

Strategies for cost-effective marine restorations in the Nordics



Contents

Executive Summary	5
Introduction	7
Objectives of the webinar	7
Details and agenda	9
Webinar attendance and audience composition	10
Audience roles and composition	10
Geographical representation	11
Setting the scene	14
Building momentum for restoration	14
Putting costs into focus	15
The EU Nature Restoration Law and its vision for marine ecosystems	16
Ambitious targets for marine restoration	16
Challenges and opportunities	17
Support for implementation	18
Cost-effectiveness in marine ecosystem restoration	19
Navigating high costs	20
Identifying the most efficient measures	20
Illustrating cost-effectiveness: a practical example	20
Controlling stressors for successful restoration	21
Addressing uncertainties in cost-effectiveness	21
A tailored approach to restoration	22

Insights from the CLIMAREST Project on Arctic Marine Ecosystem Restoration	23
Project scope and objectives	23
Challenges in Svalbard: coastal erosion and pollution	23
Addressing wastewater impacts in Longyearbyen	24
Cost-benefit analysis and key insights	25
Lessons learned and future recommendations	25
Habitat restoration in coastal lagoons in Finland	27
Overview of the Life IP Biodiversea project	27
Challenges and natural processes	28
Restoration methods and costs	28
Example costs and the Helmi Habitats Programme	29
Finland's national plan for habitat restoration	29
Benefits of coastal lagoon restoration	29
The lifespan of restoration efforts	30
Active restoration of marine habitats in Denmark	31
Key habitats requiring restoration	31
Case study: Blue Reef Project	31
Seascape restoration: a holistic approach	32
Passive restoration and stressor removal	33
Tools and guidelines for restoration	33
Monitoring and scaling up	33
The Marine Natural Fund	34
Panel discussion	35
Engaging community to participate in marine restoration	35
Economic implications of restoration projects	36

Passive restoration and pressure reduction	37
Timeframes for restoration and adaptive management	38
Addressing human activities and economic pressures	39
Key takeaways and closing remarks	41
Interactive audience involvement	41
AI video – incorporating audience insights	42
Live illustration: enhancing engagement and understanding	43
Appendices	45
Appendix I: Registration information	45
About this publication	46

This publication is also available online in a web-accessible version at:
<https://pub.norden.org/temanord2025-514>

Executive Summary

The webinar on strategies for cost-effective marine restoration in the Nordics, co-organized by the Nordic Council of Ministers' Working Group for Environment and Economy and the Baltic Marine Environment Protection Commission (HELCOM), arranged under the auspice of the PROTECT BALTIC project, brought together key stakeholders to explore innovative strategies for restoring marine ecosystems in a resource-efficient manner. The event, held virtually, aimed to share knowledge, inspire collaboration, and identify pragmatic approaches to marine restoration, particularly in the Baltic Sea region.

Moderated by Mikelis Bendiks, the webinar focused on the critical aspects of marine restoration: the **why**, **what**, and **how**. While the need for marine restoration is widely recognized, the discussions concentrated on identifying actionable measures, and how to implement them effectively within the constraints of limited financial, technological, and human resources. Maximizing impact while minimizing costs was a central theme.

The event was structured into two segments over a three-hour agenda. The morning session provided foundational insights and case studies, setting the stage for a deeper discussion of restoration strategies. The afternoon session featured an additional case study and concluded with a panel discussion, where audience questions were addressed, and perspectives on marine restoration were exchanged.

A key takeaway from the discussions was the importance of shared understanding among diverse stakeholders. The webinar emphasized the need to aligning approaches, terminology, and metrics across projects and countries to better be able to evaluate and share information on restoration costs and outcomes effectively. By learning from successful practices and adapting them to specific contexts, participants explored scalable methods for marine restoration across the Nordic region and beyond.

Interactive elements enhanced the event's engagement. A pre-event questionnaire allowed attendees to share their views on the main challenges for, and potential of, marine restoration, and these insights were incorporated into an AI-generated video summarizing the participants' perspectives. Additionally, live illustration provided real-time visual interpretation of key points highlighted by the presenters and panelists, enriching the discussions and making complex concepts more accessible.

This report captures the main insights and outcomes of the webinar, serving as a valuable resource for those working in marine restoration and environmental economics. It highlights the collaborative spirit, innovative approaches, and interactive methods that shaped the event, offering key takeaways for advancing cost-effective marine restoration efforts.

The recording of the event is available on HELCOM's YouTube channel:

<https://youtu.be/yQftuBMzi9A>

Presentations from the event are available on the event page at:

<https://helcom.fi/strategies-for-cost-effective-marine-restoration-in-the-nordic/>

Introduction

This report summarizes the key insights, discussions, and outcomes from the webinar. The primary purpose is to provide an overview of the event, which brought together a diverse group of experts and stakeholders to explore innovative, cost-effective strategies for restoring marine ecosystems in the Nordic region.

The webinar was held in response to the growing political attention on marine ecosystems, driven in part by the new EU regulation on nature restoration. As the impact of climate change and human activities continues to threaten marine environments, there is an urgent need for effective restoration strategies that can enhance biodiversity, provide natural coastal defenses, and contribute to climate change mitigation efforts.

In the Nordic region, marine restoration is particularly challenging due to a variety of socio-economic and ecological factors. The complexity of comparing costs and evaluating benefits across different regions adds another layer of difficulty. The webinar aimed to address these challenges by bringing together researchers, policymakers, environmental economists, and marine restoration practitioners. By leveraging their expertise and experience, the event provided a platform to discuss the economic, ecological, and social dimensions of marine restoration.

Objectives of the webinar

The key objectives of the webinar were:

1. **To explore cost-effective strategies for marine restoration:** Identifying innovative approaches that can maximize ecological impact while minimizing financial, technological, and human resource constraints in the Nordic region.
2. **To facilitate knowledge sharing among experts and stakeholders:** Engaging researchers, policymakers, and practitioners to share successful restoration case studies, methodologies, and insights relevant to the Nordic context.
3. **To assess the socio-economic implications of marine restoration:** Promoting better understanding of how restoration efforts can contribute to both biodiversity enhancement and climate change mitigation, while addressing the challenges of comparing costs and benefits across regions.
4. **To identify knowledge gaps and propose solutions:** Fostering collaboration among stakeholders to uncover critical gaps in knowledge, and discussing how to develop unified methodologies for assessing the costs and impacts of marine restoration efforts across the Nordic region.

5. **To promote dialogue on the EU's ambitious restoration goals:** Discussing how the EU's Nature Restoration Regulation can be implemented in the Nordic region, addressing challenges, and outlining practical steps forward.

This report serves as a comprehensive resource for researchers, policymakers, environmental economists, and marine restoration practitioners, providing valuable insights into marine restoration efforts in the Nordic region and highlighting the potential for scaling and replicating successful strategies for marine restoration.

Details and agenda

The webinar took place on 4 December 2024 between 09:00-12:00 (CET). The audience joined online while speakers and panelists were present on site at Valo Hotel & Work in Helsinki, Finland, with the exception for two speakers who presented online.

The event was streamed through a virtual platform called AirMeet, allowing for seamless interaction between attendees. Interactive chat features were integrated with audience members encouraged to submit their questions for the speakers.

Time (CET)	Programme Item	Presenter
09:00-09:05	Introduction and questionnaire	Moderator: Mikelis Bendiks
09:05-09:10	Welcome from HELCOM	Rüdiger Strempele, Executive Secretary, HELCOM Secretariat
09:10-09:15	Welcome from NME	Lotta Eklund, Coordinator for the Nordic Group on Environment and Economy (NME)
09:15-09:30	EU Nature Restoration Law	Vedran Nikolic, European Commission, DG Environment (<i>online</i>)
09:30-09:45	Cost-effectiveness and Marine Restoration	Wenting Chen (NIVA) (<i>online</i>)
09:45-10:00	Arctic Marine Ecosystem Restoration – Insights from Svalbard	Laura Wendling (SINTEF Ocean)
10:00-10:15	Habitat restorations in the coastal lagoons in Finland	Sanna Kuningas (LUKE)
10:15-10:30	Break	
10:30-10:45	Active restoration of marine habitats in Denmark	Federica Montesanto (Aarhus University)
10:45-11:45	Panel discussion	Laura Wendling (SINTEF) Sanna Kuningas (LUKE) Federica Montesanto (Aarhus University) Liisa Saikkonen (SYKE) Moderator: Mikelis Bendiks
11:45-12:00	Wrap up	Moderator: Mikelis Bendiks

Webinar attendance and audience composition

A total of 90 participants attended the webinar, representing a diverse mix of professional backgrounds, roles, and geographical regions. This attendance reflected strong engagement, with participants spending an average of approximately 2 hours and 20 minutes out of the total 3-hour duration actively watching the event, suggesting sustained interest in the content provided.

Audience roles and composition

The audience consisted of a variety of roles, broadly categorized to provide insights into the professional makeup of attendees. These categories highlight a balance of researchers, practitioners, and policymakers, aligning closely with the roles represented during registration (see [Appendix I](#)). Here is a breakdown of roles based on categorized frequency counts:

Table 1: Frequency of audience roles based on categorized grouping

Audience role	Count	Audience role	Count
Researcher	23	Director	5
Marine Specialist	10	Coordinator	5
Manager	9	Consultant	4
Specialist	9	Student	4
Advisor	8	Officer	4
Other	6	Professor	3

Key observations

Researchers formed the largest group (23 participants, 25.6%), encompassing various research-focused roles dealing with marine conservation, ecology, geology, fisheries and restoration.

Marine specialists (10 participants, 11.1%) and **managers** (9 participants, 10%) were well-represented, highlighting a significant presence of professionals directly applying their expertise in marine conservation and overseeing the implementation of restoration projects in the field.

Roles grouped as **specialist** (9 participants, 10%) and **advisor** (8 participants, 8.9%) also showed notable representation, underscoring the event's relevance to subject matter experts and policy professionals.

Smaller but significant contributions came from **directors** (5 participants, 5.6%) and **coordinators** (5 participants, 5.6%), reflecting leadership and operational roles.

A broad **other** category included roles such as "Business Developer" and "Artist," indicating the event also attracted participants beyond the primary target audience.

This diverse audience composition suggests the webinar successfully appealed to a wide range of stakeholders, from academic researchers to policy advisors and operational leaders.

Geographical representation

Participants hailed from 13 countries, predominantly from Northern and Western Europe. The distribution of participants by country is shown here:

Table 2: Frequency of participants by country

Country	Count	Country	Count
Finland	36	UK	2
Sweden	13	Spain	1
Denmark	13	Poland	1
Germany	10	Italy	1
France	3	Norway	1
Estonia	3	Tunisia	1
Latvia	2	Netherlands	1

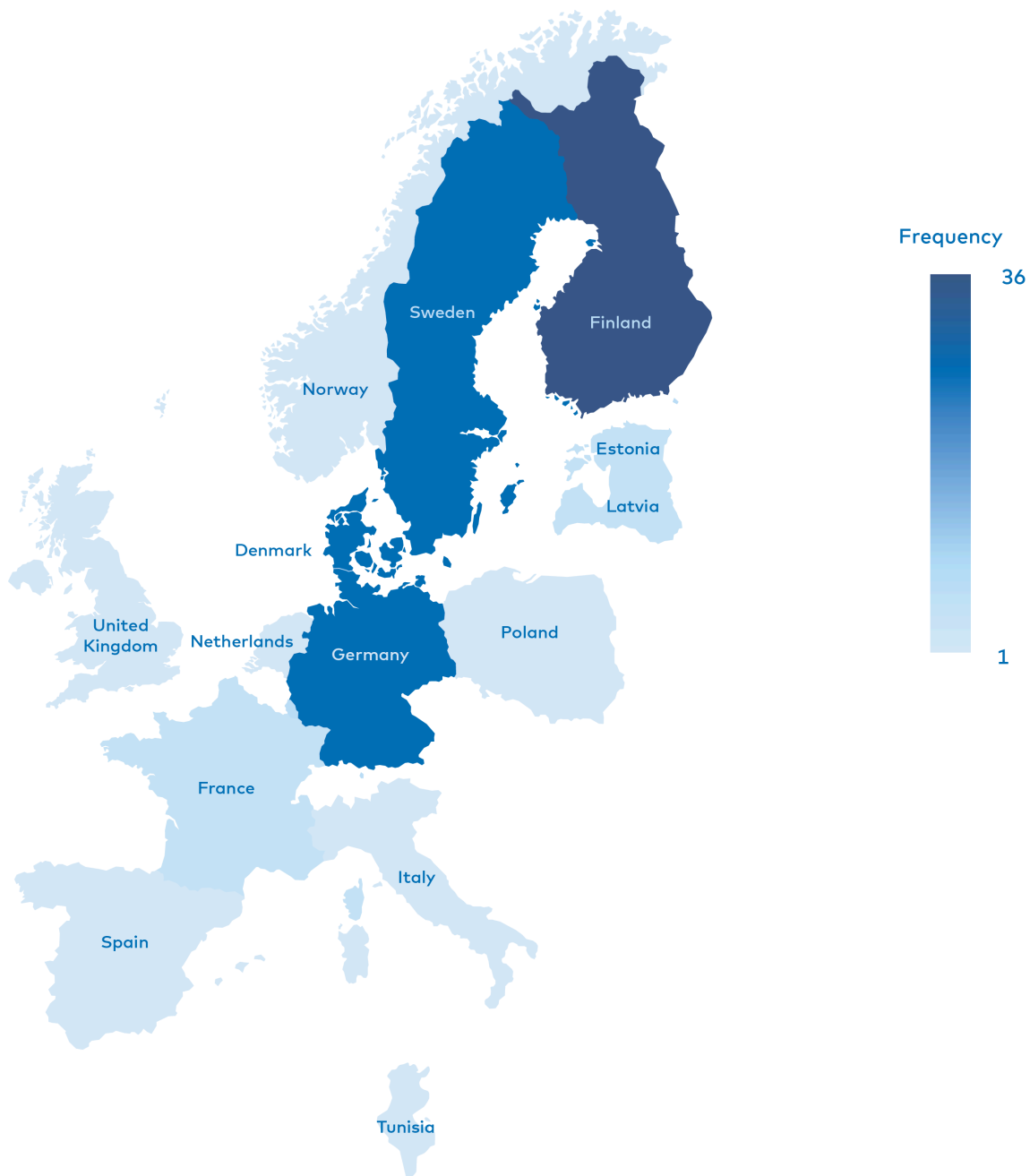


Figure 1: Map outlining frequency of geographic location of webinar participants.

Key observations

The largest group of participants came from **Finland** (36 participants, 40%), reflecting the country's strong interest in the webinar's theme and also that it was the host country of the event.

Significant representation from **Sweden** (13 participants, 14.4%) and Denmark (13 participants, 14.4%) points to robust regional engagement within many of the Nordic countries.

Germany (10 participants, 11.1%) accounted for the highest representation outside the Nordic countries, showcasing that cost-effectiveness of marine restoration is a topic that piques broader European interest.

Smaller numbers of participants from countries such as **France** and **Estonia** (3 each) and others highlight that the webinar had a wider reach beyond the primary Nordic audience.

The geographical diversity of attendees, dominated by Nordic and Western European countries, underscores the relevance of the webinar's content to these regions while hinting at potential for broader international outreach.

The attendance profile demonstrates its appeal across a wide range of professional roles and countries. The strong representation from researchers and marine specialists suggests the content resonated well with audiences deeply involved in scientific and conservation efforts. Meanwhile, participation from diverse countries, especially the Nordic region, highlights the event's relevance to these communities. However, there was little participation from Norway and none from Iceland, and for future events more time should be invested in reaching out to those audiences too.

Setting the scene

The webinar began with welcome speeches from Rüdiger Strempele, Executive Secretary of the Baltic Marine Environment Protection Commission (HELCOM), and Lotta Eklund, Coordinator for the Nordic Council of Ministers' Working Group for Environment and Economy (NME). These speeches set the tone for the event, emphasizing the shared challenges and opportunities in advancing marine restoration across the Baltic Sea and throughout the Nordic region.

Building momentum for restoration

Rüdiger Strempele

Rüdiger Strempele highlighted the growing global and regional focus on ecosystem restoration, citing milestones like the UN Ocean Decade and the EU Nature Restoration Regulation. He framed nature restoration as a vital response to the interconnected crises of climate change, biodiversity loss, and pollution.

Strempele acknowledged the scale of the task, particularly for marine ecosystems, emphasizing the need for pragmatic, cost-effective strategies. He underscored the value of regional collaboration, noting the overlap in environmental challenges and commitments among Nordic and Baltic Sea countries.

Strempele expressed gratitude for the partnership between HELCOM and the Nordic Council of Ministers, emphasizing that their shared values and successful history of cooperation position them well to tackle these issues.



"Make no mistake, nature restoration can come with a hefty price tag, which is why it makes sense to do two things: explore cost-effective ways to address the issue, and seek synergies in addressing it."

Rüdiger Strempele, HELCOM



Putting costs into focus

Lotta Eklund

Lotta Eklund welcomed participants with a focus on the socio-economic dimensions of marine restoration. Representing the Nordic Council of Ministers' Working Group for Environment and Economy (NME), she acknowledged that while the group excels in economic instruments and policies, it benefits from collaboration with HELCOM on the marine-specific aspects of restoration.

Eklund emphasized that socio-economic analysis is essential for developing effective policies and guiding decision-making in marine restoration efforts. She explained that understanding the costs and benefits of different measures is critical for comparing their effectiveness and determining which actions should be prioritized. Without this analysis, it becomes challenging to align restoration efforts with the ambitious targets set by the EU for biodiversity and ecosystem recovery.

She described the webinar as a valuable platform for sharing ideas and expertise, addressing the pressing need to restore degraded marine ecosystems. By focusing on strategies that maximize environmental benefits while keeping costs manageable, the event aimed to provide practical insights and inspire impactful solutions tailored to the Nordic region's unique challenges.



Together, these opening speeches underscored the dual imperatives of restoring marine ecosystems and doing so in a resource-efficient, collaborative manner. They set the stage for a day of exploring actionable insights and strategies to meet these challenges effectively.

The EU Nature Restoration Law and its vision for marine ecosystems

Vedran Nikolic

The next segment of the webinar featured a presentation by Vedran Nikolic from the European Commission, providing an in-depth overview of the groundbreaking EU Nature Restoration Law – a transformative regulation hailed as the first of its kind globally.

Representing the Commission's Directorate-General for Environment, Nikolic offered a detailed look at the law's objectives, its implementation framework, and its potential to revolutionize marine ecosystem restoration.

Nikolic began by emphasizing the urgency of addressing ongoing ecosystem degradation across Europe, highlighting its far-reaching implications for biodiversity, climate resilience, and economic stability. He explained that healthy ecosystems are not merely an environmental priority but a fundamental pillar for sustaining robust economies and thriving societies. The shift from voluntary targets to binding legal obligations, he argued, was essential to ensure meaningful progress after previous biodiversity strategies failed to achieve their goals.

Ambitious targets for marine restoration

The regulation, which has been in force since August 2024, sets legally binding restoration targets. By 2030, 20% of EU land and seas must be covered by restoration measures, with all ecosystems in need addressed by 2050. For marine ecosystems, the focus lies on restoring degraded seabed habitats, closing knowledge gaps about their condition, and ensuring the recovery of species habitats.

Nikolic highlighted the intricate obligations for member states, particularly for seabed habitats such as seagrass beds, macroalgal forests, and shellfish reefs. Restoration measures must progressively cover degraded habitats, starting with 30% by 2030 and reaching 90% by 2050. In addition to improving existing habitats, countries must also re-establish lost habitats, such as boulder reefs, to achieve favorable reference conditions.

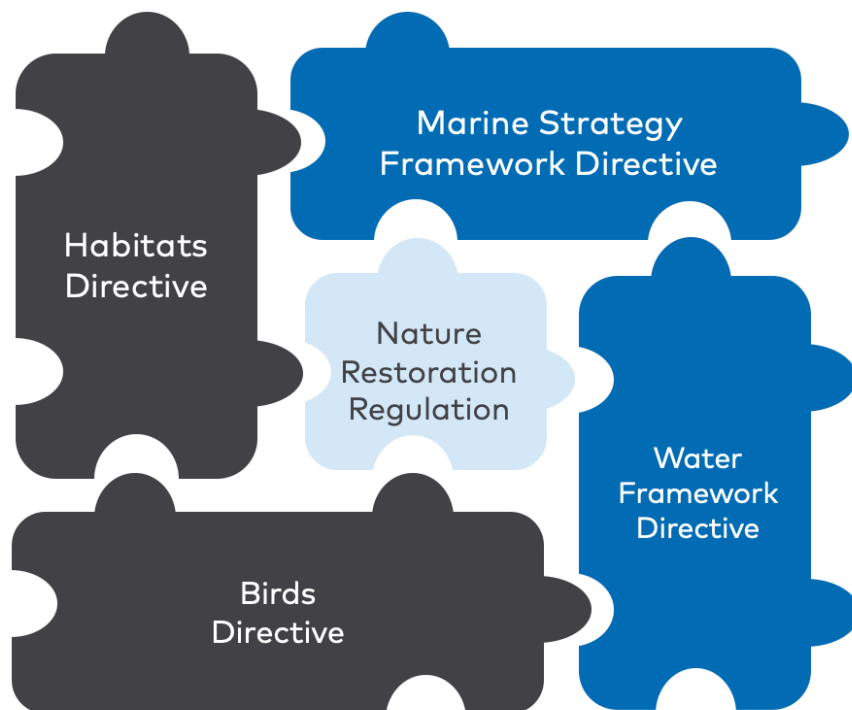


Figure 2: Where the Nature Restoration Regulation fits into the environmental legislative puzzle.

Challenges and opportunities

Despite its ambition, the law faces some significant hurdles. Limited knowledge about the current state and location of marine habitats, as well as uncertainty surrounding restoration success in the dynamic marine environment, complicates efforts. Nikolic noted the pressing need for upscaling small-scale restoration projects and fostering cross-border cooperation, particularly in shared marine regions like the Baltic Sea.

The Commission has mandated that member states develop National Restoration Plans by August 2026, which will outline specific actions, financing needs, and implementation strategies. Nikolic pointed out the critical role that regional collaboration through structures like HELCOM and projects under Mission Ocean achieving synergies and addressing shared challenges.

Support for implementation

To assist member states, the European Commission is mobilizing significant resources, including funding through Horizon Europe and tailored guidance. A dedicated LIFE project is underway to support habitat mapping, condition assessments, and the development of restoration measures. Looking ahead, the Commission will publish a report on funding needs and gaps in 2025, informed by input from events like this webinar.

Nikolic concluded his presentation with a message of optimism and readiness, emphasizing the European Commission's commitment to supporting member states in the challenging yet vital journey of ecosystem restoration. He highlighted that the Commission is fully prepared to assist throughout the implementation of the Nature Restoration Law, stressing the importance of working together in achieving the shared goal of restoring Europe's marine ecosystems.

The leadership of Jessica Roswell, the newly appointed EU Commissioner for Environment, was also noted as a key factor in driving this effort forward. Nikolic conveyed that the Commission, under her guidance, is dedicated to providing the necessary resources and support for the successful restoration of Europe's marine environments.



"Healthy ecosystems are not just an environmental priority; they are the foundation of healthy economies and societies."

Vedran Nikolic, DG Environment



Cost-effectiveness in marine ecosystem restoration

Dr Wenting Chen

Dr Wenting Chen, Senior Researcher from the Norwegian Institute for Water Research (NIVA), began by addressing the immense challenges marine ecosystems have faced in recent years, with many habitats now in degraded states. Citing a recent European Environment Agency (EEA) report and the European Climate Risk Assessment, she highlighted the critical and catastrophic impacts of climate change on both coastal and marine ecosystems.

This year's Ocean Health Index, Dr Chen noted, showed a score of only 73 out of 100, signaling that the ocean is not healthy enough to deliver its crucial ecosystem services. This, she emphasized, is a clear indication of the urgent need for ecosystem restoration across the marine environment. The Nature Restoration Law, which mandates restoring degraded habitats, underscores the scale of the task ahead.

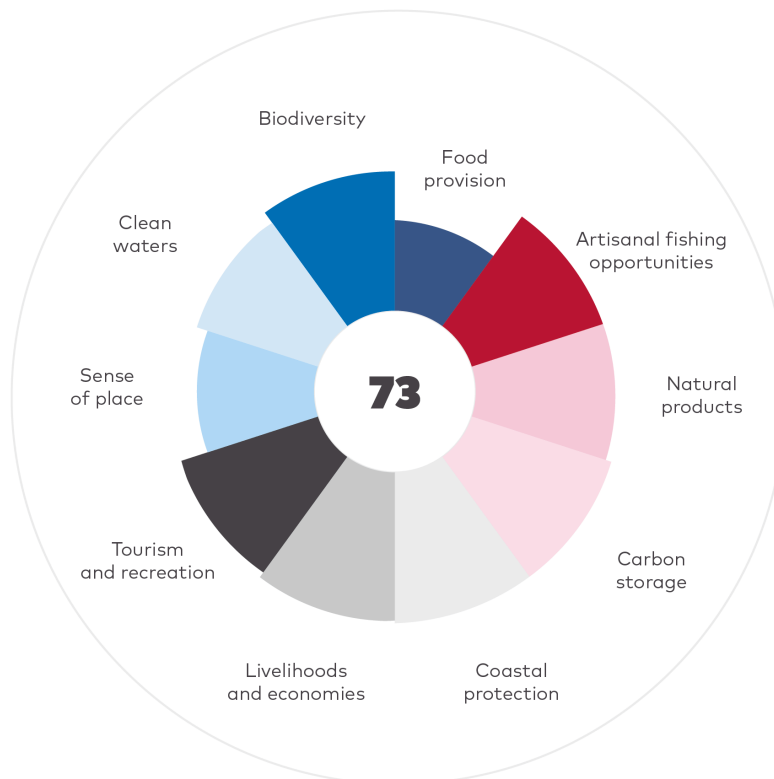


Figure 3: Global ocean health index score 2023. A score of only 73 out of 100 signals that the ocean is not healthy enough to deliver its crucial ecosystem services. Source: *Ocean Health Index. 2023. ohi-global version: Global scenarios data for Ocean Health Index, [date downloaded]. National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara. Available at: <https://github.com/OHI-Science/ohi-global/releases>*

Navigating high costs

Dr Chen elaborated on the high costs of marine ecosystem restoration, explaining that restoration efforts can be very expensive due to a variety of factors. Different restoration methods, such as those for salt marshes, seagrass, or coral reefs, come with different cost ranges. On this note, she provided a comparison of costs across various marine restoration projects, illustrating that restoration for different habitats can vary significantly.

For example, salt marsh restoration is comparatively cheaper than coral reef restoration, and methods for restoring seagrass fall in between. The varying costs of these approaches depend on many factors including the type of habitat, the method used, and the level of restoration required.

Identifying the most efficient measures

A key challenge discussed was determining which restoration measures to invest in, especially given their varied costs and potential outcomes. Here, she introduced the concept of cost-effectiveness analysis, which is a common tool used in project appraisals, particularly when benefits are not easily quantified in monetary terms.

She clarified that, in marine ecosystem restoration, the goal is to identify the most cost-effective measures that will still meet restoration targets. The success of restoration measures can vary, and some approaches require multiple attempts before achieving the desired result. Dr Chen then emphasized that cost-effectiveness analysis allows for comparing different restoration methods to identify the one that achieves the target at the lowest cost, while considering the likelihood of success and the time required for restoration.

Illustrating cost-effectiveness: a practical example

To demonstrate the application of cost-effectiveness analysis, Dr Chen presented a comparison of three different restoration measures, each with a different level of success and associated cost. In her example, the measures all aimed to achieve a 95% success rate for restoration, but each required a different number of attempts to reach this target.

She showed that while some measures (e.g. Measure 1) had high costs and low success rates, others (e.g. Measure 2) were more successful despite a higher per-square-meter cost. In this case, Measure 2 turned out to be the most cost-effective despite its higher initial cost because it required fewer attempts overall to reach the success target (see Table 3).

Table 3: Cost effectiveness of marine restoration measures can be connected to a minimum success rate.

Restoration measures			
	Measure 1	Measure 2	Measure 3
Target success rate	0.95	0.95	0.95
Expected success rate at each restoration cycle	0.45	0.90	0.35
Number of attempts	6	2	7
Cost (NOK/m ²)	76.0	47.8	27.3
PV (mill NOK)	1.6	0.5	1.1

Controlling stressors for successful restoration

Dr Chen also underscored the importance of controlling stressors when restoring marine ecosystems. She explained that many marine habitats are affected by factors such as fishing, agricultural runoff, invasive species, and marine litter, which can significantly impact the success of restoration efforts. She stressed that controlling these stressors should be an integral part of any restoration project, and the costs of stressor control should be included in the overall restoration budget.

Addressing uncertainties in cost-effectiveness

Finally, Dr Chen addressed the issue of uncertainty in cost-effectiveness analysis. Restoration outcomes are inherently uncertain due to various factors, including incomplete knowledge about the ecosystem, data limitations, and unpredictable environmental conditions. She identified three main types of uncertainty: incomplete knowledge, unpredictability, and ambiguity.

She emphasized that cost-effectiveness analysis should not just provide a single figure but rather a range of outcomes that consider all the uncertainties involved in the restoration process. This would give a more comprehensive understanding of the costs and potential benefits, helping policymakers make more informed decisions about which restoration measures to pursue.

A tailored approach to restoration

In conclusion, Dr Chen emphasized the need for context-specific solutions that consider local conditions, species, and habitat types. She reiterated that, while the methods for marine ecosystem restoration may vary, the goal remains the same: to restore marine habitats in a cost-effective manner that will ultimately support the broader environmental and societal goals of sustainability.

"For marine ecosystem restoration, cost-effectiveness analysis is suitable for situations where benefits cannot be expressed in monetary terms, allowing us to compare the costs of different measures to achieve the same restoration target."

Wenting Chen, NIVA



Insights from the CLIMAREST Project on Arctic Marine Ecosystem Restoration

Laura Wendling

Laura Wendling, representing the CLIMAREST project coordinated by Sintef Ocean, shared her insights into the ongoing work on coastal climate resilience and marine restoration tools in the Arctic Atlantic basin. The CLIMAREST project, an EU-funded initiative under the EU Mission to Restore Our Oceans and Waters, began in 2022 and will run until 2025.

It aims to develop a toolbox consisting of modular, interoperable tools designed to guide local stakeholders through restoration processes. Although the cost and benefit estimates from the project will not be universally applicable, they will provide valuable ballpark figures for planning and decision-making.

Project scope and objectives

The CLIMAREST project covers five unique restoration environments, with a focus on Svalbard in the Arctic. Other sites include seagrass meadow restoration in Ireland, oyster reef restoration in Brittany, blue lobster restoration in Galicia, and rocky algae forest restoration in Madeira.

The overarching goal of the project is to conserve biodiversity and protect ecosystems while ensuring minimal environmental footprints. The project is committed to adapting restoration methods to each specific environment, factoring in local conditions, stakeholders, and socio-economic contexts.

Challenges in Svalbard: coastal erosion and pollution

Svalbard, located in the Arctic, faces significant challenges due to rapid climate change. Warming in this region occurs at a rate of 2 to 2.5 times faster than the global average, with permafrost degradation further exacerbating coastal erosion. The coastal ecosystems are under threat from both natural and anthropogenic pressures, particularly the erosive wave action exacerbated by melting permafrost, which destabilizes the sediment and threatens both ecosystems and human infrastructure.

A critical focus of the project is to mitigate coastal erosion while maintaining the integrity of both ecological and social systems. Restoration in this context involves a “hybrid nature-based solution,” integrating natural features with robust engineering techniques to provide both ecological resilience and technical reliability. This approach aims to protect the coastal community in Longyearbyen, where the population is vulnerable to these environmental changes.

Addressing wastewater impacts in Longyearbyen

Another aspect of the CLIMAREST project in Svalbard involves reducing the impact of wastewater discharges into the Adventfjord. Longyearbyen, a small community of 2,500 residents, relies on a wastewater treatment system that discharges treated water into the fjord. However, the current treatment system, which only uses a mechanical sieve to filter large particles, is insufficient to fully protect the sensitive Arctic ecosystem.

The team has engaged both the local community and tourists to reduce the environmental pressure by raising awareness of the wastewater system's limitations. Simple measures, such as informing people not to dispose of inappropriate waste in toilets, have proven to be an effective short-term strategy. This initiative has provided critical insights into how simple community actions can complement larger restoration efforts.

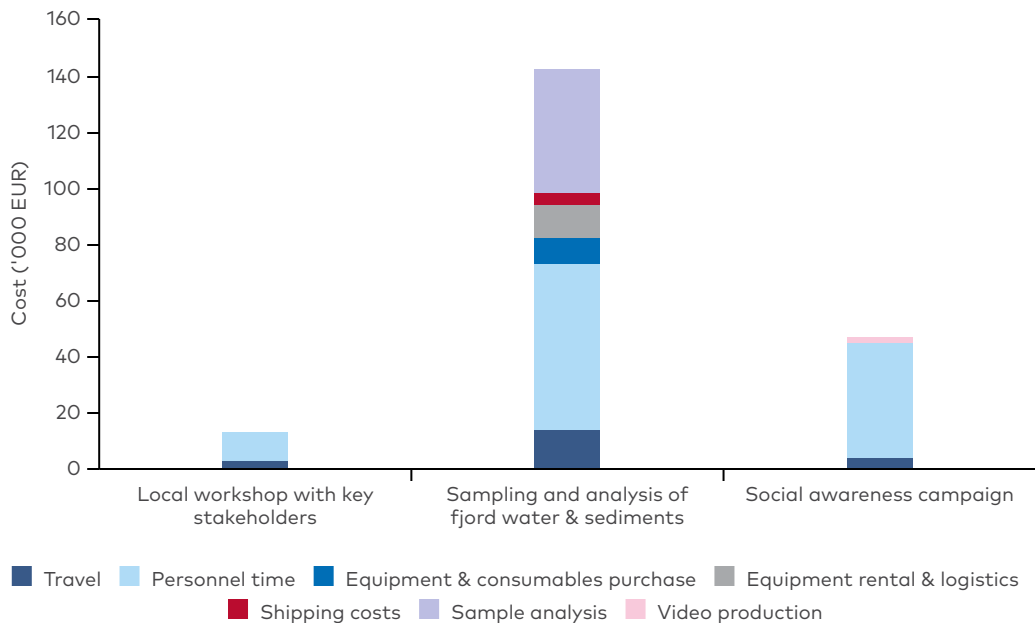


Figure 5: Costs of baseline assessment and social awareness campaign by CLIMAREST.

Cost-benefit analysis and key insights

A crucial part of the CLIMAREST project is assessing the costs and benefits of the restoration measures. Wendling highlighted that stakeholder engagement, particularly with local communities, was a low-cost but highly valuable activity. The local and traditional ecological knowledge gathered from workshops has proven to be far more valuable than the costs incurred in conducting them. However, significant costs were associated with sampling and analysis of water and sediment quality in remote areas, with shipping and personnel time also contributing to the overall cost.

The project's cost-benefit analysis has shown that while it's difficult to apply exact numbers universally, the research provides important frameworks for understanding the relative costs of different restoration phases. Stakeholder engagement, in particular, was identified as a crucial element that would help ensure the success and future funding of restoration efforts.

Lessons learned and future recommendations

Wendling concluded with several key lessons learned from the project:

1. **Community engagement:** Broad engagement with stakeholders, including local residents, tourists, and indigenous knowledge holders, is essential for long-term success. Gaining community buy-in is critical to ensure that the restoration efforts are supported and sustainably funded.
2. **Non-structural roles:** In addition to physical restoration activities, understanding and managing ecosystems – such as sustainable use and protection—are equally important. This also includes efforts to reuse materials and integrate circular economy principles into restoration practices.
3. **Leveraging existing data and citizen science:** Utilizing existing data and citizen science opportunities can enhance restoration efforts while keeping costs manageable.
4. **Systems thinking:** Combining diverse initiatives and using a systems thinking approach allows for a holistic view of restoration. In Svalbard, addressing both coastal erosion and wastewater treatment together has provided a more comprehensive understanding of the environmental challenges.



"Engaging local communities, including tourists, and integrating traditional ecological knowledge has proven to be far more valuable than the costs incurred."

Laura Wendling, SINTEF Ocean



Habitat restoration in coastal lagoons in Finland

Sanna Kuningas

Sanna Kuningas, representing the Natural Resources Institute Finland (LUKE), shared insights on the restoration of coastal lagoons in Finland. These lagoons are vital habitats for spring-spawning fish species, such as perch and pike, and the restoration efforts aim to improve fish spawning conditions. Sanna provided an overview of the ongoing Life IP Biodiversea project and the cost considerations of these restoration activities.

Overview of the Life IP Biodiversea project

The Life IP Biodiversea project is Finland's largest cooperation initiative to safeguard the biodiversity of the Baltic Sea. The project, with a budget of €20,000,000 over 8 years, involves nine partners and focuses on various themes related to the protection of nature. Of this budget, €567,000 is allocated for the restoration of coastal lagoons, particularly for fish spawning areas.

Sanna explained that the restoration of these habitats primarily targets enhancing the natural reproduction of spring-spawning fish, such as perch and pike, by restoring at least 20 coastal lagoons along the entirety of Finland's coast, from the Bay of Bothnia to the eastern Gulf of Finland. Coastal lagoons are important because they provide shelter for fish during spawning, and their water temperatures in the spring are significantly warmer than the open sea, which is crucial for successful reproduction.

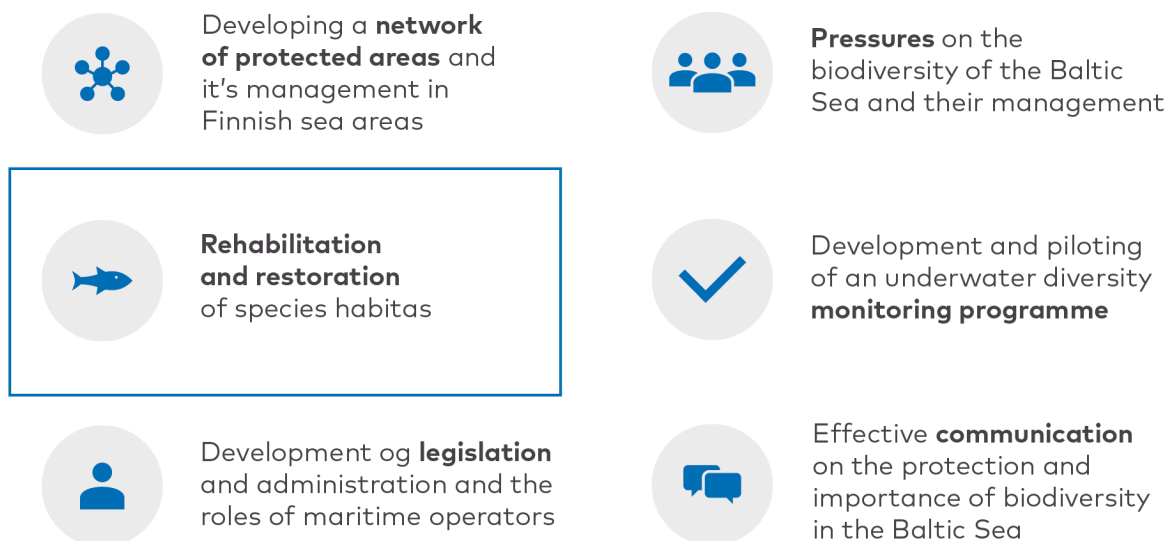


Figure 6: Finland's largest cooperation project to safeguard the diverse nature of the Baltic Sea with a budget of over €20 million over eight years.

Challenges and natural processes

Coastal lagoons are formed due to land uplift after the Ice Age, with Finland's land rising by up to 8 millimeters each year. While new lagoons are continuously being formed, many are disappearing due to both natural and human-induced pressures. Human activities, such as dredging channels for boating purposes and dealing with eutrophication, have damaged these sensitive habitats. Dredging, which was initially intended to improve water circulation and combat eutrophication, has had unintended consequences, such as disrupting the natural shelter and temperature regulation essential for fish spawning.

Eutrophication is also a significant issue, as it promotes the rapid growth of reed belts that can block the migration channels used by fish to access the lagoons.

Restoration methods and costs

Sanna provided examples of different restoration methods, such as the opening of channels blocked by reed growth or artificial structures like culverts, to ensure fish can migrate freely. One example of channel restoration involved manually opening a channel, which is a less expensive approach compared to using machinery. The costs for these methods can range depending on the complexity and scale of the work. For instance, restoring a channel by opening it with machinery can be more expensive due to the cost of materials and labor, while some simple rock placements to control the flow of water can cost as little as €500.

However, the most significant costs in these restoration projects are often the preparatory activities, including mapping the location, designing a restoration plan, obtaining necessary permissions, and engaging relevant stakeholders. Monitoring post-restoration is also a crucial and costly step to ensure the success of the project.

Example costs and the Helmi Habitats Programme

Sanna mentioned that the Helmi Habitats programme, which works alongside the Life IP Biodiversity project, focuses on restoring habitats like dredged channels. A key example involved restoring a dredged channel by using rocks sourced locally, which cost about €5,000. The Helmi programme also utilizes consultants for restoration planning, with typical costs for these plans ranging from €1,000 to €4,000.

For a larger scale, the restoration of all coastal lagoons in Finland that have been dredged would amount to an estimated €14,500,000. The restoration cost per lagoon is approximately €16,000, based on a comprehensive analysis conducted by colleagues at Metsähallitus, who used aerial images to identify all dredged coastal lagoons.

Finland's national plan for habitat restoration

Looking ahead, Finland is preparing its national plan to fulfil the mandate set by the EU Nature Restoration Law, which is due for submission by the summer of 2026. Some preliminary work on cost estimation for habitat restoration has been completed, but the detailed report is currently available only in Finnish.

Sanna highlighted that the restoration of coastal lagoons is expected to cost between €5,000 and €25,000 per site, depending on the specific condition of the lagoon.

Benefits of coastal lagoon restoration

Sanna emphasized the multiple benefits of these restoration efforts. Beyond improving fish stocks, which in turn supports commercial fisheries, restoring coastal lagoons also enhances food provisioning, contributing to the overall health of the ecosystem. These benefits underscore the importance of the restoration work, which is not just an environmental initiative but one that has socio-economic advantages as well.

The lifespan of restoration efforts

In conclusion, Sanna expressed her appreciation for the opportunity to present the ongoing restoration efforts in Finland and the associated costs.

She was asked about the expected lifespan of the open channels created in the lagoons and the need for future management. While she noted that the natural process of land uplift could affect the longevity of these restoration efforts, Sanna agreed that periodic revisits and further restoration work would be necessary, with the timing depending on the region's rate of land uplift.

She concluded that the reoccurring nature of restoration work is important to consider when assessing the long-term cost-efficiency of these efforts.

"When the EU nature restoration law was discussed, much of the public focus in Finland was on the costs. The benefits, such as ecosystem services and biodiversity gains, were not emphasized enough. We need to communicate those positives more effectively."

Sanna Kuningas, LUKE



Active restoration of marine habitats in Denmark

Federica Montesanto

Federica Montesanto from Aarhus University presented a detailed overview of active marine restoration projects in Denmark, focusing on various habitats that are targeted for restoration and key methodologies that are employed. She emphasized the importance of stakeholder engagement, cost-effectiveness, and long-term monitoring in these initiatives.

Key habitats requiring restoration

Denmark faces significant challenges in marine habitat degradation, primarily due to land reclamation, pollution, and overfishing. The habitats requiring the most urgent restoration efforts include:

Fjords and shallow habitats: Approximately 400 square kilometers have been lost due to land reclamation.

Boulder reefs: Once abundant, these reefs have been extensively damaged through fishing practices and construction activities.

Biogenic reefs: These habitats have been heavily impacted by fishing and other anthropogenic activities.

Eelgrass beds: These crucial habitats are severely threatened by eutrophication, pollution, and physical damage.

Case study: Blue Reef Project

One of the first major EU LIFE marine projects funded in Denmark was the Blue Reef Project, which began in 2017 and ran until 2022. This project focused on restoring a degraded Natura 2000 reef site located on Læsø Island in northern Denmark. The restoration involved placing 500,000 tonnes of boulders in the area to restore biodiversity and ecosystem function.

Key findings from this project include a significant increase in biodiversity over a six-year period, with biodiversity levels increasing by approximately 4–5 times compared to baseline data. Post-monitoring was identified as a critical component of the project, highlighting the importance of long-term data collection to assess

the success and cost-effectiveness of restoration efforts. Additionally, the largest portion of the project budget was allocated to post-monitoring, which underscored the importance of ongoing evaluation.

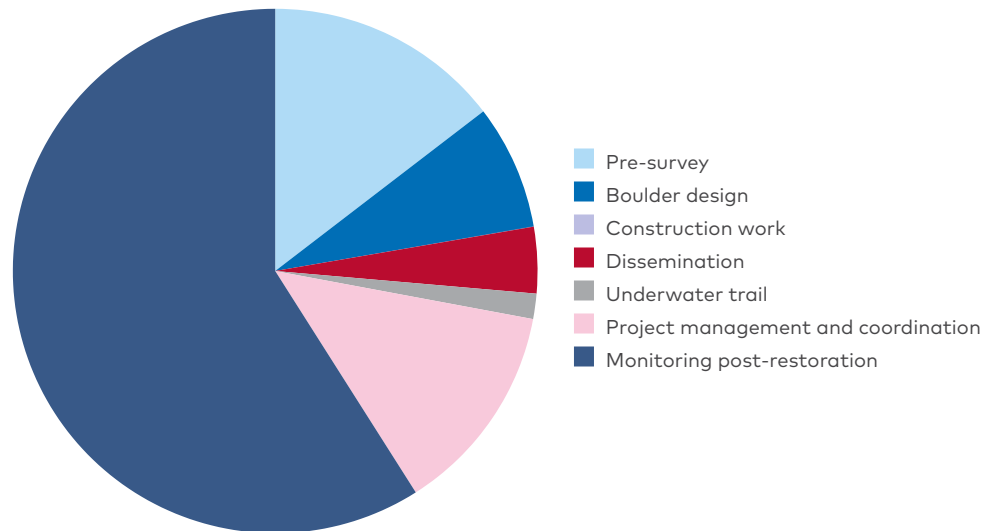


Figure 7: Costs of activities under the Blue Reef project

Seascape restoration: a holistic approach

Montesanto emphasized a shift toward seascape restoration in Denmark, a method that combines multiple habitat types into broader restoration projects. This approach contrasts with earlier efforts that focused on single habitat restoration, moving towards projects that restore entire ecosystems. For example, projects are increasingly focused on combining:

Eelgrass beds, which provide critical ecosystem services like coastal protection and carbon sequestration;

Boulder reefs, which support marine life by providing nursery habitats and fishery spillover; and

Biogenic reefs, which contribute to biodiversity and marine food webs.

The Sandvejs Fjord project, which combines these three habitats, is one example of seascape restoration that is still ongoing and involves intensive monitoring and a significant investment of resources.

Passive restoration and stressor removal

In addition to active restoration, passive restoration methods, such as the removal of green algae (which negatively affects eelgrass growth), are integral to the overall success of restoration efforts. These actions help reduce anthropogenic pressure on the ecosystems and enhance the effectiveness of active restoration measures. The inclusion of passive restoration techniques in cost-effectiveness analyses is essential for understanding the full impact of restoration projects.

Tools and guidelines for restoration

To support the growing field of marine restoration, Denmark has developed several tools and guidelines:

Guidelines for restoration projects are provided by the Danish Coastal Authority to guide municipalities and stakeholders in implementing restoration projects.

GIS tools to select the most suitable areas for restoration based on factors such as physical stability, historical presence of target habitats, and environmental conditions.

A **decision wheel** has been developed to help practitioners decide when to implement active versus passive restoration techniques based on site-specific conditions.

Furthermore, a **stakeholder questionnaire** is being used to assess perceptions of restoration success, which helps improve future planning and decision-making.

Monitoring and scaling up

Montesanto highlighted the importance of both short-term and long-term monitoring. Short-term monitoring often shows immediate biodiversity gains, especially in projects like boulder reef restoration. However, long-term monitoring is necessary to track the restoration of food webs and ecosystem functions, which require more extensive data collection and expertise.

As the number of restoration projects increases, there is also a growing demand to scale up these efforts. To do so, clear monitoring guidelines and well-defined indicators for restoration success are essential. Understanding the cost-effectiveness of these projects is also crucial to ensure the efficient allocation of funds.

The Marine Natural Fund

Denmark has demonstrated a commitment to marine habitat restoration through multiple projects funded by the EU, the Danish Ministry of Environment, and various foundations. The Marine Natural Fund, set to begin in 2024, will further support these efforts over the next six years. By combining active and passive restoration, using advanced tools for site selection, and focusing on long-term monitoring, Denmark aims to ensure the success and sustainability of its marine restoration projects.



"We're moving towards seascape restoration, targeting multiple habitats instead of focusing on just one. Combining habitats enhances ecosystem services like coastal protection and carbon storage."

Federica Montesanto, Aarhus University



Panel discussion

The panel discussion was a thought-provoking conversation on the complexities of balancing active and passive restoration strategies, community engagement, socio-economic considerations, and the role of communication in driving long-term environmental change. The panelists included the presenters Laura Wendling, Sanna Kuningas, Federica Montesanto, and they were joined by Liisa Saikkonen from the Finnish Environmental Institute (SYKE). The discussion was moderated by Mikelis Bendiks.

Engaging community to participate in marine restoration

The panel began by discussing the importance of community involvement in marine restoration projects. The conversation touched on the complexities of engaging local communities, who may prioritize their rights and interests (such as ownership of land and water) over broader environmental goals.

Community engagement and volunteering: The panelists agreed that involving local communities could lead to positive outcomes, such as people contributing their time and resources for the restoration projects. Federica Montesanto noted that some individuals, particularly retirees, are eager to volunteer, especially if they feel personally invested in the cause, such as seeing more fish in local waters. She shared an example from Denmark, where local boat owners have volunteered to take restoration experts out on the water, offering their boats for surveys and data collection. This informal collaboration is seen as mutually beneficial.

Laura Wendling emphasized the importance of informal collaborations and noted that these partnerships can provide mutual benefits, as local knowledge complements scientific expertise.

However, Liisa Saikkonen raised concerns about the financial costs associated with raising awareness and educating the public. The panel debated the balance between the financial investment in educating and engaging the community versus the benefits of their involvement. The consensus seemed to be that while there is an initial cost, these investments pay off in the long run by building social capacity and increasing public support for restoration work.

Education and communication: Liisa Saikkonen discussed the need for clear communication on the benefits of restoration, in terms of environmental impact and socio-economic advantages. She cited the example of Finland, where media coverage of the EU Nature Restoration Law emphasized the potential costs of restoration but failed to adequately focus on the long-term benefits of healthier ecosystems.

Sanna Kuningas added that communicating the value of marine ecosystems to a wider audience is essential. She stressed the importance of ensuring that the public understands the benefits restoration can bring to both nature and human societies.

Community contributions to science: Federica Montesanto highlighted the growing role of citizen science in marine conservation. She shared an example of divers in Madeira, who have been involved in monitoring sea urchin populations while enjoying their diving activities. This underscores how communities, including tourists and volunteers, can contribute to restoration efforts through data collection and monitoring.



Economic implications of restoration projects

A significant part of the discussion centered around the economic aspects of marine restoration and whether community involvement helps or hinders the financial feasibility of these efforts.

Cost vs. value of community involvement: Liisa Saikkonen explained that while education and awareness campaigns come with a cost, the long-term socio-economic benefits of public involvement outweigh the initial investment.

Federica Montesanto emphasized that restoration projects also strengthen social fabric by fostering cooperation and innovation within communities. Laura Wendling added that investing in people creates a multiplier effect, leading to more sustainable practices and broader acceptance of restoration efforts.

Economic benefits of ecosystem services: Laura Wendling pointed out that marine restoration enhances ecosystems' capacity to provide services like clean water, fisheries, and tourism opportunities. She argued that delaying restoration efforts could lead to greater economic costs in the future, particularly in terms of biodiversity loss or declining fish stocks.



Passive restoration and pressure reduction

The panel discussed the concept of passive restoration, which refers to allowing ecosystems to recover naturally when anthropogenic pressures are reduced. This was contrasted with active restoration efforts where human intervention is necessary.

Passive restoration in the Baltic Sea: In the Baltic Sea, passive restoration plays a crucial role, particularly in relation to reducing eutrophication (nutrient pollution) that affects various marine habitats. Liisa Saikkonen emphasized the importance of addressing eutrophication in the Baltic Sea. She explained that while active restoration efforts, like planting seagrass, are beneficial, their long-term success depends on reducing underlying pressures such as nutrient pollution.

Balancing active and passive restoration: The panelists agreed that active and passive restoration are complementary strategies. Federica Montesanto stressed the importance of removing stressors, such as invasive species, in areas unsuitable for active restoration. This approach can make these sites viable for future interventions.

Economic considerations of passive restoration: While passive restoration may seem like a cost-effective approach in some cases, the panel acknowledged that it might not always be a sufficient solution, particularly in areas that have been heavily degraded by human activity. In some cases, however, reducing pressure on ecosystems could allow nature to recover on its own, thus reducing the need for more expensive active interventions. The balance between active restoration and passive restoration, and how to manage both in the context of economic costs, remains a central challenge.



Timeframes for restoration and adaptive management

The conversation delved into the timelines involved in marine restoration projects, particularly regarding how long it takes for ecosystems to recover after restoration efforts.

Timeframe of passive restoration: Sanna Kuningas mentioned that the concept of passive restoration is tied to specific ecological conditions, such as land uplift. In Finland, some coastal areas are naturally being uplifted, and restoration efforts are complicated by these natural processes. The question of how to distinguish between natural recovery and the effects of eutrophication was raised, indicating the challenge in defining clear timelines for passive restoration. Without addressing eutrophication, passive restoration may only provide short-term benefits.

Additionally, she noted that public perception plays a crucial role in “valuing” restoration initiatives. When the EU Nature Restoration Law was discussed in Finland, much of the media coverage and public focus was on the costs involved. However, the benefits, such as improved ecosystem services and biodiversity gains, were not emphasized enough. She stressed the need for more effective communication to highlight these long-term positives and garner broader public support for restoration efforts.

Adaptive management approach: Laura Wendling discussed the need for adaptive management, which involves continually monitoring, assessing, and adjusting restoration efforts. She highlighted the importance of integrating restoration with broader maritime spatial planning, identifying key areas for restoration, and managing them strategically. Management frameworks that incorporate both active restoration and passive restoration, while considering broader pressures and threats, were seen as crucial for achieving long-term success.



Addressing human activities and economic pressures

Finally, the panel discussed the tension between addressing the root causes of environmental degradation (such as fishing practices) and pursuing restoration efforts simultaneously.

Fishing and restoration: Federica Montesanto highlighted the challenge of restoring ecosystems, such as fish spawning grounds, while allowing fishing activities to continue in the same areas. For example, limiting fishing during critical spawning

periods can help ensure the success of restoration efforts. This was framed as an example of how pressure reduction (in this case, fishing restrictions) can complement active restoration measures.

Balancing restoration with economic activities: Liisa Saikkonen emphasized the need to balance restoration efforts with economic activities like fishing and agriculture. She suggested that, while it might be difficult to eliminate harmful practices entirely, a more integrated approach – where restoration and sustainable use of resources go hand-in-hand – could provide a solution.



In conclusion, the discussion highlighted the importance of community involvement, effective communication, and balancing both active and passive restoration efforts. While challenges remain, particularly in managing economic pressures and ensuring the sustainability of restoration work, there is a shared belief that restoration efforts, combined with pressure reduction and strategic management, offer the best pathway to healthy and resilient marine ecosystems.

The panelists were optimistic that with the right investments in both people and the environment, restoration projects could provide long-term benefits, not just ecologically, but also economically and socially.

Key takeaways and closing remarks

As the event concluded, the importance of not only executing restoration projects but also critically assessing their effectiveness in hindsight was emphasized. It was suggested that lessons learned should inform better decision-making in the future.

The critical role of communication was highlighted, particularly between diverse stakeholders involved in marine restoration across various scales, including governmental, private, and community-level actors. The event was an opportunity to reflect on the complexities of marine restoration, with a cohesive, collaborative approach across actors and countries being emphasized as essential to addressing these challenges. It was noted that although the process may initially seem complex and daunting, it becomes more manageable and meaningful with careful attention and collaboration.

Particular importance was placed on data sharing, with accurate and trustworthy communication being deemed essential for the success of marine restoration efforts. The value of shared data was discussed, and it was noted that while careful interpretation is required, such data must be universally understood and trusted by different stakeholders. A common understanding of what works and what does not was also stressed, as well as the importance of defining the value proposition of shared data collaboratively by all involved parties.

Interactive audience involvement

In a nod to the active involvement of the audience throughout the event, Mikelis Bendiks revisited the questions posed earlier in the day regarding the challenges of marine restoration. The audience responses, which were collected earlier, were used to create a video using AI technology.

This AI-generated video showcased the key challenges faced in the context of marine restoration, offering a summary of the audience's perspectives and concerns. It serves as a creative way to highlight the audience's input, providing an engaging wrap-up to the event's discussions.

AI video – incorporating audience insights

A unique and innovative element of this event was the creation of an AI-generated video that synthesized the insights and responses provided by the audience. Before the event, participants were invited to answer three key questions about marine restoration.

1. What are the main challenges?
2. What is needed to overcome them?
3. If we overcome the challenges, what can restoration do for the health of the marine environment?

This AI-driven approach allowed for an engaging, data-driven summary of the audience's input, bringing their voices to life in a format that added depth to the event.

The video serves as a reflection of the audience's thoughts but also highlights the diverse perspectives surrounding marine restoration and the challenges associated with it. By processing the audience's feedback and transforming it into a coherent and accessible visual representation, the AI video effectively bridged the gap between abstract ideas and real-world concerns.

Incorporating AI in this way offers several benefits. It makes complex information easier to digest, offers a new way to engage the audience, and provides an opportunity for people to see their contributions reflected in real-time. Moreover, the AI-generated video can act as an innovative tool for reinforcing key messages from the event, ensuring that the main challenges and solutions discussed were clearly communicated and accessible to all attendees, both during and after the session.

The AI video has been published on HELCOM's YouTube channel. You can access it here: <https://youtu.be/bOMBPlgbcMU>

Live illustration: enhancing engagement and understanding

Throughout the event, Doti – a skilled artist from Illustrations by Illustrated Live – captured key moments, ideas, and themes visually in real-time, translating the complex concepts being discussed into an accessible and visually-engaging narrative. By translating the presentations and panel discussion insights into illustrations, this creative process not only helped to simplify complex concepts but also deepened the audience's engagement with the topics being discussed.

Live illustration is an effective tool for enhancing communication and audience engagement, as it provides a dynamic and creative way to summarize and highlight key points. It helps capture the essence of the event in a visual form, allowing the ideas to come to life and giving participants a clearer connection between the discussions and the practical implications of marine restoration.

The illustrations also serve as a valuable resource for reinforcing learning and ensuring that important concepts are retained long after the event has concluded. This method of communication is particularly beneficial in complex subjects like marine restoration, where diverse and technical topics can sometimes be difficult to fully absorb. Live illustration helps make these discussions more memorable, turning abstract concepts into tangible representations that foster a deeper understanding of the challenges and opportunities within the field.

A video of the Live Illustration is available to watch on HELCOM's YouTube channel: <https://youtu.be/p-HaLJkErdw>



Figure 8: Strategies for cost-effective marine restoration in the Nordics. Illustrations by Doti at Illustrated Live. Image credit: katiechappell.com

Appendices

Appendix I: Registration information

142 people signed up to attend the webinar with a mix of researchers, practitioners, policymakers, economists, NGOs and students signing up.

Main audience types

Audience Type	Count
Researcher	50
Marine Restoration Practitioner	24
Policymaker	19
Environmental Economist	10
NGO	8
Student	7

Collated other miscellaneous audience types:

Role Category	Count
Environmental & Marine Related Roles	15
Consulting/Advisory Roles	9
Policy and Governance Roles	9
Academic Roles	4
Artist/Creative Roles	3

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