European Commission

Recommendations for positive interactions between offshore wind farms and fisheries

Short Background Study

STRATÉGIES MER ET LITTORAL

Eau de Web

Aets apave

Pescares Italia

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INTRODUCTION

Objective

In view of the European objective to decarbonize Europe before 2050, there is a need to understand and anticipate future interaction and possible conflict between fisheries and windfarms and associated mitigating approaches. In 2019, under the Assistance Mechanism for MSP, a preliminary study was conducted on the subject. Building on examples from North Sea countries and France, it provided a detailed overview of the principal sources of conflict, as well as a set of 14 solutions implemented to deal with them. The "Offshore wind and Fisheries - Conflict fiche" is available on the European MSP Platform. The objective of this present study is to provide further insight to the actual interactions between the two sectors, building on the most recent documentation available.

The study aims to answer the following questions:

- What are the tensions/conflicts between offshore wind farms and fisheries?
- How have these conflicts been addressed in EU Member States (at policy level, planning level and operational level)? Can some best practices be identified that could be duplicated?
- What could be done to better assess potential conflicts?
- Are there potential synergies that could be developed to mitigate these conflicts and improve cohabitation?

For information on interactions between Offshore Wind Farms (OWF) and other sectors, please refer to the following fiches which are available on the European MSP-Platform: Tourism and Offshore wind; Conservation and Offshore wind ; Transport and Offshore wind.

This technical study is based on desk research, using scientific literature, technical literature - including licensing files, political documents and the press. It focuses especially on the North Sea countries (Belgium, Denmark, Germany, the Netherlands and the United-Kingdom) where most European OWF is currently found.

Context

Offshore wind energy production, both fixed and floating, is considered to have great potential to decarbonize our energy mix. Europe is global leader in offshore wind and its production is projected to rise from the current 22GW to 270 GW by 2040, and eventually up to 450GW if the vision of a carbon neutral Europe is to be achieved. This means a twenty-two-fold increase from current production, with numerous new OWF and increasing turbine capacities.

Whereas most "historic" activities (maritime transport, fishing, dredging and aggregate mining, leisure activities) evolve at the sea-surface and are dynamic (in space, time and depth) and with a low permanent footprint, windfarms are a significant game changer. Their installations (masts, turbines, cables, substation, land connection, etc.) can bring permanent constraints for other maritime activities, from simple technical inconvenience to complete incompatibility. Until now, only oil rigs -and to a lesser extent pipelines and cables (energy or data)- had been included in this category of activities, with far less structures and over much smaller areas. Therefore, the offshore wind energy sector will increasingly experience and exert more competition for space in a context where maritime space is often extremely coveted.

While cohabitation of dynamic activities usually creates limited tension and conflict, beyond safety risks (e.g. collisions between large commercial ships or fishing vessels), offshore wind farms (OWF) could represent a source of conflict in some sea basins.

The case of the North Sea is however an encouraging example, as an intensively sailed sea basin, where most European OWF development has taken place, and without major conflict with other sea-uses. In some countries in this region, permanent offshore energy structures have been part of the landscape for about 50 years in the case of oil and gas, and for over 20 years in the case of offshore wind.

State of play of offshore wind production in Europe

Most recent information and statistics on offshore wind in Europe can be found in the 2019 WindEurope annual report.

Offshore Wind Farms (OWF) are the most mature marine renewable energy (MRE) structures. Europe is global leader in offshore wind with over one hundred OWF, 5000 individual turbines, and a capacity of 22GW over approximately 5000 km². To date, European OWF are almost exclusively found in the North Sea, with UK alone accounting for 45% of the European offshore wind capacity, see Table 1.

COUNTRY	No. OF WINDFARMS CONNECTED	CUMULATIVE CAPACITY (MW)	NO. OF TURBINES CONNECTED	NET CAPACITY CONNECTED IN 2019 (MW)	NO. OF TURBINES CONNECTED IN 2019
UK	40	9,945	2,225	1,760	252
Germany	28	7,445	1,469	1,111	160
Denmark	14	1,703	559	374	45
Belgium	8	1,556	318	370	44
Netherlands	6	1,118	365	0	0
Sweden	5	192	80	0	0
Finland	3	70.7	19	0	0
Ireland	1	25.2	7	0	0
Spain	2	5	2	0	0
Portugal	1	8.4	1	8	1
Norway	1	2.3	1	0	0
France	1	2	1	0	0
TOTAL	**110**	**22,072**	**5,047**	**3,623**	**502**

Table1. Overview of grid-connected offshore wind power projects at the end of 2019 (source: Offshore wind in Europe – Key trends and statistics 2019 – WindEurope)

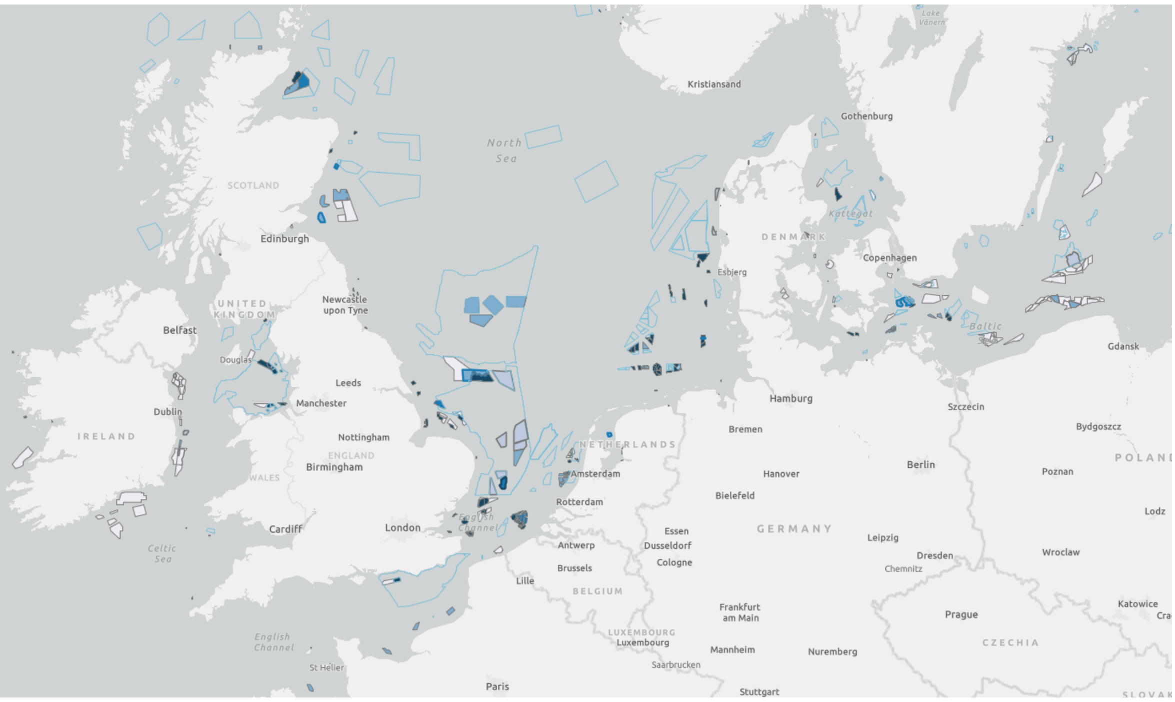

Figure 1. OWF in the North Sea – all stages of development. Source: 4Coffshore, 2020.

According to WindEurope estimations, approximately half of the expected 450GW in 2050 would be found in the North Sea, and the other half equally distributed between the Atlantic Ocean, the Baltic Sea and Southern European waters (south Atlantic and Mediterranean) ("Our Energy, Our Future" report).

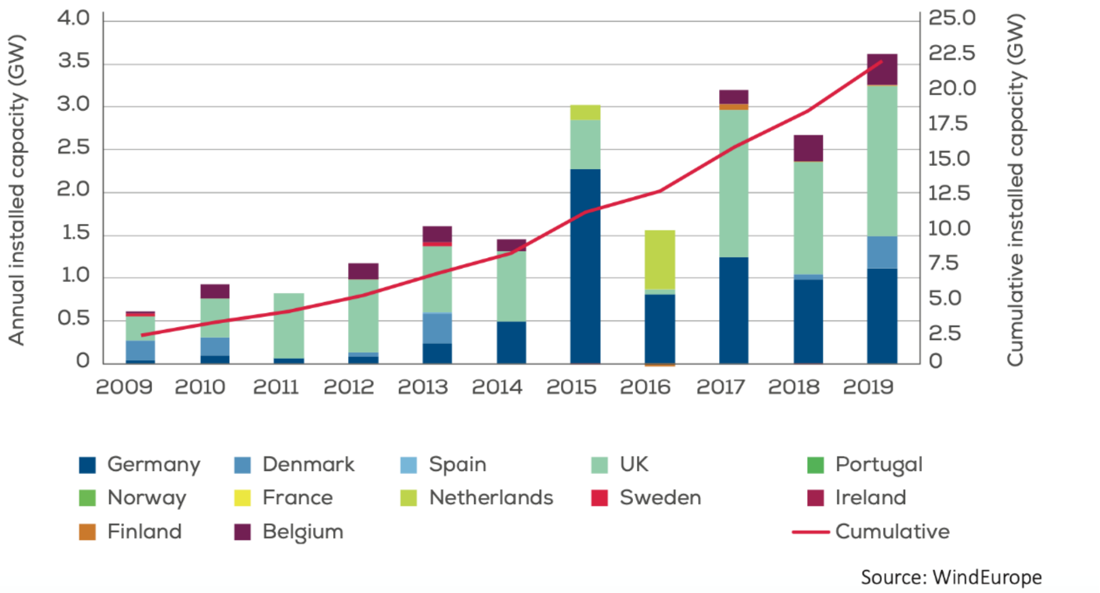

Figure 2. Annual offshore wind installations by country (left axis) and cumulative capacity (right axis)

Since 2010, OWF capacity almost doubled, from an average of 313MW to 621MW. This results from both: 1) higher turbine capacity, which has increased by 16% every year since 2014 - reaching 7,8MW in 2019; 2) larger OWF, with more turbines installed - the firsts OWF were generally made of about 50 turbines, but most of the recent projects aim at 100 to 150 turbines or more[1].

The **spatial footprint** of OWF is mainly dependent on the production capacity, more than on the number of turbines, as these can vary in size and power, as well as in spacing. The

[1] See the Hornsea One OFW (UK, 2019), world's largest OWF, comprising 174 turbines over more than 400km^2.

current capacity production ratios are about 5 to 10MW/km^{2} [2]. In the North Sea, where the production should meet at least 70 GW for 2030, this would translate into finding an additional 5,000km^2 to 10,000km^2 for new projects.

Until relatively recently, offshore wind farm development was limited to shallow water areas (< 40 m) since they required fixed seabed. The development of floating OWF opens opportunities in areas with deeper water (> 100 m)[3] and thus extends the available space as for development. However, longer distance to shore implies energy losses during transport as well as higher costs for both distribution infrastructures and for construction and maintenance.

State of play of fisheries in Europe

Fishing has historically been an extensive activity in most EU waters, and investments in fishing fleets during the last decades have led to an even greater fishing intensity over ever larger areas.

Commercial fisheries represent an important economic sector for coastal regions and communities in many EU countries. Gross profit and net profit margins have improved over recent years, due to good market conditions, healthier stocks and aided by more selective fishing methods. Industrial methods are becoming common in the entire value chain, and new techniques are constantly being introduced to optimise the value of the overall catch while decreasing bycatch.

According to the 2018 annual economic report on the EU blue economy, the added value of the extraction of marine living resources sector has been expanding since 2013. This is certainly true for the capture fisheries sector, where exploitation of stocks is being brought in line with maximum sustainable yield (MSY) and is providing higher catches, of better value, and at lower cost. The improved performance of the fisheries sector is due to increased efforts under the EU Common Fisheries Policy (CFP) to fish at sustainable levels. Moreover, the sector has benefited from lower fuel prices and higher average first sale prices. Available data shows a positive link between sustainable fishing and positive economic performance, in particular in fishing regions in the North Sea and North-East Atlantic, where an increasing number of commercially important fish stocks are being fished at sustainable levels. The 2018 Annual Economic Report on the EU fishing fleet provides an overview of the structure and economic performance of the 23 coastal EU Member State fishing fleets.

The EU fishing fleet numbered around 83,300 vessels with a combined gross tonnage of 1.56 million tonnes and engine power of 6.3 million kilowatts. Almost 80% of the total EU fishing vessels were active in 2017. In terms of landed weight, the North Sea & Eastern Arctic fishing areas account for 32% of the total landings by the EU fleet. In terms of value, the Northeast Atlantic ranks first, accounting for 33% of the total landed value. The Mediterranean Sea accounts for only 7% of the total landed weight, but 18% of the value. Conversely, the Baltic Sea provides 13% of the landings in weight but only 3% of the value.

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[2] See the report on Capacity Densities of European Offshore Wind Farms, 2018

[3] See for instance the Hywind tampen wind project (140 km off the Norwegian coast) with water depth at the wind farm site that ranges between 260 m and 300 m.

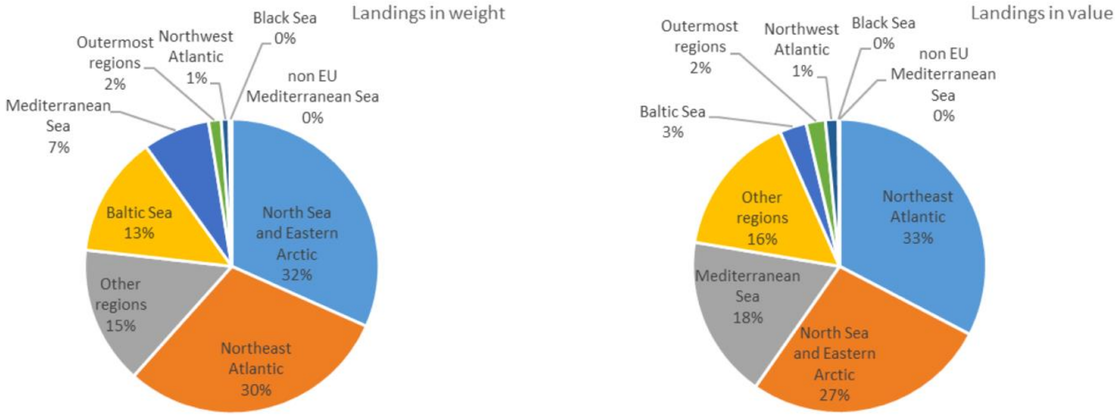

Figure 3. Fish landings in the EU (2018 Annual Economic Report on the EU Fishing Fleet (STECF 1807))

Commercial fishing is in fact a form of hunting. Although the exact patterns depend on the type of fish, fishermen mostly look for shoals of fish which move between different food-rich areas. Unlike other vessels that mainly make use of shipping lanes (optimal, shorter or regulatory), fishing vessels move in a less predictable way. In terms of landings (volumes), the most common fishing method is bottom trawling, which is used to catch the majority of commercial species such as cod, haddock, plaice, sole and whiting. Fixed gear, including permanent fish traps in coastal areas and bottom and midwater gill nets, is usually anchored to the ground, and can be permanently installed for certain periods of the year.

Commercial fishing competes with other maritime activities in terms of access to resources and space. This is particularly the case with respect to coastal tourism, recreational fishing, shipping, offshore oil and gas, marine mining (aggregates) and offshore windfarms.

INTERACTIONS BETWEEN OFFSHORE WINDFARMS AND FISHERIES

There are many potential implications for OWF on other maritime activities, which have been well documented in the literature, in particular on fisheries[4]. The most recurrent sources of tension appear to concern direct space-related conflicts and exclusion of fisheries.

Indirect conflicts occur on possible impacts of windfarms on fish stock, and more broadly on the marine environment.

Spatial interactions and tensions - Spatial exclusion as a common practice

According to UNCLOS[5], States can establish a safety zone of up to 500m around offshore installations -such as an OWF- within its Exclusive Economic Zone. In Europe this precautionary approach is being applied in most cases, although adjustments are gradually being made with the growing experience. These decisions are mainly made at a national level, but sometimes by energy companies themselves (and their insurances).

To date, for safety reasons associated with accidental damage and collisions, most ships are not allowed to enter the vicinity of a European OWF. However, exceptions are progressively being granted, in particular for vessels less than 24m - although with prerogatives in terms of atmospheric visibility and speed of vessels (e.g. Germany, Netherlands)[6]. Thus, these regulations mostly have impacts on large vessels such as cargo ships. The impacts for maritime transport, such as lengthened routes and risk avoidance

[4] E.g. Kafas et al., 2013

[5] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].

[6] Such as within the vicinity of harbors. Defined at local level. See for instance : Danish Maritime Authority, 2015

measures are of significant interest for coastal States and are continuously investigated. A synthetic analysis of [interactions between maritime transport and OWF](#) is available on the MSP-Platform. As can be seen from the literature, these impacts have not been the subject of any remarkable conflicts, certainly because maritime transport is mostly confined to specific shipping lanes - especially in heavily navigated waters – and thus more easily considered in the OWF site-designation process[7].

Fishing vessels, on the other hand, move in more unpredictable ways. Consequently, with even more reason, in terms of safety, fishing activities whether active or passive are in most cases forbidden within the vicinity of OWF and their associated subsea cables[8], with a special concern towards trawling practices – which is the dominant fishing method in Europe. In the North Sea, where most operational European OWF are found, it is the case for:

- Belgium, Germany and the Netherlands, where fishing is excluded in a 500m buffer zone around OWFs and associated cables.
- Denmark, where fishing is excluded from the entire OWF area and in a buffer zone of 200m along each side of the export cable.

The case of **United Kingdom** is yet an exception, as fishing in OWFs is only prohibited during construction or maintenance phases. Although no legal prohibition applies, a study conducted by the National Federation of Fishermen's Organisation (NFFO) in 2016[9] showed that fishermen -especially with trawling gears[10]- tended to avoid OWF and their surroundings because of the risks involved for themselves as for their gear and vessels.

The expansion of OWF development expected in Europe could lead to a reduction in access to traditional fishing grounds and to a carry-over[11] to other areas, with multiple implications for fisheries:

- **Economic**: Spatial exclusion can induce reductions in economic return, either directly as a result of limited access to the area and the resources it hosts, or indirectly as a result of a carry-over to potentially less profitable or less reliable areas. It can also increase travel costs, as a result of lengthened routes to and from fishing grounds beyond OWF, even though this specific aspect is progressively solved through the opening of OWF for transit of fishing vessels under 24m. It also undermines fishermen's flexibility to adapt to resources' spatial variability, further accentuated by climate change. These implications are strengthened for small-scale fisheries, which have fewer alternative options.

  Even in the UK, where there is no regulatory spatial exclusion for fisheries, OWF can lead to financial loss, either as a result of voluntary avoidance of these areas due to the inherent risk of gears getting stuck on seabed obstacles (cables, turbines).

- **Environmental**: Displacement from customary fishing grounds often leads to carry-over fishing to other areas, thus intensifying fishing pressure in these areas ("knock-on effect")

- **Social**: The carry-over of fishing activities from one area to another can lead to increased competition, affecting previous balances in more and more crowded areas.

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[7] See North SEE report – 2017 and Raza et al. – 2018

[8] Interactions between subsea cables and fisheries are specifically addressed on the MSP-Platform here

[9] See the study conducted by the NFFO in 2016 here

[10] Listen to the UK fishermen avoiding OWF – The Publics Radio, 2019

[11] See an example of carry-over in the Adriatic after an environmental temporary ban: Elahi et al. -2018

Temporal interactions and tensions

Interactions between OWF and fisheries – as well as with other maritime activities - can take place at different temporal scales (temporary to permanent), and at different stages of an OWF lifecycle (from designation to dismantling).

Phase 1: Pre-Construction

According to WindEurope "Our Energy, Our Future" report (2019), one of the key challenges to reach the European objectives for 2050 is to increase the rate of site allocation and development. Currently, getting from site identification to the production phase of an OWF often takes more than 10 years. To get to 450GW, this time period will have to be shortened in order to reach annual installation rates of 7GW before 2030 to 20GW before 2040.

This particularly applies to the first two stages of OWF development, namely Designation and Licensing (cf. Figure 4).

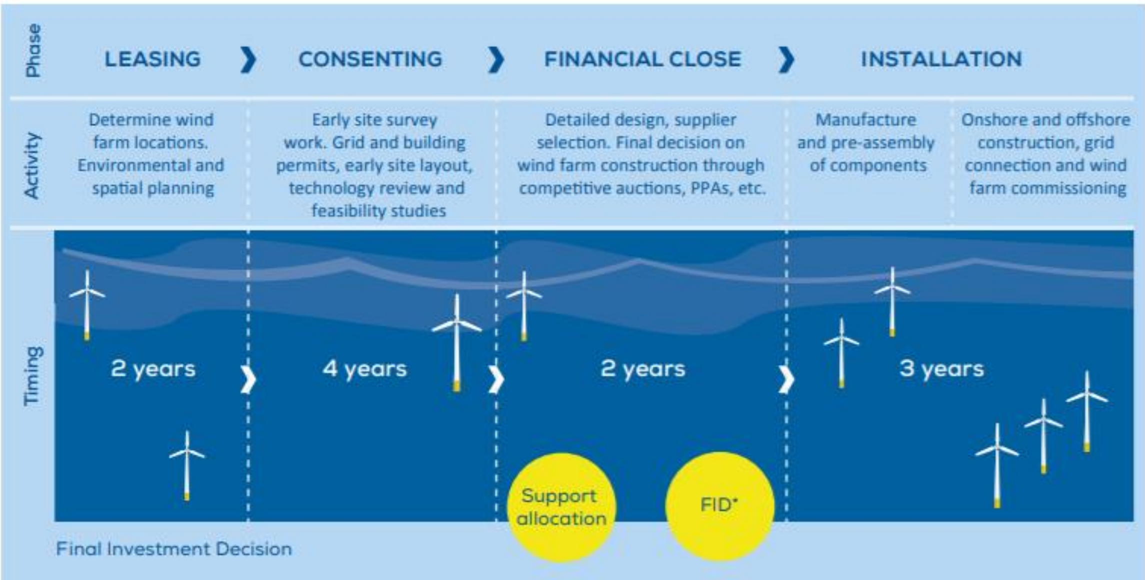

Figure 4. Overview of OWF development stages (source: "Our energy, our future" 2019 - WindEurope

Designation

The identification of suitable sites for the development of offshore wind energy is based on 3 main aspects, which can be considered successively or simultaneously:

- **Technical potential and constraints**: wind resource, depth and characteristics of the seabed, possibilities of connection to land. In northern European waters (Baltic, North Sea and north Atlantic), technically suitable sites are abundant, and even more so with the development of floating turbines. The collect of data (e.g. wind, bathymetry) can be time-consuming.
- **Existing activities**: For safety reasons mainly, existing activities (shipping, fishing, dredging, etc.) are carefully considered during the planning phase in most North Sea countries.
- **Environment**: To avoid major environmental impacts on sensitive habitats or species, all European projects are subject to a preliminary Environmental Impact Assessment (EIA).

In most countries, these aspects are considered from both a data-centred approach and through stakeholder consultation (economic activities, public). The consultation process is addressed further in the report as an important aspect to prevent conflicts.

This first phase, and especially the precise identification of existing activities constraints, is certainly the most crucial to prevent conflicts in the context of OWF development. Conflicts occurring during the planning phase can induce delays, mainly as a result of administrative appeals.

Licensing

As highlighted in the technical study on Maritime Spatial Planning (MSP) for Blue Growth (2018), two main methods exist for the designation of specific offshore windfarm zones: the "call for tenders" method and the "open door policy" method.

The **call for tender** method implies that governments conduct the site selection process, after which a tender is released to select the final developer. This method allows the government to make use of their timetable, as a way to meet national energy objectives. It is considered as an efficient way for large-scale deployment of offshore wind farms in the short term.

The **open-door policy**, where developers can take the lead by proposing projects on sites, they have identified themselves. However, in the few countries where this method applies, developers are legally bound during the study phase (e.g. need to obtain study permits) and often confined to predefined macro-zones. This approach is seen as a way to foster innovation and facilitate input by the industry.

In 2017, **Germany**[12] set explicit OWF development objectives: reaching 15GW in 2030. To reach those, Germany undertakes a "call for tender" approach, and preliminary investigation of sites is to be conducted by government agencies.

In **Belgium**[13], the "call for tender" method applies, and preliminary investigations of sites are conducted by government agencies. With regards to the size of Belgian waters, two unique macro-zones were defined by national authorities, and call for tenders apply for plots within these macro-zones.

In the **Netherlands**[14], the "call for tender" method applies, and preliminary investigations of sites are conducted by government agencies.

In **UK**[15], the "call for tender" method applies, but round 4 launched in 2019 introduced a light "open door policy", as it also offers developers the freedom to identify their own project sites within available areas.

In **Denmark**[16,17], both "call for tender" and "open door policy" methods apply. However, up to now, most new offshore wind farms in Denmark are established after a tendering procedure. Preliminary investigations are conducted either by government agencies or energy companies depending on the method.

In most other member states where OWF are planned or under development, the "call for tender" method remains the most widely used.

Phase 2: Construction

The construction phase of an OWF could lead to intense but temporary interactions with fisheries. The actual construction phase at sea often lasts less than a year but generally

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[12] See Offshore Wind Energy Act, 2017

[13] See the legal framework for OWF in Belgium

[14] See the legal framework for OWF in the Netherlands

[15] See the introduction of the offshore wind leasing round 4 – sept. 2019 - The Crown Estate.

[16] See Procedures and Permits for Offshore Wind Parks, Danish Energy Agency

[17] See Danish Experience from Offshore Wind Development, 2017

involves an interruption of other activities including fishing in the construction area as well as in the transit areas of the multiple construction vessels. Moreover, studies have shown that fish tend to avoid the surrounding wind parks that are under construction, especially due to disturbance of habitat, underwater noise and turbidity[18], leading to temporary displacement or reduction in fish and shellfish resources.

These constraints can be softened by adapting the construction calendar, as advised by the OSPAR guidance on environmental considerations for the development of offshore wind farms. As fishing activities are mostly seasonal (in relation to the seasonality of ecological processes), the choice of the construction period can be crucial to reduce impacts on the activity. Informal examples of such calendar adaptations have been reported by some developers, however there is no formal or regulatory approach to it in North Sea countries and developers generally tend to prioritise limited availability of installation vessels and weather conditions / windows rather that fishing seasons so far. These adaptations appear to be highly case specific and limited by technical constraints of the construction process – usually lasting for about a year, and subject to meteorological conditions.

Phase 3: Production and maintenance

Once the OWF is built, interactions with fisheries mainly concern the spatial dimension addressed above. With a lifespan of OWF of 25-30 years, these interactions are long lasting and should be considered permanent. Maintenance work may temporarily accentuate these interactions.

Another parameter than can induce interactions with fisheries is the effect of the OWF production phase on fish stocks. This controversial issue is intensively studied in Europe: initially, concerns were (and are still being) raised on the potential impacts of the operation of turbines on commercial species, such as through vibration, visual turbine blade flashing, electromagnetic emission from cables and chemical pollution from the material used for cable armouring. However, most reviews of wind farm ecological monitoring data were inconclusive on this aspect, and even showed an increase of fish stocks within the studied OWF[19]. This so-called "reserve effect" is assumed to be both the result of the OWF structure, that "*provides a haven for the seabed to regenerate so there are more complex habitats that fish like to feed, hide and breed in*"[20], and of the reduction of the fishing pressure.

The spill-over effect resulting from these artificial reefs (i.e. increased fish resource around OWF), of significant interest for fisheries, has not been demonstrated yet. Uncertainties remain regarding this potential positive impact, as modifications to ecosystems could be diverse in the long term (e.g. attraction of non-human predators[21], or diminution of the primary productivity[22]).

Phase 4: Dismantling

To date, only 3 European OWF have been dismantled[23] and their specificities (size, number of turbines) do not yet allow for generalization. However, the overall learning from these cases is that the dismantling phase can be considered as the opposite of the installation phase[24]. Its impacts on fisheries have not yet been documented but can presumably be considered as equivalent.

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[18] See Ashley et al, 2018 ; Sanders et al., 2017 ; Popper et al., 2003

[19] See Stenberg et al., 2015 ; DONG Energy, 2006; Coates et al., 2016; Van Hal et al., 2017 ; Reubens et al., 2013 ; Methratta and Dardick, 2019 ;

[20] Jason Hall-Spencer - marine biology professor at Plymouth University, UK.

[21] See Mikkelsen et al., 2013

[22] See Slavik et al., 2019

[23] in Denmark: Yttre Stengrud; Lely; Vindeby

[24] See Topham and McMillan, 2017

INVENTORY OF CONFLICTS

If evidences of conflicts between fisheries and OWF development are found in the literature[25], most non-conflictual situations fall under the radar, which can give an interpretation bias. Indeed, most of the 110 European OWF seem to have been developed without any major conflicts.

Conflicts and tensions between fisheries and OWF appeared a while ago, as already described in 2002 in "Who Owns the Sea". More recently, a few cases of conflict were identified in the North Sea: in **Germany**[26], **Belgium** and the **Netherlands**[27].

In contrast, in **UK**, no major conflict has been identified, nor in **Denmark**, where most OWF have been built in areas with initially low fishing activity.

In **France**, where there is no OWF in production up to now, opposition has induced significant delays in the development of projects[28].

As highlighted in the 2019 Conflict fiche, conflicts are usually case specific, depending on the local geological characteristics, types and intensity of fisheries, and the OW technology applied. It also appears that countries with a historical background of offshore energy structures (O&G or OW), such as Denmark, have fewer conflicts overall. Conflicts also seem to be dependent on the socio-cultural importance of fisheries at local level and the "sense of ownership" of marine space in fishing communities. In these cases, conflict can have broader implications than the unique spatial exclusion, as OWF can be perceived as the last arrival in a long line of restrictions, threatening not only livelihoods but also a traditional way of life. In some cases, these conflicts can also be part of a broader windfarm opposition[29].

SOOTHING TENSIONS

Preventing conflict

Preventing conflicts is above all a question of implementing strategic solutions, such as an appropriate and agreed planning framework, based on solid evidence and stakeholder participation. In any case, the first requirement to prevent conflict lies on a national agreement to consider OWF as a key component in national "green" energy production. In countries (e.g. Germany, United-Kingdom) where offshore wind objectives and policy are strongly supported by government and population, fewer conflicts occur. In contrast, when the offshore wind is considered as an expensive solution compared to other energy solutions within the national mix (e.g. France), more conflicts occur challenging this option.

Through spatial planning

As mentioned above with regards to the site designation processes, the early stages of OWF planning – whether integrated or sectoral - are crucial to prevent conflict with other activities, and especially with fisheries.

In the UK, it was already highlighted in 2016 that greater co-existence between OWF and fisheries could be achieved by collaborative planning[30].

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[25] E.g. "Fishermen and wind farms struggle to share the sea", Politico, 2017

[26] See Handelsblatt, 2018 and Nicolai and Wetzel, 2017

[27] See articles from The Guardian and GardezLesCaps (in French)

[28] See Teller Report, 2018, and the movie "Le Vent du Mensonge" (in French)

[29] See Michael Waters, 2018, and Al Maiorino, 2019

[30] See the study conducted by the NFFO in 2016 here

Through efficient planning, it is possible to:

- Identify and avoid major fishing grounds
- Identify and avoid essential habitats for specific fish stocks, such as spawning and nursery areas
- Reduce overall impacts on ecosystems that fisheries depend on.

Some European researchers are starting to link conflicts at sea, especially with regards to offshore wind, to a lack of integrative planning[31].

Assessing socio-economic incidences on fisheries

The assessment of socio-economic incidences of OWF on fisheries is an integral part of the planning process. It is an essential tool to improve interactions between windfarms and fisheries, through prospective, anticipation of conflict and adaptation of projects.

Ex-ante assessment is very strongly dependent on data (economic, environmental, social), and especially on GIS data[32]. Through the CFP, the EU has strongly invested in fisheries reporting, and numerous data are available within each member state. In particular, the EU has made it compulsory for fishing vessels above 12m to be monitored with the Vessel Monitoring System (VMS), which allow for the capture of precise information on fishing activities and dynamics[33]. However, the inherent limitations of this system (e.g. frequency of emission unsuitable for describing certain fishing practices, spatial scales, or reporting) and the proportion of European vessels under 12m results in a very fragmented knowledge. In some countries, participative initiatives have been designed to fill some of these gaps (Scotland[34], Poland[35], France[36]). However, these initiatives face a traditional reluctance of fishermen to share economic information about their fishing areas. Either way, even with available data, the assessment of the precise incidences on the potential loss of production, and therefore on the economy of fisheries remains complex to predict, particularly because of the spatial and temporal variability of this activity[37].

It should be noted that effects of OWF on fisheries are currently assessed at individual OWF level, forgetting the importance of considering cumulative effects of all OWF at regional or sea basin level[38].

Establishing permanent consultation processes

As the sea is a public domain, fishermen -as other marine users- have no legal rights on their fishing areas, and the authorities (national, regional or local) may legally allocate shared or exclusive rights to any other use. However, fishermen consider that they should be involved in the decision making for alternative uses of "their" fishing areas, where they can claim "grandfather rights". This issue has progressively been recognized in most North Sea countries, and the involvement of fishermen in the planning process of OWF has progressively become standard over Europe. However, the level of cooperation – and the willingness to cooperate- between fishermen and OWF developers remains variable from country to country.

In the UK, where very few conflicts have occurred, both industries have maintained a regular dialogue since 2002 through the Fishing Liaison with Offshore Wind and Wet

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[31] See Clarke and Flannery, 2019 and Spijkerboer et al., 2020

[32] See Castro-Santos et al., 2020; Janßen et al., 2018 ; Petruny-Parker et al., 2015

[33] See Oostenbrugge and Hamon, 2017 ; Eigaard et al., 2016 ; Campbell et al., 2014 ; Vandendriessche et al., 2011

[34] See ScotMap

[35] See Mytlewski and Psuty, 2017

[36] See Valpena

[37] See Janßen et al., 2018

[38] See Berkenhagen et al., 2009

Renewables Group (FLOWW)[39]. In 2016, the UK reaffirmed that communication, information and knowledge exchange were a key aspect to improve the working relationships between the two sectors. In addition, with a broader MSP process, it seems that this accentuated bi-sectoral linkage can reduce tension and risks. In the UK, the Kingfisher Information Service (KIS-ORCA) places emphasis on communicating seabed hazards such as exposed cables and lost objects to the fishing industry.

In Denmark, Germany, the Netherlands and Belgium, although no national bi-sectoral working group has been established, consultation with the fisheries sector appears as an inherent part of the planning process at local scale, either in bilateral or in a broader dialogue. In addition, the International Council for the Exploration of the Sea (ICES), created a working group on offshore wind development and fisheries (WGOWDF) in 2016[40], with a focus on the North Sea.

Designing fishing compatible OWF

As mentioned previously, the main constraint for fisheries is the spatial exclusion in and around OWFs. This has progressively and partially been solved with regards to the **transit** of fishing vessels. To avoid lengthened routes for other maritime activities, and especially for fisheries, several countries from the North Sea have allowed small to medium-sized vessels (often <24m) to go through OWF under good weather conditions - either freely or within defined corridors. This is facilitated by the fact that wind turbines are generally spaced more than 1 km from each other, which makes risks very low for mere transit. It is the case in Denmark, Germany and the Netherlands. In the Netherlands, in 2018, after 3 years of study, the government decided to open 3 OWFs for transit by fishing vessels under 24m. In Poland, where the OWF sector is emerging, the government stated that offshore wind farms should be navigable for ships up to 50 meters.

Nonetheless, most actual **fishing** activities remain excluded within OWF up to now, except in UK – where fishermen do not seem to seize the opportunity, as mentioned previously. However, the design of fishing compatible OWF has gained more and more interest in the recent years, both from governments and developers[41], as well as from fishermen themselves[42].

With regards to this matter, different fishing method may receive different treatments.

- The conduct of **static fisheries** within OWF appears to be realistic, with some successful examples of crab and lobster pot fisheries in Scotland and the UK and some promising studies in the Netherlands and Germany.
- The conduct of **sea-bed fisheries** within OWF however seems unlikely. In the **UK**, where it is possible, there is not yet conclusive evidence of significant levels of towed gear fishing activity taking place. In the **Netherlands**, following the government's wishes to develop co-use within OWF, the Netherlands Enterprise Agency (RVO) ordered a study on the Consequences of possible sea-bed fishery in future offshore wind farms in July 2019. It concluded that sea-bed fishery in future OWF shall affect all stakeholders and increase the cost of energy produced by affected offshore wind farms. Indeed, due to space requirements, sea-bed fisheries such as seine netting and pair trawling cannot physically operate among wind farms under current typical turbine layouts. This would require adapting the design of future OWF, creating wide corridors that would drastically extend the OWF area to meet the same production objectives. Finally, the report also stressed the probable increase in cost of insurance policies for both industries,

[39] See UK "co-existing in marine space" report, 2020.

[40] See the Terms of Reference of the WGOWDF

[41] See WindEurope, January 2020

[42] See Nicolai and Wetzel, 2017

effectively increasing the operational expenditure and ultimately the electricity tariff. The construction of such OWF is however being considered by developers in France for some projects. In the USA, industries are also trying to propose a common layout between all OWF to facilitate co-use with fisheries. In 2020, the MMO (UK) highlighted that, along with technology developments, especially the implementation of turbines with larger generating capacities, the spacing requirement between turbines could increase, potentially improving the prospect for co-existence with commercial fisheries.

Synergies based on multiuse (e.g. fish farms, aquaculture…) and involving alternative uses of space should not be considered direct synergies with fishing activities, even if fishermen (among other stakeholders) may benefit from such activities. However, they present a certain interest from a unique protein-based prism. These options have been widely studied in Germany[43], Denmark[44] and UK[45], especially within the MUSES project (2016-2018). However, only pilot projects have been developed.

Mitigating conflicts

In situations where conflict with fisheries has not been identified nor addressed during the OWF planning, compensation of losses (by states of OWF developers) to individual fishermen or fisheries organisations can be seen as a mitigation measure. This solution is however not encouraged in most North Sea Countries. In **Belgium**, **Germany** and the **Netherlands**, no compensation procedure applies.

In **UK**, commercial compensation is considered as the last resort, when there is significant residual impact that has not been avoided through planning. In this case, the FLOWW Best Practice Guidance indicates that compensation should only be paid on the basis of factually accurate and justifiable claims. There is therefore an obligation upon affected fishermen to provide evidence (such as three years' worth of catch records) to corroborate any claims. The FLOWW is not involved in compensation negotiations.

Denmark is the only North Sea country where, according to the Danish Fisheries Act[46], all fishermen who normally fish in the affected area must be compensated for the loss of income. It is the responsibility of the developer to negotiate compensation with every affected fisherman, and the licence to produce electricity from the offshore wind farm (power plant) can be granted to the Developer only if an agreement has been made with all affected fishermen.

Indirect mitigation measures have also been observed in UK, where OWF developers financed the installation of ice plants at Maryport and Barrow, through the West of Morecambe Fisheries Fund (WofMFF) contributing to a reduction in the cost of fuel at the Whitehaven Fishermen's Cooperative-leased fuel facility. This type of mitigation measures appears as interesting options, potentially more widely accepted than direct compensation.

MSP as a way in – and out

If sectoral planning, as practised in the North Sea before the Maritime Spatial Planning Directive implementation, can lead to prevention of conflicts, integrated marine spatial planning appears as a way in and out for the expected offshore wind development in the coming years and the potential issues it raises for other maritime sectors such as fisheries. In most European countries, in response to the MSP Directive, the development of integrated marine spatial plans has been ongoing for a few years. Marine renewable

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43 See Schupp and Buck, 2017

44 See Karlson et al., 2017

45 See Christie et al., 2014 and Onyango and Papaioannou, 2017

46 See the Danish Fisheries Act

energies, which were one of the primary drivers for the development of MSP in many western European countries[47] are a major topic within these national processes.

In countries where marine spatial plans have already been produced, different approaches to offshore wind planning have been observed, with different levels of commitment. Within their plans, some countries (e.g. Belgium, the Netherlands) have pre-allocated exclusive use in identified areas, where other have kept to the identification of larger potential zones to be further investigated (e.g. Denmark). As stressed by Spijkerboer et al. (2020), the labelling of offshore wind as a 'use of national importance', creating an explicit hierarchy and legitimizing its prioritization over other uses in designated areas, can be a lever to facilitate MSP processes.

As part of the integrated dimension of MSP, most countries have engaged consultation with economic stakeholders as well as with citizens at political, strategic and operational levels. These governance mechanisms are a way to better anticipate, mitigate or compensate incidences of windfarms on activities such as fishing. The integrated dimension of MSP also leads to more cross-border interactions, particularly through sea-basin based projects. This kind of supra-national approach appears as a significant tool for engagement, appropriation and acceptation, as the North Sea and Baltic Sea highlight. Integration is needed at all levels.

Conclusions

- Further the specific allocation of space, developing OWF as any permanent fixed offshore infrastructure generates constraints on maritime activities for safety and insurance issues. These constraints can evolve on the various stages of the life cycle of the OWF. As a consequence, potential conflicts can be different for each stage (banning during construction or maintenance, restricted in operation).

- Even if national approaches/ restrictions can be different to assess the risks and to take decision, Offshore windfarms (OWF) have been well developed so far in the North Sea which is by far the most sailed and busy European sea basin. This is taking place without major conflicts with other sea-uses.

- In most cases, chosen locations are different, and interactions limited with fisheries by choosing areas with low fishing activities.

- With the expected development of OWF, conflicts may increase together with the need to prevent them. The reduction of the potential conflicts is to be undertaken:
  - With the global socio-economic assessment of the OWFs impact on the fisheries sector under the umbrella of the MSP in a cumulative approach;
  - And then by considering the specificities in each OWF project: location, fishing technics used, targeted species, etc. in order to consider the multi-use of the space while maintaining safety for all the activities within the OWF.

- The governance for MSP is a core component to prevent conflicts. The involvement of all the stakeholders (including all the fisheries sectors and OWF promoters) at the early stage of the dialogue is one key of the success.

- The dialogue for the MSP definition to meet the low carbon objectives of the national energetic policy (including OWF) are pivotal for the endorsement of the OWF set up.

[47] See Spijkerboer et al., 2020

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