Costs of the final proposal for seabed protection on the Frisian Front and Central Oyster Grounds for the Dutch fishing sector

Addendum to LEI report 2015-145

Hans van Oostenbrugge, Mike Turenhout and Katell Hamon

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In aanvulling op de kosten-batenanalyse die in Van Oostenbrugge et al. (2015) is uitgevoerd, biedt deze nota een schatting van de kosten van sluiting van gebieden voor de Nederlandse visserij voor het beschermen van het bentische ecosysteem van het Friese Front en de Centrale Oestergronden. De kosten van sluiting variëren tussen 1,8 en 5,7 mln. euro, afhankelijk van de onderliggende aannames.

This memorandum provides an estimation of the costs for closures for the protection of the benthic ecosystem on the Frisian Front and the Central Oyster Grounds for the Dutch fishing sector in addition to the cost-benefit analysis carried out in Van Oostenbrugge et al. (2015). The costs of the closures vary between 1.8 and 5.7m euros, depending on the assumptions chosen for external developments (PEI scenarios) and the effects of displacement (displacement scenarios).

Key words: Fisheries, closures

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Summary

S.1 Key findings

The closures for protection of the benthic communities of the Frisian Front and the Central Oyster Grounds proposed by the Ministry of Economic Affairs and the Ministry of Infrastructure and the Environment (Figure S.1) lead to a reduction of the Net Present Value of the Gross Value Added of 0 to 5.7m euros, depending on the assumptions chosen for external developments (PEI scenarios) and the effects of displacement (displacement scenarios) (Table S.1). The current memorandum provides an overview of these costs in addition to the results of Van Oostenbrugge et al. (2015). The costs are comparable to the lowest costs of the variants that were evaluated in June 2016 (Van Oostenbrugge et al., 2016).

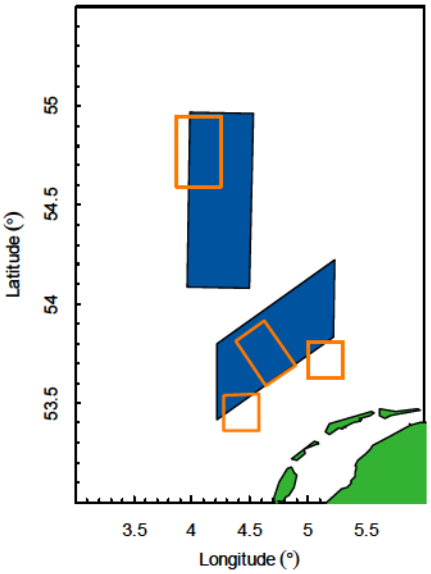


Figure S.1 *Maps of the areas taken into consideration*
Source: Ministry of I&M, processed by Wageningen Economic Research.

The proposed closures (Figure S.1) cover a total area of 2,400 km^2, which is split into one subarea in the Central Oyster Grounds and three in the Frisian Front.

Table S.1 *Overview of fishing activities in the areas (average 2008-2014) and the costs of closures in case of 4 Policy Innovation and Economics scenarios (PEI scenario 0-3) and 3 Displacement scenario (A-C). NPV, Net Present Value (future discounted costs over 30-year period); GVA, Gross Value Added*

Type of costs/benefits			
Fishing activities			
Days at sea		248	
Landings volume (tonnes)		591	
Landings value (m euros)		1.4	
GVA (m euros)		0.5	
Costs of closures (NPV of GVA, m euros)			
Displacement scenario	**A**	**B**	**C**
PEI scenario 0	1.8	3.9	0
PEI scenario 1	2.2	5.7	0
PEI scenario 2	1.8	3.5	0
PEI scenario 3	2.1	5.1	0

Depending on the assumptions taken, the total costs for the Dutch fishing sector, measured as the negative effect on net present value of the gross value added, range from 0 to 5.7m euros (Table S.1).

This memorandum provides additional information on the estimated costs of the closures for the Dutch fisheries. The results show that the absolute values of the future costs are highly uncertain and dependent on both external developments (prices, fish populations, management etc.) and the behavioural changes of fishermen and their economic consequences. Displacement scenario C assumes that the fishermen will be able to reallocate their fishing activities without having any costs.

S.2 Complementary findings

When compared to the original variants as defined in Van Oostenbrugge et al. (2015), the effects on the fishing sector of the closures in this memorandum are intermediate. The economic effect is comparable to the effect of variant Capelin. Compared to the variants presented to the parliament in June 2016, the effects are low (Van Oostenbrugge et al., 2016). The effects of the closures are relatively low, when taking into account that the total size of the closures is much larger (2,400 km^2) than the surface area of variant Capelin (1,600 km^2). The main reason for this is the fact that a large part of the extra 800 km^2 is situated south of the Frisian front in an area with low fishing intensity.

S.3 Method

This memorandum is a partial extension of the complete cost-benefit analysis carried out by Van Oostenbrugge et al. (2015) to estimate the costs for the Dutch fishing sector of a set closures of areas in the Frisian Front and the Central Oyster Grounds. These closures for demersal fishing activities are set up in order to protect the benthic habitats. The study was commissioned by the Ministry of Infrastructure and the Environment and carried out by Wageningen Economic Research.

In Van Oostenbrugge et al. (2015) other costs (including social effects, monitoring costs and enforcement costs) and ecological benefits were assessed as well as the importance of foreign fleets in the area. The inclusion of these other effects would be beneficial for a proper evaluation of the effectiveness of the area closures in reaching their management objectives.

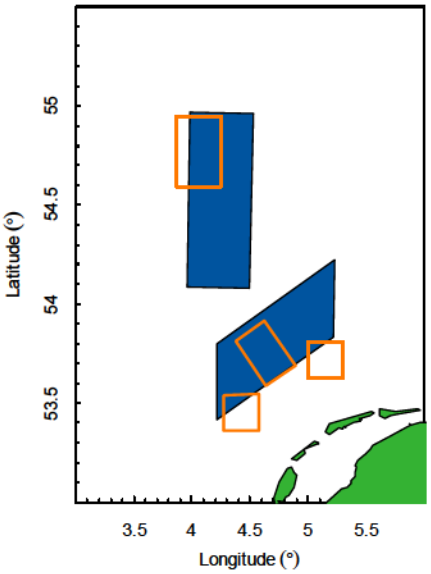
The costs for the Dutch fishing sector were estimated using the methodology developed by Van Oostenbrugge et al. (2015). The main steps taken are:

- An inventory of the fishing activities in the areas is based on an analysis of detailed vessel position data (VMS), official logbook data and economic data from the Wageningen Economic Research panel.
- Estimations of the economic value of the areas were made using four Policy, Economy and Innovation scenarios (PEI scenarios) which combined expected developments on fish stocks, fish prices, fuel prices, technical developments, management measures and other area closures.
- Costs of closing the areas were assessed using three displacement scenarios. These were based on scientific publications (scenario A), expert knowledge from the fishing sector (scenario B) and the assumption that the sector would be able to reallocate their activities without any costs (scenario C).
- The resulting costs were combined into one indicator for the economic costs: the Net Present Value of the gross value added over a 30-year period.

Samenvatting

S.1 Belangrijkste uitkomsten

Een verbod op visserij in delen van het Friese Front en Centrale Oestergronden ter bescherming van de bentische gemeenschappen, zoals voorgesteld door het ministerie van Economische Zaken en het ministerie van Infrastructuur en Milieu (Figuur S.1), leidt tot een verlaging van de Netto Contante Waarde van de Bruto Toegevoegde Waarde van 0 tot 5,7 m euro, afhankelijk van de onderliggende aannames over de externe effecten en de consequenties van verplaatsing (tabel S.1). Naast de resultaten van Van Oostenbrugge et al. (2015) biedt de huidige nota een overzicht van deze kosten. De kosten zijn vergelijkbaar met de laagste kosten van de varianten die in juni 2016 zijn geëvalueerd (Van Oostenbrugge et al., 2016).



Figuur S.1 *Kaarten van de geanalyseerde gebieden*
Bron: Ministerie van Infrastructuur en Milieu, bewerkt door Wageningen Economic Research.

De voorgestelde gesloten gebieden (Figuur S.1) bestrijken een gebied ter grootte van totaal 2.400 km^2 dat is opgesplitst in één subgebied in de Centrale Oestergronden en drie op het Friese Front.

Tabel S.1 *Overzicht van visserijactiviteiten in de gebieden (gemiddelde over 2008-2014) en de kosten van sluitingsvarianten in het geval van 4 beleids- en innovatiescenario's (PEI-scenario 0-3) en 3 verplaatsingsscenario (A-C). NCW, netto contante waarde (toekomstige verdisconteerde kosten over een periode van 30 jaar); BTW, bruto toegevoegde waarde*

Type kosten/baten			
Visserijactiviteiten			
Dagen op zee		248	
Hoeveelheid aanvoer (tonnen)		591	
Waarde aanvoer (m euro)		1,4	
BTW (m euro)		0,5	
Kosten van sluitingen (NCW van BTW, mln. euro)			
Verplaatsingsscenario	**A**	**B**	**C**
PEI-scenario 0	1,8	3,9	0
PEI-scenario 1	2,2	5,7	0
PEI-scenario 2	1,8	3,5	0
PEI-scenario 3	2,1	5,1	0

Afhankelijk van de onderliggende veronderstellingen variëren de totale kosten voor de Nederlandse visserij, gemeten als het negatieve effect op de netto contante waarde van de bruto toegevoegde waarde, van 0 tot 5,7 mln. euro (tabel S.1).

Deze nota biedt extra informatie over de geschatte kosten van de sluitingen voor de Nederlandse visserij. De resultaten geven aan dat de absolute waarden van de toekomstige kosten zeer onzeker zijn en afhangen van zowel externe ontwikkelingen (prijzen, vispopulaties, beheer enzovoort) als van de gedragsveranderingen van vissers en de daaruit voortvloeiende economische gevolgen. Verplaatsingsscenario C gaat ervan uit dat de vissers in staat zijn hun visserijactiviteiten zonder enige kosten te verplaatsen.

S.2 Overige uitkomsten

Vergeleken met de oorspronkelijke varianten in Van Oostenbrugge et al. (2015) hebben de sluitingen in dit memorandum een gemiddeld effect op de visserij. Het economische effect is vergelijkbaar met het effect van variant Capelin. In vergelijking met de varianten die in juni 2016 aan het parlement zijn gepresenteerd zijn de effecten klein (Van Oostenbrugge., 2016). De effecten van de sluitingen zijn relatief laag gezien het feit dat de totale omvang van de sluitingen veel groter is (2.400 km^2) dan het oppervlaktegebied van variant Capelin (1.600 km^2). De voornaamste reden hiervoor is dat een groot deel van de extra 800 km^2 ten zuiden van het Friese Front ligt in een gebied waar de visserij intensiteit laag is.

S.3 Methode

Deze nota is een gedeeltelijke uitbreiding van de complete kosten-batenanalyse die door Van Oostenbrugge et al. (2015) is uitgevoerd ter inschatting van de kosten voor de Nederlandse visserij van vier varianten voor een verbod op visserij in delen van het Friese Front en Centrale Oestergronden. Deze sluitingen voor demersale visserijactiviteiten zijn opgesteld om de bentische habitats te beschermen. Het onderzoek is uitgevoerd door Wageningen Economic Research op verzoek van het ministerie van Infrastructuur en Milieu.

Door Van Oostenbrugge et al. (2015) werd ook onderzoek verricht naar overige kosten (waaronder de kosten van sociale effecten, monitoring en handhaving) en de ecologische voordelen én naar het belang van de gebieden voor buitenlandse vloten. Deze overige effecten moeten ook worden meegewogen om de effectiviteit van de gebiedssluitingen bij het behalen van de beheerdoelen goed te kunnen evalueren.

De kosten voor de Nederlandse visserij zijn geschat met behulp van de methode die door Van Oostenbrugge et al. (2015) is ontwikkeld. Hierbij zijn de volgende belangrijke stappen genomen:

- Een inventarisatie van de visserijactiviteiten in de varianten is gebaseerd op een analyse van gedetailleerde gegevens over de locatie van visserijschepen (VMS), officiële logboekgegevens en economische gegevens van het Wageningen Economic Research -panel (Bedrijveninformatienet).
- Er is een schatting gemaakt van de economische waarde van de gebieden met behulp van vier beleids-, economische en innovatiescenario's (PEI-scenario's) met daarin een combinatie van verwachte ontwikkelingen van visbestanden, visprijzen, brandstofprijzen, technische ontwikkelingen, beheermaatregelen en overige gebiedssluitingen.
- De kosten van het sluiten van de gebieden werden geëvalueerd met behulp van drie verplaatsingsscenario's. Deze waren gebaseerd op wetenschappelijke publicaties (scenario A), vakkennis binnen de visserij (scenario B) en de veronderstelling dat de sector zijn activiteiten zonder enige kosten zou kunnen verplaatsen (scenario C).
- De daaruit volgende kosten werden samengevoegd tot één indicator voor de economische kosten: de netto contante waarde van de bruto toegevoegde waarde over een periode van 30 jaar.

1 Introduction

Background

The Frisian Front and Central Oyster Grounds have been selected for area protection measures under the Marine Strategy Framework Directive (MSFD, EU, 2008). Within this framework it is planned that - part of - the Frisian Front and Central Oyster Grounds area will be closed for seabed disturbing fisheries, in order to protect the benthic community.

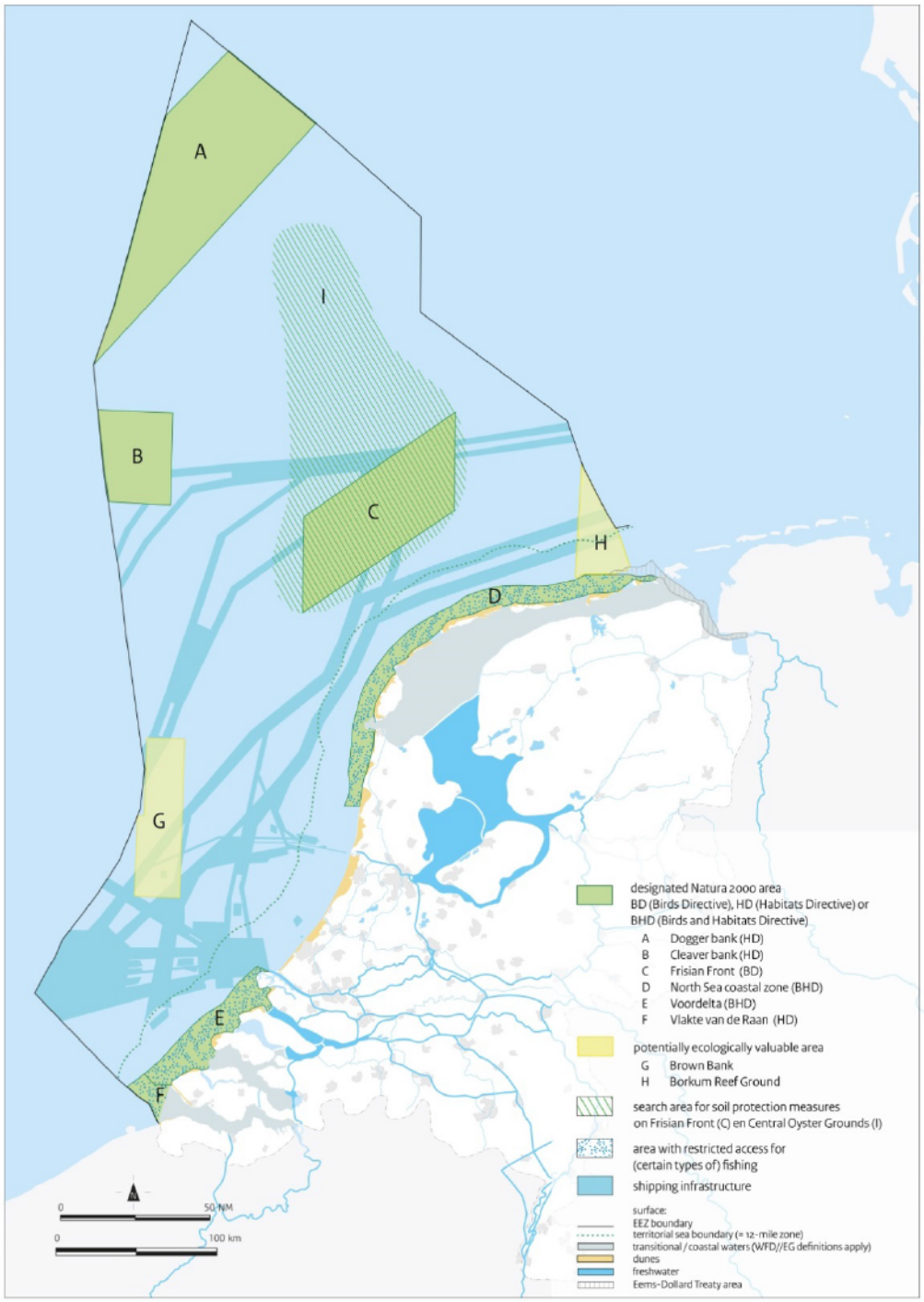


Figure 1.1 *Area use in the Dutch part of the North Sea, showing optional locations for fisheries restricting measures in the Central Oyster Grounds and the Frisian Front*
Source: adapted from Ministry of I&M, Ministry of EZ (2014b).

The Frisian Front and Central Oyster Grounds (Figure 1.1) have been selected for area protection measures under the MSFD because of high benthic biodiversity scores (Bos et al., 2011) relative to the rest of the Dutch North Sea. The deep silty benthic habitat and the front system present in the central North Sea (Frisian Front, Central Oyster Grounds) is characterised by a high species richness, high biomass, high density, the presence of vulnerable species and large-growing species. As these habitats are not listed in the Habitat Directive Annex I, they are excluded from Natura 2000 protection measures.

The overall aim of the Dutch government for the Dutch part of the North Sea is to protect 10-15% of the Dutch Continental Shelf against appreciably disrupting by human activities, with a minimum impact for the fishermen (Ministry of I&M, Ministry of EZ, 2012). The fishery measures in Natura 2000 areas (North Sea Coastal Zone, Vlakte van de Raan, Voordelta, Dogger Bank and Cleaver Bank) partly contribute to this aim. The closures on the Frisian Front and Central Oyster Grounds should help to reach the 10-15% and contribute to the targets as defined in the Dutch Marine Strategy Part 1 (Ministry of I&M, Ministry of EZ, 2012).

In preparation of a proposal for closures in the Frisian Front and the Central Oyster Grounds, various studies were carried out and a stakeholder process was conducted to develop options. First, an overview was made of available ecological and fishery knowledge for the Frisian Front and Central Oyster Grounds (Slijkerman et al., 2013). Next, studies to explore area closure measures using Marxan (Slijkerman et al., 2014) and an expert judgement workshop on the potential for recovery of the area after closure (Jongbloed et al., 2013) were conducted. In addition, recent trends and possible future developments in the Dutch fishing sector were described (Kuhlman and Van Oostenbrugge, 2014). These studies were used as input for a stakeholder consultation process that resulted in six variants for closures. The consequences of each of the variants were assessed in a cost-benefit analysis (Van Oostenbrugge et al., 2015). Based on the outcomes of the cost-benefit analysis and the input from stakeholders, the Ministries of I&M and Economic Affairs formulated two preferential variants. Both variants consisted of one or two areas in the Central Oyster Grounds and two or three areas in the Frisian Front (Figure 1.2).

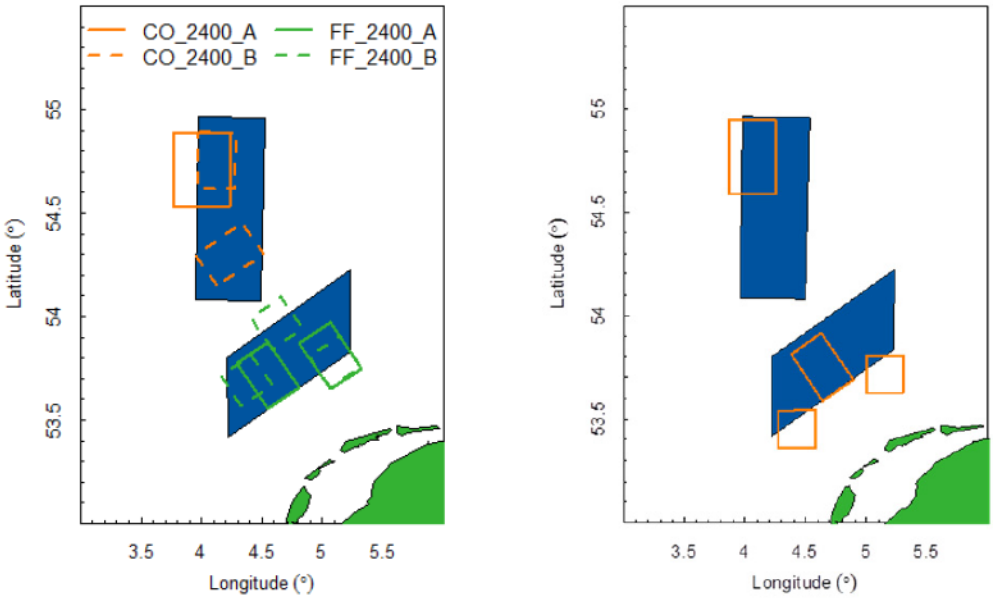


Figure 1.2 *Area use in the Dutch part of the North sea, showing the subareas of the two preferential variants for fisheries-restricting measures in the Central Oyster Grounds and the Frisian Front as presented to the parliament in June 2016 (left) and the final variant presented to the parliament in November 2016 (right)*
Source: Ministry of I&M.

The two preferential variants were presented to the parliament in June 2016, together with an estimate of the costs for the Dutch fishing sector (van Oostenbrugge, 2016). The parliament asked the minister to consult the fisheries sector in order not to close areas rich of fish. After consultation with the fishing sector, the ministry of I&M and EZ developed the final proposal that will be presented to the parliament in November 2016.

Objective addendum

This addendum to the cost-benefit analysis provides an estimate of the costs for the Dutch fishing sector of the final proposal for the closed areas in the Frisian Front and the Central Oyster Grounds. This is done using the methodology as specified in the report on the cost-benefit analysis (Van Oostenbrugge et al., 2015). As such it is by no means a complete overview of the costs and benefits of the closures as in Van Oostenbrugge et al. (2015) as this only concerns part of the costs and no benefits.

The project has been carried out by Wageningen Economic Research for the Ministry of I&M in November 2016.

2 Methods

2.1 Areas taken into consideration

The Ministry of I&M and the Ministry of EZ have formulated a proposal for closed areas on the Frisian Front and the Central Oyster Grounds. The proposal consists of four areas with a total surface area of 2,400 km^2, 1,400 km^2 (three subareas) on the Frisian Front and 1,000 km^2 (one subarea) on the Central Oyster Grounds (Figure 2.1).

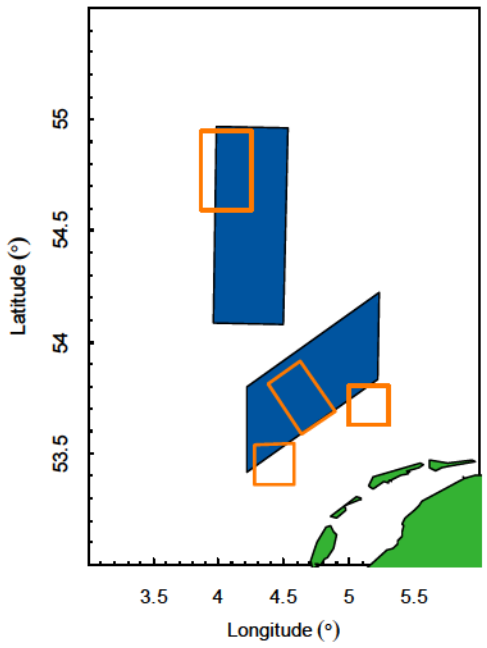


Figure 2.1 *Map showing the location of the four subareas taken into consideration*
Source: Ministry of I&M, processed by Wageningen Economic Research.

2.2 Estimation of costs of closures

The costs of implementation of the closures for the Dutch fishing sector have been estimated using the same methodology as described in the cost-benefit analysis done previously and described extensively in Van Oostenbrugge et al. (2015). Here a summary of the methodology is provided with reference to the chapters of the original report.

The costs are estimated using the following steps:

Recent fishing activities (see Section 5.1)
An inventory of the fishing activities in the areas is based on an analysis of detailed vessel position data (VMS), official logbook data and economic data from the Wageningen Economic Research panel.

Value of areas (see Section 6.1.1)
Estimation of the economic value of the areas were made using four Policy, Economy and Innovation scenarios (PEI scenarios). These PEI scenarios have been developed to assess potential effects of external developments on the fishing activities in the areas. The combined expected developments on

fish stocks, fish prices, fuel prices, technical developments, management measures and other area closures.

Costs of displacement of fishing activities (see Section 6.1.2)
Costs of closing the areas were assessed using three displacement scenarios. Displacement scenario A was based on scientific insights into the specific fishing opportunities in the areas, the effects of crowding and the effect of fishermen's knowledge. Displacement scenario B was based on the view of fishermen's representatives and also includes costs for some vessels that will stop fishing.

Displacement scenario C assumed that the costs of the closures are negligible because fishermen will quickly adapt and find new fishing opportunities.

Combining future costs in Net Present Value (see Section 6.1.3)
The resulting costs were combined into one indicator for the economic costs: the Net Present Value of the GVA over a 30-year period.

3 Results

In the results section, first the historic patterns in fishing activities in the area are described after which effects of the PEI scenarios on the fishing intensity in the areas and the resulting value are presented. Finally, the effects of the displacement scenarios are presented in combination with the PEI scenarios.

3.1 Recent fishing activities

In the period 2008-2014 the amount of fishing activities from the Dutch fishing sector varied from year to year (Table 3.1). On average Dutch vessels spend around 250 days in the areas, landing somewhat less than 600 tonnes, worth 1.4m euros. These landings contributed around 0.5m euros to the Gross Value Added (GVA) of the Dutch fishing sector. The average total value of the landings by the Dutch demersal fishing sector amounted to approximately 250m euros per year in the same period (www.visserijincijfers.nl).

Table 3.1 *Overview of effort, landings and values and gross value added of the Dutch fishing sector in the designated areas*

Variant	2008	2009	2010	2011	2012	2013	2014	Average
Effort (days at sea)	260	325	274	221	280	205	169	248
Effort (fishing days)	183	239	190	151	206	151	124	178
Landings (tonnes)	385	992	417	268	1,321	389	364	591
Value (1,000 euros)	1,434	1,742	1,261	943	2,462	929	703	1,353
Gross Value Added (1,000 euros)	483	699	462	312	656	363	246[a)]	460

a) preliminary estimates.

Source: Logbook data and VMS data, processed by Wageningen Economic Research.

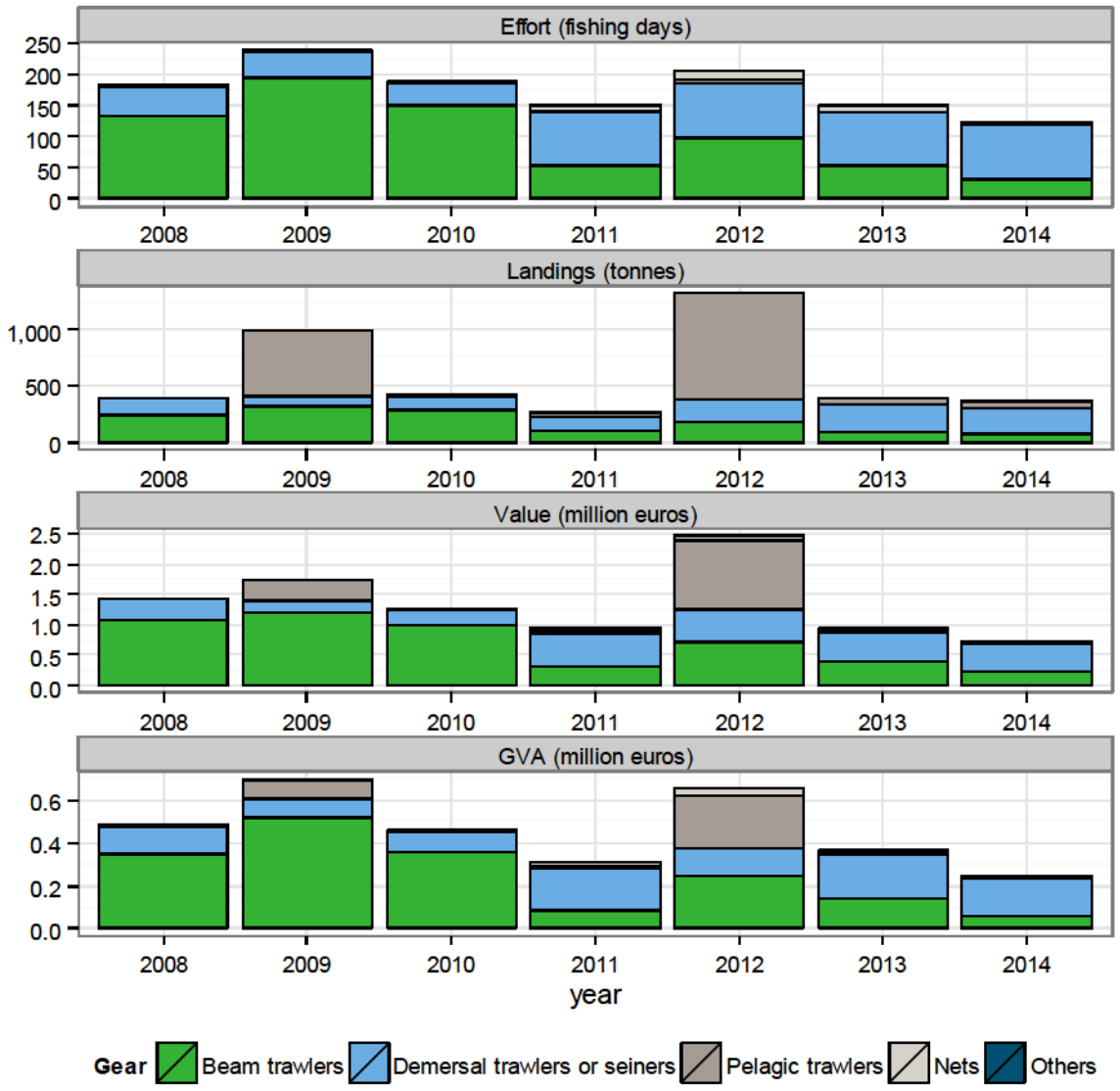


Figure 3.1 *Historical trends of the fishing activities by the Dutch fleet in the designated areas. Effort, landings, value of landings and GVA are given by gear groups as specified in the European DCF Source: Logbook data and VMS data, processed by Wageningen Economic Research.*

The fishing activities in the area have decreased during the seven years taken into consideration (Figure 3.1). On average the decrease in GVA was largest (9% per year). The reductions in landings value and effort were comparable (7% per year) and the reduction in landings volume was lowest (2% per year). This is mainly due to the general increase in fishing opportunity in the North Sea and decreasing prices.

The main gear types used in the area are bottom gears such as the traditional beam trawl and its innovative successors (pulse trawl, pulse wing and SumWing) and other types of bottom trawls. Over the period 2008-2014 the importance of the beam trawls (including pulse trawls) decreased considerably and the activity with this type of gear was partially replaced by other bottom trawls and seines such as otter trawl and twin trawl. Because of this, as from 2013 onwards beam trawls (including pulse trawls) were no longer the dominant group of gears used in the areas, but other bottom trawls and seines became more important (Figure 3.1). In 2012 considerable catches of pelagic fish have been caught in the areas, but these catches were incidental and they represent a low value because of the low prices of pelagic fish. Nets and other gears (dredges or shrimp trawls) are hardly used in the areas.

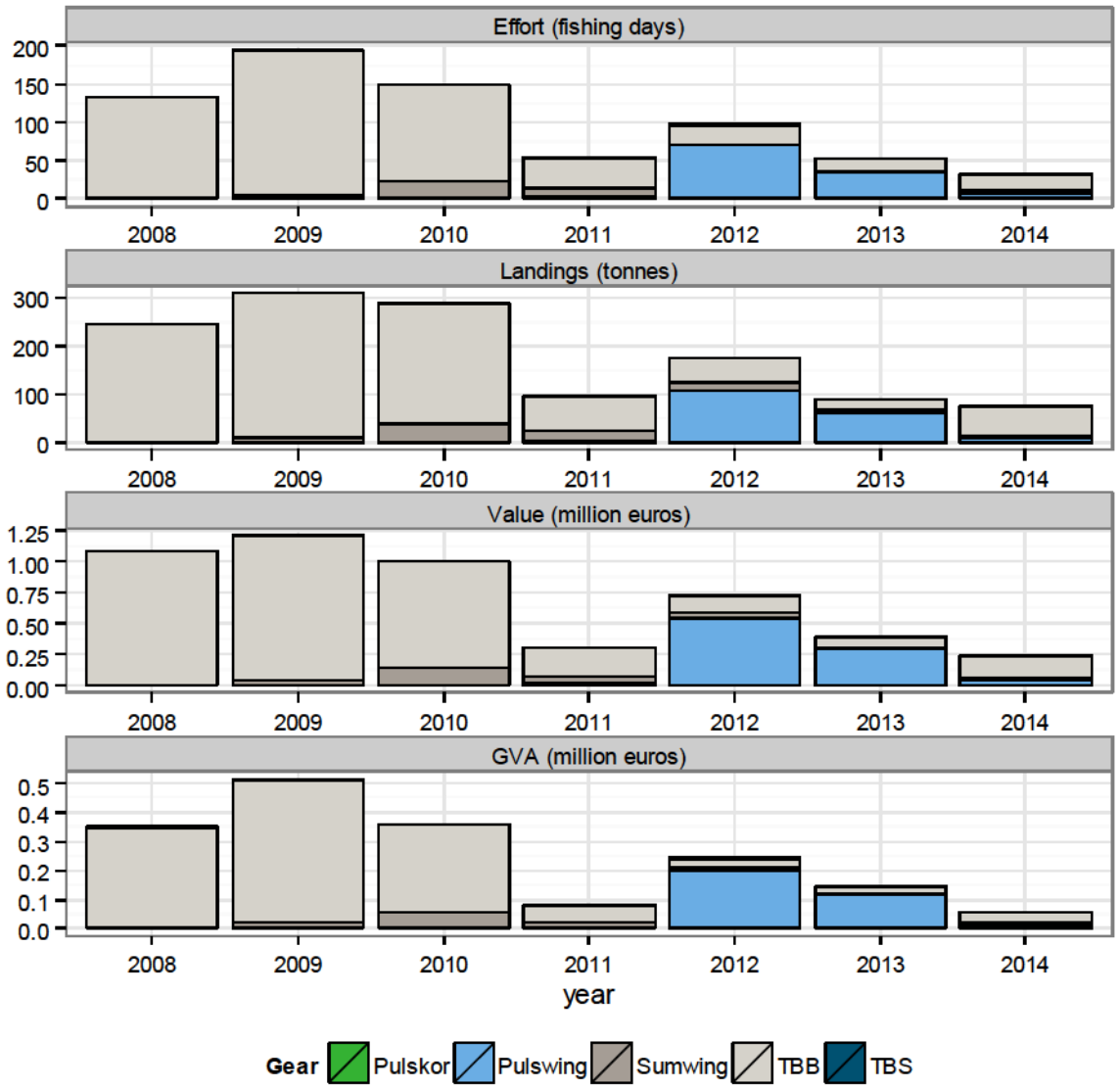


Figure 3.2 *Historical trends of the fishing activities by the Dutch beam trawl fleet (including traditional and pulse trawl gears) in the designated areas. Effort, landings, value of landings and GVA are given by gear type; TBB, traditional beam trawl; TBS, shrimp trawl*
Source: Logbook data and VMS data, processed by Wageningen Economic Research.

Activity levels of beam trawl fisheries (including pulse gears) in the areas are mainly influenced by the area choice in the Frisian Front (Figure 3.2) and in all areas the total fishing intensity of the beam trawl gears (including pulse gears) have been reduced considerably. In the latter years a considerable part of the fishing activities with the traditional beam trawl has been replaced by activities with innovative beam trawl gears such as the pulse wing. However, the use of pulse trawls in the area decreased from 2012 onwards and in 2014 the traditional beam trawl was again the most important beam trawl gear used. Good fishing opportunities for plaice and relatively low fuel prices might have contributed to this development.

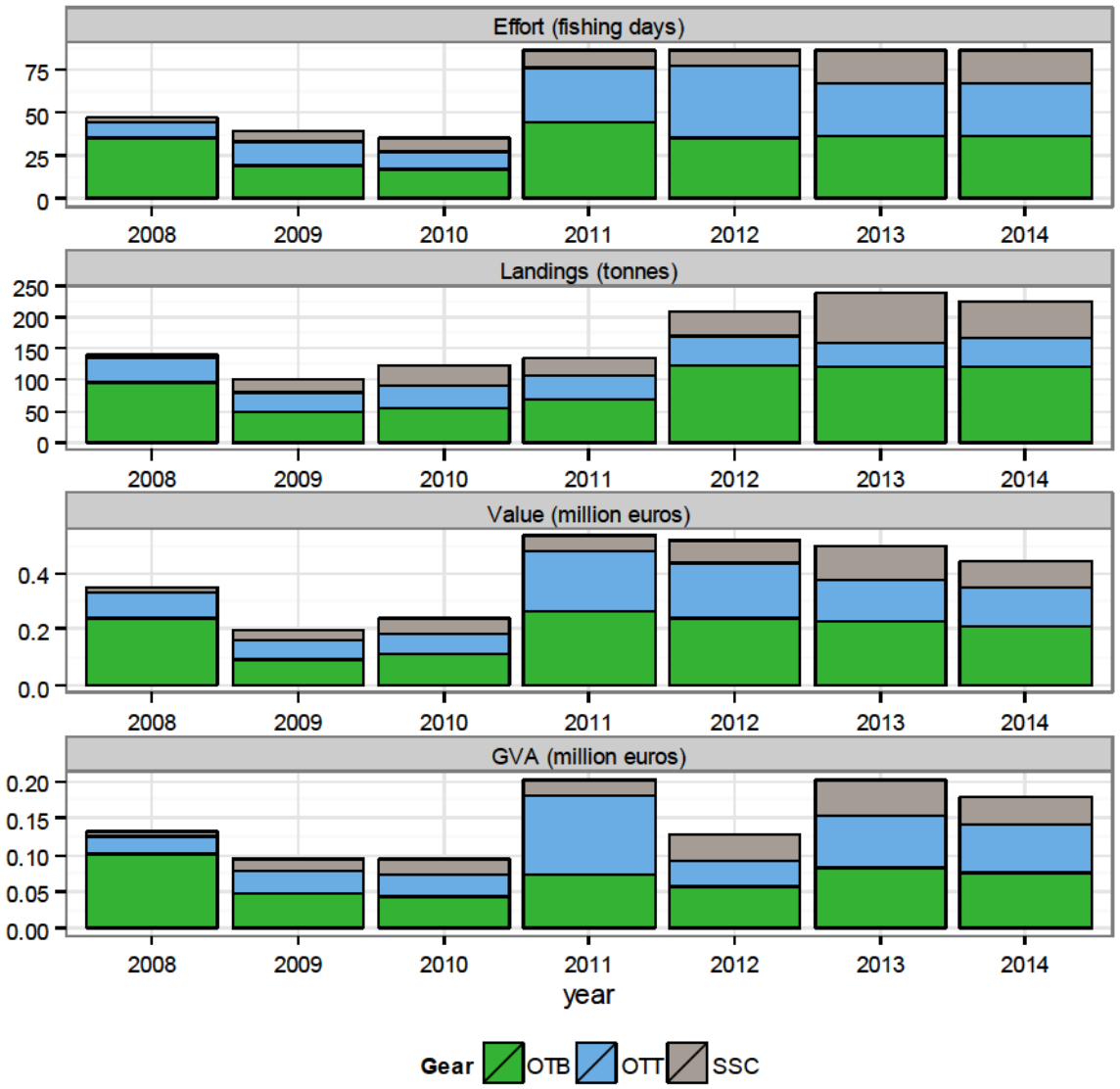


Figure 3.3 *Historical trends of the fishing activities by the Dutch demersal trawlers in the designated areas. Effort, landings, value of landings and GVA are given by gear type: OTB, otter trawl bottom; OTT, twin trawl; PTB, pair trawl bottom; SSC, Scottish seine (fly shoot fishery) (see also Appendix 6)*
Source: Logbook data and VMS data, processed by Wageningen Economic Research.

Activity levels of 'other trawls and seiners' have been relatively high during the last years and these gears have become the most important types used in the area (Figure 3.1).

The most important gears used were bottom otter board trawl (OTB) and twin trawl (OTT). The importance of twin trawls (including the quadrig and multirig fishery) has increased and in recent years these gears are almost equally important as the bottom otter board trawl fishery. This has mainly been the result of changes in the relative availability of quota of the target species for these gears. The relative importance of the otter trawl fisheries was highest, whereas the flyshoot fishery has been of relatively minor importance.

Dependency on the areas
The relative contribution of the areas to the total economy of the Dutch demersal fishing sector (the cutter fleet as specified in Taal et al., 2010) was less than 1% over the period 2008-2014 (Table 3.2). As for the total fishing activities, the dependency on the area has decreased over the last years.

Table 3.2 *Relative contribution (%) of the fishing activities in each of the areas to the fishing activities of the Dutch demersal fishing sector over the period 2008-2014*

	average	stdev
Effort (sea days)	0.5%	0.1%
Landings (kg)	0.7%	0.5%
Value (euros)	0.6%	0.2%
Gross Value Added (euros)	0.6%	0.2%

Source: Logbook data and VMS data, processed by Wageningen Economic Research.

Although the overall contribution of the areas to the whole fishery is low, dependency can be high for individual vessels for specific seasons. Figure 3.4 shows the relative contribution of the fishing activities to the total revenue of individual vessels per quarter and averaged over the period 2008-2014. This means that the vessels that are in the class between 10-20% dependency obtained between 10-20% of their total income of that quarter from the area over the period 2008-2014.

The total number of vessels operating in the areas in a quarter ranges from around 20 to 40. More than 80% of the vessels that fish in the areas are less than 10% dependent on these areas for their total revenue of that quarter and a limited number of vessels are more dependent. In quarter 2, the dependency is highest and around 3 vessels get more than 10% of their revenues from the area. In quarter 4, the dependency is lowest.

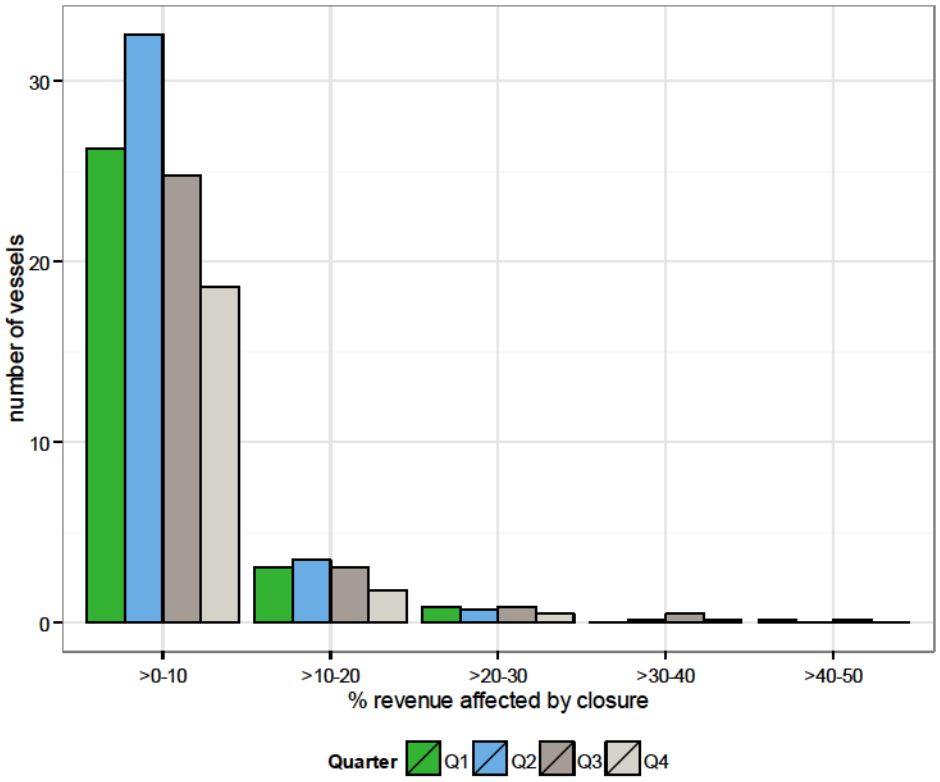


Figure 3.4 *Quarterly stress profiles of the Dutch fishing fleet, based on average dependency of the areas in the period 2008-2014. Dependency is measured by the percentage of the revenue that is taken from the designated areas*
Source: Logbook data and VMS data, processed by Wageningen Economic Research.

3.2 Value of the areas in Policy, Economy and Innovation scenarios

The outcomes of the PEI scenarios illustrate the uncertain future for the Dutch fishing fleet. Although the effort in the area is similar for all scenario's, their resulting economic performance can vary significantly depending on the developments taken into account.

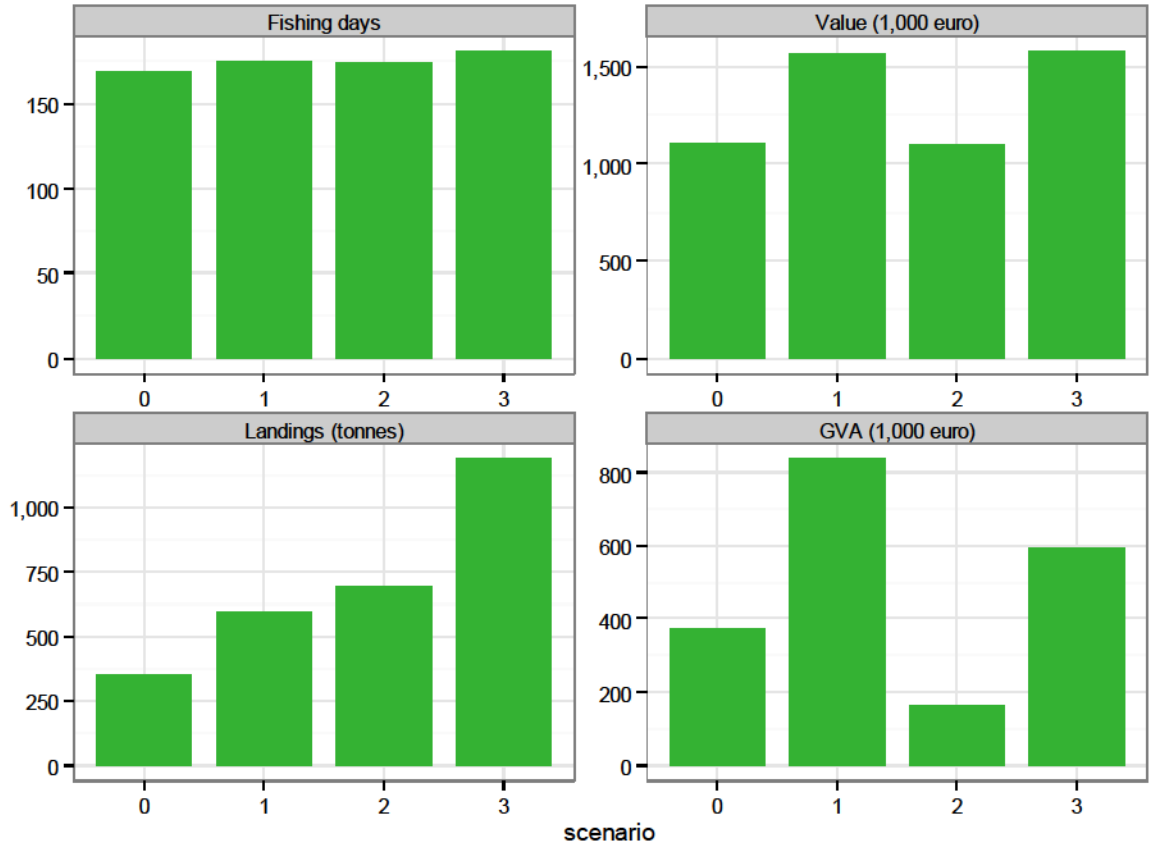


Figure 3.5 *Consequences of the Policy, Economy and Innovation scenarios for the fishing activities of the Dutch fleet in the designated areas (annual totals) in case the areas are not closed*
Source: Logbook data and VMS data, processed by Wageningen Economic Research.

All scenarios indicate that fishing activities in the areas would slightly increase in case the areas are not closed and that the value and volume of landings will be larger than in the current situation (scenario 0, Figure 3.5). This is realistic, based on the fact that the total fishing area will get smaller because of closures elsewhere and the fish stocks and thereby the possible landings will increase. Effort increases slightly due to area closures and the change to pulse gears that are not allowed north of 55 degrees latitude. This causes an effort increase of around 7% in scenario 3. For scenario 1 and 2 the increases are lower.

Landings increase significantly in all PEI scenarios, ranging from 70% to 240%. This leads to total landings that range from 600 tonnes in PEI scenario 1 to 1,200 tonnes in PEI scenario 3. The main reasons for this increase are the increase of fish biomass in PEI scenario 1 and the inclusion of discards that have to be landed in PEI scenario 2. Also the increase in effort contributes to the increased landings.

Landings value also increases in al PEI scenarios, but the change is much smaller than for landings volume. This is mainly due to the low price of discards and the fact that the biomass of sole is

assumed to be stable. Because of this the vast majority of extra fish that is caught has a relatively low value, especially in PEI scenario 2.

GVA is influenced most by all the assumed changes in the PEI scenarios and shows that, depending on external developments, economic performance in the areas might vary considerably. In PEI scenario 1 the GVA increases by 120% of the original value and in PEI scenario 2 the GVA decreases by 56%. In PEI scenario 3 these opposite effects partly mitigate each other, and the overall effects of all developments result in an increase of the GVA of 59%.

3.2.1 Displacement costs

As a consequence of area closures a vessel can either increase its effort and costs or decrease its landings and income. Which option is chosen depends on the dependency of the vessels, the variant and the gear used. Because these characteristics vary among vessels, the two effects can occur simultaneously within the fleet; for some vessels revenues will be lower, while for others costs will increase. As vessels reallocate their fishing activities from the areas into other fishing areas, they will also affect other vessels. This effect of crowding has been taken into account separately in case of displacement scenario A.

Table 3.3 and Figures 3.6-3.7 show the effects of displacement of the fishing activities from the closed areas for the vessels directly affected by the closures. As displacement scenario C results in 0 costs for the fisheries, these have not been presented in the graphs, but have been mentioned in the graph and table headers.

Table 3.3 *Net effects of effort displacement in case of area closures for the Dutch fleet in the first, second and fifth year after the closure for PEI scenario 0 and 1 and displacement scenario A and B. Only the costs for directly affected vessels are shown. For displacement scenario C the changes in effort, landings, value and Gross Value Added are 0*

	Effort (sea days)		Landings (tonnes)		Value (1,000 euros)		Gross Value Added (1,000 euros)	
Displacement scenario	A	B	A	B	A	B	A	B
PEI scenario 0								
Year 1	0.8	0	-16.2	-87.1	-48.8	-275.8	-49.5	-255.8
Year 2	0.8	0	-16.2	-87.1	-48.8	-275.8	-49.5	-255.8
Year 5	0.8	0	-16.2	-87.1	-48.8	-275.8	-49.5	-255.8
PEI scenario 1								
Year 1	0.9	0.0	-30	-156	-79	-420	-78	-389
Year 2	0.9	0.0	-29	-152	-73	-406	-72	-376
Year 5	0.9	0.0	-28	-150	-71	-400	-70	-371

Source: Logbook data and VMS data, processed by Wageningen Economic Research.

Table 3.3 and Figure 3.6 and 3.7 show that the overall pattern in the effects of effort displacement for scenarios A and B is comparable in the PEI scenarios. The effects of closing the areas on the GVA of the vessels affected range from 50k euros to 260k euros in the first year after the closure in PEI scenario 0 (base case), depending on the displacement scenario.

The effects of displacement in scenario B are around 5 times higher than those in displacement scenario A. This accounts for the landings volume, landings value and the resulting GVA. Only in case of displacement scenario A, closures result in (a low amount of) extra effort as it is assumed that fishermen will compensate losses in catch efficiency for sole by either making extra seadays or by transferring their fishing rights to other vessels that will use them. In scenario B it is assumed that the fishing fleet is not able to extend its fishing activities to compensate for the loss of catch efficiency (see also Van Oostenbrugge et al., 2015). Table 3.3. shows however that the extra effort in displacement scenario A is very small (<1 seaday). In case of displacement scenario C there is no difference in the resulting costs, the costs are 0.

In both displacement scenario A and B the effect of displacement is equal among all years for PEI scenario 0. This is because no vessels are categorised as dependent on the areas in PEI scenario 0. In other PEI scenarios a small proportion of the vessels are categorised as dependent and the costs of displacement become lower as specialist fishermen learn to use other areas (assumed), but the resulting effects on the totals are small.

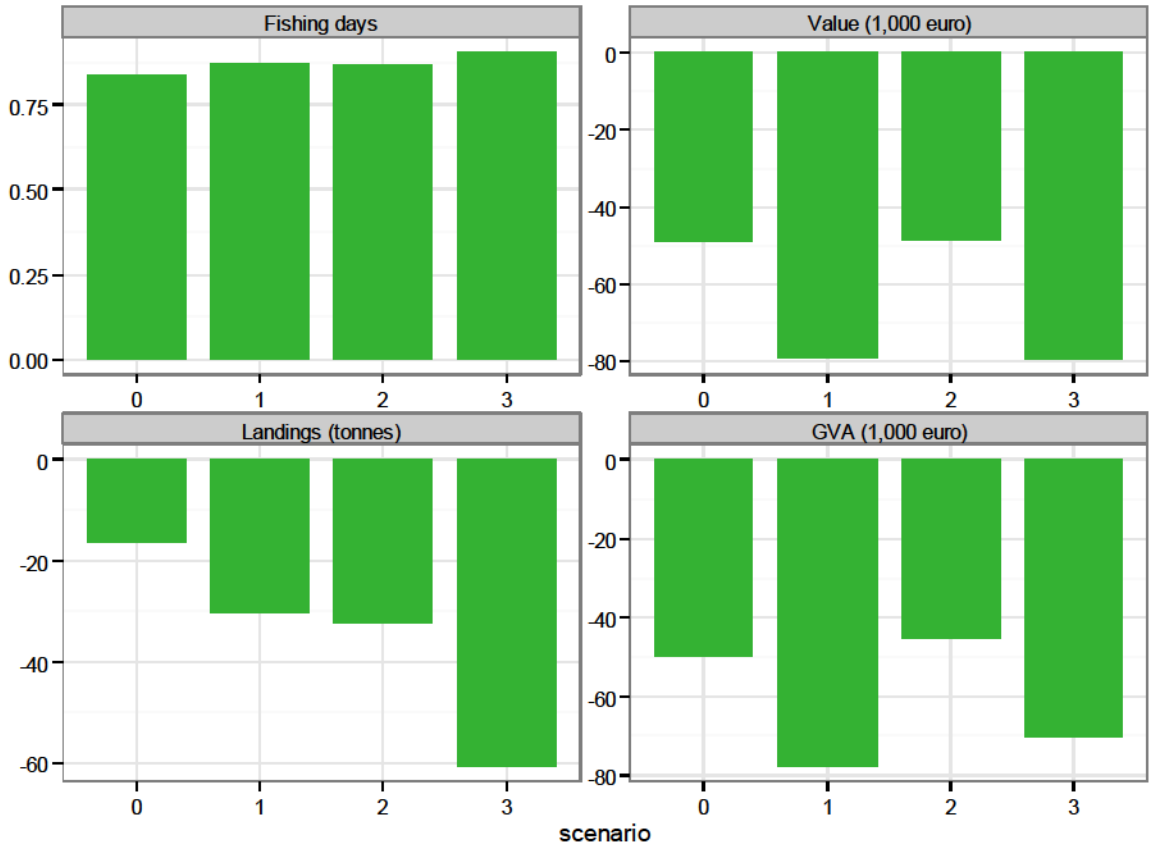


Figure 3.6 *Effects of effort displacement on the effort, landings volume, landings value and GVA in the first year after the closure for displacement scenario A. Series show the effects of the PEI scenarios (see text for further explanation)*
Source: Logbook data and VMS data, processed by Wageningen Economic Research.

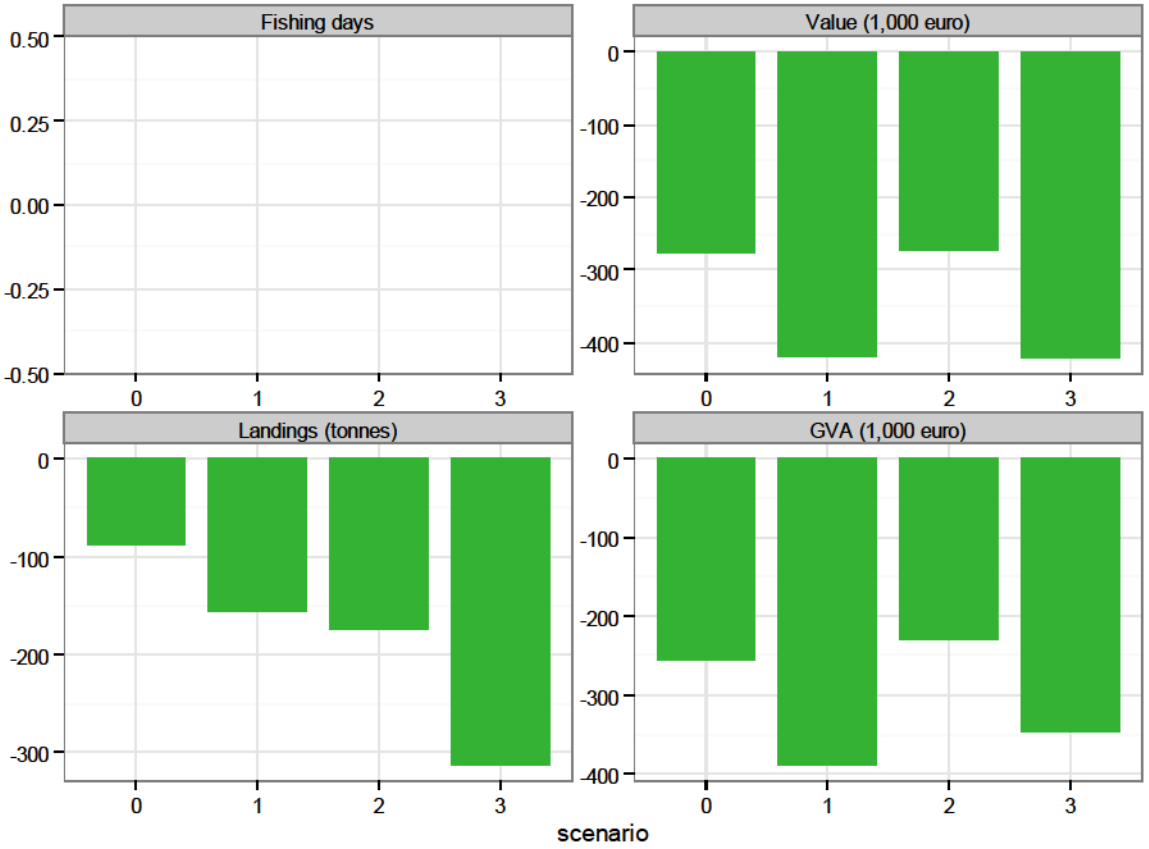


Figure 3.7 *Effects of effort displacement on the effort, landings volume, landings value and GVA in the first year after the closure for displacement scenario B. Series show the effects of the PEI scenarios (see text for further explanation)*
Source: Logbook data and VMS data, processed by Wageningen Economic Research.

Figures 3.6 and 3.7 show the impacts in the first year after the closure in the various PEI scenarios. Comparison of Figures 3.6 and 3.7 shows that the patterns for the two displacement scenarios are nearly identical. Only the extent of the effect is much larger in case of displacement scenario B and in displacement scenario B the number of fishing days does not change. The high decrease in landings volume in PEI scenario 3 can be explained by the overall increase in landings, both as a result of increased fish stock size and because of the implementation of the landing obligation (see also p. 20). The effect of the PEI scenarios on the impact of displacement is large, similar to the effects previously discussed on the value of the areas. Especially scenario 1 and 3 increase the effect of the closures considerably by around 40%.

In case of displacement scenario A, additional costs are estimated for the whole fleet, based on the assumed crowding effect. This is the effect that the vessels that have reallocated their fishing activities have on the catch efficiency of the vessels that already utilise these areas; because it is getting more crowded in the remaining fishing grounds, the fishing efficiency will decrease. In displacement scenario B this phenomena has not been addressed explicitly. Table 3.4 summarises the effects of crowding for the whole Dutch fleet, based on the effort increase in the remaining open area for each of the PEI scenarios. The effect of increased crowding is around 1.1m euros in all PEI scenarios.

Table 3.4 *Overview of the resulting effect of crowding for the various PEI scenarios. See text for explanation. NPV; Net present value over 30 years*

	PEI scenarios			
	0	1	2	3
Effort displaced (% of total effort of Dutch fleet)	0.52	0.54	0.53	0.55
Relative effect on Value per sea day of Dutch fleet (%)	0.04	0.04	0.04	0.04
Effect on NPV of GVA of Dutch fleet (m euros)	1.1	1.1	1.1	1.1

Table 3.5 summarises the effects of both PEI scenarios and displacement scenarios on the net present value of the GVA. The Net Present Value indicates all future costs for the closures, discounting costs for a period of 30 years (See also Chapter 2). Changes in the NPV of GVA ranges from -0.0m euros for displacement scenario C to -5.7m euros in PEI scenario 1 and displacement scenario B. This shows that external uncertainties have a large effect on the absolute outcome of the analyses.

Table 3.5 *Net effects of effort displacement on the net present value of the GVA (million euros) in the various PEI scenarios and displacement scenarios*

	PEI scenario 0			PEI scenario 1			PEI scenario 2			PEI scenario 3		
Displacement scenario	A	B	C	A	B	C	A	B	C	A	B	C
Total	-1.8	-3.9	0	-2.2	-5.7	0	-1.8	-3.5	0	-2.1	-5.1	0

Source: Logbook data and VMS data, processed by Wageningen Economic Research.

3.2.2 Sensitivity analysis

In Van Oostenbrugge et al. (2015) an extensive sensitivity analysis is carried out on the effects of level of fishing activities in the areas, scenario parameters and the reference period (Section 6.2.3). As the effects are similar, that part of the report is also applicable to the results presented here.

4 Discussion and conclusions

This memorandum shows the potential costs of area closures in the Frisian Front and the Central Oyster grounds using the methodology developed for the cost-benefit analysis for area closures in the areas (Van Oostenbrugge et al., 2015). The costs for the Dutch fishing sector have been estimated using historic data on fishing activities in the areas and different PEI scenarios (Policy, Economics and Innovation scenarios) and displacement scenarios. The PEI scenarios have been developed to assess potential effects of external developments on the fishing activities in the areas. The displacement scenarios are used to estimate the costs in case the areas are closed. Each of the three displacement scenarios is based on a specific set of assumptions: Displacement scenario A is based on scientific insights into the specific fishing opportunities in the areas (for non-quota species), the effects of crowding and the effect of fishermen's knowledge. Displacement scenario B is based on the view of fishermen's representatives and also includes costs for some vessels that will stop fishing. Displacement scenario C assumes that the costs of the closures are negligible because fishermen will quickly adapt and find new fishing opportunities.

Depending on the assumptions taken, the costs range from 0 to 5.7m euros, depending on the assumptions chosen for external developments (PEI scenarios) and the effects of displacement (displacement scenarios). When compared to the original variants as defined in Van Oostenbrugge et al. (2015), the effects on the fishing sector of the variant in this note are intermediate and comparable to those of variant Capelin. Compared to the variants discussed with the parliament in june 2016, the effect of the present variant is small; for displacement scenario A the effects are comparable to the variant with the smallest impact (COA_FFB), for displacement scenario B the effects are 10% lower. The effects of the closures are relatively low, when taking into account that the total size of the closures is much larger (2,400 km^2) than the surface area of variant Capelin (1,600 km^2). The main reason for this is the fact that a large part of the extra 800 km^2 is situated south of the Frisian front in an area with low fishing intensity.

Table 4.1 *Minimum and maximum net effects of effort displacement on the net present value of the GVA (million euros) in displacement scenarios A and B for the areas under study and the variants of Van Oostenbrugge et al. (2015).* ***For displacement scenario C all costs are 0***

Displacement scenario	A		B	
Variant	min	max	min	max
Abalone	-1.4	-1.6	-3	-4.6
Brill	-0.8	-0.9	-1.3	-1.9
Capelin	-1.8	-2.2	-3.9	-6.1
Dab	-1.1	-1.3	-1.9	-2.9
Eel	-3.6	-4.6	-9.0	-14.7
Flounder	-10.3	-14.4	-30.1	-49.6
COA_FFA	-2.1	-2.6	-4.9	-7.7
COA_FFB	-1.7	-2.2	-3.8	-6.5
COB_FFA	-2.4	-3.0	-5.7	-8.9
COB_FFB	-2.0	-2.6	-4.7	-7.9
Final	-1.8	-2.2	-3.5	-5.7

Source: Logbook data and VMS data, processed by Wageningen Economic Research.

Van Oostenbrugge et al. (2015) provides an extensive general discussion of the results. Here some highlights are summarised.

The estimation of the costs are based on numerous assumptions and various scenarios (both PEI scenarios and displacement scenarios). Because of this, the outcomes are valid for the comparison of

the areas with previously analysed variants, but care should be taken when using the absolute numbers from the various scenarios in isolation (see also p. 117 of Van Oostenbrugge et al., 2015).

The costs of closures for the foreign fleets have not been taken into account in the request for this addendum because of time constrains. However, Van Oostenbrugge et al. (2015) showed that the contribution of the foreign fishing activities in the Friesian Front and Central Oyster grounds to their GVA is approximately 1.2 to 2.0 times as high as for the Dutch fishing sector (Van Oostenbrugge et al., 2015, Table S.1). Based on this and assuming that the fishing patterns of the Dutch and foreign fleets are similar the contribution to the foreign fleets from the areas could be somewhere between 0.6 and 0.9m euros per year. Because of the uncertainty in this estimate it is impossible to draw a conclusion on the effects of closures on the foreign fleets.

Van Oostenbrugge et al. (2015) provides a full cost-benefit analysis of six variant closures including ecological benefits, social effects and costs for monitoring and enforcement. This note adds to this report by providing the economic effects of closures for the Dutch fishing sector and the results show that the choice for one variant or another will have different economic implications. However, in order to fully evaluate the benefits and costs for the areas under study it would be advisable to also take into account the other effects of the closures when evaluating the effectiveness of these measures in reaching the management objectives stated in the Dutch Marine Strategy Part 1 (Ministry of I&M, Ministry of EZ, 2012).

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Appendix 1 Overview of effort, landings and values and gross value added of the Dutch fishing sector in the various subareas

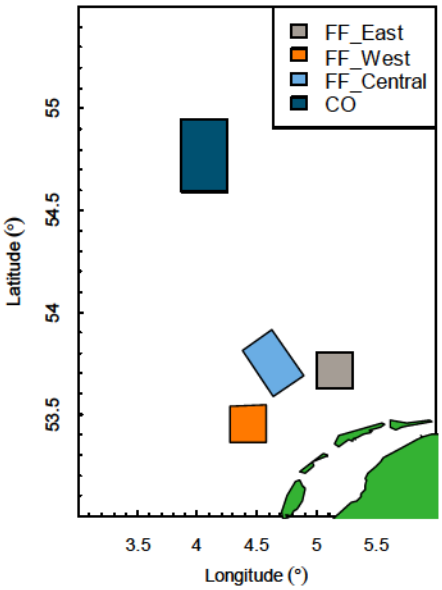

Figure A1.1 *Map showing the location of the four subareas taken into consideration*
Source: Ministry of I&M, processed by Wageningen Economic Research.

Table A1.1 *Overview of effort, landings and values and gross value added of the Dutch fishing sector in the various subareas*

Variant	Subarea	2008	2009	2010	2011	2012	2013	2014	Average
Effort (days at sea)	CO	53	30	28	8	40	37	23	31
	FF_east	41	58	42	44	60	52	37	48
	FF_west	45	52	33	16	18	16	3	26
	FF_central	120	185	172	152	161	99	104	142
	Total	260	325	274	221	280	205	169	248
Effort (fishing days)	CO	35	19	18	5	29	21	20	21
	FF_east	32	42	27	22	32	31	22	29
	FF_west	37	49	28	13	14	14	5	23
	FF_central	79	130	117	110	131	84	78	104
	Total	183	239	190	151	206	151	124	178
Landings (tonnes)	CO	125	615	73	20	181	104	83	172
	FF_east	37	83	53	39	418	137	51	117
	FF_west	63	47	26	17	29	21	2	29
	FF_central	160	248	266	191	693	125	228	273
	Total	385	992	417	268	1,321	389	364	591
Value (1,000 euros)	CO	295	437	124	43	294	153	120	209
	FF_east	177	181	110	151	670	177	97	223
	FF_west	302	204	117	69	85	85	9	124
	FF_central	659	920	911	679	1,413	513	477	796
	Total	1,434	1,742	1,261	943	2,462	929	703	1,353
Gross Value Added (1,000 euros)	CO	103	141	48	11	63	58	45 a)	67
	FF_east	67	78	44	61	193	73	40 a)	80
	FF_west	98	89	43	19	28	35	4 a)	45
	FF_central	214	391	327	220	372	196	157 a)	268
	Total	483	699	462	312	656	363	246 a)	460

a) preliminary estimates.

Source: Logbook data and VMS data, processed by Wageningen Economic Research.

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Wageningen Economic Research
MEMORANDUM
2016-117

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

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