Nancy Couling

Losing Sea. Abstraction and the End of the Commons in the North Sea

Chapter 3

Nancy Couling

> *It was much bigger than I expected . . . it was like a full city in the middle of the North Sea and I felt very small.*[1]

The Process Electrician worked at Ekofisk for 35 years, since he was 19 years old. He described his first offshore impressions, how he loved both his job and the working environment and how he developed strong bonds with workmates. The regular office job he tried once just didn't suit him and he couldn't wait to head back offshore.

In December 1969, Ekofisk became the North Sea's first major oil discovery on the Norwegian continental shelf. It turned out to be a giant reservoir and was developed rapidly into a complex of eight fields with over 30 different installations, including a sub-sea storage tank the size of a city block, leisure facilities, and accommodation for workers from over 50 different professions. "Ekofisk City," as it was called, was located in the extreme south-west corner of the Norwegian continental shelf, 280 kilometres from Stavanger, in waters 70 to 75 metres deep.[2] [Fig. 1]

The North Sea hosts a working life that goes beyond standard formats. The longevity, operational density, and functional complexity of the Ekofisk fields, including its residential components, challenge inherited understandings of urbanisation. In the early 1970s, a new type of space was produced offshore, marked by giant clusters of steel and concrete, with long distances to land and extreme on-site spatial restrictions. These places emerged above petroleum-rich geological formations located up to 3,200 meters below the sea's crust. They were far removed from established places of work or settlement. During the construction phase, 7,000–8,000 workers were based at Ekofisk—a population four times that of most Norwegian coastal towns. Ekofisk has been the singularly most important place for the Norwegian economy. It earned Norway 190 billion US dollars between 1974 and 2004. This amount is equivalent to 20% of Norway's total oil and gas production during this period.[3] The discovery of the Ekosfisk field marked the beginning of a new oil economy, manifested

Fig. 1

by the Government Pension Fund of Norway, otherwise known as the "Oil Fund." Despite the current process of North Sea decommissioning, the oil economy is still omnipresent.

Today the Ekofisk complex is a cultural artefact that has outlived its original life expectancy. While some parts are currently being dismantled, the Ekofisk South field is still being developed, making Ekofisk the longest-producing field on the North Sea. Due to its remarkable place in Norwegian history, the Ekofisk complex has been recognised by the Norwegian Directorate for Cultural Heritage as a technical-industrial monument.[4]

At the Ekofisk complex, all three "dimensions of urbanisation" conceptualised by Henri Lefebvre and further articulated by Neil Brenner and Christian Schmid are manifest: the explicit forms of territorial regulation that enabled its emergence, the physically constructed "urban fabric"—it is the North Sea's most concentrated agglomeration of material installations and pipelines—and the highly regulated practices of everyday working life.[5] Yet despite these characteristics, sites like Ekofisk City and numerous other manifestations of extended urbanisation in the North Sea are unfamiliar and enigmatic in urban terms. They contradict conventional notions of the urban, such as density, diversity, and centrality, and they exemplify a specific operationalised and industrialised territory located at a carefully maintained distance outside public visibility and consciousness.

This chapter tells the story of intensifying urbanisation processes in the North Sea. These processes enabled national governments and industrial enterprises to take possession of the entire sea and fill it with a particular type of urban fabric exemplified by Ekofisk, which requires organised labour relations to operate and maintain it. The sea space has become a place where capitalist practices accumulate, thereby inducing accumulated forms of loss; the loss of the sea as a socio-cultural space,

F. 1 Ekofisk complex, North Sea.

as a space of human labour, as a commons, and finally as a space of balanced ecosystems.

The historical overview in the first section charts the role of the sea in western European socio-cultural and economic relations from the Roman Empire to the Second World War. The central nexus of trading activity moved from the Mediterranean to the North Sea during this period, where the sea was increasingly exploited in the service of the expansion of empires and the commodity economy. It began to be conceptualised and mapped in a rational way, illustrating the transformation of the sea from an animated space full of geographic features and human experience to an efficient, neutralised trading highway. By the seventeenth century, the sea was losing its socio-cultural significance, followed by its importance as a place of work in the twentieth century as containerisation and air travel began to make large sections of maritime labour redundant.

The second section examines how the urbanisation of the North Sea began in earnest after the Second World War. The North Sea played a major role in the conflicts of both World Wars, and the military domination meant that the sea had been largely cleared of civilian activities—the state had gained a major role in organising and controlling the sea commons. International post-war conventions not only resulted in the regulation of sea space but also paved the way for creating a state space, determining resource use in vast exclusive economic zones at the expense of the sea commons. The way these zones consumed the sea space entirely in the North Sea, resulted in the loss of the sea commons.

The abstract state enclosures in the North Sea established the basis for further planning and operationalisation for oil and gas and, more recently, wind-energy industries. The third section illuminates this process and how the urban fabric described above for Ekofisk was constructed for a dedicated workforce under strict codes, rhythms, and spatial constriction.

In 2018, the *New York Times* published the article "Losing Earth: The Decade We Almost Stopped Climate Change," about the years 1979–1989 when the effects of climate change were already understood, but scientists, politicians, and activists did not manage to finalise a global framework to reduce carbon emissions.[6] This chapter's title, *Losing Sea*, is in reference to this poignant article. It demonstrates how processes of extended urbanisation in the North Sea, although facilitating unprecedented economic gains for northern Europe, have resulted in an ecologically degraded marine habitat and immeasurable loss.

INHABITING THE SEA: A BRIEF HISTORY

The transformation of society's relationship to the sea over the long timespan between the Romans and the end of the Second World War is examined in this section. During this period, the leading trading region shifted from the Mediterranean to the North Sea. The nation-state emerged with colonial ambitions realised through the domination of maritime space, which was then heavily occupied by military activities in both World Wars. The world capitalist economy became increasingly dependent on long-distance maritime networks, culminating in the post-war container revolution. These events set up the conditions for the urbanisation of the sea, an urbanisation process paralleled by the systematic emptying of the sea's traditional socio-cultural significance.

EARLY MARITIME TERRITORIALISATION FROM MARE NOSTRUM TO MARE LIBERUM

Before the development of road networks in Western Europe, waterways were the major logistical routes for exchanging goods, people, and knowledge.[7] It was across the water that connections were established and sustained between important regional centres whose wealth frequently depended more on international trade than their hinterlands. Between 700 and 1,600, and before the rise of the nation-state, people were constantly migrating around

the North Sea; the Anglo-Saxons came to England in the fifth century from Germany and Denmark and continued to settle; the Vikings travelled and settled all around the region, and the Shetland Islands were under Norwegian rule from the ninth to the fifteenth century.[8] Traces of language, music, arts, and architecture testify to constant circulation—the material culture of marine societies around the North Sea was more similar than diverse and coastal cities had more in common with their opposite shores than with their hinterlands.[9] Wealth gained through trade was physically manifested in the built environment, and around the sixteenth century, literacy rates were higher on the coasts than inland.[10] The common sea space supported and facilitated this exchange. Such evidence of the sea's critical role in commercial and socio-cultural dynamics has long been recognised. Still, until recently, the sea has not been considered integral to urbanisation processes.

Historically in Europe, kingdoms or political entities ruling over coastal land that partially enclosed seas used the concept of *Mare Nostrum* (Roman for "our sea"), where sea and land were integrated into a territorial whole. The Mediterranean unified under Roman rule from 31 BC to 200 AD is a well-known example. Also, when the rule of the Norwegian Kings extended to Greenland and Iceland from the tenth to thirteenth centuries, they aimed for a similar concept: *Mare Clausus* (closed sea). At that time, Greenland was thought to extend to Svalbard, and Svalbard to Novaya Zemlya, thereby closing the "Northern Sea" dominion (*Mare Septentrionalis*).[11] The difference between *Mare Nostrum* and *Mare Clausus* could be slight, depending on the exertion of power to claim exclusive rights and access. While the Norwegian Kings tried to establish a *Mare Clausus* by preventing foreign ships from entering and trading during this period, according to Steinberg, the Romans developed a doctrine of stewardship, claiming *imperium* (right to command) in the Mediterranean, but not *dominium* (right to own). For the Romans, the sea, a *res communis* was a thing that by nature was common to all and therefore governed according to *jus gentium* (common law), and not *jus civile*—the law applied to Roman citizens on land.[12]

The sixteenth-century Mediterranean was the focus of Fernand Braudel's groundbreaking work, which accomplished the first comprehensive history of a western European maritime space, including port cities and hinterlands.[13] His work contributed to a specific spatial dimension, considering the Mediterranean's climate and geography together with its central focus on the economic life of maritime trade. It became the most important historical precedent for conceptualising maritime space connecting a system of cities. Braudel describes the Mediterranean's centre of power during the fifteenth and sixteenth centuries as an "urban quadrilateral," comprising the four main centres of Venice, Milan, Genoa, and Florence. Venice disposed of a limited hinterland, and in order to achieve continuous expansion, markets were sought through overseas trade. The powerful influence of the Venetian Republic and its integrated trade and communication systems encompassed the Mediterranean and beyond, including the most prosperous ports, a series of secondary urban centres, and peripheral areas—each operating with different dynamics but all part of a widespread economic system. The sea is drawn into urbanisation processes as a major feature and the facilitator of a dilating, coherent space of extended urban relations. Braudel argues for the Mediterranean as an *économie-monde*—an extensive network of economic exchange comprising an economically autonomous section of the planet.[14]

For Braudel, the Mediterranean also clearly demonstrates the inextricable link between long-distance trade and the expansion of capitalism, exemplified by the Italian city-states sometime around the thirteenth century.[15] Manuel de Landa continued this line of thought, referring to maritime port cities connected by the medieval Baltic, Mediterranean, and North Seas, which were not interested in accumulating territory, but rather "exhibited the kind of weightlessness or lack of inertia that we

associate with transnational corporations today."[16] In the seventeenth century, the dominance of Venice in European trade declined in favour of northern Europe, and the central nexus of activity migrated from the Mediterranean to the North Sea. The dynamics of this shift have been discussed thoroughly by historians. It has been linked to the deliberate undercutting of high-quality Venetian products by the English and the rapid expansion of the Dutch and then English colonial empires.[17]

The North Sea was a geographical region distinct from the Mediterranean with its own cultural and economic history. Control of trade around the North Sea had changed hands over the centuries, from the Frisians (first to the eighth century) to the Vikings (eighth to tenth century), and subsequently to the Hanseatic League (at its height between the twelfth and fifteenth centuries). These groups were highly skilled navigators who could find their way in the fog and knew the seasons and the difficult North Sea storms, tides, and currents. Norse sagas tell how the indigenous Sámi people—who were excellent navigators—built the boats that proved such a success for the Vikings. The North Sea measures around 600 kilometres at its widest part, a distance Viking vessels easily crossed in four to five days. It was a topographical zone filled with human activity linked to specific seascape characteristics communicated through narratives of first-hand experience— for example, detailed knowledge about the rich local fishing grounds. Competing ruling feudal states sometimes attempted to annex these grounds as territorial extensions under their power, the Nordic Kings being one such example.

The North Sea was also marked by fierce independence from political domination before the rise of the nation-state. This is true for the Frisians, who today are still proud of "Frisian Freedom"; since the ground was poor and difficult to farm, foreign rulers were never interested in owning it, and the Frisians remained independent until the sixteenth century. Likewise, the Hanseatic League was an independent business confederation of 200 coastal and river ports throughout the Baltic and the North Sea regions, united as free trading cities in the interests of commerce, without ambitions of territorial expansion.

But by the seventeenth century, Dutch trading companies had expanded beyond the North and Baltic Seas, initially pursuing the lucrative spice trade but also aiming to overthrow the Portuguese control and monopoly on strategic trading posts and maritime routes. Succeeding Spain and Portugal, they established the Dutch colonial empire in Africa, North and South America, India, the Middle East, China, Japan, and Indonesia. Their greatest maritime rival, the UK, was pursuing similar ambitions. In this context of competing for territorial claims at sea linked to trade, in 1609, the Dutch lawyer Grotius formally articulated the principle of "freedom of the seas for all" in his book *Mare Liberum*.[18] Vested interest in trade was Grotius' primary motivation, but he embellished this commercially grounded idea with ethical arguments, insisting that this freedom was in the general interest of humankind. The publication also pointed to the English monarchy, which threatened to take over large maritime areas as a sovereign right. *Mare Liberum* suited the commercial importance of the sea for both parties—they could continue their expansion of trade across seas unimpeded by territorial claims. It remained the guiding principle for all seas for over 300 years until after the Second World War and the adoption of the United Nations Convention on the Law of the Sea (UNCLOS).

Mare Liberum was intended to facilitate worldwide capitalist expansion and colonisation by European powers through maritime means. It was further enabled by the combined technological improvements in ocean navigation, which Braudel named among the three great technical revolutions from the fifteenth to the eighteenth century, alongside artillery and the printing press.[19] These developments meant that during the seventeenth and eighteenth centuries, empires were established based on oceanic rather than terrestrial dominance, and international relations were configured

Fig. 2

worldwide rather than in regional systems, including the global imbalances that emerged as a result.[20]

THE MAKING OF "THE GREAT VOID"

The rise of the nation-state and its domination of trade and commerce throughout the North Sea and beyond—first by the Dutch and then the English empires during the sixteenth to the nineteenth centuries—set a parallel process of socio-cultural evacuation in motion. Rather than the obviation of state power, the expanding transnational networks were the very expression of it. As Michael Miller put it: "In nearly every instance when global processes can be identified, it is possible to locate a state presence or the advancement of the state." [21] The international consensus to maintain a *Mare Liberum* for trade prioritised the abstraction of the sea to a horizontal transport surface across what Steinberg calls the "great void" rather than a differentiated seascape supporting coastal life. This was a space within which European sea powers exerted and consolidated their political and economic strength, primarily through trade, with a military escort if required.[22]

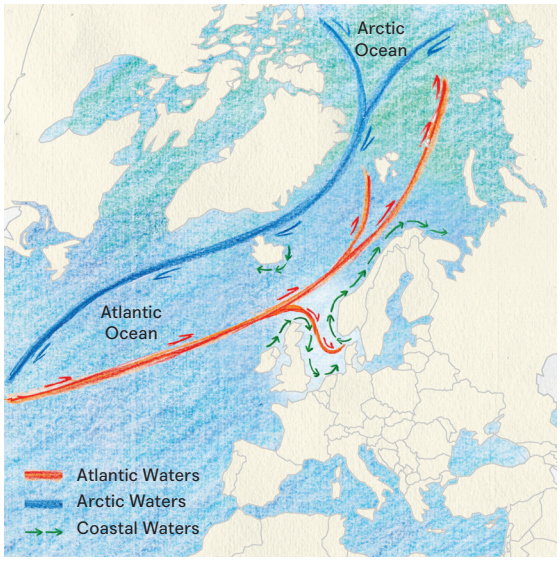
Cartographic abstraction served the void conceptualisation of sea space and the subjugation of local knowledge; up to the sixteenth century, maritime maps had incorporated narrative features, expressing both real and imagined experiences at sea. The "Carta Marina" map of the northern lands by Swedish ecclesiastic Olaus Magnus, portrays an animated sea, illustrating not only accurate geographic information from different sources, including the cartographer's own experience, but also sailor's descriptions of marine features such as the maelstrom off the Norwegian coast, and mysterious sea creatures. [Fig. 2] By the seventeenth century, with the rise of the early modern state and when rational science began to influence cartography, the sea became increasingly featureless, emptied of such imaginaries.[23] Carta Marina also illustrates portolan lines—diagonals emanating from centre

points and representing up to 32 wind directions—which were the main navigational aids at sea from the medieval to the early modern period. Sea maps from the seventeenth century lost the multitude of portolan lines and increasingly adopted abstract, gridded lines of latitude and longitude, even though longitude was still only a concept that could not be accurately measured.[24] As Wood stated, "cartographic control" took over the sea "to give the elusive idea of the state concrete form."[25] Pre-existing maritime histories and beliefs were overwritten, and places were renamed or erased into blankness. Through these practices, socio-cultural seas were the first to be lost to imperial expansion and colonisation all over the globe.

THE GEOPHYSICAL NORTH SEA

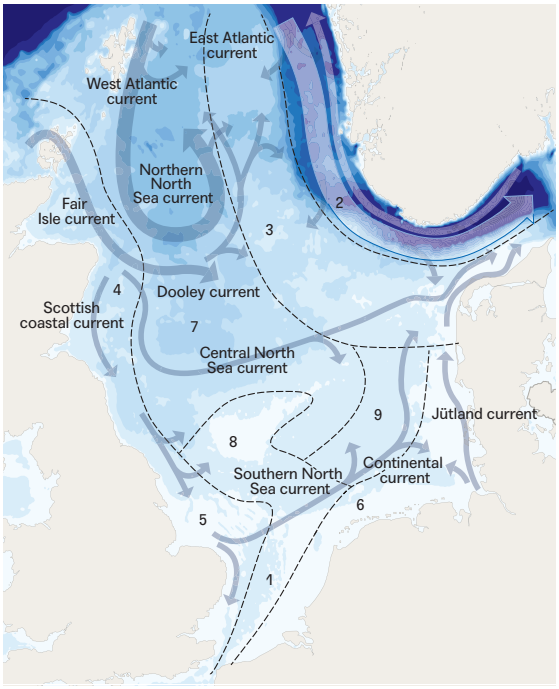
Processes of urbanisation in the North Sea are tightly linked to its geophysical properties. This is a shallow but stormy subdivision of the Atlantic Ocean, located between 51 and 61 degrees north. [Fig. 3] Covering an area of 575,000 km^2, it is around 970 kilometres long and 580 kilometres wide, and with an average depth of just 95 metres, it is a "shelf" sea, mostly lying on the continental shelf (see below). The maximum depth of 700 metres occurs in the Norwegian trench, running along the Norwegian coastline.

The southern part of the North Sea is only 20–40 metres deep, with depths increasing northwards at around 58 degrees north. This bathymetric feature retraces the outline of the higher parts of prehistoric "Doggerland," named after the Dogger Bank—an area of shallow waters located in the middle of the North Sea—which was a vast, low-lying plain with river valleys and a large population of Mesolithic people, washed over and submerged by the sea around 10,000 years ago.[26] Settlements around the North Sea are faced with constant storms and flooding, so they were originally established close to natural estuaries, sheltered ports or higher ground. Nearly all great northern European ports—for example, Hamburg, Rotterdam, and previously London—are located on tidal rivers, providing shelter from the open sea and links to the hinterland.[27] The seabed in the southern North Sea is mainly sandy



THE NORTH SEA: A POCKET OF THE ATLANTIC OCEAN
Fig. 3

F. 2 Carta Marina, Olaus Magnus, 1539.
F. 3 Altantic Ocean and the North Sea with main currents.



1 Channel water, warm, 35% salinity
2 Skagerrak water, low salinity
3 Transition water (2–7), surface salininty
4 Scottish coastal water
5 English coastal water, vertical mixing
6 Continental coastal water, low salinity
7 North Atlantic water 35.2 salinity
8 Mixture of types 1, 4, 5, 6
9 East-west salinity increase

NORTH SEA CURRENTS
AND HYDROGRAPHIC REGIONS
Fig. 4

and once boasted abundant oyster beds since removed through centuries of trawling. This sandy substrate and the proximity to dense urban areas have recently made it a favoured offshore wind farm development site.

Salinity, temperature, currents, and bathymetric characteristics have resulted in a complex oceanography, naturally divided into nine hydrographical regions according to different water masses. [Fig. 4] The North Sea ecosystem is nutrient-rich due to inflow from major European rivers—Elbe, Rhine-Meuse, Humber, and Thames—and oceanic inflow from the Atlantic, producing one of the world's most abundant fishing grounds. Wind-driven currents contribute to the dominant counter-clockwise water circulation, which ensures a continuous distribution of nutrients and organisms. Areas of coarse substrate on the seabed are important for spawning fish, particularly herring. Until the 1970s, captive fisheries harvested up to 4 million tonnes in the North Sea annually.[28]

Thousands of metres below the surface, the composition of ancient sedimentary layers has also become crucial for the urbanisation of the North Sea, determining the spatial configuration of oil and gas installations. Continental shelves are a continent's submerged periphery; hence they collect organic deposits from both the land and the sea. In addition, the geology of the North Sea is made up of a series of buried basins, which support the accumulation of vast sedimentary layers from surrounding landmasses.[29] Petroleum was formed due to the particular North Sea conditions during the late Jurassic/early Cretaceous period when geological rifts occurred, tectonic plates moved apart, and sediments were deposited along rift margins.[30] This was followed by a rise in sea level and the burial of the Jurassic rock containing hydrocarbons, creating the major geological features of the Viking Graben and the Central Graben, down the middle of the North Sea, where much of the North Sea petroleum has been discovered.[31]

LOADING AND EMPTYING THE SEA

Human activity has taken place around specific spaces produced by the North Sea's geophysical properties: fishing grounds and hydrocarbon formations, but also its interconnected transport surface and the space for offshore wind. Since Braudel, and as pointed out by philosophers, historians, and human geographers, Western academic thought has been overwhelmingly terrestrial, lacking the imagination to embrace the space of the sea, let alone analyse processes of urbanisation there.[32] The socio-cultural sea has been preserved in its otherness in European maritime societies. It is cognitively separate from land in both antagonistic and complementary ways, as archaeologist Westerdahl has specifically shown of prehistoric northern Europe.[33] This otherness appears more recently in Nordic folklore. While several of the marine activities in the North Sea listed above can be easily identified prehistorically, Hatch reminds us, "When a landscape has true cultural value … engagement moves beyond simple exploitation. Cultures invest their maritime landscapes with ritual and symbolic depth." [34]

As the world capitalist economy became increasingly dependent on long-distance maritime networks in the nineteenth and twentieth centuries, and as the exploitation of marine resources expanded exponentially, the sea as a space of human labour was the second sea to be lost. Until the mid-twentieth century, and before its subsequent rapid industrialisation, the North Sea supported a sizeable human labour force; it was crossed by numerous passenger ferries, hosted a large fishing fleet, and shipping and port operations required manual work. Port workers in London—the world's busiest port in tonnes until the Second World War—numbered 54,000 in 1925 and, although diminished, still 28,722 in 1960.[35]

However, two transformative events occurred in 1956: the Pan Am transatlantic jet service was introduced on the same day as a converted tanker carried 58 truck trailers from Newark to Houston—the predecessor of the contemporary container ships.[36] The subsequent evacuation of the large-scale public presence in the sea, the rapid standardisation and mechanisation of the shipping industry geared to containers, and the discovery of offshore oil transformed the nature of urbanisation in the North Sea and seas around the world. These factors, combined with the parallel beginnings of global maritime planning initiatives, signalised the historical moment when the urbanisation of the sea began in earnest.

Containerisation revolutionised maritime transport and reorganised world labour relations through a new international division of labour and a shift to cheap production regions. Over 90% of all goods travel across the ocean in containers. But containerisation turned the sea into what Alan Sekula calls "The Forgotten Space." Not only were containers impenetrable, anonymous, odourless, revealing nothing of their contents, but working lives at sea were banished to a liquid no-mans-land. Sekula stated, "100,000 invisible ships, 1.5 million invisible seafarers binding the world together through trade." [37] Sekula's work traces the social spaces of the shipping industry in the urbanised sea, both internally sharply controlled and obscured from the outside. As the sea was increasingly loaded with goods and vessels, it was also being emptied of social activities, legal rights, and the historically respected culture of seamanship.

THE SEA AS TERRITORY

The recognition of sea regions as territories in their own right is critical to the understanding of sea space in relation to urban dynamics. If the sea is understood and treated as a territory, urbanisation processes can be analysed at a range of scales and can consider the notion of *seascape* in both its cultural and geophysical dimensions. Within the tradition established by Claude Raffestin, where territory is considered a socially appropriated space, Bernard Debarbieux proposed an understanding of the territory as a dynamic set of conditions needed to support a social community.[38] With specific reference to my analysis of the Barents and Baltic Seas, I defined maritime territory as formed through the interactions

between geophysical, biological, and socio-economic layers.[39] Such a fluid, relational perspective enables critical examination of both the sea territory as a spatial entity with specific characteristics and the largely hidden exploitive practices and movements within them.

Parallel to cultural landscapes, cultural seascapes are produced by mutually transformative interactions between human activity and the natural environment. Specific characteristics of *sea*scapes—the depth and salinity of the water, the seafloor composition, and their capacity to sustain marine life or resource-driven maritime activities—have steered human interaction. Thus dredging, trawling, dumping of waste, shipwrecks, laying of mines, detonations to clear munitions, drilling, and injections of carbon have contributed to a continuous moulding and transformation of these very seascapes over time.[40] It is imperative to extend the concept of territory "beyond terra," in particular to oceans, to gain a clearer understanding of the economic activity and political power being exerted in such unbounded places undergoing continual transformation.[41] Together, the design and research projects described below highlight the exploitation through capitalist industrialisation, the infrastructural density, the extent of segregation, levels of state control, and the resulting public retreat that characterises contemporary urbanised sea territories.

After Braudel's work on the Mediterranean, significant spatial perspectives that encompassed sea spaces and a shift of focus from the land to the sea were first seen in association with systems thinking. Bringing land and sea together in one comprehensive understanding of world systems was one of the aims of the visionary architect, inventor, and designer Richard Buckminster-Fuller. This included potential flows and the design of an equitable distribution of energy and resources that could, together with technological advances, solve society's burgeoning problems. The "one-ocean-world" version of Fuller's Dymaxion map aimed to broaden the narrow historical perspective that prioritised small continents (30%) over the vast ocean (70%) and to promote fluidity, interconnectivity, and dynamics in place of the prevailing static, entrenched, and isolated "landlubber" world-view.[42] [Fig. 5]

Resource flows across the world's oceans have become hallmarks of the capitalist system. As Sloterdijk affirms, ocean space has been the "natural media of unrestricted capital flow." [43] Maritime transport systems reveal the central contradiction of capitalist urbanisation: it is simultaneously fixed and in motion. As identified by Harvey and Brenner, the de-territorialising aspect of capital, its "drive toward spatial expansion, temporal acceleration and relentless spatiotemporal restructuring," is only possible through the production of more permanent, "fixed," physical infrastructure, resulting in a massive extension of the built environment on land and sea.[44] Fixed offshore facilities and supporting infrastructure for the maritime transport of oil, containerised goods, and communications are primarily out of sight yet comprise a vast, uneven template of cables and pipelines on the seafloor. At the same time, physical modifications are continuously being made to the seafloor along dedicated heavy maritime traffic routes.[45] The invisibility of these systems enables the capitalist illusion of smooth, uninterrupted flows to persist. The "vast logistical landscape" of the ocean is the subject of still unrecognised material, political, and ecological significance, according to landscape architect Pierre Bélanger.[46]

In addition to shipping, industrial exploitation of the sea is continuously advancing, even into what the WWF describes as Europe's last intact marine ecosystem, the Barents Sea. Ironically, the alarmingly rapid depletion of sea ice has massively increased the strategic territorial role of this sea space. It has been opened up for exploitation by the new Northern Sea Route across the Arctic Ocean, a part of the north-east passage that lies entirely in Russia's exclusive economic zone, and by releasing new petroleum exploration licenses in increasingly ice-free areas. Design research at the EPFL Laboratory Basel highlighted the mounting geopolitical pressure to transform the Barents Region into

Fig. 5

an extractive "province," setting the planning processes and construction of the required infrastructure in motion.[47]

The Mediterranean has also changed dramatically and turned into what Stefano Boeri and John Palmesino called "the solid sea," a complex, stratified, and highly controlled space through which people, information, and materials move.[48] Their research identified mutually exclusive trajectories that seldom offer the possibility of any kind of exchange. Although the authors began with understanding the sea basin as a liquid continent, "the only certain territory" was a volatile region of shifting borders. The resulting view of the Mediterranean was of "a 'Solid Sea,' a territory ploughed by predetermined routes and insuperable boundaries and subdivided into strictly regulated bands of water. A solid space, crossed at different depths and in different directions by distinct flows of people, goods, information, and money." [49] Subsequently, the deadly hardening of the Mediterranean's borders in response to migrant crossings has been precisely documented in the work of Forensic Oceanography—a specialist group within the Forensic Architecture research agency at Goldsmiths, University of London. "Liquid violence" is their term for the state practices of militarising the EU border but renouncing rescue obligations at the same time.[50]

The fragmentation and separation of contemporary sea space recognised by Boeri and Palmesino found unequivocal resonance in other regions. The once open, fluid archipelago comprising Singapore and regions of Malaysia and Indonesia is today divided by the proliferation of maritime borders designed to secure vital shipping functions and prevent the informal exchange of people and goods. Milica Topalović and her team demonstrate how the role of the connective sea is reversed to a "carceral" space of separation.[51] Tightly controlled borders also determine the reclaimed Singapore coastline, completely transformed to accommodate the needs of the military, port functions, and the petrochemical industries. As a result of the reconfiguration of coastal and maritime space for commercial and industrial purposes, the public has also been forcibly withdrawn from the sea. Topalović's *Hinterland* research revealed how only 7.5% of the Singapore coastline is accessible to the public.[52] The organisation of settlements

F. 5 A variation of Fuller's Dymaxion projection to show a continuous "One Ocean."

has been disconnected from relations to the sea and is evolving according to the dominant land-based logic. Hence, the experience of the sea has also retreated from the public consciousness.

Parallel to this work, the theory of planetary urbanisation provided a theoretical framework for empirical research and design within which the global ocean was implicated.[53] Neil Brenner's *Extreme Territories of Urbanization* included cartographic studies on the Pacific Ocean, representing previously undetected levels of urbanisation, not only on the ocean surface through global shipping but also across the continental shelves and the deep seabed. For the first time, the ocean was identified as an urbanised realm, not in relation to the population density within a territorial space, but rather in terms of its infrastructural networks and widely dispersed concentrations of intense activity. In my research, I recognised such patterns of dispersed intensity as indicators of the urbanised sea.[54] These are spaces of extended urbanisation, mostly remote from established settlements but connected through robust delivery systems since settlements depend on this connection for vital resources.

Critical reflection on urbanisation processes in the North Sea has been rare, despite, or perhaps because of, its highly industrialised state. One exemplary contribution is "Future Commons 2050," a speculative project that recognises the imminent threat to the sea commons by offshore economic zones. In response, the project proposes that the economic zone in Belgium be transformed into an official "Maritime Commons," a radical proposal based on socio-ecological and ethical rather than economic concerns.[55] My North Sea research published with Carola Hein, "The Urbanisation of the Sea: From Concepts and Analysis to Design," responds to this lack of critical analysis. We show how conceptualising the sea as an urbanised realm is a vital tool to track, confront, and reveal hidden processes, spatial discontinuities, and rarely noticed state planning decisions. Particularly in the face of the ecological crisis, it is crucial to link the understudied sea to the land across the land-sea urban continuum.[56]

THE ABSTRACTION OF THE NORTH SEA

The industrialisation of the North Sea advanced rapidly after the Second World War, which marked the moment when the urbanisation of the sea began in earnest. But this type of urbanisation demanded more than accelerating industrial processes; it required a full state apparatus to transform the very nature of the sea space, render it abstract rather than "natural," and then perform operations of homogenisation. This meant fundamentally transforming a complex, differentiated, *living and contingent* space, resulting in one of the most contradictory examples of abstract state space in the Lefebvrian sense. This section explains how military activities took over the North Sea (along with other seas worldwide) as an extension of state sovereignty after the war through the establishment of exclusive economic zones. By forming this new state space, the sea commons in the North Sea were eliminated entirely.

IT STARTED WITH FISH[57]

Transfiguration of the North Sea into an abstract space of state management results from a process that ironically started with fish and an unpredictable, volatile form of extraction that, aquaculture excluded, still depends on a healthy marine ecosystem. Not only did industrialisation and excessive exploitation of North Sea resources first appear in the fishing sector, but the push for regulation to secure exclusive national control over resources led to the introduction of a systematic series of restrictions.

Fishing is the extraction of "wild" biomasses from the sea. Fishing technology in Europe gradually developed with beam trawling and well boats appearing at the beginning of the fourteenth century, which held a tank and could deliver fresh fish to Hamburg and London from the central North Sea.[58] Medieval technologies of sail, oar, hook, trap, and net prevailed in the eighteenth and mid-nineteenth centuries until the advent of the steam engine in the 1880s expanded vessel size, enabling fishing further offshore and in deeper

waters. Diesel replaced steam in the early twentieth century, with further increases in size and power and advancements in net materials from hemp and cotton to monofilament.

These developments caused what Holmes calls the "Great Acceleration" in post-war fishing, parallel to the sharp increase of resource use and the human planetary footprint in other sectors.[59] He links this exponential increase directly to the war, which led to the improvement of navigation technologies, vessel size, and power.

Until the Second World War, European fishing areas were rarely spatially defined. Fishing was carried out in a *Mare Liberum*. However, it was both the industrialisation and commodification of the industry and the emergence of territorial claims on fishing grounds that pre-empted the demand to extend territorial sovereignty out to sea in the form of exclusive economic zones. Holm claims that the advent of "ocean management"—a new centralised, abstracted, standardised form of territorial regulation in the space of the sea—was also a direct result of the Second World War. Wartime geopolitics around the strategic position of Iceland, where increasing German presence resulted in the 1940 invasion by British forces, led to the Icelandic declaration of independence in 1944. With this autonomy came the proclamation of a separate, exclusive fishery zone of 12 nautical miles beyond its territorial sea during the 1950s.[60] This launched the "cod wars" with the UK, which was finally settled in 1975 and demonstrated the state's increasing interest in spatially defined fishing grounds and maritime borders. Recent Brexit disputes demonstrate the ongoing conflict around the still highly lucrative UK fishing industry and the importance of state borders, which may or may not align with commercial quantities of fish.

THE MILITARISATION OF THE NORTH SEA

Until after the Second World War, the formal spatial regulation of the sea was limited to a narrow coastal strip originally as wide as the reach of a cannon shot, to which a nation's sovereign rights extended. Defence practices were carried out within this strip of the territorial sea, and the protection of merchant's vessels was expected. Beyond the territorial sea lay the "high seas" or international waters, which were not yet regulated or otherwise defined but understood as long-term "voids" that could also be appropriated for military purposes if required. This "neutral," non-developable void offered a realm external to the land ruled by monarchs and governments, which could be appropriated for their displays of military power and outright warfare. The rivalry between the Dutch Republic and England culminated in the Anglo-Dutch wars of the mid-seventeenth to the late eighteenth centuries. Other major North Sea battles were the Battle of Jutland (1916) and the Battle of the Atlantic (1939–1945) between Germany and Britain.

During both world wars, the North Sea was mined and otherwise exploited for military purposes, thereby reducing and excluding the civilian component and reconceiving, physically constructing, and occupying the sea as an abstract, strategic military space. Battles, mines, and blockades were aimed at severing enemy supply lines since urban centres on both sides of the North Sea relied on these extended maritime delivery systems. Still recognised as the high seas and not yet divided into its surrounding nations, the North Sea hosted the conflict for land-based power, transforming the geography of its "international waters" into a labyrinth of mines, patrol lines, and potential U-boat locations. Miller states of the First World War: "The maritime history of the war thus emerges, ironically, as the pivotal factor in a conflict centred on colossal land battles." [61]

The First World War "North Sea Mine Barrage" stretched from the Orkney Islands to Norway, and together with minefields in the English Channel, aimed to prohibit German U-Boats from leaving the North Sea and sabotaging important Atlantic supply lines from the US to the UK. [Fig. 6] The German strategy to destroy enemy supply lines through U-boat attacks on escorted merchant ships in the North Atlantic was again deployed in the Second

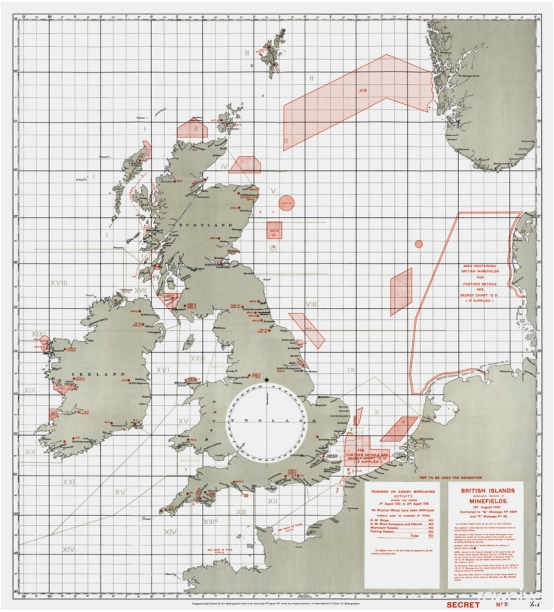


Fig. 6

F. 6 British Islands: approximate position of minefields, 1918. Hydrographic Department of the Admiralty.

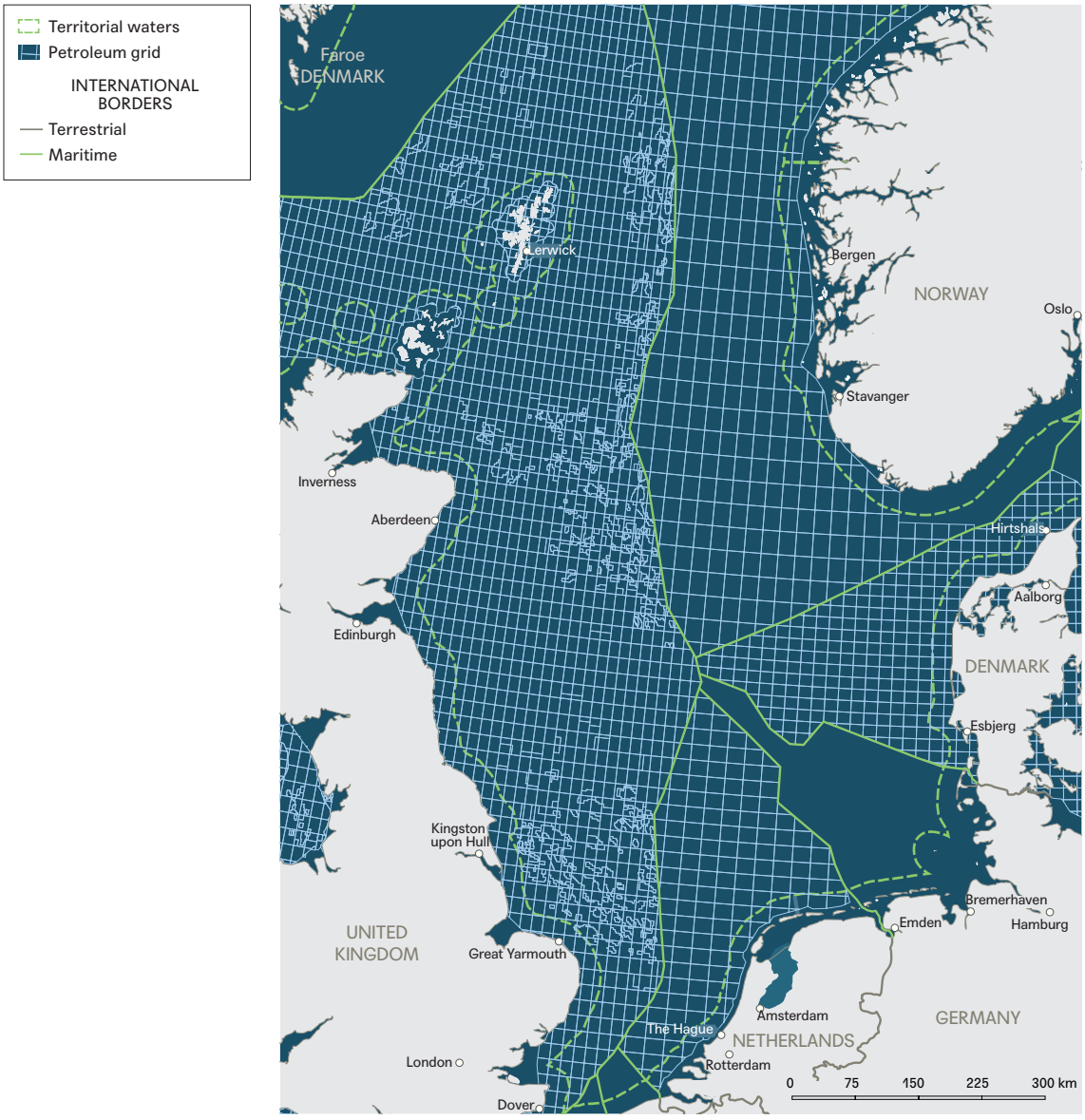
World War, supported by using "Marine-quadratkarten," which were coded military maps where geography was subordinated to a secret numbered grid. The North Sea "quadrat" (square) was coded as "AN" and divided into 81 smaller numbered squares.

The legacy of military presence in the North Sea and other seas across the world has had long-lasting implications and given the state a dominant role in maritime affairs. After the Second World War, the North Sea *international waters* were gradually eliminated. Mounting international concern about the continued presence of nuclear-powered submarines and military plans to place antiballistic missile systems on the seabed, alongside an alarming reduction of fish stocks, increased pollution, and national ambitions to control marine resources, contributed to the reassessment of the *Mare Liberum* doctrine by the United Nations. This resulted in a series of international conventions and, ultimately, the entire sea being given over to industrial activities. While ostensibly initiated for peaceful democratic purposes, it "turned into a global diplomatic effort to regulate and write rules for all ocean areas, all uses of the seas, and all of its resources," as the UN itself concedes.[62]

THE ENCLOSURE OF THE SEA COMMONS

Directly after the end of the Second World War, President Truman declared that all natural resources on the US continental shelf would be subject to US jurisdiction. This claim was an unprecedented extension of sovereignty into sea space and a historic event that influenced the UN's decision to take action.[63] Truman was prompted by Japanese salmon fisheries off the Alaskan coast and sustained pressure from the petroleum industry, pushing to explore further offshore. During the war, new technology had been developed both in the fishing and petroleum industries, and particularly relevant for the oil industry, steel was again more readily available. A series of similar claims from other nations directly followed that of the United States.

In response to these claims, the first United Nations Conference on the Law of the



NORTH SEA PETROLEUM GRID
Fig. 7

Sea was held in Geneva in 1956 and established four separate conventions governing the use and definition of sea space.[64] For example, the Convention on the Continental Shelf (1964) was explicitly defined according to the possibility of resource exploitation; hence, the world's continental shelves were earmarked as new extractive territories from the outset.[65] Once this Convention was in place, national legislation moved quickly to establish international maritime borders and thereby facilitate petroleum exploration. In 1964 a grid of coordinates across the North Sea was established by the UK in collaboration with Norway, based on quadrants of 1-degree latitude by 1-degree longitude. In the first UK licensing round in 1965, 394 blocks

subdivided within these quadrants were licensed to 22 applicants, thereby launching a half-century of extensive petroleum exploration in the North Sea.[66] With the exception of Germany, all North Sea countries adopted the grid as an efficient means of accelerating offshore exploration; hence, the seascape was geometrically organised and swiftly commodified for the extraction and production of oil and gas. [Fig. 7]

In 1982 the four previous conventions were consolidated in the United Nations Convention on the Law of the Sea (UNCLOS), which included the precise definition of a radical new state space—the Exclusive Economic Zone (EEZ). This zone extends from baselines along the coast to 200 nautical miles offshore, overlapping the previous commons of the High Seas, thereby greatly reducing what had previously been "international waters" at the global scale. With this convention, the sea emerged as a *new type of state space* of vast proportions. Unimpeded by the property rights and long-term forms of habitation that have accumulated on land, the sea offered the state abundant space to manoeuvre. For Lefebvre, state space displays "a rationality of unification […] used to justify violence," a unification that tends towards homogeneousness, which is subsequently perceived as a consensus by the public.[67] The global dimension of this new type of sea space became an historic precedent, arguably exemplifying the first rules of modern international law.[68] It also illustrates the advancing spatial demands of the state ostensibly aligned to the practical purpose of keeping order in the world's oceans and seas. The wholesale absorption of expansive areas of sea space into state-controlled extractive zones, justified through motives of peace-keeping and improving maritime spatial coordination between rivalling nations, is a primary example of such unification.

Campling and Colas have described the establishment of the formal instrument of the EEZ as "the single greatest enclosure in human history."[69] An enclosure of this nature is usually ascribed to large-scale privatisation and commodification of property on *land.* Using the example of seventeenth-century English parliamentary enclosure, Sevilla-Buitrago argues that this is an important historical form of extended urbanisation, which gathered previously autonomous (relatively) rural areas into new spatial-social relations for extraction and accumulation.[70] The collective use and management of the commons was an essential aspect of pre-capitalist land-use arrangements, comparable to the sea commons of the *Mare Liberum*. The sea was not a site for human habitation. Still, traditional fishing communities around the North Sea interacted daily in common fishing grounds, which were not subject to formalised ownership or static regimes of control. Therefore, the establishment of EEZs is part of the history of colonial capitalism in the form of the enclosure of sea as on land. The significance and unprecedented nature of the expansion of sovereign rights into the common sea space reached a crescendo in the twentieth century by dramatically extending capitalist maritime space and setting up conditions for the establishment of operational seascapes.

Although UNCLOS was a reaction to mounting conflict around resource extraction, it also comprised the last step towards an urban world "without an outside," to quote Brenner.[71] The fluid gap or "void" between exploitable *land* territories closed across the North Sea; today, EEZs have consumed the water completely. Together, the former high seas comprised the largest commons on Earth. Subsequent to the notions of the sea as a socio-cultural space, then as a space of human labour, the sea commons were the third type of sea to be lost through processes of extended urbanisation. They were dramatically reduced because of the UNCLOS while areas of sovereign space were extended, ripe for new forms of capitalist exploitation, which, once established, were refitted to suit successive industrial requirements. Nationalised, bounded, and over-exploited regional seas, one of the last planetary frontiers for state expansion with mounting spatial conflicts, have become state spaces to be "managed" and planned.

A NEW STATE SPACE

The new state space of the North Sea was intangible, defined only by abstract coordinates and subdivided with grids. The grid is an age-old rational and generic planning device of colonisation and a powerful vehicle of extended urbanisation.[72] It has been implemented throughout history to impose a superficial layer of imperial order on unknown territories, irrespective of geography. Likewise, in the North Sea, governments had little information about what was below the water surface or on the seabed at sites offered for petroleum exploration. Wave heights and weather conditions affecting potential structures in the stormy North Sea had not been systematically recorded. North Sea waters presented the most demanding offshore environment for oil and gas so far, surpassing previous technical limits of, for example, the calmer seas of the Persian Gulf.

My conclusions about the petroleum grid in the Barents Sea also apply to the North Sea; "The grid establishes an immutable, orthogonal, and highly resilient referential layer, presupposing the possibility of development anywhere within its range," while in theory, the water column still remained a dubious "common" rented out to transient oilrigs.[73] As abstract political devices, the borders and grids of offshore economic zones are also highly resilient; their positions result from state negotiations, but once set, activities within them can be transformed as required by capitalist projects. The current transformation of the North Sea from oil and gas to wind energy, discussed in the next section, exemplifies this process.

The homogeneous, easily extendable North Sea petroleum grid exemplifies Lefebvre's notion of abstract space.[74] Lefebvre clarifies that the state, having gained its sovereignty through latent or overt violence, accumulates wealth, land, and in this case, sea. Imposing administrative divisions "aggressed all of nature" according to the rationality of accumulation.[75] Lefebvre argues that the political principle of unification (of legislation, culture, knowledge, and education) is imperative to this project, without which it cannot be realised. In the North Sea, national interventions worked hand in hand with the demands of global oil corporations to establish a "unified" referential space of extraction. This principle of unification explains the simultaneously abstract and concrete character of state space. Passing for *absence*, the abstract space constructed by the state in the North Sea conceals the *presence* of operational procedures and their physical results.[76] Lefebvre distinguishes "three formants" of abstract space, the *geometric,* the *optical,* and the *phallic,* which both imply and conceal one another.[77] The geometric formant is expressed in homogenous, Euclidean space; the optical format promotes the dominance of the visual, simulating full reality also to conceal; and the phallic formant is expressed through the power and violence of symbolic objects and icons. Particularly pertinent to the North Sea are the geometric and optical formants.

Geometric formant: The power of the geometric formant lies in reducing social space to a Euclidean abstraction by flattening three dimensions to a two-dimensional plane.[78] The complexity of the geophysical North Sea, as previously described here, is irrelevant to the petroleum grid. In the early stages of the Ekofisk development, it was not clear how oil could be transported to the Norwegian mainland, given the topography of the Norwegian trench with depths up to 700 metres directly adjacent to the coastline. Pipeline technology had not advanced sufficiently to master such depths but only became possible later.[79]

Following the establishment of EEZs in 1984, littoral countries began the process of planning these zones, designating areas for a range of uses such as transport routes, offshore wind parks, sand extraction, military exercise zones, and protected areas. EU Directive 2014/89 required that all European countries present marine spatial plans for their EEZs by 31 March 2021.[80] The production of such plans has developed into a fully-fledged discipline called "Marine Spatial Planning," led by the state and initially following simplified, two-dimensional planning methods inherited from land, thereby not considering the motion,

depth, or volume of the marine environment. Exploiting the *economic capacity* of the sea space, rather than addressing the ecological balance, has emerged as the main objective of such plans. In the German EEZ, environmental assessment reports are used to ascertain if exploitative activities within protected natural areas result in adverse effects. Assessments of long-term cumulative effects—as in the exponential increase in offshore wind parks—demand technocratic calculations whose accuracy is not guaranteed. But the EU has established a series of "Blue Growth" objectives, which aim to expand and exploit the economic potential of the maritime industries in Europe through a variety of planning instruments.[81] "Blue-green" has replaced "Green" in much official literature around the transition to renewable energy production and sustainable development. At the same time, the ecological condition of European seas continues to decline.

Despite the production of increasing quantities of maritime data, the reduction of complexity permeates state-led planning initiatives in the sea. Political scientist and anthropologist James C. Scott regards abstract standardised units of measurement and cadastre plans as an unequivocal exercise of power and control that inevitably cannot be thoroughly upheld.[82]

Optical formant: Lefebvre's optical formant of abstract space deceives and conceals through the domination of vision over other senses leading to a different kind of simplification: "that which is merely seen is reduced to an image." [83] The open sea provides the possibility to experience space in one of its most abstract forms. While the sea's topographical features are located on the seafloor, invisible from the surface, the sea surface appears devoid of spatial information. As Howard and Rogers argue, there is a lack of "visual depth cues," which mediate between the body and the environment, transmitting information on scale and distance.[84] The surface of the open sea is also characterised by a lack of enclosure, augmented by the ultimate boundary of the horizon itself, which like a horizontal curtain, enables objects and landmarks to slip behind it. From the natural human viewpoint, this occurs at a distance of just under 5 kilometres; hence the abstract spatial experience of the sea is one of continuous opening and unfolding but also of concealment.[85] The horizon, and what may lie beyond it, has stimulated human imagination and spirituality throughout time, described, for example, by author Didier Maleuvre as "a shifting line where perception trails off" and thematised by artist Hiroshi Sugimoto as the meeting place of water and air: "so very commonplace are these substances … yet they vouchsafe our very existence." [86] [Fig. 8]

Observation of the horizon dividing sea and sky is the defining visual experience of "seascapes." The common usage of the word seascape corresponds closely to the concept of landscape as a pictorial view, which according to landscape researchers is still the predominant understanding.[87] Although the German *Landschaft* and the Dutch *landshap* were originally a unit of political organisation, when the English term *landscape* was imported at the end of the sixteenth century, it meant at first only Dutch landscape painting.[88] Capturing the sea through paintings followed the genre of landscape painting, although at a later date.

This understanding of seascapes has entered into planning considerations around the North Sea, referring to the visual preservation of an uninterrupted horizon, for example, in the case of Dutch and German planning policies.[89] In Germany, offshore wind production has been politically driven and allocated large areas in Europe's first legislative Marine Spatial Plan in 2009. But wind turbines have been kept at a minimum of 32 kilometres from the coast, with visible hub heights limited to 125 metres to preserve the visually open seascape.[90] In the case of the Wadden Sea UNESCO World Heritage site—itself, a cultural landscape extended and modified over hundreds of years of human intervention—a visually constructed "ring of nature" is preserved around the coastal edge.[91] Beyond lies an energy zone capable of producing 6,436 MW, equal to 8.3% of total German electrical power production.[92]

Fig. 8

Due to the location of geological formations containing hydrocarbons in the North Sea, a sprawling combination of rigs, platforms, and infrastructure for the petroleum industry emerged far offshore, removed from the North Sea's visual seascape.[93] This is the North Sea's offshore "petroleumscape," a term developed by urban and architectural historian Carola Hein to define the palimpsestic, ubiquitous spatial formation serving the petroleum industry that is deeply embedded in our landscapes in ways beyond pure infrastructure yet remains hidden from ordinary life. According to Hein's research, the petroleumscape does more than simply steer flows; it transitions smoothly between the different layers of ports, industrial enterprises, administration, retail, and infrastructure creating lasting narratives that provide a "feedback loop" that perpetuates oil dependency.[94] Discussing the invisibility of the petroleumscape, we concluded, "Corporations and nations control the spaces of oil and gas in secrecy and concealment, making it extremely difficult to *site* as well as *sight*[...] The industry is a multinational giant without a face, both ostensibly liberated from and inextricably implicated in state operations." [95]

Back on shore, the effect of "pure spectacle" described by Lefebvre in relation to the optical formant is most palpable at Scheveningen, where surfers paddle out from the shore, framed by the Port of Rotterdam's industrial silhouette. [Fig. 9] An urban seafront has been conceived and constructed as a backdrop and a place from which to view the lively spectacle of a crowded beach with a string of leisure facilities. Vessels heading in and out of Rotterdam plough the horizon. Offshore, just beyond the territorial waters, two munitions dumping sites organised after the Second World War lie submerged, their metallic coatings slowly corroding, becoming "ticking time bombs." [96] In the Netherlands, the contradictions and deceptions of a "purely visual space" are most evident in the face of the heavy

F. 8 Hiroshi Sugimoto, Seascape Rügen, Baltic Sea, 1996.

Fig. 9

F. 9 Surfers at Scheveningen, 2019.

industrial use of the limited North Sea space; the foreground seascape, preserved as a visual metaphor for leisure and relaxation, upstages the blurred perception of the background industrial activities.[97]

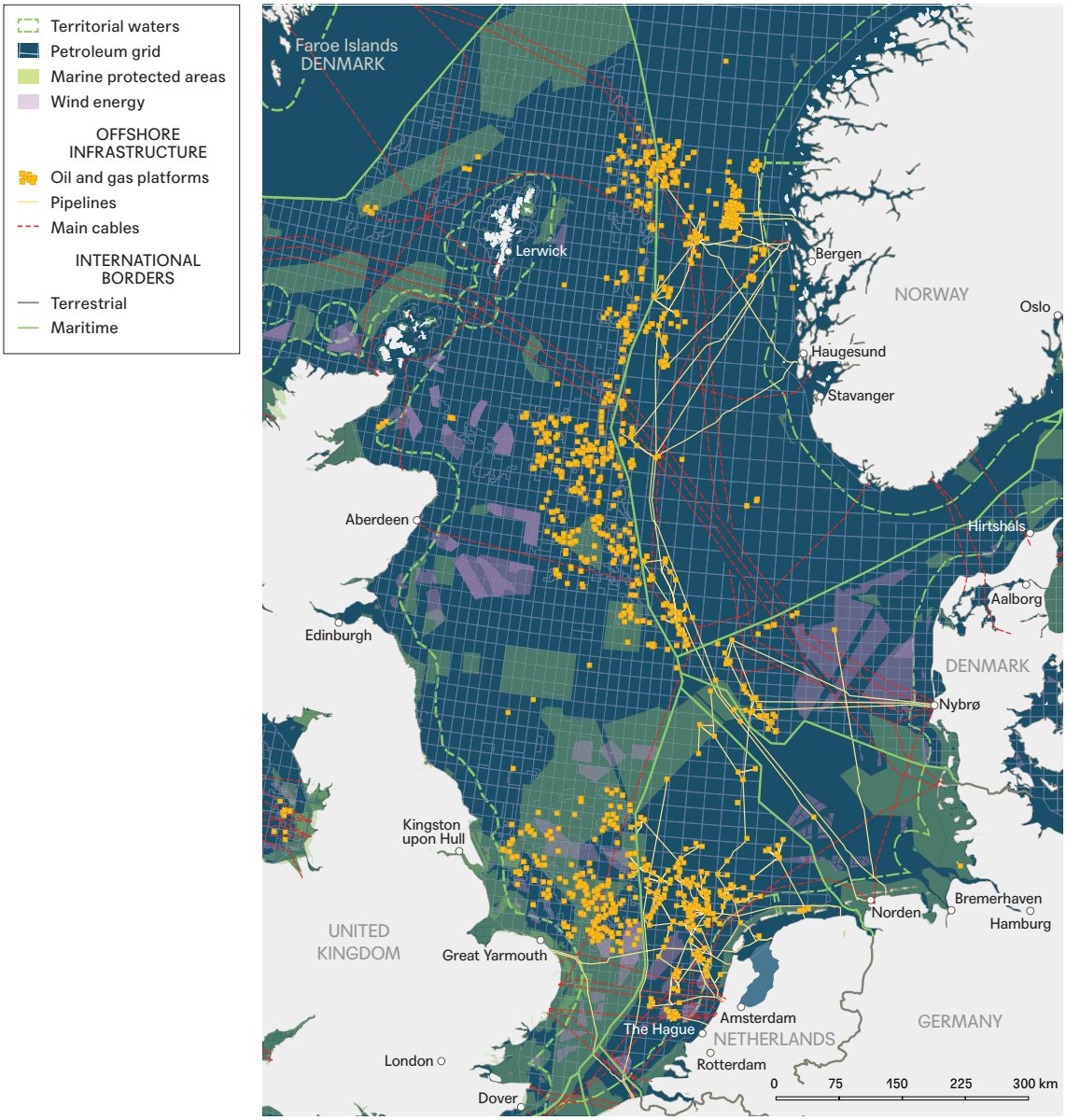
THE OPERATIONAL SEASCAPE

The transformation of the North Sea into a state space, organised around abstract borders and a unifying petroleum grid, enabled governments and companies to further optimise the space for industrial production. This led to the construction of an operational seascape composed of pipelines, cables, sea lanes, and offshore installations for wind farms and oil fields. Katsikis and Brenner describe operationalised landscapes as the capital-intensive, highly industrialised, and densely equipped hinterlands of the *Capitalocene* that, primarily for primary production, are laid out for maximum efficiency and are intermeshed with one another through complex extended global linkages.[98]

THE OFFSHORE URBAN FABRIC

The urbanised North Sea shows different types of technical installations and enclosures: cables, pipelines, and the industrial activities of oil, gas, and wind energy, as well as proposed marine protected areas. [Fig. 10] While the combined vessels for fishing, heavy shipping routes, and constantly circulating offshore petroleum servicing make a dense spatial imprint on the North Sea, these activities are not represented in this map since the objective is to draw attention to the multitude of fixed elements, which represent a marked spatial departure from the long-standing "fluid" maritime industries. The piecemeal, fragmented industrial logic of this space is apparent; operations are organised around national territories and are not coordinated. Offshore installations and their infrastructures have emerged over time; as new oil and gas discoveries were made, the offshore urban fabric was extended and adapted according to the technological limits and short-term practical and economic considerations only. It was never clear during the first phases of development how large complexes such as "Ekofisk City" would grow. The abstract unified state space of the sea afforded the conditions for unlimited and uncoordinated expansion irrespective of the sea's inherent geophysical properties.

North Sea governments not only authorised the large-scale operationalisation of sea space for production purposes but, in particular in the case of the UK, also aimed to attract the interest of petroleum companies through rapid preparation of the territory for exploration. This operational seascape is closely aligned with the traits of operational landscapes. It includes the production of a comprehensive system of encompassing territorial regulations, the physical construction of offshore installations, the laying of infrastructure to deliver supplies through



THE URBANISED NORTH SEA
Fig. 10

pipelines, cables, and shipping lanes, the securing of landings for delivering offshore resources into downstream networks, and the continuous displacement of a large rotating workforce.[99] While organised around the regular grid, the operational seascape is uneven and hugely distorted, at once thinly stretched over large distances and extremely compacted at industrial nodes. It is mostly invisible and kept out of sight from the recreational and contemplative "visual" seascape and served either by permanently moving vessels or undersea conduits.

The above map of the urbanised North Sea presents an unfamiliar geography of offshore industrial operations, with places frequently named after Norse gods on the Norwegian side

Fig. 11

Fig. 12

F. 11 Entrance plaque to the Frigg platform, named after the Norse goddess of love. Norwegian Petroleum Museum Stavanger.
F. 12 Dry Docks World-Graha, Indonesia, 2018.

of the continental shelf and birds on the UK side, in an appeal to a national cultural imagination. Between 1972 and 2010, the Norwegian Petroleum Directorate presided over the naming of oilfields in a deliberate effort to link these strange new geographic places with thousands of on-site construction workers and heroic, nationalistic Norse mythology. Place names such as Frigg, the goddess of love and the wife of chief Norse god Odin, or Gannet, a beautiful yellow-headed seabird, are pure abstractions, disconnected from the geophysical characteristics of the sea or navigational conditions. [Fig. 11] Early nineteenth-century North Sea maps included features such as the Dogger and other offshore banks, the Norwegian trench, indications of the seabed composition, depth soundings, and the course of important vessels.[100] Knowledge of the sea space was socially acquired through physical engagement, and place names of towns and cities around the sea edge were synonymous with the life of the sea. Today, the petroleum delivery system is organised around secured, obscure coastal landings nobody has heard of, removed from established settlement sites. Technology has also enabled the long, deep, sometimes horizontal drilling procedures to fully disconnect both the surface and seabed "geography" from the hydrocarbon source far below.[101]

The extraction of hydrocarbons from the North Sea and other global sites has directly contributed to the fourth and ultimate form of loss; the loss of the sea's ecological balance. As historical extraction sites reach maturity—meaning full depletion of oil and gas resources—the petroleum industry continues to earmark deeper, colder, more technologically extreme sites while investing in other forms of energy extraction in the sea space. Wind-energy pilot projects executed by Equinor—the new name for Norwegian Statoil, which avoids any allusion to oil extraction—are a prime example. Carbon emissions from fossil fuels have led to expanding seawater, rising sea temperatures, and the destruction or transformation of local ecosystems. The North Sea is warming, cod are migrating further north to cooler waters,

THE CIRCULATION OF AN ACCOMMODATION RIG
Fig. 13

invasive species are thriving, and more frequent storm surges are observed, resulting in destruction and flooding around the North Sea perimeter, partly in densely populated areas.

EVERYDAY LIFE ON THE RIG

The operational seascape is not yet fully automated on the North Sea and still requires a large human workforce. A Lefebvrian "lived space" is therefore anchored by a highly specific everyday existence offshore. Life on a rig echoes the distorted, uneven nature of the offshore urban fabric itself and is rigidly organised in extreme spatial confinement and intense bursts of time.

Offshore rigs are temporary by definition—they are vessels constructed for a lifespan of around 25 years, during which they will work in different fields. Once an unfamiliar sight, unemployed rigs stranded at landings have become more common around the North Sea in recent years, bringing the scale of otherwise inaccessible and rarely visible North Sea oil operations into public range.

I arrive at the accommodation rig *Haven*, moored at a 7 hectare site not far from Bergen, Norway. Owned by a firm originally established to serve Ekofisk, this service base for offshore industries offers quays adjacent to water 50 metres deep; the extension of the Norwegian trench provides deep-water docks inside some fjords. *Haven* is a jack-up accommodation rig with a maximum capacity of 443 occupants—the largest of this type currently in operation in the North Sea and requires a deep dock. Jack-up rigs work like a woodpecker screwdriver in reverse; on arrival at its destination, the legs are levered down notch by notch to the required depth. *Haven* has been stationed at the base for several months while strengthening and lengthening work on its legs is carried out in addition to providing new spud cans—the huge suction pads that attach the rig to the seafloor. Time is running, the work is over schedule, and overshooting the original estimate of $100 million. The pinch is being felt all over in the offshore industries. Owned by Jacktel, a subsidiary of Master Marine, founded in 2009

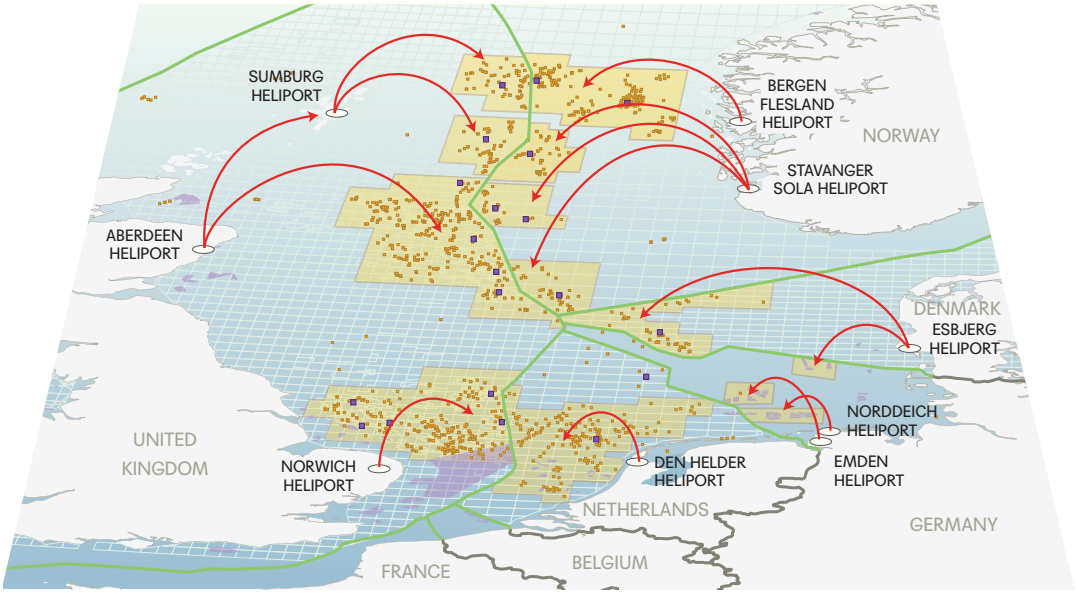
and registered in Oslo, *Haven* is rented out for specific periods according to awarded contracts. Therefore, it is an itinerant vessel sailing under the Cyprus flag and constantly looking for work. Different contracts mean different water depths; therefore, lengthening work can be required.

Haven was constructed in 2011 at Dry Docks World-Graha on the Indonesian island of Batam, itself a special economic zone serving global manufacturing industries, set up under Singaporean management. [Fig. 12] It was immediately mobilised to the Ekofisk field, after which she served in the Danish North Sea until 2015. Following structural improvements, *Haven* provided accommodation at the state-of-the-art Johan Sverdrup oilfield, located on the Norwegian continental shelf at water depths of 115 metres and ceremoniously opened by the Norwegian Prime Minister on 7 January 2020. Following structural adjustments at a different Norwegian base, *Haven's* next contract is for 20 months at the Danish North Sea field Tyra, which is undergoing redevelopment. While decommissioning of some of the over 8,000 structures in the North Sea (including platforms, pipelines, and wells) is already underway, selected projects such as the Johan Sverdrup field have been freshly completed. It is one of the five largest oilfields on the Norwegian continental shelf, cited by Equinor as "one of the most important industrial projects in Norway in the next 50 years." [102] [Fig. 13]

Offshore operations are carried out by a myriad of service companies with limited contracts; rig workers of all professions, including engineering, catering, maintenance, and cleaning (amongst others), do not work directly for oil companies but for separate contracting companies. Precarity is built into the operational logic of offshore oil and gas extraction. The continuous circulation of people, materials, finance, and machines, imperative to the ongoing capitalist project of North Sea oil and gas, leaves no time or space for continuity, responsibility, or concern. Temporariness, therefore, serves as a systematic means to maintain fluid, flexible, unchallenged operations while successive contracts add up to long-term activities at sea *simultaneously*. The longevity of a field is not determined by the license but rather by the exploitable quantities of oil or gas. Regulations have been developed to enable both the rapid abandonment of unprofitable fields and the full exploitation of lucrative fields.

Rigs occupy privatised and securitised zones, inaccessible to the general public and only connected to the North Sea urban fabric by specific pathways, some of which lead to part-time homes for thousands. According to current data, about 60,000 itinerant workers comprise the North Sea's oil and gas population. [Fig. 14] The rituals of physical and psychological preparation for a ride of up to two hours and a separation from land life of two to three weeks begins at restricted heliport gateways. Workers describe how tension is already building up in families a week before flying out.

Crews will board *Haven* in a two-week on/four-week off rhythm according to the Norwegian system, or three weeks on/three weeks off according to the UK system. Oil workers explain how the extreme life on a rig becomes normal; you get used to its particular sway within half a day, and some claim that the main difference to land is the highly regimented rhythm penetrating every minute of the day and night. Curiously, rig-life is described by a worker as being like a "rest home" not because it is relaxing but because a strict schedule dictates working days from 5:30 am to 10:30 pm with minimal deviations of time and space.[103] Daily routines are ingrained, and tasks are frequently repetitive, making it challenging to maintain concentration. This type of environment leaves nothing to chance. Many rigs have reached an age where they require urgent maintenance. This work must be carried out at the same time as production continues and therefore requires an increased workforce on an already crowded rig. During maintenance, two-bed cabins are shared by three rotating workers, called "hard-lie" in offshore jargon. The tightening of profit margins in the industry is reflected in tightening spatial conditions for offshore workers, who, on the UK continental shelf, for example, are now required to change



THE CIRCULATION OF OFFSHORE LABOUR
Fig. 14

from the previous two weeks on/two weeks off, to a three-week rhythm. Worker's unions have protested that this rhythm is a serious danger to health, and in 2019 a strike took place on four platforms run by the French company Total. Further strikes by other platform groups followed, and oil companies were forced to go into negotiations with worker's unions about improving offshore conditions.

Platforms stand above the 30 metres wave safety margin. In normal weather the sea is visible far below but also all around. You can hardly hear it because the rig is a noisy place with 24-hour production. A crane operator described what he could see from his position high up in the cab: storms coming through, an occasional whale, seals, gannets, and kestrels picking off small migratory birds. Some workers seek out the sea and embrace the experience, relishing the strange North Sea weather and the unique feeling of being suspended between sky and sea. But for many, the sea remains in the background, perceived as vast and dangerous. Yet, for those who love the sea, even at 280 kilometres offshore, it is difficult to catch a glimpse during their daily indoor work routine. A rig sounds and smells metallic. Hard security lighting illuminates cold, smooth surfaces. This is an unforgiving built environment, which workers know could easily be much improved if oil companies so desired. The requirements of *working* are prioritised over the requirements of *living*.

Haven's neighbour at the base is a semi-submersible drilling rig floating on wide pontoons. The sea heaves restlessly at the rig's lowest level, temporarily caged inside a space between the pontoons called the *moonpool.* [Fig. 15] Here, the grip of steel feels precarious in the face of the pulsing North Sea, yet the persistent socio-cultural imprints of human work overlay this otherwise technical and wholly artificial environment; human habitation and imagination are captured by the way a fragment of the contained sea is named after the reflection of the moon.

F. 14 Offshore workers commute through specialized heliports to North Sea "neighbourhoods"

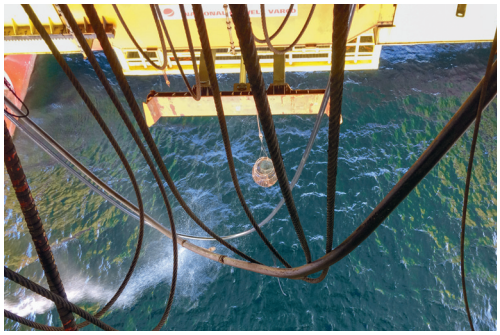


Fig. 15

Fig. 16

F. 15 The moonpool.
F. 16 The mirage of active oilfields, unidentified rig, North Sea, 2019.
F. 17 The arrival of the Brent Delta topside at Hartlepool, UK. May 2017.

THE WASTELAND

Both active and decommissioned platforms appear on the horizon when sailing through the industrial wasteland on one of the last remaining ferries crossing the North Sea. The active fields looked like an improbable mirage of floating industrial cathedrals. [Fig. 16] The Frigg field made history by straddling the UK/Norway North Sea border. Fully decommissioned in 2010 after a six-year process, Frigg's concrete gravity foundations, one around 100 metres in diameter, are still in place and make a strange ensemble protruding from the sea surface. They are an urban residue for which we have no name or conceptual foundation. The abstract space in the North Sea is mutating into new "formants" of wasteland space, although we have hardly noticed it unfolding. Its material legacy is not so easily dislodged from the sea; while floating and jack-up rigs can relocate, the support systems of pipelines, cables, and concrete foundations to which they were attached mostly remain in place, successively taken over by marine life.

Some scientists say removing structures like Frigg is more harmful to the marine environment than leaving them in place. In the last 50 years, a diverse range of species has adapted to the strange mineral substrates that provide new habitats. Jørgensen argues that not only have planning instruments failed to realise that the North Sea is fully urbanised, but they also insist on the temporary nature of installations despite continuous construction work in the last 50 years. However, if the urban sea is seen as something more permanent, a more careful consideration of the emerging ecosystems could be achieved.[104]

On 2 May 2017, the 24,200-tonne, 130-metre topside from Brent Delta, a Shell-operated field in the northern North Sea, arrived at the UK port of Hartlepool to be dismantled and sold as scrap metal by the British company Able UK. Topsides are the part of a platform above the waterline, which have been severed from their concrete foundations and, in this case, lifted onto a barge and transported back to shore. Such operations are full of superlatives: the heaviest offshore lift onto the world's largest barge and the first major piece

Fig. 17

of infrastructure to be decommissioned in the North Sea. [Fig. 17] The Brent field on the UK continental shelf was one of the first to be discovered and began production in 1976. Therefore, it was also one of the first to be dismantled. It was located 186 kilometres north-west of Lerwick in the Shetland Islands in water depths of 140 meters.

By law, decommissioned offshore facilities must be brought back to land. In the North Sea, over 800 structures will be up for decommissioning over the next twenty years. Hartlepool has a legacy of maritime industries that have suffered economic decline; the thriving shipbuilding and steelwork industries experienced setbacks after heavy bombing in the Second World War, and the subsequent de-industrialisation and closure of the British Steel Corporation in 1977 contributed to the highest levels of unemployment in the UK at the time. The Brent Delta topside contains 17,000 tonnes of steel, enough to build the Eiffel tower twice over, 98% of which is being recycled. But apart from the steel, the arrival of the Brent Delta enabled daily life offshore to be brought into a local field of vision. It had been a part-time home for thousands of workers, was worn, slightly old-fashioned, a bit rusty, and had developed a certain patina coated with emotion: As journalist Lusher reported: "In the canteen, the tables were lined up in one long row, decorated with plastic flowers. A manager told me they had held a special dinner to mark their final night on the Delta—with the table layout resembling the painting of the Last Supper." [105]

OPERATIONALISATION OF THE WIND

After the fifty years of North Sea oil and gas launched at Ekofisk in 1969, most "easy oil" had already been extracted, and production is declining. My research shows how selected new activities linked to wind energy production, CO_2 capture and storage, and potentially hydrogen storage and distribution are recolonising and retrofitting the operational seascape originally laid out for hydrocarbons.[106] As objectives for reducing northern European

CO_2 emissions fail to be reached and the areas required for increased wind energy can no longer be found on land, the North Sea is now earmarked for offshore wind-energy production on a grand scale. The wholesale expansion of the North Sea's post-oil wind-energy production demonstrates how the hydrocarbon enclosure has rapidly reoriented to renewables in the brief half-century of depleting those very resources. According to the development scenarios tested by the project Energy Odyssey 2050, the North Sea can potentially accommodate 90% of European energy demand by the year 2050.[107] The spatial impact of such a scenario, however, would be overpowering. Renderings of this possible future show the North Sea consumed by dispersed, luminous, pulsing nodes extending out from the coastlines. A sea completely operationalised for the production of renewable wind energy, which would be landed at a series of unfamiliar coastal sites.

Offshore wind energy is a highly technical industry relying on state administration of tracts of sea space even larger than blocks within the petroleum grid. It requires the production and delivery of specialised components, continuous construction and dismantling to upgrade efficiency through scaling-up, and a substantial workforce to operate and maintain the system. The offshore wind industry had grossly underestimated the required maintenance and is now erecting accommodation rigs for staff rotating on a two-week basis. These new ways of living and working at sea are technical in nature, carried out in a rigidly laid-out sea, inflexible to shifting conditions, and closing off increasingly large areas. The configuration of a wind park is based on the geometry of turbine spacings, which are proportional to their height. Therefore, wind park areas expand exponentially according to turbine size. Applying a 500 metres safety zone around the projected number of North Sea wind parks would potentially produce both an energy territory and a no-fishing zone of 12,000 km^2 by default, given that these areas are also restricted to fishing.[108] Greater pressure on fish stocks in non-restricted zones is predicted as a result. Fishers who know the sea argue that the long-term ecological effects of the vast expansion of offshore wind parks have not been considered. And they notice that wind patterns have changed, and no one knows how this will affect the water circulation patterns of the North Sea itself.

RECONNECTING TO THE SEA

This chapter shows how offshore activities in the North Sea are inextricably linked to land-side urban development in a reciprocal process operating across the land-sea threshold and mobilising people, vessels, materials, finance, and legal instruments. These operations perform vital functions for highly urbanised northern Europe and are interlocked into global economic networks. North Sea maritime activities are strictly programmed and regulated to extend, perpetuate, and intensify systems of delivery and exchange to urban agglomerations. Vast tracts of sea space and dedicated coastal sites are planned and reorganised, daily, and weekly human rhythms are strictly set, and unprecedented volumes of materials are transported across its surface, fixed to the seafloor and again dismantled in ongoing cycles.

Industrialisation has caused the social space of the sea to be replaced by a space of extraction—biomass (marine life), hydrocarbons, and wind energy—and the movement of goods, while selected shoreline spaces are redesigned to offer "leisure" and to artificially intensify the seaside experience. The conceptualised map of the urbanised North Sea illustrates this reversal. Clusters of fixed petroleum infrastructure form a series of dispersed centralities down the middle of the North Sea on which development is focused and around which operations and movements circulate. These sites are extended centres of action controlled by landside headquarters and government departments. [Fig. 18] When less dominated by industrial functions, the sea's periphery forms a ring towards the coastlines, where the sea can be experienced as a cultural space and consumed in a pre-industrial visual form, expressly preserved for this purpose. In this

CENTRES

High concentration of industrial activities and human circulation

Oil and gas infrastructure (platforms and pipelines)

PERIPHERY

Maritime territory with less intense activity but still impacted by the centres

Marine protected areas

Windparks

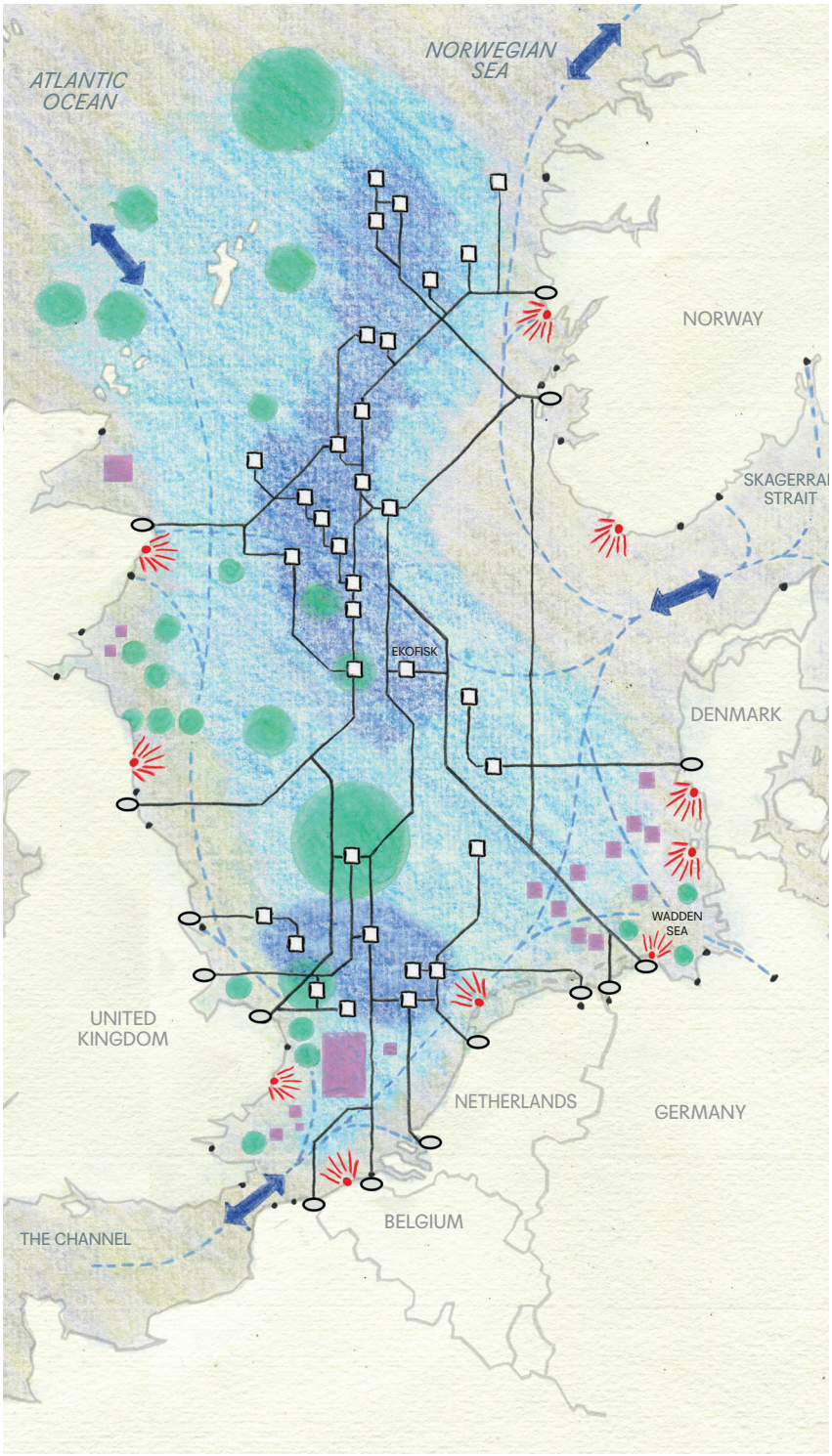
INTERFACE LAND/SEA

Coastal waters linking the industrialised and urbanised North Sea, and other water bodies

Industrial infrastructure, interface between sea and land

Cultural sites, recreation and visual consumption of the sea space

Main merchandise transport routes and connections



THE REVERSAL OF CENTRE AND PERIPHERY IN THE URBANISED NORTH SEA
Fig. 18

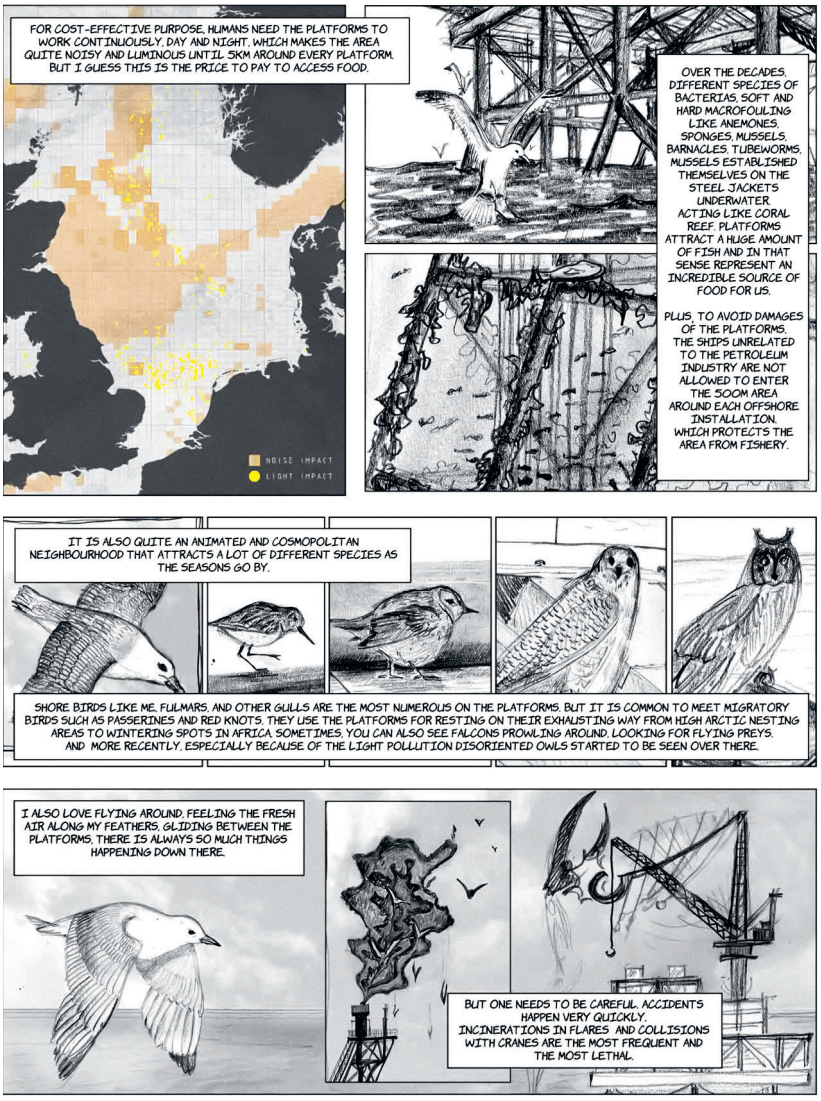


Fig. 19

way, we continue to uphold an artificial culture/nature conceptual divide within maritime space while industrial residue has long been fully absorbed into the North Sea's biochemical composition.

This process of urbanising the North Sea has been a process of loss; the loss of the socio-cultural sea, the loss of the sea for human labour, the loss of the sea as commons, and the loss of the ecological sea. The reinforcement of the peripheral leisure sea facilitates an illusion

F. 19 Bird Station- an alternative to decommissioning. The North Sea rig Gyda is decommissioned and transformed into a bird station where migrating birds can rest, nest, and receive care if injured, and bird-watchers can observe at close range. Zoelie Millereau-Dubesset BAS 2020.

of concealing these lost seas—until storm surges of increasing force and frequency pound the North Sea coastlines.

What is the outcome of this loss? Instead of unfolding complexity, diversification, and interconnectivity, which could generate social conditions comparable to those found in urban environments, extended urbanisation in the North Sea does *not* produce urban qualities, offer social interaction spaces, or promote synergies. Instead, this urbanisation process gathers the discrete and inert loads of industrial production while pushing selected layers of socio-cultural meaning to its very edge. The cultural links between social life and new technological workplaces offshore are tenuous. In contrast to the North Sea's heterogeneous oceanographic features, and complex ecological system, resource management is increasingly streamlined, rigid, and subject to technological abstraction and operationalisation. All sectors are tightly controlled by the state in collaboration with multinational companies or other organisations wielding power. This resonates with Lefebvre's critique of the attack on the urban from the state level: "a global project to subject the national territory to a process of 'development' controlled by industrialisation," where "the urban is reduced to the industrial" and where the places to assert rights have also been eroded.[109]

The grave ecological condition of the planet's *one ocean* is an urgent consequence of extended urbanisation, and the evacuation of the social sea has facilitated unchecked industrial expansion. As a result, we are now losing the sea to climate change. It is, in fact, within these very relations that organic reactions, not in a social but in an ecological sense, have occurred out of the control of grids, directives, and planning efforts. Long-range pollutants, such as microplastics, are transported by currents through a *borderless* ocean.

In the North Sea, the "urban" must also face its own specific mode of transformation of nature. Having arrived at an understanding of the current situation through research and analytical work, it is the further task of architectural, urban, and territorial design to set the processes of *reconnecting to the sea* in motion. Urban theorist Roberto Luis Monte-Mor has also provided some important responses. He argues that the intimate relationship between urban ecology and the environmental question is not yet well understood and that we should also work to rebuild and *reproduce* the relationships between built and natural space. "We must confront extended urbanisation with extended naturalisation if we are to deal not only with urban and environmental problems at the micro-level of everyday life but also with the global aspects of environmental and social crises." [110]

Reimagining the damaged sea with its more-than-human inhabitants is one way of assuming responsibility. Bird Station is a project that aims to reconnect people to the transformed, living sea space. [Fig 19] We can bridge the widening public gap engineered by the industrial-technological take-over through engagement and education. Reconnecting to the sea will require a major transdisciplinary effort and, in particular, a host of powerful and enticing creative visions.

ENDNOTES

1 *Oljeliv/Offshore ID.*
2 Kvendseth, *Giant Discovery.*
3 Gjerde, "Ekofisk Industrial Heritage."
4 Sandberg and Gjerde, "Preserving Norway's Oil Heritage."
5 Lefebvre, *The Production of Space*; Brenner and Schmid, "Towards a New Epistemology of the Urban?"; Diener et al., *The Inevitable Specificity of Cities.*
6 Rich, "Losing Earth."
7 Engel et al., *OverHolland*, 10.
8 Pye, *The Edge of the World.*
9 Ayers, *The German Ocean.*
10 Blass, *The Naked Shore.*
11 Theutenberg, *Mare Clausum et Mare Liberum.*
12 Steinberg, *The Social Construction of the Ocean.*
13 Braudel, *The Mediterranean and the Mediterranean World.*
14 Braudel, *Civilization and Capitalism.*
15 Braudel, *Civilisation and Capitalism*
16 De Landa, *A Thousand Years of Nonlinear History*, 128.
17 Rapp, "The Unmaking of the Mediterranean Trade Hegemony."
18 Grotius, *Mare Liberum.*
19 Braudel, *Civilization and Capitalism.*
20 Mancke, "Early Modern Expansion."
21 Michael B. Miller, *Europe and the Maritime World,* 8.
22 Steinberg, *Social Construction.*
23 As mapped by Dutch cartographer Frederik de Wit, for example, *Nova Orbis Tabula in Lucem Edita* by De Wit, c. 1665.
24 Sobel, *Longitude.*
25 Wood, *Rethinking the Power of Maps*, 31.
26 Spinney, "Searching for Doggerland."
27 Miller, *Maritime World.*
28 ICES, "Greater North Sea Ecoregion."
29 Chapman, *North Sea Oil and Gas.*
30 "CO2 Storage Atlas Norwegian North Sea."
31 UK Department of Energy and Climate Change, "Petroleum Prospectivity of the Principal Sedimentary Basins on the United Kingdom Continental Shelf."
32 Lambert, Martins, and Ogborn, "Currents, Visions and Voyages"; Anderson and Peters, *Water Worlds.*
33 Westerdahl, "The Maritime Cultural Landscape."
34 Hatch, "Material Culture and Maritime Identity."
35 Miller, *Maritime World.*
36 Miller, *Maritime World.*
37 Sekula and Burch, *The Forgotten Space.*
38 Debarbieux, *Social Imaginaries of Space*, Raffestin and Butler, "Space, Territory, and Territoriality."
39 Couling, "Ocean Space and Urbanisation."
40 For a discussion on the material transformation of territory over time, see Schmid, "Analysing Extended Urbanisation: A Territorial Approach."
41 Steinberg, Peters, and Stratford, *Territory Beyond Terra.*
42 Fuller, "Fluid Geography," 119.
43 Sloterdijk, *In the World Interior of Capital*, 43.
44 Brenner, "Between Fixity and Motion"; and Brenner, *New Urban Spaces.*
45 Couling and Hein, "Blankness."
46 Bélanger, "The Other 71 Percent."
47 Gugger, Couling, and Blanchard, *Barents Lessons.*
48 Boeri and Palmesino, "Around a Solid Sea."
49 Boeri and Palmesino.
50 Heller and Pezzani, "Forensic Oceanography. Mare Clausum. Italy and the EU's Undeclared Operation to Stem Migration across the Mediterranean."
51 Topalović, Hortig, and Krautzig, *Sea Region. Singapore, Johor, Riau Archipelago.*
52 Topalović et al., *Hinterland.*
53 Brenner and Schmid, "Planetary Urbanization."
54 Couling, "Nine Principles of Ocean Urbanization in the Baltic Sea."
55 Geldof and Janssens, "The Future Commons 2070."
56 Couling and Hein, "The North Sea."
57 Borgese, "Oceanic Circle."
58 Roberts, *The Unnatural History of the Sea.*
59 Holm, "World War II and the 'Great Acceleration' of North Atlantic Fisheries."
60 Iceland, although independent, was closely aligned to Denmark, which was already occupied by Germany.
61 Miller, *Maritime World*, 213.
62 UN, "United Nations Convention on the Law of the Sea (A Historical Perspective)."
63 United States Government, "1945-Truman-Proclamation-No.-2667.Pdf."
64 Convention on the Territorial Sea (1964), the Continental Shelf (1964), the High Seas (1962), and Fishing and Conservation of Living Resources of the High Seas (1966).
65 United Nations, "Convention on the Continental Shelf."
66 Kemp, *The Official History of North Sea Oil and Gas.*
67 Lefebvre, *The Production of Space,* 282.
68 Theutenberg, "Mare Clausum et Mare Liberum."
69 Campling and Colás, "Capitalism and the Sea," 780.
70 Sevilla-Buitrago, "Urbs in Rure."
71 Brenner, "Introduction: Urban Theory Without an Outside."
72 See also Katsikis, this volume.
73 Couling, "Urbanization of the Ocean," 245.
74 Couling and Hein, "Blankness."
75 Lefebvre, *The Production of Space,* 280.
76 Lefebvre, 289.
77 Lefebvre, *The Production of Space,* 285.
78 Lefebvre, 285.
79 Kvendseth, *Giant Discovery.*
80 European Parliament and the Council of the European Union, "Directive 2014/89/EU Establishing a Framework for Maritime Spatial Planning."
81 European Commission, "Report on the Blue Growth Strategy Towards More Sustainable Growth and Jobs in the Blue Economy."
82 Scott, *Seeing Like a State.*
83 Lefebvre, *The Production of Space*, 286.
84 Howard and Rogers, *Perceiving in Depth.*
85 Couling, "Formats of Extended Urbanisation in Ocean Space."
86 Maleuvre, *The Horizon*; and Sugimoto.
87 Prominski, "Landschaft."
88 Olwig, Kenneth R. *Landscape, Nature, and the Body Politic.*
89 Dutch Ministry of Infrastructure and the Environment and Dutch Ministry of Economic Affairs, "Policy Document on the North Sea 2016–2021."
90 BSH, "Anlage Zur Verordnung Über Die Raumordnung in Der Deutschen Ausschließlichen Wirtschaftszone in Der Nordsee (AWZ Nordsee-ROV) Vom 21. September 2009."
91 Couling, "Extensions and Viscosities in the North Sea"; see also Castriota, this volume.

92 Eckert, "German North Sea Wind Capacity Rose Almost to 2020 Target Last Year – TenneT."
93 Couling, "The Offshore Petroleumscape."
94 Hein, "Oil Spaces."
95 Couling and Hein, "Blankness"; see also Wilson and Pendakis, "Sight, Site, Cite."
96 Franzen, "Ticking Time Bombs on the Bottom of the North and Baltic Sea | DW | 23.08.2017."
97 Lefebvre, *The Production of Space,* 286.
98 Brenner and Katsikis, "Operational Landscapes."
99 Katsikis, "On the Geographical Organization of World Urbanization."
100 See, for example, the 1796 map of the "North Sea with the Kattegat from the Chart of Messrs. De Verdun, Borda and Pingre" by William Faden.
101 Couling, "Extractive Geometries."
102 See, https://www.equinor.com/en/what-we-do/johan-sverdrup.html.
103 A home for the elderly.
104 Jørgensen, "The Anthropogenic Seascape and the Energy Transition."
105 Lusher, "Brent Delta."
106 Couling, "The Offshore Petroleumscape."
107 Sijmons and Hajer, "IABR."
108 Equal to 1.6% of the North Sea area; ICES, "Greater North Sea Ecoregion?"
109 Lefebvre, *The Urban Revolution,* 94.
110 Monte-Mór, Roberto Luís, "Extended Urbanization," 118.

BIBLIOGRAPHY

Anderson, Jon, and Kimberley Peters, eds. *Water Worlds: Human Geographies of the Ocean*. Farnham: Ashgate, 2014.

Ayers, Brian. *The German Ocean. Medieval Europe around the North Sea*. Studies in the Archaeology of Medieval Europe 6. Sheffield: Equinox, 2016.

Bélanger, Pierre. "The Other 71 Percent." *Harvard Design Magazine* 39, no. F/W 2014 (2014).

Blass, Tom. *The Naked Shore: Of the North Sea*. London: Bloomsbury, 2015.

Boeri, Stefano, and John Palmesino. "Around a Solid Sea." *ARCHIS* Flow, no. 5 (October 2002).

Borgese, Elisabeth Mann. "The Oceanic Circle: Governing the Seas as a Global Resource." Tokyo: The Club of Rome, 1998.

Braudel, Fernand. *Civilization and Capitalism: 15th-18th Century*. Translated by Siân Reynolds. New York; Cambridge [etc.]: Harper & Row, 1981.

———.*The Mediterranean and the Mediterranean World in the Age of Philip II*. Vol. 1. New York: Harper, 1972.

Brenner, Neil. "Between Fixity and Motion: Accumulation, Territorial Organization, and the Historical Geography of Spatial Scales." *Environment and Planning D: Society and Space* 16, no. 4 (1998): 459–481.

———."Introduction: Urban Theory without an Outside." In *Implosions / Explosions: Towards a Study of Planetary Urbanization*, 14–30. Berlin: Jovis, 2014.

———.*New Urban Spaces: Urban Theory and the Scale Question*. New York NY: Oxford University Press, 2019.

Brenner, Neil, and Nikos Katsikis. "Operational Landscapes: Hinterlands of the Capitalocene." *Architectural Design* 90, no. 1 (2020): 22–31.

Brenner, Neil, and Christian Schmid. "Planetary Urbanization." In *Urban Constellations*, edited by Matthew Gandy. Berlin: Jovis, 2011.

———."Towards a New Epistemology of the Urban?" *City* 19, no. 2–3 (4 May 2015): 151–182.

BSH. "Anlage Zur Verordnung Über Die Raumordnung in Der Deutschen Ausschließlichen Wirtschaftszone in Der Nordsee (AWZ Nordsee-ROV) Vom 21. September 2009." Bundesanzeiger Verlag GmbH, 21 September 2009.

Campling, Liam, and Alejandro Colás. "Capitalism and the Sea: Sovereignty, Territory, and Appropriation in the Global Ocean." *Environment and Planning D: Society and Space* 36, no. 4 (6 November 2017): 776–794.

Chapman, Keith. *North Sea Oil and Gas: A Geographical Perspective*. Problems in Modern Geography. Newton Abbot a.o: David & Charles, 1976.

Norwegian Petroleum Directorate. *CO2 Storage Atlas Norwegian North Sea*. Stavanger: NPD, 2011.

Couling, Nancy. "Extensions and Viscosities in the North Sea." In *The Urbanisation of the Sea: From Concepts and Analysis to Design*, edited by Nancy Couling and Carola Hein, 189–203. Rotterdam: nai010, 2020.

———."Formats of Extended Urbanisation in Ocean Space." In *Emerging Urban Spaces- A Planetary Perspective*, edited by Philipp Horn, Paola Alfaro d'Alençon, and Ana Claudia Duarte Carduso, Cham:Springer, 2018

———."Nine Principles of Ocean Urbanization in the Baltic Sea." In *The Baltic Atlas*, 172–179. Berlin: Sternberg Press, 2016.

———."Ocean Space and Urbanisation: The Case of Two Seas." In *The Urbanisation of the Sea: From Concepts and Analysis to Design*, edited by Nancy Couling and Carola Hein, 189–203. Rotterdam: nai010, 2020.

———."The Offshore Petroleumscape: Grids, Gods and Giants of the North Sea." In *Oil Spaces: Exploring the Global Petroleumscape*, edited by Carola Hein, 109–126. New York: Routledge, 2022.

———."Urbanization of the Ocean; Extractive Geometries in the Barents Sea." In *Infrastructure Space*. LaFargeHolcim Forum for Sustainable Construction. Berlin: Ruby Press, 2016.

Couling, Nancy, and Carola Hein. "Blankness: The Architectural Void of North Sea Energy Logistics." *Footprint* 12, no. 23 (2018).

———."The North Sea: New Perspectives on the Land-Sea Continuum." In *The Urbanisation of the Sea: From Concepts and Analysis to Design*, 6–15. Rotterdam: nai010, 2020.

Debarbieux, Bernard. *Social Imaginaries of Space*. Cheltenham, UK; Northampton MA, USA: Edward Elgar, 2019.

Diener, Roger, Manuel Herz, Jacques Herzog, Marcel Meili, Pierre de Meuron, Christian Schmid, and Milica Topalović, eds. *The Inevitable Specificity of Cities: Napoli, Nile Valley, Belgrade, Nairobi, Hong Kong, Canary Islands, Beirut, Casablanca*. Zürich: Lars Müller, 2015.

Dutch Ministry of Infrastructure and the Environment and Dutch Ministry of Economic Affairs. "Policy Document on the North Sea 2016–21." Dutch Ministry of Infrastructure and the Environment, December 2015.

Eckert, Vera. "German North Sea Wind Capacity Rose Almost to 2020 Target Last Year–TenneT." *Reuters*, 13 January 2020.

Engel, Henk, Esther Gramsbergen, Henk Hoeks, and Reinout Rutte, eds. *OverHolland 10: The Transformation of the Landscape of the Western Region of the Netherlands (9th to 21st Century).* OverHolland: Architectural Studies for Dutch Cities 10/11. Amsterdam: Sun Publishers or Faculty of Architecture TU Delft, 2011.

European Commission. "Report on the Blue Growth Strategy Towards More Sustainable Growth and Jobs in the Blue Economy." Commission Staff Working Document. Brussels: European Commission, 31 March 2017.

European Parliament and the Council of the European Union. "Directive 2014/89/EU Establishing a Framework for Maritime Spatial Planning." European Union, 23 July 2014.

Franzen, Harald. "Ticking Time Bombs on the Bottom of the North and Baltic Sea | DW | 23.08.2017." *DW.COM*, 23 August 2017.

Fuller, Richard, Buckminster. "Fluid Geography." *American Neptune-A Quarterly Journal of Maritime History and Arts* IV, no. 2 (April 1944).

Geldof, Charlotte, and Nel Janssens. "The Future Commons 2070: The Ethical Problem of the Territorialization of the North Sea," 2014. https://publications.lib.chalmers.se/records/fulltext/230581/local_230581.pdf.

Gjerde, Kristin, Ø. "Ekofisk Industrial Heritage – How to Document and Communicate a Large Technical-Industrial Monument at Sea." Minneapolis, MN, 2005. https://www.academia.edu/3715 5653/Ekofisk_Industrial_ Heritage3.doc

Grotius, Hugo. *Mare Liberum, Sive de Jure Quod Batavis Competit Ad Indicana Commercia Dissertatio*. Dutch Republic: Lodewijk Elzevir, 1609.

Gugger, Harry, Nancy Couling, and Aurélie Blanchard, eds. *Barents Lessons. Teaching and Research in Architecture*. Zürich: Park Books, 2012.

Hatch, Heather, E. "Material Culture and Maritime Identity: Identifying Maritime Subcultures Through Artifacts." In *The Archaeology of Maritime Landscapes*, edited by Ben Ford. When the Land Meets the Sea. New York: Springer-Verlag, 2011.

Hein, Carola. "Oil Spaces: The Global Petroleumscape in the Rotterdam/ The Hague Area." *Journal of Urban History*, 13 February 2018,

Heller, Charles, and Lorenzo Pezzani. "Mare Clausum: Italy and the EU's Undeclared Operation to Stem Migration Across the Mediterranean." *Forensic Architecture* (2018).Holm, Poul. "World War II and the "Great Acceleration" of North Atlantic Fisheries." *Global Environment* 5, no. 10 (1 January 2012): 66–91.

Howard, Ian P., and Brian J. Rogers. *Perceiving in Depth*. Oxford: Oxford University Press, 2012.

ICES. "Greater North Sea Ecoregion: Ecosystem Overview." ICES Ecosystem Overviews, 2018.

———."Greater North Sea Ecoregion: Fisheries Overview." ICES Fisheries Overviews. Copenhagen: ICES, 30 November 2018.

Jørgensen, Anne-Mette. "The Anthropogenic Seascape and the Energy Transition: The Need for a New Perspective on Marine Nature and Human-Made Structures." In *The Urbanisation of the Sea: From Concepts and Analysis to Design*, edited by Nancy Couling and Carola Hein. Rotterdam: nai010, 2020.

Katsikis, Nikos. "On the Geographical Organization of World Urbanization." *MONU*, Geographical Urbanism, 20 (2014).

Kemp, Alex. *The Official History of North Sea Oil and Gas: Vol. I: The Growing Dominance of the State*. Abingdon, Oxon: Routledge, 2013.

Kvendseth, Stig, K. *Giant Discovery. A History of Ekofisk through the First 20 Years.* Norway: Phillips Petroleum Company, 1988.

Lambert, David, Luciana Martins, and Miles Ogborn. "Currents, Visions, and Voyages: Historical Geographies of the Sea." *Journal of Historical Geography*, Historical Geographies of the Sea, 32, no. 3 (July 2006): 479–493.

Landa, Manuel de. *A Thousand Years of Nonlinear History*. New York: Zone Books, 1997.

Lefebvre, Henri. *The Production of Space*. Translated by Donald Nicholson-Smith. Oxford, UK etc: Blackwell, 1991.

———.*The Urban Revolution*. Minneapolis: University of Minnesota Press, 2003.

Lusher, Adam. "Brent Delta: A North Sea Giant Gives up Its Secrets." *Inside Energy, Shell Global*, 19 July 2019. https://www.shell.com/inside-energy/brent-delta-north-sea-oil-gas.html.

Maleuvre, Didier. *The Horizon: A History of our Infinite Longing.* Berkeley: University of California Press, 2011.

Mancke, Elizabeth. "Early Modern Expansion and the Politicization of Oceanic Space." *Geographical Review* 89, no. 2 (1 April 1999): 225–236.

Miller, Michael B. *Europe and the Maritime World: A Twentieth-Century History*. New York: Cambridge University Press, 2012.

Monte-Mor, Roberto Luis. "Extended Urbanization and Settlement Patterns in Brazil: An Environmental Approach." In *Implosions / Explosions Towards a Study of Planetary Urbanization*, 109–120. Berlin: Jovis, 2014.

Oljeliv/Offshore ID. Norwegian Petroleum Museum, 2018. https://www.norskolje.museum.no/en/how-is-life-with-mum-working-offshore/.

Olwig, Kenneth R. *Landscape, Nature, and the Body Politic: From Britain's Renaissance to America's New World*. Madison: University of Wisconsin Press, 2002.

Prominski, Martin. "Landschaft." In *Über Den Zwischenraum // Zum Wandel Des Ästhetischen Interresses*, edited by Christophe Gilot, Anette Freytag, Susanne Hofer, and Albert Kirchengast. ETH Zürich, Departement Architektur, ILA, 2011.

Pye, Michael. *The Edge of the World: How the North Sea Made Us Who We Are*. London: Penguin Books, 2015.

Raffestin, Claude, and Samuel Butler. "Space, Territory, and Territoriality." *Environment and Planning D: Society and Space* 30, no. 1 (1 February 2012): 121–141.

Rapp, Richard T. "The Unmaking of the Mediterranean Trade Hegemony: International Trade Rivalry and the Commercial Revolution." *The Journal of Economic History* 35, no. 3 (1975): 499–525.

Rich, Nathaniel. "Losing Earth: The Decade We Almost Stopped Climate Change." *The New York Times*, 1 August 2018, sec. Magazine. https://www.nytimes.com/interactive/2018/08/01/magazine/climate-change-losing-earth.html.

Roberts, Callum. *The Unnatural History of the Sea*. Washington D.C: Island Press, 2007.

Sandberg, Finn, H, and Kristin Gjerde Ø. "Preserving Norway's Oil Heritage." In *Artefacts: Studies in History Science and Technology*, 150–167. Smithsonian Institution Scholarly Press, 2017.

Schmid, Christian. "Analysing Extended Urbanisation: A Territorial Approach." In *The Urbanisation of the Sea: From Concepts and Analysis to Design*, edited by Nancy Couling and Carola Hein, 189–203. Rotterdam: nai010, 2020.

Scott, James C. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. The Institution for Social and Policy Studies. New Haven, CT: Yale University Press, 2008.

Sekula, Allan and Nöel Burch. *The Forgotten Space*, 2010. http://www.theforgottenspace.net/static/notes.html. Accessed 12 December 2022.

Sevilla-Buitrago, Alvaro. "Urbs in Rure: Historical Enclosure and the Extended Urbanization of the Countryside." In *Implosions / Explosions Towards a Study of Planetary Urbanization*, 236–259. Berlin: Jovis, 2014.

Sijmons, Dirk, and Maarten Hajer. "IABR. 2050: An Energetic Odyssey." Accessed 20 September 2019. https://iabr.nl/en/projectatelier/Atelier2050.

Sloterdijk, Peter. *In the World Interior of Capital: For a Philosophical Theory of Globalization*. Cambridge: Polity, 2013.

Sobel, Dava. *Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time*. London: Fourth Estate, 1996.

Spinney, Laura. "Searching for Doggerland." *National Geographic Magazine*, December 2012.

Steinberg, Philip E. *The Social Construction of the Ocean*. Cambridge Studies in International Relations 78. Cambridge [etc.]: Cambridge University Press, 2001.

Steinberg, Philip E., Kimberley Peters, and Elaine Stratford, eds. *Territory Beyond Terra*. Geopolitical Bodies, Material Worlds. London: Rowman & Littlefield International, 2018.

Theutenberg, Bo Johnson. "Mare Clausum et Mare Liberum." *ARCTIC* 37, no. 4 (December 1984).

Topalović, Milica, Hans Hortig, and Stefanie Krautzig, eds. *Architecture of Territory. Sea Region. Singapore, Johor, Riau Archipelago*. Zürich: ETH Zürich DArch, FCL Singapore, 2015.

Topalović, Milica, Martin Knüsel, Martin Jäggi, and Stefanie Krautzig, eds. *Hinterland: Singapore, Johor, Riau*. Zürich: ETH Zürich DArch, 2013.

UK Department of Energy and Climate Change. "Petroleum Prospectivity of the Principal Sedimentary Basins on the United Kingdom Continental Shelf." UK Department of Energy and Climate Change, December 2013.

UN. "United Nations Convention on the Law of the Sea (A Historical Perspective)." 1998. https://www.un.org/Depts/los/convention_agreements/convention_historical_perspective.htm#Historical%20Perspective. Accessed 3 March 2023.

United Nations. "Convention on the Continental Shelf," 29 April 1958.

United States Government. "1945-Truman-Proclamation-No.-2667.Pdf." 1945. https://cil.nus.edu.sg/wp-content/uploads/2017/08/1945-Truman-Proclamation-No.-2667.pdf. Accessed 3 March 2023.

Westerdahl, Christer. "The Maritime Cultural Landscape." *International Journal of Nautical Archaeology* 21, no. 1 (1992): 5–14.

Wilson, Sheena, and Andrew Pendakis, eds. "Sight, Site, Cite. Oil in the Field of Vision." *Imaginations: Journal of Cross-Cultural Image Studies*, Sighting Oil, 3, no. 2 (6 September 2012).

Wood, Denis. *Rethinking the Power of Maps*. New York: Guilford Press, 2010.

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