Joanne R Moss

Critical Perspectives: North Sea Offshore Wind Farms

Oral histories, aesthetics and selected legal frameworks relating to the North Sea

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Master's thesis in Global Environmental History

Abstract

Moss, J.R. 2021. Critical perspectives: North Sea offshore wind farms.
Oral histories, aesthetics and selected legal frameworks relating to the North Sea.

Moss, J.R. 2021. Kritiska perspektiv: vindkraftparker i Nordsjön
Muntlig historia, estetik och utvalda rättsliga ramar relaterade till Nordsjön

The study is developed from five in-depth interviews with individuals from different walks of life who have interacted significantly with the North Sea. The study discusses change in the North Sea specifically in the development of fixed turbine wind farms and their physical and aesthetic effects. Observations speakers make as to changes in the North Sea and as to its beauty are contextualised and discussed using NASA satellite images, photographs and review of available academic literature, UK policy documents and law. This context includes a study of the industrialised North Sea with reference to the sediment sea plumes behind monopile turbines. The United Kingdom was selected for particular study of its wind farm development permissions process, including evaluations of seascape and the requirement of independence for expert evidence. Decline of trawler access to the North Sea is referenced to wind farm growth, and to adverse changes in public opinion leading to closure of the UK Dogger Bank to trawlers. Finality of wind farm development decisions is considered against the prospect of overturn by the courts. This aspect covers the application and development of principles relating to appeal by way of judicial review in the UK jurisdictions of Scotland, England and Wales, and Northern Ireland. The study identifies, and explains the English aesthetic evaluation of wind farms. It concludes that sea plumes are the result of a legal choice to allow permit applications to succeed without testing by reference to detailed in-sea turbine dimensions. In the permissions process (a) sea plumes are not evaluated by the seascape criteria applicable to coastal or off-coastal wind farms (b) deep offshore wind farms are instead evaluated by possible changes to character of the sea. The study further concludes that (i) the open horizon of the North Sea has been lost in significant part (ii) the combined aesthetic of transience, decay, and nostalgia underlies the aesthetic of the North Sea Maunsell forts (contrasted to Sealand), and also underlies attitudes to decommissioning wind farms, and (iii) concepts of sea beauty may be based on appearance or health, being regulated by different legal regimes in each eventuality (respectively the European Landscape Convention, or the OSPAR/ biodiversity/ habitat initiatives)

Keywords: Aesthetics, Coastal, Decay, Decommission, Development permission, European Landscape Convention, Fluid dynamics, Horizon, Industrial, Judicial review, Marine management, Maunsell, Monopile, NASA, North Sea, Offshore, Oral history, OSPAR, Scotland, Scour, Sealand, Sea plumes, Seascape, Sediment, SPM, Suspended particulate matter, Transience, Trawler, Turbine, United Kingdom, Wind farm.

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Acknowledgments

ABSTRACT BLUE© JOANNE MOSS 2018

This is dedicated to all those beloved of me.

With special thanks to Anneli Ekblom, my supervisor; to interview contributors Prince Michael of Sealand, Mr Dick Beaumont, Councillor Paul Gilson, Ms Christina Platt and the anonymous engineer; and to another engineer, Mark Keith Alexander, for his poignant photography; and to the Rt Hon Lord Gill for reading and reviewing my commentary on the law of Scotland.

October 2021

Contents

1. Introduction

1.1 Explaining the Project

This study originates from five in-depth interviews recording certain aspects of the speakers' engagement with the North Sea. It raises questions about their experiences of change, of changes of behaviour, and about perception of that sea. These interviews led on to some thoughts as to the aesthetics of wind farms and the legal framework in which those aesthetics are viewed. The interviewees spoke of change and their relationship to the North Sea. They stimulated my curiosity as to sediment sea plumes as they trail behind fixed wind turbines. I had never heard of them or seen pictures of them before. I tracked them down across several divergent fields, and traced timelines that might contribute to an understanding of the wind farms where the sea plumes were found. The development of my project was not as I would have predicted at the outset. The project began as an attempt to record memories of historical fishing near wind farms and other sea structures such as Sealand (a former naval fort in the North Sea owned by one of my speakers, Prince Michael of Sealand). Listening to what was said diverted the whole focus of the study. Consequently, this thesis is not simply an appreciation of the interview contents. The narratives of the speakers are arranged in a pattern that allows them to shape and inform the progress of my contextualisations and investigations in Chapters 2-6.

The stories chosen are those of a small (not intended to be representative) number of interviewees whose individual knowledge of the marine environment or wind farms or sea structures enables their stories and opinions to widen the ways in which we think about the frontier to industrialisation that the sea may for some of us represent. In fact the seas, and especially the North Sea, are already industrialised. Wind turbines are structures colonising the surface of the sea. They are sited on a visually sensitive part of it from a human perspective. Deep offshore locations are not visible from the coast. There is consensus between myself and all these interviewees that offshore wind energy is a desirable improvement on fossil fuels. It is now a mature and necessary industry. There are some things about it that are not spoken of, including the price of aesthetic change. As to the interviews, oral histories and speaker-opinions are based on personal experiences. They offer a legitimate contrast to statistical information as well as potentially a complement to it. Such histories root a reader in the realities described by the narrator as the narrative proceeds. Personally, I find them more approachable, more colourful, and perhaps of greater longevity, than scientific studies based purely on quantitative data may be. The school textbook truths of my youth are nowadays considered simply wrong. Much underlying scientific hypothesis of that day is now considered seriously inadequate. The feelings of these narrators and their opinions are written as they are at a certain point in time. The record of them is in some sense a historical document, though perhaps of a transient quality.

1.2 Story-telling

A history of wind farming can be told exclusively through scientific literature and statistics. It can also, differently, be told evaluatively by an engineer working for many years in the wind turbine industry. Likewise, the story of the sea presence of a retired military structure, such as Sealand, can be told as part of the military history of the UK. It can also be told, differently, as the owner of Sealand would tell it as a background of fishing presence and responsibility. Fishing for a living is a profession with many pressures, including change to the environment. It can be studied and argued about relative to fish surveys and fishing gear, quotas, by-catch, food processing and exports. It can be opened up, differently, through other narratives about how fishermen might contribute to critique of other industries in the sea, and how the love of fishing may be something other than a simple focus on earning more money. Alongside support for wind farm development, there is a place for narratives that recognise its potential negative impact on sea aesthetics.

Storytelling or personal narrative is an old art, found everywhere[1], perhaps recently gaining better visibility[2]. As a research tool it has been adapted over the years to modern topics of interest[3] and to digital forms of recording personal narratives including by filming or in the form of internet blogs[4]. Some stories are organised in the form of dramas and formal narratives. Some are disorganised fragments of the past narrated as a tale. Some are recreations of past experiences partly in narrative form. Some stories are expressed as opinions based on thinking about personal stories that are not directly relayed. Whether the opinions or recollections take a formal theme or anecdotal shape, storytelling is woven into almost every personal opinion based on personal experiences, in my estimation, regardless of how that opinion is expressed[5]. The art of communication based on personal experiences, whether wholly narrated, fragmented or simply in the background is how I broadly interpret storytelling for the purposes of this project. The different forms of narration were all present in the discussions that resulted in the statements. Because the speakers all were involved in editing the statements (sometimes quite substantially), I did not feel that reducing them to writing distanced them from the interviewees. I also did not try to rearrange the material so as to make the structure more logical and less authentic to the discussions. That is why speakers sometimes come back to topics from time to time in their original statements.

One advantage of choosing storytelling as an approach to parts of this topic is the equality of the voices. What is important is that the reader is able to obtain a perspective that offers insight, even if it is controversial. The interviewees mentioned below are from different times of life and different occupations. All are thoughtful and have been generous in participating in the project. They do not all share the same opinion about everything. It is not my task to reconcile their differences, as opposed to simply being aware that honest differences of opinion about certain things exist. I have listened closely to what these individuals say as I have approached my own attempt to formulate a personal narrative through the background literature and information. I was born in an industrialised part of England into a landscape dominated by factory architecture, ravaged by coal mining and swathed in boundless environmental filth. It was jokingly said that even the local rabbits coughed. Whilst I have an intellectual

[1] Tonkin (1992).
[2] Brinkmann (2014).
[3] Bailey (2002) as regards better understanding of medical patients.
[4] Chen (2020).
[5] Compare co-created films with input from interviewed documentary participants, researchers and film-makers where the product emerges from shared endeavour: Lang (2020).

interest in individual industrial installations, I am not nostalgic for the metallic and chemicalised, human-exploited, landscapes of my childhood. This lack of nostalgia on my part towards large decaying industrial installations needs to be bourne in mind when my narrative turns to consider the aesthetic of decay, transience and nostalgia.

1.3 Introducing the interviewees

In some instances, interviewees have been chosen to "lead" certain sections of the text. This is because their experiences or observations have a special relevance to the underlying subject-matter. Each of them also appears in numerous places with comments on other aspects. I do not introduce them in full where they first appear because that is likely to be at a point where they are not leading the narrative but simply adding a comment. Therefore, immediately below is a general background for each speaker.

Prince Michael of Sealand (born 1952) has been involved with Sealand since 1967. Sealand is a naval fort off the coast of Britain, erected during the Second World War as a defensive placement in what were then the high seas. Prince Michael's father took it over independently of the UK. On his death Prince Michael inherited the structure and its responsibilities. In speaking of the fishing around Sealand, and of his later experience as a fisherman commercially, Prince Michael goes on to share his feelings for the sea. He comments on the question of impact by wind farms. As he speaks of sustainability of fishing and familiarity with changes of fishermen's attitude over the years, the reader experiences Prince Michael's perception of change, as well as his apprehension as to possible changes in the future.

Councillor Paul Gilson (born 1953) comes from a family that have been fishermen along the East coast of England for generations. His sense of wanting to make a difference to his community and to the wider public is evident. He generously spent hours on the telephone or zoom explaining his position and outlining his worries about certain things. He spoke of investigations into the marine environment, and threat to it represented by wind farms amongst other things. He pointed out possible problems with the objectivity of commissioned scientific evidence. His approach was always positive and down to earth. He speaks eloquently of the beauty of the sea and the intrusions into by the dredging and wind farm industries. He has long experience of running a commercial trawler fishing boat.

Mr Dick Beaumont is theoretically retired but active in pursuing his business and love of yachting. He brings to my project over 40 years of diving and active experience of the oceans. His narrative comes with a commitment to clean energy but also an understanding that the impact on the sea of wind farms is obvious. He describes the changeability and moods of the North Sea, the challenges over the years of diving it, and the problems of water visibility exacerbated by wind farms. He speaks of the attitude of humans in changing the seas. He is of a similar generation to the first two speakers identified above.

Ms Christina Platt is from a younger generation and has a Masters degree in Environmental Science. Her job is as a marine planning officer with The Wildlife Trusts. That group works with other nature and wildlife organisations in the UK. Overall they carry responsibilities that cover "more than 2,300 nature reserves, covering 98,500 hectares, and operate more than 100 visitor and education centres in every part of the UK, on Alderney and the Isle of

Man."[6] She is responsible for coverage of marine spatial planning and responses to offshore planning enquiries. She is able to offer active insight into the decision-making process in the UK.

I was fortunate to have a long interview with a highly qualified senior engineer with four decades of experience of wind turbines and wind farms in Northern Europe. He preferred to remain unnamed but approved an extract summary of his conversation. He is able to highlight perspectives on the phases of development of the offshore wind industry, and to explain his views on some technical issues as well as describing his own affection for the sea.

The interviews with Prince Michael, Paul Gilson and Dick Beaumont took many hours and several revisions each of their statements. Because of the fragmented nature of building up the narrative with several revised versions of text and the time that took, it was not appropriate or efficient to make recordings. The interview process was often guided by themes rather than by specific questions from me, because I found that specific questions tended to "close down" interviewees' own choices on directionality. I was happy for interviewees within overall topics to steer their comments to particular subjects and areas as they wished. Where interviewees wanted particular things to be emphasised in the thesis, I did this in the text (eg Dick Beaumont wanted it to be clear that in general he was supportive of wind energy). The statements cover things well beyond the passages selected by me as part of this study. The two professional experts gave me one interview each and then were involved in editing their contributions. I encouraged them to go beyond an expert opinion and to express their feelings about the sea. I found that their aesthetic appreciations became important to opening up other perceptions of beauty as related to the health of the seas and not limited to their appearance.

1.4 A word about the North Sea

The dark seas round the United Kingdom inspired me to paint the work Abstract Blue, which I placed in the Acknowledgment section at the front of the thesis. The North Sea was chosen as a particular focus because it is a special environment- shallow, environmentally complicated, inhospitable, beautiful, as well as one of the earliest locations for fixed turbine wind farm development. This sea already has dense marine traffic, an oil and gas sector, a highly regulated fishing sector, significant wildlife protection and a now substantial wind farm presence. Viewed in some ways, this project represents a small and partial study in the bio-cultural evolution of the North Sea. It is written as we stand on the brink of an explosion of provision by renewable energy, and when we have a need to understand whatever our historic dealings with offshore wind, most especially in the North Sea, can contribute. This sea is one that all five speakers have had intimate dealings with, in some cases for most of their lives. It was obvious to me that the speakers each had tremendous affection for the North Sea, and none intended to harm her.

Decisions had to be made about the presentation of the North Sea itself, and the legal processes that govern certain of its aspects. Due to the dominance of the UK as installer of North Sea fixed turbine wind farms in the period following 2010, as well as the fact that for many years I practised as a lawyer in England and Wales, I chose also to focus on aspects of

[6] https://www.wildlifetrusts.org/what-we-do (accessed 3 4 2021).

the English permissions process. By the end of writing the study, I felt able to offer some conclusions of my own.

1.5 Progress of the project

I progressed by asking myself a sequence of simple questions. What do the interviewees say? What is the factual and legal context in which their narrative exists? How does that context help me understand what they are saying? What do I think as a result? That last question revealed a problem, the presence of sea plumes. The issue for me was whether to include discussion of them in the study. I decided to do so.

The interviewee narratives are not intended to be representative, rather a reflection of who the speakers themselves are. I am looking at the North Sea and wind turbines through their eyes, and thinking about it. I do reach conclusions. Furthermore, they are of a kind that my interviewees probably would not reach. I struggled with how to explain this. What we see is always partly about what we are conditioned to see. I have mixed the speaker narratives with each other, and also with the investigations they triggered.

The aesthetic appreciation of wind farms, the sea and other things is an important perspective. Tracking down the process of evaluation attached to different seascapes in the grant of permissions to build wind farms inevitably led to a consideration of how opinion works in decision-making. This showed other things in its turn. Although this is not a study of fishing per se, I became aware of the relationship between fishing and wind farming. Wind farms bring big changes to the fishing industry. Two things in particular stand out: (a) the synergies between commercial shellfish fishing and the wind farms (Prince Michael's background is coastal cockle fishing), and (b) the incompatibility of wind farms with bottom-fishing and trawler activity (Paul Gilson's background).

Contextual materials also revealed the industrial character of the wind installations. They are not artworks in the sea. They are pieces of working machinery serving the onshore electricity industry and they share the utilitarian and uncompromising geometry I associate with that. We need what they can do. They change the previous appearance of large areas of the North Sea in a way that the relatively physically confined sea and surface intrusions of the oil and gas industry do not. In the background to an absence of discussion about deep offshore aesthetics is another question: when do we have enough offshore wind energy? This study creates a legal and historical framework in which to ask the question, but does not attempt to answer it.

I am immensely grateful to all interviewees, and I have tried to include in this text more than is strictly required to record their opinions on any one narrow point. I specifically do not want to quote the interviewees in such a limited way that the thrust and context of their individual narrative is lost. I felt it was important for the reader to have some view of them as individuals with interests and personal histories. These shaped the way in which the speakers interacted with the sea and helped to form their anxieties where they were expressed. Two of my interviewees, experienced mariners, described sea plumes and speculated as to their effects. These plumes were first mentioned to me by speaker Paul Gilson, a retired fisherman, who observed that the massive plumes could be seen from space. They can, and the NASA photographs of them opened up for me an unexpected diversion from my previous plan simply to document what my speakers thought. I decided to investigate the sea plumes: what are they and why are they there? My interviewees feature as major voices in grounding the

direction of the investigation in their own observations, but the reasoning and structure of the investigation are mine.

In the end, the study moved through the individual narratives and questions relating to the sea plumes. The product is, I hope, an improved understanding of the history of wind farms, of their aesthetics and of the law relating to both wind farms and their aesthetics. Beyond academic articles, policy documents, books and news site materials, I have incorporated into the project my own work based on available documents of the London Array Environmental Assessment, of the Dogger Bank Inquiry and on computerised searching within commercial legal databases giving access to case reports and statutory materials. Some of my work involves drawing out inferences or making deductions beyond, or besides, the point for which these narrow technical materials were created. This is especially true of Chapter 5. I am only qualified to utilise technical legal reasoning in the England and Wales jurisdiction, and where materials for Scotland are used, this should be remembered. I have been most fortunate in that my friend and former chambers colleague, the Rt Hon Lord Gill, retired Lord President of Scotland, was kind enough to read and provide feedback on Chapter 5. The Chapter contains a good deal of Scottish case law. Any legal assessment and evaluation of selected legislation or other materials of a technical legal character are made as a matter of my own opinion (without any need for external academic support), as is customary practice for English lawyers. Conclusions drawn from them, and any errors, are my own.

1.6 Organisation of Illustrations

The fully itemised acknowledgments (for example for the embedded annotations) are separately shown in the Copyrights section, accessible from the Table of Contents. That section records the copyrights of images contained in the deposited Appendices. Some Appendix images are not given a Figure number because they are not part of the study. They appear only in the statements reproduced exactly as agreed with the interviewees. Those images that are used are listed in Group 1 Figures.

I decided to group the material and number it according to its Group because the illustrations are material to more than one Chapter and perform different tasks for the reader's understanding. A sight of the Fig. 1 series of illustrations is important to visualising the content of Chapters 2-4. Rather than fragment the collection, I left it together so that the reader could easily access a visual understanding of turbine size and design together, alongside sea aesthetics and structure locations. Most of the Group 1 materials were (a) compared in the text with other images and (b) referred to more than once and for different purposes. For instance, Fig. 1.3 (photograph of Shivering Sands military fort) is used as part of the materials for coastal wind farm location, and quite differently for the purpose of analysing the underlying aesthetics of the Maunsell forts. Captions also show the utility of comparing illustrations. Mark Keith Alexander kindly gave me the opportunity to reproduce my choice of images from his extensive portfolio of the Maunsell forts. The images were taken from a boat on the North Sea in the spring of 2021. Theirs is a curious, romantic, aesthetic, and I included examples showing both horizon and machinery.

The Fig. 2 series of illustrations includes a distinct group of satellite images taken by NASA from 2013 onwards. Group 2 Figure titles are as found in searches. These images form the central subject for discussion in Chapter 6 and have been placed immediately in front of that Chapter. They are proof of the scale and appearance of the sea plumes, and the interference

in the sea highlighted by interviewees in the early part of Chapter 6. The attribution to NASA relates to the underlying images including those with NASA-embedded annotations. Authored embedded annotations in Fig. 2.6 are licensed subject to acknowledgment and are as also detailed in the Copyrights section.

1.7 Organisation of Text

1.7.1 Structure and contents

I needed a sufficiently coherent organisational structure for personal narratives as well as investigation of the background relevant to some of the questions above. But the reader needed the ability to weave back and forwards through the materials as different areas are considered. The outcome is a compromise. Content has been arranged according to themes, usually mixed with observations from the interviewees.

Chapter 1 seeks to explain the genesis and parameters of the thesis project. Chapter 2, entitled "Industrial/ commercial faces of the North European Seas", covers the industrialisation of those seas and the state of knowledge against which early wind farm decisions in the North Sea were made. It traces the evolution of fixed wind turbine design and the early, mainly Danish, development of the offshore industry. Next, it carries the history through the phase of UK dominance and the creation of a mass market in cheap electricity. Finally, it considers the anxieties some speakers expressed about the possibly uncontrolled expansion of offshore wind, and its decommissioning.

Chapter 3 canvasses the aesthetics of wind farms and of the sea. The Chapter contains a time frame and tentative classifications for wind farm types so that the reader can visualise the state of the North Sea to the East of England, and can imagine what the future will look like in physical terms. Aesthetic responses to the sea may include concerns as to its health, the openness of its horizon and to the extent of human visibility on its surface. Chapter 3 flags the special aesthetic of decay, transience and nostalgia. This aesthetic applies to the Maunsell fort structures in the North Sea so as to produce a positive response. The same aesthetic applies to aspects of the debate about decommissioning so as to produce a negative response. Why this difference should exist was analysed, alongside some possible consequences. Lastly the Chapter points to two international treaties, the OSPAR treaty and the European Landscape Convention, as regards the kinds of aesthetic they protect.

Chapter 4, entitled "UK wind farms: decisions and opinions", straddles four areas. First, there is material regarding the policy background of the UK, and the formal English structures created for assessing wind farm applications. Secondly, attention is given to policy and to evidential concerns raised by interviewees about the permissions process or scientific evidence. Thirdly, the process of opinion-making both in the real world and in the implementation of guidelines for aesthetic assessment is considered. Finally, opinion-making and change in fishing is examined, ultimately considering whether the open sea aesthetic conflicts with possibilities to use wind farms to close the seas to trawler fishing.

Chapter 5 traces across the three main UK jurisdictions the willingness or otherwise of courts to intervene in administrative or political decisions taken outside the courts' structure. The robustness of the initial decision is measured against its likely finality. The Chapter is novel in that, though the general principles could be traced in other areas of the law, there is

no published study of (a) wind farm cases applying them, and (b) tracing the application of the principles in such case law across more than one jurisdiction. This study uses the crucible of litigation as a test of whether the initial determination system as a whole is strong or weak. Where interviewees express concern about the changes they experience or about what they observe, the decision-making level at which effective changes are made becomes an important part of the picture.

Chapter 6, "The power of the sea", contains, amongst other things: a depiction of sea plumes, their history of discovery, and of the research that they prompted. Two of the mariners interviewed had much to offer by way of instructive comment and description. The final section places sea plumes in a legal context. There is a case for reading Chapter 6 first, though placing it at the beginning of the thesis is illogical as against the other themes that require to be dealt with so as to provide the overall context in which the sea plumes themselves appear. Chapter 7 contains conclusions from the study.

1.7.2 References

The references section is divided into three parts as follows.

Publications

This lists peer-reviewed articles and books.

Legal references

This lists legal sources hierarchically. Legal references do not normally carry a web address but in References I have included a few where I thought it would be helpful. The group arrangement is: international, European Union, United Kingdom, United States. UK materials listed include Consultations, Policy Documents, Reports and official Drafts. These are listed by usual designation, meaning alphabetically by title. These materials are given web addresses but I usually refer to them in footnotes by title. Where a commissioned Report is officially adopted as policy it is listed here. Non-adopted commissioned Reports appear under Internet sources. Reported case references are given their usual formatting. Case Report web locations are never conventionally used. References to multiple citations for one case have been placed in the References section, not in every footnote. I have not assimilated the assorted formats for legal sources where they are official. I decided for convenience to include in this section officially deposited government-held documents submitted to inquiries for inquiry use. These do have web addresses.

Internet sources

This is a default category and includes non-peer-reviewed articles, as well as additional government materials, such as the internally-directed National Audit Office Reports. Full web addresses are given in References but not in every footnote. Some do appear in the footnotes if I thought the reader might want to open them at once (eg certain videos or some interactive maps).

1.7.3 Appendix Deposit

The Appendices are included by way of deposit and are not otherwise part of the study. I have explained above how images are dealt with. The deposit items (four statements and one summary interview extract) are presented in exactly the form and version that were agreed with the interviewees and they have not been edited. For convenience, passages referred to are duplicated in the text and referenced "A" followed by the number of the relevant Appendix, next followed by a page reference. These page references are the ones within the original statements, not the pagination within this study. The original paginations appear inside the Appendices contained in diamond (eg <4>). So Paul Gilson's statement reference might

be A4:4. The reader would go to Appendix 4 and look for <4> within it. I cannot claim originality for this method of referencing as it is regularly to be seen where modern legal electronic databases replicate existing printed volumes of reported cases. Altering the original printed pagination would create chaos.

The Appendices are dated as follows:
A1 Christina Platt 22 May 2021;
A2 Dick Beaumont July 2021 (finalised by email 23 July 2021);
A3 The unnamed engineer (undated) supplied by him on 26 April 2021;
A4 Paul Gilson (undated) finally approved 21 May 2021;
A5 Prince Michael dated 15 April 2021.

1.8 Abbreviations

These are not often used, and for the most part the full form of words is visible shortly before use of the abbreviation that follows. There are a few abbreviations of familiar names whose abbreviated form is regularly used. They are provided together for additional convenience:

BEIS Department for Business, Energy and Industrial Strategy
DEFRA Department for Environment, Food and Rural Affairs
ICES International Council for the Exploration of the Sea
MMO Marine Management Organisation
OLI Operational Land Imager
OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic (from Oslo-Paris Conventions, 1972 and 1974)
SPM Suspended particulate matter

1.9 Disclaimers

Because I have been a practising lawyer, I am sensitive to the risk in relation to any published work that it may be used by a reader as though it were legal advice. Views expressed by me as to legal matters are only for the purposes of this project and are not available to be relied on as legal advice for any purpose. Readers in need of legal advice may not rely on it, and I disclaim all responsibility in that regard on the part of myself and also the University of Uppsala. Likewise the views of interview contributors are given specifically for the purposes of this project and may not be relied on for any purpose beyond the terms of this project. These disclaimers cover all parts of this work.

Group 1 Illustrations listed

Fig. 1.1: Fort locations

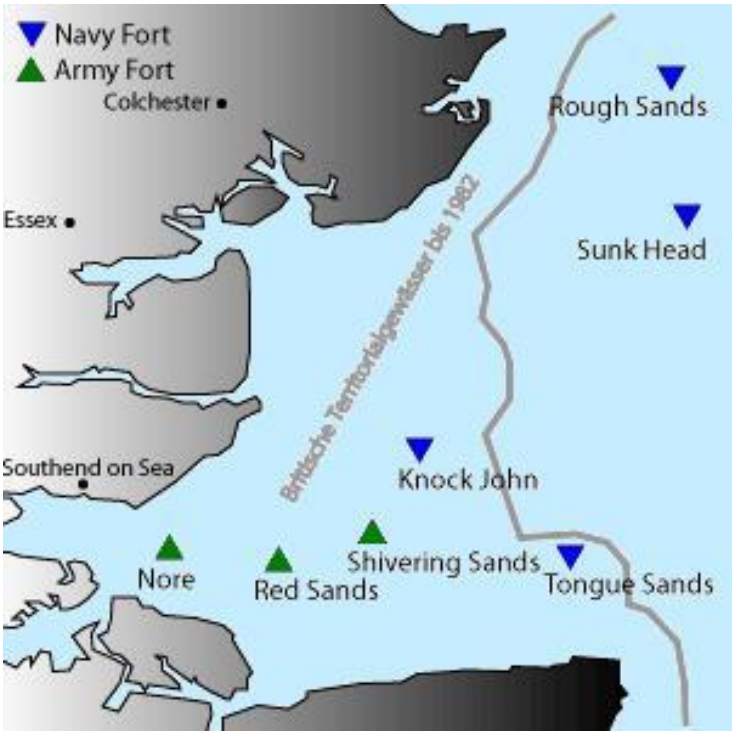

Fig. 1.1 Fort locations (Wikipedia)
Fig. 2.6 shows the sandy coastline on satellite. Army forts are depicted at Fig. 1.3 Shivering Sands and Fig. 1.6 Red Sands. Navy forts are depicted at Fig. 1.4 Sealand and Fig. 1.5 Knock John. Forts shown here are inside the original three mile territorial boundary. Sealand is further North, and outside it. These forts protected the mouth of the Thames.

Fig. 1.2: Map of Sealand location

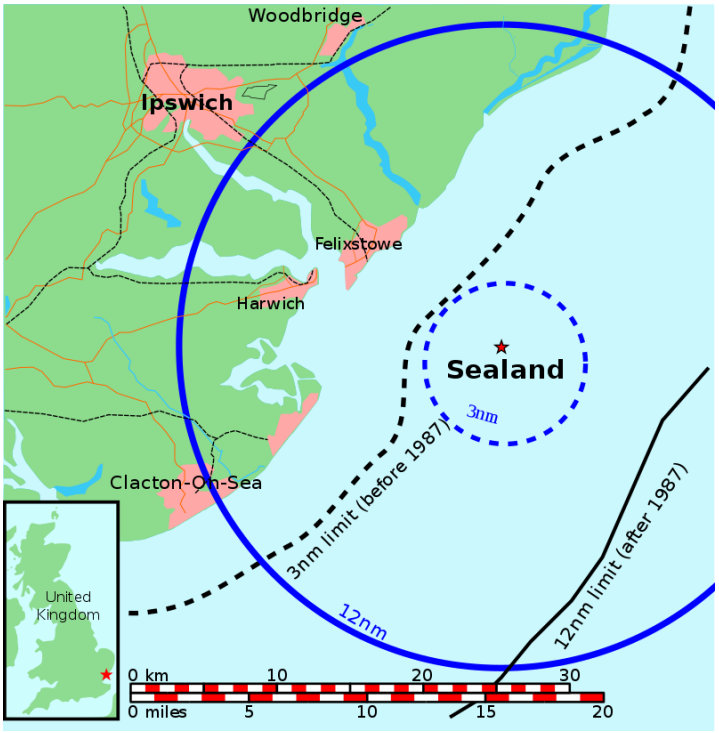

Fig. 1.2: Map of Sealand location (Wikipedia)
Map shows three mile territorial limit (applied until 1987), replaced with the 12 mile limit shown marked. Sealand is shown in Fig. 1.4. Note major ports at Felixstowe and Harwich. Note the once strategic position of Sealand in protecting these ports. This position is imaged in Fig. 2.7 in its North West coastal section.

Fig. 1.3: Shivering Sands

Fig. 1.3: Shivering Sands ©Mark Keith Alexander 2021 reproduced with permission.
This shows a typical design of army fort. Kentish Flats wind farm 2015 extension is in the background. Compare Fig. 1.6 Red Sands. Shivering Sands is in an advanced state of collapse and all walkways have fallen. Remnants of a fallen gun tower are seen sticking up in the centre of the image. Location is shown on Fig. 1.1.

Fig. 1.4: Sealand structure

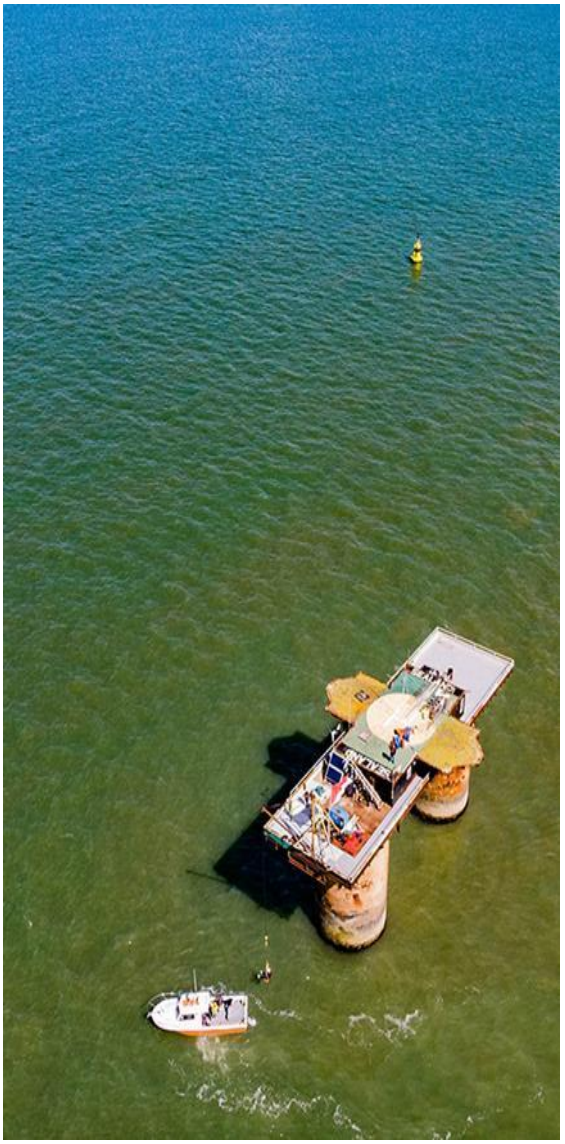

Fig. 1.4: Sealand structure ©Government of Sealand 2021 reproduced with permission.
Sealand is the only inhabited fort. Note the sandy bottom around it. It has the identical design to the dilapidated Knock John, shown at Fig. 1.5. The position of Sealand is shown on Fig. 1.2. That position is imaged in Fig. 2.7 (North West coast).

Fig. 1.5: Knock John

Fig. 1.5: Knock John ©Mark Keith Alexander2021 reproduced with permission.
This romantic image shows the solitary silhouette of Knock John framed by an open horizon. This records the appearance of the sea without wind farms. Sealand is a twin structure (see Fig. 1.4). Knock John is marked on Fig. 1.1.

Fig. 1.6: Red Sands

Fig. 1.6 Red Sands ©Mark Keith Alexander2021 reproduced with permission.
This shows a metal army fort whose gun towers were linked by overhead walkways. One walkway is shown surviving on the left. The installation is less damaged than Shivering Sands (at Fig. 1.3).

Fig. 1.7: Photo 1 Paul Gilson

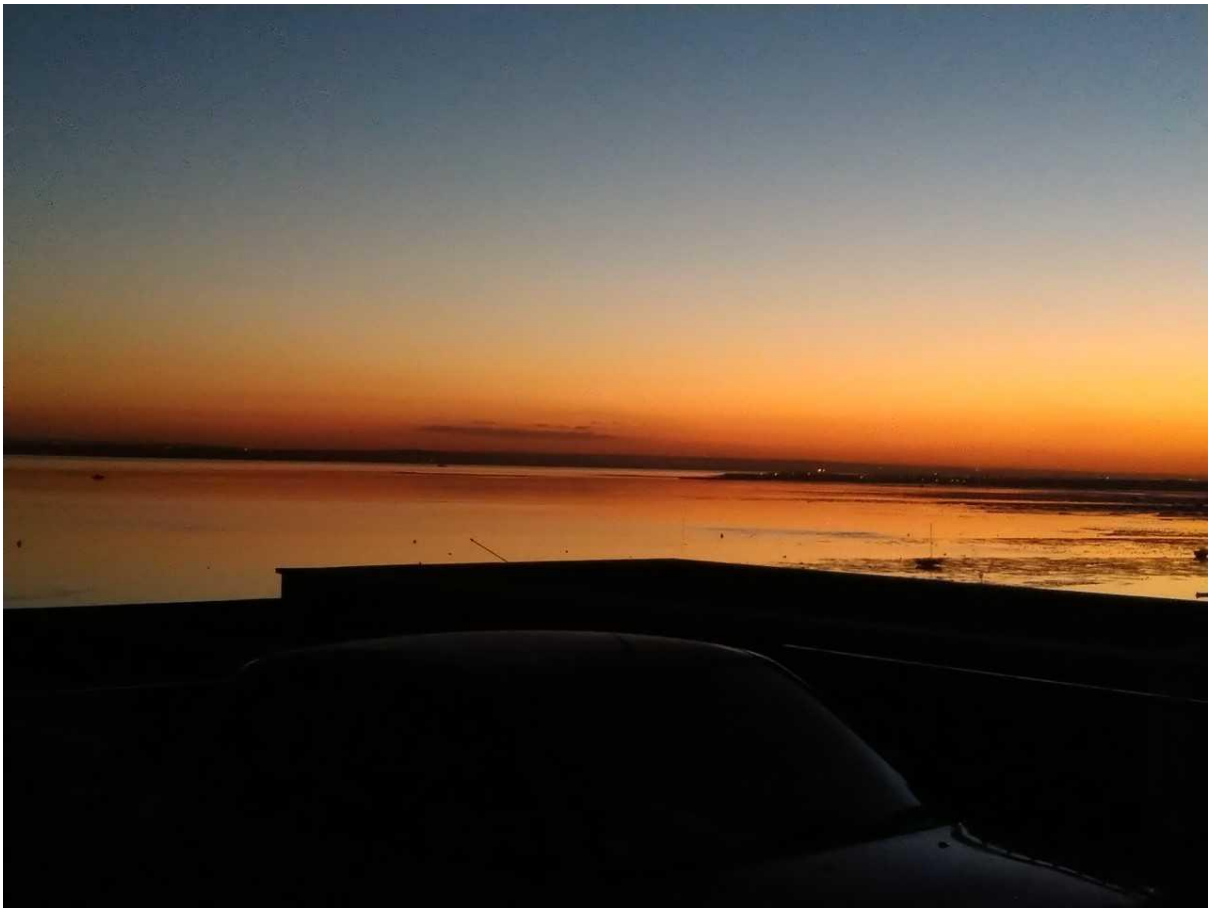

Fig. 1.7: Photo 1 Paul Gilson ©Paul Gilson 2020 reproduced with permission.
Taken at sunset, this is a study in evening calm, photographed by a fisherman from land near where he lives. There is a boundary wall and car in the foreground. Note the flat, uninterrupted lines of the enveloping horizon. Camera slightly angled towards the photographer's right shoulder as his sailor's eye aligns the point of the garden wall and the distant spithead point. Compare and contrast with its inverse, Fig. 1.8.

Fig. 1.8: Photo 2 Paul Gilson

Fig. 1.8: Photo 2 Paul Gilson ©Paul Gilson 2018 reproduced with permission.
Taken at sunrise, the land is photographed from the sea with horizon broken by giant turbines. The haze is pollution over the land. The coastline is discernible in front of the sun. The central turbine is at the mid-point of the image, with almost identical angles from the central turbine head to the turbines to left and to far right. This is the carefully chosen arrow-head point of wind farm geometric turbine layout, aligned by an experienced eye. Compare and contrast with its inverse, Fig. 1.7. The image in Fig. 1.8 triggered anxieties for Paul Gilson (see Chapter 3.4.5).

Fig. 1.9: Collage wind turbine designs

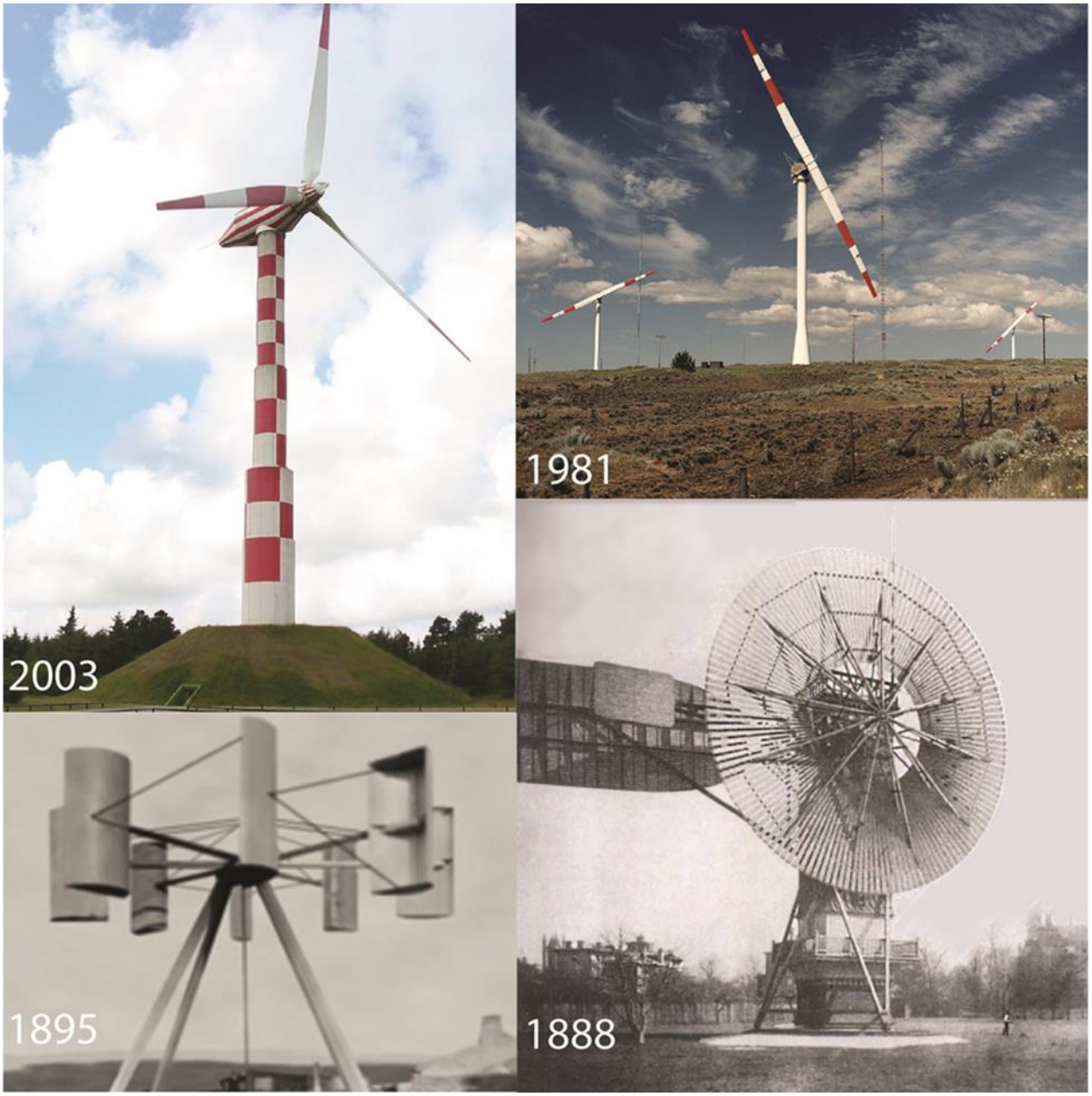

Fig. 1.9: Collage wind turbine designs (Wikipedia)
Early wind turbines producing electricity. The 1888 image should be scaled by the man stood on the right, and the trees. The 1895 design-type is still used but not at sea. The NASA 1981 prototype could not work at sea due to the blade lengths. By 1991 Vindeby in Denmark was the first ever offshore wind farm, deploying the design shown above labelled as 2003. By 2000 Middelgrunden was an icon of the Danish capital (see Fig. 1.14). Compare dates and sizes with those shown on Fig. 1.10.

Fig. 1.10: Wind turbine size increase 1980-2010 US Dept of Energy

Wind turbine size increase 1980-2010 showing relative size of the swept area as wind turbines increased from 75 kW to 3 MW (2012)

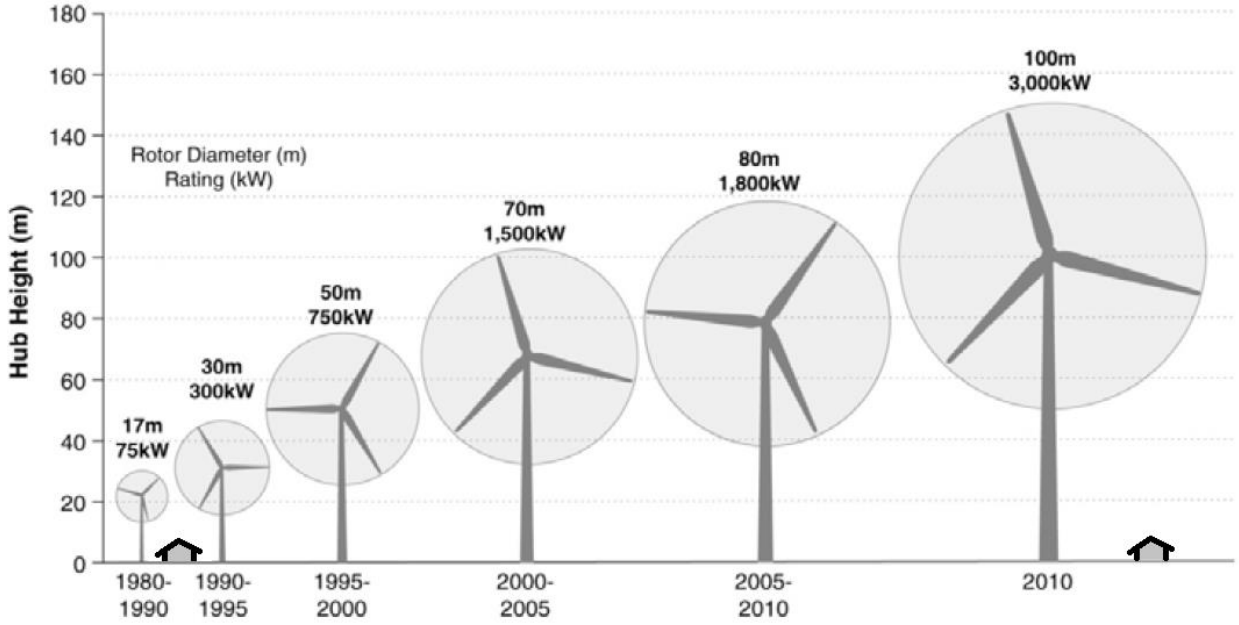

Fig. 1.10: Wind turbine size increase 1980-2010 US Dept of Energy (Public Domain)
These are based on on-shore turbine designs but are the same for offshore. The year 2010 marks the rise of the UK as the biggest installer of offshore turbines .Design profile remains the same but size increases exponentially.

Fig. 1.11: Lillgrund windfarm, Sweden (aerial view) 2011

Fig. 1.11: Lillgrund windfarm, Sweden (aerial view) 2011 (Wikipedia)
This wind farm was built from 2006 and commissioned 2008. It has 48 turbines, each 2.3 MW standing in shallow coastal waters. Compare turbine size with diagram in Fig. 1.10, and other views of the same wind farm in Fig. 1.12 and Fig. 1.13.

Fig. 1.12: Lillgrund windfarm, Sweden (view from coast) 2008

Fig. 1.12: Lillgrund windfarm, Sweden (view from coast) 2008 (Wikipedia)
Untidy view profile, compare with Fig. 1.14.

Fig. 1.13: Lillgrund windfarm, Sweden (aerial view) 2007

Fig. 1.13: Lillgrund windfarm, Sweden (aerial view) 2007 (Wikipedia)
Gaps in turbine layout are shown as also in Fig. 1.11.

Fig. 1.14: Middelgrunden wind farm Copenhagen, Denmark, 2004

Fig. 1.14: Middelgrunden wind farm Copenhagen, Denmark 2004 (Wikipedia)
This shows a highly visible installation, once the world's biggest offshore (2000), close to the city and in shallow water (3-8) metres. The tidy profile includes 20 turbines with 2 MW capacity. Compare layout and aspect with Lillgrund, Fig. 1.12.

2. Industrial/ commercial faces of the North European Seas

2.1 The sea as an industrial matrix and the development of the European offshore wind industry

The Global Wind Energy Council, an international "forum" for the industry, does not lack ambition. 93 GW of generating capacity was installed in 2020 (over a 50% increase on the previous year). The industry calls for installation to take place three times more quickly in the next ten years.[7] The overwhelming majority of this increase was onshore, not offshore. Cumulatively to the end of 2020, onshore turbines represent 95.25% of capacity, and offshore only 4.75%. Offshore is very much the minority activity for the wind industry as a whole. The future bulk drive for offshore wind globally will probably depend on improved floating wind installations of a type currently in a relatively early stage of development. These will be required to install capacity in deep ocean locations, where the seabed falls quickly from the land. Such is not the geography of the shallow North Sea, which has an average depth of around 94 metres.[8] By comparison, the Statue of Liberty is 93 metres from ground level to the torch.

The North Sea is peculiarly suited to the installation of fixed turbines, being shallow enough for their installation and wild enough to utilise the substantial wind requirements of the largest turbines. Mass installation of wind turbines may well soon reach a point where the density of installations causes the general aspect of the sea to be significantly altered. There is an appreciable risk that what began as an open sea surface with a few installations in it may become so densely populated by turbines that it resembles an assemblage of industrial structures from almost every angle once away from the coast. This risk is apparently one not in political or academic discussion, but it looms within the figures implicit in discussions about expansion of wind energy sites in the North Sea. It is the cumulative magnitude of installation, not that of any specific wind farm, that I refer to. The character of individual turbines is uncompromisingly industrial in appearance, and the geometry of their layout is striking. I make no complaint about either. My initial concern is to trace the comments of the interviewees and place them in a more general context so that they have their full impact.

This thesis will focus on fixed offshore wind turbines where the base of the turbine is bedded directly or via a heavy rock apron into the seabed. It is a tried and familiar technology, whose main customers so far have been in China or the coastal states of the North Sea. In 2019 6.1 GW of new offshore capacity was installed[9]. China accounted for 2.4 GW, the UK for 1.8 GW and Germany for 1.1 GW. In other words, between them the UK and Germany put in almost half of all new global offshore installations that year.[10] In the following year, 48.08% of new global offshore wind capacity was installed by the UK, Germany, Belgium

[7] Global Wind Energy Council Report for 2021 key findings.
[8] See generally description in Phillips (2017).
[9] 1,000 kilowatts (kw) = 1 megawatt (MW); 1,000 megawatts = 1 gigawatt (GW).
[10] Global Wind Energy Council Report for 2020 key findings.

and the Netherlands in the shape of another 2,916 MW[11]. By then, those four European nations had installed a cumulative total of 22, 806 MW capacity, 64.80% of world offshore installations. Transformation of the North and Irish Seas is underway.

The North Sea has other uses on-going and projected. The physical space requirements of new technologies and infrastructure are an additional layer and are expected to grow significantly in the North Sea.[12] Quite apart from wind energy, there are dense networks of cable and pipe lines for a large number of industries including telecommunications and oil and gas. Increasingly it is expected there will be further networks established to save or to transmit electricity between national grids, bearing in mind the grid interconnection system for the EU has not yet satisfied its targets.[13] Beyond that, there are: the needs of shipping for transit routes and acceptable places to drop anchor; for fishing, especially for trawling; for military exercises; for sediment extraction (dredging for sand and gravel); for fish farming; and, foreseeably perhaps, for the integration of old oil pipes for new carbon storage networks. There are also nature reserves planned by the contracting parties to the North East Atlantic regional treaty, OSPAR[14], under their various Marine Protected Areas. This includes the North Sea. Inevitably there will be conflicts and choices between uses that are not compatible in the same physical space. Levels of information about certain uses may be limited by their origins (military secrets, the loss of older records) or by a failure to disclose (as where cables are simply abandoned in case legal liability for their removal is too burdensome). The assimilation of OSPAR and EU marine monitoring reporting is part of an ongoing post-2014 process.[15]

There are many historic pressures from man on the Northern Seas. And there is a long history of industrial exploitation of the Northern Seas without knowledge of the overall picture either of uses or the biological environment. It is specifically the build-up of this exploitation during the second half of the twentieth century that has caused concern because the total cumulative picture cannot be ascertained. Historic uses of the North East Atlantic deep sea floor (excluding the North Sea, which is under 200 metres depth) have probably never been fully documented. The OSPAR region was surveyed in 2010[16] by researchers (partially funded by the EU) who were trying to assess the spatial extent of a narrow basket of uses. The sample year chosen was 2005, the survey being done in the run-up to the creation of Marine Protected Areas. The investigated uses took place against this background: "though the deep seafloor covers approximately 60% of Earth's surface [1] only about 0.0001% of it has been the focus of biological scientific investigation." Only after 2008 have attempts been made to moderate fishing with conservation, in line with a memorandum between OSPAR and the North East Atlantic Fisheries Commission (NEAFC). The uses to be traced by Benn and colleagues were military/industrial, except in the last case. They were: cabling; marine research; oil and gas industrial installations; dumping of chemical weapons, armaments, radioactive wastes; direct military activity (no information was supplied to the researchers); and bottom trawling. OSPAR and NEAFC still have to struggle against the idea that fishing (under certain flags) can legally be done without any hindrance or limitation on the high seas. I say this due to the pointed tone of the NEAFC legal memorandum negating

[11] Global Wind Energy Council Report for 2021 Market status pages 8-9.
[12] Wright (2019).
[13] 10% grid interconnection by 2020; 15% interconnection by 2030. (ibid).
[14] OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic 1992 (an anti-dumping and pollution agreement) contains in Annexe V provisions as to the protection of eco-systems and biological diversity as from 1998. The UK remains bound to this Treaty despite Brexit. Norway and Iceland are independent signatories.
[15] OSPAR Coordinated Environmental Monitoring Programme (CEMP).
[16] Benn (2010).

such an idea.[17] Benn, amongst other things, concludes that "significant improvements are required in data collection and availability." His study suggests to me an absence of informed curatorship of the seas, alongside a persistent ignorance of the cumulative environmental impact. It is against this general background that the pattern of making individual choices for the permitted uses of the sea needs to be viewed.

The shallow coastal seas round the UK were considered by Eastwood (2007), who investigated the spatial extent of oil and gas activities, wind farms, cabling, aggregate extraction, waste disposal (sediments not human waste), wrecks, and trawling. The work revealed the limits of official data, and the poor prior state of information: "The most recent pressure assessment covering multiple sectors was published almost a decade ago, using statistics compiled during the mid-1980s from unpublished and grey literature sources." In 2020, reporting by the European Commission to the European Parliament on its marine oversight policies separately confirmed that in 2010 "data and knowledge from the marine environment were (and still are) scarce for some topics and regions".[18] What this means is that many of the decisions made in the period 1990-2010 as to wind farm location or overall impact could not possibly have been made against an informed background of wider ocean uses and impact.[19] In 2014 the British House of Lords reported[20] to Parliament (by its highly regarded European Select Committee) the fruits of its investigation under the remit: "*The North Sea under pressure: is regional marine co-operation the answer?*" The report catalogued what amounted essentially to overuse, limited overall information and conflicting policies, stating:

> "The North Sea… is one of the most industrialised seas in the world. Ships queue to progress through the southern North Sea, and the number of offshore wind farm turbines in UK waters is likely to increase from the current 1,000 to an estimated 3,000 by 2020. Figure 1 demonstrates the intensity of the use of the North Sea in UK waters. We were not able to source a map displaying similar usage for the entire basin—a fact which demonstrates that marine co-operation and cross-border marine planning in the North Sea have a long way to go…There is a plethora of different policies and approaches, yet a distinct lack of political leadership. The failure to agree on a coherent fisheries management plan on the Dogger Bank since 2011, for example, has paralysed progress in environmental management of the whole area."[21]

Action without full knowledge is a concern that fisherman Paul Gilson repeatedly pointed out to me: "The kind of harm that concerns me is this charging ahead without knowing the full damage.[22]" He was speaking of wind farm construction suspected to have been made without detailed information as to the use of fossil energy by the wind industry, and without an idea of how much wind energy provision was to be built overall. This lack of detailed marine industrial planning is a theme picked up by Christina Platt in Chapter 4. The period 2011-2014 and 2014 to June 2021 have seen increasing amounts of environmental information entering the UK decision-making process, until recently largely as a result of European Union Directives. The first of these periods saw the introduction of Environmental Impact Assessments as a requirement of submitting, amongst other things, the request for na-

[17] North East Atlantic Fisheries Commission Advice by S Ásmundsson, Secretary of NEAFC.
[18] REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL 25 June 2020 on the implementation of the Marine Strategy Framework Directive (Directive 2008/56/EC) para 2.2.
[19] Though impact on the biological layers of the Irish Sea bed had been reported back to the UK government indirectly: Tyler-Walters (2003).
[20] House of Lords Select Committee Report (2014) *European Union Committee - Tenth Report.*
[21] Chapter 1 (ibid).
[22] At A4:8.

tional infrastructure permission in England and Wales.[23] By 2017 the Regulations required the wind farm developer to provide a range of information, but there are types of accumulated historical information not known to the public, or even the department handling the application. Steps are being taken as of June 2021 to improve the coherence of marine planning policy and the information available to the Marine Management Organisation.[24] Where we consider the installation of historical wind turbines (such as those photographed by NASA in 2013), these are likely to have been permitted on the basis of limited historical background information.

2.2 Danish creation of the fixed offshore wind turbine industry

The aesthetic of the modern wind farm is Danish. Modern wind power offshore began with Denmark, long the pioneer and still the source of major companies invested in providing wind capacity. Windmills and their basic principles have been well understood for centuries, and wind power for electricity generation is almost as old as the commercial harnessing of electric power. Alexander Lodygin patented the filament bulb in 1872. By 1878 Charles Brush in the US had designed a quality generator, followed in 1888 by an automatically functioning 12 kw wind turbine generator. It is big and clumsy, looking very different from its commercial successors. Fig. 1.9 is a collage of turbine designs, beginning with Brush's. In Scotland James Blyth built a wind-driven dynamo that spent 30 successful years powering a lunatic asylum, again with a design far from that of the modern three-bladed turbine. The collage shows also the two-bladed design trialled by NASA following the oil crisis of the 1970s, but it was abandoned when oil prices came down. The three-bladed design that is dominant today (see the Fig. 1.9 collage) was not necessarily predestined to surpass its rivals, such as the two-bladed Swedish design[25]. Other designs still exist for small or experimental projects, but the Danish design dominated from an early point. That design was trialled and worked on by dedicated Danish pioneers, whose supportive government did not possess oil reserves and may well have had concerns about security of energy supplies. Wind energy onshore predated its offshore counterpart. The first offshore wind farm was Vindeby built in Denmark in 1991 and decommissioned in 2017 by full removal. In a very real sense, the commitment of the Danes to this technology established Denmark as a world leader in the period running through to 2010. From that time the UK rapidly caught up then surpassed it in terms of installed offshore capacity.[26] For the best part of the last decade, therefore, the UK has been the European country with the most focus on offshore wind. The legal frameworks, assessments and choices made about offshore wind farms now shape the physical environment of significant parts of the North Sea. It is this physical infrastructure that the interviewees experience and comment on.

How is it that an offshore technology that began in the early 1990s took so long to become widely accepted? There are background issues about the relative cost of producing wind energy, but it appears that the biggest changes came suddenly around 2010. We can see the size of turbines illustrated in Fig. 1.10 (a document produced by the US Department of En-

[23] Details of the relevant instruments are catalogued and summarised at *Raymond Stephen Pearce v Secretary of State for Business Energy and Industrial Strategy v Norfolk Vanguard Limited* [2021] EWHC 326 (Admin): Directive 2011/92/EU and the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (2009/2262), Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU, and the Infrastructure (Environmental Impact Assessment) Regulations 2017(2017/572).
[24] See further in Chapter 4.
[25] See Möllerström (2019).
[26] For detailed figures see Higgins (2014).

ergy). The turbines increased continuously in size during the period through to 2010. As regards the look of individual wind farms, the general layout depends on the size of the turbines and the atmospheric wind tunnels behind them. As the turbines became bigger, they became increasingly more spaced apart. Bigger turbines are capable of generating more power, and in turn require more capacious cables. As a sight, in my view, turbines were impressive from the beginning. By 2010 they were majestic. The earliest depicted turbines shown are 30 metres high (75 kw) rising by 2010 to 150 metres high (3 MW). By comparison, London's Big Ben is 96 metres high. This size trajectory continued after 2010. By February 2021, the Danish company Vestas was unveiling its latest and biggest wind turbine prototype at 260 metres high (15 MW). To give comparison, that is about twice the height of the London Eye (at 135 metres). Foundation requirements are also substantial for offshore turbines. A contract recently (9 September 2021) signed by another Danish company, Ørsted, for the provision of offshore foundations for 107 turbines in two German wind farms will create for each turbine 100 metres by 10 metres of foundation, each foundation weighing over 1,200 tonnes.[27] The turbines in question are modest 11 MW items compared to the Vesta 15 MW prototype. Looking back, it is smaller turbines closer to shore which feature through to 2010. The later, larger, designs were used for further out to sea. Installation periods for the offshore development of a single wind farm may spread over several years, during which access to marine traffic is denied.

In piecing together an understanding of the development of the offshore wind industry, I am particularly grateful to the unnamed engineer that I interviewed. His perspectives come from a love of the sea, a commitment to renewable non-carbon energy, and to a familiarity with the development of the technology, as he himself says. His was accordingly chosen as the lead commentary on the ways in which offshore wind energy has had to fit into the North Sea. He also comments on the development of the turbine industry and the changes within it:

> *"My attitude to the sea*
> I am a sailor and have spent part of my life with boat racing and tour-sailing. I love many things about it, primarily as a nature experience. I have a sailing boat. It has an engine, but we only use the sails. If your mind is full of things, when you get on the boat, it all disappears. Your worries go away. Every time I get to our home port, I think of the sea as a fluid connecting all parts of the world - I could sail to China if I wanted and dared. It is a fantastic idea. When sailing, it is mostly about the overall experience of nature, but I also fish and I swim. Personally, I have always preferred that offshore wind farms are out of sight so that people do not see industrial equipment in the seas. We obviously know that there are ships, oil rigs, commercial fishing, etc. out there, and we know that the sea is a workplace, but it would be good if we could still be awestruck by the sea. For me, a feeling of awe happens in some parts of the Alps, in blizzards and in thunderstorms, and I also get this feeling from the sea. Coastal offshore wind farms can also have a complex impact on the overall landscape. With the Middelgrunden offshore wind farm off Copenhagen, you see Malmo in Sweden in the background, and it is overall a big populated and industrial area. Here it is perfectly fine with the turbines. In pristine areas I am less comfortable. Therefore, I advocate setting wind farms 40 kilometres or more off the coast. At this distance, the nacelle of the turbine is below the horizon, and you will only be able to see the upper part of the blades from the beach, and that only under very unusual atmospheric conditions with unlimited visibility. Any aerial warning light will

[27] Ørsted Newsfeed (2021) *Ørsted signs monopile foundation contracts for offshore wind projects* 6 September 2021.

> not be seen at night-time. And yet, offshore wind may provide all the electricity that we need. If I ventured into debate about industrialising perspectives of the sea, or the idea that any change from pristine could be bad, I would say it is much worse not to do something about climate change. In this perspective, offshore wind is a low-impact solution to the climate crisis. As regards the sea, it is a question of balance. I see marine shipping and I feel good; trading with shipping is something humans did for millennia. On the other hand, I feel bad about yellow smoke. Some might say it is "ugly"."[28]

It is important to note that the sea is viewed with respect and affection, especially as an encounter with nature, and the potentially industrialising effect of wind farms is weighed against the environmental disaster that would be caused by failure to reduce carbon emissions. There is an apparent sense that in the sea away from the coast, turbines are effectively out of sight, and there is no doubt that siting of turbines away from "pristine" coastal landscapes preserves the character of those coastal areas. There is also a view that further industrialising an already industrial landscape is far less of a problem. In this is recognition that turbines are part of an industrial usage and create by their presence an awareness of that fact. In relation to a highly subjective area such as landscape assessment and quality, great care needs to be taken as to underlying assumptions. In particular, readers will need to bear in mind that the surface of the sea is comparatively only a small part of its presence, though it is the one humans first think of and perhaps most easily respond to. Secondly, human ideas of pristine or industrial often relate to that interface with surfaces and their own activities. I was roughly reminded of this many years ago when I went to swim in waters off Western Australia where super-pods of dolphin chose the busy town harbour for their breeding ground. All around were industrial winching gears and huge harbourside chemical factory buildings. This was very much not a "pristine" untouched area or one with a sea surface over which a human would normally project a vision of unspoiled nature. Yet in the sea right next to this, over 250 dolphin went about their everyday business and actively guarded the entrance to the harbour from passing sharks. In the sea, the presence of the turbines is described by the engineer as part of a balancing exercise. Few would dispute that; indeed, the task facing regulators for all countries bordering the North Sea is how to get that balance correct.

The engineer is able to offer an explanation for the growth of the turbine industry that goes beyond the raw statistics of energy generated and turbines installed. He throws light on the critical mass of development against a time line, and the relationship between the sudden leap in installations and the attempts (described below) to create a suitable mass market for the supply of offshore electricity. I was supplied with extracted published figures underlying his analysis (though they are not part of the retained materials of this project), and they are reproduced correctly in the passages below where he speaks of the triggers for industrialisation and the shift to a mass rather than a niche market in electricity. This is about the move from say, supplying a single large farm with turbines of small size to supplying whole towns or regions with cheap grid electricity. For the latter, what is needed is space to house the infrastructure alongside a recognition that it has to go somewhere that is both accessible to a national grid, but at the same time not such as to create a visual or auditory nuisance to people living in the area. If we ask ourselves what industrialisation and mature industry may mean in this context, I would suggest these are notions of standardisation of product allowing key components to be known as complete packages with identical dimensions. So a pur-

[28] A3:3

chaser or supplier could simply take an order for an item and inform the recipient of its pre-made characteristics. The buyer is neither expected nor required to participate in customising the dimensions of the product to his location and use. Secondly, we include a move away from production facilities and circumstances triggered by individual orders to a situation where there is a mass market for the end product and therefore confidence to create an industry for the component parts of the supply chain that can be made available at any time. At first glance, one might have expected the cheapness of the purchasing wholesale electricity market to have the opposite effect, namely driving electricity suppliers out of business. In fact, in this case, the scale of a stable mass market altered supply economics in justifying major investment in permanent supply capacity. Standardisation using a regular component supply base allowed the supply network to take advantage of bulk commodity purchases, and to learn from experience so as to make costs savings. The link to the mass electricity market is about the stability of demand, longer term contracts, and a drive towards input costs reduction. These assumptions underlie what the engineer states in relation to motivations and the growth of offshore wind power:

> "In the early days there was no offshore wind. It was relatively highly profiled in the research community in the 1970s and early 1980s because it was expected to become dominant. Subsequently, Californian onshore wind power was booming, the focus shifted to onshore, and then the discussion of offshore died out. In 1989 the Danish government had its concerns about the domestic onshore market of wind turbines becoming saturated. The onshore market has its limitations where you have a pastoral landscape and an energy source that affects the landscape. Offshore wind had the potential to deliver power out of sight, without trouble about noise or visual impact. Offshore would be an unlimited resource, and it could be part of the answer to becoming independent of imported fuels…..Offshore wind developed over the 25 years with around 70 projects in 8 different European countries. In that time 11.2 GW was installed. From 2000 until 2010 the growth curve is linear and upwards, and from 2010 the line takes off almost vertically and continues to climb steeply without hesitation. Whether the industry was genuinely mature in 2010 is a question. Infrastructure supplies were still somewhat on a steep learning curve, and were too individualistic to specific projects. Mass production benefits were only there from around 2015 onwards, and that happened because of price pressure. The energy market moved from a fixed price to an auction regime price. This essentially drove widespread industrialisation in Europe. There is a coming market in the USA and contracts are being signed. As we talk there are 6 turbines in operation in the USA. China has a mature industry, but it is specific to China. I am speaking now generally of Europe."[29]

2.3 Creation of cheap wind energy supply for the mass electricity market (2010 onwards)

These comments from the engineer regarding changes in the industry can conveniently be traced in academic articles. Because lesser returns for supply of electricity were anticipated, the energy suppliers were forced to reduce their costs, but the reduced supply cost of electricity in consequence assured a stable mass market for the product. It is a conundrum beyond my project whether the mass market being stable created the industrialisation of supply or whether the cheap supply created the stable mass purchasing market, or whether some

[29] A3:1

third scenario really explains the synchronicities involved. There were various subsidy or minimum guaranteed returns for suppliers that affected different countries. The UK eventually ran a successful system whereby the supply of wind energy to the national grid was done competitively but where the difference would be paid to suppliers by the government if suppliers did not receive the guaranteed price level from their direct purchaser.[30] If the supplier could force down the cost of supply by standardisation, better or cheaper sub-supply, know-how improvements, economies of scale, reduced external insurances etc, the resultant gap represented a guaranteed profit opportunity or profit enhancement achievable. The big climb in UK wind installations offshore from around 2010 enabled the newer bigger turbines to be deployed so as to produce greater returns per installation.

Eliaac (2020) traces the causes for reductions in costs in the supply of turbines in the period 2005-2017 using a bottom-up costs model. It was found that 30% of the reduction in this period was caused by changes in materials costs, productivity and external services; 50% was caused by learning by-deployment "learning by-deployment also includes relative effects of knowledge spillover and manufacturing scale." Though the study was based on onshore wind turbines, the main data supplier, Vestas, was also a big offshore supplier. More recently, Jansen (2020)[31] considers the impact of electricity market design in producing or supporting falls in supply cost. Five countries, including the UK, had similar experiences of being able to take advantage of the falling supply prices in that period despite their different internal auction designs: "Between 2015 and 2019, the price paid for power from offshore wind farms across northern Europe fell by $11.9 \pm 1.6\%$ per year."[32]

If the turbine industry was essentially mature in 2010, one might well wonder why it took the UK until 2017 to come up with a successful support mechanism that encouraged the industry without draining the public purse. In fact, there had been a troublesome learning curve: the original chaotic and unsuccessful Non-Fossil Fuel Obligation system (1990-98) was replaced from 2002 by the Renewable Obligation Certificate (ROC) support mechanism. Higgins (2014) describes the latter politely: the scheme support was tied to the certificate, but these were separately capable of being traded. However, the new system remained chaotic and unsuccessful despite the attempted reworking and the exclusion of nuclear from it.[33] These ROCs were finally brought to an end at the beginning of April 2017.

What the above describes is the creation of a new mass market in the supply of cheap electricity able to compete with all existing sources of energy supply, and to do so on a reliable and technologically mature and standardised basis. Wind energy using fixed turbines now enjoys international confidence, and in 2020 solar and wind supply grew at rates even faster than in the last 20 years. This increase is expected to continue so as to make these the "new norm" for electricity supply.[34]

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[30] Scheme fully described as current Contracts for Difference and Capacity Market Scheme Update 2020.

[31] Also widely reported in the engineering industry: see Professional Engineering news article, in-house (2020) *Astonishing' drop in offshore wind costs could reduce household energy bills* (27 7 2020).

[32] Abstract. Further note that MWh is a measure of electricity. 1MWh is the quantum of electricity produced by a 1MW generator in operation for an hour.

[33] For full details see Wood (2011) which lists failures as "finite and limited duration of subsidies due to limited mechanism lifespan, excessive focus on competition and low costs, mechanism uncertainty, unresolved planning and electricity grid network issues and policy uncertainty/excessive change" as well as uncertainty as to how much payment would be received thus causing financing problems in obtaining loans, and building uncertainty as to how much energy would be generated in which way.

[34] International Energy Agency Press Release (2021) *Renewables are stronger than ever as they power through the pandemic* 11 May 2021.

2.4 Anxieties regarding uncontrolled offshore wind farm development and its decommissioning

There were two other specific areas where offshore wind farms creating visual industrialisation gave rise to concerned comment. The first is the idea of development driven forwards without any apparent natural limitation. The second was the prospect of the period after the useful life of the many turbines had come to an end, and the concern that the North Sea would become a graveyard not for the occasional graceful military ruin, but rather for a host of un-decommissioned "broken junk."[35]

The question on the first concern is: when is there enough offshore wind energy provision? Paul Gilson observed that: "there is an issue about how much wind energy we should be creating. When do we have enough?..... There is no obvious restraint on the infinite development of them <wind farm turbines>[36]." The unnamed engineer was careful in how he answered the question as to whether one could speak of an "enough" point. He commented, addressing himself to the present time rather than the future generally:

> "I do not think that we are yet anywhere near an "enough" point. What we see is vast areas of sea that could be used to mitigate climate change. I believe that it is a fundamental premise for the offshore wind industry that we do good for the world. In most locations the benefits in the form of climate change mitigation outweigh the sum of any negative effects in the sea. …When is there enough offshore wind development? I do not see an "enough" point until we have a full transition to clean energy from wind, solar PV, hydropower, etc. But obviously, you can get "enough" in specific areas. Fortunately, we are typically able to relocate projects if too many other interests are affected.."[37]

If I understand this correctly, the limitation is not set by the demand for energy but by the method of its supply, and wind development is further curtailed by the strength of competing interests or objections in any given location. However, unless there is common governmental policy agreement as to when there is sufficient development of the North Sea, it seems likely that increased availability of cheap electricity will simply stimulate the demand for it. An instance of this may be anticipated in regard to electric transportation.

This spread of opinion between the speakers in my project serves to highlight the uncertainty that unlimited wind farm industrialisation represents to the appearance of the sea. It is difficult to imagine because the lifespan of an individual wind farm begins with a period of several years' construction closing off the area completely, followed by a 20-25 year working life closed to trawler fishing, and is ended by the decommissioning period (depending on what kind of decommissioning takes place). All of this will undoubtedly occur with differential timescales for each wind farm, and around this the shipping and other uses will have to fit. The presence of the turbines is not a flexible one: mobile uses have to move or adapt. The turbines by their presence become primary determinants of the geographical space and what is possible within it. This sort of idea seems to me to underlie Paul Gilson's worries. What we may need to envisage is a more general densification of what is happening already

[35] Prince Michael's words A5:3.
[36] A4:8
[37] A3:1

in some coastal areas. Perhaps we may have to imagine a wide "North Sea motorway" hedged about by wind farms. Dick Beaumont's description of the East coast is as follows:

> "Five miles off anywhere on the East coast you can't help but see massive wind farms The sea is not open any more as these huge areas must be avoided during the several years of installation…. There's nothing natural about 20-30 container ships or oil tankers anchored awaiting cargo and to control the increased shipping movements now much of the east coastal area of the UK falls into traffic separation zones which mariners can only enter leave or cross in a specified method…" [38]

The second anxiety mentioned by interviewees relates to the decommissioning of disused wind farms, and what will remain in the sea so as to impact the surface and its uses. Prince Michael feared wind farms might be left as "broken junk" and noted that there seemed to be no discussions or consultations about decommissioning wind farms. Paul Gilson, by contrast, was confident that the recycling value of metals and cables would in practice drive the removal of disused wind farm parts. He also perceived there to be risk in leaving the structures in place:

> "If the wind farms were simply left there as a form of decommissioning they would be a naval risk. We might have, say, 300 turbines in muddy water with the sea rolling over it. The sea bottom is full of holes and the whole environment changes. There are streams of sandy water. In any case I think the removal of the sea cables releases a colossal scrap value so it will be done."[39]

The engineer had this to say:

> "In 2018 Vindeby was decommissioned and broken up and there were no problems. I have no experience with decommissioning of monopile foundations, but I know from planning permissions what is typically to be expected. The monopile foundations are generally assumed to be cut below the seabed surface, the upper part lifted off and the lower part left and covered. The remains would then just be a piece of inert steel as a man-made item below the seabed. It will be completely covered."[40]

There is no doubt that the so far few instances[41] of wind farm decommissioning are instances of full decommissioning, as the unnamed engineer describes. Vindeby saw the removal of the concrete turbine bases. But we need to remember that Vindeby was the first generation of offshore installations and was smaller and more accessible than many of those of the present or probably the future. Equally, there would seem to be naval risk from turbine shafts, as Paul Gilson points out, alongside trawler fishing risk where cables are concerned. Prince Michael states there are currently no public consultations regarding decommissioning once permissions have been granted to construct a wind farm.

To make sense of these observations as part of a bigger picture, it is necessary to recall the poor reputation of the oil and gas industry (the first offshore energy industry) in controlling oil spills, and their attempts to avoid (expensive) full decommissioning by removal. The

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[38] From A2:5 onwards.
[39] A4:9
[40] A3:3
[41] See Table 1 in Topham (2019).

(1995) Brent Spar[42] and (2010) Deepwater Horizon[43] incidents reinforced hostility within European governments to anything short of full decommissioning by removal for offshore structures in the North Sea.[44] OSPAR rules universally required it through until 2019[45], and both British wind farm development permissions and the leases for it granted by the Crown Commissioners did the same. UK permission procedures for a wind farm offshore require the advance filing of a detailed[46] decommissioning scheme in compliance with section 105 of the Energy Act 2004, and building cannot begin until the plan has been filed. This plan is updated as necessary and forms the basis for the Final Decommissioning Plan to be agreed with the Crown Commissioners. In practice, however, a study shows that such initial decommissioning plans do not predict key features of the actual environmental conditions observable from time to time, still less as at the decommissioning date, and are in need of attention.[47] Cabling left in situ is governed by individual states not OSPAR. Cabling remains the responsibility of the former operators of the wind farm, though it appears some cables are only vaguely reported or not reported (in an attempt to avoid legal responsibility)[48].

By contrast, in the USA there have for years been movements for and against the leaving of manmade infrastructure in seas and inland waters as places where fish might breed and tourists dive. This was the essence of the Rigs-to-Reefs initiative[49], resulting in widely different policies from state to state. Some generally insisted on almost complete decommissioning, whereas other states were more open to allow oil rigs to be toppled on their side and left in place or be dragged to a suitable location. The environmental debate remains active because removal avoids rust contamination whereas reefing saves existing marine colonisations on the infrastructure.[50] Focus in more recent European academic and scientific discussion has been on the possible negative effects of disturbing certain seabed structures such as wind farm cabling or concrete structures protecting fish or being colonised by corals or shellfish.[51] These general environmental concerns likely lie behind the relaxations in full decommissioning for OSPAR byelaws in 2019 so as to allow individual signatory states to authorise specific instances of sea retention of concrete bases and heavy steel structures. This is despite a shortfall in scientific evidence regarding the detailed environmental impact of de-

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[42] In June 1995 following a mass consumer resistance campaign by the German branch of Greenpeace, Shell were forced to end plans for the abandonment of decommissioned oil storage facility and tanker buoy the Brent Spar in deep water. Instead they decided for on-land disposal. Currently the company has open historical archives and claims to have changed its practices following the incident. See Brent Spar archives.

[43] The world's deepest oil well was drilled out by the Deepwater Horizon rig. On 20 April 2010 an explosion killed 11 people and two days later the rig sank. The well burst open and caused the largest oil spill in history, gushing into the Bay of Mexico unrestrained until 15 July capping and 19 September declaration of the well being dead. A US federal judge, Judge Carl Barbier, found gross negligence and wilful misconduct by BP. The fines, civil suits and clean up costs BP paid are in the order of 60 billion US dollars. See Deepwater Horizon on Wikipedia https://en.wikipedia.org/wiki/Deepwater_Horizon#Explosion_and_oil_spill (accessed 5 9 2021) and Uhlmann, DJ (2020) *BP paid a steep price for the Gulf oil spill but for the US a decade later, it's business as usual* 23 April 2020.

[44] For the influence of Brent Spar on policy see the letter by Jørgensen (2012a).

[45]OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations amended from 18 12 2019 so as to allow individual derogations by signatory party states for concrete bases and steel structures weighing over 10,000 tonnes https://www.ospar.org/work-areas/oic/installations (accessed 5 9 2021), and OSPAR Decommissioning Options (2019) *Comparative Evaluation of Decommissioning Options in support of Derogation Proposals meeting* 18 December 2019 Information page.

[46] Section 105(8) stipulates the developer include the steps to be taken as well as costs estimates, schedules for works and the planned timing of them, details of the proposed restoration to an identified condition, and full monitoring and maintenance details for anything to be left in place. European countries can have very varied and different requirements on the detail: see the contrast between Sweden and Italy in policy for and computation of decommissioning costs in Giovannini (2014).

[47] Hall (2020).

[48] Wright (2019) Page 42 (Annexe 1).

[49] Jørgensen (2012) protests OSPAR's exclusion of reefing.

[50] See Gerretsen, I (2021) *The new use for abandoned oil rigs* Future Planet, Feature Item BBC 27th January 2021.

[51] See for example Fowler (2018) and Birchenough (2020).

commissioning[52]. In Chapter 4 there is mention of wind farms deliberately referenced as a way of stopping trawler activity. What we should not imagine is that an area previously used for wind farming will automatically become a pristine area even if it is reinstated to its original surface condition. Other pressures will remain. Moreover, reinvestment in new infrastructure in the place of the old may ultimately seem to be an acceptable strategic alternative for any area that has become part of a much more industrialised sea. This is the transition observed in on-shore wind farm decommissioning on occasions[53].

The above, essentially based on and triggered by speaker narratives, gives a more detailed look at the size and scale of offshore wind turbines as they have developed through to the present time. The siting of these large man-made structures is recognised by an engineer responsible for them as sensitive from a coastal perspective. This visually distinctive industry has also generated interviewee concern about its density and ultimate dismantling. I tried to imagine the near future appearance of the North Sea, and was impressed by its likely colonised and industrial aspect superimposed on the uses described in the early part of this Chapter. There is at least a possibility that changes to the North Sea in building the wind farms are semi-permanent, because once an area has been part of a wind farm project it may be viewed as industrialised or degraded compared to areas where no such impact has been sustained. I say "semi-permanent" because I remember the collapse of the coal mining and heavy engineering industries that preceded the re-naturalisation and clean-up of the North of England landscapes of my childhood. I am personally prepared to assume that one day in the future the turbine industry may also collapse.

[52] Fowler (2019).
[53] Szumilas-Kowalczyk (2020).

3. Aesthetics and wind farms

Here is a true story. Many years ago I went to a friend's home and was shown her new chair. It was a modernistic extravaganza in highly coloured leather and filled with plastic balls. (Yes, the 1980's).The rest of the furniture was antique wooden furniture bought cheap from the local auction house. My first degree was in history. Hers was in the natural sciences. She loved her chair, and it was very comfortable. The dissonance between its design and the surrounding pieces from the 1800s was completely invisible to her. I have often thought of that visit in connection with wind farm aesthetics. To many people, a wind farm is wholly defined by its function. They cannot see anything beyond that. No discussion about wind farm aesthetics can proceed on that bald basis, and that is precisely why at present there is no discussion going on. UK wind farm development has moved deep offshore where there are no aesthetic objectors.

I decided it would be a stimulus to thinking about the aesthetic implications of wind farms in the North Sea if this Chapter built up from the turbine development information in Chapter 2. Using it, we are able to understand individual wind farms. From there we can group wind farms so as better to understand the pattern of their development in the North Sea. After that, we can try to imagine what the near future is committed to in visual terms. Beyond that, we can at last visualise what the unchecked UK ambition for the North Sea must look like. Only then is it useful to ask more general questions about aesthetics in order to see what frameworks of evaluation there may be. There are questions about the perception of beauty and the extent to which it is protected or capable of protection by the current law.

3.1 Looking closely at wind farms

There is no avoiding the fact that weaving between Chapters and Illustrations is part of reading this study. I will say at once that the designations below of "coastal", "off-coastal" and "deep offshore" wind farms are mine. They apply loosely as broad generalisations to the English wind farms, and perhaps will be helpful elsewhere. Their sole point is to dispel the idea that all wind farms are the same and that information from one will automatically provide useful information for another. The date of writing an academic article, for instance, may raise an instantaneous question as to the age and location of a wind farm being discussed, if we have an awareness of these broad labels. This is most especially true of aesthetic matters, but also has some force where environmental assessments are concerned. This latter point arises because it is in the interests of the developers applying for permissions to use earlier data necessarily not reflective of wind farms of the power and at the exposed locations that they are planning to exploit. The terms invented are approximations linking size, location and consequences for the appearance of an offshore wind farm. Without some such classification, it is less easy to understand either the changes in the sea or the aesthetics per-

haps required for the present and near future. I am pleased to note that an almost identical ranking was envisaged in 2016 in OESEA3[54] as follows:

> "The more recent development of offshore renewables, namely offshore wind farms (OWFs), has led to a greater consideration of landscape/seascape issues as they are relatively large (160m blade tip for a representative 3.6MW turbine, though up to 190m for larger units), and numerous (for example Gwynt y Môr contains 160 turbines), and until recently technically limit in the depths to which they could be deployed and therefore favouring shallow near shore sites. In the UK, OWFs have therefore largely been coastal phenomena, however the more recent Round 3 developments are largely located further offshore, and significant cost reduction in fixed and floating foundations makes sites further from shore more desirable, and there are typically fewer constraints in these areas..."[55]

3.1.1 Lillgrund and Middelgrunden

A discussion of offshore wind farm aesthetics can better progress after the reader has some familiarity with the main characteristics of offshore wind farms and their historical evolution. The reader is, accordingly, invited to turn to Figures 1.11-13, and to look closely at these photos (taken at different dates). The question is: what do we see? All three photos are of the Lillgrund wind farm situated in the Sound (Øresund) between Denmark and Sweden. The Sound is a relatively narrow sea area to the East of Copenhagen. That city is joined by a bridge over the water to the Swedish city of Malmö. The Sound continues South, whence it opens into the Baltic Sea.

Here are the obvious things that a first look discloses. Fig. 1.13 is the first in time, 2007, at a point when the wind farm had not been fully commissioned. That happened in 2008. This photo indicates that there are lines of turbines all within easy sight of each other and placed offshore. It seems to be a sunny day and there are some vague shadows on or under the surface of the water. Fig. 1.12 is taken in 2008 and gives a coastal view. This time the turbines have a somewhat untidy appearance. It is not a clear day, and this may account for the blurred horizon where the prominent turbines appear. There is no sense given of the overhead pattern of the turbines and no ability to see the surface of the water between the turbines. Fig. 1.11 is another aerial view, this time showing the full extent of the turbines against a coastal background. The overall group has some gaps in the lines as laid out. Unlike Fig. 1.13, we can immediately see that the wind farm is very close to the coast. We can also see the boundaries of the wind farm and the sea surrounding it. In none of the photos do we have a North sign to indicate directionality. Perhaps we may be tempted to speculate that the gaps in Fig. 1.13 are where turbines have broken down and been removed since 2007, but on closer inspection of the earliest photo, we can see the gaps in the lines. It might occur to us that the coastal area shown is sparsely, if at all, developed. The coast in Fig. 1.13 shows no cities or dense building areas. There are eight different parallel lines of turbines. It is not possible to know whether the photo in Fig. 1.12 was taken from the coast opposite as depicted.

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[54] UK Offshore Energy Strategic Environmental Assessment, **OESEA3** Environmental Report Future Leasing/Licensing for Offshore Renewable Energy, Offshore Oil & Gas, Hydrocarbon Gas and Carbon Dioxide Storage and Associated Infrastructure (2016) Department of Energy and Climate Change, March 2016.
[55] Page 283, paragraph 5.8.1.

Information about Lillgrund adds another dimension. The water it stands in is shallow, between 4 and 8 metres deep. The nearby coast is 7 km (4.3 miles) away. The 48 turbines are Siemens Wind Power, SWT-2.3-93, each rated as 2.3 MW. The rotor diameter is 93 metres. These turbines I will take as having a hub height of 65 metres[56]. (The hub height is sometimes listed as a minimum between 80-101 metres for this model.)[57] This turbine was first available in 2005. If we turn to Fig. 1.10 we see that the size profile for 2005-2010 fits these turbines. They are "state of the art" for 2005 but significantly smaller than the 150 metre, 3 MW turbines available by 2010. The Lillgrund installations have been there 13 years, probably about half their anticipated lifetime. The untidy patterning of the turbine layout indicates to me a design used to maximise wind uptake efficiency, making no concession to the coastal viewer.

The next layer of information, comparison to an earlier wind farm, places a historical perspective on Lillgrund wind farm. No two wind farms are the same. Middelgrunden wind farm, 3.5 km outside Copenhagen, Denmark is shown in Fig. 1.14. There we see the installations that in 2000 constituted the largest wind farm in the world. It had 20 turbines capable of 2 MW each. The layout is completely different to Lillgrund, having a simpler, more regular, pattern to it. It is obviously an earlier wind farm with smaller turbines and in full sight of Copenhagen. The water is 3-8 metres deep and the foundations concrete. It had been preceded by a three year long (1996-9) public engagement process to mitigate opposition.

3.1.2 Coastal as against off-coastal wind farms

The above two projects encapsulate the dilemmas facing wind farm designers within sight of the coast. First, there is a need to create an acceptable profile, in anticipation of opposition (Middelgrunden) rather than the most efficient engineering layout (Lillgrund). Second, increased turbine size and suitable cable connections would allow movement away from the coast for the wind farms. Middelgrunden is 3.5 km out in water 3-8 metres deep. Lillgrund is double the distance from the land but in similar depths. What these wind farms have in common is placement in relatively sheltered waters. In Chapter 2 I trace the increase in turbine size and capacity. We see that the latest models are 260 metres high, with a generating capacity of 15 MW. They are designed to cope with intense wind pressure, and the strongest tides. By comparison, the turbines at Middelgrunden and Lillgrund are tiny. In 2013 NASA photographed the lines in the sea behind the London Array turbines and those of other wind farms somewhat further from the coast. These white lines ("sea plumes") are the result of tidal forces, discussed in Chapter 6. They are the product of an obstruction meeting the tide. Fig. 2.2 (Thanet), Fig. 2.3 (the London Array) and Fig. 2.4 (Greater Gabbard) comprise a set of NASA photos dating from 2015. The layout of the turbines in these three wind farms has taken a strict geometric shape, with much bigger spaces between the installations. These wind farms are unlike the early coastal wind farms at Lillgrund and Middelgrunden. All three differ in their regular geometric layout, and in the presence of the sea plumes. I find it more helpful to think of these three UK wind farms as off-coastal not coastal. In size, visibility, location, turbine sizes, layout and visual appearance including the sea plumes they are very different from the wind farms I would think of as coastal. The London Array, for example, is exactly 12 miles (20 km) off the coast, at the UK territorial limit. As of 2018 it has 175 turbines. Those shown in the 2013 photograph are 3.6 MW turbines with a hub at 87

[56] Lillgrund wind farm on Wikipedia https://en.wikipedia.org/wiki/Lillgrund_Wind_Farm (accessed 29 9 2021).
[57] The Wind Power (undated) *Wind Energy Market Intelligence: Siemens turbines SWT-2.3-93 specifications* (as used at Lillgrund) https://www.thewindpower.net/turbine_en_22_siemens_swt-2.3-93.php (accessed 29 9 2021).

metres and a rotor diameter of 120 metres. The Array covers 122 sq km (47 sq miles)[58]. The space occupied can no longer be compared to the modest early coastal wind farm developments. Early coastal developments like Lillgrund could easily be photographed from light aircraft. The off-coastal wind farms cannot. Their graphics are shown by NASA. Of course, these three are not the only off-coastal wind farms.

3.1.3 UK timelines leading to deep offshore wind farms

Aside from the timeline for development of turbine technology, I thought it useful to create two separate but inter-related timelines. One is that of the claims of the UK to an Exclusive Economic Zone around the UK. The other is the assertion of exclusive control for renewables by the Crown Estate. The two are not the same but they are connected by the underlying theme, namely to acquire and assert dominance as regards renewables. Receiving permissions for a wind farm and the point of completion of the wind farm may be separated by years. My designations are not prescriptive but indicative. The timelines enable us to see the patterns affecting the choice whether to see a wind farm as coastal, off-coastal or deep offshore. An example is the Teesside[59] wind farm on the North East of England coast. It is a mere mile and a half offshore in shallow water at Coatham Sands near Redcar in Cleveland. It was permitted in 2004 (Round One of the Crown Estate bidding procedures, as to which see below). The original plan for three rows of ten turbines of 3.6 MW each was changed into a plan for 27 turbines of 2.3 MW each. The construction began in 2011, and the opening was in April 2014. The permission date, eventual turbine power, low numbers of turbines and location make this recognisable as a coastal wind farm despite it being opened as late as 2014. I reflect that in many other parts of the country it would never have been permitted so close to land. Current guidelines[60] for coastal permissions would nowadays stop so visible a development on aesthetic grounds. However, there is a tradition in the local Teesside area of proud and joyous jumbling of industrial buildings, futuristic bridges, giant gas works, dominating chemical processing plants, curious modern buildings, outdoor sculptures and historic low-rise redbrick housing. Wind farms are just another novelty.

Timelines for UK renewables exclusivity in parts of the North Sea can be tracked straightforwardly in legislation. Prior to the Territorial Sea Act 1987, the territorial waters of the UK were defined as waters three nautical miles to the landward side of a "baseline" representing the low water tide mark. This definition, incidentally, was a happy one for Prince Michael's family because when British forces boarded Sealand (which had been built then abandoned by the British), the High Court in London announced that it had no jurisdiction over Sealand. Sealand was outside the three mile limit. The three mile limit is shown on Fig. 1.2 as a dotted line. After 1987, the new limit was set by the UK as 12 nautical miles from the baseline[61]. That line is also shown on Fig. 1.2 as a black line in the waters. Inside the territorial line, the UK controls the air, waters and seabed. The Energy Act 2004, section 84, lays claim to an area of 200 nautical miles from the baseline as being an exclusive zone for renewable energy. Similar ambitions in regard to fishing rights and pollution control were later reduced to an envelope representing the Exclusive Economic Zone. ("EEZ") The 2004 Act was the beginning, not the end, of the process of assertion. Five years later, Section 41 of the Marine and Coastal Access Act 2009 enacted the power to make a declaration of an EEZ as envis-

[58] London Array on Wikipedia https://en.wikipedia.org/wiki/London_Array (accessed 29 9 2021).
[59] Teesside wind farm on Wikipedia https://en.wikipedia.org/wiki/Teesside_Wind_Farm (accessed 30 9 2021).
[60] See Chapter 4
[61] See the Territorial Sea (Amendment) Order 1998, SI 1998/2564

aged by Part V of the United Nations Convention on the Law of the Sea. North Sea neighbouring countries had to be consulted and bargained with. It took a further five years before agreements could be separately entered into with neighbours. The last agreement to be finalised was with Belgium in August 2013.[62] With effect from 31 March 2014 (by declaration in SI 2013/3161 under section 41 of the 2009 Act, the designation of the EEZ well beyond the territorial waters took place. On this timeline, therefore, there was a decade between 2004 and 2014 where siting of offshore wind might be affected by the legal status of the areas beyond the 12 mile limit. One assumes that the closer to the 12 mile limit, the fewer problems there might be.

The next timeline is that generated by the Crown Estate in its "Rounds" of opening specific areas for bidding by potential developers of wind farms.[63] Exactly what the Crown Estate involvement amounts to is discussed in Chapter 4. For now, it suffices to note the dates and the fact that the areas under designation were shown marked on maps. I assume that these designations in part reflected what current or anticipated turbine technologies might make possible for wind exploitation. The Round One designations (1998 onwards) were coastal, and met a barrage of opposition from people who did not want wind turbines in their sightlines. Teesside wind farm was an example of a Round One wind farm, but there the delay was financially caused.

Round Two was announced in December 2003, and the areas were further from shore generally. Round Two resulted in the "off-coastal" wind farms and the first of the sea plumes. 2004 is an important date in the UK EEZ timeline. Round Two wind farms include Thanet, the group of wind farms just outside The Wash (see below), and the group of wind farms around the Thames Estuary. The general pattern that emerges is one in the East of England where wind farms are closer to or beyond the 12 miles limit but where the size of the overall development is not as big as later seen. At the time, there may have been a fear on the part of investors of possible insolvency of developers. We see from Chapter 2 that the UK mass market in electricity does not find a stable model until 2017. Triton Knoll illustrates perhaps the higher level of Round Two ambition. The project was 33 km (21 miles) off the coast and was finished in September 2021 by which time there were 90 turbines at 80 metres height (260 feet). For the most part the developments in Round Two are in areas most unlikely to run into UK EEZ difficulties because they were situated just outside sight of land. Fig. 2.6 shows a NASA overhead of the Thames Estuary as at 2013. The Round Two wind farms shown are Gunfleet (as extended in 2010), the London Array and Thanet. Greater Gabbard is further north but is also a Round Two wind farm. It is shown on Fig. 2.7 as being just North of the London Array. Kentish Flats is much closer to land and is a Round One wind farm on shallow flats. Fig. 2.6 is especially interesting because it shows the patterning of development. Round One and Round Two wind farms have been completed and in some cases extended. They are there to be discussed and experienced by my mariner interviewees, and by Prince Michael. I think it unlikely that their comments and anxieties, based on the built environment, would have taken into account the extent of the committed and impending development in Rounds Three and Four.

Round Three runs from June 2008. It straddles the 2009-2014 negotiation period in the EEZ timeline. By now the ambitions for development are clearly deep offshore. This Round re-

[62] For the full list of agreements see the Explanatory Note for Article 2 of the Marine Management, The Exclusive Economic Zone Order 2013 (SI 2013/3161) coming into force on 31 March 2014

[63] For general background see Wind power in the United Kingdom on Wikipedia https://en.wikipedia.org/wiki/Wind_power_in_the_United_Kingdom (accessed 30 9 2021).

sulted in wind farms such as East Anglia, Hornsea and the Dogger Bank. Their state of permission and completion is shown as at 2020 on the interactive map (see below) produced by Wind Energy Network, a communications hub.[64] Round Four opened in September 2019 and results were delivered in February 2021[65]. The Round Four bidding areas are marked on the interactive map and Round Three wind farms are seen marked inside them. The Round Four areas go right up to the international boundaries to the East. The six wind developers successful in securing options for development in Round Four are split into two groups. One relates to the Western side of the British Isles opposite the North Wales (three wind farms). The remaining group relates to three further wind farms. These are two more at Dogger Bank (1500 MW capacity each), and one in the Southern North Sea opposite Lincolnshire (1500 MW). All the Round Three and Round Four wind farms are ones I would designate as deep offshore.

3.1.4 Deep offshore wind farms

The reader is invited to watch the approximately 3 minute long news video[66] featuring Hornsea One. It is not identified in the video but the number of turbines makes the identification correct. The scale of installations, harsh weather, wave conditions and infrastructure support required characterise the deep offshore energy environment. Wind farms in deep offshore locations are different from coastal and off-coastal wind farms. These wind farms are invisible from the coast and are much bigger than the off-coast wind farms. I estimate they will deploy turbines of 7-11 MW at least. I say this because the minimum size will exceed that of turbines at Galloper and will at least match Hornsea One. The likelihood is that the larger size chosen for the German Bight is within range. Galloper wind farm, an extension of Greater Gabbard wind farm (construction 2014-18) installed 6.3 MW turbines[67]. Hornsea One installed 174 turbines each with 7 MW capacity[68]. The recently contracted size for the replacement turbines in the German Bight is 11 MW: see Chapter 2.

For deep offshore wind farms, especially those under construction currently, there is a curious lack of specificity as to their dimensions at the assessments stage. This is because the applications and environmental assessments are done before the developer decides on the turbine size or type. The applications generally request a number of turbines, and the decisions generally stipulate maximum turbine numbers and turbine height dimensions, but not a turbine capacity. So Hornsea One's newsletter[69] announcing the permission granted on 31 December 2020 for the impending Hornsea Three extension was only able to indicate that 231 turbines were allowed, provided the lowest tip of each turbine blade was 40 metres above sea level so as to minimise bird loss. This implies very big machinery. The installation in question for Hornsea Three is to be 120 km (75 miles) out to sea. I am inclined to use turbine size and size of the wind farm to place a wind farm in the deep offshore category.[70]

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[64] Wind Energy Network Map 2020 https://www.windenergynetwork.co.uk/wp-content/uploads/2020/01/A1-Map_Issue-52.pdf (accessed 26 9 2021).
[65] Crown Estate (2021) Round Four Results *Offshore Wind Leasing Round 4 signals major vote of confidence in the UK's green economy* 8 February 2021.
[66] BBC News (2021) *Life at sea by world's largest offshore wind farm in North Sea* 4 10 2021 https://www.bbc.com/news/av/science-environment-58761725 (accessed 4 10 2021).
[67] Galloper wind farm data on Wikidata https://www.wikidata.org/wiki/Q56026054 (accessed 1 10 2021).
[68] Hornsea One video (2019) *World Wind Tours: Hornsea 1* (30 second Ørsted promotional video) 9 April 2019 https://www.facebook.com/Orsted/videos/world-wind-tours-hornsea-1/508568540309030/ (accessed 1 10 2021).
[69] Hornsea One Community newsletter by Ørsted (2021) April *Ørsted Hornsea Project Three Offshore Wind Farm.*
[70] For example East Anglia One whose western edge is around 28 miles (45 km) from the coast.

There are other features of these later wind farms that should be pointed out. The vast majority of the early wind farms use monopiles fixing the turbine into the seabed, and the remainder use gravity base structures where the turbine is attached to a heavy base. Since around 2019, some wind farms (eg Anglia One) have begun to use jacket foundations instead[71]. Jackets serve the same anchoring purpose but they are made up of a tubular steel lattice in a sharp-edged conical shape. The bottom of the lattice has four corner piling points. These can be attached to the seabed by pre-piled points or the four base-points of the lattice can be attached by suction bucket to the seabed. A suction bucket (caisson) bores its way into the seabed by natural pressure of the water. So far as I am able to ascertain, monopiles and jacket foundations are offered by manufacturers right up to the 12 MW size. The recent White Paper view of the US authorities[72] (as to what depths are suitable for what type of foundation) has been so heavily criticised that I discount it[73]. The likelihood is that price and availability will influence foundation choices.

The relevance of this is that some of the UK deep offshore wind farms are using jacket foundations and others will probably do the same. This affects the appearance of the sea surface far less. The off-coastal wind farms have surface-visible sea plumes owing to the size of the single obstruction standing against the tide. Jacket foundations have a different pattern of resistance to the tide where the strong vortices are at the wider base and the surface appears calm. In surface appearance terms, the visuals are lessened but the seabed impact, I would expect, requires evaluation. In turn this means that aesthetic evaluations would have to be very clear as to whether they were confined to what the human eye could perceive or whether they were to embrace beauty meaning health. In the discussion that follows I return to this difference.

I assume that geometric layout and spacing like that of the London Array and other off-coastal wind farms (as shown in the Group 2 illustrations) will probably be replicated in the deep offshore farms. This is on the basis that such patterning has worked satisfactorily so far with shipping lanes and other sea users' safety. I randomly picked a group of deep offshore turbines shown on NASA imaging for LandSat 8 in the North Sea due East of East Anglia as at September 2021. A westwards line made landfall at approximately the location of Aldeburgh Suffolk, and I deduce that the image at Fig. 2.8 shows a section of East Anglia One wind farm (completed April 2020). The screenshot of the image shows the same geometric pattern that was used earlier, but the spacing is likely to be more distant to reflect the larger size of the turbines (7 MW) compared to the London Array (3.6 MW). A similar geometric pattern in shown in Fig. 2.5 at a location in the North Sea in March 2020, as preselected by NASA. Deep offshore wind farm promotional literature often shows arrow-like formations when the turbines are seen at an angle. We see this in Fig. 1.8, a photograph by Paul Gilson. On the seabed a different, almost flower-like, pattern of cables may be laid. At Triton Knoll that seabed pattern is shown in a short concept video.[74] The matter of the cables is considerable: Hornsea One has at least 467 km of offshore cabling alone.[75] I note these vast designs on

[71]Offshore Magazine Notice, in-house (2020) *UK leading offshore wind jacket foundation trend* 13 February 2020.
[72] OCS Study, BOEM 2020-041 (U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs) (2020) *Comparison of Environmental Effects from Different Offshore Wind Turbine Foundations*.
[73] NGOs' Letter of concern (2020) dated 8 December 2020 issued in response to OCS Study, BOEM 2020-041. Letter is addressed to Environmental Studies Chief OREP and BOEM from NGOs Audubon New York, Connecticut Audubon Society, and 13 others.
[74] *Triton Knoll Offshore Wind Farm in 3D* (29 Sept 2020) https://www.youtube.com/watch?v=gJLDE6_Adtg (accessed 3 10 2021) at approx. 50 seconds
[75] Offshore Engineer News Update (2018) *Hornsea One Export Cable Installation Completed* (11 December, 2018).

the seabed itself, especially since decommissioning in some instances may leave them for ecological reasons as permanent features.

The matter of the sea vortices, whether at surface in the form of plumes or deeper as sediment disturbances, is troubling. Not only are they being substantively ignored in the critical overall permission evaluations, but the way in which this is achieved is one that can be criticised (see below). The reader is referred back to Figures 2.2-4. The sea plumes are the result of obstructing the tide: the bigger the obstruction, presumably, the bigger the disturbance. Chapter 6 looks in more detail at them. If monopile or gravity-based foundations are chosen, any sea plumes are likely to reach the surface behind increased obstructions. If jacket foundations are chosen, tides will create vortices but not perhaps at the surface. This is a matter that appears to be left outside the assessment process, beyond the simple matter of "scour" adversely affecting turbine foundations.

Norfolk Boreas wind farm (72 kms offshore) is a case in point. I quote below the Scoping Report for the Environmental Impact Assessment, which explains the basis on which the detailed subjects will subsequently be approached and investigated. I note that the Report cites in support of its approach two other assessments done for two separate extensions of the deep offshore Anglia wind farm. The Norfolk Boreas wind farm is one of two "sister" projects, the other being the Norfolk Vanguard. The developers of Vanguard (47 km out to sea) applied for 200 turbines but were permitted 158. The blade tip height was restricted to 350 metres. Boreas separately applied for a brace of permissions and became delayed by litigation. The complaints were about the onshore electricity station to serve Boreas not being evaluated properly.[76] Norfolk Boreas will occupy 725 sq km.[77] It is huge, quite outside the scale of the "coastal" and "off-coastal" developments. The Norfolk Boreas Offshore Wind Farm Environmental Impact Assessment Scoping Report (2017) was drawn up at a time when the much smaller off-coastal wind farms were well-known to produce sediment plumes. The material parts of this document read as follows (italics mine):

> "Potential impacts during operation [ie post construction]
> 326. Effects on hydrodynamic regime (waves and tidal currents): *Multiple foundations are likely to increase local drag forces* and tidal flows and potentially diffract and scatter waves which could lead to physical process changes *at the coast.*
>
> 327. Evidence from monitoring work at operational offshore wind farms demonstrates that *effects on the hydrodynamic regime are restricted to near-field changes only (i.e. close to the structures);* far field effects (such as at adjacent coastlines) have not been observed. This is supported by Walker and Judd *(2010)* who reviewed the results of monitoring from *several UK offshore wind farm projects* and found no evidence for far-field effects….
>
> 330. Effects on sediments and sedimentary structures: Effects on sediment transport (through accretion or erosion) have been studied at industry level (ABPmer, *2005)* as well as for site-specific monitoring studies (Cefas, *2005*). Such studies have concluded that minimal effects can be expected on prevail-

[76] See *Raymond Stephen Pearce v Secretary of State for Business Energy and Industrial Strategy v Norfolk Vanguard Limited* [2021] EWHC 326 (Admin), Holgate J, discussed in Chapter 5.
[77] Vattenfall is the developer: Vattenfall Notice, in-house *(*2020) *Vattenfall in Norfolk, Norfolk Boreas Offshore Wind Farm.*

ing sediment transport conditions, both within *wind farm sites as well as in the far-field*, provided that the foundations are adequately spaced (which would vary depending on the details of the foundations and wind farm layout). *Effects on sediment transport are likely to be localised to the areas immediately surrounding the individual foundations (or scour protection or cable protection material)* in the form of seabed scour where the sediment is soft enough to be mobilised. *Scour at each foundation* will be assessed using well-established empirical methods applied to offshore wind farms elsewhere.

331. Effects on suspended sediment concentrations and transport: During the operational phase, there is *potential for sediments to be re-suspended by scouring effects. Consideration will be given* (using expert geomorphological assessment) to likely changes in suspended sediment concentrations due to scour during both the construction and operational phases…

336. Given that the *likely* hydrodynamic and sedimentary effects of Norfolk Boreas would be *restricted to near-field change only*, transboundary impacts are unlikely to occur or would be insignificant and therefore the Applicant *proposes not to consider transboundary impacts* for marine geology, oceanography and physical processes further during the EIA. *This approach was also taken by the EIAs for East Anglia ONE (EAOW, 2012b) and East Anglia THREE (EATL, 2015).”*[78]

From the perspective of what is required by the process, the observations made on the part of the developer are compliant. Nonetheless, they reveal ways of deflecting attention from the lack of detailed information that would allow inconvenient questions about turbines and their impact. The points below follow the sequence of the document.

- The document has to begin by recognising that drag forces will increase by the presence of multiple foundations. There is no recognition that the size of these foundations is highly relevant and will directly determine the length and strength of the sediment disturbances. Instead, concern is deflected onto the coast and the possibility of impact there. The dichotomy of coastal/ near-field distracts from consideration of the tidal forces at the turbine bases. Since coastal threats are discounted, the matter of tidal impact is closed.

- Effects observed are stated to be in the “near field” ie round the structures. This commentary entirely ignores the 2013 NASA photographs and the body of research it triggered. Quoting research done in 2010 must refer to an early model of wind farm and a low density of wind farm provision. It is not known what monitoring is referred to and what kind of wind farm. If there is a firm belief that near-field is the only relevant one, monitoring may have been limited accordingly.

- The quoted passages make the fundamental choice to ignore turbine size. The size of the Norfolk Boreas turbines makes observations based on information from

[78] Norfolk Boreas Offshore Wind Farm Environmental Impact Assessment Scoping Report (2017) EN010087-000015-Scoping Report. Vattenfall Wind Power Ltd (by Royal HaskoningDHV) Document Reference: PB5640-102-101 (May 2017) https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000015-Scoping%20Report.pdf (accessed 30 9 2021).

coastal or even off-coastal wind farms inadequate comparators when turbulence from foundations is discussed. It must by now be clear that the coastal projects cannot usefully be compared. Even the London Array with its 3.6 MW turbines is certain to be dwarfed by the Boreas turbines.

- It is not a satisfactory explanation for avoiding calculations to rely on the fact that the applications process allows the developer to specify the type of turbine at a later stage. It does, but for the environmental assessment on sediment movement to have meaning, estimates could be done for the types of turbines available or being considered. There are other completed deep offshore wind farms where wideset data could be requested.

- As regards the sediment aspects, reliance on industry data that is twelve years old is not likely to stand scrutiny. Papers written in 2005 must relate to data from coastal wind farms.

- It follows that I am unconvinced by the assertion that sediment transportation will be "localised" to the turbine bases. This is an unsupported assertion.

- No explanation is given for equating the scour and sediment transport, even though sediment transport causes scour. The sediment vortex causes the scouring of the turbine bases by sand and tide, but is not defined by it. Assessing scour at the foundations only deals with that matter but is not conclusive of the impact of the scouring beyond the foundations and further afield.

- Paragraphs 331 and 336 make it plain that there is no intention to do anything, and that is their practice elsewhere on the two other large developments cited.

- "transboundary" means as affecting international neighbours, in this case particularly the Dutch. Section 2.17 (paragraph 875 and following) lists many possible areas for transboundary problems. Not one of them relates to the appearance of the sea or the possible presence of sediment vortices or sea plumes.

The environmental assessments are public documents and to some extent may serve to frame public engagement. The above treats all offshore wind farms as the same, which is not the case. It also treats the size of the impending turbines as irrelevant, whereas they are central to an understanding of the "drag" admitted at the outset. The rest obscures the presence of the sea plumes or (in the case of jacket foundations) sediment vortices. This is done by asserting that disturbances are (a) confined to the area of the turbine bases and (b) only relevant to the scouring of the bases. Proposition (a) is observably wrong relative to the offcoastal wind farms, and unsupported in relation to Norfolk Boreas. Proposition (b) is misleading. Just because scouring does one thing does not tell us if it also does another.

3.2 Wind farms off the East of England

What wind farms are there now or impending off the East of England? Can we imagine how the developments look or will look? I took an imaginary tour up the North Sea opposite the coast of the East of England, heading North from the mouth of the Thames. This is the general area most familiar to three of my interviewees. Paul Gilson and Dick Beaumont speak

directly of it. The area contains Sealand, and towards the South of Sealand, the various North Sea forts shown in Fig. 1.1. The discussion above about the development of and the differences between the generations of turbines and wind farms means that we should not be thinking of all wind farms as alike. My interviewees make no differentiation as they comment because they are speaking of the general phenomenon of wind turbine presence. To a mariner the effect may be much the same in terms of avoidance. The interactive map[79] referred to below and the illustrations allow a degree of visualisation for the imaginary tour.

There is a 53 second clip on Youtube[80] that features sea plumes. The person filming uses what seems to be a fisheye lens so as to produce an ultra-wide view. In the background the viewer can see (speeded up) what it is like to move within the Thanet wind farm in a boat. I characterise that view as industrial, but the reader can make up their own mind. There are multiple relatively close-set turbines in view. They are 3 MW turbines. Thanet wind farm is seven miles (11 km) from the Kent coast and was completed in 2010. It can be seen on Fig. 2.2 as at 2015. Thanet was identified as an off-coastal wind farm. Another place where a turbine-packed view can be obtained is Fig. 1.3 showing the Shivering Sands fort with wind turbines in the background. These are the turbines of the Extension to Kentish Flats wind farm that was constructed in 2015. The original area and location of the Kentish Flats wind farm is shown in Fig. 2.6 towards the bottom of the picture. That wind farm is approximately 6 miles (10 km) off Whitstable, mentioned by Paul Gilson in Chapter 6 as changing the fishing. I have identified that above as a coastal wind farm. These images will not reflect the aspect of the deep offshore wind farms because of the size of their layout and the modest size of their turbines. The industrial appearance of the turbines, on the much bigger scale, will remain.

Fig. 2.6 also indicates the level of wind farm density considered acceptable as at 2013 in an area that has high levels of competing interests in the form, particularly, of dredging, port activity and general shipping. The mouth of the Thames and its approach shipping lanes must be one of the busiest places in Europe. Eight years later, we can find the current state of development in map form, collated by a magazine for the wind industry, so as to demonstrate the areas selected by the Crown Commissioners for possible development. All UK wind farms as at 2020 are shown, whether they are built, under construction, permitted or presently under process of consideration.[81] The area in Fig. 2.6 has undergone and is undergoing further development. Kentish Flats was extended (see above); Thanet has an application in for an extension. I can only wonder what level of density of provision would be thought acceptable where these other competing pressures are less. Some idea can be had by considering the areas immediately to the North.

As we move (on the 2020 map) only a little further north from the London Array, there are installed wind farms at Greater Gabbard and at Galloper (once itself regarded as an extension of Greater Gabbard) opposite the ports of Harwich and Ipswich. Both of these have applied for large extensions. For this purpose I comment on size relative to area contained by the overall wind farm. Moving slightly further North of Ipswich again, opposite Lowestoft and Great Yarmouth there is a built wind farm at East Anglia One, but there are full permissions issued for three vast extensions, each as big as or bigger than the original hub.

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[79] Wind Energy Network Map 2020 https://www.windenergynetwork.co.uk/wp-content/uploads/2020/01/A1-Map_Issue-52.pdf (accessed 26 9 2021).
[80] *Surveying of sediment plumes at Thanet offshore windfarm* (2017) https://www.youtube.com/watch?v=09LAgv70hDU (accessed 22 9 2021).
[81] Wind Energy Network Map 2020.

These are all with full permissions for construction: East Anglia Hub One North; East Anglia Hub Two, East Anglia Hub Three. Just slightly further North of these is the site of the wind farms currently in planning stages containing the Norfolk Vanguard and Boreas applications. Those two in combination are as big as the whole of the four components of the East Anglia Hub. In other words, what is seen as built in this area is only roughly one eighth as much as is permitted or requested to be permitted in 2020. It is not surprising that a judge has slowed the planning process for reassessment because the detailed permissions granted failed to consider the cumulative impact onshore of both Vanguard and Boreas being constructed.[82]

This Eastern area off the Suffolk /Norfolk coast is the area described by Dick Beaumont in Chapter 6 (at 6.3) "off Harwich and along the coast Southwold/ Aldeburgh / Lowestoft / Yarmouth." His comments related to orange streaks in the water and visibility problems are generated by the one eighth constructed provision. Paul Gilson speaks of this whole coast from North Foreland in Kent northwards to The Wash (bay/inlet on the northern coast of East Anglia) in these terms: "They are from North Foreland to the Wash. For 6 to 12 miles there is virtually a constant line of wind farms.[83]"

In The Wash area itself there are, further, built wind farms at Sheringham Shoal, Race Bank, Inner Dowsing, Lincolnshire and Lynn. In the sea opposite and to the East is East Dudgeon wind farm. Big extensions are permitted and are shown in the 2020 map as currently under pre-construction at Sheringham Shoal, Dudgeon and Race Bank. Just North of these and further away from land is the site where Titan Knoll is permitted.

Slightly further North again, off the Yorkshire coast opposite Hull, there is currently built wind farm provision at Watermouth Rough and at Humber Gateway. Further out to sea is the Hornsea Project. The physical area showing Hornsea Project One as under construction is seen on the 2020 map, but there are a further three following phases shown, all permitted or in construction. Matters have moved on rapidly. Hornsea One[84] was completed in January 2021 and the areas for Hornsea Project Two and Three are under construction. Hornsea Four is permitted but not yet under construction. These four Hornsea Projects occupy a swathe of the North Sea originally comprised in the bidding Round 3 granted by the Crown Estate in 2010.[85] The total Hornsea zone is 4730 sq km (1830 sq miles). Within that, the permitted turbines' area will occupy 2325.6 sq km (892.1 sq miles)[86]. The Hornsea complex is obviously a deep offshore wind farm.

What the 2020 map does not show, but we should add on the imaginary tour, is the wind farms accepted in 2021 for the Round Four Crown Estate bidding. Somewhere off Lincolnshire (ie North of the East Anglia One complex) inside the Round Four leasing area as marked on the map will be another wind farm with a capacity of 1500 MW. To give an idea of how much space this will take, we can see marked on the map the four Dogger Bank wind

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[82] See Chapter 5.11.
[83] Passage quoted in Chapter 6.2.
[84] See generally Hornsea wind farm on Wikipedia https://en.wikipedia.org/wiki/Hornsea_Wind_Farm#Hornsea_Project_2 (accessed 25 9 2021).
[85] The approximate area to be covered by the four Hornsea turbine sites is extrapolated by me from figures on Wikipedia where the original links are dead, and presumably the supporting documents have been moved to the National Archives. I did not chase this further because my interest is only in the overall estimates, and I can see from the interactive 2020 map that these are plausibly correct.
[86] Hornsea Project One 629.6 sq km (243.1 sq mls); Hornsea Project Two 400 sq km (150 sq mls); Hornsea Project Three 696 sq km (269 sq mls); Hornsea Project Four 600 sq km (230 sq mls)

farms (currently under construction). These have a capacity of 1200 each. On top of this, the four current 1200 MW wind farms at the Dogger Bank will be added to by a further two bigger wind farms (1500 MW each) as permitted in the Round Four bidding.

3.3 Seeing the future

In the near future significant parts of the UK area of the North Sea will be covered by wind farms. In October 2020 Boris Johnson, the Prime Minister, announced that the previous overall wind farm target for 2030 of 30 GW was henceforth increased by a third up to 40 GW.[87] This can only mean that more wind farm extensions and additional permissions will come into being. There is no natural restraint on the building of wind farms. Neither is the UK the only country sourcing wind energy in the North Sea. The Netherlands and Belgium[88], have become major customers for turbine suppliers in the period since 2019. The more difficult question is what areas will not be covered by wind farms. If we are to imagine what this means in visual terms, there will probably be a carpet of wind turbines in view in all directions. The turbines are installed at bigger and bigger generating capacities and are increasingly visible, experiencing "drag" all the way to the seabed. It is impossible to say what the water clarity or the overhead appearance of the sea will be because the wind farm developers resolutely refuse to confront this, at any rate in the UK environmental assessments prior to the grant of development permission. The sea within the UK EEZ will soon not look as it does today, when only a fraction of permitted capacity has been installed with a further 4500 MW to be added in the North Sea from Round Four allocations. The cumulative changes will remove an open horizon in the North Sea. The resulting seascape will undoubtedly display the industrial character of the geometrically placed turbines. We do not know what the cumulative wave and sediment disturbances will be[89]. If we are to consider aesthetics usefully in relation to North Sea wind farms, we cannot ignore the commitments that will change the aspect of that sea. We cannot ignore the unfulfilled targets that are likely to speed further encroachment on the remaining areas.

This is not simply speculation based on past activity. The new "Explore Marine Plans" interactive data site[90] enables the user to choose one of the areas around the UK and to zoom in with detailed locations for activity, industry by industry. "Energy" includes all the offshore sites including those just designated in the Round Four releases. What is also shown is the areas coloured marked "Offshore Wind High Potential Future Development Areas". These are virtually the entire EEZ excepting the territorial waters. The overlay allows all existing areas permitted or in development to be shown as well as the Round Four designated sites. If the oil wells are added (a further overlay available) to the map, they complete the jigsaw. If one tries to decide how strong a tool the sea character assessments are as a means of slowing or deflecting development of wind energy, this information makes it appear weak, except in the coastal and coastally visible areas. The 2011 Marine Policy Statement[91], recently updated to show on-going EU commitments, at 2.6.5.1 continues to define "seascape" in terms of the coastally visible areas. That would have been accurate as at 2011 and there seems to have been no revision of it either in 2014 on declaration of the EEZ or in 2021 at the update. I

[87] BBC News (2020) *Boris Johnson: Wind farms could power every home by 2030* 6 October 2020 https://www.bbc.com/news/uk-politics-54421489 (accessed 1 10 2021).
[88] See Chapter 2.
[89] See Chapter 6.11.
[90] MMO Interactive marine data portal Explore marine plans (marineservices.org.uk) (accessed 6 10 2021).
[91] Marine Policy Statement (2011) All UK Governments, last updated September 2020.

found this confusing in isolation, even after discovering the seascape character assessment provisions elsewhere. It is only where the interactive map is considered that the retention of the definition in isolation makes practical sense. The coastally visible areas are likely to be the main areas, alongside marine conservation (protected) zones, where the renewables industry might be fought off. The policy priorities placed on decision-makers when considering applications for development in marine areas are squarely placed in favour of the renewables industry.[92]

3.4 Aesthetic responses to wind farms

Just as the growth of wind farm provision has generated different historical layers of activity and provision in the UK, so also has the aesthetic response to wind farms reflected that pattern of activity. Initially the concerns were all about coastal wind farms, and later about off-coastal wind farms where they could be seen. Coastal residents fought back against coastal wind farms, sometimes successfully. Guidelines came into force so that the off-coastal wind farms and later built extensions could be evaluated using standard criteria (see Chapter 4). The evaluations concerned "seascape" as capable of being perceived on land. Wind turbine technology was pioneered by the Danes, and early research did not anticipate or need to anticipate the colonisation of deep offshore areas. It was designed to scope the responses to wind farms that could be seen from the coast. Interesting as the findings are in themselves, they tell us no truths about human nature and nothing at all about how those same people might feel about saturation of the North Sea by wind farms. However, they do chart historical aesthetic responses to the coastal wind farms in particular communities. They do explain some of the early changes to wind farm layout and design to accommodate viewer preferences. To read them is to enter a different historical time frame. Activity in the North Sea has moved on.

I have occasionally seen conclusions drawn from these early studies, or heard honest beliefs expressed in line with them, to the effect that what one cannot see does not matter. This is a running theme in the background of this study. I disagree with such conclusions and beliefs. The most powerful tool of environmental, landscape and seascape protection is the power of the imagination. Organisations that protect sea creatures or special environments (such as peatlands or rivers) are supported by individuals who may well live in urban areas, or who may never have seen creatures threatened with extinction. Most Greenpeace supporters (see Chapter 4) will never have seen or been to the Dogger Bank. These supporters clearly have an opinion that the things they do not see matter to them. Often the cause is an aesthetic self-identification with or preference for or protective aesthetic or emotional orientation towards something under threat. Many such threats are an unrestrained exercise of industrial activities that in moderation would not cause opposition. Conflicts in the North Sea regarding the sharing of space include conflict between trawler fishers and conservationists (see Chapter 4). Aesthetics as a basis for engaging with the North Sea is a part of everyday life for sailors. There is no reason to regard the aesthetic opinions of those who cannot see the North Sea as illegitimate or marginal. Indeed, I suspect the power of public opinion (see Chapter 4) is one very good reason for officials and developers to keep it out of their way on the march towards the 2030 UK wind energy targets.

[92] Marine Policy Statement (2011) 3.3.4 page 30.

This study takes the pragmatic line that there are subjective aesthetic preferences connected to the appearance of the sea, to wind farms in it, and to industrial aspects of the sea. The economic aspect of those aesthetics can be strong. Generally, people on land like to see un-industrialised nature, and will pay to avoid living in an obviously industrialised environment.[93] This is an underlying explanation for hostility towards the wind farm development discussed in Yuriko Saito's aesthetic study of the proposed Cape Cod wind farm.[94] Her work explores the incorporation of aesthetics into the everyday lives and activities of people, and on the impact of those aesthetics. She reflects on the values underlying the positions taken by those supporting the development, and on the implications on a wider scale of these attitudes. The initial proposal was filed in 2001, and the discussion proceeds on the basis that: "One thing that can never be changed, even with better technology, is the turbines' visibility." [95] Her endeavour is essentially to reframe aesthetic and moral sensitivity towards the structures in an endeavour to render them acceptable visually. This parallels the kind of battles that surrounded the coastal North Sea wind farms. The Round Two wind farms were to a limited extent visible from the coast. The on-going litigation regarding wind farms tends to concentrate on the supporting onshore infrastructure, not the turbines. Battles still rage over the landscape impact and siting of the electricity stations required to access and convert the incoming power. These are large scale structures and understandable conflicts, but they stand some distance from the focus of this study of the sea itself.

3.4.1 Emotions, memory and perceptions mixed

If by aesthetics we partly mean an appreciation of beauty, whether or not natural, it is interesting to see how this quickly prompts allied thoughts of ethical or philosophical positions. I agree with Saito that the underlying value-structure cannot be divorced from aesthetic positions. She tries to change the positions by altering the underlying structures. Engagement with early attitudes to possible coastal development evidences this intermixing of aesthetic perceptions with moral stances, memories and emotions. This is mirrored in a study just over a decade ago in Germany at a point where the government had clearly decided[96] where wind farms were to go offshore but before the huge development had started. In the hope of alerting people in the relevant areas proximate to the coast to the economic advantages that wind farm development would bring, research was commissioned about attitudes and their causes[97]. The deconstruction of attitudes was sufficiently sophisticated to use techniques of association to gauge possible underlying attitudes, and to assess hostilities even though they might be ascribed to others. Analysis of the attitudes of 387 local people to the prospect of offshore wind farms shows a possibly typical range of feedback. The anxiety and perceived threat (despite uncertainty as to whether any turbines would be visible from the coast) were found to be expressed as potential deterrence to tourism, but frequently reflected an aesthetic rejection of wind turbines as an imposition on the notion of the seas as open spaces. Surveys revealed at least two types of non-monetary response. There were those based on ethics, the morality of protecting creation and the right of the sea to exist as is. Secondly, there were

[93] There have been various attempts to calculate the avoidance values of an industrialised view eg by Chiang (2016) relative to the Lake Michigan area in North America. Chiang measured "how much a resident is willing to pay or willing to accept (WTA) as an additional cost or discount to their monthly electricity bill for a potential OWF located at a specific distance from shore". His secondary study concerned the drop in residential property values: "This real impact in property values demonstrates the economic losses that may occur from wind turbines, losses that are external to the power generation itself."

[94] Saito,Y (2017) *Aesthetics of the Familiar: Everyday Life and World-Making* Oxford University Press, Oxford in Chapter 4.

[95] At page 94.

[96] Umweltbundesamt (2021) Coastal Futures. German government, environment ministry.

[97] Gee (2010)

those based on visual qualities in the landscape benefitting individuals or communities. Neither is accessible to discussions of economic benefit. In summary form: "the notion of spatial expanse and openness of landscape, concepts that are closely linked to the spiritual and aesthetic values ascribed to both landscape and seascape."[98] These were built on amalgamations of emotions, memories and perception. Ideas connected to that of the sea as industrialised were linked to hostility to wind farms, despite the fact that transient ships were not seen in that way[99]. The attitude of government bodies was dictated by the drive to renewable energy. The local population had ethical and aesthetic reservations. The question was finally raised: "how much offshore wind is acceptable?"[100]

3.4.2 Danish coastal dwellers

The point made in interview by the unnamed engineer as to setting offshore wind farms out of view of coastal dwellers[101] is one that reflects a desire to protect the visual (and potentially auditory) amenity of settled areas. This follows in line with Danish research in 2012 that, subject to costs, it was better to be out of sight.[102] At that time, it was apparently the depth of the water, rather than simply the distance from the shore, that caused installation costs to increase. However, the attitude of people to wind farms in aesthetic terms seems perhaps in certain ways surprising. For example, it appears that people found the view of wind farms with many turbines more pleasing than with fewer.[103] Danish attitudes surveyed depended more on whether the person used the beach and how often, compared to age or education or social status or gender[104]. The unnamed engineer is less troubled by adding another industrial component to an existing industrial land- or seascape.[105]

3.4.3 Creation of wind farm geometry

The existence of huge geometric wind farms as a growing feature of the seascape is relatively new. In Chapter 4 I examine the coastal seascape guidance applied to evaluate the visual impact of offshore wind farms (including especially OSEA 3 and 4). The guidance refers to the size of the wind farm profile on the horizon because there is an anticipation that the development will be out to sea but still visible. Where a development is not visible from the coast there are instead criteria to consider the possibility of change to the character of the sea, which is a matter for the Marine Management Organisation to evaluate.

Aesthetic considerations have also been important in creating early coastal and onshore pattern lay-outs for wind farms so as to minimise the overall impact for the viewer. Lillgrund from the coast has a chaotic profile (Fig. 1.12). Striking examples of the difference and the calculations to achieve it are provided by Mazlov (2017). The off-coastal (Round Two) wind farms and the deep offshore wind farms share a ruthlessly geometric pattern that is different from the pattern of Lillgrund. This new geometric form is nowadays imposed on the seas and its users rather than coastal dwellers. What this means visually, and in other ways in-

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[98] Ibid.
[99] A view the engineer shared: A3:4.
[100] See Chapter 2 .4.
[101] "I advocate setting wind farms 40 kilometres or more off the coast… you will only be able to see the upper part of the blades from the beach": A3:4.
[102] Ladenburg (2012).
[103] Ladenburg (2011).
[104] Ladenburg (2010).
[105] "With the Middelgrunden offshore wind farm off Copenhagen, you see Malmo in Sweden in the background, and it is overall a big populated and industrial area. Here it is perfectly fine with the turbines. In pristine areas I am less comfortable": A3:3.

cluding from the air, is considered in Chapter 6. Standing back from the chaotic horizontal profile of wind farms like Lillgrund (Fig. 1.12), it is right to ask what exactly the problem is. It is not sufficient to observe that the profile is untidy. The better question is why a tidy profile is more acceptable. Here may be the impact of unconscious classification of the turbines with man-made and not biologically created. To make this clearer, a field of daisies where each flower was geometrically arranged relative to its neighbours would strike an observer as definitely generated by the intervention of man. Biological examples of geometric preferences can, of course, be found. They are perhaps curiosities and enjoyed for the contrast, as with certain types of mushrooms that grow in circles. The untidiness of the early turbine profiles together may be disturbingly reminiscent of growing things. This challenges assumptions of origin and expectations of clean lines, which the turbines individually have. The point being made ultimately is that an aesthetic response carries an association, and understanding it requires the association to be uncovered. Unexpectedness or juxtaposition of origin may not always be an aesthetic positive.

3.4.4 Legacy of early aesthetic responses

The concerns and complaints generated in connection with coastal and off-coastal wind farms dictated a focus on the aesthetic relating exclusively to the visibility and placement of the turbines themselves. In consequence, it seemed to me that virtually the entire aesthetic perception of wind farms for a wider public had been drawn to focus on those things. What impact had the sea plumes made in the period since their discovery eight years ago? As a crude measure of what is available for the popular imagination when it comes to visual matters, I decided to check on the internet. 0n 14 August 2021, inside Google images, I searched "wind turbines". Of the first 250 images of turbines, not one showed a sea plume, despite the presence of a substantial seascape element. I then searched for images under "offshore wind turbines". Of the first 250 images, only 2 showed sea plumes. One was from a university website for an article about modelling and capture of energy, so was specifically relevant to topic. The second example was shown on the website of a turbine supplier. The shot was of mid-sea turbines, and the photo was intended to convey the difficulties of the harsh sea environment (and by implication the excellence of their product and expertise). All the other 248 images were such as to show the setting, the weather or the turbine heads. To find the NASA images discussed in Chapter 6, it was necessary to know about their existence and provenance. Atmospheric plumes that manifest in certain weather conditions such as mist had been captured by a handful of accessible websites, but seemingly by way of showing a fleeting phenomenon. The permanent presence of sea plumes in the water itself, as a generally perceived aesthetic component, was apparently almost completely missing. Sea-users experience more than the distant or photographic contact with wind turbines, and may be expected to have a different perception of the sea and of wind farms.

3.4.5 Sea users and the North Sea

Sea users, as mariners, experience the qualities of the sea very differently from the ways in which coastal dwellers do. For a start, they are actively engaged in doing something in an all-enveloping and potentially dangerous environment. They are also, at the present time, mostly people who remember seas without wind farms. They may therefore be more sensitive to the intrusive nature of the installations compared to a generation that has always known the seas with them. In a way, that makes the reactions of current mariners all the

more valuable if the context of the wind farm decommissioning discussion is to be preserved.[106]

Dick Beaumont, diver

Dick Beaumont made clear his support for clean energy and wind farms in general, but nevertheless described them as "visually polluting"[107], even though "Only mariners see them (20 miles out)."[108] When asked as to how he saw the sea he vividly described the coastal areas as quoted in Chapter 2[109], adding "The proliferation of fish farms has also turned many wild areas of the sea into commercially zoned production facilities."[110] The aspect of wildness and uncontrollability was clearly one of the big attractions for him to the North Sea as a dive location, despite the visibility issues he encountered[111]:

> "The North Sea is a big part of my life. It is a challenging environment to dive in, as impossible to be able to fully forecast what, why and when diving can be successfully carried out in complete control. You have serious weather systems that you have to work with. It is such a vicious, cold and unforgiving sea. It is not a playground, but is very intriguing from a diving perspective."[112]

The level of change he perceived affected the open aspect of the sea as it had been. The changes in water visibility and the seabed impact of the wind farms are linked:

> "I have not experienced noise or vibration with wind currents by wind farms. I am convinced the positioning of the wind farms has a dramatic effect on the bottom of the seabed and causes disturbance, as I have said earlier. Previously there would only have been a natural smooth sandbank which the tide and waves run across, and now this is completely disrupted. The wind farms kick up sediment stripes."[113]

It came across strongly that an underlying explanation for the occupation of the sea by wind turbines was: "We have used the sea as a resource. This is especially illustrated in Mediterranean where fish farms proliferate especially around Greece and Turkey. You have bass and bream that are not natural to the Med being grown in the Med." In contrast to a colonized human-focused environment, he describes "sailing at night across an open ocean" as a "special experience":

> "You develop a symbiotic relationship between yourself, the boat and the natural environment. I am sure this symbiotic relationship used to exist once on the land but we can largely now ignore the weather and the environment. The sea is, though, a harsh taskmaster. You must live in symbiosis with the sea. You are subservient to the wind and the waves. It creates a lack of certainty that you simply have to accept exists."

Asked whether he thought wind farms were a good idea he replied:

> "Not quite: I think they are the least worst of the alternatives available to us at this time. I would much prefer the oceans and seas stayed free and wild, but since we humans are unable to curtail continuous population expansion we must employ those power sources that do the least damage to this blue planet."[114]

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[106] See Chapter 2.4.
[107] A2:4
[108] A2:4
[109] See Chapter 2.4.
[110] A2:5
[111] See Chapter 6.
[112] A2:6
[113] A2:8
[114] A2:8

These are opinions that contain moral values, here a resistance to the notion that human concerns and requirements should be all-pervasive and exploitative without significant restraint. By selecting and pinpointing wind farms, commercial navigation and fish farms as reducing the wildness of the sea, he shows sensitivity to the cumulative industrialising content of human activities. There is a sense that those who interact directly with the sea have a connection to nature that has been lost in the changes made to life on land. "Symbiosis" is a powerful description for interdependence of sea and sailor. He is used to being physically in the water as well as on it. Wind farm building is changing the character of the marine environment. Changes include those to the seabed as he knew it and to the quality of the water. Clearly, Dick Beaumont experiences a loss of wildness. Encroachment by the wind farms is a negative consequence of their positive purpose.

Paul Gilson, fisherman

Paul Gilson gave me some photographs he had taken. Two of them are reproduced as Fig. 1.7 and Fig. 1.8. He introduced his aesthetic views by describing the sea as "a living moving person that can only express itself through action. It can change mood and change your mood. There are many emotions that the sea can express and communicate- fear, anxiety, anger, calm, reassurance, joy ..."[115] The beauties he consciously chose to capture are those capable of universal appreciation: sun colours over the seas close to the places he lived and worked in.

As a pair, the two images are deeply bound together, and vividly illustrate an aesthetic replete with memory. The one is the inverse of the other. One shows the sea from the land whereas the other shows the land from the sea. One is taken at sunset, and the other is taken at sunrise. The first is an image of evening calm depicting the pleasing flat line of the horizon uninterrupted. The second is a depiction of a polluted sky and a broken horizon taken from a perspective where the turbines dominate everything. The anxieties Paul Gilson explains are in relation to this second image. To pick up on the obvious point, a broken horizon is the opposite of the open seascape that Paul Gilson will have known for many years. Less obviously, both pictures show brilliant deployment of a sailor's skill of sightline alignment. I refer to the captions under Fig. 1.7 and Fig. 1.8. Older sailors were required to be trained in the use of a sexton, and the point of reference is the horizon line. Both images are infused with personal meaning. Fig. 1.7 shows in the foreground images representative of stability on land: a boundary wall and a parked car. Fig. 1.8 is perfectly and skilfully aligned with the most threatening point of the turbine array. The giant central turbine is the arrow-head point of the layout geometry, with near-perfect angles aligning the nearest turbines (left and far right) with the central turbine head. The fleeting, overwhelming beauty of the natural colours is seen through the geometric abstractions of the wind turbines. Land is discernible as a line in front of the sun.

The grain of the background colours in Fig. 1.8 is linked to the pollution the wind farms are designed to overcome. The overcoming imposes its own burden of uncertainty and anxiety. This is an aesthetic that draws with it worry about the speed of change and the potential consequences. It is not moral but practical anxiety about the unforeseen and possibly regrettable impacts that the mass arrival of wind farms may bring. It is easy to see his point if we reflect (a) on the poor state of knowledge in which many previous decisions have been made, as discussed in Chapter 2, and (b) on the current wind farm construction boom detailed in

[115] A4:4

Chapter 3.2 and Chapter 3.3. Paul Gilson explains his feelings about the representational aspects of Fig. 1.8 in this way:

> "I was fishing a couple of years back and I saw a sunrise through a wind farm. I had the photo printed on a solid surface because of the shapes and colours in the shot. You could slip a knife between the shapes and colours. They were so clear it was like a caress. I was watching the sunrise develop and this was a sudden perfect moment, a single right moment, a fleeting glimpse of heaven. Sometimes I think the wind farms look like abstract art, shapes and shadows. This photo to me shows the sun coming up on the beginning of a new era. It is the start of a new day and here are the turbines. In the picture, everything is stationary but this shows them as to how it will be. I feel concerned due to the lack of knowledge and lack of forethought. It seems a blinkered approach, like a running horse blinkered so it does not get frightened. We are seeing a headlong charge and we do not know what we are doing here. …To me it represents both the dawn of a new age and what it is trying to prevent. In the picture you can see the pollution cloud, the scum in the sky behind the turbines at the dawn of this new age."[116]

3.4.6 Perceived and real changes in the sea

The openness of the sea and new closed environments

Perceived or actual threats to the openness of the sea evidently stir concerns as to how far mankind should intervene to industrialise the sea. None of my interviewees thought that humans should be barred from industrial use of the sea; indeed one of them, the engineer, had been instrumental in furthering it. All of the interviewees have a love of the sea, in the case of the marine planning officer despite the need to take seasickness tablets whenever she went into a boat.[117] However, once the level of industrialisation is played out on the surface of the sea rather than out of sight, three interviewees, Dick Beaumont, Paul Gilson and Prince Michael did not simply limit their responses to the matter of how the sea looked. They are sea users, and the wind farms caused disquiet. Prince Michael considered the appearance of the wind farms to be necessary but at the same time disfiguring: "I am concerned that they will turn into broken junk. …I hate them. They are a blight on the landscape. They are taking over my sea."[118] Paul Gilson was worried about the wind farms damaging a free-ranging environment for fish (see Chapter 6). He did not exclude the wind farm structures from his appreciation of them as seascape components. The industrial origin and function of the wind farm structures did not render them disfiguring. "I am affected by the sight of the wind farms: how can something so beautiful to see be so harmful?"[119]

In line with Chapter 3.3, I regard the open horizon or open sea view from within the North Sea as shortly to be unavailable on the UK side. People who knew the sea as an open place will categorise such an outcome as regrettable. Those who grow up with it may have an aesthetic that associates childhood with pleasing aspects of functioning wind farms. There are parallels for this in regard especially to the affection in which older models of diesel trains are held. The aesthetic of an open horizon will become inappropriate to large parts of the

[116] A4:7
[117] A1:2
[118] A5:3
[119] A4:8

North Sea. Fi.g 1.5 (Knock John) is the perfect romantic representation of an open sea horizon. Dense development of wind farms will, conversely, be associated with the decline of trawler activity in those areas. For many people, that association is a positive one due to the poor press that the trawler and bottom-fishing industry receive. I consider the increase in hostility to these parts of the fishing industry in Chapter 4. The wild, meaning not visibly touched by humans, aesthetic of the North Sea will be substantially modified by the deep offshore wind farms. Unlike their cousins on the coast or the near-coastal areas, the sheer scale of development means that boundaries pass out of vision and whole seascapes will change. The extent of this is dramatic.

If by wild beauty we include environmental matters, there are many indicators that the wind farms bring ecological change. I touch on aspects of this in Chapter 6. Essentially the previous coarse-sanded bottom areas are colonised by different fauna, especially mussels, and an entirely different ecosystem develops[120]. This is an unstoppable roll of development for so long as the wind farms are in place. It is different. It is free of trawler activity. It will probably one day come to be valued, for the same reasons of acquiescence and nostalgia for something one knew at a point in the past. There are real and substantial changes in the sea. These include: increased levels of finer sand,[121]changes in water currents over long distances where there are monopiles,[122] and changes to the circulation of nutrients in the sea during summertime.[123] These changes are associated with the anxieties expressed in Chapter 2.4 about the point at which there is enough development in the North Sea. In turn, such anxieties possibly reflect a desire to preserve valued aspects of the current look of the sea. Reflection upon the changes that develop in areas closed off from trawlers reminds us of separateness engendering difference. These wind farms will have their own ecology. We also realise that the open horizon aesthetic is compatible with trawler activity and the kinds of fishing they have traditionally done. The fish of the closed wind farm environments are already different. Shellfish and sea bass are plentiful. Sand worms and the fish that like to eat them are in retreat. If wind farm operators are canny, they will be able to tap into the romance of a secret garden. There are many positive images that could enter this area of ecological and aesthetic discussion.

Machinery and equipment in the sea

There can be no wind farms unless there is equipment in the sea. There are turbines, electrical cables, monitoring ships, electricity sub-stations and many other things. To permit a wind farm is to allow all of these. In the deep offshore area, it is known that these things will be present on a huge scale. It is easy to see how admiration for the clean lines of these installations might become popular. The attractiveness of big geometry draws tourists to places where there are major feats of engineering, be they railway and canal bridges, suspension bridges, locks, tunnels through mountains, skyscrapers, dams, drains such as the giant storm drains of Tokyo, dykes across the Netherlands, and even nuclear power stations. The wind farm fields of the North Sea may one day be admired in the same way. This is the positive side of the aesthetic of Big and Manmade. Such an aesthetic is not easily shaken. The Aswan dam was regarded as positive long after desertification in Egypt and the spread of bilharzia were associated with it. What the wind farm fields will have to absorb is criticism based on the disturbances in the water, should they prove to intensify changes to the seabed. The sea

[120] See Chapter 6.4.
[121] See Chapter 6.11.4.
[122] See Chapter 6.11.2.
[123] See Chapter 6.11.3.

plumes are caused by sediment agitation. There are no plans to alter the off-coastal wind farms where the phenomenon is known. There may or may not be equivalent forces in the wind farms with jacket foundations. Either way, the muted response to the established presence of the wind farms indicates so far that neither scientists nor the public manifest concern. The loss of water visibility, increase in suspended particulate matter (especially fine sand and detritus from mussels), and possible deterrence to fish have caused no outcry in the seven years since the sea plumes were "discovered." Chapter 6 lists some possible impacts of the sea plumes. On that basis, the aesthetic of Big and Manmade is entering its heyday because turbines become bigger at pace. One day the size of turbines may be such that few are needed where today many would be required. This aesthetic is proud, declaratory and optimistic.

3.5 The aesthetic of decay, transience and nostalgia

3.5.1 General

Appreciation of the sea linked to the idea of industrialised nature is sometimes associated with ideas of decay, transience and nostalgia. It may seem odd to enjoy the decay of what might otherwise become safe permanent reminders of a formerly important industry or a time past. But there is without question a phalanx of followers for that. In Iceland, former fish processing factory buildings were restored to safety for heritage visitors, much to the dismay of Pétursdóttir.[124] The target of her annoyance was the process of conservation itself, she taking the view that there was more, and more of heritage relevance, to be learned by letting the decayed buildings experience their own right to decay and to be swallowed by the sea. She writes: "maybe we should also consider the possibility that the ruins themselves, in their dynamic state of being, may be the source of their own value and significance." The consequence would be to embrace the transience of the remains and ultimately release them from heritage into memory. It is an aesthetic of transience that has outstanding artistic support in the work of the land artist Andy Goldsworthy, in his studies working to create forms using materials that degrade in outdoor conditions that cause degradation. I think of ice block arches in differing states of melt, of sheep's wool woven round trees, of wicker and mud structures, of extraordinary shapes made from autumn leaves, from sand, from brushwood, from fallen logs, from juxtaposed flowers and twigs. Whether or not they are photographed and preserved as a transmissible memory, his compositions are playful, astonishingly beautiful and unquestionably reflective of the aesthetic of transience and decay[125].

There is a lively, and to some people doubtless incomprehensible, joy in the decaying presence of the North Sea forts. They are distinctly and definitely not considered "broken junk" because of the element of aesthetic appreciation, and (in the case of all but one) nothing else. They are clearly falling into the sea, many of them sooner rather than later. Only one is occupied or used: Sealand, owned by Prince Michael. What the abandoned structures (ignoring Sealand) reflect is nostalgia- a love of old machinery and historical military installations. The North Sea forts are named after their creator, Guy Maunsell.

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[124] (2012).
[125] Goldsworthy, Andy: compilation (2014) by Niall Dickinson https://www.youtube.com/watch?v=vWcebVXNrDw (accessed 13 6 2021), 3 minutes 39 seconds long.

3.5.2 The aesthetic of the Maunsell forts

The Maunsell forts are remnants of army or naval defences erected in the sea off the East of England during the Second World War. They are but part of a panoply of much earlier military defence structures around England that were built, used, then abandoned by the armed services of their day. There are two main groups of Maunsell sea-based defences. The first group was erected by the army and comprises mounted metal gun placements, eerily stalking the sea. The second group consists of the two naval forts, Sealand and Knock John. These are identical in build and comprise twin sturdy concrete support pillars with a platform on the top. The naval forts are safe to land on. The military forts are in advanced states of degradation.

Fig. 1.1 shows where most of the southerly placements are. They are easily accessible from the mainland by boat. Fig. 1.2 indicates the more northerly position of Sealand, somewhat set apart from the rest. In the 1960s, Sealand was just outside British territorial waters whereas now it would be inside the new 12 mile line[126], except Prince Michael would claim a theoretical corresponding 12 miles around his structure.[127] The fort once protected the port towns opposite. This section of the coast is displayed in Fig. 2.7 in the North West section of the NASA image. The entire coastline is naturally sandy, as is the area immediately around each of the forts. This is shown on the satellite images at Fig. 2.6 and Fig. 2.7. The Sealand structure is shown in Fig. 1.4 from above. We see the solid-looking pillars and the sandy waters around it. In Fig. 1.5 we see its brother, Knock John, a shot taken in the distance by Mark Keith Alexander from a boat. He is himself an engineer (but is not to be confused with the unnamed engineer I interviewed). The twin supports and top mantle form an intriguing silhouette, much similar to that of Sealand. What makes Fig. 1.5 a romantic image is the open horizon and the temple-like, tiny silhouette. Knock John is in disrepair, but can be visited. Knock John is shown on Fig. 1. 1, as are all the military forts.

The military forts are collapsing, or partially collapsed. Red Sands is shown in Fig. 1.6, and it is now the subject of possible volunteer conservation interest so as to preserve it. The rescue project seems to have sponsors and volunteers.[128] Shivering Sands shown in Fig. 1.3 has gone too far for conservation. At least one gun tower is missing and metal debris sticks up in the sea. All the overhead walkways are gone. Visitor interest is not a rational one but rather an aesthetic and nostalgic one, a trip to see objects in terminal decline.

Machinery abandoned in the sea and left to collapse can be considered beautiful. Fig. 1.3 (Shivering Sands), Fig. 1.5 (Knock John) and Fig. 1.6 (Red Sands) were kindly supplied by Mark Keith Alexander from a large portfolio of stunning images. It is obvious that the photographer enjoys the sight of these intriguing remnants of the Second World War. I pursue this in relation to decommissioning. [129]The photos show to best advantage the positive aesthetics that can include aspects of nostalgia for the past and the type of engineering, an appreciation of the almost romantic process of decay, and an acceptance of the intensity of the moment. The military forts fall apart in different ways, lean precariously in different ways. They remind the viewer that they once served a purpose in a dangerous and desperate time beyond the memory of the visitors. This aesthetic can be a recognition of and tribute to the power of the sea and its overcoming of the works of man. There is physical poetry in the

[126] Marine and Coastal Access Act 2009 Explanatory Notes.
[127] A5:6
[128] Red Sands fort https://project-redsand.com/project-team (accessed 13 6 2021).
[129] See Chapter 3.5.3.

juxtaposition of the vigorous faceless waves, and the eventual surrender of the metal. It is in this respect different from the "educational tourism" that has started up in California where decommissioned onshore wind farms are visited.[130] Discussion of European wind farm decommissioning amounting to abandonment of equipment in the sea has included attempts to justify this by reference to habitat preservation. Though there are many thousands of shipwrecks and other items abandoned in the sea, no one defends abandonment of wind farms on purely nostalgic or poetic grounds.[131]

3.5.3 The aesthetic of decay, transience and nostalgia applied to decommissioning

There are moral and political aspects to debates around decommissioning obsolete industrial machinery in the sea, as the oil and gas industry is aware. In Chapter 2.4 the efforts of some environmentalists are noted where they attempt to persuade opinion towards abandonment of wind farm debris in the sea. The photographs attending such efforts often show the ecology sought to be protected by this abandonment. Where one finds illustrations in online magazines discussing this possibility in the Gulf of Mexico, say, the sight of diver swimming by a warm water coral assemblage would typically play into acceptable positive associations. Articles directed to the debate in the North Sea, by contrast, often simply show living plants and fauna growing on abandoned metal objects or cables in what is very obviously a harsh, cold environment. What the authors presumably see are positive depictions of a persuasive character. In fact the exact opposite effect may be experienced by many readers because of the negative side of an aesthetic of decay, transience and nostalgia applied to decommissioning. What some people see is, overpoweringly, decay together with a morally reprehensible reflection of humans excessively exploiting the sea environment. They fail to remove their debris when their greed is satisfied. These readers may have a romantic nostalgia for a sea untouched by humans. Their attention is drawn by the decaying elements to the chaos that ensues where humans do not take responsibility for the transience of their current technological needs. Such readers can experience the images as pitiful and as embodying human carelessness towards environments that do not support their own homes. There are strong elements in this of the moral revulsion Dick Beaumont evidences in Chapter 3.4.5 where he speaks of human exploitation of resources. These are powerful associations, and almost instantaneously in play. What we choose to see and the framework we place it in will likely determine the choices we make on issues such as decommissioning.

If we ask why the aesthetic of decay, transience and nostalgia produces a positive response in relation to the Maunsell forts, and a negative one in relation to the issue of decommissioning by abandonment, there are many possible answers. The Maunsell forts are the remnants of the Second World War. They form part of the gun defence system to protect London, and as such they are associated for many English people with a mythic time of communal purpose and the ethic of bravery and self-sacrifice. It is a military theme that engenders sentiments of respect and gratitude in military cemeteries, and in memorial services for the dead of wars dating from the time of the great grandparents of modern people. The defects in the twisted metal are associated with an ethic of endurance for the good of others. What would be ugly is transformed into noble scars. The forts are honourable but elderly survivors, and they will die in post. Well, that is a romantic set of associations. There is not one jot of commonality with the discard of the wind farm industry where corporate profit is the immediate cause and measure of action, or inaction. Environmentalists unable to confront this

[130] Szumilas-Kowalczyk (2020).
[131] See Chapter 2.4.

associative level are likely blind to the aesthetic rage that "broken junk" provokes. This is the description Prince Michael used in connection with his concerns about decommissioning. He is visualising the abandonment of turbines standing in the sea. Yet he owns an abandoned naval fort. It is an interesting contrast, the difference in the two being the negative and the positive faces of the same aesthetic. If we view Prince Michael as a lifelong fisher, the difference becomes clearer. Sealand is a place from which and round which fishing can take place. It has positive associations for him from the age of 14. He is a user, necessarily, of different kinds of big, working machinery- boats with winches, navigational equipment, engines, fishing gear. All those things need to be maintained. For him, equipment that functions is good: equipment that does not function has no function. If a thing is broken, it is "junk." Its presence connotes rubbish dumps and disfigurement. Sealand is the exception in the Maunsell fort group. It is still used, and people can and do live or work there. It does not currently share the same level of engagement with the positive side of this aesthetic of decay, transience and nostalgia.

If some degree of decommissioning by sea abandonment is allowed, it may well relate only to the cables. There are thousands of kilometres of these and there will be many more by the time the full development of the North Sea is reached. Older cables will probably be replaced by newer types and different sizes. Older cables will probably be colonised by sea plants and creatures. Sea abandonment for cables is likely to evoke much the same set of negative associations, except that cables have never functioned above the sea. This may be relevant. Mental constructs of cable patterns are capable of latching onto ideas of grand geometry. Stonehenge is the paramount example of this. There is some romantic acceptance of objects being "lost" at sea. This includes ships and anchors. Many things are "lost" at sea, less acceptably so. These include fishing lines and nets, thousands of goods containers every year, and untold quantities of plastic detritus. Leaving cables in the sea by choice will have to find a place in the list of things viewed positively as resident in the sea. However, the extent of abandonment may perhaps be determinative of public response in the future, and that future is distant so long as cables are economically valuable to recover. The aesthetics of the future are unpredictable, as the acceptance of expensive, eccentric, controversial buildings like the Sydney Opera House attest. People who grew up with something grow attached to it.

3.6 Legal protection of seascape aesthetics

3.6.1 General approaches

What kind of aesthetic currently has protection, if any? It is material to note that the UK initially claimed a renewable energy and pollution zone extending to 200 nautical miles of the coast.[132] The wind farms appear inside and also outside territorial waters in the designated Exclusive Economic Zone. The implementation of permissions to build wind farms is a heavily regulated matter.[133] The issues as to decommissioning are also well covered on an individual wind farm basis. What is less clear is what types of protection there are at international level offering ways to protect the wild beauty of the seas. Such treaties and commitments are translated into domestic policy and law through multiple agencies, not necessarily themselves with the control of wind farms specifically in mind. My interviewees between them have created a useful separation of two ways of conceiving of beauty including wild-

[132] Marine and Coastal Access Act 2009 Explanatory Notes under "Renewable Energy Zone/ UK pollution zone."
[133] See Chapter 4.

ness: health of the seas, and seas free from excessive human visibility and interference. Sometimes these two ideas produce the same result, but I can see that there may be occasions where the one approach will yield to the other. I think of Saito's effort to change environmental outcome by relying on ethical arguments. So, let us suppose that health and biodiversity would lead to protection of a certain plankton type whose presence made the sea look ugly. Healthy sea conflicts with visual beauty (or nostalgic ideas of what that beauty looks like). Here the conflict is resolvable, following Saito, by reconstructing what is regarded as visually beautiful. This may sound far-fetched but in fact there are many examples where changed priorities change ideas of visual beauty. Dramatic instances include the recreation of wild or under-farmed ("extensively farmed") areas on formerly intensively farmed land. The change is to support biodiversity. In the 1970s, land that looked as modern flower meadows do would lead to accusations of bad farming. Another example is the beauty seen in dangerous animals, especially creatures such as snakes and crocodiles. The mainstreaming of aesthetic change may be traceable to the late Steve Irwin. The animals are now seen as beautiful and worthy of protection. In my childhood, such an idea would have been ridiculous. These two different approaches to the idea of beauty reflecting aesthetic value are seen in international treaties. The treaties related to the health of the seas are perhaps more directed in content. The European Landscape Treaty is essentially an inspirational document intended to assure democratic involvement with reintegrating landscape values into the lives of ordinary people. It has a less specific content but involves an encouragement to institutional enlightenment towards non-economic values.

Wind farm development and its impact comprise different elements. There is the visual aspect of what can be seen on the horizon, horizontal to the sea surface, from above by drones or satellites, from within the seas through water visibility, and by divers on the bed of the sea. By contrast, the elements of concern listed as against biodiversity, pollution, habitat, safety and other practical matters produce a list of individual features or behaviours that may require monitoring or correction. Cumulative effects are a known phenomenon to agencies engaged in monitoring. For such purposes one would expect direct and indirect causation to be scrutinised. Separation of issues such as chemical dumping by operators, paint pollution, noise pollution, serious damage to the seabed or to fish habitat, risk to seabirds and mammals or endangered or protected creatures can all be anticipated and dealt with through the use of the planning process and conditions attached to it. These adjustments establish a restraint on wind farm activity that is not "natural" but derives from a sense of collective restraint in face of conflicting goals. In the UK many of these restraints appear in pre-existing legal frameworks that were designed for immediate poet-Second World War planning circumstances. These have been updated and to an extent gradually radicalised by international treaties, which crystallise in a specific way the nature of the problem that is posed.

If by beautiful we intend notions of health and biodiversity, then there is wide legal provision. Christina Platt, the marine planning officer, did explicitly relate wildness and beauty to marine health. Her definitions included people and their activities, so falling squarely into a notion of wildness and beauty that would in principle be substantively protected by environmentally-focussed conventions and programmes. Her definition of wildness was in no sense limited to areas from which people were excluded, the "blue carbon" habitats. The beauty of the North Sea lies in its variety. She explains her thoughts in this way:

> "I love the sea and the wildness of it. It is one of the last few places that is unknown and unexplored. In the UK we have a lot of wildlife that people don't think of. We have coral, seals and dolphin. "Wildness" means healthy and liv-

> ing, something that can co-exist with human life and not be damaged by it. My definition of "wildness" includes humans- it has to. We are all animals on this planet. I know to some the definition is more prescriptive and removed from human interaction. We need areas without humans- vulnerable areas needing protection for ecology or climate (such as the "blue carbon" habitats). We do not know how to manage activity so that we can coexist….[the North Sea] is beautiful in the range and uniqueness of its shallow ocean. It has an interesting range of sediment environments and habitats, and also a unique history. I cannot explain it. It has a mix of national lines, different countries, with such varied wildlife habitats in one geographic space."[134]

Christina Platt also refers to a different understanding of wildness, one she did not herself subscribe to: "I know to some the definition is more prescriptive and removed from human interaction."[135] This is likely a closer position to views expressed by Dick Beaumont.[136] Prince Michael thought that wind farms are "taking over" or were becoming "a blight on the landscape."[137] The inference here is that human presence has become over-dominant, not that it should be altogether excluded. These are ideas of wildness or beauty that place limits on human visibility in the seascape. These ideas may better be expressed in the protection generated by the European Landscape Convention and its derived domestic legislations than under the biodiversity regimes.

3.6.2 OSPAR, biodiversity and the health of the seas

The OSPAR Convention covers areas both within the 12 nautical mile limit of territorial waters, as well as the high seas within a certain geographical designation.[138] That Treaty is primarily concerned with activities not appearances. But it does focus on the health of the seas environmentally. In turn, it proved one of the critical inspirations for the EU Biodiversity programme[139], alongside the 1992 United Nations Convention on Biological Diversity. The EU works to OSPAR's "five thematic strategies…on eutrophication, hazardous substances, radioactive substances, offshore oil and gas industry, biodiversity and ecosystems."[140]

3.6.3 Bio-cultural seascape: the European Landscape Convention

The appearance of the sea, its wildness, its character, and its impact on people are difficult to define and difficult to protect. Coastal policies cover the seas when visible from the coast. This is essentially the consequence of convergence of approaches that predate the ratification of the European Landscape Convention. The Convention-based policies have now subsumed other initiatives. The idea of bio-cultural protection is covered by the European Land-

[134] A1:2
[135] A1:2
[136] Wind farms as "visually polluting the sea" at A2:4.
[137] At A5:3
[138] OSPAR Convention 1992 Article 1(a) definitions: "Maritime area."
[139] Currently reflected in the European Union (2021) *Biodiversity Strategy 2030* Prepared by Directorate-General for Environment (European Commission), EU Publications 19 5 2021.
[140] EU OSPAR thematic work source page at the European Commission website: https://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/ospar/index_en.htm (accessed 18 6 2021).

scape Convention.[141] The Convention was ratified by the UK, and was the subject of a declaration on 21 November 2006 by the UK Permanent Representative at the Council of Europe that the UK would "initially apply the Convention to the metropolitan area of Great Britain and Northern Ireland.".[142] This limits application to the UK proper and does not cover the Crown dependencies[143]. Coverage extends to the entire territory, "land, inland water and marine areas."[144]This includes the territorial waters to the 12 nautical mile limit. The UK marine area includes sea within the UK Exclusive Economic Zone as well as the territorial seas[145]. Within the EEZ, a state has sovereign rights to the production of wind energy.[146] The UK EEZ has been in place since 2014. The Marine Management Organisation has obligations[147] to create management plans for each sea region. It may be entitled to take account of the European Landscape Convention for the EEZ and must do so relative to the areas within the envelope of the territorial sea.

The European Landscape Convention has a number of purposes[148]. Article 3 identifies its overall purpose as to promote landscape protection, management and planning, Landscape for present purposes means seascape. Article 5 obliges parties to establish and implement seascape policies. The point of this activity is to protect the quality of people's experience of seascape. This is wide enough in extent to cover seascapes that may become affected by over-prominent or excessive wind turbine provision, or by abandoned or decaying turbines, provided this could be seen by people (including fishermen and divers). The expression of Convention responsibilities in the UK is built into the planning system and is discussed in that connection in Chapter 4. These responsibilities are also expressed in the domestic guidelines for coastal visual protection referred to there. The presence of sailors and others is thought to found a basis for such protections looking landward, in terms of the policies applied. The Marine Management Organisation local marine structural plans are considered in Chapter 4. That Chapter in part relates to the process for acquiring consent for building offshore wind farms.

[141] European Landscape Convention, European Treaty Series - No. 176 Florence, 20.X.2000. Note that this is a product of the Council of Europe not of the European Union. Iceland, Norway and the United Kingdom have independently acceded to it.
[142] Notification of United Kingdom ratification of the European Landscape Convention (ETS No 176) dated 21 November 2006.
[143] Reference to "metropolitan areas" is not a phrase known to English law. Rather, it refers to urban areas, which makes no sense in ratification terms. I think the phrase is a bad translation to parallel the recognised French term "metropolitan" meaning France in Europe excluding its colonies which are technically part of France.
[144] Article 2.
[145] Marine and Coastal Access Act 2009 section 42.
[146] Convention on the Law of the Sea Article 56.1.
[147] Under the 2009 Act (above).
[148] General guidance (beyond the Treaty text including Recitals) is to be found in the European Landscape Convention Florence, 20.X.2000 Explanatory Report ("Explanatory Report") and the European Landscape Convention Guidelines (2008) Recommendation CM/Rec(2008)3 of the Committee of Ministers to member states on the guidelines for the implementation of the European Landscape Convention *(at the 1017th meeting of the Ministers' Deputies* ("Guidelines").

4. UK wind farms: decisions and opinions

This Chapter centres on an understanding of how policies are translated through legal structures into individual decisions about wind farms and their surrounding seascape. Much of it was prompted by observations from Christina Platt and Paul Gilson in particular. The puzzle is to understand how generalised policies are applied so as to create an active decision, and how evidence enabling that decision to be made is collected. Opinion, whether expert or not, and change is a second theme. The aesthetic assessments of coastal seascapes are considered. The Chapter reveals tensions in English policy as to whether or not the European Landscape Convention should be applied actively to the wind farms invisible from the coast.

4.1 Environmental policy background

UK environmental policy is largely in the hands of DEFRA[149], though significant areas also fall to be delivered by others, including Highways England and by BEIS[150]. The general content of DEFRA's policies, including historical drivers such as the EU-based habitat and birds' legislation, has been concentrated down into convenient aspirational policy documents from time to time. A Green Future (2018) has been supplemented by an open Consultation (March to June 2021)[151], the latter being directed to educating all Ministers and their policy teams as to how to include environmental matters in their policies. Reports from the National Audit Office[152] in its evaluations of departmental performance essentially indicated lack of coherent targets across the environmental spectrum and very slow progress. These Reports have precipitated the creation of a statutory watchdog designed at least to ensure that the responsible Minister is informed of any poor performance by DEFRA. However, the eventual appointment of the statutory overseer is criticised by the Public Accounts Committee[153] as not delivering sufficient Parliamentary accountability: by implication, failing Ministries report to their own failing Ministers. It is beyond the scope of the current study to investigate why such poor achievement of DEFRA's overall goals occurs. By contrast, there are some areas of government policy where rapid real progress in short time scales is made. Wind farming, in particular offshore, is one of them. The supply of renewable energy falls to be dealt with by BEIS, not by DEFRA. It seems likely the explanation surrounding wind farm progress is a combination of factors. Strong possibilities are: an anticipation of revenue to the Crown; the creation of jobs in some of the more depressed coastal areas of the UK; and, the desire to vary the national energy portfolio mix in favour of renewables, significantly at the expense of non-governmental consortia. Together these are powerful economic drivers but compliance with environmental conditions for development will be required.

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[149] Department for Environment, Food and Rural Affairs.
[150] Department for Business, Energy and Industrial Strategy.
[151] Environmental Principles Consultation (2021) (DEFRA).
[152] Environmental metrics: government's approach to monitoring the state of the natural environment (January 2019) National Audit Office and Departmental Overview 2019 DEPARTMENT FOR ENVIRONMENT, FOOD & RURAL AFFAIRS (2020) National Audit Office.
[153] "We also remain to be convinced either that the new watchdog, the Office for Environmental Protection, will be able to hit the ground running after the delay to its creation or be sufficiently independent from government." Public Accounts Committee, UK Parliament, Summary of Report February 2021.

How does UK wind farm regulation compare with that of other countries? In 2019, New York-based international attorneys White & Case[154] produced a client leaflet displaying their offshore wind credentials in the form of summarising legislation across a spread of countries that looked promising for or were actually engaged in offshore wind: Mexico, Germany, Japan, Australia, the USA and the UK. The idea was presumably to demonstrate knowledge of how to obtain consent for wind farm development and to plan for decommissioning in the hope that this persuades potential clients to come forwards or current clients to expand their contact. Two things stand out immediately. The first is the fact that there are significant differences internationally between countries in their regulatory processes for offshore wind. There appears in particular to be a difference whereby countries such as Germany and the UK (which both have considerable offshore provision) have high levels of regulatory control, whereas this is less the case for countries with low current provision (such as Mexico and Australia). Secondly, the installation figures as at the time of White & Case writing (the March 2019 offshore UK figures are quoted) have been and will continue to be improved on. In 2020 the Office for National Statistics reported wind energy as providing 24% of all electricity.[155] In November 2020 the UK government announced that it would quadruple existing wind energy by 2030.[156] It seems tolerably clear that the more detailed regulatory requirements in the UK are not operating to deter investment.

4.2 Legal structure of offshore wind development

There are two levels at which control over offshore wind development occurs. One is the action of the Crown Estate Commissioners to grant agreements for the use of part of the UK territorial waters or areas used for UK renewables exploitation. The Crown Estate Commissioners will identify large areas where they anticipate granting a lease to a developer. Bids are considered and accepted. A chosen bidder is then granted rights to take an agreement relating to a specific area within the area initially put up to the bidding process. After the permissions have been obtained in accordance with any agreement, an completed lease will be entered into. Conditions will be embedded into this. The lease and its precursor agreements will almost certainly specify (a) the developer's financial payments to the Crown, (b) reporting obligations, (c) obligations to comply with all permissions granted by the public authorities, and (d) conditions for decommissioning and reinstatement at the end of the lease. This kind of general framework for proceeding is familiar to legal practitioners in the oil and gas fields. It gives the Crown as a private landlord the opportunity to dictate mechanisms placing risk and compliance on the developer in a form that can be enforced as a private contract.

The second level of control is that established in the process of the operator/ developer applying for consents to construct a wind farm, to construct electricity generating infrastructure[157], and to obtain a host of supporting consents. The latest explanation for the relationship between policies and organisations is in the draft (September 2021) version of National

[154] White & Case (2019).
[155] Office for National Statistics Article (June 2021) *Wind Energy in the UK* showing 13% of total electricity to be from offshore wind.
[156] The Ten Point Plan for a Green Industrial Revolution (2020) HM Government November 2020 at page 12.
[157] Consents under section 36 (creation of generating station) and 37 (installation of overhead lines) are required under the Electricity Act 1989 from the Secretary of State, who is likely in the presence of objections to hold a public inquiry. Consents may include deemed planning permission to build. Applying for a generating licence is a separate matter.

Policy Statement for Renewable Energy Infrastructure (EN 3)[158]. It is normal for a number of organisations to require satisfaction of their own requirements before an applicant will be allowed to implement the main consents. In this way, the process of creating the final working wind farm is broken into stages. For example, such conditions might be used to require achieving agreement with the marine authorities as to safety compliance features such as night lighting or minimum height for ship passage under the turbine blades. Though the regimes are somewhat different in England, Scotland and Wales, the general approach embedding conditions in consents enables the grantor of the consent to secure compliance with build and operating standards. The grant or refusal of consent[159] will reflect a decision where general environmental matters, including seascapes can be considered. Quality and objectivity of evidence are critical to the making of a fair process for the granting or refusal of consent. Quality and objectivity of evidence are important to acceptance by the local community affected by the outcome of the decision-making process. For this reason, concerns expressed by my interviewees are about the very heart of the offshore development process.

4.3 Concerns

4.3.1 Christina Platt on the consents process

Christina Platt, Marine Planning Officer, works for a national charity (The Wildlife Trusts) that is active across the UK, whose focus is the practical aspects of wildlife engagement in all environments, and with public education as to wildlife matters. The charity is over a hundred years old and has a large member base. The core belief is that "we need nature and nature needs us." According to their website[160] they consist of 600 trustees, about 2,000 paid staff members, a volunteer staff of more than 35,000 people and a membership in excess of 850,000. There is a central professional team, to which Christina Platt belongs, where policy response and contribution to inquiries and planning is dealt with. Her background is from an academic Master's degree in Environmental Science, and from a practical consultancy on the offshore environment for some years: "I deal with marine spatial planning and I respond to consultations for offshore projects. I work for a central team and I work across England and sometimes in Wales. I also help out on other marine-related matters."[161] The reason I contacted her team was because I had read an excellent, clear and well-worked submission that had been made by the Wildlife Trusts in connection with the then on-going Dogger Bank inquiry. Her involvement is professionally rather than as a sailor or sea-user, in contrast to some of the other interviewees. She describes the focus of her work as follows: "We prioritise on risk to the environment. We look at risk to harming the protected features of Marine Protected Areas, and in terms of the vulnerability of the animals and what the project could do."[162] This kind of professional engagement has a helpful detached quality, advisory in its basic approach and capable of insight as to the process of creating useful evidence for immediate wind farm planning decisions. Thus, as Christina Platt explains:

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[158] Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) (2021) Department for Business Energy and Industrial Strategy September 2021.
[159] For example under paragraph 21 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (2017/572).
[160] https://www.wildlifetrusts.org/about-us (accessed 3 4 2021).
[161] A1:1
[162] A1:2

> "At the moment there are many things about policy and the licensing regime that make it quite challenging to look at the impact for the sea. The regime was originally created for land. We ought to have policies based on the sea. For example, the licensing regime is very developer-led. They decide where to place the project based on the resource. It is getting better because more people are talking about environmental concerns. However, these views are from a perspective of the consents process rather than a strategic perspective. We need to plan for the least risk, we being governments and industry, as a basic approach. This is something that is done relatively well in other areas."[163]

What she refers to here is the fact that the planning system for land was created in 1947 in the immediate aftermath of the Second World War at a time when the centrally controlled war economy of the UK was being slowly altered for peacetime. Prior to the war there had been no requirement to secure permission for development on land; after 1947 began a sequence of statutes that progressively required a variety of local authority permissions to build, to build within a time-frame and to build according to standards laid down. This familiar system was adapted very little in the need later to control wind energy development. In the normal way, many forms of technical assessment and permission might be required for larger developments before building or demolition could be commenced. Local authorities dealt with the overwhelming majority of projects at local level, but large or important projects were and are made the subject of formal inquiries. In those formal inquiries, inspectors deliver to the relevant Minister an opinion on technical implications. They also deliver a recommendation whether to allow or deny the requested permission. For these large or important applications, the ultimate administrative/political choice always lies with the Minister regardless of the recommendation. The only restraint is that the Minister must take the recommendations into account. He does not have to follow the recommendation. Nationally significant infrastructure projects such as big wind farms[164] fall into this second category and will be dealt with by inquiry, report and Ministerial decision.

Christina Platt's view is that the handling of the marine environment is over-influenced by the processes of land-based procedures for permission. The need for more developed sea-focused policies is one aspect she mentions. Another is the initiative available to developers to make fundamental choices as to the precise location of a development (within, of course, the areas generally indicated for it by bidding zones indicated by the Crown Estate Commissioners.) Her stated concern is the absence of detailed strategic policy plans for risk to the marine environment. The kind of risk involved is that threatening the health of the seas and that of marine wildlife. Her observations are consistent with her perspectives on the sea's aesthetic, and in particular its beauty conceived of as health (as described in Chapter 3).

To understand her comments about the influence of the developer, we need only for a moment consider the strategies that can be deployed to maximise the industrial potential for a wind farm. One strategy would be to pick, say, three areas for development and include as one of them an area that contains wildlife risk. Subsequently withdrawing applications in respect of the wildlife-rich area under anticipated opposition from wildlife organisations has the impact of deflecting criticism of the other two areas. These which well have been the focus of interest all along, and might otherwise themselves have been the subject of much stronger opposition. Similar strategies for land-based permissions can be, and in my experi-

[163] A1:2
[164] In England meaning those over 100 MW.

ence are, used to "draw" opposition from sources of genuine interest. Another strategy is to apply for an unrealistically large development, intending to limit matters to a smaller area when opposition surfaces, if opposition appears strong. These are effective "litigation games" that are regularly played in land-based inquiries by the developer, but they have an attritional quality resulting in delay and expense and considerable stress for opponents. In relation to wind farms, the positioning of turbines and the number of them are issues that lend themselves to this tactic. Christina Platt's statement was finally dated 22 May 2021, at which time full marine planning had not been finalised. Her idea is in line with the European Landscape Convention, which is explained as drawn to "view the territory as a whole (and no longer just identify places to be protected)."[165]

At the time Christina Platt's statement was completed, the Marine Management Organisation (MMO) had been engaged for several years with a consultation process as to its policies and plans for the areas under UK marine control.[166] In the House of Lords Select Committee Report (2014)[167], it was noted that the Marine Management Organisation believed that the DEFRA was responsible for marine policy whereas the MMO should only deal with licences to perform activities within marine areas. By contrast, the DEFRA Minister was of the view that the MMO set policy, leaving DEFRA simply to commission evidence. Following criticism in the 2014 Report as to lack of leadership, the MMO took the (slow) initiative and produced in the following eight years two marine use plans: The East Marine (2014) and the South Marine (2018). These evidently represented the beginnings of more detailed integrated marine policy plans for the whole of the UK waters. The legal background has evolved in the period since 2011. As of 2011 there had been a common UK marine policy statement[168]. The Scottish government developed its own marine policies and plans[169]. England produced a suite of regional policies and plans in 2014, 2018 and 2021 covering inshore and offshore waters[170]. On-land and coastal planning is dealt with under planning legislation whereas territorial seas fall under the maritime spatial planning directive[171] of EU member states. The UK has retained this part of EU legislation[172]. Under Article 8.2 of that directive, renewable energy is to be included in the planning and its policies. By Article 15.3, the directive requires EU coastal states to deposit marine plans with the European Commission by 31 March 2021. Six states did so by that date, and there are other plans for deposit in progress[173]. The directive intended explicitly to "to promote sustainable development and to identify the utilisation of maritime space for different sea uses as well as to manage spatial uses and conflicts in marine areas."[174] Over-exploitation of finite resources and lack of policy information and inter-state cooperation are the concerns targeted.

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[165] European Landscape Convention Guidelines (2008) Clause 1.4.
[166] Under the Marine Policy Statement (2011) All UK Governments, last updated September 2020.
[167] House of Lords Select Committee Report (2014) *European Union Committee - Tenth Report.*
[168] Marine Policy Statement (2011) All UK Governments, last updated September 2020.
[169] Scotland National Marine Plan (2015) Scottish Government, Marine Scotland 27 March 2015. Applications, data and plans searchable from Scottish Government Marine Scotland online database https://marine.gov.scot/ (accessed 16 2 2021).
[170] https://www.gov.uk/government/news/adoption-of-marine-plans-marks-big-step-forward-for-englands-seas (accessed 16 9 2021)
[171] DIRECTIVE 2014/89/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 July 2014 establishing a framework for maritime spatial planning https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0089&qid=1631785680077&from=en (accessed 16 9 2021). Exclusions for coastal areas are at Article 2.1.
[172] Marine Policy Guidance https://www.gov.uk/government/publications/uk-marine-policy-statement/guidance-to-the-uk-marine-policy-statement-from-1-january-2021 (accessed 16 9 2021) updated September 2020
[173] Late submission of Maritime Spatial Planning documents (April 2021) was noted by the wind industry https://windeurope.org/newsroom/news/maritime-spatial-planning-most-countries-late-offshore-wind-must-remain-a-priority/ (accessed 16 9 2021)
[174] Recital 19 of directive 2014/89/EU

On 23 June 2021, a brace of separate plans were published online for the remainder of England.[175] Each regional marine plan consists of an overall policy document separately supplemented by a technical annex detailing individual policies, their legal derivations, interpretations, and referencing guidance documents and methods of application. The plan, for example, for the North East[176] includes in the technical annex a list of industries operating in the designated area (including renewables) and summarises how applications will be treated by the MMO where it decides or contributes to decisions of other departments. It is questionable at this point whether the need for historic information would be satisfied by policy plans, as the lack was highlighted in Chapter 2. There is now an Evidence Strategy intended to cure information deficits. This Strategy recognises explicitly that previous evidence gathering has been site specific and needed to be widened for the future in line with the plans.[177] These new plans are to be available for digital consultation online, displaying relevant policies and applications with locations.[178] For on-going matters, the database will likely create a new information baseline, but the Technical Annexes offer no statement of priority between the competing industries. What the North East Plan appears to offer is methodological encouragement to avoid or mitigate effects for existing users, leaving plenty of space for developers to adapt their litigation strategies as well as continuing to argue their intended use is more important than an existing use. That Plan also leaves developers the freedom to choose their sites. Due to the physical overlapping of uses, zoning is a weak tool of policy; similarly the many strategies affecting the marine area are frequently not in the control of the MMO[179]. I have commented above that the renewables industry has been placed in prime position in relation to decision-making.[180] The policy deficit identified by Christina Platt is being to some extent addressed. Her evident frustration at the previous situation is noted.

4.3.2 Paul Gilson on evidence

Paul Gilson expressed two very different concerns about evidence that might influence policy or determination of inquiries or court processes. The first was the way in which a commercial operator could affect the supply of information so as to change the impression it created. The second is the concern that scientists might not be acting impartially, or did not seem to be so, due to their engagement with commercial companies. Together these factors made him less confident in current legal processes. Though his trade was as a fisherman, his life experience and his commitment to policy matters were much wider. At the time of my discussions with him, he had engaged significantly with government policy and also was the elected Chairman of the town Council for Leigh-on-Sea, a coastal community in Essex of around 39,000 people. He felt in particular that the behaviour of the dredging industry had a negative impact in relation to those two aspects. On the flow of information being controlled he observed:

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[175] MMO and DEFRA Press Release (2021) *Adoption of Marine Plans marks big step forward for England's seas* 23 June 2021. Scottish and Northern Irish governments produce their own policy documents. Drafts had been released in early 2020.

[176] MMO North East Inshore and North East Offshore Marine Plan (2021) HM Government June 2021 and MMO North East Inshore and North East Offshore Marine Plan Technical Annex (2021) HM Government June 2021.

[177] Evidence Strategy https://www.gov.uk/government/publications/evidence-strategy-for-the-marine-management-organisation-mmo-2021-2025 (accessed 12 9 2021) at page 15.

[178] MMO Interactive marine data portal Explore marine plans (marineservices.org.uk) (accessed 6 10 2021).

[179] See MMO North East Inshore and North East Offshore Marine Plan Technical Annex (2021) HM Government June 2021 at page 16.

[180] See Chapter 3.3.

> "Basically, the dredging industry has locked down the flow of information. For example there is a new port being built and the fishermen were paid off. I refused. I would not be silenced. I felt very strongly about it all. The payment out would have been around £160,000. But the person who received it blamed everything but the dredging for the environmental change. It was an overnight dramatic change and the fish were suddenly gone… My fishing colleagues have been gagged by their pay-outs. DEFRA now sees that there is a problem but my colleagues cannot speak. They have been gagged. It all comes down to money. For me I hate the lies, not the different priorities. That is true of the fisheries officers. If in fact they start to understand, they get moved on."[181]

Paul Gilson goes on to discuss the importance of scientific evidence being, and being seen to be, impartial:

> "I am dissatisfied with the scientific evidence. They claim there are fish where there are none at all. The scientific information is affected by the finances. In one case, a scientist actually accused a captain of not really trying to catch fish! Where research is privately paid, that is where you find a scientist… We must ensure the survey people have no dealings with turbine builders or running wind farms. I have had a poor experience with scientists with dredging connections and I am not confident in their reports. The problem is that the immediate aim is so important compared to the immediate consequences, in their perception….. We need better science but there is no money for this. The work must be done by independent scientists."[182]

Information lockdown and the appearance of scientific bias are perennial problems that the UK courts, arbitrations and tribunals have had to consider on many occasions. There is no real cure for information lockdown, and I cannot speculate as to how common it is overall, except to comment that I have frequently seen it. Paul Gilson's experience of activity on the part of the dredging industry makes perfect sense. It may well be economic in terms of outlay and delay for a commercial operator to try to buy off opposition. In an adversarial system of law, such as the UK, the courts encourage settlement of disputes whenever possible. Conceived of as a dispute between a commercial operator seeking to get authorisation for an activity that may damage another person's livelihood, it is entirely to be expected that each opponent will try to maximise the nuisance value of his claim before settling it for financial compensation. It also makes sense, where there are multiple possible compensation claimants, for the payer to insist on non-disclosure clauses in individual agreements for payment. The purpose is to stop one claimant bargaining his figures higher because he is aware of higher figures being agreed with someone else. However, the effect is to close down direct sources of information about the value of the entire spread of payments. The net result can be most unfortunate because it leaves professionals investigating value without reliable evidence of bargains struck. Occasionally this kind of situation is deliberately exploited by the payer of multiple settlements only leaving in the public domain the information that relates to the lower band of payments, thereby giving an entirely misleading impression of the true level of payments actually being made.

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[181] A4:12
[182] A4:12

The facts behind any suggestion of an appearance of scientific bias will normally be clear where the scientist has declared the source of funding and anything that might affect evaluation of his work. This is commonly done[183], and the reader is left to figure out how serious the link and its possible impact are. With funding for research, especially where the funder is involved in drawing up the research parameters, it is to be expected that third party evaluation will bear the connection in mind. Perhaps more subtly, funding is likely to be made available where a favourable outcome is expected. Usually, a lack of independence, especially where a funding connection is disguised or concealed, is the marker that raises the possibility of an appearance of bias.

Criticism of experts will take place even outside the strict confines of court-based litigation if it is thought that an expert has not lived up to the standards set by Part 35 of the Civil Procedure Rules[184], which regulates the giving of expert evidence. The fears of Paul Gilson as outlined above are reflected in the terms of Part 35 and its Practice Direction[185]. These are rules that all experts giving evidence in court must adhere to, and if they sign-off a report knowing Part 35 has been breached, they are liable for contempt of court proceedings,[186] which are punishable by imprisonment. Bias and the appearance of bias are high on the list of matters to be dealt with by the Rules. Thus, Rule 35.3 creates an overriding duty to the court: "This duty overrides any obligation to the person from whom experts have received instructions or by whom they are paid." The concern is evident in the Practice Direction (at 2.2): "Experts should assist the court by providing objective, unbiased opinions on matters within their expertise, and should not assume the role of an advocate." The giving of reasons and a fair view of the information is all part of the expert's duty. If followed correctly, the rules for creating and presenting an expert's report can give it a peculiarly convincing quality. So much so, that sometimes it is almost possible to forget that the expert has been paid for a particular opinion. What one cannot know is how many experts have been instructed and discarded because their conclusions were unpalatable before this particular expert was finally instructed. In fact, the place of experts or scientists acting as experts is self-evidently significant in giving investigatory advice and, ultimately, in supporting litigation or investigatory processes such as with wind farm consents. Since 2014 environmental assessments in the UK have been subject to specific guidance that developers must use competent experts and reviewing authorities must have sufficient expertise available to examine the statement provided.[187]

4.4 Opinion-making

4.4.1 Criticality of opinion-making

Every request for consent requires the findings of fact as a basis for proceeding; the creation of an opinion on the part of the investigator as to the correct choice where there are options; and, ultimately, an opinion as to whether consent ought as a matter of discretion to be rec-

[183] See for instance Glasson (2020) and the connection with Vattenfall.
[184] Civil Procedure Rules, Part 35 (current) Anonymous, HM Courts &Tribunals Service, authorised for online hosting by the Ministry of Justice https://www.justice.gov.uk/courts/procedure-rules/civil/rules/part35 (accessed 20 8 2021).
[185] Civil Procedure Rules, Practice Direction Part 35 https://www.justice.gov.uk/courts/procedure-rules/civil/rules/part35/pd_part35#2.1 (accessed 20 8 2021).
[186] Civil Procedure Rules, Practice Direction Part 35 paragraph 3.3.
[187] EXPLANATORY MEMORANDUM TO THE TOWN AND COUNTRY PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2017 (2017 No. 571) AND THE INFRASTRUCTURE PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2017 (2017 No. 572), paragraph 7.4.

ommended. Ministers receive the investigatory recommendation with evaluations of fact and a reasoned recommendation as to what the final decision should be. Obviously all technical matters are likely to attract one or more experts into the submission of reports and/or the giving of commentary on other reports submitted in respect of the same issues and given in the same discipline. So a marine biologist might criticise another marine biologist, but not a structural engineer. Experts are always involved in giving their own opinion, limited as they think fit. If the expert could not limit his opinion, it might give a misleading impression or the expert might find himself speaking on matters not directly within his expertise. In this way, expert contribution preforms outcomes, and in the wider sphere, expert involvement can change opinion generally.

The importance of expertise in the formation of decisions, and more generally of wider public understanding, is critical to the processes of change. Prince Michael made this acute comment about a practical understanding of otherwise somewhat vague abstract ideas:

> "Conservation and sustainability is improving. Years ago we were all philistines. We used to throw our rubbish out of the boat etc. We have all changed. We are now re-educated and we have gone a bit green. Last night on the news I was hearing about Israeli people being told not to go down onto the beach because of oil clumps from ships. That used to be normal here. It is not now. Previously we pumped the bilge out of the boat. We don't do that anymore."[188]

What he evidences is the re-education of people in the way it influences their daily practices. These kinds of long-term changes mentioned by Prince Michael are apparently the result of "re-education", the re-making of opinion in the wider society. It is therefore not surprising that Paul Gilson expresses himself as concerned in circumstances where the full information has been locked away, or where partisan colour is suspected to affect either the factual or discretionary parts of an allegedly impartial scientific or expert report.

Where public opinion is strong in the UK, there is clear evidence of a shift against powerful lobbies such as that supportive of trawler activity. DEFRA has shown itself susceptible to this pressure and has reversed its priorities accordingly. Thus, Jean-Luc Solandt of the charity Marine Conservation Society in interview with Oceanographic Magazine in 2019:

> "We've [the UK] got more than 350 designated MPAs [Marine Protected Areas] currently, but we've calculated that only 7% of those are protected from bottom trawling...In 2012-2013 the government had an opportunity to set up approximately 60 no-take zones, which were recommended by some stakeholder groups, but they didn't even designate one. We think the government was pressured by the fishing lobby at the time. There's a lot of kickback from industry… they [the government] did a big call for evidence for the last round of marine conservation zones. They got 40,000 responses with positive messages of support for increased marine protection. And then the Secretary of State Michael Gove designated every single site."[189]

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[188] A5:4

[189] Oceanographic Magazine (2020) Interview of Jean-Luc Solandt of the Marine Conservation Society, conducted by Beth Finney *Out of sight, out of mind* Issue 20 (undated) https://www.oceanographicmagazine.com/features/uk-marine-protection/ (accessed 24 9 2021).

4.4.2 The treatment of aesthetics

Here I return to the topic of sea aesthetics. For now, I note that the implementation of seascape aesthetics is essentially limited to the coastal areas in practice, and that there is no aesthetic evaluation of sea plumes. It seems quite possible the explanation for this is two-fold. In the early days of offshore wind farms, coastal perception of turbines was the focus of much investigation, giving rise to a specialised type of assessment of its impact (see below). With such a focus, matters occurring inside the sea itself were irrelevant. Secondly, once wind farm development became possible well outside the coastal areas, the absence of political opposition about aesthetics made ignoring the topic easy. To ignore the subject was a developer-friendly choice. Responsibility lies with government and democratic processes, and not with "experts," when it comes to applications of European Landscape Convention-related issues. In this connection, I note that part of the original purpose of the Convention was to take aesthetics away from "experts" altogether. The Explanatory Report (2000) is clear on this. "Official landscape activities can no longer be allowed to be an exclusive field of study or action monopolised by specialist scientific and technical bodies."[190] In commenting on the Aims of the Convention, and Article 5, it is stated: "The point of this provision is that landscape is not a question to be treated as a specialist field of public affairs."[191] Incorporation of wind farm decisions into the planning system satisfies the basic requirement, but implementation of coastal aesthetic choices may leave something to be desired. This is because the involvement of aesthetic witness experts has resulted in an approach dominated by specialised professionals.[192] Still, these experts should be given full credit where their work has created or strengthened departmental policy drafting.

4.4.3 Experts and seascape

Since independent technical expertise is necessary to many formal decisions, is it the case that it has become or may become too powerful in the formation of policy-based or court opinion? In general, courts in England and in Australia (alongside doubtless other Commonwealth jurisdictions) have allocated restrictions on the deployment of expert evidence in courts, arbitrations and tribunals. It can only be looked at where (a) a sound judgment could not be formed without it, (b) the area of expertise is "part of a body of knowledge or experience which is sufficiently organized or recognized to be accepted as a reliable body of knowledge or experience"[193] and (c) the expert is duly qualified or experienced in it so as to have a valuable view to express. These seem to be relatively uncontentious until one thinks carefully about the ways in which personal opinions of "experts" can appear to become more objective by general acceptance. In some areas this may not matter because of the underlying scientific content. In other areas it may be problematic. When it comes to matters of aesthetics, there is inevitably a need to demarcate clearly the ability of the public to contribute valid opinions without the views of an expert to inform them. That is why the personalised nature of democratic participation is emphasized by the European Landscape Convention. The Convention is also designed to offer protection to landscapes that have already become degraded or tainted by industrial appearance. Put another way, poor landscapes or seascapes do not have to get worse. There is a tendency, unless one is very careful, to assume (a) that "expert" views have a place, and (b) that expert opinions should be permitted to push out the opinions of non-experts. I refer back to the first of the three restrictions that courts impose

[190] Explanatory Report paragraph 22.
[191] Explanatory Report paragraph 50 (d).
[192] See below in relation to coastal wind farm visibility evidence.
[193] King CJ in the Australian case of *R v Bonython* (1984) 38 SASR 45, quoted in Barlow (2021).

on themselves. Could an evaluation, a sound judgment, of seascape be formed without the expert's contribution where it strays beyond technical measurements of physical phenomena?

Wind farm impact on "coastal view" has now been embedded in the expert assessments accepted at English governmental and local governmental level.[194] One firm in particular[195] has been instrumental over twenty years in producing guidance, comparative assessment and conclusions as to the quality of coastal views and the extent to which a proposed wind farm development would affect them in terms of seascape. The firm's activities have resulted in government guidance reflecting consistent input criteria and language. The documents are designed to show the techniques for implementing an assessment process for the coastal visibility of proposed wind farms. This is a concentration of influence but it also provides consistency in an exceptionally complicated area.

OESEA3 (2016), whose economic importance can immediately be understood from its full title[196], updates expectations and general policy environmental assessments for offshore renewable energy, oil and gas, hydrocarbon gas, carbon dioxide storage and all associated activity. A second report, bringing the next update to March 2020[197] explains how their assessments use predictions for view change based on "combining the sensitivity of the receptor or seascape unit that the viewpoint is located within and the magnitude of change." Sensitivity depends on individuals' views and the value ascribed to the view, and it is noted that "These judgements will be dependent on the location and context of a viewpoint, the expectations, occupation and activity of receptors and the importance of the view." Due to the subjectivity inherent in this first criterion, "the magnitude of change is the key determinant." In turn this will "involve consideration of the scale or size of effect with the extent of the area affected and duration/reversibility of that effect." No doubt measurement calculations and aspect heights and view calculations allowing for the curvature of the earth and the weather are all helpful and a basic requirement for decisions, but the essence of applying an opinion remains subjective.

Opinions about coastal seascape are in fact strongly and effectively held by the general public. The Navitus Bay wind farm project was rejected[198] in 2015 at Ministerial level following a huge public campaign[199] to stop the section of the coast from the Isle of Wight to Devon being impacted in any way whatsoever by a wind farm proposal.[200] Ostensibly the explana-

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[194] A similar approach has been used in Scotland, where similar criteria were implemented in regard to coastal views. The Seagreen Project Alpha and Bravo (respectively 27 and 38 km off the (East) Angus coast are illustrative. The full seascape assessment is available as at 2011 (the permits were not implemented and were varied in 2018. The sites are now under construction, due for completion in 2024): Seagreen Project seascape visual assessment (2012).

[195] White Consultants (undated) *Offshore energy strategic environmental assessment seascape background studies* Information page https://www.whiteconsultants.co.uk/expertise/seascape-character-assessment/oesea-round-3-offshore-windfarms-seascape-study (accessed 24 8 2021): "… we have explored the likely limits of significant visual effects on seascape from offshore wind development in English and Welsh waters for the UK government. These seascape and visual buffer studies have informed two Strategic Environmental Assessments...".

[196] UK Offshore Energy Strategic Environmental Assessment, **OESEA3** Environmental Report Future Leasing/Licensing for Offshore Renewable Energy, Offshore Oil & Gas, Hydrocarbon Gas and Carbon Dioxide Storage and Associated Infrastructure (2016) Department of Energy and Climate Change, March 2016.

[197] White Consultants (2020) *Offshore Energy Strategic Environmental Assessment Review and update of Seascape and Visual Buffer study for offshore wind farms* Review adopted for HM Government use in updating OESEA 3, Study dated March 2020, page 65 onwards.

[198] 11 September 2015 Navitus Bay Decision Letter (Department of Energy and Climate Change ENO-10024) PLANNING ACT 2008, PLANNING CONSENT APPLICATION PROPOSED NAVITUS BAY WIND PARK.

[199] See Navitus Bay Objection site (undated) *Challenge the Navitus Bay Wind Farm Proposal* (site active 2013-2015) Information page http://www.challengenavitus.org.uk/ (accessed 24 8 2021).

[200] BBC News (2015) *Navitus Bay wind farm refused permission by government* 11 September 2015.

tion was potential impact on areas of outstanding natural beauty, but the campaign had the backing of middle class opinion in Devon and of towns and tourist-based industries all along the coast.

The Marine Management Organisation and BEIS[201], which is responsible for renewable energy installations and infrastructure, actively protect the coastal areas by reference to seascape views. OESEA3 and 4 emphasise criteria that reflect the wording of the European Landscape Convention in reference to seascape. Their active implementations are aligned. The MMO has direct responsibility[202] for permits for electricity generating activities at sea where the smaller production bands are involved. They cover applications over 1 MW and up to 100 MW, after which the infrastructure planning decision passes to the Secretary of State. In OESEA3 the approach of other European countries to wind farm siting is noted, in particular where distance from shore of 50 kms removes the need for an assessment of views (as in Germany). It records an understanding that such distances "should all but eliminate visual disamenities of turbines for shore based receptors, though will obviously change the character of the North Sea and Baltic Sea from passenger ferries, recreational craft and other commercial ships."[203] Aesthetic characteristics are identified that may be relevant to general coastal/ marine seascape character assessments such as "cultural associations, preferences, memories, weather/atmospheric conditions including touch/feel, smells, sounds, sight (form, pattern, texture, colour)".[204] The most recent Consultation at BEIS (currently at the stage of processing responses to this draft, OESEA4[205]) states (page 54):

> "Where developments fall within the visual range of receptors (i.e. resident and transient people) on the coast, or are intervisible from other viewing locations at sea, for instance from recreational or commercial vessels, their character, form, aspect, spatial extent and type of movement all influence how the seascape is experienced. In view of the use of turbines of greater size and in greater number, studies and guidance documents have been produced on the assessment of seascapes in relation to offshore wind farms whose findings may be more widely applicable to other marine energy devices which have surface infrastructure. [footnoted: For example, see White et al. (2019) Seascape and visual sensitivity to offshore wind farms in Wales: Strategic assessment and guidance, and White Consultants (2020) Review and Update of Seascape and Visual Buffer study for Offshore Wind farms.]"

In the 2020 Report of White Consultants. visibility to passing commercial and recreational ships is used to justify the investigation of views towards the land from the sea. The Report guidelines do not appear to reflect any awareness of the sea plumes (clearly not classified as part of "surface infrastructure") as deserving of attention as part of the seascape. The latest draft policy document, released for consultation by BEIS in September 2021, states that sea view assessments will not necessarily be required where the proposed offshore wind devel-

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[201] Department for Business, Energy and Industrial Strategy.
[202] Electricity Act 1989 section 36.
[203] At page 330.
[204] Natural England (2012) *An Approach to Seascape Character Assessment* © Natural England 2012 (Natural England Commissioned Report NECR105, 11 October 2012) at page 17.
[205] UK Offshore Energy Strategic Environmental Assessment Future Leasing/Licensing for Offshore Renewable Energy, Offshore Oil & Gas and Gas Storage and Associated Infrastructure Scoping for Environmental Report Consultation document **OESEA4** (2021) Department for Business Energy and Industrial Strategy March 2021.

opment cannot be seen from the coast.[206] This refers to the Seascape, Landscape and Visual Impact Assessment being waived:

> "Some applications for offshore wind farms that are submitted to the Secretary of State will be proposed at distances that mean that a project would not be visible from the shore. In these instances, the Secretary of State is likely to be able to conclude that an SLVIA will not be required."

That document treats "scour effect" from offshore turbines as matters for physical not seascape assessment.[207] The Marine Management Organisation evaluates coastal views in line with the 2011 UK Marine Policy Statement, which at paragraph 2.6.5.1 refers to seascape meaning coastal areas: "In the context of this document, references to seascape should be taken as meaning landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other." Regional English marine Plans replicate this.[208] In Marine Management Organisation English regional Plans it is stated that the European Landscape Convention can be applied to seascapes from sea to sea and that they may be "relevant":

> "530. Seascape can be broken down into its constituent parts of visual resource and marine character. Visual resource can be interpreted primarily as views of the coast and sea from the land. Views from the sea to land, and from sea to sea are also relevant. In addition to the European Landscape Convention definition, seascape character includes a combination of characteristics above the surface, within the water column and on or below the seabed."[209]

Further, we see (based on the above quotation) that it is recognised that this wider possible protection applies to in-water and under-water features. Accordingly, seascape assessments based on visibility from land are within the European Landscape Convention as applied. Where there are no "receptors" and the areas in question are well out of the sight of land, it is the character of the sea that may be affected. There are now regional plans that set out the characteristics of areas and criteria by which sensitivity to change can be evaluated. An approach to seascape sensitivity MMO 1204[210] is directed to the European Landscape Convention. The document provides detailed guidance on identifying and evaluating the character of seascape and how to establish the degree to which it is sensitive to change. This includes the cumulative effect of adding additional wind farm presence (Annexe D). Where the MMO is not making the decision on a major infrastructure project offshore, it will be a statutory consultee and will submit its seascape comments accordingly to the body making recommendations to the Secretary of State. These comments can include matters such as in-water features such as the sea plumes.

The net position is that coastal view impact is considered by reference to distance from shore, intrusiveness and existing character of the view and the coast in question. Sea plumes are not visible from shore and are not visually evaluated. Replacement turbines in the off-

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[206] Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) (2021) Department for Business Energy and Industrial Strategy September 2021 at paragraph 2.35.3 page 67.
[207] At page 47. See also Chapter 6.16.
[208] For example in MMO North East Inshore and North East Offshore Marine Plan Technical Annex (2021) HM Government June 2021 at paragraph 529.
[209] MMO North East Inshore and North East Offshore Marine Plan (2021) HM Government June 2021.
[210] An approach to seascape sensitivity MMO 1204 (2019) Produced by White Consultants for official government use December 2019.

coastal areas might well have a more sophisticated sediment analysis where the sea plume had been evidenced, but this would remain as physical assessment not as seascape. For deep offshore locations, a view assessment is unlikely to be required. The evaluation is not of the installation aesthetically as such but rather of change it will make to the character of the sea. That could include sediment plumes and other in-water features (eg sediment disturbances that do not reach the surface but have other impacts). In theory, intensified use of the sea for wind turbines falls under this head. Areas designated for conservation or as having some special quality could be protected. However, given the high offshore energy targets, especially those for Offshore Region 2 (the East of England) in OESEA 3 and 4, it seems unlikely that substantial development would be restrained as a matter of principle. At paragraph 6.5 of OESEA4, under "overall spatial considerations", density limits are listed: "on the basis of recent proposed or consented offshore wind farms, it is proposed that an energy density of 3.1MW/km2 is used for those areas which do not coincide with hard constraints." "Hard constraints" refers to the physical presence of competing interests. For areas deep offshore and away from the main shipping lanes, this is some concession to the problem of concentration, though it may well not be flexible enough to survive throughout the five year period intended for this assessment report. Decision-makers are encouraged to have "flexibility" when considering offshore wind applications[211]. What this probably means is that the desire to have wind farm development will be strong enough to overcome the fact that changes to the sea character are likely or inevitable. It seems to me that only areas with special ecological significance stand much chance of withstanding the "flexibility" expected of decision-makers. Flexibility means authorising development in face of missing or deficient information and in the knowledge of environmental damage.

4.4.4 Dick Beaumont on UK policy

Dick Beaumont, a mariner, is of the view that the increasing presence of wind farms is being ignored in terms of impact on seascape. He implies that this may not matter to the government because only sailors are directly impacted so far to sea.

> "For users of the sea, what appears to be happening as regards wind farms is that although they are desirable for clean power generation they are nonetheless visually polluting the sea and causing significant obstruction to users of the sea. It seems the current UK policy is out of sight, out of mind, since recently they seem to be being developed 20 miles or so offshore. Only mariners see them this far out to sea."[212]

Perhaps the sight of an open sea is not one the general public currently readily accesses or empathises with. Paul Gilson made the point exactly that "we need to educate urban people." He was speaking of the way in which humans regarded seals as "cute" and deserving of absolute protection, regardless of their impact on fishing stocks. He identified "cuteness" as a policy determinant with effective appeal, but one where it would cause problems if resource planning and management was based on it.[213] His comments complement those of Dick Beaumont because he conversely recognised the political power of public engagement with policy.

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[211] See Chapter 6.16.
[212] A2:4
[213] A4:8

As policies are currently being applied, there is participation in inquiries by those directly impacted and also those indirectly impacted. For example, the defence of sea birds is a highly effective operation spearheaded by the Royal Society for the Protection of Birds, a single vast and wealthy[214] organisation comprising one of the biggest landed estates in the country and dedicated to the protection of birds. Its members are supportive of all birds rather than those specifically on the coast. In 2021 the organisation had a participation of over a million people in their Big Garden Birdwatch. The membership involvement is of the indirectly impacted kind, but is also major.

4.4.5 Fishing: change and sustainability

Prince Michael's comments repeatedly return to the themes of change and how a change of opinion is reflected in daily practices. What he describes is a process of adaptation in line with ideas about sustainability. He draws on memories of changes from a very different past in terms of fishing. His involvement with Sealand began in 1966 when he was a boy of 14, and has been continuous ever since. Though in later life he became a commercial fisherman in British waters, at the outset he recalled the days when he was an amateur fisher in the immediate area of the Sealand structure in the period 1967-87:

> "In these early days I remember that fishing was done simply and that the fish were frequently very big by modern standards… There were lots of boats that I saw pass with 50 lb[215] cod on the deck. 1967-1977: my impression of the recoverability of stocks at this time is that stocks (catches) reduced over the years. I could also see the catches on both commercial fishing boats that passed and recreational angling boats were getting less and less. ..I was not fishing commercially at this time so did not worry about the recoverability of the stocks. 1977-87: in this period, the species of fish remained the same but just reduced in quantities some becoming almost not part of my catch. We stopped getting large cod and tope."[216]

Eye-witness views are, of course, impressionistic when dealing with spans of years, but where statistics are unavailable, unreliable or unusable, witness accounts can be particularly interesting. The period 1967-87 was the period that saw the rise of industrial fishing fleets such that in 1992 Canada closed its cod fisheries thereby causing the collapse of its North Eastern fishing industry because the North Eastern cod had dropped to threatening extinction levels. It may be fair to say that the detailed actuality of overfishing, stock collapse and fish recovery is almost impossible to ascertain amongst the conflicting statistics, opinions and interests. There is certainly no shortage of information or organisations interpreting it, whether international[217], national or charitable[218]. It is apparently an area where opinion-making has become a paramount issue, and opinions have sharply moved towards conceptualisations such as "overfishing" and "sustainability." The UK fisheries audit for 2021 with OCEANA states: "Of the 104 UK stocks audited, 35.6% were healthy in terms of stock size relative to the Maximum Sustainable Yield (MSY)…20.2% were in a critical condition. *Da-*

[214] Reporting an income to the English Charity Commissioners (excluding Scottish income) of £147 million for the year ending March 2020.
[215] 22.68 kilos.
[216] A5:2
[217] Such as the ICES (International Council for the Exploration of the Sea).
[218] Such as OCEANA, founded 1999 by leading US foundations with the aim that OCEANA work to restore and protect the oceans.

ta limitations mean the status of the remaining 44.2% cannot be determined. (The italics are mine.)" [219] Cod are shown as "critical/overfished." The point is similarly made by even a brief glance at the heroic struggles with partial, unusable or suspect data experienced by the ICES participants in their 2021 Benchmark Workshop on North Sea Stocks.[220] Some fishers ascribe low fish stocks to causes other than overfishing. Paul Gilson does so: "Previously we would at this time of year be very excited about the Dover sole coming in but not now. This is not to do with overfishing. The amount of fishing is very small."[221] He separately drew attention to the way in which sustainability had become linked politically in some quarters to stopping fishing: "The Greens have only attacked the fishing industry. They do not like the fact that we kill things. Our livelihood depends on going back tomorrow."[222] Government in the shape of the UK Marine Management Organisation has asserted its opinion as to the scale of the decline in stocks landed, and as to its causes: "In 2019, landings of demersal fish were around a fifth of the quantity landed in 1970. The decline in landings of demersal fish has several causes, including reductions in fleet size, declining fish stocks and restricted fishing opportunities."[223]

Fair or unfair, efforts to control overfishing have for many years in Europe centred on restricting catches through establishing and policing quotas. The allocation of quotas in the UK[224] has overwhelmingly been to large vessels (defined as over 10 metres) with smaller more numerous operators receiving less than 2% of quotas despite representing 74% of fishers. Small vessels mainly[225] catch non-quota species and represent 80% of catch landed "by volume and value."[226] Despite valiant efforts to recast small fishermen as deserving of greater quota allocation because they represent a desirable form of resilience and provision of "public goods" of various kinds,[227] the concentration of fishing power in fewer industrial vessels means the balance of the distribution is unlikely to experience significant change[228]. "Vessels over 24 metres in length account for just 4 per cent of the total number but 63 per cent of the fleet's capacity and 35 per cent of the fleet's power."[229] The quota in any case cannot legally be expropriated as it is a tradable asset.[230] Shellfish have historically fallen outside this quota system generally because of the profusion of shellfish. It is in relation to these that sustainable fishing as an idea is exemplified by Prince Michael's fishing business in British waters, as he explains:

> "We only catch cockles…Normally we work where the sands dry out. The deeper water is 20 to 25 foot at best. We used drag dredges in the past in 50 foot of water but do not do this very often now. We usually go when the tide leaves. We are certified sustainable. This means that over several years our fishery has made all the right decisions. We have made the right amount of ef-

[219] OCEANA fisheries audit (2021).
[220] ICES (2021) *Benchmark Workshop on North Sea Stocks (WKNSEA)* ICES Scientific Reports Vol 3 Issue 25.
[221] A4:15
[222] A4:2
[223] MMO Sea Fisheries statistics 2019 at page 21.
[224] Clearly and simply explained in Annexe 3 of the October 2020 DEFRA Consultation (page 45). See Fisheries: Quota allocation and management in 2021 and beyond England and the Crown Dependencies (2020) DEFRA October 2020.
[225] The under 10 metre fleet receives a guaranteed minimum share in some fish types through a system of underpinning allocation.
[226] Quoted OCEANA fisheries audit (2021).
[227] Korda (2021) at 151-4.
[228] The suggestion of redistribution in favour of the small fleet was a low scoring possible aim in the October 2020 Consultation (ibid) due to fears of quota going unused by the under 10 metre fleet (some already is), and when the over 10 metre fleet required more quota for vessels with insufficient quota.
[229] MMO Sea Fisheries statistics 2019.
[230] Korda (2021) at 64.

> fort in that we have monitored annual surveys where the amount of cockles in a quadrant is surveyed. This is a grab survey where the survey boat collects sediment. We have a riddle where we only keep cockles over 16mm and above. The small ones can go back. As to consultations in the fishing industry, we have called a meeting with fishery officers and we have told them that we want to rest a particular area. We are consulted in connection with that. ..We fish historical areas. Cockles come back to these areas after we have fished… We used to fish year round but since we have become regulated we fish June to October. …It is beneficial to have these restrictions. Cockles recover quickly within two to two and a half years."[231]

This description highlights the long-term nature of sustainable action and its acceptance by Prince Michael's business operations. At every stage in the process of fishing we are told of regulatory action as to the times and ways fishing may take place. The fishers themselves have accepted that they have a responsibility and an interest in keeping the shellfish stocks replenished. It is clear that this is not simply what the business does, but also what it wants to do. Most remarkably of all, we see the fishers pressing the officials to close off areas from fishing: "we have told them that we want to rest a particular area." Underlying all ideas of sustainability there must logically be a recognition that unlimited exploitation has been shown to lead to resource pressure, and that this is undesirable. The description Prince Michael gives is of the regulatory authorities working closely with his fishing business in a world where the authorities, as a matter of normal expectation and activity, operate to conserve stocks and control fishing. Shared opinion here results in cooperative action.

4.4.6 Fishing: wind farms and trawler fishing

Elsewhere[232] I have noted two big anticipated changes in the event of an increase in wind farm provision: significant increases of shellfish (mussels) near the turbines, and the areas of the wind farms becoming closed to trawlers due to safety concerns about cables. Trawlers do not generally enjoy a good reputation due to perceptions about environmental damage and association with exploitative fishing. Paul Gilson had a succession of four trawler boats. He operated the last of them for 20 years. He describes a shifting process of adaptation:

> "I used to catch sprats, herring and cod as well as eels. We adapted and caught different fish as and when. But when the restrictions were created it brought waste and too much pressure on individual stocks. We used to stock different gear and types of nets for eel or sprat, say. Or we could be open fishing for demersibles. We could go for other types of catch but when we were banned from these other gear, it forced us simply into catching demersibles so it put stocks under pressure."[233]

He explains his view as to possible benefit of trawling:

> "Trawler fishing has some benefits, for example it stimulates the ground. The principle is like that where farmers do not like geese on ground because they pad it down. It is the same with the sea bed. In the end nothing grows. If you

[231] A5:4
[232] See Chapter 6 noting Slavik (2019).
[233] A4:10

> turn over the ground and loosen it, it stimulates the ground, in the same way that a good storm at sea will do. It reveals food. Storms can move metres of ground. With the trawlers, we tickle the ground. We are not taking it away. It is similar after trawling but it is just touching the ground…. Trawlers have a bad press, which is unfair. There is so much propaganda against us but much of it is fake news."[234]

One of the interesting features of this description is the immediate link to what he considers unfair public opinion, and by inference to the significance of such opinion. Where trawlers have a bad press, and it is probably a matter of general recognition at this point in time that they do, one can reasonably anticipate some move against trawler fishing where government is not obliged to favour the fishing industry. In terms of general environmental change in the event of wind farms becoming prevalent, is it to be expected that the exclusion of trawler fishing will be regarded as a positive benefit? If so, it potentially represents a countervailing factor to the desirability of retaining areas of open sea, which remain in physical terms available to trawler and industrialised fishing, whether or not the areas are legally banned from being fished.[235] In other words, is there evidence of an active awareness within the environmental thinking of government to the effect that wind farms are areas that self-police from trawler fishing? Recent events in the Dogger Bank suggest that this is so.

4.4.7 Dogger Bank

Dogger Bank is a large area of submerged sandbank in the North Sea along the boundaries of four European countries: the UK, Germany, the Netherlands and Denmark.[236] The first three of these declared the Dogger Bank to be an area of conservation; Denmark, whose industrial sandeel fisheries are active in the immediate area, did not. There is inherent conflict in many of the shared uses of the North Sea. An instance of this is conflict between intensive trawler activity and the desire of some conservationists to close off conservation areas to trawlers. It is a marker of how powerful the need not to upset fishing interests once was if we consider the terms of an Environmental Statement[237] submitted by Forewind in March 2014. Forewind was trying to secure English permission[238] for two huge wind farms on the very edges of the Dogger Bank. They assessed the impact of building the two wind farms over, at most, eleven years[239] as having little impact on most kinds of fishing, but as having a moderate adverse impact on the seine fishery[240]. Two features of their advocacy are notable. The first is the creative reliance on "displacement" ie the idea that the trawlers could just go somewhere else locally to fish. The second was the downplaying of the risks involved in trawlers fishing in cabled areas, as though it was realistically a matter of individual assessment for the captains involved. Once the cables had been buried, the plan was to notify the captains on the basis that "it is not envisaged that the inter-array and export cables will con-

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[234] A4:11

[235] It can be questioned sometimes how meaningful legal protection is: see the 25 August 2021 French fleet allegedly targeting rare protected blue fin tuna inside Jersey waters: Jersey Evening Post News (25 August 2021) *Call for full investigation into alleged blue fin tuna breach.*

[236] 18,000 kilometres square at approximately 150 kilometres North East of the Humber Estuary in the North of England.

[237] March 2014 Teesside A and B Environmental Statement on Commercial Fishing.

[238] For the confusing history and change of name related to these two wind farms that began as Dogger Bank Teeside A and B, see the opening paragraphs of the 30 November 2020 Dogger Bank Decision Letter (Department for Business Energy and Industrial Strategy BEIS ENO10051-002537-201130) PLANNING ACT 2008 APPLICATION BY DOGGERBANK OFFSHORE WIND FARM PROJECT 3 PROJCO LIMITED AND SOFIA OFFSHORE WIND FARM LIMITED FOR A NON-MATERIAL CHANGE TO THE DOGGER BANK TEESSIDE A AND B ORDER 2015.

[239] March 2014 Teesside A and B Environmental Statement on Commercial Fishing paragraph 7.2.39.

[240] Ibid att paragraph 7.2.23.

stitute significant fastening risks to fishing gears which in turn could affect the stability of fishing vessels… There is the potential for fishing gear to fasten on foundations"[241] It was suggested that the risk was minimised by giving information of the location and of the design of turbine foundations. The exercise appears to downplay the potential for disrupting fishing. It was further alleged that Forewind had chosen the sites for development so as to minimise fishing displacement. The Secretary of State granted permission[242]. No concern was expressed as regards fishing interference generally, because, as was noted, fishing was a constant feature of the Dogger Bank.[243] That was undoubtedly the case: the area had been heavily trawled for centuries.

In fact, trawler fishing near wind farms was known to be dangerous. It is now a baseline position for trawlers, as Paul Gilson said[244]. The cables are to be avoided at all costs. In 2014, shortly after consent had been granted for the Dogger Bank wind projects, a House of Lords Select Committee reported[245] to Parliament with recommendations for the government as to the state of marine policy in the North Sea and its delivery. They recorded clear opinion evidence given to them by the European Wind Energy Association that wind farms were to be regarded as tools of conservation precisely because they were dangerous to trawlers. EWEA had submitted "An offshore wind farm can also be an excellent natural conservation site for certain types of species, because it is a nofishing zone or because molluscs and plants all collect around the substructures."[246]

After the British, Dutch and German governments separately designated Dogger Bank with conservation status, nothing much happened to stop trawler activity. The non-participation of the Danes meant that European level agreement was unlikely. This did not please a powerful group of wildlife and conservation charities, which had expected something to happen to protect the areas in question by banning trawlers, so they complained to the European Commission about the inaction by the three countries that had declared conservation status. The terms of the complaint were specific to bottom-trawling and seine fishing, and are essentially criticising the clear pro-fishing agenda the three governments displayed:

> "A joint recommendation was officially submitted 19 June 2019 by the governments under the process of Article 11 of the CFP[247]. The measures in the Joint Recommendation propose to keep 66,2% of the total area of the sites open to fishing on an industrial scale with all types of bottom-towed fishing gear, including trawling and a specific type of mobile bottom-towed fishing gear called seine fishing. The remaining 33,8% of the total area of the sites, indicated as 'management zones', are alleged to be protected from damaging bottom-towed fishing gears. However, since in the Joint Recommendation it is also proposed to keep 95,3% of the total area of the sites open to seine fishing, the proposed measures only protect a mere 4,7% of the Dogger Banks SACs

[241] Ibid at paragraph 8.3.3/4.
[242] Development consent requested by the Forewind consortium on 28 March 2014 was granted on 4 August 2015 :see INFRASTRUCTURE PLANNING The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015 (SI 2015/1592).
[243] 4 August 2015 Dogger Bank Decision letter Department of Energy & Climate Change ENO-10051-002089 PLANNING ACT 2008 APPLICATION FOR THE DOGGER BANK TEESSIDE A AND B OFFSHORE WIND FARM ORDER at the Dogger Bank documents collection at paragraph 5.7.
[244] "When a wind farm is established you are allowed to fish there but if you snag the cable you are responsible for that. ….If a boat snags in bad weather, it can be pulled over. This has happened." A4:14
[245] House of Lords Select Committee Report (2014) *European Union Committee - Tenth Report.*
[246] Ibid at paragraph 60.
[247] Common Fisheries Policy.

> from mobile bottom-towed gear on an experimental basis and for only 3 years. As is explained below, scientific evidence clearly shows that bottom-towed fishing, including seine fishing, causes deterioration of the Dogger Bank SACs and is known to catch species which are key to the restoration and biotic equilibrium of the sites, including Habitat 1110 typical species, threatened and endangered species."[248]

The advocacy of the complaint itself was powerful, and influential. British conservation zones in marine protection had eventually been declared in a number of areas in the period since 2011 but trawler activity was still permitted in them[249]. Greenpeace in September 2020 began a series of rock-drops across the entrance to the Dogger Bank so as to stop trawlers. Influential parts of the British press took up the conservation cause[250], and the government was forced to intervene. A Dogger Bank investigation was hastily called by the Marine Management Organisation at which a great deal of fishing evidence was received. When their Report[251] was published, their recommendation was for the emergency creation of a byelaw completely banning the use of trawler gear or seine lines in the whole of the Dogger Bank conservation area. The recommendation was for fishing activities to be restricted to methods that essentially replicated what was possible in the area of wind farms, which was limited. Wind farms were held to be compatible with conservation status as were some non-bottom kinds of fishing activity. The Report then proposed the terms of a byelaw making the British section of the Dogger Bank off-limits to trawlers and seine fishing. What is especially of interest is the way in which the banning of trawlers and bottom-fishing is listed as one of three techniques for management of a conservation area rather than considering fishing as an independent right that had to be accommodated. It remains to be seen how the European Commission will deal with the conservation issue on the EU side of the Dogger Bank. Meanwhile a third wind farm at Dogger Bank is entering the construction phase, the first two still being built.[252] Once built, the collected Dogger Bank wind farms will be amongst the largest offshore wind installations in the world. Due to name changes, it can be confusing to locate the huge wind farm area covered. It can be seen as at 2020 on the interactive Wind Energy Network Map referred to in Chapter 3[253].

The above narrative demonstrates evidence of an observable English regulatory shift between 2014 and 2021 towards conservation and away from trawler fishing where the two conflict. Although the Marine Management Organisation is technically an agency independent of government, in reality it has a reporting Minister and is an arm of government. What has now emerged after years of inactivity is a decision to enforce active conservation over trawler fishing, and to do so in such a way as to assimilate fishing techniques to those compatible with wind farm presence. Given the amount of political pressure behind the Dogger Bank recommendation and the detailed investigation involved, the synergy between the ban and wind farms is obvious. Put in another way, open seas are open to trawler activity. Keeping areas of the sea open for aesthetic reasons aligns with certain fishing interests that are (a)

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[248] Dogger Bank complaint (2019).
[249] See British Sea Fishing Article in-house (updated from September 2020 to the beginning of 2021) *British Marine Conservation Zones*.
[250] McVeigh K (2020) *Revealed: 97% of UK marine protected areas subject to bottom-trawling* The Guardian 9 10 2020.
[251] Dogger Bank Special Area of Conservation (SAC) MMO Fisheries Assessment 2020 (2021) Marine Management Organisation.
[252] Dogger Bank website https://doggerbank.com/ (accessed 30 8 2021), Dogger Bank C.
[253] Wind Energy Network Map 2020 https://www.windenergynetwork.co.uk/wp-content/uploads/2020/01/A1-Map_Issue-52.pdf (accessed 26 9 2021).

in practice unable to operate in wind farm areas, and (b) at risk of being banned from other British conservation areas besides the Dogger Bank.

What the above sequence of events draws out is the importance of opinion-making in shifting the policy implementation against trawler fishing. The first wind farm consents for Dogger Bank to Forewind had been preceded by a deliberate down-playing of risks to trawlers within wind farms. Once the consents had been granted, the wind farm association evidence submitted in 2014 to the House of Lords investigation openly pressed the advantages of wind farms as no-trawler zones. We can cynically synthesise these positions by saying that wind farms are open to trawlers if they do not mind risking sinking. A more hostile position to trawler activity is hard to imagine. Paul Gilson was well aware of the safety issues. He was also very aware of the importance of the urban vote and the need to educate urban people. Greenpeace's advocacy in complaining to the European Commission presents as a significant publicity exercise in the making of anti-trawler opinion. It paved the way for illegal action and forced the UK government to investigate whether the conservation designation was compatible with bottom fishing by trawlers and seine fishermen. Once the public inquiry investigated the bottom-fishing, not to restrict it would have amounted to abandoning the conservation goal. The earlier compromise whereby a conservation label was placed on a trawler-fishing zone had to be ended because it was incapable of withstanding public opinion. The outcome constituted recognition of the status quo because the wind farm construction activity and the boulders placed by Greenpeace in combination had effectively rendered the British areas of the Dogger Bank unsafe for trawlers. This represents an extraordinarily important change because around 38% of UK waters are marine protected areas,[254] the overwhelming majority of which currently allow trawler fishing. It remains to be seen whether and where[255] the government will defend this earlier compromise so as to allow it to continue. The net position in the Dogger Bank episode is that conservation and wind farms are perceived as aligned. Combined, their publicity and financial power are shown as capable of swaying a huge change in the implementation of law and policy. It was the trawlers that were acting legally by fishing the Dogger Bank. It was Greenpeace that acted illegally (by placing obstructions on the seabed without a licence). It was opinion-making that justified the outcome.

4.5 Wind farm decision-making

A formal decision to permit the creation of wind farms offshore enables the building of major energy infrastructure in a sea already heavily in competitive industrial use. The materials submitted for the purposes of the decisions are detailed and technical, dependent on the unbiased views of experts, but experts selected by proponents of schemes. Opponents or modifiers of schemes are also in many instances experienced litigators and well-funded conservation or wildlife charities. Permissions have direct consequences for the sea. The administrative inquiry directly accesses whatever evidence, including expert evidence, it requires in evaluating any application. The ensuing decision is influenced decisively by politics. Do the courts show an inclination to intervene simply because the technical balance of such an

[254] DEFRA blog, *Defra response to Marine Conservation Society 'Blue carbon' report* 4 May 2021, Press Office.
[255] In 2021 the government announced a plan to designate some areas as Highly Protected Marine Areas where both trawlers and wind farms, amongst other things, would be banned. Pilot schemes for limited areas are being selected for designation in 2022. JNCC Highly Protected Marine Areas (undated) Information page https://jncc.gov.uk/our-work/highly-protected-marine-areas/ (accessed 24 9 2021).

evaluation or decision was wrong? Are the courts reluctant to intervene where politics is decisive? Chapter 5 investigates where, in practice, the final decision is made.

5. The robustness of UK regulatory decision-making

5.1 Purpose and background to study of UK High Court wind farm appeals

Behind each wind farm decision is a cacophanous background reflecting the flow of opinion on issues connected to wind farms. This includes the opinions of the public, of academics, of the press, of developers supporting the relevant technology, of experts, of the nature and conservation bodies, and of many more. Decisions are made in the UK by the relevant Minister. Questions about the control of this decision process are not answered simply by looking at what treaties or domestic legislation provide. There is a practical element that determines precisely whose opinion finally matters, and about, therefore, the level at which time, energy and money need to be spent, to achieve progress on the part of a developer or to block it on the part of objectors. Finding out the critical level of decision-making should tell us where influence matters overall. Aside from formal mechanisms for granting permissions for offshore and supporting installations, and the kinds of evidential processes that involves, it seemed worthwhile to investigate how strong the initial determinations by administrators really were compared with the power and willingness of the courts to intervene. This question was one where my interviewees were not able to contribute answers, whereas I can offer some observations based on a study of certain challenges made in the superior courts of the United Kingdom to the initial wind farm decision-making process.

In the UK, the finality of an administrative decision-process can be examined in different ways. I have chosen to consider it through the framework of legal challenge to an administrative decision because it throws into high relief the grounds of possible challenge, and the probabilities of success. In this text I use the word “appeal” to describe the process before the courts because it more easily conveys to a general reader what is happening. The technical term is “judicial review.” The almost universal rule to be applied in the UK is that the loser in a law suit pays the legal and other costs not just of his own side but also that of the winning side. In reference to an appeal, the layer of costs involved is that of the appeal, but in some situations, depending on the nature of the challenge, it may also include some of the wasted costs of the process before it reaches appeal. It follows, therefore, that there is a self-selecting element whereby small cases are not challenged because the costs of failure are so severe that challengers are unwilling to proceed. This study is of the robustness of the administrative decision-making process as tested by the chances of successful challenge via litigation. Where challenge is easy, the fragility of the administrative process is revealed. Where court challenge is difficult, the real battle-ground for litigants to secure favourable decision-making is revealed as the initial process. That initial process precedes the Ministerial decision and involves the experts and the direct acquisition of evidence as identified in Chapter 4.

There are six separate legal systems[256] in the British Isles, each with their own law, judges, and legal administrations. These are, in descending order of geographical and demographic mass, England and Wales (jointly because Wales had been conquered by force in the thirteenth century); Scotland; Northern Ireland; the Isle of Man, a separate nation but a Crown dependency[257]; the Bailiwick of Jersey, a Crown dependency; and the Bailiwick of Guernsey, a Crown dependency. England, Wales, Scotland and Northern Ireland[258] together form the United Kingdom. In the period from 2015 to 9 August 2021 (the date of my study closing), there have been several key wind farm cases reported on Westlaw[259] where legal challenge in the high court is used to attempt a reversal of an administrative decision. This is the situation in the three principal jurisdictions. Though the legal systems and administrations are different, it is fair to say that neither of the two main jurisdictions (England and Wales; Scotland) is disposed to tolerate easily departure from administrative decision-making. Appeals by way of judicial review (supervision of process) can only succeed within narrow parameters.
A word should be said about the hierarchy of the different courts and the way in which they view each other. In England, the Court of Appeal is ranked within the United Kingdom as equivalent to the Inner House of the Court of Session in Scotland (though this is possibly misleading because the Inner House is the highest Scottish domestic court.[260]) Those two second-level courts control appeals from all their own first level appeals courts (identified as the Outer House of the Court of Session in Scotland[261] and as the High Court at first instance for England and Wales).

Each jurisdiction primarily bases its reasoning on legislation and also its own case law (this may or may not be influenced by parallel cases in the neighbouring jurisdictions). It appears to be normal practice to quote English cases in Scottish courts; the reverse is not true. No parallel jurisdiction is therefore obliged to follow their neighbours' decisions, although within each jurisdiction lower courts are obliged to follow the rulings of their own higher courts. The Scottish legal tradition is much more open to the investigation of jurisprudence beyond its own boundaries. Therefore in a study such as mine, the Scottish cases are a better source than the English ones because the English position is frequently identified and considered as part of resolving the Scottish case.

Cases from the three main jurisdictions will be considered. The Northern Irish and Scottish cases are sufficiently close to English law in their deductive processes as to be comprehensible to an English lawyer. As to England and Wales, and Scotland, each of these jurisdictions regulates its lawyers separately but they have the following things in common. First, clients cannot insist on pressing hopeless litigation where no coherent argument in favour of the client position could be made. That is ruled out by professional standards of lawyers (court time would be wasted). Secondly, however, if a coherent argument can be made, the client can insist on pressing it, even though he may be advised he will lose. Weak cases are often not pressed due to the fear of adverse costs/ expenses orders in the event the client loses the

[256] Excluding the Isles of Scilly, which are a local authority forming technically part of Cornwall in England.
[257] Meaning defence and foreign relations are the responsibility of the English Crown. See generally Crown Dependencies on Wikipedia https://en.wikipedia.org/wiki/Crown_Dependencies (accessed 13 7 2021).
[258] Northern Ireland is not part of Great Britain.
[259] Commercial legal database professionally consulted by lawyers
[260] Outranked by the Supreme Court of the United Kingdom, which sits in London and constitutes a non-Scottish majority. It is coincidence that the current President of the UKSC, Lord Reid, is Scottish. Scotland's most senior judge is (currently Lord Carloway) the Lord President and Lord Justice General (head of all civil and criminal courts in Scotland). He presides directly participating in sittings of the First Division of the Inner House of the Court of Session in Edinburgh.
[261] First instance judges of the Court of Session are titled as a Lord Ordinary

case. Making such an order against the loser is standard practice. Thirdly, what the reader of the law reports can never know is what the clients' lawyers gave as advice, because it is forbidden to lawyers to allow legal advice to pass into the public domain. It follows that clients may, and in my experience for a variety of reasons[262] often do, choose to press cases where their lawyers have told them they are likely to lose.

5.2 Shared general approach to appeal from administrative decisions: Scotland, and England and Wales

The courts in Scotland and in England and Wales usually refuse to review the merits of an administrative decision and instead confine themselves to complaints of a very basic and serious nature. Generally this is limited to interventions where the wrong law was applied or there has been serious procedural irregularity. Serious procedural irregularity includes matters such as bias, or where there has been such irrationality by the decision-maker that it could be described as unsupported by any evidence whatsoever. It is not enough by way of challenge to suggest the decision was just wrong. This description of irrationality is known in Scotland and separately in the English/Welsh jurisdiction, and is applied in each. Matters were conveniently summarised in respect of both jurisdictions by (Scottish) Lord Drummond Young in a wind farm case *Douglas v Perth*[263] (paragraph 22):

> "interference by the courts in …a decision is only justified when the authority acts outside a well recognised set of legal norms, which are stated by Lord Greene MR in *Wednesbury* (p 228). In Scotland, an equivalent statement is found in the opinion of Lord President Emslie in *Wordie Property Co Ltd v Secretary of State for Scotland* (pp 347, 348): the court may interfere with the decision if it discloses a material error of law going to the root of the question for determination, or if irrelevant considerations are taken into account, or if relevant considerations are not taken into account, or if there is no proper factual basis to support the decision, or if the decision is so unreasonable that no reasonable planning authority could have reached it. These grounds of review are flexible, and may shade into one another, but they recognise the fundamental principle that the planning decision has been entrusted by Parliament to a particular authority, whether a local planning authority or Scottish Ministers."

The identical test is also applied in both Scottish and English/Welsh jurisdictions where there are challenges brought against decisions that were grounded on European directives and their implementing legislation. The above test is taken as satisfying and being equivalent to the description of "manifest error of assessment", which is the European standard for that purpose.[264] For present purposes, I shall refer to these limited grounds of complaint as the "narrow" test or basis because they do not in addition permit wider challenge based on a complaint that the decision was simply wrong. My interest is both in the general doctrines, and in how consistently they are applied to wind farm cases.

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[262] Test cases, for example, where many other situations may be affected; negligence cases where the insurer may be responsible for costs and may be interested in the effect of the case on a wider market; cases where personal principles are invoked; or where parties are hoping that the litigation will promoted the desire in the opposing party to settle the case amicably rather than run the costs risks.

[263] *Douglas v Perth and Kinross Council*, Court of Session (Inner House, Extra Division) Judgment Date 4 May 2017 [2017] CSIH 28.

[264] As established by this case: see Lord Drummond Young at paragraph 23, and by *RSPB v Scottish Ministers*: Lord Carloway (at paragraph 203).

5.3 Challenges in the Court of Session in Scotland

Scotland in recent years has reported wind farm cases at the level of appeal to the main high court, the Court of Session, with several at the second (higher) appeal level within that system. Of the cases chosen for particular comment here, four are second-level appeals to the Inner House: one was in 2015 and three in 2017. The 2015 case went on further (third) appeal to the UK Supreme Court. There are also chosen illustrative first instance appeal cases in the Court of Session: in 2017, 2018, and 2020. A separate system operates for the Scottish Land Court, which is a specialised court dealing with agricultural cases and crofting[265] disputes. For present purposes its decisions connected with wind farms are ignored partly because of the dire complexities of the crofting legislation and the fact that in many instances that court is the primary decision-maker not acting as an appeals review[266]. Where the Scottish Land Court supervises administrative activities within the crofting codes, it must in any case follow the rules and precedents set by the Court of Session[267].

5.4 Staged decision-making and commercial interpretations of the law supported: the *Trump* case

The *Trump*[268] case illustrates the desire of the courts to support the structure of decision-making, and to permit political decisions to be processed efficiently as far as possible. In this case, the object of discussion was an Aberdeen offshore wind farm getting consent[269] to build and operate an electricity generating station by way of extension to existing operations. The project was supported both by an injection of EU cash and by strong political policy backing for wind energy growth in Scotland. Approximately 3.5 miles from the proposed extension lay the Trump International Golf Club Scotland Ltd site, whose owners feature as the dissatisfied petitioners in the appeals. The report of the Marine Scotland Licensing Operations Team of March 2013, recommended that the application for consent be granted and that there was no need to hold a public inquiry. On the following day the Scottish Ministers did issue a decision in exactly the recommended terms, and attached conditions requiring that various related technical matters were to be agreed or the subject of an approved construction methods statement before the consent could be implemented. These included submission for approval of a detailed Design Statement. In the way in which the appeals were disposed of by the courts, we see a high level of support (a) for efficient construction of legislation and (b) for non-interference with the critical technical recommendations or with their speedy adoption by the relevant Scottish Minister.

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[265] Very small tenanted farms for the most part in specific remote areas of the Highlands and Islands and governed by their own complex land codes.

[266] For example *Viking Energy Wind Farm LLP v Crofters having rights in the Common Grazings of the Townships of Sandwick, Sweening & Laxo and Other Common Grazings*, Case reference SLC/05/20 Scottish Land Court, granting permission to proceed on crofting land, implementing section 19A(2) of the Crofters (Scotland) Act 1993.

[267] As confirmed by the Inner House in Crofters of *Sandwickhill North Street v Crofting Commission* (2020) CSIH 49 19 Aug 2020.

[268] *Trump International Golf Club Scotland Ltd v Scottish Ministers*, Court of Session (Inner House, First Division) [2015] CSIH 46; *Trump International Golf Club Scotland Limited and another (Appellants) v The Scottish Ministers (Respondents) (Scotland)* [2015] UKSC 74 (Lords Neuberger, Mance, Reed, Carnwath, Hodge).

[269] Under section 36 of the Electricity Act 1989.

The first challenge was whether the wind farm operator fell into the category of persons capable of making an application at all. The Inner House had no difficulty in rejecting this challenge, taking the line that applicants for permission were not restricted to those falling within limited predetermined categories. There was also, secondly, an attack on the footing that the conditions attached to the consent were void for their uncertain content. That latter was rejected by the same court because the conditions were described as "pre-conditions" sufficiently clear as to their parameters. The court dealt with matters on the basis of construing (interpreting) the legislation and the consent. I observe that these two challenges were resolved in ways that supported the statutory break-down of major electricity projects into stages where the principle of consent is qualified by subsequently-obtained detailed agreement on technical matters. The structure of consents and preconditions is one familiar from across the planning system for permitting development. Acceptance of the petitioners' arguments on the second challenge would, in my view, have opened up widespread chaos within the consents for development system. This is because it is commonly the case that, under various forms of legislation, an overall permission will require many things to be the subject of detailed subsequent approval. For example, consent to build a factory might be granted on condition that before works begin there should be an approved scheme of landscaping agreed with the local authority. Obviously, if this kind of staged condition procedure were to fail under attack, developers would have to spend the money required for the detailed areas without knowing whether overall permission would fail or be granted in principle. The costs of applying for larger projects can run into millions of pounds sterling, even for preliminary reports and outline consents. Normally the subsequent detailed schemes are only commissioned if the general consent is already granted. In this way we see played out the desire of the courts not to frustrate the effectiveness of structures that deliver decisions where enough technical material has been considered for the decision in principle to be granted, but where many appendant matters still have to be scoped and agreed.

Where Scottish cases are appealed to the UK Supreme Court (a court shared by both Scotland and England/ Wales as the final appeals court), general reasoning on parallel legislation sends a clear signal to English and Welsh lawyers as to how the English/Welsh version of the legislation is likely to be interpreted. It was well-known at the time (2015) that England was also in the midst of an expansion of offshore wind energy. Energy was not a devolved matter[270] in Scottish-English constitutional structures, but it was controlled via devolved planning decisions and done in accordance with the Scottish government's own energy policies. The legal guidance given would, however, likely be applied by the Supreme Court in the event that the same issues arose under the English equivalent legislative and administrative structures. The Trump case in the UK Supreme Court is an example of how that process works. The challenged consent had been granted following an application under s.36 of the Electricity Act 1989 to construct and operate an electricity station. There was no challenge in the Trump case to the rejection by the Inner House of the allegations of bias.[271] The two specific grounds of technical interpretational challenge discussed in the further appeal were unanimously rejected. The lead judgment is that of Lord Hodge, replicating in large part the reasons given by Lord Gill in the Inner House. The Supreme Court judges took the opportunity[272] to reinforce the idea that construing permissions under the planning or related regimes was an exercise where the ordinary principles of interpreting commercial documents should be deployed. Simple literal readings that resulted in anomalies were not to be encour-

[270] Ie fully under Scottish control not that of Westminster.
[271] See Chapter 5.5.
[272] Especially Lord Carnwath, as subsequently directly applied by Lady Dorrian, the Lord Justice Clerk, in *Community Windpower*, paragraph 33.

aged. The ensuing Press summary[273], whilst not authoritative in terms of the case itself, succinctly extrapolates from Lord Hodge's judgment[274] a striking point. "Parliament did not create a regulatory gap by allowing persons who are not subject to environmental duties under para 3(1) of Schedule 9 to apply for construction consents under s.36." The courts were not willing to allow a reading of the legislation that permitted applicants to by-pass environmental compliance and duties. Whilst this purposive outcome might seem obvious to lawyers in some jurisdictions, there is a long contrary history in the UK of literalism in the reading of legislation, the older line being that what Parliament says is what it is presumed to have ordered. The same press source restates the duty of the Scottish government in these terms: "The Scottish Ministers have a duty when considering a s.36 application to have regard to environmental matters, and wide powers to impose conditions to protect the environment." Thus far the case demonstrates support for the practicalities of the status quo in supporting staged development consents and in underlining the applicability of general environmental duties on all involved. Reading the complex and fragmented scheme of the legislation itself, it is not surprising that appeals to both the Inner House and the UK Supreme Court actually occurred. Lords Gill, Hodge, Neuberger and Carnwath were all judges with planning and property backgrounds, which may well have predisposed them to fortify the coherence of the legislation as far as they could.

5.5 Adherence to political policy not automatically bias

The third reported point of challenge of the Trump company in the Scottish courts is unusual and especially interesting. It went no further than the Inner House, where Lord Gill, the then Lord President, disposed of it. It represents a procedural challenge alleging impropriety of process due to bias. If proved, that is a very serious flaw in any decision and would have resulted in the consent being set aside and the process recommenced from the beginning. The allegations were built on the following facts. Apparently in the year prior to the grant of the permission, the Scottish First Minister, Mr Alex Salmond, had expressed certain views energetically supportive of the wind farm being built.[275] The actual decision was made later administratively by the Scottish Minister for Energy, Enterprise and Tourism based on the technical report. The court, when the matter was challenged in the Inner House, did not think the observations of the First Minister could be interpreted as a "considered statement" of intentions as such. A variety of individual actions[276] were complained of by the Trump company as amounting to evidence of bias. These were rejected as unsuspicious, the list cumulatively being said to be no more suspicious than its individual innocent contents. As to the policy of the Scottish government and its relationship to the consent applied for, Lord Gill commented: "The case for the petitioners fails, in my view, to distinguish between a predis-

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[273] United Kingdom Supreme Court Press Summary 0160 (2015) *Trump International Golf Club Scotland Limited and another (Appellants) v The Scottish Ministers (Respondents) (Scotland)* [2015] 16 December 2015.

[274] Lord Hodge para 17.

[275] "The petitioners' case on this point is based on an account by the American writer of a travel golf blog of an incident in August 2012. The mise en scène was a hospitality tent at the Scottish Open at Castle Stuart Golf Links in which the First Minister and other guests were having, according to this account, 'an amazing lunch'. The writer reports that his American colleague asked the First Minister whether the wind farm would ever be built, to which the First Minister replied 'Absolutely', and remarked that he would not have his energy policy 'dictated by Mr Trump'. All of this occurred on a social occasion no doubt dedicated to the appreciation of golf." (Lord President Gill) I comment that we can probably infer that the amazing lunch in question was likely to have an alcoholic component and that this out-of-office occasion was unlikely to have been taken by anyone as an event suitable for policy implementation.

[276] Not meeting with the Trump company, not personally visiting the site, granting the permission so quickly, not causing similar delays to those experienced by the Trump organisation when they tried to get the original planning permission for their golf course. (I comment that the suggestion of the Trump company that litigants must have an equally attritional reception is probably novel.)

position to favour a proposal and a predetermination to decide in favour of it, come what may." The technical reports on which specific decisions are founded are only available when an actual application is made. The general policy background is only a problem if it forms an actual decision to ignore the technical report when it runs contrary to the policy. In short, the court accepted the normality of government policy being a legitimate part of the overall predisposition of the Ministerial thinking. It was not a bar to a proper decision and not in itself evidence of bias. Had the decision of the court been otherwise, almost every policy of government would be open to attack when implementation of specific projects was applied for, it seems to me.

5.6 Three failed challenges at second level appeal in Scotland 2017

Three wind farm decisions in 2017 in the Inner House further illustrate a general disinclination to disturb the conclusions of the lowest level of the decision-making or enforcement hierarchy. The reported complaints reveal the application of the narrow test for intervention, compounded by an evident unwillingness to construe documentation in a strict or narrow fashion so as to enable appeal. *Community Windpower*, and *Douglas v Perth* are cases about onshore wind farms; the *RSPB v Scottish Ministers* case relates to an offshore installation.

5.6.1 Enforcement of conditions not interfered with*: Community Windpower*

In *Community Windpower*[277], planning permission had been granted for an onshore wind farm but the permission was subject to forty-seven conditions. One of them was not satisfied[278] and so the local authority ordered the wind farm developers to stop their drilling installing turbines. The court rejected challenges to the stop order based on its alleged uncertainty, on the footing that (1) closely related documentation could be taken into account as part of the general background and (2) the meaning of the stop notice in itself was clear. The relationship between the enforcement body and the courts was described by Lady Dorrian, the Lord Justice Clerk[279], in the following terms:

> "It is a matter of planning judgment for the authority to determine whether special reasons exist to justify immediate effect. It is not for this court to reach a decision on that matter: the point for the court is to ascertain whether the reasons advanced are legitimately capable of seeming to the authority to be special reasons.."

In other words the question is not whether the authority had made the right decision. The question was whether they seemed to have anything available to support the conclusion they reached. This is a very different matter because (1) the answer reached might well be wrong but still apparently supported by some apparent reason and (2) an apparent reason is enough, as distinct from a sufficient fully investigated real reason. This amounts to the courts deliberately closing off avenues into investigating the underlying correctness of the administrative decision. It could be argued that this attitude of non-interference allows wrong decisions to stand, and that the courts system should not close down appeals from wrong decisions. At one level, that makes sense. However, the nature of litigation in an adversarial system is

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[277] *Community Windpower Limited v East Ayrshire Council*, Inner House (Second Division) Lord Justice Clerk (Lady Dorrian), Lord Drummond Young and Lord Malcolm: 9 November 2017 [2017] CSIH 67.
[278] Regarding mitigation measures to protect water supplies.
[279] The title of Scotland's second most senior judge.

such that arguments over the balance of a decision's internal correctness would bring potentially all economic activity to a halt. At any rate in the UK, courts in general have shown no appetite for substituting their own judgments for that of an administrative body, for so long as it could be seen that the body in question had asked itself the right question, applied the correct legal test and had some apparent rationality (the strength of which is irrelevant*).* The point is that enforcement and technical decisions remain at the level closest to the practicalities of the actual problem, and are made more quickly and also quite likely by those who will have had long experience of the particular problem or case. We can see in this report, for instance, that the local authority had stepped in to protect the promise of a water supply made to local residents. The protestations and complaints of the wind developers that the matter could wait whilst they carried on with their development carried no weight with the local authority enforcers. The matter would potentially have stirred local political resentments had the developers continued unhindered. This is exactly the kind of local involvement that courts seek to avoid in order to maintain an appearance of neutrality.

5.6.2 Theoretical explanations for extensions to EU-based legislation of narrow intervention grounds*: Douglas v Perth*

In *Douglas v Perth*[280] the challenge was to the grant of permissions to build seven onshore wind turbines. The complaint of the appellants based on wildlife concerns was dismissed. It was unsuccessfully argued that (a) the wild life protection (deriving from an EU base) had to be investigated before permissions were granted, and (b) the administrative decision could be attacked on the grounds that it was wrong. Lord Drummond Young delivered the unanimous decision of the court and begins by recording the environmental protection surveys and measures that had already been taken and were continuing in the form of conditions built into the grants of permission. Unsurprisingly, the effort to establish a largely theoretical procedural "harm" failed because the *actual* procedures in effect dealt with possible harm to the protected animals. The more interesting challenge for my purposes is the attempt to get the court to examine the underlying correctness of the decision that had been made. It was claimed that "inadequate reasons" had been given. This represented a full frontal attack on an established understanding that review would be limited to the grounds I have identified above. The only reason the challenge was arguable was presumably on the basis that there was no cited Scottish decision directly establishing that calls for judicial review of administrative decisions under EU-derived legislation be treated in the same hostile way on appeal as domestically-derived legislation[281]. The English Court of Appeal had already decided that the narrow basis of review should apply to EU matters.[282] Additionally, a Scottish appeal to the UK Supreme Court in 2015 had proceeded on the clear footing that consideration of EU directives in course of a Scottish planning appeal be dealt with on the narrow basis.[283] The Inner House re-stated at some length the restricted basis for intervention and announced that that basis also applied to EU-derived legislation (in this case a directive) as well. The explanation was tied to the discretions available to local authorities, and to the general proposition that otherwise the court "would be compelled to make a technical decision in an area where it lacks expertise." The point about the discretions seems to me a good one because there is

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[280] *Douglas v Perth and Kinross Council*, Court of Session (Inner House, Extra Division) Judgment Date 4 May 2017 [2017] CSIH 28.

[281] The *RSPB v Scottish Ministers* case decided on 16 May 2017 followed publication of the decision in this case on 4 May 2017. In *RSPB v Scottish Ministers*, Lord Carloway separately justified the assimilation of the EU manifest error test to the domestic Scots law test in applying it to the actual appeal before him: see below.

[282] *Smyth v Secretary of State for Communities and Local Government* (2015) EWCA Civ 174.

[283] *Sustainable Shetland v Scottish Ministers* Supreme Court (Scotland) [2015] UKSC 4 9 Feb 2015.

an unavoidable political element in all planning policies that the courts should likely stay away from as a matter of routine. It is less immediately obvious why the second reason should prevent court review because there are many cases determined by courts on the basis of expert evidence. However, there is a simple consistency in the courts' refusal to become involved in general. The well-established limits on appeals from implementation of domestic-based legislation had hitherto been taken as universal. If EU-based legislation were to be fully reviewable in appeals from an administrative decision, the divide between the two review systems would likely, in my view, become chaotic. That is because it would be necessary to decide whether every specific component of national legislation was fully or only partially derived from an EU base. Where responsibilities derive from non-EU treaties but mirror and include EU duties, the separation would perhaps be impossible to make, or at the very least be unpredictable. The limited judicial review policy of the courts has the effect of establishing it only as a remedy for extremes, where something very serious indeed has gone wrong with the administrative decision made.

5.6.3 Justifying and applying the narrow base for intervention: *RSPB v Scottish Ministers*

The *RSPB v Scottish Ministers*[284] case is an actual application of the Inner House's power to overturn the decision of a single judge in the Outer House, the Lord Ordinary, in circumstances where the narrow test had been disregarded. This reinstated the primary administrative decision. The Lord Ordinary (here the unfortunate Lord Stewart) in the first appeal had overturned a decision of the Scottish Ministers allowing four wind farm developments in the North Sea. The Ministers had based their decision on certain findings as to the environmental impact on birds. That decision had been made by the Ministers after lengthy discussions and exchanges of scientific evidence with the Royal Society for the Protection of Birds. The RSPB seem to have jettisoned quite late a common scientific approach of their own that had been accepted by the Ministers as useful, and which the Ministers ultimately retained in their decision. At the final stage, however, the RSPB relied on an academic article as being the correct basis and not what they had previously maintained. The Lord Ordinary had been persuaded by the RSPB (wrongly, as the higher court made abundantly clear) that the EU-based legislation was to be applied independent of its Scottish implementing measures. He then, instead of confining himself to checking whether there had been an irrationality of the kind that the narrow basis of judicial review permitted, set about investigating whether the decision made by the Ministers had been substantively correct. The negative response of the Inner House is entirely consistent with a desire to preserve efficiency in the courts system and to keep the judges out of the political arena, which is where decisions of the Ministers about wind farm construction are made. The Inner House reinstated the Ministers' decision permitting construction of the wind farms. Lord Carloway, Scotland's most senior judge, made two strong points[285], each of which conveys the reality of what happens when the narrow basis of intervention is abandoned. First, there is the exampled waste of time and misdirected effort:

> "The Lord Ordinary clearly spent an extraordinary amount of time and effort analysing the scientific methodology. He must have spent weeks, if not months, trying to get to grips with the morass of scientific material, including

[284] *Royal Society for the Protection of Birds v Scottish Ministers*, Court of Session (Inner House, First Division) [2017] CSIH 31 2017 S.C. 552 Leave to appeal further was refused by the UK Supreme Court United Kingdom Supreme Court Permission to appeal decisions (7 November 2017) UKSC 2017/0143 *The Royal Society for the Protection of Birds (RSPB) (Appellant) v The Scottish Ministers and others (Respondents) (Scotland).*
[285] Paragraphs 206-7.

> data and journal articles. He did this, having expressly acknowledged the limits of judicial review. The rationale behind his thinking must have been his expression of what he regarded as a legal test; that being whether the AA's[286] conclusions were capable of removing all reasonable doubt. Yet the existence, or otherwise, of a reasonable doubt is primarily a matter of fact for the decision-maker (and not a judicial reviewer) to determine."

Secondly, there is the encroachment on the primary political context chosen by Parliament for the decision:

> "The decision is one made by the respondents, who operate in a political context, albeit constrained by the environmental regulatory regime. Despite paying lip service to the correct legal test for judicial review, the Lord Ordinary has strayed well beyond the limits of testing the legality of the process and has turned himself into the decision-maker following what appears to have been treated as an appeal against the respondents' decisions on the facts. He has acted…as a finder of fact on matters of scientific fact and methodology which…are not within the proper province of a court of review. For this reason alone, his decision on this ground cannot be sustained."

In short, even if the Ministers' decision is not one the court itself would make, it is not the business of the courts to correct it. Their task is summarised as "testing the legality of the process."[287]

5.7 Specimen challenges at first level appeal in Scotland

Two of these are essentially simple instances of the Court of Session closing down challenge. The court will check that proper procedures have been followed, that material information has been taken account of and that clear reasons on all main matters have been given. That test was stated to have been passed by the Ministers in granting onshore wind farm development planning consents in *Wildland Ltd and the Welbeck Estates v Scottish Ministers*[288]. The case also illustrates the fact that the court will not intervene to implement stronger environmental protections at the date of the appeal as against those in force when the original decision was made.[289] In *William Grant & Sons Distillers Limited*[290], the court comprehensively rejected the attempts of the distillers to prevent the completion of a wind farm project near Dufftown, close to their visitor centre. The distillery is described as the "implacable foe" of the development, and there had been previous litigation in 2012 attempting to overturn the original grant in 2011 of the permissions required. In the event, the Ministers had imposed a five year time limit for the development to be commenced before the permissions expired. The distillery claimed the development had not been commenced in time. The judge disagreed, referencing essential access roads outside the area directly covered by the wind farm consent. Ironically the distillery itself failed to make its complaint

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[286] AA means "appropriate assessment": see Lord Carloway at paragraph 4.
[287] A line also consistently taken in *Loch Hill Wind Farm (Scotland) Limited v Scottish Ministers* [2015] CSIH 37, Inner House and in *Glenmorie Wind Farm Ltd v Scottish Ministers* Court of Session (Outer House) [2016] CSOH 34 1 Mar 2016.
[288] *Wildland Ltd and the Welbeck Estates v Scottish Ministers*, Outer House, Court of Session [2017] CSOH 113, Lord Boyd of Duncansby.
[289] Lord Boyd at paragraph 41.
[290] *William Grant & Sons Distillers Limited v For Judicial Review of a decision by the Moray Council dated 6 March 2017*, Outer House, Court of Session [2018] CSOH 27, Lord Woolman.

within the prescribed period allowed for it to be made. The court implemented the time bar strictly, no good explanation for the delay being offered, and the wind farm developers by that time having spent over 100 million pounds sterling. The challenge process was rejected as not even validly made ie because it was too late. Here is revealed another background concern of the courts that unless a decision is challenged speedily, commercial parties will have relied on it. The third case, *Energiekontor UK Ltd v Advocate General for Scotland*[291], concerns the validity and application of a policy of the Ministry of Defence in operating its noise budget in the area of a sensitive military listening post[292]. The administrative policy was not defended by the Ministry against a charge of complete irrationality. Their position was affected by admissions of actionable unequal treatment, secret policies, and failure to keep essential records of reasons for individual decisions. The Ministry had from the beginning of the challenge to the decisions it made, therefore, decided not to defend its original policy because that policy was bad. The litigation arose because rival wind farm developers were each anxious to secure part of the noise budget in question. If the policy was bad, could a decision made under it be left to stand? It is evident the court had little choice but to formally strike down the entire noise budget policy from its beginning, together with the specific decision based on it. It did so in "the interests of good public administration in rectifying the practical consequences of the operation of an irrational policy."[293] Together these three cases evidence intervention against administrative decisions only where there is a serious failure in the process of public administration.

5.8 The position in England

As we have seen, the English and Welsh position coheres to that in Scotland. In the absence of a failure of process, administrative decisions whether positive in granting consent or negative in refusing it[294] will not be reversed. Wind farm decisions are like any other in that the administrative decision has to address itself to the correct legal questions and also has to be expressed in sufficiently clear terms.[295] Clear expression of reasons for an outcome should reveal errors of understanding as to what issues must legally be addressed, if there has been such an error. In relation to two large offshore wind farms, Boreas and Vanguard, off Norfolk, the stated reasons revealed that the cumulative impact of having both schemes had not been evaluated when it should have been. This led to the judge overturning the consent granted because it was irrational.[296]

5.9 The position in Northern Ireland

The position appears to be similar to the other two jurisdictions. By way of illustration, in 2018 challenges to the refusal of permissions for large scale wind energy installations onshore were unsuccessful. The attack took the familiar form of asserting a failure of process

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[291] *Energiekontor UK Ltd v Advocate General for Scotland*, 2020 WL 07865899 (2020) Lord Tyre, Outer House.
[292] Something described as "the Array" which allegedly listened for incoming nuclear missiles.
[293] Lord Tyre at paragraph 38.
[294] *Ecotricity Ltd v Secretary of State for Communities and Local Government* [2015] EWHC 801 (Admin), and see also to the same effect *R.(ON THE APPLICATION OF MYNNYD Y GWYNT LTD) v SECRETARY OF STATE FOR BUSINESS ENERGY AND INDUSTRIAL STRATEGY* [2018] EWCA Civ 231.
[295] For an exceptionally detailed investigation of these two points, see *R on the application of John Mars Jones (on his own behalf and on behalf of the Pylon the Pressure Group v The Secretary of State for Business, Energy and Industrial Strategy v SP Manweb PLC, Conwy County Borough Council, Denbighshire County Council*, [2017] EWHC 1111 (Admin) Lewis J.
[296] *Raymond Stephen Pearce v Secretary of State for Business Energy and Industrial Strategy v Norfolk Vanguard Limited* [2021] EWHC 326 (Admin), Holgate J.

in that the policy questions had been misinterpreted or the reasons were not coherently and properly stated.[297]

5.10 Evaluation of robustness of UK regulatory decision-making

A simple statistical survey of administrative decisions successfully challenged has not been attempted for the present purposes. One reason is that the reversal rate is not separately collected so as to be reflected in statistics. Neither are law databases designed for statistical collection of information. The purpose of the law reports system is to record decisions that exemplify or clarify correct legal principle. There will be many cases that never reach the courts for every one that does. The principles enable lawyers to evaluate the chances of individual decisions being successfully overturned, and the opposing lawyers will engage with the same process. It is that evaluation that determines the courses of action chosen by those affected by decision-makers. Sometimes the response will be legal challenge, but frequently it will be political challenge.

The support offered by the courts to the functioning of the administrative systems may take various forms. One, as is seen in the *Trump* case, is the interpretation of legislation in such a way as to produce workable frameworks for the decision-maker and the litigants. In *Trump* the two issues raised on the highest appeal gave the Supreme Court the opportunity to create and record support for staged permissions systems, harmonic functioning of different bodies of legislation, wider groups of applicants, and coherent imposition of environmental duties. Another form of support relates to an unwillingness to allow court process to circumvent a properly-run administrative decision process.

The control by the courts of intervention powers over administrative decisions is an important part of their work. It can be seen that there is common doctrine and approach across the two main jurisdictions, together comprising the overwhelming bulk of the land mass and population. That they should share such a common view is perhaps surprising: Scotland has a Roman-Dutch based jurisprudence; England and Wales operate a common law system, such as that of the United States or many of the Commonwealth countries. The UK does not have a written constitution, and the socially interventionist jurisprudence of the US Supreme Court is diametrically opposed to the deep instincts of UK courts to stay out of the political arena if they can. This is clearly shown in the study, especially in *Douglas v Perth* and *RSPB v Scottish Ministers*. If we consider the grounds for intervention in the two principal UK jurisdictions that have been established by their appellate courts, it is easy to see that the protections guaranteed by the courts relate to basic process and nothing beyond. Specifically, decisions will not be overturned if there has been proper process and at least the appearance of a decision being reached rationally, as stated in *Community Windpower*. The guidelines for intervention are narrow enough (provided there has been sound process) to render unarguable all forms of challenge that amount to disagreeing with the internal balance of the reasoning or with the findings of fact. This narrow basis for intervention is accordingly deterrent. It is unusual to find reported cases of successful intervention precisely because achieving the requisite standard of bad process or irrationality is hopefully rare. The kind of irrationality affecting the *Energiekontor UK Ltd* case was not defended by the Ministry, and

[297] *IN THE MATTER OF AN APPLICATION BY RES UK AND IRELAND LIMITED FOR JUDICIAL REVIEW AND IN THE MATTER OF DECISIONS OF THE PLANNING APPEALS COMMISSION DATED 26 JUNE 2017* (REFERENCES 2015/A012, 2015/A0168 and 2015/A0169) [2018] NIQB 16, Keegan J (Northern Ireland).

the argument in the report related largely as to how withdrawing the policy (but perhaps not on a backdated basis) might affect the litigants themselves. It is also noteworthy that the narrow basis for intervention has been applied to EU-based legislation as well as other types. This renders the narrow basis for intervention standard for all types of decisions regardless of underlying content.

What becomes clearly visible through the above study is a general reluctance on the part of the courts to supervise process so as to rerun political choices. That reluctance is shown to be embedded in the case law of the higher courts and will be followed by all the courts below. Some of the first level courts (for example the Scottish Land Court) exercise supervisory jurisdiction over entire specialist legislative codes where there are frequent administrative decisions. In turn this means that factual findings and factual applications of legal issues are firmly rooted at the administrative level where a decision falls to be made there. Decisions as to how to apply environmental policy, as to how factors should be assessed or evaluated and what the balance of competing factors should reflect, what conditions should apply, what kind of evidence needs to be used, how strong the evidence is, what timescales are to be adopted, what further consultations should be undertaken and what the final outcome should be- all of these are considerations that become effectively locked into the administrative layer of process. The importance of concerns identified by the interviewed speakers in Chapter 4 has to be viewed in terms of the administrative process because it is there that all aspects of practicality are determined. Decisions at the administrative layer are the ones that matter: they are extremely robust.

It follows logically that where legislative frameworks are wide enough for factors to be included that are normally overlooked (for example aesthetic matters normally excluded or new ways of conceptualising wind farm impact), what matters for changed perception is an evidence-based changed perception at the lowest administrative level. Change or enhanced understanding depends on quality of evidence and on the abilities of the administrative decision-makers to understand it, and their willingness to apply it.

Group 2 Illustrations listed

NASA photos of North Sea offshore wind farms oli (Operational Land Imager) images as follows:

Fig. 2.1: thames_oli_2013118 London Array

Fig. 2.2: thanet_oli_2015181

Fig. 2.3: londonarray_oli_2015181

Fig. 2.4: gabbard_oli_2015181

Fig. 2.5: northsea_oli_2020085_windfarm

Fig. 2.6: Thames Estuary and Wind Farms from Space NASA with annotations (2013)

Fig. 2.7: London Array and Gabbard (30 June 2015) by NASA, annotated

Fig. 2.8: Turbines East of Aldeburgh Suffolk, UK (September 2021) NASA

Credits for annotations to Fig. 2.6 and Fig. 2.7 are stated in Copyrights section below.

Fig. 2.1: thames_oli_2013118 London Array

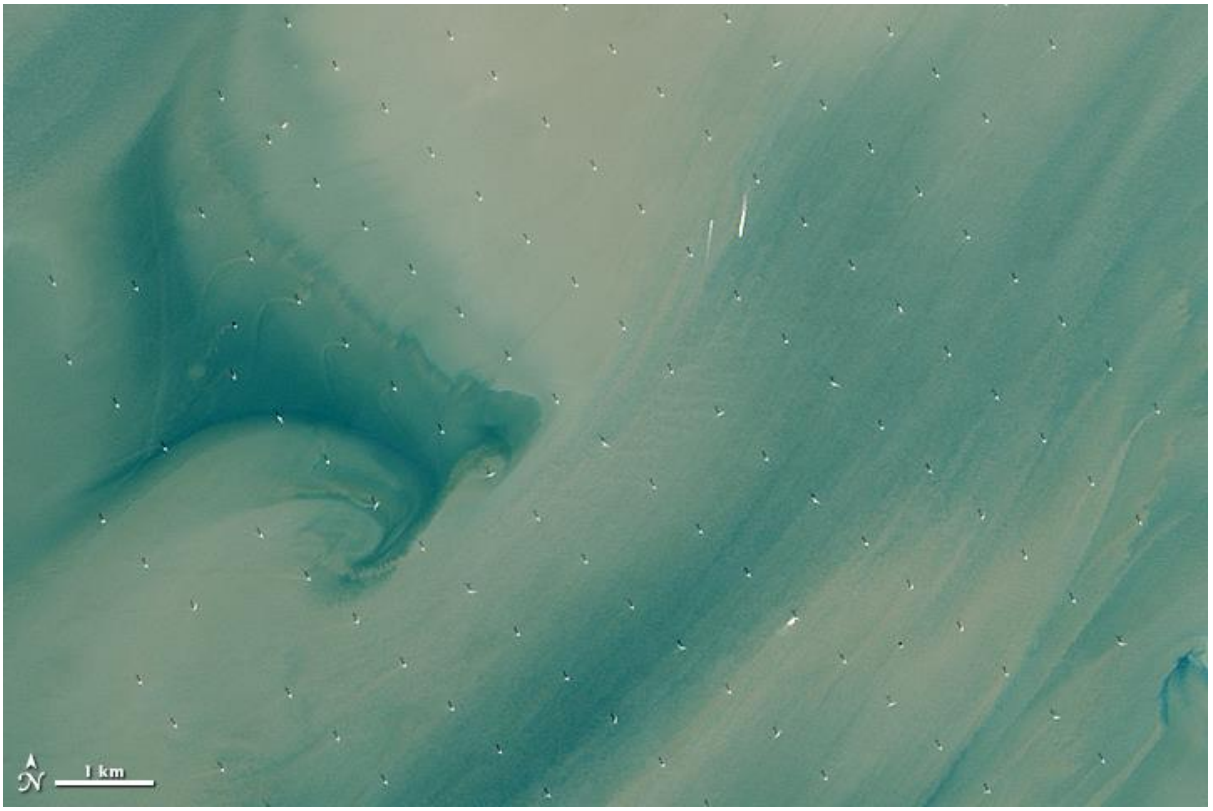

Fig. 2.1: thames_oli_2013118 London Array (NASA licensed use)
This was from the set of 2013 images that first showed the sea plumes. The North West corner shows them clearly.

Fig. 2.2: thanet_oli_2015181

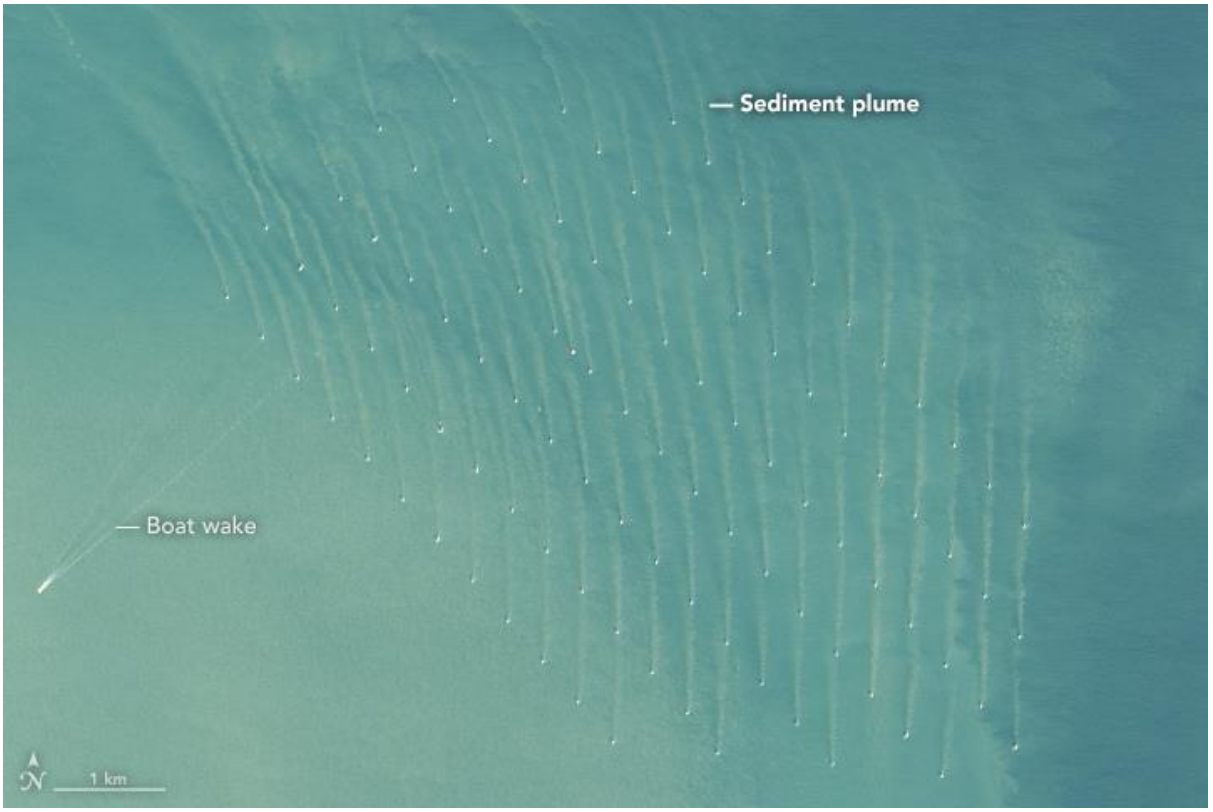

Fig. 2.2: thanet_oli_2015181 (NASA licensed use)
Thanet wind farm in 2015. By now NASA is labelling the sea plumes, which are strongly shown as deep incisions in the tidal push heading North. Contrast the shallow boat wake.

Fig. 2.3: londonarray_oli_2015181

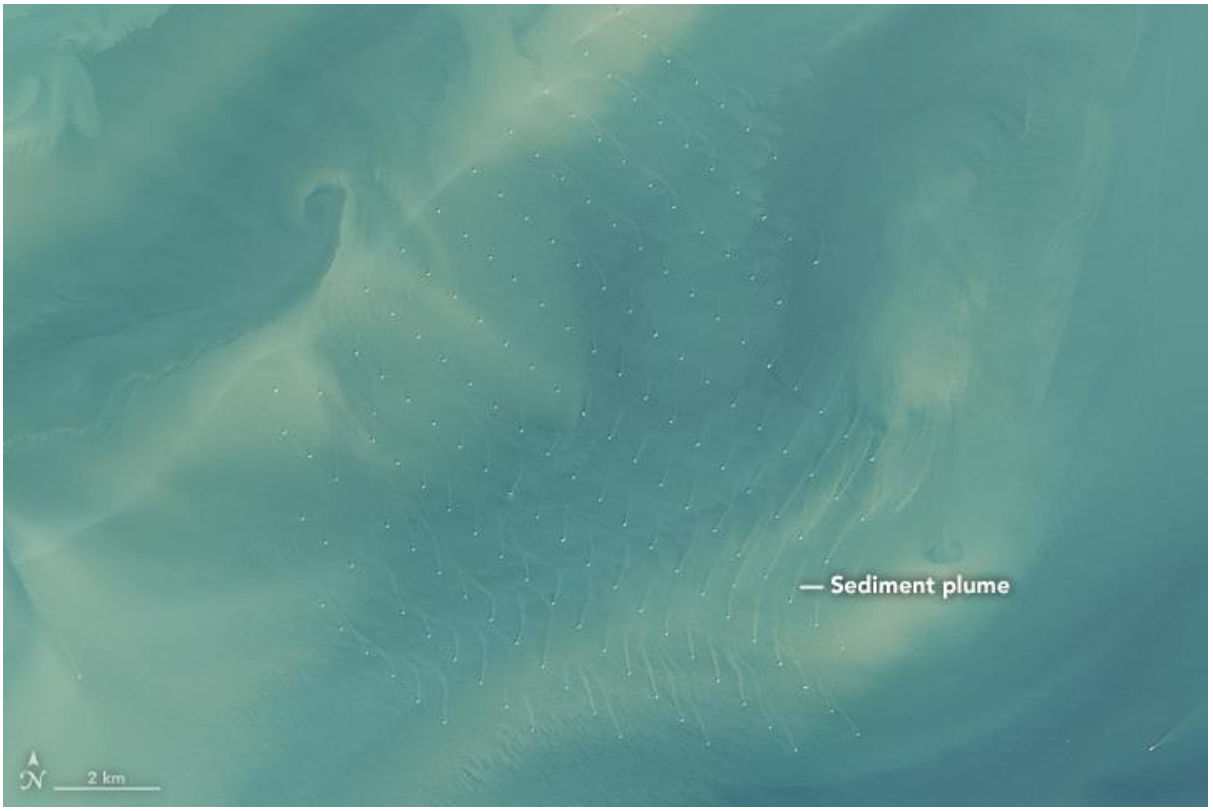

Fig. 2.3: londonarray_oli_2015181 (NASA licensed use)
London Array in 2015 with 175 turbines of 3.6 MW each. It covers 47 square miles.

Fig. 2.4: gabbard_oli_2015181

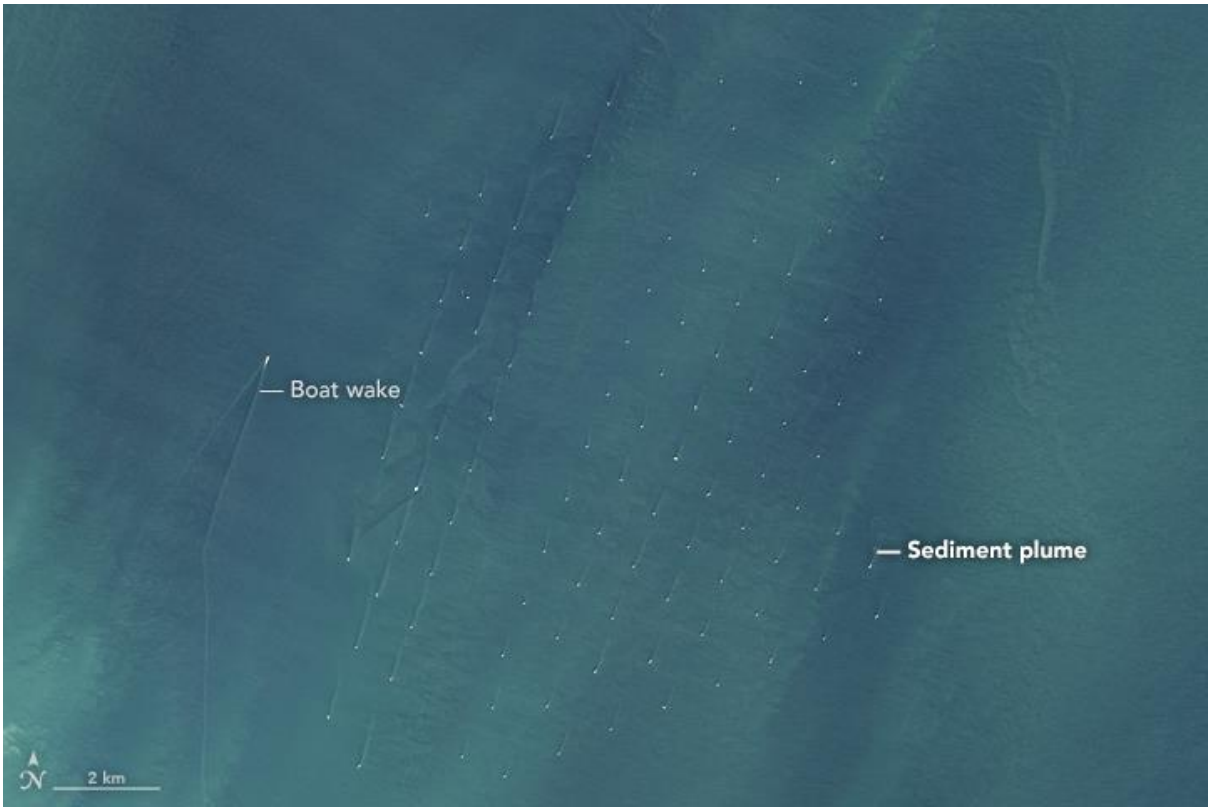

Fig. 2.4: gabbard_oli_2015181 (NASA licensed use)
Gabbard wind farm 2015.Compare positioning on Fig. 2.6. The image shows sediment plumes joining together in the tide as it heads North. But there seem to be lines visible in the sandy bottom indicating earlier East to West movement in this location. Note the scale of the image (2 km as marked by the bar bottom left).

Fig. 2.5: northsea_oli_2020085_windfarm

Fig. 2.5: northsea_oli_2020085_windfarm (NASA licensed use)
Unidentified North Sea wind farm on 25 March 2020. Note the geometric patterning and the scale (bottom left shows a 1 km bar).Sea plumes are evident.

Fig. 2.6: Thames Estuary and Wind Farms from Space NASA with annotations (2013)

Fig. 2.6: Thames Estuary and Wind Farms from Space NASA with annotations (2013) (NASA licensed image use with annotations by Delusion 23).
Note the sandy flats all along the coast. The London Array stands at the 12 miles territorial boundary. Kentish Flats wind farm is later extended (2015). Compare Fig. 1.1 for fort locations and boundaries.

Fig. 2.7: London Array and Gabbard (30 June 2015) by NASA, annotated

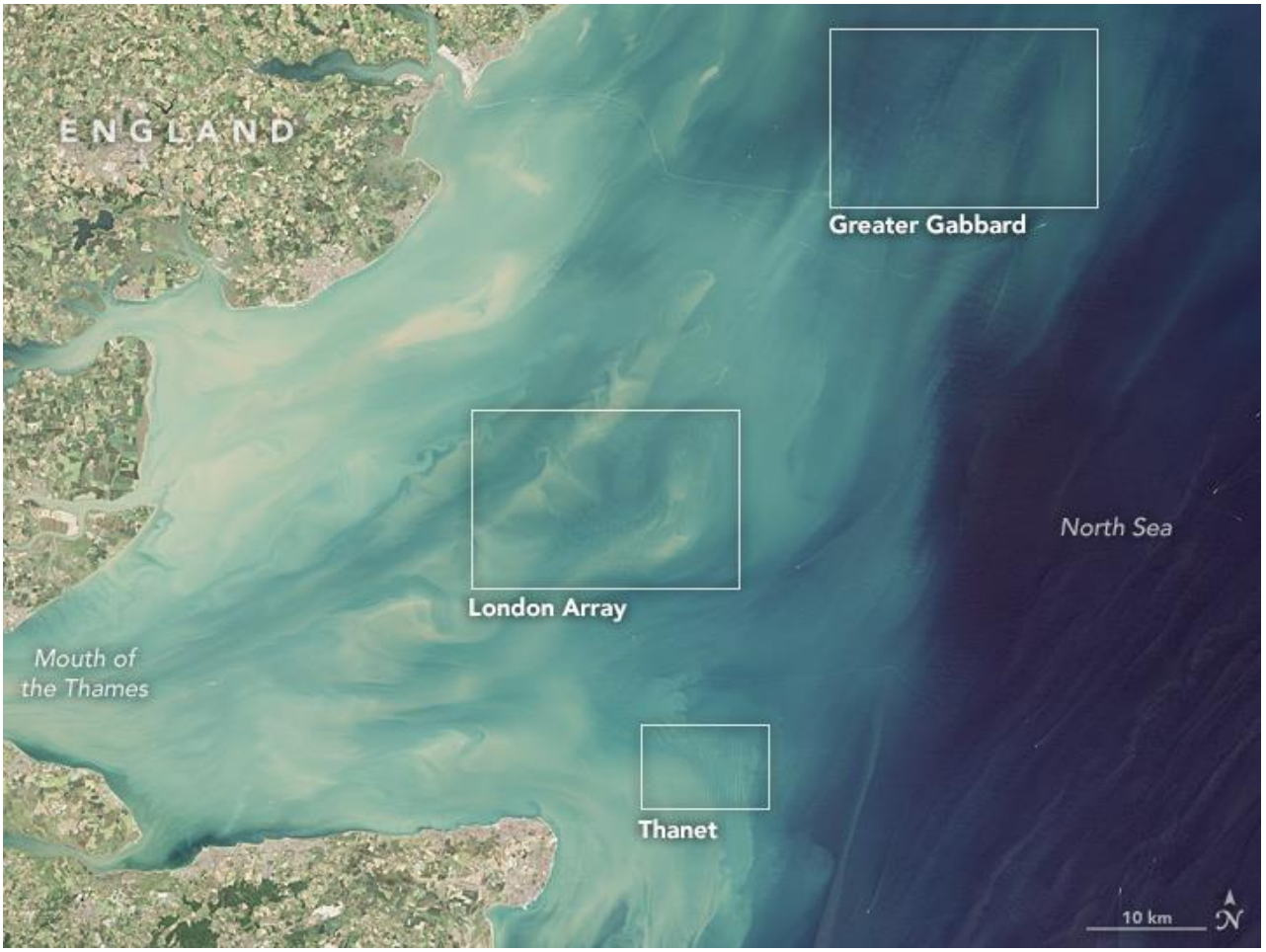

Fig. 2.7: London Array and Gabbard (30 June 2015) by NASA, annotated (NASA licensed use)
Relative positioning and size of Gabbard and the London Array is shown as at 2015. Gabbard has been significantly extended since. This area carries heavy shipping usage. North West coastline as shown includes Sealand: see plan at Fig. 1.2.

Fig. 2.8: Turbines East of Aldeburgh Suffolk, UK (September 2021) NASA

Fig. 2.8: Turbines East of Aldeburgh Suffolk, UK (September 2021) NASA (NASA licensed use)
Image probably identified as East Anglia One, a deep offshore wind farm. Turbines at 7 MW each dwarf those at the London Array at 3.6 MW.

6. The power of the sea and working wind farms

6.1 A question of observation

What we see is often what we expect to see. It can fairly be said that the focus on the vertical above-surface appearance of fixed turbines is likely to be because that is what prior to 2014 we, the general public, have expected to see from land. Seen from the air, the horizontal surface impact of fixed turbines and the under-surface turbulence ought significantly to enhance our ability to picture the overall changes made by the presence of offshore wind farms. To experience the marine environment as a daily reality, and to do so for years on end, will form a sensitivity to the sea different from that of people who do not have that life-experience. Narrated perspectives from established sea-users are a way to enable others to access opinions and concerns of those with practical expertise and direct memories of an almost entirely open sea. Two narratives of change and the ways that it is experienced in practical terms were shared with me by Paul Gilson and Dick Beaumont. Chapter 6 is led by their comments.

6.2 A story of change: Paul Gilson, fisherman

Paul Gilson on fishing:

> "I believe….that wind farms are detrimental to the environment (as I shall go on to explain). If we are to believe our Green friends, replenishing the sea is about leaving it alone, and if that were true, the East Coast should be flourishing. But inside the 12 miles coast, fishing has collapsed. This has been accelerated since wind farms have been in place. There is a north-south tidal movement past the turbines and there are sand clouds in the water of the North Sea that can be seen on NASA satellite images. The sand line is stirred by the presence of the turbines to the distance of 2,000 meters. For the fish it is like being behind a wooden door and they will not pass through the sand cloud. They are from North Foreland to the Wash. For 6 to 12 miles there is virtually a constant line of wind farms. Ten turbines are like ten sand walls stopping the fish passing through. It is an artificial barrier across the mouths of estuaries, a sand wall….There are some more effects taking place round turbines. These have buried electricity cables, and the sea bed is disturbed by that. In places the burial starts to wash away. In order to protect the cable, rocks are put on it. This changes the biodiversity, where mud and sand becomes rocks and the material around has been washed away…..Turbines under the water give an "undisturbed wreck" situation that attracts mussels, growth and becomes a feeding station. Sea bass takes advantage of it. This makes a conservation zone in which sea bass flourish. So a problem is created with assisting the growth of a top predator[298]….Whitstable was under construction for nearly 5 years before

[298] A4:1

> it produced electricity. Whitstable was renowned for its oysters. It is stony, pebbly ground. But there is now a 2 miles long barrier to protect the cables across the whole area and so the whole area has been lost to fishing that not long ago was a prime area for fisheries. We *(fishermen)* get blamed. You can check. It is all factual. My family have been fishing for a couple of hundred years[299]…I would like the world to be a better place when I left. I am much a Green in a fisherman's coat. The principle of a sustainable fishery I would protect, and I would like to enjoy the job I have had….It is a tremendous business to go and catch fish. You catch fish and the boats only half a mile away don't. I had a slightly faster boat and you learned from every tow where fish were. You eliminate possibles and would have the probable areas that they would be in. Everyone would think there was nothing there but the fish would be there. I loved my job- it was exciting to get up early and go. Even at a young age I was dreaming about *the Tizzard*. My father said Go There, and we caught more fish in one trip than the whole season. It was such fun- the sense of achievement. I loved every minute. Money was never a deciding factor[300]….In short, in very recent times (November 2020), we have come to think there are serious problems with inshore fishing possibly because of wind farms. On the East coast of England there has been a crash in fish numbers. There are various possible explanations such as the drainage of pollution or a problem in the sea itself. The cause might be one of communal activity or as caused by individuals. There has been over-development of the seas[301]….In summary, wind farms both under construction and once built, have impacts on the environment. In particular: Noise, Sediment change, Sand plumes, Buried cables[302]….Wind farms are on the seabed and they have a continual impact. The local environment will be altered and have long-term effects….When a wind farm is established you are allowed to fish there but if you snag the cable you are responsible for that. Has the cable been well laid? If a boat snags in bad weather, it can be pulled over. This has happened[303]….Wind farms are a piece of engineering. On land they need to be disguised. I hate what they are doing to the environment around them. The more there are, the bigger the impact. If we have 500 together, the fish do not like it. They go somewhere else..."[304]

There are numerous points raised in the passage quoted. They emerge together from Paul Gilson's vibrant description of his roots in the local tradition of fishing, and his love of the hunt for fish. His self-perception is that of a person seeking to operate sustainably when he and others in the fishing community are blamed for the drop in certain fish stocks that have occurred. There are at least six different themes in the above passages that surface at various points in this thesis. They are collectively demarcations of this fisherman's area of engagement:

- the collapse of East coast fishing
- the importance of sustainable fishing
- fishing as a worthwhile occupation
- overdevelopment of the seas

[299] A4:2
[300] A4:3
[301] A4:4
[302] A4:13
[303] A4:14
[304] A4:15

- adverse features of wind farms (noise, sediment change, sand plumes, buried cables)
- hostility to wind farms due to their environmental changes

6.3 A story of change: Dick Beaumont, diver

Dick Beaumont on water visibility deterioration:

> "I have sailed over 250,000 miles round the world over many years. My connection has been from an adventure standpoint and this influences it. In terms of fishing, I am an angler not a commercial fisherman. I have a lifetime of experience as a diver. My passion has been diving in the UK. Although diving is more popular now generally far less diving is carried out in the UK than in years gone by. There are many thousands of wrecks around the UK, more than in any other country. Many of the wrecks are unnamed and undived particularly those in the North Sea of the East Coast of the UK. I began diving in Dorset, Devon and Cornwall even though I always lived in Essex. With the advent of GPS we can now locate wreck out of sight of land which has made wrecks around south east and east coasts more accessible, as we can dive further out from land and water visibility improves the further we go offshore generally. I became more focused around the Kent and Sussex areas but started exploring the Suffolk and Norfolk coast some 15 years ago and this is the area most affected by wind farms. I have noticed a significant deterioration in water visibility in the areas inshore of the wind farms that have been developed over the last 8-10 years in the areas mentioned. Whilst I am very supportive of the development of green energy sources, I think it is important that we fully understand all the consequences of the various options. I had a diving company "Adventures in Diving", based in Chelmsford Essex. We trained people to dive as a leisure pursuit and we operated an amateur diving club called Wet Wrecks Diving Club. This was my vehicle to develop a group of divers with which I could dive. We dived off Harwich and along the coast Southwold/ Aldeburgh / Lowestoft / Yarmouth. I have a boat called "*Zeus*", which is my personal diveboat which I based in several areas off the East coast. Over the last 15 years I focused on that area in particular. It has more unknown wrecks than any other area (except the Thames). We have (in the area Great Yarmouth to the Thames) the most wrecks in the world. Of course there are clusters such as Skapa Flow elsewhere. The area I dived had wrecks from many sources: some were natural disasters; others were wrecked during the hostilities of the First and Second World War and were sunk by German U-boats or mines. These same sandbanks that channeled the shipping into tight lanes are now the area for the wind farm developments. Because I have consistently dived the area for 15 years, and because it is difficult to dive when underwater visibility is poor, a common subject for discussion amongst the remaining UK divers is exactly ***why*** the visibility is so poor in recent years. In the last seven to eight years we have noticed a significant deterioration. Most of us agree that this is caused by the installation of the wind farms and the turbulence they cause. It is not provable by me that the poor visibility is due to the wind farms but I think it is highly probable. We now have to go far outside of the area of the wind farms to find reasonable underwater visibility. Previously we only had to go so far out in the early part of the year, say til June. Seven or eight years ago we

would have clear visibility not so far from the coast in the period June through to October. But now it is very hard to find visibility, even in the best months and impossible outside of the period June to October. If you fly over wind farms in the area, you will see orange water streams behind the installation where the sediment behind the installation is disturbed. The region South of Great Yarmouth to north of Ramsgate has finer sediment than other regions of the UK and disturbed sediment, as created by the turbulence of the wind farm pylons, stays suspended for long periods. When we are diving in the boat we often see the big orange patches of discoloured water. These extend sometimes to 20 miles out from the coast. These patches were only previously seen during spring tides, but in recent years they are often in evidence right through the neap tides as well. Some divers believe reduced visibility may be caused by increases in rainfall on land but I believe that whilst this can cause reduced visibility inshore I can't believe that it can have an effect 5 miles or more offshore. I believe the new obstructions created by the wind farms are the major factor causing reductions in underwater visibility.[305]

…I want it to be clear that I am very in favour of non-fossil fuel being developed. I am pro clean energy, which I support. ….In speaking to Paul Gilson, I mentioned that over my time diving in the North Sea we have noticed the presence of cod on wrecks has greatly diminished. This could be for various other reasons ***or*** it's conceivable it's caused by reduced visibility created by wind farms changing the habitat. I am not sure I buy into that so much as I think the probable cause in reduction in cod numbers is due to over fishing. Or it could be the sea temperatures changing and the cod moving off because of that. It might have nothing to do with visibility. It occurred during the same kind of period but it could be coincidence. Some species find good holding areas for themselves. Maybe the fish have moved from wrecks to wind farms….In themselves wind farms are undesirable but less so than fossil fuels. I accept that no solution yet found is perfect and that there are side effects created by the wind farms that are undesirable, on balance perhaps we have to tolerate them, but I am 100% certain they have negatively affected the water clarity in the region I dive. If you fly over one you can see an orange streak behind each pylon, these orange streams are disturbed sediment. The amount of sediment that is disturbed by the turbulence created by the wind farm pylons is a factor relating to the size of the tides during any given period. The bigger the tide, the greater the disturbance. I am totally convinced that wind farms negatively affect water clarity but whether this, or over fishing, or increased water temperature is the cause of reduced fish, particularly cod, numbers in the areas mentioned I would not like to say."[306]

Dick Beaumont's narrative establishes him as a highly experienced diver with a decades-long interest in diving shipwrecks, especially along the East coast of England. He explains the importance for divers of being able to see when in the water. He sets out points that seemed important as observations or possible explanations for what he saw. The relevant ones for me at this juncture are:

- deterioration of water visibility over the last eight to ten years
- longer suspension of sediment particles

[305] A2:1
[306] A2:4

- orange plumes in the water
- plume size related to the size of the tide
- the disappearance of cod

6.4 Investigating sea plumes

Having spoken with both Paul Gilson and Dick Beaumont, it was the images that arrested my attention. What do the Group 2 illustrations show? Figures 2.1-5 each carry the North sign at the bottom, and in the case of Figures 2.2-5, NASA has helpfully labelled sediment plumes and boat wakes where they appear. The sea plume grid patterning of the depicted wind farms (London Array, Thanet, Gabbard and in the North Sea as labelled) can be seen on Figures 2.1-5. Images are identified by NASA to 2015 for Figures 2.2-4 and 2020 for Fig. 2.5. On Fig. 2.2 we can see the difference between the surface dissipation of the wake of the boat, and the extensive size, and potentially depth, of the wake or plumes behind the turbine installations. Fig. 2.3 shows changes in the directionality of the plumes as presumably reflecting the tide or current over the area of the wind farm. The image refers to the London Array in 2015 which carried 175 turbines at 3.6 MW each, placed over 47 square miles. Fig. 2.4 (Gabbard, to the North of the London Array) appears to show turbulent water plumes joining to one another in the North-South axis, a phenomenon which may have prompted the concerns of Paul Gilson about transit for fish, for instance here from East to West or vice versa.

As I consider the aerial images of working wind farms in the North Sea, I am struck by the grace of the patterning, a grace that is largely mathematical. The artificial geometric patterns of the turbines are shown further as markers of the patterns of the tides. The wake lines are intellectually pleasing. But they are pleasing as artefacts and are to my mind aggressively unnatural as a seascape. I remember the sea as an open place, as Paul Gilson and Dick Beaumont evidently do. Their reaction as to the appearance of the wind turbines, as a seascape issue (Chapter 3), is something different from their reactions to the impact of the turbines in practical terms (Chapter 6). All those reactions seemed to me historically valuable, and unlikely to be reproducible once wind farming is the dominant seascape. Some engineering appreciation of sea plumes is collected in this Chapter.

I had not previously encountered any information regarding the sea plumes either in the academic habitat literature I had been reading as background[307] or in the many wind farm promotional or documentary videos that I had watched. In fact I have only so far managed to find one (brief, unnarrated and barely viewed) clip on Youtube that films any activity directly connected to wind farm sediment plumes.[308] The existence of sea plumes is adequately verified by Figures 2.1-5. We can see there are, in addition, obvious disagreements between these two speakers as to how far the sea plumes are responsible for changes in the presence of fish generally and in particular of cod (once a numerically dominant species close to the areas of the wind farms). It was important for me to note how two people coming to interact with the sea over such long periods of time and in such very different ways were struck by

[307] Carpenter (2016) had a similar experience at that time, recorded in her article about turbine turbulence: "The literature on the impacts of OWFs <offshore wind farms> is large, but has focussed to a great degree on marine life."

[308] There is a 53 second, mute, video on Youtube showing technicians casting sample equipment overboard a wind farm maintenance vessel. It dates from 2017. *Surveying of sediment plumes at Thanet offshore windfarm* (2017). https://www.youtube.com/watch?v=09LAgv70hDU (accessed 22 9 2021).
At the time of writing (22 9 2021) it has had 134 views.

the significant change to the overall sea environment that the fixed wind turbines in practice presented. I noted the surprise with which Dick Beaumont explained how he was finally able to connect the changed visibility to the streaks of orange in the water behind wind turbines[309]. I had the impression from both speakers that these sea plumes were initially unanticipated by them. Both were quick to identify the sea plumes as demonstrating fixed turbine wind farms to be instruments of change in the strong tidal zone that the North Sea is. Each of them then applied their understanding to the things that were important to them- in the one case to the issue of fish scarcity, and in the other case to dive water visibility. Paul Gilson's comments are considered below as to the points he has made, where the research offers some clear support but in other places is inconclusive. Dick Beaumont's analysis of causation of low visibility, with connections to the tides and obstruction of them by turbines resulting in seabed changes and sediment, is fully supported by the engineering and modelling literature discussed below.

There is, so far as I can see, no single generally accepted phrase to describe the phenomenon of the sea plumes. In the engineering literature I found that "wind farm turbid wake" was the most useful search term, but the reality seemed to be that atmospheric (not in-water) wakes were the primary interest of the technical literature. This was because of the requirement to calculate the strength of the wind in particular locations. This is necessary to work out the optimal placement of individual turbines due to the cumulative effect of wind channelling behind each turbine. I initially searched for analysis of the NASA images in the parallel literature of dredging (as referenced by NASA) and of sediment dispersal, seabed dynamics, and hydrodynamic scour[310]. The lack of a consistent label for sea plumes causes difficulty. Effectively there is no unified research field. I chose to exclude some disciplines,due to time constraints, where there might be additional work of relevance. The excluded areas cover phytoplankton research[311], seabed liquefaction conditions[312], and seabed scour damage. The two chosen speaker narratives, in my view, needed to be contextualised in some kind of temporal framework as to when the sea plumes were identified as large sea features. The NASA images and the ensuing academic literature effectively begin the story in 2013.

6.5 NASA records sea plumes (2013) using Operational Land Imager

The existence of the NASA photographs at the beginning of this Chapter was drawn to my attention by Paul Gilson and Dick Beaumont separately. Despite their long experience of the North Sea, each of these interviewees seemed surprised at the strength of the phenomenon that I shall term "sea plumes." I use this term to mean a body of turbulent water and sediment streaming out as a plume behind each wind turbine under the pressure of the wind/tides. In order to understand what they are talking about, it is helpful to take a closer look at the illustrations. Fig. 2.1 is from the earliest set of relevant NASA photos I have been able to trace and shows a shot over the London Array wind farm close to the Thames estuary. The feature of interest is the series of lines behind each dot, each dot being a wind turbine. The colours within the water can otherwise be ignored. The water is dominated by algal bloom. At that time, the recently opened London Array was the world's biggest wind

[309] "It was not until I flew over one of the winds farms on a flight into Stanstead Airport on a very clear day when I could see great orange tails running behind out behind each wind farm pylon that the penny dropped." A2:8

[310] See Hydrodynamic Scour on Wikipedia https://en.wikipedia.org/wiki/Hydrodynamic_scour (accessed 26 5 2021). This is also shown in diagram form by Porter (2016) in her Fig. 2.3.

[311] Aïtelghazia (2019) pursues Landsat 7 images and plankton turbidity, for instance, to estimate the locations and distributions of plankton.

[312] Duan (2019). Liquefaction was considered impossible relative to turbines: Zhao (2017).

farm and this was probably the reason why NASA chose to feature it as an image news item[313]. Sediment plumes in Fig. 2.1, in contrast to later photographs released, are not labelled by NASA as such.

6.6 Tides and fixed structures

The NASA news item in January 2014 seems to have prompted academic investigation. The impact of the tides on fixed structures is standardly known about to engineers for a quite different reason. The pressure of the tide can cause "scouring" or removal of the seabed around a fixed structure, and may weaken an installation as a result. The naval engineers who built Sealand during the Second World War, for instance, were evidently aware of this potential impact, and avoided it. Whilst agreeing that there were sediment plumes between the feet of the Sealand structure, Prince Michael comments: "I have dived all around Sealand and I could see clear visibility. When we went diving there were no holes or under-scouring. The structure was set in a position so you didn't get under-scouring."[314] The engineering industry in general had considerable experience of scouring in connection with bridges and dams where the currents of water pushed volumes of sediment around built structures and rendered them unstable. Monitoring this effect was necessary where tidal activity, for instance, was inevitable. By 2011-2014 there were various kinds of monitoring systems in available or in development for turbines (for example in April 2014[315] an acoustic system).

This interest in scour, and sand scour where a cylinder interrupts a tidal flow, is studied closely in her laboratory modelling by Porter (2016). Her literature review[316] as at that time offers a fully explained commentary on the prevailing state of investigation relative to scour, tides, wave flows and sediments. Her project was to create and test facilities for modelling laboratory flumes as against different sand sediments. She acknowledges the difficulties in the field as often more complex and more challenging than in the laboratory.[317] Amongst her listed original results, she speaks of experiments modelled using fine sand on top of coarse sand. She concludes: "mixed sands were found to alter significantly the scour time development curve. Novel scour tests under a spring-neap tidal cycle in the clear water regime indicated *a considerable lengthening of the time to equilibrium*..." (my italics). I was struck by this finding as I read through the comments from Dick Beaumont on how water visibility was slow to be regained in the North Sea, or would be entirely missing[318]. Interestingly, Porter does not use multimedia photogrammetry (or the NASA images) because she regarded it as requiring validation and integration into the scour literature. On the basis "refraction has not been properly accounted for, resulting in a compromise in terms of the measurement accuracy,"[319] she decided to exclude this material.

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[313] NASA News item Image of the Day 21 January 2014 *London Array* https://earthobservatory.nasa.gov/images/82844/the-london-array (accessed 30 5 2021).
[314] A5:5
[315] *Scour monitoring using sonar* (4 4 2014) Advertisement for Kongsberg Gruppen https://www.youtube.com/watch?v=R004tOuVSLM (accessed 4 10 2021).
[316] At 37 and following; including also at 64-5 scour studies based on wind farm measurements.
[317] At 65.
[318] "We now have to go far outside of the area of the wind farms to find reasonable underwater visibility. Previously we only had to go so far out in the early part of the year, say til June. Seven or eight years ago we would have clear visibility not so far from the coast in the period June through to October." A2:2
[319] At 112-3.

6.7 Early descriptions of sea plume images (2014)

Vanhellemont (2014) describes the capture technique of the images: "Landsat 8 (L8) was launched on February 11, 2013 and normal operations started on May 30, 2013. L8 has a ground track repeat cycle of 16 days with an equatorial crossing time at 10:00 a.m." OLI is a designation common to Figures 2.1-5 and it refers to Operational Land Imager. Further detail as to that is given as: "The Operational Land Imager (OLI) on L8 is a nine band push broom scanner with a swath width of 185 km and eight channels at 30 m and one panchromatic channel at 15 m spatial resolution." The 2014 article is a useful reminder of the then importance of the North Sea and the UK in representing offshore capacity. The UK overall had 50% of the world's offshore wind capacity including the then two biggest wind farms in the world (London Array and Greater Gabbard, whose relative positions are shown on Fig. 2.6). Seven wind farms in the Southern North Sea (UK and Belgian locations) comprised 40% of world offshore wind capacity.

These high resolution NASA images were evaluated as good to trace suspended particulate matter (SPM) movements, as well as enabling better observation generally of the sea plumes. The simple presence of the wind turbine wakes is described as "a striking observation", which suggests that they were not part of routine environmental analysis hitherto. Indeed, one of the article conclusions is that the "impacts" of the wakes was "currently unknown" and justified further research into environmental impact. The image analysis concludes that the wakes are an "in-water" phenomenon, not simply due to wind-water interface. The patterns are said to correspond to the speed of the tidal currents, and irregular curves to represent changes in the current. These observations can perhaps be deduced speculatively by anyone taking a close look at the images. What is not immediately obvious is the sheer size of the wakes: "The plumes are 30-150 metres wide and typically extend 1 or more kilometres downstream from the turbine." At Thanet, apparently, the longest sea plumes were 10 km in length. The article concludes that the scale of SPM movement may indicate changes to the seabed.

Finally, which plays a later part in our study, the research drew a connection between the sea plumes and possible problems with scour protection for wind farm installations. At that time it is noted that such protection was only to be found where there were undersea cable crossings, practice differing beyond that. At Thanet only parts of the exporting energy cable was protected; at the London Array only the offshore sub-stations had protection.[320]

6.8 Sea plumes unanticipated

Based on the tone of the Vanhellemont article, I concluded that the presence and, accordingly, the size and power of the sea plumes had not been anticipated prior to 2014. I guessed that they had never been (a) fully or accurately calculated, or (b) been appropriately included in environmental impact assessments. I see this occurred to others at the time:

> "Recent news about the London Array wind farm shows the incompatibility between the EIA <Environmental Impact Assessment> report, which states that the risk of scouring should be addressed by the use of scour protection, and the feedback from local fishers, who report that the entire sediment bed

[320] Rock deposits were then the normal form of protection chosen.

> has shifted within and outside the array, completely remaking the benthic habitats and changing fishing grounds permanently."[321]

I was perplexed that these large sea plumes had apparently not been anticipated. Wind turbines had by 2013 been in place in offshore locations since the 1990s. However, early offshore installation sites had been closer to land, therefore not exposed to the current strengths of the North Sea[322]. Secondly, the early turbines were smaller. Turbine size affects the sea plume size behind it. My checks in relation to the London Array Phase 1 also indicated a lack of involvement with this issue in the technical evaluation for permit purposes.[323]

6.9 Current practice: the engineer (March 2021)

Current engineering practice is reflected in the comments of the engineer, in his response to questions as to the sea plumes:

> "I never personally had the responsibility for monopile foundation design and installation; this was always the developer's part of the supply. Enough protection is required to prevent erosion but not so much that it takes too much of the seabed. This is a balancing act. Common practice now is typically a scour protection pad that has up to approximately 10 metres radius from the foundation centre of a large turbine. A typical 10-metre radius of scour protection will lead to roughly 300 square metres of seabed area affected. In comparison, there may be 1500 metres between large turbines. That means that the overall seabed footprint of a large turbine in a wind farm is around 2.2 million square metres. The proportion of the seabed affected by scour protection is then about 0.01%. I guess that most people would regard this area as marginal.
> For gravity bases you would normally need to remove the seabed surface at the so-called mudline for construction. You place a stone pad (a level area of crushed stone) and the concrete gravity foundation is then placed on the stone pad. All the early Danish projects were done this way. Disturbance of the top layer was a concern but in practice it did not give rise to observed issues. The monopile is driven into the seabed without any prior preparation of the seabed. After that, the scour protection is installed around the foundation, normally without prior excavation of the seabed."[324]

He is talking about structures to stop the inevitable scouring from taking away the seabed areas around the turbine base, and rendering the turbine weaker or unstable. The scour protection is not there to prevent the development of sea plumes or to protect the seabed generally.

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[321] Vaissiere (2014).
[322] "Advances in the offshore wind sector have allowed the construction of OWFs <offshore wind farms> in deeper waters further away from the coast, where stronger winds are found. While in 2013 the mean depth of OWFs was 16 m, in 2017 the mean depth reached 27.5 m." Schultze (2020). The same general point is noted in Carpenter (2016).
[323] See below in Chapter 6.15.
[324] A3:3

6.10 Converting NASA images for digital modelling of particulate matter in sea plumes

Researchers investigated the extent to which L8 images- or for that matter images from two Chinese satellites showing similar information- could be regarded as reliable in terms of SPM[325] images, including algorithmic conversion of them for general digital modelling purposes. The aerial information required to be checked with physical samples and with other datasets before digital modelling to calculate the shape and velocities involved in the sea plumes. Only with this done effectively could scientific and engineering techniques be updated. Separately, and consequent on those investigations, there lay the task of evaluating in engineering terms the impact of the information.

Translating aerial materials and checking or evaluating their utility has been and remains an on-going process. It is natural enough to assume that the information in high resolution satellite images would be used to correct or validate other numeric simulations. This had early been done in China[326] referencing high resolution satellite images (from a smaller Chinese satellite HJ-1A/1B rather than L8) to meet the pressing need to track and evaluate atmospheric systems that might result in toxic algal bloom. Poisoned water had on occasions affected individual cities, such as the 1 million users in the waterworks closures of Wuxi City in May-June 2007, but the initial target for study was the Deep Bay area and the Hong Kong/ Guandong water vulnerability to red tides. The images were considered suitable to support the hydrological simulations, and were reported in the research fields of remote sensing and total suspended sediment.

A similar combination of high resolution images and digital modelling has been more recently explored in three rather different European studies involving particulate matter. Gohin (2020) reports monitoring of the 2017 season off the French coastline in terms of turbidity and total suspended particulate matter. The point of the immediate exercise was to use actual data to evaluate whether a particular conversion algorithm of high resolution satellite images[327] performed well. Behind that was an expressed desire to monitor environmental changes affecting water quality by reliably using satellite images in big datasets. I infer this (described as “a major challenge for the next years”) was not as yet being done. Tsapanou (2020) does use the Landsat 8 images taken over the North Eastern Aegean/ the Evros river estuary, and correlates them to actual water/particulate samples. This somewhat complex project was, amongst other things, a validation exercise for a new multiband algorithm, which proved more accurate than a locally-tuned single algorithm. Their literature summary indicates that it was in the period 2016-17 that a longer term oceanographic analysis began to use Landsat 8 for SPM monitoring. Nazirova (2021) traces the timeline of algorithms developed for accessing numerically several different generations of satellites, and concludes that appropriate choice of one of the standard conversion algorithms (as opposed to a locally crafted one) will produce reasonably accurate outcomes. The project uses SPM sampling from a boat at the mouth of the heavily-used River Myzynta (tourist resorts, fish farming, and industrial installations) in the North Eastern Black Sea coastal resort area of Sochi (Russia’s biggest tourist resort). From these studies we can observe that (a) use of L8 images[328] in numeric modelling is now considered reliable and reflective of actual SPM density, and (b) for the most part, the literature reporting on it is specific to remote sensing journals.

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[325] Suspended particulate matter.
[326] Tian (2014).
[327] Not in this instance Landsat 8.
[328] Despite some constraints compared to infra-red sensing equipment: see Kim (2015).

6.11 Fluid dynamics research

There are four main areas where the sea plume phenomenon at fixed turbine wind farms has resulted in research investigations using complex fluid dynamics calculations. These are studies of: fixed turbine scouring, water currents, stratified sea temperatures, and the behaviour of particulate matter. There is generally perceived to be risk where densification of wind farm provision may alter calculations based on extrapolation from density of provision at the time when articles are written. The dates of the articles assume importance against the known density of wind farm provision the UK is currently committed to.

6.11.1 Fixed turbine scouring

Turbine scouring displays three interlinked areas of practical concern. These are: weaknesses in the structure of the fixed turbines, attempts to correct that by strengthening the base of each turbine, and the suitability of the kind of protection used for this purpose. Matutano (2013) creates a recommendation for better incorporation of wave length calculations in designing protections, but is referred to here for the information as to what is happening as to scour protection in built installations. The article reports the current cost of support structures as representing 30% of the total cost of installation, a cost that cannot be avoided due to the risk of loss of stability of the structure as also to the danger of the structures sliding from their initial placement. Matutano records 1021 monopiles, at 75% of all offshore European turbines installed since 1991, and 286 gravity based structures ("GBS")[329], representing 21% of installed items. Monopiles are inserted into a hole in the seabed. GBS turbines have a heavy attached concrete base. Matutano also stated that protection "may also be required" for the cables within the wind farm as well as the cable exporting the energy. The subject study covers the earliest offshore installations in Denmark to examine the kinds and extent of protection used. I noted that: "To date, many of the offshore wind farms selected have been built without considering the design of scour protections. This allowed us to avail of real data on completely unprotected structures." The commonest foundation protection was simply dumped rocks and stones round the turbine. One should note in passing that there are factors beyond the tides that influence the scouring effect, including weather systems, and the vibrations of the turbines. Monitoring the progress of scouring is not easy. Indirect means of doing so using sensors for various kinds of vibration or inclination data continue to be devised and tested.[330]

6.11.2 Water currents

Vanhellemont's article prompted studies of water current in wind farms, and to boost interest in modelling them whether in laboratories or mathematically. The connection to Vanhellemont and the NASA images is openly acknowledged, alongside a degree of initial anxiety as to the possible changes within wind farms, or even coastally, that the sea plumes might have.[331] Grashorn's point was that Kármán vortices[332] behind the fixed turbines needed to be modelled in order to predict impact where changes in sediment and sea bed contours might result. The article reports complex patterns of varying velocity due to the depth of the studied monopiles, with surface, mid-zone and bottom vortices showing different characteristics. That study was stated to be a preliminary to actual environmental studies.

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[329] Still considered a successful technology generally: for a design history see Esteban (2019).
[330] Tang (2021).
[331] Grashorn (2016).
[332] Repeat patterns caused (fluid dynamics) by the forced casting of vortices around a fixed object.

Directly in response to the NASA images, unstructured grid[333] modelling was used in what became a key study establishing the power of the sea plumes to extend far beyond the confines of the wind farm into the surrounding sea. Cazenave's study (2016) began with an expectation that sea plumes would have little disturbance effect beyond a few kilometres of the wind farms, but concluded that impacts were experienced in significantly bigger areas.[334] Specifically, the eastern Irish seas were judged unproblematic due to full temperature mixing but for areas off the East coast of England, concern was expressed as to potential increased flood risk because of the changed perception of hydrographic modelling in the event that fixed turbine wind farms proliferated either at coastal or more distant sites. Riviere's (2016) article is another early instance of current/hydrographical modelling linking prediction to, in this case, a proposed wind farm off the Normandy coast of France. Here the focus of interest is water current alterations, sediment deposition and changed deposition patterns as a consequence of the calculated or observed vortices. Each of these studies expresses the view that their or equivalent modelling is important to evaluate the densification of wind farm provision, given the recognised EU and UK positions of commitment to renewable energy.

6.11.3 Stratified sea temperatures

Studies conclude that any future widespread installation of wind farms will potentially have significant effects on stratified sea temperatures. Temperature modelling is considered by Schultze (2020) in relation to the German Bight[335], a tidally affected shelf sea with summer temperature stratification. The German Bight is well supplied with offshore wind farms. The seas have a flow within them, a source of turbulence. Wind farm turbines constitute resistance to that flow and so remove energy from it when flow meets their obstruction. The water column within the sea can be stratified vertically at different temperatures. This is especially true of the North Sea during the summertime because the upper layers are not mixed quickly enough by the movement of wind and bottom friction of the tide. There may be a noticeable difference in sea temperatures comparing the surface with sea bottom water.[336] As the tide moves, mixing within the water column occurs and serves to move nutrients from the lower layers upwards[337]. This is environmentally significant for algal processes and carbon dioxide within the sea. Mixing within thermally stratified water is the subject of the article to see what effect the presence of turbines has, additional to the mixing of strata caused naturally by the tidal flow. Turbine mixing is caused by the turbine wakes ie the sea plumes. The article records the initial state of information with the comment that "it remains largely unknown if OWF <offshore wind farm> mixing is significant in altering stratification in shelf seas."

Back in 2016, Carpenter had concluded that the mixing effect of individual wind farms was not significant in terms of sea stratification but that widespread wind farm installation would be. In the plain language summary, Schulze concludes[338] "Our results suggest that the effect of OWF structures is small compared to other naturally occurring mixing mechanisms, however can be comparable to the rate of stratification buildup." Stratification buildup means the

[333] Tiling a flat space with smaller repeated simple shapes. "An unstructured grid or irregular grid is a tessellation of a part of the Euclidean plane or Euclidean space by simple shapes": https://en.wikipedia.org/wiki/Unstructured_grid (accessed 22 9 2021).
[334] "The horizontal extent of this disturbance is significantly larger than the sum of the footprint of the monopiles."
[335] An area within the North Sea.
[336] Carpenter (2016).
[337] Described by Schultze as an "egg beater" mixing process.
[338] Abstract.

speed with which the sea becomes thermally stratified in the summer. The conclusions were based on two actual studies of individual turbines, one in 2015 and a different one in 2017, followed by simulations. In other words, individual turbines are not significant at currently installed levels compared to natural background mixing. However, it is also suggested in the same study that there is potential for wind farms to have substantial impact if constructed over extremely large areas. This is because an important part of the calculations reflects the time that the water spends within the field of wind farm turbulence. The study does not investigate biological activity, though for future studies that possibility is highlighted as a suggestion. As turbines proliferate across the North Sea, this is an area of potential problems.

6.11.4 Behaviour of particulate matter

As to the behaviour of particulate matter, early study (2015)[339] established that finer particulate matter was resuspended in monopile vortices and was transported downstream. This was an acoustic survey of a Belgian wind farm (Belwind 1) during May 2013. The source of the finer material was suggested as faeces and debris from creatures colonising the surface of the monopiles. The authors conclude that additional suspended matter at the bases of the monopiles was due to fauna and not to the effect of scouring. Tracking sediment deposition is a discipline familiar also in the area of dredging, whether by marine aggregate extraction[340] or by fishing[341]. Other ways of calculating particulate matter behaviour include drag flume[342] models (said to be suited to wind farm situations).[343]

The North Sea is a changeable environment. This makes it difficult to evaluate scientifically. The North Sea sustains significant movement of suspended particulate matter in any event, quite apart from the impact of the turbine sea plumes. For example, the feature of the East Anglian plume (a flow of particulate matter from the East coast of England across the southern North Sea) has been estimated by Tiessen (2017) to transport net approximately 13 million kilos of SPM every tidal cycle. This last estimate is approximately double the size of the previous calculated expectation.

6.12 Ørsted cabling disaster (April 2021)

Recent events have served to refocus attention on the power of the sea to distress and sever the cables serving wind farm installations. My interview with the unnamed engineer took place on 23 March 2021. I certainly had no idea that the narrow topic I was interested in would suddenly shortly afterwards hit the news. On the 26 of April 2021 it came out that the Danish company Ørsted under its cable warranty provisions would have to correct damage to undersea cables it had supplied. Tidal action had caused cables to rub against rocks, with the result that outages had occurred. Initially the problem had been investigated at the 91 turbine Race Bank wind farm, a marine installation off the coast of Norfolk in the UK. As an isolated problem for a single company, one might have thought little of it perhaps, but Ørsted were the principal suppliers of wind energy in the world, and are reported as responsible in 2020 for 29% of global wind capacity so far installed.[344] The company's explanation was

[339] Baeye and Fettweis.
[340] Van Lancker (2015).
[341] Pastor (2020).
[342] A flume is an artificial channel for water that sits above ground. They are open at the top and chute-like in shape.
[343] Soler (2017).
[344] Storrow, B (2020) *How one fossil fuel company became a green giant* E&E News item article regarding Ørsted, 9 9 2020 https://www.eenews.net/stories/1063713187 (accessed 1 6 2021, site since rendered subscriber only).

that ““The damage is caused by the fact that the cable protection system, which is both from the turbines and links to the cable, is placed on top of rocks. With the movement in the sea, this cable protection system gets damaged.”[345] The measures to be taken were quoted as threefold: dumping extra rocks on cable routes; where required (expensive) replacement of cables; and mass cable surveys running through 2023. The company estimated the immediate costs as 489 million USD. The result was a massive stock market hit on the company to the tune of half a billion USD.[346]

The stock market fall was not, in my view, irrational. The company's position[347] was that the practice of handling cables as they did at installation was standard at the time. That, as far as my research goes, appears to be correct. The company remain under supply warranty so it is immaterial for the purposes of the customers to ask whether there was corporate negligence. The essence of any negligence aspect is that either the supplier or developer had done something careless or failed to do something that it ought to have done if it were acting carefully. That would cover research, design, build, testing, supply and installation. Without litigation, it seems most unlikely that the design and build figures and assumptions would ever be known, let alone available for public criticism. That kind of information would be considered copyright protected and confidential even if supplied, unless it appeared in a decided and reported lawsuit. Whilst I do not foresee such an eventuality, keeping existing customers reassured as to repairs and corrections is by no means an end of the matter, even if the initial cash estimate is sufficient to cover extra rocks and some new cabling. We see the extent to which the company accepted the need for action in response to a specific immediately discovered cycle of damage.

There are other matters that occur to me as relevant beyond that. First there is the question of the damaged cables themselves. These are obtained by the developer via chosen subcontractors. Cables for Hornsea One's giant wind farm complex off the Yorkshire UK coast were supplied from Norway. Those for Hornsea Two (due to be completed in 2022) were supplied in 2018 from Sweden. Swedish suppliers, Nexans, describe Hornsea Two's contract as "worth over 150 million euros to supply over 200 km of 245 kV cross-linked polyethylene insulated (XLPE) near shore export cable system."[348] The same source indicates that the Hornsea One cables were supplied by Nexans Norway to the extent of "139 km of three-phase 36 kV subsea cable inter-linking a total of 58 wind turbines and connecting them to the offshore transformer station." Wind farm cabling is plastic lined. Plastic-covered cables are vulnerable to impact erosion. One might expect water quality regulators to become sensitised to the issue of degrading plastic in the water as a result of the Ørsted publicity. The EU has for a decade required marine water quality to be maintained[349]. I assume post Brexit the UK will follow similar if not identical requirements.

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[345] Ibid.

[346] Radowitz, B (2021) *Damaged offshore wind cables to cost Orsted almost half a billion dollars* CFO Recharge Online Updated News Item (29 April 2021 updated 4 May 2021) https://www.rechargenews.com/wind/damaged-offshore-wind-cables-to-cost-orsted-almost-half-a-billion-dollars-cfo/2-1-1002964 (accessed 5 5 2021).

[347] Mathis, W (2021) *Wind Power Giant's Profit Hit by Rocks on the Seabed* Bloomberg Green online news item regarding Ørsted (29 April 2021) https://www.bloomberg.com/news/articles/2021-04-29/wind-power-giant-s-profit-hit-by-rocks-on-the-seabed (accessed 5 5 2021); also in the Rechargenews item above.

[348] Nexans Article, in-house (2021) *Nexans wins major power export cable contract for Ørsted's Hornsea 2 wind farm* 19 November 2018 https://www.nexans.com/newsroom/news/details/2018/11/Nexans-wins-major-power-export-cable-contract-for-Orsteds-Hornsea-2-wind-farm.html (accessed 5 5 2021).

[349] European Commission (2010) Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (notified under document C(2010) 5956)(2010/477/EU). Official Journal of the European Union L232:12–24; later replaced by COMMISSION DECISION (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised

6.13 Significance of NASA images

Until the NASA photographs were published, there existed no general awareness of sea plumes. Publication of the Landsat 8 imagery created such awareness and awakened an interest in the phenomenon. Scholarship about the turbine sea plumes has a distinct commencement in 2014. I note that in the week following opening of the London Array, on 12 July 2013, the Triton Knoll wind farm permission was announced on the news. Unremarked in the background of the final few frames, the sea plumes at the London Array can clearly be seen on the surface of the water.[350] The NASA images independently opened up research across a variety of fronts as to the properties of the sea plumes. Without these images, it seems likely that the extent of sea plume impact would have passed unnoticed, despite the fact that fishermen or divers might experience their effects.

Did engineers underestimate scour strength? Perhaps. Such things are possible: after all, the East Anglian plume was reckoned at half its transportation power. The concern at the time of the London Array permissions was specific to turbine scouring not to the risk of sea plumes. Engineers must have advised about scour in relation to every wind farm, but that does not mean they necessarily were much concerned about the existence or extent of any turbulence beyond the issue of turbine stability. The lack of scour protection for many fixed turbine installations as highlighted by Matutano suggests a calculated risk against the costs of using scour protection. At 30% of installation cost, scour protection would be unlikely if engineers could advise the risk of instability was low. The unnamed engineer's comments were not directed to the plumes per se. They were directed to the cause of the plumes. He speaks of the problem of scour and of its impact by reference to the physical space taken by the scour protection. "Enough protection is required to prevent erosion but not so much that it takes too much of the seabed. This is a balancing act." This comment is about protecting the turbine and changing the sea bed in specific areas with the chosen protection.

6.14 Contextualising Paul Gilson's comments

Paul Gilson's estimation of working wind farms and the sea plumes reflects concerns that the presence of wind farms precludes the presence of trawler fishing, and also that fish are being kept out of the traditional places that they swam. This first point is well-recognised and is apparently being used to visualise wind farms as protective against fishery interest[351], as discussed above in Chapter 4, due to the dangers of trawler lines snagging on cabling. The second point is not that wind farms are a bad habitat but that they establish different patterns of fish presence, behaviour or migration. In commenting on sea plumes in 2016, NASA also drew attention to the potential habitat differences that might occur: "it is not yet clear how this increased amount of suspended sediment could affect the relatively shallow underwater environment, which is known to be an important fish nursery."[352] Paul Gilson's point is that the fish are deterred from passing through wind farms in order to go to their usual foraging

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methods for monitoring and assessment, and repealing Decision 2010/477/EU.. See: European Union explanation to the United Nations (2020) *Achieve the good environmental status of EU Member States' marine waters by 2020* 16 October 2020 https://oceanconference.un.org/commitments/?id=17530 (accessed 20 4 2021).

[350] *Look East: Triton Knoll* (12 Jul 2013) https://www.youtube.com/watch?v=FMl8gONu43I (accessed 4 10 2021).

[351] See Ashley (2014) highlighting the potential for wind farms as no or restricted fishing areas.

[352] Offshore Wind Article, in-house (2016) *Offshore Wind Turbines Make Sediment Plumes in North Sea* 8 November 2016 https://www.offshorewind.biz/2016/11/08/offshore-wind-turbines-make-sediment-plumes-in-north-sea/ (accessed 18 2 2021).

or breeding sites across the coast of the East of England. I have seen no studies that specifically consider this possibility in relation to sea plumes, though clearly Paul Gilson has given it a lot of thought. There is a certain parallel in the conception that the wind farms are as much a barrier to the fishermen as to the fish.

The idea of changes to fish behaviour in connection with renewable energy installations is one that has won traction in relation to tidal energy barriers. There the ultimate concern is fish or predator collision with blades. Behavioural differences are noted due to turbulent water, and behavioural changes are potentially reflected all the way through the predator chain to mammals. Where there are strong tides or vortices within the water, or flows over 4 metres per second, these are recognised as having "the potential to aggregate, disaggregate and disorient prey, or provide a physical barrier within the water column."[353] To this extent Paul Gilson is supported. Williamson's study (directed to reliability of data for collision risk modelling) of fish behaviour near tidal installations, however, concludes that fish schools are attracted to these sites, not so much prompted by noise or visual cues but rather by "changes likely arising from the wake and structure (visual and hydrodynamic perception)". Such factors are obviously ones present with sea plumes, despite the differences between tidal and turbine energy installations. If Williamson's results are crudely applied to sea plumes, they might suggest that fish would be attracted to sea plumes rather than driven off. But the shape of the sea plumes is distinctive, changes with the tides, and would require to be separately studied.

Fish habitat focus of a more general kind in relation to wind farms appears to suggest that they partake (with the exception of mussels, crabs and similar shellfish) in the generally poor fish assemblage levels of surrounding areas. Griffin (2016) addresses the fact that knowledge of fish assemblages around wind farms was "limited." The authors are reporting on trial technology[354] used near and some distance from wind farm turbines (Walney off the Eastern UK) in the Irish Sea. It makes for depressing reading, recording, as it does, low numbers of fish and low species diversity. The observation is made that near wind turbines (the test sites had each turbine equipped with 20 metres of rock scour protection), the species types are those associated with rocky sea bottoms, and further away they are those associated with muddy sea bottoms.

More recently, due to the realisation that the future will involve wind farm reliance at significantly increased levels, the different habitat provided by wind farm turbines (ignoring the presence of any sea plumes) has been critically studied. Slavik (2019) points out the prevalence of blue mussel colonisation on turbines, arguing that these provide good general prey for a diverse range of predators including crabs, and that essentially wind farms may protect exotic passenger species, but definitely deter trawler fishing. It is thought there is no significance attached to the corresponding increase in water filtration by the mussels themselves. Shell debris is described as potentially diversifying the wind farm areas for faunal settlement. Taking all present and planned wind farms in the Southern North Sea, the authors calculate that there will be a 40% increase in blue mussel biomass in the region. The constraints on accuracy of their numbers are pointed out, figures mostly being "upscaling" from data for individual turbines. Similarly, it is admitted that there are likely to be unknown changes in the ecosystem that result. They conclude there is evidence for "a larger regional effect on biomass and productivity that extends up to several 100 s of km beyond the bounds of the

[353] Williamson (2019).
[354] Baited Remote Underwater Stereo-Video systems

OWF area." Griffin and Slavik provide, effectively, scientific background for the view expressed by Paul Gilson,[355] that the presence of a rocky environment around the turbines has changed the biodiversity of the North Sea.

It may be difficult to imagine exactly what that means. I certainly found it so initially. Essentially a coarse sand environment inhabited significantly by worms is replaced by an environment of fine sediment and rocks/ manmade structure, inhabited dominantly and first by mussels. Over time, other species associated with mussel colonisation also come to live in the area. The worms migrate away. The colonisation spreads out from the man-made structures onto the sea bed, attracting the kinds of fish that predate on the colony. An excellent depiction of this process of major change is in the presentation by Monique LaFrance Bartley at an online conference in July 2020[356]. Her study is of the area round the five prototype Block Island wind turbines 3 miles off the coast of Rhode Island on the Eastern seaboard of the United States. She describes the environmental change (illustrated by pictorial and mapping materials) as "profound and expanding." She reported increased levels of fish present in this kind of community but the previous benthic fauna (creatures that live under the coarse sand layer) as being negatively impacted.

6.15 Contextualising Dick Beaumont's comments

There can be little doubt that the commentary of Dick Beaumont on sea plumes has been fully bourne out by the scientific evaluations of the sea plumes in relation to suspended particulate matter and water visibility. Given that the need for scour protection was so seriously underestimated, it seems reasonable to suppose that the size and power of the sea plume vortices were similarly uninvestigated or under-evaluated. Phase 1 (630 MW) of the London Array was completed in 2013; Phase 2 (240 MW) was abandoned in early 2014, allegedly partly due to technical issues, but more likely, in my view, due to the certain delay caused by opposition of the Royal Society for the Protection of Birds unless further studies, anticipated to last at least three years, produced satisfactory results.[357] The initial permits for the Array were granted in 2006, then revised in 2009. At the 2009 re-evaluation, studies of the marine environment were profiled towards anticipated difficulties or risks.[358] I have found no evidence that vortex simulations were included in the public materials at any point.[359] Rather, the issue of scouring had, in 2005, apparently been settled by a reference to the prevailing practices without further comment. This is included in the Non-Technical Summary, a public document, at a time when the size of the turbines had not even been chosen:

> "Recommended mitigation measures against scour are firstly, to ensure that cable burial is of sufficient depth to prevent bed changes leaving cables exposed on the surface of the seabed and secondly, the use of materials around the base of turbine foundations to prevent scour from occurring. Following

[355] "This changes the biodiversity, where mud and sand becomes rocks and the material around has been washed away." Above and at A4:1

[356] Conference presentation at minute 24:28 "Learning from the Block Island Wind Farm: Sediment and Sound" July 2020, https://www.youtube.com/watch?v=tO1wJ308Vrc (accessed 22 9 2021).

[357] Smith (2014); also BBC News (2014) *Sea bird halts London Array wind farm expansion* 19 February 2014 *https://www.bbc.com/news/uk-england-26258271* (accessed 20 6 2021).

[358] London Array Ltd (2010) P*re-Construction Environmental Monitoring Plan* February 2010 https://londonarray.com/wp-content/uploads/2020/06/LAL-EMP-Preconstruction.pdf (accessed 18 2 2021).

[359] Missing from the listed pre-permit studies: London Array Ltd (undated) *List of Studies* https://londonarray.com/wp-content/uploads/2020/06/List-of-studies.pdf (accessed 18 2 2021).

such mitigation measures, the operational effect of the wind farm on the coastal processes is likely to be insignificant, irrespective of which foundation option is finally selected."[360]

The sediment disturbance was stated to be limited to the construction period. Likewise changes in water quality, sound and vibration were anticipated to be limited to construction periods and to have no longer term effect. The net result seems to be that long-term or on-going post-construction impact on the sea or its bed by the turbine vortices were not part of the public discussions relating to the London Array after 2005 through to the point where it was fully permitted[361]. To engage with this subject, turbine sizes would have been part of the basic calculations but these were unknown at the time of key permissions being requested. Consultations with divers were listed as scheduled, but these are unlikely, therefore, to have included a warning as to changes in sea conditions and water visibility. It is understandable that Dick Beaumont wanted to know what the cause of the orange water and lack of visibility was. He had for years belonged to an era where the sea was broadly uniform in the local tidal conditions.

6.16 Legal treatment of sea plumes

Sea plumes have no place in coastal visual assessments, though they may be considered as impacting on the character of the sea. They are, however, specifically included as physical effects resulting from tide and obstruction of it by turbine foundations. The decision-making bodies are given guidance as to this, as are applicants for consents in EN3. This document is currently in a September 2021 released draft (which itself is an update of a 2011 document[362] containing much the same provisions). To give this study longer utility I quote the draft update. There are no material changes in the passages quoted. Foundation choice is not overseen directly by the reviewing authorities in the context of planning applications, except for a limited purpose. There is a clear awareness of sediment disruption and the process of scour. Draft EN3[363] provides:

"2.22.14 The onus is on the applicant to ensure that the foundation design is technically suitable for the seabed conditions and that the application caters for any uncertainty regarding the geological conditions. Whilst the technical suitability of the foundation design is not in itself a matter for the Secretary of State, the Secretary of State will need to be satisfied that the foundations will not have an unacceptable adverse effect on marine biodiversity, the physical environment or marine heritage assets."

(At page 47 it enumerates the effects to be scrutinised.)
"• scour effect – the presence of wind turbines and other infrastructure can result in a change in the water movements within the immediate vicinity of the infrastructure, resulting in scour (localised seabed erosion) around the struc-

[360] London Array Ltd produced by RPS (June 2005) *Non-technical summary* https://londonarray.com/wp-content/uploads/2020/07/Non-technical-summary.pdf (accessed 18 2 2021).
[361] Though after construction, normal monitoring of the wind farm would be in place.
[362] National Policy Statement for Renewable Energy Infrastructure (EN-3) (2011) Department of Energy and Climate Change July 2011.
[363] Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) (2021) Department for Business Energy and Industrial Strategy September 2021.

tures. This can indirectly affect navigation channels for marine vessels, marine archaeology and impact biodiversity and seabed habitats
• sediment transport – the resultant movement of sediments, such as sand across the seabed or in the water column, can indirectly affect navigation channels for marine vessels, could affect sediment supply to sensitive coastal sites and impact biodiversity and seabed habitats
• suspended solids – the release of sediment during construction, operation and decommissioning can cause indirect effects on marine ecology and biodiversity."

(The Applicant is obliged to address these issues.)
"2.25.2 The assessment should include predictions of the physical effect that will result from the construction and operation of the required infrastructure and include effects such as the scouring that may result from the proposed development and how that might impact sensitive species and habitats."

This sounds concise and as though it covers the problem completely. It does not. The structure of assessment is not criticised as a structure. Though there are visual aspects to the sea plumes, classification as to causation may make better sense. The correct cause and a number of related possible effects are noted. The difficulty is in the wording of paragraph 2.25.2 which is aspirational. If the turbine types and sizes (or more than one size if appropriate) are not supplied, the impact of the proposed development cannot be calculated with precision. This makes it understandable that developers would seek to restrict responses in relation to these matters by equating sediment effects to scour to their foundations. If supporting data is supplied from monitoring elsewhere of the likely foundation type, this may well not throw any light on the overall impact of the tidal scour disturbances. This is because the operators of a wind farm are only concerned with the maintenance requirements of installations at the base of them and the immediately surrounding area. What might have been a simple omission when the London Array was constructed could not have had that character even by 2011. At the present time, what we see here is a policy choice to allow developers to go ahead anyway. By the time problems surface, the only strategy is ex post facto mitigation. The only body with an interest in correcting problems will be the Marine Management organisation, but there are no signs that their protective policies (outside the coastal areas and areas designated for protection) pose an active threat to the built deep offshore wind farms at this point in time.

When the Norfolk Boreas developers drew up their environmental reports, we see the equation in play of sediment disturbance and foundation impact[364]. There appears to be no possibility that this "gap" in information is accidental. It is a policy decision not to require the supply of sufficiently detailed information such as the foundation type and size and the exact turbine shaft dimensions (or a range of them). The move towards wind energy has been fully supported by central government in this respect. Where decision-makers are requested for consent, they are directed to use "flexibility" where information is not given. They have powers to prohibit specified foundation types and to order changes in rocky scour protections (paragraph 2.6.196) but all of this occurs in a permissive context giving the developer choices to secure a favourable decision where important choices have not been made:

"Flexibility in the project details

[364] See paragraph 3.1 above

2.6.42 Owing to the complex nature of offshore wind farm development, many of the details of a proposed scheme may be unknown to the applicant at the time of the application to the IPC, possibly including:
- precise location and configuration of turbines and associated development;
- foundation type;
- exact turbine tip height;
- cable type and cable route; and
- exact locations of offshore and/or onshore substations.

2.6.43 In accordance with Section 4.2 of EN-1, the IPC should accept that wind farm operators are unlikely to know precisely which turbines will be procured for the site until some time after any consent has been granted. Where some details have not been included in the application to the IPC, the applicant should explain which elements of the scheme have yet to be finalised, and the reasons. Therefore, some flexibility may be required in the consent. Where this is sought and the precise details are not known, then the applicant should assess the effects the project could have (as set out in EN-1 paragraph 4.2.8) to ensure that the project as it may be constructed has been properly assessed (the Rochdale Envelope)[365]. In this way the maximum adverse case scenario will be assessed and the IPC should allow for this uncertainty in its consideration of the application and consent."

The theory is that a consent request would be refused if the worst case scenario calculations are considered insufficient to counter anticipated negative effects. The drafting of applications in line with that of Norfolk Boreas would equate scour with sediment effects. The worst case scenario then is that the foundations are impacted. The applicants deal with that by relying on their planned monitoring and maintenance. Ultimately the problem becomes one of risk to the developer, which is not primarily a concern here for the independent planning exercise. Absent the foundation type and size, and the exact turbine shaft dimensions (or a range of them), the assertion that the scour is confined to the immediate foundation area does not have to be questioned. We have seen above the research to the effect that the sea plumes reflect across distances before dissipating. If that is correct, the sediment disturbance consequent on the application is probably underestimated.

[365] Quoted footnote derives from the original document: "Case law (for example Rochdale MBC Ex. Parte C Tew [2000] Env LR 1) provides a legal principle that indicative sketches and layouts cannot provide the basis for determining applications for EIA development. The "Rochdale Envelope" is a series of maximum extents of a project for which the significant effects are established. The detailed design of the project can then vary within this 'envelope' without rendering the ES inadequate.

7. Conclusions

Reasoning for conclusions I reach are stated in Chapters 2-6 as they proceed. This Chapter draws together threads.

7.1 Background fact findings

This study has ranged over a number of areas where putting together a historical narrative has involved creating timelines for different industries and processes. It seems useful to begin by isolating what has emerged. Chapter 2 highlights the extent to which competing, uncoordinated industrial uses exist in the North Sea at given points. There remains much that is not known about these historic uses. Decisions made in the period to 2014 were made in ignorance of the overall North Sea environment. That includes decisions about wind farms. The beginning of 2014 was the time at which NASA released images of the sea plumes from various wind farms especially those near the Thames Estuary. Chapter 2.2 considers wind energy devices, and the development of the familiar three-bladed turbine, from earliest beginnings to the giant turbines of today. Bigger turbines generate more electricity but this presupposes fiercer winds to power them. Bigger turbines enabled wind farms to move further and further away from the shore. Chapter 2 .3 describes the mass market in cheap wind electricity, which in UK terms stabilised in 2017 with the creation of the contract for difference regime. The unnamed engineer was able to explain the growth of the turbine industry development as linked to the electricity market. Wind developers responded by driving down their costs and becoming profitable. These are preconditions for confident investment in provision. Until 2010 Denmark was the world leader in installing offshore wind, at which point it was overtaken by the UK. For the remaining period, the UK, in terms of new European wind farms, has been the dominant player. It has announced a one third increase in targets, so present development will continue. Not all of this new development will be in the North Sea.

The period between 2000 and today has witnessed the spread of wind farms across the North Sea. The industry is mature and capable of absorbing investment in turbines, cables, ships, electricity stations and new technical research. My mariner interviewees had concerns both as to the lack of natural boundaries on this activity, and also as to later decommissioning. There is no natural boundary on expansion of wind farms. Such limits as there may be will take the form of self-restraint, but there are few signs of that at present. Decommissioning in the North Sea is regulated at international, national and policy implementational levels. The UK is signatory to the OSPAR treaty and itself supervises wind farm development through public law process (inquiries) and private process (leases can be enforced by the Crown Estate). Installations are supposedly to be removed at the end of the wind farm's service life. This is a matter for OSPAR and anti-dumping, anti-pollution regimes at international level. Initial service life of wind farms is thought to be around 20-25 years but reinvestment in the same space may well occur. Total removal of installations is no longer mandatory but the extent of permitted deposit at sea is likely to be extremely limited. The hopes of some environmentalists to see long term dumping to create reefs has not been realised as yet, and may

never be so. Removal of cabling is governed by national law and the Crown Estate is in a position to enforce this under the terms of its leases. The Crown's ability to act as a private landlord enables it to take an absolute line in favour of full decommissioning if it chooses to.

Against this background, Chapter 3 discusses three phases of wind farm building so as to make clearer the changes in wind farm design and capability consequential on the changes in the turbines themselves. I use three descriptions of wind farms: coastal, off-coastal and deep offshore. I provide timelines linking the UK's ambitions for an agreed Exclusive Economic Zone outside territorial waters with the release by the Crown of areas for wind farm development. These are not simple connections because there was a period stretching from 2004 to 2014 before the EEZ was agreed. In the meantime, wind development relatively close to the coast was permitted, and also represented the limits of existing turbine technology. The early coastal wind farms gave way in investment terms to a group of "off-coastal" wind farms, including the London Array and others shown in the NASA images. Later developments, both fully constructed or permitted or undergoing application stage, are considered to be deep offshore in their character and placement. They become a possibility in and after Round Three of Crown releases of areas for bidding. By the time these are developed, and at all points thereafter, the deep offshore model will be both dominant and expanding.

The full extent of the permitted development is not visible at present but to give a sense of its scale, I take the reader on an imaginary tour up the East side of the North Sea opposite the English coast. Dogger Bank will also carry a total of six large wind farms. Four of these are under construction. Another two have been authorised. Each of these Dogger Bank deep offshore wind farms is for 1200 or 1500 MW. The Hornsea complex spreads over 1830 sq miles (4730 sq kms). The East coast of England, ignoring the three massive Round Four designations, now physically manifests less than one eighth of the development that has been allowed. When my interviewees describe their fears for the loss of an open horizon, it is based on what they can see. Chapter 3 concludes that across the East side of the North Sea, the horizon has already been lost because of the cumulative authorised wind farm provision. Chapter 3.3 crystallises what the future has in store, and where. UK government designations of areas with high potential for wind farm development cover virtually the whole UK EEZ, the main exclusion being the territorial waters. Priority for this development weakens effectiveness of assessment tools regarding sea character.

The building of wind farms affects not just the surface of the sea (whether we view it from the surface level or from overhead) but also the structures under the sea. From above, a wind farm constructed from 2010 onwards will have a standard geometric pattern at the surface, and a flower- or labyrinth-style pattern of cables on the seabed. The off-coastal wind farms that are shown in the NASA images have fixed monopile turbines where the force of the tides creates swirls of current at the base of the turbines and beyond. These are sea plumes[366], and they are a disturbance of a major kind in the water column. These disturbances will bring change. I do not pursue in this project the scale of seabed change. I do note some studies as to changes in the environment local to wind turbines and changes consequently in the fish and faunal assemblages. Where there are turbines, there are generally foundation scour protections (usually rocks) that are colonised by mussels and (over periods of time) other creatures associated with rocky-bottomed seabed areas. This contrasts with the coarse sandy bottom of the North Sea before the wind turbines arrived. I have noted the possibility as to the impact of sea plumes on fish behaviour, but the matter is not pursued. I did

[366] See Chapter 6 generally

look into deterioration in water visibility, and there is no doubt that this is caused by the sea plumes. If we take the overall impact of mass wind turbine provision and known consequences of providing a rocky or concrete base for these turbines, the net result is to change the area environmentally. The extent of the change over the working life of any given wind farm will be considerable, and there are estimates for a 40% increase of mussel growth.

This new geography is coupled with a profound incompatibility with trawler fishing. The trawler industry has declined in reputation since the London Array was built. Trawler activity on or very near the seabed cannot take place in wind farms because the cables may snag on the gear and the ship may capsize. It is generally accepted that trawlers receive a bad press, and there is clear evidence that the UK government has been forced by pressure from powerful public opinion (and Greenpeace) to ban trawler fishing from the Dogger Bank. The sea conservation areas (38% of total) may become the subject of a similar ban in due course. These areas become all the more precious because they will preserve an ecology that may otherwise one day be overwhelmed by environmental changes within the wind farms. There is a new division in the fishing industry. The former division is between big vessels and little ones with the divide expressed as under or over a vessel length of 10 metres. It has been joined by a new practical divide between those whose fishing is compatible with wind farms and those whose fishing is not, and who will be displaced.

These are relatively sudden and widespread changes. Looking into the requirements for creating new wind farms and trying to understand the level at which this was permitted caused me in Chapter 4 to set out the UK policy and decision-making structure for large infrastructure projects (over 100 MW). It is a public process of investigation followed by a recommendation to the Minister. The Minister's decision must take account of the findings but the final decision is political. The permission to build a wind farm is made at a stage before the exact turbine size has been selected. The consequence is that permission is granted without the detailed scrutiny that would perhaps reveal the full features of the water disturbances beyond issues of stability for the turbines. This is unfortunate, making the investigation effectively incomplete on matters affecting the seabed and other things in consequence.

Chapter 5 investigates the willingness of the UK courts to interfere with Ministerial decisions where they might be criticised as being wrong in their conclusions. The lead jurisdiction for wind farm cases is Scotland for the period of my scrutiny (2015- August 2021), followed by England and Wales and finally by Northern Ireland. The response from all three main jurisdictions in the UK is a categorical refusal to open up matters internal to a decision beyond proper process. It is not enough to found a complaint that the decision was wrong in the conclusion it reached. If a correct process was given, the courts decline to intervene. Correct process is of a basic kind: a lack of bias, application of the right legal tests, and a reasoned outcome that might be supportable by some evidence. Reluctance to intervene is demonstrated by examples from case reports. It is based on an unwillingness to become involved in politics. Courts also do not wish to replay a hearing that has already taken place. This tough line applies to all attempted reversals of administrative decisions, including those where the law being applied derives from European legislation not domestic law alone. These two sources of law (European and domestic) account for all relevant areas of law as regards wind farm permissions. The international treaties are not ones that citizens can rely on in the UK. This means that what happens at the administrative stages is critical to the outcome in permit terms.

A process dependent on expert evidence (as wind farm development applications are) led to an investigation of the qualities required of that evidence. They are impartiality and compliance with standards for truthfulness and clear reasoning, as set out in the procedure for the courts themselves. Opinion was found to play a significant part in the politics of the sea, illustrated by the Dogger Bank incidents, as well as in changes in fishing practices. Chapter 4 introduced an awareness of expert evaluation of "seascape" effectively meaning views from the coast and views of the coast. There is a common understanding of this by both the Marine Management Organisation and BEIS[367], the department responsible for renewable energy. What it amounts to is a relatively settled system where the size of the intended development and its distance from the coast are evaluated for impact on the coastal view. For deep offshore areas there is probably no need to file a visual impact assessment because of distance from the shore. However, the Marine Management Organisation will evaluate proposals for any impact changing the character of the sea. This is not exactly a case of "out of sight, out of mind", but the question of appearance is not the main issue. The point is to test how far the proposals alter sea character. It remains to be seen how the new (June 2021) Structural Plans will affect matters.

Sea plumes are investigated in Chapter 6. They are produced where an obstruction is placed in the way of the tide. Water turbulence, sedimentary disturbance and patterns in and on the water could have been expected, and to an extent were expected by wind engineers and the wind industry. Their interest was only relative to turbine stability. The opening of the London Array triggered NASA's release of images in early 2014, drawing attention to the length of the plumes and the distances the sedimentary disturbances spanned. In turn, this brought about academic literature to describe and understand the forces involved and the practical consequences of the sea plumes. The images themselves formed part of a wider literature in remote sensing where algorithms were devised, tested and compared so as to enable the extraction of data depicting sedimentary movement. Studies in fluid dynamics relevant to the sea plumes include scouring, impact on water columns, effect on stratified sea temperatures, and the behaviour of particulate matter. The 2014 images clearly had novelty in terms of the sea plumes. This was later dramatically underlined when tidal forces caused expensive cable failures owing to friction. It seems that scour force had been underestimated and protections were inadequate. Deep offshore wind farms as of 2019 may increasingly have a different type of foundation (jackets). The patterns of tide behind those foundations are less visible on the surface and more powerful at the lower part of the water column. I have not studied jacket foundations, but the process that led to non-prediction of the sea plumes is still in place. It is in consequence unclear whether the sea plumes are exclusively a feature of the off-coastal wind farms, or whether beneath the surface of the deep offshore jacket foundations other strong tidal processes may have unanticipated outcomes. Clearly, the sea plumes spurred scientific advance.

7.2 Interviewee narratives

Between them, I estimate my interviewees had over 160 years' experience of the North Sea. At every stage in the study, they had insightful things to say. At key points they were able to crystallise issues in the most enlightening way. The unnamed engineer was able to help in creating a timeline and an underlying explanation for the turbine industry that went far be-

[367] Department for Business, Energy and Industrial Strategy

yond the statistics themselves. He was able to speak of the choice to site turbines in the early days away from habitation if possible. Christina Platt drew attention to a completely different conception of wild beauty to that derived purely from vision and nature without visible human impact. She pointed to the issue of sea health. Paul Gilson is witness to the fact that a former trawler fisher wants his industry to be sustainable, and is clearly hurt by the bad press and attacks of the Greens. His is a narrative sensitive to changes that are going on in the North Sea and especially the changes in fish presence. He draws attention to environmental changes and offers thoughts about decommissioning wind farms. He believes that there will be sufficient value in former wind farm materials to make it commercially worthwhile to recover and recycle them. He expressed the view that wind farm development was being done in a rush without the consequences being known. He was intrigued by the possibility that the sea plumes were responsible for fish not reaching the East of England. He observed the water column impact of the sea plumes and tried to link them to what he had observed over the years as to fish behaviour. In this he is logical and highly observant. Paul Gilson is a guide to the present visual appearance of the East coast of England, as is Dick Beaumont. Dick Beaumont described the sea plumes and the dramatic effect they have on the clarity of sea water and in consequence on diving. He was also unhappy at the changes to the coastal areas where the wind farms were always in sight. As it happens, the scientific literature in Chapter 6 fully validates his layman's conclusion that the orange sea plumes were caused by the turbines and varied with the tides. Prince Michael was able to speak to profound alterations of behaviour whereby over the years the idea of sustainability had become embedded in everyday practice of fishing off the British coast. His descriptions of shellfish fishing anticipate a successful fishing future.

The North Sea is on the brink of massive changes in wind farm provision that have been committed to. There is no going back, with these levels of investment, for many years. The seascape of the near future is characterised as visibly colonised by this energy industry at every level: seabed, water column, surface and horizon. Different creatures will choose to live there in comparison to the open coarsely-sanded sea bottom in areas where there are no wind farms. The seascape that we grow up with and perhaps early become accustomed to is the one that we are likely to value the most. Despite supporting the growth of offshore wind as an industry, all three mariners (Paul Gilson, Dick Beaumont and Prince Michael) regarded the turbines as a partially unwelcome intrusion on the former appearance of the sea. However, the North Sea is a wild place as they describe it. We know tides are strong enough to upset the wind farm cabling, and the scouring process means there is a need for constant vigilance inside the wind farms to maintain them. The collective wisdom of the interviewee group started the search to understand the sea plumes, as well as making coherent many aspects of the timelines and factors behind wind and fishing industry developments.

7.3 Legal perspectives

I have highlighted a current gap in the operation of the domestic UK legal structure. The gap has apparently existed throughout and is traceable so far since at least 2011. The problem now lies in paragraphs 2.6.42 and 2.6.43 of EN3 in allowing applications to proceed without the applicant in every case giving the foundation type and size, and the exact turbine shaft dimensions (or a range of them). This is discussed in Chapter 6.16. The consequence is poor perception of sediment changes and water disturbance. Prior to the grant of a permit to build a wind farm, these matters are assessed for physical impact only. Late commitment by a developer to specific turbines has obvious commercial attraction. The provision of the missing information would confine later choices. Conversely, a failure to give the information weak-

ens the accuracy of calculations of drag experienced from tidal forces and calculations of sediment-filled turbulent water columns. The problem is a familiar one. Sea plumes highlight what this legal gap facilitates. Another such highlight is the malfunction of the cabling that will cost a major wind farm developer, Ørsted, half a billion dollars for a preliminary fix[368].

The second observation I make relates to the treatment of visual matters[369]. There are effectively two different regimes. Coastal views or views of areas coastally visible are assessed in an exact fashion. Deep offshore wind farm appearance is effectively weakly assessed because it forms part of a wider sea sensitivity to change analysis. There are recent indications of a possible maximum density target for wind farms but no praxis as yet. Sediment or sea plumes are not part of any coastal view assessment. They may feature in sea character assessments.

The familiar idea of visual seascape is covered by the European Landscape Convention, and is applied to areas that can be seen from the coast[370]. Wild beauty conceived of as health of the seas requiring responsible curatorship of the North Sea falls into a different set of treaties and policies. [371] These protections have been built up gradually through accumulation. The OSPAR obligations of the UK, as well as those relating to biodiversity and habitat are implemented at international, European and domestic level. These obligations cover the deep offshore areas and are designed for them. In general, UK wind farm developers are dealing with a detailed and clear framework of law, rules and regulations. Evidently this detail is not deterrent to development. Comparisons to other countries indicate that the countries with heavy regulation are the ones with a lot of experience of successful wind farm development.[372]

7.4 Aesthetic opinions

For the purposes of my project, aesthetic preferences are subjective matters bound up with ethics, memories, personal conceptions of beauty, emotional attachment and many other elements. Some forms of aesthetic appreciation are bound up with ideas of decay, transience, and nostalgia. The desire people have to live away from an industrial view has resulted in the legal focus on the coastal view impact of turbine profiles. Separately, there is a dominance of depictions of turbines and of the horizon in the way that wind farms are represented generally. The sea plumes are little known. Cable configurations on the seabed are not even thought of as an aesthetic legacy for the future. Thus some obvious elements present in wind farms are not matters of focus in aesthetic terms.

Anxieties regarding decommissioning arise from hostility to an aesthetic of decay, transience and nostalgia. We have seen what this aesthetic can embrace in terms of the affection in which the abandoned military forts of the North Sea are held. Campaigners for abandoning oil rigs and other metal debris in the seas on a permanent basis are clearly accepting of the aesthetics of transience and decay. They see the corals flourish around the sunken metal.

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[368] Chapter 6.12
[369] See generally Chapter 4.4.3 and as to marine plans Chapter 4.3.1
[370] Chapters 3.6.3 and 4.4.3
[371] Chapter 3.6.2 and 4.4.3
[372] Chapter 4.1 above

Others might see the jagged rusted metal and feel sorry for the corals and be ashamed of the human discard in that environment.

One key to aesthetics is association, whether with personal memories or moral positions. As Saito hopes, confronting an ethical change may alter aesthetic preferences to produce social gain. It is easy to see the moral positives of wind energy compared to use of fossil fuels. Wind farms have also brought scientific advancement, employment opportunities, and are themselves major, aesthetically inspiring projects. These positive associations may lead many to accept all or some of the changes that cannot be negotiated. Such changes include structural industrial colonisation of the surface of the sea, altering the sea faunal assemblages, the creation of water column disturbance, the presence of sea plumes, the end of an open horizon, the presence of thousands of kilometres of plastic-coated sea cables, the end of clear seas for divers, and the end of trawler fishing in large areas of the sea that have been traditionally available.

An acceptance of contradictions is perhaps part of the aesthetic of appreciating the beauty of the North Sea. All my interviewees spoke of this beauty, but did so in different ways. We hear[373] of wildness and uncontrollability, symbiosis with the forces of nature and disapproval for over-exploitation of the sea by humans (Dick Beaumont). We share with Paul Gilson his love of the colours of sunset over the sea, and his appreciation of turbines as beautiful abstract forms. He tells of the moods of the sea communicated to him - of "fear, anxiety, anger, calm, reassurance, joy." Prince Michael speaks of the need for turbines in the sea but also that they are a blight, taking over "my sea." The unnamed engineer described[374] the sea as "a fluid connecting all parts of the world" that gave him experiences of nature, a sense of calmness and of awe. Christina Platt described[375] the wild beauty of the sea, a sea that is complicated, varied and unique. All of them love the sea and are, or were, professionally engaged with it. Perhaps the acceptance of contradictions and compromises is always part of love. That is exactly why beauty is in the eye of a beholder.

There is no escape from the ways in which aesthetic preferences govern the responses of the public, of politicians, and of those creating wind farms. Efforts to resolve complicated oppositions are likely to take time and an adjustment to other people's way of prioritising or seeing the world. The Marine Management Organisation now at last has criteria and structure plans that will guide sea character sensitivity assessments.[376] The UK regulators face an almost impossible task but in the last two years have significantly updated policies and improved information access. The UK is collectively by default committed to new sea geometry above the surface and a new faunal environment beneath the sea surface.

7.5 My perspective

The sea plumes have been explained. They arose accidentally because wind farm developers myopically concentrated on estimates of scour at turbine bases. They still do, which means that other problems connected to sediment disturbance are likely. Sea plumes are not evaluated visually because they cannot be seen from shore. They will be evaluated as sediment streams for their physical impact on the character of the sea.

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[373] Chapter 3.4.5
[374] Chapter 2.2
[375] Chapter 3.6.1
[376] Chapter 4.3.1 and 4.4.3

My impression is that the roll-out of wind farms will not be stopped by departments of government except in extreme cases. It is the force of public opinion that counts where major commercial interests are to be deflected, as the Dogger Bank story in Chapter 4.4.7 shows. It seems that trawler bottom-fishing will in practice end across large areas of the North Sea: all wind farms, the Dogger Bank, and potentially also in the areas of marine conservation. People who like to eat mussels are in luck. Wind farms are a committed future for the North Sea, at least for fifty years or so. Their presence alters the balance of commercial use of the North Sea. Future generations of mariners and of the public will not recall the North Sea as a place of open horizons and will be undisturbed by the loss keenly felt by three of my interviewees. The North Sea remains powerful and defiant. I agree with Christina Platt about wildness and beauty being connected to health of the sea. The presence of machinery in the waves only makes visible what has been known for many years. The North Sea is an international industrial zone.

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Group 1 Illustrations

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Fig. 1.2: Map of Sealand location. *Map of Sealand and the United Kingdom, with territorial water claims of 3 and 12 nmi* (6 and 22 km) shown by Chris 73 / Wikimedia Commons, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1476777 (accessed 25 9 2021) Chris 73 / Wikimedia Commons. Originally by User:Chris 73; redone in svg by User:Indolences. Uploaded: 18 October 2014, given with express disclaimers as to nautical and legal accuracy.

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Fig. 1.9: Collage wind turbine designs

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2003 Tvindmøllen (Denmark) by Anders Kjeldsen by wiki commons license
https://en.wikipedia.org/wiki/File:Tvindm%C3%B8llen.jpg (accessed 27 5 2021)

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https://commons.wikimedia.org/wiki/File:Wind_turbine_size_increase_1980-2010.png (accessed 8 6 2021) US Dept of Energy, public domain

Fig. 1.11: Lillgrund windfarm, Sweden (aerial view) 2011

https://en.wikipedia.org/wiki/Lillgrund_Wind_Farm#/media/File:Turbiny_wiatrowe_w_Szwecji,_2011_ubt.JPG (accessed 29 9 2021)
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https://en.wikipedia.org/wiki/Lillgrund_Wind_Farm#/media/File:Lillgrund,_Malm%C3%B6.jpg (accessed 28 9 2021)
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Fig. 1.13: Lillgrund windfarm, Sweden (aerial view) 2007
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Fig. 1.14: Middelgrunden wind farm Copenhagen, Denmark, 2004
https://en.wikipedia.org/wiki/Middelgrunden (accessed 29 9 2021) Wikipedia, Creative Commons License. English Wikipedia, original upload 15 July 2004 by Leonard G. en:Image:DanishWindTurbines.jpg
https://upload.wikimedia.org/wikipedia/commons/1/17/DanishWindTurbines.jpg (accessed 29 9 2021)

Group 2 Illustrations

NASA photos of North Sea offshore wind farms:

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A5:1 Map of Sealand location, Wikipedia creative commons by David Liuzzo 2007 https://en.wikipedia.org/wiki/Principality_of_Sealand (accessed 16 5 2021)

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Appendices

These Appendices present the full interview transcripts. Four participants chose to be named and are accordingly named here. One interviewee chose to be anonymous and is referred to here as "unnamed." Full details of the individuals interviewed are found in the thesis (see in particular Chapter 1.3).

The four named persons were interviewed (on zoom or on Whatsapp telephone link) where they initially spoke and I then prepared a handwritten memo which later was typed and remitted to them for approval or editing. Usually this was emailed but several times where the statement draft was long, I posted a printed version. In the case of Ms Christina Platt, the version used is the version as last edited by her following a single zoom interview. In the cases of Dick Beaumont, Councillor Gilson and Prince Michael of Sealand there were at least four interviews, each interview lasting between one hour and four hours. The process of transcription and editing or approval by the interviewees took place regularly and the final version used (presented here and referred to in the thesis) is as signed or last approved by the interviewee. The unnamed engineer had a single interview on the telephone and ultimately authorised the use of the summary extract which he approved for the purpose of the project. The methodology is explained in detail in Chapter 1.3.

There were many instances where interviewees corrected or changed what I had prepared initially, whether for editing improvement, for technical accuracy or for personal preference. Because of these differences in editing the individual transcripts are slightly different in character.

The dates for the final record of interviews are: A1 Christina Platt 22 May 2021; A2 Dick Beaumont July 2021 (finalised by email 23 July 2021); A3 the unnamed engineer (undated) supplied by him on 26 April 2021; A4 Paul Gilson (undated) finally approved 21 May 2021; A5 Prince Michael dated 15 April 2021.

1. Ms Christina Platt

Christina Platt

The Wildlife Trusts

REFLECTIONS ON THE MARINE ENVIRONMENT INCLUDING AS A HABITAT WITH SPECIAL REFERENCE TO WINDFARMS AND OTHER STRUCTURE-AFFECTED HABITATS

I work as Marine Planning Officer for The Wildlife Trusts.

The Wildlife Trusts describes itself online in these terms: "The Wildlife Trusts is a grass-roots movement of people from a wide range of backgrounds and all walks of life, who believe that we need nature and nature needs us. We have more than 850,000 members, over 35,000 volunteers, 2,000 staff and 600 trustees."[377]

We describe online what we do in these terms: "We work on land and sea, from mountain tops to the seabed, from hidden valleys and coves to city streets. Wherever you are, Wildlife Trust people, places and projects are never far away, improving life for wildlife and people together. For more than a century, we have been saving wildlife and wild places and helping people to get closer to nature. We look after more than 2,300 nature reserves, covering 98,500 hectares, and operate more than 100 visitor and education centres in every part of the UK, on Alderney and the Isle of Man. We work closely with schools, colleges and universities, with hundreds of farmers and landowners, fishermen and divers; with thousands of companies, big and small; with community groups and other environmental organisations; with lotteries, charitable trusts and foundations; with politicians from across the political spectrum; with local and national governments; and more."[378]

Each Wildlife Trust is an independent charity formed by people getting together to make a positive difference to wildlife and future generations, starting where they live.

As part of my role I respond to offshore wind casework and work to influence offshore wind development policy with Dr Lissa Batey (Head of Marine Conservation), Tania Davey (Marine Planning Manager) and Joan Edwards OBE (Director of Policy and Public Affairs) and other members of the team. I have a specific marine planning role that I have held for around six months. I deal with marine spatial planning and I respond to consultations for offshore projects. I work for a central team and I work across England and sometimes in Wales. I also help out on other marine-related matters. I was an environmental consultant for three years dealing with offshore energy. Prior to that, I had done a Masters degree in Environmental Science.
That is the broad background. I came to marine environments in a slightly unusual way, because I had not initially been attracted due to the fact that I do get seasick easily. I have some memories of boats that are unpleasant, but I do like the coast. Growing up, boats were for me a no-go. However I became interested in a whole-planet perspective and I learned <2>about the marine environment. It seemed more unexplored and I really wanted to go for those jobs. So now I take a sea-sickness pill.

I love the sea and the wildness of it. It is one of the last few places that is unknown and unexplored. In the UK we have a lot of wildlife that people don't think of. We have coral, seals and dolphin.

"Wildness" means healthy and living, something that can co-exist with human life and not be damaged by it. My definition of "wildness" includes humans- it has to. We are all animals on this planet. I know to some the definition is more prescriptive and removed from human interaction. We need areas without humans- vulnerable areas needing protection for

[377] https://www.wildlifetrusts.org/about-us (accessed 3 4 2021).
[378] https://www.wildlifetrusts.org/what-we-do (accessed 3 4 2021).

ecology or climate (such as the “blue carbon” habitats). We do not know how to manage activity so that we can coexist.

Sometimes you need a degree of restrictive management. This depends on the situation and the stakeholders. Many stakeholders need to use any given area. We are working with people to find a way find effective management that allows for ecosystems to have environmental headroom. There is no “silver bullet”. We have to pick where we can contribute.

I was asked about possible post-construction turbulence in areas with wind farms, but I am not familiar with anyone specialising in that.

Wind farms:

The Wildlife Trusts aims to be involved pre- and post- commissioning and right up until decommissioning. We have a few concerns about what it will look like.

As to decommissioning policy, we do not have a formal policy about that. For a formal policy we would have to have a formal position statement, but in this area there is new science every week. So none has been issued.

We prioritise on risk to the environment. We look at risk to harming the protected features of Marine Protected Areas, and in terms of the vulnerability of the animals and what the project could do. We do not cover phytoplankton because we do not have the capacity to cover that.

The Environmental Assessment process:

At the moment there are many things about policy and the licensing regime that make it quite challenging to look at the impact for the sea. The regime was originally created for land. We ought to have policies based on the sea. For example, the licensing regime is very developer-led. They decide where to place the project based on the resource. It is getting better because more people are talking about environmental concerns. However, these views are from a perspective of the consents process rather than a strategic perspective.

We need to plan for the least risk, we being governments and industry, as a basic approach. This is something that is done relatively well in other areas.

The North Sea:

<3>It is beautiful in the range and uniqueness of its shallow ocean. It has an interesting range of sediment environments and habitats, and also a unique history. I cannot explain it. It has a mix of national lines, different countries, with such varied wildlife habitats in one geographic space.

(22 5 2021)

2. Mr Dick Beaumont

Dick Beaumont

Kraken Yachts

REFLECTIONS ON THE MARINE ENVIRONMENT INCLUDING AS A HABITAT WITH SPECIAL REFERENCE TO WINDFARMS AND OTHER STRUCTURE-AFFECTED HABITATS

July 2021

I have three major themes in my life as connections to the sea: sailing, fishing and diving.

(Courtesy of Dick Beaumont 2021)

I gave my card to Paul Gilson to get in touch with you and the card shows the name of my company Kraken Yachts. The company builds blue-water cruising yachts. I have sailed over 250,000 miles round the world over many years. My connection has been from an adventure standpoint and this influences it. In terms of fishing, I am an angler not a commercial fisherman. I have a lifetime of experience as a diver. My passion has been diving in the UK. Although diving is more popular now generally far less diving is carried out in the UK than in years gone by. There are many thousands of wrecks around the UK, more than in any other country. Many of the wrecks are unnamed and undived particularly those in the North Sea of <2>the East Coast of the UK. I began diving in Dorset, Devon and Cornwall even though I always lived in Essex. With the advent of GPS we can now locate wreck out of sight of

land which has made wrecks around south east and east coasts more accessible, as we can dive further out from land and water visibility improves the further we go offshore generally. I became more focused around the Kent and Sussex areas but started exploring the Suffolk and Norfolk coast some 15 years ago and this is the area most affected by wind farms.

I have noticed a significant deterioration in water visibility in the areas inshore of the wind farms that have been developed over the last 8-10 years in the areas mentioned. Whilst I am very supportive of the development of green energy sources, I think it is important that we fully understand all the consequences of the various options.

I had a diving company "Adventures in Diving", based in Chelmsford Essex. We trained people to dive as a leisure pursuit and we operated an amateur diving club called Wet Wrecks Diving Club. This was my vehicle to develop a group of divers with which I could dive. We dived off Harwich and along the coast Southwold/ Aldeburgh / Lowestoft / Yarmouth. I have a boat called "*Zeus*", which is my personal dive-boat which I based in several areas off the East coast. Over the last 15 years I focused on that area in particular. It has more unknown wrecks than any other area (except the Thames). We have (in the area Great Yarmouth to the Thames) the most wrecks in the world. Of course there are clusters such as Skapa Flow elsewhere. The area I dived had wrecks from many sources: some were natural disasters; others were wrecked during the hostilities of the first and second world war and were sunk by German U-boats or mines. These same sandbanks that channeled the shipping into tight lanes are now the area for the wind farm developments. Because I have consistently dived the area for 15 years, and because it is difficult to dive when underwater visibility is poor, a common subject for discussion amongst the remaining UK divers is exactly ***why*** the visibility is so poor in recent years. In the last seven to eight years we have noticed a significant deterioration. Most of us agree that this is caused by the installation of the wind farms and the turbulence they cause. It is not provable by me that the poor visibility is due to the wind farms but I think it is highly probable. We now have to go far outside of the area of the wind farms to find reasonable underwater visibility. Previously we only had to go so far out in the early part of the year, say til June. Seven or eight years ago we would have clear visibility not so far from the coast in the period June through to October. But now it is very hard to find visibility, even in the best months and impossible outside of the period June to October. If you fly over wind farms in the area, you will see orange water streams behind the installation where the sediment behind the installation is disturbed. The region South of Great Yarmouth to north of Ramsgate has finer sediment than other regions of the UK and disturbed sediment, as created by the turbulence of the wind farm pylons, stays suspended for long periods. When we are diving in the boat we often see the big orange patches of discoloured water. These extend sometimes to 20 miles out from the coast. These patches were only previously seen during spring tides, but in recent years they are often in evidence right through the neap tides as well. Here is some terminology:

Neap tides are the smaller tides and which based Dover tele tables are up to 6 metres at high water.

<3>Spring tides are 6-7.2 metres over datum at high water. The spring tide has more water movement, more current and more flow. This induces more sediment to be pulled up from the sea bed.

We dive the neap tides only. After the neap tides we used to be able to continue diving until the spring tide reached 6.3 on Dover tide predictions, beyond that the tide rips the sea bottom up and visibility greatly deteriorates. This is our diving pattern.

We also consider the wind direction. Some divers believe reduced visibility may be caused by increases in rainfall on land but I believe that whilst this can cause reduced visibility in-

shore I can't believe that it can have an effect 5 miles or more offshore. I believe the new obstructions created by the wind farms are the major factor causing reductions in underwater visibility.

Very few people have dived the ocean over the period of time I have. We dived there ***because*** it is hard to dive so many of the wrecks remain undived. The wrecks are therefore largely unknown. Often we are able to name the wrecks we dive by recovering artefacts identifying the ship that sank. Most named wrecks are known to the hydrographic department but the wrecks section of the hydrographic department will have a name for some others. We use the classifications for wreck location or naming: possibly, probably, unknown. Possibly and probably are also essentially unknown but they are working from other information especially the sinking or surface surveys by the Royal Navy. The hydrographic department can give the approximate measurements of ships and they try to match and name.

In my experience, the "possibly/probably" namings are mostly wrong. It is only if we have a lifted artefact that we can be sure. That might be a bell or a telegraph with the maker name or a boiler plate. We can then trace the ship. We can also use cutlery that has the ship name (this is quite rare) or crockery with the emblem of the shipping line or knives and forks with a stamp on them. We then make the deductions to research the name of the ship and the wreck.

In the past I used to have a good relationship with staff of the UK hydrographic office. I would send information and they would let me know about other unnamed wrecks in the area. This relationship has been undone now because reports now go British Heritage, who have introduced unworkable reporting regulations, so now we cannot raise many of the artefacts we discover, so the wrecks remain unknown. I do realise some unscrupulous divers have profited from the sale of artefacts they secretly raised and either not reported or erroneously reported and then sold. Clearly this is wrong and should be stopped but now British Heritage require the divers to get permission to raise an artefact they have found after it has been discovered but this is not practicable as there may only be diveable visibly a few days a year, if at all. This means that the artefact in question will not be able to be located again.

An example is the case of the wreck of the "*William Hutt*" which we dived before British Heritage took control of ship wreck discoveries. It had gone down in 1890. We were on the way to elsewhere and were only 3 miles offshore. Normally there would be no visibility in that location but on that one particular day there was. So we changed our plans and dived this <4>unknown wreck and we raised ship's bell which was embossed with the name "William Hutt". We notified the hydrographic department and they recorded the wreck that was previously unknown as the William Hutt .This would no longer possible under British heritage rules, so the wreck would have remained unknown for another 130 years I'm sure.

The result of British Heritage's policies is now that there is vastly reduced flow of information.

I asked British Heritage for an area license from Lowestoft- Aldeburgh on the basis that we would faithfully report all artefacts we recovered and offered that any items that were considered to be of historic value would be donated to them. After a year or so of questions and deliberations they refused.

I have no problems in being identified by name in giving this statement with just one caveat. I want it to be clear that I am very in favour of non-fossil fuel being developed. I am pro clean energy, which I support. For users of the sea, what appears to be happening as regards wind farms is that although they are desirable for clean power generation they are nonetheless visually polluting the sea and causing significant obstruction to users of the sea.

It seems the current UK policy is out of sight, out of mind, since recently they seem to be being developed 20 miles or so offshore. Only mariners see them this far out to sea.

In speaking to Paul Gilson, I mentioned that over my time diving in the North Sea we have noticed the presence of cod on wrecks has greatly diminished. This could be for various other reasons ***or*** it's conceivable it's caused by reduced visibility created by wind farms changing the habitat. I am not sure I buy into that so much as `I think the probable cause in reduction in cod numbers is due to over fishing. Or it could be the sea temperatures changing and the cod moving off because of that. It might have nothing to do with visibility. It occurred during the same kind of period but it could be coincidence. Some species find good holding areas for themselves. Maybe the fish have moved from wrecks to wind farms.

I am now theoretically retired but I am happy to participate in this study. I would like to see the environment retained. I have spent my life in the sea.

I did not previously know Paul Gilson. I understand he has an interest in a fishing company that targets herring. I believe this company is now run by his nephews. They supply frozen herring to many outlets including zoos. I use them for bait. It was literally last month I went for some herring and we had a conversation about water visibility and the changed fish patterns. He mentioned your project. I was just a customer he was chatting with. In fact the guy who told me about Gilsons was a new friend, a charter boat skipper called Shane. His boat is called Hard Labour. I was talking to Paul, when Shane turned up. I was just talking about fish migration and he came into the conversation. He fishes the wind farms.

Wind farms:

In themselves wind farms are undesirable but less so than fossil fuels. I accept that no solution yet found is perfect and that there are side effects created by the wind farms that are <5>undesirable, on balance perhaps we have to tolerate them, but I am 100% certain they have negatively affected the water clarity in the region I dive. If you fly over one you can see an orange streak behind each pylon, these orange streams are disturbed sediment.

The amount of sediment that is disturbed by the turbulence created by the wind farm pylons is a factor relating to the size of the tides during any given period. The bigger the tide, the greater the disturbance. I am totally convinced that wind farms negatively affect water clarity but whether this, or over fishing, or increased water temperature is the cause of reduced fish, particularly cod, numbers in the areas mentioned I would not like to say.

Wind farms are changing the sea environment and the look of it. Although we need them as we move away from fossil fuels, they do bring a significant degree of visual pollution.

Five miles off anywhere on the East coast you can't help but see massive wind farms The sea is not open any more as these huge areas must be avoided during the several years of installation.

How do people see the sea?

Wild place or a commercial resource? I see it as a wild environment but clearly this is increasingly untrue. It is much less wild and unspoilt than in past years especially near the coast. Whilst wind farms have the greatest aesthetic impact other developments have also eroded the wild and natural sea environment.

Due to the expansion of sea borne transport, shipping, many coastal areas are now designated anchorages for shipping. There's nothing natural about 20-30 container ships or oil tankers anchored awaiting cargo and to control the increased shipping movements now much of

the east coastal area of the UK falls into traffic separation zones which mariners can only enter leave or cross in a specified method.

The proliferation of fish farms has also turned many wild areas of the sea into commercially zoned production facilities.

I have dived near sea fish farms and environmentally that are a disaster. The excess food dropping through the fish cages onto the sea bed, combined with the fish excretions fouls the sea bed in a wide area around the fish farm; also, since unnaturally the fish are in living in close proximity to one another, they carry lice and spread them very easily. This again requires chemical treatment to kill or control the fish lice but the residue of the chemical treatment obliterates the balanced and diverse flora and fauna of the sea bed.

Scotland with its many lochs, sounds and bays has been particularly affected due to the demand of salmon.

I dived a wreck called the Shuna in the Sound of Mull many times as part of a sabbatical dive trip to Tobermoray. It was alive with all kinds of fish, invertebrates and in particularly was home to several types of cold water nudibranchs, and was once full of fish life. One year we <6>discovered a fish farm had be sited 100m or so from it. The wreck was covered in a grey fine sediment and there was no life in evidence at all. The whole seabed had become dead. It was a wasteland.

The toxicity of the fish farms regularly affects another major natural crop in Scotland, scallops. We used to dive and gather scallops during the week for food. The intensity of fish farms is such that they all became toxic. Shellfish from a large region of East Scotland became unfit for consumption for several months

We have used the sea as a resource. This is especially illustrated in Mediterranean where fish farms proliferate especially around Greece and Turkey. You have bass and bream that are not natural to the Med being grown in the Med.

I started diving 50 years ago. Altogether I have spent a year of my life underwater! I am still excited about diving. The North Sea is a big part of my life. It is a challenging environment to dive in, as impossible to be able to fully forecast what, why and when diving can be successfully carried out in complete control. You have serious weather systems that you have to work with. It is such a vicious, cold and unforgiving sea. It is not a playground, but is very intriguing from a diving perspective. In the UK east coast sea area from The Wash to the entrance to the Thames there are literally thousands of wrecks .The majority of wrecks are from World War I & II as well as many wrecks caused due to accident or foul weather. Many of the wrecks here are still very much unexplored.

I began diving the East coast 20 years ago basing my dive boat Zeus at Shotley Marina Harwich, but gave up diving this area when the MCA[379] introduced a huge rotational shipping separation system covering many of the wrecks I had been diving. Although I did obtain permission to anchor and dive in this separation zone, it was far too dangerous with many huge vessels traveling at high speeds in our immediate proximity. We relocated to Lowestoft and Southwold, were we continue to dive today.

Although it is a difficult area to dive, the attraction of diving wrecks on the east coast is that the water depth is relatively shallow compared to that of the south coast of the UK. If you want to dive unexplored wrecks on the south coast, you have to go deep and use mixed gas

[379] Maritime and Coastguard Agency (UK)

or rebreather diving systems, whereas in the North Sea it stays shallow- rarely over 50 metres deep. Diving deep increases risk so I prefer to dive on simpler open circuit systems.

The North Sea is intriguing because it is so changeable. East, North East and North winds have huge unobstructed 'fetch'. The seas build up unfettered by land. The sandbanks become totally exposed in North and North East winds. Visibility is ruined because waves are smashing against the sand banks. Many sandbanks break the surface or reach to within 10m or so off the low tide sea surface and the big waves, generated by storms in the North Sea, will crash into the sand banks and reduce water clarity to zero. This is due to turbulence created by the presence of wind farm pylons which are sited on the sand banks. The water <7>clarity now takes much longer to re-establish after high winds. Nonetheless it is the changeable nature of the North Sea that makes it attractive to me.

Underwater visibility in the area varies greatly; you can find a wreck one day with 10 or even 20 metres visibility and it will be a wonderful dive. A few days later visibility may have dropped to a metre visibility, rendering it undiveable. You never know one dive to the next what the visibility will be. You are hunting for the nirvana of clear water. You could dive a wreck ten times with 2-4 metres of visibility, and you cannot get much of an idea of the lay of the wreck or underwater topography surrounding it. But suddenly you can get 20 metres visibility and you see the whole wreck. Most of the wrecks are between 50 -100 metres long. From a diving perspective, I can honestly say I and the whole Zeus Diving Group would rather dive there in the North Sea than anywhere else in the world. There are unexplored wrecks; you are never certain that you can do as you want. The Holy Grail is to find the ship's bell and the ship. I have found 5 bells myself. Bells found by *Zeus Dive Group* have named 18 previously unknown shipwrecks.

In 2-3 metres visibility just 10 metres down, it is black. We use big torches. It is chance if you find the bell or any other artefact in such dive conditions. If you have 10- 20 metres visibility, the chances increase dramatically. It can be the bow bell or the bridge bell. In earlier times the bridge was centrally placed (modern ones are aft) due to containers. Most ships carried two bells, one at the bow another smaller one in the bridge, so we target these areas first.

Sometimes the wreck may be upside down, on its side or broken, which makes finding artefacts to name it very unlikely. But the thrill is that you know you are probably the first person to see the wreck since the day the ship sank.

Diving has changed dramatically over the years. I began diving long before GPS. Previously we were restricted to finding wrecks by known transit lines line from the shore and markers (eg a telegraph pole). It was a bit hit and miss[380]. 20 to 30 years later, hand-held GPS plotters are accessible and at low cost. They were originally accurate to within 25-100 metres. It was limited by the US military to 150 metres variation initially.

The lobster fishermen of Maine lobbied so as to request President Nixon to remove the GPS inaccuracy. It was removed, and now hand-held GPS is accurate to within one metre. These devices have proliferated and are now more accurate than that. They are an effective means of pinpointing the wreck we are looking for. £1,000-£2000 now buys you a combined a GPS plotter/detailed sonar (fish finder). You can even identify specific parts of a wreck. All these advances in a marine navigational equipment completely changed UK diving. Now it is 100 times easier to find dive sites, but there are far less people doing it. Divers used to be BSAC

[380] Unpredictable in terms of success

(British Sub-Aqualung Club)[381] qualified but now BSAC as an amateur organisation has been are subsumed by the proliferation of PADI dive centres. The Professional Association of <8>Diving Instructors, is also known (to us) as Put Another Dollar In! The courses do not teach you to run dives but are mainly suited for teaching in a pool or inland lake or pit-diving.

In the late 1970s on a weekend at Littlehampton on the South Coast there would be 10 or 12 dive ribs lined up to use the slipway to go diving. Today you'll be unlikely to see one dive boat launch a month.

Sailing

My other passion is ocean sailing .The sea itself creates a psychological mind-set that you do not find on land. The psychological impact created by the loneliness of the sea and the demands of sailing always affects the crew. Sailing at night across an open ocean is special experience. Waking and sleeping patterns are dictated by the sea and the boat. I normally work to 4 or 3 hour watch, dependent on the crew. It will be 3 hours if there are only 2 or 3 crew so you will only get two and a half hours sleep at once.

You develop a symbiotic relationship between yourself, the boat and the natural environment. I am sure this symbiotic relationship used to exist once on the land but we can largely now ignore the weather and the environment. The sea is, though, a harsh taskmaster. You must live in symbiosis with the sea. You are subservient to the wind and the waves. It creates a lack of certainty that you simply have to accept exists. Land lubbers struggle with the concept. If you want to meet up with someone, name a time OR a place but never both or you will push the envelope further than you should in dealing with the weather. You might have to stop or divert in reality.

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Do I think wind farms are a good idea?

Not quite: I think they are the least worst of the alternatives available to us at this time. I would much prefer the oceans and seas stayed free and wild, but since we humans are unable to curtail continuous population expansion we must employ those power sources that do the least damage to this blue planet.

I have not experienced noise or vibration with wind currents by wind farms. I am convinced the positioning of the wind farms has a dramatic effect on the bottom of the seabed and causes disturbance, as I have said earlier. Previously there would only have been a natural smooth sandbank which the tide and waves run across, and now this is completely disrupted. The wind farms kick up sediment stripes. I began to speculate about this, what was changing the underwater visibility some 5 or 6 years ago. The wind farms along the East coast had begun to be developed just a couple of years earlier, and I was diving in the area at the time when I began to notice patches or plumes of orange-coloured water in the otherwise clear water. It was not until I flew over one of the winds farms on a flight into Stanstead Airport on a very clear day when I could see great orange tails running behind out behind each wind <9>farm pylon that the penny dropped.[382] We were seeing great orange patches when we were on the boat but couldn't see where they were emanating from because we were too close to the sea. We knew when in the tide cycle they would occur. I am sure when spring tides surge through the wind farms the turbulence created by the pylons rip up the seabed.

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[381] https://www.bsac.com/club-life/find-a-bsac-club/ (accessed 11 4 2021)
[382] Meaning understanding suddenly came.

It became clear to me that we needed to avoid the big spring tides but over time it has become even less possible to predict visibility even on smaller tides. Of course now there are many more wind farms than before. I have no doubt this visibility reduction is due to the positions of the wind farms.

What do you think is the impact of the "sand plumes"?

Some anglers believe fish may be attracted to the areas behind the wind farms but I cannot prove that. A skipper I know fishes behind the wind farms. Possibly fish are attracted by the invertebrates that thrown up by the turbulence. I think that's probable.

Several things are happening. Some fish (eg mackerel) that did seem come to be more prolific in these waters require vision to predate on small fish. This is inhibited where there is no water clarity. Fishing with lures or feathers is less successful than several years ago. I think Perhaps the fish are still there, I cannot tell.

It has been noticeable that lobster stock has quite dramatically reduced over recent times, but I think this was caused when there were exceptionally cold and strong winter winds from the east 'the Beast from the East' [383] when truckloads of dead lobsters were removed from the east coast beaches. That was when the water temperature dropped and there was wave disturbance. I think the stocks have now recovered. The winds can cause disturbance up to 25 metres down.

I have no experience of wind farm vibrations. I have dived relatively close, say a third of a mile on the outside edge of a wind farm. I did not experience noise. In the construction phase, you cannot go within a mile of the farm and we would need to detour around it which would take us up to 10 miles out of the way, which is of course is very inconvenient. For whatever reason even though the wind farm off Southwold is completed we have been told we cannot go through it. The vessel protecting it would not allow passage.

You can however go through the Swallow Tail wind farm of Clacton and others.

Have you ever been consulted about wind farms?

I have never been consulted or contacted regarding any element of the wind farms. There has been no evidence of any form of publicity regarding their development or positioning that I am aware of. I ran a diving centre based in Chelmsford, Essex. Nothing was heard through any contact there and our dive club Zeus Diving has never been contacted. I know that other <10>divers who dive in the area have also never been contacted. I think it unlikely that divers will be consulted about wind farms and I have never heard of any contact from the developers of wind farms amongst the diving community. Why? We are not consulted due to a government feeling of ownership. Perhaps discourse is not invited from anglers, leisure sailors or divers who might disagree. As to the government situation, I do not know how consultations work. I do know considerable amounts of surveys are carried out. I imagine it is the government because they hold the fishing rights. I do not know of any mechanism to make people aware of how to get into contact with people who use particular areas. You would go to the ports or the marinas. Perhaps it is up to individuals to inform themselves, but there seems to be no mechanism or infrastructure in place to distribute information to leisure users off the sea.

Fishing is a profession and so might be a "vested interest" but maybe the sea as a resource for social life would not be considered a "vested interest."

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[383] Anticyclone bringing widespread uncharacteristically low temperatures and significant snowfall to widespread areas of Great Britain and Ireland eg beginning on 22 February 2018 Anticyclone Hartmut

Wind farms affect diving and sailing and fishing. I believe the sea is a resource for social activity with sailing and diving and fishing and the relevant bodies should at least attempt to contact non-commercial users. There is no attempt to consult with us. It would be helpful if people constructing wind farms consulted with sea users as I feel sure leisure users could contribute to the discussions. For example, instead of building a 6-7 mile long wind farm banking one block they could build them with a throughway in the centre or develop in two parts so as to allow passage.

There are 15 members of our dive club who dive in the affected area. If wind farms are responsible for reduced visibility, and from a diving perspective the adverse effect the wind farms have on our leisure pursuit affects no more that maybe 30 people in this area, I am unaware of the extent they will effect sea users nationally. The recipients of the energy they produce are the whole nation. Perhaps it is unrealistic that they would consult. When only sandbanks were used for wind farms there was no sailing inconvenience, but now these wind farms are 15-30 miles out from land and they are now being built in areas that are not on sand banks. Leisure users of the sea are the most impacted because the environment is no longer wild, and many of the leisure users resent their visual impact and see the coastal waters' attraction diminish as a wild and free resource. It is a real impact because it is not a wide open ocean any more. They are ugly and almost always in sight in the East Coast sea area.

Research

In general I do trust what scientists are discovering and I do understand the need for an alternative to fossil fuel, but am concerned about who is funding the research especially because I am not informed about research. I am not aware how wind farm expansion is planned. It would be helpful to understand for example what reduction the proliferation of the wind farms has made to the UK's fossil fuel consumption.

Since when we are out at sea, we see the wind farm support vessels, maybe 10-12 of them, running at high speeds back and forth from Lowestoft. These vessels are diesel powered and it is clear to me that the wind farm power generation does have a significant carbon footprint. <11>It would be interesting to know how 'clean' the wound farms' generated electricity actually is.

Information would help people generally better understand, but as far as I know the information is not out there and the statistics should be better publicized.

Everyone knows the UK committed itself to 2050 zero carbon, but no one has illustrated the subject of *how* we are getting there. I'm sure the general public does not understand the scale and connection or reduction of emissions afforded by the wind farms to the carbon emission problem.

(Courtesy of Dick Beaumont 2021)

3. The unnamed engineer

An experienced wind turbine engineer

REFLECTIONS ON THE MARINE ENVIRONMENT INCLUDING AS A HABITAT WITH SPECIAL REFERENCE TO WIND FARMS AND OTHER STRUCTURE-AFFECTED HABITATS

I am happy to provide an interview, but I wish to be anonymous. I do not want to sign anything; I see no reason to do so.

Enthusiasms, background, and motivations in relation to offshore wind power:

In the early days there was no offshore wind. It was relatively highly profiled in the research community in the 1970s and early 1980s because it was expected to become dominant. Subsequently, Californian onshore wind power was booming, the focus shifted to onshore, and then the discussion of offshore died out.

In 1989 the Danish government had its concerns about the domestic onshore market of wind turbines becoming saturated. The onshore market has its limitations where you have a pastoral landscape and an energy source that affects the landscape. Offshore wind had the potential to deliver power out of sight, without trouble about noise or visual impact. Offshore would be an unlimited resource, and it could be part of the answer to becoming independent of imported fuels.

When and why did offshore wind become a mature industry? What was the growth of the industry?

Offshore wind developed over the 25 years with around 70 projects in 8 different European countries. In that time 11.2 GW was installed. From 2000 until 2010 the growth curve is linear and upwards, and from 2010 the line takes off almost vertically and continues to climb steeply without hesitation.

Whether the industry was genuinely mature in 2010 is a question. Infrastructure supplies were still somewhat on a steep learning curve, and were too individualistic to specific projects.

Mass production benefits were only there from around 2015 onwards, and that happened because of price pressure. The energy market moved from a fixed price to an auction regime price. This essentially drove widespread industrialisation in Europe. There is a coming market in the USA and contracts are being signed. As we talk there are 6 turbines in operation in the USA. China has a mature industry, but it is specific to China. I am speaking now generally of Europe.

Can we speak of an "enough" point for offshore wind power?

I do not think that we are yet anywhere near an "enough" point. What we see is vast areas of sea that could be used to mitigate climate change. I believe that it is a fundamental premise for the offshore wind industry that we do good for the world. In most locations the benefits in the form of climate change mitigation outweigh the sum of any negative effects in the sea.

<2>After the 1995 installation of the Tunø Knob Project there was a bird count. It turned out, somewhat to the surprise of many, that the number of birds increased by having the wind farm there. The result was generally interpreted as the result of the turbine foundations acting as miniature reefs where fish were breeding, thereby leading to more foraging birds. This is still a feeling that we share in the industry, i.e., that it is not obvious that we might be

bird killers. You cannot fish between the turbines, and thereby offshore wind farms have a bird sanctuary effect.

In the early projects, seals were studied. They seemed unaffected by the installation of gravity bases, but there has sometimes been concern about monopile foundation piling noise, the noise made by the ramming of the foundation into the seabed. The mitigation actions include bubble curtains that have good effect. Floating turbines do not appear to have the risk of disturbing marine mammals in the same way. There is still some noise, as there is for any marine operation, but I am not aware of it being a major issue.

In the German Bight in some areas, it was noted some years back that the sighting depths increased. This was again interpreted as the wind turbine foundations acting as miniature reefs, supporting mussel colonies that are breeding on the foundations and filtering the water. That might be good, or it might deprive other species of food. There is considerable concern in the Great Lakes in the USA where there is now much clearer water than before due to effects of an invasive species, the zebra mussel. This has nothing to do with offshore wind (there is none in the Great Lakes), but it could be an extreme variant of what we might see with offshore wind foundations.

As an offshore wind professional, I do not see wind turbines as overall damaging to the marine environment. They have environmental effects, as do all other human activities, but I am convinced that in most relevant locations the benefits in the form of clean energy far outweigh the relatively moderate environmental impact.

Of course, fixed structures in the sea are potentially conflicting with other commercial interests such as commercial shipping and fishing, and in some cases also military interests. Generally, it is possible to locate projects where such impact is minimized, off the shipping lanes and the nature reservations, and not conflicting with military interests. Still, any limitation of area may be seen as negative by fishing interests. I believe that the "sanctuary" effect of wind farms has overall positive effects for fishing interests, but in many cases, it is still necessary to offer some sort of economic compensation to the fishermen.

When is there enough offshore wind development? I do not see an "enough" point until we have a full transition to clean energy from wind, solar PV, hydropower, etc. But obviously, you can get "enough" in specific areas. Fortunately, we are typically able to relocate projects if too many other interests are affected, and on the global level we also have onshore wind, solar PV, and hydropower to supplement offshore wind in the electricity supply.

Any comments about wind farm "plumes" in the sea?

<3>I never personally had the responsibility for monopile foundation design and installation; this was always the developer's part of the supply. Enough protection is required to prevent erosion but not so much that it takes too much of the seabed. This is a balancing act. Common practice now is typically a scour protection pad that has up to approximately 10 metres radius from the foundation centre of a large turbine. A typical 10-metre radius of scour protection will lead to roughly 300 square metres of seabed area affected. In comparison, there may be 1500 metres between large turbines. That means that the overall seabed footprint of a large turbine in a wind farm is around 2.2 million square metres. The proportion of the seabed affected by scour protection is then about 0.01%. I guess that most people would regard this area as marginal.

For gravity bases you would normally need to remove the seabed surface at the so-called mudline for construction. You place a stone pad (a level area of crushed stone) and the concrete gravity foundation is then placed on the stone pad. All the early Danish projects were done this way. Disturbance of the top layer was a concern but in practice it did not give rise

to observed issues. The monopile is driven into the seabed without any prior preparation of the seabed. After that, the scour protection is installed around the foundation, normally without prior excavation of the seabed.

Decommissioning

In 2018 Vindeby was decommissioned and broken up and there were no problems.

I have no experience with decommissioning of monopile foundations, but I know from planning permissions what is typically be expected. The monopile foundations are generally assumed to be cut below the seabed surface, the upper part lifted off and the lower part left and covered. The remains would then just be a piece of inert steel as a man-made item below the seabed. It will be completely covered.

My attitude to the sea

I am a sailor and have spent part of my life with boat racing and tour-sailing. I love many things about it, primarily as a nature experience. I have a sailing boat. It has an engine, but we only use the sails. If your mind is full of things, when you get on the boat, it all disappears. Your worries go away. Every time I get to our home port, I think of the sea as a fluid connecting all parts of the world - I could sail to China if I wanted and dared. It is a fantastic idea. When sailing, it is mostly about the overall experience of nature, but I also fish and I swim.

Personally, I have always preferred that offshore wind farms are out of sight so that people do not see industrial equipment in the seas. We obviously know that there are ships, oil rigs, commercial fishing, etc. out there, and we know that the sea is a workplace, but it would be good if we could still be awestruck by the sea. For me, a feeling of awe happens in some parts of the Alps, in blizzards and in thunderstorms, and I also get this feeling from the sea.

Coastal offshore wind farms can also have a complex impact on the overall landscape. With the Middelgrunden offshore wind farm off Copenhagen, you see Malmo in Sweden in the <4>background, and it is overall a big populated and industrial area. Here it is perfectly fine with the turbines. In pristine areas I am less comfortable.

Therefore, I advocate setting wind farms 40 kilometres or more off the coast. At this distance, the nacelle of the turbine is below the horizon, and you will only be able to see the upper part of the blades from the beach, and that only under very unusual atmospheric conditions with unlimited visibility. Any aerial warning light will not be seen at night-time. And yet, offshore wind may provide all the electricity that we need.

If I ventured into debate about industrialising perspectives of the sea, or the idea that any change from pristine could be bad, I would say it is much worse not to do something about climate change. In this perspective, offshore wind is a low-impact solution to the climate crisis.

As regards the sea, it is a question of balance. I see marine shipping and I feel good; trading with shipping is something humans did for millennia. On the other hand, I feel bad about yellow smoke. Some might say it is “ugly”.

Is there a disorienting effect at sea where all wind turbines look the same?

You can have disorientation at sea for many reasons. Estimating distances is notoriously difficult. I have had the same boat in the same port for 30+ years and I still make errors sometimes. I think disorientation would not be more than optical effects and that it would not affect navigation in practice. Everybody is basing navigation on GPS nowadays.

What of the working life of wind farms and/or maintenance?

The machinery is always monitored with automatic condition monitoring systems. In addition, regular visual inspections are part of the service effort. Typically wind farms are involved in environmental or biological monitoring. For example, the presence of seals has been monitored before construction and noted their numbers regularly in the project life to discover how the seal population developed. The owners also monitor the wind farm.

What of the redeployment of cables after the commercial life of the original turbines, or the reinstallation of new turbines on the existing foundations? We have, say, 25 years use for the cables, and they could easily be used for much longer, but in practice the cables from a 25-year-old wind farm will be too small for modern turbines. Nowadays you would have fewer turbines of higher power rating. Consequently, you would remove and recycle the original cables and install fewer new turbines with new and larger cables. The same would apply to the foundations. Having said that, I am not aware of any offshore wind farm that has been upgraded this way yet.

What about floating turbines?

Offshore wind is very successful. It is designated to be the main source of electricity in the EU by 2050. But there is a downside, and that is that offshore wind power as we know it is not so easily applied everywhere in the world. The North Sea and the Baltic have lots of <5>shallow water area close to highly populated areas. This is true also for the east coast of the USA and for China. But in most parts of the world the water depths offshore of highly populated areas will be too deep for conventional bottom-fixed foundations. Therefore, the total available resource of conventional offshore wind is "only" 1.5 times the world's total consumption of electricity. If we expand our technology by including also floating offshore wind, the International Energy Agency[384] says we can supply more than ten times the world's total consumption of electricity.

Climate challenge is getting under control in countries like Denmark with pathways towards reasonable non-fossil energy production. But many emerging economies have a combination of increasing population and a universal desire for the population to have a better standard of living. The human development index couples a higher quality of life with a higher level of energy consumption per capita. We are looking at countries with increasing population that have vast needs for energy supply. Floating wind power and energy storage can be a fundamental solution for the energy supply in such emerging economies.

[384] https://www.iea.org/ (accessed 7 4 2021)

4. Councillor Paul Gilson

Paul Gilson

Councillor Gilson, Chairman, Leigh on Sea town council.

REFLECTIONS ON THE MARINE ENVIRONMENT AS A HABITAT WITH SPECIAL REFERENCE TO WINDFARMS AND OTHER STRUCTURE-AFFECTED HABITATS

I believe, as many others do including Dutch fishermen, that wind farms are detrimental to the environment (as I shall go on to explain). If we are to believe our Green friends, replenishing the sea is about leaving it alone, and if that were true, the East Coast should be flourishing. But inside the 12 miles coast, fishing has collapsed. This has been accelerated since wind farms have been in place. There is a north-south tidal movement past the turbines and there are sand clouds in the water of the North Sea that can be seen on NASA satellite images. The sand line is stirred by the presence of the turbines to the distance of 2,000 meters. For the fish it is like being behind a wooden door and they will not pass through the sand cloud. They are from North Foreland to the Wash. For 6 to 12 miles there is virtually a constant line of wind farms. Ten turbines are like ten sand walls stopping the fish passing through. It is an artificial barrier across the mouths of estuaries, a sand wall.

Also (as I have been told by other fishermen) there is a noise barrier. One man was shrimp catching in the Wash and his engine stopped. He was astounded by the noise being transmitted from the engine room but it was wind turbines. This has been confirmed by CEFAS.[385] Their scientists thought their engines were playing up and so they closed the engine down. They were five miles from where the (turbine) piling was taking place.

There are some more effects taking place round turbines. These have buried electricity cables, and the sea bed is disturbed by that. In places the burial starts to wash away. In order to protect the cable, rocks are put on it. This changes the biodiversity, where mud and sand becomes rocks and the material around has been washed away.

I comment on sea bass (which are allegedly under environmental threat, though this was possibly decided so as to give the Greeks a financial advantage in respect of the Mediterranean). Turbines under the water give an "undisturbed wreck" situation that attracts mussels, growth and becomes a feeding station. Sea bass takes advantage of it. This makes a conservation zone in which sea bass flourish. So a problem is created with assisting the growth of a top predator.

Along the East coast we have a Dover sole fishery. Our efforts there are disturbed by aggregate digging. There is a breeding season in the spring and the fish move off in the autumn. In recent years since the wind turbines have become more prolific, the previous inshore migration of Dover sole has collapsed to next to nothing. One boat got out and had 5 kilos for three tows. That is not economic. Fish have stopped coming inshore. Yet the <2>scientists have suggested a 20% increase in numbers last year and another 20% increase in this year for Dover sole. The Dutch are not seeing a drop in sole stocks; they are seeing an increase. Work has been done on this by scientists offshore. They saw a large increase in the amounts of mature fish breeding successfully. So there are questions (to my mind) about the barrier-effect of wind farms and the destruction of the sea bed preventing migration.

[385] Centre for Environment Fisheries and Aquaculture Science https://www.cefas.co.uk/about-us/ (accessed 18 10 2020).

Dredging, wind farms and cables are never mentioned as a problem. We had a tremendous number of meetings and groups discussing the question of sustainability. The Greens have only attacked the fishing industry. They do not like the fact that we kill things. Our livelihood depends on going back tomorrow. We had more sustainability 20 years ago when we had 20-30 boats going out every day than we do now.

In the past there was a mistake by the Ministry: we had no quotas. I carried on fishing. I was fined £400,000 and I lost my house. The Ministry people have all moved on. The new ones want my knowledge. When I was attacked by the Ministry, it was because I was talking. Lots of my colleagues say: "Sorry, Paul. I am not saying anything because I am afraid of being attacked." I am still here and happy.

You can see a copy of my Dredging Powerpoints. The narrative is mine. Recently it has been taken on board by DEFRA[386] and it shows Dover sole then and now. The actions of man are having a bigger detrimental effect than possibly global warming. Recently (7 October 2020[387]) there was an article in the Telegraph saying Don't Eat Sea Bass. They said we were purchasing from France from people who were killing lots of dolphin and porpoises. This is an unproved article. We do not purchase wild sea bass. We purchase farmed sea bass from France. We export sea bass because they pay more money.

In the English Channel this summer we had the biggest shoal of blue fin tuna along the English coast ever. There were 400lb tuna jumping out of the water. The crabbers (crab fishermen) were concerned the tuna would jump and crush their small boats.

Lots of things are connected with the quest for green energy (which I accept we need to have). But wind farms may not be so green. They use diesel engines for the quiet times. The cost of maintenance and boats for almost daily maintenance is colossal.

Whitstable was under construction for nearly 5 years before it produced electricity. Whitstable was renowned for its oysters. It is stony, pebbly ground. But there is now a 2 miles long barrier to protect the cables across the whole area and so the whole area has been lost to fishing that not long ago was a prime area for fisheries. We get blamed. You can check. It is all factual.

<3>My family have been fishing for a couple of hundred years. I left school at 15- not because I wasn't intelligent. The teachers begged me to stay. I always hated bullies, and always fought back even from being 11 years old. From my mid 20s I was helping at the fishing association. It was older people and they were using the early computers. I love the outdoors. I shoot and I love wildlife. Scientists came out with me and learned how birds reacted to us. The fishery officer would see you, and you know he's talking nonsense. I have been here. I said they have less than accurate views. You cannot beat being on the ground to actually learn. I would sit and watch birds do things.

I would like the world to be a better place when I left. I am much a Green in a fisherman's coat. The principle of a sustainable fishery I would protect, and I would like to enjoy the job I have had. Last week I was talking to a South Shields fisher who said regulations and rules have taken all the fun out of the job. It is a tremendous business to go and catch fish. You catch fish and the boats only half a mile away don't. I had a slightly faster boat and you learned from every tow where fish were. You eliminate possibles and would have the probable areas that they would be in. Everyone would think there was nothing there but the fish would be there. I loved my job- it was exciting to get up early and go.

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[386] Department for Environment, Food and Rural Affairs https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs (accessed 18 10 2020).

[387] Rudgard, Olivia *Wild sea bass off the menu as charity warns European trawlers kill dolphin* The Telegraph 7 10 2020 https://www.telegraph.co.uk/news/2020/10/06/wild-sea-bass-menu-charity-warns-european-trawlers-kill-dolphins/ (accessed 18 10 2020)

Even at a young age I was dreaming about *the Tizzard*. My father said Go There, and we caught more fish in one trip than the whole season. It was such fun- the sense of achievement. I loved every minute. Money was never a deciding factor. I have written a book[388], and have another ready. The new book is also short stories. I am also writing a novel. There is politics- I am Chairman of the town council. I was born on 10 November 1953. My father was a lifeboat man before me. He was away in the 1953 floods and when he returned, I was there. I was fulltime fishing from when I was 15. I left school in the April when I was fifteen and a half.

I was on the parish council at the time and I was sick of reading what the borough council (Leigh) were doing. When I first stood for election to the borough council I failed by a handful of votes. This was around 3-4 years ago. It came to the job that I was always complaining and felt I should make a difference. It is important to get people to work together. I am two time Commodore of the yacht club. I try to talk to people openly and frankly. Previously we would have a meeting with the Minister. After the fourth year you would see his head drop- as in Oh No, Not Him Again. But I went to London and had an hour with the Minister on my own. My views are open and honest.

We have to be very careful with scientific investigation. In my experience people cannot speak openly- they say reports are total lies but the work has been done, and it gives me no pleasure. So when I was in my 20s and 30s, or even if we go back 14-15 years, everything looked fantastic. We were going to take advantage of increased fish stocks, especially skate and sole. But within 5 years this was turned upside down. There was a rapid decline in this area. My boat was not finished. I kept it with the help of others shielding me from other problems.

<4>It was me telling people about the fish species. There were two seahorses and there have been none since. I think it is a domino effect. Porpoises and dolphins- we see very many of them. In 2014 there were porpoises, dolphins and seals washing up dead. They were not just one species. I think it was poison: the Pitsea landfill site was a toxic tip. There had been dredging, two dredgers in the same place for three months. In 2014 the heavy rains came and the water from the landfill site drained into the bottom of the sea by "leaching out".

I would like the place to be better. I have Dutch contacts who might be worth your talking to. There is a big fishing organisation looking into it.

Wind farms

When they made the announcement that there would be more and more wind farms, the quest for cheap electricity is outstripping the actual knowledge that we have. It is about priorities: for example with these huge ships, we change the river to accommodate them not the other way round. We can see a lot of environmental damage for a disproportionately short pleasure such as when people buy cheap balloons. I detest seeing electricity wasted- illuminated buildings with lights on all night. Then someone accuses me of killing all the fish. I would not want to see Scandinavia covered by wind farms- they have tidal resources.

In short, in very recent times (November 2020) we have come to think there are serious problems with inshore fishing possibly because of wind farms. On the East coast of England there has been a crash in fish numbers. There are various possible explanations such as the drainage of pollution or a problem in the sea itself. The cause might be one of communal activity or as caused by individuals. There has been over-development of the seas.

Now we are experiencing great concern about some of the offshore wind farms that have floating turbines and moorings that attach them to the sea bed. These floating turbines off the North Devon coast each have a mile of chain that scours the sea bed. We know this happens because we

[388] Gilson, Paul *Sole Searching: Tales of a Thames Fisherman* Estuary Publishing ISBN-10 : 0957063504 ISBN-13 : 978-0957063501

have seen it with ships where they cast anchor. There are three Devon moorings and they are of a huge size. We need to evaluate what this is doing to the environment and what conservation issues it presents.

My relationship to the sea and conservation:

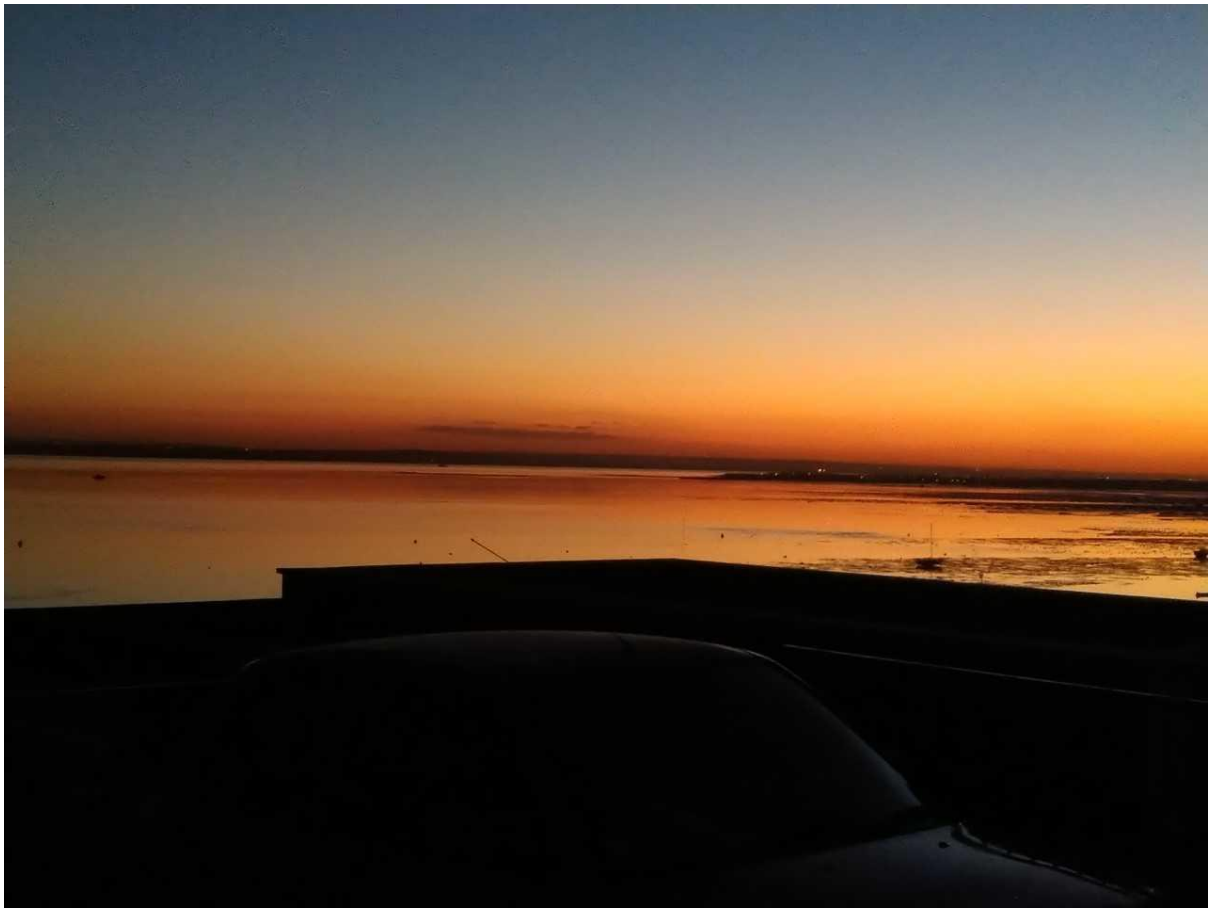
PHOTO 1

The sea is a living moving person that can only express itself through action. It can change mood and change your mood. There are many emotions that the sea can express and communicate- fear, anxiety, anger, calm, reassurance, joy and many others. You can quote the Bible about those that go down to the sea will see the wonders of the deep. But only for those that use their eyes.

In the week of 6 November 2020 I have taken some photos of the sunset over the sea near to where I live. They are about the beauty of the sea. Photo 1 is one of them.

<5>

PHOTO 1 © Paul Gilson 2020



<6>PHOTO 2 © Paul Gilson 2018

PHOTO 3 © Paul Gilson 2020

<7>PHOTO 2

I was fishing a couple of years back and I saw a sunrise through a wind farm. I had the photo printed on a solid surface because of the shapes and colours in the shot. You could slip a knife

between the shapes and colours. They were so clear it was like a caress. I was watching the sunrise develop and this was a sudden perfect moment, a single right moment, a fleeting glimpse of heaven. Sometimes I think the wind farms look like abstract art, shapes and shadows. This photo to me shows the sun coming up on the beginning of a new era. It is the start of a new day and here are the turbines. In the picture, everything is stationary but this shows them as to how it will be. I feel concerned due to the lack of knowledge and lack of forethought. It seems a blinkered approach, like a running horse blinkered so it does not get frightened. We are seeing a headlong charge and we do not know what we are doing here.

I am apprehensive about incompetence both of political leaders and of Green groups. If you look at politics lately, those who have been screaming the loudest have got their way. It is true in lots of areas and protests, and serious issues are complicated but have been diverted from a serious focus. For example, take the grey seal. There are 4,000 of them on a sandbank and they are all eating fish. We are changing the environment by over-protection of seals. This is a serious question, but the BBC approached me to talk about what we should call a female that goes fishing. I refused. (As a matter of fact they want to be called fishermen not "fisher-lassies" or some such). I am also worried about the motivation of some of the people consulted, especially whether the individuals have personal financial other unworthy goals. I have, for instance, known a fraudster who had run off with moneys be included in a consultation group just because he is a good talker. I do everything for nothing and I am doing it to improve things and so that decision-makers have the use of my knowledge. Older people have knowledge of earlier mistakes, changes and they can bring calm to a process. You cannot buy experience for young people. There is a big difference between intelligence and common-sense.

Photo 2 was taken long before the 2020 lockdown due to covid19. To me it represents both the dawn of a new age and what it is trying to prevent. In the picture you can see the pollution cloud, the scum in the sky behind the turbines at the dawn of this new age.

My daughter had the original photo printed onto a metal plate/canvas. I have it at home in my main living room and it looks at me all the time. It is with me when I relax. The colours especially are a stunning capture of what I saw. That day the sun rose at the end of Southend Pier. I saw a huge red ball holding on to the sea. For a few minutes it was red then a glowing orange so bright that you could not look at it. It was a fleeting fantastic moment.

In the Turner[389] Gallery in Margate[390] there was a small Turner picture. If you go close up, it comes to life. The groups of people are looking at you. It is Margate before the industrial revolution. The colours are so vivid. I have a neighbour who is an abstract artist but when I see his art I get depressed because I see a troubled mind. Artists are all different. Another I <8>know can sell his pictures for hundreds of thousands of pounds but he has one picture that he keeps for himself because it comes alive for him. I am affected by the sight of the wind farms: how can something so beautiful to see be so harmful?

The kind of harm that concerns me is this charging ahead without knowing the full damage. When wind farming first began it was heavily subsidised and the production cost was very high. They have diesel engines to keep the turbines moving. I feel there is uncertainty about the net amount of electricity that is produced if you were to account for the energy used in creating it.

I also think there is an issue about how much wind energy we should be creating. When do we have enough? I can think of Whitstable where the wind farm is in the sea many miles from land and these non-natural structures are not visually intrusive from land at all. There is no obvious restraint on the infinite development of them. Wind farms and dredging take priority over environmental protection. Big business and commerce seem to come first. There are consequences

[389] https://en.wikipedia.org/wiki/J._M._W._Turner (accessed 6 12 2020)
[390] https://turnercontemporary.org/ (accessed 6 12 2020)

for the use of electricity. The wastage of electricity causes society to want infinite absorption of electricity. If we dropped our power consumption by 10% it would make an enormous difference. But there are problems in getting people to change their ways. People are wasteful: but they can change, like if you get them to use a reusable plastic bottle. Unfortunately wind farms are not associated with understanding wastefulness or showing restraint. When you go out to sea, especially the southern North Sea, you are very aware of the wastage of electricity from the lights and glow from Zeebrugge or Dover or Calais or Margate or Whitstable or from London. In Harwich and Felixstowe they are walking about under full open-air artificial lights.

When you sit in a boat you are watching, looking and thinking. I have always been a bit different from the norm. A yacht club colleague once said: you always seem to have an opinion on something. I said: don't you? I am often on tv for that reason- local tv and also in France. On the question of legacy, I want to leave things better than when I came in. I think generally that management is worse than it was and there is too much greed and false information. We need to educate urban people. 25 years ago there were 25 seals that turned up on the coast. Now we have 4,000. Each one of them eats 7 kilos of fish a day. They eat salmon, these grey seals. We have to look at how far they are responsible for a decline in fish stocks. The "Awww!" factor is a bad base for management policy. Cuteness is a problem. If people see an injured pigeon they say "What can I do?" but nature is nature. People feeling good does not always give rise to good policy. The "mob" (the biggest in number) is not always right. The general public can be misinformed and there are people who play on the "feel good" factor. People say things like "Oh isn't he lovely!" but this is a creature that can rip you up and only looks cute if his mouth is shut. Predators should not increase beyond their natural sustainable capability. The pups that are deserted by their parents are looked after by wealthy organisations when nature would keep the numbers down. MPs do not stand up for a proper policy.

Wind farms:

<9>The fishing industry is clearly affected by them because they damage the ground. There are some good things about wind farms, though. The skills of fishermen are used on the wind farm boats and it is well-paid work. I also think that these wind farms assist with sea bass stocks, because they are like artificial wrecks. The fish take to hiding near the structure and they grow there. We see more bass than ever.

If I had the power, I would re-site the wind farms and put them on land and especially on uninhabited islands like they have in Scotland. There is an environmental cost to leaving them on land but it is very expensive to maintain them at sea where there are so many practical factors against you. It has a big financial cost to keep them in the sea.

The problem is there about decommissioning wind farms. They are difficult structures. I hear that the Danes have removed sea turbines because they have a limited life-span. There are thousands of turbines in the North Sea and the sea bed is now unworkable due to damage such as fouled cables. Fishing inside a wind farm risks damage and very few people do it. A few do if they are looking for crab or lobster possibly.

The Bristol Channel has proposed floating wind farms. It is a big operation dealing with the water depth and the tides.

If the wind farms were simply left there as a form of decommissioning they would be a naval risk. We might have, say, 300 turbines in muddy water with the sea rolling over it. The sea bottom is full of holes and the whole environment changes. There are streams of sandy water. In any case I think the removal of the sea cables releases a colossal scrap value so it will be done. I have never seen the engineering models for the basic structures.

Oil rig sites are very different. With them you have a miniscule site physically because it is all in one place with a single structure, say. But with wind farms you have thousands of sites with structures spread over very large areas.

I believe harvesting the wind farms at the end of their lives will be financially worthwhile. The metals are valuable. We know there is a reclaim industry because the many US and Japanese vessels sunk in the Second World War are harvested for scrap. I do not know who does this. They take the propellers and the armaments because they date from the pre-nuclear era and are of better quality. Allegedly you can make surgical instruments better from these recycled materials. Wind farms will give thousands and thousands of tons of clean metal that can be recycled. I would say that an outlet will be there. The electricity cables will be recycled for sure.

If we look 50 or 100 years ahead, metal digging will be expensive and so material will be harvested from old sources. We know that the old tin mines in Cornwall are being re-opened because the costs now make it more viable. There are deposits there and the prices make the extraction viable. The same is true of gold in Wales. I am going to assume that currency will still be in use and that metal will still be used.

<10>Retired fishermen will tell you that this used to be the season for cod ending but now everything has changed and there are no shrimp for the cod to feed on. Things are very different but change is always going to be there.

I have been fishing close to various structures. There are a lot in the sea such as red sand towers, shivering sand towers and also those gun placement towers that used to be used for pirate radio stations. Most of them are very different from Sealand. One of them always had bass nearby. The second set of structures not so much. These were the Maunsell anti-aircraft towers from the Second World War. One was knocked down in the 1950s when a ship ran into it.

Sealand is on a sandbank. There are two round concrete towers. There was not a lot of fishing there except bass, at least that was my own experience. We fished close to the Maunsell Towers on a day to day basis. They had smaller columns and there was no cabling risk.

I used to work four boats over time. One was a conventional Scottish-style wooden trawler, although the boat was built in Northern Ireland. It was typical of its age.

My next boat was a beam trawler (heavy duty nets attached to a steel beam that holds the nets open). Later I had another that was slightly bigger. My fourth boat was a stern trawler (built for hauling heavy catches up the stern onto the working deck). I worked that one for 20 years. I used to catch sprats, herring and cod as well as eels. We adapted and caught different fish as and when. But when the restrictions were created it brought waste and too much pressure on individual stocks. We used to stock different gear and types of nets for eel or sprat, say. Or we could be open fishing for demersibles. We could go for other types of catch but when we were banned from these other gear, it forced us simply into catching demersibles so it put stocks under pressure.

There is no over-fishing, I think. There is a general over-pressure on the environment. We need the environment to work. We fishermen are not the bad guys. The damaging factor could be drugs or other toxins being used on land and finding their way through sewage systems into the sea. The pill created more male than female shrimps. If there are no shrimps we see a reduction in whiting and cod that feed on them.

Regional management plans get people to understand their own mistakes so they can be rectified and people can adapt for the future. Policy needs to be reset for the contemporary situation. Right now there are vast shoals of blue fin tuna. These areas could generate a huge number of jobs for hotels and builders. I was at a meeting yesterday and I see that people do go places to buy and eat locally caught fish. Fishing supports other industries. We are the last of the hunters.

In the South China seas- where there is very little tide- there is over-fishing because the waters are stationary. The North Sea is part of the Atlantic where the seas move and the variability is notable. The North Sea is currently being treated as industrial. It is not a brownfield site for extractive industry. For something that can be so vibrant, I am worried about it. There is too much

alteration, for example in the Dogger Bank, where it is being <11>suggested there should be a wind farm and fishing ban. We (the UK and the Danes) have fished it for hundreds of years on the East side of the North Sea. There are huge volumes of plaice. However, I do think that the South East of England is over-populated. Even treated sewage puts hot water into the sea. Scandinavia is not over-populated so fish like it there.

If Nature is left alone, it will regenerate. Fish are opportunistic. The same fish will come back. The numbers dropped with skate. Scientists predict extinction but we were seeing vast numbers of babies (around two inches across) when we were doing surveys. We now have so much skate you can do a year's quota in a single haul. This is true from Lowestoft to Folkestone heading southwards. The sea bass are similarly on the rise. Skate are not in danger. The Greens say do not eat skate because they say they are in danger. It is not true. As to the return of the skate, we have no idea why they have come back. We do not know where the spawning site for skate is but baby skate are everywhere so there must be eggs everywhere. We have no idea where. There are big, big numbers of them now. The Greens have this information but for them it is a point of principle. Greenpeace claimed there was over-fishing and they got lots of money. We all want the same thing but they have no practical experience.

Trawler fishing has some benefits, for example it stimulates the ground. The principle is like that where farmers do not like geese on ground because they pad it down. It is the same with the sea bed. In the end nothing grows. If you turn over the ground and loosen it, it stimulates the ground, in the same way that a good storm at sea will do. It reveals food. Storms can move metres of ground. With the trawlers, we tickle the ground. We are not taking it away. It is similar after trawling but it is just touching the ground. The Dutch are developing water jets and have some positive outcomes.

There is also pulse-beaming where electricity is used to make the fish jump. This means that you can re-harvest in the same places. They catch boxes of fish. They are within quota and have not killed the fish. There is a lot of envy against the Dutch because they are more efficient. We are more like artisan fishers whereas the Dutch are businessmen.

Trawlers have a bad press, which is unfair. There is so much propaganda against us but much of it is fake news. There are rumours of fishermen moving from Scotland to Northern Ireland but do not believe it. Fishing is part of the EU negotiations and is highly political. We are putting out confusion to our enemies and are putting out doubt. A lot of people are sick of the BBC and how they are handling the news. They were wrong about Brexit. The Telegraph today had a column where they suggested there be cameras on boats all round the English coast to see if we are killing dolphin. We are not killing dolphin. The cameras are being suggested for boats under 10 metres in length. These are open boats so it would leave the boat and the fisherman with no privacy whatsoever. We would be watched all the time, for hours. Think about it: is it worth the outcome? We have recently doubled the number of small businesses: is the furlough money being wisely spent?

Dredging in the Thames:

<12>It is noisy. To build houses you need sand and gravel. We do not allow sand pits to be on land these days so we are using sea-based materials. The East coast for about 6-12 miles is regularly dredged. It means millions of tons a year are taken by dredging and this really causes habitat destruction. Where it has been dredged the environment is completely changed and becomes pebbles or rocks and is no longer sand and mud. The dredged holes bring in material from their surrounding areas. Fish often do not return because there is no food. Where boats have tried to fish in dredged areas it is not worth it. The nets are filling with rocks for a very few fish. Apparently science claims otherwise. I disagree. Surveys are being done by people who previously could not catch fish and suddenly "can". People (fisherman) are not effectively being allowed to speak because if they tell the truth they have contractual clauses in their contracts that mean any compensation become repayable.

Basically, the dredging industry has locked down the flow of information. For example there is a new port being built and the fishermen were paid off. I refused. I would not be silenced. I felt very strongly about it all. The payment out would have been around £160,000. But the person who received it blamed everything but the dredging for the environmental change. It was an overnight dramatic change and the fish were suddenly gone.

I have been to the Maritime Museum where there are charts from the Second World War. There are no indications of pebbles along the foreshore. Nowadays the sand and mud is gone. 31 million cubic tons of material have been taken from the middle of the river under a harbour empowerment order. It affected 6- 12 miles. The Dutch say their offshore fishing has not changed and they have turbot and brill. If there were fish, our boats were out of that area. If there were fish inside our area we would be fishing there. The movement of the fleet tells you where the fish are. Many UK people turned to whelk fishing instead. The dredged areas are dead for fish.

Recovery:

Logically areas can recover, but the question is over what period. Dredging companies say they cannot take all the sand and gravel but once a trench has been dug, the sides fall in. This is mostly my deduction from the information we do have. I am dissatisfied with the scientific evidence. They claim there are fish where there are none at all. The scientific information is affected by the finances. In one case, a scientist actually accused a captain of not really trying to catch fish! Where research is privately paid, that is where you find a scientist.

We have had honest people. There was an Environment Agency man who said there was damage to the Thames. He was first moved on, and then sacked. The Environment Agency were bought off on the day of a public enquiry. Suddenly a phone call came. They had previously had a pro-fishing stance and they just withdrew from it on the very day of the hearing. I was also annoyed that the judge at the hearing mocked us. This was the DP World Thames Gateway and they put in a bird lagoon above the site. They began dredging for the port and there were 400 metre long ships dredging in all states of the tide. I have a map showing the main dredging on the flats. There is a run down to Shoebury where all the sands are reduced. In most cases the area of the water is half a mile away.

<13>My fishing colleagues have been gagged by their pay-outs. DEFRA now sees that there is a problem but my colleagues cannot speak. They have been gagged. It all comes down to money. For me I hate the lies, not the different priorities. That is true of the fisheries officers. If in fact they start to understand, they get moved on. I have myself spoken to Eustace[391], one of the DEFRA Ministers. We can talk to him. He understands.

Experiments:

If I had my way and could control a scientific investigation I would like to see experiments investigating:

1: dredging

2: the sand wall caused by wind farms

3: regeneration after trawling, and more generally as well.

I would like to instil some fun into fishing and see it have a future.

I would also have new non-transferable licences for the young and a test for them after 2 years. The East coast has too few fish for the number of boats. I am worried about stocks collapsing. We have seen the start of something where we do not apparently know why we have no fish and

[391] George Eustace, Secretary of State for DEFRA https://www.gov.uk/government/people/george-eustice (accessed 10 4 2021)

the other side of the English Channel is teeming with brown shrimp. We have next to nothing, apart from the Wash where they are doing OK.

I would like to see the reintroduction of the small fish survey carried out by CEFAS. We need the information.

Fishing enriches local communities socially:

Fishing depends on weather. Today it is too windy to go out. Tomorrow it might be herring and sprats we have. I love to talk with my customers about what we will have and how it can be cooked. My customer sometimes comes in, I will know him, and he might like to swap eggs for fish.

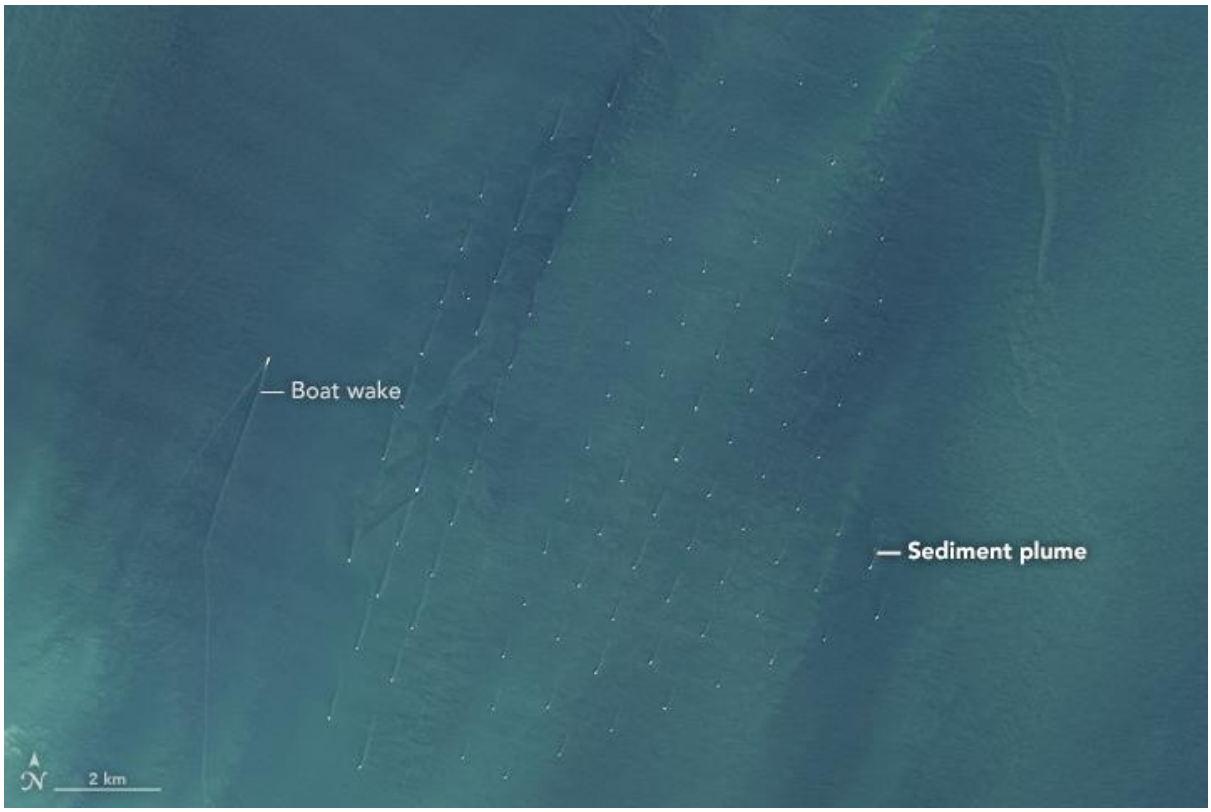
In summary, wind farms both under construction and once built, have impacts on the environment. In particular:

Noise

Sediment change

Sand plumes

Buried cables



<14>gabbard_oli_2015181 (NASA)

Wind farms are on the seabed and they have a continual impact. The local environment will be altered and have long-term effects.

A lot of work has gone on into sea noise. CEFAS put recording equipment into the English Channel and found the noise from shipping was colossal. Originally they were monitoring to check on whales and mammals. They are considering widening the study. I am 3-4 miles away from the port, but noise from shipping / dredging can make my house shake. We have much more focus on energy when it comes to wind farms.

We must ensure the survey people have no dealings with turbine builders or running wind farms. I have had a poor experience with scientists with dredging connections and I am not confident in their reports. The problem is that the immediate aim is so important compared to the immediate consequences, in their perception.

When a wind farm is established you are allowed to fish there but if you snag the cable you are responsible for that. Has the cable been well laid? If a boat snags in bad weather, it can be pulled over. This has happened. There was a Dutch incident in the English Channel off Newhaven. Two men died. One was saved by a float. They had a beam trawler and when one side snagged, it went down. The ship got caught on whelk pots on the seabed. I have local knowledge of this that came from the survivor.

When a wind farm has been built, it is potentially dangerous because its geometric structure can be disorienting. Maybe different colours might help. I noticed this with the London Array <15>because if you aim for one of the turbines and look away momentarily, you might look back at another one.

There are fish in the inshore areas but their movements are not tracked. We need better science but there is no money for this. The work must be done by independent scientists. When someone tells you the fishing is as good if not better than the port dredging works, that is not right. Before, there were 20-30 boats, and fish volumes were increasing 14 or 15 years ago. Now only sea bass and skate are increasing.

The Dutch have very high volumes of fish. The Dutch and the Belgians dominate the North Sea. We no longer have much of a fleet. 40 years ago at Lowestoft there were over 100 trawlers 60-90 ft long. Now there are none and instead there are only a few beam trawlers. Some fishermen converted to oil rig support work. Some sold their licences. The Dutch bought quite a lot of those. On the other side of the English Channel north of Calais you have shrimp boats round the coast (especially last year).

Wind farms are a piece of engineering. On land they need to be disguised. I hate what they are doing to the environment around them. The more there are, the bigger the impact. If we have 500 together, the fish do not like it. They go somewhere else. We are running out of somewhere else. I am fearful we are changing the environment beyond its capability to cope. We are all at risk not thinking far enough ahead.

We need to look at plastic. We could see it 25 to 30 years ago. But 40 years ago almost every mash had sanitary detritus in it. You would not believe what you saw. It was disgusting. Since then it has been cleaned up considerably. Yet we still have plastics and chemicals.

At the mouth of the Thames, they will be pinching every inch. The sea has its own shape and needs. It should not be an industrial environment. It can only take so much.

Much of my industry is disillusioned. We are taught by stories from our fathers and grandfathers. Fishermen learn about nature and can interpret it. When I was young there were two fishermen who worked together, a skipper and his mate. One of them was very gifted and had a natural feeling for where the fish would be. He made fortunes because of this knowledge. He was making £90,000 odd per trip.

The speed of management is too slow in relation to many of these items. When something good is going on (eg tuna) we should develop the opportunity. It would bring high financial returns for the community for very little outlay. People would come to use the boats, pubs, beaches etc. all along the south coast we have no quota so we cannot take fish. I do not know if we can do catch and release.

We should have the UK eating its own fish. We have a fishing industry and we pay a levy. Fish are landed but the advertising campaign is not of local fish (but of, for example, prawns from Vietnam). My fish are sold locally and I used to export. I am not pushing volume sales as I used

to. I now just sell locally. I have seen 18-20 boats here. Previously we would at this time of year be very excited about the Dover sole coming in but not now. This is not to do with overfishing. The amount of fishing is very small. The Thames is not awash with fish <16>generally, only skate and sea bass. We have proved that there were a lot more fish than the Kent and Essex Sea Fisheries thought to be the case. There are 9 skate species, not just one. Brussels has classified them all together. There are a lot of certain types of skate (eg the Thornback ray). You can fish it but you cannot sell it. There is no demand due to negative press.

(screenshot by Joanne Moss March 2021)

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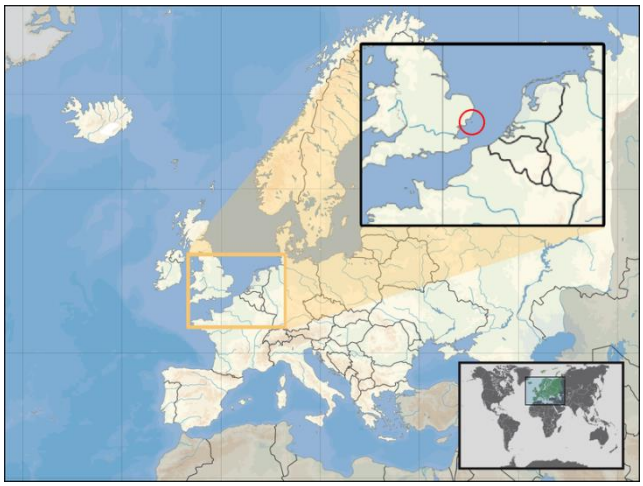
5. Prince Michael of Sealand

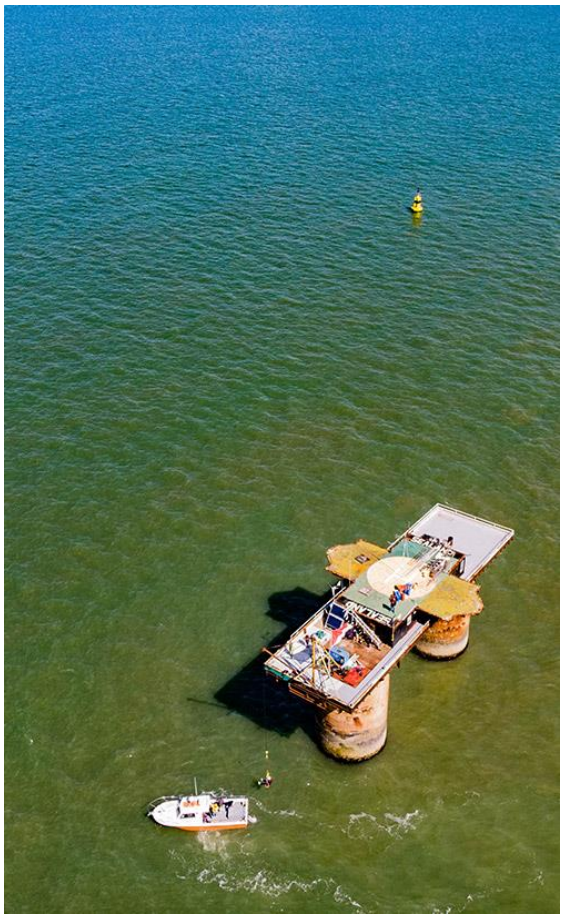
Prince Michael Bates of Sealand

REFLECTIONS ON SEALAND AND THE MARINE ENVIRONMENT AS A HABITAT

I refer to the website of the government of Sealand[392] for photographs and information about the Principality, which was founded in 1967 in the high seas off the UK.



Map by David Luizzo[393]



Courtesy Sealand government https://sealandgov.org/ (accessed 11 4 2021)

[392] https://sealandgov.org/ (accessed 11 4 2021)
[393] https://en.wikipedia.org/wiki/Principality_of_Sealand#/media/File:Europe_location_SLD.png (accessed 11 4 2021)

<2>I have known the fishing conditions in and around the Sealand structure man and boy for decades. Here are my thoughts and reminiscences as best I can. There may be some documents that do or might help my recollection, in which case I refer to them.

The Sealand structure is made of concrete and steel and dates from 1942 when it was created as part of Britain's sea defences during the Second World War[394]. The history of its construction and features is public knowledge and I do not cover this in my statement as there is no need.

I was born in 1952, and my first contact with the structure came in around 1966 when my family took over the structure. My knowledge and involvement with it has been continuous since that time.

When we first arrived, the structure had been there for almost 25 years. I remember that there were a lot of mussels and limpets on the Tower, but they have long since gone because, I think, they were disturbed by the generators that we installed.

In these early days I remember that fishing was done simply and that the fish were frequently very big by modern standards. Crab and lobster fishing fleets used ring nets in these early days. This involved the use of a barrel hoop and a tarred rope. There was mesh in the middle and egg-shaped pellets on the surface and salted flounder heads for bait. These were left in the water, and the boats returned later to collect and pull them up.

It may seem strange now, but I recall that you could use a fuse box as a weight with some bent wire as a hook and some attached bacon for bait. This was enough to catch magnificent cod.

There were lots of boats that I saw pass with 50 lb cod on the deck.

1967-1977

As to types of fish in and around the structure, there have always been and still are grey mullet that swim around the towers nibbling at the green weed. There were limpets and mussels attached to the towers.

In April garfish would appear under the lights at night.

Fishing with a rod and line there were pouting close in under the structure. Casting out, there were large cod, skate, tope, dog-fish, smooth hounds, pollock, and mackerel.

During this time I was fishing with rod and line, as well as ring netting for crabs and lobster.

All of this was just fishing for the pot, not as part of a business. It was own consumption only.

<3>I fished whenever the weather was good enough.

Open Lobster boats would fish nearby using ring nets (about 30) that they would lay on the last of the ebb tide then haul after about half an hour.

As to where the different shellfish were to be found, there were mussels and limpets on the towers and crabs and lobsters underneath.

I was mostly casting off from the structure. The fishing equipment I used was rod and line, ring nets, and lobster pots.

The quality of the water/environment in terms of cleanliness/ silt/ general health was clean but mostly silty.

The waters were not monitored at all.

There were no others apart from my family fishing in this place.

[394] https://en.wikipedia.org/wiki/Principality_of_Sealand (accessed 11 4 2021)

My impression of the recoverability of stocks at this time is that stocks (catches) reduced over the years. I could also see the catches on both commercial fishing boats that passed and recreational angling boats were getting less and less.

I was not fishing commercially at this time so did not worry about the recoverability of the stocks.

1977-87

In this period, the species of fish remained the same but just reduced in quantities some becoming almost not part of my catch. We stopped getting large cod and tope.

What is my feeling towards the sea and why? We need to protect stocks and reduce pollution.

I think these feelings are shared by others in the same way.

Do you have any views or experiences about wind farms?

Wind farms are a blight on our seas. Also I wonder if they are a good return in energy to justify them or just a political gambit.

Wind farms

Are you optimistic about what you see when you look at wind farms?

I am concerned that they will turn into broken junk. I do not know if they are viable as a power source. Probably they have the hang of it now. I hate them. They are a blight on the landscape. They are taking over my sea.

I was living in Scotland for 5 years from 1988. A few years after that they began to appear and were suddenly on the radar. They are marked on charts and shown electronically. We are <4>aware of them. I remember returning once from the pub in Leigh-on-sea and could see them clearly. We have to accept them to replace coal etc.

If there were wind farm islands you would have to navigate them. The environmental impact would possibly be less if it was wave or tidal power.

Decommissioning wind farms is not being discussed. Oil rigs neglected to take account of the barnacle and so they became rusty and fell down. There are no consultations with wind farms about decommissioning.

There are some coral areas near the Thames- off Margate, Kent and Essex. We cannot work there.

Cockle-fishing

When we have been cockle-fishing (commercially) we have skip loads of shells. We can get 30 tons of shell into every skip, and we have to pay to have it dumped. We need to turn the shells into something useful.

We only catch cockles. They lay cables to wind farms and that requires dredging. Normally we work where the sands dry out. The deeper water is 20 to 25 foot at best. We used drag dredges in the past in 50 foot of water but do not do this very often now. We usually go when the tide leaves.

We are certified sustainable. This means that over several years our fishery has made all the right decisions. We have made the right amount of effort in that we have monitored annual surveys where the amount of cockles in a quadrant is surveyed. This is a grab survey where the survey boat collects sediment. We have a riddle where we only keep cockles over 16mm and above. The small ones can go back.

As to consultations in the fishing industry, we have called a meeting with fishery officers and we have told them that we want to rest a particular area. We are consulted in connection with that.

We have no consultations in connection with Sealand: I am talking about parts of UK coastal waters.

We fish historical areas. Cockles come back to these areas after we have fished.

How do you feel the future will develop for the sea environment in the places you have been fishing in recent times? Conservation and sustainability is improving.

Years ago we were all philistines. We used to throw our rubbish out of the boat etc. we have all changed. We are now re-educated and we have gone a bit green. Last night on the news I was hearing about Israeli people being told not to go down onto the beach because of oil clumps from ships. That used to be normal here. It is not now. Previously we pumped the bilge out of the boat. We don't do that anymore.

Shellfish prefer to be closer to civilisation. You especially notice it in Scotland. Even with Stone Age settlements they found this. They were there because the cockles were there.

<5>We used to fish year round but since we have become regulated we fish June to October. English Nature gives the licence to IFCA[395] (Association of Inshore Fisheries and Conservation Authorities). It is beneficial to have these restrictions. Cockles recover quickly within two to two and a half years. In the Solway you would find these tiny spats. Cockles have a great future. This winter we reinvested due to Brexit so as to go into canning. I was against Brexit because the EU was a trading club. I recall the complexities of before the EU. We also buy cockles from other people and we send lorry loads of canned cockles to Spain. We are producing 80-100 cans of cockles per minute from each canning line. I am cheerful about the future of my industry. In the last 4 years, the last one came good. Fishermen who want to leave Europe have forgotten where their markets are- in France and Spain. My products have a shelf life of four years. We can them in two lines and they look like the old-fashioned sardine cans. They are RO 200 round. Processing and sorting in the west is hand-graded only. In the east we use a blow-out propeller. We suction dredge and you do get the odd skate but it is mainly cockles. You do see quite a lot of skate (rays/rocer) and they are under quota.

How is the sea area around it affected by boat traffic? Shipping lanes have moved away from us as ships have become fewer but much bigger.

Dredging

At Tilbury, the European Gateway Thames, the owners are Dubai Port who own the company doing the dredging. I hired lawyers alongside other fishers because of the activities of the dredging company. It cost us £150,000 in legal fees each and we had to sign and go away in the end because Dubai Port, for the dredging company, hired some large firm of lawyers in London. Dredging causes noise pollution to the fisheries and it damages the cockle-meat. The sole spawning by Canvey Island was damaged and we wanted to claim compensation.

Sea-plumes

We get these between the feet of Sealand, and under-scouring is familiar. Tides can be strong. In Scotland I have known 10 metre tides. When cockling you try to float as long as you can. I have had a 60 foot boat go aground where you could walk on one side of it and on the other it is deck-level high with sand.

In the Second World War, there was built a row of naval forts across the access to the Thames. This includes ours. The army forts were a different design and were batteries and guns. Tongue fort by Margate was twisted and bent by the tide and there was a hole in it. As a lad I crawled through and onto it. There are a cluster of seven army forts.

[395] http://www.association-ifca.org.uk/ (accessed 11 4 2021)

I have dived all around Sealand and I could see clear visibility. When we went diving there were no holes or under-scouring. The structure was set in a position so you didn't get under-scouring. Normally you cannot see in the water because of the sand there is no visibility.

I do not know if fish avoid the sand from under-scouring. I would think they did.

<6>Tides can be 10 metres at low tide and at high tide 4.2 to 5 metres. You get 6 metre tides in Southend.

My memory of the North Sea is that it is bloody cold. I have spent a lot of time on it in quite dangerous situations. It is not polluted any more. There used to be London effluent barges dumping in the sea but this stopped 20 to 30 years ago. The North Sea is beautiful in a cold way. I have circumnavigated the whole UK. My most vivid memory of Sealand is from the age of 14 onwards. I had been at a boarding school in North Wales. Early on my father had constant threats of invasion. We had a 24 hour watch: three hours on then three off. It was exhausting. I recall the peek of the sun over the horizon at 3 am. Sunrise over the calm sea is beautiful.

How do you feel about the responsibility of looking after Sealand?

It is very important to me. We claim a twelve mile limit as ours around the structure. The UK, since the extension of coast from three to twelve miles, now claims that they own the seas all around us. We have announced a marine exclusion zone but in practice have had boats very close. We have a diesel hydraulic hoist to lift people or boats. Previously we had a server farm there in around the year 2000. Right now there are minimal staff present. There is a small wind turbine and solar panels. There is also a small generator but this is rarely used. There are two turbines with one and a half metre blades on the helipad. They have been there about 10 years. Two people live on the structure and we have considered things like having an artists' sanctuary. But you would obviously need insurance. When I think of responsibilities I think of things like safety and replacement.

I love to swim and I love boats. If I had a magic wand it would be used to make Sealand a modernised new structure so that it was more sustainable. We need something larger that could harbour a boat in worse weathers than now. If a ship launches a boat the ship gives it some protection, a lee. For us, the boat hits the sea exactly as it is.

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