Fishing activities on the Dogger Bank
2006-2011

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1 Introduction

1.1 Motivation

In 2008, the Minister of Agriculture, Nature and Food Quality notified four proposed Sites of Community Interest (pSCIs) to the European Commission (for protection as Special Conservation Areas (SCAs) under the Habitats Directive). These areas are the Dogger Bank, Cleaver Bank, the Coastal Zone and the Vlakte van de Raan. The areas have been chosen, based on their specific habitats and ecological values (Bos et al., 2008). In addition, the Frisian Front will be designated as SPA (Special Protection Area) under the Bird Directive. Based on this decision a process has been executed during the last four years for the development of the provisions of this Directive in Dutch legislation and policy, namely the North Sea Natura 2000 project.

LEI facilitated this process by making an initial inventory of the fishing activities of both Dutch and foreign fleets in these areas (Van Oostenbrugge et al., 2010). The current status is that for the areas in the coastal zone, management measures have been finalised and implemented. In the Dutch exclusive economic zone the state of play is that for the Dogger Bank, Cleaver Bank and the Frisian Front management proposals are being prepared for decision making in the Common Fisheries Policy (CFP) context.

Designating these areas under national law requires the Nature Protection Act to enter into force in the Dutch EEZ. This has been discussed in parliament (on 13 June 2012). Some questions remain on the importance of these areas for the Dutch fisheries and the economic consequences of management measures. The consequences of the management regime for the Dogger Bank are estimated by ICES in the international process of the Dogger Bank Steering Group for the period 2007-2009. In addition the ministry of Economic Affairs has asked LEI to update the report from 2010 for this area and describe the trends in fishing activities for all fleets which are important to the Dutch fishing sector. Because a large part of the Belgian, UK and German flagged vessels are owned by Dutch companies, those fishing fleets are also taken into account in the current study.

1.2 Objectives

The objective of the current project is to give insight into the trends of the fishing activities of the Dutch and important foreign fleets (Belgian, German and UK) in the area of the Dogger Bank in the period 2006-2011. In the analyses attention is given to developments in effort, landings and economic value of the landings.

1.3 Results

This resulting memorandum describes the developments of Dutch and foreign fleets in the Dogger Bank. The developments are presented for different vessels sizes, based on their engine power (0-300 hp, 301-1,500 hp and >1,500 hp) and registered gear type in the logbook. As innovative gears with far lower bottom impact (pulse trawls) have recently been increasingly used by vessels and are treated differently in spatial management measures, these vessels are also distinguished. For each of the fisheries (combination of hp-class, gear type and country) an analysis of the coverage of the data is provided.
1.4 Contents

This memorandum describes the time trends in the fishing activities in the Dogger Bank. Chapter 2 contains an explanation of the various sources of the data and the manner in which the data was processed. Chapter 3 reviews the importance of the various areas to the Dutch and non-Dutch fisheries. Chapter 4 discusses the methods and results, and is completed with the conclusions and recommendations.
The methods applied and the data used were similar to those used for the previous study (Van Oostenbrugge et al., 2010). In addition some extra data checks were included and another data processing platform was used for part of the analysis. Because of the large similarity in the method, this report contains a limited description focussing on small adjustments that have been made. A complete description can be found in Van Oostenbrugge et al., 2010.

2.1 Data sources

Several data sources were used in the evaluation. The data sources used were Vessel Monitoring System (VMS) data, catch data from VIRIS (Fish Registration and Information System), Fleet data from the NRV (Netherlands Register of Fishing Vessels), average monthly price data per species collected by the Productschap Vis (Netherlands Fish Product Board) and economic data (The LEI panel). The datasets used and the data coverage are described in more detail in appendix 1 and 2.

2.2 Processing of data for Dutch vessels

Several steps were needed to process the Dutch data for the analysis. First of all, the VMS data were processed and the patterns in fishing efforts were determined. To clean up the VMS data set, the R package VMS-tools was used (Hinzen et al., 2011). Duplicated points, points in harbour, points on land and points with impossible speed/location were removed.

Next, the fishing efforts were used to distribute the catches between the various points. The method used is illustrated by the example included in Table 2.1. First, the sailing speed was used to determine whether the vessel was fishing or sailing at each VMS point based on fixed speed thresholds derived from South et al. (2009).

<table>
<thead>
<tr>
<th>DH1</th>
<th>Time</th>
<th>Speed</th>
<th>Duration</th>
<th>Catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-aug</td>
<td>14:00</td>
<td>0.2</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>21-aug</td>
<td>15:00</td>
<td>5.6</td>
<td>1:00</td>
<td>0</td>
</tr>
<tr>
<td>21-aug</td>
<td>17:00</td>
<td>3.4</td>
<td>2:00</td>
<td>1,200</td>
</tr>
<tr>
<td>21-aug</td>
<td>18:00</td>
<td>3.2</td>
<td>1:00</td>
<td>600</td>
</tr>
<tr>
<td>21-aug</td>
<td>19:00</td>
<td>0</td>
<td>1:00</td>
<td>0</td>
</tr>
<tr>
<td>Total catch</td>
<td></td>
<td></td>
<td></td>
<td>1,800</td>
</tr>
</tbody>
</table>

Table 2.1: Example of a calculation of the catch at the VMS positions during one trip of a vessel of 300 hp using Otter board Trawl (OTB)

Table 2.2 shows the thresholds per gear determining fishing and steaming activities. Any gears missing in this table were assigned the activity ‘Unknown’.

In Table 2.1 the speed of VMS point at time 14:00 is too low to be fishing. At the second VMS point (15:00) the speed is too high to be fishing. Therefore neither of these points gets catch attributed. The next two VMS points (17:00 and 18:00) have a speed that falls within the fishing speed range. These points get catch assigned. Next, the duration was determined for each position (the time interval between the current and previous position). The catch (kg) was distributed on the basis of the duration at the various positions at which the vessel was fishing.
Table 2.2: Determination fishing and steaming activity

<table>
<thead>
<tr>
<th>Gear</th>
<th>Fishing</th>
<th>Steaming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gill nets, Danish seines</td>
<td>speed&lt;0.3</td>
<td>speed&gt;=0.3</td>
</tr>
<tr>
<td>Scottish seine</td>
<td>speed&lt;7</td>
<td>speed&gt;=7</td>
</tr>
<tr>
<td>Beam trawl, shrimp trawl</td>
<td>Speed within 3 to 6</td>
<td>Speed&lt;3 or speed&gt;6</td>
</tr>
<tr>
<td>Otter board trawl 0-300hp</td>
<td>Speed within 3 to 5</td>
<td>Speed&lt;3 or speed&gt;5</td>
</tr>
<tr>
<td>Otter board trawl &gt;300hp</td>
<td>Speed within 3 to 4</td>
<td>Speed&lt;3 or speed&gt;4</td>
</tr>
<tr>
<td>Twin trawl 0-300hp</td>
<td>Speed within 3 to 5</td>
<td>Speed&lt;3 or speed&gt;5</td>
</tr>
<tr>
<td>Twin trawl &gt;300hp</td>
<td>Speed within 3 to 4</td>
<td>Speed&lt;3 or speed&gt;4</td>
</tr>
</tbody>
</table>

Source: South et al., 2009.

The example in table 2.1 discusses the ideal situation where a trip is comprised of a number of fishing and/or sailing VMS points and the day catch is available. This was not always the case. Several factors could complicate the distribution of catch over the VMS points. For example in a number of cases a vessel was sailing at all the available VMS positions on a day or data was lacking, for example on the fishing gear, HP and speed, which made it not possible to allocate an activity to a VMS point. To still be able to allocate catch to VMS locations a number of assumptions needed to be made in the case of missing data. The distribution methods used in these cases are summarised in Table 2.3.

Table 2.3: Distribution catch in several situations

<table>
<thead>
<tr>
<th>Day catch recorded for trip</th>
<th>Day catch recorded on day</th>
<th>Type of Activity</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Fishing and other</td>
<td>Fishing time/fishing time on fishing day</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Only steaming</td>
<td>Catch not distributed</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Only unknown</td>
<td>Time unknown/time on fishing day unknown</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Steaming and Unknown</td>
<td>Catch not distributed</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>All combinations</td>
<td>Catch not distributed</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>Fishing and other</td>
<td>Fishing time/fishing time on fishing day</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>Only steaming</td>
<td>Catch not distributed</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>Only unknown</td>
<td>Time unknown/time on trip unknown</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>Steaming an unknown</td>
<td>Catch not distributed</td>
</tr>
</tbody>
</table>

The VMS data does not provide full coverage. This is, in particular, due to vessels with a length less than 15 meters and which consequently do not have on-board VMS as well as an inability to fully distribute all the catches between VMS points. This was corrected by increasing the catches by a factor based on coverage percentages (see appendix 2 for coverage in VMS data per gear). So for example if for a certain gear type the coverage was 90%, the total catches with this gear type were multiplied by a factor (1/0.9). This approach provided for the distribution of all catches as found in the VIRIS logbook data.

The catches and average auction prices were used to determine the value of the catches at the various VMS points. Finally, the contribution to the gross value added was calculated on the basis of the average percentage of the gross value added’s (GVA) contribution to the production value as known in LEI’s Farm Accountancy Network.

This described method is in agreement with the methods used in earlier LEI reports on the determination of the value of fishing areas (such as Van Oostenbrugge et al., 2010).

2.3 Processing of data for foreign vessels

The foreign data were processed in a similar way to the data from the Dutch vessels. However there was one fundamental difference in the data that meant that the data needed to be processed slightly different-
ly. Namely the VMS data for the foreign vessels only covered the Dutch section of the continental shelf. The difference in attributing catches to VMS points for the foreign vessels is illustrated by an example in table 2.4.

First, similar as for the Dutch vessels the sailing speed was used to determine whether the vessel was fishing or sailing at each VMS point. Next, the duration was determined for each position (the time interval between the current and previous position). It was checked whether the time interval did not exceed 2 hours. In the example in table 2.4 at time 14:00 previous VMS points were clearly lacking. Therefore the time interval at this point is corrected to 2 hours instead of the calculated 12 hours.

Since the VMS points only cover the Dutch part of the continental shelf it is very likely that the VMS points do not cover the complete trip of a foreign vessel. Therefore a distribution of the total catch over the available VMS points will most likely lead to an overestimation of the catch at each of the VMS positions. Therefore the catch to be distributed between the VMS positions was calculated from the total catch on the basis of the share of the duration that was allocated to the VMS positions and the total duration of the trip. In the example 30% of the trip was covered by the VMS positions. Therefore, only 30% of the total catch is attributed to the VMS positions. The resultant catch (kg) at the VMS positions was distributed on the basis of the duration during which the vessel fished at the various positions.

<table>
<thead>
<tr>
<th>DH1</th>
<th>Time</th>
<th>Speed</th>
<th>Duration</th>
<th>Catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-aug, leaves port</td>
<td>02:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-aug</td>
<td>14:00</td>
<td>0.2</td>
<td>12:00</td>
<td>2:00*</td>
</tr>
<tr>
<td>21-aug</td>
<td>15:00</td>
<td>5.6</td>
<td>1:00</td>
<td>0</td>
</tr>
<tr>
<td>21-aug</td>
<td>17:00</td>
<td>3.4</td>
<td>2:00</td>
<td>360</td>
</tr>
<tr>
<td>21-aug</td>
<td>18:00</td>
<td>3.2</td>
<td>1:00</td>
<td>180</td>
</tr>
<tr>
<td>21-aug arrives at port</td>
<td>22:00</td>
<td>0</td>
<td>1:00</td>
<td>0</td>
</tr>
<tr>
<td>Total duration of trip</td>
<td>20:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total duration of VMS</td>
<td>6:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VMS share of total duration in trip (%)</td>
<td>30%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-allocated catch</td>
<td></td>
<td></td>
<td></td>
<td>1,260</td>
</tr>
<tr>
<td>Total catch</td>
<td></td>
<td></td>
<td></td>
<td>1,800</td>
</tr>
</tbody>
</table>

* Duration of period before first ping has been adjusted to two hours, assuming it has been out of the Dutch part of the North Sea.

The VIRIS data does not provide full-coverage for foreign vessels. Foreign vessels are only included in the VIRIS dataset if they actually land their fish in a Dutch harbour. Therefore catches were scaled up to the total quantity of VMS positions. If catches were not available for a VMS position, catches were estimated on the basis of Catch per Unit of Effort (CPUE) estimates. These CPUE estimates were calculated for each country, HP category and type of fishing gear on the basis of catches at VMS positions for which catch data was available.

The catches and average auction prices were used to determine the value of the catches at the various VMS points similar to the Dutch vessels. No gross value added was calculated for the foreign vessels.

2.4 Historical fishing trends in areas of interest

Landed catches, value of landed catches and GVA (for Dutch fleet only) were done for the Dutch and the foreign fleets separately. For the years 2006 to 2011, the effort, landed catch, value of landed catch in the areas were computed as the sum of the effort (landed catch/value of landed catch) of all pings of which the coordinates were in the area. For the Dutch fleet, the data was then scaled up to account for missing VMS data and the contribution to the production value was calculated.
3 Historic trends in fishing activities

In general, the fishing intensity in the area of the Dogger Bank and the resulting landings value are low for the Dutch fleet (on average 0.15 kEur/km²/year). Because of the large size of the area, the total value of the landings from the area for the Dutch and foreign fleets together adds up to between €1m and €3m per year. For the Dutch fleet, the fish taken from this area contributes to a GVA of between 90 and 536 kEur per year. This has been fluctuating considerably over the years and has increased considerably in 2011 because of a sharp rise in the fishing activities of the Dutch fleet by almost a factor 4. The trends for the Dutch and foreign fleets are discussed in more detail below.

<table>
<thead>
<tr>
<th>Table 3.1</th>
<th>Overview fishing activities of the Dutch fleet and foreign fleets on the Dogger Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas</td>
<td>2006</td>
</tr>
<tr>
<td>Dutch fishing fleet</td>
<td></td>
</tr>
<tr>
<td>Landings (tonnes)</td>
<td>204</td>
</tr>
<tr>
<td>Value (kEur)</td>
<td>476</td>
</tr>
<tr>
<td>Gross value added (kEur)</td>
<td>133</td>
</tr>
<tr>
<td>Landings value per km² (kEur per km²)</td>
<td>0.10</td>
</tr>
<tr>
<td>Foreign fishing fleets</td>
<td></td>
</tr>
<tr>
<td>Landings (tonnes)</td>
<td>515</td>
</tr>
<tr>
<td>Value (kEur)</td>
<td>1,341</td>
</tr>
</tbody>
</table>

\(a\): Provisional estimate.
Source: Logbook data and VMS data, processed by LEI.

3.1 Dutch Fleet

The effort of the Dutch fleet has been highly variable over the years with large increases from 2007-2008 and from 2010-2011 (figure 3.1). The fishery was almost completely dominated by two gear types, the traditional beam trawl (mainly operated by 2000 hp vessels in the area) and the otter board trawl fishery (mainly operated by euro cutters in the area). The patterns in landings, landings value and contribution to the GVA are quite similar, whereas the relative importance of the effort for otter board trawls is larger (figure 3.1). This is due to the fact that the beam trawl fishery in the area is mainly carried out by large beam trawlers obtaining larger catches per fishing day than the smaller euro cutters that operate the otter board trawl fishery. The effort of beam trawlers was between 10 and 30 fishing days per year for most of the period and increased sharply in 2011 (40 fishing days, figure 3.2). The fishing effort of otter board trawlers has varied a lot between 10 and 60 fishing days per year (figure 3.2), resulting in equally large variations in landings and the contribution to the GVA.
Figure 3.1  Historical trends of the fishing activities in the Dogger Bank by the Dutch fleet. Effort, landings, value of landings and GVA are given by gears aggregated at the level of European codes.

Source: Logbook data and VMS data, processed by LEI.
Figure 3.2  Historical trends of the fishing activities in the Dogger Bank by the Dutch Beam trawlers. Effort, landings, value of landings and GVA are given for flatfish beam trawlers (TBB) and pulse trawlers (TBP).

Source: Logbook data and VMS data, processed by LEI.
Figure 3.3  Historical trends of the fishing activities in the Dogger Bank by the Dutch Demersal trawlers. Effort, landings, value of landings and GVA are given for otter board trawls (OTB) twin trawls (OTT) Danish seines (SDN) and Scottish seines (SSC).

<table>
<thead>
<tr>
<th>Gear</th>
<th>Effort (fishing days)</th>
<th>Landings (tonnes)</th>
<th>Value (million euros)</th>
<th>GVA (million euros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTB</td>
<td><img src="image" alt="Effort OTB" /></td>
<td><img src="image" alt="Landings OTB" /></td>
<td><img src="image" alt="Value OTB" /></td>
<td><img src="image" alt="GVA OTB" /></td>
</tr>
<tr>
<td>OTT</td>
<td><img src="image" alt="Effort OTT" /></td>
<td><img src="image" alt="Landings OTT" /></td>
<td><img src="image" alt="Value OTT" /></td>
<td><img src="image" alt="GVA OTT" /></td>
</tr>
<tr>
<td>SDN</td>
<td><img src="image" alt="Effort SDN" /></td>
<td><img src="image" alt="Landings SDN" /></td>
<td><img src="image" alt="Value SDN" /></td>
<td><img src="image" alt="GVA SDN" /></td>
</tr>
<tr>
<td>SSC</td>
<td><img src="image" alt="Effort SSC" /></td>
<td><img src="image" alt="Landings SSC" /></td>
<td><img src="image" alt="Value SSC" /></td>
<td><img src="image" alt="GVA SSC" /></td>
</tr>
</tbody>
</table>

Source: Logbook data and VMS data, processed by LEI.
3.2 Foreign Fleets

The economic importance of the area to the Belgian, German and UK fleet was in most years much larger than that of the Dutch fleet and ranged from €1.2-2.2m per year (Figure 3.4). UK beam trawlers dominated the fishing activities in the area (Figure 3.4 and 3.7), and the effort and the resulting landings are considerable (€0.8-1.6m per year). The shifts in gear use in the Belgian fleet (Figure 3.5) might be caused by random variation as the activity levels for this fleet are very low and therefore the number of observations is low as well.

Figure 3.4 Historical trends of the fishing activities in the Dogger Bank by the foreign fleets. Effort, landings and value of landings are given by country

<table>
<thead>
<tr>
<th>Year</th>
<th>Effort (fishing days)</th>
<th>Landings (tonnes)</th>
<th>Value (1000 euros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Logbook data and VMS data, processed by LEI.
Figure 3.5  Historical trends of the fishing activities in the Dogger Bank by the Belgian fleets. Effort, landings and value of landings are given by gear.

Source: Logbook data and VMS data, processed by LEI.
Figure 3.6  Historical trends of the fishing activities in the Dogger Bank by the German fleets. Effort, landings and value of landings are given by gear.

Source: Logbook data and VMS data, processed by LEI.
Figure 3.7  Historical trends of the fishing activities in the Dogger Bank by the British fleets. Effort, landings and value of landings are given by gear.

Source: Logbook data and VMS data, processed by LEI.
4 Discussion and conclusions

4.1 Discussion

This memorandum gives an overview of the historic fishing activities in the area of the Dogger Bank. As can be seen from the results the area is of limited importance for the Dutch fishing fleet. Despite its large surface area (8% of the total Dutch part of the continental shelf), the value of the landings obtained from the area are less than 1% of the total landings value of the Dutch cutter fleet for the period up to 2010 (Taal et al., in prep). Herewith, the level of fishing activity in this area is comparable of that in the Central Oyster Grounds. The Frisian Front and Cleaver Bank have shown higher levels of fishing activity than the Dogger Bank (Van Oostenbrugge et al., 2010, Harmon et al., 2013).

The general low exploitation pattern for this area by the Dutch fleet has most probably been caused by the northerly position (causing considerable time and fuel needed to go up there), and the fact that the plaice TAC has been relatively low, so that most plaice could be caught in the mixed fishery with sole in the southern part of the north sea. The higher plaice TAC in 2011 and the higher CPUE’s for plaice could potentially have triggered the large increase in both effort and landings from the area that is well known for its high plaice catches. This also shows that the potential of an area is hard to quantify from these time series and depends highly on the circumstances, both biological, economic and management.

Several factors affect the reliability of the results. First, the fishing effort, landings and value of individual pings are estimated based on assumptions about the speed at which fishing occurs and the equal allocation of landings to the fishing pings. Those values usually relate to pings that are emitted every two hours during which the vessels can sail more than 15 nm but the values are allocate to a single point. Fixed speed thresholds were used to decide whether a vessels was fishing or not. Recently, the method to make that distinction has been refined by basing the thresholds on actual speed frequency distributions of individual vessels for individual years. In this way individual preferences for fishing speeds and possible changes in fishing speeds caused by e.g. high fuel prices can be taken into account and the nature of the operation at every ping can be determined with a lower uncertainty. In order to be consistent with the previous study these new techniques were not applied here, but this increases the statistical uncertainty of the outcome. Secondly, the method of effort allocation based on vessel speed is less appropriate for static gears such as nets. The coverage of those vessels is already lower than for active gears primarily due to the size of the vessels (see Appendix 1). In addition, as the amount of vessels using this gear is low, the uncertainty of the estimate is large. Therefore any conclusion on the activity of the netters will be highly uncertain. Thirdly, there is no speed thresholds agreed for the pelagic trawlers while they are by definition very mobile. This means that every ping collected for these large trawlers will be assigned part of the large landings volume which can result in artificially landings for these vessels in an area. As these vessels catch relatively large amounts of low-value fish, compared to other fishing fleets, this only comes up in the landings figures. Currently, LEI and IMARES, together with the industry are working on an improved method to estimate the value of fishing grounds. This method will probably become available early 2013 and will take care of some of the concerns mentioned above.

For the foreign data there is an additional problem influencing the quality of the results: the quality of the foreign data. To estimate the value of the areas three data sets need to be combined: logbook data, fleet data and VMS data. To combine the datasets the vessel name is used. However the vessel name is in many cases not consistent between data sets. E.g. in many cases the vessel name in the VMS data set does not match vessel names in either the fleet registry or the logbook data. The vessel name in the VMS data set in some cases seems to be the radio name but in other cases could not be matched at all. These data errors are complicating the data processing for the foreign fleets and the results for those fleets would be far more reliable if the datasets were checked and made more consistent by the ministry. Until these problems have been solved, data processing is very time consuming and the results of the analyses can only be regarded as indicative.
4.2 Conclusions

From this study the following can be concluded:
- The area of the Dogger Bank represents limited value for both the Dutch and foreign fishing fleets with total value of landings between €1-3m per year for the Dutch and foreign fleets combined. For the Dutch fishery, the value of the landings per year from the area represent on average less than 1% of the total landings value for this period.
- The fishing intensity in the area has been highly variable and has increased substantially during 2011 by the Dutch fleet.
- These historical values cannot be used as an indication of the potential value of the area for the fleets, because the analysed patterns are results of the historical context, which will change in the future.
- Results for analysis for foreign fleets could be enhanced considerably in case consistency and quality of the basic data (logbook, VMS, fleet) for these fleets would be increased.


Appendix 1

Data sources

VIRIS data
The catch data originates from the VIRIS (Fish Registration and Information System) database that contains records of all landings by vessels sailing under the Dutch flag and all landings by vessels sailing under a non-Dutch flag landing fish at ports in the Netherlands. These records are based on the logbooks kept by the fishers. The catches of each species controlled by quotas must be entered in this logbook per sailing day and ICES quadrant. Records of the catches of species not controlled by quotas are kept per trip.

Fleet data
The catch data for the various types of fisheries was calculated using the technical data listed in the NRV (Netherlands Register of Fishing Vessels). The combination of NRV data and VIRIS data yielded information about the technical specifications of the vessel on each trip. Not all the technical specifications of non-Dutch vessels are known.

VMS data
Since 1 January 2000, an increasingly large proportion of fishing vessels are under the obligation to operate an onboard VMS system (Vessel Monitoring System) within the context of the European inspection policy. This VMS system transmits the position of the vessel, vessel identification code and the vessel’s sailing speed to a central computer about once every two hours. The computer stores these data (EU Regulation 2244/2003). The vessel’s sailing speed can be used to make a distinction between the various activities (fishing, sailing and at anchor). Although this distinction cannot be made completely, the potential error is small relative to the total number of records. Information about the presence of non-Dutch vessels in the Dutch section of the North Sea is also available.

Price data
The value of the catches was determined using the average monthly price data per species collected by the Productschap Vis (Netherlands Fish Product Board). Price data are not collected for all the species listed in VIRIS. When specific price data was not available for fish species then the value of the catches was determined using the average price of less specific market categories (for example, ‘other seafish’). Appendix 2 lists the classification of fish species. In addition, prices from other sources were used for a number of fish species (in particular, sprat and herring, grey mullet and smelt) (requested from fishers and collected from the accounts of the high-sea fisheries) since these species are rarely traded on the fish auctions and the auction prices are not representative of the actual prices paid for the fish. The average auction price of catches by vessels with fixed fishing gear were increased by 15%: an analysis of a limited dataset with price data for the fisheries with fixed fishing gear and discussions with fishers revealed that these fisheries’ catches are, in general, traded at higher auction prices due to a different market grading (in general, larger sole) and quality (fresh fish with less damage as compared to fish caught with beam trawls).

Economic data
The LEI panel has economic data for the various fisheries over the entire period of the study. The data contains the total annual proceeds of the Dutch cutter fisheries in the various fisheries and the relationships between the total proceeds and the gross value added. However, these data are not classified by fishing area. Consequently, the economic data needs to be combined with catch data to arrive at an estimate of the contribution each fishing area makes to the economy.
Appendix 2
Quality of the data

This Section begins with a discussion of the quality of the data from each source and continues with a presentation of an analysis of the effects on the quality of the estimates.

Data used for Dutch vessels

**VIRIS data**
The VIRIS data covers the entire Dutch fleet. It is possible that some of the catches are not recorded in the VIRIS database since vessels with a length of more than 10 metres do not need to keep records of catches of less than 50 kg per species. This was examined for a number of vessels: this revealed that the differences between actual and registered landings are small. However, it is possible that these differences are of relevance for some other vessels. Nevertheless, it may be assumed that this underestimation is negligible. A small fraction of the catches were allocated retrospectively to the trip catch on the basis of the auction data and then distributed between the fishing days. Although this distribution results in additional uncertainty this error, in view of the small quantities involved, will also be very small.

**VMS data**
Table 1 lists the coverage percentages of the VMS data on the basis of the total distributed catches. The coverage is good for most types of fishing gear used by the cutter fleet. The VMS coverage is high for the most common forms of fishing gear such as beam trawl. The coverage is low to very low for a number of types of fishing gear that are not used frequently, such as angling lines. However, the catches made with these types of fishing gear are also limited.

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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
Tables 2 to 7 for 2006 to 2011 show how the VMS catches were distributed between the three categories, whereby a distinction was made in terms of the availability of day/catch figures (see also Table 2.2). It was readily feasible to determine the VMS points where vessels fitted with the most important types of fishing gear, such as beam trawl (TBB) and bottom otter trawl (OTB) fishing gear had fished. Shrimp vessels (shrimp trawl [TBS], <300 HP) are not under the obligation to report day catches: consequently, trip catches were used for these vessels instead of day catches. However, it was possible to allocate catches to the VMS points in practically all instances.

### Table A2.2

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a) Fishing gear codes are included in Appendix 4.

Source: Logbook data and VMS data, processed by LEI.
### Table A2.3

Share of the VMS catches distributed in the various manners (see also Table 2.2) per HP category and type of fishing gear in 2007

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<th>HP category</th>
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<td>Only unknown</td>
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<tr>
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| High Seas fleet |              |                    |                |                   |                   |             |
| OTM     | >1,500       | 319,014            | 0              | 100               | 0                 | 0            |
| PTM     | >1,500       | 18,404             | 0              | 100               | 0                 | 0            |
| UKN     | >1,500       | 4,518              | 0              | 0                 | 0                 | 100          |

a) Fishing gear codes are included in Appendix 4.

Source: Logbook data and VMS data, processed by LEI.
Table A2.4: Share of the VMS catches distributed in the various manners (see also Table 2.2) per HP category and type of fishing gear in 2008

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a) Fishing gear codes are included in Appendix 4.

Source: Logbook data and VMS data, processed by LEI.
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<th>HP category</th>
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<th>With catch day</th>
<th>Without catch day</th>
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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
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| High Seas fleet | | | | | |
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| OTM | unknown | 49,007 | 0 | 100 | 0 |
| PTM | >1,500 | 17,823 | 0 | 100 | 0 |
| UKN | >1,500 | 4,742 | 0 | 0 | 100 |

a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
Table A2.7 | Share of the VMS catches distributed in the various manners (see also Table 2.2) per HP category and type of fishing gear in 2011

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<th>Gear a)</th>
<th>HP category</th>
<th>VMS catch (tonnes)</th>
<th>With catch day</th>
<th>Without catch day</th>
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<tr>
<td>Cutter fleet</td>
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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.

Price data
The price data cover all landings of species controlled by quotas in the Netherlands. Landings outside the Netherlands are not included in these data. However, the quantities of most species are relatively small. The coverage for the catches of shrimps is somewhat lower since much of the catch is sold directly to the processing industry. However, it is assumed that the prices are indicative.
Economic data
The economic data cover the major segments and types of fishing gear. The average ratio of the landing value to the gross value added for various types of fishing gear is used for the other types of fishing gear.

Data used for non-Dutch vessels

VIRIS data
The VIRIS data cover trips of non-Dutch vessels that land in the Netherlands. Consequently, no catch are available for some VMS points. Non-Dutch vessels, in analogy with Dutch vessels, with a length of more than 10 metres do not need to keep records of catches of less than 50 kg per species. As indicated earlier, this can be of relevance to specific vessels. However, it is safe to assume that this underestimation is relatively small. Table 3.5 lists the coverage percentages of the VIRIS data on the basis of the duration at the VMS points. The coverage is reasonably good for most types of fishing gear, although much lower than for the Dutch segments.
Table A2.8  Fishing effort in VMS data for foreign fleets, VIRIS catch allocated to VMS pings and coverage percentages of VMS effort in VIRIS for 2006

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<th>Fishing effort in VMS (fishing days)</th>
<th>Viris catch allocated to VMS pings (tonnes)</th>
<th>Percentage of VMS effort linked to Viris</th>
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a) Fishing gear codes are included in Appendix 4.
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a) Fishing gear codes are included in Appendix 4.

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a) Fishing gear codes are included in Appendix 4.  
Source: Logbook data and VMS data, processed by LEI.
Table A2.11  Fishing effort in VMS data for foreign fleets, VIRIS catch allocated to VMS pings and coverage percentages of VMS effort in VIRIS for 2009

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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
Table A2.12  Fishing effort in VMS data for foreign fleets, VIRIS catch allocated to VMS pings and coverage percentages of VMS effort in VIRIS for 2010

<table>
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<th>Percentage of VMS effort linked to Viris</th>
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a) Fishing gear codes are included in Appendix 4.

Source: Logbook data and VMS data, processed by LEI.
Table A2.13  Fishing effort in VMS data for foreign fleets, VIRIS catch allocated to VMS pings and coverage percentages of VMS effort in VIRIS for 2011

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<th>Viris catch allocated to VMS pings (tonnes)</th>
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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
**VMS data**
The Netherlands is responsible for the control of fishing vessels in the Dutch section of the continental shelf and, consequently, has all VMS data relating to the area at its disposal. However, this is often only part of the VMS information about the trip since these vessels spend only part of the time of their trip in the Dutch section of the continental shelf. Vessels with a length of 15 metres are not governed by the VMS obligation. It is assumed that the number of non-Dutch vessels of a length of less than 15 metres that fish in the Dutch section of the continental shelf is negligible.

**Price data**
The price data covers all landings of species controlled by quotas in the Netherlands. Since the large majority of the catches are landed in the Netherlands, it has been decided that these prices will also be used for non-Dutch vessels.
Appendix 3
Fishing trends in the areas

This section contains the historical trends of fishing activities of the Dutch and foreign Fleets in the Dogger Bank. The data are aggregated by Fleet, horsepower categories and gear type. Years covered are 2006 to 2011.

Dutch Fleet

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<th>2010</th>
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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
### Table A3.2
#### Landings of each fleet segment in the Dogger Bank area (tonnes)

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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.

### Table A3.3
#### Value of landed catches of each fleet segment in the Dogger Bank area (€1,000)

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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
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a) Fishing gear codes are included in Appendix 4.
Source: Logbook data and VMS data, processed by LEI.
### Table A3.5
Effort of each foreign fleet segment in the Dogger Bank area (days at sea) and the proportion of the time spent fishing

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a) Fishing gear codes are included in Appendix 4.

Source: Logbook data and VMS data, processed by LEI.
### Appendix 4

#### Gear codes

<table>
<thead>
<tr>
<th>Gear code</th>
<th>Gear type</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPO</td>
<td>Pots</td>
</tr>
<tr>
<td>GN</td>
<td>Gillnets (not specified)</td>
</tr>
<tr>
<td>GNC</td>
<td>Encircling gillnets</td>
</tr>
<tr>
<td>GND</td>
<td>Drift nets</td>
</tr>
<tr>
<td>GNS</td>
<td>Set gillnets (anchored)</td>
</tr>
<tr>
<td>GTN</td>
<td>Combined gillnets-Trammel nets</td>
</tr>
<tr>
<td>GTR</td>
<td>Trammel nets</td>
</tr>
<tr>
<td>LHP</td>
<td>Hand-lines and pole-lines (hand operated)</td>
</tr>
<tr>
<td>LL</td>
<td>Longlines (not specified)</td>
</tr>
<tr>
<td>LLD</td>
<td>Drifting longlines</td>
</tr>
<tr>
<td>LLS</td>
<td>Set lines (longlines set)</td>
</tr>
<tr>
<td>LN</td>
<td>Lift nets (not specified)</td>
</tr>
<tr>
<td>MIS</td>
<td>MISCELLANEOUS GEAR</td>
</tr>
<tr>
<td>OTB</td>
<td>Otter trawls bottom</td>
</tr>
<tr>
<td>OTM</td>
<td>Otter trawls midwater</td>
</tr>
<tr>
<td>OTT</td>
<td>Otter twin trawls</td>
</tr>
<tr>
<td>PTB</td>
<td>Pair trawls bottom</td>
</tr>
<tr>
<td>PTM</td>
<td>Pair trawls mid-water</td>
</tr>
<tr>
<td>SDN</td>
<td>Danish seines</td>
</tr>
<tr>
<td>SSC</td>
<td>Scottish seines</td>
</tr>
<tr>
<td>TBB</td>
<td>Beam trawls</td>
</tr>
<tr>
<td>TBS</td>
<td>Shrimp trawls</td>
</tr>
</tbody>
</table>