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Scale, space and delimitation in marine legal governance – Perspectives from the Baltic Sea

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A B S T R A C T

Recent decades have seen an increasing emphasis on (re)structuring marine governance regulation to fit relevant natural systems in terms of scale and spatial scope, and thus also on the delimitation of spatial units. Being at the heart of ecosystem based management, this focus on the relationship between scale and space in nature and in regulatory systems necessitates an increased awareness of the use of spatial and scale-related concepts in marine governance regulation. Using the regulatory context of the Baltic Sea as the focal point, this article examines concepts central to marine governance such as 'ecosystem', 'water body' and 'marine waters'. It investigates how changes in the physical environment are reflected in the legal concepts, but also how these concepts affect the understanding or definition of the 'natural' phenomena ostensibly representing the scales on which the regulatory system should be premised.

1. Introduction

Marine governance is replete with notions or concepts relating to space and its delimitation into units, natural (e.g. ecosystems) or legal/administrative (e.g. 'marine waters'). Increasingly, the latter form of units, or systems, are expected to be premised on the former so that legal/administrative units and their boundaries correspond to or support the spatial distribution of ecosystems. Also in terms of scale, the legal/administrative system should be modelled so as to fit relevant natural scales [1, p. 152, 2]. The bewildering expansion in recent decades of legal instruments relating to the marine environment [3], not least in the European Union (EU) and in the Baltic Sea region, has made it pressing to reflect on our understanding of space and scale in nature and in law, respectively, and how these relate to each other. Predominantly, however, the focus on scale and space follows from the ecosystem approach, or more specifically ecosystem based management ('EBM', also ecosystem management, ecosystem based approach to management, etc.) being embraced – at least in principle – both globally and by the EU [on the definition and evolution of these concepts, see 4, pp. 3–5, for a critical review of the ecosystem approach, see 5].

EBM tends to be highly scale dependent and premised on management measures being adapted to appropriate biophysical boundaries, thus requiring us to engage with the nature and relationships between different kinds of spaces and scales [1, p. 152, 6]. The 'Malawi Principles for the Ecosystem Approach', developed within the framework of the international Convention on Biological Diversity (CBD), stresses the need for ecosystem management to 'be undertaken at the appropriate spatial and temporal scales' [7]. Within the EU, this idea is reflected in legislation relating to the marine environment, predominantly the Marine Strategy Framework Directive (MSFD) [8], and the Water Framework Directive (WFD) [9], but also, inter alia, in the Common Fisheries Policy (CFP)-regulation [10].

The Baltic Sea is characterized by an unusually dense fabric of legal and administrative structures dedicated to the utilization and preservation of the marine environment and its resources [11,12]. It is also a marine region where the environmental conditions tend to be quite diverse over rather small scales. This makes it pertinent to use the Baltic Sea as the focal point when looking at issues of space and scale in marine governance.

In line with these observations, this article aims to contribute to an increased understanding of the complexity and dynamism of space, scale and the associated boundaries and delimitations as used in or affecting marine environmental regulation. Attention is paid to the way in which legal and natural concepts and phenomena relating to space and scale are interrelated or impart meaning to each other so that the relative indeterminacy or temporal dynamism of one adds to the indeterminacy or dynamism of the other. An attempt is also made to clarify the spatial applicability of the WFD and the MSFD. Importantly, the article deals only in passing with the dimension of scale that concerns the relationship between different levels or spheres of law, such as EU directives compared to international agreements, including regional seas conventions, since that has been extensively addressed elsewhere [11,12].

2. Method and delimitation

The study is based on an inventory of spatial and scale-related features of marine regulation with a particular emphasis on the main

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pieces of EU law relevant to the protection of the marine environment of the Baltic Sea, i.e. the WFD and the MSFD. This means that dimensions of scale and space relevant to other pieces of EU law affecting the marine environment, including the CFP and the Habitats Directive [11,13], will not be explicitly dealt with, although many of the observations are also relevant in relation to these pieces of law. Additionally, significant natural scales have been identified in the scientific literature [14,15] dealing with the natural conditions and processes of the Baltic Sea.

Scales and associated boundaries and delimitations identified in law and in nature have been assessed in order to ascertain to what extent they are related or even functionally dependent on each other. Legal/natural scales or spatial concepts that are particularly interesting, e.g. because they define the scope of legal instruments or constitute fundamental units for marine governance, have been selected for discussion. It must be emphasized that the study does in no way purport to have identified or considered all potentially relevant scales and spatial boundaries, nor to have captured the full complexity of natural or regulatory notions of space, scale and delimitation.

3. A brief characteristic of the Baltic Sea

The particular natural characteristics of the Baltic Sea are strongly linked to the fact that it is connected to the North Sea only by narrow and shallow sills in the Öresund and Danish Belts and heavily affected by fresh water input [16]. More than 200 rivers discharge their water into the sea. The drainage area is about 1.7 million km^2, several times larger than the sea itself [15, p. 31, p. 43]. This means that nutrients and pollutants reach the Baltic Sea through runoff from far afield. The limited inflow of water from the North Sea also makes water renewal (turnover time) slow. In the southern part of the sea, it takes around 30 years for the water to be renewed, whereas it takes around 40 years for that to happen in the northern part [15, p. 47].

The Baltic Sea is small, despite being a sea. However, even with its limited size, not many statements about the characteristics of the sea can be made that will hold true for the whole Baltic Sea area. Ecological systems are inherently variable at a range of spatial and temporal scales [17, p. 169]. In the Baltic Sea, life is also subject to basic environmental conditions that vary 'dramatically' throughout the sea and over time [14]. While the Baltic is considered one of the world's largest bodies of brackish water, differences in salinity result in very strong gradients [15, p. 51]. In the northern most part (Bothnian Bay) salinity can be below 2 PSU whereas it is up to 30 PSU in the south-western part (Kattegat) that connects the Baltic to the North Sea (where salinity is 34–35 PSU) [15, p. 30].

However, there is much more than salinity that varies between different parts of the Baltic Sea. Another such factor is water acidity. In coastal waters in the Bothnian Bay acidity can vary more than one pH unit (e.g. from 7.4 to 8.5) over a year due to seasonal variation [18]. An even more dramatic difference between areas (defined horizontally as well as vertically in the water body) is related to availability of oxygen, with large parts of the deeper areas of the Baltic Proper being hypoxic or anoxic, i.e. suffering from a dearth or complete lack of oxygen [19, p. 48].

There are also very significant differences in temperature, both seasonal and between surface and bottom water. Surface-water temperature varies over the year between < 0 and about 20 °C [15, p. 55]. Climate change is unquestionably strongly associated with temperature, but is likely to affect the natural conditions of the Baltic Sea in many ways. In the future, the region is likely to experience a strong increase in air temperature, especially in winter, affecting sea ice conditions [20, p. 5]. There is also likely to be an increase in precipitation and, particularly in wintertime, increased freshwater run-off to the Baltic Sea leading to a lowering of salinity levels and also an increased nutrient load from rivers [20, pp. 5–6, p. 11].

Salinity, temperature, and pH all affect the performance and survival of organisms and thereby limit the distribution of species across the sea area. Changes in these conditions can cause species relocations or even disappearance of species.

Over time scales of hundreds and thousands of years, the Baltic Sea has seen major fluctuations in its environmental conditions, driven primarily by climate variations. Currently, however, human activities cause large-scale changes to the Baltic Sea environment, which occur at a dramatically faster pace than most non-anthropogenic changes [15, p. 64]. From the early 20th century, human activities such as draining of wetlands, increased use of fertilizers, and the decimation of seals (previously being dominant top predators), have likely brought about fundamental changes of the Baltic Sea ecosystem(s), including a likely irreversible shift from an oligotrophic clear-water system to a eutrophic one, and a linked but perhaps less dramatic shift from cod as the dominating fish species to a system dominated by sprat and herring [21].

In the light of all this, it is rather obvious that dealing with the environmental challenges of the Baltic Sea requires a high awareness of natural processes and ecosystem components at many scales, and also of how these relate to and are affected by the scales and delimitations applied by the relevant legal frameworks.

4. The naturalness of natural systems and scales

As noted initially, the emergence of EBM has emphasized the need for premising environmental management institutions and instruments on relevant features of the environment, rather than pre-existing administrative structures [1, p. 152, 2]. Indeed, scale mismatches have been found to result in 'a variety of consequences, including the mismanagement of ecosystems and the resulting decline or degradation of both social and ecological systems' [22]. This implies, inter alia, a need for adapting the regulatory system to the relevant scales and spatial characteristics of the natural environment. While acknowledging the general persuasiveness of the idea that regulatory systems should be made to 'fit' the natural systems which they are set to manage, it must also be recognized that the natural systems that serve as objects of management are themselves to a significant extent subject to social definition. In some instances, this is more obvious than other times. Leaving more fundamental epistemological issues aside [see instead 23], it is still clear that there can be no description without (un)conscious choices about what to describe and how to describe it. A simple example is provided by a coastline. Although a perfectly natural phenomenon, a coastline does not have any distinct, natural length. The length attributed to any stretch of coast depends on the scale and exactness of measurement, which in turn are typically determined by the intended use of the resulting figure, and by the technical and other resources available for the measurement.

A more complex but also more pertinent example for the present discussion is 'ecosystem', a fundamental concept in marine governance but also one subject to many definitions and even distinctly different meanings [5,24]. Even when there is sufficient agreement on the general definition of 'ecosystem', any particular ecosystem that is to be studied must be defined and a decision must be made on how to delineate the system in order to study it or manage its components. This requires choosing an appropriate scale, both in the sense of geographical delimitation and level of detail. This choice is very important. Indeed, patterns that can be found at one spatial scale may be invisible at another [23, p. 279], and the same is clearly true for level of detail. The delineation also impacts how and where the studied ecosystem interacts with other systems. Spatial delineations may be fairly simple in the case of e.g. small lakes but is typically much more challenging in a marine context where clear physical boundaries are scarce. The appropriate level of detail also does not follow from the environment as such. In practice, the scale is affected by the preferences and capabilities of the observers and is also by necessity tied to the scales at which information can practically be collected [22].

In this sense, a specific ecosystem is liable to change over time not only through changes in the physical conditions and processes, but also due to the system being redefined due to changes in technology, techniques, scientific conceptions and even political objectives since the latter may redefine what scientists need to look for. The (legal) concepts used to describe, quantify and assess different aspects of the marine environment also constitute a conceptual frame that influence observations and evaluations [25, p. 147].

Species, another fundamental scale for marine governance is also subject to multiple and changing definitions. What constitutes a species today may not do so tomorrow, either because a new definition is applied, or because more detailed study has revealed differences between subgroups that qualify as constituting factors for species status [on the concept(s) of species and their formation, see 26].

That many seemingly fundamental concepts and units used in marine governance (and indeed all environmental governance) are more or less indeterminate, vague and temporally dynamic is nowadays common ground among scientists [25, p. 146]. At the same time, the legal regime for marine and water governance is replete with concepts such as 'ecosystem', 'water body' and 'transitional waters' which are often, at least in the regulatory context, assumed to have a clear spatial nature or otherwise a distinct meaning. For practical reasons, such an assumption may often be necessary. Nonetheless, those set to interpret and apply the law need to be aware of the 'unstable' nature of most natural phenomena and of the extent to which law and science, or law and nature (as understood through science), interact to create our understanding of the environment that we attempt to manage. Otherwise, misconceptions may undermine the effectiveness of the regulatory system and disrupt the crucial exchange of information between science and law.

Having concluded that (humanly defined) natural phenomena tend to be rather indeterminate and temporally dynamic, it is perhaps less surprising that the same applies to explicitly social and legal constructs. However, the ways and extent to which natural and legal concepts interact and shape each other require further attention. We will first look at the spatial characteristics and boundaries associated with the nation state, i.e. the fundamental social construct in the regulatory context, to the extent that they are relevant for marine governance. After that, we move on to look at some issues of space, scale and delimitation associated more immediately with the legal frameworks for marine environmental governance.

5. The state and its (natural) delimitation

Despite globalization, law is predominantly premised on the nation state as both the prime creator of legal obligations and in particular as implementer and enforcer. Even under the partly supranational structure of EU law, the individual member states are at the centre of the law-making process, important interpreters, and almost exclusive enforcers of the law [27, chapter 1]. In many ways, this makes states the Archimedean point or scale of reference in law.

The geographical extent of any state's legal power (jurisdiction) is clearly a social construct, but, particularly in the marine context, also one linked to natural conditions. This makes it necessary for the legal system to respond to changes in these conditions, either by adjusting the spatial application of the legal provisions or concepts concerned, or by severing the link between law and nature in order to preserve the spatial stability of the legal concept. Naturally, a third possibility is to accept an increasing mismatch between the law and the supposedly defining natural phenomenon.

Maritime zones, i.e. the geographical areas with respect to which states exercise jurisdiction and have corresponding obligations at sea, are immediately linked, through the concept of baselines, to natural phenomena like the low-water line along the coast or islands. Baselines are either 'normal' or 'straight'. According to the UN Law of the Sea Convention (LOSC) [28], the normal baseline is the low-water line 'as marked on large-scale charts officially recognized by the coastal State', whereas straight baselines may be formed by linking 'appropriate points' on islands and certain low-tide elevations [28, Arts. 5 and 7]. Unsurprisingly, this process of transforming natural phenomena into legally relevant conditions entails a level of discretion and gives rise to differing ideas and principles for how this should be carried out [29].

The reference to the low-water line 'as marked on large-scale charts officially recognized by the coastal State' seems to imply that the chart itself determines the position of the baseline irrespective of the physical realities of the coast. However, drawing on the findings of international courts and tribunals, the International Law Association's Committee on Baselines under the International Law of the Sea has concluded that the normal baseline should be the actual low-water line along the coast at the so called vertical datum, also known as the chart datum, indicated on charts officially recognized by the coastal State [30, p. 31]. The line drawn on the sea chart is thus an interpretation or representation and does not constitute the baseline as such. That is instead constituted by the actual low-water line. The Committee therefor characterizes the baseline as 'ambulatory' and capable of moving seaward (e.g. due to land rise, the construction of harbour systems, coastal protection and land reclamation projects) and also landward as a consequence of erosion and sea level rise.

Global sea-levels rise as a consequence of rising temperature which makes the water mass expand and leads to melting of land-based ice. Projections indicate a rise in global average sea levels in the range of 0.2–2.0 m by 2100 [31]. With the exception of the northern part, which is experiencing land rise (post-glacial or isostatic rebound), the Baltic Sea is likely to see changes in the sea level similar to the global average [32]. From a legal perspective, sea level rise has been discussed primarily in relation to small island states or other low laying countries [33,34]. Also in the Baltic, however, sea level changes and coastal erosion has the potential to change the coastline and thus the baselines from which maritime zones are measured. Particularly if straight baselines have been drawn and one or several 'appropriate points' become inundated by the sea.

Since the geographical boundaries of the EU are defined by the boundaries of the member states, any changes to the maritime zones of the member states are also reflected in corresponding changes to the areas under the spatial purview of EU law [10, Art. 4(1)]. The EU has a very limited role in relation to maritime delimitation and definition of maritime zones as such, since that is an area in which the member states have not transferred decision-making power to the Union [35, p. 11]. However, the findings of the Court of Justice of the EU (CJEU) in the *Mox Plant* case [36] indicate that the Court has jurisdiction to rule on the appropriateness of maritime boundaries 'where the substance of a maritime limits or boundary dispute relates to the marine environment' [35, p. 229]. However, any such findings can only affect the nature and location of maritime boundaries as concerns the relations between EU member states and between such states and the Union itself, since third states are not under the jurisdiction of the CJEU.

With regard to fishing in EU waters, an activity almost exclusively regulated at the EU level [10], the CJEU has held that the baselines relevant to fishery zones are those that were in place in 1983 when the basic management regulation underpinning the CFP was adopted [35, p. 244, 37]. For states joining the EU at a later date, the date at which the CFP became applicable could be relevant. Of more general significance is, however, that the Court rejected application of the concept of ambulatory baselines. It thus seems that changes to coastlines as a result of e.g. rising sea levels do not affect the geographical area of application of EU fisheries law. Whereas the CFP is strongly characterized by the logic of relative stability, i.e. maintaining the relative share of the different member states in the common fisheries resource stable over time, the logic of the Union's marine environmental legislation is rather one of ensuring effective protection of the marine environment. This argues against severing the link between the natural phenomenon, i.e. the actual coastline, and the coastline as a legal

concept in the application of e.g. the WFD.

Marine governance thus offers examples of strong links between dynamic natural phenomena and legal delineations as well as of the opposite, i.e. the severing of the link between a natural phenomenon and the law and its replacement by a purely legal concept.

6. Space and scale in the Water Framework Directive and the Marine Strategy Framework Directive

Since all but one of the Baltic Sea coastal states are EU members, EU law plays a crucial role in establishing standards and coordinating efforts for the protection of the marine environment in the region. Two pieces of EU law aim to provide a framework for national measures pertaining to marine and freshwater protection, the WFD and the MSFD. The WFD, adopted in 2000, was the first EU act addressing water protection in a comprehensive manner. It was followed in 2008 by the MSFD that takes a similar, but in some ways less elaborate, approach to management of marine waters. Compared to the regional international law framework provided by the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention) [38], to which all the Baltic Sea coastal states including Russia and also the EU itself are parties, the EU directives are much more detailed, not least with respect to different spatial dimensions. Due to the nature of EU law, including its primacy in relation to national law, the compulsory jurisdiction of the CJEU and the enforcement powers of the EU commission [27, chapters 1 and 5], the directives also have a greater and more direct impact on the marine governance systems of the EU member states compared to traditional international law instruments. Therefore, this section will discuss issues of scales and boundaries in relation to these two instruments while acknowledging that they are far from the only ones relevant to the protection of the marine environment of the Baltic Sea region, nor ones that cover the whole of the Baltic Sea catchment area [other relevant EU law instruments include 39–41].

6.1. Spatial applicability of the Water Framework Directive

Although the WFD is primarily concerned with freshwater, it is also applicable to some parts of the Baltic Sea. In fact, the WFD's geographical applicability is not very clearly defined. The Directive does, however, 'establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater' [9, Art. 2]. The reason provided in the WFD for including transitional and coastal waters is that 'an effective and coherent water policy must take account of the vulnerability of aquatic ecosystems located near the coast and estuaries or in gulfs or relatively closed seas, as their equilibrium is strongly influenced by the quality of inland waters flowing into them' [9, preambular para 17]. Indeed, by governing the quality of water in the hundreds of rivers and streams that feed into the Baltic Sea, the WFD is of crucial importance for the environmental status of the sea as a whole. Here, however, we focus on the part of the sea to which the WFD is formally applicable. This necessitates a closer look at the notions of 'transitional' and 'coastal' waters respectively, since they define the seaward delimitation of the WFD.

In the terminology employed by the WFD, 'coastal water' is 'surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters' [9, Art. 2] The application of the WFD in the marine environment is thus directly linked to the baseline discussed in Section 5 above. This means that where straight baselines are applied, e.g. where there are archipelagos, the WFD can cover large expanses of water. It also means that the geographical applicability of the directive follows shifts in the baseline. Still, linking it to the baseline makes its geographical scope in the marine environment fairly easy to establish.

The identification of 'transitional waters' is much less straightforward and necessitates the determination of whether a 'partly saline' area of surface water is 'substantially influenced by freshwater flows' [9, Art. 2]. Not only is this a rather imprecise criterion, it also concerns conditions that are likely to change over time, e.g. as a consequence of increased precipitation. Not surprisingly, the EU regime for water quality management in transitional and coastal waters, including the precise definition of estuarine limits, has been described as 'placing a heavy burden' on estuarine and coastal science [42, p. 479]. Typically, however, the notion of 'transitional waters' does not define the geographical applicability of the WFD as such, since such waters do not reach beyond the area that is already covered by the directive as being coastal waters.

Confusingly, the WFD includes a definition of 'surface water' according to which this notion also includes territorial waters – i.e. the territorial sea which according to the LOSC extends up to 12 nautical miles from the baseline – but this definition only applies in respect of chemical status [9, Art. 2]. However, as noted above, the purpose of the directive is limited to establish a framework for the protection of *inland* surface waters, transitional waters, coastal waters and groundwater, and thus not for surface waters beyond the outer limit of coastal waters, i.e. one nautical mile seaward of the baseline. The WFD also does not require the member states to delineate and characterize bodies of surface water beyond coastal waters [9, Annex II, Section 1.1]. It is, however, made clear in the WFD's declaration of purpose that it should contribute to 'the protection of territorial and marine waters' [9, Art. 1]. Presumably, the reference to chemical status in territorial waters relates to *impact* on areas beyond coastal waters, rather than to measures to be taken beyond coastal waters. This is further corroborated by the directive linking measures to cease or phase out discharges, emissions and losses of certain hazardous substances to achieving 'close to zero' or 'near background' concentrations of these substances in the marine environment [9, Art. 1].

Limiting the geographical scope of the WFD to one nautical mile seaward from the baseline has been deemed 'artificial' and as violating the ecosystem approach [see e.g. 43, p. 2]. Clearly, this coarse delimitation is not tailored on relevant ecological considerations but is rather due to administrative expediency. However, the impact of this delimitation was at least partly ameliorated by the adoption of the MSFD, although that also gives rise to some issues of coordination. This will be discussed in Section 6.4 below. Nonetheless, this delimitation of the WFD constitutes a clear exception to the principle of adjusting management structures to relevant ecological conditions.

6.2. Spatial units within the Water Framework Directive

All waters covered by the WFD (and not being beyond the outer limit of coastal waters) must be divided into distinct units ('bodies of water', further discussed below in this section) and identified as falling within one of six surface water categories: rivers, lakes, transitional waters or coastal waters; or as artificial surface water bodies or heavily modified surface water bodies. For each surface water category, the relevant surface water bodies within a river basin district – i.e. an administrative unit linked to a natural river basin – must be differentiated according to type [9, Annex II, Section 1.1]. To reflect ecologically relevant units, the types are defined based on ecoregions, physical properties, and chemical properties [17, p. 169]. This may be done using either of two systems, called A and B. System A entails initial differentiation by relevant ecoregions (as defined in the WFD, Annex 2, section 1.2), followed by further differentiation by surface water body types according to descriptors. For coastal waters, the descriptors used for typing relate to mean annual salinity and mean depth (i.e. conditions that are likely to change due to climate change) [9, Annex II, Section 1.2.4]. If using system B, member states must achieve at least the same degree of differentiation but the system allows for larger variation of factors to be used. Despite the relative flexibility provided by these systems, the typology inevitably entails the imposition of

distinct types and associated boundaries on what, in reality, is a continuum of spatially and temporally varying natural conditions.

As noted above, the Baltic Sea is characterized by great variability in space and time, not least in salinity. Much of the ecological variability is also linked to processes that occur at smaller scales than those reflected in the typology, or is caused by factors not used in defining the typology [17, p. 169]. This results in uncertainty in the data used for typing, and can also make the typology less suitable for the subsequent assessment of ecological status for which the types are intended (i.e. type-specific references and class-boundaries may not in fact be representative of all sites and water bodies within a type). In fact, the parameters used for typology have been identified as major sources of uncertainty in ecological assessment [44, p. 4012]. If increased precision is to be achieved, site-specific characteristics must often be taken into account [45, p. 21]. That, however, can be so time and resource consuming as to be practically unfeasible.

The overall aim of the WFD, with respect to surface water, is that 'good surface water status' should be achieved and/or preserved [9, Art. 4]. 'Good surface water status' is present only if both ecological status and chemical status are found to be at least 'good' [9, Art. 2, point 18]. Whether 'good ecological status' is achieved for a specific water body is determined by means of reference conditions for each type. To this end, type-specific reference conditions are set, representing the values of specific quality elements at high ecological status.

Good status requires that the biological quality elements for the surface water body type show low levels of distortion resulting from human activity and deviate only slightly from those normally associated with the surface water body type under undisturbed conditions [9, Annex V, Section 1.2]. However, finding areas with (almost) undisturbed conditions in marine areas is difficult or even impossible due to the high connectivity of such ecosystems [46, p. 143]. In the Baltic Sea, there is also a very high prevalence of diffuse anthropogenic pressures, including excess nutrients, which may be hard to quantify. This can necessitate relying to a large extent on historical data, modelling, and expert judgment for defining type-specific reference conditions and class-boundaries, rather than actually identifying (largely) undisturbed reference sites [46, p. 143]. However, historical data is often poor (to the extent that it was at all collected it was not with the requirements of the WFD in mind) and expert judgement tends to be coloured by the experiences and conceptual frames of each new generation of experts, leading to baseline conditions shifting in time [25, p. 157, 47, p. 430]. There are hence many ways in which the 'natural' reference conditions may be (un)intentionally influenced by legal, scientific and social conceptions.

Once the reference conditions have been determined, assessing the status of a specific water body raises issues of how to measure and how to interpret measurements. For example, it is not made clear by the WFD how the average status for the biological quality elements is to be established for the most important spatial-temporal scale, i.e. the whole water body for an entire six-year assessment period [45, p. 29].

The notion of water body is itself spatially challenging. A surface water body is defined as 'a discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water' [9, Art 2(10)]. The WFD does not provide explicit guidance on how to identify the elements that should be regarded as 'discrete and significant'. However, since the water body is essentially a unit for assessing and comparing environmental quality against a reference value, it is treated as 'spatially uniform' [42, p. 479], and should not contain significant elements of different status. If it does, the water body cannot be assigned to a single ecological status as premised by the WFD governance model [48, p. 9].

In the relevant guidance document developed within the framework of the Common Implementation Strategy (CIS) for the WFD [on the CIS, see 49], it is acknowledged that there are practical constraints to how far waters may be subdivided to reflect varying characteristics. It is therefore 'necessary to balance the requirement to adequately describe water status with the need to avoid the fragmentation of surface waters into unmanageable numbers of water bodies' [48, p. 9]. Inevitably, there is a tension between the desire to capture ecologically relevant variation, and the need to keep the system practically manageable and no too costly to operate.

The provisions on how to define water bodies, both those in the WFD and those found in the CIS guidance documents leave the member states with considerable discretion in this regard. For the Baltic Sea area, this is reflected in the fact that the average size of coastal water bodies varies starkly between the coastal states, from 906 km^2 in Estonia and 309 km^2 in Germany, to 57 km^2 in Lithuania and 58 km^2 in Sweden [50].

Not only is it often challenging to define water bodies, not least in the marine environment. The relevant conditions may also be subject to significant change, often as a consequence of human activities. For example, a decrease in the amount of nutrients that reach a water body can change the nature of that body in a way that makes it similar to a neighbouring water body from which it had been distinguished based on nutrient conditions. A part of a water body can also be affected by changing human pressures in such a way that the water body as a whole should no longer be assigned to one class. Water bodies are thus not fixed in time and space [43, p. 14]. Although there is no explicit provision for revising water bodies in the WFD, such revisions may be necessary if the units are to correctly reflect relevant environmental characteristics over time. If that is done, however, the basic spatial unit for environmental assessment is changed, thus negatively impacting on comparability over time. There is also little clarity on how large an area of an existing water body that must be effected for there to be a need to reassess the delineation of that water body, considering that small-scale fluctuations may be very prevalent.

In 2015, in the so-called *Weser case* [51], the CJEU found that the obligation of the WFD to prevent deterioration of the status of all bodies of surface water is binding in nature and involves obligations which must be complied with by the competent authorities when approving individual projects in the context of the legal regime governing the protection of waters. A member state must refuse authorisation for any project that will result in deterioration of the status of the water body concerned or even jeopardise the attainment of good surface water status, unless the project is covered by a derogation [51para 50]. This can have far-reaching implications for permit requiring activities that may negatively impact a water body. It also makes the scale of the assessment of deterioration critical. Should the status be considered to have deteriorated if a small, or even very small part of a water body is affected in a way that in itself meets the criteria for constituting deterioration? What if the change can be expected to be short term? As noted above, there are large differences in the average size of marine water bodies between the Baltic Sea coastal states. It does not take any stretch of the imagination to think that this may impact the assessment of whether e.g. a coastal point source is deemed to negatively affect the status of a water body, or whether it will be considered too marginal an effect. Although there is a significant literature on how to determine the status of water bodies under the WFD [52–54], the application of the *Weser case* criteria in individual cases is often characterized by large uncertainty.

6.3. Spatial applicability of the Marine Strategy Framework Directive

In one sense, the spatial application of the MSFD is straightforward: it applies to all marine waters. For each EU member state, this includes the waters, the seabed and subsoil from the baseline out to 'the outmost reach of the area where a member state has and/or exercises jurisdictional rights' [8, Arts. 2–3], i.e., as far seaward as the state may exercise jurisdiction based on it being a coastal state. Since the maritime boundaries in the Baltic Sea, with a few exceptions, are clearly established [55], this makes the geographical responsibility of each member

state under the MSFD fairly easy to define. In this respect, the Baltic region differs starkly from e.g. the Mediterranean where maritime delimitation is much more disputed [35, p. 218, p. 220]. Since there is no high seas – i.e. areas beyond the jurisdictional zones of any coastal state – in the Baltic Sea, all the water seaward of the respective baselines is covered by the MSFD, with the exception of waters under Russian jurisdiction. However, this means that the MSFD and the WFD are both applicable to 'coastal waters' as defined in the WFD, i.e. the area from the baseline and one nautical mile seaward, but with the exclusion of transitional waters [8, Art. 3, 9, Art. 2]. The relative nebulousness and variability of transitional waters as a spatial concept (see Section 6.1 above) thus also impacts on the delineation of the applicability of the MSFD.

However, coastal waters are only covered by the MSFD 'in so far as particular aspects of the environmental status of the marine environment are not already addressed through [the WFD or other EU] legislation' [8, Art. 3, point 1]. This gives rise to issues of interpretation and coordination [56, p. 23]. These may be compounded by some apparent confusion in the literature regarding the spatial applicability of the directives, e.g. that the MSFD would apply 'from the high water mark and across the mouth of estuaries' [56, p. 23]. In legal terms, the applicability of both the WFD and the MSFD in marine areas is measured from the baseline, i.e. the low-water line 'as marked on large-scale charts officially recognized by the coastal State' unless straight baselines have been used in which case there is no immediate connection between the baseline and the waterline [28, Arts. 5 and 7].

Hopefully, the overlap of the WFD and the MSFD should guarantee that some issues of marine environmental governance are not 'dropped' one nautical mile seaward of the baseline. Among the issues covered by the MSFD but not by the WFD, thus making the MSFD relevant also for coastal waters, are marine litter and noise [56, p. 20]. It must also be acknowledged that, since the catchment area of the Baltic Sea is not included in the spatial scope of the MSFD, the objectives of the directive to a large extent have to be achieved by the measures and structures set up under the WFD [57, p. 157].

6.4. Spatial units of the Marine Strategy Framework Directive

When implementing the MSFD, the member states must take due account of the fact that their respective marine waters form an integral part of a marine region or subregion, as defined in the MSFD. The Baltic Sea is one such region, for which no division into subregions is made in the directive [8, Art. 4(1)]. Unlike the WFD, the MSFD does not provide for any further delineation of waters, e.g. into water bodies. The implications of this become clear when considering that the MSFD, which aims for the achievement or maintaining of good environmental status in the marine environment [8, Art. 1], requires the assessment of whether this objective is reached or not to be made at the level of a region [8, Art. 3, point 5], i.e. in this case the whole of the Baltic Sea.

Good environmental status is subject to a lengthy definition part of which is that marine waters should 'provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations' [8, Art. 3, point 5]. This rather vague definition is given concrete content by the member states. Based on an initial assessment, the MSFD required them to determine, by 2012, a set of characteristics for good environmental status in respect of each marine region or subregion on the basis of 11 qualitative descriptors (listed in Annex I) [8, Art. 9]. Descriptors that are not deemed appropriate for the specific region are not required to be used [8, Annex I]. The descriptors are supplemented by 'indicative' lists of characteristics, pressures and impacts [8, Annex II].

The MSFD operates at a much-magnified scale compared to the WFD which, as concluded above, is itself associated with problems of how to deal with small scale variability in water bodies. Indeed, the regions and subregion set out in the MSFD may mask more local pressures and their impacts [53, p. 4]. In order to take into account the specificities of a particular area, member states may implement the MSFD by reference to further subdivisions at the appropriate level of the marine waters [8, Art. 4(2)]. Hydrodynamic characteristics, freshwater input and mixing/stratification of the water column, as well as biogeographic distribution patterns of habitats and populations, have been identified as important features for defining the boundaries of ecologically meaningful subdivisions [53, p. 5]. Many of these are clearly dynamic over time and may be strongly influenced, directly or indirectly, by human activities and pressures, including climate change and eutrophication. Reporting by the member states shows that in practice a wide variety of geographical scales are used for the assessment of environmental status under the MSFD [53, p. 36].

6.5. Scales of assessment under the Marine Strategy Framework Directive

The need to 'integrate and geographically scale-up' assessments under the MSFD to the level of region (e.g. the Baltic Sea) requires assessment criteria and methods to be reasonably consistent and avoid cross-border anomalies [52, p. 21]. To promote consistency, criteria to be used for assessing the extent to which good environmental status is being achieved was set out in an EU Commission decision in 2010 [58]. The decision included 29 criteria for good environmental status linked to the 11 descriptors of the MSFD. Some of these represent important ecosystem features, such as biological diversity, food webs, and sea floor integrity, in terms of favourable or threatened features. Other descriptors represent pressures on ecosystems, such as fishery, eutrophication, and litter [59, p. 18]. Not least with respect to pressures, which are often represented by point sources, extrapolating to whole regions is difficult [52, p. 23]. Many of the 29 criteria were also vaguely defined, leading to very different interpretations [59, p. 22].

Already from the time of their adoption, the criteria of Decision 2010/477/EU were intended to be revised after the Commission's assessment of the first environmental targets and monitoring programmes to be established by the member states in 2012 [58, preambular para 4]. The revision process identified a need for significantly improving the quality and coherence of the member states' determination of good environmental status and emphasized the need for regional cooperation [60, preambular para 3]. In 2017, the Commission adopted a new Decision (Decision, 2017/848) with a reduced number of criteria and further specifying the criteria and their use [60, preambular para 6]. Importantly, the Decision provides for the setting of threshold values through Union, regional or subregional cooperation. Such threshold values are to be 'a value or range of values that allows for an assessment of the quality level achieved for a particular criterion' [60, Arts. 4(1) and 2]. The threshold values are required to be set at 'appropriate geographic scales of assessment to reflect the different biotic and abiotic characteristics of the regions, subregions and subdivisions'. The values, which 'may be' periodically reviewed and amended in the light of scientific and technical progress, shall also reflect natural ecosystem dynamics, 'acknowledging that the ecosystem or parts thereof may recover, if deteriorated, to a state that reflects prevailing physiographic, geographic, climatic and biological conditions, rather than return to a specific state of the past' [60, Art. 4(1)]. While attempting to ensure more consistency in the assessment of environmental quality, there is thus also recognition of the fact that the (realistically) desirable state of the marine environment may change over time. We cannot expect ecological regime shifts to be reversed, at least not within relevant timescales, and climate change is likely to affect what kind of ecological equilibrium can be aimed for in a given area.

Of particular relevance for the present analysis is that the decision defines, with varying detail, geographic scales for assessment. For some criteria, the scale is 'region, subregion or subdivisions' (Descriptor 11, Energy/noise) or 'subdivisions of the region or subregion' (Descriptor 2, Non-indigenous species; Descriptor 5, Human-induced eutrophication,

for areas beyond coastal waters). For Descriptor 1 (Biological diversity), the scale of assessment for population abundance is, for many species groups, 'region or subdivisions' (for the Baltic Sea) [60, Annex]. In these cases, the scale of assessment may thus depend on subdivisions established by the individual member states. Such subdivisions, however, are optional ('may') and the MSFD provides little guidance on how they should be made ('in order to take into account the specificities of a particular area'), thereby leaving this, and effectively also the scale of assessment, to the individual member states to decide. This is reflected in the wide spread in the number of assessment areas reported by the member states, ranging, in the Baltic Sea, from 1 (Denmark, Estonia, Germany) to 48 (Sweden) [53, p. 37]. Interestingly, for coastal fish, the scale of assessment of population abundance of the species is given as 'subdivision of region or subregion', thereby ostensibly requiring the member states to make at least some sort of subdivision [60, Annex].

Interesting as it may be, scale of assessment is obviously just one dimension of a complex process. Of crucial importance are clearly the threshold values, at what level they are set and how they are defined, and, as always, how they are implemented in practice by the different member states.

7. Conclusions

The adoption of EBM as an ideal or a requirement necessitates an increased engagement with space and scale in marine governance, not least by requiring that regulatory instruments and institutions be adapted to the scales of natural systems. This may seem particularly relevant in a context such as that of the Baltic Sea, characterized as it is both by high spatial and temporal variability in the natural environment and by complex regulatory structures. Otherwise, mismatches between the regulatory structures and natural systems may impede the achievement of desired policy outcomes. However, the distinction between natural and regulatory space and scale may not be as clear as is first assumed. Natural systems, or rather our perception or definition of natural systems and their constituent parts, are partly shaped by the concepts found in regulatory and scientific systems and communities. A pertinent example is 'water body'. Although ostensibly a natural concept, it is one subject to a social definition that strikes a balance between fidelity to natural conditions and administrative expedience or governability, thereby necessitating cognizance of how and to what extent the nature of each water body is in fact constructed by the regulatory system itself.

Many of the fundamental concepts used in marine governance, both those supposedly natural and those of obvious social origin, tend to be relatively indeterminate and/or temporally dynamic. Treating them as distinct or static may nevertheless be appropriate in certain situations for practical reasons. However, there needs to be a preparedness within the regulatory system to grapple more consciously with the dynamism and complexities of these concepts when needed. This will not least facilitate meaningful communication between the legal and scientific communities.

Marine management is associated with several challenges relating to scale and space. An important one is the need, inherent in the WFD and the MSFD, to aggregate assessments in order to be able to say something meaningful about the overall state of the marine environment as such (rather than its many dimensions), or to determine the status of a whole water body or even a whole marine region, such as the Baltic Sea.

Pertinent EU law leaves many decisions relating to space and scale to the individual member state to decide. This enables local natural as well as practical/administrative conditions to be taken into account. At the same time, it risks creating diverse preconditions for assessing environmental status and implementing preventive or restorative measures. Not least when the determination of whether an activity may result in deterioration of the water status can have far-reaching effects for individual projects, as can be the case after the *Weser* decision of the CJEU, it is problematic if such assessments are affected by different choices of scale for relevant management units.

Both the WFD and the MSFD are inherently adaptable to changing circumstances in different ways, although explicit provisions for revising relevant spatial units or types may be missing. The MSFD has, through the Commission decision of 2017, taken a significant step towards enhanced clarity in terms of the spatial dimension of assessment and with respect to what thresholds should apply when determining the extent to which good environmental status is being achieved. Is also explicitly recognises the temporal dynamism of natural systems and the fact the they may never return to 'a specific state of the past' but rather find new healthy and productive states consistent with new climatic and other conditions. At the same time, the recognition of variability or relative indeterminacy, both of the 'natural' and legal concepts and units that we use for marine governance, and also of the desirable environmental states that we aim for, should not be allowed to justify the continued gradual degradation of the marine environment as the inevitable result of changing conditions [61, p. 39]. There is an important distinction between accepting inevitable change and using that recognition as a pretext for resisting (by action or inaction) the taking of measures necessary for the long-term viability of marine ecosystems in a state that present and future generations are likely to find desirable or at least acceptable.

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Glossary

CBD: International Convention on Biological Diversity
CFP: Common Fisheries Policy
CIS: Common Implementation Strategy
CJEU: Court of Justice of the EU
EBM: Ecosystem based management
LOSC: United Nations Convention on the Law of the Sea
MSFD: Marine Strategy Framework Directive
PSU: Practical salinity unit
WFD: Water Framework Directive