Low environmental literacy hampers sustainability efforts, while short-term funding limits long-term strategies. (*technological*)

MARINE ECOSYSTEM SERVICES

The Algarve's future vision for marine ecosystem services focuses on maximising coastal and marine benefits while ensuring sustainability. The Estratégia Regional Algarve 2030 aims to promote sustainable fisheries, aquaculture development, and efficient water management, targeting sustainable fish stocks and increased aquaculture production to enhance food

security and economic growth. It also emphasizes health and well-being tourism, highlighting the connection between marine ecosystems and human health. However, challenges such as climate change, invasive species, and maritime tourism require adaptive management strategies to address environmental changes and human impacts effectively.

STRENGTHS	**WEAKNESSES**
The Algarve region provides diverse marine ecosystem services essential for the local economy, including fisheries and coastal protection. Strong conservation efforts, like the Environmental Education Network and marine protected areas, support this. Key industries, such as tourism and artisanal fishing, significantly contribute to the area's socio-economic landscape. (*socio-economic*) The Algarve's marine habitats, including seagrasses and saltmarshes, support biodiversity and provide essential services like food resources and water purification. Coastal ecosystems such as the Ria Formosa lagoon play a key role in carbon sequestration and mitigating ocean acidification, contributing to climate change efforts. *(ecological - biophysical*) The Algarve prioritizes ocean literacy through initiatives like REASE, integrating ecosystem services into education. It has strong scientific capacity, with the Center of Marine Sciences (CCMAR) at the University of Algarve enhancing the management of marine ecosystem services. (*technological)*	Managing marine ecosystem services requires balancing stakeholder interests, which can lead to conflicts. The fishing industry is at risk from climate change and unsustainable practices, jeopardizing socio-economic reliance on fisheries, compounded by inadequate resource management and increasing pressures. (*socio-economic*) Marine ecosystem services face threats from habitat loss, pollution, and overfishing, compromising coastal ecosystem resilience. Additionally, climate change impacts, such as sea-level rise and ocean acidification, may disrupt the provision of crucial ecosystem services. (*ecological - biophysical)* The Algarve requires more investment in technology and infrastructure for sustainable marine ecosystem management and better monitoring systems to ensure long-term resilience. *(technological)*
OPPORTUNITIES	**THREATS**
Waste treatment technologies can enhance water quality and ecosystem health, supporting marine services. Raising public awareness fosters conservation support. Establishing co-management committees and initiating special programs are also essential for sustainability. (*socio-economic*) Sustainable management practices can enhance food production from marine resources while	Pollution significantly threatens marine ecosystems, hindering waste regulation and conservation efforts. Challenges also include climate change, invasive species, and pressures from tourism and real estate development. (*socio-economic*) Overfishing and unsustainable use of marine resources threaten biodiversity by depleting essential species, disrupting ecosystems, and

conserving genetic and medical resources, promoting long-term ecosystem health and resilience. (*ecological - biophysical*) Promoting recreational and tourism activities focused on marine ecosystems can raise awareness and appreciation, supporting conservation efforts and sustainable management practices. (*technological*)	compromising the services they provide. (*ecological - biophysical*) Tourism harms marine habitats and species, disrupting ecosystems and cultural services, which undermines conservation efforts. (*technological*)

SWOT– Brest, France

MARINE RENEWABLE ENERGY

Brittany's future regarding marine renewable energy (MRE), seen through the prism of sustainable development, looks promising and rich in opportunities, while at the same time facing significant challenges. The vision for the region's future revolves around the harmonious integration of its environmental, economic and social dimensions, with a particular emphasis on innovation, resilience and inclusion.

To realize this vision, Brittany must continue to foster stakeholder engagement at all levels, invest in research and innovation, and promote policies that support a just and inclusive transition. By meeting these challenges and capitalizing on its assets, Brittany can not only achieve its sustainable development goals, but also serve as an inspiring model for other regions.

STRENGTHS	**WEAKNESSES**
Brittany is a leader in renewable marine energy in France, with key projects such as the "Éolien Flottant Bretagne Grand Large" floating wind farm and the Saint-Brieuc offshore wind farm driving innovation. (socio-cultural) The presence of renowned research centers, such as IFREMER, France Energies marines or Naval Energies in Brest, and specialized higher education institutions, provides a solid base for innovation and skills development in marine sciences and environmental technologies. (technological)	The marine renewable energy sector's dependence on subsidies, illustrated by the need for government funding for offshore wind projects, highlights the economic fragility of the sector in the face of variations in support policies. (socio-cultural) Despite numerous projects and initiatives, a certain fragmentation may exist, making it difficult to implement a coherent, integrated regional strategy for sustainable development. (technological)
OPPORTUNITIES	**THREATS**
Rising electricity prices since 2022 have made marine renewable energy (MRE) projects more competitive, offering new opportunities for the	Protests against the Saint-Brieuc offshore wind farm emphasize the need for an inclusive approach to development to

region in the renewable energy sector. (*socio-cultural)* The regional objective of reducing greenhouse gas emissions by 40% by 2030, in part through MRE, reflects the opportunity to make a significant contribution to the national energy transition and regional energy self-sufficiency. (*ecological-biophysical*) The development of advanced technologies in MRE and marine sciences offers opportunities to export know-how and create highly skilled jobs .(*technological*)	address community concerns and maintain social cohesion. (socio-cultural) The increase in maritime activities and pollution, such as the green algae affair on Brittany's beaches, highlights the risks of environmental degradation linked to insufficient management of economic activities. (ecological- biophysical) Brittany's ability to remain competitive in the international MRE and blue economy market in the face of growing competition represents a major challenge. Maintaining a leading position in these sectors will require continuous innovation and adaptability. (technological)

SPATIAL PLANNING OF SOCIO - ECONOMIC ACTIVITIES

Marine spatial planning will play a key role in the sustainable management of Brittany's maritime resources, enabling the harmonious coexistence of economic activities, ecosystem conservation and recreation. By adopting an integrated approach, the region can ensure the sustainability of its traditional industries, such as fishing and tourism, while welcoming new developments like MREs.

STRENGTHS	**WEAKNESSES**
Brittany's Water Policy, exemplified by the "Breizh Biodiv" program, reflects the region's strong commitment to preserving aquatic biodiversity and marine ecosystems through a holistic resource management approach. (*ecological-biophysical*)	The accelerated coastal erosion in Erquy and the loss of agricultural land illustrate Brittany's direct vulnerability to the impacts of climate change, posing threats to the region's environmental and economic resilience (*ecological*)
OPPORTUNITIES	**THREATS**
The development of sustainable tourism, such as the "Valeur Parc Naturel Marin" label for businesses in the Iroise Marine Natural Park, demonstrates how the valorization of natural heritage can stimulate the local economy. This presents opportunities for Brittany to leverage its unique coastal assets (*socio-economic-ecological*)	The intensification of maritime activities and pollution, as exemplified by the issue of green algae on Brittany's beaches, underscores the risks of environmental degradation resulting from insufficient management of economic activities. Ensuring the sustainable use of marine resources is crucial. (*ecological*)

SWOT– Cadiz, Spain

CIRCULAR BLUE ECONOMY:

The future vision for a Circular Blue Economy in the Andalusian coastal zone integrates innovative approaches to sustainable packaging and circular practices. It is claimed a shift towards eco-friendly materials and processes, reducing waste and environmental impact in coastal industries. This includes transitioning towards circular practices across sectors such as fisheries, aquaculture, and tourism, promoting resource efficiency and sustainable consumption patterns.

STRENGTHS	**WEAKNESSES**
The region benefits from research institutions, universities, and organizations like Futuralga, which contribute expertise and innovation (*socio-cultural*) Andalusia boasts rich marine biodiversity and resources, providing a strong foundation for the development of a Circular Blue Economy. (*ecological - biophysical*)	Fragmentation in regulatory frameworks and institutional arrangements across sectors and administrative levels. (*sociocultural*) Limited infrastructure and capacity in waste management, recycling facilities, and circular economy practices. (*technological*)
OPPORTUNITIES	**THREATS**
Increased awareness and participation of coastal communities in circular economy initiatives, fostering local ownership and social cohesion. (*sociocultural*) Adoption of circular practices reduces resource dependency, carbon emissions. *(ecological - biophysical*) Development of research and innovation hubs for circular blue economy technologies and solutions. (*technological*)	Rapid development of circular blue economy projects may lead to displacement of traditional livelihoods and cultural practices. (*socio-cultural*) Climate change-induced events such as sea level rise and extreme weather events pose threats to circular blue economy infrastructure. (*ecological - biophysical*) Limited access to advanced technologies may constrain innovation and implementation of solutions for sustainable coastal management. (*technological*)

MARINE RENEWABLE ENERGY

The vision for developing marine renewable energies ensures that the development of offshore wind and other marine renewable energy sources aligns with broader coastal management objectives, balancing environmental protection and socio-economic

development. It is emphasizing the need for streamlined permitting processes, grid integration solutions, and robust stakeholder engagement mechanisms. The vision also underscores the importance of promoting innovation and research to advance technologies and methodologies for sustainable energy generation from marine sources.

STRENGTHS	**WEAKNESSES**
Andalusia's strategic location offers proximity to major energy markets and potential synergies. (*socio-cultural*) Significant potential for marine renewable energies, including offshore wind, wave, and tidal resources. (*ecological - biophysical*) The region benefits from research institutions and universities with expertise in marine science. (*technological*)	Offshore wind farms are not usually accepted by Andalusian people. (*socio-cultural*) There are insufficient studies demonstrating impacts on marine biodiversity. (*ecological biophysical*) Developing marine renewable energy projects in Andalusia faces technical challenges and infrastructure requirements.(*technological*)
OPPORTUNITIES	**THREATS**
The development of marine renewable energies can stimulate economic growth. (*socio-cultural*) Reduce greenhouse gas emissions, mitigate climate change impacts, and enhance environmental sustainability. (*ecological - biophysical*) Rapid advancements in marine renewable energy technologies. (*technological*)	Intense competition from traditional energy sources. (*socio-cultural*) There are insufficient studies demonstrating impacts on marine biodiversity (*ecological - biophysical*) Complex technical requirements and studies. (*technological*)

SPATIAL PLANNING OF SOCIO-ECONOMIC ACTIVITIES

The future vision for spatial planning of socio-economic activities in the Andalusian region integrates principles from the European Platform. Sustainable development practices are promoted, including blue tourism, sustainable fisheries management, and green infrastructure development, to balance economic growth with environmental protection and social equity. Community engagement is essential, fostering stakeholder participation and ensuring that spatial plans reflect local needs and values. Additionally, it is necessary to implement adaptive management approaches.

STRENGTHS	**WEAKNESSES**
A rich cultural heritage and maritime traditions.A diverse economy with activities	Urbanization, population growth, and socio-economic disparities can create conflicts

such as tourism and fisheries.Strong stakeholder collaboration promotes inclusive decision-making and consensus-building. (*socio-cultural*) Abundant natural resources, including diverse marine ecosystems and habitats, support ecosystem services. (*ecological - biophysical*) Remote sensing, GIS, and advancements in green infrastructure and renewable energy support sustainable coastal resource management and development. *(technological*)	between development and conservation, hindering inclusive planning. (*socio-cultural*) Vulnerability to climate change and pressure from human activities lead to sea-level rise and habitat degradation. (*ecological - biophysical*) High costs associated with technology. (*technological*)
OPPORTUNITIES	**THREATS**
Growing interest in sustainable tourism and seafood production, supported by the development of the Blue Andalusian Strategy. (*socio-cultural*) Development of projects related to maritime spatial planning and the ecosystem approach. (*ecological - biophysical)* Advancements in technology and data analytics offer opportunities for improved spatial planning tool (*technological*)	Political and regulatory uncertainties, along with stakeholder conflicts over competing socio-economic priorities, may hinder long-term planning. (*socio - cultural*) Climate change impacts threaten coastal communities and activities. (*ecological - biophysical*)

MARINE ECOSYSTEM SERVICES

Vision for **MARINE ECOSYSTEM SERVICES**: The future vision to establish marine ecosystem services in the Andalusian coastal zone entails a comprehensive strategy that integrates participatory processes, restoration efforts, and recognition of ecosystem values. Through inclusive engagement, stakeholders collaborate in ecosystem-based management approaches, ensuring local knowledge informs decision-making. Restoration and conservation strategies prioritize protecting critical habitats like coral reefs and wetlands while mitigating human impacts. Emphasizing the value of ecosystem services, particularly in safeguarding coastal areas, fosters sustainable development and resilience. By incorporating these principles into coastal management, Andalusia aspires to create a future where marine ecosystems thrive, supporting both human well-being and environmental health.

STRENGTHS	**WEAKNESSES**
Rich maritime heritage, diverse economic activities, strategic location, and a strong scientific community support sustainable	Overreliance on traditional industries, fragmented governance, short-term profit

practices, eco-friendly initiatives, and evidence-based decision-making. (*socio - cultural*) Rich marine biodiversity and natural habitats like wetlands enhance ecosystem resilience and provide essential functions. (*ecological biophysical*) Coastal protection structures like breakwaters and seawalls mitigate erosion and protect habitats, while advancements in marine monitoring technologies enhance these efforts.(*technological*)	incentives prioritizing exploitation, and limited public understanding of marine ecosystem services can hinder sustainability efforts. (*socio - cultural*) Coastal development and pollution reduce habitat availability, while rising sea levels and temperatures threaten marine ecosystems. Non-native species and unsustainable fishing practices further degrade these ecosystems. (*ecological biophysical)* The increase of infrastructures such as ports and marinas, can have adverse effects on marine ecosystems. (*technological*)
OPPORTUNITIES	**THREATS**
Development of sustainable blue economy sectors and the promotion of sustainable tourism and sustainable fishing practices. (*socio-cultural)* Existence of habitat restoration projects. (*ecological-biophysical*) Projects about innovative solutions such as artificial reefs and offshore wind farms and availability of technology for monitoring and data collection. (*technological*)	Lack of community engagement and awareness and Pressure from unsustainable tourism. (*socio-cultural*) Increasing frequency and intensity of climate-related events. (*ecological-biophysical*) Poorly planned or implemented engineering projects along the coastal zone. (*technological*)

SWOT– Malta

CIRCULAR BLUE ECONOMY:

Circularity and sustainable development are at the core of a transition to a climate neutral economy. Malta's vision for a circular economy is that of reducing the input of new resources and maximising the efficiency of resource use by transforming sustainable production and consumption processes, thereby reducing the negative impacts on the climate as well as on land and the aquatic environment. Industry and consumers are at the heart of a circularity transition. Particularly industry will be incentivized to adopt procedures and technologies that reduce the carbon footprint, together with the reshaping of consumer choices.

STRENGTHS	**WEAKNESSES**
Collaborative activities with producers, importers and retailers; waste management service providers and consumers aimed at curtailing plastic pollution (*socio-economic*) Sustainable public procurement creating demand for new products derived from waste streams (*socio-economic*) Research and innovation funding for ecotechnologies and innovation in advanced recycling technologies and remanufacturing (*technological*)	Insufficient awareness of the economic potential and opportunities from the circular economy and the value of waste (*socio-economic*) Lack of economies of scale for industry to adopt innovative technologies and production processes for reuse and recycling (*socio-economic, technological*) Malta's dependence on importation of raw materials and finished goods limits interventions on the integration of circular principles in product design and manufacture (*ecological-biophysical*) Lack of a local market to process main biowaste streams such as manure, sewage sludge, food waste and other biodegradable waste (*socio-economic*)
OPPORTUNITIES	**THREATS**
Waste streams and secondary materials that support new market opportunities both locally and overseas (*socio-economic*) Extended Producer Responsibility schemes for producers to bear financial and/or organisational responsibility for the	Insufficient knowledge and know-how on how to integrate circular economy principles and the restructuring activities required to transition from circular to linear modes of production (*socio-economic*) Cultural resistance towards sustainable patterns of production and consumption as evidenced by short-lived initiatives e.g.,

management of the waste stage of a product's life cycle *(socio-economic*) New opportunities for circular business models incorporating sustainable use of marine and coastal resources (*ecological, socio-economic)*	electric car sharing and bicycle sharing initiatives and e-bicycle services (*socio-economic*) Burden of increasing volumes of solid waste originating from the hospitality industry (*socio-economic*)

MARINE RENEWABLE ENERGY

Malta's vision is for marine renewable energies to contribute to diversifying the local energy mix and achieve affordable, reliable, and clean energy generation, reducing impact on the environment and reducing energy import dependency. Malta has raised its renewable energy ambition in line with the Low Carbon Development Strategy and National Energy and Climate Plan that will be supported by higher investments in large-scale floating offshore wind and solar technologies as the technically feasible options in the short- to medium-term.

STRENGTHS	**WEAKNESSES**
An enabling policy framework and political commitment towards achieving the EU goal of climate neutrality by 2050 (*socio-economic*). Malta's agility to fast-track the commissioning of large-scale infrastructural projects (*socio-economic*) High potential for solar energy development (*technological*) A growing knowledge base and research capacity in offshore solar and energy storage (pump storage) (*technological*)	Limited economies of scale for offshore installations to attract foreign direct investment (*socio-economic*) A closed energy system characterized by a single energy distributor limiting the attractiveness of large scale generation and distribution of renewable energy (*socio-economic*) Competition with other marine uses of the sea, including aquaculture farms, subsea cabling, oil/gas exploration wells, and special areas of conservation (*socio-economic*) Grid infrastructure unable to support and stabilize intermittent energy derived from large scale renewable energy production (*technological*)
OPPORTUNITIES	**THREATS**
An energy mix that relies on different energy sources mitigating external shocks (*socio-economic*) An ambition to invest in offshore marine renewables in line with Malta's Low Carbon Development Strategy and National Energy and Climate Plan *(socio-economic*)	A reduction of fossil fuel prices globally alongside security of supply creating competing interests with investments in large scale RE (*socio-economic*) Limited capacity of local supply chain actors to manufacture and operationalise large-

A willingness to pay for higher energy prices from renewables produced locally to ensure security of energy supply *(socio-economic*) A potential to establish a one-stop-shop for operators to coordinate and streamline permitting, licencing, and environmental assessment and expedite commissioning of offshore installations *(socio-economic*) Research and innovation advances in large-scale utility battery storage systems e.g., on durability and energy density enabling integration of renewable energy into the grid and scale-up of new offshore wind farm deployments (*technological*) Offshore floating structures as a technically feasible option countering challenge of deep sea bathymetry (*technological*) Malta as a knowledge hub supporting regional actors in large-scale deployment of offshore solar infrastructure (*technological*) International cross-border cooperation spearheading the adoption of renewable sources of energy infrastructures (*technological*)	scale offshore wind projects *(socio-economic*) The negative environmental impacts of onshore and coastal ancillary infrastructures (*ecological*)

SPATIAL PLANNING OF SOCIO-ECONOMIC ACTIVITIES:

The Vision for the coastal zone and marine areas is that of accommodating all legitimate compatible uses in such a way as to maximise the potential for sustainable socio-economic growth and renewable energy infrastructure, and, sustain the livelihood of the fishing community, remain rich in biodiversity and accessible for public enjoyment. The vision for regulating the spatial use of the Maltese Islands' land and maritime territory as laid out in the SPED reflects the recognition that the sustainable use of land and sea resources depends on the efficient use of available space together with effective protection of the islands' natural, cultural and heritage resources.

STRENGTHS	**WEAKNESSES**
Malta's first marine spatial plan launched in 2015 as a guiding framework to regulate the	Limited coordination on policy implementation across sectors with

sustainable use and management of land and sea resources (*socio-economic*) Inter-ministerial technical committee overseeing planning, data management and international cooperation activities (socio-economic) Enhanced engagement of non-governmental organisations in management and planning of marine parks and marine protected areas (*socio-economic*) Research and innovation capacity in water and energy technologies e.g., supported by national research and innovation funding (*technological*)	jurisdiction over the coastal and marine areas (*socio-economic*) A focus on land-based socio-economic activities with limited consideration of the coastal and marine areas in strategic socio-economic policy making (*socio-economic*). Lack of a sustained dialogue bridging between policy and industry stakeholders (*socio-economic*) Artificialisation of the coastline and loss or degradation of natural habitats (*ecological*) Reliability and availability of data for implementation and monitoring of marine spatial plans (*ecological*, *socio-economic*)
OPPORTUNITIES	**THREATS**
Convergence of policy implementation and stakeholder engagement through high-level coordination by government advisory body (*socio-economic*) Develop a robust methodology and approach to quantify the value of ecosystem services using appropriate socio-economic and ecological indicators (*socio-economic*) Inter-regional collaboration on research and innovation e.g., in aquaculture and blue biotechnology, and multi-use platforms combining offshore renewables and aquaculture (*ecological, technological*) Digital technologies and artificial intelligence for habitat monitoring and spatial planning (*technological*)	Conflicts from multiple uses and activities including maritime transport, short sea shipping, fishing, aquaculture, and competition with strategic infrastructures such as energy generation and water desalination (*ecological, socio-economic*) Side-lining the social and recreational benefits of the sea on human wellbeing (*socio-economic*) Impact on biodiversity from alien species (*ecological*). Lack of research initiatives on nature-based solutions to mitigate the impacts of climate change (*ecological*)

MARINE ECOSYSTEM SERVICES

Malta's Sustainable development Strategy 2050 identified as one of its strategic goals "the conservation and sustainable use of natural capital including land, marine and freshwater ecosystems and their services." Conservation and sustainable use of land and maritime natural resources are considered crucial for a good state of the environment and the multiple

ecosystem services that sustain economic activities particularly water management, agriculture and rural development, fisheries and tourism and ensure the wellbeing of communities.

STRENGTHS	**WEAKNESSES**
An Integrated Maritime National Strategy Committee set in July 2013 up to oversee the monitoring and evaluation of the National Integrated Maritime Policy, including in relation to the provisioning of marine ecosystem services. (*socio-economic*) A rich indigenous biodiversity and niche habitats of high ecological importance (*ecological*) Strong historic and cultural ties of local communities and their recreational and commercial activities with the coastal and maritime area (*socio-economic*) Coastal regions, characterised by multiple and heterogeneous habitats and rich biodiversity and endemism, have a higher capacity to provide and deliver a broad range of ecosystem services, particularly food provisioning ecosystem services, nursery habitats and cultural and aesthetic services and benefits compared to urban areas. (*ecological*) Competencies and know how on high value species aquaculture and global recognition as leading producer of farmed Bluefin tuna	Urban sprawling and tourism activities along the coast impacts the capacity of coastal habitats to support ecosystem services despite the high demand for these services and their cultural and aesthetic benefits (*socio-economic*) Short-term social and recreational benefits of ecosystem services, prioritized over other less tangible benefits e.g., (biodiversity and species richness (*socio-economic*) Limited resources and institutional capacity to manage and protect MPAs and ecosystem services (*socio-economic*) Negative public perception on the impacts of aquaculture on the marine and coastal waters (*socio-economic*) Ecological sensitive habitats, including cliffs, sand dunes, salt marshes, as well as marine habitats such as maerl beds and *Posidonia* meadows, threatened by natural and anthropogenic processes e.g., quarrying for mineral extraction in cliffside communities (*ecological*) Lack of a comprehensive map and categorization of ecosystem supported by coastal and marine areas (*ecological*)
OPPORTUNITIES	**THREATS**
Integrated spatial planning as an opportunity to optimise the provision of ecosystem services (*socio-economic*) Enhanced awareness, as well as public and sectoral engagement on conserving biological diversity, and developing nature-based solutions (*socio-economic*) Governance frameworks that facilitate communication and information sharing among	Loss of marine natural capital and coastal landscapes jeopardize main economic sectors linked to the coasts (aquaculture, tourism fishing) as well as energy generation, water abstraction and wastewater activities (*socio-economic*) Negative impacts of climate change and alien species, leading to further degradation of marine habitats and seagrass meadows (*socio-economic*)

stakeholders (particularly educational institutions, non-governmental organisations, and the private sector) and managing authorities to achieve integrated conservation of biodiversity (*socio-economic*) Research new or undiscovered ecosystem services supported by niche habitats e.g., coastal sand dunes and other specialised marine ecosystems harbouring a rich biodiversity (*ecological*) Support decision-making through "citizen science" activities engaging local communities and stakeholders (*socio-economic*)	Threats to biodiversity and ecosystem services caused by loss of coastal landscapes and degradation in water quality due to discharges (e.g., of municipal wastewater, brine water from desalination plants), nutrient enrichment, and shipping and port-related activities (e.g., dredging and sediment resuspension). (*ecological*) The perception that ecosystems provide an endless and plentiful supply of goods and services, resulting in limited priority for conservation in the short and medium term (*ecological*)

SWOT– Naples, Italy

CIRCULAR BLUE ECONOMY

The establishment of a hub to support, also through the provision of contributions, the creation of start-ups and small and medium-sized enterprises operating in the field of the "blue economy" and sustainable innovative technologies, according to a network logic between companies. In particular, the actions that should be implemented are:

• Attracting investments for the sustainable and innovative development of maritime services and the tourist and cultural sector connected to the sea, also through forms of public-private partnerships;

• Developing training opportunities that meet the needs of the sector to increase employment;

• Organizing scientific dissemination spaces in collaboration with universities and research center on innovative technologies and the protection of the marine ecosystem.

STRENGTHS	**WEAKNESSES**
Implementation of innovation hubs; regional projects; implementation of a holistic approach; implementation of an interdisciplinary approach; Involvement of private and public actors. (*socio-cultural*)	Cultural issues; lack of connections for an integrated strategy that aims at involving all the sectors of the blue economy. (*socio-cultural*) Limited investments; Poor management skills. (*technological*)

Monitoring and assessing blue natural capital and ecosystem services provided (e*cological-biophysical*) Implementing blue transition energy installing innovative tools to generate energy from sea. (*technological*)	
OPPORTUNITIES	**THREATS**
Positioning the Campania region as a leader in blue growth in Italy by creating new job opportunities; and successfully tapping into EU funding (*socio-economic*) Rising international tourism demand. (*socio-cultural*) Reaching the goals of international and national strategies to preserve the marine environment. (*ecological - biophysical*) Establishing the Campania region as a leader in Italy of new technologies for example, by investing in green and digital technologies in port areas. (*technological*)	Lack of an integrated policy and management strategies. (*socio-cultural*) Reconfiguration of the global value chain in the international transport supply chain sector. (*ecological - biophysical*) Changes in governance. (*technological*)

MARINE RENEWABLE ENERGY

In general, the development of marine renewable energies can be truly and appropriately achieved taking into account their environmental impact. This development can also be a driving force for the development of skills and an ad hoc regional economy which already expresses adequate technical capabilities.

The main initiative that is occurring in the Campania region has been the born of the first research laboratory for renewable marine energy of the Mediterranean, Marine Renewable Energy Laboratory (MaRELab). In terms of future developments, they will continue to study the complex interaction between local thermal wind and wave patterns at nearshore locations, and the impact of their combination on survival strategies and the dynamics of blue energy technologies.

STRENGTHS	**WEAKNESSES**
There is a political interest and the need to promote these alternative sources, both from an ecological and geopolitical point of view. (*socio-cultural*)	The coast is a great cultural and economic heritage and, however, it must also be preserved. (*socio-cultural*)

The nearshore location and the peculiarity of the Tyrrhenian Sea meteo-climatic conditions. In addition, there are some positive experiences in the Region. (*ecological-biophysical*) There are companies and expertise that can support the development of these initiatives. One example is MaRELab, the first research laboratory for marine renewable energy in the Mediterranean. (*technological*)	Coastal populations can counter these initiatives. Lack of previous data in Campania on this type of analysis in the literature. (*ecological-biophysical*) The largest companies have their decision-making "head" outside the Region. (*socio-economic*)
OPPORTUNITIES	**THREATS**
The regional administration pays attention to these issues. (*socio-cultural*) There are environmental practices and parks with related widespread activities. (*ecological-biophysical*) It is certainly an engine for developing skills that could be exported out of the Region at international level. (*technological*)	The Region is a political entity that cannot but be affected by national and European policies. (*socio-cultural*) The development of infrastructure for harnessing marine renewable energy may impact coastal fishing activities. Additionally, the rapidly changing physicochemical variables of the Tyrrhenian Sea could influence the feasibility and success of these projects. (*ecological-biophysical*) There are similar European initiatives already well underway which could reduce the development of local skills. (*technological*)

SPATIAL PLANNING OF SOCIO - ECONOMIC ACTIVITIES

The regional administration of Campania has proven to be very attentive to implementing planning of production activities linked to the coast and the sea. In particular, the management policies of the coastal strip (also with a view to investment and economic support) have been defined by recognizing the lack of multi-sectoral and coordinated planning of maritime activities as one of the main points of weakness in the management of the coastal strip (DR. 35 of 15.03.2019). However, in the last five years there have been notable efforts to implement a project aimed at collecting useful information for the development of detailed management of coastal activities. The Campania Region definitely wants to invest in the creation of aquaculture plants for the purpose of drastically reducing the impact of fishing on the marine-coastal environment. From this perspective, it is worth highlighting the economic distribution of the new fund for maritime affairs, fishing and aquaculture (FEAMPA) where a greater percentage of funds is aimed precisely at aquaculture activities. It is possible to believe

that the territorial planning of the socio-economic activities of the coastal strip is a priority for this region also by evaluating some initiatives linked to maritime traffic (implementation of connections between coastal countries by sea in periods of greatest tourist influx), the specific strategies of local development of local action groups (GAL-PESCA) focused on the creation of structural management and connection networks between coastal territories, structural and economic support to the places of landing of fishery products and landing places for maritime traffic.

STRENGTHS	**WEAKNESSES**
Campania is investing in marine spatial planning and blue growth, with regional technicians available for stakeholder dialogue. Local development plans from coastal action groups offer opportunities for innovative research and legislation, supported by significant economic resources. *(socio-cultural)* A strong network of research institutions is dedicated to monitoring and assessing the health of marine environments, supported by numerous marine protected areas and sites of community interest. (*ecological - biophysical*) Implementation of technologies for coastal zone management. (*technological*) Significant investments throughout the coastal area regarding the reduction of marine litter also from a technological point of view (recycling-reuse) (*technological*)	Challenges include incompatible methods that clash with fragile ecosystems and environmental laws, political dynamics favoring individual interests over collective good, a shortage of skilled actors to align with community directives, and bureaucratic obstacles that impede long-term project development. (*socio-cultural*) Management of marine protected areas and sites of community interest of inadequate competence. (*ecological-biophysical*) Lack of ability to systematize (long-term economic sustainability of pilot activities) the initiatives undertaken. (*technological*)
OPPORTUNITIES	**THREATS**
Presence of numerous "native production chains" which, if supported by adequate scientific research and governance, could be a driving force for a local economy and also of considerable attraction for tourism. (*socio-cultural*) Coastal area is among the richest in the Mediterranean in terms of biodiversity due to the notable geological and biological diversity hosted. (*ecological-biophysical*) Presence in the area of the main companies regarding maritime transport and fishing (e.g.	Large-scale distribution and the lack of recruitment of young people towards these indigenous production chains e.g. fishing, processing laboratories, maritime craftsmanship. (*socio-cultural*) There is insufficient communication and oversight regarding activities that impact biodiversity, along with a lack of ecosystem governance, as efforts are often sector-specific and not integrated into a broader ecosystem approach. (ecological-biophysical)

tuna fleet) with economic capacity capable of investing in sustainable solutions for the future. (*technological*)	Lack of enforcement governance capable of directing private investments which are always aimed at individual rather than collective interests. (*technological*)

MARINE ECOSYSTEM SERVICES

Thanks to the constant monitoring of Marine Protected Area, it is possible to have an annual biophysical assessment of natural capital stocks and an economic assessment of ecosystem services and the benefits related to these habitats. The combined use of these approaches is an important prerequisite for the implementation of future actions to manage marine habitats in a sustainable manner and the results can be a starting point for future projects concerning the value of the ecosystem services offered by the Mediterranean Sea on a national scale, also focusing on the analysis of potential threats to these habitats, which could cause a loss of value for ecosystems. Based on the analysis of potential threats, it will be possible to define future mitigation and compensation actions for ecosystem services.

STRENGTHS	**WEAKNESSES**
The establishment of the MPAs is crucial for the sustainable management of the coast together with the creation of a standardized protocol for the assessment of ecosystem services provided by the MAES. (*socio-cultural*) The numerous marine protected areas (MPAs) in Campania help preserve ecosystems, contributing to high biodiversity and the presence of endemic and protected habitats listed in the Habitats Directive (92/43/EEC). Priority habitats, such as Posidonia oceanica meadows, also offer valuable ecosystem services. (*ecological-biophysical*)	There is still no conventional methodological framework; Lack of cooperation and citizen participation in decision-making. Lack of monitoring coastal erosion affecting economic activities (e.g., tourism). (*socio-cultural*) Difficulty in monitoring all marine habitats. (*ecological-biophysical*)
OPPORTUNITIES	**THREATS**
National funds for supporting projects on assessing marine ecosystem services. (*socio-cultural*) Research focus of regional universities on marine ecosystems and biodiversity. (*ecological-biophysical*) Research projects for restoring marine habitats at regional level. (*technological*)	Overfishing. Difficulties in facing illegal fishing. (*socio-cultural*) Anthropogenic impacts, in particular fishing. Pollution from regional rivers affecting the delivery of ecosystem services. (*ecological-biophysical*)

SWOT– Split, Croatia

CIRCULAR BLUE ECONOMY:

The future vision for a Circular Blue Economy in the coastal region focuses on creating a sustainable ecosystem that respects local heritage, promotes local product consumption, and strives for a zero-waste principle by leveraging knowledge and new technologies. Key components of this vision include:

- Zero-Waste Principle: The vision aims to minimize waste by adopting a zero-waste principle, ensuring that all materials are reused, recycled, or composted. Special attention is given to the significant amount of waste, particularly plastic, coming from the Montenegrin and Albanian coastlines due to the direction of currents. Efforts include not only collecting this waste but also sorting and recycling it within coastal areas.
- Local Heritage and Product Consumption: Promoting the consumption of local products to support the local economy and reduce the carbon footprint associated with importing goods. Encouraging practices that respect and preserve local heritage, integrating traditional knowledge with modern sustainable practices.
- Innovative Waste Management: Implementing innovative waste management solutions, such as desalination plants on the outer islands of the Croatian Adriatic coast, where transporting potable water from the mainland is more challenging. Utilizing advanced technologies to enhance waste collection, sorting, and recycling processes, particularly focusing on the problematic plastic waste.
- Desalination and Water Management: The use of desalination plants is emphasized, especially in areas where it is difficult to transport potable water, to ensure a sustainable supply of fresh water for residents and tourists.

By integrating these components, the Circular Blue Economy vision aims to create a sustainable, resilient, and self-sufficient coastal ecosystem. This approach not only addresses current environmental challenges but also ensures the long-term health and prosperity of coastal communities and their natural surroundings.

STRENGTHS	**WEAKNESSES**
The area features protected natural and cultural heritage, mapped underwater habitats, a relatively preserved coastline, and established scientific institutions and infrastructure, providing a foundation for developing an innovation ecosystem. (*socio-cultural*) Local and regional governments are developing climate resilience plans, supported by financial	The waste disposal system is poorly implemented and needs simplification. The 4H ecosystem is underdeveloped for generating innovations in CBE. Tourism dominates the coast, limiting other economic uses. Navigation of yachts and boats is insufficiently regulated, affecting marine ecology. *(socio-cultural)*

mechanisms for green infrastructure development. (*ecological-biophysical*) Implement water purification systems prior to discharging industrial and municipal wastewater into the sea. *(technological*)	There are inadequate plans and existing green infrastructure. The construction of coastal wind turbines disrupts the landscape and negatively affects wildlife, especially bird populations. (*ecological-biophysical*) Renewable energy sources for electricity production are lacking in remote areas of the outer Adriatic islands, and there are concerns about the proper disposal of solar panels at the end of their lifespan (approximately 30 years). (*technological)*
OPPORTUNITIES	**THREATS**
Establishing Centres of Excellence, implementing tailored grant schemes, promoting investment opportunities, and creating mechanisms to identify entrepreneurs' needs are key initiatives. (*socio-cultural*) Enhanced ecosystem management practices can be achieved through new technologies, alongside financial instruments that support sustainable practices. (*ecological-biophysical*) Key initiatives include connecting, coordinating, and optimizing existing infrastructure, encouraging industry participation in research and innovation (R&I), interconnecting different infrastructure operators, and adopting new technologies. (*technological*)	Insufficient financial support and investment can hinder the development of innovative solutions, while a lack of collaboration among governmental institutions and complicated administrative mechanisms further impede progress. (*socio-cultural*) Biodiversity loss is occurring due to habitat degradation and fragmentation, making ecosystems more vulnerable to climate change. Additionally, there are challenges in implementing green infrastructure projects. (*ecological-biophysical*) High costs and financial barriers hinder the implementation of advanced technologies, which also carry environmental risks. Additionally, smaller coastal communities have limited access to these technological solutions. (*technological*)

MARINE RENEWABLE ENERGY

The future vision for developing marine renewable energies in the coastal region involves a strategic approach encompassing infrastructure development, policy implementation, and the promotion of alternative fuels. Key elements include:

- Infrastructure Development: Establishing a robust energy infrastructure along the coast to support the growth of marine renewable energy sources. This includes building the necessary facilities for offshore wind farms, floating wind turbines, and floating solar power plants, positioned far from the shore to preserve the landscape.
- Promotion of Alternative Fuels: Turning to wider applications of electricity and alternative fuels such as LNG, hydrogen, methanol, and ammonia. These fuels are

considered for ship propulsion, and efforts will focus on solutions for their cheaper use and the development of corresponding infrastructure.

- Energy and Transport Integration: Encouraging the use of electricity and hydrogen across all types of transport, as well as for heating and hot water preparation, to reduce dependence on fossil fuels.
- Policy and Zoning: Defining specific zones in spatial plans for the construction of marine renewable energy projects. Passing laws to facilitate the granting of concessions for using these areas for hydrogen and electricity production. The state should hold tenders where the best bidders receive the rights to build and utilize these zones.
- Hydrogen Production: Utilizing renewable energy to produce hydrogen, which requires significant energy input. Offshore wind and solar power will be crucial in this process, despite the region's calm seas and limited wave and tidal energy potential.

Overall, the vision includes coordinated infrastructure development, the promotion of alternative fuels, comprehensive policy frameworks, and strategic planning to advance marine renewable energies, thereby reducing reliance on fossil fuels and fostering sustainable development.

STRENGTHS	**WEAKNESSES**
The region has a leading position in charter nautical tourism, offers solid education at technical faculties, and presents local business investment opportunities. (*socio-cultural*) The area benefits from favorable climate conditions, a diverse marine ecosystem, and extensive wastewater treatment. (*ecological-biophysical*) There is a strong electrical industry and technical faculties, alongside projects focusing on solar and wind energy for smaller vessels. (*technological*)	The bureaucratic system for issuing permits is slow, laws regarding space are poorly written, public awareness of new technologies and regulations is low, and there is a lack of unified public strategies and plans. *(socio-cultural*) Tourism negatively impacts ecological balance and may disrupt fish and bird migration patterns. (ecological-biophysical) There is a lack of innovation and inadequate energy generation for large vessels, along with issues related to speed, reliability, and long charging times. (*technological*)
OPPORTUNITIES	**THREATS**
Key initiatives include developing education, science, and innovation capacities; attracting investment from domestic and foreign sources; adapting laws to support marine renewable energy projects; and creating a National Spatial Plan for the marine area. (*socio-cultural*) Utilizing renewable resources can improve ecological systems, positively impact the environment, and help mitigate local climate change. Additionally, implementing algae and	Public support has declined due to decreased awareness of environmental benefits, leading to coordination challenges among environmental institutions, fisheries, and the military. There is also opposition to marine landscape destruction and overcrowding. (*socio-cultural)* Significant plant construction threatens micro-area ecological balance and disrupts fish and bird migration in remote areas. *(ecological - biophysical)*

shells on floating systems is part of this approach. (*ecological - biophysical)* There is development in engineering infrastructure and technology solutions, with vast marine areas available for renewable energy projects and potential for multi-purpose development with minimal environmental impact. (*technological*)	Wind energy faces competition from other economic sectors, particularly tourism, along with maintenance challenges during strong winds and operational limitations in extreme weather conditions*. (technological)*

SPATIAL PLANNING OF SOCIO-ECONOMIC ACTIVITIES:

The future vision for spatial planning of socio-economic activities in the coastal region centers around integrated coastal management that prioritizes environmental protection and the well-being of the local population. This vision aims to minimize habitat degradation and carefully manage the number of different types of tourists through planned and limited approaches. It promotes small-scale economic activities to reduce dependency on seasonal labor imports, aiming to extend the tourist season to last all year round.

Sustainable growth and development in maritime trade and passenger transportation are key aspects, ensuring that future investment decisions are contextually informed and harmonious with the plans set by the port, the City of Split, and the region. The vision seeks to provide users and partners with information about future development to meet their needs effectively.

Improving the quality of life for citizens is a priority, which involves increasing urban development and establishing more public recreational spaces. A harmonized urbanization framework is envisioned to enable even and fair development across the city. Biodiversity provisions and spatial planning guidelines will be implemented to ensure sustainable development. The coastline will be remodeled to be more accessible to all citizens, including those with disabilities, while protecting valuable natural areas in response to climate change. The plan includes planting more trees and developing green infrastructure to create shade, improve the local microclimate, and collect rainwater.

The general urban plan will define the direction for spatial development and renewal of the city, protecting natural, cultural, and historical values while setting guidelines for the arrangement and protection of spaces. Large city projects crucial for development will be identified and prioritized. The redevelopment of park areas and the development of green city areas are integral parts of this vision. Energy efficiency and climate adaptation of buildings, especially those in the old city center at high risk of earthquake damage, are key areas of improvement. Implementing smart and integrated solutions will be necessary to enhance energy efficiency and climate resilience.

The vision addresses the current socio-ecological issues caused by progressive concrete development, which has turned the coast into a profit source for the wealthy, displacing other populations. Transparent and well-designed spatial planning regulations will help accommodate different activities and ensure the availability of data, involving various stakeholders in designing measures. This comprehensive approach aims to create a sustainable, resilient, and inclusive

coastal region that balances economic growth with environmental stewardship and social equity.

STRENGTHS	**WEAKNESSES**
Integrated Coastal Zone Management focuses on tourism, infrastructure, environmental conservation, and climate adaptation. Strong societal awareness supports small-scale nature preservation initiatives and comprehensive measures for demographic revitalization and inclusivity. (*socio-cultural*) Global marine spatial planning improves territorial water management, backed by strong regulations for protecting ecologically sensitive areas and enhancing environmental quality and climate resilience. (*ecological-biophysical*) There is advanced broadband infrastructure and sustainable traffic systems, emphasizing energy efficiency, clean energy transition, and smart solutions for climate change adaptation in buildings. (*technological)*	Waste disposal systems are implemented ineffectively, and an overemphasis on tourism has resulted in the loss of green spaces and urban challenges. (*socio-cultural)* Habitat degradation is caused by excessive construction and urbanization, along with insufficient plans and infrastructure for green initiatives. This situation increases vulnerability to climate change impacts, including rising sea levels and extreme weather. (*ecological-biophysical*) Implementing green infrastructure and renewable energy systems in remote locations faces high costs and logistical challenges, along with potential negative impacts on landscapes and wildlife from infrastructure projects. *(technological*)
OPPORTUNITIES	**THREATS**
There is an emphasis on sustainable tourism, a multidisciplinary approach to resources, and opportunities for scientific, cultural, and health tourism. EU support is available for higher education infrastructure, innovative teaching programs, and integrating green infrastructure with reintroduced extinct species. *(socio-cultural*) Agritourism features green infrastructure and extends the tourist season into spring, autumn, and winter. The region has high biodiversity and excellent air quality, using AI for optimizing human-nature interactions and monitoring environmental status. *(ecological-biophysical)* High-tech waste management and eco-friendly public transport systems are being introduced, with support for entrepreneurial initiatives.	A long-term sustainable approach requires strategies beyond election cycles, with reduced student accommodation and declining enrollments in schools. Funds are often diverted to short-term projects, and there is a lack of interest in enforcing legislation. (*sociocultural*) Conflicts among space users and potential sea pollution from maritime traffic pose risks, along with natural disasters and climate change impacts. Demographic decline reduces environmental awareness, leading to resource overexploitation and a devastated coastline. (*ecological-biophysical)* There is a shortage of specialized experts for high-tech applications, a lack of a consistent national housing policy, and insufficient regulation and enforcement. Environmentally friendly innovations are not being utilized. (*technological*)

Modern construction technology and AI are used to achieve sustainability. (technological)	

MARINE ECOSYSTEM SERVICES

The future vision for marine ecosystem services in the coastal region revolves around sustainable practices, technological innovation, international collaboration, and community engagement. This comprehensive approach aims to promote the conservation of marine biodiversity, restore degraded habitats, and ensure the sustainable use of marine resources while fostering economic development and environmental protection.

Sustainable fisheries management practices, such as implementing science-based approaches and spatial and temporal regulations, are crucial for ensuring the long-term viability of fish stocks and supporting the livelihoods of fishing communities. Additionally, the establishment of marine protected areas and the proclamation of no-take zones, like the Jabuka Pit, demonstrate effective conservation efforts that safeguard crucial spawning and nursery grounds for commercially important species.

Integrated coastal zone management plays a vital role in balancing the interconnectedness of terrestrial and marine ecosystems, considering the needs and interests of various stakeholders. This holistic approach includes the conservation and restoration of coastal habitats, such as estuaries, seagrass beds, which provide critical habitats for marine species and mitigate coastal erosion and storm damage.

Climate change adaptation and resilience-building initiatives are essential for addressing the impacts of sea-level rise, ocean acidification, and extreme weather events on coastal ecosystems and communities. This involves enhancing the adaptive capacity of coastal ecosystems and implementing measures to minimize vulnerability.

Public awareness and engagement are integral components of the future vision for marine ecosystem services. Promoting ocean literacy and raising public awareness of the value of marine ecosystems through education, outreach, and community engagement initiatives are essential for fostering support for conservation efforts and encouraging sustainable behavior among coastal communities.

Furthermore, international collaboration and research initiatives, such as the Ecological Observing System of the Adriatic Sea (ECOAdS) and the Natura 2000 network, contribute to advancing marine ecosystem services on a global scale. These efforts aim to address knowledge gaps, enhance conservation measures, and promote sustainable resource management practices through collaboration and knowledge sharing.

Despite challenges such as administrative complexities and financial constraints, efforts to establish marine ecosystem services in the coastal region are ongoing. Continued commitment to sustainable practices, technological innovation, international collaboration, and community engagement will be crucial for achieving the future vision of thriving coastal ecosystems and resilient communities.

STRENGTHS	WEAKNESSES

Significant national and international projects focus on preservation, backed by strong scientific research capacity in marine fields. Effective collaboration exists among scientific institutions, policymakers, and the fisheries sector, along with increased ocean literacy and public awareness of marine threats. (*socio-cultural*) The area boasts high biodiversity and effective habitat conservation practices. Preserved marine areas maintain good environmental status, with ongoing efforts to improve biodiversity preservation and marine resource restoration, alongside increased public awareness over the past decade. (*ecological-biophysical*) Advanced technology aids in monitoring plant and animal life and fosters collaboration among research fields. Strong ties between the scientific sector and SMEs lead to nature-based solutions, while new technologies help minimize marine environmental impact. Public interest in the marine environment has grown over the past decade. (*technological*)	Human-induced devastation continues, alongside insufficient respect for scientific opinions and a lack of ocean-related topics in education. Public awareness of marine ecosystem services is limited, and coordination among six Adriatic countries creates uneven progress. (*socio-cultural*) Human activities threaten biodiversity and increase the risk of invasive species, complicating effective ecosystem management. Major impacts affect coastal regions, and monitoring of legislation is insufficient. Lack of financial resources for scientific research may hinder marine protection and efforts to achieve Good Environmental Status (GES) in the Adriatic Sea. (*ecological-biophysical*) Overexploitation stems from advanced sonars and lack of transparency. Environmental challenges complicate marine infrastructure maintenance, with limited use of nature-based solutions. Overpopulation and inadequate infrastructure persist, while disparities in development and EU membership hinder initiatives and funding for scientific solutions. (*technological*)
OPPORTUNITIES	**THREATS**
National projects and international agreements are increasing, promoting collaboration across sectors. New study programs aim to educate specialized professionals, and investment in science and innovation boosts employment and public involvement. (*socio-cultural*) Biodiversity conservation is enhanced through improved ecosystem management and green infrastructure. Climate-adaptive strategies mitigate climate change impacts, and AI supports ecosystem monitoring. Efforts also focus on developing new ecosystem-based models. (*ecological-biophysical*) Innovative engineering solutions, including nature-based approaches, address coastal infrastructure challenges. Investments in	Collaboration and financial support are lacking, with poor expert selection and recurring elitism. Employment opportunities and economic progress are unevenly distributed, and governmental connectivity suffers from complicated administrative processes. (*socio-cultural*) Biodiversity loss results from habitat degradation and fragmentation, and green infrastructure implementation faces challenges. Increased vulnerability to climate change impacts and insufficient financial resources for monitoring programs are also concerns. (*ecological- biophysical*) New technologies pose environmental risks, and smaller coastal communities face limited

technology enhance operational efficiency and reduce environmental impact, while efforts improve observational infrastructure and products. (*technological*)	access to advanced solutions. Regulatory constraints and unequal technological progress exist across the Adriatic, compounded by insufficient financial resources for infrastructure. (*technological*)

SWOT– Gdansk, Poland

CIRCULAR BLUE ECONOMY

The vision for a sustainable coastal region within Pomerania covers five important areas:

- **Sustainable coastal infrastructure**: its development should be based on the principles of sustainable development including minimising environmental impacts while ensuring safety and convenient accessibility for local communities and tourists.
- **Protection and restoration of coastal ecosystems**: Taking action to this end should strengthen resilience to climate change, support biodiversity and provide habitat for a range of species.
- Cross-**sectoral cooperation**, including with public administrations, the private sector, NGOs, and local communities. Working together on spatial planning, environmental protection and promoting sustainable practices can benefit all stakeholders.
- Use **modern technology and innovation** to accelerate the transformation towards a sustainable coast. Solutions such as smart waste management, water quality monitoring and the use of renewable energy can be key to achieving sustainability goals on the coast.
- Sustainable **maritime economy**: development of the maritime sector should follow ecological principles, minimise emissions, use renewable energy sources and promote efficiency in the use of marine resources.

STRENGTHS	**WEAKNESSES**
Strong maritime heritage, supportive communities, and maritime traditions foster stewardship. A diversified economy includes shipbuilding and tourism, supported by skilled labor and established regulations. Funding opportunities, strategic trade location, and collaboration between government, industry, and civil society enhance opportunities. (*socio - cultural*) Rich biodiversity supports conservation, aided by protected areas and established ecosystem management practices. Opportunities exist for green infrastructure projects, renewable energy generation, and integrating green solutions into urban planning. Collaboration with research institutions and NGOs, along with technological advancements, enhances ecosystem management and restoration efforts. (*ecological - biophysical*)	Limited public awareness of the Circular Blue Economy, resistance to change, and cultural barriers hinder sustainable practices. Economic disparities, bureaucratic hurdles, and limited public engagement affect progress. Inconsistent enforcement, lack of coordination, insufficient data, and challenges in securing funding and investment further complicate efforts. *(socio - cultural*) Biodiversity faces threats from habitat degradation, pollution, and overexploitation, exacerbated by weak conservation enforcement. Insufficient green infrastructure investment and fragmented habitats weaken resilience, while limited resources and reliance on fossil fuels increase environmental challenges. *(ecological - biophysical)*

Pomarania's advanced maritime infrastructure supports the Circular Blue Economy. The established built environment aids sustainable technologies, while universities drive innovation in waste management, renewable energy, and smart infrastructure. Continuous technology advancements promote sustainable practices. (*technological)*	Pomarania has outdated infrastructure that hinders the Circular Blue Economy. High costs, resistance to change, and unsupportive regulations slow technological adoption. A skills gap in renewable energy and waste management exists, requiring targeted training. Reliance on traditional industries complicates the shift to sustainable practices, emphasizing the need for supportive policies. *(technological)*
OPPORTUNITIES	**THREATS**
Job creation will arise from new industries and businesses, while sustainable practices will help preserve Pomarania's cultural heritage. The region can access EU funding for technological development and infrastructure improvements to support its transition to a Circular Blue Economy. (*socio-cultural*) Coastal ecosystem restoration boosts biodiversity and carbon sequestration while reducing marine pollution enhances water quality. Supportive policies promote sustainability, and growing demand for sustainable seafood benefits local fisheries. Integrating renewable energy sources mitigates climate change impacts. (*ecological - biophysical*) Advancements in recycling and waste management enhance resource recovery and reuse. Innovations in renewable energy, like offshore wind and tidal energy, support the transition to sustainable systems. There is potential for job creation in renewable energy, aquaculture, and eco-tourism, as well as growth in eco-friendly technologies and services. (*technological*)	Resistance to traditional economic models and socio-economic disparities limit access to circular economy opportunities. Demand for cheaper, unsustainable seafood hinders sustainable fisheries, while established supply chains restrict eco-friendly product access. There is also a lack of targeted policies for the Circular Blue Economy. *(socio - cultural*) Vulnerability to climate change challenges the sustainability of circular practices, while conflicts with existing land use in densely populated areas may arise. Additionally, inconsistent enforcement of environmental regulations and coastal zone management plans further complicates efforts. (*ecological - biophysical)* High initial investment costs and dependence on external funding slow the adoption of circular solutions. Infrastructural challenges and fossil fuel interests hinder the transition to renewable energy, while limited access to advanced technology and resistance within traditional industries impede innovation. (t*echnological*)

MARINE RENEWABLE ENERGY

The Pomeranian Region, with its strategic location on the Baltic Sea, identifies Marine Renewable Energies (MRE) as a key area for future sustainable development. According to the

"Pomerania Development Strategy 2030" and related energy policy documents, the region aims to utilize its potential in offshore wind energy, wave energy, and tidal energy.

Looking ahead to 2030 and beyond, there are plans to significantly increase the installed capacity of offshore wind farms. Pomerania focuses on innovation and technological development, supporting research projects and international cooperation in the field of MRE. The priority is not only energy production but also the protection of marine biodiversity and minimizing environmental impact.

Further investments in infrastructure, such as port expansion and logistics improvement, are intended to support the development of the MRE sector. The region also focuses on education and skills enhancement of the local community in new energy technologies, aiming to increase social acceptance and integration with the local economy.

The strategic approach to MRE means improving energy security and contributing to achieving the climate goals of Poland and the European Union. The long-term vision anticipates that the region will become a leader in sustainable sea-based energy production, bringing both environmental and economic benefits.

STRENGTHS	**WEAKNESSES**
Pomerania's Baltic Sea coastline offers substantial potential for offshore wind farms, supported by a skilled workforce. Regulatory frameworks in Poland attract investment, while local universities facilitate research in renewable energy. Increasing public support encourages government and private investment in sustainable projects. *(socio - cultural)* Pomerania's strong offshore winds make it ideal for wind energy projects, and its marine biodiversity can support diverse energy solutions with minimal ecological disruption. The region is also investing in green infrastructure that complements renewable energy development, including coastal protection measures. *(ecological - biophysical)* Pomerania's strong engineering base in offshore engineering and renewable technologies supports marine energy development. Local research institutions and universities drive innovation in this field. Its strategic Baltic Sea location provides access to local and international markets, enhancing economic potential. Supportive national and regional policies offer incentives and regulatory	Marine renewable energy projects face barriers like high upfront costs and community resistance to visual impact and disruptions. Pomerania lacks infrastructure for manufacturing and maintenance, requiring investment in port facilities. Complex regulations can deter investors, and specialized workforce skills require training investments. Environmental impacts must be carefully managed. (*socio - cultural*) Marine renewable energy projects can harm ecosystems through noise pollution and habitat disruption, requiring careful planning and assessments. Pomerania's coastal areas face climate change vulnerabilities, such as sea-level rise, threatening the stability of infrastructure and potentially leading to public opposition. (*ecological - biophysical)* Offshore renewable energy projects, especially wind farms, face high upfront costs and technical challenges in design. Pomerania may lack essential infrastructure, necessitating investment. Variability in marine resources can cause energy

frameworks to encourage investment in marine renewables. *(technological)*	intermittency, requiring storage solutions. A lack of training programs may lead to a shortage of qualified personnel. (*technological*)
OPPORTUNITIES	**THREATS**
N/A	N/A

SPATIAL PLANNING OF SOCIO-ECONOMIC ACTIVITIES

The spatial planning vision for socio-economic activities in Pomarania is to create a sustainable and resilient environment that balances economic development with environmental protection and social wellbeing. This vision includes a comprehensive approach that integrates different sectors and stakeholders to ensure the long-term prosperity of the region:

- Implementing an integrated approach to coastal zone management that considers the interconnectedness of land and sea, focusing on conserving biodiversity, protecting ecosystems, and enhancing coastal resilience.
- Promoting sustainable tourism initiatives that respect the region's natural and cultural heritage while providing economic opportunities for local communities.
- Adopting blue economy principles to stimulate economic growth through responsible and innovative use of marine resources such as aquaculture, renewable energy, and ecotourism.
- Planning and developing infrastructure to support socio-economic activities while minimising environmental impacts, including ports, transport networks and renewable energy installations.
- Engaging local communities, businesses, and stakeholders in the planning process to ensure inclusivity, transparency, and ownership of development initiatives.
- Building resilience to climate change and natural hazards by integrating adaptation measures into spatial planning, such as coastal protection, flood management and land use planning.
- Investing in research and innovation to develop and implement state-of-the-art solutions for sustainable coastal development, including advanced resource management and environmental monitoring technologies.

STRENGTHS	**WEAKNESSES**
Pomerania's coastline offers sustainable tourism opportunities, like eco-friendly accommodations, supported by effective marine spatial planning. The region benefits from a skilled workforce, including fishermen, shipbuilders, and marine engineers, who contribute to these initiatives. (sociocultural)	Pomerania's economy relies on traditional industries like fishing and shipping, which may resist changes from marine spatial plans. Additionally, there may be a lack of awareness among locals and businesses about the benefits of collaborating on

Protecting rich ecosystems is essential in Pomerania for effective marine spatial planning. The region has significant potential for renewable energy generation, particularly offshore wind, with various projects integrated into its marine spatial development plans.(*ecological - biophysical)* Pomerania's ports, including Gdansk, Gdynia, and Szczecin, support marine logistics and marine renewable energy (MRE) activities. These ports are key for developing offshore industries, particularly wind farms. The region hosts research institutions that advance marine technology and environmental engineering, fostering sustainable innovations for marine spatial planning and resource management.*(technological*)	comprehensive marine spatial planning. (socio - cultural) Incorporating climate change impacts, such as sea level rise and extreme weather, into marine spatial plans is difficult due to funding shortages for adaptive measures like flood defenses. Additionally, there is no strategy to address land-based pollution's effects on the marine environment. Marine spatial planning should focus on reducing nutrient runoff and integrating water quality management to protect sensitive Baltic ecosystems. *(ecological- biophysical)*
OPPORTUNITIES	**THREATS**
Pomerania's strategic Baltic Sea location enhances cooperation with neighboring countries, promoting common standards for marine resource management. Participation in European governance for fisheries and habitat protection can help align marine spatial plans with European environmental and economic goals. *(socio - cultural*) The Pomeranian region benefits from cooperation with other Baltic countries on environmental and biodiversity protection initiatives like HELCOM, enabling joint projects. Access to modern ecosystem monitoring and management technologies, backed by EU research and development funds, enhances the effective management of natural resources. *(ecological biophysical*) Pomerania's investment in new technologies improves its energy balance and creates jobs. Enhancements in waste management, recycling, renewable energy, and sustainable transportation promote circular economy initiatives and strengthen the region's environmental resilience. (*technological*)	External competition may cause conflicts and environmental pressures, requiring careful management in marine spatial plans. Changes in national and international policies can also introduce uncertainty and instability in marine resource management. (*socio - cultural)* Pollution from neighboring regions around the Baltic Sea adversely impacts water quality and marine ecosystems in the Pomeranian Region, threatening biodiversity and complicating resource management. Poorly managed activities and the absence of marine spatial plans can lead to the loss of key habitats, further jeopardizing ecological stability. (*ecological - biophysical*) Dependence on foreign suppliers risks access to technologies during political or economic changes. International conflicts can delay infrastructure projects and affect marine spatial plans. Additionally, reliance on digital technologies for marine management increases vulnerability to cyberattacks and failures, jeopardizing safety and efficiency. (*technological*)

MARINE ECOSYSTEM SERVICES

The future vision for a sustainable coast in the Pomerania region involves creating a harmonious balance between economic development, social well-being, and environmental conservation. The future involves protection and maintaining healthy ecosystems, where renewable Energy sources are utilised. Additionally, implementing eco- friendly eco-friendly tourism, aquaculture, renewable energy generation, and marine biotechnology flourish, providing employment opportunities and economic growth while minimising environmental impact. Local communities are engaged in making decisions and encouraged to participate in coastal management. Public awareness and education campaigns promote a culture of environmental sustainability. Cross-border partnerships promote knowledge exchange, scientific research, and collaborative action to protect shared marine resources and address transboundary environmental issues. The future vision for a sustainable coast in Pomerania is where economic prosperity goes hand in hand with environmental integrity and social equity.

STRENGTHS	**WEAKNESSES**
Pomerania's coastal community has a rich maritime cultural heritage, supported by various associations dedicated to preserving cultural identity. Strong community involvement and government support, along with a skilled maritime labor force, enhance these efforts. *(socio cultural)* Pomerania benefits from abundant marine resources, a strategic location for trade and transport, access to populated areas for economic growth, and a wide coastline. *(ecological biophysical)* Pomerania hosts numerous research and innovation centers, making it an ideal location for renewable energy technologies and biotechnological innovations. *(technological)*	Pomerania faces fading traditions, disappearing regional products, and a decline in practitioners of vanishing craft trades, highlighting the need for skills development. (*socio-cultural*) Coastal regions are vulnerable to climate change, and human activities can threaten biodiversity, despite significant investments in infrastructure. (*ecological biophysical)* Challenges include a lack of standardized metrics and benchmarks, limited availability of certain materials, and difficulties in interactions between marine and terrestrial environments. (*technological*)
OPPORTUNITIES	**THREATS**
Key factors for growth include job creation and economic development, community education, international collaboration, and increasing demand for eco-friendly and regional products, alongside access to EU structural funds. (*socio-cultural*) The focus is on sustainably managing marine resources, reducing waste, and preventing climate change. (*ecological biophysical)*	Challenges include the need for significant funding, equitable distribution, regulatory limitations, community habits, and reliance on traditional linear economy models. (*socio- cultural)* Challenges include limitations in natural resources, environmental risks, and the introduction of invasive species. *(ecological biophysical)*

The emphasis is on supporting future innovations in aquaculture, improving transport efficiency, and developing a circular economy within the maritime sector. *(technological)*	Challenges include technological barriers, disruption to traditional industries, high energy consumption for reprocessing materials, and insufficient infrastructure. *(technological)*

SWOT– Bodø, Norway

CIRCULAR BLUE ECONOMY

The future vision for a circular blue economy in Northern Norway's coastal region focuses on creating sustainable value from marine and coastal resources while actively reducing environmental impacts. Central to this vision is the integration of circular economy principles within the marine sectors, particularly fisheries and aquaculture, which are vital to the region. A key component of this vision is advancing strategies that reduce marine waste and transform it into valuable resources. Projects like RE-D-USE have been instrumental in developing educational programs to reduce waste and exploring circular economy ventures that treat marine waste as a resource. This includes recycling and upcycling materials like fishing nets and gear into new products, thereby closing the loop on marine resource use. The vision also encompasses robust systems of integrated ocean management that support sustainable practices across all marine activities. This ensures that economic development does not come at the expense of ecological health, aligning with broader goals for sustainable development and environmental stewardship.

Moreover, innovation and technology are focused on enhancing marine industries' resource efficiency and waste management. This includes developing new materials and processes that minimise ecological footprints and promote the reuse of materials at the end of their life cycle. These initiatives are supported by policies and collaborations that foster sustainable practices throughout the value chain, from harvest to market.

STRENGTHS	**WEAKNESSES**
Northern Norway's coastal region features strong regulatory frameworks for sustainable marine and environmental management. Local communities value sustainability, and collaboration among government, research institutions, and private enterprises enhances circular economy strategies by pooling resources and knowledge for effective practices. *(socio cultural)* Northern Norway's coastal region features rich biodiversity that supports fishing and tourism while showcasing ecological resilience. Established green infrastructures, like protected areas, promote ecological stability and sustainable interactions with the environment. This integration of ecological and economic goals fosters a circular economy, balancing	The local economy's reliance on traditional fishing and oil extraction limits flexibility in adopting sustainable practices. Inadequate waste processing and recycling infrastructure hampers effective waste management aligned with circular economy principles. Additionally, skill gaps in the workforce regarding circular economy practices highlight the need for targeted training programs. (*socio-cultural*) The coastal region's ecosystems are vulnerable to climate change, threatening marine biodiversity and resource sustainability for a circular blue economy. There are insufficient restoration programs and limited green infrastructure, reducing effectiveness in conservation. Economic

conservation with economic growth for enhanced resilience. *(ecological biophysical)* Northern Norway's extensive coastlines and strong winds enable high renewable energy production, particularly from wind and hydroelectric sources. This supports sustainable industries and reduces carbon footprints. Investments in sustainable technologies, like eco-friendly aquaculture systems, minimize ecological impacts and foster a circular blue economy. *(technological)*	pressures lead to overexploitation of fisheries, undermining sustainability. Fragmented management among regulatory bodies results in inconsistent policy enforcement, hindering effective resource management. (*ecological biophysical)* The region faces challenges in adopting new sustainable technologies due to high costs and disruptions. Limited technology transfer between sectors hinders the effective implementation of a circular economy. (*technological*)
OPPORTUNITIES	**THREATS**
The transition to a circular economy offers opportunities to improve institutional frameworks by enhancing collaboration among government, industry, and academia. Updating regulations to promote recycling and renewable energy can support sustainable development, while specialized educational programs can focus on sustainability and resource management. (*socio-cultural*) Opportunities in Northern Norway include enhancing biodiversity through circular economy principles, expanding green infrastructure like coastal wetlands, and developing climate adaptation strategies. Integrating ecosystem services into economic planning can also promote environmental sustainability. (*ecological biophysical)* Northern Norway can use its advanced engineering infrastructure to promote sustainable technologies in waste management and energy efficiency. Opportunities include innovating waste-to-resource technologies and adopting digital solutions to optimize resource use and enhance efficiency. *(technological)*	Inadequate investment in circular innovations threatens the development of a circular blue economy. Resistance from established sectors like oil and fisheries, which are central to the region's identity, may hinder the transition to circular practices. (s*ocio- cultural)* Climate change poses significant threats to marine ecosystems, disrupting biodiversity and affecting fisheries, tourism, and resource availability. Overexploitation of natural resources driven by economic pressures and the erosion of traditional ecological knowledge further threaten sustainable resource management. (*ecological biophysical)* A skills gap in emerging technologies may hinder the implementation of systems essential for a circular economy. Training and retaining a skilled workforce is challenging, while financial constraints and high initial costs deter businesses from investing in innovative technologies, slowing progress. *(technological)*

SPATIAL PLANNING OF SOCIO-ECONOMIC ACTIVITIES

The future vision for spatial planning of socio-economic activities in the coastal region, emphasizes a comprehensive and integrated approach to managing the diverse and often conflicting uses of coastal and marine resources. Key aspects of this vision include: The vision prioritizes integrated management strategies that involve multiple stakeholders, including local communities, industries, and governments. This collaborative approach aims to balance economic development with environmental sustainability. Ecosystem-based management practices are heavily emphasized. This method ensures that spatial planning supports economic development, such as fisheries, tourism, and aquaculture, and maintains the ecological integrity of coastal environments.

The planning process highlights the importance of involving local communities in decision-making processes. Ensuring these communities have a voice in spatial planning helps tailor developments to local needs and increases the resilience of socio-economic activities to environmental changes.The vision incorporates adapting to and integrating international environmental standards and practices. This global alignment is crucial for managing transboundary environmental impacts and for attracting international funding and support.

STRENGTHS	**WEAKNESSES**
Northern Norway has transparent governance, promoting informed decision-making and economic diversification, including adaptive aquaculture. Challenges include declining indigenous cultures and limited transport infrastructure. Public involvement supports balanced growth, while climate adaptation innovations leverage regional strengths. *(socio cultural)* Northern Norway's diverse marine ecosystem supports fisheries and aquaculture, with climate adaptation and sustainable practices reducing environmental impact. Integrated plans and research guide resource management. Challenges include climate change, overfishing, limited green infrastructure, and risks from industrial activities. *(ecological biophysical)* Northern Norway's aquaculture employs advanced technologies for sustainability. Its maritime infrastructure supports fishing and renewable energy, while investments in wind and hydrogen reduce emissions. Buildings are designed for Arctic conditions, ensuring energy efficiency. *(technological)*	Limited transport infrastructure hinders economic development, while reliance on fisheries and aquaculture makes the economy vulnerable to environmental changes. Top-down governance can overlook local preferences, leading to conflicts and reduced support. (*socio-cultural*) The region's ecosystems are vulnerable to climate change and overfishing, impacting marine biodiversity. Limited green infrastructure hinders sustainable development, while industrial activities risk pollution and habitat disruption. Public awareness of climate issues is present, but local engagement in biodiversity management is insufficient. (*ecological biophysical)* Maintaining maritime infrastructure is challenging due to advancing technology and industrial demands. Modernization is needed for larger vessels, while the harsh environment complicates maintenance. The energy sector struggles to transition to green technologies, and investments in renewables are insufficient to meet growing demands. Integrating these technologies into the

	energy grid is crucial for sustainability. (*technological*)
OPPORTUNITIES	**THREATS**
The region is diversifying its economy with sustainable tourism, renewable energy, and advanced aquaculture, enhancing resilience against market fluctuations. Strengthening regulatory frameworks can improve management and support sustainable growth. Investing in education will prepare the workforce for jobs in green technologies. (*socio-cultural*) Expanding protected marine and coastal areas can enhance biodiversity and support eco-tourism. Integrating traditional knowledge with modern science in ecosystem management will create effective, sustainable resource management strategies. (*ecological biophysical)* The coastal region can excel in renewable energy and modernize maritime infrastructure for advanced technologies, boosting efficiency and safety. Smart city technologies will enhance urban services, while focused engineering education will prepare the workforce with essential skills*. (technological)*	By 2050, the coastal region may face economic stagnation from reliance on declining traditional industries, worsened by global market fluctuations. Governance may struggle to adapt to rapid changes, missing opportunities in renewable energy and tourism. An outdated education system could leave the workforce unprepared, stifling innovation and competitiveness. (*socio- cultural)* Climate change threatens marine and coastal ecosystems through sea-level rise, extreme weather, and ocean acidification, leading to biodiversity loss and impacting fishing and tourism. Pollution from plastics and chemicals degrades water quality, while invasive species disrupt local biodiversity, complicating conservation efforts without strong biosecurity measures. (*ecological biophysical)* Obsolete infrastructure may struggle to support new technologies, including outdated energy systems and transportation networks. As the region advances, it faces cybersecurity risks, with critical infrastructure vulnerable to cyber-attacks. Pollution from electronic waste and energy consumption, along with habitat disruption from construction, adds to these challenges. *(technological)*

MARINE ECOSYSTEM SERVICES

The future vision for a sustainable coast in the region includes some key points. Primarily, it acknowledges the demands placed on regional resources, which often exceed the capacity of

the local environment. This challenge requires international and national management strategies to ensure sustainability. The vision includes integrating local communities into decision-making processes and ensuring active participation in shaping their environment. Furthermore, the approach emphasizes the need for ecosystem-based spatial planning, which is essential to managing various stakeholders' competing interests, including industrial activities and conservation efforts. This planning aims to sustain regional activities like fisheries, marine transportation, aquaculture, and tourism while protecting the environment. The sustainable future of the coast also relies heavily on the successful implementation of international cooperation and integrated management plans that align with global

environmental standards and policies. The ongoing initiatives in regions like Northern Norway, where integrated management plans are already being implemented, serve as a model for effective regional management, demonstrating the potential for balancing local interests with broader environmental imperatives.

STRENGTHS	**WEAKNESSES**
Northern Norway's fishing industry thrives on sustainable practices and strict regulations that protect marine resources. High public awareness and community engagement support local conservation efforts. The region excels in marine science, driving innovation, while eco-tourism promotes economic incentives for conservation. An integrated governance system ensures effective management of marine ecosystem services. *(socio cultural)* Northern Norway's coastal region features rich biodiversity that supports its fishing industry and ecological resilience. Marine protected areas help preserve habitats, while cold currents mitigate climate impacts. Effective management practices, backed by ongoing research, sustain marine resources and enhance understanding of the region's ecology. *(ecological biophysical)* Northern Norway utilizes advanced marine research technologies, including remote sensing and underwater robotics, to improve ecosystem management. The region promotes renewable energy, especially wind power, and has made advancements in sustainable aquaculture. Strong infrastructure and substantial investments support these initiatives, while collaborations among research institutions and	Northern Norway's economy relies on fishing, which risks overfishing and ecosystem disruption, highlighting the need for diversification. Despite high environmental awareness, understanding of marine ecosystems is limited, hindering conservation efforts. Conflicts between commercial interests and marine conservation can impede sustainability. Local adoption of technological innovations in marine services often lags, reducing effectiveness, and educational initiatives fail to reach remote areas, limiting their impact on promoting sustainability. (*socio-cultural*) Northern Norway's economy, reliant on fishing, risks overfishing and ecosystem disruption, highlighting a need for diversification. Pollution threatens water quality and marine life, while overfishing depletes stocks and disrupts food chains. A lack of long-term data on climate change impacts hampers effective management of marine ecosystems. (*ecological biophysical)* Northern Norway's aging marine infrastructure leads to inefficiencies. Limited access to advanced technologies hampers resource management, and there's often poor integration between new solutions and existing practices. Reliance on external

industry drive innovation in marine management. *(technological)*	technology providers delays implementation and increases costs, while transferring innovations from research to practical use is challenged by regulatory hurdles and funding issues. (*technological*)
OPPORTUNITIES	**THREATS**
Northern Norway can boost eco-tourism by leveraging its natural landscapes and marine biodiversity, enhancing conservation awareness. Developing integrated governance models with local communities and NGOs would improve marine resource management. Expanding research institutions and strengthening public-private partnerships could attract investments in sustainable projects. Additionally, increasing educational initiatives on marine conservation can foster a culture of sustainability. (*socio-cultural*) Northern Norway can enhance marine ecosystem restoration, such as reseeding kelp forests, to boost biodiversity. The region can also develop climate adaptation strategies that protect marine life. Opportunities for carbon sequestration through blue carbon initiatives can mitigate climate change impacts. Integrated management practices can improve sustainability, while innovative technologies provide real-time insights for proactive management. Targeted biodiversity programs can help preserve unique species and attract scientific interest. (*ecological biophysical)* Northern Norway can advance marine technologies like underwater robotics and monitoring systems, enhancing conservation efforts. Upgrading infrastructure, such as ports and coastal defenses, will support sustainability and reduce environmental impacts. Embracing green technologies and utilizing big data analytics and IoT will improve decision-making for ecosystem services. *(technological)*	Northern Norway's reliance on oil, gas, and fisheries threatens marine ecosystems and leads to overexploitation. Policy inconsistencies hinder effective management, while lack of stakeholder engagement undermines conservation efforts. Financial constraints limit research and management capacity, and the migration of skilled professionals depletes local talent needed for innovative strategies. (*socio- cultural)* Climate change, including ocean acidification and rising temperatures, threatens Northern Norway's marine biodiversity. Coastal development, pollution, and certain fishing practices cause habitat destruction, while invasive species disrupt local ecosystems. Overfishing and unsustainable harvesting endanger marine populations. A lack of cohesive management exacerbates these issues, hindering recovery efforts. (*ecological biophysical)* Technological changes may outdate existing infrastructure, requiring ongoing investments for effective management of marine ecosystems. High costs and reliance on external expertise limit Northern Norway's ability to adopt advanced conservation technologies. Additionally, a lack of integration between new solutions and existing management frameworks can hinder practical application. *(technological)*

SWOT– Kiel, Germany

MARINE ECOSYSTEM SERVICES

The future vision is based on the following key strategic areas:

- 12.5% of the Baltic Sea in Schleswig-Holstein is placed under strict protection by 2030 (including three new marine protected areas and three existing Natura 2000 sites that will receive a stricter protection status)
- Integrated Baltic Sea Station (at Ministry of Environment) to link nature conservation with tourism and education
- Reduction of eutrophication
- Salvage of old munitions dumps
- Recovery of lost fishing gear (i.e. ghost fishing)
- Scientific advisory board in support of the Action Plan 2030

STRENGTHS	**WEAKNESSES**
High level of general awareness regarding the value of ecosystem services, including for economic value creation (*socio-economic*) Political frameworks between neighbouring states for both the North (OSPAR) and the Baltic Sea (HELCOM)(*socio-economic*) North Sea with Wadden sea UNESCO World Natural Heritage (*ecological*) Highly technological-engineering coastal protection at the North Sea (dike construction, flood barriers and sluices) under public administration (*technological*) Sand management (e.g. island of Sylt) (*technological*)	Conflicts of use (in particular agriculture and fishing, tourism and water sports, as well as naval bases, energy production) (*socio-economic*) Old ammunition dumps, estimate for Germany 1.3 million tonnes (North Sea), 300,000 tonnes (*ecological*)
OPPORTUNITIES	**THREATS**
Baltic Sea Conservation Action Plan 2030 (*socio-economic*) Strong research programme e.g., sustainMARE (*socio-economic*)	The Baltic Sea is a security-critical region for NATO (*socio-economic-political*) Increase oxygen minimum zones (Baltic Sea) (*ecological*) Overfishing (*ecological*) Northerly shift of ecozones (*ecological*)

	Industrialisation of the seas (*ecological-economic*) Target for offshore wind energy in EEZ to increase to at least 30 gigawatts (GW) by 2030, at least 40 GW by 2035 and at least 70 GW by 2045 (*technological*)

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