Overview of the Dutch fishing activities in the Hornsea Project Three wind farm area

Trends in effort, landings and landings value for 2011-2015

Hans J.A.E. van Oostenbrugge and Katell G. Hamon

WAGENINGEN
UNIVERSITY & RESEARCH

Overview of the Dutch fishing activities in the Hornsea Project Three wind farm area

Trends in effort, landings and landings value for 2011-2015

Hans J.A.E. van Oostenbrugge and Katell G. Hamon

This study was carried out by Wageningen Economic Research and was commissioned and financed by RPS Energy

Wageningen Economic Research
Wageningen, August 2017

REPORT
2017-059
ISBN 978-94-6343-666-3

WAGENINGEN
UNIVERSITY & RESEARCH

Oostenbrugge, J.A.E. van and K. G. Hamon, 2017. *Overview of the Dutch fishing activities in the Hornsea Project Three wind farm area; Trends in effort, landings and landings value for 2011-2015.* Wageningen, Wageningen Economic Research, Report 2017-059. 18 pp.; 4 fig.; 2 tab.; 6 ref.

In response to a request to Wageningen Economic Research from RPS Energy, this memorandum provides an analysis of the fishing activities of the Dutch fishing fleets in the period 2011-2015 in the area of the proposed Hornsea Project Three wind farm and in the surrounding area (defined as ICES rectangles 36F2, 36F1, 35F1 and 34F1). During the reference period, Dutch vessels spent around a total of 650 fishing days per year in the ICES rectangles selected, catching approximately 1.7m kg of fish worth 5.5m euros. Within the wind farm area, Dutch vessels spent approximately 120 days annually over the period 2011-2015, resulting in an average landings volume of 0.3m kg of fish, worth around 1.0m euros.

Key words: Spatial analysis, Bottom fishing, Hornsea Project Three, wind farm

This report can be downloaded for free at https://doi.org/10.18174/421103 or at www.wur.eu/economic-research (under Wageningen Economic Research publications).

P.O. Box 29703, 2502 LS The Hague, The Netherlands, T +31 (0)70 335 83 30,
E communications.ssg@wur.nl, http://www.wur.eu/economic-research. Wageningen Economic Research is part of Wageningen University & Research.

Wageningen Economic Research is ISO 9001:2008 certified.

Wageningen Economic Research Report 2017-059 | Project code 2282200273

Cover photo: Shutterstock

Contents

Summary

In response to a request to Wageningen Economic Research from RPS Energy, an analysis of the fishing activities of the Dutch fishing fleets in the area of the planned Hornsea Project Three wind farm was prepared. This report uses the method presented in Chapter 5 of *Effects of seabed protection on the Frisian Front and Central Oyster Grounds* (Van Oostenbrugge et al. 2015), to estimate the fishing effort, landings volume and landings value of the Dutch fleet in the period 2011-2015 in the total area around the Hornsea wind farm (defined as ICES rectangles 36F2, 36F1, 35F1 and 34F1) and the area of the planned wind farm. The area around the Hornsea wind farm is a fishing ground for beam trawls and, to a lesser extent, for demersal trawls and seiners. During the reference period, Dutch vessels spent around in total 650 fishing days per year in the ICES rectangles selected, catching approximately 1.7m kg of fish worth 5.5m euros. The wind farm area resembles an important fishing ground within the selected rectangles. Dutch vessels spent approximately 120 days annually over the period 2011-2015. The fishing activities resulted in an average landings volume of 0.3m kg of fish, worth around 1.0m euros. Although in total, landings from the wind farm area represent approximately 0.4% of the total landings value of the Dutch demersal fleet over the reference period, the productivity of around 1.4 kEur/km^2/year makes the area a valuable fishing ground for the Dutch fleet. The total fishing activities in the area have probably been larger, given the international nature of fisheries.

1 Introduction

Currently several wind farms are being developed in various parts of the North Sea. For each of these parks, environmental impact assessments need to be developed. Within the framework of such an environmental impact assessment, the UK consultancy RPS Energy is working on an analysis of the effect of the development of the Hornsea Project Three wind farm (Figure 1.1) on the distribution of international fishing effort as the reallocation of fishing effort might have detrimental environmental effects elsewhere.

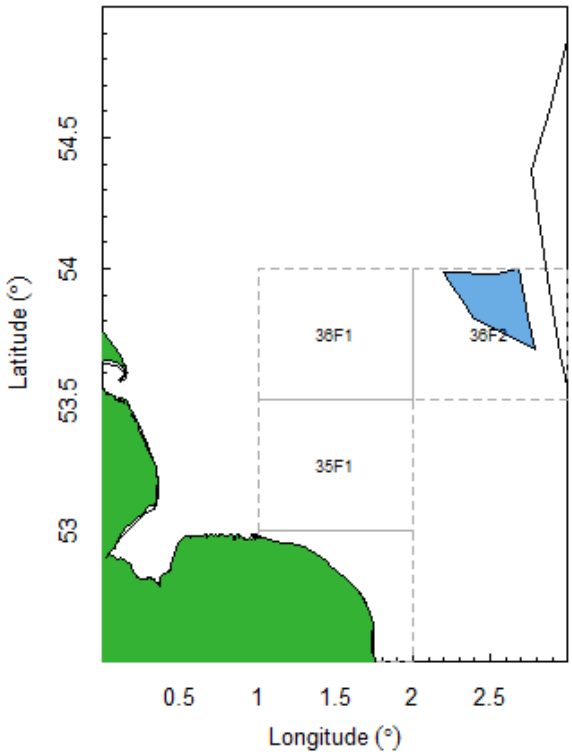

Figure 1.1 *Map of the proposed Hornsea Project Three wind farm with the adjacent ICES rectangles*

Within this framework, RPS Energy has a need for an overview of the fishing activities of the Dutch fishing fleet in the area of the Hornsea Project Three wind farm and its surroundings and has contacted Wageningen Economic Research, the main expertise group in this field of work. The request from RPS Energy to Wageningen Economic Research is twofold:

- a report with recent trends in the fishing activities in the area of the Hornsea Project Three wind farm and
- a dataset including data on the distribution within the wider area which can be used by RPS Energy for further analysis on the effects of this windfarm.

The objectives of this project are to:

- provide RPS Energy with a memorandum on the Dutch fisheries activities in and around the Hornsea Project Three wind farm:
  - *Description of the methodology used for the analyses*
  - *Description of trends in Effort, Landings and Landings value of Dutch flagged vessels*
  - *Gear type*

    As specified in the DCF (beam trawl, demersal trawls and seines, pelagic trawls etc.);

  - *Period*
    2011-2015.
- provide RPS Energy with a dataset with the following information:
  - *Variables*
    Effort, Landings and Landings value of Dutch flagged vessels
  - *Gear type*
    As specified in the DCF (beam trawl, demersal trawls and seines, pelagic trawls etc.)
  - *Spatial dimension*
    ICES rectangles 36F2, 36F1, 35F1 and 34F1, per 1/200 rectangle
  - *Period*
    2011-2015.

The former is covered by the present report and the latter is provided separately.

2 Methodology

The methodology used for the estimation of the fishing activities in the area follows the methodology as described in Chapter 5 of *Effects of seabed protection on the Frisian Front and Central Oyster Grounds* (Van Oostenbrugge et al. 2015).

2.1 Data

Several data sources were used in this study: Vessel Monitoring System (VMS) data, catch data from logbooks (Fish Registration and Information System), Fleet data from the Netherlands Register of Fishing Vessels (NRV) and data on fish prices from the Dutch auctions.

2.2 Fishing activity

2.2.1 Base data

The data from the above-mentioned sources are being analysed in a standardised manner, where a script is developed that describes the processing and analysis of the data sets and can be applied by any nation that has similar VMS and logbook data in a standardised format. The script calculates effort, total landings and landings of the main fish species in the area of interest based on VMS and logbook data for the years 2011 to 2015.

First the datasets were pre-processed to remove erroneous fields. This pre-processing of the dataset for the Dutch data follows the approach developed in Hintzen et al. (2012, 2013).
VMS records are removed when they are:

- Duplicates or pseudo-duplicates
- Not positioned on the globe
- Located in a harbour
- Located on land
- Associated with vessel speeds >20 knots.

Logbook records are removed when they:

- Are duplicates
- Have arrival times before departure times
- Start before the 1 January of the year considered (despite the fact that the end of the trip falls within the considered year)
- Overlap with other trips

2.2.2 Link VMS and logbook data

To further analyse the data, the spatial resolution in the VMS data must be linked to the catch and effort data in the logbooks. Therefore, the VMS and logbook data in the ICES rectangles of interest were selected. All ICES rectangles overlapping with the Hornsea Project Three wind farm area were selected (see Figure 1.1).

VMS and logbook datasets are linked using the vessel identifier and date-time stamp. In other words, records (also called pings) in the VMS dataset that fall within the departure-arrival timeframe of a trip described in the logbook are assigned the unique trip number from the logbook record and allow for an analysis of the two datasets simultaneously.

2.2.3 Define fishing activity

For each gear type, the activity of the vessel (floating, fishing or steaming) is defined based on the instantaneous speed in VMS records (see Table 2.1). For each ping, the state of the vessel is identified based on gear and speed.

Table 2.1 *Determination of fishing activity based on the vessel speed. The speeds used in the Dutch fleet are presented*

Gear	Gear code	Floating	Fishing	Steaming
Beam trawls	TBB	<2 knots	2-8 knots	>8 knots
Danish and Scottish Seines	SDN and SSC	<0.5 knots	0.5-6 knots	>6 knots
Dredges	DRB	<1 knots	1-5 knots	>5 knots
Otter board or twin trawls	OTB and OTT	<1 knots	1-5 knots	>5 knots
Pair trawls	PTB	<1 knots	1-5 knots	>5 knots
Pelagic trawls	OTM and PTM	<1 knots	1-7 knots	>7 knots
Lines	LHM		<4 knots	>4 knots
Nets	GNS		<4 knots	>4 knots

Source: Hintzen et al. (2013).

2.2.4 Assign effort and landings to pings

Each VMS ping represents a certain amount of time, usually equal to the interval rate at which VMS pings are emitted, ranging from 30 minutes to 2 hours. The fishing effort is defined as the sum of these time steps for those pings where the previous analysis indicated a 'fishing' state.

The landings are recorded by trip, per ICES rectangle and day in the logbook. For this analysis, the total landings per year for the ICES rectangles and gears of interest were retained.

For each trip that could be linked to VMS data, the landings and the days at sea, as registered in the logbooks, are allocated to the VMS pings in a stepwise process: If a match in trip, ICES rectangle, and fishing day is found, the registered landings are assigned to the VMS pings, weighted by the average time each VMS ping represents (ranging from 30 minutes to 2 hours). If a match cannot be found, fishing day and/or ICES rectangle is left out of the equation. Any remaining logbook record that could not be matched to any VMS ping is assigned to following the same stepwise process, but dropping the requirement that vessel ID in both datasets must be the same. This results in a full allocation of all landings of the logbook data to the VMS data.

2.2.5 Define pings in the areas of interest

The coordinates of each VMS ping are compared to the location of the proposed Hornsea Project Three wind farm area (see Figure 1.1). When a VMS ping is located inside any of the areas, it is selected and assigned to the area of interest (see Figure 1.1 for information on the area).

The data are hereafter aggregated by year, area, gear type and vessel length category. The logbook records without VMS data are also aggregated by year, ICES rectangle and gear type.

2.2.6 Uncertainty in the analyses

In the analyses a number of assumptions have to be made related to fishing activity and linking catches to VMS pings. Although these assumptions have been tested thoroughly, consultations with fishermen to verify our assumptions and international consultations on these methods have taken place, the final results are uncertain and changes in assumptions will likely affect the numeric values presented in the results. It is anticipated however that these differences do not alter the conclusions. No exercise has been undertaken to quantify the uncertainty however.

2.3 Economics

The value of landings was based on the landings volume per species and the average auction prices per month and species from Dutch auctions. From the vast majority of landings (>95% of total value) prices per month and species were available. For other (rare) species aggregated prices of 'other species' were used.

3 Results

Over the period from 2011 to 2015, the area around the Hornsea Project Three wind farm has been an area of interest for the Dutch fishing fleet. On average Dutch vessels spent around 650 fishing days in the ICES rectangles selected catching approximately 1.7m kg of fish worth 5.5m euros (Table 3.1). During the reference period, the fishing activities and the resulting landings decreased, despite some variation from year to year. On average the effort and landings value decreased by 13% annually and the landings volume by 6%. This decrease was mainly due to the drop in activities in 2015 when effort and landings from the area dropped by more than one third. Although it is not clear what the specific reason for this sudden drop in effort in the area is, there has been a general trend over the last decade of effort reallocation in relation to the development and use of the pulse gear (Turenhout et al. 2016). Vessels using the pulse gear have reallocated their activities to viable sole areas (e.g. Smith's Knoll) and areas with softer grounds (e.g. between the Foreland grounds and the South Falls (near to the Thames) which were not accessible to the traditional beam trawlers.

Table 3.1 *Overview of effort, landings and values of the Dutch fishing sector in the research area and the proposed wind farm area (VMS and logbook merged data only)*

	2011	2012	2013	2014	2015	Average
Total area (ICES rectangles 36F2, 36F1, 35F1 and 34F1)						
Effort (days at sea)	806	645	711	669	420	650
Landings (tonnes)	1,784	1,705	1,819	2,001	1,283	1,718
Value (1,000 euros)	6,766	5,547	5,949	5,663	3,670	5,519
Planned wind farm area						
Effort (days at sea)	130	139	112	122	100	121
Landings (tonnes)	322	330	252	412	394	342
Value (1,000 euros)	1,038	1,050	867	986	897	968

Source: Logbook data and VMS data and data from Dutch auctions, processed by Wageningen University & Research.

Within the research area, fishing effort was generally higher in the offshore the North eastern part, where also the wind farm is planned (Figure 3.2). The absence of fishing activities near the coast is explained by the fact that Dutch fishermen are not allowed to fish within the UK 12-mile zone. The data presented here represent more than 97% of the total landings as nearly all of the logbook records in the area could be matched with VMS data (see Appendix 2). This result allows to focus more on the dataset where VMS and Logbooks are linked and provide greater spatial and temporal resolution.

Within the proposed wind farm the Dutch fleet spent approximately 120 days annually over the period from 2011 to 2015. The fishing activities resulted in an average landings volume of 0.3m kg of fish, worth around 1m euros. In contrast to the trend in the overall research area, trend in fishing activities in the wind farm is not that clear: effort seems to be decreasing slowly (by 7% in 5 years), whereas landings from the area have increased in the same period (6%). Landings value has decreased (7%), which is probably mainly due to a change in species composition.

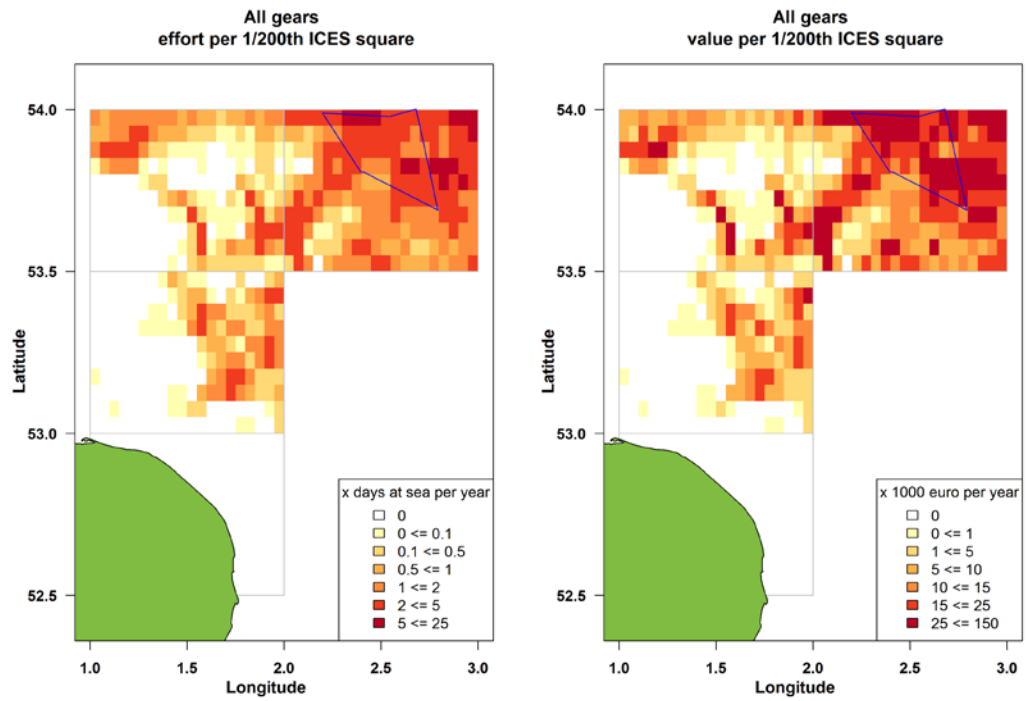

Figure 3.1 *Spatial distribution patterns of effort (left) and landings value (right) per year, 2011-2015*

Source: Logbook data and VMS data and price data, processed by Wageningen University & Research.

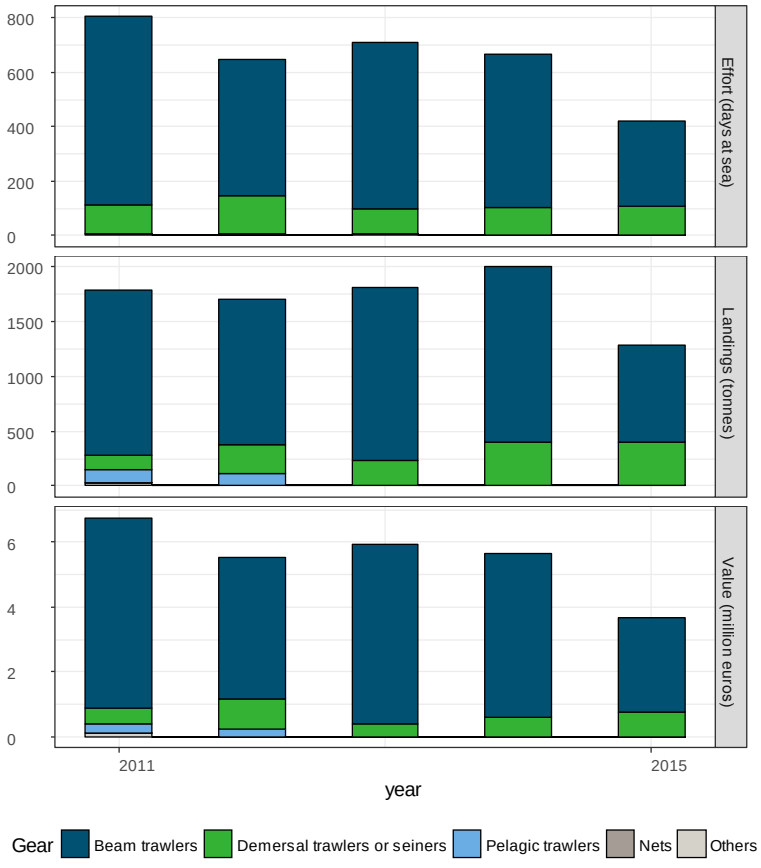

Figure 3.2 *Historical trend of the fishing activities with different gear types in the area around the Hornsea Project Three wind farm (4 ICES Rectangles)*

Source: Logbook data and VMS data and price data, processed by Wageningen University & Research.

In the greater research area, effort by Dutch vessels has been dominated by beam trawlers (Figure 3.3). More than 80% of the fishing activities in the area were carried out by this type of gear. This gear category includes both the traditional beam trawler with heavy tickler chains as well as the recently developed pulse trawls. The other main gear used in the area was the gear group of demersal trawlers and seines. This group consists of outrig fisheries, otter trawls and twin rig fisheries, and Scottish and Danish seines. This group of gears contributed around 20-25% to the total effort in the area and the same in terms of value of landings. The contribution to the landings volume is somewhat higher as these gears (especially twin rig fishery) can be used to catch large amounts of plaice, that has a relatively low price. Whereas the fishing activities of the beam trawlers decrease over the reference period, the activities of the demersal trawler and seiners was stable/increased slightly. Other gears like pelagic trawls and nets were hardly operated in the area.

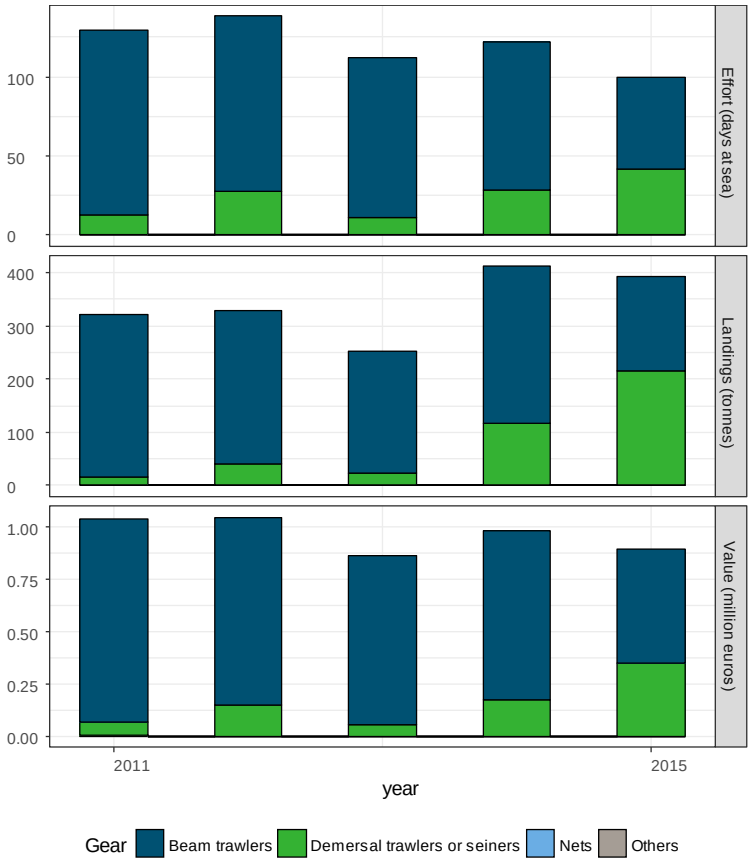

Figure 3.3 *Historical trend of the fishing activities with different gear types in the proposed area of the Hornsea Project Three wind farm*
Source: Logbook data and VMS data and price data, processed by Wageningen University & Research.

Within the planned wind farm, the balance between the main gear types shifted during the reference period (Figure 3.3). In 2011, the beam trawl was by far the most important gear used in the area, whereas by 2015, more than half of the landings from this area caught by demersal trawlers and seiners. As the beam trawl fishery targets the more valuable sole, this fishery still represents to biggest part of the value of landings (approximately 60%). Other fishing gears such as pelagic trawls of static gears (gill nets) have been hardly operated in the area.

4 Discussion and conclusion

This memorandum provides an overview of the Dutch fishing patterns and temporal changes in the fishing activities in and around the proposed area for the Hornsea Project Three wind farm. It is concluded that the area was used mainly by Dutch beam trawlers and demersal trawlers and seiners and represented a total landings value of around 5.5m euros per year during the reference period (2011-2015) in the total research area and 1.0m in the area of the planned wind farm. The total landings from the wind farm area made up around 0.4% of the total landings value of the Dutch demersal fishing fleet for the reference period (www.visserijincijfers.nl). However, with the productivity of around 1.4 kEur/km^2/year, the productivity and relative importance of the area was comparable to that of the Cleaver Bank (Hamon et al. 2013), which is acknowledged as an important fishing ground for the Dutch fleet. Moreover, if effects are small at the scale of the fleet, this does not imply that individual fishers will not be affected substantially by a closure of a specific area at sea. The effects of closing a specific area are generally thought to have less effect fleet wide than on specific individuals or fishing companies. Besides, the total effects on international fisheries might well be bigger than for the Dutch fleet.

The numbers presented here as the value of the area for the Dutch fishing fleet represent the current knowledge on estimation of spatial fishing activities (Hintzen et al. 2013). As stated before, there is a number of uncertainties and assumptions in the analysis that cause uncertainty in the outcomes. The main ones are briefly discussed here:

- The values are based on a combination of the official logbook and Vessel Monitoring System data. The data cover in principle the complete Dutch fleet, but the combination of both datasets shows that both datasets are not completely compatible. This results in coverage rates of the data that are less than 100%, but the % of data that cannot be merged is small
- The status of the vessel (fishing or steaming) is derived from the vessel for which there are general thresholds per gear. Although for the majority of the pings this assessment will be valid, for some of the pings this will lead to an erroneous allocation of landings.
- In allocating the landings to the VMS pings, it is assumed that the landings volume of each of the species is proportional to the effort applied by the vessel during that day. In other words it is assumed that the productivity per hour fishing is constant for all species within a day of a fishing trip. This assumption introduces uncertainty in the estimate of the landings from an area as catches vary from haul to haul and from location to location.

Al of these assumptions might lead to increased uncertainty, especially in small areas in which low levels of fishing effort, so it is assumed that for the area under study, the possible uncertainty in the data is low. Nevertheless, more research is needed to quantify this uncertainty.

The reported values of the areas of interest do not necessarily reflect the value of these areas for the fishing sector in the (near) future. The value of an area results from the combination of available fish, fish prices and the effort applied in an area. Moreover, the applied effort in the area depends on the fisheries context (management, fish prices and fuel prices). Currently, many of these factors are uncertain as a result of the developments in the landing obligation, Brexit, other area closures for environmental protection or other wind farm developments, and the transition to pulse fishing. If one of these factors changes, the value of fishing areas change as well. When fishers move their effort to different locations, the future value of these areas will decline and closure of these specific areas may result in smaller economic losses. It is assumed that fishers move their effort to other locations in case of area closures. The effects of moving effort to another location (displacement) on catch and revenue are less well understood. Research in the field of displacement is therefore necessary.

References and websites

Hamon, K., J.A.E. van Oostenbrugge and H. Bartelings (2013). Fishing activities on the Frisian Front and the Cleaver Bank; Historic developments and effects of management. LEI Memorandum 13-050. 67 p., fig., tab., app.

Hintzen, N., A. Coers and K. Hamon (2013). A collaborative approach to mapping value of fisheries resources in the North Sea (Part 1: Methodology). IMARES Wageningen UR IMARES Wageningen UR. C001/13: 24p.

Hintzen, N.T., F. Bastardie, D. Beare, G.J. Piet, C. Ulrich, N. Deporte, J. Egekvist and H. Degel (2012). 'VMStools: Open-source software for the processing, analysis and visualisation of fisheries logbook and VMS data.' Fisheries Research 115: 31-43.

Oostenbrugge, J.A.E. van, D.M.E. Slijkerman, K.G. Hamon, O.G. Bos, M.A.M. Machiels, O.M.C. van der Valk, N.T. Hintzen, E.J. Bos, J.T. v. d. Wal and J.W.P. Coolen (2015). Effects of seabed protection on the Frisian Front and Central Oyster Grounds; A Cost Benefit Analysis. LEI Report LEI Wageningen UR. 2015-145: 170p.

Turenhout, M.N.J., B.W. Zaalmink, W.J. Strietman and K.G. Hamon, 2016. Pulse fisheries in the Netherlands; Economic and spatial impact study. Wageningen, Wageningen Economic Research, Report 2016-104. 32 pp.; 18 fig.; 1 tab.; 5 ref.

Wageningen Economic Research (2017). *www.visserijincijfers.nl.*

Appendix 1 Location data of the Hornsea Project Three wind farm

Table A1.1 *Location data of the Hornsea Project Three wind farm (Figure 1.1)*

Waypoint	Longitude	Latitude
1	2.681292	54.00112
2	2.748306	53.81587
3	2.793313	53.68948
4	2.791698	53.68998
5	2.563585	53.75998
6	2.474751	53.78724
7	2.465356	53.79013
8	2.455088	53.79328
9	2.412119	53.80647
10	2.395448	53.80753
11	2.332437	53.86545
12	2.236012	53.95408
13	2.197415	53.98956
14	2.226303	53.98869
15	2.545529	53.97848
16	2.681292	54.00112

Appendix 2 Coverage of VMS-logbook data

Table A2.1 *Percentage coverage of the VMS logbook data compared to the logbook data in the ICES rectangles of interest (Figure 1.1)*

Country	Data	2011	2012	2013	2014	2015	Average
NLD	Effort	98	93	99	99	98	97
NLD	Landings	98	97	99	99	98	98

Wageningen Economic Research
P.O. Box 29703
2502 LS The Hague
The Netherlands
T +31 (0)70 335 83 30
E communications.ssg@wur.nl
www.wur.eu/economic-research

Wageningen Economic Research
REPORT
2017-059

To explore the potential of nature to improve the quality of life

Wageningen Economic Research
P.O. Box 29703
2502 LS Den Haag
The Netherlands
E communications.ssg@wur.nl
www.wur.eu/economic-research

Report 2017-059
ISBN 978-94-6343-666-3

The mission of Wageningen University and Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 5,000 employees and 10,000 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.