Methodological report for the Dutch economic data collection programme on fisheries and aquaculture

Evaluation of the 2020 collection programme

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This study was carried out by Wageningen Economic Research and was commissioned and subsidised by the Dutch Ministry of Agriculture, Nature and Food Quality within the context of the Statutory Research Tasks (WOT-06-001-006).

Wageningen Economic Research
Wageningen, July 2022

REPORT
2022-080
ISBN 978-94-6447-244-8

J.A.E. van Oostenbrugge, F.F. Hoekstra, A. Mol, A.J. Klok & J.L. Roskam, 2022. *Methodological report for the Dutch economic data collection programme on fisheries and aquaculture; Evaluation of the 2020 collection programme.* Wageningen, Wageningen Economic Research, Report 2022-080. 60 pp.; 8 fig.; 20 tab.; 17 ref.

Het Bedrijveninformatienet voor Visserij[1] is een instrument om de sociaal-economische en financieel-economische prestaties van de actieve Nederlandse visserij te evalueren. De bedrijven die zijn opgenomen in het Informatienet voor Visserij vormen een steekproef van actieve Nederlandse visserijbedrijven. Dit rapport beschrijft de achtergronden van de steekproef en de ontwikkelingen aangaande de populatie en de steekproef in 2019. Alle stappen van het bepalen van het selectieplan, het werven van bedrijven en de kwaliteit van de steekproef worden beschreven.

The Farm Accountancy Data Network for Fisheries is an instrument for evaluating the socio-economic and financial performances of Dutch fisheries enterprises. The enterprises included in the Farm Accountancy Data Network are a sample of fisheries companies from the Dutch fisheries census. This report explains the background of the sample and the developments concerning the population and sample of 2019. All phases from the determination of the selection plan, the recruitment of companies to the quality control of the final sample are described in this report.

Key words: FADN, sample, population, fisheries

This report can be downloaded for free at https://doi.org/10.18174/570634 or at www.wur.eu/economic-research (under Wageningen Economic Research publications).

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Wageningen Economic Research Report 2022-080 | Project code 2282200374

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[1] https://www.wur.nl/nl/Onderzoek-Resultaten/Wettelijke-Onderzoekstaken/Centrum-voor-Economische-Informatievoorziening-1/Visserij.htm

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Preface

The Farm Accountancy Data Network for Fisheries and Aquaculture is an instrument to annually collect financial, economic and social data from Dutch fisheries and aquaculture enterprises. This task is carried out by Wageningen Economic Research on behalf of the Centre for Economic Information (in Dutch, the *Centrum voor Economische Informatievoorziening*, CEI). To comply with EU regulation 2017/1004, the quality of the estimates of economic key variables from the Dutch fisheries and aquaculture sector is assessed. This report assesses the quality of the voluntary panel of fishing and aquaculture enterprises concerning the population and sample of 2019 that were collected during 2020. This information is used to adjust the data collection and the design of the panel to future developments and information requirements.

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Summary

The Dutch selection plan for socio-economic information on the fisheries and aquaculture sector has the aim to fulfil the requirements for the EU data collection framework and to provide the basic data for socio-economic analysis for management development and evaluations in the Netherlands. The current report outlines the methodology used to design the data collection programmes and shows that the current sampling programme results in data that fits these objectives well for most segments and sectors.

The vessels included in the Dutch Farm Accountancy Data Network are a sample of fisheries and aquaculture holdings from the Dutch fisheries fleet. A selection plan is created to make sure that the sample is a good representation of the different fisheries types and vessel sizes in the Netherlands. In 2019, the financial results of 216 vessels were collected and used to estimate and deliver the economic performance indicators to the Dutch government and to the European Commission. In addition, the statutory obligation of delivering data has been met.

The Dutch fisheries fleet can be divided into (1) pelagic trawlers, (2) active cutters with active demersal gears, (3) small coastal fisheries and (4) mussel and oyster aquaculture vessels.

Because of the limited number of large pelagic trawlers these vessels are covered by census, resulting in estimates for these vessels which are the same as the figures of the whole population. For the cutter sector with active demersal gears, high quality estimates of costs and earnings are provided and the bias in the various strata is relatively low. The recently implemented, new estimation procedures for the cutter sector have enhanced the quality of the estimates further and due to the new procedures, the outcomes of various stratifications of the cutter fleet do not affect the outcomes as the economic variables are estimated for all individual vessels in the population. However, for some subsectors (e.g. the small shrimp vessels) the coverage of the population could be further enhanced to fully exploit the potential of this new method.

For the small coastal fisheries, the response rates to the questionnaire on the economic information have been in decline for the last years, resulting in low accuracy of the estimated cost structures and potential bias in the outcomes. The response rate was on average 24%. Increasing engagement with these small coastal fisheries could potentially have a positive effect on the response rates. Another option would be to implement other estimation procedures as were implemented for the cutter sector to enhance the quality of the estimates.

For the mussel sector the structure of the sector changed during the last years, increasing the concentration of production rights and production into fewer, larger cooperatives. Because of this, the sampling unit should be changed to the seed collective and the population should be stratified into large and small seed collectives. Including two more large seed collectives in the sample will reduce privacy issues for reporting in this group, lower the risk of bias and enhance the quality of the estimates of this sector. The increased science-sector cooperation in the framework of the monitoring of the mussel covenant may be beneficial to enhance the sample quality.

The sampling of the oyster sector has been notoriously difficult over the last years, resulting in very low response rates and the inability to provide socio-economic information for this sector. Despite the failure of the various initiatives over the last years to convince entrepreneurs to provide data, the key to success in the data collection from this group is still the discussion with the involved stakeholders.

Samenvatting

Het Nederlandse selectieplan voor sociaal-economische informatie over de visserij- en aquacultuursector heeft tot doel te voldoen aan de vereisten voor het EU-kader voor gegevensverzameling en om de basisgegevens te leveren voor sociaal-economische analyse voor managementontwikkeling en evaluaties in Nederland. Het huidige rapport schetst de methodologie die is gebruikt om de programma's voor gegevensverzameling te ontwerpen en laat zien dat het huidige steekproefprogramma resulteert in gegevens die goed passen bij deze doelstellingen voor de meeste segmenten en sectoren.

De schepen die zijn opgenomen in de Nederlandse Farm Accountancy Data Network zijn een steekproef van visserij- en aquacultuurbedrijven van de Nederlandse visserijvloot. Er wordt jaarlijks een selectieplan gemaakt om ervoor te zorgen dat de steekproef een goede afspiegeling is van de verschillende visserijsoorten en vaartuiggroottes in Nederland. In 2019 zijn de (financiële) resultaten ingewonnen van 216 schepen en gebruikt voor de schatting en oplevering van de economische resultaten aan de Nederlandse overheid en aan de Europese Commissie. Hiermee is voldaan aan de wettelijke verplichting tot aanleveren van gegevens.

De Nederlandse visserijvloot zou kunnen worden onderverdeeld in (1) pelagische trawlers (2) actieve kotters met actieve demersaal vistuigen (3) de kleine kustvisserij en (4) de mossel- en oestervloot.

Vanwege de kleine hoeveelheid grote pelagische schepen worden van al deze schepen de economische data verzameld, wat leidt tot schattingen van de economische resultaten die gelijk zijn aan de resultaten van de totale populatie.

Voor de kottersector met actieve demersale vistuigen worden hoogwaardige schattingen van kosten en opbrengsten gegeven en is de bias in de verschillende strata relatief laag. De recent geïmplementeerde, nieuwe schattingsprocedures voor de kottersector hebben de kwaliteit van de schattingen verder verbeterd en door de nieuwe procedures hebben de uitkomsten van verschillende stratificaties van de kottervloot geen invloed op de uitkomsten, aangezien de economische variabelen worden geschat voor alle individuele schepen van de populatie. Voor sommige subsectoren (bijvoorbeeld de kleine garnalenvisserij) zouden de mogelijkheden van deze nieuwe methode beter kunnen worden benut met een betere dekking van de populatie.

Voor de kleine kustvisserijen is de respons op de vragenlijst over de economische informatie de laatste jaren afgenomen, wat heeft geleid tot een lage nauwkeurigheid van de geschatte kostenstructuren en mogelijke vertekening in de uitkomsten. Het responspercentage was gemiddeld 24%. Het vergroten van de betrokkenheid bij deze kleine kustvisserij zou mogelijk een positief effect kunnen hebben op de responspercentages, maar een andere optie zou implementatie van andere schattingsprocedures kunnen zijn zoals die zijn geïmplementeerd voor de kottersector om de kwaliteit van de schattingen te verbeteren.

Voor de mosselsector is de structuur van de sector de afgelopen jaren veranderd, waardoor de concentratie van productierechten en productie in minder, grotere coöperaties is toegenomen. Daarom moet de steekproefeenheid worden veranderd in het zaadcollectief en moet de populatie worden gestratificeerd in grote en kleine zaadcollectieven. Het opnemen van nog twee grote MZI-collectieven in de steekproef zal privacykwesties voor rapportage in deze groep verminderen, het risico op vertekening verminderen en de kwaliteit van de schattingen van deze sector verbeteren. De versterkte samenwerking tussen wetenschap en sector in het kader van de monitoring van het mosselconvenant kan gunstig zijn voor de kwaliteit van de steekproef.

De bemonstering van de oestersector is de afgelopen jaren moeilijk geweest, wat heeft geleid tot zeer lage responspercentages en het onvermogen om sociaal-economische informatie voor deze sector te verstrekken. Ondanks dat er de afgelopen jaren diverse initiatieven zijn mislukt om ondernemers te overtuigen om data aan te leveren, ligt de sleutel tot succes bij de dataverzameling van deze groep toch in de discussie met de betrokken stakeholders.

1 Introduction

Within the EU data collection framework for fisheries and aquaculture data (EU regulation 2017/1004 and Commission Implementing Decision (EU) 2019/909), data on the economic and social aspects of the fisheries and aquaculture sectors have been collected since 2001. The aim of this data collection framework is to monitor the economic, financial and social developments in the fisheries and aquaculture sector in the EU member states. Every year the European Commission publishes the Annual Economic Report of the EU fishing fleet,[2] an overview of the economic importance and developments in the EU fishing fleets. Once every two years, a similar publication is made for the aquaculture and processing sector.[3]

In the Netherlands, the data are collected by Wageningen Economic Research on behalf of the Centre for Economic Information (in Dutch, *Centrum voor Economische Informatievoorziening*, CEI). The data are being collected from a multitude of sources using various instruments. One of these instruments is the Farm Accountancy Data Network (FADN) for fisheries and aquaculture. Other instruments include interviews and (online) questionnaires. The information that is gathered by the Netherlands is specified in the National plan 2022-2027 for data collection[4] and annually each MS reports on the implementation of the National plan.[5]

Although these reports provide a general overview of all activities planned and carried out, the reports give ample information on the procedures and the quality aspects of the data collection. This reports provides background information on the sampling strategies of the various sampling programmes for the economic data for the various Dutch fisheries and aquaculture sectors included in the national plan and provide an assessment of the quality of the resulting data. In this report, the Dutch fisheries and aquaculture sector is divided into (1) pelagic trawlers (2) active cutters with demersal gears (3) small coastal fisheries and (4) mussel and oyster fleet.

In Chapter 2, the relation between the population and the target population is described. Chapter 3 presents the selection plan. Chapter 4 describes the evaluation of the quality of the sample and Chapter 5 concludes and recommends actions to be taken to enhance the quality of the Dutch data collection plan. The appendices provide more details on the various surveys carried out for the different parts of the Dutch fisheries and aquaculture sector. General statistical terms are explained in Appendix 1.

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2 https://ec.europa.eu/jrc/en/publication/scientific-technical-and-economic-committee-fisheries-stecf-2019-annual-economic-report-eu-fishing

3 https://stecf.jrc.ec.europa.eu/reports/economic

4 Ministerie van LNV, Wageningen Marine Research, Wageningen Economic Research, 2019. https://datacollection.jrc.ec.europa.eu/wp/2022-2027

5 Ministerie van LNV, Wageningen Marine Research, Wageningen Economic Research, 2020. https://datacollection.jrc.ec.europa.eu/ars

2 Population of the Dutch Fisheries and aquaculture sector

2.1 Overview

The population for the EU data collection for fisheries and aquaculture consists of all registered fishing vessels used in sea and coastal fisheries and all companies involved in aquaculture activities (Commission Delegated Decision (EU) 2019/910 of 13 March 2019).[6] According to the Dutch Chamber of Commerce (CoC) the Dutch fisheries and aquaculture sector are composed of 790 and 155 companies respectively. These companies include both sea and inland fisheries, and saltwater and freshwater aquaculture. The companies have in total 904 vessels registered in the Dutch fleet register (in 2019). A total number of 630 companies own registered fishing vessels (Table 2.1), which is lower than the total number of companies registered as fishing companies in the CoC data (Table 2.2). This difference is caused by the fact that not all Dutch fishing companies own a vessel: they either use the vessel from another company, operate from shore, or they own foreign fishing vessels. The same accounts for the difference in the number of inland fishing companies. Besides, small differences in the number of companies might be due to the timing of the data acquisition (e.g. two saltwater aquaculture companies more in the fleet register). The data from StatLine covers the 4th quarter of 2019 whereas the data from the fleet register resemble the situation on 31 December.

For the data collection on fisheries, the unit of data collection is the fishing vessel. According to EU legislation, both vessels registered at the end of the year and vessels that displayed fishing activities during the year (but were absent from the fleet at the end of the year) should be taken into consideration (EU-map). Comparison of the logbook data and the fleet data shows that for the Dutch fleet in 2019, this last group consisted of three vessels. As a result, the frame population consists of 727 fishing vessels involved in the sea and coastal fisheries and 92 companies (involved in saltwater aquaculture like mussel and oyster farming). Within the EU data collection inland fisheries and freshwater aquaculture are not taken into account until 2021 (Ministry of Agriculture, Nature and Food Quality, 2019). From 2022 onwards eel aquaculture will also be included in the data collection programme, but since no data on this sector is available yet, this is outside the scope of this report.

Table 2.1 *Population of registered fishing and aquaculture vessels and companies in the Netherlands (ultimo 2019)*

Fleet register segment:	Number of vessels	Number of companies
Sea fishery (MFL1 and MFL2)	724	571
Inland fishery (ART1)	69	59
Aquaculture (AQUA)	111	92
Total	**904**	722

Source: Fisheries fleet, Statistics Netherlands, calculations by Wageningen Economic Research.

Table 2.2 *Population of companies in the fisheries and aquaculture sector (4th quarter 2019)*

Nace segment	Number of companies
0311 Sea and coastal fisheries	620
0312 Inland fisheries	170
0321 Saltwater aquaculture	90
0322 Freshwater aquaculture	65
Total	945

Source: Fisheries fleet, Statistics Netherlands, calculations by Wageningen Economic Research.

6 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D0910&from=EN

Figure 2.1 shows the relation between the census, target population and sample. The figure consists of different layers:

- The outer layer (census) represents all Dutch fishing an aquaculture companies registered in either the Dutch Chamber of Commerce (CoC) and National Fisheries Register (NVR). This census is broader than the fisheries and aquaculture sectors taken into account; even other types of vessels (e.g. inland fisheries and fishing companies operating foreign vessels) are included;
- The next layer (target population) consists of the Dutch flagged sea fishing vessels and the saltwater aquaculture companies. This is the population which is used in the EU data collection framework. These Dutch companies with vessels are found in the database owned by the Dutch Ministry of Agriculture, Nature and Food Quality with a Dutch fishing license;
- Finally, the sample is selected based on those fishing vessels registered by the fleets determined by (technical) fisheries types. Technical characteristics of the fleet, fishing activities from the logbooks and other information such as ownership are applied for a selected year to determine the sample.

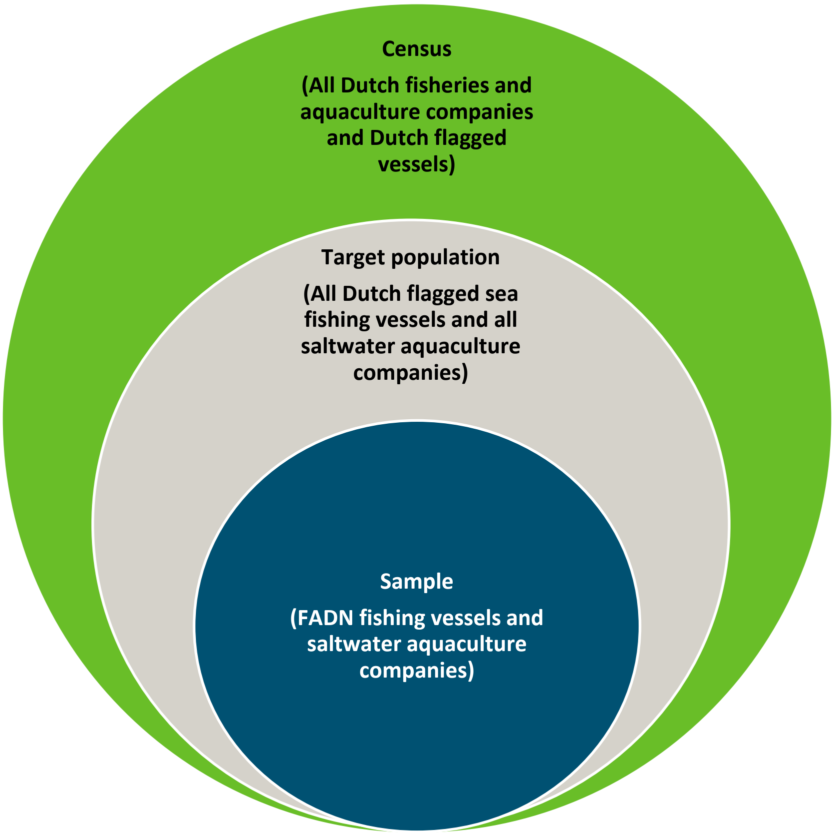

Figure 2.1 *Relationship between census, target population and sample (FADN; Farm Accountancy Data Network)*

Within the target population three segments are distinguished for the fishery (1-3) and two for the aquaculture (4-5):

1. Pelagic trawlers targeting small pelagic fish for human consumption (approximately 30% of the total value of the Dutch fleet);
2. Active cutters using demersal active gears on a commercial basis add more than 95% of the remaining commercial catches from fisheries;
3. Vessels in the small coastal fisheries are either vessels that participate occasionally or never in the sea fishery or vessels that use passive gears or dredges;
4. Mussel farming in the coastal waters having an annual turnover of around 40-60 million euros;
5. Oyster farming which occurs mainly in Zeeland and had an annual turnover of around 5-15 million euros.

To distinguish between the active cutters and the small coastal fisheries the main gear and a threshold on gross revenue is used. Active cutters are defined as vessels using active gears (trawls and seines) targeting fish (or shrimps) and having a gross revenue of at least 50,000 euros per year. All other vessels are classified as small coastal fisheries. At the end of 2019, the Dutch fleet consisted of 7 pelagic trawlers, 291 cutters and 222 vessels classified in the small coastal fisheries (www.visserijincijfers.nl). Besides, 204 vessels were registered, but did not show any activity and three cutters were active in 2019 but were not registered at the end of 2019, because they stopped fishing.

2.2 Coverage

Table 2.3 gives an overview of the number of vessels and the percentage of total revenues of the various fleet segments that are covered by the sampling frame. Only the other aquaculture vessels are not covered by the sampling programme. This group includes small vessels which are not used for aquaculture of fisheries purposes but still have a licence. In the fisheries sector this group of so called inactive vessels is much larger (204 vessels) but is included in the data collection on other coastal fisheries.

Table 2.3 *Number of fisheries companies and their relative economic importance (measured in revenues) in the 2019 fishery and aquaculture*

	Number of vessels	Percentage of vessels	Percentage of total revenues
All vessels in the Fisheries fleet	**733**	**100**	**100**
Fisheries			
Pelagic trawlers	7	1	27
Cutter	294	40	69
Other coastal fishers*	432	59	5
Aquaculture	**111**	**100**	**100**
Mussel	68	61	85
Oyster	28	25	15
Other	15	14	0

Source: Fisheries fleet, Statistics Netherlands, calculations by Wageningen Economic Research, VisserijinCijfes.nl. *:including 204 inactive vessels.

Quality of the sampling frame

Only the other aquaculture vessels are not covered by the sampling programme. This group includes small vessels that are not used for aquaculture or fisheries purposes but still have a licence. In the fisheries sector this group of inactive vessels is much larger (204 vessels) but is included in the data collection on other coastal fisheries. The sampling frame therefore covers 100% of the registered landings for the marine fisheries and 100% of the saltwater aquaculture activities (Figure 2.1).

3 Selection plan

3.1 Introduction

A selection plan is a key document which specifies how the selection activities will be organised, initiated and conducted. The selection plan for the Dutch Fisheries fleet, consists of the following steps:
1. Determination of the fisheries (technique) types
2. Determination of the number of vessels per fisheries type
3. Determination of the stratification scheme (depending on the number of vessels per fisheries type
4. The sample vessels per fisheries type are distributed over the size classes.

The selection plan for each of the following fleet segments of the Dutch fisheries and aquaculture is described in this chapter:
- Pelagic trawlers
- Active cutter fleet
- Small coastal fisheries
- Mussel and oyster fleet.

In case of the active cutter fleet, there is a difference between the European and the national (Dutch) stratification. Within the European stratification, the criteria for classification of the vessels are the length and the predominant fishing technique (e.g., demersal trawl, bottom trawl, dredger) of the vessel. For the national stratification of the active cutter fleet, the classification is based on the engine power of the vessel as this characteristic has a strong link with the Dutch management context and the fishing opportunities for the vessels. Each of the segments will be described in the sections below. General design principles are described in Appendix 2.

3.2 Pelagic sector

3.2.1 Vessel types

Pelagic trawlers target small pelagic fish species (e.g., herring, blue whiting, mackerel, sardines and horse mackerel) for human consumption by mid-water trawling nets in the European and far distance international seas. The Dutch pelagic trawlers process and freeze their caught fish on board and export for more than 90% of the landed volume to African countries.

3.2.2 Data collection method

The social economic and financial data of the sampled active Dutch pelagic freeze trawlers are collected by financial accountancy data from the Dutch FADN. These companies with active fisheries vessels participate voluntary in this panel by providing their accountancy reports to Wageningen Economic Research for the national and European economic data collection for the fisheries fleet. More information on the definition and calculation of the individual variables can be found in Appendix 3.

3.2.3 Sampling plan

3.2.3.1 Number of sampled vessels per type

The Dutch pelagic fishery consisted of 7 vessels in 2019 owned by 3 companies. Under the EU classification these vessels are classified as vessels longer than 40m using pelagic trawls.
As the number of vessels and companies is quite small, the economic data is collected for all vessels in the census.

3.2.3.2 Stratification scheme

As all vessels are sampled in this group, no further stratification is applied.

3.3 Cutter sector

3.3.1 Vessel types

Active cutters using demersal active gears on a commercial basis add more than 95% of the remaining commercial catches. There are diversified types of fishing techniques applied by the Dutch active cutter sector: bottom trawl (including pulse and Sum wing) and twin rig/otter trawl/quad rig, seiner (also snurrevaad or flyshoot fishery) as demersal trawls. Target fish species depend on the fishing technique and could be flatfish (plaice, sole), crustaceans (shrimps or nephrops) and groundfish (e.g., red mullet, squid and gurnard).

3.3.2 Data collection method

The social, economic and financial data of the sampled active Dutch cutters are collected by financial accountancy data administrators. These companies with active fishing vessels participate voluntarily in this panel by providing their accountancy reports with Wageningen Economic Research for the national and European economic data collection for the fisheries fleet. More information on the definition and calculation of the individual variables can be found in Appendices 4-7.

3.3.3 Sampling plan

3.3.3.1 Number of sampled vessels per type

For the national and European stratification, the active cutter fleet of 294 vessels (2019) varies between multiple segments of vessels between 12 and 40m in length and between larger than 0 (on average a minimum of 200) and 2,000 horsepower (hp) of the engine.

3.3.3.2 Stratification scheme

Below the national and European stratification are described.

National stratification

The first segmentation criteria for the national stratification is based on the power of the vessels' engine. For decades this manner of segmentation is applied for the national stratification as it distinguishes in an accurate way the different types of fishing techniques. This results in 5 segments:

1. Hp class 1: vessels with an engine power between 0 and 26hp
2. Hp class 2: vessels with an engine power between 261 and 300hp
3. Hp class 3: vessels with an engine power between 301 and 800hp
4. Hp class 4: vessels with an engine power between 801 and 1,500hp
5. Hp class 5: vessels with an engine power larger than 1,500hp.

The size of the different segments of the active Dutch cutter sector is summarised in Table 3.1 by the target population and the sample frame. The sample frame consists of those active vessels that participate in the Dutch FADN as a Dutch cutter.

Table 3.1 *Stratification scheme 2019 according to national classification (size classes in one row represent one stratum)*

Hp class	Target population	Total of sample frame	
	Number of vessels	Number of vessels	Number of vessels in sample frame as % of target population
1 (0-260)	31	5	16
2 (261-300)	160	38	24
3 (301-800)	18	9	50
4 (801-1,500)	19	11	58
5 (>1,500)	66	26	39
Total	***294***	***89***	***30***

EU stratification

Within the EU stratification the vessels are classified based on their length and the dominant gear used (more than 50% of time at sea). This results into 5 segments:

1. Vessels with a length from 18-24m using predominantly demersal trawls
2. Vessels with a length from 24-40m using predominantly demersal trawls
3. Vessels with a length from 18-24m using predominantly beam trawls[7]
4. Vessels with a length from 24-40m using predominantly beam trawls
5. Vessels with a length of over 40m using predominantly beam trawls.

Combining the national and EU stratification for the cutter sector results in a large number of segments (Table 3.2). For both national and EU stratification the sample rate varies between 16% and 58%. The main rules of thumb that are used to distribute sample vessels have been incorporated to pursue the threefold objective of the sampling scheme:

- Optimisation of the estimate of the economic performance of the total fleet
- Gaining insight in the cost structures of all main fishing activities
- Minimising the risk of low quality estimates for small groups in case of non-response.

This results in the following rules of thumb:

- Economically important segments have higher sampling fractions as these segments contribute more to the total variation in costs and earnings (according to Neyman allocation)
- Segments with heterogeneous fishing activities have higher sampling fractions
- Small segments have higher sampling fractions.

As a result of this, the sampling fraction for the large beam trawl vessels (>1,500hp) is relatively high, because of their large economic importance and the fact that over the last years, this group contained both traditional beam trawlers and pulse trawlers with very different cost structures. Sampling fractions of the vessels with an engine power between 301-800 and 801-1,500 were also large because of the variation in fishing methods used by these vessels. On the other hand, the sampling fraction of small vessels (1-260hp) was relatively low because of the homogeneity in this group, using only one type of gear.

[7] This segment also includes 8 small active cutters with a length between 15-18m.

Table 3.2 *Segmentation by national and European stratification for the active cutter sector*

		Hp class			Hp class			Hp class			Hp class			Hp class			Total		
		1-260			261-300			301-800			801-1,500			>1,500					
Length class	**Gear**	**Total**	**Sample**	**Sampling fraction (%)**	**Total**	**Sample**	**Sampling fraction (%)**	**Total**	**Sample**	**Sampling fraction (%)**	**Total**	**Sample**	**Sampling fraction (%)**	**Total**	**Sample**	**Sampling fraction (%)**	**Total**	**Sample**	**Sampling fraction (%)**
18-24m	Demersal trawls				15	2	13%	2	1	50%							17	3	18%
24-40m	Demersal trawls				6	4	67%	16	8	50%	11	6	55%				33	18	55%
18-24m	Beam trawls	31	5	16%	127	31	25%										158	36	23%
24-40m	Beam trawls				12	1	8%				3	1	33%	10	3	30%	25	5	20%
>40m	Beam trawls										5	4	80%	56	23	41%	61	27	44%
	Total	31	5	16%	160	38	24%	18	9	50%	19	11	58%	66	26	39%	294	88	30%

The same holds for the EU segments: sampling fractions are in general larger for larger vessels, and small diverse segments (e.g. demersal trawls 24-40m) show relative high sampling fractions.
The EU segment of beam trawlers between 24-40m also shows high levels of variability in cost structure, as this segment consist of very different vessels being either just above 24m or just below 40m. The so called euro cutters[8] (just over 24m) have an engine power of 300hp and a fishing pattern and cost structure similar to the vessels under 24m (Figure 3.2). The vessels of little less than 40m have an engine power which is more than 6 times larger (2,000hp), fish in other areas and have cost structures that are similar to the beam trawlers over 40m.

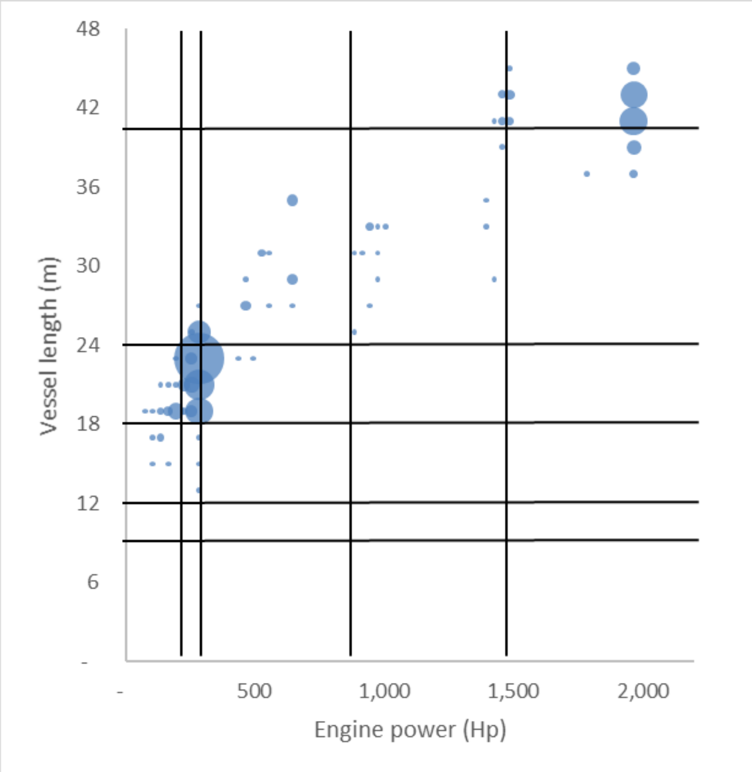

Figure 3.1 *Distribution of vessels with certain engine powers and vessel lengths in the active cutter sector. Bubble size represents the number of vessels in a combination of engine power (10hp interval) and vessel length (2m interval). Horizontal lines represent the borders of the size classes in the EU segmentation (10, 12, 18, 24 and 40m). Vertical lines represent the borders of the hp classes in the national segmentation (260, 300, 800 and 1,500hp)*

As a result this segment (Beam trawlers 24-40m) is not regarded as a target segment and no action has been taken to increase the sampling rate for this segment.

8 Euro cutters is a specific type of demersal trawling cutters with a maximum of 300HP engine power. Originally the first vessels were built in the beginning of 1980s. Sometimes euro cutters were extended (longer than 24m) and with more engine power.

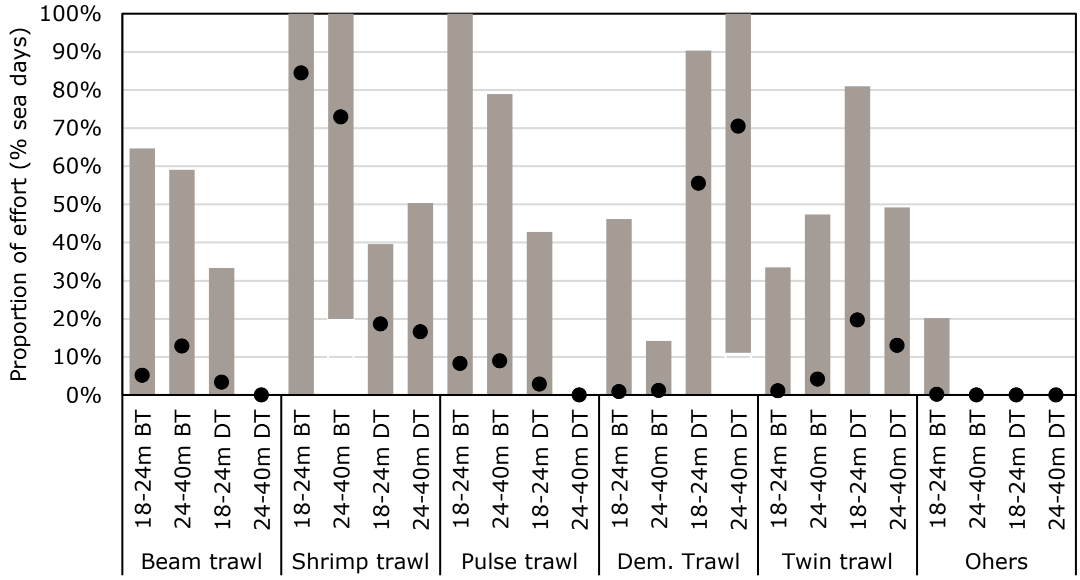

Figure 3.2 *Proportion of effort in various fisheries of the vessels under 300hp in the EU segments 18-24m Beam Trawl, 24-40m Beam Trawl, 18-24m Demersal trawl and 24-40m Demersal Trawl. The dots represent the average percentage in the segment, the bars represent the variation in the segment. E.g. The average proportion of effort in the Demersal trawl fishery in the segment 24-40m DT is 71%, but for individual vessel it ranges between 12 and 100%*

Another specific problem of the application of the EU segmentation to the Dutch fleet is the separation between the demersal trawlers and beam trawlers with engine powers <300hp. This group uses various fishing techniques in different combinations and the variation in the proportion of the fishing gears used is high (Figure 3.2). As cost structures for various fishing techniques (e.g. between beam trawlers and shrimp trawlers) differ more than the overall cost structures between the demersal and beam trawl vessels, the distinction between the two segments is not regarded as helpful to increase the quality of the estimates. Instead, the group of all vessels between 261 and 300hp is stratified based on the main gear type used in the Dutch data collection programme.

The above analyses show that the combination of the Dutch engine power (hp) classes and the EU length classes results in artificial groups which do not represent homogeneous segments suitable for data collection and estimation. As a result the Dutch data collection programme combines the main characteristics of the two programmes to generate an optimal sampling stratification scheme for the Dutch cutter sector. This scheme takes into account the following characteristics (Figure 3.3):

1. Engine power
2. Dominant (most applied) gear type
3. Fishing efforts (sea days).

These three characteristics are ranked in this order since it fulfils a quality procedure of the homogeneity within random selected samples. Fishing effort (3) is added as it is an indication of the economic scale of operation of a company and is often rather stable between years for individual vessels. There could be vessels in one stratum with less than 50 fishing days per year and other sides vessels with more than 300 fishing days that year (Table 3.3).

The application of these three criteria results in groups of vessels that are homogeneous in terms of vessel characteristics, fishing behaviour and scale of operation, and thereby, have a homogeneous cost structure.

National stratification:
Based on engine power (in hp):

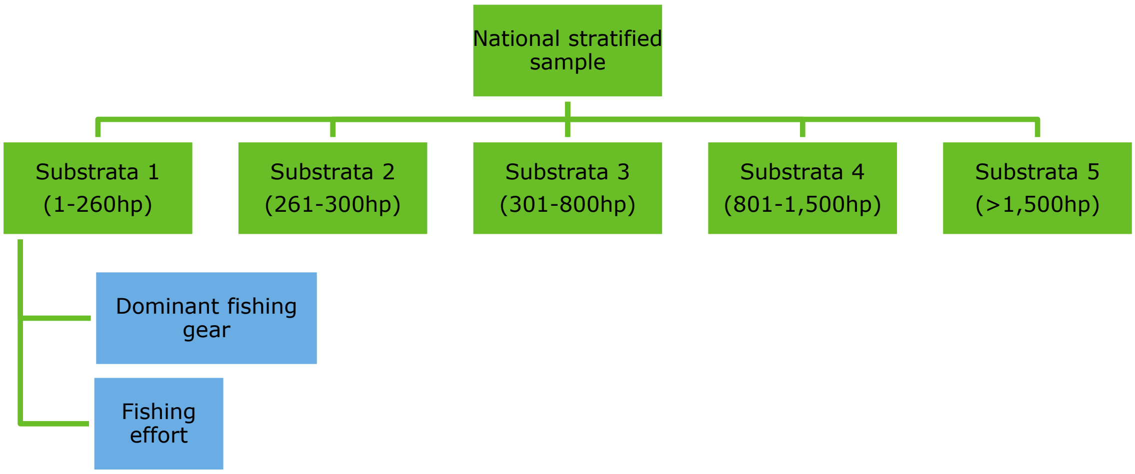

Figure 3.3 *Stratification for the active cutter sector for the data collection*

3.3.3.3 Sample vessels per stratum

Table 3.3 presents the sampling fraction per stratum for 2019, based on the design principles described above and in Appendix 2. The distribution of the vessels from the sample across the size classes has remained broadly the same and is mainly determined by the further stratification in the dimension of vessels' activities. All strata with more than 3 vessels are covered by the sampling scheme and because of the new methodology used for the estimation of the economic results, also for the other strata, the costs and earning can be estimated with high precision (see also Appendices 4-8).

Table 3.3 *Sampling fraction per stratum from the Dutch active cutter fleet in 2019*

Effort (days at sea)		**0-100**			**101-200**			**201-300**			**>301**			**total**		
Hp class	**Dominant gear**	**total**	**sample**	**sampling fraction**	**total**	**sample**	**sampling fraction**	**total**	**sample**	**sampling fraction**	**total**	**sample**	**sampling fraction**	**total**	**sample**	**sampling fraction**
1-260	shrimp trawl	26	4	15%	5	1	20%							31	5	16%
261-300	beam trawl				2	1	50%							2	1	50%
261-300	demersal trawl				5	1	20%							5	1	20%
261-300	pulse trawl				10	4	40%	3	1	33%				13	5	38%
261-300	shrimp trawl	89	18	20%	36	8	22%							125	26	21%
261-300	twinrig	1	1	100%	12	2	17%	2	2	100%				15	5	33%
301-800	demersal trawl	1	1	100%	3	0	0%							4	1	25%
301-800	flyshoot	2	1	50%	7	4	57%	2	1	50%				11	6	55%
301-800	twinrig				2	1	50%	1	1	100%				3	2	67%
801-1,500	beam trawl				3	1	33%	1	1	100%				4	2	50%
801-1,500	demersal trawl				2	1	50%	1	0	0%				3	1	33%
801-1,500	flyshoot				6	5	83%	1	0	0%				7	5	71%
801-1,500	pulse trawl				2	2	100%	1	0	0%	1	1	100%	4	3	75%
801-1,500	twinrig	1	0	0%										1	0	0%
>1,500	beam trawl	2	0	0%	22	6	27%	16	6	38%	1	1	100%	41	13	32%
>1,500	demersal trawl							1	0	0%				1	0	0%
>1,500	pulse trawl				13	8	62%	10	5	50%	1	0	0%	24	13	54%

3.4 Small coastal fisheries

3.4.1 Vessel types

Vessels in the small coastal fisheries are either vessels that participate occasionally (or never) in the sea fishery or vessels that use passive gears or dredges. Paradoxically to the term 'small', the length of vessels vary strongly from around 12m to more than 40m. Also the type of fishing techniques are diversified as gill nets, pots and traps (often for North Sea crab), fishing rod (sea bass, grey mullet or cod) and dredges (shellfish other than mussel and oyster).

3.4.2 Data collection method

The social economic and financial data of the sampled active Dutch small coastal fisheries is collected by annual surveys among the Dutch companies in this fleet sector. Companies provide by this manner their social economic and financial data to Wageningen Economic Research for the national and European economic data collection for the fisheries fleet. The data collection method of questionnaires by telephone and/or (e-)mail is applied since the response rate is low. The data collection process consists of two steps.

1. Telephone questionnaire on fishing activities
2. Paper/internet questionnaire on economic and social variables.

During the first phase, all vessel owners (whose telephone numbers are available, approximately 80%) are contacted to collect information on the level of fishing activities and the main gear used during the year. In case fishing vessels have not been active, the owner is asked for the value of the vessel and the percentage of own capital. This fulfils all the data needs for the data collection programme for inactive vessels. Moreover, the owners are asked whether they are willing to fill in the questionnaire on the economic and social data of their vessel and whether they want to receive the questionnaire by mail (i.e., hardcopy) or e-mail.

Based on the information obtained from the telephone questionnaire, the questionnaire is send out to all owners of fishing vessels that:

- Could not be reached during the telephone survey;
- Have stated that want to receive the questionnaire during the telephone survey.

The responders may answer the questionnaire either by returning the questionnaire on paper, returning the questionnaire by e-mail or by filling in the questionnaire directly online. The responses from the questionnaire are monitored and two to three weeks after the questionnaires have been sent, a reminder is sent to those owners who did not respond.

More information on the definition and calculation of the individual variables can be found in Appendix 8.

3.4.3 Sampling plan

3.4.3.1 Number of sampled vessels per type

The Dutch small coastal fisheries consisted in 2019 of 435 vessels, including 205 vessels that are regarded as inactive. The target population for the data collection is the complete population of both active and inactive vessels.

3.4.3.2 Stratification scheme

The vessels use a large variation of fishing techniques ranging from active suction dredging gears for collecting shellfish to passive gears (see Table 3.4). Because of the large variation, many small segments are identified, based on the EU legislation. During the analysis/reporting, however many segments are clustered (according to EU guidelines), because of confidentiality and because the number of samples obtained does not allow for detailed analysis.

Clustering is based on the type of gears used (active and passive gears are clustered together) and the length of the vessels.

Table 3.4 *Stratification scheme of small coastal fisheries in 2019 according to EU classification (size classes in one cell represent one stratum), cells/strata with the same type of shading are clustered together for analysis/reporting*

	Length class						
Gear type	**0-10m**	**10-12m**	**12-18m**	**18-24m**	**24-40m**	**40 m**	**total**
Beam trawlers	5	2	6	6			19
Demersal trawlers and/or seiners	5		2	1			8
Pelagic trawlers			1				1
Purse seiners	2						2
Dredgers					3	4	7
Vessels using passive gears only for vessels < 12m	164	18					182
Drift and/or fixed netters			4	1			5
Vessels using pots and/or traps			3	2			5
Vessels using polyvalent passive gears only			1				1
Inactive vessels	139	14	15	16	17	4	205
Total	**315**	**34**	**32**	**26**	**20**	**8**	**435**

3.5 Mussel and oyster fleet

3.5.1 Vessel types

The mussel and oyster vessels operate as part of the Dutch saltwater aquaculture in the deltas and coastal waters. Culture of mussels begins with the collection of mussel seed either from natural beds or from a rope or other collector placed in areas chosen for their currents and the presence of micro-organisms. The seeds are collected and transferred to mussel farms, generally in the period between May and July. Mussel dredgers transfer the juveniles from natural beds to sheltered growing areas inshore. The same holds for oysters, although there is an increasing use of production methods of off bottom cultivation by growing the juvenile oysters on a kind of wooden tables to avoid predators like snails (e.g. Asian oyster drill).

3.5.2 Data collection method

The economic and financial data of the sampled active Dutch mussel en oyster growers is collected through the annual reports from the Dutch FADN. These companies participate voluntary in this panel by providing their annual reports to Wageningen Economic Research. Because these reports become available only 16 months after the reference year, data collection is delayed by one year, therefore data is available two years after the end of the reference year, one year later than the data for the other sectors. Therefore, the analyses of the data covers the 2018 data. The annual turnover rate of the companies in the sample is relatively low (<10%), but because of earlier experiences of low response rates in random sampling, a panel approach is thought to be the most suitable type of data collection. Total volume of landings and value of landings for the mussel sector is obtained from the mussel auction, covering 100% of the mussel landings. For the oyster sector no such landings statistics are available, and therefore all data is gathered from national statistics.
More information on the definition and calculation of the individual variables can be found in Appendix 9.

3.5.3 Sampling plan

3.5.3.1 Number of sampled vessels per type

By the end of 2018, the Dutch mussel fleet consists of 53 active mussel vessels and 26 active oyster vessels (Agrimatie: www.visserijincijfers.nl). Out of these 11 mussel vessels and 3 oyster vessels have been sampled.

3.5.3.2 Stratification scheme

During the last years the panel of mussel and oyster vessels consisted of a panel that was selected randomly from the frame population without further stratification.

4 Evaluation of the samples

4.1 Methodology

The samples of the different segments are evaluated by checking the response rate, the representativeness of the sample and the statistical reliability.

4.1.1 Response rate

The response rate was determined as the number of sampled units per segment relative to the total number of sampling units in the frame population.

4.1.2 Representativeness of the sample

To determine the statistical reliability an analysis has been conducted to what extent the sampling units (in most cases vessels) are representative for the frame population.

For the fisheries sectors, the following parameters are used to test the representativeness of the sample:

- **Technical characteristics:** the mean of the sample is compared to the mean of the total sampling frame. In order to have an accurate sampling for the economics (e.g. financial cost structures) of the Dutch cutter fleet following two characteristics are analysed:
  - Size and weight of vessels (tonnage, GRT)
  - Engine power of vessels (kilowatt, kW).
- **Activities (effort):** the fishing activities also determine whether a vessel is representative for the stratum and sampling frame. Fishing activities are expressed by using the following characteristics:
  - Fishing effort (days at sea or fishing days per year)
  - Total landed fish volume (in kilograms)
  - Total landed value fish (in euros).

For each characteristic the mean is tested via the Z-test to analyse whether the sample was deviating from the sampling frame.

In case of the mussel sector, the sampling units were not the vessel and other parameters are used to test the representativeness of the sample. The method used is described in the section of this sector.

4.1.3 Statistical reliability

The statistical quality of the estimates resulting from the sampling scheme is analysed as the sample should provide an accurate view of the cost structures of the Dutch fisheries and aquaculture fleet.

The standard error is determined for each (sub)stratum by applying the standard method for randomised sampling.

The variances in the estimations $(v(Y_{Dh}))$ is calculated by:

$$v(\overline{Y}_{Dh}) = \frac{(1 - f_h)}{n_h} s^2_{y,h}$$

Where:

$(s^2_{y,h})$ = Standard deviation in stratum h

n_h = Number of vessels in stratum h

f_h = Sampling fraction in stratum h

For the active cutter sector, the estimating procedure has been enhanced in 2019 by using the relationships between the cost items and activity variables and technical variables which are available for all vessels in the target population. For this specific fleet segment the method for estimation is explained in Appendix 5.

4.2 Pelagic trawlers

The economic information is available for all trawlers and the coverage is therefore 100%. No additional analyses are therefore needed.

4.3 Cutter sector

4.3.1 Response rate

The members of the cutter panel have been committed to provide economic data over a long time period. Every year between 4-7 vessels (5-9% of total) resign from being a panel member. These vessels are replaced by randomly chosen vessels from the same stratum. Success rates of inviting new panel members are generally high (around 60-80% over the last years).

4.3.2 Representativeness

National stratification
Table 4.1 provides an overview of the relative differences between the average of the sample and the average of the population for different characteristics of the vessels in the sample. For most segments the deviation of the sample from the frame population is small (<10%). Exceptions are the engine power and days at sea for small vessels (0-260hp) and the landings (both volume and value) for vessels with an engine of 801-1500hp. For vessels with engine power of more than 1,500hp the landed volume of the sample was lower than the average in the population. This is mainly due to the fact the vessels targeting (large amounts of) plaice are underrepresented in the panel. The total value of this segment did not show a large difference with the average value in the frame population. None of the differences between the sample and the population were significant. With regards to the gear types used, Figure 4.1 shows that for most fleet segments the distribution of effort over the various fisheries is similar to the distribution in the population. Only in hp class three, fish trawls are underrepresented. For other segments it is concluded that the sample is representative.

Table 4.1 *Relative differences between the sample average and the average in the frame population in 2019. The yellow marked values demonstrate significant deviations (Z<0.05) (national stratification)*

Hp class	Kilowatt (kW)	Gross Tonnage (GRT)	Days at sea	Landed volume (in kg)	Landed value (in €)
1 (0-260)	11%	1%	13%	5%	5%
2 (261-300)	0%	6%	9%	6%	13%
3 (301-800)	-1%	-4%	-6%	-4%	-6%
4 (801-1,500)	4%	3%	7%	17%	15%
5 (>1,500)	-1%	1%	4%	-13%	-2%

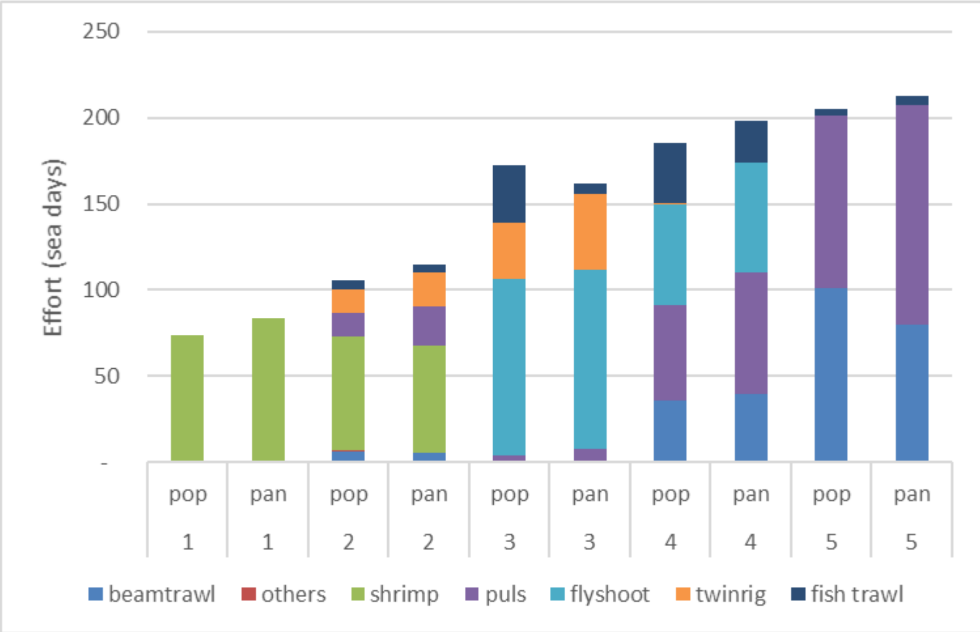

Figure 4.1 *Average amount of seadays in the various fishing techniques for the vessels in the sample (pan) and the population (pop) in each of the segments. The numbers 1-5 correspond to the hp class (see Table 4.1)*

European stratification

For some of the EU segments the differences in the characteristics of the sample and the population are slightly larger than for the national segments (see Table 4.2). This is mainly the case for the demersal trawlers 18-24m and the beam trawlers 24-40m. However, only a significant difference between the panel and the population is found for the landed value of the beam trawlers 24-40m as the variability between vessels in this segment is large. For the other strata the differences between sample mean and sampling frame mean are rather small (frequently less than 10%). Also with regard to the effort in the various fishing techniques, the sample represents the fisheries in the population (see Figure 4.2). The largest differences can be found in the segments of the demersal trawlers 18-24m and the beam trawlers 24-40m. Here again, fish trawls are underrepresented in one segment. It is concluded that, apart from this, the sample of the EU segmentation is representative.

Table 4.2 *Relative differences between sample means and sampling frame means as a percentage. The yellow marked values demonstrate significant deviations between sample and sampling frame (Z<0.05) (EU stratification) in 2019*

EU length class	Kilowatt (kW)	Gross Tonnage (GRT)	Days at sea	Landed volume (in kg)	Landed value (in €)
DTS,4 (18-24m)	10%	14%	-11%	-22%	-14%
DTS,5 (24-40m)	-4%	-7%	0%	3%	2%
TBB,4 (18-24m)	3%	8%	10%	8%	14%
TBB,5 (24-40m)	48%	44%	31%	22%	59%
TBB,6 (40m+)	-3%	0%	3%	-12%	-5%

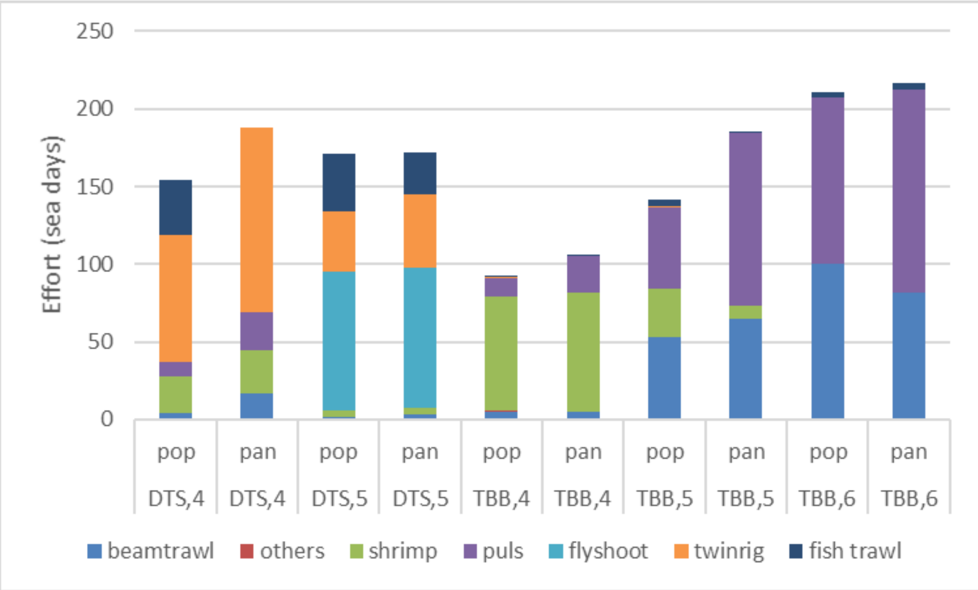

Figure 4.2 *Average amount of seadays in the various fishing techniques for the vessels in the panel and the population in each of the segments. The numbers 1-5 correspond to the length class (see Table 4.2)*

4.3.3 Statistical reliability

National stratification

Table 4.3 provides an overview of the quality of specific costs (e.g. employment costs) of the randomly selected vessels. The calculated relative standard error is a measure of the potential deviation between the estimation and actual value by the indicator in the sampling frame. The mean of the sampling frame is between a probability area of 95% within a range of twice the standard error of the statistical estimation. To illustrate, with a relative standard error of 0.18%, there is a probability of 95% that the mean of the sampling frame deviates less than 36% (i.e., twice the standard error) of the statistical estimation.

In general, most standard errors are below 10%, especially for the larger vessels. This demonstrates that the estimations provide an accurate sample.

The exception to the rule is the segment of small shrimp cutters (hp class 1) for which standard errors range from 10% for fuel costs to 22% for variable costs. This is mainly due to the large variation in the activity levels of the vessels in this group. In the new approach implemented from 2020 onwards, the statistical uncertainty has been lowered as a result of using regression analyses to estimate the costs (see Section 4.3.4).

Table 4.3 *Relative standard errors of the estimation of the selected economic indicators based on the randomly selected vessels in 2019 (national stratification)*

Hp class	Revenue	Employment costs	Fuel costs	Variable costs	FTE
1 (0-260)	0.12	0.12	0.10	0.22	0.03
2 (261-300)	0.07	0.10	0.08	0.11	0.06
3 (301-800)	0.08	0.10	0.06	0.09	0.03
4 (801-1,500)	0.06	0.09	0.06	0.05	0.06
5 (>1,500)	0.02	0.04	0.04	0.03	0.02

European stratification

For the EU segments, standard errors are frequently around 10% or less. Only the standard errors of the demersal trawlers 18-24m are relatively high, as the sampling fraction of this segment is relatively low. The sampling fraction of the segment of beam trawlers between 24-40m is relatively high due to the large variability in this segment as explained in the national stratification.

Table 4.4 *Relative standard errors of the statistical estimation of the considerable economic indicators based on the randomly selected vessels in 2019 (EU stratification)*

EU length class	Revenue	Employment costs	Fuel costs	Variable costs	FTE
DTS,4 (18-24m)	0.22	0.13	0.33	0.54	0.10
DTS,5 (24-40m)	0.06	0.07	0.07	0.07	0.05
TBB,4 (18-24m)	0.08	0.11	0.10	0.12	0.07
TBB,5 (24-40m)	0.09	0.15	0.11	0.10	0.08
TBB,6 (40m+)	0.02	0.04	0.04	0.03	0.02

4.3.4 New estimation methodology for cutter fleet

Although the statistical reliability and representativeness of the Dutch cutter panel are generally fine, the data availability allows for a more advanced estimation procedure which corrects for the potential bias in the sample and results in better estimates. As the information gathered includes the costs per vessel for each fishery and the same information is available for each vessel in the population, regression analysis can be used to estimate the relationships between costs items and independent variables which are available for all vessels in the population (e.g., effort, landings weight, landings value and technical characteristics). Based on these relationships, the costs can be estimated for each vessel in the population and the resulting estimates will not be biased by differences in the independent variables. Nevertheless, it is important to have enough information on the cost structures from vessels varying in fishing technique and other metrics such as effort and landings value in order to estimate the relationships properly. The newly developed estimation method was implemented for the first time in 2020 and applied to the 2019 data for the cutter sector.

Table 4.5 gives an overview of the relationships used for the estimation of the various cost items and the resulting increase in statistical reliability of the estimates for the complete active cutter fleet. The table shows that the application of the regression method caused considerable increased in the statistical reliability of the estimates. The reliability of the total costs for the cutter sector increased by 50% and for many cost items the increase was even higher; reliability of crew costs increased by 75% and auction claim costs 80%. However, reliability of some other cost items such as insurance costs or navigation costs did not increase at all as there was no relationship with any of the independent variables. An additional advantage to the applied regression method is the fact that the costs and earnings are available for all vessels in the population and therefor the results of the economic performance are independent of the way in which the vessels are classified. Detailed information on the application of the new method, the technical details and more detailed results can be found in Appendices 5-7.

Table 4.5 *Relationships used for the estimation of the various cost items and the resultant increase in statistical reliability of the estimates for the complete active cutter fleet (expressed in the relative standard error (standard deviation/mean). Landings; landings volume, value; landings value, GRT day; effort in tonnage days, GRT; Gross Tonnage, hp days, effort in hp days, age; age of the vessel, man days; number of crew days at sea, vessel; no regression used, calculation; summation of cost items*

Variable	Independent variable	Aggregation Level	Relative standard error		Reduction due to new method (%)
			Old method	New method	
Arrangement Withdraw Cost	landings	Vessel	38%	25%	34%
Auction Claims Cost	Value	Fishing type	13%	3%	80%
Crew Days Ashore	GRT days	Vessel	29%	14%	52%
Deck Needs Cost	GRT days	Vessel	11%	8%	29%
Depreciation Hull Engine Cost	Age	Vessel	27%	11%	60%
Factor Cost	GRT	Vessel	31%	31%	0%
Fishing Gear Cost	GRT day	Fishing type	13%	10%	22%
Freight Cost	GRT	Vessel	27%	26%	2%
Gasoil Amount	Hp days	Fishing type	12%	4%	71%
Gasoil Amount Boiling Shrimp	Landings	Fishing type	14%	1%	93%
Gasoil Cost	Hp days	Fishing type	12%	3%	71%
Gasoil Cost Boiling Shrimp	Landings	Fishing type	14%	1%	91%
General Cost	Vessel	Vessel	14%	14%	0%
Ice Cooling Cost	GRT day	Vessel	22%	15%	34%
Insurance Cost	Vessel	Vessel	11%	11%	0%
Interest Cost	Age	Vessel	20%	10%	51%
Lease Quota Cost	Vessel	Vessel	40%	40%	0%
Lease Quota Revenue	Vessel	Vessel	38%	38%	0%
Lubricating Oil Amount	Hp days	Vessel	17%	11%	37%
Lubricating Oil Cost	Hp days	Vessel	18%	9%	52%
Maintenance Engine Cost	GRT	Vessel	16%	12%	27%
Maintenance Hull Cost	GRT	Vessel	13%	10%	28%
Navigation Cost	Vessel	Vessel	15%	15%	0%
Other Revenue	Vessel	Vessel	49%	49%	0%
Processing Shrimp Cost	GRT days	Fishing type	26%	26%	0%
Provision Cost	Man days	Vessel	11%	2%	85%
Replacement Value Hull Engine	Age	Vessel	19%	11%	42%
Salt Package Cost	Landings	Fishing type	75%	75%	0%
Social Security Cost	Crew	Vessel	11%	7%	38%
Sort Landing Cost	Landings	Vessel	11%	5%	52%
Total Cost	Calculation	Fishing type	13%	6%	50%
Total Crew Cost	Calculation	Fishing type	10%	3%	69%
Total Non-Variable Cost	Calculation	Fishing type	18%	13%	30%
Total Revenue	Calculation	Fishing type	0%	0%	0%
Total Variable Cost	Calculation	Fishing type	13%	7%	49%
Travel Expense Cost	Vessel	Vessel	16%	16%	0%
Wages Crew Cost	Value	Vessel	9%	2%	75%
Wages Crew Extra Work Cost	Vessel	Vessel	38%	38%	0%
Wages Sailed Owner Cost	Value	Vessel	12%	2%	79%
Wages Sailed Owner Extra Work Cost	Vessel	Vessel	56%	56%	0%

4.4 Small coastal fisheries

4.4.1 Response rate

In total 105 of the 435 vessel owners replied to the survey. Thereby, the overall response rate of the surveys for economic information from the small coastal fisheries was low: 25%, and it varied substantially between segments (see Table 4.6). The highest response rate was reached for dredgers and small inactive vessels (43 and 35% respectively), whereas low response rates were reached for segments with larger inactive vessels (6%) and vessels using passive gears only 10-12m (11%).

Table 4.6 *Population size and response rate for each of the clusters of fleet segments in the small coastal fisheries in the 2019 survey*

Cluster	Length class	Population size (# vessels)	Responses to survey	Response rate (%)
Beam trawlers	0-10m	14	3	21
	12-18m	9	2	22
Dredges	24-40m	7	3	43
Vessels using passive gears only for vessels <12m	0-10m	164	34	21
	10-12m	18	2	11
Drift and/or fixed netters	18-24m	18	3	17
Inactive vessels	0-10m	139	49	35
	10-12m	14	2	14
	12-18m	15	4	27
	18-24m	16	1	6
	24-40m	21	3	14
Total		435	104	24

4.4.2 Representativeness

Differences between the sample and the population are observed for the selected variables, and sometimes these differences are substantial (Table 4.7) or represent a substantial part of the average (Table 4.7). The large differences are mainly caused by the small sample size (in most segments consist of only 2 vessels) and the large variability in the population. In order to assess the extent to which the differences are problematic, both absolute and relative differences are taken into consideration:

- For the beam trawlers 0-10m the size of the vessel and the activities of in the sample are 4-10 times lower than the average in the population. The absolute differences are however small as the level activity in this segment is low. The same holds to a lesser extent for the segment 12-18m
- For the dredgers, the absolute differences in engine power, landed volume and landed value are large, but these are relatively small differences as the overall level of activity (and landings) is much higher than for the other groups. Moreover, this group consists of 7 vessels and has a high variability in both technical characteristics and landings
- For the 0-10m vessels using passive gears only, absolute differences in all variables were small, but due to the low activity of this group and the large variability among vessels, relative differences were substantial and the days at sea of the panel was significantly higher than that of the population. This is also partly because the values in the questionnaires sometimes differ substantially from the values in the logbooks
- For the 10-12m vessels using passive gears only, only 2 vessels are sampled out of 18 in the population, which shows high variability (e.g. landings ranged between 20 and 25,000 kg). Moreover, differences between sample and population are small compared to the large variation in the population
- Three Drift and/or fixed netters are included in the sample out of 18 vessel from a highly variable segment (e.g., landings ranged from 5-77,000 kg). Although technical characteristics from the sample and the population are similar, activity levels are relatively low for the sample
- For the inactive vessels, sampling fractions vary and so do the absolute and relative differences.

As a result, almost none of the observed differences is significant. The only exceptions are the gross tonnage of vessels using passive gears only from 10 to 12m, for which the gross tonnage in the sample (2 vessels) is 80% higher than the average in the population and the days at sea for the vessels using passive gears 0-10m. Therefore, it is concluded that for most segments the sample is representative for the population.

Table 4.7 *Absolute differences between the sample average and the average in the frame population in 2019. The yellow marked values demonstrate significant deviations (Z<0.05). Activity data for the vessels from the sample have been taken from the questionnaires*

Cluster	Length class	Kilowatt (kW)	Gross Tonnage (GRT)	Days at sea	Landed volume (*1000 kg)	Landed volume (*1000 €)
Beam trawlers	0-10m	-45	-3	-3	-1.3	-2.9
	12-18m	34	5	5	-2.6	7.9
Dredges	24-40m	106	7	-22	-511.2	-644.5
Vessels using passive gears only for vessels < 12m	0-10m	-16	-0	16	0.7	7.1
	10-12m	102	6	4	-2.5	-15.3
Drift and/or fixed netters	18-24m	-27	-0	15	-11.4	-27.7
Inactive vessels	0-10m	7	0			
	10-12m	-26	-2			
	12-18m	-74	1			
	18-24m	51	17			
	24-40m	4	-47			

Table 4.8 *Relative differences between the sample average and the average in the frame population in 2019. The yellow marked values demonstrate significant deviations (Z<0.05). Activity data for the vessels from the sample have been taken from the questionnaires.*

Cluster	Length class	Kilowatt (kW)	Gross Tonnage (GRT)	Days at sea	Landed volume (in kg)	Landed volume (in €)
Beam trawlers	0-10m	-79%	-75%	-61%	-86%	-81%
	12-18m	26%	23%	40%	-34%	44%
Dredges	24-40m	16%	2%	-30%	-33%	-33%
Vessels using passive gears only for vessels < 12m	0-10m	-16%	-1%	150%	30%	43%
	10-12m	60%	80%	31%	-62%	-62%
Drift and/or fixed netters	18-24m	-17%	-1%	70%	-83%	-77%
Inactive vessels	0-10m	18%	5%			
	10-12m	-20%	-18%			
	12-18m	-46%	6%			
	18-24m	30%	39%			
	24-40m	1%	-30%			

In most segments the distribution of the effort over various fishing techniques is representative of the population (Figure 4.3). Only in case of the cluster of drift and fixed netters, the relative contribution of set nets in the panel was larger than in the population and the contribution of pots is lower.

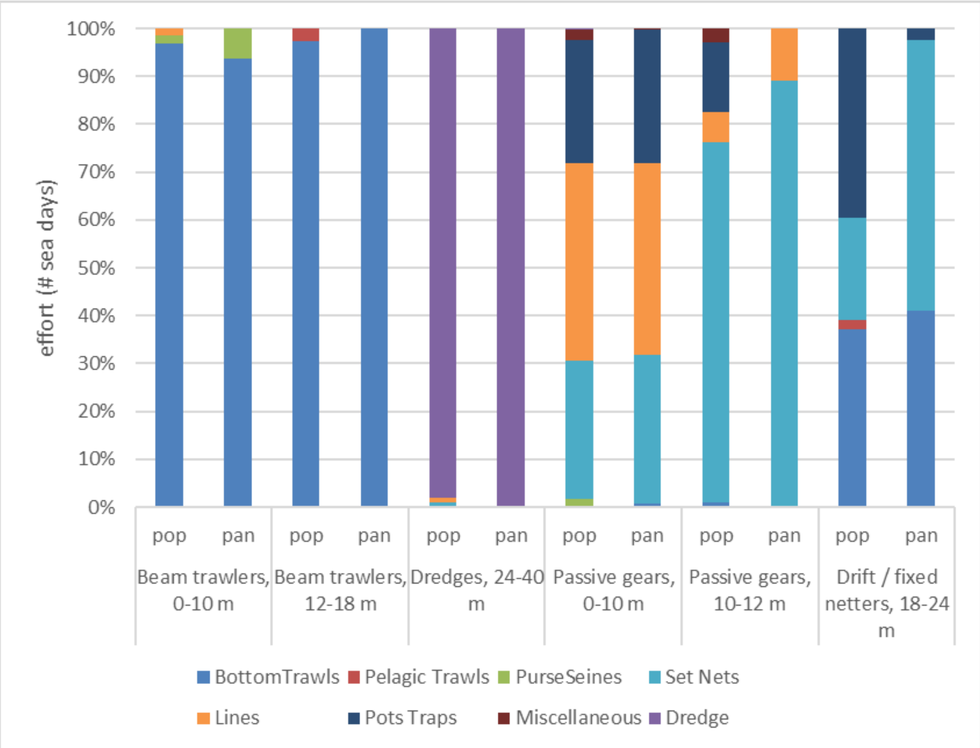

Figure 4.3 *Average amount of seadays in the various fishing techniques for the vessels in the sample and the population in each of the segments*

4.4.3 Statistical reliability

Table 4.9 provides an overview of the relative standard errors of some economic indicators of the different clusters distinguished in the sample. The calculated relative standard error is a measure of the potential deviation between the estimation and actual value by the indicator in the sampling frame. The mean of the sampling frame is between a probability area of 95% within a range of twice the standard error of the statistical estimation. To illustrate, with a relative standard error of 18%, there is a probability of 95% that the mean of the sampling frame deviates less than 36% (twice standard error) of the statistical estimation. From Table 4.9, it can be concluded that the relative standard errors of the economic indicators are high for all clusters, indicating the low accuracy of the estimations. This is mainly due to the low sampling fractions and the high variability in the clusters. As a result the estimates can only be regarded as rough indications of the population values. The reliability is highest for the cluster of vessels using passive gears 0-10m as this cluster is relatively large with a higher number of sampling units.

Table 4.9 *Relative standard errors of the statistical estimation of the considerable economic indicators based on the randomly selected vessels in 2019 (national stratification)*

Cluster	Length class	Revenue	Employment costs	Fuel costs	Variable costs	FTE
Beam trawlers	0-10m	62%	35%	42%	27%	61%
	12-18m	83%	18%	22%	0%	74%
Dredges	24-40m	33%	9%	43%	49%	35%
Vessels using passive gears only for vessels <12m	0-10m	16%	1%	26%	26%	20%
	10-12m	83%	47%	29%	64%	13%
Drift and/or fixed netters	18-24m	61%	25%	72%	46%	60%

4.5 Mussel and oyster sector

4.5.1 Response rate

The mussel and oyster sector are sampled by means of a panel of companies that provide their fiscal annual reports on a voluntary basis. For the mussel sector approximately one fifth of the total production capacity (active production vessels) is included in the sample (Table 4.10). For the Oyster sector, the response has been very low over the last years, despite several efforts to engage the sector in the data collection process. Less than ten percent of the companies is providing their data.

Table 4.10 *Population size (number of active production vessels) and response rate for the mussel and oyster sector in the 2019 survey*

Sector	Population size (# vessels)	Response rate (%)
Mussel sector	53	21
Oyster sector	38	8

4.5.2 Representativeness

The sampling units for the mussel sector have traditionally been the parent companies (Table 4.11). The size of these companies can be measured using various metrics that are all related (see also Figure 4.4):

- The number of production vessels
- The amount of seed rights
- The total production

The amount of seed rights is the best indication of size for the companies as 1) it is more stable than the production and is available at the start of the year and 2) it is more specific than the number of vessels. The sample included both smaller and larger parent companies and was representative for both groups (Table 4.11).

Table 4.11 *Characteristics of the parent companies in the mussel sector in the population and the sample in 2017*

	Total		Small (<2% seed)		Large (>2% seed)	
	Population	Panel	Population	Panel	Population	Panel
# parent companies	50	10	31	7	19	3
Coverage	20%		23%		16%	
Average seed rights	2.0	2.0	1.2	1.3	3.5	3.6
Standard dev. Seed rights	1.7	1.3	0.4	0.4	1.9	1.4
Average # production vessels	1.0	1.1	0.8	1.0	1.3	1.3
Standard dev. # production vessels	0.6	0.4	0.4	0.0	0.7	0.6

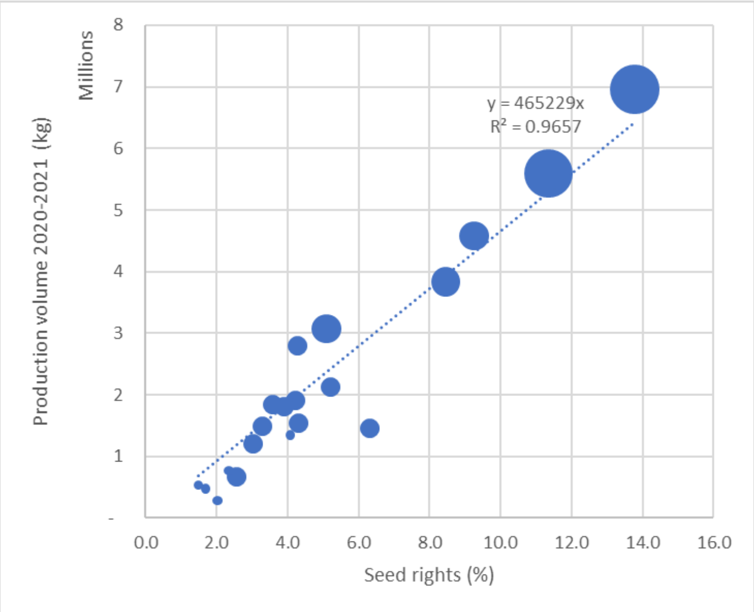

Figure 4.4 *Relationship between seed rights, production volume and number of production vessels (size of the bubbles) for seed clusters in the mussel sector in the season 2020-2021*

During the last decade the structure of the mussel sector has changed substantially and thereby the way in which the representativeness of the sample was measured has also been evaluated. Because of the transition from bottom seed fishery to the collection of seed using mussel seed collectors, the cooperation in the sector has increased and new informal co-operatives have emerged (see also van Oostenbrugge et al. 2018). The average size of these so-called mussel seed collectives has increased and there has been an increase in the concentration of seed rights. Because of this the parent company is not the most suitable sampling unit any longer, but the mussel seed collective should be taken. Table 4.12 shows that in 2020 the panel was representative for the smaller seed collectives in both seed rights, the number of production vessels and the average production and that the sampling proportion increased for this group relative to 2017. For the larger seed collectives, however, the coverage has declined, and in this group only one seed cluster is part of the sample. This seed cluster is representative of the whole group, but because of privacy reasons, no information can be provided on the characteristics. It is therefore recommended that the coverage in this group should be increased by including two more seed clusters in the sample in order to have the same sampling fraction for the larger companies as for the smaller ones (around 40%). This will also reduce the privacy issue for this group.

Table 4.12 *Characteristics of mussel seed collectives in the mussel sector population and the sample in 2020. Because of privacy reasons, no information can be provided on the characteristics of the seed cluster included in the panel in the group of large seed clusters*

	Total		Small (<5% seed)		Large (>5% seed)	
	Population	**Panel**	**Population**	**Panel**	**Population**	**Panel**
# seed clusters	20.0	6	13	5	7	1
Sampling fraction	30%		38%		14%	
Average seed rights	5.0	3.5	3.1	3.1	8.5	
Standard dev. Seed rights	3.2	1.0	1.0	0.7	3.0	
Average # production vessels	2.2	1.8	1.6	1.5	3.3	
Standard dev. # production vessels	1.1	0.7	0.5	0.5	1.2	
Average production (*1000 kg)	2,214	1,468	1,281	1,066	3,945	
Standard dev. Production (*1000 kg)	1,747	865	692	356	1,793	

As the sample for the oyster sector is too small, no representativeness analysis for this sector can be presented.

4.5.3 Statistical reliability

In the estimation procedure for the mussel sector totals, different variables are estimated using information on the total production and the number of vessels (Table 4.13). For most variables, the relative standard errors are lower than 15%. Only for minor cost items (e.g. other income and costs of seed or mussel shells) relative standard errors are higher (up to 0.50). Including more larger seed clusters in the sample will increase the coverage substantially and will likely further lower the relative standard error.

Table 4.13 *Estimated statistical reliability indicators of the economic variables of the mussel sector, based on the vessels in the panel for 2018*

Variable	Basis for aggregation	Mean value per unit	Sampling proportion	Relative standard error
Other income	Production	0.15	0.17	0.38
Fuel costs [€]	Production	0.10	0.17	0.14
Maintenance costs [€]	Production	0.10	0.17	0.12
Land rent for mussels [€]	Production	0.09	0.17	0.05
Cost of seed or mussel shells [*1000 €]	# vessels	34.5	0.21	0.50
Personnel costs [*1000 €]	# vessels	210.9	0.21	0.09
Other variable operating costs [*1000 €]	# vessels	50.5	0.21	0.14
Fixed costs [*1000 €]	# vessels	119.2	0.21	0.14
Depreciation vessel [*1000 €]	# vessels	61.0	0.21	0.20
FTE	# vessels	3.1	0.21	0.05

5 Discussion and conclusions

The Dutch selection plan for socio-economic information on the fisheries and aquaculture sector has the aim to fulfil the requirements for the EU data collection framework and to provide the basic data for socio-economic analysis for management development and evaluations in the Netherlands. The current report outlines the methodology used to design the data collection programmes and shows that the current sampling programme results in data that fits these objectives well for most segments and sectors.

For the large pelagic sector and the cutter sector, high quality estimates of costs and earnings are provided and the bias in the various strata is relatively low. The recently implemented, new estimation procedures for the cutter sector have enhanced the quality of the estimates further and due to the new procedures, the outcomes of various stratifications of the cutter fleet do not affect the outcomes as the economic variables are estimated for all individual vessels in the population. However for some subsectors the database cannot yet support high quality analysis or could be further enhanced.

For the small coastal fisheries, the response rates to the questionnaire on the economic information has been in decline for the last years, resulting in low accuracy of the estimated cost structures and potential bias in the outcomes. The response rate was on average 24% in 2019, which was comparable to other recent years (e.g. Dutch Ministry of Agriculture, Nature and Food Quality, 2019a, 2019b, 2020, 2021), but is quite low to obtain statistically sound estimates. A recent study on the response rate in surveys for family businesses (Pielsticker and Hiebl, 2020) reveals that in most surveys response rates are also low (21% on average from 126 surveys) and that response rates have been decreasing over the years. Increasing engagement with these small coastal fisheries and/or setting up a panel could potentially have a positive effect on the response rates and decrease interannual variation in response rates. Another option would be to implement other estimation procedures as were implemented for the cutter sector to enhance the quality of the estimates. Implementation of these enhanced estimation procedures might be challenging as there are indications that in some of the segments there are inconsistencies in the outcomes of questionnaires and the official logbook information.

For the mussel sector the structure of the sector changed during the last years, increasing the concentration of production rights and production into fewer, larger cooperatives. Because of this, the sampling unit should be changed to the seed collective and the population should be stratified into large and small seed collectives. Including two more large seed collectives in the sample will remove bias in the sample, reduce privacy issues for reporting in this group, and enhance the quality of the estimates of this sector. The increased science-sector cooperation in the framework of the monitoring of the mussel covenant may be beneficial.

The sampling of the oyster sector has been notoriously difficult over the last years resulting in very low response rates and the inability to provide socio-economic information for this sector. Despite the fact that various initiatives over the last years to convince entrepreneurs to provide data failed, the key to success in the data collection from this group is still the discussion with the involved stakeholders.

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Appendix 1 Sampling Theory and Methodology

Concepts and Methods

Population
According to Cochran (1977), the definition of the population is: 'The aggregate from which the sample is chosen'. A population is thus an aggregate of creatures, things, cases, etc.

Target population
Cochran (1977) defined the *target* population as the population about which information is desired. The population to be sampled (the *sampled* population) should coincide with the *target* population.

Sampling frame
The sampling frame is the source material or device from which a sample is drawn. It is a list of all those within a population who can be sampled, and may include individuals, households or institutions.

Sampling
Sampling is a statistical procedure that relates to the selection of the individual sampling units. Sampling helps to make statistical inferences about the population.

Sample
In statistics, a sample refers to a set of observations drawn from a population. A sample is a subset of a population. A sample can be collected either at random or through systematic methods.

Random sampling
Random selection is an application of probability sampling in which each unit in the population has an equal chance of being included in the sample (Cochran, 1977). In the case of stratified sampling, each unit in a stratum has the same chance of being included.

Quality of survey samples

Accuracy
The degree to which a measurement represents the true value of something. The confidence interval indicates the accuracy of a measure. The smaller the confidence interval of a measure, the higher the accuracy of a measure.

Reliability
The overall consistency of a measure, i.e. how dependably an observation is exactly the same when repeated. The stand error can be an indication of the degree of reliability.

Representativeness
Representativeness is a well-known concept in the context of sampling. Nevertheless, depending on the context, there are different definitions and interpretations. Kruskal and Mosteller (1979a, 1979b, 1979c, and 1980) distinguish the following interpretations (among others):
1. Random without a selective mechanism.
2. The sample as a miniature representation of the target population: all subpopulations in the sample are in the same proportions as in the total population.
3. No significant difference between the estimated value of the target value and the actual value of the target population (compare Van der Veen et al., 2014).
4. Coverage of the sample of certain farm types or farms in certain size classes.

An indication of the representativeness for a random sample without selection (interpretation 1) is the R indicator. This indicator gives an indication of the possible non-response bias (Bethlehem et al., 2008). To be able to calculate the R-indicator, the response chance of a farm is estimated based on a number of variables available in the Fisheries fleet (Appendix 2).

Interpretation 2 is intuitively the most logical and the most used interpretation in survey research. It is of less importance for the FADN because the FADN is a disproportionate stratified sample. To be able to determine whether a sample is representative according to interpretations 3 and 4, it is necessary to indicate which characteristics of the population should be included in the sample. This is the target variable for research. Talking about representativeness in broad terms is therefore not very meaningful. The sampling method used for the FADN is in line with interpretation 3. However, other aspects are taken into account where relevant.

Non-response

Not all farms approached for participation in the sampling are willing to participate, leading to a non-response factor in the recruitment process. Non-response is the failure to measure some of the units in the selected sample (Cochran, 1977). A low response rate does not necessarily provides incorrect results (Bethlehem 2008). However, if the non-response is biased, certain groups can be overrepresented or underrepresented.

Standard error

The standard error of a statistic (i.e. usually an estimate of a parameter) is the standard deviation of its sampling distribution or an estimate of that standard deviation (Everitt, 2003). If the parameter or the statistic is the mean, it is called the standard error of the mean.

Relative Standard Error

The relative standard error is the standard error expressed as a fraction of the estimate and is usually shown as a percentage. Estimates with a Relative Standard Error of 25% or greater are subject to high sampling error and should be used with caution.

Appendix 2 Design principles and requirements

EU regulations

COMMISSION DELEGATED DECISION (EU) 2019/910 of 13 March 2019 sets out rules for the target population, such as definitions for fishing types and size classes. The regulation prescribes several size classes and options for the clustering of size classes.

Target population

The EU Regulation describes that economic data should be collected for all active and inactive vessels registered in the Union Fishing Fleet Register as defined in Commission Regulation (EC) No 26/2004 (10) on December 31st of the reporting year and vessels that do not appear on the Register at that date but have fished at least one day during the reporting year.
For the aquaculture sector data shall be collecter from all enterprises whose primary activity is defined according to the European Classification of Economic Activities NACE (11) codes 03.21 and 03.22 and who operate for profit.

Sampling frame

For practical and methodological reasons, a limitation on 'other income of the fishing vessel' is used for sample vessels. A vessel should gain at least 25% of its turnover from primary fishing activities. Furthermore, fishing activities (in the broadest sense including other gainful activities) should comprise the largest share of the turnover of the fisheries.

Number of sample units per fishing type

When determining the number of sample units per stratum, the number units in the target population, the economic significance of the stratum, the landed value and volume of fish, and the heterogeneity within a stratum are important considerations.
Strata can be heterogeneous in terms of scale or effort. The selection plan largely matches the numbers of vessels that would be expected based on the criteria of economic importance, heterogeneity and number. As a rule of thumb, the total number of units in one stratum should be at least 10 because of privacy reasons[9]. It is recommended to merge these (sub)strata with other substrate to have at least the number of 10 vessels within it.

Stratification scheme and sample vessels per stratum

The Fisheries Business Information Network sample distinguishes groups based on economic size and type of fishing. Within a type of fishing, the principles of optimum allocation (see Appendix 1) determine both the stratification scheme and the distribution of fishing over the size classes. The variance of strata in different clustering schemes (as described in the EU Regulation) is calculated based on the SO. These variances are used to calculate the standard error. The optimum clustering scheme is chosen based on the standard error. As the number of strata increases, the variance of the target variable will gradually decrease. If the reduction

[9] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D0910&from=EN

in the variance of adding an extra stratum is less than 5%, no more strata are added. For more details, see Vrolijk and Lodder (2002). Given this optimised stratification scheme, more sample vessels are assigned to a stratum in the event that farms are shown to be more heterogeneous. In the extreme example that all vessels were exactly alike, one observation is sufficient to make reliable estimates.

Besides the abovementioned statistical criteria, some practical criteria exist too:
- The maximum number of vessels within a stratum is 10% of the total number of vessels of the target population within that stratum. A larger number would lead to problems in recruiting vessels.
- The minimum number of vessels within in a stratum is five to avoid a situation in which the selection plan comprised mainly large vessels. For research purposes, small vessels are relevant too. For many of the smallest strata, the minimum of five is not feasible given the small numbers of vessels in the target population and the maximum proportion of 10%.

Recruitment

Vessels are randomly selected from the Fisheries fleet based on the selection plan. Vessels from a selected fishery type are approached and asked whether they would be willing to participate. If the vessel owner declines, another vessel from the same strata will be approached.

The likelihood of being included within a stratum should theoretically be the same for every vessel within that stratum. However, this is not the case in practice. Although the selection plan is determined afresh each year, the vessels for the sample are not drawn from the target population from scratch each year. For practical reasons, the vessels currently in the sample are retained wherever possible. Vessels can shift between strata from one year to the next (different type of fisheries/gear and/or different size class). This means that the inclusion probability may be different from the original probability.

Appendix 3 Data collection procedures for economic variables of vessels in the panel of the large pelagic trawlers

Data from the pelagic trawlers are obtained directly from the accountings and from information retrieved from the companies by means of filled in excel sheets. This information is collected on an annual basis. Most cost items are directly copied into the database. For some cost items specific methods are used as specified below:

a. The gross value of landings is based internal prices to determine the crew share. As all of the companies are vertically integrated, there are no marked prices for these landings and this is assumed to be the best estimate.
b. Data on costs are gathered for a number of specified cost items (see Table A3.1) and aggregated in the totals for the EU cost items
c. Data on employment is obtained from the official vessel register. It is assumed that all fishermen work full-time so that the total number of jobs equals the number of FTE.
d. Information on subsidies (both investment subsidies and operational subsidies) is obtained from the national authorities (Rijksdienst Voor Ondernemend Nederland, RVO).
e. Total value of physical capital is estimated by the insurance value (factor 50).
f. Based on expert knowledge of the sector unpaid labour and the value of unpaid labour is assumed to be zero.
g. The value of quota and other fishing rights is not collected as there is no market for the trade in pelagic fishing rights.
h. Information on catches and effort are retrieved from the official catch database (RVO, VIRIS database). For the vessel in the panel, this information is cross-checked against available accounting information and information from the fish auction databases.
i. Technical information on vessel size, engine power etc. is retrieved from the official vessel register (i.e., NRV).

Table A3.1 *Overview of identified cost items in the data collection sheets for the large pelagic trawlers and classification for the EU cost items*

EU cost item	NL cost item	Description
Consumption of fixed capital	Depreciation costs	Depreciation costs (from bookkeepings)
Energy consumption	Energy consumption	Amount of fuel purchased
Energy costs	Energy costs	Purchase of fuel.
Income from leasing out quota or other fishing rights	Income from leasing out fishing rights.	
Interest costs	Interests	Costs of interest (from bookkeepings)
Investments in tangible assets, net	Investments in new equipment	
Lease/rental payments for quota or other fishing rights	Leasing quota costs	Costs of leasing fishing rights
Non-variable costs	Insurance costs	Costs for the insurance of the vessel and it's equipment
Non-variable costs	Vessel supplies	Purchase of small equipment for use on deck
Non-variable costs	Other costs	Other non-variable costs (e.g. administration)
Other income	Other income	Income from other sources than the sale of fish (e.g. research)
Personnel costs	Crew wages and social security costs	Total costs for crew including social security costs
Repair and maintenance costs	Maintenance Hull costs	Costs for repair and maintenance of the hull.
Repair and maintenance costs	Maintenance Engine costs	Costs for repair and maintenance of the engines
Repair and maintenance costs	Navigation and fish detection equipment costs	Costs for maintenance and leasing of navigation and fish detection equipment
Repair and maintenance costs	Catch processing equipment costs	Costs for the maintenance and depreciation of catch processing equipment
Repair and maintenance costs	Cool and freezing costs	Costs for the maintenance and depreciation of cooling and freezing equipment
Variable costs	Packing material costs	Purchase of packing material.
Variable costs	Fishing gear costs	Purchase of fishing gears and cables
Variable costs	Loading/unloading costs	Costs of loading and unloading the catches

Appendix 4 Data collection procedures for economic variables of vessels in the panel of the active cutter fleet

Data from the active cutters are obtained directly from the accounts. Most cost items are directly copied into the database. For some cost items specific methods are used as specified below:

- The gross value of landings is based on sales information obtained directly from fish auctions. This information is checked with and when needed (in case of direct sells to private parties in e.g. shrimp fishery) complemented with information from company accounts.
- Imputed value of unpaid labour is calculated on a trip-by-trip basis. For each trip the owner joins the vessel, he/she gets the same share as a crew member. Whether the owner has joined the trip is deduced from the total share of paid wages in the net income (gross value of landing – landing costs and fuel costs). When the share is lower than normal (around 40%) it means that the owner has also joined the trip.
- Leasing of equipment is highly uncommon in the Dutch fishing fleet. Over the last years, none of the panel members leased any equipment. Therefore, the invested capital of leased equipment is not applicable to this fleet.
- Annual depreciation is calculated the total of the depreciation of the hull, engine and other assets and the investments collected as described under investments. The engine and the hull of the vessel are written down exponentially, whereas all other assets are written down linearly. This methodology is consistent with the (Perpetual Inventory Method) PIM.
- Investments are valuated, based on the actual purchase price whenever possible. In case this is not possible insurance value is used as a proxy of the replacement value, or the value of the investment is estimated based on the technical characteristics and standards costs per unit of capacity like is done in the PIM.
- The debt-asset ratio is calculated based on information from the balance sheet on debts and the estimated capital value.
- The number of full time employees is estimated per vessel based on detailed information on the time on board of each individual crewmember. Per crew member the total number of hours at sea is registered. Using a constant this amount is corrected for the hours rest on board and the amount of labour on shore. The constants are fleet specific. The resulting hours worked are used to estimate total FTE.
- All other costs items are calculated directly from the financial accounts.
- Information on catches and effort are retrieved from the official catch database (VIRIS). For the vessel in the panel, this information is cross-checked against available accounting information and information from the fish auction databases.
- Technical information on vessel size, engine power etc. is retrieved from the official vessel register (i.e., NRV).

Appendix 5 Estimation of the costs for cutter vessels

A5.1 Methodology

In order to assess the costs and earnings for the cutter fleet data on a large number of detailed cost and earnings are gathered from a sample of the cutters (roughly 25% of the population), the so called Farm Accountancy Data Network. Besides this information, information is available for all vessels in the population on the following characteristics:

- Technical characteristics (engine power, vessel size, age of vessel and engine)
- Fisheries activities: fishing effort per type of fishing gear
- Landings and landings value per species and type of fishing gear.

Until 2020 the economic performance of the fleet was estimated using the information from the Dutch FADN and the information on the average number of vessels in the fishing fleet in each of five vessel classes, specified by the engine power. Because all vessels use active bottom gears, and there are different management regimes for the various groups of vessels based on engine power categories (e.g. access to fishing grounds) this is for the Dutch cutter fleet the most appropriate way of dividing the sector into smaller classes. The sector totals were estimated from the average costs of the Dutch FADN vessels in each of the hp classes and the average number of vessels in the population. This aggregation procedure assumed the Dutch FADN vessels to be representative for the effort and landings for each of the fishing types. Because of problems in the registration procedure of the fishing gears in the logbooks this was hard to check for some gears (especially pulse trawl) , but differences in fishing activities in various gear types existed, which biased the estimated outcomes for these fishing types.

Table A5.1 *Number of vessels in each of the hp classes in the population and the Dutch FADN (for 2018)*

Hp class	Fishing type	Observations Dutch FADN sample	Observations population
1-260	Shrimps	6	35
260-300	Beam trawl	2	11
260-300	Others	2	11
260-300	Shrimps	29	152
260-300	Pulse	5	17
260-300	Quadrig	3	6
301-800	Others	1	6
301-800	Pulse	1	1
301-800	Quadrig	1	1
301-800	Snurrevaad	6	11
801-1,500	Beam trawl	1	4
801-1,500	Others	4	6
801-1,500	Pulse	5	7
801-1,500	Snurrevaad	5	7
>1,500	Beam trawl	14	33
>1,500	Others	1	2
>1,500	Pulse	22	49

Over the last few years, the quality of the information on fishing activities, landings and landings value has increased. The main issues were solved, i.e., the registration of the proper fishing gear (especially for pulse trawling) and the availability of price data for most fish species. As a result, there is from 2018 onwards, a

high quality dataset available for the effort, landings and landings value for all main gear types used in the cutter fisheries[10].
Many of the costs items depend at least partly on the characteristics of the vessels or the fishing activities. By using the available information from all vessels in the population, the costs and earnings can be estimated with a greater precision if this information is used and the quality of this information can be trusted. The newly proposed estimation procedures test the quality of the data on fisheries activities and landings and landings value and use this information and simple regression techniques to estimate the total costs and earnings of the cutter sector.

A5.1.1 Objective

The objective of this procedure is to estimate the costs and earnings of the cutter fisheries, based on cost data of the panel and the information that is available from the population. The estimated costs and earnings need to be estimated for both the total, the individual hp classes and the main fishing types (beam trawl, pulse fishing, shrimp fishing, flyshoot fishing and demersal trawling).

A5.1.2 Principles

Besides the above described classification a number of other principles are used:

- The basic assumption for this way of estimation is that the metrics that are available for the whole fleet are of good quality. The first step in the process of aggregation is to check whether this is the case. This is done by comparison of the metrics from the official statistics (available for the complete fleet) with the information that is available for the vessels in the Dutch FADN panel. Checks are done for: (1) effort, (2) landings volume and (3) landings value for each of the fishing types. For 2018 data this comparison turned out to be very close. Appendix 7 gives the outcomes of this analysis;
- The statistical unit for the estimation is a specific fishing vessel from a specific owner (combination of vessel ID and hull ID), its technical characteristics and fishing activities;
- In case the technical characteristics of the vessel change during the year (e.g. because of a new engine) the average technical characteristics of the vessel are used (based on the time period of the year for which the technical characteristics have been registered;
- Costs and earnings are estimated for a vessel which is registered the whole year. In case a vessel is not registered for the whole year, all costs that have not been estimated based on the level of fishing activities are adjusted accordingly based on the part of the year that the vessel was registered;
- For vessels which take part in the FADN sample, the data from the sample of total effort, landings and landings value are assumed to be the best source of information. In case of differences with the data from the logbooks, the costs are not adjusted;
- The main strata to be used in the aggregation procedure are the hp classes. Within these hp classes, experts can specify more detailed stratifications based on their expert knowledge (e.g. in 2018 a few vessels from the panel engaged in flyshoot fishing for the first time and had relatively high costs and low performance; hence, these vessels were set aside in a specific subgroup);
- In the initial analysis, the costs and all independent metrics are correlated and examined by experts to find those relations with a theoretical basis and the best relationships. These relationships are stored in an overview of the methods that is used in the final analysis. As a result the used relationships are transparent and can be changed easily, without changing the code of the analysis;
- In the final analysis, costs are estimated based on either significant relations with previously defined independent metrics that are known for the whole population, or based on group averages in case the assumed relations turn out not to be significant (i.e., previous method);
- Most costs are estimated on the level of the vessel, but some costs like fishing gear costs or gasoil costs are estimated on the fishing type level as these costs are specific for different fishing types (e.g., pulse fishing, beam trawl);
- In order to calculate the economic outcomes of each of the fishing types, costs estimated on the level of the vessel and which have no relationship with landings or landings value are distributed overfishing types on the basis of effort (sea days). In case there is a relationship with landings volume or value, this metric is used for the division.

[10] Some issues remain for the distinction between the various demersal trawls (outrig, twinrig, quadrig and otter trawl).

A5.1.3 Process of estimation

In the process of estimating the costs and earnings eight phases can be distinguished:
1. Preparation of the compiled dataset and calculation of the basis (independent) variables which are available for the whole fleet;
2. Estimation of the values for the costs items for all vessels by means of various methods (regression, or simple means);
3. Choosing the appropriate estimate, based on the outcome of the various models;
4. Combination of the results for the different variables;
5. Distribution of the costs that were estimated on the vessel level over the various fishing types;
6. Calculation of the parameters that are based on logbook data;
7. Adjustment of costs to the registration time of vessels;
8. Calculation of the overall cost items (crew cost, variable cost, non-variable cost, total costs, total revenue and net result).

Steps 2-6 are carried out separately at the level of the vessel and the fishing type. These phases are discussed in more detail in the sections below.

A5.1.3.1 Preparation of the compiled dataset and calculation of the basis (independent) variables

In the first step, the datasets with the basis data are combined:
- Dataset with the basic information from logbooks, technical characteristics of vessels and FADN data;
- Dataset with expert estimates for the crew size of all vessels. These estimates are based on the size of the vessel and the type of fisheries the vessel has been engaged in;
- Dataset with corrections for the gear type of the logbook data. These corrections have been made by experts based on comparison of logbook data for the whole year and mostly include errors in gear type for single trips;
- Dataset with the preferred estimation method for all cost items. This dataset includes for each of the cost items the independent variable that should be used for the estimation procedure (see Table A5.2). In most of the cases, this variable is consistent for all hp classes, but in some specific cases (e.g. fishing effort in hp class 2) specific metrics are set for specific hp classes.

After that, the hp days and Grt-days and man days are computed as measures of fishing effort to be used in the estimation process.
For the estimation of capital costs, the age of the vessel is estimated (based on the average of the hull age and the engine age). As for some of the vessels the engine age is not known, the average engine age in the group is used as a proxy.
All costs items are estimated on the level of a vessel that has been active during the whole year. As some of the vessels in the FADN sample have not been registered for the whole year, non-variable costs (e.g., interest, insurance) are lower than expected. Therefor these costs are calculated for the whole year, based on the time that the vessel has been registered.
After that two datasets are made: one aggregated at the level of fishing type (i.e. fishing gear) and one aggregated at the level of the vessel.
For the analysis on the level of the fishing type too few observation are available for each fishing type for each hp class to do a proper analysis per fishing type. Therefore, a clustering of fishing types and hp classes is carried out for which the expert think that the relations between the costs and the independent variables are comparable. The dataset with the clustering information is stored in a separate dataset for transparency (i.e., classification cutters for aggregation).

A5.1.3.2 Estimation of the values for the costs items for all vessels by means of various methods (regression, or simple means)

In this step, the costs and incomes of all vessels are estimated based on the known relationships these items have with the various independent parameters. An overview of the methods for each cost item can be found in Table A5.2.

Table A5.2 *Overview of the independent variables and the aggregation level used for the estimation of each of the economic variables specified in the data collection programme for the Dutch cutter fleet*

Variable	Estimation/calculation Method	Independent variable	Aggregation Level
Arrangement withdraw cost	Regression	Landings volume	vessel
Auction claims cost	Regression	Landings value	fishingtype
Commodity board cost	Regression	Landings value	vessel
Crew days ashore	Regression	GRT days	vessel
Crew days at sea	Calculation	Sea days * crew size	fishingtype
Crew size	Calculation	Expert knowledge	Vessel
Days at sea	Calculation	Logbooks	fishingtype
Deck needs cost	Regression	GRT days	vessel
Depreciation hull engine cost	Regression	Age vessel	vessel
Factor cost	Regression	GRT vessel	vessel
Fishing gear cost	Regression	GRT days	fishingtype
Freight cost	Regression	GRT vessel	vessel
Gasoil amount	Regression	Hp days	fishingtype
Gasoil amount boiling shrimp	Regression	Landings volume	fishingtype
Gasoil cost	Regression	Hp days	fishingtype
Gasoil cost for boiling shrimp	Regression	Landings volume	fishingtype
General cost	Regression	Vessel average	vessel
Ice and cooling cost	Regression	GRT days	vessel
Insurance cost	Regression	Vessel average	vessel
Interest cost	Regression	Age vessel	vessel
Lease quotum cost	Regression	Vessel average	vessel
Lease quotum cevenue	Regression	Vessel average	vessel
Lubricating oil amount	Regression	Hp days	vessel
Lubricating oil cost	Regression	Hp days	vessel
Maintenance engine cost	Regression	GRT vessel	vessel
Maintenance hull cost	Regression	GRT vessel	vessel
Navigation cost	Regression	Vessel average	vessel
Other revenue	Regression	Vessel average	vessel
Processing shrimp cost	Regression	GRT days	fishingtype
Provision cost	Regression	Man days	vessel
Replacement value hull engine	Regression	Age vessel	vessel
Salt package cost	Regression	Landings volume	fishingtype
Social security cost	Regression	Crew size	vessel
Sort landing cost	Regression	Landings volume	vessel
Travel expense cost	Regression	Vessel average	vessel
Wages crew cost	Regression	Landings value	vessel
Wages crew extra work cost	Regression	Vessel average	vessel
Wages sailed owner cost	Regression	Landings value	vessel
Wages sailed owner extra work cost	Regression	Vessel average	vessel

In order to carry out the regression analyses simultaneously, a new independent variable is specified and this variable gets the value of the used independent variable (e.g. age, seadays, landings volume). The file is split up in datasets based on the variable to be tested, the hp class, group, and (if appropriate) fishing type. The estimation procedure is done using a linear regression model with the independent variable both with and without an intercept. Only in case of the capital costs (interest and depreciation) and book value of the vessel (which are known to be nonlinear over time), the age of the vessel and engine is log10 transformed. The value of the wages for the owner are part of the total crew wage. This total crew wage has a relation with the value of the landings, but the part which is paid to the joining owner depends on the number of owners that joins the crew. Therefore the total of the crew share is estimated, based on the value of landings, and the proportion of the wages for the joining owners is based on the average in the group.
In the regression model the FADN vessels are weighted based on the part of the year they have been registered as these values are less accurate that those for “complete” vessels.

Next to this regression, also the average of the costs for the FADN vessels are calculated as a fall-back option in case the regression does not result in significant results. In this average, all vessels are treated equally as the costs of vessels that were partly active have been adjusted.

A5.1.3.3 Choosing the appropriate estimate, based on the outcome of the various models

After combining the outcomes of the regression with the dataset with the estimated results, the most appropriate estimate is selected for further use in the calculations. Various situations can be distinguished:

- The vessel is a FADN sample vessel: the original data is used. In case the total effort, landings volume or landings value in the logbooks differs from the FADN data on costs is used and not adjusted;
- The vessel is not a FADN vessel and the regression with the intercept is not significant, or the number of observations (of known costs for individual vessels or vessel-fishing type combinations) is less than 5: the average of the segment (hp class) is used;
- The vessel is not a FADN vessel, there are more than 4 observations and the regression with the intercept is significant ($P<0.05$) and the intercept is positive and significant: the outcomes from the regression with intercept is used;
- The vessel is not a FADN vessel, there are more than 4 observations and the regression with the intercept is significant ($P<0.05$) and the intercept is either negative or non-significant and the regression without the intercept is significant: the outcomes from the regression without intercept is used.

The last option has been introduced to prevent the occurrences of negative outcomes of the estimated costs in case of relationships with effort and landings volume and value.

A5.1.3.4 Combination of the results for the different variables

After the regression, the outcomes of the various regression models are combined into one file for the models on the level of the vessel and one file for the models on the fishing type level.
The wage costs for the crew and for the joining owners are calculated based on the estimated total crew wage and the part of the total wage for the owners.

A5.1.3.5 Distribution of the costs that were estimated on the vessel level over the various fishing types

The costs that were estimated at the vessel level are distributed per vessel over the various fishing types in which the vessel has been active. This is done based on the proportion of the total effort in each of the fishing types.
In a limited number of cases the number of fishing types of FADN vessels does not correspond to the number of fishing types in the logbook data. This is checked by comparing the number of fishing types in both sources. If so, the costs are also divided over the fishing types as for the other vessels.
Also the costs that were estimated on the level of the fishing types need to be distributed over the various fishing types because in some cases the fishing types were combined. To do so, the file with the original data is combined with the clustering and proportion of the seadays, landings and value are calculated for each fishing type (per vessel and cluster of fishing types). The total value of the cluster of fishing types is distributed over the individual fishing types, based on the parameter that was used to estimate the value (so values that were estimated using the value of landings, are distributed based on this metric). In case no relationship was found with a specific parameter, and values were estimated on the average of the group, the totals are distributed over the individual fishing types based on the proportion of effort (days at sea).

A5.1.3.6 Calculation of the parameters that are based on logbook data

The parameters that can be copied from the logbook data and the crew size are calculated from the available information in the dataset.

A5.1.3.7 Adjustment of costs to the registration time of vessels

As some of the vessels are not active all year round all costs that are not estimated based on the activity level are adjusted based on the time that the vessel was registered. This procedure includes all cost items that are estimated based on age, crew, Gross Tonnage and vessel, and all other items that were estimated based on the average of the group.

A5.1.3.8 Calculation of the overall cost items

In order to calculated the total cost items, the dataset is merged with a dataset with the classification of all cost items. Based on this classification, the costs are totalised and the total costs are included in the dataset. Lastly, all missing costs (cost items for other fishing types for which the vessels did not carry out any activities) are set to 0.

A5.1.4 Checks

In order to check the proper performance of the new method and the script that was developed a number of checks were performed.
The checks that were performed were:

- Checks on the calculations of the various part of the code:
  - Calculation on missing ages for engines (L126);
  - Calculation on proportion of wages for joining owner (L153);
  - Calculation on distribution of wages over joining owner and crew (L699);
  - Distribution of costs per vessel overfishing types (L746);
  - Distribution of costs from combined fishing types over individual fishing types (L833);
  - Calculation of total costs (l942).
- Consistency checks with basic information:
  - Total effort, landings and landings value should match totals in logbooks;
  - Total costs and earning from FADN-vessels should match totals in input file;
  - Total crew members should match the totals in input files.
- Fit of data to statistical models:
  - Visual inspection of outcomes of regression analysis for all costs and earnings;
  - Detection of outliers from the regression analysis (costs and earnings from FADN-vessels) and checks with primary information;
  - Detection of outliers in the outcomes of the data.

Outcomes of these tests have been summarised in Appendix 6.

A5.2 Results

The objective of the application of the new method is to enhance the quality of the estimated costs and earnings for the Dutch cutter fleet. Table A.5.2 gives an overview of the relative standard errors in the estimates of the overall costs and earnings for the various cost items for the whole cutter fleet. In Appendix 6 the results for the individual fishing types are provided. The enhancement in the quality of the estimates of the total costs is 50%. For individual costs items it varies from 0% for fixed costs such as general costs to more than 90% for those costs items that are highly correlated to one of the independent variables.

Table A.5.3 *Estimates of the relative standard error in the estimates of the total population for the various cost items as a result of the previous method (using averages) and the new method (using regression estimates)*

Variable	Relative standard error		Reduction due to new
	Old method	New method	method (%)
Arrangement Withdraw Cost	38%	25%	34%
Auction Claims Cost	13%	3%	80%
Crew Days Ashore	29%	14%	52%
Days At Sea	0%	0%	NA
Deck Needs Cost	11%	8%	29%
Depreciation Hull Engine Cost	27%	11%	60%
Factor Cost	31%	31%	0%
Fishing Gear Cost	13%	10%	22%
Freight Cost	27%	26%	2%
Gasoil Amount	12%	4%	71%
Gasoil Amount Boiling Shrimp	14%	1%	93%
Gasoil Cost	12%	3%	71%
Gasoil Cost Boiling Shrimp	14%	1%	91%
General Cost	14%	14%	0%
Ice Cooling Cost	22%	15%	34%
Insurance Cost	11%	11%	0%
Interest Cost	20%	10%	51%
Lease Quotum Cost	40%	40%	0%
Lease Quotum Revenue	38%	38%	0%
Lubricating Oil Amount	17%	11%	37%
Lubricating Oil Cost	18%	9%	52%
Maintenance Engine Cost	16%	12%	27%
Maintenance Hull Cost	13%	10%	28%
Navigation Cost	15%	15%	0%
Other Revenue	49%	49%	0%
Processing Shrimp Cost	26%	26%	0%
Provision Cost	11%	2%	85%
Replacement Value Hull Engine	19%	11%	42%
Salt Package Cost	75%	75%	0%
Social Security Cost	11%	7%	38%
Sort Landing Cost	11%	5%	52%
Total Cost	13%	6%	50%
Total Crew Cost	10%	3%	69%
Total Non-Variable Cost	18%	13%	30%
Total Revenue	0%	0%	0%
Total Value Landings	0%	0%	NA
Total Variable Cost	13%	7%	49%
Total Volume Landings	0%	0%	NA
Travel Expense Cost	16%	16%	0%
Wages Crew Cost	9%	2%	75%
Wages Crew Extra Work Cost	38%	38%	0%
Wages Sailed Owner Cost	12%	2%	79%
Wages Sailed Owner Extra Work Cost	56%	56%	0%

Besides the enhancement in the quality of the estimates the new method also provides some other advantages:

- The dataset with the estimates per vessel can be used both for the data delivery for fisheries in figures and the EU data call. Because of this, the economic results for both publications will be consistent, despite the difference in classification of the vessels;
- Also the data of vessels that have been in the panel for part of the year might be used in the new estimation procedure, increasing the number of observations and making better use of the collected data;

- As the new method takes into account the amount of fishing activities in the different fishing types, the potential bias in the results due to differences in the fishing patterns between the panel and the population are taken away;
- The methodology and procedure might be extended to estimate the results for the period for which no panel data are available yet. This is described in more detail in the section below.

A5.3 Discussion, action points:

Although this method provides a big step forward in the estimation there are always additional items to take into account:

- The relations for the cost items and the independent variables need to be documented and annexed to this document;
- In the logbook data the distinction between the twinrig, outrig and demersal trawl is not always correct. This prevents further specification for these fishing types in the estimation procedure. Distinction between pulse fishing and beam trawl is under development. This will also allow the estimation of the costs using the new methodology for previous years;
- Other fisheries still includes trips for other activities and demersal trawl fisheries. These other activities make up a very small part of the fishing activities, so the error is relatively small. Ultimately, however, the other activities (e.g., research) should be separated and additional costs and earnings should be estimated at the vessel level;
- The clustering of fishing types for which there is not enough information to conduct a separate regression is now done on expert knowledge. A detailed analysis of the costs of these fishing types could be beneficial in deciding which fishing types and hp classes could be best clustered;
- Many of the variable costs like gasoil costs and crew costs are available at the trip level for the panel vessels and all independent variables (i.e., days at sea, landings and landings value) are also available at this level. In the current analysis, the costs and independent variables are aggregated per fishing type and year for the analysis. However, this analysis could also be done at the trip level, increasing the number of observations and reducing the uncertainty of the estimates even further. The current methodology could be used to do so, but the information from the logbook data and the costs should then be merged and quality checked at the trip level. This additional step would take more time and therefor it was not implemented. Further investigation into the possibilities of such a more detailed analysis could be carried out in future;
- Estimation of the capital costs is now done on the total costs for hull and engine. This could be separated. This year also a study will be carries out looking at the value of new engines and hulls. The results of this study can be incorporated in the estimation methodology;
- For most costs and earnings linear regression is used as the preferred method to estimate the values for all vessels in the population. These regressions are based on the available information from the panel vessels for the fishing types in which these vessels have been active. For those fishing types in which the vessels are not active, the costs and earnings are assumed to be zero. For most vessels which carry out the same fishing types every year, this will be true, but if a vessel shifts from one to the other fishing type, some costs (capital costs) will continue and will be underestimated in the current procedure. It is assumed that this bias is low;
- The relationships between the costs and the independent variables are tested both with and without an intercept. In case the intercept is not significant, the estimates from the relationship without the intercept are used. This procedure allows for the estimation of cost items that are not proportional to the independent variables. The relationship is assumed to be linear, does not take into account that without any activities, the costs for a certain fishing type are 0. In an extension of the procedure, non-linear relationships could be tested, enhancing the quality of the estimates. Another possibility is to specify beforehand whether we assume the costs to be zero in case the independent variable is 0. This can be implemented through an extension of the methodology specification file;
- As a result of the analyses of the relationships between the costs and the independent variables a few action points for the administration of the costs have been identified:
  - The income from withdrawal arrangement costs from the previous years should be booked on other income.

Appendix 6 Outcomes of the analyses of the comparison of the logbook data and the accountants data on effort, landings value and landings volume

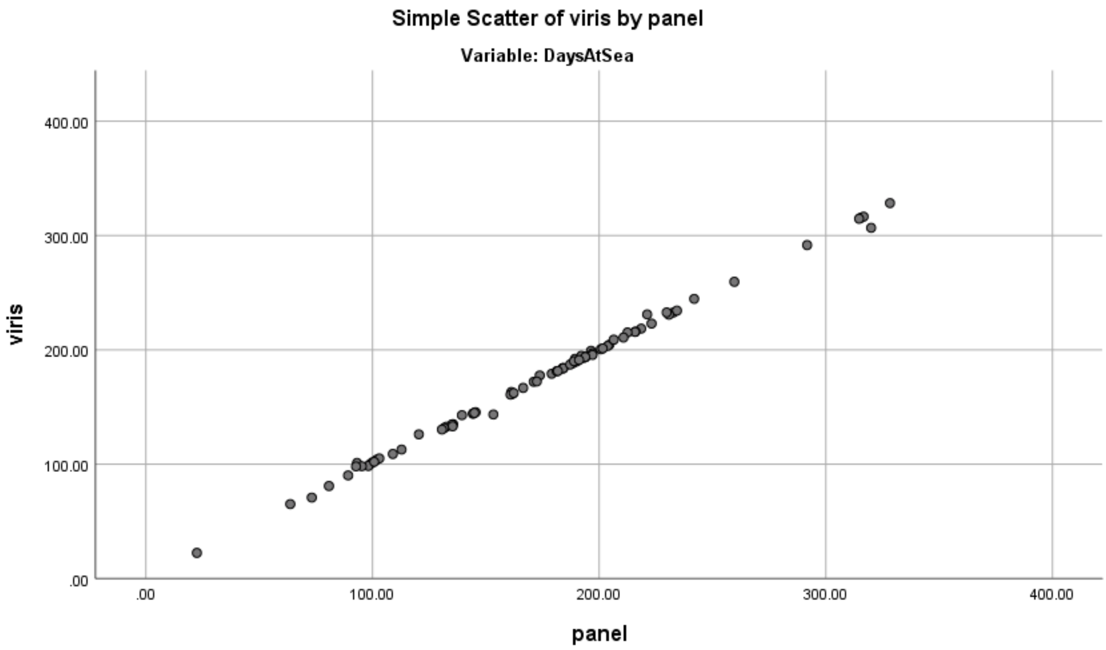

Figure A6.1 *Comparison of the effort (Days at Sea) in the logbooks (Y-axis) and the panel data (X-Axis) for the panel vessels in 2018*

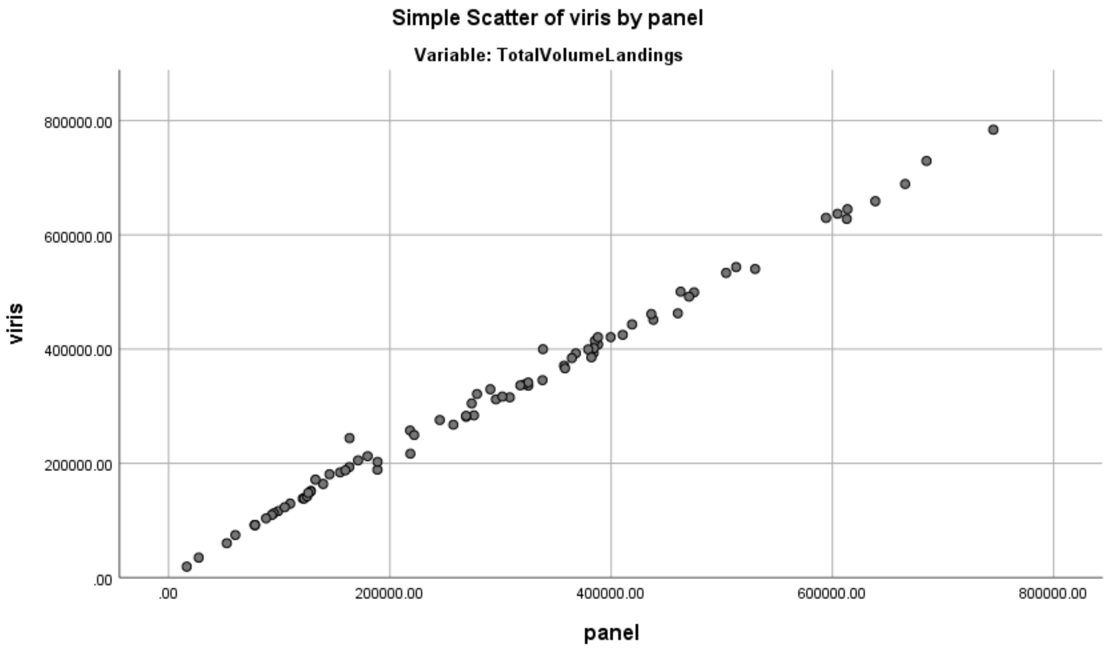

Figure A6.2 *Comparison of the landings volume in the logbooks (Y-axis) and the panel data (X-Axis) for the panel vessels in 2018*

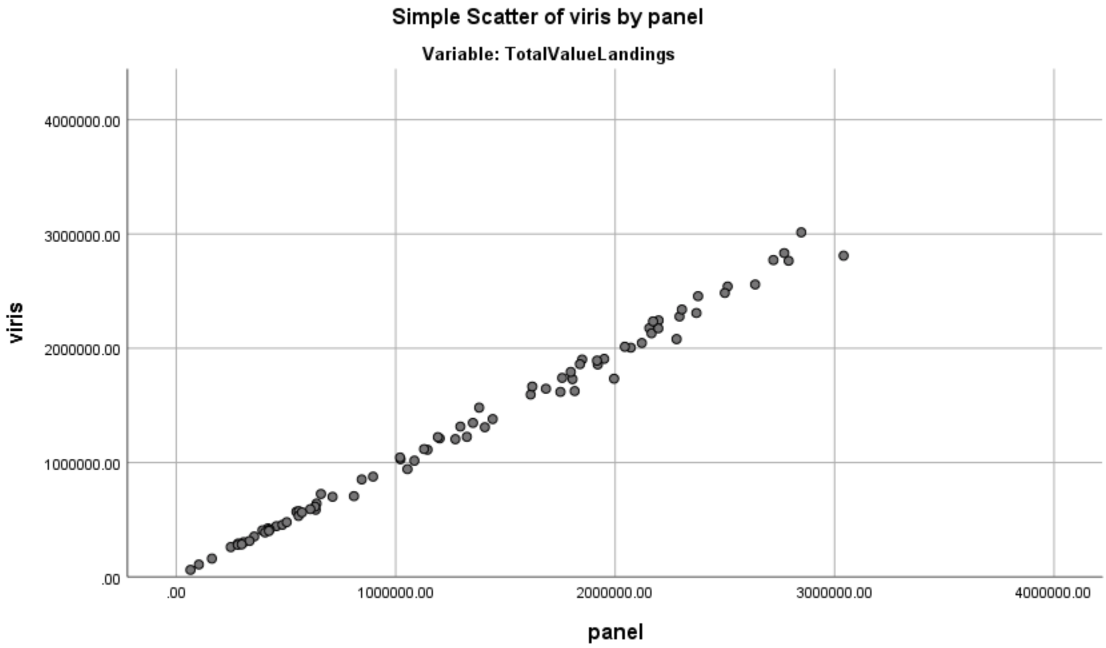

Figure A6.3 *Comparison of the landings value in the logbooks (Y-axis) and the panel data (X-Axis) for the panel vessels in 2018*

Table A6.1 *Descriptive statistics of the relative difference between the three metrics from the panel data and the logbook data (panel-logbook/panel)*

Variable	Mean	St. dev.	Min.	Max.
Days at sea	0.0045	0.018	-0.09	0.06
Landings volume	-0.1058	0.085	-0.49	0.01
Landings value	0.0154	0.043	-0.10	0.13

Note that the values of the days at sea and the value of landings are very similar (average difference is around 1%). For the volume of landings, the average negative difference results from the fact that the volume in the logbooks is measured in live weight and the volume in the accounts is the dead weight. The difference between the two is fixed and depends on the species and way in which the fish is landed; for shrimps the relative difference in weight is 17% and for most fish species the difference is just a few percent.

Appendix 7 Comparison of outcomes of previous and current estimation method for the cutter sector

Table A7.1 *Estimates of the relative standard error in the estimates of the total population for the various cost items and fishing types in the cutter sector as a result of the previous method (using averages) and the new method (using regression estimates)*

Variable	Fishing type	Relative standard error		Reduction due to new method (%)
		Old method	New method	
ArrangementWithdrawCost	Beam trawl	46%	45%	2%
ArrangementWithdrawCost	Other	65%	57%	11%
ArrangementWithdrawCost	Shrimp trawl	28%	11%	61%
ArrangementWithdrawCost	Pulse trawl	61%	56%	7%
ArrangementWithdrawCost	Quadrig	20%	8%	61%
ArrangementWithdrawCost	Flyshoot	322%	322%	0%
AuctionClaimsCost	Beam trawl	27%	1%	98%
AuctionClaimsCost	Other	40%	17%	58%
AuctionClaimsCost	Shrimp trawl	32%	16%	49%
AuctionClaimsCost	Pulse trawl	5%	1%	90%
AuctionClaimsCost	Quadrig	30%	0%	99%
AuctionClaimsCost	Flyshoot	6%	3%	52%
CommodityBoardCost	Beam trawl	0%	0%	0%
CommodityBoardCost	Other	0%	0%	0%
CommodityBoardCost	Shrimp trawl	0%	0%	0%
CommodityBoardCost	Pulse trawl	0%	0%	0%
CommodityBoardCost	Quadrig	0%	0%	0%
CommodityBoardCost	Flyshoot	0%	0%	0%
CrewDaysAshore	Beam trawl	31%	16%	47%
CrewDaysAshore	Other	36%	28%	21%
CrewDaysAshore	Shrimp trawl	42%	12%	72%
CrewDaysAshore	Pulse trawl	21%	11%	49%
CrewDaysAshore	Quadrig	4%	2%	60%
CrewDaysAshore	Flyshoot	25%	25%	0%
DaysAtSea	Beam trawl	0%	0%	0%
DaysAtSea	Other	0%	0%	0%
DaysAtSea	Shrimp trawl	0%	0%	0%
DaysAtSea	Pulse trawl	0%	0%	0%
DaysAtSea	Quadrig	0%	0%	0%
DaysAtSea	Flyshoot	0%	0%	0%
DeckNeedsCost	Beam trawl	9%	8%	3%
DeckNeedsCost	Other	8%	6%	23%
DeckNeedsCost	Shrimp trawl	18%	11%	40%
DeckNeedsCost	Pulse trawl	6%	6%	8%
DeckNeedsCost	Quadrig	2%	1%	42%
DeckNeedsCost	Flyshoot	4%	4%	0%
DepreciationHullEngineCost	Beam trawl	33%	9%	72%
DepreciationHullEngineCost	Other	29%	14%	50%
DepreciationHullEngineCost	Shrimp trawl	32%	15%	53%
DepreciationHullEngineCost	Pulse trawl	20%	5%	73%
DepreciationHullEngineCost	Quadrig	7%	3%	64%
DepreciationHullEngineCost	Flyshoot	21%	10%	51%
FactorCost	Beam trawl	30%	30%	0%
FactorCost	Other	16%	16%	0%

Variable	Fishing type	Relative standard error		Reduction due to new method (%)
		Old method	New method	
FactorCost	Shrimp trawl	0%	0%	0%
FactorCost	Pulse trawl	35%	35%	0%
FactorCost	Quadrig	0%	0%	0%
FactorCost	Flyshoot	29%	29%	0%
FishingGearCost	Beam trawl	23%	10%	56%
FishingGearCost	Other	22%	9%	58%
FishingGearCost	Shrimp trawl	20%	20%	0%
FishingGearCost	Pulse trawl	8%	8%	0%
FishingGearCost	Quadrig	41%	1%	99%
FishingGearCost	Flyshoot	8%	8%	0%
FreightCost	Beam trawl	19%	19%	2%
FreightCost	Other	23%	23%	-1%
FreightCost	Shrimp trawl	84%	84%	0%
FreightCost	Pulse trawl	26%	25%	1%
FreightCost	Quadrig	5%	5%	0%
FreightCost	Flyshoot	12%	11%	6%
GasoilAmount	Beam trawl	24%	2%	90%
GasoilAmount	Other	30%	16%	46%
GasoilAmount	Shrimp trawl	12%	4%	62%
GasoilAmount	Pulse trawl	5%	2%	67%
GasoilAmount	Quadrig	29%	1%	98%
GasoilAmount	Flyshoot	5%	5%	0%
GasoilAmountBoilingShrimp	Beam trawl	0%	0%	0%
GasoilAmountBoilingShrimp	Other	0%	0%	0%
GasoilAmountBoilingShrimp	Shrimp trawl	14%	1%	93%
GasoilAmountBoilingShrimp	Pulse trawl	0%	0%	0%
GasoilAmountBoilingShrimp	Quadrig	0%	0%	0%
GasoilAmountBoilingShrimp	Flyshoot	0%	0%	0%
GasoilCost	Beam trawl	24%	3%	89%
GasoilCost	Other	29%	16%	46%
GasoilCost	Shrimp trawl	11%	4%	67%
GasoilCost	Pulse trawl	5%	2%	64%
GasoilCost	Quadrig	28%	1%	97%
GasoilCost	Flyshoot	5%	5%	0%
GasoilCostBoilingShrimp	Beam trawl	0%	0%	0%
GasoilCostBoilingShrimp	Other	0%	0%	0%
GasoilCostBoilingShrimp	Shrimp trawl	14%	1%	91%
GasoilCostBoilingShrimp	Pulse trawl	0%	0%	0%
GasoilCostBoilingShrimp	Quadrig	0%	0%	0%
GasoilCostBoilingShrimp	Flyshoot	0%	0%	0%
GeneralCost	Beam trawl	9%	9%	0%
GeneralCost	Other	15%	15%	0%
GeneralCost	Shrimp trawl	24%	24%	0%
GeneralCost	Pulse trawl	7%	7%	0%
GeneralCost	Quadrig	4%	4%	0%
GeneralCost	Flyshoot	8%	8%	0%
IceCoolingCost	Beam trawl	20%	19%	3%
IceCoolingCost	Other	29%	24%	17%
IceCoolingCost	Shrimp trawl	33%	13%	59%
IceCoolingCost	Pulse trawl	13%	12%	10%
IceCoolingCost	Quadrig	4%	2%	56%
IceCoolingCost	Flyshoot	16%	16%	0%
InsuranceCost	Beam trawl	9%	9%	0%
InsuranceCost	Other	12%	12%	0%
InsuranceCost	Shrimp trawl	21%	21%	0%
InsuranceCost	Pulse trawl	6%	6%	0%

Variable	Fishing type	Relative standard error		Reduction due to new method (%)
		Old method	New method	
InsuranceCost	Quadrig	4%	4%	0%
InsuranceCost	Flyshoot	7%	7%	0%
InterestCost	Beam trawl	15%	7%	55%
InterestCost	Other	24%	15%	37%
InterestCost	Shrimp trawl	27%	13%	53%
InterestCost	Pulse trawl	11%	4%	61%
InterestCost	Quadrig	8%	3%	63%
InterestCost	Flyshoot	18%	11%	39%
LeaseQuotumCost	Beam trawl	43%	43%	0%
LeaseQuotumCost	Other	54%	54%	0%
LeaseQuotumCost	Shrimp trawl	113%	113%	0%
LeaseQuotumCost	Pulse trawl	25%	25%	0%
LeaseQuotumCost	Quadrig	116%	116%	0%
LeaseQuotumCost	Flyshoot	19%	19%	0%
LeaseQuotumRevenue	Beam trawl	31%	31%	0%
LeaseQuotumRevenue	Other	71%	71%	0%
LeaseQuotumRevenue	Shrimp trawl	58%	58%	0%
LeaseQuotumRevenue	Pulse trawl	22%	22%	0%
LeaseQuotumRevenue	Quadrig	3%	3%	0%
LeaseQuotumRevenue	Flyshoot	44%	44%	0%
LubricatingOilAmount	Beam trawl	12%	11%	3%
LubricatingOilAmount	Other	15%	12%	23%
LubricatingOilAmount	Shrimp trawl	39%	13%	66%
LubricatingOilAmount	Pulse trawl	11%	10%	9%
LubricatingOilAmount	Quadrig	3%	1%	62%
LubricatingOilAmount	Flyshoot	10%	10%	0%
LubricatingOilCost	Beam trawl	11%	10%	6%
LubricatingOilCost	Other	16%	11%	33%
LubricatingOilCost	Shrimp trawl	42%	9%	78%
LubricatingOilCost	Pulse trawl	9%	8%	17%
LubricatingOilCost	Quadrig	3%	1%	75%
LubricatingOilCost	Flyshoot	10%	10%	0%
MaintenanceEngineCost	Beam trawl	14%	13%	2%
MaintenanceEngineCost	Other	15%	12%	20%
MaintenanceEngineCost	Shrimp trawl	25%	13%	46%
MaintenanceEngineCost	Pulse trawl	11%	10%	6%
MaintenanceEngineCost	Quadrig	4%	2%	51%
MaintenanceEngineCost	Flyshoot	9%	9%	0%
MaintenanceHullCost	Beam trawl	13%	13%	2%
MaintenanceHullCost	Other	11%	10%	16%
MaintenanceHullCost	Shrimp trawl	21%	11%	47%
MaintenanceHullCost	Pulse trawl	9%	9%	7%
MaintenanceHullCost	Quadrig	3%	1%	49%
MaintenanceHullCost	Flyshoot	6%	6%	0%
NavigationCost	Beam trawl	12%	12%	0%
NavigationCost	Other	20%	20%	0%
NavigationCost	Shrimp trawl	21%	21%	0%
NavigationCost	Pulse trawl	9%	9%	0%
NavigationCost	Quadrig	3%	3%	0%
NavigationCost	Flyshoot	12%	12%	0%
OtherRevenue	Beam trawl	46%	46%	0%
OtherRevenue	Other	57%	57%	0%
OtherRevenue	Shrimp trawl	70%	70%	0%
OtherRevenue	Pulse trawl	33%	33%	0%
OtherRevenue	Quadrig	9%	9%	0%
OtherRevenue	Flyshoot	22%	22%	0%

Variable	Fishing type	Relative standard error		Reduction due to new method (%)
		Old method	New method	
ProcessingShrimpCost	Beam trawl	0%	0%	0%
ProcessingShrimpCost	Other	0%	0%	0%
ProcessingShrimpCost	Shrimp trawl	26%	26%	-1%
ProcessingShrimpCost	Pulse trawl	0%	0%	0%
ProcessingShrimpCost	Quadrig	0%	0%	0%
ProcessingShrimpCost	Flyshoot	0%	0%	0%
ProvisionCost	Beam trawl	5%	1%	77%
ProvisionCost	Other	11%	2%	84%
ProvisionCost	Shrimp trawl	32%	4%	88%
ProvisionCost	Pulse trawl	4%	1%	77%
ProvisionCost	Quadrig	2%	0%	79%
ProvisionCost	Flyshoot	6%	1%	82%
ReplacementValueHullEngine	Beam trawl	19%	7%	61%
ReplacementValueHullEngine	Other	19%	15%	23%
ReplacementValueHullEngine	Shrimp trawl	26%	18%	31%
ReplacementValueHullEngine	Pulse trawl	13%	5%	62%
ReplacementValueHullEngine	Quadrig	9%	5%	44%
ReplacementValueHullEngine	Flyshoot	13%	13%	0%
SaltPackageCost	Beam trawl	0%	0%	0%
SaltPackageCost	Other	0%	0%	0%
SaltPackageCost	Shrimp trawl	75%	75%	0%
SaltPackageCost	Pulse trawl	0%	0%	0%
SaltPackageCost	Quadrig	0%	0%	0%
SaltPackageCost	Flyshoot	0%	0%	0%
SocialSecurityCost	Beam trawl	8%	8%	4%
SocialSecurityCost	Other	9%	6%	30%
SocialSecurityCost	Shrimp trawl	19%	8%	56%
SocialSecurityCost	Pulse trawl	6%	5%	12%
SocialSecurityCost	Quadrig	2%	1%	65%
SocialSecurityCost	Flyshoot	4%	4%	0%
SortLandingCost	Beam trawl	6%	6%	10%
SortLandingCost	Other	14%	7%	47%
SortLandingCost	Shrimp trawl	32%	10%	69%
SortLandingCost	Pulse trawl	5%	3%	41%
SortLandingCost	Quadrig	3%	1%	70%
SortLandingCost	Flyshoot	9%	7%	25%
TotalCost	Beam trawl	15%	5%	64%
TotalCost	Other	20%	11%	44%
TotalCost	Shrimp trawl	19%	10%	50%
TotalCost	Pulse trawl	7%	4%	39%
TotalCost	Quadrig	12%	1%	91%
TotalCost	Flyshoot	9%	6%	32%
TotalCrewCost	Beam trawl	6%	3%	57%
TotalCrewCost	Other	14%	5%	67%
TotalCrewCost	Shrimp trawl	16%	4%	73%
TotalCrewCost	Pulse trawl	5%	2%	59%
TotalCrewCost	Quadrig	2%	1%	75%
TotalCrewCost	Flyshoot	8%	3%	60%
TotalNonVariableCost	Beam trawl	15%	10%	34%
TotalNonVariableCost	Other	20%	14%	29%
TotalNonVariableCost	Shrimp trawl	26%	19%	26%
TotalNonVariableCost	Pulse trawl	11%	7%	35%
TotalNonVariableCost	Quadrig	5%	3%	33%
TotalNonVariableCost	Flyshoot	13%	9%	30%
TotalRevenue	Beam trawl	0%	0%	0%
TotalRevenue	Other	0%	0%	0%

Variable	Fishing type	Relative standard error		Reduction due to new method (%)
		Old method	New method	
TotalRevenue	Shrimp trawl	1%	1%	0%
TotalRevenue	Pulse trawl	0%	0%	0%
TotalRevenue	Quadrig	0%	0%	0%
TotalRevenue	Flyshoot	0%	0%	0%
TotalValueLandings	Beam trawl	0%	0%	0%
TotalValueLandings	Other	0%	0%	0%
TotalValueLandings	Shrimp trawl	0%	0%	0%
TotalValueLandings	Pulse trawl	0%	0%	0%
TotalValueLandings	Quadrig	0%	0%	0%
TotalValueLandings	Flyshoot	0%	0%	0%
TotalVariableCost	Beam trawl	20%	6%	72%
TotalVariableCost	Other	23%	13%	43%
TotalVariableCost	Shrimp trawl	20%	10%	47%
TotalVariableCost	Pulse trawl	7%	5%	32%
TotalVariableCost	Quadrig	22%	1%	96%
TotalVariableCost	Flyshoot	7%	7%	7%
TotalVolumeLandings	Beam trawl	0%	0%	0%
TotalVolumeLandings	Other	0%	0%	0%
TotalVolumeLandings	Shrimp trawl	0%	0%	0%
TotalVolumeLandings	Pulse trawl	0%	0%	0%
TotalVolumeLandings	Quadrig	0%	0%	0%
TotalVolumeLandings	Flyshoot	0%	0%	0%
TravelExpenseCost	Beam trawl	14%	14%	0%
TravelExpenseCost	Other	19%	19%	0%
TravelExpenseCost	Shrimp trawl	21%	21%	0%
TravelExpenseCost	Pulse trawl	10%	10%	0%
TravelExpenseCost	Quadrig	5%	5%	0%
TravelExpenseCost	Flyshoot	11%	11%	0%
WagesCrewCost	Beam trawl	5%	2%	66%
WagesCrewCost	Other	14%	3%	77%
WagesCrewCost	Shrimp trawl	15%	3%	79%
WagesCrewCost	Pulse trawl	4%	1%	67%
WagesCrewCost	Quadrig	2%	0%	79%
WagesCrewCost	Flyshoot	8%	3%	67%
WagesCrewExtraWorkCost	Beam trawl	25%	25%	0%
WagesCrewExtraWorkCost	Other	32%	32%	0%
WagesCrewExtraWorkCost	Shrimp trawl	91%	91%	0%
WagesCrewExtraWorkCost	Pulse trawl	21%	21%	0%
WagesCrewExtraWorkCost	Quadrig	29%	29%	0%
WagesCrewExtraWorkCost	Flyshoot	16%	16%	0%
WagesSailedOwnerCost	Beam trawl	6%	2%	68%
WagesSailedOwnerCost	Other	15%	3%	78%
WagesSailedOwnerCost	Shrimp trawl	15%	3%	80%
WagesSailedOwnerCost	Pulse trawl	5%	2%	70%
WagesSailedOwnerCost	Quadrig	4%	1%	83%
WagesSailedOwnerCost	Flyshoot	9%	3%	69%
WagesSailedOwnerExtraWorkCost	Beam trawl	100%	100%	0%
WagesSailedOwnerExtraWorkCost	Other	68%	68%	0%
WagesSailedOwnerExtraWorkCost	Shrimp trawl	116%	116%	0%
WagesSailedOwnerExtraWorkCost	Pulse trawl	39%	39%	0%
WagesSailedOwnerExtraWorkCost	Quadrig	1%	1%	0%
WagesSailedOwnerExtraWorkCost	Flyshoot	43%	43%	0%

Appendix 8 Data collection procedures for economic variables of vessels in the other small coastal fisheries

Data from the small coastal fisheries are obtained through a questionnaire which encompasses all EU variables. Specific calculation procedures are used for the following variables:

- The total effort is calculated based on the number of trips and average trip duration from the questionnaire
- Based on the output of the surveys (both the telephone and the economic) the vessels are classified using the EU classification based on the main gear use
- If more than half of the effort is spend with one gear category than that gear category is assigned
- If only active gears are used but none of them is used more than 50% then the gear category 17 (Vessels using polyvalent active gears only) is assigned
- If only passive gears are used but none of them is used more than 50% then the gear category 25 (Vessels using polyvalent passive gears only) is assigned
- If both passive and active gears are used and none of them is used more than 50% then the gear category 30 (Vessels using polyvalent gears) is assigned
- If the vessel has not been active than the gear category 50 (nonactive) is assigned
- In case the questionnaires are filled in but not all income and cost items are filled in it is assumed that the items not filled in are zero
- Missing fuel costs and fuel use are estimated based on average prices
- Missing labour costs are imputed based on the following assumptions
- Gill nets: Labour costs = 0.26*(income – fuel costs)
- Other passive gears: Labour costs = 0.17*(income – fuel costs)
- Polyvalent active gears: Labour costs = 0.3*(income – fuel costs)
- Other gears: Labour costs = 0.2*(income – fuel costs)
- Unpaid labour is calculated based on the information about the crew and the labour costs;
- Depreciation and interest costs are estimated based on insurance value: total = 8% of insurance value
- FTE is calculated based on effort and number of crew members.

Appendix 9 Data collection procedures for economic variables of mussel en oyster companies

Data from the mussel and oyster companies are obtained from the annual fiscal reports. This information is collected on an annual basis. Most cost items are directly copied into the database. For some cost items specific methods are used as specified below:

- Data on costs are gathered for a number of specified cost items (see Table A9.1) and aggregated in the totals for the EU cost items.
- Information on subsidies (both investment subsidies and operational subsidies) is obtained from the national authorities (Rijksdienst Voor Ondernemend Nederland, RVO).
- Data on employment is obtained from the fiscal reports. It is assumed that all employees work full-time so that the total number of jobs equals the number of FTE.
- Based on expert knowledge of the sector unpaid labour and the value of unpaid labour is assumed to be zero.
- Total value of physical capital is obtained from the fiscal reports.
- Technical information on vessel size, engine power etc. is retrieved from the official vessel register (RVO).

Table A9.1 *Overview of identified cost items in the data collection sheets for the mussel companies and classification for the EU cost items*

EU cost item	NL cost item	Description
Consumption of fixed capital	depreciation of material non-current assets	Depreciation costs (from fiscal reports)
Debt	Long-term debt	Long-term loans such as mortgages
Debt	Short-term debt	Short-term loans
Energy costs	Fuel costs	Purchase of fuel.
Feed costs	none	For bivalve culture in the Netherlands no feeding is carried out
Financial expenses	Interest and similar expenses	Paid interests (from fiscal reports)
Fish Feed used	none	For bivalve culture in the Netherlands no feeding is carried out
Gross sales per species	Net turnover	Sales of mussel and oyster sales
Investments in tangible assets	Investments	Net investments
Livestock costs	Cost of seed and half-grown	Purchase of seed and half-grown mussels
Net Investments		Purchase of new equipment
Operating subsidies	Grants received	Total grants received
Other income	Work (for) third parties	Income received for activities for other parties
Other income	Mussel seed yield	Sale of mussel seed
Other income	Incidental benefits	Incidental income
Other operating costs	Other variable costs	Other costs that are connected to the cultivation of mussels/oysters
Other operating costs	Lease of mussel plots	Lease costs of mussel plots from the Dutch authorities
Personnel costs	Personnel costs	Total costs for personnel, including management fees and social security costs
Repair and maintenance costs	Repair and maintenance costs	Total costs for repair and maintenance of the vessel and equipment
Subsidies on investments	Grants received	Total of grants for investments received
Total value of assets	Total assets	Total value of the tangible and intangible assets
Weight of sales by species	- Net amount of mussels	Net weight of mussels sold

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REPORT 2022-080

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Report 2022-080
ISBN 978-94-6447-244-8

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