

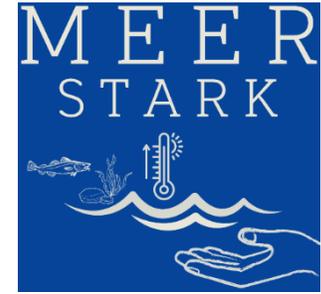
Bridging Science and Policy- Exploring the Marine Protection and Climate Adaptation Nexus

MEER:STARK Final Event: 3.-4. November 2025

Umwelt 
Bundesamt



Ecollogic Institute
Science and Policy
for a Sustainable World

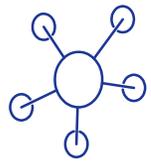


Bridging Science and Policy- Exploring the Marine Protection and Climate Adaptation Nexus

MEER:STARK Final Event: 3.-4. November 2025

Umwelt 
Bundesamt

Project Aims



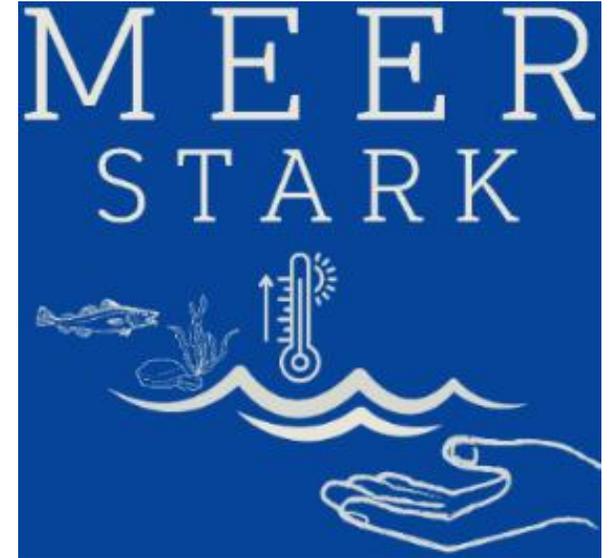
Highlight linkages between marine conservation and climate change adaptation



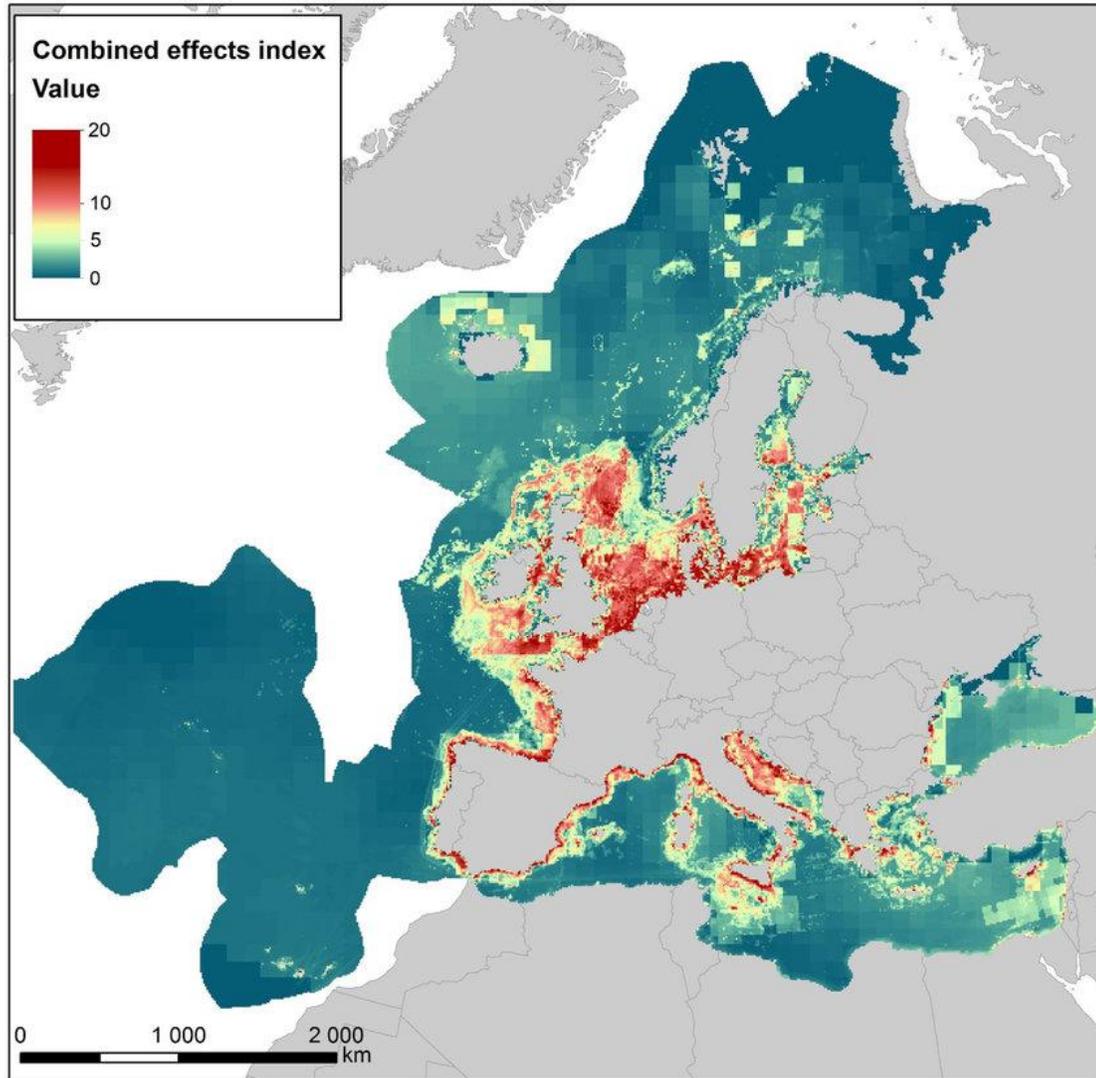
Promote cross-sectoral dialogue at national and European level



Develop concrete **cross-sectoral proposals**



Project Background: European Seas are under significant threat!



- ▶ Many species and their habitats in European Seas are face intense **cumulative pressure**, especially in coastal zones.
- ▶ Overfishing, pollution, invasive species, unsustainable marine use, and climate change **overlap and amplify each other**, weakening ecosystems and reducing their capacity to adapt to change (↓ resilience).
- ▶ Ecosystems are **changing rapidly** due to human influences, challenging our ability to conserve biodiversity, ecosystem functions, and human well-being.

Urgent climate risks to marine and coastal ecosystems

Table ES.1 Assessment of major risks

Climate risks for 'Ecosystems' cluster	Urgency to act	Risk severity			Policy characteristics		
		Current	Mid-century	Late century (low/high warming scenario)	Policy horizon	Policy readiness	Risk ownership
Coastal ecosystems	Urgent action needed	+++	+++	+++	Medium	Medium	Co-owned
Marine ecosystems	Urgent action needed	+++	+++	++	Medium	Medium	EU
Biodiversity/carbon sinks due to wildfires (hotspot region: southern Europe)	Urgent action needed	+++	++	++	Medium	Medium	Co-owned
Biodiversity/carbon sinks due to wildfires	More action needed	+++	++	++	Medium	Medium	Co-owned
Biodiversity/carbon sinks due to droughts and pests	More action needed	+++	++	++	Long	Medium	Co-owned
Species distribution shifts (*)	More action needed	+++	++	++	Medium	Medium	Co-owned
Ecosystems/society due to invasive species	More action needed	+++	++	++	Medium	Medium	Co-owned
Aquatic and wetland ecosystems	More action needed	+++	++	++	Medium	Medium	Co-owned
Soil health (*)	More action needed	+++	++	++	Medium	Medium	Co-owned
Cascading impacts from forest disturbances	Further investigation	+	+	+	Long	Medium	Co-owned

Legends and notes

Urgency to act	Risk severity	Confidence
Urgent action needed	Catastrophic	Low: +
More action needed	Critical	Medium: ++
Further investigation	Substantial	High: +++
Sustain current action	Limited	
Watching brief		

➤ **Risks to marine and coastal ecosystems have reached critical levels and are the most severe, requiring urgent and decisive action to avoid becoming catastrophic**

Challenges and the need for action – North and Baltic Seas

- ▶ Many species and their habitats in the North and Baltic Seas are under **significant pressure**, with 1/3 of marine life in the Baltic Sea endangered.
- In Germany, approximately **3.2 million people** live in coastal areas vulnerable to flooding.
- Rising extreme water levels increase the risk of flooding, and storm surges lead to greater coastal erosion.
- This threatens coastal protection systems, causes damage to coastal settlements and infrastructure, and results in property loss and displacement of people.
- In Schleswig-Holstein, one-quarter of the land area (333,000 people) is at risk from marine flooding.

Final MEER:STARK Workshop

Main Aims:

- **Present and discuss key outcomes** from the Nexus and the project's thematic focus areas: *Eutrophication, Nature-based Coastal Protection, and Climate-ready Marine Protected Areas*
- **Refine and validate recommendations:** Translate MEER:STARK findings into **concrete next steps for policy and practice**
- **Co-identify opportunities** for integration of marine protection, climate adaptation, and spatial planning in ongoing national and EU processes
- **Legacy:** Prioritise actions and partnerships to continue the work beyond the project

NEXUS: Marine protection and climate adaptation are deeply interconnected

= a holistic approach and integrated actions for the protection of the oceans and adaptation to climate change

- ▶ **Protecting the oceans/coasts and their biodiversity** is a crucial part of climate adaptation and vice versa, with numerous interactions and synergies between both approaches.
- ▶ **Yet sectoral fragmentation** still leads to inefficiencies, conflicting measures, and lost synergies
- ▶ **Promoting resilience** is essential to support the adaptability of ecosystems as well as human communities to climate impacts.

From silos to systems – Why the Nexus matters

A **nexus or system-based approach** fosters coherence and efficiency by:

- Developing integrated marine biodiversity and climate adaptation policies
- Aligning objectives and actions across governance levels and sectors
- Mitigating trade-offs between conservation, climate, and economic goals
- Fostering joint implementation and co-funding mechanisms

IPBES Nexus Assessment (2024):

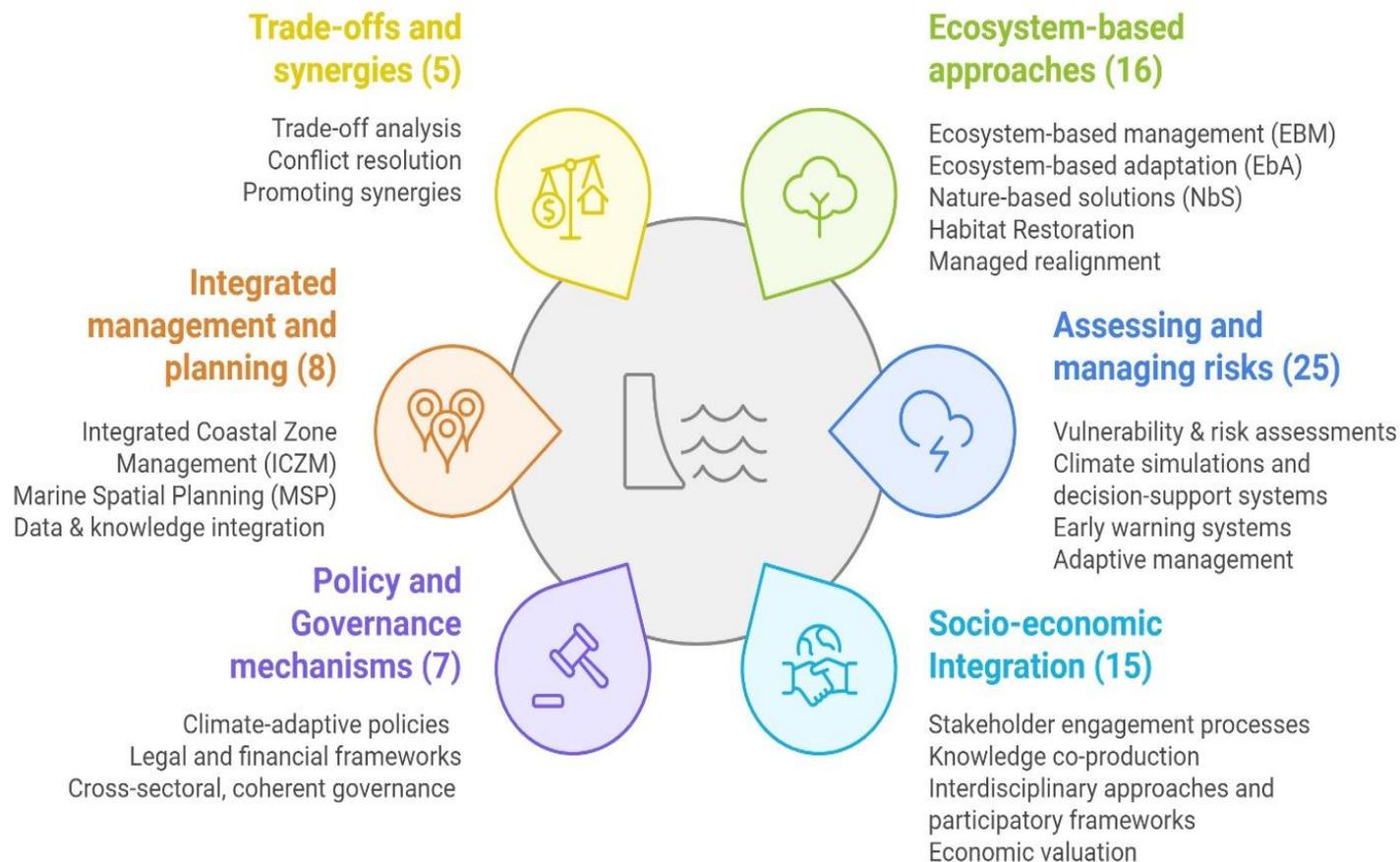
Nature-oriented nexus approaches bring the highest co-benefits across Sustainable Development Goals — particularly SDG 14 (Life below water), SDG 13 (Climate action), and SDG 3 (Health and well-being).

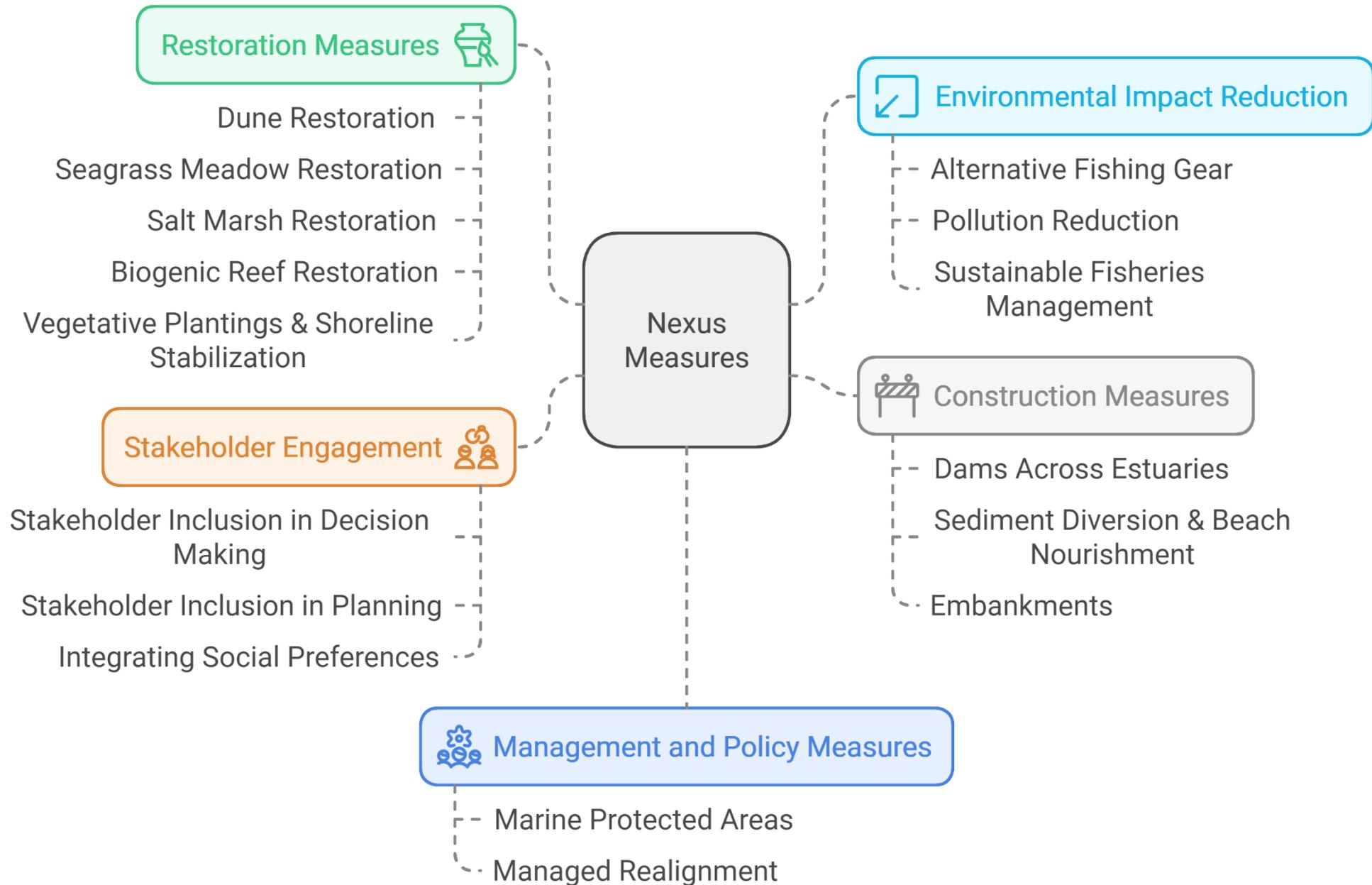
Key Outcomes of MEER:STARK – Knowledge to Action

Evidence base

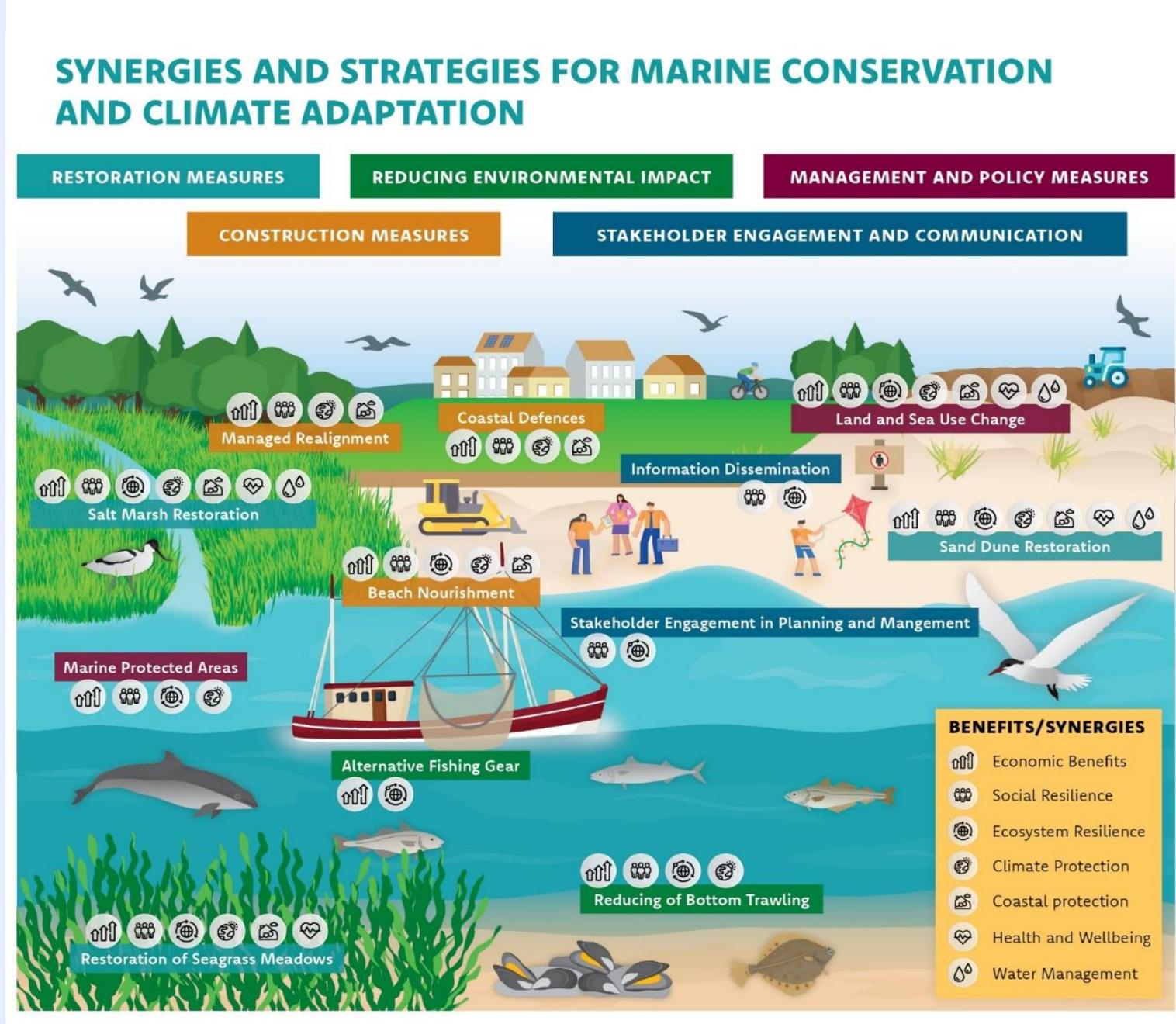
- Conducted a comprehensive literature review on the marine protection–climate adaptation nexus (305 → 61 relevant studies).
- **Identified core nexus strategies** →
- **Revealed gaps:** limited applied examples, fragmented governance, few integrated tools.

Nexus strategies for marine conservation and climate adaptation





- Healthy, resilient marine ecosystems provide **diverse services and benefits** (ecological, social, economic)
- **Promote biodiversity** (ecosystems, species, genes)
- **Significant role in the climate system** (oxygen production, CO₂ storage/blue carbon, regulation by absorbing excess heat, etc.)
- **Adaptation to climate-related changes and disaster risk reduction** (e.g. protection of coasts from rising sea levels, flooding, and erosion)
- **Economic and social benefits** through fisheries, renewable energy, and tourism
- **Health and well-being** (provision of food and water)



Key Outcomes of MEER:STARK – Knowledge to Action

Co-creation & dialogue (How we translated evidence into process)

- Held three cross-sectoral workshops on key themes:
 Eutrophication |  Nature-based Coastal Protection |  Climate-ready MPAs
- Brought together practitioners, policymakers, and researchers to co-develop recommendations.
- Enhanced science–policy dialogue across North and Baltic Sea regions and beyond

Outputs & legacy (*What it delivers / what comes next*)

- Produced actionable recommendations to guide integrated marine and climate policies.
- Contributed to a peer-review publication (Fuchs et al. 2025) and another under revision (Fuchs et al., *submitted to npj Ocean Sustainability*) providing a consolidated evidence base.
- Established a foundation for follow-on work, policy incorporation and regional uptake

Fuchs, G., Kroos, F., Scherer, C., Seifert, M. and Stelljes, N., 2025. Exploring marine conservation and climate adaptation synergies and strategies in European seas as an emerging nexus: a review. *Frontiers in Marine Science*, 12, p.1542705.



MEER:STARK Core Messages

1 Integration is essential

Marine protection and climate adaptation must be approached together, not in silos. This is crucial for the long-term resilience of coastal marine ecosystems in Europe as well as the quality of life of coastal communities and all those who depend on the sea. MEER:STARK underscores that nexus.

Adaptation of coastal and marine ecosystems is about **aligning biodiversity, ecosystem-function, governance and human uses in one frame.**

For the North and Baltic Sea region, this integrated lens is timely: multiple pressures (eutrophication, sea-level rise, warming, habitat loss) converge.

MEER:STARK Core Messages

2 Ecosystem-based and nature-based strategies unlock strong synergies

Approaches such as ecosystem-based adaptation (EbA), ecosystem-based management (EBM), nature-based solutions (NbS) are key entry points for the nexus.

By leveraging ecosystem functions (e.g., coastal wetlands, seagrass, natural dunes) we can build resilience to climate change *and* protect marine biodiversity — win-win.

But implementing such strategies needs robust governance, capacity and cross-sector coordination.

MEER:STARK Core Messages

3 Context-specificity & flexibility matter

“One size fits all” doesn’t work: each sea basin (North Sea, Baltic Sea) has its own combinations of pressures, governance arrangements and opportunities.

Climate change adds dynamic uncertainty — thus management must be adaptive, iterative, flexible rather than fixed.

The project’s cross-sectoral format emphasizes rapid learning, monitoring and adjustment.

MEER:STARK Core Messages

4 Governance & cross-sectoral dialogue are critical enablers

Measures on the ground won't be effective unless the right policy, management and institutional frameworks are in place (risk assessments, adaptive management loops, integrated planning).

The project emphasised the need to engage sectors typically outside “marine protection” (e.g., tourism, shipping, agriculture) to avoid trade-offs and foster synergies.

The **final event is about moving from knowledge to action**: shifting from “what we know” to “what we can do” in the form of joint recommendations



MEER:STARK Core Messages

Actionable recommendations and measures

The project will present targeted recommendations on three priority themes — eutrophication, ecosystem-based coastal protection, climate-ready MPAs.

The final event is designed for co-development of those tools — moving from theory to practical uptake.



Conclusions and outlook

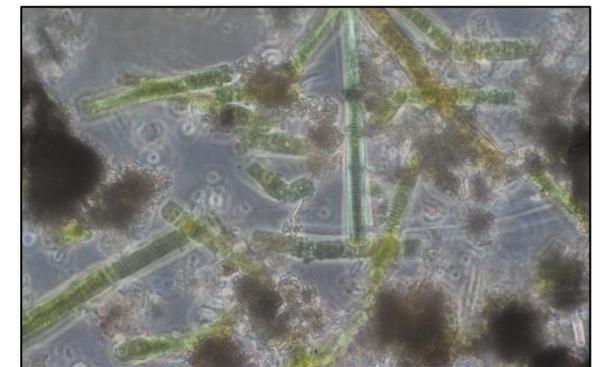
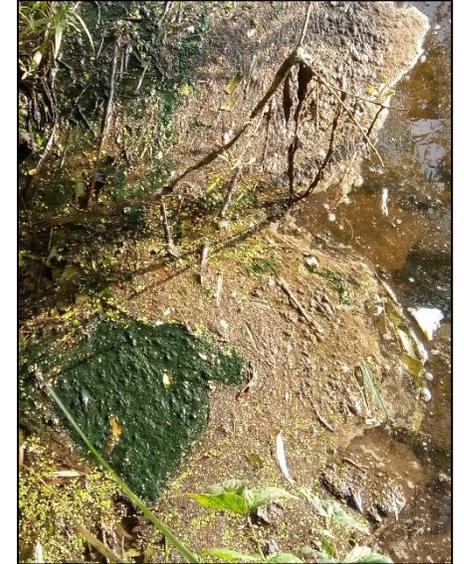
- ▶ This requires a coordinated approach that takes a holistic view of the various pressures and challenges and promotes ecosystem resilience through EBM and effective and innovative NBS
- ▶ Precautionary and integrative planning involving all relevant actors and sectors is crucial for long-term success

Eutrophication

**Presentation of MEER:STARK
preliminary Recommendations
& Impulse Statements**

Eutrophication: Overview

- Definition (according to HELCOM): *“An increase in the supply of organic matter to an ecosystem through nutrient enrichment is induced by excessive availability of nitrogen and phosphorous for primary producers”*
- Combating Eutrophication in the North- and Baltic Sea
 - More important than ever, specially since climate change exhilarates the process in ways we cannot fathom
- OSPAR focuses on measures within its Northeast Atlantic Strategy
- HELCOM proposes specific targets and measures for nutrient reduction in its Baltic Sea Action Plan
- WFD and MFSD focus on nutrient reduction measures in agriculture and sewage as well as atmospheric nitrogen emissions
- About 200 measures are currently underway



- MEER:STARK's first workshop in 2023 focused on eutrophication and saw 30 participants across academia, governmental bodies and practitioners
- **Core questions were discussed:**
 - Are reduction targets under the MSFD or the EU Nitrates Directive still valid in light of climate change?
 - Who are the target groups?
 - What is the connection to climate protection?

Central Recommendations

- **Close stakeholder involvement:** Nutrient reduction measures should involve much closer and early involvement of all stakeholders. It provides an overview of implementation progress at various levels and improve communication overall with increased knowledge leading to better connections
- **Improved organization:** Measures would benefit from adapted exchange formats, enabling more efficient use of resources
- **Developing financial sources:** Close, ongoing and effective stakeholder engagement from the outset would open up additional financial sources and thus provide more opportunities to advance the implementation of nutrient reduction measures from a climate protection perspective more quickly and efficiently.

Ecosystem-based coastal protection

**Presentation of MEER:STARK
preliminary Recommendations
& Impulse Statements**

Nature-based Coastal Protection: Overview

- Nature-based Solutions (NbS) integrate ecological and climate adaptation goals.
- Coastal ecosystems such as saltmarshes, seagrass meadows, dunes, and biogenic reefs provide natural defence, biodiversity benefits, and carbon sequestration.
- MEER:STARK workshop examined how NbS can complement or replace conventional hard-engineered protection.
- The project's 2024 workshop gathered ca. 35 experts from administration, academia, and practice.

Protection of
people and
property



Reducing ecological impacts
Improving biodiversity and
ecosystem services

- Nature-based adaptation measures provide **coastal protection through ecosystem processes**: They are often more cost-effective, resource-efficient, and enhance ecosystem functions and resilience.
- **Wave attenuation**: Reduced wave height and energy, which helps mitigate storm damage.
- **Flood and storm surge attenuation**: Coastal habitats reduce the height or duration of high water levels and flooding caused by sea-level rise.
- **Shoreline stabilization**: Reduction of erosion and land loss.
- Further assessments are necessary to determine the actual costs and benefits.
- The literature addresses **dune habitats, oyster reefs, salt marshes, and seagrass meadows**.

Key Findings from the Workshop

- **NbS offer co-benefits:** climate adaptation, carbon storage ('blue carbon'), and ecosystem recovery.
- **Implementation barriers remain:** legal, financial, and institutional.
- **Social acceptance** depends on transparency, local engagement, and education.
- **Pilot projects and Living Labs** are effective tools for testing and scaling NbS.
- Need for **stronger integration** of NbS into coastal and spatial planning frameworks.

Key Recommendations (1/2)

- **Promote integrated, cross-sectoral approaches**
 - Link coastal protection and climate adaptation systematically with marine conservation.
 - Use the *Nexus* approach to align disciplines, planning levels, and policy tools early on.
- **Expand and institutionalise Nature-based Solutions (NbS)**
 - Treat NbS (e.g. seagrass, saltmarshes, dunes, biogenic reefs) as equal to technical infrastructure.
 - Introduce a mandatory “NbS review” in coastal protection planning and approval processes.
- **Strengthen communication, education, and acceptance**
 - Build public understanding and trust through transparent information and participation.
 - Use pilot projects and training programmes to demonstrate NbS benefits in practice.

Key Recommendations (2/2)

- **Improve institutional cooperation and capacities**
 - Establish better coordination across local, regional, and national levels.
 - Support joint, cross-departmental projects through targeted funding mechanisms.
- **Strengthen the evidence base and adaptive planning**
 - Close research gaps on effectiveness, feasibility, and monitoring of NbS.
 - Apply adaptive planning and long-term pilot projects to refine and scale innovative approaches.

Climate-Ready MPAs
Presentation of MEER:STARK
preliminary Recommendations
& Impulse Statements

Making MPAs “climate-ready”

- Ecologically robust (e.g. protects refugia, ensures connectivity, adapts to species shifts)
- Socially legitimate (e.g. co-designed, equitable, livelihood-aware)
- Governance-enabled (e.g. adaptive planning, legal flexibility, financing)

2 expert workshops, 70+ participants across Europe

Structured around 3 dimensions

Table 1

Ecological Responses

(i.e. resilience, connectivity, integrating climate projections into MPA planning, leveraging data and technology, monitoring etc.)

Table 2

Social, Cultural, and Economic Dimensions

(i.e. socio-economic benefits, sustainability, balancing trade-offs, engaging communities, etc.)

Table 3

Policy, governance and scaling solutions

(cross-sectoral coordination, regulatory frameworks, enforcement and compliance mechanisms, scaling solutions, etc.)

Synthesized expert inputs into challenges, opportunities, and 11 prioritised recommendations

TOWARDS CLIMATE-READY MARINE PROTECTED AREAS: CHALLENGES AND STRATEGIC PATHWAYS

1. FRAMING & RESEARCH QUESTION

- How can MPAs be designed to be resilient to future climate impacts?
- How can MPAs support broader adaptation efforts within coastal and marine environments?



2. TRANSDISCIPLINARY METHODOLOGICAL PROCESS

STEP 1 STRUCTURED EXPERT WORKSHOPS

- **70+ participants** from science, policy & practice

STEP 2 THEMATIC SYNTHESIS

- Clustering of **challenges, opportunities, and actions** via digital whiteboards
- Cross-cutting analysis to derive priorities

STEP 3 VALIDATION AND PRIORITISATION

- Prioritising **impact and effort** (via live polling tool)
- Refined co-author synthesis and expert feedback loop



3. ANALYTICAL DIMENSIONS

ECOLOGICAL RESPONSES

- Species shifts
- Climate refugia
- Monitoring
- Connectivity



SOCIAL & ECONOMIC DIMENSIONS

- Community participation
- Sustainable livelihoods
- Equity



GOVERNANCE & POLICY

- Legal flexibility
- Cross-sectoral coordination
- Adaptive management



THEMATIC DIMENSIONS IDENTIFIED

4. RECOMMENDATIONS

KEY RECOMMENDATIONS

We developed **11** key recommendations to better integrate climate adaptation into MPA design, governance, and monitoring. The recommendations are clustered around:

- Integrate **climate risks** into Marine Spatial Planning & MPA design
- Strengthen **socio-economic resilience** through inclusive governance & co-management
- Build **regional monitoring systems & scenario-informed planning tools**
- Mainstream **climate adaptation** across legal mandates and funding strategies

We identify future directions for research, policy and practice across different levels of integration:

- **Foundational actions** (essential, immediate priority)
- **Enabling actions** (important, medium-term priority)
- **Strategic knowledge and capacity building** (supporting, long-term priority)

- 5. Climate-ready MPAs must be more than ecological reserves. They require robust legal mandates, inclusive and adaptive governance, climate-informed design, and sustained funding – grounded in co-produced knowledge and cross-sectoral collaboration.

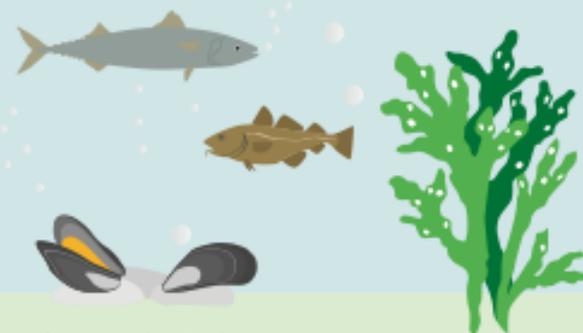
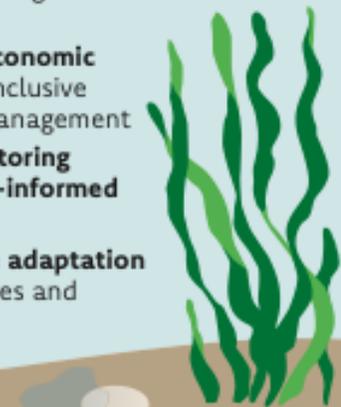
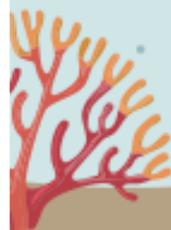


Table 1 Workshop results: Ecological responses in climate-ready MPAs

Key challenges and gaps	Opportunities	Concrete ideas and actions
<p>Complexity of interactions makes detecting tipping points challenging. →</p>	<p>Improve synthesis of research for better decision-making →</p>	<p>Develop cross-disciplinary collaborations and meta-analyses to integrate fragmented ecological data.</p>
<p>Uncertainty management and modeling approaches insufficient</p>	<p>Invest in climate modeling & scenario planning</p>	<p>Develop better (e.g. AI-driven) ecosystem modeling tools and integrate climate risk scenarios into MPA management plans.</p>
<p>Many strategies remain conceptual, lack of clear implementation pathways in MPAs.</p>	<p>Strengthen knowledge exchange through case studies</p>	<p>Create an open-access MPA knowledge hub for sharing best practices and lessons learned.</p>
<p>Data gaps persist, including species distributions, carbon and nutrient cycles, and connectivity patterns.</p>	<p>Expand long-term ecological monitoring and data-sharing</p>	<p>Implement coordinated regional monitoring programs and encourage open-access marine biodiversity databases.</p>
<p>Lack of baseline data for key indicators affects monitoring and adaptive management.</p>	<p>Establish standardized monitoring frameworks</p>	<p>Develop MPA-specific climate resilience indicators and require baseline assessments before designation.</p>
<p>Limited integration of MPAs with surrounding ecosystems (e.g., land-based influences, distant but connected areas).</p>	<p>Improve multi-scale planning and ecological connectivity</p>	<p>Incorporate climate refugia and stepping-stone corridors into MSP.</p>
<p>Insufficient training and capacity among MPA managers to address climate change.</p>	<p>Enhance capacity-building and skills development</p>	<p>Launch tailored training programs on climate adaptation, resilience planning, and NbS implementation.</p>

Table 2 results: Social, cultural, and economic dimensions

Key challenges and gaps

Early and long-term engagement with local users is essential but **often lacking**. →

Capacity-building is needed to monitor socio-economic impacts of climate change in MPAs.

Funding challenges persist for long-term monitoring, enforcement, and adaptive management.

Inclusive stakeholder engagement remains difficult, particularly in cross-sectoral planning.

No clear financial mechanisms exist yet to support long-term conservation - green financing remains in early development stages.

Opportunities

Strengthen participatory governance & community-driven conservation. →

Invest in social science research and local capacity development.

Explore innovative financing mechanisms for MPAs.

Improve cross-sectoral dialogue and policy integration.

Strengthen the integration of MPAs into the blue economy and financial markets.

Concrete ideas and actions

Implement **co-management frameworks** where local communities are directly involved in MPA decision-making and monitoring.

Establish **training programs for local stakeholders** on socio-economic data collection and impact assessment.

Develop **sustainable funding models** such as blue carbon credits, biodiversity offsets, and eco-tourism revenue reinvestment.

Establish **multi-stakeholder platforms** for fisheries, tourism, conservation groups, and policymakers to align MPA goals.

Pilot **public-private partnerships** that provide long-term financial support for MPA management through corporate biodiversity pledges and conservation-linked investments.

Table 3 Results: Policy, governance, and management

Key challenges and gaps

Conflicts between precautionary ocean management and sectoral expansion (offshore energy) need to be addressed.

Who enforces MPAs, and how is effectiveness measured? Gaps remain in compliance monitoring.

NbS-projects are often small-scale and **underfunded**, limiting broader impact.

Lack of flexible and dynamic protection measures that can respond to climate change impacts.

Inter-sectoral coordination gaps hinder integrated management approaches.

Challenges in aligning fisheries management with conservation goals.

Opportunities

Improve cross-sectoral coordination between conservation, fisheries, and other ocean uses.

Strengthen management effectiveness, enforcement, and compliance mechanisms.

Scale up NbS projects through financial and regulatory support.

Introduce adaptive governance models for MPAs.

Strengthen regulatory frameworks and policy instruments to ensure better alignment between conservation and development goals.

Reform fisheries policies to integrate sustainability into resource use.

Concrete ideas and actions

Develop **integrated ecosystem-based MSP** approaches that incorporate conservation objectives into offshore wind energy planning and fisheries management.

Establish **standardized enforcement protocols**, enhance remote monitoring (e.g., satellite tracking, AI-based compliance tools), and introduce community-led compliance initiatives.

Embed NbS into national biodiversity and climate strategies, create **dedicated funding streams for NbS implementation within MPAs**, and **incentivize private investment through ecosystem service valuation**.

Develop **legal frameworks for dynamic MPAs** that allow for shifting boundaries based on ecological changes, seasonal closures, or real-time environmental monitoring.

Establish **inter-agency task forces** to align marine policies across fisheries, conservation, climate adaptation, and economic development sectors.

Improve implementation of **Article 17 of the Common Fisheries Policy (CFP)** to prioritize environmental and social sustainability in fisheries management decisions.

Our findings and stakeholder dialogues suggest there's no single blueprint.

Climate-readiness will require a combination of design principles, governance adaptations, and cross-sector integration, tailored to local and regional realities.

DAY 2

Working Sessions

Climate-Ready MPAs
Presentation of MEER:STARK
preliminary Recommendations
& Impulse Statements

Working Session: Exploring What It Means in Practice (45–60 min)

Discuss the recommendations for climate-ready MPA design and management (next 3 slides).

In addition:

- What data, tools, or partnerships are needed to operationalize climate-ready approaches?
- How can results feed into policy processes (e.g. MSP, MSFD, Nature Restoration Law, EU Ocean Pact)
- Collect ideas for transfer and uptake across governance levels and sea basins

Further Questions for discussion

1. How can we improve climate-adaptive monitoring frameworks for MPAs?
2. What are the best strategies for integrating climate refugia into MPA networks?
3. Which existing MPAs (national, regional, transboundary) already integrate climate considerations?
4. How can functional and structural connectivity be enhanced across protected areas?
5. How to make management adaptive (periodic review cycles, flexible permits, trigger points)?
6. How to coordinate across sectors and levels (national–regional–EU, EEZ–ABNJ)?
7. Explore enabling conditions: legal instruments, institutional readiness, funding mechanisms.

References

- ▶ Aminian-Biquet et al., 2024. Aminian-Biquet, J., Gorjanc, S., Sletten, J., Vincent, T., Laznya, A., Vaidianu, N., Claudet, J., Young, J. and e Costa, B.H., 2024. Over 80% of the European Union's marine protected area only marginally regulates human activities. *One Earth*, 7(9), pp.1614-1629. <https://doi.org/10.1016/j.oneear.2024.07.010>
- ▶ Arafeh-Dalmau, N., Brito-Morales, I., Schoeman, D.S., Possingham, H.P., Klein, C.J., Richardson, A.J., 2021. Incorporating climate velocity into the design of climate-smart networks of marine protected areas. *Methods in Ecology and Evolution* 12, 1969–1983. <https://doi.org/10.1111/2041-210X.13675>
- ▶ Bates, A.E., Cooke, R.S., Duncan, M.I., Edgar, G.J., Bruno, J.F., Benedetti-Cecchi, L., Côté, I.M., Lefcheck, J.S., Costello, M.J., Barrett, N., and Bird, T.J., 2019. Climate resilience in marine protected areas and the 'Protection Paradox'. *Biological Conservation*, 236, 305–314. <https://doi.org/10.1016/j.biocon.2019.05.005>
- ▶ Berkström, C., Wennerström, L. and Bergström, U., 2022. Ecological connectivity of the marine protected area network in the Baltic Sea, Kattegat and Skagerrak: Current knowledge and management needs. *Ambio*, 51(6), pp.1485-1503. <https://doi.org/10.1007/s13280-021-01684-x>
- ▶ Bruno, J.F., Bates, A.E., Cacciapaglia, C., Pike, E.P., Amstrup, S.C., Van Hooidek, R., Henson, S.A. and Aronson, R.B., 2018. Climate change threatens the world's marine protected areas. *Nature Climate Change*, 8(6), pp.499-503. <https://doi.org/10.1038/s41558-018-0149-2>
- ▶ Costello, M.J., 2024. Evidence of economic benefits from marine protected areas. *Scientia Marina*, 88(1), e080. <https://scientiamarina.revistas.csic.es/index.php/scientiamarina/article/view/5526>
- ▶ Jacquemont, J., Blasiak, R., Le Cam, C., Le Gouellec, M., and Claudet, J., 2022. Ocean conservation boosts climate change mitigation and adaptation. *One Earth*, 5, 1126–1138. <https://doi.org/10.1016/j.oneear.2022.09.002>
- ▶ Korpinen, S., Laamanen, L., Bergström, L., Nurmi, M., Andersen, J.H., Haapaniemi, J., Harvey, E.T., Murray, C.J., Peterlin, M., Kallenbach, E., and Klančnik, K., 2021. Combined effects of human pressures on Europe's marine ecosystems. *Ambio*, 50, 1325–1336. <https://doi.org/10.1007/s13280-020-01482-x>
- ▶ Magris, R.A., Pressey, R.L., Weeks, R., and Ban, N.C., 2014. Integrating connectivity and climate change into marine conservation planning. *Biological Conservation*, 170, 207–221. <https://doi.org/10.1016/j.biocon.2013.12.032>

References

- ▶ Micheli, F., Saenz-Arroyo, A., Greenley, A., Vazquez, L., Espinoza Montes, J.A., Rossetto, M., and De Leo, G.A., 2012. Evidence that marine reserves enhance resilience to climatic impacts. *PLOS One*, 7(7), e40832. <https://doi.org/10.1371/journal.pone.0040832>
- ▶ Nowakowski, A.J., Canty, S.W., Bennett, N.J., Cox, C.E., Valdivia, A., Deichmann, J.L., Akre, T.S., Bonilla-Anariba, S.E., Costedoat, S., and McField, M., 2023. Co-benefits of marine protected areas for nature and people. *Nature Sustainability*, 6(10), 1210–1218. <https://doi.org/10.1038/s41893-023-01150-4>
- ▶ Ondiviela, B., Losada, I.J., Lara, J.L., Maza, M., Galván, C., Bouma, T.J., and van Belzen, J., 2014. The role of seagrasses in coastal protection in a changing climate. *Coastal Engineering*, 87, 158–168. <https://doi.org/10.1016/j.coastaleng.2013.11.005>
- ▶ Rankovic, A., Jacquemont, J., Claudet, J., Lecerf, M., and Picourt, L., 2021. Protecting the ocean, mitigating climate change? State of the evidence and policy recommendations. Ocean & Climate Platform Policy Brief. Available at: https://ocean-climate.org/wp-content/uploads/2022/11/Policy-Brief_Adaptation_MPA.pdf
- ▶ Roberts, C.M., O’Leary, B.C., McCauley, D.J., et al., 2017. Marine reserves can mitigate and promote adaptation to climate change. *Proceedings of the National Academy of Sciences*, 114(24), 6167–6175. <https://doi.org/10.1073/pnas.1701262114>
- ▶ Russi, D., Pantzar, M., Kettunen, M., Gitti, G., Mutafoglu, K., Kotulak, M., and ten Brink, P., 2016. Socio-economic benefits of the EU Marine Protected Areas. Institute for European Environmental Policy (IEEP) for DG Environment. [Socio-Economic-Benefits-of-EU-MPAs-2016_IEEPEC.pdf](https://www.ieep.eu/sites/default/files/2016-12/Socio-Economic-Benefits-of-EU-MPAs-2016_IEEPEC.pdf)
- ▶ Schmidt, D.N., Pieraccini, M., and Evans, L., 2022. Marine protected areas in the context of climate change: Key challenges for coastal social-ecological systems. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 377, 20210131. <https://doi.org/10.1098/rstb.2021.0131>
- ▶ van Zelst, V.T., Dijkstra, J.T., van Wesenbeeck, B.K., et al., 2021. Cutting the costs of coastal protection by integrating vegetation in flood defenses. *Nature Communications*, 12(1), 6533. <https://doi.org/10.1038/s41467-021-26887-4>
- ▶ Wilson, K.L., Tittensor, D.P., Worm, B. and Lotze, H.K., 2020. Incorporating climate change adaptation into marine protected area planning. *Global Change Biology*, 26(6), pp.3251-3267. <https://doi.org/10.1111/gcb.15094>



Ecologic Institute

Science and Policy
for a Sustainable World

Thank you. Any questions?

Gregory Fuchs

gregory.fuchs@ecologic.eu

Ecologic Institute

Pfalzburger Str. 43/44

10717 Berlin

Germany

Tel. +49 (30) 86880-0

ecologic.eu