An overview of the pulse logbook data collected in 2017-2019

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Contents

1 Nederlandse samenvatting

Kennis over hoe vissers hun visgronden exploiteren is essentieel voor het begrijpen hoe de visserij de populatie dynamica van de gevangen soorten en het ecosysteem beïnvloedt. Het introduceren van een nieuw vistuig kan invloed hebben op waar en wanneer vissers gaan vissen. Met ingang van 1 januari 2017 is een begin gemaakt met het registreren van de gedetailleerde vangstgegevens van de pulsschepen. WMR heeft de tot 31 december 2019 verzamelde gegevens geanalyseerd en het visgedrag van pulsschepen vergeleken met dat van traditionele boomkorschepen (verzameld tussen 2000-2005). Dit rapport geeft een update van de analyse van de data verzameld in de periode 1 januari 2017 en 31 december 2019.

Doel van het logboekonderzoek is om inzicht te krijgen of het visgedrag van schippers is veranderd door de overgang van wekkertuigen naar pulstuigen. In totaal zijn, na het filteren van de gegevens op kwaliteit, de gegevens van 141.000 trekken van 75 pulsschepen onderzocht. De resultaten van de analyse van de logboeken over de periode 01/01/2017-30/08/2018 verschillen nauwelijks met de resultaten over de periode 01/01/2017-31/12/2019 en worden om deze reden ook niet in dit rapport bediscussieerd.

De catch per unit effort (cpue) van tong volgt een duidelijk seizoenspatroon voor de pulsvisserij en lijkt met de tijd licht af te nemen. Daarnaast is ook duidelijk te zien hoe het aantal ingevulde logboeken is afgenomen als gevolg van de besluitvorming van de EU jegens de pulsvisserij.

De gepresenteerde resultaten zijn voorlopig en het onderzoek wordt voortgezet. De logboekgegevens geven de gedetailleerde informatie waarmee de lokale visgronden in kaart kunnen worden gebracht en waarmee kan worden onderzocht hoe de lokale visgronden worden geëxploiteerd. Deze informatie is belangrijk om de invloed van de pulskorvisserij op de visbestanden en op het bentische ecosysteem te beoordelen. De volgende stap zal zijn om de wekelijkse visserijpatronen van de hele vloot te analyseren en de interacties tussen visserijvaartuigen te bestuderen.

2 Abstract

Knowledge on how fishers exploit their fisheries resources is important for understanding how fishing affects the population dynamics of the exploited species and how the fishery may affect the ecosystem. The introduction of a new gear may affect the way fishers deploy their gear in space and time. We compared the behaviour of pulse trawl vessels to the behaviour of traditional beam trawl vessels. Because the pulse logbook monitoring is still ongoing, the results are preliminary and will be updated when the complete data set will become available. The logbook data set analysed comprised catch and effort information per tow collected between 1 January 2017 and 31 December 2019. The results were compared with an analysis of logbook data of traditional beam trawl vessels collected between 2000 - 2005.

This report repeated the analyses of the previous report (data from 01/01/2017-30/08/2018) and found very similar results regarding the differences between fishing patterns of the pulse trawl and the traditional beam trawl. In total, after quality filtering, data of 141,000 hauls from 75 pulse vessels were investigated. The previous study showed that pulse trawl (PT) and traditional beam trawl (BT) vessels had similar fishing patterns with alternating periods of searching, or sampling, for fishing grounds and exploitation of fishing grounds. The main differences with the results of the previous report is that a longer time series and therefore more data has been used to analyse the logbooks. Because of this similarity, the results of these analyses will not be reported in this provisional report but will be discussed in the final report.

The cpue (catch per unit effort) of sole follows a clear seasonal pattern and seems to decrease slightly through time. Also the number of logbook received by fishermen clearly decreased as a result of the ban on pulse fisheries by the EU.

The logbook data provide detailed information on what happens on the local fishing grounds which is fundamental to assess the impact of the pulse trawl fishery and beam trawl fishery on the fisheries resources and on the benthic ecosystem. The study of the total pulse fleet provides a unique data set to study not only the dynamics of the whole fleet, including the interactions among pulse vessels, but also provides a solid basis to study competitive interactions with other fisheries. The next step is to study the weekly fishery patterns of the fleet as a whole and to study the interaction between vessels.

3 Introduction

Between 2009 and 2015, a large part of the Dutch beam trawl fleet targeting sole in the North Sea has switched from using the traditional tickler chain beam trawl to the electrified pulse trawl (Turenhout et al., 2016; Haasnoot et al., 2016). The pulse trawl requires less fuel to tow the gear over the sea floor and catches about 52% (large vessels) and 94% (small vessels) more sole per hour fishing than the traditional beam trawl (Poos et al., in press). Since electric fishing is prohibited in the EU, vessels operate under a (temporary) exemption. The legal basis of the exemptions and the number of licenses issued is given by (Haasnoot et al., 2016). In 2006, the EU introduced a derogation (under Annex III (4) of Council Regulation (EC) No. 41/2006) allowing 5% (22 vessels) of the beam trawler fleet by Member States fishing in ICES zones IVc and IVb to use the pulse trawl on a restricted basis. In 2010 twenty additional licenses were issued based on Article 43,850/199820, and in 2014 another 42 licenses were issued based on Article 14. The exemptions were issued under the condition of scientific research to address the concerns expressed by ICES about the ecological impacts of pulse trawling and the implications for the sustainable exploitation of the target species (ICES, 2007).

One of the research programmes is collecting, per haul, catch and effort data of all pulse trawlers when fishing for sole. The objective of the project is to obtain insight in how pulse fishers exploit flatfish resources on local fishing grounds and how this affects the catch efficiency. It is at the local scale (km) that fishers impact the ecosystem and that fishers may compete with other fishers (Rijnsdorp et al., 2011; Branch et al., 2005; Eigaard et al., 2017; van Denderen et al., 2015; Sys et al., 2016). Knowledge on the behaviour of pulse fishers will provide the background to understand for instance the processes that affect the catch efficiency of the gear, provide insight in how pulse fishing activities affect local catch rates and provide insight in the impact on the benthic ecosystem.

It is common knowledge that adopted changes in fishing technology improves either the catch efficiency of the fishing operations or reduces the cost of fishing (Eigaard et al., 2014). Changes in catch efficiency may have important consequences for the sustainable management of a fisheries, for instance due to the introduction of bias in the time series of catch per unit of effort as a measure of the trend in fish stock biomass (Quirijns et al., 2008). An improved catch efficiency may also give rise to an increased competition among fishing vessels.

The catch efficiency of a gear is not only determined by the proportion of the fish in the path of the trawl that is caught, but also by the possibility to deploy the gear on the fishing grounds with the highest abundance of the target species. The location choice of a fishing vessel is expected to be a trade-off between the expected catch rate and species composition and the risk of damaging the gear. The analysis of high resolution information on the distribution of beam trawl vessels revealed that vessels avoided areas with a rough seafloor (Rijnsdorp et al., 1998; Hintzen et al., 2018). An analysis of the hot spots, areas where the fishers concentrated their fishing activities over several years, showed that beam trawlers targeting sole concentrated their trawling activities in warmer, shallow, dynamic, nearshore habitats, and within these specifically the depressions between sand ridges. Hotspots of beam trawlers targeting plaice occurred in the exposed, non-muddy flanks of the Dogger Bank and similar large-scale elevations (50-75 km) where especially the ridges of smaller sand banks are used (van der Reijden et al., 2018).

A comparison of the spatial distribution of the pulse trawl fleet and the traditional beam trawl fleet showed that both fleets exploited similar fishing grounds although the fishing intensity in the German Bight has reduced and the intensity in the south-western North Sea has increased (Turenhout et al., 2016); (ICES, 2018). An analysis of the habitat preferences of the pulse and the traditional beam trawl showed subtle differences (Hintzen et al., submitted). The lack of clear differences in distribution between pulse and traditional beam trawlers contrast anecdotal information from the fishing industry that vessels that switched to pulse trawling were able to fish in specific areas (muddy grounds) where traditional vessels were unable to fish and where large concentrations of sole occurred.

In order to efficiently catch sole or plaice, fishers need to find the fishing grounds where the highest concentrations of their target species occur (Poos and Rijnsdorp, 2007; Rijnsdorp et al., 2011). The areas vary seasonally due to the seasonal migrations between feeding and spawning areas and the annual offshore migration of young fish from the inshore nursery grounds. Superimposed on the seasonally varying distribution patterns, sole and plaice may temporarily concentrate in specific locations with a rich food availability (Shucksmith et al., 2006).

The fishing pattern of beam trawl vessels during a fishing trip has been studied by Rijnsdorp et al (2011) using detailed information on the location and catch rate of individual tows. They showed that a vessel alternates periods of searching, where the successive tows do not overlap, with periods of the exploitation of local grounds, where successive tows are taken close to each other. The catch rate of exploitation tows was significantly higher than during searching tows. During the exploitation period, the catch rate gradually decreased to the background catch rate of the searching tows.

In a previous report (Rijnsdorp et al. 2019) we analysed the location and catch rates of pulse trawlers reported for individual tows, to describe the fishing patterns and compared these with the fishing patterns of traditional beam trawlers based on data collected in the first half of this century. These preliminary data (collected between 1 January 2017 and 30 September 2018) showed that pulse trawl (PT) and traditional beam trawl (BT) vessels had similar fishing patterns with alternating periods of searching, or sampling, for fishing grounds and exploitation of fishing grounds. The catch rate of sole during exploitation of a fishing ground was on average 22% (PT) and 23% (BT) higher than while searching for fishing grounds. PT deploy 73% of their tows while exploiting a fishing ground and 27% while searching or sampling, as compared to 69% and 31% in BT. The number of tows taken on a fishing ground by PT (large vessels: median = 16.4; small vessels: median = 18.8) was higher than by (large) BT (median = 13.0).

In this report, we repeated the analyses reported in the previous paragraph and provide an overview of the data.

4 Material and Methods

4.1 Logbook data

Pulse trawl vessels.
A recording programme of the catch of the main target species and position per tow was set up in collaboration with the fishing industry. Data recording started on 1 January 2017 using a standardised input programme developed by Wouter van Broekhoven (VisNed) and Brita Trapman (Nederlandse Vissersbond). Data recording was restricted to the trips where the vessels deployed a pulse trawl. In this report, data were analysed that were collected in the period 1 January 2017 till 31 December 2019. The data set contains the following information for each tow: time at start and end of the tow, location of the start and end of the tow, catch (kg) of sole, plaice, turbot and brill. The summed weights per species are estimated by the fishers. Weights are generally recorded with a precision of 5kg. The local Dutch time recorded by the fishers was converted to the winter time zone.

Weekly data sheets were collected by the producers organisations (PO's) and checked for errors in data format or missing information. In case of data problems the PO's contacted the skipper to solve the problem. Corrected data sets were send to Wageningen Marine Research where the data are stored in a central data base which is only accessible for authorised persons. To warrant the confidentiality of the data, the vessel identity in the data sets used for the analysis is replaced by a unique code. WMR ran another quality control check to test amongst others for the agreement of the reported catches and the total trip catch as reported by the skipper in the mandatory EU-logbook. Table 1 shows the number of trips which fulfilled the quality control criteria and were used in the present analysis. 17% of the trip data sets were not included in the analysis because of erroneous time recordings. Criteria for quality assurance were set high to avoid unnecessary noisy data for the analysis of the fishing patterns.

Tickler chain vessels.
A data set of catch weight of sole and plaice species and the positions per tow was available for beam trawl vessels from a previous study (Rijnsdorp et al., 2011). Here we used a selection of the fishing trips targeting sole with a mesh size of 80mm which is restricted to the area south of 55°N - west of the 5°E, and south of the 56°N - east of the 5°E.

The data set used in the current study contained information of just over 140.000 tows of pulse trawlers and 86.000 tows of traditional beam trawlers.

4.2 Analysis of fishing patterns

The analysis of fishing patterns is described in Rijnsdorp et al. (2019). In summary, fishing hauls are attributed to specific fishing grounds and the analyses takes place at the unit of a fishing ground. A statistical model is fit that follows the catch rate through time to test for a decrease in catch rate over time for both exploitation and searching events.

5 Results

5.1 Comparison with previous report

The analyses of the fishing patterns (e.g. catch rate of sole during searching and exploitation events) found very similar results regarding the differences between fishing patterns of the pulse trawl and the traditional beam trawl as the previous analysis reported in Rijnsdorp et al. (2019). The main differences with the results of the previous report is that a longer time series and therefore more data has been used to analyse the logbooks. Because of this similarity, the results of these analyses will not be reported in this provisional report but will be discussed in the final report.

5.2 Catch rate through time

The cpue (kg/hr) of sole during searching and exploitation appears to remain relatively stable through time (Figure 1). The cpue during exploitation is, as to be expected, higher than during searching. There is also a clear seasonal pattern in cpue (both during exploitation and searching) with increasing cpue in July-August, peaking in October-December and then slowly decreasing to the lowest cpue in May-June, from which the seasonal pattern starts over. The seasonal pattern is less clear in 2019 compared to 2017 and 2018, probably because the amount of logbook data received by fishermen decreased considerably due to EU ban on electric fishing (Figure 2).

6 Discussion

This report presents the results of an intermediate analysis as it is based on the data collected up-to 31 December 2019. Because the logbook project is still ongoing, the results are preliminary and will be updated in the final report based on the complete data set that will become available at the end of this research project.

Since the EU has approved the ban on electric fishing in February 2019, part of the pulse fishers had to stop using pulse per 1 June 2019, another part was allowed to fish until 31 December 2019 and only a few pulse fishers are allowed to continue till 1 July 2021. This decision clearly had an effect on the amount of logbook data received from the pulse fleet (Figure 2). The number of ships supplying logbook data declined rapidly after the decision of the EU and remained low after 1 June 2019 when a large number fishers had to stop using the pulse technique.

The logbook data provide the detailed information on what happens on the local fishing grounds which is fundamental to assess the impact of the pulse trawl fishery and beam trawl fishery on the fisheries resources and on the benthic ecosystem. The next step will be to analyse the weekly fishing patterns of the whole fleet in order to estimate the dimensions of the fishing grounds and to explore how the fishing patterns of the fleet change from week to week. The study of the total pulse fleet provides a unique data set to study not only the dynamics of the whole fleet, including the interactions among pulse vessels, but also provides a solid basis to study competitive interactions with other fisheries.

7 Acknowledgments

This study was funded by the ministry of Agriculture, Nature and Food security (project no. BO-43-023.02-004). The individual data were collected under the responsibility of the Producers Organisations and fisheries organisations VisNed and Nederlandse Vissersbond. We thank all pulse vessels skippers to record their catches by individual tow and Wouter van Broekhoven and Brita Trapman for their support in the data collection.

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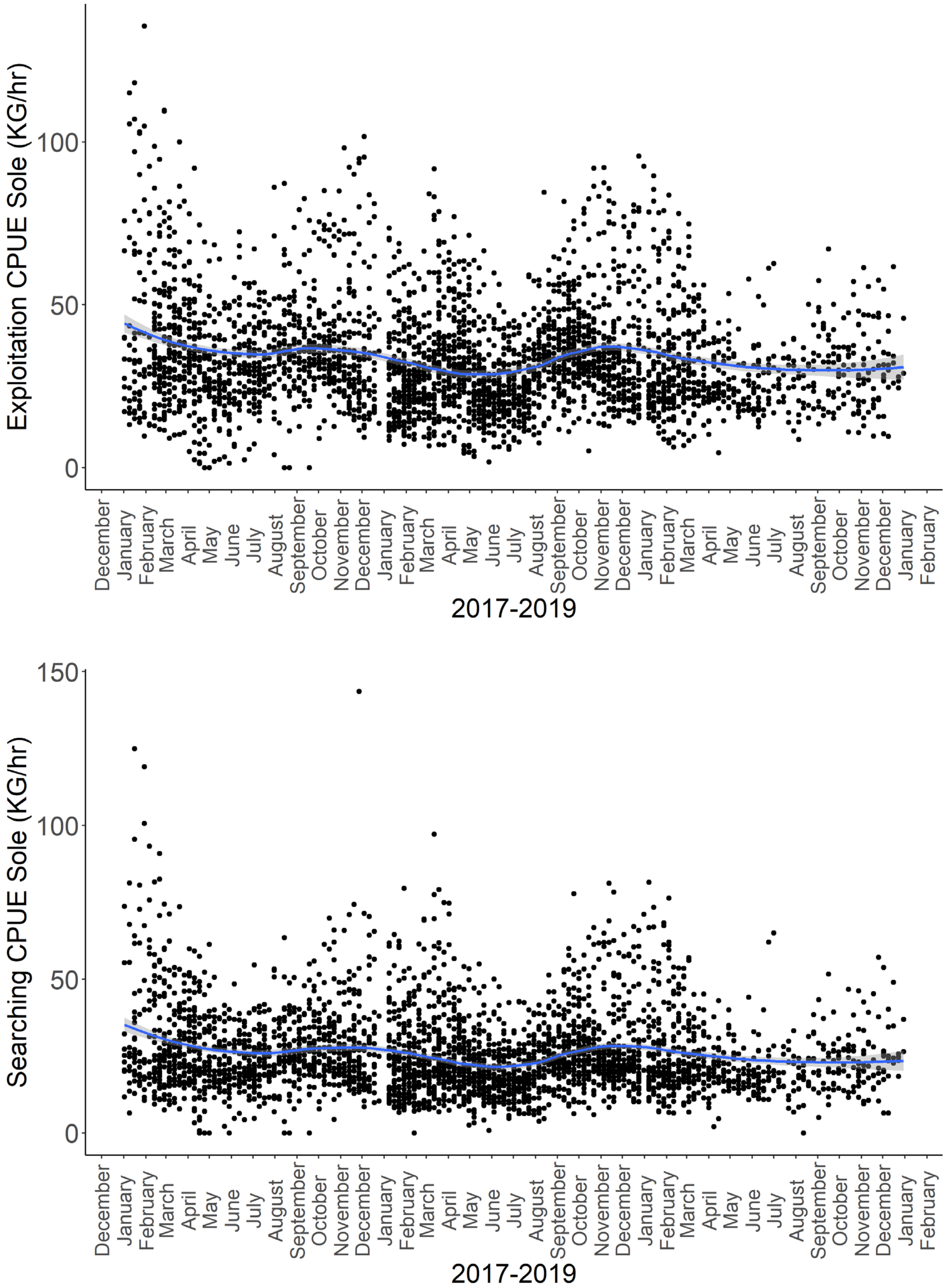


Figure 1. CPUE (KG/hr) of sole during exploitation (top) and searching (bottom) per trip from 2017-2019. A regression with LOESS (locally estimated scatterplot smoothing) and a span of 0.5 was drawn to illustrate the seasonal pattern (blue line) with a confidence interval of 0.95 (grey area).

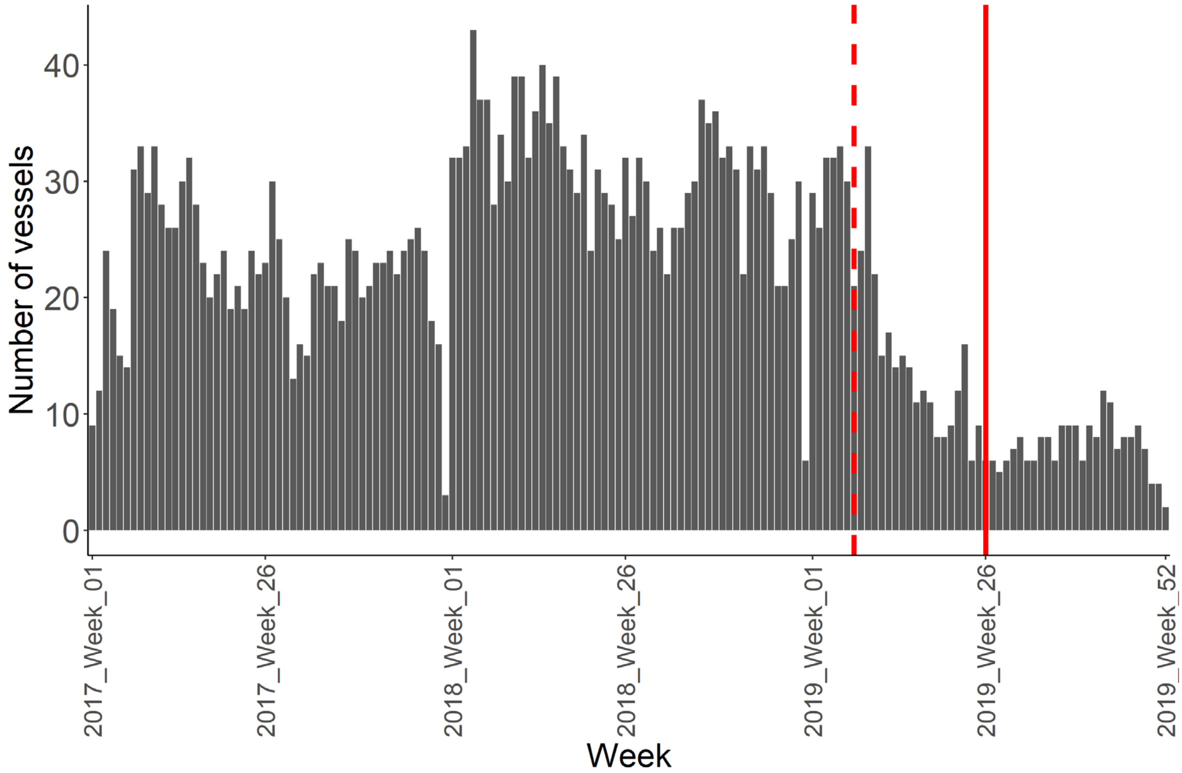


Figure 2. Number of ships that reported logbook data per week (after removal of five ships from which the data did not met the quality standards needed for analysis) from 01-01-2017 till 31-12-2019. The dashed red line represents the week of 13 February 2019 when the EU decided on a ban on electric fishing. The solid red line represents the week of 1 June 2019 when the first fishermen had to stop fishing with the pulse technique.

Table 1. Overview of the coverage of the Dutch[1)] pulse trawl fleet targeting sole for which detailed logbook data have been collected in the period between 1-1-2017 and 31-12-2019. Data of some ships was removed as it did not met the quality requirements for analysis (too little data or erroneous time recordings), numbers of ships used for the analyses are given in parentheses

		Logbook data per tow					
	Number of vessels	Number of vessels			Number of tows (after quality filtering)		
	2017-2019	2017	2018	2019	2017	2018	2019
Vessel class							
Euro cutters	16 (14)	15 (13)	13 (12)	7 (6)	6643	11034	2602
Large vessels	59 (58)	53 (53)	57 (53)	44 (43)	40623	57025	23876

1) Including two flag vessels

9 Quality Assurance

Wageningen Marine Research utilises an ISO 9001:2015 certified quality management system. This certificate is valid until 15 December 2021. The organisation has been certified since 27 February 2001. The certification was issued by DNV GL.

Furthermore, the chemical laboratory at IJmuiden has EN-ISO/IEC 17025:2017 accreditation for test laboratories with number L097. This accreditation is valid until 1th of April 2021 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation. The chemical laboratory at IJmuiden has thus demonstrated its ability to provide valid results according a technically competent manner and to work according to the ISO 17025 standard. The scope (L097) of de accredited analytical methods can be found at the website of the Council for Accreditation (www.rva.nl).

On the basis of this accreditation, the quality characteristic Q is awarded to the results of those components which are incorporated in the scope, provided they comply with all quality requirements. The quality characteristic Q is stated in the tables with the results. If, the quality characteristic Q is not mentioned, the reason why is explained.

The quality of the test methods is ensured in various ways. The accuracy of the analysis is regularly assessed by participation in inter-laboratory performance studies including those organized by QUASIMEME. If no inter-laboratory study is available, a second-level control is performed. In addition, a first-level control is performed for each series of measurements.
In addition to the line controls the following general quality controls are carried out:

- Blank research.
- Recovery.
- Internal standard
- Injection standard.
- Sensitivity.

The above controls are described in Wageningen Marine Research working instruction ISW 2.10.2.105. If desired, information regarding the performance characteristics of the analytical methods is available at the chemical laboratory at IJmuiden.

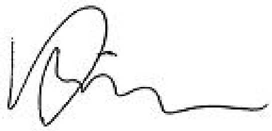
If the quality cannot be guaranteed, appropriate measures are taken.

Justification

Report C083/20
Project Number: 4318200064

The scientific quality of this report has been peer reviewed by a colleague scientist and a member of the Management Team of Wageningen Marine Research

Approved: Niels Hintzen
Researcher

Signature: 

Date: 7nd of October 2020

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