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Marine Geoengineering to Abate Eutrophication in the Baltic Sea

How to Address Regulatory Voids and Uncertainty

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8.1 INTRODUCTION

Sea-based measures represent a new way of dealing with eutrophication in the Baltic Sea. In brief, they refer to different technological innovations that could be implemented at sea to target pollution that has already been released, in contrast to reducing discharges from the original source on land. These measures are not directly subject to any specific regulation. It is therefore interesting to study what rules apply for such activities but also to explore more generally how marine environmental law operates in the absence of specific rules, and how environmental principles manage to fill those gaps. The topic thus serves as a case study on how the rule of law functions in the absence of specific legal rules and how environmental principles may serve to fill such gaps. Moreover, sea-based measures raise interesting issues linked to the balancing of interests, as the arguments both against and in favour of the measures are based on environmental protection, and as their environmental impact is uncertain. Eutrophication is the main environmental problem in the Baltic Sea. This is the result of excessive inputs of nutrients, mainly phosphorus and nitrogen, from a variety of sources, including industry, agriculture and wastewater. These nutrients stimulate growth of aquatic plant life. Yet, overgrowth of plants and algae blocks sunlight and, in the degradation phase, consumes oxygen from the sea, thereby contributing to a state of hypoxia. This lack of oxygen at the bottom of the sea, in turn, initiates a chemical process whereby phosphorus (from historical excess inputs) tied to the seabed sediments is released, thereby causing another source of nutrients in the sea.[1]

Over recent decades a broad range of initiatives have been taken to mitigate eutrophication in the Baltic Sea. As many steps have already been taken to reduce

[1] See, e.g., Vahanen Environment Oy and Centrum Balticum, *Speeding up the Ecological Recovery of the Baltic Sea* (Report for Ministry of the Environment of Finland, Helsinki, 2018) 29–31, https://vahanen.com/app/uploads/2018/05/Speeding_up_the_ecological_recovery_of_the_ Baltic_Sea.pdf

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nutrient input into the sea through land-based measures, attention is increasingly turning to new forms of reduction measures, including sea-based measures to target phosphorus leakage from the seabed. The sea-based measures that are currently envisaged for the Baltic Sea can be broadly grouped into three main categories: (1) those focusing on removal of the phosphorus-rich parts of sediments (through dredging or 'skimming'), (2) those influencing the chemical composition of sediments through treating the seabed with chemicals and (3) those seeking to improve oxygen levels in the seabed through different forms of oxygenation (notably by pumping oxygen-rich surface water down to the bottom). For reasons of convenience the three categories are generally referred to as 'dredging', 'chemical treatment' and 'oxygenation'.

All sea-based measures include some environmental risks, albeit that the nature and magnitude of the risk varies between techniques.[2] For all three main groups of techniques, the longer-term risks and effects on the marine ecosystem are significantly under-studied, in particular with respect to larger-scale and off-shore operations. Establishing the polluting impact of sea-based measures is therefore coupled with serious challenges from a scientific perspective, which also affects their legal status, for example, as to whether the measures themselves qualify as 'pollution'. At the same time, the whole idea behind sea-based measures is to function as a potentially important cure for the eutrophication problem of the Baltic Sea.

Based on this concrete example, this chapter explores how environmental law (Section 8.2) and environmental principles (Section 8.3) apply to and operate in the absence of specific regulation of a given activity, and where a high degree of uncertainty exists about the effects of the activity. The chapter ends with some concluding thoughts on the format of potential future regulation of marine geoengineering measures in the Baltic Sea (Section 8.4).

8.2 RULES APPLICABLE TO SEA-BASED OR GEOENGINEERING MEASURES?

8.2.1 *The International Legal Framework*

At the time of writing, there are no rules specifically regulating sea-based measures, at any regulatory level (global, regional, EU or national regulation). This section very briefly summarizes some of the key rules in this respect and how they relate to the three categories of sea-based measures.[3]

[2] See e.g., ibid.

[3] The review here is by no means exhaustive. For more details, see e.g., H. Ringbom, B. Bohman and S. Ilvessalo, 'Combatting Eutrophication in the Baltic Sea: Legal Aspects of Sea-Based Engineering Measures', *Legal Perspectives, The Law of the Sea*, Issue 2.4, 2019, 1–96.

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Being the global 'constitution for the oceans', covering all usages of the sea, the United Nations Convention on the Law of the Sea (UNCLOS)[4] is the obvious starting point for any legal inquiry into maritime activities. In the Baltic Sea, maritime delimitation as provided by UNCLOS is nearly complete, that is, apart from a few minor exceptions, the maritime borders are settled between the littoral countries. In terms of jurisdiction, the entire sea is covered by coastal zones (internal waters, territorial seas and exclusive economic zones) of the coastal States, as far as environmental protection is concerned.[5]

UNCLOS Part XII includes obligations for States to protect and preserve the marine environment.[6] Notably, all States have an obligation inter alia to protect the marine environment and must not cause damage by pollution. Furthermore, States individually or jointly are to prevent, reduce and control pollution of the marine environment from any source.[7]

'Pollution of the marine environment' is broadly defined to include 'the introduction by man of substance or energy into the marine environment', which would encompass any of the sea-based measures discussed. However, the definition also includes a requirement with respect to the environmental effect of such activity,[8] which performs a legal assessment as to whether or not the measures are to be considered pollution, dependent on their harmful impact. Ultimate assessment of whether sea-based measures qualify as 'pollution of the marine environment', or 'dumping' for that matter,[9] depends on the level of environmental risk linked to those measures. On the basis of the uncertainties related to sea-based measures, it seems prudent to assume that the measures fall within these definitions. This does not in itself rule out such activities but involves a range of consequential obligations in UNCLOS and other instruments that specifically relate to pollution.[10]

Apart from UNCLOS, the London Dumping Regime, composed of the 1972 London Dumping Convention and its 1996 Protocol,[11] is also applicable.

[4] Montego Bay, 10 December 1982, in force 16 November 1994, 1833 UNTS 397.

[5] As to jurisdiction in the EEZ, see UNCLOS, Art. 56(1)(a) and (b)). On the maritime delimitation of the Baltic Sea, see E. Franckx, 'Gaps in Baltic Sea Maritime Boundaries', in H. Ringbom (ed.), *Regulatory Gaps in Baltic Sea Governance: Selected Issues* (Cham: Springer, 2018), 7.

[6] UNCLOS, Part XII, Arts. 192–195.

[7] UNCLOS, Art. 194(1).

[8] Under UNCLOS Art. 1(4), the definition focuses on the environmental perspective and is not dependent on matters such as the intention behind the act that caused it. See also P. Birnie, A. Boyle and C. Redgwell, *International Law and the Environment*, 3rd ed. (Oxford: Oxford University Press, 2009) 188–189.

[9] For more details, see Ringbom et al. (n 3).

[10] E.g., UNCLOS Arts. 194(2) and (4), 195, 199, 204 and 205.

[11] The 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Washington/Moscow/London/Mexico City, adopted 29 December 1972, in force 30 August 1975, 1046 UNTS 120 (the London Convention); 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 36 ILM 1. Dumping is also regulated in UNCLOS, but in less detailed terms.

These instruments are most relevant with regard to measures in the form of chemical treatment of the seabed and sediments, which may qualify as 'dumping' according to the relevant legal definitions but have recently gained a potentially more general relevance with respect to sea-based measures, through the adoption of rules and principles relating to 'marine geoengineering'.

The applicability of dumping obligations to chemical treatment depends on the effects, including the environmental effects, of such measures. The greater risk they constitute for the marine environment, the more likely it is that they will be considered to work against the aims of the conventions and hence included in the definition of dumping, independently of whether or not the purpose is to dispose of chemicals. However, even if an activity falls within the definition of dumping, it does not necessarily follow that it is completely prohibited.

In this respect, the rules differ significantly between the Convention and the Protocol. The Protocol is stricter, imposing a general prohibition on dumping, with the exception of wastes and other matters listed in its Annex I. The Protocol also introduces a specific obligation for the States parties to apply a precautionary approach to environmental protection from dumping.[12]

In the subsequent practice of the international dumping regime, certain environmental measures that were not foreseen by its drafters have been considered to be dumping and therefore ruled out by the governing bodies. A particularly relevant example is ocean fertilization for mitigation of climate change, which was not considered to be permitted under the Protocol, except for legitimate scientific research purposes, with reference to the precautionary approach required by the Protocol.[13] Many, if not all, proposed sea-based measures to reduce the amount of phosphorus in the Baltic Sea include important similarities to such geoengineering activities.

8.2.2 *Regional Rules: The Helsinki Convention and EU Law*

The key regional environmental instrument covering the Baltic Sea is the Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention),[14] which operates through the so-called Helsinki Commission (HELCOM). In addition, all Baltic Sea coastal States, except Russia,

[12] London Protocol, Art. 3. Both instruments apply to all coastal waters, except to the internal waters of States, hence including both the EEZ and the territorial sea of the States parties. In addition, the Protocol extends certain parts of its permit procedures to internal waters.

[13] London Protocol, Art. 3(1); Resolution LC-LP.1(2008) on the Regulation of Ocean Fertilization, adopted on the Thirtieth Meeting of the Contracting Parties to the London Convention and the Third Meeting of the Contracting Parties to the London Protocol; see also P. Sands and J. Peel, *Principles of International Environmental Law*, 3rd ed. (Cambridge: Cambridge University Press, 2012) 187ff , 396.

[14] Helsinki, 22 March 1974, in force 3 May 1980, 1507 UNTS 166.

are Member States of the European Union (EU), which plays an increasingly important role in the regulation and governance of the Baltic Sea.[15]

The legal relationship between the HELCOM regime and the EU is complex. On the one hand, the EU, alongside some of its Member States, is a party to the Helsinki Convention, signifying that the Convention, at least in part, forms an integral part of EU law, including being subject to review by EU institutions. On the other hand, certain key HELCOM measures, notably the Baltic Sea Action Plan (BSAP), represent a means of implementing EU maritime legislation at regional level. The two regulatory layers are hence increasingly intertwined and need to be considered together.

The Helsinki Convention covers a wide range of activities within its scope, but includes no direct rules on sea-based measures. Complementing the requirements found in the Convention and its annexes, substantive standards are commonly introduced in the form of recommendations, which is the main regulatory tool of HELCOM. Apart from a series of HELCOM recommendations on agricultural discharges and wastewater treatment adopted over the years, the revised BSAP of 2021 places further emphasis on certain key issues, including eutrophication, and establishes a country-by-country nutrient reduction scheme through a system of maximum allowable inputs (MAI).[16]

The revised BSAP includes references to the internal load of nutrients, but there are no concrete actions connected to this in the BSAP. Most requirements and approaches taken to combat eutrophication to date have focused on land-based sources and measures to reduce pollution from the land,[17] which is consistent with the fact that most eutrophic pollution comes from the land.

A similar focus on land-based measures has been dominating EU legislation. At EU level, some key rules from the early 1990s place ceilings on release into the sea of certain types of nutrients, notably the Nitrates Directive (91/676/EEC) and the Urban Wastewater Treatment Directive (91/271/EEC). However, since the turn of the Millennium the focus of EU marine policy has been on more holistic, goal-based legal instruments. Today the key EU measures for addressing eutrophication in the Baltic Sea are the EU Marine Strategy Framework Directive (MSFD)[18] and

[15] See e.g., H. Ringbom and M. Joas, 'Concluding Remarks: Regulatory Gaps and Broader Governance Patterns in the Baltic Sea', *Marine Policy*, Volume 98, 2018, 317.

[16] 'The aim is to reach HELCOM's vision for good environmental status in the Baltic Sea', BSAP Eutrophication segment, the BSAP Preamble, para. 3. See also: '*HELCOM Ecological Objectives for an Ecosystem Approach*', document for HELCOM Stakeholder Conference on the Baltic Sea Action Plan, Helsinki, Finland, 7 March 2006.

[17] See, e.g., the HELCOM Copenhagen Ministerial Declaration, 'Taking Further Action to Implement the Baltic Sea Action Plan: Reaching Good Environmental Status for a Healthy Baltic Sea', Copenhagen, Denmark, 3 October 2013, including the acts adopted, 'HELCOM Palette of optional agro-environmental measures and Recommendations'.

[18] 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, OJ L 164/19.

the Water Framework Directive (WFD).[19] Both instruments set out general environmental goals, and each establishes a procedural framework for identifying and adopting measures required to reach those goals but include few precise obligations for the Member States. The MSFD is applicable to marine areas, including EEZ,[20] but has a significant focus on the land–sea interplay and thus mainly on land-based sources of eutrophication. The focus of the WFD is more land-based and mainly concerns sea areas only up to one nautical mile from the coast/baseline.

The provisions in the MSFD also include a requirement to restore marine ecosystems where they have been adversely affected,[21] which could be taken as a positive obligation to undertake, inter alia, sea-based measures. Both directives include a rule aimed at preventing environmental deterioration.[22] The Court of Justice of the EU has interpreted this rule strictly in its case law on the WFD, by ruling that any activity that will lead to deterioration, even on a temporary basis, is prohibited in accordance with the non-deterioration rule.[23] This ruling significantly limits the scope for EU Member States to approve sea-based measures to abate eutrophication in their internal and coastal waters, but it is unlikely that a similar interpretation would apply to the MSFD.[24]

Apart from these two directives, certain EU environmental rules of more horizontal applicability will be of relevance for sea-based measures. This is notably the case for the directives aimed at protecting biodiversity and nature, that is, the Habitats and Birds Directives,[25] to the extent that sea-based measures take place in or affect areas covered by those directives, which are not further discussed here.

[19] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L327/1 (the WFD).

[20] MSFD, Art. 3(1)(a) and (b).

[21] MSFD, Art.1(2)(b).

[22] MSFD, Art. 1(2)(a) and WFD Art. 4.

[23] Case C-461/13 *Bund* v. *Germany* (the *Weser* case). The Court also ruled (at para. 68) that the balancing between long-term and short-term consequences in relation to activities that deteriorate the ecological surface status should only be undertaken through the derogations foreseen in Article 4(7) of the Directive. See also T. Paloniitty, 'Analysis: The Weser Case: Case C-461/13 Bund v Germany', *Journal of Environmental Law*, Volume 28, Issue 1, 2016, 157.

[24] Like the WFD, the MSFD includes a non-deterioration rule, which could suggest that the interpretations in the *Weser* ruling could be applied analogously. However, many key aspects are designed rather differently in the MSFD. Another important difference is that the areas protected by the MSFD are much larger than in the WFD and are also more difficult to monitor and control. Hence, the link between a specific plan or project and deterioration is much more uncertain under the MSFD. While the general principles of the *Weser* ruling could perhaps be seen as parallel in relation to the aim and application of MSFD, the general conclusions are probably, therefore, not directly transferable.

[25] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the Birds Directive) OJ L 20/7; Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) OJ L 206/7.

8.2.3 *Conclusions*

It follows from the brief review in the preceding sections that some aspects of sea-based measures are subject to international regulation, while others are not. At the jurisdictional level, things are reasonably clear. It is the coastal State that exercises sovereignty over measures, independently of the coastal zone concerned. In most coastal States, such measures are supposedly subject to some form of permit, and it is accordingly for the permit authorities of the coastal State concerned to decide whether the measures may take place and impose more precise conditions.

In the absence of specific rules, reliance has to be directed to general environmental obligations, which essentially make the legality of measures dependent on their effectiveness. If sea-based measures are successful in improving the environment without posing major short-term risks, the law presents few obstacles for their introduction. Indeed, it may even oblige them to undertake such measures as part of their general environmental due diligence duties. Conversely, if the benefits are limited and the environmental risks are significant, a whole range of legal obstacles present themselves across all legal levels. In the end, the legality of any kind of sea-based measure, in any sea area, depends on the risks it presents – in both the short and long term – balanced against their long-term benefits. In view of this, one particular category of measures cannot be legally preferred over another without having regard to their performance and environmental impact.

A peculiarity with sea-based measures, however, is the scientific uncertainty that surrounds them. The knowledge required for determining their risks and benefits – and hence the applicable legal constraints – is simply not available.[26] This state of affairs prompts the question as to how environmental law deals with scientific uncertainty. The matter is addressed through general principles of environmental law, the most relevant of which are addressed in the next section.

8.3 ENVIRONMENTAL LAW PRINCIPLES

8.3.1 *General*

Just like environmental law generally, environmental law principles are primarily focused on the balance between prevention or protection against environmental harm and other interests, such as exploitation of natural resources. Compared to the rules discussed in the previous section, international environmental law principles are designed to play a more flexible role to ensure regulatory proactivity and precaution in relation to the changing environment and changing knowledge.[27]

[26] See e.g., Ringbom et al. (n 3), 3–5, 48.

[27] Sands and Peel (n 13) 187ff. See also the Treaty on the Functioning of the European Union, Art. 191.

'Principles' in this context refers more to function than legal status. All principles discussed here, at least in some measure, feature in the Helsinki Convention or its annexes. This ensures their applicability as binding law throughout the Baltic Sea.[28] As always, however, acceptance of the applicability of a certain principle does not necessarily guarantee agreement on what the principle actually provides in substantive terms, whether in general or in the specific case.

8.3.2 *The Principle of Prevention*

One of the main and most long-standing principles of international environmental law is that States must not permit their territory or operations under their jurisdiction to harm the interests of other States or territories beyond their jurisdiction (the 'no harm' principle). It has since been supplemented by the principle of prevention, which is broader as it is not limited to transboundary harm.[29] The principle requires prevention of damage to the environment, including within national borders, or, otherwise, to reduce, limit or control harmful activities.

This does not amount to a duty to prevent any environmental harm, however. It is an obligation of conduct, rather than of result, and the key standard of care required is to exercise due diligence to prevent harm. International case law has further specified, inter alia, that harm which is merely potential must also be considered if it is significant (even if not serious or irreversible)[30] and that the standard of diligence expected is higher with respect to riskier activities.[31]

Despite this, the no-harm and preventive principles will not, as such, prevent sea-based measures. Their application depends on assessing whether any of the suggested sea-based measures would cause (potentially significant) harm to the environment, within or beyond the territory of the State where the measure takes place. As already noted, sea-based measures are difficult to assess in this respect. They do not pose obvious immediate threats to the environment – within or beyond national borders – which would rule them out on that basis alone. However, the consequences of sea-based measures may not be sufficiently known to justify application of the prevention principle.

Yet the matter can also be reversed. Sea-based measures are aimed at repairing the environment, which also opens up application of the principles in favour of the measure. In this perspective, sea-based measures could be regarded as a necessary

[28] Helsinki Convention, Art. 3(2).

[29] N. De Sadeleer, *Environmental Principles: From Political Slogans to Legal Rules* (Oxford: Oxford University Press, 2002) 63–64.

[30] ICJ Judgment in *Pulp Mills on the River Uruguay* (*Argentina* v. *Uruguay*) 20 April, 2010 ICJ Rep. 14, para. 101.

[31] Responsibilities and obligations of States sponsoring persons and entities with respect to activities in the Area (Request for Advisory Opinion submitted to the Seabed Disputes Chamber), International Tribunal for the Law of the Sea, Case No. 17, para. 117.

preventive measure to mitigate damage caused by past polluters. The validity of that argument, however, depends on their consequences and effect, which, again, leads to the question of their factual effectiveness and impact, which is surrounded by uncertainty.

In summary, assessment eventually comes down to scientific uncertainty regarding threats versus possible positive longer-term effects for the environment.

8.3.3 *'Best Available Technology'*

The principle of best available technology (BAT) is a requirement that keeps evolving with the development of new technology.[32] The flexibility of the principle lies in this way of continuously raising the bar. The BAT principle is generally acknowledged and is closely connected to the prevention principle as a tool for acting cautiously.

In the Helsinki Convention the BAT principle, together with best environmental practice (BEP), is laid down in Article 3(3). The wording requires the use of BAT and BEP to 'prevent and eliminate pollution'. The general approach of the Helsinki Convention framework has been to emphasize land-based sources and reducing input of pollution.[33] However, the terms 'prevent and eliminate' in this paragraph might just as well be interpreted more broadly as also including minimization of the 'internal load' by means of sea-based measures.

BAT is further defined in Annex II of the Helsinki Convention. Here it is established that this principle refers to '... the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges',[34] coupled with a list of criteria to be applied when determining BAT.

Sea-based measures definitively represent a new technology for addressing eutrophication. However, that novelty does not in itself make it the best technology for the purpose. For establishing whether a technology is 'best' for this purpose, the criteria of Annex II must be taken into account. Some of the listed criteria may strengthen the position of sea-based measures over land-based reduction measures (e.g., low waste technology), while others (time limits, economic feasibility and the precautionary principle) could work in the opposite direction. A related issue is whether sea-based measures should be assessed and compared in this context to other forms of sea-based measures or whether the reference point in this respect should be technologies for land-based phosphorus reduction measures.

Naturally, assessment may also vary between different types of sea-based measures. The risks, uncertainties and general knowledge vary significantly between, say,

[32] De Sadeleer, (n 29), 84–86.

[33] See e.g., B. Bohman, 'Lessons from the Regulatory Approaches to Combat Eutrophication in the Baltic Sea Region', *Marine Policy*, Volume 98, 2018, 229–230.

[34] Helsinki Convention, Annex II, Regulation 3, para. 1.

oxygenation and chemical treatment, and between small-scale operations in bay areas and measures applied in the open sea. In the end, a key issue is weighing the potential risks of sea-based measures with potential gains. This, in combination with the limited scientific certainty of those risks, leads to the precautionary principle, which is also acknowledged as a key consideration under the Helsinki Convention in determining whether a particular process, facility or method constitutes BAT.[35]

8.3.4 *The Precautionary Principle*

8.3.4.1 General

The precise content of the precautionary principle is not settled.[36] In view of this uncertainty, international courts, including the International Court of Justice (ICJ), have been reluctant to acknowledge the principle as forming part of customary law.[37] But for present purposes, all principles discussed are adopted in the Helsinki Convention and it suffices to note that the principle is laid down in relatively similar terms in both the Helsinki Convention and the London Protocol.

> The Contracting Parties shall apply the precautionary principle, i.e., to take preventive measures when there is reason to assume that substances or energy introduced, directly or indirectly, into the marine environment may create hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea even when there is no conclusive evidence of a causal relationship between inputs and their alleged effects.[38]

The definition makes it clear that application of the principle is not facultative, but States are to apply preventive measures when a certain activity may harm the marine environment. Reference to the absence of conclusive evidence of harm presupposes that some evidence exists to suggest that the activity is harmful, but not enough to provide certainty on the matter.

8.3.4.2 Application to Sea-Based Measures

The precautionary principle suggests that States must 'take preventive measures'. This presumably involves significant restraints or caution in authorizing the activity. Furthermore, in relation to sea-based measures this principle would, in contrast to

[35] Helsinki Convention, Annex II, Regulation 3, para. 2.

[36] World Charter for Nature, 1982, UN General Assembly, UNGA Res. 37/7, 22 ILM 455 (1983), Art. 11(b).

[37] E.g., the *Pulp Mills* case (n 30), 14. However, a Special Chamber of the International Tribunal for the Law of the Sea in 2011 declared that the inclusion of Rio Principle 15 into several international conventions 'has initiated a trend towards making this approach part of customary international law'. SDC Advisory Opinion (n 31) para. 135.

[38] Helsinki Convention, Art. 3(2). See also London Protocol, Art. 3(1) and TFEU, Art. 191(2).

other principles and rules discussed earlier, prevent them from being applied, due to scientific uncertainty and the potential risks surrounding them.

On the other hand, the environmental objectives of sea-based measures need to be acknowledged here, too. It may be argued that the state of eutrophication in the Baltic Sea requires further mitigation measures and that all options to ameliorate the ecological state of the sea have to be examined. The precautionary approach should not, accordingly, be used as an excuse for not further exploring new options of interest. At the very least, the fact of a significant knowledge gap – which triggers the precautionary principle – should not be used as an excuse for not undertaking the kind of research necessary to gain that missing knowledge.[39] Application of the precautionary approach in the London Convention provides an example of how this delicate balance could be maintained.

8.3.4.3 The Precedent in the London Dumping Regime

The London dumping regime recently addressed ocean geoengineering measures used to mitigate climate change. This may be of significant value for how sea-based measures could be tackled from a governance point of view in relation to the precautionary principle. The amendment to the London Protocol is not yet in force, but it represents an example of a way to balance the different risks and interests involved in novel measures to address environmental concerns, where the risks are not fully understood, and, hence, entails many similarities to sea-based measures.

The framework for dealing with geoengineering measures under the London Protocol has been developed to deal specifically with ocean fertilization to abate climate change. However, it may be extended to other geoengineering activities.[40] The parties to the London Convention first confirmed the applicability of the dumping regime to ocean fertilization in a joint resolution in 2008. This provided for a precautionary approach by stating that 'given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed'.[41] The parties further agreed that in order to provide for legitimate scientific

[39] See also: V. Galaz, 'Geo-engineering, Governance, and Social-Ecological Systems: Critical Issues and Joint Research Needs', *Ecology and Society* , Volume 17, Issue 1, 2012, 24, http://dx.doi.org/ 10.5751/ES-04677-170124; K. Güssow et al., 'Ocean Iron Fertilization: Why Further Research Is Needed', *Marine Policy*, Volume 34, Issue 5, 2010, 911–918.

[40] The London Protocol defines marine geoengineering, see LC 36/16, Annex 5, 1, Guidance for Consideration of Marine Geoengineering Activities, Section 2, para. 2. *Proceedings of the 2015 Science Day Symposium on Marine Geoengineering*, held on 23 April 2015 at IMO Headquarters, London, United Kingdom.

[41] Resolution LC-LP.1(2008) on the Regulation of Ocean Fertilization, para. 8. Even if the resolution is not binding as such, it can be seen as a subsequent agreement or practice between the parties under the Vienna Convention on the Law of Treaties, Vienna, 23 May 1969, in force 27 January 1980, 1155 UNTS 331, Art. 31(3) and, through that, have implications for the interpretation of the London Convention and Protocol.

research, and hence to gain more knowledge about ocean fertilization, an assessment framework should be adopted in order to define projects for research purposes. That framework was to include, inter alia, tools for determining whether or not the proposed activity is contrary to the aims of the Convention and Protocol,[42] hence setting out a new way to respect and operationalize the precautionary principle, while still providing a pathway to promote further knowledge through scientific research. A new resolution was adopted in 2010, known as the 'Assessment Framework for Scientific Research Involving Ocean Fertilization',[43] which guides the parties on how to assess proposals they receive for ocean fertilization research and provides criteria for an initial assessment of such proposals.[44]

In 2013 a resolution was adopted on the 'Amendment to the London Protocol to regulate the placement of matter for ocean fertilization and other marine geoengineering activities'.[45] The amendment provides that 'Contracting Parties shall not allow the placement of matter into the sea from vessels, aircraft, platforms or other man-made structures at sea for marine geoengineering activities listed in Annex 4, unless the listing provides that the activity or the sub-category of an activity may be authorized under a permit'.[46]

'Marine geoengineering' is defined to mean deliberate intervention in the marine environment to manipulate natural processes, including to counteract anthropogenic climate change and/or its impacts, and that has the potential to result in deleterious effects, especially where those effects may be 'widespread, long lasting and severe'.[47] A new Annex 5 also adds an Assessment Framework that lists a number of points to be described, following an initial assessment of whether the activity falls within the definition of dumping at all and hence can be considered within the framework.[48]

If a project is accepted under the Assessment Framework, a thorough monitoring mechanism has to be established to consider both the long-term and short-term impacts of the activity. This forms a safeguard for the general lack of knowledge that remains, despite the review process, and bridges the risks that cannot be accounted for due to the fact that these are methods still under research. While the 2013 amendment is not formally in force, it provides an interesting model for operationalizing the precautionary principle for activities aimed at environmental protection that entail uncertain risks. It could, therefore, also serve as a model for addressing sea-based measures more generally in the specific Baltic Sea context with a view to

[42] Resolution LC-LP.1(2008) on the Regulation of Ocean Fertilization, para. 5.
[43] Resolution LC-LP.2(2010).
[44] *Proceedings of the 2015 Science Day Symposium on Marine Geoengineering*, held on 23 April 2015 at IMO Headquarters, London, United Kingdom.
[45] LP.4(8), see circular LC-LP.1/Circ.61.
[46] Art. 6bis.
[47] Art. 1(5bis).
[48] An arrangement of such experts in the consultation process was adopted by the governing bodies in 2014 as Annex 4 to document LC 36/16.

gaining more knowledge about the effects of such measures.[49] This has partly materialized, through endorsement of the 'HELCOM Guidelines for sea-based measures to manage internal nutrient reserves' by the Heads of Delegation in June 2021.[50] The aim of the guidelines is to 'to provide guidance for researchers planning to undertake research projects and for operators and environmental managers planning to implement activities' related to sea-based measures, but also to 'provide decision support for relevant authorities when administering consultations and environmental permitting'.[51] The new BSAP adopted in October 2021 makes specific reference to these Guidelines, adding that through their application, 'measures to manage these internal nutrient reserves should utilize the best available scientific knowledge and minimize potential risks'.[52]

8.3.5 *Conclusions on the Role of Environmental Law Principles*

The environmental law principles, too, leave many questions open as to how and when sea-based measures should be assessed and permitted. The first issue is that the environmental principles discussed in this chapter may be used both ways. Sea-based measures do not – as indeed many of the principles implicitly seem to assume – relate to the balance between environmental objectives as against other objectives, such as economic benefits. They do not even balance different environmental objectives against each other, as in the case of marine geoengineering measures to mitigate climate change. Instead, both the arguments in favour of and against the measures centre on very similar concerns for the marine environment and the long-term survivability of the marine ecosystems. This raises issues on how the principles operate, and those issues cannot be addressed without a proper analysis of the effect of the measures. Thus, these principles, like the rules discussed in Section 8.2, presuppose some degree of knowledge of the risks and/or dangers linked to a certain activity before they can provide useful guidance.

A second problem with sea-based measures is that this knowledge is not available. Generally speaking, the impact and effectiveness of sea-based measures in achieving their objectives are not well understood. Their effectiveness is highly disputed, and there is no certainty or consensus among scientists as to the likely environmental outcome of sea-based measures, in particular for large-scale measures. Indeed, marine biologists in the Baltic Sea region have voiced strong concerns about the

[49] Such research cooperation, and harmonization of permit policies, is also called for in Art. 24(1) of the Helsinki Convention.

[50] HELCOM Doc. HOD 60, 5-3 (Guidelines for Sea-Based Measures to Manage Internal Nutrient Reserves in the Baltic Sea Region); See also HELCOM Doc. HOD 60-2021 (Outcome of the HOD 60), para. 5.26.

[51] HELCOM Doc. HOD 60, 5-3, para. 1.

[52] BSAP 2021 (Helcom 2021), 22.

negative impact that the measures may have and questioned whether they have any benefits at all in the longer term.[53]

The precautionary principle should be able to navigate through the seas of this kind of scientific uncertainty and the principle has an unusually clear legal foundation in the Helsinki Convention. Nevertheless, it turns out that similar uncertainties that pertain to the other principles apply to the precautionary principle as well. These, too, could be used both ways while waiting for scientific data to build up. Halting sea-based measures across the board based on existing scientific uncertainty would ignore the differences between different types of measures. More importantly, it would effectively also halt research and development of more effective measures to deal with the internal load. This, in turn, would mean that a potentially useful tool for improving the environmental status of the Baltic Sea would already be lost at the outset, which does not correspond well with the rationale of the precautionary or other principles discussed previously.

In view of these dilemmas, it seems that the only way forward is to gain more knowledge about the effectiveness of sea-based measures through cautious and controlled measures. One way of achieving this would be to limit permits to scientific purposes and imposing particular criteria for the purpose. The approach adopted by the London Protocol could serve as an important example but needs some further refinement for sea-based measures in the Baltic Sea context in view of the many features that distinguish sea-based measures from most other marine geoengineering measures. The benefits of a tailor-made solution for the Baltic Sea are further emphasized by the legal setting in the region, where the entire sea area is covered by zones where coastal States enjoy jurisdiction over environmental matters, and a strong governance framework in place, with a long tradition of close cooperation in environmental matters, centring around the Helsinki Commission.

8.4 CONCLUDING OBSERVATIONS

No specific laws apply to any of the sea-based measures. Further, the more generic laws that exist do not generally provide much guidance in the matter, except where the measures fall within the scope of the dumping regime. The relevant rights and obligations depend on the environmental effects, both positive and negative. Since sea-based measures present potential risks, while at the same time being potential problem-solvers in relation to eutrophication, weighing their effect is not obvious and leaves much depending on scientific results, which are currently not available.

The same dilemma persists when analysing sea-based measures in the light of various environmental law principles. These principles are generally designed to balance environmental risks against the need for exploitation, by steering away from

[53] See e.g., Swedish newspaper *Svenska Dagbladet*, 1 September 2015: 'Det finns ingen mirakelmedicin för Östersjön' (There is no miracle cure for the Baltic Sea).

the most apparent environmental risks. In this case, where the alternative is not exploitation, where geographical flexibility is limited and the measures to be assessed are actually aiming to solve the very same environmental problems that its opponents are criticizing it for contributing to, clearly much of the balancing will have to centre on scientific knowledge and certainty. The key issue to be balanced is weighing the risk of further escalating eutrophication with all its consequences, and to continue only with land-based measures, against the risks that sea-based measures may have on the ecosystem – due to their novelty and the fact that they have not been sufficiently tested in relation to risks. However, the fact that other methods are available to combat eutrophication, namely land-based measures, that do not involve corresponding environmental risks, that directly aim at stopping the discharges at source and that are proven to work, affects this balance. The availability of land-based measures as an alternative also affects the role of principles such as BAT or BEP. Sea-based measures may definitely represent the most novel techniques in the field, but is it the best available technology? The fact that other measures are available, involving lower risks, will also put the risk assessment in another light since the necessity for the measures is likely to be reduced.

In short, the legality of any kind of sea-based measures, in any sea area, depends on the risks they present – in the short- and long-term – balanced against their long-term benefits. In that light, one particular category of measures cannot be legally preferred over another without having regard to their performance and environmental impact. If a particular measure improves the marine environment without much risk, it is legally easy to justify, while, conversely, a measure with uncertain benefits and large risks meets resistance in a variety of applicable legal rules and principles across many levels.

Lack of scientific certainty about the risks and effects of sea-based measures significantly complicates assessment in this regard, in connection to the precautionary principle. Yet that uncertainty should not be used to dismiss sea-based measures altogether. Rather, it calls for further research into the matter, guided by the precautionary principle.

As sea-based measures are receiving increased focus in the Baltic Sea context, it is important to acknowledge the number of uncertainties involved without giving up potential useful tools to fight eutrophication in the future. At this stage, we conclude that it is both important and appropriate to focus on developing a new framework or guidelines, inspired by the Assessment Framework developed under the London dumping regime, to coordinate policies among the Baltic Sea States, thereby helping permit authorities in their tasks. With the recent adoption of the HELCOM Guidelines, this process appears to be well under way.