Coalition Clean Baltic

GUIDING RECOMMENDATIONS FOR SOURCE-TO-SEA RESTORATION
-
IN RIVERINE, COASTAL, AND MARINE ECOSYSTEMS

2025

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Coalition Clean Baltic

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GLOSSARY

- **Active restoration**: involves intentional "human interventions aimed at influencing and accelerating natural successional processes to recover" an ecosystem from a degraded state.[1]
- **Barrier**: an artificial structure that decreases connectivity and blocks free-flowing rivers, e.g., dams, weirs, sluices, fords, ramps, and culverts.[2]
- **Connectivity:** in rivers refers to the exchange of water, energy, material, and biodiversity in the four dimensions of fluvial systems: longitudinal, vertical, lateral/transverse (between a river and its surrounding environment), and temporal.[3]
- **Free-flowing river**: occurs when connectivity (as defined above) is not affected by anthropogenic influences.[4] In regards to the NRR, it refers to rivers where longitudinal, lateral, and vertical connectivity specifically are not hindered by artificial barriers (as defined above).[5]
- **Good condition**: in the NRR refers to the ecological integrity, stability and resilience of habitat structures, functions, and species compositions that is needed to reach or maintain a favourable conservation status in habitats listed in the Habitats Directive (Annex 1) or good environmental status in marine ecosystems (relating to the MSFD).[6]
- **Good Environmental Status**: of marine waters refers to ecologically diverse, dynamic, clean, unpolluted (from anthropogenic inputs of substances and energy), fully functional, resilient to human-induced environmental change, and sustainably used oceans and seas, in which marine species and habitats are protected and biodiversity does not decline due to anthropogenic activities.[7]
- **Passive restoration**: relies on the "natural process of ecological succession to restore degraded ecosystems" and involves "measures to protect a site from processes that currently prevent natural recovery".[8]
- **Source-to-Sea approach**: acknowledges the continuum and downstream flow from terrestrial ecosystems to riverine, coastal, and marine ecosystems, and thereby the impacts of up-stream activities on down-stream environments. This flow applies to water, sediments, pollutants, organisms, materials, and ecosystem services.[9]
- **Water resilience**: Water resilience refers to the ability of water systems, within a social-ecological frame, to cope with and recover from changes and stressors, and ensures stability in ecosystems and biomes, climate and Earth systems, and water supplies for societies.[10]

1. IPBES, 2018. The IPBES assessment report on land degradation and restoration. Montanarella, L., Scholes, R., and Brainich, A. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 744 pages. See *here*
2. Belletti, B., Garcia de Leaniz, C., Jones, J., Bizzi, S., Börger, L., Segura, G., Castelletti, A., Van de Bund, W., Aarestrup, K., Barry, J. and Belka, K., 2020. More than one million barriers fragment Europe's rivers. *Nature*, 588(7838), pp.436-441
3. Stoffers, T., Altermatt, F., Baldan, D., Bilous, O., Borgwardt, F., Buijse, A.D., Bondar-Kunze, E., Cid, N., Erős, T., Ferreira, M.T. and Funk, A., 2024. Reviving Europe's rivers: Seven challenges in the implementation of the Nature Restoration Law to restore free-flowing rivers. *Wiley Interdisciplinary Reviews: Water*, 11(3), p.e1717.
4. Stoffers, T., Altermatt, F., Baldan, D., Bilous, O., Borgwardt, F., Buijse, A.D., Bondar-Kunze, E., Cid, N., Erős, T., Ferreira, M.T. and Funk, A., 2024. Reviving Europe's rivers: Seven challenges in the implementation of the Nature Restoration Law to restore free-flowing rivers. *Wiley Interdisciplinary Reviews: Water*, 11(3), p.e1717
5. European Parliament, Council of the European Union (2024) Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance). Off J Eur Union, Brussels (BE)., Art. 3(22)
6. European Parliament, Council of the European Union (2024) Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance). Off J Eur Union, Brussels (BE)., Art. 3(4)
7. European Parliament, Council of the European Union (2008) Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (Text with EEA relevance). Art. 3(5).
8. IPBES, 2018. The IPBES assessment report on land degradation and restoration. Montanarella, L., Scholes, R., and Brainich, A. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 744 pages. See here
9. Mathews, R. E., Tengberg, A., Sjödin, J., & Liss-Lymer, B. (2019). Implementing the source-to-sea approach: A guide for practitioners. SIWI, Stockholm.
10. Falkenmark, M., Wang-Erlandsson, L. and Rockström, J., 2019. Understanding of water resilience in the Anthropocene. *Journal of Hydrology* X, 2, p.100009.

OBLIGATIONS UNDER THE EU NATURE RESTORATION REGULATION FOR RIVERINE, COASTAL, AND MARINE ECOSYSTEMS

Anthropogenic pressures drive the poor status of habitats and species in the Baltic Sea, as determined by HELCOM's recent holistic assessment of the 'State of the Baltic Sea'.[11] Good Environmental Status (GES) of EU marine ecosystems was intended to be reached by 2020, as set out by the Marine Strategy Framework Directive (MSFD). In failing to achieve this goal, and with 2021-2030 having been declared the UN Decade for ecosystem restoration, it is now widely recognised that restoration efforts are needed to contribute to reaching GES in the Baltic Sea and across Europe.[12]

The Global Biodiversity Framework and the EU Biodiversity Strategy for 2030 have set similar targets for ecosystem protection and restoration, such as the 30/10 % target by 2030. On the 18th of August 2024, a key commitment under the EU Biodiversity Strategy was strengthened when the EU Nature Restoration Regulation (NRR)[13] came into effect, establishing **legally binding and quantifiable targets for 2030 to 2050**.

The NRR further complements and expands on the Birds and Habitats Directives by including measures beyond Natura 2000 sites. Additionally, it addresses the global UN Sustainable Development Goals (SDGs, 14.2 and 15.1-3) and aims for synergies with the MSFD, Common Fisheries Policy, and European Climate Law.

Under the NRR, EU Member States (MS) are required to implement restoration and habitat re-establishment measures gradually. These measures shall cover at least **20% of land and sea areas in the EU by 2030, and all ecosystems in need of restoration by 2050** (Art. 1(2)). It also requires MS to assist in restoring at least **25 000 km of free-flowing rivers by 2030** (Art. 9).

Specifically, MS must implement restoration measures on habitat areas not in good condition (Art. 4(1), 5(1)) and take measures to re-establish habitats to reach their favourable reference areas (Art. 4(4), 5(2)). These measures must cover at least 30% of the total area of habitats listed in Annexes I and II by 2030, 60% of each habitat group by 2040, and 90 or 100% by 2050 (Art. 4(1, 4), 5(1, 2)). Crucial to reaching these targets are the obligations for MS to **1)** know the condition of 90% of terrestrial, coastal and freshwater habitats (included in NRR Annex I) and of 50% of marine habitats (included in NRR Annex II) by 2030, and of all habitats by 2040 [14] (Art. 4(9), 5(7)); and **2)** establish restoration measures aiming at continuous habitat improvement and deterioration avoidance (Art. 4(11, 12), 5(9, 10)).

11. HELCOM, 2023. State of the Baltic Sea. Third HELCOM holistic assessment 2016-2021.
12. HELCOM, 2021. Baltic Sea Action Plan 2021 Update (Actions B25-27).
13. European Parliament, Council of the European Union (2024) Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance). Off J Eur Union, Brussels (BE).
14. With the exception of marine habitat 7: soft sediments at < 1000m depth (NRR, Annex 2), for which 50% is to be known by 2040, and all by 2050 (NRR, Art. 5(7), p.24).

In the Baltic Sea and its catchment area, these targets apply to various coastal and freshwater habitats listed in Annex 1 of the NRR (including dunes, beaches, cliffs, estuaries, etc. - see table 3.1 on Appendix III) and four out of seven specific groups of marine habitats of Annex 2 (see table 3.2 on Appendix III), namely: (1) seagrass beds, (2) macroalgal forests, (3) shellfish beds, and (5) sponge, coral, and coralligenous beds. Lower target percentages, however, apply to widespread habitats covering >3% of an MS's terrestrial, coastal or freshwater territory and marine soft sediments at less than 1000m depth (habitat n.7) (Art. 5(7)). In addition to these habitat-specific obligations, MS are obliged to put in place restoration measures aiming for sufficient quality and quantity of habitats of species included in the Birds and Habitats Directives, and of marine species in Annex 3 of the NRR (Art. 4(7), 5(5)). The latter includes salmon (*Salmo salar*), sea trout (*Salmo trutta*), basking shark (*Cetorhinus maximus*), and houting (*Coregonus oxyrhynchus*) in the Baltic Sea catchment area.[15]

MS shall submit Nature Restoration Plans (NRP) for their territories, including exclusive economic zones (EEZ),[16] **by the 1st of September 2026** (Art. 16), indicating how the NRR targets will be implemented and achieved. A NRP requires, among other things, preparatory monitoring and research, identification of appropriate restoration areas and methods, and an inventory of existing artificial river barriers (Art. 14, 15).

The main cause of eutrophication in rivers, reservoirs, and seawater is the excess of nitrogen and phosphorus from agricultural sources, which adversely affects the water´s trophic status. River barriers enhance eutrophication processes by slowing down the natural free-flow of water and reducing self-purification abilities.

15. Houting (Coregonus oxyrhynchus) is currently listed as extinct on the IUCN Red List, however, it can be found in a few Danish rivers leading to the Wadden Sea (Life 3.0 - Public Database). The basking shark (Cetorhinus maximus) is a rare visitor to the Baltic Sea (HELCOM, 2013. Red list of fish and lamprey species (Accessed 14 Feb., 2025)).

16. The NRR does not explicitly state that the EEZ is included, however, in Art. 2(c) it states that the regulation applies to waters, seabed, and subsoil extending to the utmost reach where Member States exercise sovereign rights, in accordance with UNCLOS. Part V, Art 56 of UNCLOS states that MS have sovereign rights in the EEZ for the purpose of (a) conserving and managing natural resources, and (b. iii) for the protection and preservation of the marine environment. As such, the NRR obligation naturally extends to MS's EEZ, where they have the authority to regulate and implement conservation measures.

CCB´S POSITION & MAIN GUIDING RECOMMENDATIONS FOR RIVERINE, COASTAL, AND MARINE RESTORATION

To stop the aquatic ecosystems of the Baltic Sea catchment area from deteriorating, swift actions are required. For MS to effectively fulfil nature restoration obligations under the NRR, **the development of NRPs and implementation of measures must be done from an ecosystem perspective and with cross-border thinking.** The latter should foster a regional common understanding of the implementation of the NRR across the Baltic Sea catchment area, facilitating both the exchange of national planning strategies, such as Maritime Spatial Plans (MSPs), and the development of NRPs for regional coherence.

While the NRR sets obligations for MS to have restoration measures in place by 2030, 2040, and 2050, it is essential that these measures are clear and measurable. Most importantly, **measures in place must deliver actual source-to-sea restoration of all riverine, coastal, and marine ecosystems in the Baltic Sea catchment area.** While achieving milestones for 2030, 2040, and 2050 is an important step toward reaching GES, these milestones should not be seen as ultimate goals but as markers of true ecological restoration.

CCB calls on HELCOM and MS to integrate the NRR goals within their main strategies and legal regulations, avoiding any environmental regression or weakening of their domestic levels of environmental protection. Below, CCB has listed eleven guiding recommendations for achieving restoration targets and, ultimately, GES in the Baltic Sea catchment area:

1. **Source-to-sea approach and ecological connectivity must be considered**. Land-based restoration, even hundreds of kilometers from the sea, will indirectly (or passively) help recover marine and freshwater ecosystems, for instance, through reducing nutrient runoff, increasing soil quality and landscape diversity. Given that the agriculture sector is the main contributor of nutrients to the Baltic Sea, a minimisation of overfertilization is necessary.

2. **Restoration measures for all coastal, river, and marine ecosystems must be included in NRPs and need to be site-, habitat-, and species-specific.** Restoration efforts with positive impacts on multiple habitats and species should be prioritised (e.g. in protected areas).

3. **Restoration efforts should be linked and contribute to** the EU Biodiversity Strategy and the HELCOM Baltic Sea Action Plan (BSAP), as well as to other targets under EU nature legislation (Birds and Habitats Directive, Water Framework Directive, MSFD, etc.).

4. Both **active and passive restoration efforts**, ensuring effective management (e.g. for protected and strictly protected areas), are needed in the Baltic Sea catchment area, and restoration outcomes must be secured on a long-term basis.[17] If applicable, passive restoration, through effective protection, should be prioritized over active restoration measures.

5. **Firm monitoring practices must be implemented** to follow the state of both passive and active restoration areas, considering climate change, eutrophication, pollution, and other anthropogenic stressors. These practices strengthen climate adaptation and help in choosing the right restoration tools for the area of restoration.

6. **Implement continuous genetic and biome mapping and sampling, and refine restoration practices** by integrating proven and new methods to enhance restoration success, biodiversity resilience, and species recovery.

7. **Follow a coherent approach at the regional level and generate synergies among MS and NRPs.** These actions will increase benefits, enhance shared knowledge in the region, implement cost-effective measures, and allow sharing of equal burden between MS to reach regional goals.

8. **Set ambitious, clear, and achievable targets,** ensuring effective use of resources and coordination across jurisdictional levels, sectors, and other stakeholders.

9. **Source-to-sea restoration should be seen as a climate-related policy.** Restoration efforts should contribute to climate change mitigation and adaptation, including such considerations in the design process of restoration measures (e.g., by increasing carbon stocks and sink capacity).[18,19] This approach will help fulfil commitments under the EU Green Deal and support climate and water resilience in countries and regions.

10. **Secure long-term financing** for the implementation of the NRR at the national level and through the formation of an (EU) Ocean Fund that supports conservation and restoration actions.

11. **Involve civil society through citizen science and citizen engagement actions** in monitoring and restoration practices. Moreover, provide local support and finance for re-education from e.g. fishing to habitat restoration of riverine, coastal, and marine restoration.

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17. Pawlaczyk, P., Biedroń I., Brzóska P. Dondajewska-Pielka R., Furdyna A., Gołdyn R., Grygoruk M., Grześkowiak A., Horska-Schwarz S., Jusik Sz., Kłósek K., Krzymiński W., Ligięza J., Łapuszek M., Okrasiński K., Przesmycki M., Popek Z., Szałkiewicz E., Suska K., Żak J., 2020. Handbook of good practices for surface water renaturation in Poland. Państwowe Gospodarstwo Wodne Wody Polskie, Krajowy Zarząd Gospodarki Wodnej, Warszawa.

18. Pörtner, H., Scholes, R., Arneth, A., Barnes, D., Burrows, M., Diamond, S., Duarte, C., Kiessling, W., Leadley, P., Shunsuke Managi, P. McElwee, G. Midgley, Ngo, H., Obura, D., Pascual, U., Sankaran, M., Shin, Y., Va, A.L., 2023. Overcoming the coupled climate and biodiversity crises and their societal impacts. Science, 380, eabl4881. DOI: 10.1126/science.abl4881

19. Abdul Malak, D., Marin, A.I., Trombetti, M., San Roman, S., Carbon pools and sequestration potential of wetlands in the European Union, European Topic Centre on Urban, Land and Soil Systems, Viena and Malaga, 2021, ISBN 978-3-200-07433-0.

The implementation of active restoration methods, involving direct interventions for ecosystem restoration, can play an important role in effectively reaching targets under the NRR. Yet, these methods are highly dependent on financial support and often limited by scale, scope, and access to sites.[20-22] **Passive restoration, on the other hand, can be more efficient and less costly since it is strongly interlinked to conservation measures in protected ecosystems, especially in strictly protected ones, allowing them to recover through natural processes.**[23] These passive measures, however, require setting clear objectives and effective measures to deliver actual positive outcomes, avoiding falling into the designation of paper parks only. Hence, depending on anthropogenic pressures, level of degradation, recovery capacity, and climate adaptation, combining both restoration approaches is key to ensuring successful restoration.[24] The successful implementation of restoration measures is linked to the management and planning of human activities, which requires close coordination between NRPs and spatial planning. In particular, the designation of strictly protected areas requires the exclusion of various anthropogenic activities and, therefore, depends on appropriate implementation within spatial planning.

Following our guiding recommendations above, CCB has also developed tailored ecosystem-specific recommendations for riverine, coastal, and marine restoration (active and passive) in the Baltic Sea (Table 1), illustrating the importance of the land-to-sea connection.

20. Bayraktarov E, Saunders MI, Abdullah S, Mills M, Beher J, Possingham HP, Mumby PJ, Lovelock CE, 2016. The cost and feasibility of marine coastal restoration. *Ecological Applications* 26:1055-1074
21. Danovaro, R., Aronson, J., Cimino, R., Gambi, C., Snelgrove, P.V. and Van Dover, C., 2021. Marine ecosystem restoration in a changing ocean. *Restoration Ecology*, 29, p.e13432.
22. Waltham, N.J., Elliott, M., Lee, S.Y., Lovelock, C., Duarte, C.M., Buelow, C., Simenstad, C., Nagelkerken, I., Claassens, L., Wen, C.K. and Barletta, M., 2020. UN decade on ecosystem restoration 2021–2030—what chance for success in restoring coastal ecosystems?. *Frontiers in Marine Science*, 7, p.71.
23. Kotowski et al. 2016. Restoration of temperate fens matching strategies with site potential. Peatland Restoration and Ecosystem Services. Science, Policy and Practice. Cambridge University Press. Cambridge, UK, 2016, 170-191.
24. Abelson, A., Reed, D.C., Edgar, G.J., Smith, C.S., Kendrick, G.A., Orth, R.J., Airoldi, L., Silliman, B., Beck, M.W., Krause, G. and Shashar, N., 2020. Challenges for restoration of coastal marine ecosystems in the Anthropocene. *Frontiers in Marine Science*, 7, p.544105.

CCB’s Guiding Recommendations for Source-to-Sea Restoration

AI generated image

Riverine	Coastal	Marine
Natural water courses, incl. rivers, streams, floodplains*	Inlets, transitional waters, coastal beaches, dunes, wetlands*	Coastal water (low tide level), shelf, open ocean, column and seabed*
Passive Restoration		
• **No intervention**, allow natural fluvial processes (*e.g.* river bank erosion, migration of riverbeds) • **Allow development of native vegetation** in river bank zones, forming complex buffer zones • **Designate riverine protected areas**	• **Limit recreational use of threatened areas**, to reduce beach / dune erosion, pollution • **Allow natural processes** (*e.g.* beach and dune accumulation / erosion, natural cliff erosion) • **Protect vulnerable habitats**, MPA designation & management	• **Designate and effectively manage strictly protected areas**, limit human intervention (see CCB´s MPA position paper)[26] • **Regulate boating, anchoring and recreational fishing** in restoration / sensitive areas (*e.g.* seagrass meadows, biogenic or stone reefs, blue mussel beds)
Active Restoration		
• **Ensure river connectivity and continuity** (longitudinal, lateral, and four-dimensional), with clear barrier removal goals (5-10 yrs) • **Remove bank reinforcements** to allow fluvial processes (*e.g.* bank erosion) • **Restore woody debris, stones / gravel in riverbeds**, incl. riffle-pool sequences in gravel rivers • **Ensure safe fish migration, and restore spawning / nursery grounds, and river morphology** • **Establish continuous natural buffer zones** along rivers, tributaries and water bodies • **Reduce nutrient input**	• **Reed and dune management** (e.g. removal of invasive and overgrown species threatening native plant communities in Baltic coastal dunes) • **Restore or recreate coastal wetlands and lagoons** by increasing water retention to prolong flooding • **Re-wet peat soils**, necessary for carbon storage and for decreasing nutrients outflow towards the sea	• **Increase CO_2 reservoirs, sequestration rates and biodiversity** through restoration of macroalgae and seagrass meadows, incl. identifying suitable locations and methods • **Restore native stony reefs** with natural rocks to re-establish native hard-bottom communities • **Restore biogenic reefs** to improve habitat function and coverage & **restoration of shellfish beds**, particularly blue mussel reefs (*Mytilus edulis / trossulus*) by adding recruitment sites (e.g. shells), or transplanting material post-recruitment or adult mussels

This is Table 1. *The habitat classification is based on the Eurostat EU ecosystem typology.[25] A detailed list of relevant NRR habitats can be found in Appendix III. A detailed list of riverine measures can be found in Appendix I.

CHALLENGES TO RESTORATION EFFORTS AND SOLUTIONS

While the NRR offers a valuable framework for environmental restoration in the EU, significant challenges and gaps remain to be addressed for its successful implementation in riverine, coastal, and marine ecosystems. Starting from the 'watering-down' of the final NRR, the level of flexibility introduced, and the simplified view of targets have raised concerns regarding ecosystem targets matching actual restoration needs.[27,28] For instance, for reaching the target of free-flowing rivers, water quality improvement and biodiversity rehabilitation are urgently needed, beyond the removal of physical barriers.[29] Therefore, **it is key that a common understanding is reached and clear guidelines are developed regionally and, most importantly, that NRPs include achievable yet ambitious targets for the whole catchment area, to deliver real contributions towards reaching GES in the Baltic Sea region.**

An important point to consider is the distinction between implementing measures to restore aquatic ecosystems versus altering or creating entirely new ecosystems where native ecological functions are not aimed to be restored. This is an existing risk, mainly through the introduction of artificial environments (e.g. hard substrates in soft-bottom ecosystems), that needs to be thoroughly considered to prevent shifting species dominance, including for invasive species, as well as ecosystem functionality.

Although most of the restoration work has historically been implemented in coastal marine ecosystems, for instance, through passive restoration with area-based measures (e.g. MPAs) and active restoration (mainly in relation to eelgrass and coral reef restoration), available knowledge, best-available techniques and harmonised data are still scarce or lacking for aquatic ecosystems.[30] **Using historical data with appropriate baselines,[31] improving knowledge of best practices, and increasing understanding of habitats and species - including ecological function, ecosystem services, and effects of climate change scenarios -, are essential steps towards implementing strategies that address and/or maintain restoration needs adequately.** Sufficient financial support and strong political will are also crucial factors for successfully reaching restoration targets both at national and Baltic Sea levels.[32,33]

25. Eurostat, 2024. EU ecosystem typology – Technical Note. Eurostat, Environment methodology, available here. Published Dec. 2024. Categorisation is based on the MAES ecosystem typology and aligned with EUNIS habitat level 2 classification.
26. Coalition Clean Baltic, 2024. Position paper on Marine Protected Areas (MPAs)
27. Cliquet, A., Aragão, A., Meertens, M., Schoukens, H. and Decleer, K., 2024. The negotiation process of the EU Nature Restoration Law Proposal: bringing nature back in Europe against the backdrop of political turmoil?. *Restoration Ecology*, p.e14158
28. Stoffers, T., Altermatt, F., Baldan, D., Bilous, O., Borgwardt, F., Buijse, A.D., Bondar-Kunze, E., Cid, N., Erős, T., Ferreira, M.T. and Funk, A., 2024. Reviving Europe's rivers: Seven challenges in the implementation of the Nature Restoration Law to restore free-flowing rivers. *Wiley Interdisciplinary Reviews: Water*, 11(3), p.e1717
29. Stoffers, T., Altermatt, F., Baldan, D., Bilous, O., Borgwardt, F., Buijse, A.D., Bondar-Kunze, E., Cid, N., Erős, T., Ferreira, M.T. and Funk, A., 2024. Reviving Europe's rivers: Seven challenges in the implementation of the Nature Restoration Law to restore free-flowing rivers. *Wiley Interdisciplinary Reviews: Water*, 11(3), p.e1717
30. Darre, M.E., Constantinides, P., Domisch, S., Floury, M., Hermoso, V., Ørsted, M. and Langhans, S.D., 2025. Evaluating the readiness for river barrier removal: A scoping review under the EU nature restoration law. *Science of the Total Environment*, 959, p.178180
31. Soga, M., Gaston, K., 2018. Shifting baseline syndrome: Causes, consequences and implications. *Front Ecol Environ*, 16(4): 222–230, doi: 10.1002/fee.1794
32. Silliman, B.R., Angelini, C., Krause, G., Saunders, M.I., Smith, C.S., Valdez, S.R., McLean, J.E., Paxton, A.B., Heide, T.V.D. and Abelson, A., 2023. Marine ecosystem restoration (MER)–a call for a more inclusive paradigm. *Frontiers in Marine Science*, 10, p.1250022
33. Cliquet, A., Aragão, A., Meertens, M., Schoukens, H. and Decleer, K., 2024. The negotiation process of the EU Nature Restoration Law Proposal: bringing nature back in Europe against the backdrop of political turmoil?. *Restoration Ecology*, p.e14158


Credit: Martina Roth Kunst-Foto-Design

Overall, even when challenges still exist for riverine, coastal, and marine restoration, current regional projects, research, and monitoring programmes are already addressing some of these gaps. Nevertheless, the remaining challenges **should not prevent MS from taking further steps and increasing efforts towards implementing restoration.**

However, there are several prerequisites for successful restoration measures, especially in the context of source-to-sea approaches. Restoration of e.g. blue carbon habitats, such as seagrass meadows, strongly depends on water quality (nutrient load, sunlight immersion depth), which is almost exclusively a result of agriculture uses on land. Consequently, promoting organic farming and improving soil stability also contributes to marine restoration efforts. On a similar note, the reestablishment of healthy populations of salmon and sturgeon at sea is strongly dependent on free-flowing river systems and semi-natural estuaries.

Additionally, the impact of climate change needs to be considered when planning and identifying areas for restoration. As far as possible, scientific forecasts (models) should be used to assess if an area, or habitat forming species, will be able to thrive and survive under future climate scenarios in a particular region. In other areas, the removal of invasive species can be of high importance for the success of measures. Appropriate (maritime) spatial planning should help secure restoration areas over the long-term and avoid conflicts of use. Cohesive regulation of human activities from land to sea as well as coordinated follow-up actions are prerequisites to securing long-term restoration success.

In lay terms, **the achievement of a GES of the Baltic Sea and the surrounding landscape should be considered as a precondition and the ultimate goal of nature restoration in the Baltic Sea catchment area.**

AFTER-RESTORATION: HOW TO SECURE LONG-TERM RESTORATION?

To achieve long-term recovery of riverine, coastal, and marine ecosystems, MS should not only aim to restore habitats but also ensure their non-deterioration afterwards. This means that effective restoration measures should also address the underlying causes of ecosystem degradation.[34-36] Therefore, **the adoption of policies, strategic use of MSPs and introduction of protective measures, such as the designation of effectively protected and strictly protected areas, are key**[37,38] to: 1) prevent further ecosystem degradation (e.g. through passive restoration), 2) maintain connectivity (e.g. MPA networks and river connectivity), 3) ensure adaptability to climate change impacts,[39] and 4) sustain restoration success of passive and active restoration.[40,41] Yet, the Baltic Sea is still far from achieving the 30/10 % target for marine protection (16.5 %),[42] with remaining challenges for connectivity from land to sea.

Moreover, given that the NRR only sets obligations for the introduction of measures (obligation of means or best effort), rather than achieving specific restoration results (obligation of results), **NRPs must address reporting needs and include clear monitoring mechanisms**. Having these mechanisms in place will ensure that restoration measures are regularly assessed and that they deliver long-term positive ecological outcomes. Furthermore, they allow us to learn where restoration works best,[43,44] and which methods work for different sites, habitats, and species within riverine, coastal, and marine ecosystems. Monitoring and evaluation of restoration measures should always be science-based and assess effectiveness in scientific, social, and economic spheres.[45]

Finally, stakeholder engagement, following a coordinated and participatory approach, will also be key to providing long-term success and promoting cultural and social shifts for restoration at the regional, national, and local levels. Ensuring long-term funds for research and the build-up of expertise, while providing sufficient human capacity, are therefore essential factors when implementing, connecting, and exchanging practices across the region. After all, restoration contributions to reaching a GES in the Baltic Sea will not only benefit our riverine, coastal, and marine ecosystems but also our economy and society.

34. Abelson, A., Reed, D.C., Edgar, G.J., Smith, C.S., Kendrick, G.A., Orth, R.J., Airoldi, L., Silliman, B., Beck, M.W., Krause, G. and Shashar, N., 2020. Challenges for restoration of coastal marine ecosystems in the anthropocene. *Frontiers in Marine Science*, 7, p.544105.
35. Silliman, B.R., Angelini, C., Krause, G., Saunders, M.I., Smith, C.S., Valdez, S.R., McLean, J.E., Paxton, A.B., Heide, T.V.D. and Abelson, A., 2023. Marine ecosystem restoration (MER)–a call for a more inclusive paradigm. *Frontiers in Marine Science*, 10, p.1250022
36. Rossbach, S., Steckbauer, A., Klein, S.G., Arossa, S., Geraldi, N.R., Lim, K.K., Martin, C., Rossbach, F.I., Shellard, M.J., Valluzzi, L. and Duarte, C.M., 2023. A tide of change: What we can learn from stories of marine conservation success. *One Earth*, 6(5), pp.505-518
37. Langhammer, P.F., Bull, J.W., Bicknell, J.E., Oakley, J.L., Brown, M.H., Bruford, M.W., Butchart, S.H., Carr, J.A., Church, D., Cooney, R. and Cutajar, S., 2024. The positive impact of conservation action. *Science*, 384(6694), pp.453-458.
38. Sala, E., and Giakoumi, S., 2018. No-take marine reserves are the most effective protected areas in the ocean. ICES Journal of Marine Science, 75(3), 1166-1168
39. Abelson, A., Reed, D.C., Edgar, G.J., Smith, C.S., Kendrick, G.A., Orth, R.J., Airoldi, L., Silliman, B., Beck, M.W., Krause, G. and Shashar, N., 2020. Challenges for restoration of coastal marine ecosystems in the anthropocene. *Frontiers in Marine Science*, 7, p.544105.
40. European Parliament, Council of the European Union (2024) Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance). Off J Eur Union, Brussels (BE). Preamble 46
41. HELCOM, 2021. Baltic Sea Action Plan 2021 Update (Actions B1).
42. HELCOM, 2023. State of the Baltic Sea, 2023.
43. Fraschetti, S., McOwen, C., Papa, L., Papadopoulou, N., Bilan, M., Boström, C., Capdevila, P., Carreiro-Silva, M., Carugati, L., Cebrian, E. and Coll, M., 2021. Where is more important than how in coastal and marine ecosystems restoration. *Frontiers in marine science*, 8, p.626843.
44. HELCOM ACTION, 2021. Restoration measures for coastal habitats in the Baltic Sea: cost-efficiency and areas of highest significance and need. Available here (Accessed 14 Feb. 2025)
45. Lundquist, C.J. and Granek, E.F., 2005. Strategies for successful marine conservation: integrating socioeconomic, political, and scientific factors. Conservation Biology, 19(6), pp.1771-1778

APPENDIX I.

Complementary information to riverine restoration measures

Given that riverine (freshwater) measures require a more detailed explanation, in this Appendix a continuation of the description from Table 1 is provided:

Passive measures:

- No-intervention and allowing natural fluvial processes: i.e. ceasing recurrent "river maintenance" measures, such as recurrent dredging, vegetation removal or mowing, coarse woody debris removal etc.; no-intervention after flooding episodes - accepting hydromorphological transformations after high flow.
- Allow river bank erosion and migration of riverbeds.
- Remember that passive measures are applicable elsewhere, not only in protected areas.

To achieve freshwater restoration - prioritisation needs to be considered. Measures should prioritise rivers with endangered species, e.g. salmonids, eels, freshwater pearl mussels. Moreover, building resilience of freshwater ecosystems and ensuring continuity of the flow are key aspects.

Active measures:

- For longitudinal continuity, total dam removal should be a priority. Focus on natural by-passes and install fishways only if dams cannot be removed. Establish a requirement of a minimum annual flow so all aquatic species can survive and a slope angle of 2 degrees so all kinds of river fauna can migrate up and down streams.
- Restore also lateral connectivity and improve the natural functions of the floodplains, i.e. remove artificial embankments, and restore floodplains.
- Ensure safe downstream fish migration, restoration of fish spawning and nursery grounds, as well as river channel morphology, in particular in rivers classified as natural habitats (3210, 3260, 3270) or significant bird biotopes (e.g. for kingfisher and dipper). Fish larger than 10cm (smolt) should always be screened away from the hydropower plant (HPP) turbines. Fish/Fauna passes should allow migration of all aquatic species and age groups. Best Available Technology (BAT) should be used to ensure efficient fish passage.
- Ensure natural buffer zones along the entire river and tributary length and, for water bodies of at least 10-20 m, for 80% of the river length to reduce eutrophication pressure.
- Reduce input of nutrients from livestock and farming (e.g. by promoting organic farming, improving soil stability) and via minimization of nutrient surplus with fertilization practices (which can be seen as a passive measure) which would reduce water column nutrient concentrations.

APPENDIX II. Timeline of the NRR with matching BSAP targets for 2025 to 2050

Table 2. Overview of the timeline and deadlines for actions and targets included in the NRR in regard to riverine, coastal, and marine ecosystems. The timeline is matched with BSAP targets and deadlines post-2025, except for key actions occurring earlier.

NRR TIMELINE		
Deadline	**Event or Target**	**NRR ref.**
18th Aug. 2024	EU Nature Restoration Regulation came into effect.	
no date	**Species-specific habitat restoration**: member states (MS) to implement restoration measures for habitats of species in the NRR Annex 3* and Habitats and Birds Directives until sufficient quality and quantity of these habitats is reached.	Art. 4(7), p.21, Art. 5(5), p. 23
no date	**Monitoring area, condition and quality of habitats**: by MS (1) upon implementing restoration measures, and (2) in coordination with reporting cycles of Habitats Directive (next: 2025) and MSFD's initial assessment (2012). Repeats at least every six years and applies to habitats in NRR Annexes 1 and 2 and of species' in NRR Annex 3 and the Habitats and Birds directives.*	(1) Art. 20 (1.a, 2, 6), pp. 36, 37 (2) Art. 20 (1.h, 1.i, 6), pp. 36, 37
19th Feb., 2025	**Deterioration prevention at larger biogeographic scale:** MS to notify commission if applying this derogation (only outside of Natura 2000 sites). Start monitoring habitats within this area: sig. of deterioration and efficacy of measures (every 3 years).	Art. 4(13), p.22, Art. 20(1.j, 5, 6), p.37
1st Sep., 2026	**Draft National Restoration Plans** (NRP) need to be submitted by MS. Plans should cover up to 2050. Commission to submit assessment of NRP to MS within 6 months.	Art. 16, p. 34

MATCHING BSAP TARGETS		
Actions	**Year**	**BSAP ref.**
• **Salmon** management plans and **sea trout** stream restoration.	2025	S50, 51, p. 45
• **HELCOM MPAs** protecting threatened species and biotopes.	2030	B7, p. 15
Monitoring: regionally coordinated (every six years), and operationalising Baltic-wide monitoring of currently unmonitored biotopes and habitats.	2026, 2030	S38, p. 43; HT6, 8, 10 p. 52
Related to NRP preparation:		
• **Migratory fish restoration**: identify areas and measures for it.	2023	B16, p. 16
• **Benthic habitats restoration**: mapping lost / disturbed habitats, assessing status, identifying measures.	2023-2024	S67, 68, p. 47
• **HELCOM Action Plan for habitat and biotope restoration.**	2025	B27, p. 16
• **Key habitats mapping** of potential spatial distribution.	2025	B25, p. 16
• **Active & passive restoration scoping**: ID suitable measures & habitats / biotopes / ecosystems.	2025	B26, p. 16
• **Conservation measures' effectiveness**: assessment and developing tools therefore.	2025	B24, p. 16, B30, p. 17
• **Fish habitat restoration**: data recording / reporting to identify and implement measures for GES.	2025	S40, p. 44

NRR TIMELINE		
Date	**Event, Target, or Deadline**	**NRR ref.**
1st Sep., 2027	**Final NRP submission** (within 6 month of Commission's feedback)	Art. 17(6), p. 35
	Preventing significant habitat deterioration: MS to endeavour to have implemented measures aiming to prevent significant deterioration in NRR's Annexes 1 and 2* habitats that are in good condition, or areas needed to meet overall targets.	Art. 4(12), p. 22, Art. 5(10), p.24
19th Feb., 2028	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 2028	**1st data reporting deadline** on restoration progress (every 3 yrs)	Art. 21(1), p. 38
2030	**Effective and area-based restoration**: overarching NRR target for measures to cover at least 20% of land and 20% of sea areas.	Art. 1(2), p. 18
	Restoration measures for habitats 'not in good condition': should cover 30% of total area of habitats in NRR Annexes 1 and 2* (specifically marine habitats 1-6). MS to implement these. Notably: from 2030, terrestrial, coastal, and freshwater Natura 2000 are no longer priority sites.	Art. 4(1 & 1.a), 5(1.a), p. 20, 21, 23
	Reaching favourable habitat reference areas: restoration measures by MS should cover 30% of the total additional surface area needed per overarching habitat group (Annex 1 and 2 habitats* (only marine habitats 1-6)) to reach this target.	Art. 4(4), 5(2), p. 21, 23

MATCHING BSAP TARGETS		
Actions	**year**	**BSAP ref.**
Specific protection by HELCOM MPAs for regionally / near threatened biotopes.	2030	B7, p. 15
Contributions to passive restoration:		
• **Underwater noise** (impulsive & ambient) through Regional Action Plan on Underwater Noise.	2025-2029	S55-58, 60, 62, p. 46
• **MPA and conservation plan effectiveness** through MPA management guidelines & plans being legally binding and enforced.	2025-2028	B3, 4, 23, 29, pp. 14, 16, 17 & S64, p. 47
• **Reducing eutrophication, emissions and air pollution.**	2027-2028	E13,14 & S24, pp. 24, 43
• **Sustainable boat / shipping** practices (incentives to use port facilities, grey water assessment).	2025, 27-29	S12, 14, 15, 17, 18, p. 42
• **Minimal seabed disturbance.**	2026	S65, p. 47
• **Coastal fish** restoration actions.	2026	S53, p. 45
• **Incentive correction** (more beneficial and less harmful ones).	2025, 2030	HT21, 22, p. 54
• **Reduced introduction of invasive spp.**	2026	S10, p. 42
• **Reducing pollution** (marine litter, biofouling, mercury, PFAs, chlorinated paraffins, offshore platforms)	2025-2028	HL12, 19-21, 29-32 & HT23-25, & S1, 10, 16, 22, pp. 34, 35, 41-43, 55

NRR TIMELINE		
Date	**Event, Target, or Deadline**	**NRR ref.**
2030 cont.	**Habitat condition to be known** by MS for at least 90 and 50% of total area of Annex 1 and 2* (1-6) habitats, respectively.	Art. 4(9), 5(7.a), p. 22, 24
	Source-to-sea restoration through agricultural targets, MS to have implemented: • Measures to increase the grassland butterfly index, stock of organic carbon (OC) in cropland mineral soils, and agricultural land with high diversity landscape features. • Measures aiming for a 5 and 10% increase in common farmland bird index from 1st Sep. 2025, for MS historically less and more depleted in farmland birds respectively **. • Measures aiming to restore organic soils in 30% of agricultural land constituting drained peatlands (with 1/4th to be rewetted).	Art. 11(2, 3, 4), p. 27, 28
	EU Biodiversity Strategy for 2030 targets: • **30x30** with 10% under strict protection, and no deterioration in conservation trend of species' / habitat's status, • improve 30% of species / habitats not in favourable status, • **25 000 km of free-flowing rivers**.	Preamble (10, 11, 50), p. 2, 9. Art. 9(1), p.26
	European Climate Law target: net greenhouse gas emissions reduced by at least 55% compared to 1990 levels.	Preamble (19), p. 4
19th Feb., 2031	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 2031	**1st comprehensive progress report** from MS toward targets and NRR implementation (every 6 yrs).	Art. 21 (2), p. 38
	MS data reporting deadline (2nd) (every 3 yrs).	Art. 21(1), p. 38
30th Jun., 2032	**1st MS review and revision of NRP** (every 10 yrs).	Art. 19 (1), p. 36
19th Feb., 2034	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 2034	**MS data reporting** deadline (3rd) (every 3 yrs).	Art. 21 (1), p. 38
2036	**Source-to-sea restoration through agricultural targets:** MS to have implemented measures aiming to increase 2/3 indicators: the butterfly index, OC in soils, high diversity features.	Art. 11(2), p. 27

MATCHING BSAP TARGETS		
Actions	**year**	**BSAP ref.**
• **Mapping habitats**, to produce Baltic-wide models and maps • **Holistic ecosystem assessment**: development and utilisation of indicators	2028 2030	HT9, p. 52 B33, 34, p. 17
• **Organic farming** on 25% of agricultural land. • **Reduce ammonia and greenhouse gas emissions** from livestock: recommendations. • **Reduce phosphorus leaching** from clay soils by implementing best practices.	2030 2025 2027-2028	E9, p. 24 E13, 14, p.24 E8, p. 24
• **HELCOM MPAs cover 30% of Baltic Sea**, with 1/3 under strict protection. • **River dam and barrier removal.**	2030 2023	B1, p. 14 B16, p. 16

NRR TIMELINE		
Date	**Event, Target, or Deadline**	**NRR ref.**
19th Feb., 2037	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 3037	**MS data and progress reporting** deadline (4th data deadline and 2nd progress report on targets and NRR implementation).	Article 21 (1, 2), p. 38
2040	**Restoration measures on habitats 'not in good condition'**: MS to have implemented measures on 60% of area per habitat type in NRR Annex I and II (excl. group 7)*. For marine habitat 7: on 2/3 of 2050 target percentage (set in NRP).	Art. 4(1.b), 5(1.b-d), p. 20, 23
	Reaching favourable habitat reference areas: MS to have implemented measures on 60% of the area that is needed.	Art. 4(4), 5(2), p. 21, 23
	Habitat condition to be known for all areas of Annex 1 and 2 habitats (marine 1-6). Annex 2, group 7 (soft sediments): condition to be known for 50% of area.	Art. 4(9), 5(7.b, c), p. 22, 24
	Source-to-sea restoration through agricultural targets • Measures implemented by MS that aim for a 10 and 20% increase in common farmland bird index from 2025, for MS historically less / more depleted, respectively **. • Measures aiming to restore organic soils in 40% of agricultural land constituting drained peatlands (with 1/3rd to be rewetted).	Art. 11(3, 4), p. 27, 28
19th Feb., 2040	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 2040	**MS data reporting** deadline (5th) (every 3 yrs).	Art. 21 (1), p. 38
30th Jun., 2042	**MS review and revision of NRP** (2nd) (every 10 yrs).	Art. 19(1), p. 35
2042	**Source-to-sea restoration through agricultural targets** MS to have implemented measures aiming to increase 2/3 indicators: the butterfly index, OC in soils, high diversity features.	Art. 11(2), p. 27
19th Feb., 2043	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 2043	**MS data and progress reporting** deadline (6th data deadline and 3rd progress report on targets and NRR implementation).	Art. 21 (1,2), p. 38
19th Feb., 2046	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 2046	**MS data reporting** deadline (7th) (every 3 yrs).	Art. 21 (1), p. 38

MATCHING BSAP TARGETS		
Actions	**year**	**BSAP ref.**

NRR TIMELINE		
Date	**Event, Target, or Deadline**	**NRR ref.**
2048	**Source-to-sea restoration through agricultural targets** MS to have implemented measures aiming to increase 2/3 indicators: the butterfly index, OC in soils, high diversity features.	Art. 11(2), p. 27
19th Feb., 2049	**Monitoring of habitats** that have significantly deteriorated or are subject to compensatory measures	Art. 20(1.j, 5, 6), p.37
30th Jun., 2049	**MS data and progress reporting** deadline (8th data deadline and 4th progress report on targets and NRR implementation).	Art. 21 (1, 2), p. 38
2050	**Effective and area-based restoration**: on all land and sea areas	Art. 1(2), p. 18
	Restoration measures on habitats 'not in good condition': MS' restoration measures cover 90% of habitat area per habitat type in Annex I and II (excl. group 7). For marine habitat 7: 100% of 2050 target percentage (set in NRP).	Art. 4(1.b), 5(1.b-d), p. 20, 23
	Reaching favourable habitat reference areas: MS to have implemented measures covering 100% of area needed.	Art. 4(4), 5(2), p. 21, 23
	Habitat condition to be known for total area of marine habitat 7.	Art. 5(7.d), p. 24
After 2050	Activities presumed to continue past 2050 as no deadline is specified. Notably, NRPs only cover until 2050. **Monitoring** (every 3-6 yrs), **Reporting** (every 3-6 yrs), **NRP revision** (every 10 yrs), and **improvement of agricultural indicators** (butterfly index, OC, diversity features).	Art. 11(2), 15(1), 19(1), p. 27, 32, 39

MATCHING BSAP TARGETS		
Actions	**year**	**BSAP ref.**
Monitoring of the environment and habitats to continue, every six years.		S38, p. 43; HT6, 8, 10 p. 52

* NRR Annex 1: terrestrial, coastal, and freshwater habitats, Annex 2: 7 marine habitats, Annex 3: specific marine species for which habitats should be restored.
** MS historically more depleted in farmland birds: Czechia, Denmark, Germany, Estonia, and Finland. MS historically less depleted: Latvia, Lithuania, Poland, Slovakia, Sweden

APPENDIX III

NRR habitats and species in the Baltic Sea catchment area

Table 3.1. Riverine and coastal habitats in NRR Annex I that, according to the EUNIS and Biodiversity Information System for Europe (BISE) platforms, are found in the Baltic Sea Catchment Area's EU Member States. Habitats with only a few occurrences on coastal areas were also included.

Code (from Annex 1 of Directive 92/43/EEC)	Habitat type
Coastal and salt habitat (part of group 1: coastal & inland wetlands)	
1130	Estuaries
1140	Mudflats and sandflats not covered by seawater at low tide
1150	Coastal lagoons
1310	*Salicornia* and other annuals colonizing mud and sand
1320	Spartina swards (*Spartinion maritimae*)
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
1650	Boreal Baltic narrow inlets
Wet heaths and peat grassland (part of group 1: coastal & inland wetlands)	
4010	Northern Atlantic wet heaths with *Erica tetralix*
Mires, bogs, and fens (part of group 1: coastal & inland wetlands)	
7110	Active raised bogs
7140	Transition mires and quaking bogs
7230	Alkaline fens
7150	Depressions on peat substrates of the *Rhynchosporion*
Coastal and dune habitats (part of group 2: Grasslands and other pastoral habitats)	
1630	Boreal Baltic coastal meadows
Rivers and lakes (part of group 3: River, lake, alluvial and riparian habitats)	
3210	Fennoscandian natural rivers
3220	Alpine rivers and the herbaceous vegetation along their banks
3230	Alpine rivers and their ligneous vegetation with *Myricaria germanica*
3240	Alpine rivers and their ligneous vegetation with *Salix elaeagnos*
3260	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
3270	Rivers with muddy banks with *Chenopodion rubric* p.p. and *Bidention p.p* vegetation
Alluvial meadows (part of group 3: River, lake, alluvial and riparian habitats)	
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
6440	Alluvial meadows of river valleys of the *Cnidion dubii*
6450	Northern boreal alluvial meadows
Alluvial / Riparian forests (part of group 3: River, lake, alluvial and riparian habitats)	
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli*
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
91F0	Riparian mixed forests of *Quercus robur, Ulmus laevis, Ulmus minor, Fraxinus excelsior, Fraxinus angustifolia,* along the great rivers (Ulmenion minoris)
Sea cliffs, beaches, and islets (part of group 6: Rocky and dune habitats)	
1210	Annual vegetation of drift lines
1220	Perennial vegetation of stony banks
1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts
1610	Baltic esker islands with sandy, rocky, and shingle beach vegetation and sublittoral vegetation
1620	Boreal Baltic islets and small islands
1640	Boreal Baltic sandy beaches with perennial vegetation
Coastal and inland dunes (part of group 6: Rocky and dune habitats)	
2110	Embryonic shifting dunes
2120	Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")

2140	Decalcified fixed dunes with *Empetrum nigrum*
2150	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
2160	Dunes with *Hippophaë rhamnoides*
2170	Dunes with *Salix repens* ssp. *Argentea (Salicion arenariae)*
2180	Wooded dunes of the Atlantic, Continental and Boreal region
2190	Humid dune slacks
2250	Coastal dunes with *Juniperus* spp.
2310	Dry sand heaths with *Calluna* and *Genista*
2320	Dry sand heaths with *Calluna* and *Empetrum nigrum*
Rocky habitats (part of group 6: Rocky and dune habitats)	
8210	Calcareous rocky slopes with chasmophytic vegetation
8230	Siliceous rock with pioneer vegetation of the *Sedo-Scleranthion* or of the *Sedo albi-Veronicion dillenii*
8310	Caves not open to the public

Table 3.2. Marine ecosystems listed in the NRR's Annex II as Baltic Sea habitats.

EUNIS code (in brackets: corresponding code in Annex 1 of Directive 92/43/EEC)	**Habitat type**
Group 1: Seagrass beds	
MA332 (1130, 1160, 1610, 1620)	Baltic hydrolittoral coarse sediment characterised by submerged vegetation
MA432 (1130, 1140, 1160, 1610)	Baltic hydrolittoral mixed sediment characterised by submerged vegetation
MA532 (1130, 1140, 1160, 1610)	Baltic hydrolittoral sand characterised by submerged rooted plants
MA632 (1130, 1140, 1160, 1650)	Baltic hydrolittoral mud dominated by submerged rooted plants
MB332 (1110, 1160)	Baltic infralittoral coarse sediment characterised by submerged rooted plants
MB432 (1110, 1160, 1650)	Baltic infralittoral mixed sediment characterised by submerged rooted plants
MB532 (1110, 1130, 1150, 1160)	Baltic infralittoral sand characterised by submerged rooted plants
MB632 (1130, 1150, 1160, 1650)	Baltic infralittoral mud sediment characterised by submerged rooted plants
Group 2: Macroalgal forests	
MA131 (1160, 1170, 1130, 1610, 1620)	Baltic hydrolittoral rock and boulders characterised by perennial algae
MB131 (1170, 1160)	Perennial algae on Baltic infralittoral rock and boulders
MB232 (1160, 1110)	Baltic infralittoral bottoms characterised by shell gravel
MB333 (1110, 1160)	Baltic infralittoral coarse sediment characterised by perennial algae
MB433 (1110, 1130, 1160, 1170)	Baltic infralittoral mixed sediment characterised by perennial algae
Group 3: Shellfish beds	
MB231 (1170, 1160)	Baltic infralittoral bottoms dominated by epibenthic bivalves
MC231 (1170, 1160, 1110)	Baltic circalittoral bottoms dominated by epibenthic bivalves
MD231 (1170)	Baltic offshore circalittoral biogenic bottoms characterised by epibenthic bivalves
MD232 (1170)	Baltic offshore circalittoral shell gravel bottoms characterised by bivalves
MD431	Baltic offshore circalittoral mixed bottoms characterised by macroscopic epibenthic biotic structures
MD531	Baltic offshore circalittoral sand characterised by macroscopic epibenthic biotic structures
MD631	Baltic offshore circalittoral mud characterised by epibenthic bivalves
Group 5: Sponge, coral, coralligenous beds	
MB138 (1170, 1160)	Baltic infralittoral rock and boulders characterized by epibenthic sponges
MB43A (1160, 1170)	Baltic infralittoral mixed sediment characterized by epibenthic sponges (Porifera)

MC133 (1170, 1160)	Baltic circalittoral rock and boulders characterized by epibenthic cnidarians
MC136 (1170, 1160)	Baltic circalittoral rock and boulders characterized by epibenthic sponges
MC433 (1160, 1170)	Baltic circalittoral mixed sediment characterized by epibenthic cnidarians
MC436 (1160)	Baltic circalittoral mixed sediment characterized by epibenthic sponges
Group 7: Soft sediments (not deeper than 1000 m)	
MA33 (1130, 1160, 1610, 1620)	Baltic hydrolittoral coarse sediment
MA43 (1130, 1140, 1160, 1610)	Baltic hydrolittoral mixed sediment
MA53 (1130, 1140, 1160, 1610)	Baltic hydrolittoral sand
MA63 (1130, 1140, 1160, 1650)	Baltic hydrolittoral mud
MB33 (1110, 1150, 1160)	Baltic infralittoral coarse sediment
MB43 (1110, 1130, 1150, 1160, 1170, 1650)	Baltic infralittoral mixed sediment
MB53 (1110, 1130, 1150, 1160)	Baltic infralittoral sand
MB63 (1130, 1150, 1160, 1650)	Baltic infralittoral mud
MC33 (1110, 1160)	Baltic circalittoral coarse sediment
MC43 (1160, 1170)	Baltic circalittoral mixed sediment
MC53 (1110, 1160)	Baltic circalittoral sand
MC63 (1160, 1650)	Baltic circalittoral mud
MD33	Baltic offshore circalittoral coarse sediment
MD43	Baltic offshore circalittoral mixed sediment
MD53	Baltic offshore circalittoral sand
MD63	Baltic offshore circalittoral mud

*Habitats in groups 4 (maerl beds) and 6 (vents and seeps) of the NRR are not listed as Baltic Sea habitats.

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Coalition Clean Baltic

FOR PROTECTION OF THE BALTIC SEA ENVIRONMENT

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