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POSITION PAPER

Partnering for the Climate: cooperation between HELCOM and Baltic Earth as a key element in science-based regional climate policy[1]

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Abstract
The accelerating triple planetary crisis of climate change, biodiversity loss and pollution is heavily impacting the Baltic Sea. However, the region offers an encouraging example of successful science-policy cooperation in addressing climate change: Since 2018 the Helsinki Commission (HELCOM) and Baltic Earth have established a fruitful exchange underpinning informed, science-based decision-making within HELCOM, exemplified by the HELCOM-Baltic Earth Climate Change Fact Sheet, as well as the previous 2007 and 2013 HELCOM thematic assessments of climate change in the Baltic Sea Area, which were based on the BALTEX and Baltic Earth Assessments of Climate Change for the Baltic Sea Basin (BACC). As HELCOM implements its 2021 Baltic Sea Action Plan and starts looking beyond the Plan's 2030 target date, cooperation between the two organizations will remain a key element in regional efforts to address the impacts of a shifting climate.

Keywords
Baltic Earth; Baltic Sea; Climate change; HELCOM

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1. Introduction

In recent years, various media have taken to predicting a Mediterranean-like future for Europe's northern regional seas. Very similarly, in 2024, the Interreg Baltic Sea Programme promoted its BEACH-SOS project using the caption, "The Baltic: A New Mediterranean?" and going on to refer to the challenges and opportunities of "the Baltic's new Mediterranean identity" (Interreg Baltic Sea Region, 2024).

Notwithstanding the undeniable element of sensationalism to statements of this sort, they all contain the core message that climate change is having a significant impact on our region. A message that is borne out by scientific research. Climate change is happening here and now. As the IPCC notes, "It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred (...) Global surface temperature will continue to increase until at least mid-century under all emissions scenarios considered. Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO2 and other greenhouse gas emissions occur in the coming decades" (IPCC, 2021). And our region is perceptibly affected – more so, in fact, than the global average, as marginal seas are warming faster than the open ocean and the Baltic Sea is warming fatster than most. Despite differences between the Baltic and North Seas (cf. Meier et al., 2022, p. 1, pp. 538 *et. seq.*) both have experienced rapid warming in recent decades. A 2019 study demonstrated that, "The Baltic Sea showed the largest temperature change of 1.35 K since 1982, followed by the North Sea, with a change of 1.31 K. Both changes were more than 7 times larger than the global rate" (Kniebusch et al. 2019, p. 1.). This adds to the woes of the already struggling Baltic Sea. To quote the 2024

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HELCOM/Baltic Earth Climate Change Fact Sheet: "The Baltic Sea is facing a complex system of effects and feedbacks between climatic and non-climatic factors. Multiple environmental pressures affect the ecosystem, and climate change adds further cumulative pressures to the existing anthropogenic ones" (HELCOM/Baltic Earth, 2024, p. 6). Not surprisingly, therefore, climate change has long been on the agenda of the Baltic Marine Environment Protection Commission (Helsinki Commission, or HELCOM). And for many years, Baltic Earth has been the organization's trusted partner in addressing this challenge.

2. Material and methods

Based primarily on key HELCOM policy documents and publications, such as the 2007 and 2021 Baltic Sea Action Plans, recent HELCOM Ministerial Declarations, the 2021 and 2024 HELCOM Baltic Earth Climate Change Fact Sheet and the Terms of Reference (TOR) of the joint HELCOM/Baltic Earth Expert Network on Climate Change (ENClime), this piece describes the inception and gradual evolution of climate change policy in the framework of HELCOM and the key role of Baltic Earth and its predecessor, Baltic Sea Experiment (BALTEX), in providing the scientific underpinnings of that policy.

3. Results

HELCOM was established in 1974 and for roughly the first two decades of its existence, it did not concern itself with climate change. Nor, for that matter, did most of the rest of the world, though the phenomenon had long since been recognized. The 1990s, however, marked a turning point, as global warming climbed higher on the global policy agenda, the landmark United Nations Framework Convention on Climate Change (UNFCCC) entered into force in 1994 and the Kyoto Protocol was signed three years later.

Meanwhile, the topic was also gaining traction in the Baltic Sea region. In 1992 the BALTEX network, the precursor to today's Baltic Earth, was established. Launched in 1992 as a Continental-scale Experiment (CSE) of the Global Energy and Water Cycle Experiment (GEWEX) in the framework of the World Climate Research Program (WCRP), BALTEX was "an environmental research network dealing with the Earth system of the entire Baltic Sea drainage basin. Important elements include the water and energy cycle, climate variability and change, water management and extreme events, and related impacts on biogeochemical cycles. (…) Phase I (1993–2002) was primarily dedicated to hydrological, meteorological and oceanographic processes in the Baltic Sea drainage basin, hence mostly dealt with the physical aspects of the system. Scientific focus was on the hydrological cycle and the exchange of energy between the atmosphere, the Baltic Sea and the surface of its catchment. The BALTEX study area was hydrologically defined as the Baltic Sea drainage basin. The second 10 yr phase of BALTEX (Phase II: 2003–12) has strengthened regional climate research, water management issues, biogeochemical cycles and overarching efforts to reach out to stakeholders and decision makers, as well as to foster communication and education" (Reckermann et al., 2011, p. 1; for a detailed overview of the project and key results cf.; Raschke et al., 2001).

The program undertook foundational research, on which HELCOM drew to inform its assessments and policies. To name two examples: The 2007 and 2013 HELCOM thematic assessments of climate change in the Baltic Sea Area, both published in the Baltic Sea Environment Proceedings (BSEP) series (HELCOM, 2007, 2013b), were based on the BALTEX and Baltic Earth Assessments of Climate Change for the Baltic Sea Basin (BACC) (cf. BACC, 2008, 2015).

However, while HELCOM recognized climate change as a significant pressure affecting the Baltic Sea, it was rather slow to systematically integrate it in all policy areas, as reflected by the 2007 Baltic Sea Action Plan (BSAP), which merely acknowledged that "…climate change will have a significant impact on the Baltic Sea ecosystem requiring even more stringent actions in the future…" (HELCOM, 2007a, p. 3).

In the Twenty-Teens, however, things accelerated. The decade that has otherwise been described as "the most sort-of decade of all times" (Sheffield, 2019) was decisive for HELCOM insofar as climate change increasingly began to move to the fore within the organization. This evolution is reflected in the three HELCOM Ministerial Declarations adopted between 2010 and 2019.

The 2010 Moscow Declaration merely "acknowledged" the 2009 UNFCCC Copenhagen Accord (HELCOM, 2010) and agreed "on the need for supplementary actions; and specifically taking into account that climate change may have profound consequences both for the environmental status of the Baltic Sea as well as for the scope of the measures adopted by the Contracting Parties until now (…) to further assess in cooperation with the BALTEX community, the current and predicted effects of climate change on the pressures affecting the marine ecosystem" (HELCOM, 2010).

Three years later, in Copenhagen, the HELCOM ministers declared their awareness "that climate change already has an impact on ecosystems and exacerbates pressures on the marine and coastal environment" (HELCOM, 2013, paragraph 6) and agreed "to make the assessment of regional climate change and its implications on the Baltic Sea ecosystem a regular activity, collaborating with Baltic Earth (BALTEX) in this respect, with the aim to make it an indicator-based assessment" (ibid., paragraph 1 (K), lit. f).

It was the 2018 Brussels Ministerial Declaration, however, that took the greatest leap forward. The Ministers now noted "with great concern the impacts of climate

change and future ocean acidification on the marine environment of the Baltic Sea," stating, moreover, "that these impacts compound existing pressures on marine ecosystems and thus make the need to reduce these pressures even more important, also so as not to further impair the ability of the seas and oceans to act as climate regulator" (HELCOM 2018a, paragraph 4). Furthermore, with a nod to UNFCCC and the global framework it established, they welcomed "the increasing recognition of the link between oceans and climate" (ibid., paragraph 5). Perhaps more significantly yet, the Brussels Ministerial Declaration devoted an operative segment of its own to climate change, which contained the following call to action: "WE STRESS the need for research and adaptive management to strengthen the resilience of the Baltic Sea in the face of climate change impacts. WE AGREE to increase HELCOM's preparedness to respond to climate change impacts, by taking foreseen climate change impacts into account when updating the BSAP and by exploring the needs and possibilities to further adapt HELCOM's policies and recommendations 1) in line with existing objectives of protection of the marine environment and sustainable use of marine resources, also under the changing climate, and 2) to maximise the capacity of the Baltic Sea ecosystem to contribute to mitigation of climate change through blue carbon storage; WE EMPHASIZE the need to further strengthen the scientific understanding of the impacts of climate change together with multiple other stressors on the Baltic Sea marine environment, and AGREE that HELCOM should take action to bridge this knowledge to policy and practice" (ibid., paragraphs 47 and 48).

Climate change had found its permanent place on the HELCOM agenda. And the call to action was indeed followed by action. Already since the middle of the past decade, global warming had become increasingly integrated into HELCOM assessments and climate drivers had begun to be considered more systematically in the organization's thematic assessments and the work of its Expert Groups. Meanwhile, in 2013, BALTEX had been succeeded by Baltic Earth, which continued but also broadened the work of its predecessor organization. As noted by Meier et. al., Baltic Earth is "an expanded program with a revised focus on Earth system science (…). Baltic Earth has been given a head start by inheriting the BALTEX network of people and institutions; its infrastructure, including the BALTEX secretariat, conferences, workshops, and publication series; and its scientific legacy (Reckermann et al., 2011, and references therein). Like its progenitor, Baltic Earth aims to contribute to the understanding of regional energy, water, and matter fluxes and their effects on the regional climate. Thus, the vision of Baltic Earth is to achieve an improved Earth system understanding of the Baltic Sea region, with a more holistic view that encompasses processes in the atmosphere, land, sea, and anthroposphere" (Meier et al., 2014, p. 109).

Moreover, in 2017 Baltic Earth adopted a Science Plan, highlighting this improved understanding as "the basis for science-based management in the face of climate, environmental and human impact in the region." The Plan also identified six so-called "Grand Challenges," related to "the atmosphere, land and marine environment of the Balic Sea, its drainage basin and nearby areas with relevance for the Baltic Sea region" and to be "tackled through joint research efforts, workshops, conferences and capacity building events accompanied by a continuous process of synthesis of the current state of knowledge" (Baltic Earth, 2017, p. 3).

This confluence of interests between Baltic Earth and HELCOM was serendipitous. And following the 2018 Brussels Ministerial Meeting the two organizations moved from serendipity to synergy as they established a joint Expert Network on Climate Change, referred to in HELCOM terminology as EN Clime. Originally reporting to the now defunct HELCOM State and Conservation Working Group, EN Clime today falls under the remit of the Working Group for the Implementation of the Ecosystem Approach (WG GEAR).

As per its TOR, updated in 2025 (HELCOM, 2018b, 2025), the network is co-chaired by representatives of HELCOM and Baltic Earth and composed of delegates from the HELCOM Contracting Parties and experts representing Baltic Earth. It is open to observers according to HELCOM procedures and additional experts can also be invited as guests on a case-by-case basis. It currently brings together over 100 experts from around the Baltic Sea region. An excellent example of how HELCOM works at the science-policy interface and seeks to ensure the requisite flow of information between scientists and policy makers, EN Clime was established to serve "as a coordinating framework and a platform to harness the expertise of leading scientists on both direct and indirect effects of climate change on the Baltic Sea environment, and to make this expertise available to, and open for closer dialogue with, policy makers." In doing so, the Network "is to facilitate the regional cooperation in relation to climate change and its impacts, including transferring quality assured science to end users, and to provide clear guidance on the level of confidence in information which is presented." Moreover, it should "support the identification of knowledge gaps and identification of possible future research priorities. The main goal is to condense the large body of scientific research into a form that is directly utilizable in developing HELCOM core indicators, updating and implementing the BSAP, and in preparation of future HELCOM Assessments on climate change" (HELCOM, 2025; note: the wording of the 2018 and 2025 TOR is largely identical, with the scope broadened in 2025 to also cover the 2021 BSAP).

The Network wasted no time in getting to work. In September 2021, less than three years after its establishment, the HELCOM-Baltic Earth "Climate Change in the

Baltic Sea. 2021 Fact Sheet" was published (HELCOM/Baltic Earth, 2021), drawing on the BACC and the subsequent Baltic Earth Assessment Reports (BEAR) (cf. Meier et al., 2022, pp. 520 *et seq.*). Far from being a mere sheet, it was an 86-page publication aimed at policy makers as well as the general public. Based on 34 parameters and including confidence levels for its findings, it was intended to summarize the latest state of knowledge on climate change and its effects on the Baltic Sea, as well as outline possible future developments.

The Fact Sheet is one of HELCOM's flagship publications, designed explicitly to be policy relevant and, importantly, to retain its relevance, as a living document subjected to periodic updates. A second edition, using 38 parameters, was published in 2024 (HELCOM/Baltic Earth, 2024). It presents the latest knowledge on topics such as the impact of climate change on the Baltic Sea's carbon uptake and storage potential, acidification, marine and coastal ecosystem services, algal blooms, biofouling and marine litter, thereby testifying not only to the climate-ocean nexus but also the multiple interlinkages between the three elements of the triple planetary crisis of climate change, biodiversity loss and pollution. A further update of the Fact Sheet is planned and due to be published by the end of this decade. The publication of the second update is timed to be able to take into account the scientific reports of the projected BEAR II series of assessment reports.

These periodic updates of the Fact Sheet are not random but called for by another key HELCOM document, indeed, the organization's central policy document: the 2021 Baltic Sea Action Plan (2021 BSAP), adopted by the 2021 HELCOM Ministerial Meeting in Lübeck, Germany (HELCOM, 2021). This plan too, is reflective of HELCOM's increased focus on climate change. Whereas its 2007 predecessor had contained little more than an acknowledgment of global warming as a pressure affecting the Baltic Sea, the 2021 BSAP states, "Climate change is … a horizontal issue affecting the entire Baltic Sea region. With the entire marine environment affected by climate change, its effects are already evident in the Baltic Sea … Policies on climate change and its effects on the marine environment need to consider the dissimilarities in the Baltic Sea region and follow an adaptive management approach based on the best available science … With respect to climate change, the ultimate aim of HELCOM is to increase the resilience of the ecosystem of the Baltic Sea to its impacts. All measures that lead to a stronger Baltic marine ecosystem should therefore also be regarded as climate adaptation measures" (HELCOM, 2021, pp. 50, 51).

Accordingly, climate change is contained in the Horizontal Topics segment of the 2021 BSAP, which is dedicated to issues that are "by their nature cross-cutting, or 'horizontal,' thus potentially affecting the implementation of all elements of the … BSAP as a whole" (ibid., p. 50). Heading this segment are five BSAP actions (Actions HT 1–5) specifically dedicated to the subject of climate change. These actions are related to: periodic updates of the Climate Change Fact Sheet and committed implementation of the HELCOM Science Agenda with a view to improving the access of policy makers to relevant scientific information, as well as the incorporation of the possible effect of climate change into HOLAS by 2030 (HT 1); further adapting HELCOM policies and recommendations to account for effects and impacts of climate change and initiating a climate change policy review process (HT 2); practical measures to minimize the carbon footprint of HELCOM as an organization (HT 3); increasing the understanding of the role of the Baltic Sea land-sea system in the carbon cycle and identifying and implementing measures aimed at climate change mitigation by natural blue carbon processes (HT 4); developing first steps towards a strategic approach to ocean acidification for the Baltic Sea by 2025 (HT 5). Clearly, with the exception of HT 3, these actions are aimed at promoting relevant research, closing the science-policy gap and mainstreaming climate change and related issues into HELCOM policies across all thematic areas. While Baltic Earth is explicitly referenced in Action HT 1 on periodic updates of the Climate Change Fact Sheet, the TOR of EN Clime underscore the Expert Network's role in the delivery of Actions HT2, HT4, and HT5 (HELCOM, 2025). It is worthy of mention that one of the objectives listed in Action HT 1, the incorporation of the possible effects of climate change into the HELCOM holistic assessments of the status of the Baltic Sea (HOLAS), was already achieved in the third and most recent such assessment. HOLAS 3 was published in 2023 and was the first such assessment to analyze the links between climate change, eutrophication, biodiversity loss and pollution. This approach is also being followed for the ongoing fourth Holistic Assessment, which is due to be published by 2029.

Progress is therefore being made in implementing the evolving HELCOM climate change agenda, which the 2021 BSAP summarizes as follows: "With regard to climate change, the ultimate aim of HELCOM is to increase the resilience of the ecosystem of the Baltic Sea to its impacts. All measures that lead to a stronger Baltic marine ecosystem resilience should therefore also be regarded as climate adaptation measures. In order to support adaptive management, climate change work within HELCOM will focus on long-term, multi-disciplinary approaches" (HELCOM, 2021, p. 51).

With global warming here to stay and likely to accelerate, exacerbating existing challenges while triggering new ones – some of which we are as yet unaware of – Baltic Sea science and science-policy cooperation will indeed need to continually evolve to identify and address nascent issues. The climate change segment of the updated HELCOM Science Agenda, projected to be adopted at the HELCOM Ministerial Meeting in Warsaw, Poland in Novem-

ber of this year, is intended to further contribute towards achieving this by highlighting emerging related science needs.

Fulfilling those needs may pose increasing challenges against a background of growing budgetary constraints. However, the costs of inaction should not be underestimated. These are often difficult to quantify, as noted by the European Environment Agency (EEA): "The costs of preventive actions are usually tangible, clearly allocated and often short term, whereas the costs of failing to act are less tangible, less clearly distributed and usually longer term, posing particular problems of governance. Weighing up the overall pros and cons of action, or inaction, is therefore very difficult…" (EEA, 2001, pp. 3–4). It seems clear, however, that in the Baltic Sea region as elsewhere "The longer we delay meeting total climate investment needs, the higher the costs will be, both to mitigate global temperature rise and to deal with its impacts. Although annual climate investment needs are large, the amount required is a fraction of the estimated losses likely to be incurred if we continue with business-as-usual (BAU) investments that cause global temperature increases well above 1.5°C" (CPI, 2023, p. 4). Regarding the overall cost of environmental degradation for the Baltic Sea region, HOLAS 3 has yielded the estimate that achieving good environmental status in national marine waters by 2040 is worth 5.6 billion euros per year to Baltic Sea region societies (HELCOM, 2023, p. 7). HOLAS 3 also notes that the pressures on the Baltic Sea environment, and hence the need for stronger measures, are accentuated by climate change (ibid., p. 8).

Finally, it should be noted that the consequences of climate change, as well as other elements of the triple planetary crisis, transcend the purely environmental domain. As the world pivots towards increasing geopolitical instability, the security implications of climate change – long recognized by the security and defense community, as evidenced for instance by NATO's 2021 Climate and Security Action Plan (NATO, 2021) or the recent report "The Effects of Climate Change on Security", published by the NATO Science & Technology Organization (NATO, 2026), or indeed, the American security establishment (cf. White House, 2015) – will become more evident and pressing. So too will the related issue of energy security, which – certainly in our region – will require enhanced energy efficiency as well as increasingly resorting to renewable, locally generated energy, both of which in turn will be beneficial and, indeed, essential in addressing climate change. The linkages in this context have been aptly and succinctly summed up as follows: "Energy in the BSR (Baltic Sea Region) has never been just a question of access or efficiency. It is a field of power: a domain in which sovereignty, resilience and vulnerability are continuously reshaped. As the region hastens its transition towards renewables, the challenge will not only be technical or economic, but geopolitical" (Slakaityte and Surwillo, 2025, p. 195).

Table 1. Milestones in Baltic Sea regional climate policy and HELCOM-BALTEX/Baltic Earth science policy cooperation.

HELCOM	BALTEX/Baltic Earth
1974: HELCOM established	
1992: Helsinki Convention revised (in force since 2000)	1992: BALTEX established
	1993–2002: BALTEX Phase I
	2003–2012: BALTEX Phase II
	2004–2008: BALTEX Assessment of Climate Change for the Baltic Sea Basin (BACC) carried out
2007: HELCOM Thematic Assessment of Climate change in the Baltic Sea Area	
2007: HELCOM Baltic Sea Action Plan (BSAP)	
	2008: BALTEX Assessment of Climate Change for the Baltic Sea Basin (BACC) published
2010: HELCOM Moscow Ministerial Declaration	2010–2013: Second BALTEX Assessment of Climate Change for the Baltic Sea Basin (BACC II) carried out
2013: HELCOM Thematic Assessment of Climate Change in the Baltic Sea Area	2013: Baltic Earth established
2013: HELCOM Copenhagen Ministerial Declaration	
	2015: Second BALTEX Assessment of Climate Change for the Baltic Sea Basin (BACC II) published
First version of the HOLAS II State of the Baltic Sea report published in 2017, updated report published in 2018	2017: Baltic Earth Science Plan adopted
2018: Joint HELCOM Baltic Earth Expert Network on Climate Change (EN Clime) established	
2019–2022: Baltic Earth Assessment Reports (BEARs) published	
2021: HELCOM/Baltic Earth Climate Change Fact sheet published	
2021: Updated HELCOM Baltic Sea Action Plan (2021 BSAP) adopted	
2023: HOLAS 3 State of the Baltic Sea report published	
2024: Updated HELCOM/Baltic Earth Fact sheet published	

4. Conclusion

While HELCOM was somewhat slow to adopt climate change as an established element of its agenda, the issue is now firmly embedded in the organization's work as a cross-cutting ('horizontal') topic, systematically integrated into all HELCOM policy areas. Since the outset, BALTEX and Baltic Earth have played a key role in grounding the organization's climate change policies in science (Table 1).

The 2021 BSAP charts HELCOM's course through to the end of this decade, and also largely defines the organization's climate change agenda during that period. This is reflected in the current and upcoming work of EN Clime, which is faced with an impressive array of tasks related largely, though not solely to the relevant BSAP Actions. In addition to elaborating a further update of the Climate Change Factsheet and developing key messages on emerging climate parameters, this includes working to close knowledge gaps, preparing a stocktake of ocean acidification with a view to enabling the development of a strategic approach to this issue, and exploring enhanced cooperation with other relevant organizations, notably the OSPAR Commission.

As global warming continues to unfold and accelerate, hitting the Baltic Sea region harder than the global average, climate change and its corollaries will remain on the HELCOM agenda well beyond 2030. Against a background of global polycrisis, science-policy cooperation as the foundation of informed, science-based policy making will be at once more challenging and more crucial than ever. The unique, tried and tested science-policy link afforded by the close partnership between HELCOM and the Baltic Earth expert network will continue to ensure such cooperation in the Baltic Sea region.

Conflict of interest

None declared.

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