Overview of the International Fishing Activities on Protected Areas in the North Sea

Fishing activities of the Dutch, Danish, German, Belgian, Swedish and French fleet for the period 2015-2019

J.L. Roskam, K.G. Hamon and B. Deetman

WAGENINGEN
UNIVERSITY & RESEARCH

Overview of the International Fishing Activities on Protected Areas in the North Sea

Fishing activities of the Dutch, Danish, German, Belgian, Swedish and French fleet for the period 2015-2019

J.L. Roskam, K.G. Hamon and B. Deetman

This study was carried out by Wageningen Economic Research and subsidised by the Dutch Ministry of Agriculture, Nature and Food Quality within the context of the 'North Sea' research theme of the Policy Support Tasks (project number BO-43-116.01-005)

Wageningen Economic Research
Wageningen, June 2021

REPORT
2021-038
ISBN 978-94-6395-839-4

WAGENINGEN
UNIVERSITY & RESEARCH

J.L. Roskam, K.G. Hamon and B. Deetman, 2021. *Overview of the International Fishing Activities on Protected Areas in the North Sea; Fishing activities of the Dutch, Danish, German, Belgian, Swedish and French fleet for the period 2015-2019.* Wageningen, Wageningen Economic Research, Report 2021-038. 82 pp.; 38 fig.; 12 tab.; 13 ref.

Dit rapport geeft een overzicht van de sociaal-economische data van de gebieden waarvoor het ministerie van Landbouw, Natuur en Voedselkwaliteit een Joint Recommendation moet leveren onder Artikel 11 van Verordening (EU) nr. 1380/2013. Dit wordt niet alleen voor de Nederlandse vloot gedaan, maar ook voor de Belgische, Franse, Duitse, Zweedse en Deense.

This report provides an overview of socio-economic data of areas for which the Ministry of Agriculture, Nature and Food Quality has to provide a Joint Recommendation for fisheries management under Article 11 of Regulation (EU) No. 1380/2013. This not only for the Dutch fleet, but also for the Belgian, French, German, Swedish and Danish fleet.

Key words: North Sea, Fishing, Protected Areas, Natura 2000, Marine Strategy Framework Directive

This report can be downloaded for free at https://doi.org/10.18174/547774 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 9001:2015 certified.

Wageningen Economic Research Report 2021-038

Cover photo: Oscar Bos / Wageningen University & Research

Contents

Preface

In 2020 the future agenda for the spatial management of the North Sea was laid down in the North Sea Agreement. In this agreement a number of area closures for the Dutch part of the North Sea have been proposed both within the international frameworks of Natura 2000 and the Marine Strategy Framework Directive.

For these areas the Ministry of Agriculture, Nature and Food Quality has to provide a Joint Recommendation for fisheries management under Article 11 of Regulation (EU) No 1380/2013 (the Basic Regulation) on behalf of the Netherlands and other Member States that have a direct management interest regarding fisheries management measures. The aim of the proposals is the recovery of substantial parts of the seabed ecosystem from a disrupted state towards a natural condition.

The Joint Recommendation contains the requests to the European Commission to regulate fisheries in the Natura 2000 areas Dogger Bank, Cleaver Bank and North Sea Coastal Zone, and the MSFD areas Central Oyster Grounds, Frisian Front and Borkum Reef Grounds. For each area, background documents are provided to substantiate these requests. Wageningen Economic Research and Wageningen Marine Research were asked to provide the ecological and socio-economic data for the background documents.

This report provides an overview of the socio-economic data of the proposed fisheries closures. We thank the research institutes from Sweden, Denmark, Germany, Belgium and France for their quick and accurate response to our data call.

Ir. O. (Olaf) Hietbrink
Business Unit Manager Wageningen Economic Research
Wageningen University & Research

Summary

S.1 Main findings

For the Natura 2000 areas Dogger Bank, Cleaver Bank and North Sea Coastal Zone, and the Marine Strategy Framework Directive (MSFD) areas Central Oyster Grounds, Frisian Front and Borkum Reef Grounds socio-economic data are provided in Table S.1. At the request of the Ministry of Nature, Agriculture and Food Quality data for both N2000 and VIBEG2 were given for the North Sea Coastal Zone. The data of the N2000 area of the North Sea Coastal Zone provides insight into the importance of this area for the fisheries. A closure of this area isn't proposed in the North Sea Agreement.

For the areas mentioned in Table 5.1, except the North Sea Coastal Zone (N2000), the Ministry of Agriculture, Nature and Food Quality has to provide a Joint Recommendation for fisheries management under Article 11 of Regulation (EU) No 1380/2013 (the Basic Regulation). The aim of the proposals is the recovery of substantial parts of the seabed ecosystem from a disrupted state towards a natural condition. The Joint Recommendations contains the requests to the European Commission to regulate fisheries in the proposed areas. For each area, background documents are provided to substantiate these requests.

Table S.1 *Summary of the main results*

Area	Average total contribution to GVA[1] (1,000 euros)	Main gears[2]	Main countries	Trends
Borkum Reef Grounds	761	TBS	DEU and NLD	Volatile
Central Oyster Grounds	2,272	OTB and OTM	DNK	Decreasing (2015-2017) and Increasing (2018-2019)
Cleaver Bank	892	SSC and TBB	NLD	Decreasing
Dogger Bank	857	OTB, OTM and TBB	DNK and NLD	Increasing (DNK) and Decreasing (NLD)
Frisian Front subarea 1	2,262	OTM, OTT and TBB	DNK and NLD	Decreasing
Frisian Front subarea 2	256	OTM, SSC and TBS	DNK and NLD	Decreasing (DNK) and Volatile (NLD)
North Sea Coastal Zone (N2000)	16,107	TBS	NLD	Volatile
North Sea Coastal Zone (VIBEG2)	788	TBS	NLD	Volatile

S.2 Methodology

In 2020 the future agenda for the spatial management of the North Sea was laid down in the North Sea Agreement. In this agreement a number of area closures have been included both within the international framework of the Natura 2000 network and the Marine Strategy Framework Directive (MSFD): Dogger Bank, Cleaver Bank, Central Oyster Grounds, Borkum Reef Grounds, Frisian Front subarea 1, Frisian Front subarea 2, and parts of the North Sea Coastal Zone. The objective of this study is to provide an overview of socio-economic value for fisheries of the areas to be closed. This not only for the Dutch fleet, but also for the Belgian, French, German, Swedish and Danish fleet.

[1] Gross Value Added.
[2] OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SSC: Scottish seines; TBB: beam trawls; TBS: shrimp trawls.

To provide the required data the following steps were taken:

1. Discussing the format for the required data with the Ministry of Agriculture, Nature and Food Quality. Our data is directly used by the Ministry to answer the questionnaire from the Commission.
2. Datacall to Belgium, France, Germany, Sweden and Denmark
3. Analysing the data

Several data sources are 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 landings value and economic performance of all fleets that were obtained from the database of the Annual Economic Report of the EU fishing fleets.

1 Introduction

In 2020 the future agenda for the spatial management of the North Sea was laid down in the North Sea Agreement.[3] In this agreement a number of area closures have been included both within the international framework of the Natura 2000 network and the Marine Strategy Framework Directive (MSFD): Dogger Bank, Cleaver Bank, Central Oyster Grounds, Borkum Reef Grounds, Frisian Front subarea 1, Frisian Front subarea 2, and parts of the North Sea Coastal Zone (see Table 1.1 and Figure 1.1). Actually there is one MSFD Frisian Front area. However, the Frisian Front can be divided in two subareas in which different fishing measures will be applied. Therefore this area is divided into two subareas: Frisian Front subarea 1 and Frisian Front subarea 2. The North Sea Coastal Zone can be divided in two management zones: the Natura 2000 site North Sea Coastal Zone (restricted access based on Dutch Nature Conservation Law) and the North Sea Coastal Zone VIBEG2 areas (closed to (demersal) fishing activities). To inform the European Commission about the possible consequences of these management measures and to implement these closures an assessment of both ecological and socio-economic consequences of these closures is needed. For the proposed areas the Ministry of Agriculture, Nature and Food Quality (LNV) has to provide a Joint Recommendation for fisheries management under Article 11 of Regulation (EU) No 1380/2013 (the Basic Regulation). The aim of the proposals is the recovery of substantial parts of the seabed ecosystem from a disrupted state towards a natural condition. The Joint Recommendation contains the requests to the European Commission to regulate fisheries in the proposed areas. For each area, background documents are provided to substantiate these requests. To write these background documents, the Ministry of LNV has requested Wageningen University & Research to deliver an update on data and analysis on the economic value of the fishing activities of the Dutch, Danish, German, Belgian, Swedish and French fishing fleets on the proposed areas for closure of the for the years 2015 to 2019. The objective of this study is therefore to provide an overview of socio-economic value for fisheries for the areas to be closed.

An overview of these areas is mapped in Figure 1.1 with the adjacent ICES rectangles. The areas and their corresponding surface area are shown in Table 1.1. This report is a follow-up on the previous analysis of fishing activity performed by Wageningen Economic Research (e.g. Hamon et al. 2013, Oostenbrugge et al. 2013, Oostenbrugge and Hamon et al. 2014, Oostenbrugge et al. 2015, Hamon et al. 2020). The part of the Central Oyster Grounds that overlaps with the Dogger Bank (see Figure 1.1) does not belong to the area of the Central Oyster Grounds. This part will only be designated under the Habitat Directive and not under the MSFD.

This report with the historic fishing activities in the areas, is a first step in order to assess the effects of the closures on the fishing sector. This is important for the estimation of the costs of closures as historic data provide the basis for any analysis of effects of closures and the effect of closures depend on the extent of fishing activities, the type of fisheries in the area and the dependency of these fisheries on the area. Research institutes of Denmark (DTUAQUA), Germany (TI), Belgium (ILVO), Sweden (SLU) and France (IFREMER) were asked to provide aggregated data on the fishing activities of their countries in the proposed areas for closure, to obtain an overview of the international activities on these fishing grounds. Fishing activities in the areas were quantified in terms of effort, landings volume, landings value and contribution to the Gross Value Added (GVA). The GVA is especially important as this metric indicates the economic value of the fishing activities to society: the returns on the invested capital (fishing vessel) and labour by the crew.

[3] https://www.rijksoverheid.nl/documenten/rapporten/2020/06/19/bijlage-ofl-rapport-het-akkoord-voor-de-noordzee

Table 1.1 *Overview of the proposed areas for closure and the corresponding surface in km²*

Name of the area	Surface in km²	Type of closure
Borkum Reef Grounds	653	MSFD
Dogger Bank	1,918	N2000
Cleaver Bank	1,241	N2000
Central Oyster Grounds	2,063	MSFD
Frisian Front subarea 1	1,658	MSFD
Frisian Front subarea 2	366	MSFD
North Sea Coastal Zone a)	1,445	N2000
North Sea Coastal Zone VIBEG2 b)	158	N2000

a) Note that the North Sea Coastal Zone is the entire N2000 area and not the VIBEG2 area.

b) Wageningen Marine Research applied a calculation to estimate the contribution of the VIBEG2 areas.

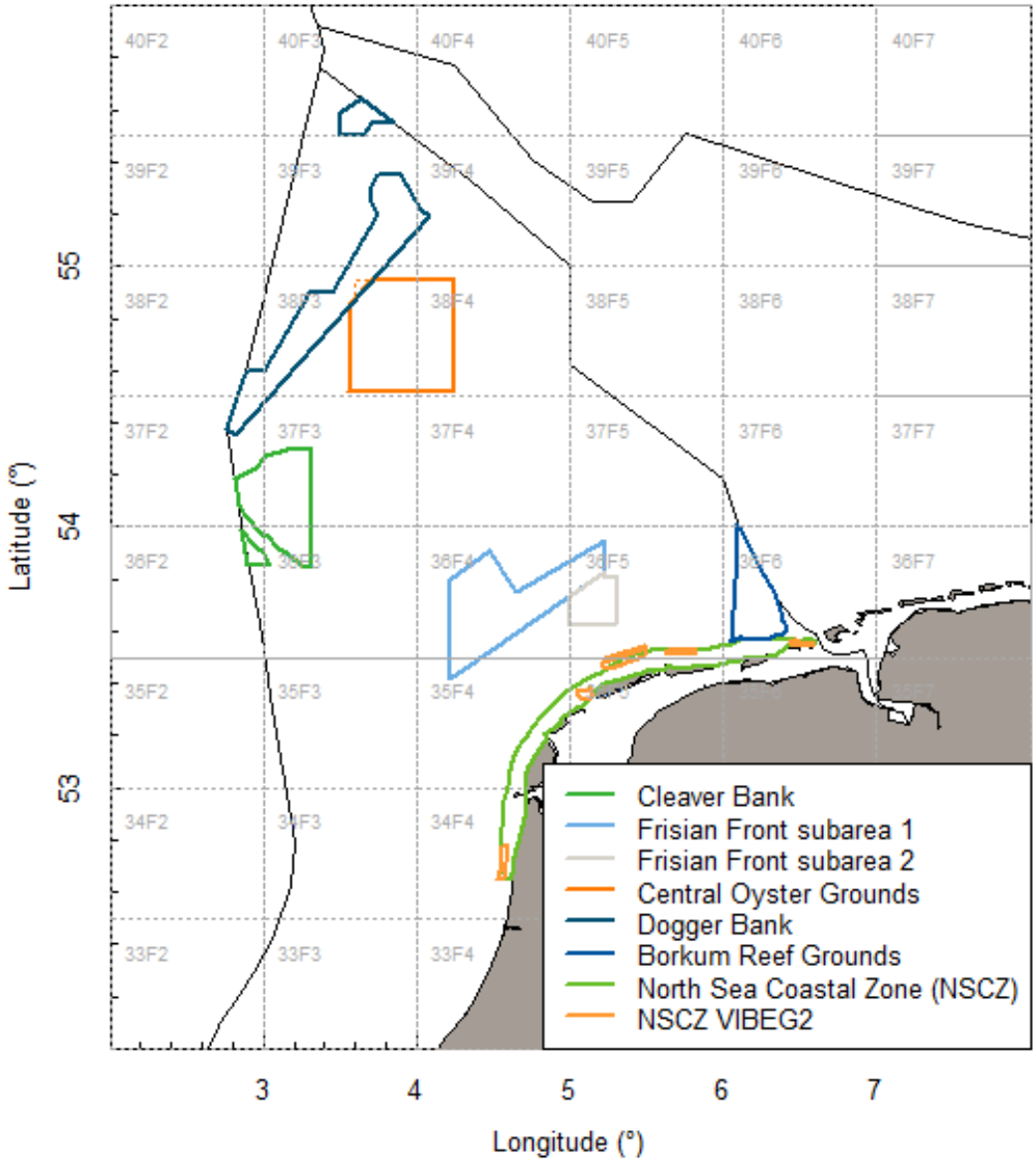

Figure 1.1 *Maps of the proposed areas for closure with the adjacent ICES rectangles*

2 Methodology

2.1 Standardised processing fishing activity data

2.1.1 Data sources

Several data sources are 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 landings value and economic performance of all fleets that were obtained from the database of the Annual Economic Report of the EU fishing fleets (STECF, 2020).

2.1.2 Pre-processing

The data of the above-mentioned sources are analysed in a standardised manner, where an R-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. Wageningen Research provided an R-script to collect data from the different countries. The same standardised script is applied to Dutch, Danish, German, Belgian, Swedish and French data. France uses their own software to process the data but follows similar steps as outlined by Wageningen University & Research. The R-scripts estimate effort, total landings, landings of the main fish species, total value of landings and the number of active vessels in the area of interest based on VMS and logbook data for the years 2015 to 2019 (see Hintzen et al. 2012 for a description of the data format). The pre-processing of the dataset for the data follows the approach developed in Hintzen et al. (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 1st of January of the year considered (despite the fact that the end of the trip falls within the considered year)
- Overlap with other trips.

2.1.3 Combine VMS and logbook data

Link VMS and log-book 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. To limit the size of the datasets, the VMS and logbook data in the ICES rectangles of interest are selected. All ICES rectangles overlapping with the areas as described in the introduction are selected.

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 to the unique trip number from the logbook record and allow for an analysis of the two datasets simultaneously.

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 (Poos et al. 2013). For each ping, the state of the vessel is identified based on gear and speed. The speed thresholds are defined by each country for their own fleets based on the best available knowledge.

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 total fishing effort per trip and ICES rectangle 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, we retained the demersal seine landings of the top 10 species (in volume) and the total landings per year and per country for the ICES rectangles and gears of interest. For each trip that could be linked to VMS data, the landings, 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 within a matched trip, the fishing day and/or ICES rectangle cannot be matched, landings are assigned to the VMS pings based on the rest of the fishing trip.
- If no link to VMS points could be found for a trip (e.g. small vessels that do not carry VMS transducers on board), the total days at sea and landings in the adjacent ICES rectangle are aggregated. Afterwards data are aggregated by gear and type of vessel and the estimated effort within the area is adjusted for the percentage of landings/effort that cannot be distributed.
- Fishing effort is calculated as the sum of the fishing pings, each being allocated the duration between two consecutive pings (from 30 min to 2 hours).

Define pings in the areas of interest
The coordinates of each VMS ping are compared to the location of the ICES rectangles in the area of interest. When a VMS ping is located inside any of the areas, it is selected and assigned to the area of interest.

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. Each country participating to this study uses the assumptions that best fit their data based on their local expertise and international consultation. 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 result remains an estimation and changes in assumptions will likely affect the numeric values presented in the results (Oostenbrugge et al. 2010). It is anticipated however that these differences do not alter the conclusions.

2.2 Defining the socio-economic importance

2.2.1 Economic value

For each country, the effort, total landings, landings for the main species, value of landings and number of individual vessels active at the ping level is hereafter aggregated by year, subarea, gear type and vessel length category. The logbook records not linked to VMS data are also aggregated by year, ICES rectangle, gear type and vessel length category. The logbook data in the ICES rectangles of interest that were not linked to VMS data are used to estimate the coverage of VMS data and included in the data shown at the ICES rectangle level.

Vessel length is used to link the data to STECF economic data and estimate the gross value added (GVA). The value of landings data was combined with economic information from the database of the Annual Economic Report of 2020 (STECF, 2020). In this database, revenue and costs are available per fleet.

The GVA generated in the different areas by each gear (g), vessel length category (l), country (c) and year (y) ($GVA_{g,l,c,y}$) was estimated using the value of landings in the area of interest for the gear, vessel length category, country and year, $value_{g,l,c,y}$, obtained from the VMS and logbook analyses and the GVA per euro landed for each fleet of the same vessel length category using the gear:

$$GVA_{g,l,c,y} = value_{g,l,c,y} \cdot \frac{\sum_f GVA_{f,c,y} \sum_f GVA_{f,c,y}}{\sum_f value_{f,c,y} \sum_f value_{f,c,y}} \; \forall \text{ fleets } f \text{ with vessel length } l \text{ using gear } g$$

The GVA calculation is done as follow:

$$GVA_{f,c,y} = \left(value_{f,c,y} + rightIncome_{f,c,y} + otherIncome_{f,c,y}\right) - \left(EnergyCost_{f,c,y} + rightCost_{f,c,y} + VariableCost_{f,c,y} + RepairCost_{f,c,y} + FixedCost_{f,c,y}\right)$$

Where *rightIncome* and *rightCost* represent the income and costs to lease quota out or in, *otherIncome* are all the other income sources apart from value of landings and right income. In addition to right costs, energy costs (*EnergyCost*), repair costs (RepairCost), other variable costs (*VariableCost*) and fixed costs (*FixedCost*) are also considered in the calculation of the GVA.

2.2.2 Individual dependency of vessels to the areas

It is possible to go beyond the fleet indicators and to look at the dependency of vessels on areas. This analysis can be useful for areas that are not so important at the fleet level but where a couple of fishermen fish intensively. Reallocation of effort to new fishing grounds becomes more complicated when a large part of the known fishing grounds of a fisher is closed. It is therefore important to identify whether an area closure will potentially substantially impact individuals. At the vessel level[4] we look at the estimated proportion of revenue coming from the area of interest. The ratio of the value of landings from the area of interest over the total value of landings for fisher i is called 'individual stress-level' and is calculated per year, y.

$$ISL_{i,y} = \frac{value_{i,y}}{Totvalue_{i,y}}$$

Because this analysis requires access to individual vessel data, it was only performed for the Dutch fishery. As for the other countries, owing to confidentiality issues, only fleet-aggregated data were made available. The individual stress analysis of the Dutch fleet is only performed with data from vessels with VMS data. Within the analysis, distinction is made between four different regions: Zeeland, Urk, North and Holland. An overview of the harbours that are attributed to these regions are presented in Table 2.1.

Table 2.1 *Overview of the regions and corresponding harbours*

Region	Harbour
Zeeland	"ARM", "BR", "BRU", "BZ", "GOE", "HON", "KG", "KL", "MS", "NZ", "TH", "VL", "VLI", "WSW", "YE", "ZL", and "ZZ"
Urk	"UK"
North	"DZ", "FL","GM", "HA", "HI", "HL", "LE", "LO", "OL", "ST", "TM", "TS", "TX", "UQ", "VLL", "WK", "WL", "WON", and "ZK"
Holland	"BIW", "BU", "DM", "EH", "GO", "HD", "HK", "HN", "IJM", "KW", "ME", "MO", "NB", "OD", "OH", "SCH", "SL", "VD", "WR"

[4] Given the data availability we make the assumption that a vessel represents one skipper.

3 Results

In this chapter the outcomes of the analyses are described for each of the proposed areas. The description of the results per area starts with an explanation of the effort, landings, values and the contribution to the gross value added of the fishing activities of the different fleets followed by an individual stress analysis for the Dutch fleet. The results are presented for the whole area. Additional information on the characteristics of the fisheries in the areas are given in the appendices: figures with historical trends in fishing activities are shown in total (see Appendix 1) and per gear (Appendix 3) and metrics are shown per km^2 for all areas (Appendix 2).

3.1 Borkum Reef Grounds

3.1.1 Economic value of the Borkum Reef Grounds

Over the 2015-2019 period the amount of fishing activities has varied significantly from year to year in the Borkum Reef Grounds (Table 3.1). Total effort in the Borkum Reef Grounds varied between 200 and 380 days at sea (average of 296 days) and the added value varied between 0.4 and 1.0m euros (average of 0.8m euros). Fishing activities in this area were dominated by the Dutch and the German fleet. A (large) part of the German flagged shrimp trawls are owned by Dutch fishermen. Belgian, Danish and Swedish fleets were virtually absent and the French fleet have not fished at all in the Borkum Reef Grounds during the 2015-2019 period. Except for 2016, fishing activities were dominated by the Dutch fleet (attaining more than 70% of the total GVA on average).

Table 3.1 *Overview of effort, landings, values and gross value added of the fishing sector in the Borkum Reef Grounds are given by country. France has declared no fishing activities in this area for the period 2015-2019.*

	Country	2015	2016	2017	2018	2019	Average
Effort (days at sea)	BEL	1	2	1	>0	>0	1
	DEU	77	217	118	42	77	106
	DNK	>0	>0	0	>0	>0	>0
	NLD	236	104	252	225	128	189
	SWE	0	>0	0	0	0	>0
	Total	315	322	372	267	205	296
Landings (tonnes)	BEL	1	3	>0	>0	>0	1
	DEU	79	142	56	63	70	82
	DNK	>0	1	0	>0	3	1
	NLD	293	141	158	456	187	247
	SWE	0	>0	0	0	0	>0
	Total	373	287	214	520	260	331
Value (1,000 euros)	BEL	5	7	1	1	>0	3
	DEU	228	745	365	166	187	338
	DNK	>0	>0	0	>0	1	>0
	NLD	853	625	1,073	1,523	436	902
	SWE	0	>0	0	0	0	>0
	Total	1,086	1,377	1,439	1,690	624	1,243
Gross Value Added (1,000 euros)	BEL	2	4	1	>0	>0	1
	DEU	130	515	223	111	125	221
	DNK	>0	>0	0	>0	1	>0
	NLD	490	426	649	878	248	538
	SWE	0	0	0	0	0	>0
	Total	622	945	873	990	373	761

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Shrimp fisheries represented by far the most important fishing activities in this area for both Germany and the Netherlands (Figure 3.1). For the Netherlands, also some fishing activities with Scottish seines were taking place in the area of the Borkum Reef Grounds.

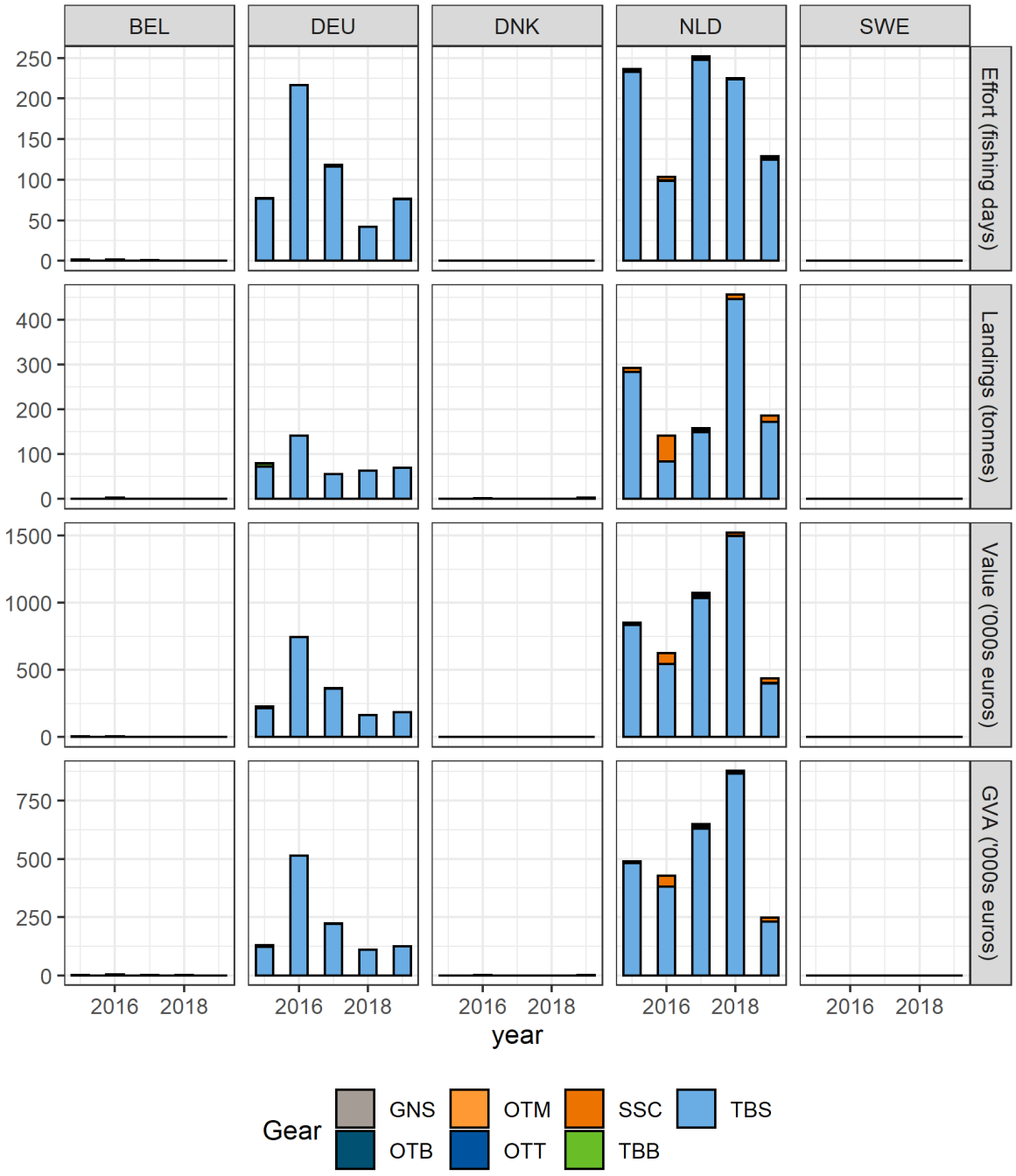

Figure 3.1 *Historical trend of the fishing activities in the Borkum Reef Grounds with different gears (GNS: set gillnets (anchored); OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SSC: Scottish seines; TBB: beam trawls; TBS: shrimp trawls,) in the proposed closure of the Borkum Reef Grounds for the different countries. Effort, landings, value of landings and GVA are given by country. France has declared no fishing activities in this area for the period 2015-2019*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.1.2 Main species caught in the Borkum Reef Grounds

The main species caught in this area are Common shrimp (*Crangon crangon*; CSH) and Tub gurnard (*Chelidonichthys lucerna*; GUU). Figure 3.2 shows the species, caught in the Borkum Reef Grounds by the Belgian, German and Dutch fleet. Common shrimp were mostly caught by the German and Dutch fleet with beam trawlers. In addition, demersal trawlers or seiners were used by the Dutch fleet to catch tub gurnard. Note that the figure only shows the landings of the main gears.

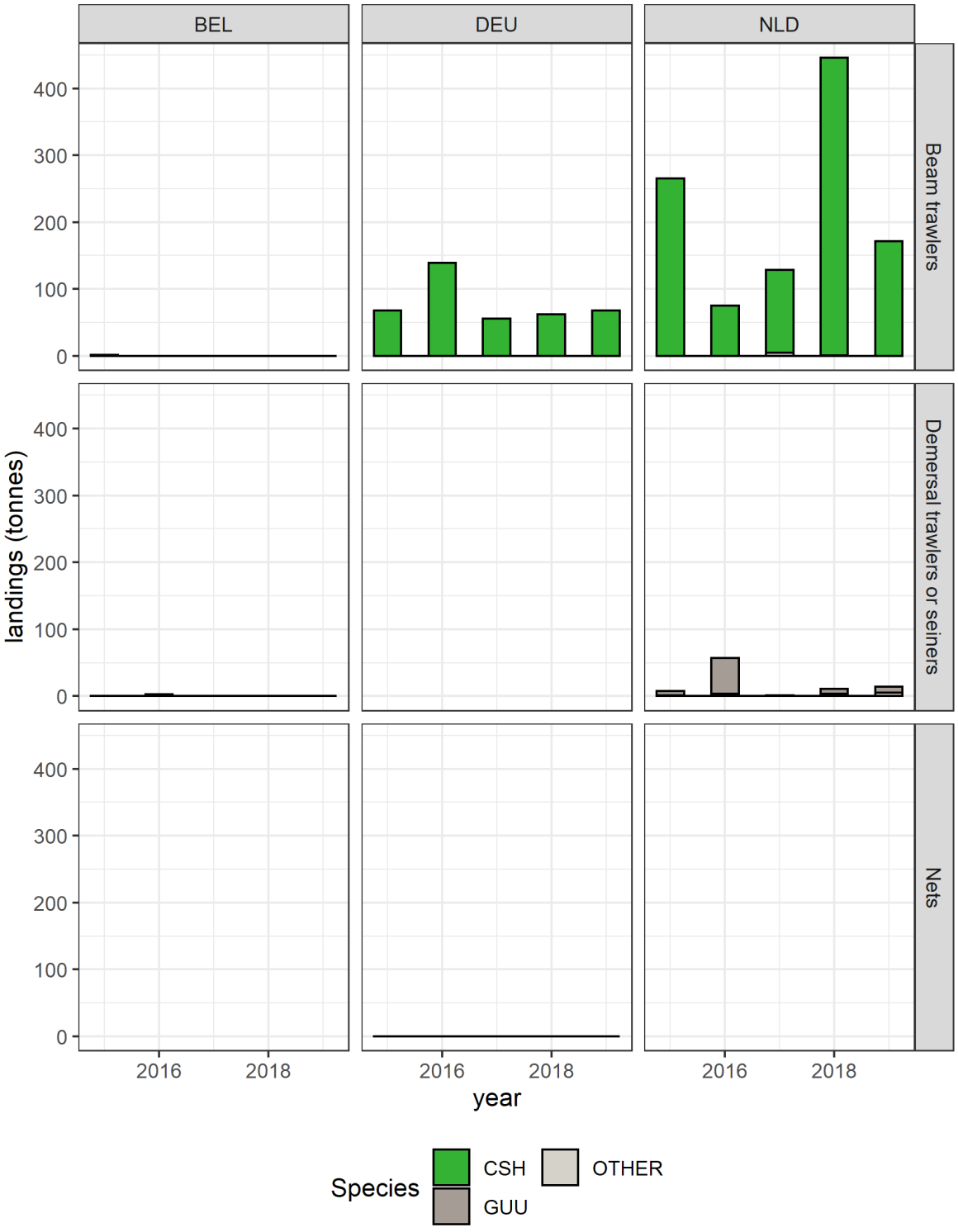

Figure 3.2 *Historical trend of the species caught in the Borkum Reef Grounds by the Belgian, German and Dutch fleet (CSH: Common shrimp; GUU: Tub gurnard; Other: other species) Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.*

3.1.3 Individual dependency of Dutch fishermen to the Borkum Reef Grounds

Figure 3.3 shows that the number of Dutch vessels with fishing activities in the Borkum Reef Grounds were relatively stable and varied between 50 and 70 vessels per year. The revenue dependency of the vessels was moderate since for most of the vessels less than 10% of their total revenue originated from the Borkum Reef Grounds and only in 2017 one vessel attained more than 20% of his total revenue from this area.

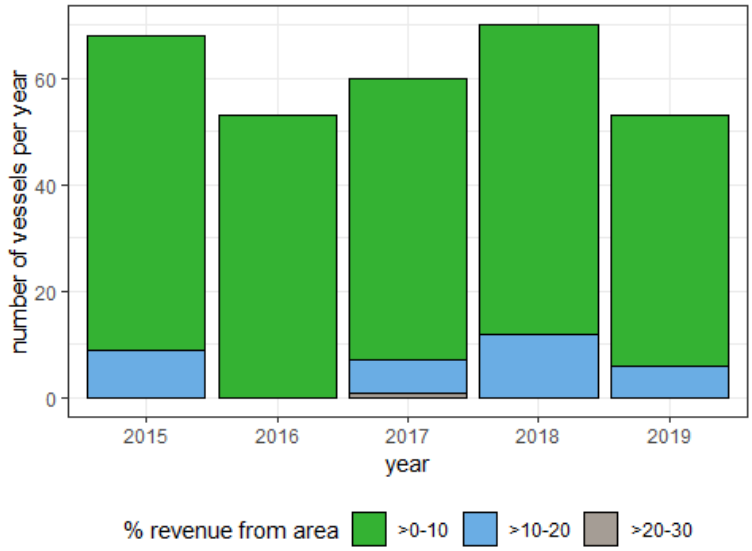

Figure 3.3 *The number of Dutch vessels per year and the revenue dependency*

Figure 3.4 shows the average number of Dutch vessels with fishing activities in the Borkum Reef Grounds for the 2015-2019 period according to their revenue dependency and the region the vessels originate from. Most vessels had a revenue dependency of less than 10% originating from the regions Urk, North and Holland. A couple of vessels from the North region showed a revenue dependency between 10 and 20% and one vessel had a revenue dependency between 20 and 30%.

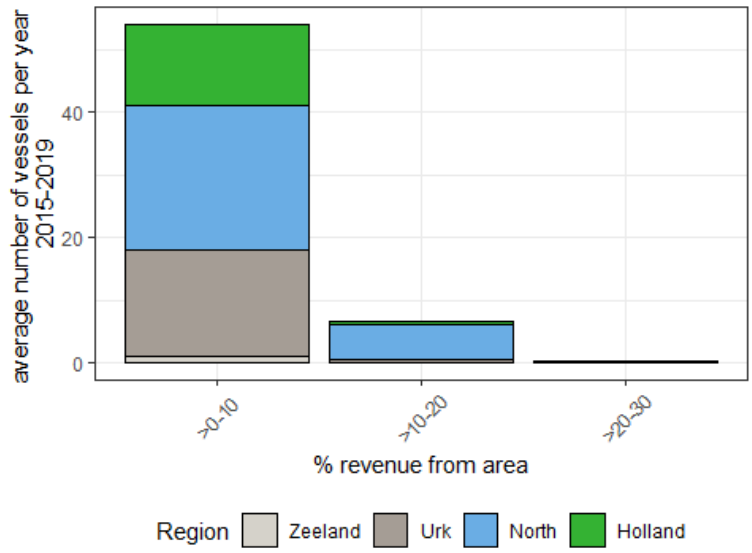

Figure 3.4 *The average number of vessels per region and the revenue dependency*

Figure 3.5 shows that for the Dutch shrimp trawls (TBS) the majority of the average annual revenue from the area were obtained by vessels having moderate dependency on this area. Only around 70 thousand euros per year (<10% of the total) was attained by the vessels that are more dependent on this area than 20%. The revenue dependency of the vessels mainly varies between 0 and 10%, and 10 and 20%. The average total revenue in this graph differs a little from the total average revenues in Table 3.1 as in this analysis the revenues of the vessels are first averaged over the years and then added up, whereas for Table 3.1 the totals have been calculated per year and have afterwards been averaged.

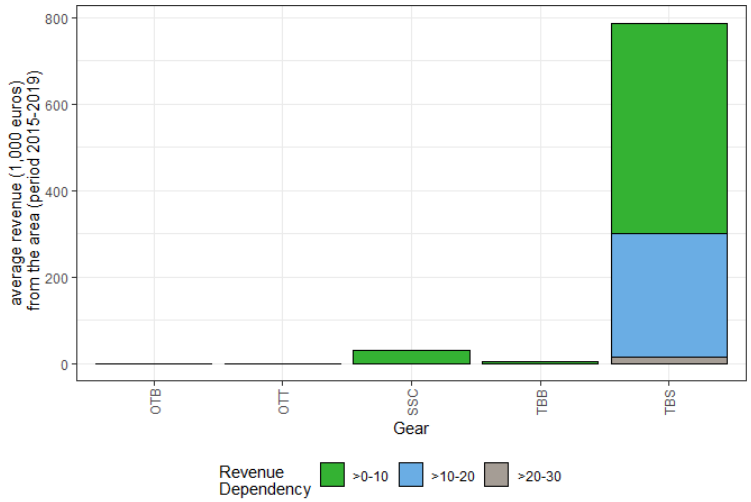

Figure 3.5 *Total of the average revenues (x 1,000 euros) of the vessels with different dependencies on the area per gear type*

3.2 Central Oyster Grounds

3.2.1 Economic value of the Central Oyster Grounds

Over the 2015-2019 period the amount of fishing activities has varied significantly from year to year in the Central Oyster Grounds and all countries were active in this area for at least one year during the period (Table 3.2). Total effort in the Central Oyster Grounds was between 90 and 220 days at sea (average of 159 days) and the added value varied between 1.5 and 3.6m euros (average of 2.3m euros). The Danish fleet was (by far) the most important fleet in this area in economic terms; the GVA of this fleets contributed to more than 70% of the total GVA from this area. The German and Dutch fleet showed considerable levels of fishing activities in the area, but the economic importance was much lower for these fleets, especially in the early years of the time series.

Table 3.2 *Overview of effort, landings and values and gross value added of the fishing sector in the Central Oyster Grounds are given by country*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	9	2	27	15	26	16
(days at sea)	DEU	30	32	59	29	64	43
	DNK	78	41	19	16	10	33
	FRA	0	0	1	0	0	>0
	NLD	40	54	90	30	110	65
	SWE	1	4	4	2	2	3
	Total	158	134	200	92	212	159
Landings	BEL	37	5	91	43	51	45
(tonnes)	DEU	253	345	364	41	533	307
	DNK	15,042	8,039	5,373	5,736	5,953	8,029
	FRA	0	0	1	0	0	>0
	NLD	387	174	324	72	174	226
	SWE	529	671	1,152	906	293	710
	Total	16,249	9,233	7,304	6,799	7,005	9,318
Value	BEL	66	21	315	162	196	152
(1,000 euros)	DEU	224	290	548	140	436	328
	DNK	3,818	2,136	931	1,380	1,688	1,991
	FRA	0	0	4	0	0	1
	NLD	309	417	850	221	687	497
	SWE	120	216	251	191	68	169
	Total	4,537	3,081	2,898	2,094	3,076	3,140
Gross Value	BEL	36	13	172	82	102	81
Added	DEU	128	189	321	90	269	199
(1,000 euros)	DNK	3,166	1,756	726	1,129	1,385	1,632
	FRA	0	0	2	0	0	>0
	NLD	156	249	471	115	356	269
	SWE	71	116	145	81	29	89
	Total	3,556	2,323	1,836	1,497	2,142	2,272

Source: Logbook data and VMS data and data from the Annual Economic report (STECF, 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

The Danish fleet was dominated by midwater otter trawls (OTM) and bottom otter trawls (OTB) and showed decreasing effort, but increasing landings and economic indicators after 2016 (Figure 3.5). The Dutch fleet in the area mainly used OTB and otter twin trawls (OTT), just as most other fleets. The economic importance for the Danish fleet, and particularly the GVA, was first decreasing (2015-2016) and then increasing (2017-2019).

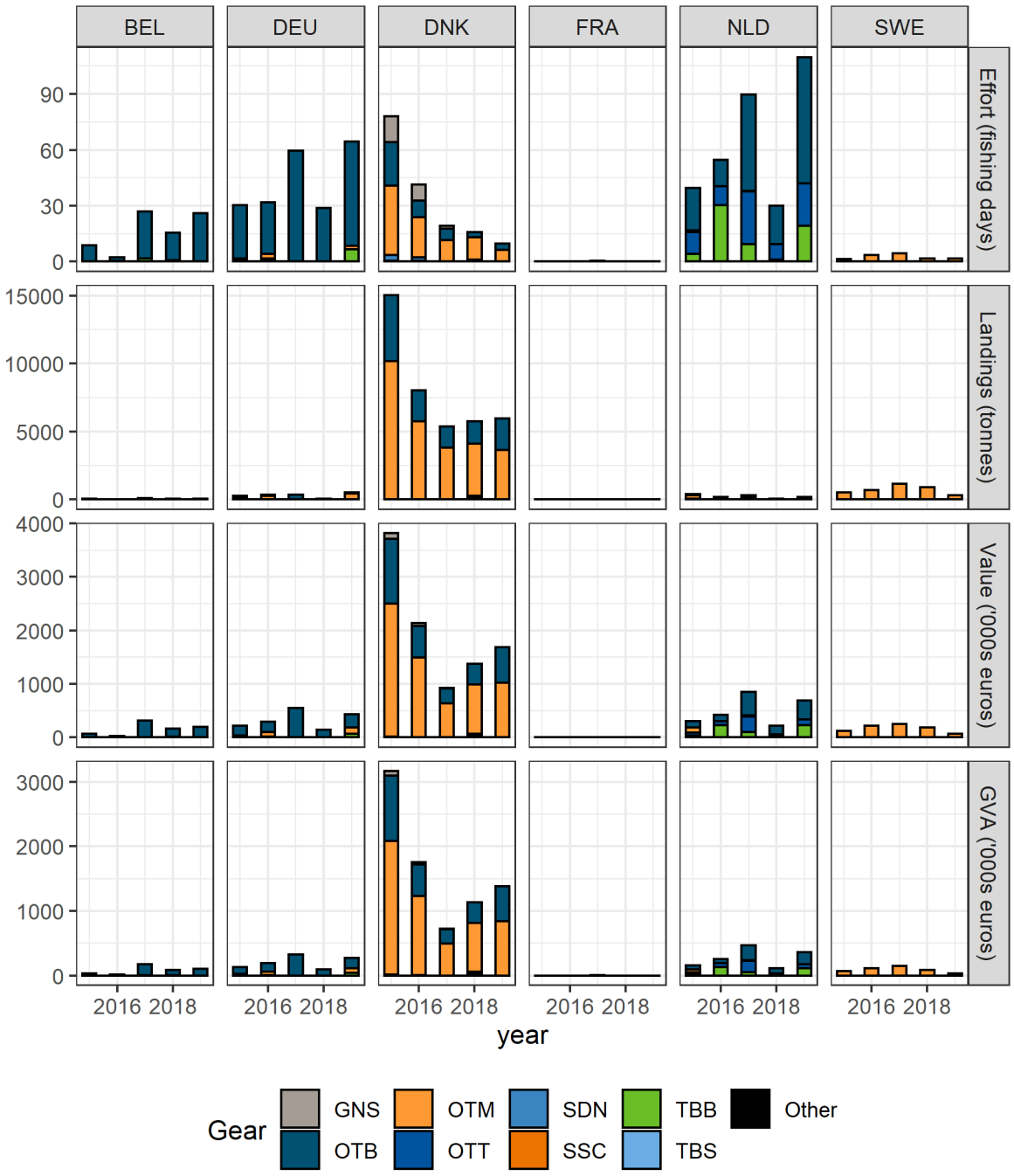

Figure 3.6 *Historical trend of the fishing activities in the Central Oyster Grounds with different gears (GNS: set gillnets (anchored); OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; TBS: shrimp trawls, Other: other gears) in the proposed closure of the Central Oyster Grounds for the different countries. Effort, landings, value of landings and GVA are given by country*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.2.2 Main species caught in the Central Oyster Grounds

The main species caught in this area are Atlantic herring (*Clupea harengus*; HER) and European sprat (*Sprattus*; SPR). Figure 3.7 shows the species that are caught in the Central Oyster Grounds by the Belgian, German, Danish, French and Dutch fleet. European sprat are mostly caught in the Central Oyster Grounds by the Danish fleet with demersal trawlers or seiners. In addition, Danish demersal trawlers or seiners were used to catch Atlantic herring in the Central Oyster Grounds. Other species are also caught by the other fleets, but to a lesser extent. Note that the Figure 3.7 only shows the landings of the main demersal gears. Pelagic trawls are not included in the Figure because these trawls will not be banned when this area is closed.

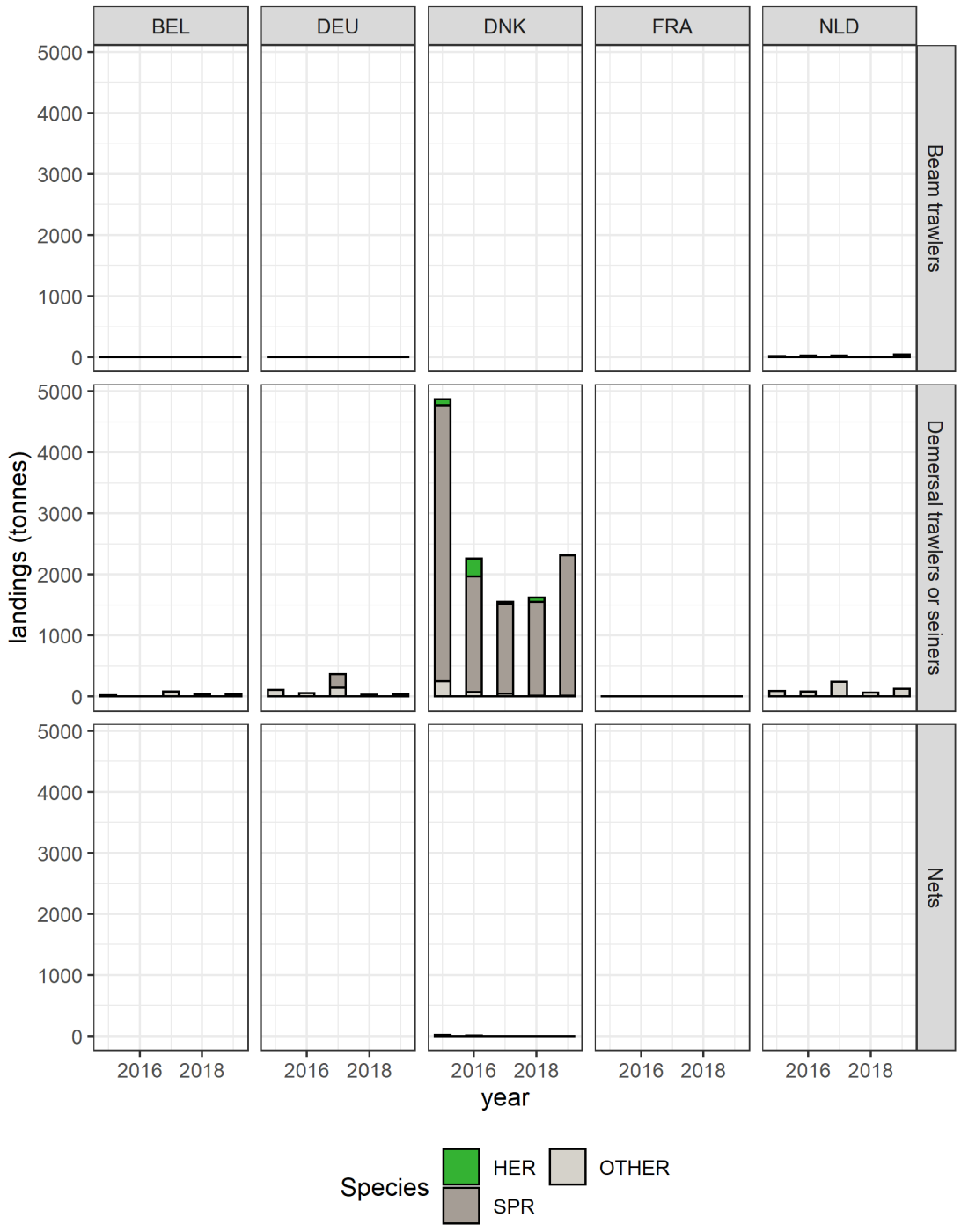

Figure 3.7 *Historical trend of the species caught in the Central Oyster Grounds by the Belgian, German, Danish, French and Dutch fleet (HER: Atlantic herring; SPR: European sprat; Other: other species)*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.2.3 Individual dependency of Dutch fishermen to the Central Oyster Grounds

Figure 3.8 shows that the number of Dutch vessels with fishing activities in the Central Oyster Grounds were relatively stable after a decrease in 2016 compared to 2015. In the last year, there has been an increase in the number of Dutch vessels per year. The revenue dependency of the vessels was moderate since for most of the vessels less than 10% of their total revenue originates from the Central Oyster Grounds.

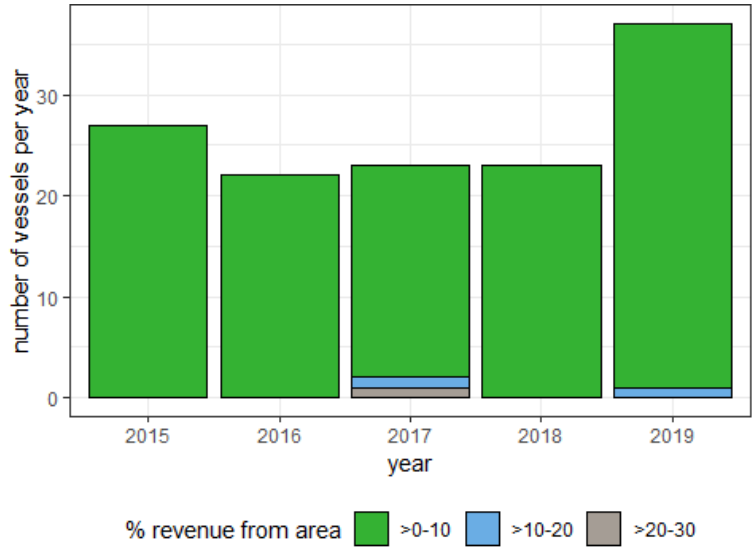

Figure 3.8 *The number of Dutch vessels per year and the revenue dependency*

Figure 3.9 shows that the average number of Dutch vessels with fishing activities in the Central Oyster Grounds for the 2015-2019 period according to their revenue dependency and the region the vessels originate from. Most vessels had a revenue dependency of less than 10% originating from the regions Urk and Holland. The remaining vessels originated from the regions North and Zeeland.

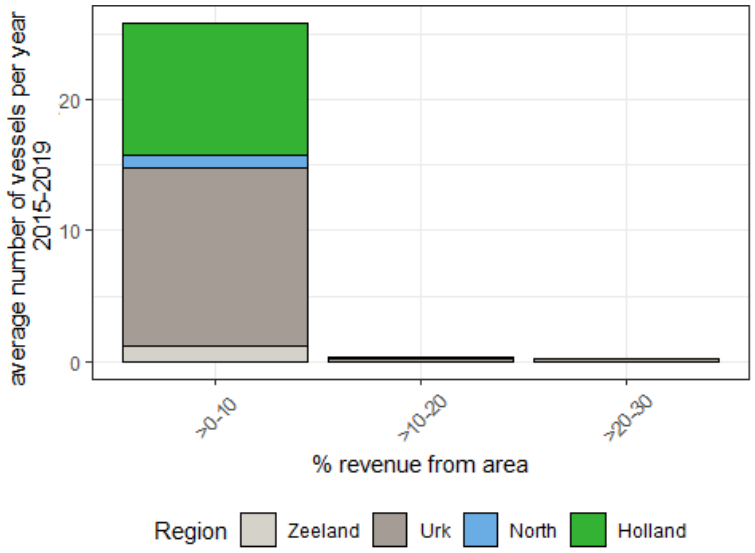

Figure 3.9 *The average number of vessels per region and the revenue dependency*

Figure 3.10 shows that the Dutch fleet mainly used bottom otter trawls (OTB) with a revenue dependency varying between 0 and 30%. More than half of the area's value for OTB is generated by one single vessel that depends on this area for more than 20% of its income. Other Dutch vessels used otter twin trawls (OTT) and beam trawls (TBB) with a revenue dependency between 0 and 20%. The average total revenue in this graph differs a little from the total average revenues in Table 3.2 as in this analysis the revenues of the vessels are first averaged over the years and then added up, whereas for Table 3.2 the totals have been calculated per year and have afterwards been averaged.

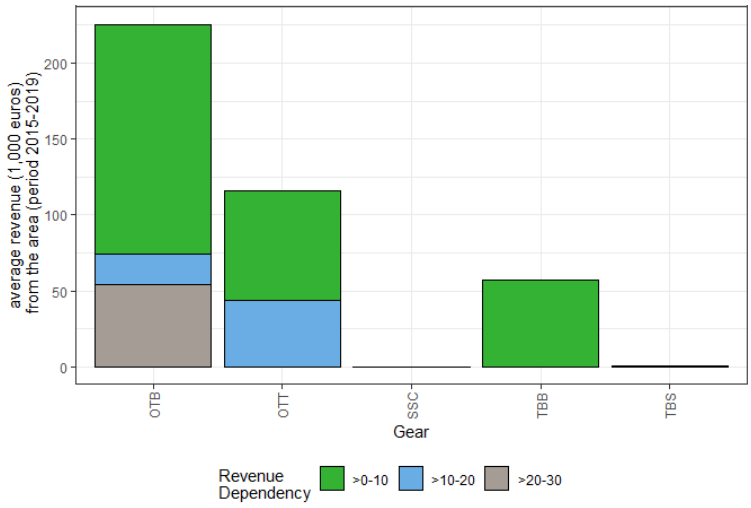

Figure 3.10 *Total of the average revenues (x 1,000 euros) of the vessels with different dependencies on the area per gear type*

3.3 Cleaver Bank

3.3.1 Economic value of the Cleaver Bank

Over the 2015-2019 period the amount of fishing activities has varied significantly from year to year in the Cleaver Bank and all countries were represented in this area (Table 3.3). Total effort in the Cleaver Bank was between 60 and 160 days at sea (average of 112 days) and the added value varied between 0.4 and 1.3m euros (average of 0.9m euros). Belgian, German and Swedish fleets are virtually absent in this area. The area was dominated by the Dutch fleet, contributing to more than 70% of the total GVA for this area. However, the level of fishing activities by the Dutch fishing fleet has decreased considerably over the time period, from a GVA of more than 1.0m euros in 2016 to more than 0.3m euros in 2019.

Table 3.3 *Overview of effort, landings and values and gross value added of the fishing sector in the Cleaver Bank are given by country*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	14	13	4	8	3	9
(days at sea)	DEU	9	8	9	12	11	10
	DNK	3	0	2	2	>0	1
	FRA	3	13	8	17	7	10
	NLD	126	100	71	67	46	82
	SWE	0	>0	0	0	>0	>0
	Total	153	135	94	106	68	112
Landings	BEL	38	88	39	18	2	37
(tonnes)	DEU	21	32	31	237	16	68
	DNK	546	156	35	822	1	312
	FRA	0	51	47	94	41	46
	NLD	787	755	421	338	251	510
	SWE	0	7	0	0	8	3
	Total	1,393	1,089	572	1,508	320	981
Value	BEL	94	185	79	56	12	85
(1,000 euros)	DEU	53	81	111	153	79	95
	DNK	139	43	12	220	1	83
	FRA	1	170	207	347	85	162
	NLD	1,917	1,773	1,029	902	651	1,254
	SWE	0	1	0	0	2	1
	Total	2,204	2,253	1,438	1,678	830	1,682
Gross Value	BEL	51	109	44	28	6	48
Added	DEU	31	54	57	90	48	56
(1,000 euros)	DNK	116	36	9	181	1	69
	FRA	1	85	102	153	37	75
	NLD	903	1,007	550	434	325	644
	SWE	0	1	0	0	1	>0
	Total	1,102	1,291	762	885	418	892

Source: Logbook data and VMS data and data from the Annual Economic report (STECF, 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Figure 3.9 presents the historical trend of the fishing activities in the proposed closure area of the Cleaver Bank for the different countries with different gears per country. From the Figure it can be seen that Danish vessels mainly use midwater otter trawls (OTM), French vessels mainly use midwater otter trawls (OTM) while Dutch vessels mostly use Scottish seines (SSC) in the area.

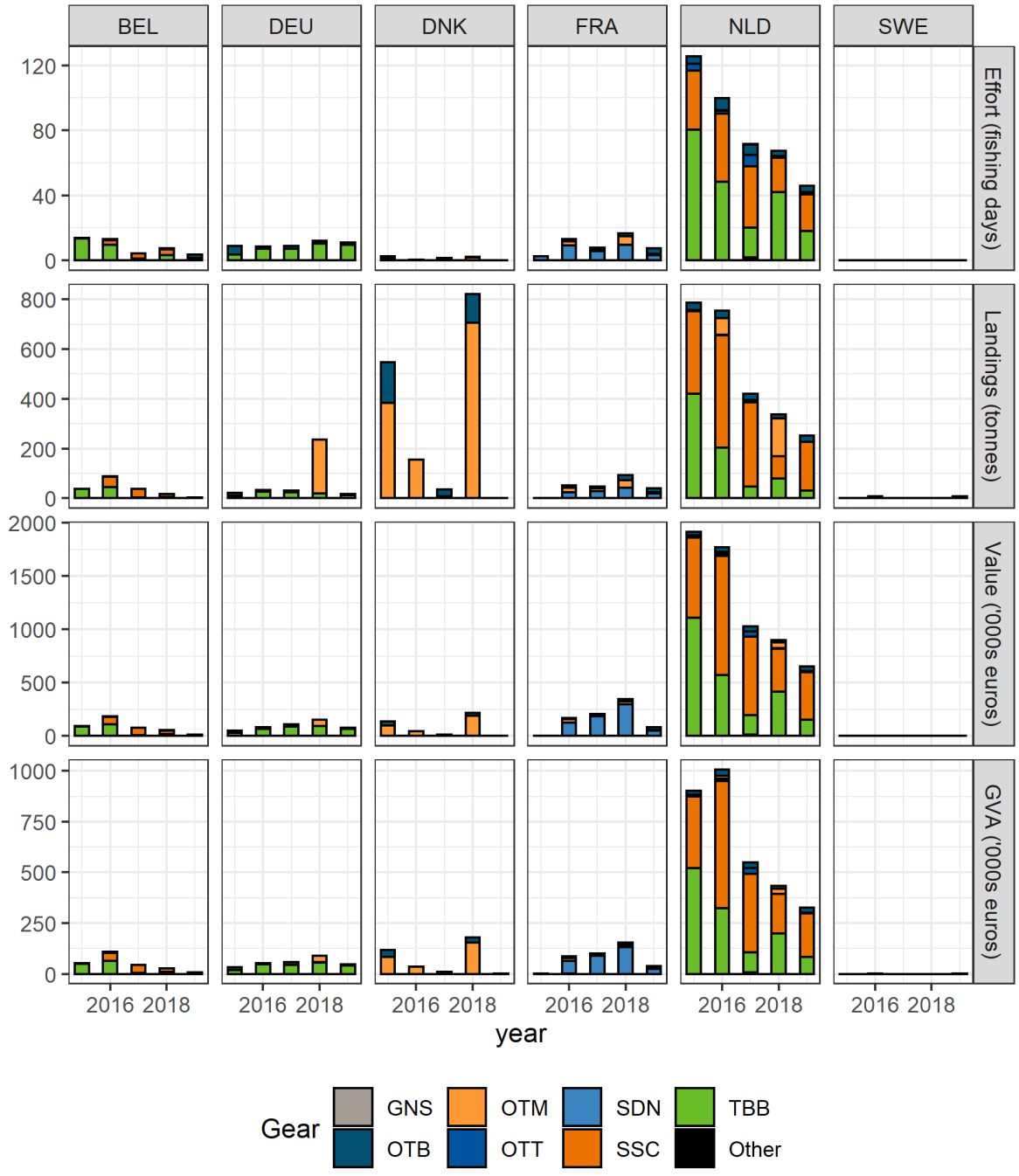

Figure 3.11 *Historical trend of the fishing activities in the Cleaver Bank with different gears (GNS: set gillnets (anchored); OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; Other: other gears) in the proposed closure of the Cleaver Bank for the different countries. Effort, landings, value of landings and GVA are given*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.3.2 Main species caught in the Cleaver Bank

The main species caught in thus area are Atlantic mackerel (*Scomber scombrus*; MAC), European plaice (*Pleuronectes platessa*; PLE) and European sprat (*Sprattus sprattus*; SPR). Figure 3.12 shows that most species in the Cleaver Bank are caught by the Dutch fleet. European plaice was mainly caught with Dutch trawlers, but the amount of European plaice caught decreased over time. In addition, demersal trawlers or seiners were mainly used by the Dutch fleet to catch Atlantic mackerel in the Cleaver Bank. The size of the landings caught with demersal trawlers or seiners varied overtime. Other species and European sprat were also caught by the Danish and Dutch fleet, but to a lesser extent compared to the amount of Atlantic mackerel caught with demersal trawlers or seiners in the Cleaver Bank. Note that the figure only shows the landings of the main gears.

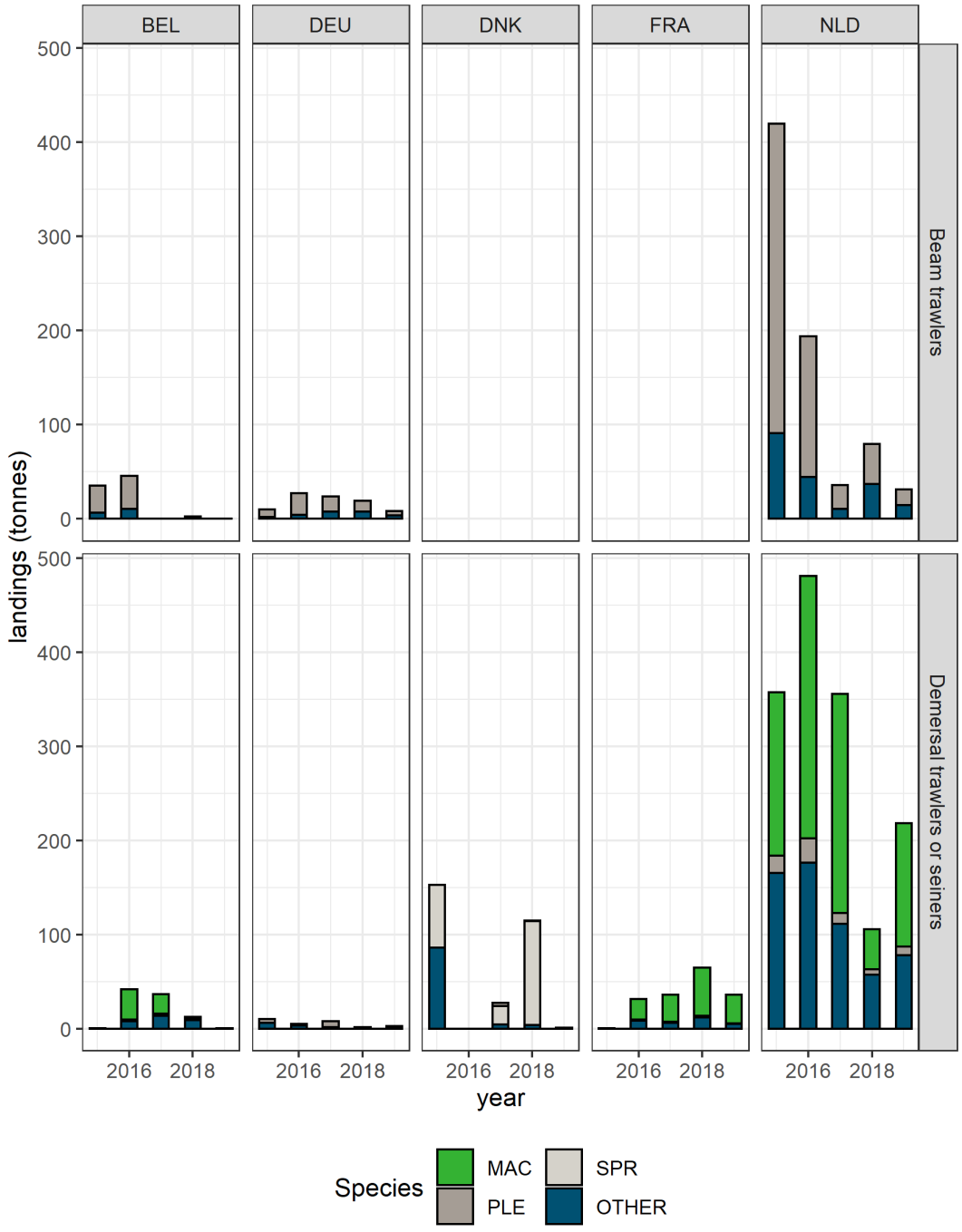

Figure 3.12 *Historical trend of the main species caught in the Cleaver Bank by the Belgian, German, Danish, French and Dutch fleet (MAC: Atlantic mackerel; PLE: European plaice; SPR: European sprat; Other: other species)*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.3.3 Individual dependency of Dutch fishermen to the Cleaver Bank

Figure 3.13 shows that the number of Dutch vessels with fishing activities in the Cleaver Bank was relatively stable after a decrease in 2016 compared to 2015. The revenue dependency of the vessels was moderate since for most of the vessels less than 10% of their total revenue originates from the Cleaver Bank.

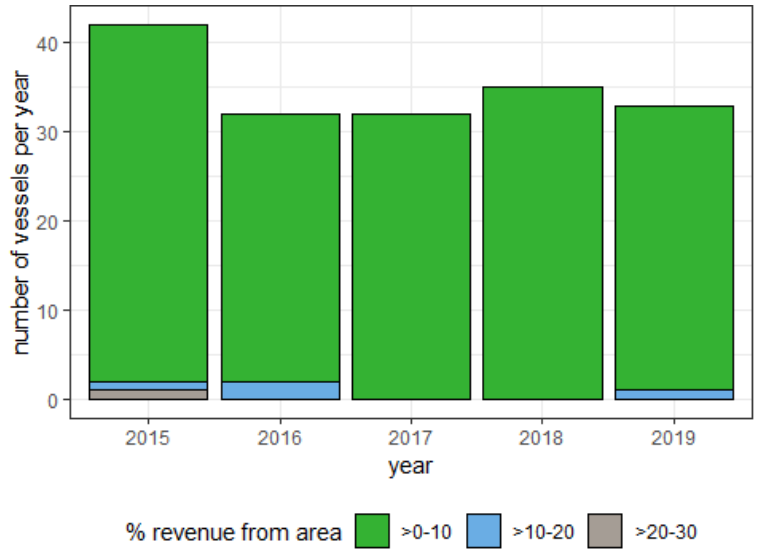

Figure 3.13 *The number of Dutch vessels per year and the revenue dependency*

Figure 3.14 shows that the average number of Dutch vessels with fishing activities in the Cleaver Bank for the 2015-2019 period according to their revenue dependency and the region the vessels originate from. Most vessels had a revenue dependency of less than 10% originating from the regions Urk and Holland. The other vessels were from the regions North and Zeeland.

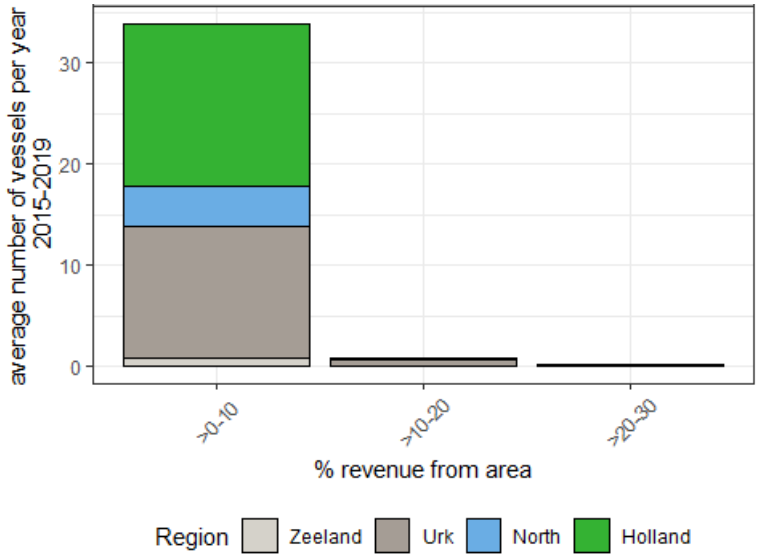

Figure 3.14 *The average number of vessels per region and the revenue dependency*

Figure 3.15 shows that the Dutch fleet mainly used beam trawls (TBB) and Scottish seines (SSC) with a revenue dependency varying between 0 and 30%. More than half of the area's value for TTB is generated by one single vessel that depends on this area for more than 20% of its income. The revenue dependency of the vessels using SSC mainly varies between 0 and 10%. The average total revenue in this graph differs a little from the total average revenues in Table 3.3 as in this analysis the revenues of the vessels are first averaged over the years and then added up, whereas for Table 3.3 the totals have been calculated per year and have afterwards been averaged.

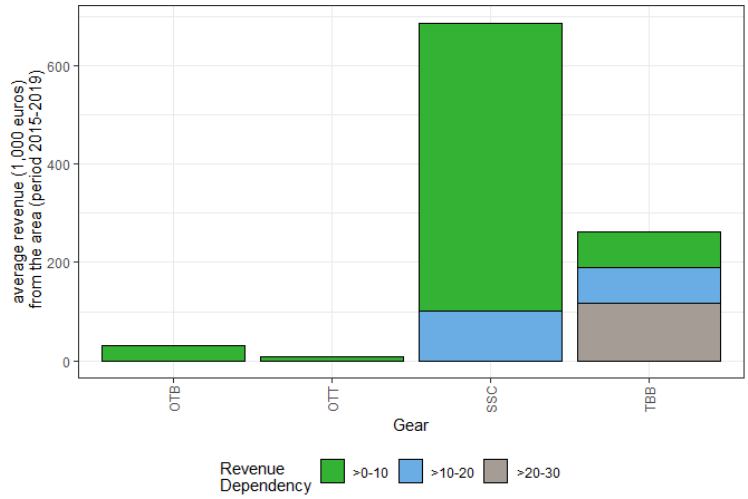

Figure 3.15 *Total of the average revenues (x 1,000 euros) of the vessels with different dependencies on the area per gear type*

3.4 Dogger Bank

3.4.1 Economic value of the Dogger Bank

Over the 2015-2019 period the amount of fishing activities has varied significantly from year to year in the Dogger Bank and fishing fleets of all countries have been active in this area, except for France (Table 3.4). Total effort in the Dogger Bank was between 70 and 110 days at sea (average of 87 days) and added value between 0.6 and 1.1m euros (average of 0.9m euros). In economic terms the Danish fleet was the most important fleet in this area, although the effort of the Dutch fishing vessels was on average higher. The Swedish fleet was virtually absent in this area.

Table 3.4 *Overview of effort, landings and values and gross value added of the fishing sector in the Dogger Bank are given by country. France has declared no fishing activities in this area for the period 2015-2019.*

	Country	2015	2016	2017	2018	2019	Average
Effort (days at sea)	BEL	9	4	11	9	15	10
	DEU	11	5	5	7	14	8
	DNK	13	13	7	8	19	12
	NLD	75	71	51	52	31	56
	SWE	1	1	1	>0	3	1
	Total	110	93	75	77	82	87
Landings (tonnes)	BEL	52	47	63	27	40	46
	DEU	75	151	25	17	74	68
	DNK	1,541	2,903	1,206	2,313	3,643	2,321
	NLD	465	355	310	174	126	286
	SWE	72	81	204	96	508	192
	Total	2,204	3,536	1,808	2,627	4,390	2,913
Value (1,000 euros)	BEL	91	84	141	78	112	101
	DEU	90	54	39	43	67	59
	DNK	323	752	194	588	997	571
	NLD	725	649	534	394	337	528
	SWE	14	21	44	22	129	46
	Total	1,243	1,562	952	1,126	1,643	1,305
Gross Value Added (1,000 euros)	BEL	50	49	78	40	56	55
	DEU	51	33	22	28	40	35
	DNK	266	628	152	476	818	468
	NLD	359	377	285	202	164	277
	SWE	9	11	26	9	55	22
	Total	734	1,098	563	756	1,134	857

Source: Logbook data and VMS data and data from the Annual Economic report (STECF, 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Figure 3.13 presents the historical trend of the fishing activities in the proposed closure area of the Dogger Bank for the different countries with different gears per country. From the Figure it can be seen that Danish vessels mainly used bottom- and midwater otter trawls (OTB and OTM), while the Dutch fleet mostly used beam trawls (TBB), next to the use of otter twin trawls (OTT). The activities of the Dutch beam trawlers decreased from 2016-2018 (see also Figure 3.17).

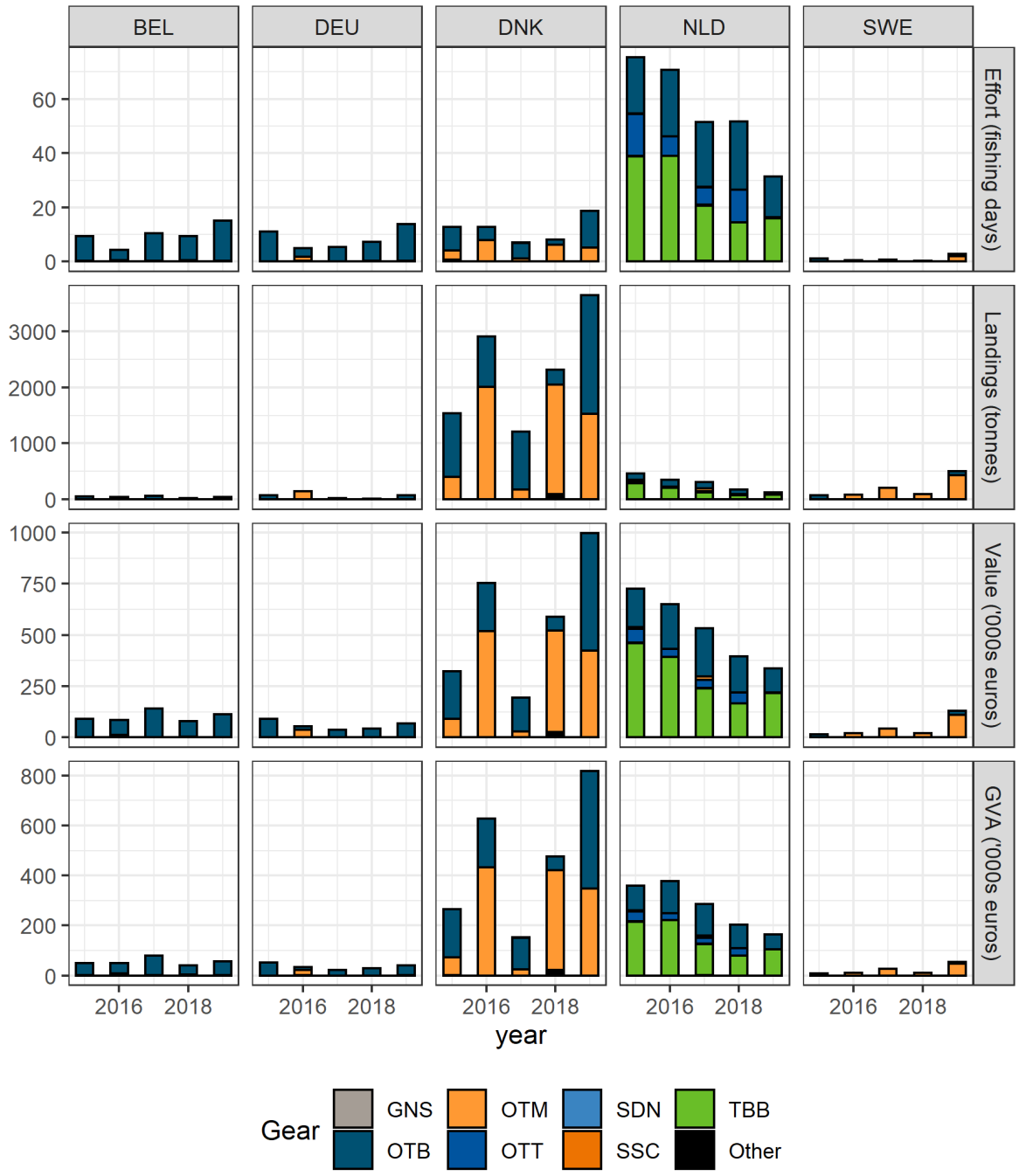

Figure 3.16 *Historical trend of the fishing activities in the Dogger Bank with different gears (GNS: set gillnets (anchored); OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; Other: other gears) in the proposed closure of the Dogger Bank for the different countries. Effort, landings, value of landings and GVA are given per country. France have declared no fishing activities in this area for the period 2015-2019 Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.*

3.4.2 Main species caught in the Dogger Bank

The main species caught in this area are Sandeels (*Ammodytes* sp.; SAN), European sprat (*Sprattus sprattus*; SPR), Atlantic herring (*Clupea harengus*; HER) and European plaice (Pleuronectes platessa; PLE). Figure 3.17 shows that most species in the Dogger Bank are caught by the Danish fleet. Sandeels (= Sand lances) nei were mainly caught with Danish demersal trawlers or seiners in the Dogger Bank, as well as European sprat. In addition, Dutch beam trawlers and Dutch demersal trawlers or seiners mainly caught European plaice in the Dogger Bank. However, the landings of the Dutch fleet were much lower compared to the landings of the Danish fleet caught in the Dogger Bank. Note that the Figure only shows the landings of the main gears Pelagic trawls are not included in the Figure because these trawls will not be banned when this area is closed.

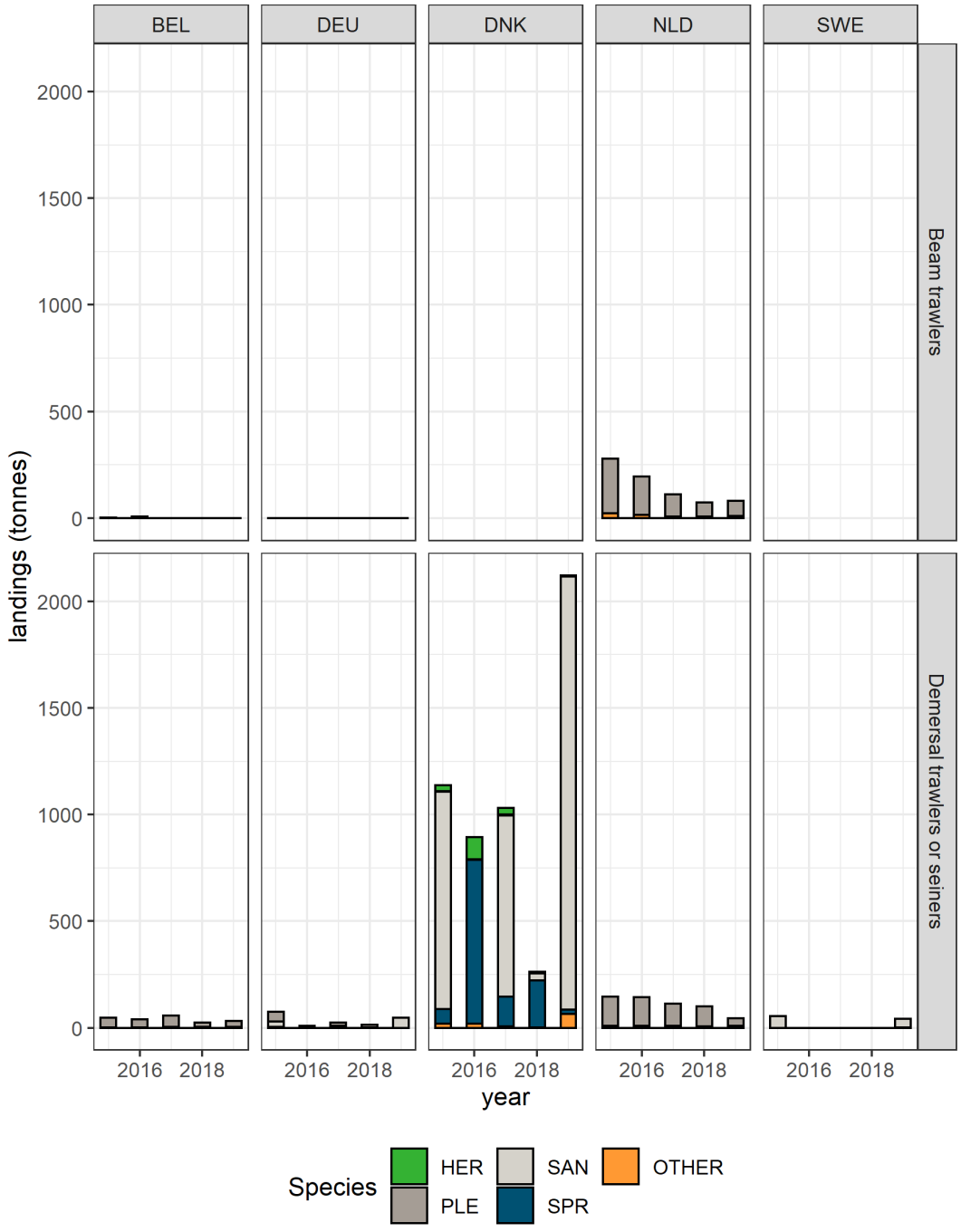

Figure 3.17 *Historical trend of the species caught in the Dogger Bank by the Belgian, German, Danish, Dutch and Swedish fleet (HER: Atlantic herring; PLE: European plaice; SAN: Sandeels (=Sandlances) nei; SPR: European sprat; Other: other species)*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.4.3 Individual dependency of Dutch fishermen to the Dogger Bank

Figure 3.18 shows that the number of Dutch vessels with fishing activities in the Dogger Bank were relatively stable at around 25 vessels after a decrease in the period 2015-2017. The revenue dependency of the vessels was moderate since for almost all of the vessels less than 10% of their total revenue originates from the Dogger Bank.

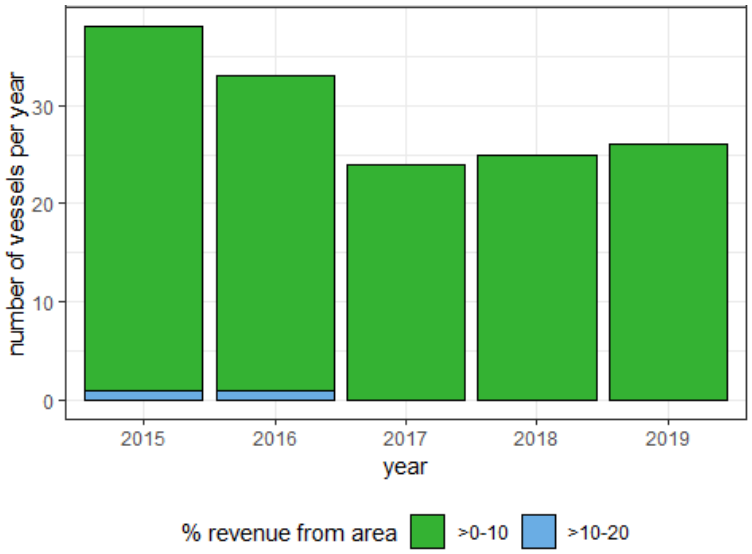

Figure 3.18 *The number of Dutch vessels per year and the revenue dependency*

Figure 3.19 shows that the average number of Dutch vessels with fishing activities in the Dogger Bank for the 2015-2019 period according to their revenue dependency and the region the vessels originate from. Most vessels had a revenue dependency of less than 10% and originate from the regions Urk and Holland. The other vessels originated from the regions North and Zeeland.

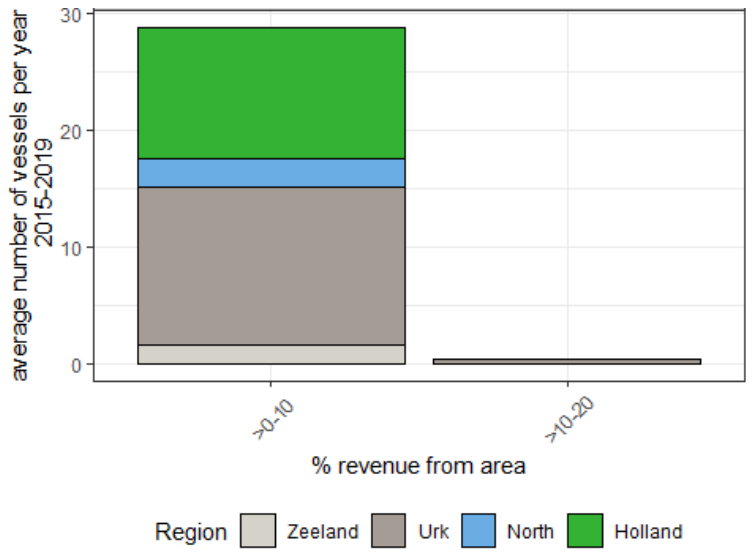

Figure 3.19 *The average number of vessels per region and the revenue dependency*

Figure 3.20 shows that the Dutch fleet mainly used bottom otter trawls (OTB), beam trawls (TBB) and otter twin trawls (OTT) with a revenue dependency varied between 0 and 30%. The majority of the vessels had a revenue dependency between 0 and 10%. The revenue dependency of the vessels using OTB also included percentages that vary between 0 and 10%. A part of the area's value for OTB is generated by one single vessel that depends on this area for 10 to 20% of its income. The average total revenue in this figure differed a little from the total average revenues in Table 3.4 as in this analysis the revenues of the vessels were first averaged over the years and then added up, whereas for Table 3.4 the totals have been calculated per year and have afterwards been averaged.

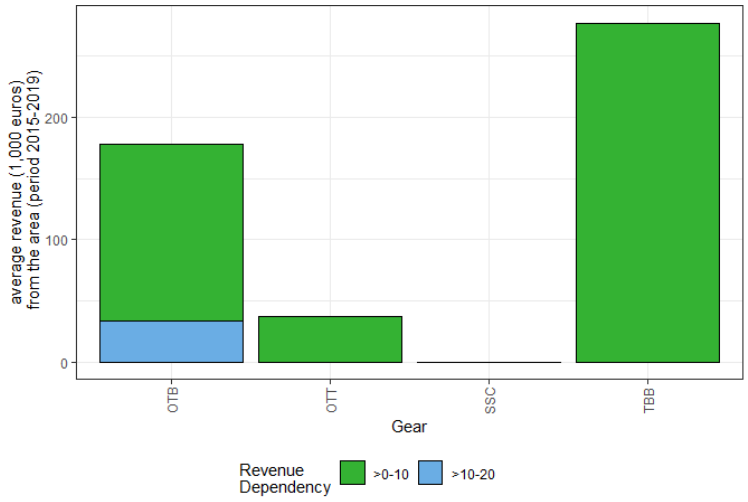

Figure 3.20 *Total of the average revenues (x 1,000 euros) of the vessels with different dependencies on the area per gear type*

3.5 Frisian Front subarea 1

3.5.1 Economic Value of the Frisian Front subarea 1

Over the 2015-2019 period the amount of fishing activities has varied significantly from year to year in the Frisian Front subarea 1 and all countries were active in this area (Table 3.5). Total effort in the Frisian Front subarea 1 was between 240 and 480 days at sea (average of 349 days) and the added value varied between 0.8 and 4.2m euros (average of 2.3m euro). The Dutch fleet was the most important fleet in this area both in effort and economic importance, but the Danish fishing fleet also added considerably to the total value attained from the area. The Belgian, French (expect for the landings in 2018 and 2019) and Swedish fleets were virtually absent in this area. The total fishing activities were decreasing in this area from 2016, especially for the Dutch (in 2018 and 2019) and Danish fleet.

Table 3.5 *Overview of effort, landings and values and gross value added of the fishing sector in the Frisian Front subarea 1 are given by country.*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	9	17	30	25	11	18
(days at sea)	DEU	57	115	73	46	62	71
	DNK	26	18	1	7	0	10
	FRA	0	0	0	5	6	2
	NLD	235	320	355	165	161	247
	SWE	1	3	0	0	>0	1
	Total	327	472	459	247	240	349
Landings	BEL	39	33	53	56	13	39
(tonnes)	DEU	275	427	153	71	76	200
	DNK	7,499	5,611	31	898	0	2,808
	FRA	0	0	0	7	13	4
	NLD	735	860	706	329	249	576
	SWE	444	419	0	0	19	176
	Total	8,991	7,351	944	1,361	370	3,803
Value	BEL	164	182	262	233	63	181
(1,000 euros)	DEU	565	1,382	582	391	362	656
	DNK	1,776	1,464	9	170	0	684
	FRA	0	0	0	32	47	16
	NLD	2,147	3,215	2,960	1,388	974	2,137
	SWE	108	102	0	0	>0	42
	Total	4,760	6,344	3,813	2,214	1,446	3,715
Gross Value	BEL	89	112	136	121	33	98
Added	DEU	331	831	299	233	222	383
(1,000 euros)	DNK	1,474	1,217	7	140	0	568
	FRA	0	0	0	14	21	7
	NLD	1,084	1,997	1,640	689	499	1,182
	SWE	64	54	0	0	>0	24
	Total	3,043	4,211	2,082	1,197	775	2,262

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Figure 3.17 presents the historical trend of the fishing activities in the proposed closure area of the Frisian Front subarea 1 for the different countries with different gears per country. From the figure it can be seen that Danish vessels mainly used bottom- and midwater otter trawls (OTB and OTM), while the Dutch fleet mostly used beam trawls (TBB), next to the use of otter twin trawls (OTT) in 2016 and 2017. Fishing activities of both gears have decreased from 2016 onwards. German fishermen mainly used beam trawls in the Frisian Front subarea 1.

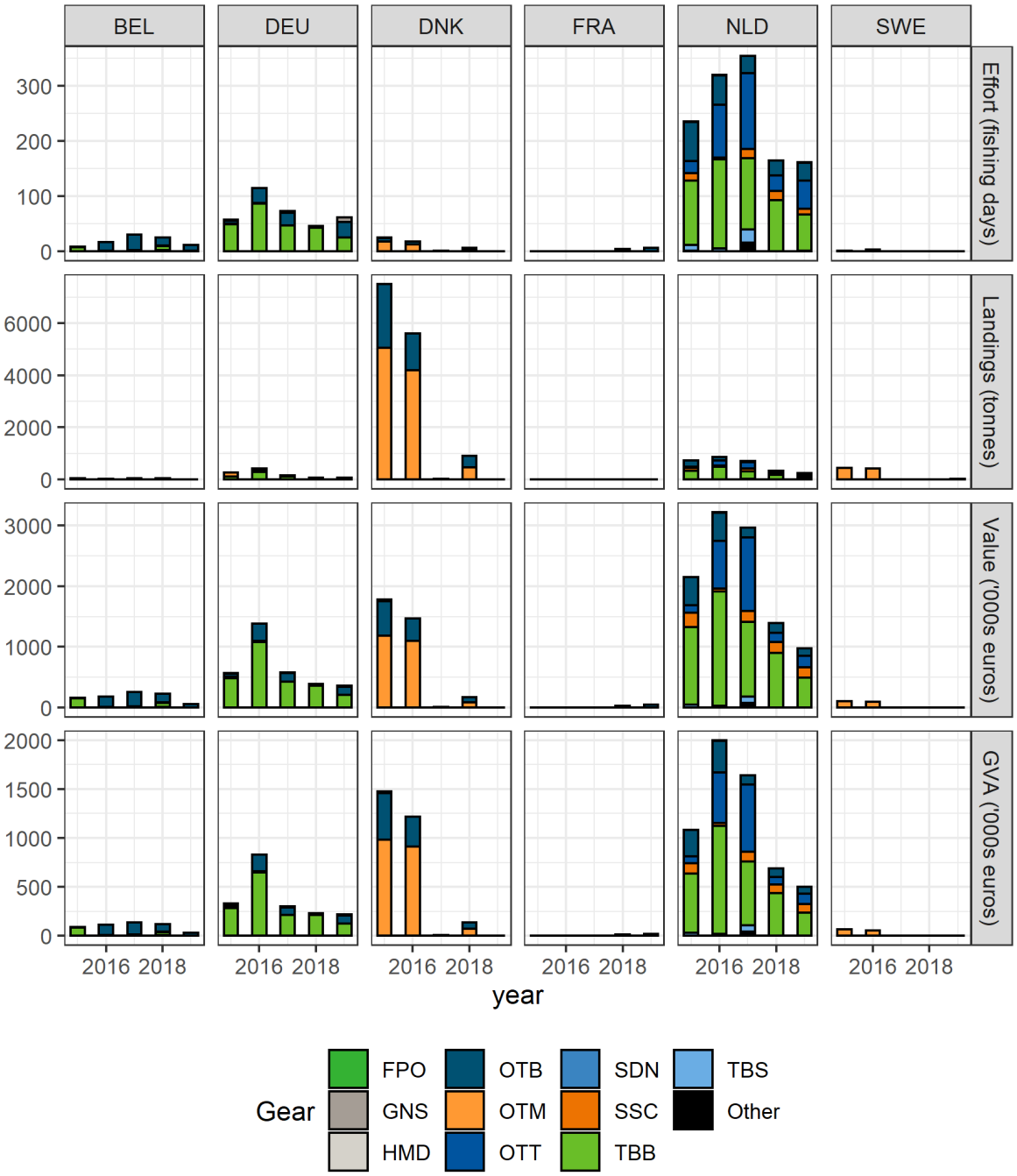

Figure 3.21 *Historical trend of the fishing activities in the Frisian Front subarea 1 with different gears (FPO: Pots; GNS: set gillnets (anchored); HMD: Mechanised dredges; OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; TBS: shrimp trawls, Other: other gears) in the proposed closure of the Frisian Front subarea 1 for the different countries. Effort, landings, value of landings and GVA are given per country*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.5.2 Main species caught in the Frisian Front subarea 1

The main species caught in this area are European sprat (*Sprattus sprattus*; SPR), European plaice (*Pleuronectes platessa*; PLE), NEP: Norway lobster (*Nephrops norvegicus*, NEP), and Tub gurnard (*Chelidonichthys lucerna*; GUU). Figure 3.22 shows that most fish in Frisian Front subarea 1 are caught by the Danish fleet. European sprat were mainly caught with Danish demersal trawlers or seiners in Frisian Front subarea 1. However, the landings decreased significantly. In addition, Dutch beam trawlers and Dutch demersal trawlers or seiners caught some European plaice, tub gurnard, Norway lobster and other species in Frisian Front subarea 1, while German beam trawlers also caught some European plaice and other species. However, the landings of the Dutch and German fleet were much lower compared to the landings of the Danish fleet caught in Frisian Front subarea 1. Note that the Figure only shows the landings of the main gears. Pelagic trawls are not included in the Figure because these trawls will not be banned when this area is closed.

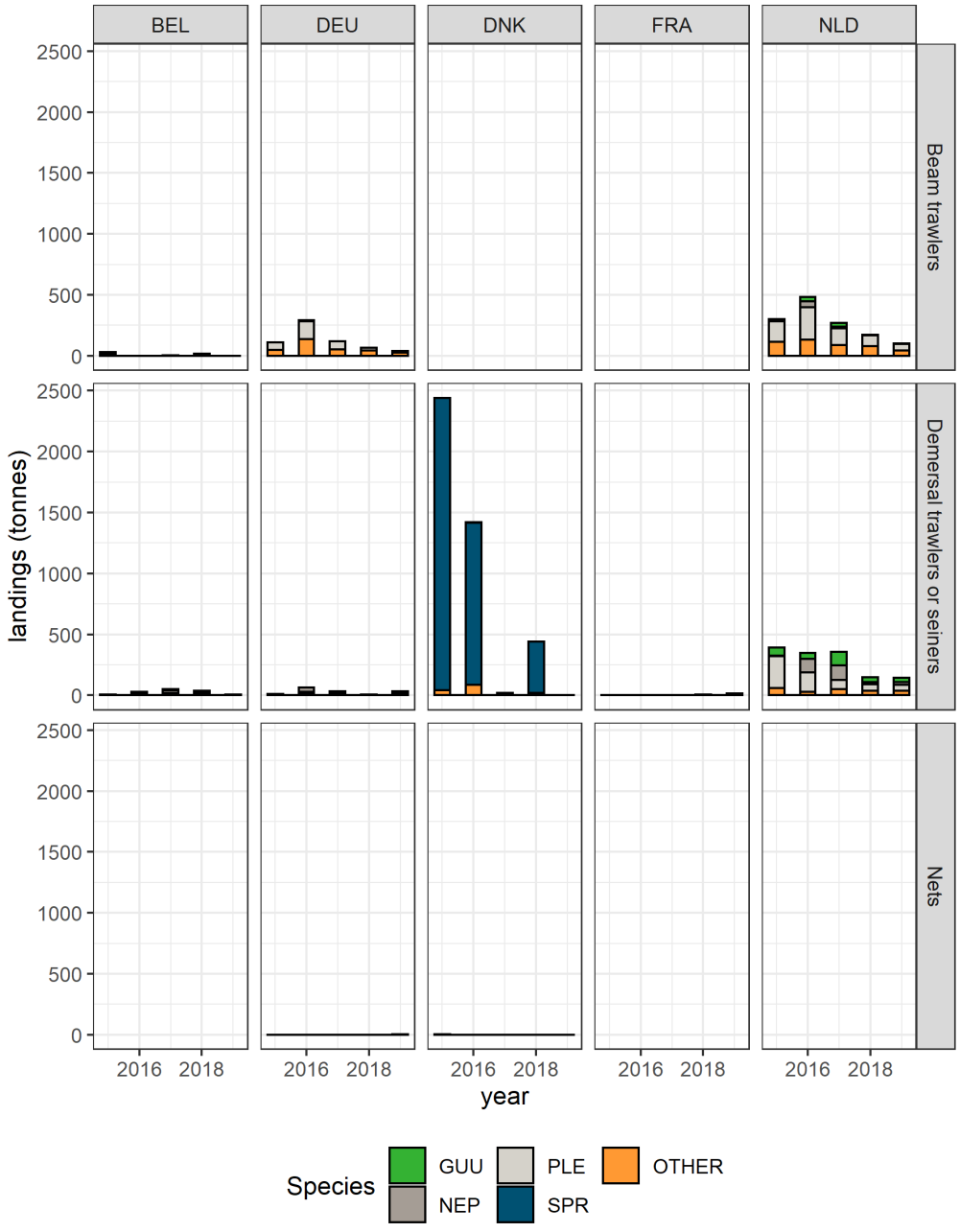

Figure 3.22 *Historical trend of the species caught in the Frisian Front subarea 1 by the Belgian, German, Danish, French and Dutch fleet (GUU: Tub gurnard; NEP: Norway lobster; PLE: European plaice; SPR: European sprat, Other: other species)*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.5.3 Individual dependency of Dutch fishermen to the Frisian Front subarea 1

Figure 3.23 shows that around 60 Dutch fishing vessels have been active in this area and this number decreased slowly in the period 2015-2018 and increased in 2019. The revenue dependency of the vessels was moderate since for most of the vessels less than 10% of their total revenue originates from the Frisian Front subarea 1. In 2017 however, around 10 vessels attained more than 10% of their total revenue from the area of which 2 vessels showed a dependency of more than 30%.

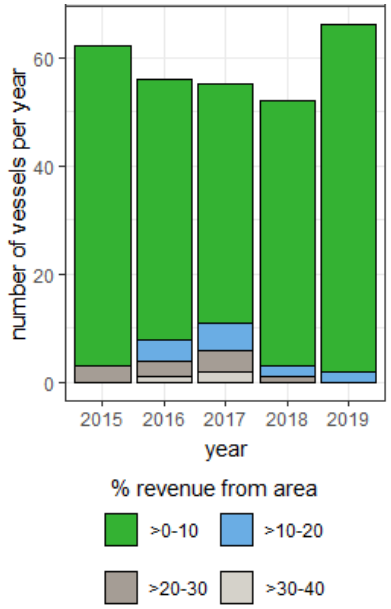

Figure 3.23 *The number of Dutch vessels per year and the revenue dependency*

Figure 3.24 shows that the average number of Dutch vessels with fishing activities in the Frisian Front subarea 1 for the 2015-2019 period according to their revenue dependency and the region the vessels originate from. Most vessels had a revenue dependency of less than 10% originated from the regions Urk and Holland, while some vessels originated from the regions North and Zeeland.

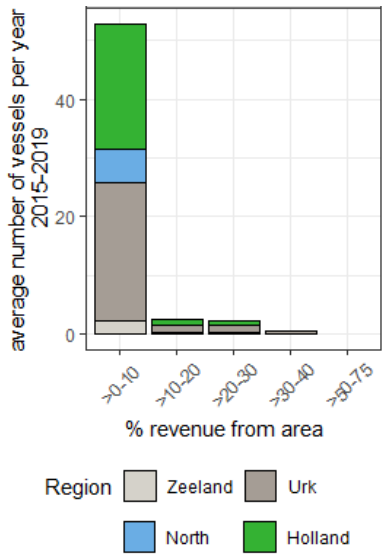

Figure 3.24 *The average number of vessels per region and the revenue dependency*

Figure 3.25 shows that the Dutch fleet mainly used otter twin trawls (OTT), beam trawls (TBB) and bottom otter trawls (OTB) with a revenue dependency varying between 0 and 40%. The revenue of OTT, TBB and OTB mainly depend on a few vessels with a high revenue dependency for this area (i.e. between 20-30% and 30-40%). The average total revenue in this graph differs a little from the total average revenues in Table 3.5 as in this analysis the revenues of the vessels were first averaged over the years and then added up, whereas for Table 3.5 the totals have been calculated per year and have afterwards been averaged.

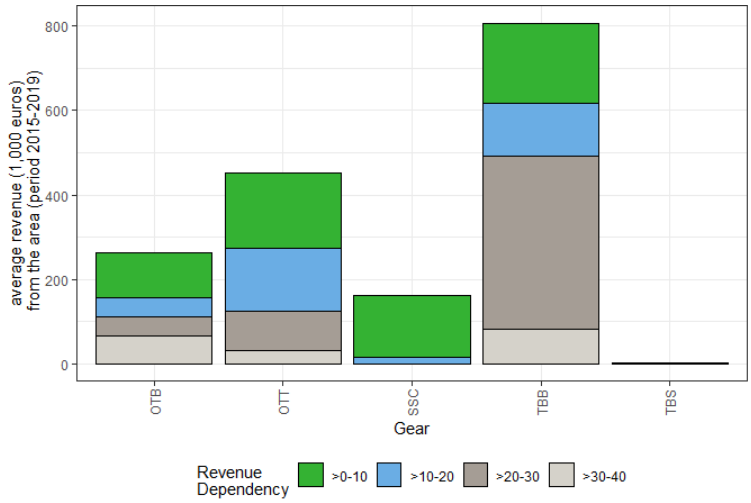

Figure 3.25 *Total of the average revenues (x 1,000 euros) of the vessels with different dependencies on the area per gear type*

3.6 Frisian Front subarea 2

3.6.1 Economic value of the Frisian Front subarea 2

Over the 2015-2019 period the amount of fishing activities has varied significantly from year to year in the Frisian Front subarea 2 and although fishing fleets from all countries were present in the area, fishing activities were in general low (Table 3.6). Total effort in the Frisian Front subarea 2 was between 10 and 40 days at sea (average of 23 days) and the added value varied between less than 0.1 and more than 0.7m euros (average of 0.3m euros). The overall time trend in this area was driven by the activities of the Danish fleet, which was dominant in 2015 and 2016, and absent in the other years. In the later years the Dutch fleet was most active in the area (on average). The German fleet had some effort but this was not reflected in the landings, value and gross value added. The Belgian, French and Swedish fleets were virtually absent in this area.

Table 3.6 *Overview of effort, landings and values and gross value added of the fishing sector in the Frisian Front subarea 2 are given by country.*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0	1	>0	2	>0	1
(days at sea)	DEU	2	4	8	4	4	5
	DNK	8	4	>0	0	0	3
	FRA	0	0	>0	0	0	>0
	NLD	20	15	29	7	6	15
	SWE	>0	1	0	0	0	0
	Total	31	23	38	13	11	23
Landings	BEL	0	3	>0	3	>0	1
(tonnes)	DEU	297	5	4	1	2	62
	DNK	3,239	999	>0	0	0	848
	FRA	0	>0	>0	0	0	0
	NLD	49	57	46	20	30	40
	SWE	81	49	-	-	0	26
	Total	3,666	1,113	50	24	32	977
Value	BEL	0	6	>0	15	1	4
(1,000 euros)	DEU	68	32	38	11	18	33
	DNK	742	266	2	0	0	202
	FRA	0	1	>0	0	0	0
	NLD	136	126	159	51	87	112
	SWE	20	9	0	0	0	6
	Total	965	440	199	77	106	357
Gross Value	BEL	0	4	>0	8	>0	2
Added	DEU	40	20	21	7	12	20
(1,000 euros)	DNK	621	222	1	0	0	169
	FRA	0	>0	>0	0	0	0
	NLD	70	75	94	25	43	61
	SWE	12	5	0	0	0	3
	Total	743	325	116	40	55	256

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Figure 3.26 presents the historical trend of the fishing activities in the proposed closure area of the Frisian Front subarea 2 for the different countries with different gears per country. From the Figure it can be seen that Danish vessels mainly used bottom- and midwater otter trawls (OTB and OTM), while the Dutch fleet mostly used Scottish seines (SSC), next to the use of shrimp trawls in 2015-2017 (TBS). The German fleet also used set gillnets (anchored) (GNS).

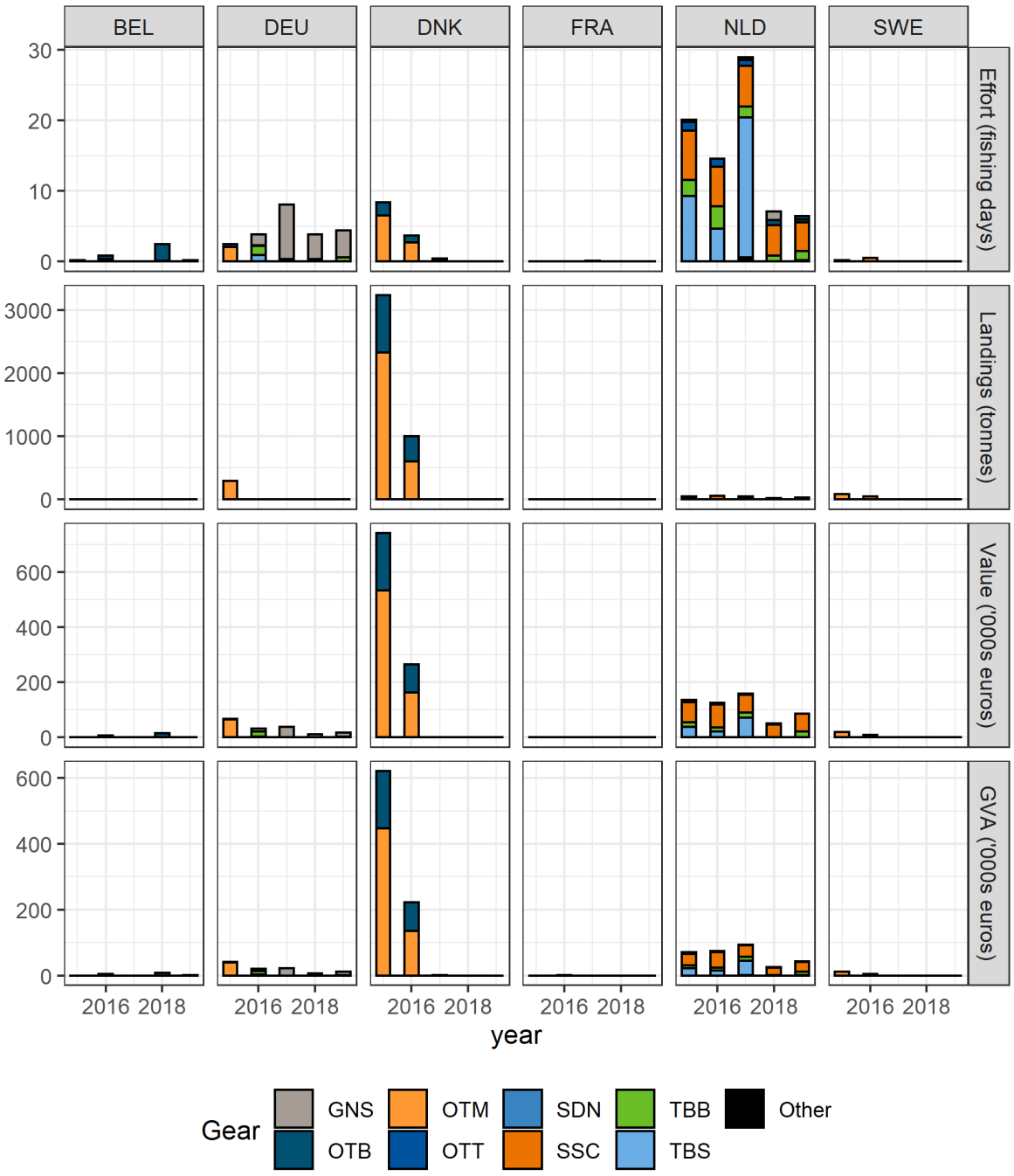

Figure 3.26 *Historical trend of the fishing activities in the Frisian Front subarea 2 with different gears (GNS: set gillnets (anchored); OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; TBS: shrimp trawls, Other: other gears) in the proposed closure of the Frisian Front subarea 2 for the different countries. Effort, landings, value of landings and GVA are given per country*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.6.2 Main species caught in the Frisian Front subarea 2

The main species caught in this area are European sprat (*Sprattus sprattus*; SPR), Tub gurnard (*Chelidonichthys lucerna*; GUU) and Atlantic mackerel (*Scomber scombrus*; MAC). Figure 3.27 shows that European sprat are mainly caught in Frisian Front subarea 2 by the Danish fleet with demersal trawlers or seiners. However, the landings decreased significantly. In addition, Dutch demersal trawlers or seiners caught some tub gurnard in Frisian Front subarea 2. However, the landings of the Dutch fleet were much lower compared to the landings of the Danish fleet caught in Frisian Front subarea 2. Note that the Figure only shows the landings of the main gears. Pelagic trawls are not included in the Figure because these trawls will not be banned when this area is closed.

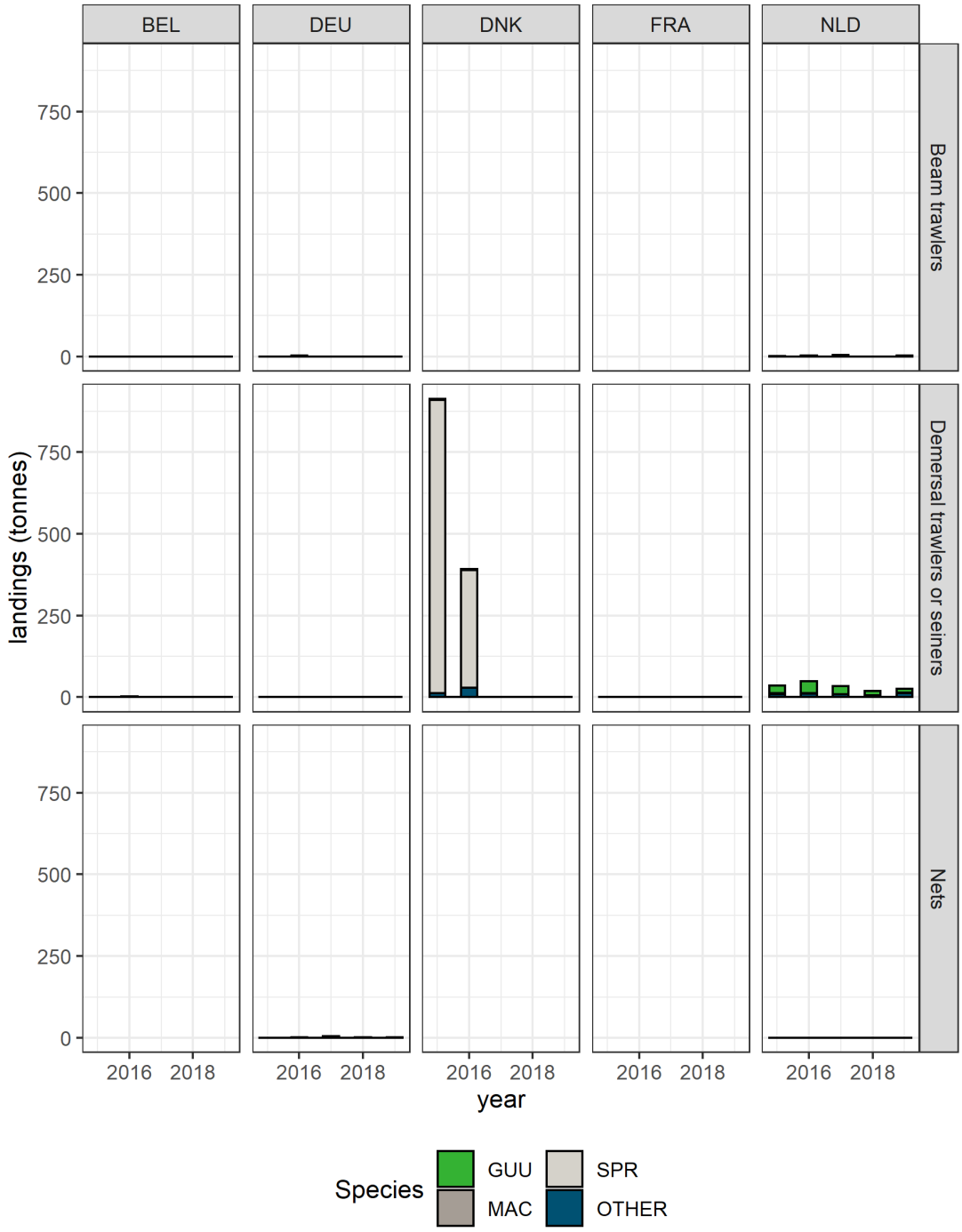

Figure 3.27 *Historical trend of the species caught in the Central Oyster Grounds by the Belgian, German, Danish, French and Dutch fleet (GUU: Tub gurnard; MAC: Atlantic mackerel; SPR: European sprat, Other: other species)*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.6.3 Individual dependency of Dutch fishermen to Frisian Front subarea 2

Figure 3.28 shows that the number of Dutch vessels with fishing activities in the Frisian Front subarea 2 were relatively volatile and varied between 8 and 14. The revenue dependency of the vessels was moderate since for most of the vessels less than 10% of their total revenue originates from the Frisian Front subarea 2.

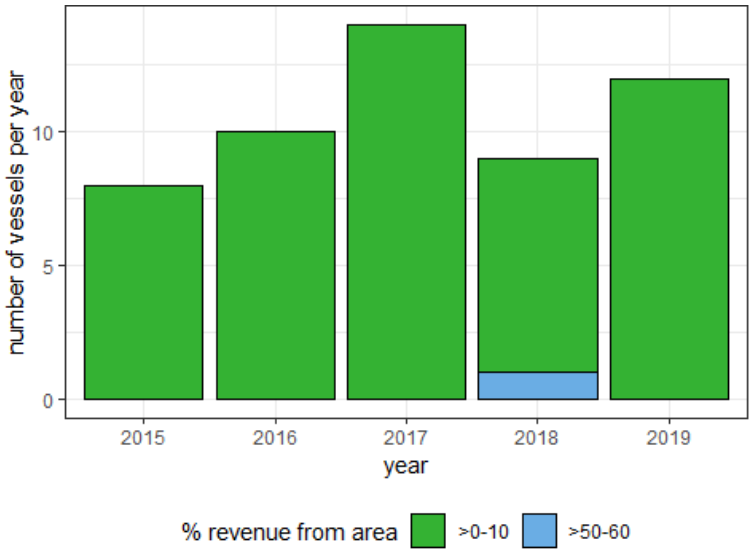

Figure 3.28 *The number of Dutch vessels per year and the revenue dependency*

Figure 3.29 shows that the average number of Dutch vessels with fishing activities in the Frisian Front subarea 2 for the 2015-2019 period according to their revenue dependency and the region the vessels originate from. Most vessels which had a revenue dependency of less than 10% originate from the region Urk.

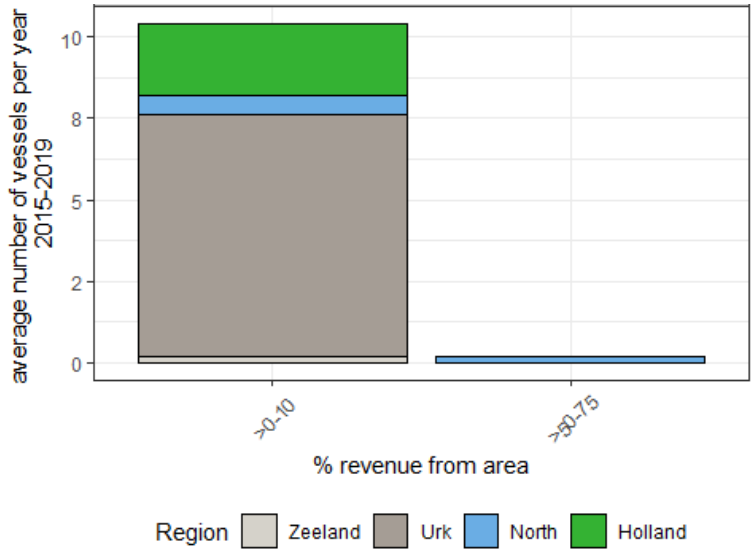

Figure 3.29 *The average number of Dutch vessels per region and the revenue dependency*

Figure 3.30 shows that the Dutch fleet mainly used Scottish seines (SSC) with a revenue dependency varying between 0 and 10%. The other gears that were used are of less importance. The average total revenue in this graph differs a little from the total average revenues in Table 3.6 as in this analysis the revenues of the vessels were first averaged over the years and then added up, whereas for Table 3.6 the totals have been calculated per year and have afterwards been averaged.

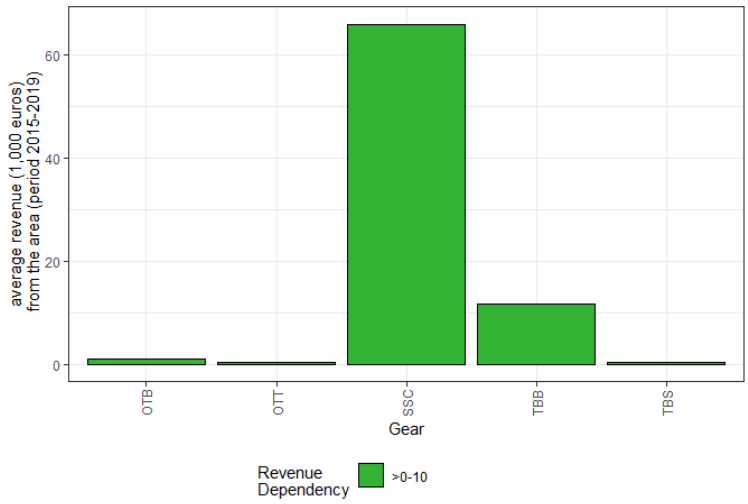

Figure 3.30 *Total of the average revenues (x 1,000 euros) of the vessels with different dependencies on the area per gear type*

3.7 North Sea Coastal Zone

The results are first presented for the Natura 2000 site North Sea Coastal Zone, and then for the proposed VIBEG2 closures.

3.7.1 Economic value of North Sea Coastal Zone (N2000)

Over the 2015-2019 period the amount of fishing activities has varied from year to year in the North Sea Coastal Zone (N2000) and fishing fleets from The Netherlands, Belgium, Germany, Denmark and Sweden were active in this area (Table 3.7). Total effort in the North Sea Coastal Zone (N2000) was between 4,100 and 7,000 days at sea (average of 5,144 days) and the added value varied between 8.0 and 31.3m euros (average of 16m euros). The North Sea Coastal Zone (N2000) was dominated by the Dutch fleet contributing more than 97% to the total GVA from the area. The Danish and Swedish fleets were virtually absent in this area.

Table 3.7 *Overview of effort, landings and values and gross value added of the fishing sector in the North Sea Coastal Zone (N2000) are given by country. France has declared no fishing activities in this areas for the period*

	Country	2015	2016	2017	2018	2019	Average
Effort (days at sea)	BEL	29	67	66	55	8	45
	DEU	78	330	57	52	47	113
	DNK	>0	0	3	0	0	1
	NLD	5,412	6,585	4,059	4,777	4,096	4,986
	SWE	0	>0	0	0	0	0
	Total	5,519	6,983	4,186	4,884	4,150	5,144
Landings (tonnes)	BEL	26	58	26	100	11	44
	DEU	80	269	31	71	48	100
	DNK	7	0	44	4	57	23
	NLD	8,275	8,629	3,426	9,846	6,152	7,266
	SWE	0	5	0	0	0	1
	Total	8,389	8,961	3,527	10,020	6,269	7,433
Value (1,000 euros)	BEL	99	382	171	366	33	210
	DEU	240	1,614	253	212	131	490
	DNK	2	0	12	1	15	6
	NLD	21,518	43,344	19,889	28,889	13,982	25,524
	SWE	0	2	0	0	0	>0
	Total	21,859	45,341	20,325	29,468	14,160	26,231
Gross Value Added (1,000 euros)	BEL	44	236	86	198	18	116
	DEU	138	1,123	155	141	87	329
	DNK	2	0	10	1	13	5
	NLD	12,139	29,896	11,879	16,415	7,955	15,657
	SWE	0	0	0	0	0	>0
	Total	12,322	31,256	12,130	16,755	8,073	16,107

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Figure 3.31 presents the historical trend of the fishing activities in the proposed closure area of the North Sea Coastal Zone (N2000) for the different countries with different gears per country. From the Figure it can be seen that Dutch vessels mainly used shrimp trawls (TBS) and to a lesser extend Mechanised dredges (HMD) in the North Sea Coastal Zone (N2000). Although the GVA was the highest in 2016 there was no clear trend in the added value of this area to the Dutch fishery.

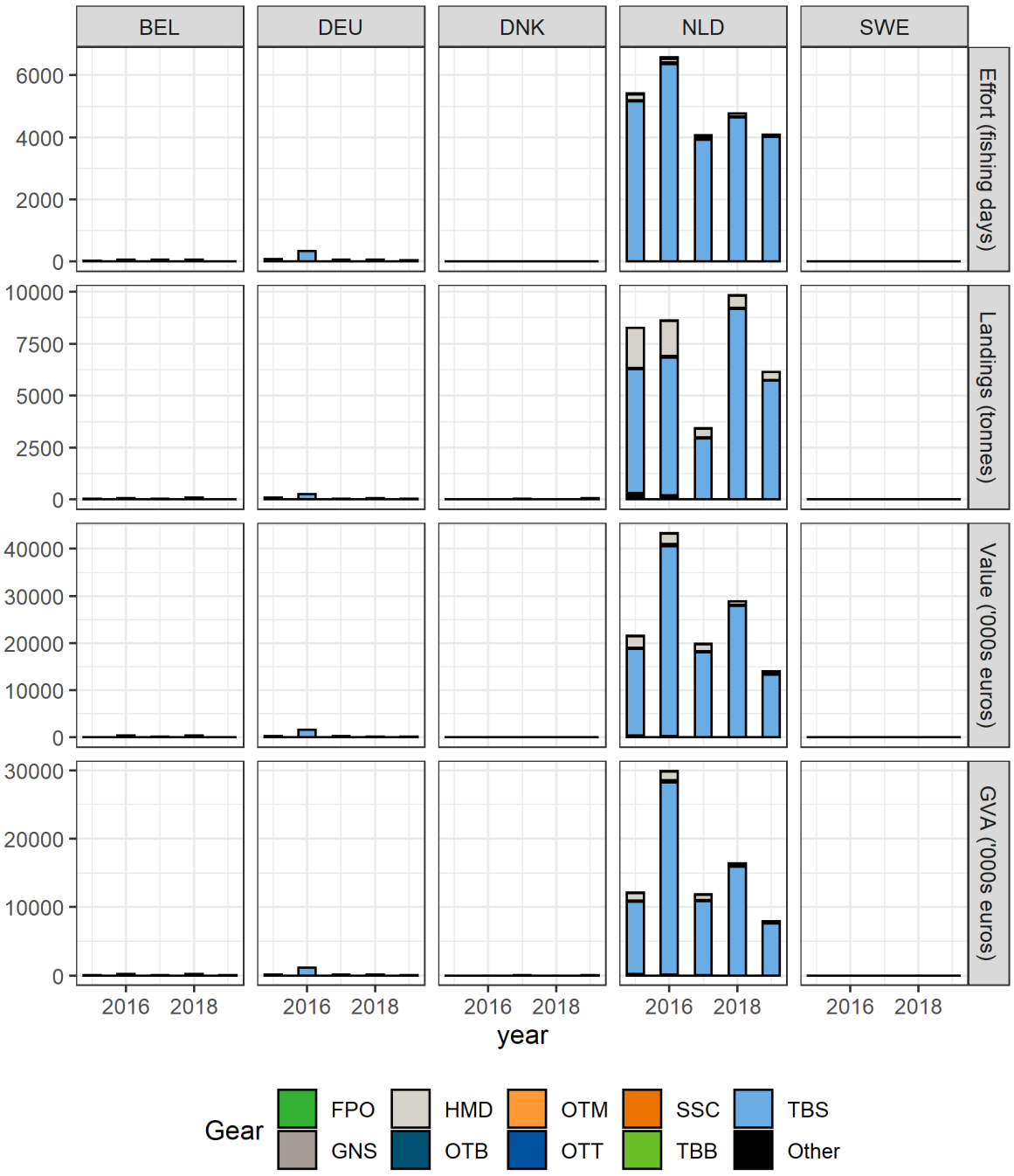

Figure 3.31 *Historical trend of the fishing activities in the North Sea Coastal Zone (N2000) with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; TBS: shrimp trawls, GNS: set gillnets (anchored); FPO: Pots; HMD: Mechanised dredges; Other: other gears) in the proposed closure of the North Sea Coastal Zone (N2000) for the different countries. Effort, landings, value of landings and GVA are given per country. France has declared no fishing activities in this area for the period 2015-2019*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.7.2 Main species caught in the North Sea Coastal Zone (N2000)

The main species caught in this area is Common shrimp (*Crangon crangon*; CSH). Figure 3.32 shows that Common shrimp are mainly caught in the North Sea Coastal Zone (N2000) by the Dutch fleet with beam trawlers. However, the landings were quite volatile. Note that the figure only shows the landings of the main gears.

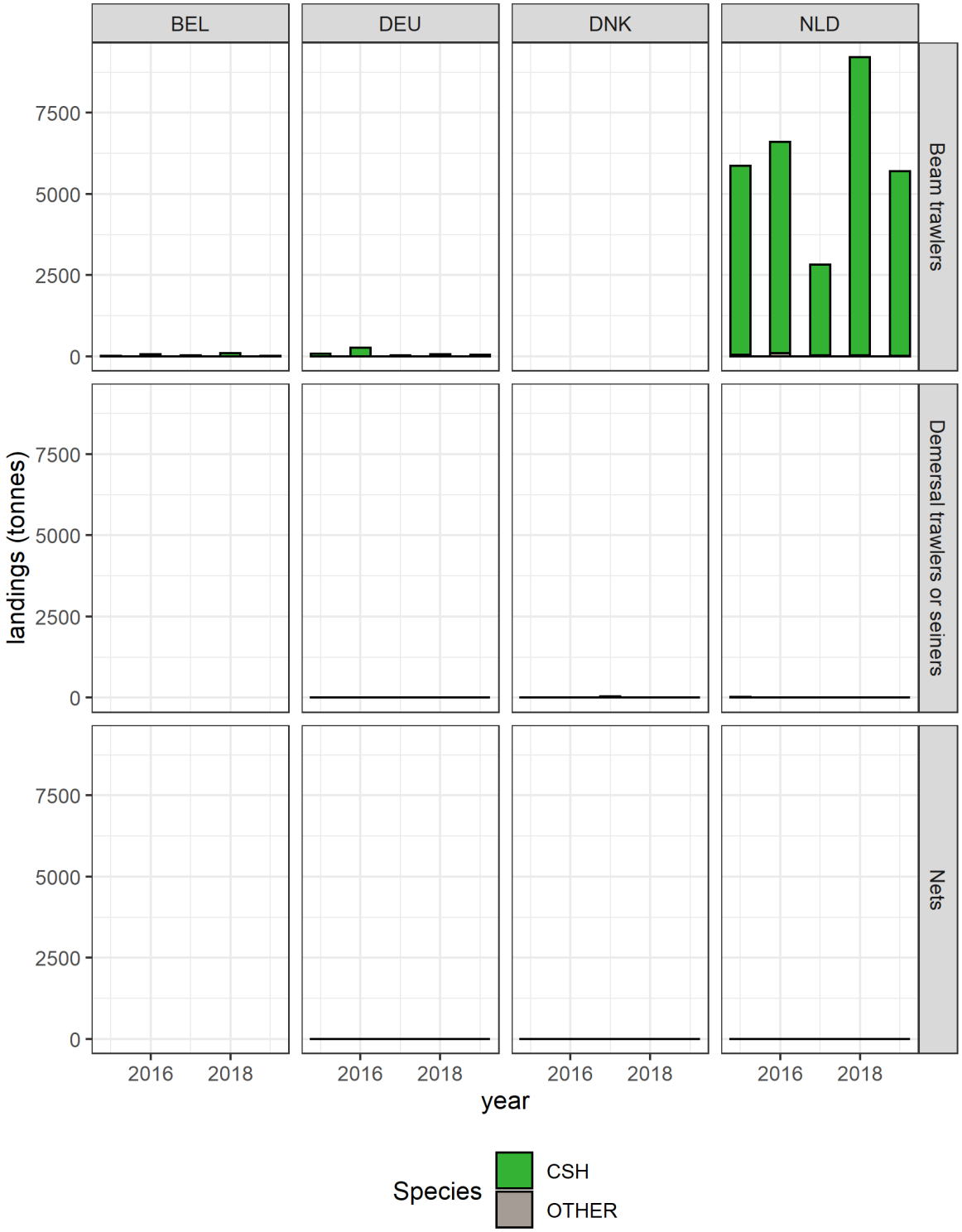

Figure 3.32 *Historical trend of the species caught in the North Sea Coastal Zone (N2000) by the Belgian, German, Danish and Dutch fleet (CSH: Common shrimp; Other: other species)*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.7.3 Economic value of North Sea Coastal Zone (VIBEG2)

Over the 2015-2019 period the amount of fishing activities has been rather stable from year to year in the North Sea Coastal Zone (VIBEG2) and fishing fleets from The Netherlands, Belgium, Germany, Denmark and Sweden were active in this area (Table 3.8). Total effort in the North Sea Coastal Zone (VIBEG2) was between 200 and 350 days at sea (average of 260 days) and the added value varied between 0.4 and 1.3m euros (average of 0.8m euro). The North Sea Coastal Zone (VIBEG2) was dominated by the Dutch fleet contributing more than 97% to the total GVA from the area. The Belgian, Danish and Swedish fleets were virtually absent in this area.

Table 3.8 *Overview of effort, landings and values and gross value added of the fishing sector in the North Sea Coastal Zone (VIBEG2) are given by country. France has declared no fishing in those areas for the period.*

	Country	2015	2016	2017	2018	2019	Average
Effort (days at sea)	BEL	2	3	2	2	1	2
	DEU	21	45	16	14	15	22
	DNK	>0	>0	1	>0	0	>0
	NLD	258	303	210	211	191	235
	SWE	0	>0	0	0	0	0
	Total	281	352	229	227	207	259
Landings (tonnes)	BEL	2	2	1	4	1	2
	DEU	25	35	10	20	16	21
	DNK	4	>0	3	>0	0	1
	NLD	250	278	130	357	284	260
	SWE	0	2	0	0	0	0
	Total	281	317	143	381	300	285
Value (1,000 euros)	BEL	5	13	6	16	2	8
	DEU	68	205	69	58	40	88
	DNK	3	2	3	>0	0	2
	NLD	770	1,594	810	2,116	643	1,187
	SWE	0	1	0	0	0	0
	Total	847	1,814	887	2,191	685	1,285
Gross Value Added (1,000 euros)	BEL	2	8	3	9	1	5
	DEU	39	142	43	39	27	58
	DNK	2	1	2	>0	0	1
	NLD	442	1,112	490	1,210	366	724
	SWE	0	>0	0	0	0	0
	Total	486	1,264	538	1,258	394	788

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Figure 3.33 presents the historical trend of the fishing activities in the proposed closure area of the North Sea Coastal Zone (VIBEG2) for the different countries with different gears per country. From the Figure it can be seen that Dutch vessels mainly used shrimp trawls (TBS) in the North Sea Coastal Zone (VIBEG2). Although the GVA was highest in 2018, there was no clear trend in the added value of this area to the Dutch fishery.

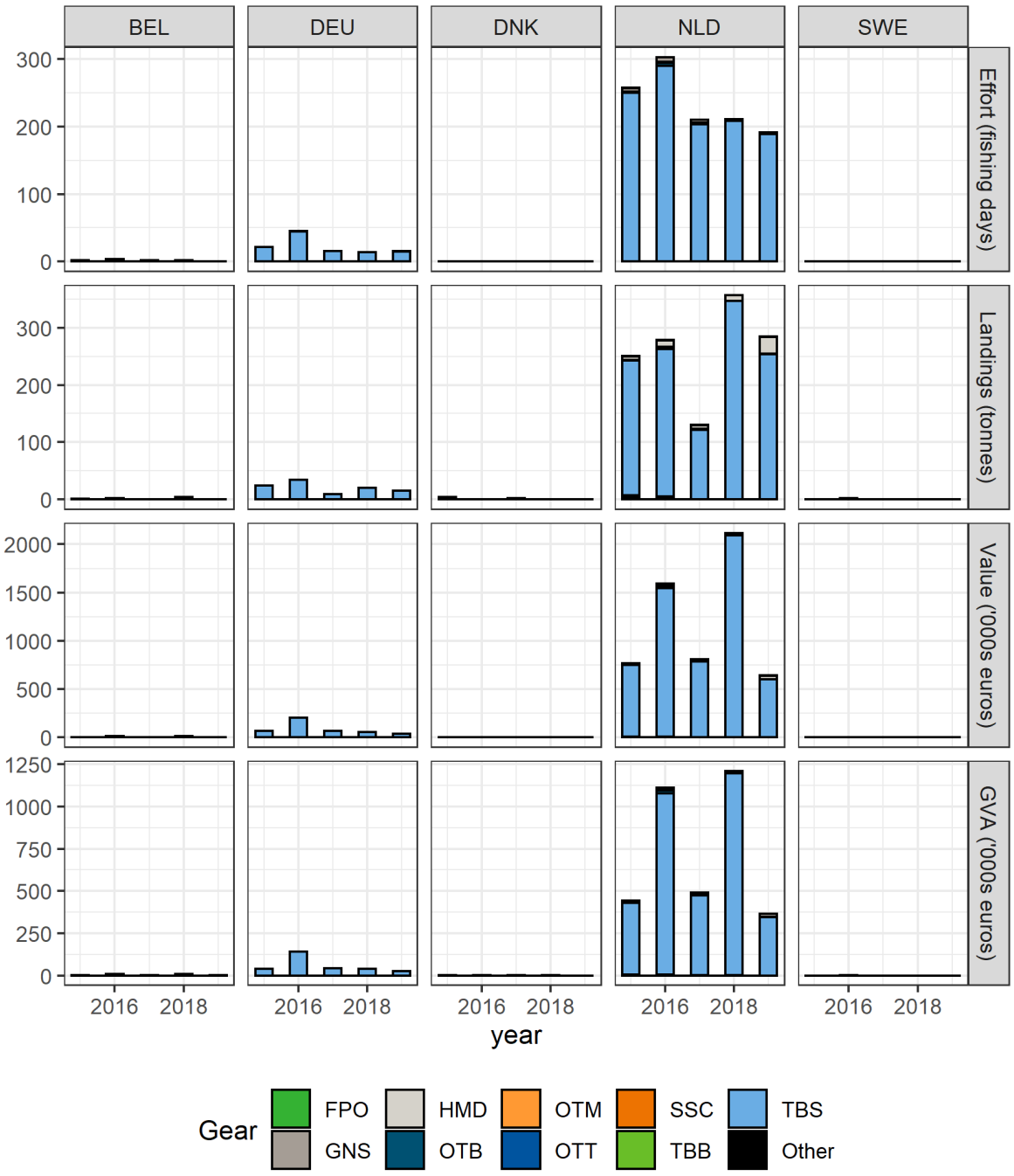

Figure 3.33 *Historical trend of the fishing activities in the North Sea Coastal Zone (VIBEG2) with different gears (FPO: Pots; GNS: set gillnets (anchored); HMD: Mechanised dredges; OTB: bottom otter trawls; OTM: otter trawls midwater; OTT: otter twin trawls; SSC: Scottish seines; TBB: beam trawls; TBS: shrimp trawls, Other: other gears) in the proposed closure of the North Sea Coastal Zone (VIBEG2) for the different countries. Effort, landings, value of landings and GVA are given per country. France have declared no fishing activities in this area for the period 2015-2019*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.7.4 Main species caught in the North Sea Coastal Zone (VIBEG2)

Figure 3.34 shows that common shrimp were mainly caught in the North Sea Coastal Zone (VIBEG2) by the Dutch and German fleets with shrimp trawlers). However, the landings were quite volatile. In addition, relatively small amounts of other species were caught. Note that the Figure only shows the landings of the main fleets.

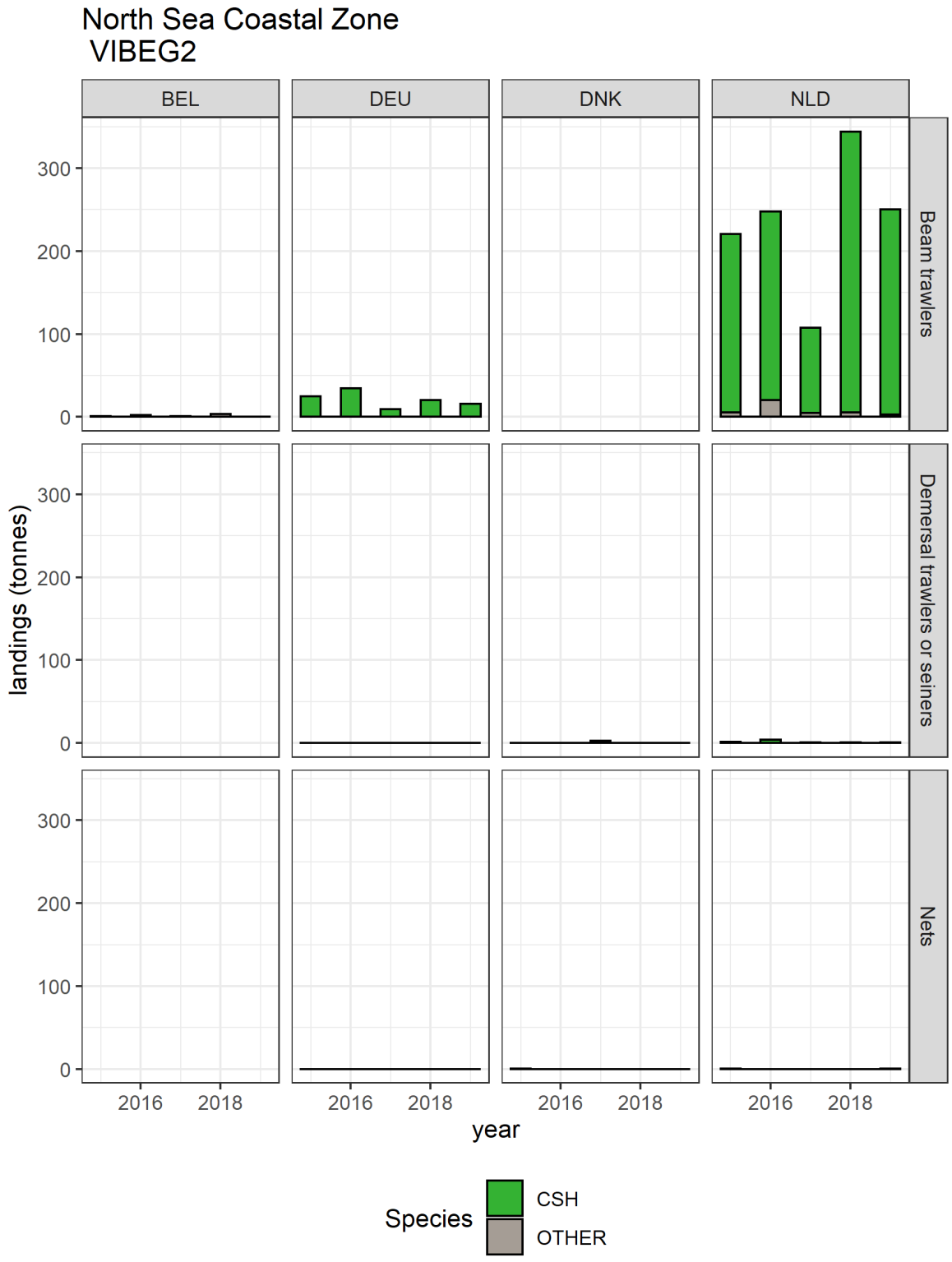

Figure 3.34 *Historical trend of the species caught in the North Sea Coastal Zone (VIBEG2) by the Belgian, German, Danish and Dutch fleet (CSH: Common shrimp; SPR: European sprat, Other: other species)*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

3.7.5 Individual dependency of Dutch fishermen to North Sea Coastal Zone (N2000)

Figure 3.35 shows that approximately 180 vessels are active in the coastal zone and the number of vessels were relatively stable. The revenue dependency of the vessels varied between 0 and 100%.

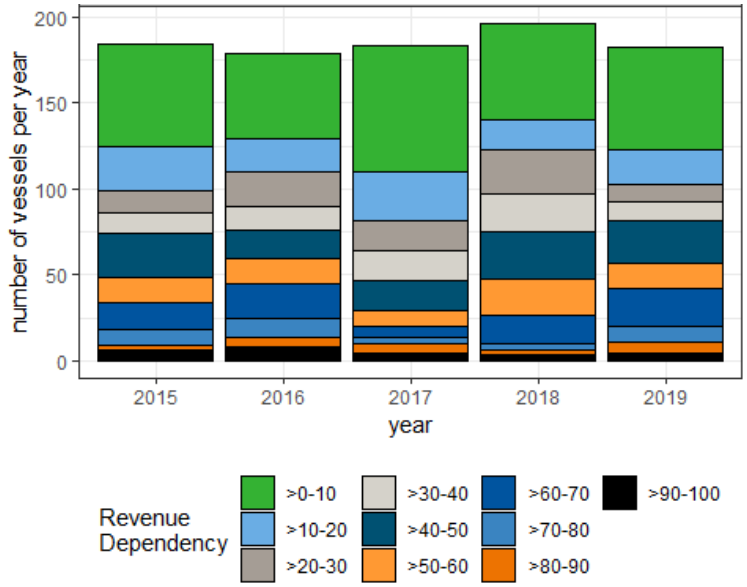

Figure 3.35 *The number of Dutch vessels per year and the revenue dependency*

Figure 3.36 shows that the average number of vessels with fishing activities in the North Sea Coastal Zone for the 2015-2019 period according to their revenue dependency and the region the vessels originate from. Most vessels had a revenue dependency of less than 10% and originated from the regions North and Holland. Most vessels with high dependency on this area originated from the North region.

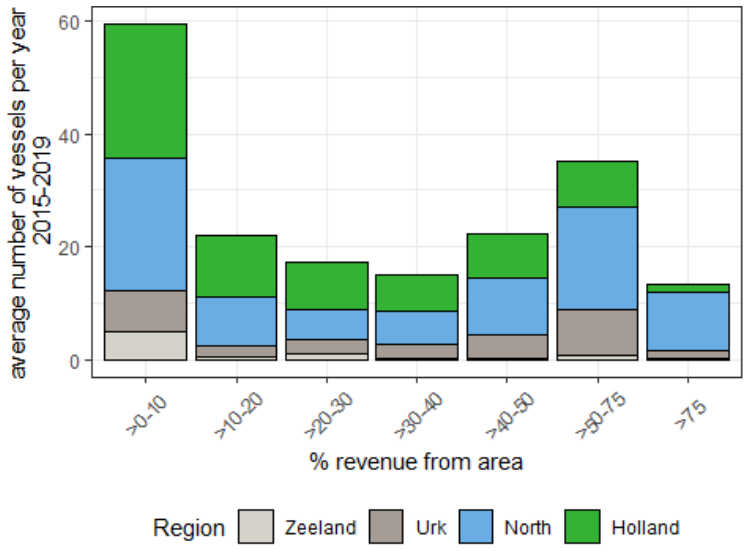

Figure 3.36 *The average number of vessels per region and the revenue dependency*

Figure 3.36 shows that the Dutch fleet mainly used shrimp trawls (TBS) with a revenue dependency varying between 0 and 100%. More than 50% of the total revenue from this area was obtained with vessels that were more than 50% dependent on this area. The average total revenue in this graph differs a little from the total average revenues in Table 3.8 as in this analysis the revenues of the vessels were first averaged over the years and then added up, whereas for Table 3.8 the totals have been calculated per year and have afterwards been averaged.

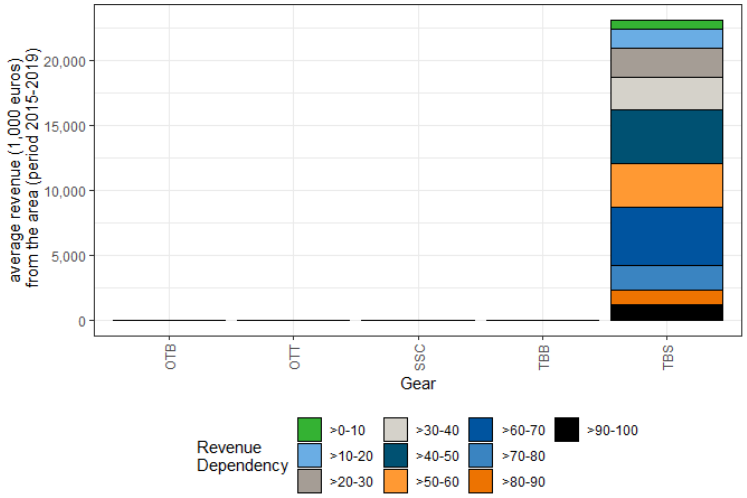

Figure 3.37 *Total of the average revenues (x 1,000 euros) of the vessels with different dependencies on the area per gear type*

4 Discussion

This report presents the effort, value and landings by the Dutch, Danish, German, Belgian, Swedish and French fishing fleets on the proposed closed areas for a period 2015-2019. The analysis of this historic information is the first step in order to assess the future costs of the closures on the fishing sector. However, the reported values of the areas of interest do not necessarily reflect the value of these areas for the fishing fleets in future.

First, there are uncertainties in the outcomes of this study due to methodological constraints. The uncertainties associated with this method are discussed in Oostenbrugge et al. (2010). A main cause of the uncertainty is the distribution of the catches per fishing trip proportionally over the fishing locations.

Second, the predictive capacity of the historic results for future economic effects of these closures is limited due to future changes in the fishing patterns. Changes in fish distribution, fisheries legislation, economic context and gear innovations will affect the fishing behaviour and therefore might change the fishing activities in the various areas. These changes could be of greater impact than the closures itself (Oostenbrugge et al., 2016). More specifically, the extent of access restrictions in waters of other Member States and additional areas reserved for offshore wind farms, nature and mariculture on the Dutch Continental Shelf and beyond will have a large impact on the fishing patterns. These (possible) limitations make it unpredictable how much space will be left for fishing, as a result of which it's impossible to predict future values of the remaining fishing grounds. It is also not possible to estimate whether the areas that remain accessible for fishing will meet the fishing pressure, as it's obvious that the pressure and the relative importance for the Dutch fishing fleet will increase (Deetman et al., 2020).

Third and most important, the economic consequences of the closures will ultimately depend on the alternative fishing opportunities that will be available after closure. As such the cumulative effects of closures will not be the simple sum of the individual historic values of the areas, but might be higher or lower depending on other developments. The effects of displacement on the overall fishing pressure in the remaining areas and the consequences for the economics of the fisheries is complex and has not been assessed so far for the Dutch fisheries in the North sea. In this dynamic interaction between nature and fisheries, also other fleets that were not taken into account here will play a role; British flag vessels also fish in the proposed closed areas. These vessels haven't been included in the analysis and as the UK fleet also will be displaced to other areas, this will lead to even more increased fishing pressure. Wageningen Research and the Dutch government are currently working on a research programme on this topic which will start in 2022 and will result in estimations of the effects of closures in the years thereafter.

In addition to the individual value of the areas for the various fisheries as estimated in this study, the fishing grounds also often have a historic, cultural value as well. Fishing practices and family businesses are often passed on to the next generation. These values add to the resistance against this loss of fishing grounds due to closures.[5]

The closures might also cause ecological effects. Because fishermen will need to move their activities to other areas, these remaining areas may therefore face increased fishing pressure, that may negatively impact the benthic communities in or near the seabed as well as vulnerable species that get

[5] A study providing an overview of the effects of offshore wind farms on fisheries and aquaculture
EASME/EMFF/2018/011 Lot 1: Final Draft Report for Specific Contract No. 03
Lead partner Wageningen Marine Research (including Wageningen Economic Research) in consortium with: MRAG Limited Europe; MRAG Limited; Centre for Environment, Fisheries and Aquaculture Science (Cefas); Research Institute for Agriculture, Fisheries and Food (ILVO); Johann Heinrich von Thünen-Institute: Federal Research Institute of Rural Areas, Forestry and Fisheries (TI), Technical University of Denmark (DTU); National Marine Fisheries Research Institute (NMFRI); Swedish University of Agricultural Sciences (SLU) and Institute of Food Safety, Animal Health and Environment (BIOR).

bycaught at higher rates in the areas open to fisheries than they were before. In addition, vessels may need to take a detour steaming towards their new fishing grounds, leading to increased CO_2 emission and costs.

The prediction of the distribution of all fleets is complex, as in practice fishing behaviour is related to many factors including abundance and distribution of target species, quota allocations (and possibilities for international quota swaps or quota leases amongst fishermen), historic preferences for fishing locations (personal knowledge about fishing grounds) combined with other choices fishermen make at sea.

Besides direct and indirect effects on the fishing sector itself, the changes in the fisheries will also need to take into account the effects on the local communities and economic activities onshore. So far, these are hampered by the lack of available and harmonised socio-economic data. Therefore, a targeted socio-economic assessment on an EU scale that takes into account the entire value chain (landings, jobs, market, etc.) and loss & benefits balance should be conducted. An uncertain factor in this process is predicting fishing behaviour (displacement) (Stelzenmüller et al. 2020).

5 Conclusion

For the proposed areas the Ministry of Agriculture, Nature and Food Quality has to provide a Joint Recommendation for fisheries management under Article 11 of Regulation (EU) No 1380/2013 (the Basic Regulation). The aim of the proposal is the recovery of substantial parts of the seabed ecosystem from a disrupted state towards a natural condition. The Joint Recommendation contains the requests to the European Commission to regulate fisheries in the proposed areas. For each area, background documents are provided to substantiate these requests. For the areas mentioned in Table 5.1, except the North Sea Coastal Zone (N2000), a background document is planned.

Table 5.1 *Summary of the main results*

Area	Average total contribution to GVA (1,000 euros)	Main gears	Main countries	Trends
Borkum Reef Grounds	761	TBS	DEU and NLD	Volatile
Central Oyster Grounds	2,272	OTB and OTM	DNK	Decreasing (2015-2017) and Increasing (2018-2019)
Cleaver Bank	892	SSC and TBB	NLD	Decreasing
Dogger Bank	857	OTB, OTM and TBB	DNK and NLD	Increasing (DNK) and Decreasing (NLD)
Frisian Front subarea 1	2,262	OTM, OTT and TBB	DNK and NLD	Decreasing
Frisian Front subarea 2	256	OTM, SSC and TBS	DNK and NLD	Decreasing (DNK) and Volatile (NLD)
North Sea Coastal Zone (N2000)	16,107	TBS	NLD	Volatile
North Sea Coastal Zone (VIBEG2)	788	TBS	NLD	Volatile

5.1 Borkum Reef Grounds

The average total contribution to GVA was approximately 0.8m euro. The historical trend of the fishing activities in the proposed closure area of the Borkum Reef Grounds were quite volatile and indicated that fishing activities on the Borkum Reef Grounds were dominated by shrimp trawls (TBS) from the German and the Dutch fleets.

5.2 Central Oyster Grounds

The average total contribution to GVA for this area was approximately 2.3m euros. The historical fishing activities in the proposed closure area of the Central Oyster Grounds were dominated by bottom- and midwater otter trawls (OTB and OTM). The fishing activities in the proposed closure area of the Central Oyster Grounds were dominated by the Danish fleet. The Danish contribution to GVA was first decreasing (2015-2016) and then increasing (2017-2019).

5.3 Cleaver Bank

The average total contribution to GVA for this area was approximately 0.9m euro. The historical trend of the fishing activities in the proposed closure area of the Cleaver Bank were quite diverse. The area was mainly dominated by the Dutch fleet (given their economic importance) which mainly used

Scottish seines (SSC) and beam trawls (TBB). The Dutch contribution to GVA was generally decreasing.

5.4 Dogger Bank

The average total contribution to GVA for this area was approximately 0.9m euros. The historical fishing activities in the proposed closure area of the Dogger Bank were dominated by the Danish and Dutch fleet using bottom otter trawls (OTB), beam trawls (TBB) and midwater otter trawls (OTM). The economic importance was increasing for the Danish fleet and decreasing for the Dutch fleet.

5.5 Frisian Front subarea 1

The average total contribution to GVA for this area was approximately 2.3m euros. The historical fishing activities in the proposed closure area of the Frisian Front subarea 1 were dominated by the Danish fleet which mainly used midwater otter trawls (OTM) and the Dutch fleet which mainly used beam trawls (TBB) and otter twin trawls (OTT). The economic importance was generally decreasing.

5.6 Frisian Front subarea 2

The average total contribution to GVA for this area was approximately 0.3m euros. The historical fishing activities in the proposed closure area of the Frisian Front subarea 2 were dominated by the Danish fleet which mainly used midwater otter trawls (OTM) which stopped their activities in this area after 2016. As a result the total GVA was smaller than 0.01m euros for the years after 2016. The Dutch fleet active in the area mainly used Scottish seines (SSC) and shrimp trawls (TBS). The economic importance was decreasing for the Danish fleet and volatile for the Dutch fleet.

5.7 North Sea Coastal Zone (N2000)

The average total contribution to GVA was approximately 16.1m euros. The historical trend of the fishing activities in the Natura 2000 site North Sea Coastal zone were dominated by shrimp trawls (TBS) used by the Dutch fleet. The economic importance of the Natura 2000 site of the North Sea Coastal zone was quite volatile.

5.8 North Sea Coastal Zone (VIBEG2)

The average total contribution to GVA was approximately 0.8m euros. The historical trend of the fishing activities in the VIBEG2 management zones of the North Sea Coastal zone were dominated by shrimp trawls (TBS) used by the Dutch fleet. The economic importance of the VIBEG2 management zones of the North Sea Coastal zone were quite volatile.

To assess the economic effects of the future closures of the various areas discussed in this report, a more in depth study of the fisheries dynamics in the different areas is needed.

Acknowledgements

This report was written with the data provided by the research institutes of Denmark (DTUAQUA), Germany (TI), Belgium (ILVO), Sweden (SLU) and France (IFREMER).

References and websites

Deetman, B., Eweg, A.Y., Oostenbrugge, J.A.E. van, Mol, A., Hamon, K.G., and Steins, N.A. (2020). Wind op Zee: zoekgebieden 2030-2050: inzicht in de sociaal-economische waarde van de zoekgebieden windenergie op de Noordzee 2030-2050 voor de Nederlandse visserij.

Hamon, K.G., 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. The Hague, LEI, part of Wageningen UR.

Hamon, K.G., S. Glorius, A. Klok, J. Tamis, and R. Jongbloed (2020). Seine fishing on the Dutch and German parts of the Dogger Bank, 2013-2019: Overview of the economic importance and the ecologic impact of the Belgian, British, Danish, Dutch, French, German and Swedish fleets, Wageningen: Wageningen Economic Research, (Wageningen Economic Research report 2020-105) – 43.

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. Fish. Res. 115, 31-43.

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, p. 24p.

Oostenbrugge, J.A.E. van, H. Bartelings, and F.C. Buisman (2010). Distribution maps for the North Sea fisheries; Methods and application in Natura 2000 areas. LEI, part of Wageningen UR.

Oostenbrugge, J.A.E. van, H. Bartelings and K.G. Hamon (2013). Fishing activities on the Central Oyster Grounds 2006-2011. The Hague, LEI, part of Wageningen UR.

Oostenbrugge, J.A.E. van, and K.G. Hamon (2014). Fishing activities on the Central Oyster Grounds. Supplement to LEI Memorandum 13-049. Den Haag, LEI Wageningen UR.

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.

Oostenbrugge, J.A.E. van, M.N.J. Turenhout, and K.G. Hamon (2016). Costs of seabed protection on the Frisian Front and Central Oyster Grounds for the Dutch fishing sector: addendum to LEI report 2015-145. No. 2016-062. LEI Wageningen UR.

Poos, J.J., M.N.J. Turenhout, H.A.E van Oostenbrugge, and A.D. Rijnsdorp (2013). Adaptive response of beam trawl fishers to rising fuel cost. Ices Journal of Marine Science 70, 675-684.

Stelzenmüller, V., A. Gimpel, J. Letschert, C. Kraan, and R. Döring (2020) Impact of the use of offshore wind and other marine renewables on European fisheries Policy Department for Structural and Cohesion Policies, Directorate-General for Internal Policies, PE 652.212. Thünen Institute of Sea Fisheries.

Appendix 1 Historical trend of the fishing activities

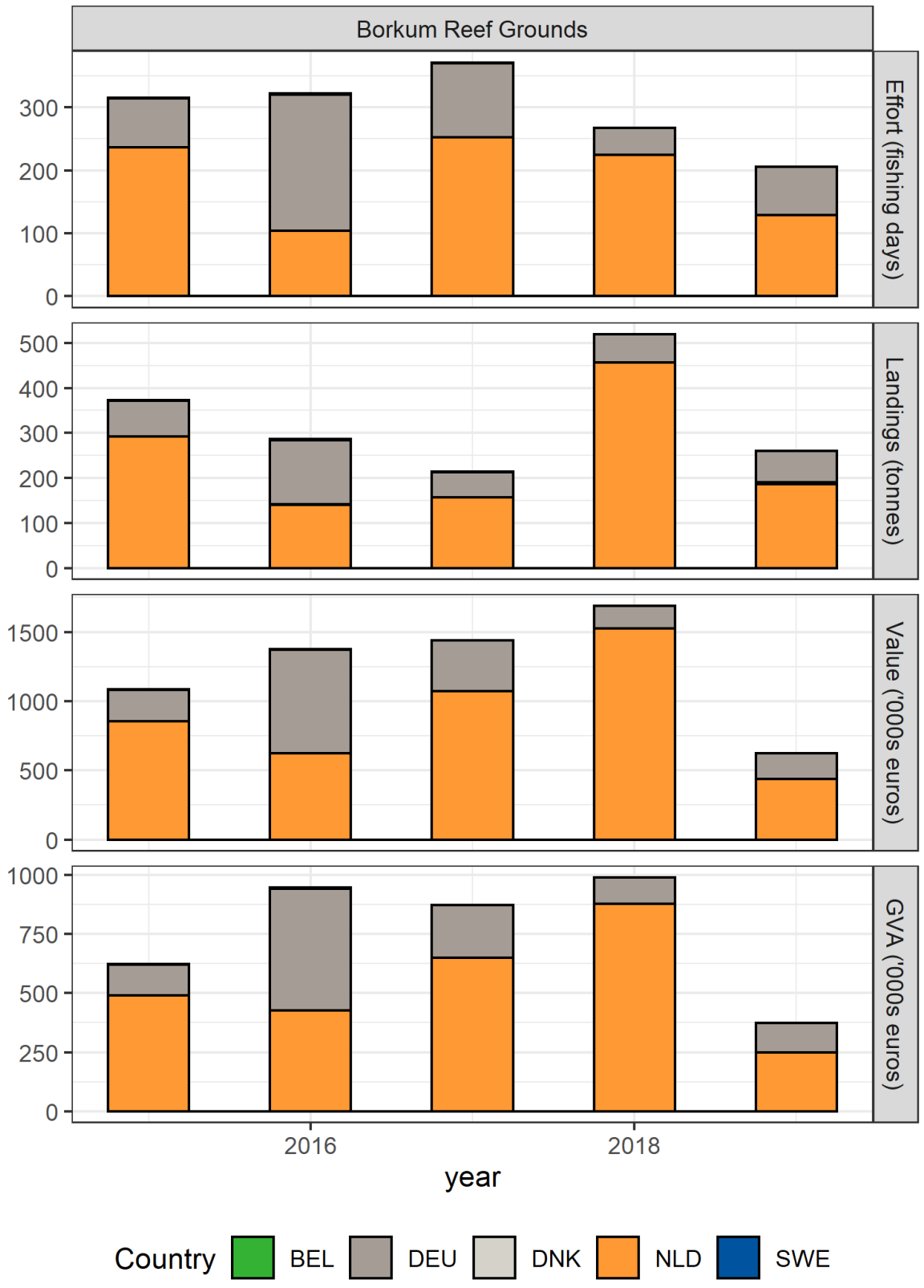

Figure A1.1 *Historical trend of the fishing activities by the different fleets in the Borkum Reef Grounds. Effort, landings, value of landings and GVA are given by country. France has declared no fishing activities in this area for the period 2015-2019*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

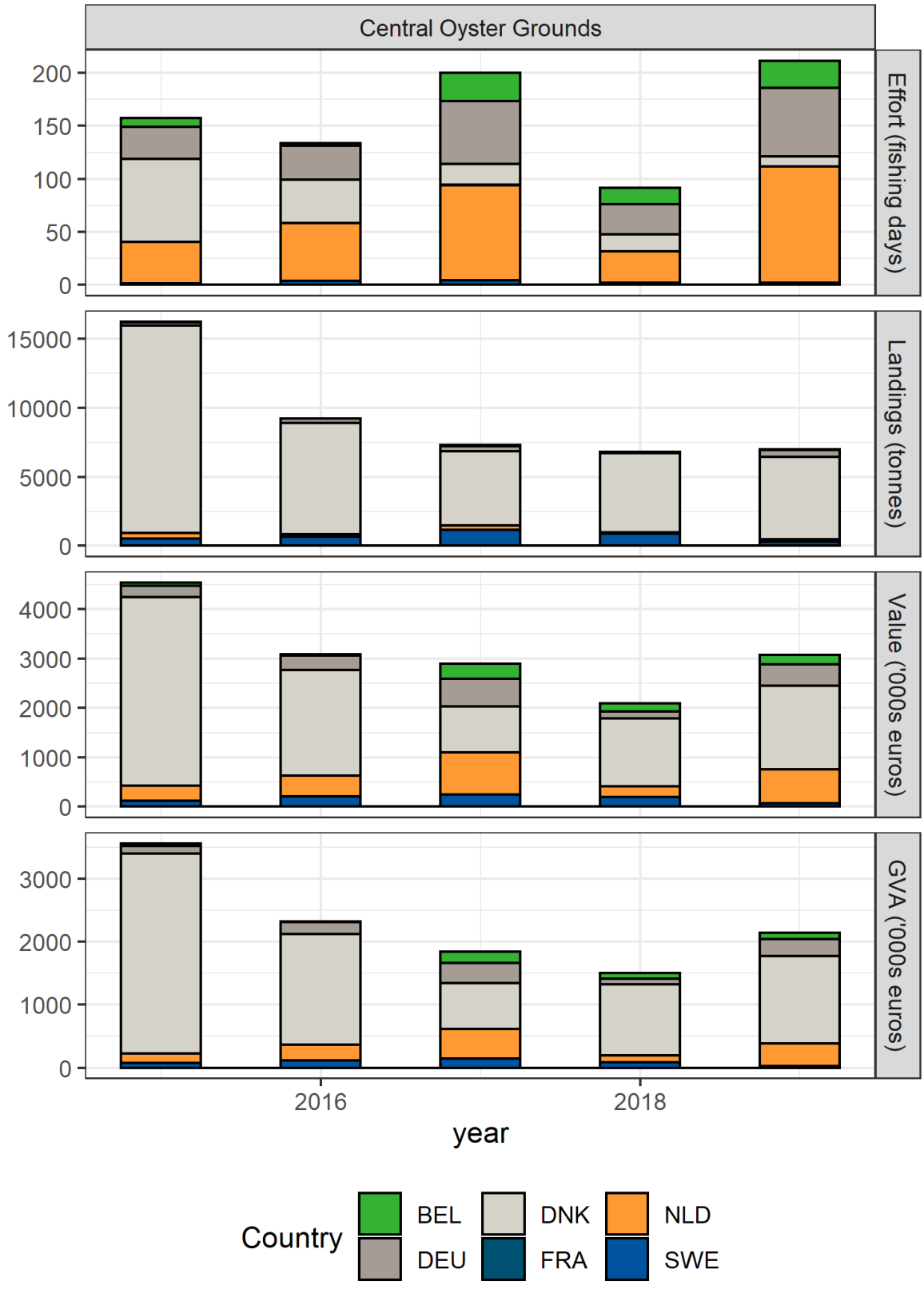

Figure A1.2 *Historical trend of the fishing activities by the different fleets in the Central Oyster Grounds. Effort, landings, value of landings and GVA are given by country*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

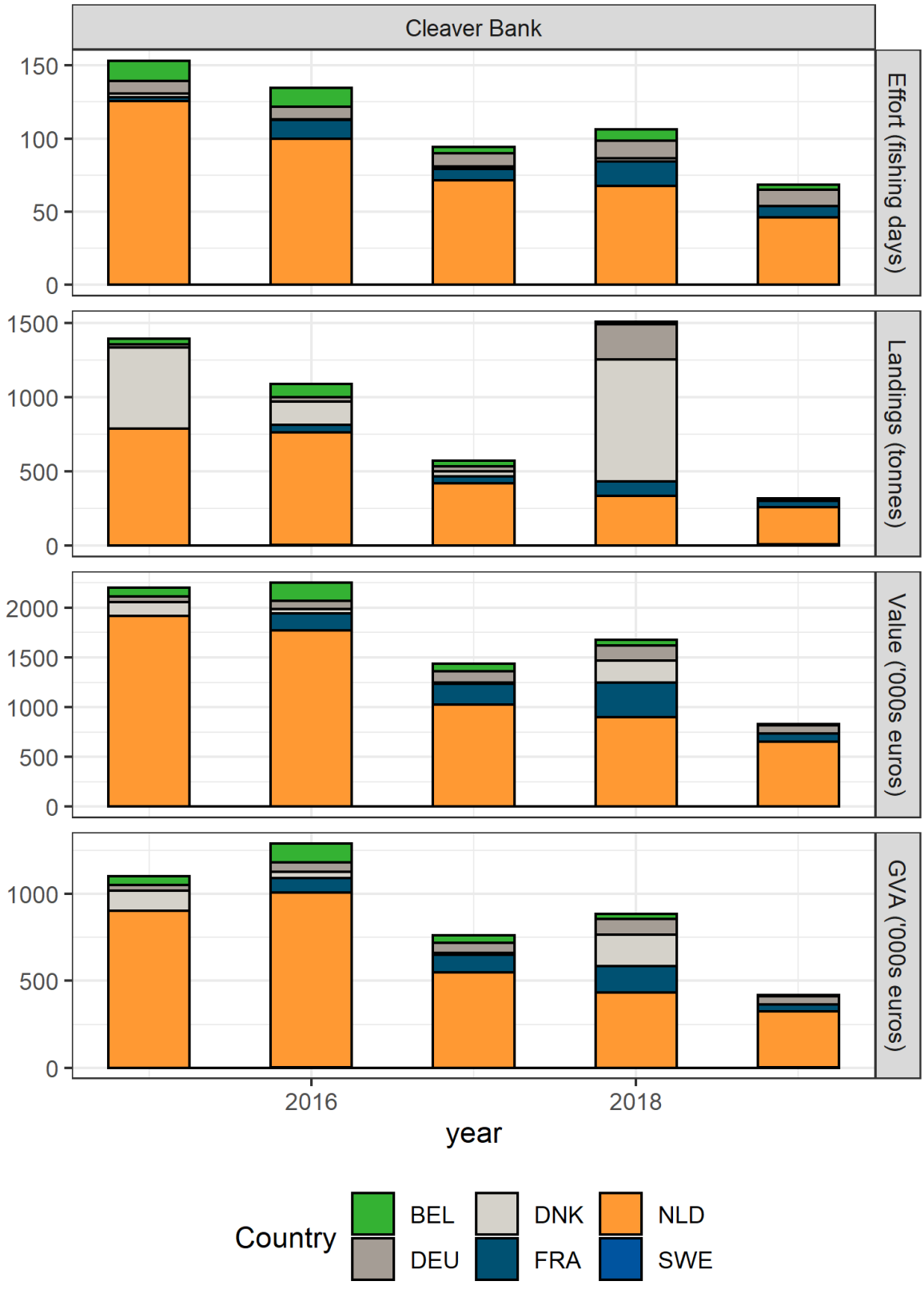

Figure A1.3 *Historical trend of the fishing activities by the different fleets in the Cleaver Bank. Effort, landings, value of landings and GVA are given by country*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

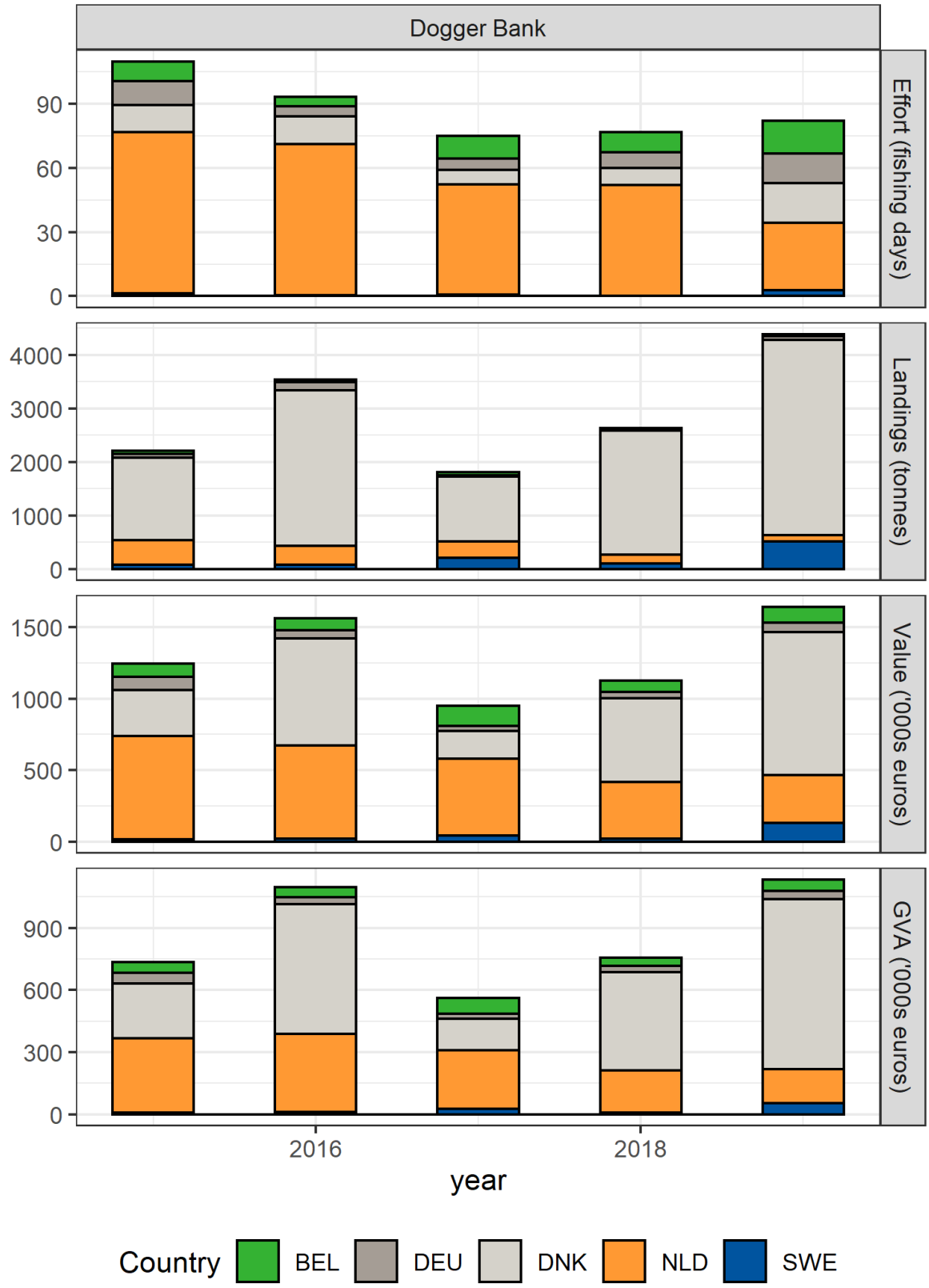

Figure A1.4 *Historical trend of the fishing activities by the different fleets in the Dogger Bank. Effort, landings, value of landings and GVA are given by country. France has declared no fishing activities in this area for the period 2015-2019*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

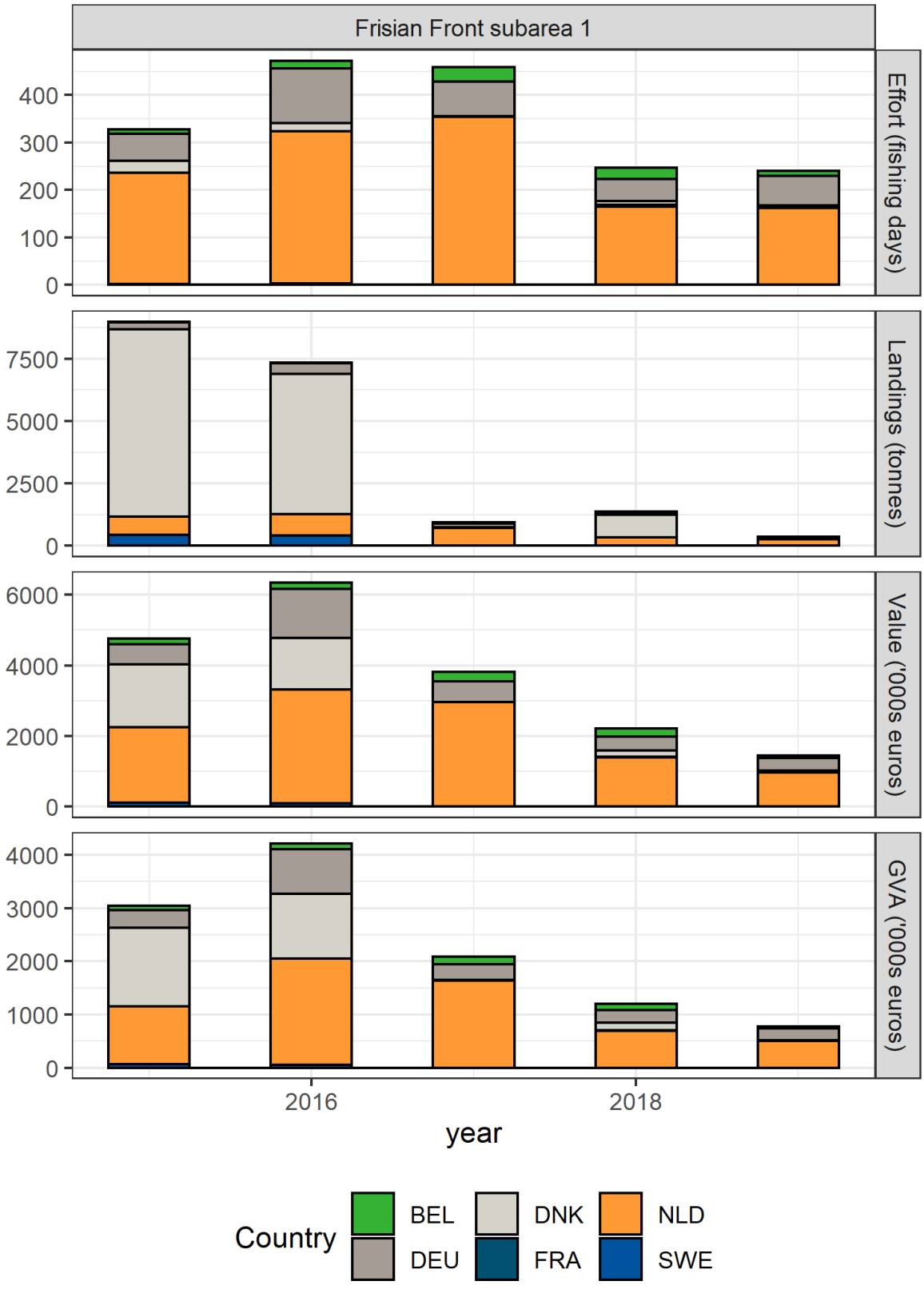

Figure A1.5 *Historical trend of the fishing activities by the different fleets in the Frisian Front subarea 1. Effort, landings, value of landings and GVA are given by country*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

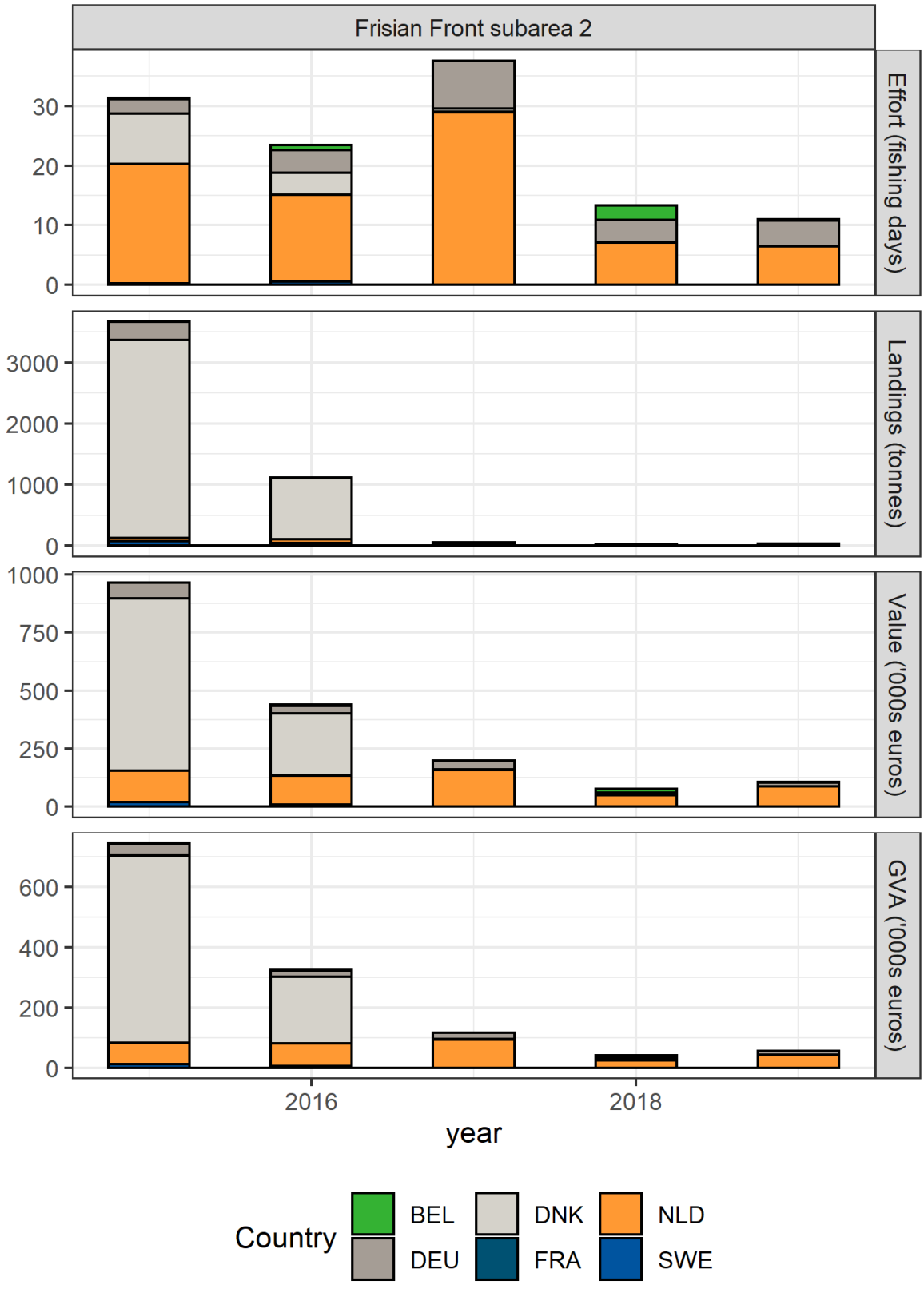

Figure A1.6 *Historical trend of the fishing activities by the different fleets in the Frisian Front subarea 2. Effort, landings, value of landings and GVA are given by country*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

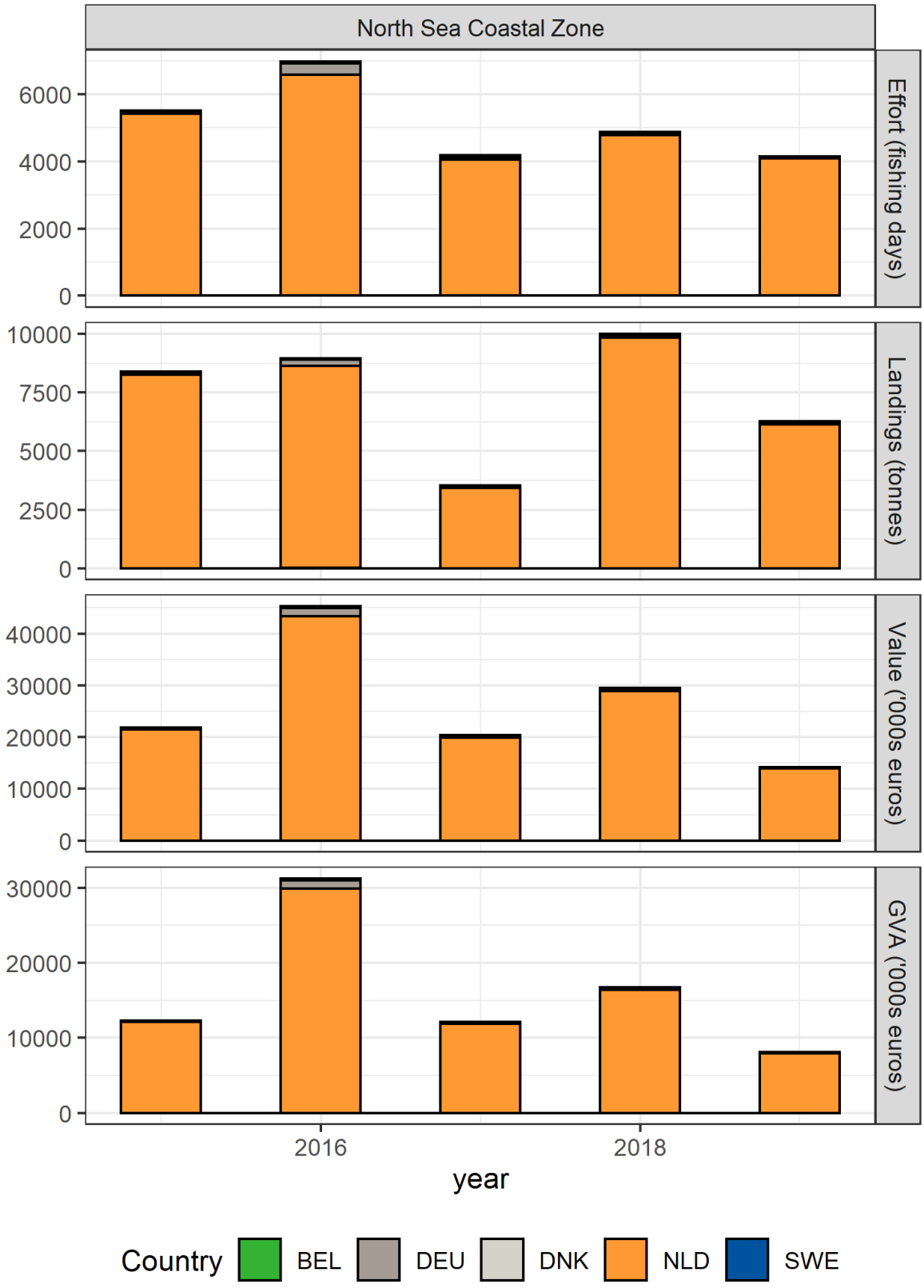

Figure A1.7 *Historical trend of the fishing activities by the different fleets in the North Sea Coastal Zone (N2000). Effort, landings, value of landings and GVA are given by country. France has declared no fishing activities in this area for the period 2015-2019*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

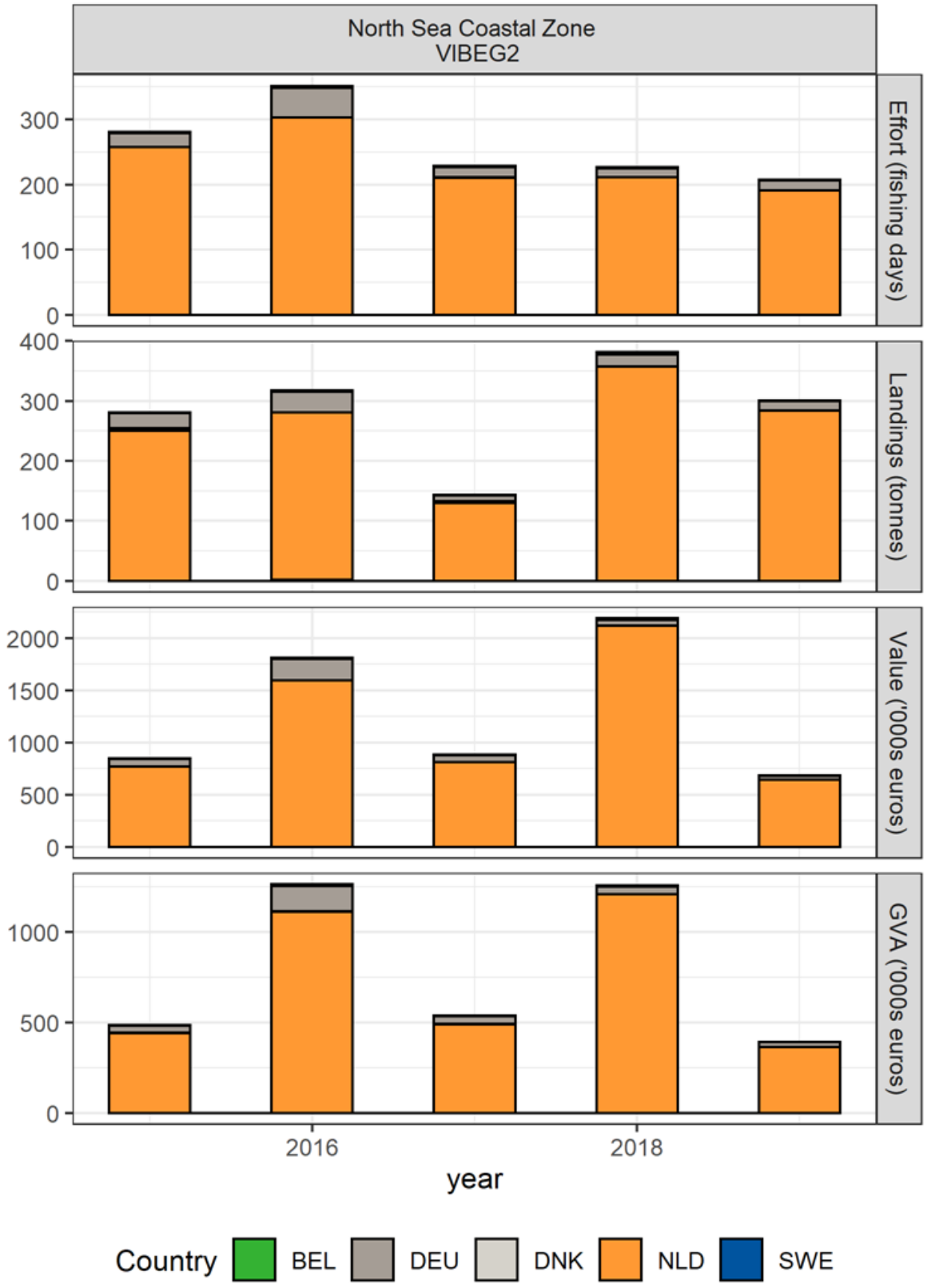

Figure A1.8 *Historical trend of the fishing activities by the different fleets in the North Sea Coastal Zone (VIBEG2). Effort, landings, value of landings and GVA are given by country. France has declared no fishing activities in this area for the period 2015-2019*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Appendix 2 Effort, landings, value and gross value added per area per km^2

Table A2.1 *Overview of effort, landings and values and gross value added of the fishing sector in the Borkum Reef Grounds per km^2 of the different fleets. France has declared no fishing activities in this area for the period 2015-2019*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	0.1	0.3	0.2	0.1	0.1	0.2
	DNK	>0.0	>0.0	0.0	>0.0	>0.0	>0.0
	NLD	0.4	0.2	0.4	0.3	0.2	0.3
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	0.5	0.5	0.6	0.4	0.3	0.5
Landings	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(tonnes)	DEU	0.1	0.2	0.1	0.1	0.1	0.1
	DNK	>0.0	>0.0	0.0	>0.0	>0.0	>0.0
	NLD	0.4	0.2	0.2	0.7	0.3	0.4
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	0.6	0.4	0.3	0.8	0.4	0.5
Value	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(1,000 euros)	DEU	0.3	1.1	0.6	0.3	0.3	0.5
	DNK	>0.0	>0.0	0.0	>0.0	>0.0	>0.0
	NLD	1.3	1.0	1.6	2.3	0.7	1.4
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	1.7	2.1	2.2	2.6	1.0	1.9
Gross Value	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
Added	DEU	0.2	0.8	0.3	0.2	0.2	0.3
(1,000 euros)	DNK	>0.0	>0.0	0.0	>0.0	>0.0	>0.0
	NLD	0.8	0.7	1.0	1.3	0.4	0.8
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	1.0	1.4	1.3	1.5	0.6	1.2

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Table A2.2 *Overview of effort, landings and values and gross value added of the fishing sector in the Central Oyster Grounds per km^2 of the different fleets*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	DNK	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	FRA	0.0	0.0	>0.0	0.0	0.0	>0.0
	NLD	>0.0	>0.0	>0.0	>0.0	0.1	>0.0
	SWE	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	Total	0.1	0.1	0.1	>0.0	0.1	0.1
Landings	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(tonnes)	DEU	0.1	0.2	0.2	>0.0	0.3	0.1
	DNK	7.3	3.9	2.6	2.8	2.9	3.9
	FRA	0.0	0.0	>0.0	0.0	0.0	>0.0
	NLD	0.2	0.1	0.2	>0.0	0.1	0.1
	SWE	0.3	0.3	0.6	0.4	0.1	0.3
	Total	7.9	4.5	3.5	3.3	3.4	4.5
Value	BEL	>0.0	>0.0	0.2	0.1	0.1	0.1
(1,000 euros)	DEU	0.1	0.1	0.3	0.1	0.2	0.2
	DNK	1.9	1.0	0.5	0.7	0.8	1.0
	FRA	0.0	0.0	>0.0	0.0	0.0	>0.0
	NLD	0.1	0.2	0.4	0.1	0.3	0.2
	SWE	0.1	0.1	0.1	0.1	>0.0	0.1
	Total	2.2	1.5	1.4	1.0	1.5	1.5
Gross Value	BEL	>0.0	>0.0	>0.1	>0.0	>0.0	>0.0
Added	DEU	0.1	0.1	0.2	>0.0	0.1	0.1
(1,000 euros)	DNK	1.5	0.9	0.4	0.5	0.7	0.8
	FRA	0.0	0.0	>0.0	0.0	0.0	>0.0
	NLD	0.1	0.1	0.2	0.1	0.2	0.1
	SWE	>0.0	0.1	0.1	>0.0	>0.0	>0.0
	Total	1.7	1.1	0.9	0.7	1.0	1.1

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Table A2.3 *Overview of effort, landings and values and gross value added of the fishing sector in the Cleaver Bank per km^2 of the different fleets*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	DNK	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	FRA	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	NLD	0.1	0.1	0.1	0.1	>0.0	0.1
	SWE	0.0	>0.0	0.0	0.0	>0.0	>0.0
	Total	0.1	0.1	0.1	0.1	0.1	0.1
Landings	BEL	>0.0	0.1	>0.0	>0.0	>0.0	>0.0
(tonnes)	DEU	>0.0	>0.0	>0.0	0.2	>0.0	0.1
	DNK	0.4	0.1	>0.0	0.7	>0.0	0.3
	FRA	>0.0	>0.0	>0.0	0.1	>0.0	>0.0
	NLD	0.6	0.6	0.3	0.3	0.2	0.4
	SWE	0.0	>0.0	0.0	0.0	>0.0	>0.0
	Total	1.1	0.9	0.5	1.2	0.3	0.8
Value	BEL	0.1	0.1	0.1	>0.0	>0.0	0.1
(1,000 euros)	DEU	>0.0	0.1	0.1	0.1	0.1	0.1
	DNK	0.1	>0.0	>0.0	0.2	>0.0	0.1
	FRA	>0.0	0.1	0.2	0.3	0.1	0.1
	NLD	1.5	1.4	0.8	0.7	0.5	1.0
	SWE	0.0	>0.0	0.0	0.0	>0.0	>0.0
	Total	1.8	1.8	1.2	1.4	0.7	1.4
Gross Value	BEL	>0.0	0.1	>0.0	>0.0	>0.0	>0.0
Added	DEU	>0.0	>0.0	>0.0	0.1	>0.0	>0.0
(1,000 euros)	DNK	0.1	>0.0	>0.0	0.1	>0.0	0.1
	FRA	>0.0	0.1	0.1	0.1	>0.0	0.1
	NLD	0.7	0.8	0.4	0.3	0.3	0.5
	SWE	0.0	>0.0	0.0	0.0	>0.0	>0.0
	Total	0.9	1.0	0.6	0.7	0.3	0.7

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Table A2.4 *Overview of effort, landings and values and gross value added of the fishing sector in the Dogger Bank per km^2 of the different fleets. France has declared no fishing activities in this area for the period 2015-2019*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	DNK	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	NLD	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	SWE	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	Total	0.1	>0.0	>0.0	>0.0	>0.0	>0.0
Landings	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(tonnes)	DEU	>0.0	0.1	>0.0	>0.0	>0.0	>0.0
	DNK	0.8	1.5	0.6	1.2	1.9	1.2
	NLD	0.2	0.2	0.2	0.1	0.1	0.1
	SWE	>0.0	>0.0	0.1	>0.0	0.3	0.1
	Total	1.1	1.8	0.9	1.4	2.3	1.5
Value	BEL	>0.0	>0.0	0.1	>0.0	0.1	0.1
(1,000 euros)	DEU	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	DNK	0.2	0.4	0.1	0.3	0.5	0.3
	NLD	0.4	0.3	0.3	0.2	0.2	0.3
	SWE	>0.0	>0.0	>0.0	>0.0	0.1	>0.0
	Total	0.6	0.8	0.5	0.6	0.9	0.7
Gross Value	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
Added	DEU	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(1,000 euros)	DNK	0.1	0.3	0.1	0.2	0.4	0.2
	NLD	0.2	0.2	0.1	0.1	0.1	0.1
	SWE	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	Total	0.4	0.6	0.3	0.4	0.6	0.4

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Table A2.5 *Overview of effort, landings and values and gross value added of the fishing sector in the Frisian Front subarea 1 per km^2 of the different fleets*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	>0.0	0.1	>0.0	>0.0	>0.0	>0.0
	DNK	>0.0	>0.0	>0.0	>0.0	0.0	>0.0
	FRA	0.0	0.0	0.0	>0.0	>0.0	>0.0
	NLD	0.1	0.2	0.2	0.1	0.1	0.1
	SWE	>0.0	>0.0	0.0	0.0	>0.0	>0.0
	Total	0.2	0.3	0.3	0.1	0.1	0.2
Landings	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(tonnes)	DEU	0.2	0.3	0.1	>0.0	>0.0	0.1
	DNK	4.5	3.4	>0.0	0.5	0.0	1.7
	FRA	0.0	0.0	0.0	>0.0	>0.0	>0.0
	NLD	0.4	0.5	0.4	0.2	0.2	0.3
	SWE	0.3	0.3	0.0	0.0	>0.0	0.1
	Total	5.4	4.4	0.6	0.8	0.2	2.3
Value	BEL	0.1	0.1	0.2	0.1	>0.0	0.1
(1,000 euros)	DEU	0.3	0.8	0.4	0.2	0.2	0.4
	DNK	1.1	0.9	>0.0	0.1	0.0	0.4
	FRA	0.0	0.0	0.0	>0.0	>0.0	>0.0
	NLD	1.3	1.9	1.8	0.8	0.6	1.3
	SWE	0.1	0.1	0.0	0.0	>0.0	>0.0
	Total	2.9	3.8	2.3	1.3	0.9	2.2
Gross Value	BEL	0.1	0.1	0.1	0.1	>0.0	0.1
Added	DEU	0.2	0.5	0.2	0.1	0.1	0.2
(1,000 euros)	DNK	0.9	0.7	>0.0	0.1	0.0	0.3
	FRA	0.0	0.0	0.0	>0.0	>0.0	>0.0
	NLD	0.7	1.2	1.0	0.4	0.3	0.7
	SWE	>0.0	>0.0	0.0	0.0	>0.0	>0.0
	Total	1.8	2.5	1.3	0.7	0.5	1.4

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Table A2.6 *Overview of effort, landings and values and gross value added of the fishing sector in the Frisian Front subarea 2 per km^2 of the different fleets*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
	DNK	>0.0	>0.0	>0.0	0.0	0.0	>0.0
	FRA	0.0	>0.0	>0.0	0.0	0.0	>0.0
	NLD	0.1	>0.0	0.1	>0.0	>0.0	>0.0
	SWE	>0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	0.1	0.1	0.1	>0.0	>0.0	0.1
Landings	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(tonnes)	DEU	0.8	>0.0	>0.0	>0.0	>0.0	0.2
	DNK	8.9	2.7	>0.0	0.0	0.0	2.3
	FRA	0.0	>0.0	>0.0	0.0	0.0	>0.0
	NLD	0.1	0.2	0.1	0.1	0.1	0.1
	SWE	0.2	0.1	0.0	0.0	0.0	0.1
	Total	10.0	3.0	0.1	0.1	0.1	2.7
Value	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(1,000 euros)	DEU	0.2	0.1	0.1	>0.0	>0.0	0.1
	DNK	2.0	0.7	>0.0	0.0	0.0	0.6
	FRA	0.0	>0.0	>0.0	0.0	0.0	>0.0
	NLD	0.4	0.3	0.4	0.1	0.2	0.3
	SWE	0.1	>0.0	0.0	0.0	0.0	>0.0
	Total	2.6	1.2	0.5	0.2	0.3	1.0
Gross Value	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
Added	DEU	0.1	0.1	0.1	>0.0	>0.0	0.1
(1,000 euros)	DNK	1.7	0.6	>0.0	0	0	0.8
	FRA	0	>0.0	>0.0	0	0	>0.0
	NLD	0.2	0.2	0.3	0.1	0.1	0.2
	SWE	>0.0	>0.0	0	0	0	>0.0
	Total	2.0	0.9	0.3	0.1	0.1	0.7

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Table A2.7 *Overview of effort, landings and values and gross value added of the fishing sector in the North Sea Coastal Zone (N2000) per km^2 of the different fleets. France has declared no fishing activities in this area for the period 2015-2019*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	0.1	0.2	>0.0	>0.0	>0.0	0.1
	DNK	>0.0	0.0	>0.0	>0.0	>0.0	>0.0
	NLD	3.7	4.6	2.8	3.3	2.8	3.5
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	3.8	4.8	2.9	3.4	2.9	3.6
Landings	BEL	>0.0	>0.0	>0.0	0.1	>0.0	>0.0
(tonnes)	DEU	0.1	0.2	>0.0	>0.0	>0.0	0.1
	DNK	>0.0	0.0	>0.0	>0.0	>0.0	>0.0
	NLD	5.7	6.0	2.4	6.8	4.3	5.0
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	5.8	6.2	2.4	6.9	4.3	5.1
Value	BEL	0.1	0.3	0.1	0.3	>0.0	0.1
(1,000 euros)	DEU	0.2	1.1	0.2	0.1	0.1	0.3
	DNK	>0.0	0.0	>0.0	>0.0	>0.0	>0.0
	NLD	14.9	30.0	13.8	20.0	9.7	17.7
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	15.1	31.4	14.1	20.4	9.8	18.2
Gross Value	BEL	>0.0	0.2	0.1	0.1	>0.0	0.1
Added	DEU	0.1	0.8	0.1	0.1	0.1	0.2
(1,000 euros)	DNK	>0.0	0.0	>0.0	>0.0	>0.0	>0.0
	NLD	8.4	20.7	8.2	11.4	5.5	10.8
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	8.5	21.6	8.4	11.6	5.6	11.1

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Table A2.8 *Overview of effort, landings and values and gross value added of the fishing sector in the North Sea Coastal Zone (VIBEG2) per km^2 of the different fleets. France has declared no fishing activities in this area for the period 2015-2019*

	Country	2015	2016	2017	2018	2019	Average
Effort	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(days at sea)	DEU	0.1	0.3	0.1	0.1	0.1	0.1
	DNK	>0.0	>0.0	>0.0	>0.0	0.0	>0.0
	NLD	1.6	1.9	1.3	1.3	1.2	1.5
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	1.8	2.2	1.4	1.4	1.3	1.6
Landings	BEL	>0.0	>0.0	>0.0	>0.0	>0.0	>0.0
(tonnes)	DEU	0.2	0.2	0.1	0.1	0.1	0.1
	DNK	>0.0	>0.0	>0.0	>0.0	0.0	>0.0
	NLD	1.6	1.8	0.8	2.3	1.8	1.6
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	1.8	2.0	0.9	2.4	1.9	1.8
Value	BEL	>0.0	0.1	>0.0	0.1	>0.0	0.1
(1,000 euros)	DEU	0.4	1.3	0.4	0.4	0.3	0.6
	DNK	>0.0	>0.0	>0.0	>0.0	0.0	>0.0
	NLD	4.9	10.1	5.1	13.4	4.1	7.5
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	5.4	11.5	5.6	13.9	4.3	8.1
Gross Value	BEL	>0.0	0.1	>0.0	0.1	>0.0	>0.0
Added	DEU	0.2	0.9	0.3	0.2	0.2	0.4
(1,000 euros)	DNK	>0.0	>0.0	>0.0	>0.0	0.0	>0.0
	NLD	2.8	7.0	3.1	7.7	2.3	4.6
	SWE	0.0	>0.0	0.0	0.0	0.0	>0.0
	Total	3.1	8.0	3.4	8.0	2.5	5.0

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

Appendix 3 Historical trends of fishing activities per gear

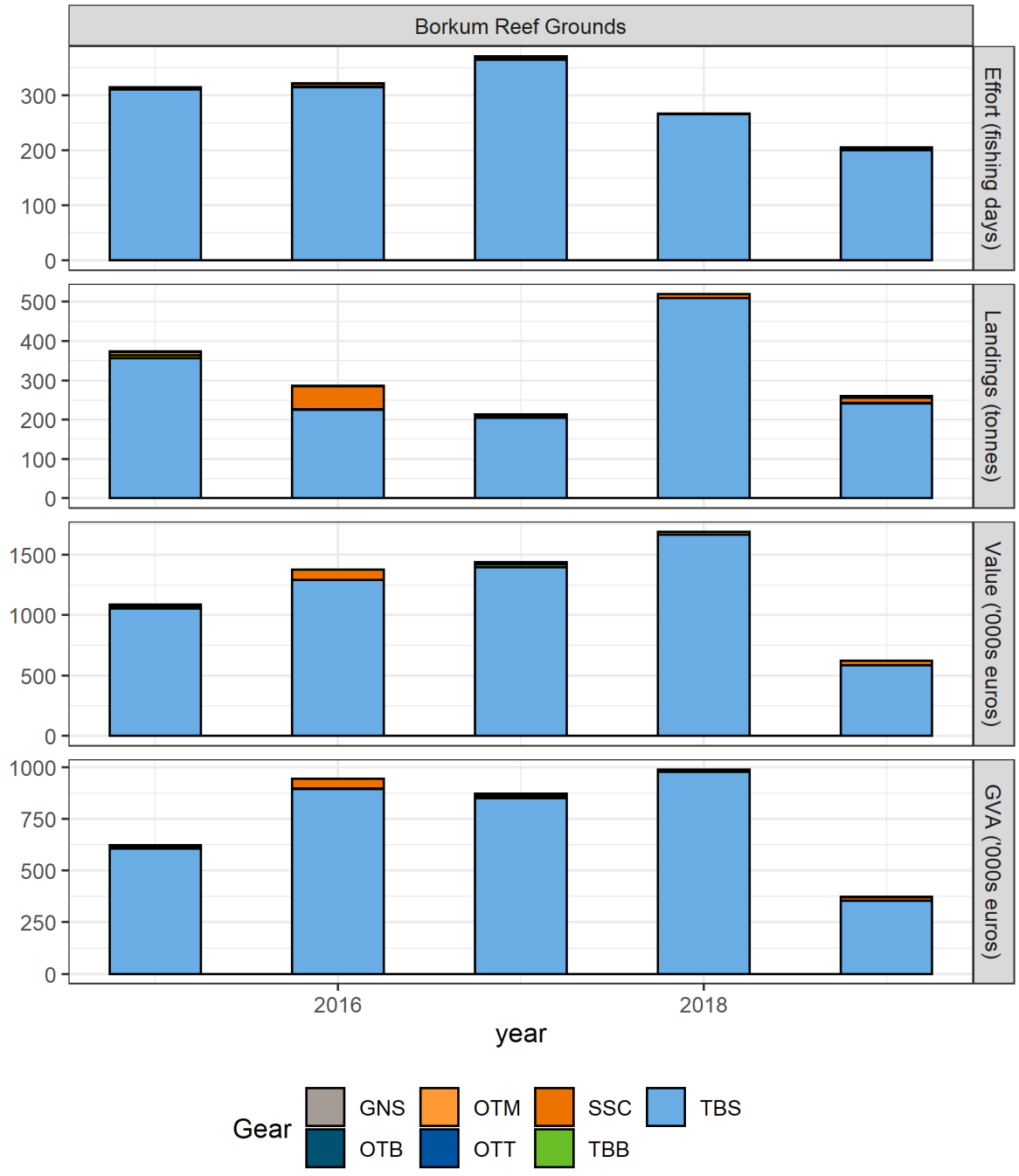

Figure A3.1 *Historical trend of the fishing activities in the Borkum Reef Grounds with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; TBS: shrimp trawls, GNS: set gillnets (anchored)) in the proposed closure of the Borkum Reef Grounds for the different countries. Effort, landings, value of landings and GVA are given*

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

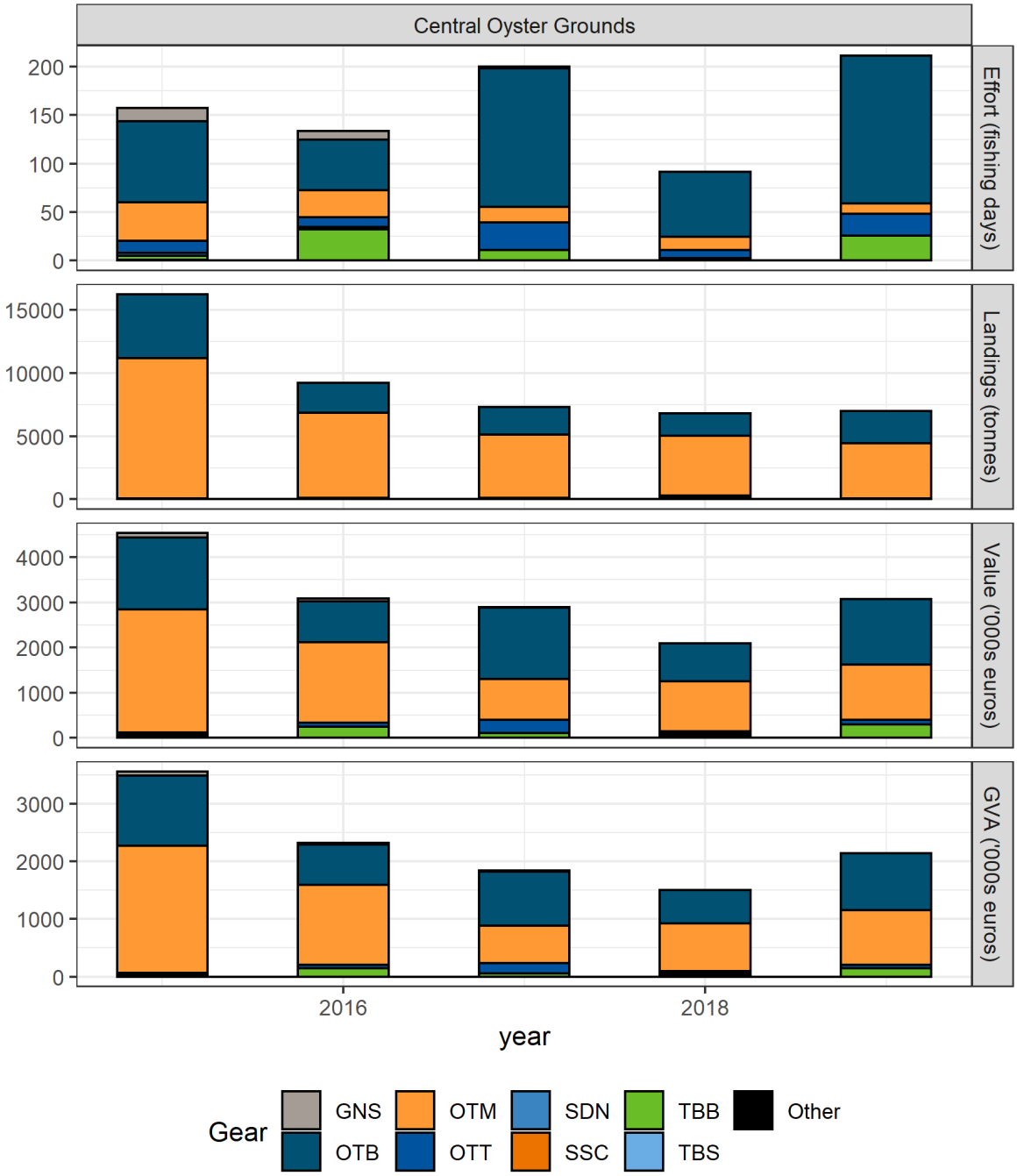

Figure A3.2 *Historical trend of the fishing activities in the Central Oyster Grounds with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; TBS: shrimp trawls, GNS: set gillnets (anchored); Other: other gears) in the proposed closure of the Central Oyster Grounds for the different countries. Effort, landings, value of landings and GVA are given*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

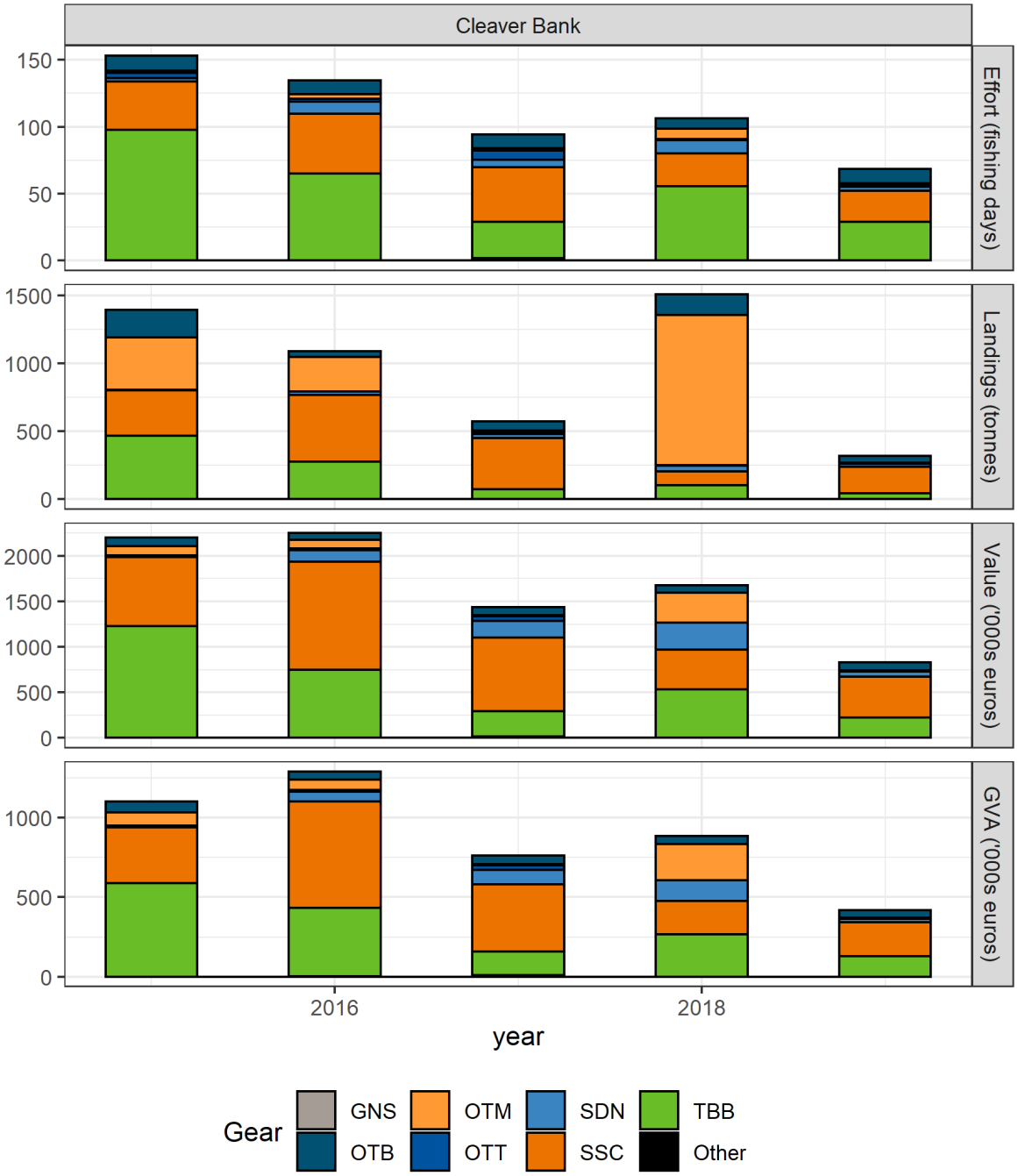

Figure A3.3 *Historical trend of the fishing activities in the Cleaver Bank with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; Other: other gears) in the proposed closure of the Cleaver Bank for the different countries. Effort, landings, value of landings and GVA are given*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

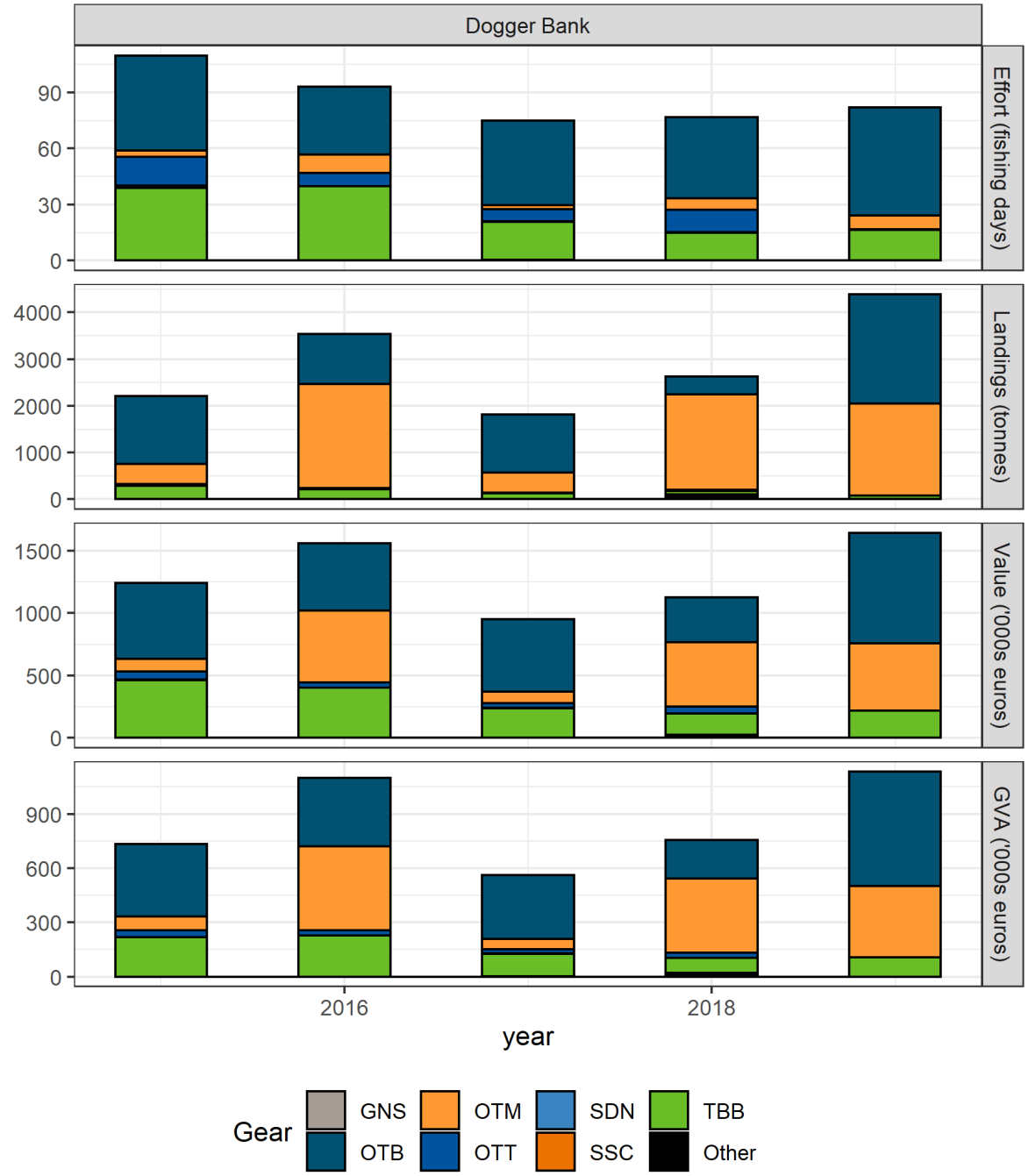

Figure A3.4 *Historical trend of the fishing activities in the Dogger Bank with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; Other: other gears) in the proposed closure of the Dogger Bank for the different countries. Effort, landings, value of landings and GVA are given*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

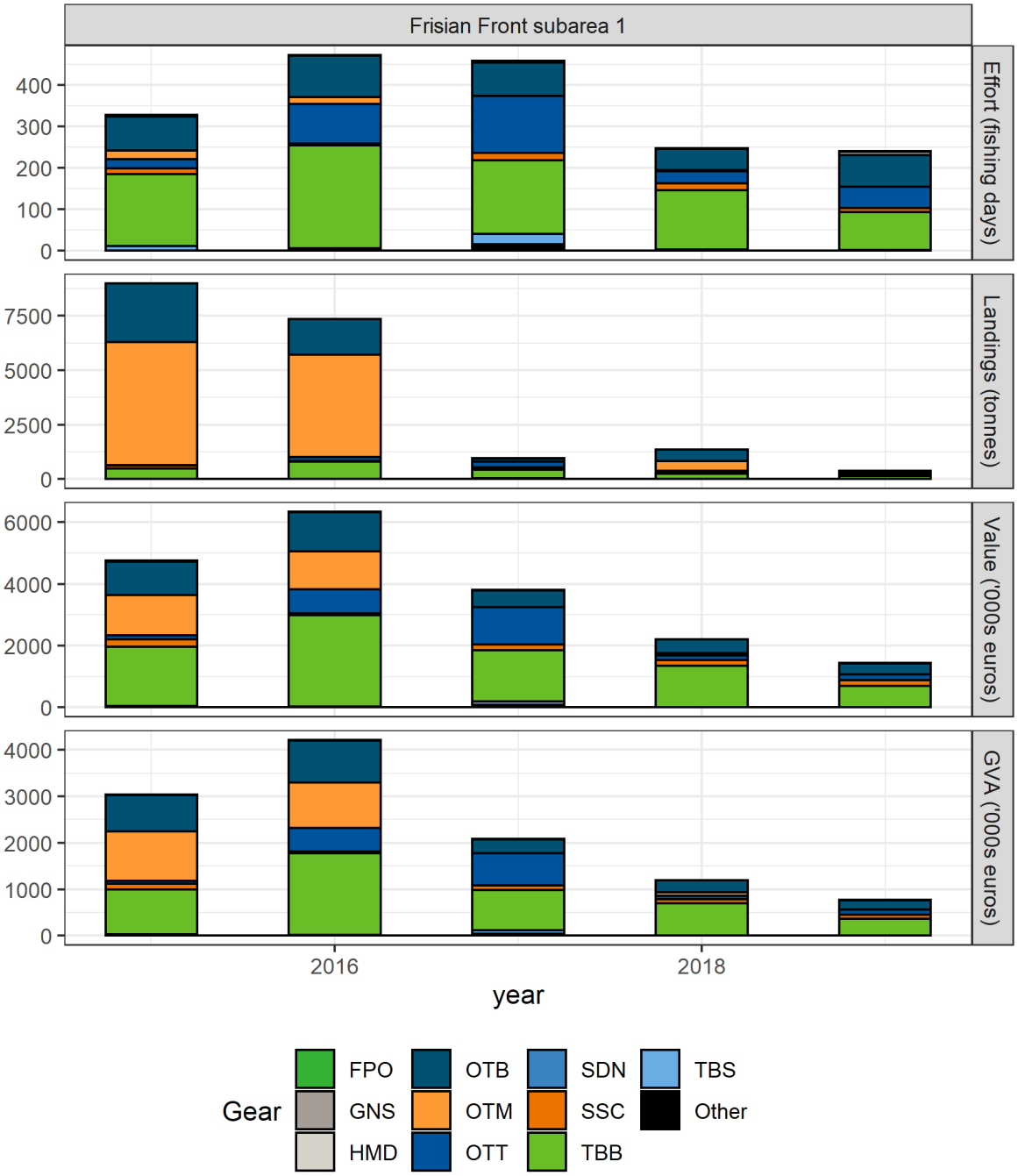

Figure A3.5 *Historical trend of the fishing activities in the Frisian Front subarea 1 with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; TBS: shrimp trawls, GNS: set gillnets (anchored); FPO: Pots; Other: other gears) in the proposed closure of the Frisian Front subarea 1 for the different countries. Effort, landings, value of landings and GVA are given*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

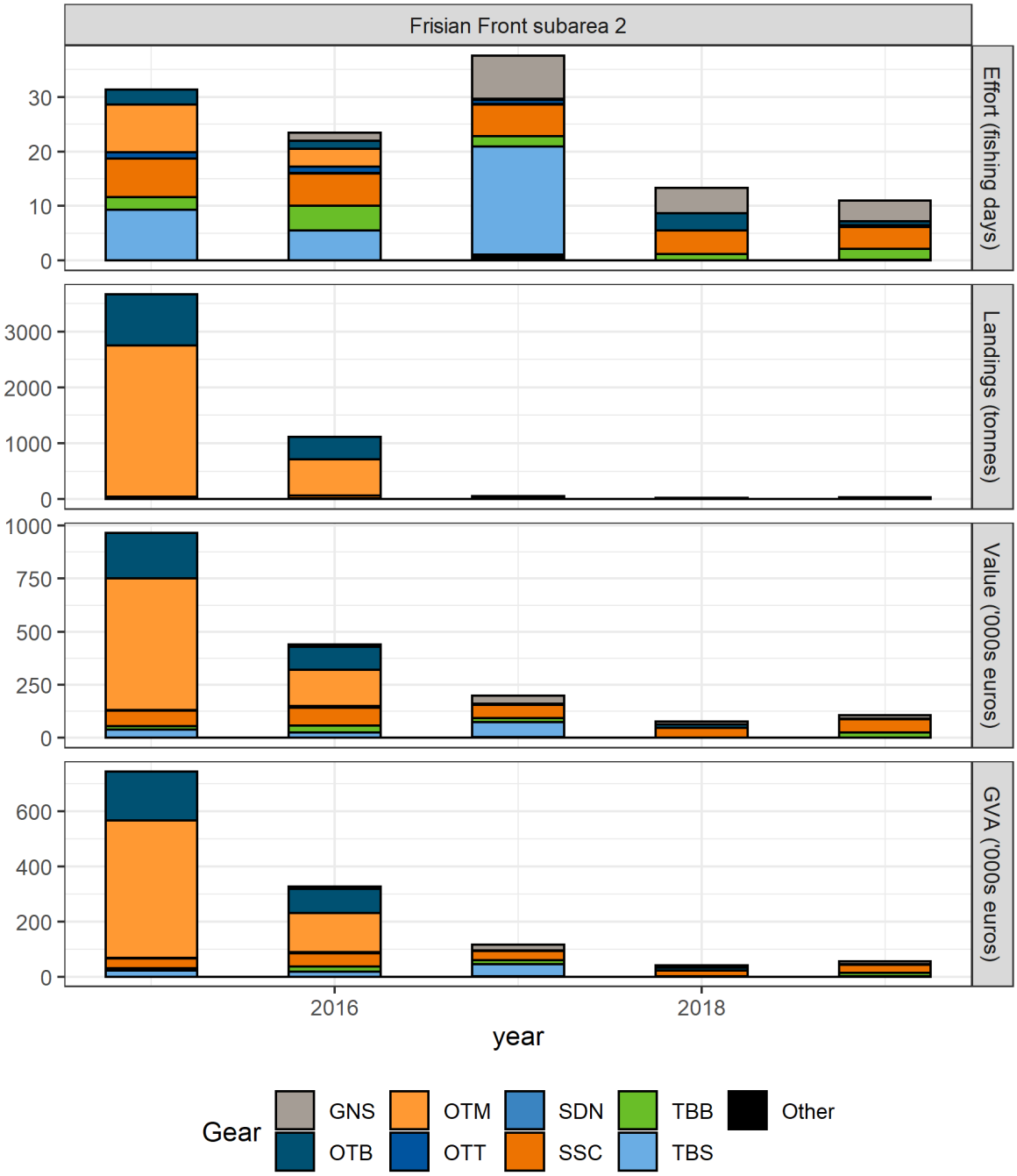

Figure A3.6 *Historical trend of the fishing activities in the Frisian Front subarea 2 with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; TBS: shrimp trawls, GNS: set gillnets (anchored); Other: other gears) in the proposed closure of the Frisian Front subarea 2 for the different countries. Effort, landings, value of landings and GVA are given*
Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

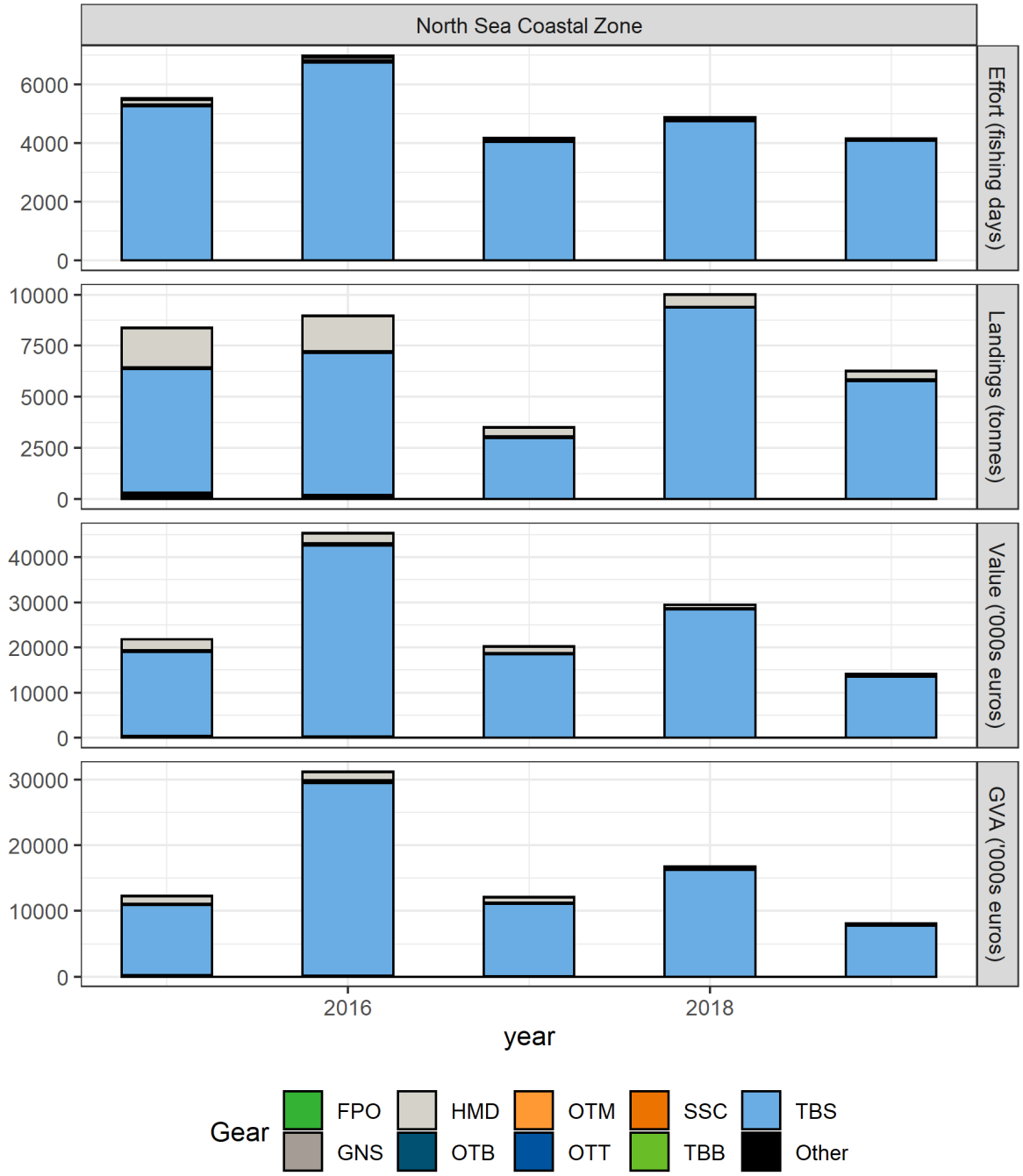

Figure A3.7 *Historical trend of the fishing activities in the North Sea Coastal Zone (N2000) with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; TBS: shrimp trawls, GNS: set gillnets (anchored); FPO: Pots; HMD: Mechanised dredges, Other: other gears) in the proposed closure of the North Sea Coastal Zone for the different countries. Effort, landings, value of landings and GVA are given*

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

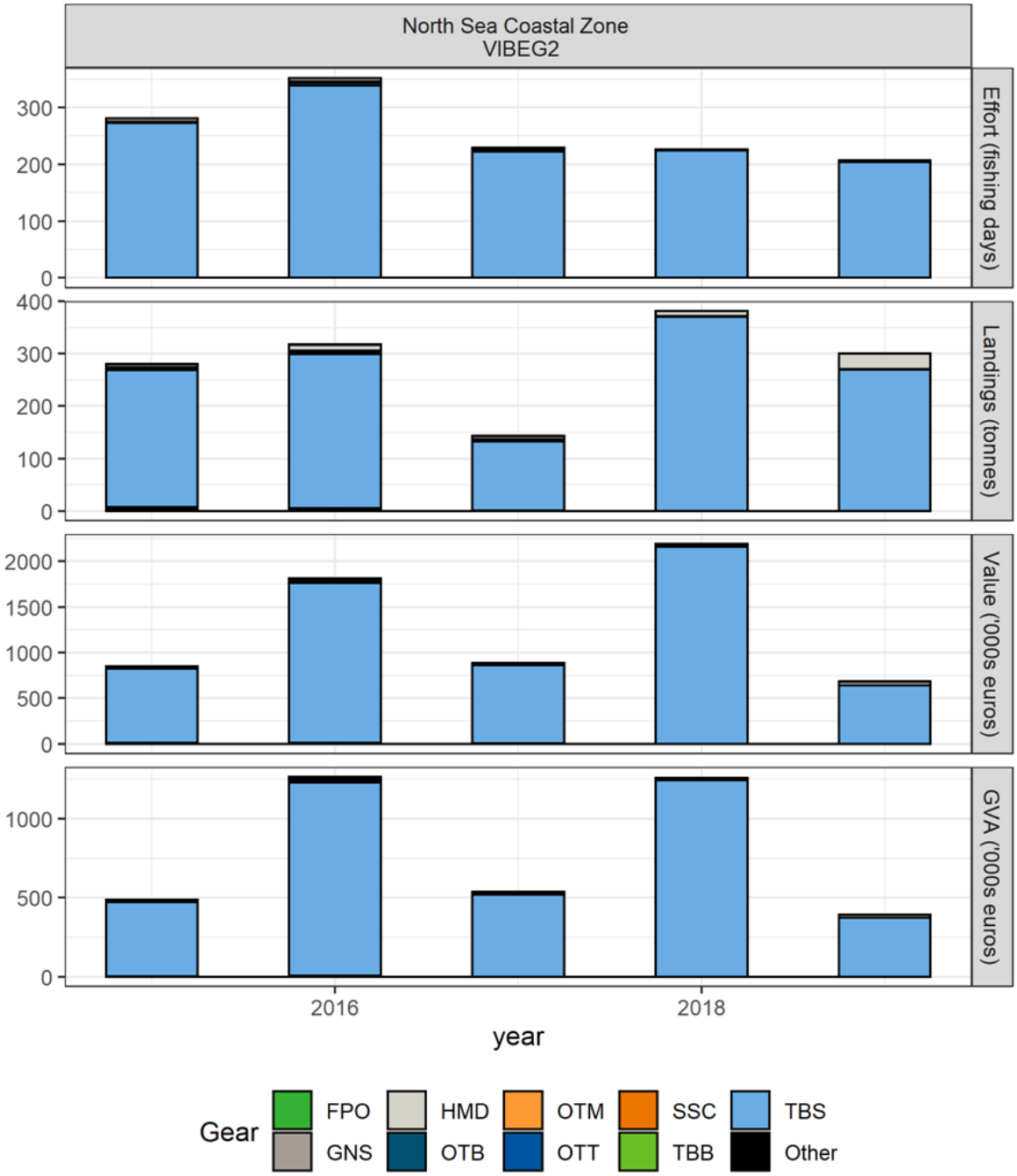

Figure A3.8 *Historical trend of the fishing activities in the North Sea Coastal Zone (VIBEG2) with different gears (OTB: bottom otter trawls; OTT: otter twin trawls; SDN: Danish seines; SSC: Scottish seines; TBB: beam trawls; OTM: otter trawls midwater; TBS: shrimp trawls, GNS: set gillnets (anchored); FPO: Pots; HMD: Mechanised dredges, Other: other gears) in the proposed closure of the North Sea Coastal Zone for the different countries. Effort, landings, value of landings and GVA are given*

Source: Logbook data and VMS data and data from the Annual Economic report (STECF 2020), processed by WUR, DTUAQUA, TI, ILVO, SLU and IFREMER.

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
2021-038

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
T +31 (0)70 335 83 30
E communications.ssg@wur.nl
www.wur.eu/economic-research

Report 2021.038
ISBN 978-94-6395-839-4

The mission of Wageningen University & 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, 6,800 employees (6,000 fte) and 12,900 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.