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Recreational fisheries in the Netherlands:
Analyses of the 2015 screening survey, the 2014 – 2015 logbook survey and the 2014 – 2015 Gillnet survey

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Summary

The legal framework for collection of recreational fisheries data by EU Member States is given by the EU Data Collection Framework (Council Regulation (EC) No 199/2008 and Council Decision 2008/949/EC). The Netherlands are obliged to report on cod, eel, sharks and rays. On behalf of the Ministry of Economic Affairs, WMR started the Recreational Fisheries Programme in 2009. The Recreational Fisheries Programme is part of the WOT (Legal Research Tasks) and is managed and designed by WMR, Wageningen UR. The Recreational Fisheries Programme consists of 3 surveys, which are conducted in collaboration with Sportvisserij Nederland and recreational fishers. These surveys are (1) screening survey, (2) logbook survey and (3) onsite survey.

In order to estimate the number of recreational anglers fishing in fresh and marine waters, a biennial online screening survey (~ 50.000 households) was implemented in December 2009. In December 2011, 2013 and 2015 the screening survey was repeated. The 2009 survey resulted in an estimate of 1.7 million recreational fishers being present in the Netherlands. Since 2009, the number of recreational anglers in the Netherlands has been declining (1.4, 1.3 and 1.2 million for 2011, 2013 and 2015 respectively). In 2015 this decline was due to the decline of fresh water anglers (1.19 million in 2013 and 1.11 million in 2015). The number of marine anglers slightly increased between 2013 and 2015 (492 thousand in 2013 and 541 thousand in 2015).

To estimate the mean catches per year per fisher, logbook surveys were conducted in 2010 (March 2010 to February 2011), 2012 (April 2012 to March 2013) and 2014 (April 2012 to March 2013). Participants for the logbook survey were recruited from the latest screening survey (~2400) and for the 2012 and 2014 logbook survey additional (high avid) fishers were recruited through recreational fishing websites (~100). This report provides an overview of the catch estimates of the most frequently caught marine and freshwater species from the logbook survey of 2014-2015. In addition, the methodology of the calculation of these estimates is described. The estimates of the retained and released fish are summarized in (Table 1-1).

At the same time as the regular logbook survey of April 2014 to March 2015 the first recreational gillnet survey was executed, aiming to provide insight into the gillnet fishery in marine water. Sixty-six gillnet fishers participated in the survey. The total number of gillnet fishers is estimated on the basis of the amount of permits (713). Flounder was caught most (32% of the catch), followed by sea bass (28%) and dab (9%). Three percent of the gill net catch consisted of cod.

Table 1-1 Amount of retained and released catches of recreational fishers (anglers) from April 2014 to March 2015 in marine and fresh water.

	Marine			**Fresh**			
	Number (x1000)		Biomass (t)		Number (x1000)		Biomass (t)
Species	Retained	Released	Retained	Species	Retained	Released	Retained
Cod	771	534	945	Perch	112	9 359	50
Mackerel	1 320	479	339	Pikeperch	142	3 931	300
Seabass	176	499	138	Pike	67	3 176	165
Sole	230	143	47	Bream/ Silverbream	86	12 887	55
Gadiformes	1 040	1 227	271	Carps	188	5 572	675
Flatfishes	2 830	2 242	412	Cyprinids	362	41 632	481
Eel	193	247	40	Eel	220	1 936	30
Total	7 298	6 695		Total	1 258	79 396	

Nederlandse samenvatting

De Nederlandse overheid is verplichtingen opgelegd door de Europese Commissie (EU Data Collection Framework EC 199/2008, Council Decision 2010/93/EC; VO 1224/2009 Art 55 Lid 3) met betrekking tot het rapporteren van vangsten door recreatieve vissers. Deze regelingen verplichten Nederland tot het verzamelen van gegevens over de omvang van de vangsten in de recreatieve visserij op kabeljauw, aal, haaien en roggen. In opdracht van het Ministerie van Economische Zaken (EZ) is WMR hiermee in 2009 begonnen. Het Recreatieve Visserij Programma is onderdeel van de Wettelijke Onderzoekstaken (WOT) en wordt uitgevoerd in samenwerking met Sportvisserij Nederland en recreatieve vissers.

In december 2009 is een online screening survey uitgevoerd onder ~50.000 huishoudens, wat leidde tot een schatting van het aantal recreatieve hengelaars (~1.7 miljoen) in Nederland in binnenwateren en zee- en kustwateren. In december 2011, 2013 en 2015 is de online screening survey opnieuw uitgevoerd. In vergelijking tot de 2009 screening survey is het aantal recreatieve hengelaars gedaald in 2011 (1.4 miljoen), in 2013 (1.3 miljoen) en in 2015 (1.2 miljoen). De daling in 2011 en 2013 vond plaats onder recreatieve hengelaars in zowel binnenwateren als in zee- en kustwateren, maar in 2015 alleen onder recreatieve hengelaars in binnenwateren, terwijl het aantal in zee- en kustwateren licht was gestegen.

Van april 2012 tot maart 2013 is de tweede logboek survey uitgevoerd en van april 2014 tot maart 2015 de derde. Deelnemers werden geworven uit de screening enquête (~2400) en daarnaast werden ~100 fanatieke recreatieve vissers geworven via sportvisserij websites. Dit rapport geeft een overzicht van de vangstschattingen van de meest gevangen zout en zoetwatersoorten uit de logboek survey van 2014-2015. Daarnaast wordt de methodiek van de totstandkoming van deze schattingen beschreven. De berekende hoeveelheden onttrokken vis in het zoute en zoete water staan samengevat in Tabel 1-1. Vangsten uit commerciële visvijvers zijn niet meegenomen in deze berekeningen.

Tegelijk met de reguliere logboek survey is van april 2014 tot maart 2015 de eerste recreatieve staand want survey uitgevoerd om inzicht te geven in de staand want visserij in het zoute water. Aan de survey deden 66 staand want vissers mee. Het totaal aantal vissers is geschat aan de hand van de hoeveelheid uitgegeven vergunningen (713). Het vaakst werd bot (32% van de vangst), zeebaars (28%) en schar (9%) gevangen. Drie procent van de staand want vangst bestond uit kabeljauw.

Tabel 1-1 Hoeveelheid onttrokken en teruggezette vangsten van recreatieve vissers (hengelaars) van maart 2014 tot februari 2015 in zee- en kustwateren en in binnenwateren.

	Zee- en kustwateren			**Binnenwateren**			
	Aantal (x1000)		Biomassa (ton)		Aantal (x1000)		Biomassa (ton)
Soort	Mee-genomen	Terug-gezet	Mee-genomen	Soort	Mee-genomen	Terug-gezet	Mee-genomen
Kabeljauw	771	534	945	Baars	112	9 359	50
Makreel	1 320	479	339	Snoekbaars	142	3 931	300
Zeebaars	176	499	138	Snoek	67	3 176	165
Tong	230	143	47	Brasem/Kolblei	86	12 887	55
Gadiformes	1 040	1 227	271	Karperachtigen	188	5 572	675
Platvissen	2 830	2 242	412	Witvis	362	41 632	481
Aal	193	247	40	Aal	220	1 936	30
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1. Introduction

Recreational fishing is a popular activity worldwide and although most recreational fishers make few fishing trips per year, collectively they can catch substantial quantities of fish. For some fish species, recreational fisheries have a significant impact on stocks and therefore there is an increasing need to provide reliable estimates of the recreational catch for inclusion in stock assessments (Coleman et al., 2004, Van der Hammen & de Graaf 2015, Van der Hammen et al. 2016).

The legal framework for collection of recreational fisheries data by EU Member States was given by the EU Data Collection Framework (Council Regulation (EC) No 199/2008 and Council Decision 2008/949/EC). The Netherlands are obliged to report on recreational catches (landed and released) of cod, eel, salmon, sharks and rays in marine waters and inland waters (eel and salmon only). On behalf of the Ministry of Economic Affairs, Wageningen Marine Research started the Recreational Fisheries Programme in 2009. The Recreational Fisheries Programme is part of the WOT (Statutory Research Tasks) and is managed and designed by Wageningen Marine Research, in collaboration with the Dutch angling organisation, 'Sportvisserij Nederland' and recreational fishers.

The dynamic nature of participation in recreational fisheries in terms of activity levels in space and time makes it challenging to accurately assess the number of people that are engaged in recreational fisheries within given timeframes and regions. To collect data on fishing participation of recreational fishers, phone or mail recall surveys, where fishers are asked to recollect their catches from the past, are straightforward, easy to administer and relatively cost-effective. In addition, phone or mail recall surveys allow assessing attitudes and socioeconomic and demographic profiling of fishers. However, the accuracy of these catch estimates are doubtful as recall surveys have been demonstrated to overestimate recreational catches. This potential for overestimation is due to the impacts of non-response bias, recall bias, digit preference and prestige bias (Pollock et al., 1994; Lyle et al., 2002; Henry and Lyle, 2003).

In order to keep the potential biases as low as possible, a survey design was developed which supports respondent participation and encourages accurate and complete data reporting as well as tracking and follow-up of non-respondents (van der Hammen et al. 2015, 2016). The general design of the current recreational fisheries survey comprises of three components; (i) screening survey, (ii) logbook survey and (iii) onsite survey. The screening survey is used to estimate the number of fishers and their demographics including avidity. Participants (~2500) for the 12 month logbook survey were recruited from the screening survey (~2400) and from recreational fisheries websites (~100). Participants were contacted online once a month by Kantar-TNS (previously TNS-NIPO) and requested to transfer the data recorded in their logbooks to online questionnaires. The monthly frequency of reporting for the logbook survey was used to ensure a short recall period. The onsite survey was used to collect additional, accurate length data of retained fish by marine anglers for the conversion of catches in numbers to biomass.

In this report, we describe the estimation method to raise the logbook data from April 2014 to March 2015 to the yearly catch estimates and we present the estimates of catches (retained and released). These methods are similar to methods in (Van der Hammen and Graaf, 2015). We also report on the recreational gillnet fishery, which was part of the 2014 logbook survey. The results are compared with the previous logbook (2010, 2012) and screening surveys (2009, 2011, 2013).

2. Materials and methods

2.1 Number of recreational fishers: Online Screening Survey 2015

The screening survey is used to estimate the number of recreational fishers and their demographics. It is a panel survey which was conducted by a commercial marketing company (Kantar-TNS). The demographics of the panel such as age, gender, education level and place of residence are controlled by the marketing company to ensure that it does not deviate from the demographics of the Dutch population.

The questions about recreational fishing were offered in December 2015 in an online omnibus questionnaire containing questions of a variety of completely different topics. Participants did not know the topics before filling in the questionnaire and were not allowed to skip topics. This is assumed to lower the non-response that is directed to fisheries questions. One member of the family filled in the questionnaire for the whole family.

In the screening survey, respondents were asked if they had fished recreationally the year before, what gear(s) they had used, if they were intending to participate in freshwater and /or marine recreational fisheries in 2016 and if they would be interested in participating in a 12 month logbook survey starting in 2016. In addition, they were asked to indicate how many fishing trips they had made in 2015 to determine their level of fishing 'avidity'. The design of the screening survey was similar to 2009, 2011 and 2013. The questions of the 2015 screening survey are listed in annex 1.

2.2 Logbook survey

The logbook survey was used to determine the fishing activity of respondents. Interested participants recruited during the screening survey were selected with a probability of inclusion based on an analysis of demographics including age, gender and region of residence such that it matched ratios found in the screening survey as much as possible. This was done on an individual basis, i.e. some members of the same household could be included in the survey, whereas others were not. The screening survey was based on a database from Kantar. This database has a turnover rate of less than 10% per year. This means that some participants have joined multiple surveys.

Because the percentage of anglers in the higher avidity groups was much lower than in the lower avidity groups (Table 2-1), it was decided that high avid anglers participating in the logbook survey should be overrepresented, to increase the precision in these avidity groups. This means that the distribution of avidities in the logbook survey differed from that of the screening survey. For the final catch estimate, correction for the difference in distribution of avidities is done by weighting the data to avoid bias. However, because the percentage of high avid anglers is low, especially for marine anglers; 0.2% (fresh, >50 fishing trips per year), <0.1% (marine, >50 trips per year, Table 3-1), the screening survey did not recruit sufficient high avid anglers to over represent this group. Therefore, (high avid) anglers were also recruited by advertisements on recreational fisheries websites (www.vangstenregistratie.nl, www.sportvisserijnederland.nl, www.topvisser.nl). Interested anglers were asked the same questions online as the participants of the screening survey about fishing avidity, as well as some of their demographics (age, gender etc.). This resulted in 131 external participants ('web' participants) being selected for the logbook survey. In addition, the highest avidity groups were merged (>10 for marine and >25 for fresh water) in order not to make avidity groups with very small sample sizes. In marine

water the numbers were lower than in fresh water. Therefore, 3 avidity groups were made for marine anglers, whereas for fresh water anglers numbers were sufficient to make 4 groups (Table 2-1).

Table 2-1 Number of logbook survey participants in each avidity group.

		Participants			*Screening (%)*	*Logbook (%)*
	Avidity	Kantar	web	total		
Marine	1-5	790	29	819	74	61
	6-10	269	11	280	14	21
	>10	245	33	278	12	19
	Total	1 304	73	1 377		
Fresh	1-5	740	2	742	55	35
	6-11	673	8	681	21	32
	11-25	429	22	451	15	20
	>25	272	92	364	8	13
	total	2 114	124	2 238		

Participants of the logbook survey were asked to maintain a logbook in which they recorded per fishing trip detailed information on catch and effort. The information in the logbooks included among other questions: fishing location, water body type, start and end date and time of the fishing trip, gear used, catch (number of fish, species, size in cm), whether a fish was retained or released and whether the recorded length of fish was measured or estimated (see annex 2 for the logbook instructions and the logbook questionnaire). New in this survey was that anglers were asked to locate their fishing trip in google maps. Anglers were also asked to report their fishing trips in foreign countries. Participants were contacted online once a month by Kantar and requested to transfer the data recorded in their logbooks to online questionnaires. The participants were also expected to indicate if they had not fished during that month.

2.3 Onsite survey

To convert numbers to weights fish lengths are needed. An onsite survey was conducted at the same time as the logbook surveys to obtain accurate length data. In order to obtain this data, Wageningen Marine Research employees trained a number of recreational anglers in accurately measuring fish lengths. Subsequently, the trained anglers approached anglers in the field and measured the lengths of retained fish. Observers collected data from anglers fishing from the shore, and anglers fishing from boats. An overview of the number of locations and sampling days in the different years is presented in Table 2-2. The length data from the onsite survey were used for the number to biomass conversion if more than a hundred individual fish were measured during the onsite surveys (2009-2014 pooled).

Table 2-2 Number of observers, location and number of observer trips in the onsite survey.

	year	Location	no. observers	shore/boat	no. observer trips
marine	2009	Middle (Zuid Holland, Noord Holland)	unknown	shore	34
		Middle (Zuid Holland, Noord Holland)	unknown	boat	5
	2012	North (Groningen, Friesland)	5	shore	8
		North (Groningen, Friesland)	3	boat	4
		Middle (Zuid Holland, Noord Holland)	2	shore	7
		South (Zeeland)	2	shore	4
		South (Zeeland)	2	boat	9
	2014	North (Groningen, Friesland)	2	shore	6
		North (Groningen, Friesland)	2	boat	4
		Middle (Zuid Holland, Noord Holland)	3	shore	4
		Middle (Zuid Holland, Noord Holland)	2	boat	2
		South (Zeeland)	2	shore	7
		South (Zeeland)	3	boat	8
fresh	2012	Middle (Zuid Holland, Noord Holland)	2	shore	12
		Middle (Zuid Holland, Noord Holland)	2	boat	2

2.4 Analysis

A simplified scheme of the raising procedure is visualized in annex 3. The screening survey is used to estimate the proportion of recreational anglers in the Dutch population for each avidity group and for fresh and marine waters. The total number of inhabitants in the Netherlands was obtained from Statistics Netherlands (CBS), which are used to raise these proportions to the total number of anglers in the Netherlands for fresh and marine waters, for each avidity group. Subsequently, the logbooks are used to estimate the catches per year per individual angler (number or weight of fish/angler/year for each avidity group) for each fish species. Multiplying the catches per year with the total number of anglers gives the total number or weight of caught fish per species and avidity group. Summing these estimates for each avidity group results in the total catch estimate per species. The raising procedure is listed in more detail in annex 4.

2.4.1 Participation

Around 40% of the logbook survey participants responded fully for the twelve months of the survey, the remainder participants responded between 1 and 11 times. If a participant in the logbook survey had not responded in one or more of the months, in the next month additional questions about their fishing activity in those missing months were asked. For those missing months only questions about the number of fishing trips were asked, questions about the catches were not asked to order to avoid recall bias. A proportion of anglers who did not fill in their logbooks every month, filled in these additional questions about their fishing activities in these months. If they did, the missing months of non-respondents from the logbooks were completed with the information about their fishing activity. Participants had to return their logbooks (supplemented with this information) at least eight times to be included in the analysis. In the months were logbook data was absent, but the additional questions were released, it was known whether an angler had fished in a specific month and how many fishing trips were made, but information about the catches was absent. Anglers indicating that they did not fish in a specific month were assigned zero catch and effort and treated as having fully responded in that month. If respondents indicated they had fished, we sought to impute their fishing activity for the missing months using hotdeck imputation (Sarndal and Lundstrom, 2005). The donor values were chosen from respondents with the same stated avidity as the recipient and who had fished in the same month as the missing value of the recipient. Avidity was expected to affect the amount of catches, because the more fish trips, the higher will be the total catch. The season (month) is expected to affect the catches, because the catches per year per

species are expected to differ per month. Imputation was done in R (R_Development_Core_Team, 2011), library StatMatch, function NND.hotdeck.

2.4.2 Drop-out removal

The population of anglers changes over time, with anglers leaving or entering recreational fishery, the so called ‘drop-ins’ and ‘drop-outs’. Drop-outs are defined as those anglers who did not fish during the timespan of the logbook survey, and were excluded from the analysis. Weighting for avidity ensures that the drop out removal is corrected for changes in the distribution of avidities. Drop-out removal was done after hotdeck imputation (see previous paragraph).

2.4.3 Weighting for avidity

The avidity distribution of the logbook participants deviated from the distribution observed in the screening survey, with the higher avidity groups being somewhat oversampled (Table 2-1). This was done on purpose in order to obtain more catch data and to obtain higher precision of the higher avid groups compared to the previous surveys. Weighting for avidity was therefore needed to estimate the total amount of catches.

2.4.4 Species recognition

The participants of the survey were provided with a species recognition card and a free smart phone app developed by the Dutch Angling organisation (Sportvisserij Nederland) to assist with identification of the catch. However, several fish species are difficult to distinguish. Therefore, in cooperation with the Dutch Angling organisation it was decided to group some species before further analyses (Table 2-3).
For the following species catch estimates were calculated at species level: (marine) cod, eel, seabass, mackerel, sole, (fresh water) eel, perch, pike, and pikeperch.

Table 2-3 Grouping of fish species during analysis

	Group	Species (UK)	Soort (NL)	Species (Latin)
Marine	Flatfishes	Plaice	Schol	*Pleuronectes platessa*
		Dab	Schar	*Limanda limanda*
		European Flounder	Bot	*Platichthys flesus*
	Gadiformes	Pout	Steenbolk	*Trisopterus luscus*
		Whiting	Wijting	*Merlangus merlangus*
		Saithe	Zwarte koolvis	*Pollachus virens*
		Atlantic pollock	Witte koolvis	*Pollachius pollachius*
		Haddock	Schelvis	*Melangrammus aeglefinus*
	Salmonids	Atlantic salmon	Zalm	*Salmo salar*
		Seatrout	Zeeforel	*Salmo trutta trutta*
Fresh	Bream & Silver bream	Common bream	Brasem	*Abramis brama*
		Silver bream	Kolblei	*Blicca bjoerkna*
	Carps	Common carp	Karper	*Cyprinus carpio*
		Prussian carp	Giebel	*Carassius gibelio*
		Crucian carp	Kroeskarper	*Carassius carassius*
		Grass carp	Graskarper	*Ctenopharyngodon idella*
	Cyprinids	Common bleak	Alver	*Alburnus alburnus*
		European bitterling	Bittervoorn	*Rhodeus amarus*
		Common roach	Blankvoorn	*Rutilus rutilus*
		European chub	Kopvoorn	*Squalius cephalus*
		Common rudd	Ruisvoorn	*Scardinius erythrophthalmus*
		Ide	Winde	*Leuciscus idus*
		Asp	Roofblei	*Aspius aspius*
	Salmonids	Atlantic salmon	Zalm	*Salmo salar*
		Seatrout	Zeeforel	*Salmo trutta trutta*
	Trouts	Brown trout	Beekforel/Bruine forel	*Salmo trutta fario*
		Rainbow trout	Regenboogforel	*Oncorhunchus mykiss*
	Catfishes	Wels Catfish	Europese meerval	*Silurus glanis*
		African catfish	Afrikaanse meerval	*Clarias gariepinus*
		Brown bullhead	Bruine dwergmeerval	*Ameiurus nebulosus*
		Black bullhead	Zwarte dwergmeerval	*Ameiurus melas*

2.4.5 Converting numbers to biomass

There were two options to estimate biomass of retained fish. First, if more than a hundred individual fish were measured during the onsite surveys (2009-2014 pooled, Table 2-4) the length data from the onsite survey were used for the number to biomass conversion using length weight relationships. Lengths were randomly assigned to individual fish in the logbooks from the pool of onsite length measurements. Weight estimates of 2010 and 2012 were measured in previous years and have not been updated in this report. Because the numbers of fish have increased in the onsite survey since 2010, the average weight per fish can differ between years. Second, if less than 100 individuals of a species were measured during the onsite survey, then the length data from the logbooks were used for the number to biomass conversion, by using the length that were assigned to the individual fish by the angler if participants had measured the fish length. If participants had estimated the fish lengths, lengths were replaced by randomly assigning lengths from the pool of measured lengths of the specific species from the 2014 survey (see Table 2-5 for the number of measures in the logbook survey). In groups of species, the length weight relationship of the species that was specified in the logbook was used. Length weight relationships are listed in annex 5.

Table 2-4 Sample size of measured retained fish in the onsite survey.

	2009	2010	2011	2012	2014
Cod	15	87	26	238	232
Mackerel	0	0	0	1 112	215
Sole	0	0	0	4	42
Seabass	0	4	0	112	49
Flatfishes	0	0	0	1 077	457

Table 2-5 Sample size of measured fish in the logbook survey (March 2014-February 2015).

Marine	no. measured fish	Fresh	no. measured fish
Cod	463	Perch	19
Mackerel	599	Pikeperch	128
Seabass	140	Pike	30
Sole	210	Bream/Silverbream	83
Gadiformes	555	Carps	55
Flatfishes	2 476	Cyprinids	156
Eel	67	Eel	135

2.4.6 Precision

The estimation procedure of standard errors of the estimates of the screening survey and the catch estimates are described in van der Hammen and de Graaf (2015). Some species were caught frequently by many anglers and some species were rarely caught by very few anglers. Sometimes only few anglers caught many fish, in which case in- or exclusion of these anglers could make a large difference for the catch estimate and thus decreasing the precision. Those extreme anglers tend to increase the standard error and the relative standard error (RSE, the standard error expressed as a fraction of the estimate). Here, estimates with a RSE of 40% or greater are flagged (pers. comm. J. Lyle) and should be used only with caution. Likewise, the estimates originating from fewer than 25 anglers who caught a specific fish species are also flagged (pers. comm. J. Lyle) and should be used with caution.

2.5 Catch & Release mortality

A proportion of the released fish will not survive the ordeal of being caught due to injuries sustained in the hooking and handling process and/or due to barotrauma. Bartholomew and Bohnsack (2005) reviewed 123 release mortality studies of catch and release fishing. The average mortality of catch and release (C&R) fishing (n=274) was 18% (modus 7%; median 11%), ranging from 0% to 95%, depending on the species.

In the Netherlands several species show high release rates, for example cod (40%), seabass (70%) and eel (80%). Unfortunately, only few C&R studies are available. Ferter et al. (2013) stressed the need for post release mortality studies to estimate total fishing mortality and to develop best practises guidelines to minimize the impacts of C&R on released marine fish in Europe. In Table 2-6 rough estimates of C&R mortalities are presented for the species studied in this report.

<u>Cod</u>

Two studies for cod are available; (Weltersbach and Strehlow, 2013) estimated C&R mortality for cod in the Baltic Sea by recreational charter boats to be 11%. However, water depths in this study area were relatively shallow (between 8.5 and 14 m) compared to the cod fishing by charter boats in the Dutch part of the North Sea. Because barotrauma was one of the highly significant factors for the mortality of

released fish (Bartholomew and Bohnsack, 2005), a 11.2% C&R mortality for cod caught by charter boats in the North Sea is possibly conservative. Capizzano et al. (2016) studied the C&R mortality of cod in the Gulf of Maine and found an average mortality rate of 16.5%. We propose the mean between the two studies, resulting in 14%.

Seabass

Striped bass (*Morone saxatilis)* is similar to European seabass in terms of morphology, habitat occurrence, and angling methods and could therefore be used as a proxy for seabass C&R mortality. The predicted long-term mortality for striped bass released in saltwater ranged from 3–26%, depending on a range of conditions (Diodati and Richards, 1996). Predicted as well as observed mortality for the entire experimental group was 9%. The Massachusetts Division of Marine Fisheries estimated that the mean C&R mortality of striped bass was 19% based on 40 different experiments by 16 different authors (ICES, 2015). Experiments are needed to estimate C&R mortality for seabass for conditions and angling methods typical of local recreational fisheries. However, until these experiments are conducted, the C&R mortality rate of 9% for striped bass by Diodati and Richards (1996) is used as a proxy for seabass C&R mortality rates.

Eel

In 2015 a C&R mortality study for eel was conducted in co-operation with German scientists and the results will be published in 2017. During the 2016 logbook survey additional questions are being asked to determine the distribution of known factors (e.g. hooking location, hook size, hook type, bait type) effecting survival of released eel, cod and seabass. To date the only active gear C&R mortality studies for European eel is based only on deep hooked eel (Weltersbach et al., 2016). Using mortality rates from deep hooked eel (~42%) as a proxy for C&R mortality will lead to an overestimation of C&R mortality by recreational anglers. Two studies are available on the C&R mortality of eel using passive gears (commercial long line). In 1940 the survival of eel caught by longline and trawl was compared (Department of Economic Affairs, 1940). Another study took place in the Lough Neagh eel fishery (Evans and Rosell, 2008). Using mortality rates from passive gears (~20%) as a proxy for C&R mortality of active gears (angling) may also lead to an overestimation of C&R mortality by recreational anglers. Bartholomew and Bohnsack (2005) stated that not sufficient data was available to analyse differences between active and passive fishing in C&R mortality. However, two studies reported that active fishing and setting the hook quickly may reduce fish mortality compared to passive fishing by preventing the fish from swallowing hooks. We propose a practical solution for the percentage of eel C&R mortality by recreational anglers. Until future studies provide more accurate insight we suggest for eel a C&R mortality of 11% (the median value in Bartholomew and Bohnsack, 2005) to be used for recreational anglers.

Flatfishes

In Bartholomew and Bohnsack (2005) 5 estimates for C&R mortality in the flatfish family (*Pleuronectiformes*) are presented. The studied species are pacific halibut and summer flounder which do not occur in the North Sea. However, until future studies provide more accurate estimates, we propose to use the mean of these 5 studies (12%) as C&R mortality rate for sole and the flatfish group.

Perch

Similarly to the flatfish family, in Bartholomew and Bohnsack (2005) 8 estimates for C&R mortality in yellow perch are presented, which also does not occur in the Netherlands. However, until future studies provide more accurate estimates, we propose to use the mean of these 8 studies (10%) as C&R mortality rate for European Perch.

Bream and silverbream

Raat et al. (1997) studied the effect of keep nets in bream. As a side effect they found that the mortality in ponds that were not angled was 3% lower than in ponds that were angled. Although this difference was not proved significant, we propose to use the 3% difference for C&R mortality of bream and silverbream.

Pike

Tomcko (1997) did a literature review on hooking mortality in northern pike which indicated that the average hooking mortality for northern pike is ~ 5%. We propose to use this value for pike.

Carps

Raat (1985) studied angling vulnerability of carps in ponds and did not found any mortality in a 22 days experiment. Although the duration of the experiment was short and individuals are less vulnerable in ponds than in the wild, we propose negligible (0%) C&R mortality for carps.

Pikeperch

No reliable estimates of pikeperch were found in the literature. Bartholomew and Bohnsack (2005) present one study of sauger (*Stizostedion canadense*) with 5% C&R mortality, which we propose to use for pikeperch.

The used C&R mortality rates are listed in Table 2-6. If no data is available, the median value (11%) of Bartholomew and Bohnsack (2005) is used.

Table 2-6 Estimates of C&R mortality

Species	C&R mortality	Basis	reference
Cod	14%	mean of undersized cod C&R mortality in the Baltic Sea (11.2) & C&R mortality in the gulf of maine (16.5)	Weltersbach and Strehlow (2013) Capizzano et al (2016)
Mackerel	11%	Median of all studied species in Bartholomew and Bohnsack (2005).	Bartholomew and Bohnsack (2005).
Seabass	9%	Hooking mortality of striped bass after catch and release in saltwater	(Diodati and Richards, 1996)
Sole	12%	Mean of 5 estimates (between 5% and 20%) of C&R mortality in Pleuronectiformes family	Trumble et al. (2002); Malchoff et al. (2002); Zimmerman and Bochenek (2002); in Bartholomew and Bohnsack (2005)
Gadiformes	11%	Undersized cod C&R mortality in the Baltic Sea	Weltersbach and Strehlow (2013)
Flatfishes	12%	Mean of 5 estimates (between 5% and 20%) of C&R mortality in Pleuronectiformes family	Trumble et al (2002); Malchoff et al (2002); Zimmerman and Bochenek (2002) in Bartholomew and Bohnsack (2005)
Perch	10%	Mean of 8 estimates (between 2% and 31%) of C&R mortality in Yellow Perch	Keniry et al. (1996) in Bartholomew and Bohnsack (2005)
Pikeperch	5%	One 1 study of Sauger (*Stizostedion canadense, 5%*)	Bettoli et al. (2000) in Bartholomew and Bohnsack (2005)
Pike	5%	Based on a literature review on hooking mortality for northern Pike.	Tomcko 1997
Bream/Silver bream	3%	Raat et al 1997 (tabel 5)	Raat et al 1997
Rainbow/ Brown trout	11%	Mean of 20 estimates (between 0% and 87%) of C&R mortality in Rainbow trout	Bouck and Ball (1966); Klein (1966); Horak and Klein (1967); Keniry et al. (1996); Ferguson and Tufts (1992); Pankhurst and Dedualj (1994) Schill (1996); Schisler and Bergersen (1996) in Bartholomew and Bohnsack (2005)
Carps	0%	22 days fishing did not result in mortality	Raat 1985
Cyprinids	11%	Median of all studied species in Bartholomew and Bohnsack (2005).	Bartholomew and Bohnsack (2005).
Eel	11%	Median of all studied species in Bartholomew and Bohnsack (2005).	Bartholomew and Bohnsack (2005).
Total (all species)	11%	Median of all studied species in Bartholomew and Bohnsack (2005).	Bartholomew and Bohnsack (2005)

2.6 Recreational Gillnet survey

Each gillnet fisher, if the municipality has granted a license, is allowed to fish with one gillnet of 50m in length (Staatscourant, 2012), with some exceptions were one gillnet of 100m or 30m is allowed (Wadden islands and Westerscheldt). From April 2014 to March 2015 a recreational gillnet survey was carried out for the first time, aiming to provide insight in the characteristics of the recreational gillnet fisheries in marine waters.

To gain insight into the number of licenses granted and to recruit participants for the gillnet survey, municipalities of the coastal provinces were asked by Wageningen Marine Research how many licences were issued in 2013. Subsequently the municipalities got in contact with the registered gillnet fishers and distributed a questionnaire. The fishers could respond voluntarily via a reply card if they wanted to participate in a one-year logbook study. More than one hundred (107) fishers responded positively to

participate in the survey, which resulted in 66 fishers actually participating (60 men, 2 women and 4 unknown).
The survey consisted of a monthly logbook, similar to the regular recreational fishing survey, where fishers recorded the number of fishing trips made (emptying the net), location (approximate), the catch and whether the catch was retained or released. Of the retained fish the length of the fish was also recorded.

3. Results

3.1 Number of recreational anglers: online screening survey

In 2015 the participation rate of freshwater and marine anglers among the Dutch population was 6.5% and 3.1%, respectively (Table 3-1). Extrapolation to the population level resulted in an estimation of 1.1 million fresh water anglers and 533 thousand marine anglers in The Netherlands. In total there were approximately 1.2 million anglers in the Netherlands. The number of anglers continued to decline from 1.7 million (2009), 1.4 million (2011), 1.3 million (2013) to 1.2 million (2015). The decline is even more pronounced considering the fact that in 2009 and 2011 only the number of recreational fishers with ages >= 6 were estimated, while since 2013 anglers of all ages are estimated (Table 3-1).

The decrease in anglers was caused by a decrease in the participation rate of fresh water anglers, from 7.1% in 2013 to 6.5% in 2015. The percentage of marine anglers increased slightly from 2.9% in 2013 to 3.1% in 2015 (Table 3-1).

Table 3-1 Results screening survey (December 2009, 2011, 2013 and 2015). Number of anglers in the Netherlands per avidity group; per waterbody type; and the total number of anglers. SE between brackets. In 2009 and 2011 the number of anglers from 6 years or older was estimated.

		Marine			Fresh			
	Avidity	No. screening	% screening	No. in NL (±SE)	No. screening	% screening	No. in NL (±SE)	Selection
2009	1-5	3 378	3.1%	477 734 (8 092)	5 614	5.1%	793 960 (10 321)	>=6
	6-10	560	0.5%	79 198 (3 338)	2 435	2.2%	344 370 (6 901)	
	11-25	234	0.2%	33 093 (2 161)	1 514	1.4%	214 117 (5 465)	
	26-50	61	0.1%	8 627 (1 104)	604	0.6%	85 421 (3 466)	
	> 50	38	<0.1%	5 374 (872)	311	0.3%	43 983 (2 491)	
	Total	4 271	3.9%	604 026 (9 060)	10 478	9.6%	1 481 851 (13 765)	
	fresh + marine	**11 703**	**10.7%**	**1 655 097 (14 457)**				
2011	1-5	2 558	2.4%	373 960 (7 305)	4 618	4.3%	675 118 (9 718)	>= 6
	6-10	614	0.6%	89 762 (3 612)	1 953	1.8%	285 514 (6 401)	
	11-25	285	0.3%	41 665 (2 465)	1 320	1.2%	192 974 (5 279)	
	26-50	97	0.1%	14 181 (1 439)	493	0.5%	72 073 (3 239)	
	> 50	40	<0.1%	5 848 (924)	240	0.2%	35 086 (2 262)	
	Total	3 594	3.4%	525 417 (8 615)	8 624	8.1%	1 260 766 (13 017)	
	fresh + marine	**9 409**	**8.8%**	**1 375 527 (13 542)**				
2013	1-5	2 177	2.1%	359 136 (7 615)	3 973	3.9%	655 420 (10 194)	All ages
	6-10	446	0.4%	73 576 (3 476)	1 553	1.5%	256 196 (6 451)	
	11-25	251	0.2%	41 407 (2 610)	1 104	1.1%	182 125 (5 452)	
	26-50	79	0.1%	13 033 (1 466)	446	0.4%	73 576 (3 476)	
	> 50	29	<0.1%	4 784 (888)	166	0.2%	27 385 (2 124)	
	Total	2 982	2.9%	491 936 (8 876)	7 242	7.1%	1 194 702 (13 531)	
	fresh + marine	**7 932**	**7.8%**	**1 308 530 (14 110)**				
2015	1-5	2 126	2.2%	375 946 (8 063)	3639	3.8%	643 494 (10 463)	All ages
	6-10	442	0.5%	78 160 (3 709)	1183	1.2%	209 193 (6 045)	
	11-25	310	0.3%	54 818 (3 108)	898	0.9%	158 796 (5 274)	
	26-50	90	0.1%	15 914 (1 676)	335	0.3%	59 239 (3 232)	
	> 50	44	< 0.1%	7781 (1 173)	159	0.2%	28 116 (2 228)	
	Total	3012	3.1%	532 620 (9 551)	6214	6.5%	1 098 838 (13 481)	
	fresh + marine	**6871**	**7.2%**	**1 215 017 (14 123)**				

3.2 Logbooks

3.2.1 Participation

After inclusion of the blanks, 78% responded 12 times and 89% responded 8-12 times, which means that 89% of the participants were included in the analysis. The participants included in the analysis summed up to 2200 respondents. The response rate has been very stable at 89-90% of the participants responding 8-12 times between 2010 and 2014 (Table 3-2).

Only a small proportion of the data (in months) was imputed; 3.0% for marine water and 4.6% for fresh water (Table 3-3).

Table 3-2 Logbook (logbook + blanks) survey response

	2010		2012		2014	
response (months)	participants	%	participants	%	participants	%
1-7	208	11	247	10	268	11
8-12	1 762	89	2 168	90	2 195	89
total	1 970		2 415		2 463	

Table 3-3 Response rate in months (number of months returned) and number of months that are imputed

Data (in total months)	Marine	Fresh
Not Imputed	14 373	22 882
Imputed	439	1 127
Total % data imputed	3.0%	4.7%

3.2.2 Data cleaning

There was a family reporting to retain large number of small fresh water fish (eel, pike, pikeperch, carps, perch). Most of these fish are usually not retained and especially not the small fishes (~25cm). Because the survey is anonymous we could not contact these fishers ourselves about the validity of their catches and if they indeed brought them home, Kantar (previously TNS-NIPO) tried to contact them, but failed because these fishers had left the Kantar database. Because of the large amount of reported catches, this family was quite influential, but due to the nature of the catches we decided to exclude the family from the analysis.
Likewise, in marine water there was one family, who caught and retained large amounts of salmon/seatrout (~600 each), almost all of which were reported to be 11 cm. These are very small for salmon caught in the sea and are expected to be of another species. These catches were excluded from the analysis.

3.2.3 Drop out removal

The number of drop outs for marine fishers are high. The percentage of marine anglers that planned to fish, but did not fish was 64%. The number of fresh water fishers who planned to fish but did not fish was much lower, 19%. The drop-outs were removed from the analysis.

3.2.4 Fishtrips

Participants of the logbook survey were asked to locate their fishing trip by clicking into google maps. This step could not be skipped and resulted in approximate locations. This also results in occasional mistakes, for example marine trips in inland areas and trips located abroad (were the country was recorded to be The Netherlands). Participants of the logbook survey also regularly mentioned that they found it difficult to locate their fish trip in this manner. In fresh water, also the number of the VBC was provided by the participants. Visualisation of the fishtrips was done by excluding the following mistakes: (a) fishtrips outside the Netherlands, (b) marine trips outside of marine water and (c) freshwater trips were the location did not match the mentioned VBC. This last step is very rigorous as it also excludes trips that are located close to the mentioned VBC. We only use this data to visualise the fishing trips. For the rest of the data analysis, we included the trips if they were documented to be in the Netherlands. Most marine fishing trips were made in the Wester Scheldt and around Scheveningen/Rotterdam/Katwijk (Figure 3-1). Most fresh water trips were also made in the Western part of the country (Figure 3-1).

In total 1676 (marine) and 18056 (fresh water) trips were included in the analysis (Table 3-4). In fresh water, the number of fish trips increases with avidity the year before, but in marine water the number of fish trips per fisher increases between 1-5 and 6-10 avidity groups, but is lower in the >11 group (Table 3-5). The number of average fishtrips in the logbook is lower than the (stated) avidity the year before (Table 3-5).

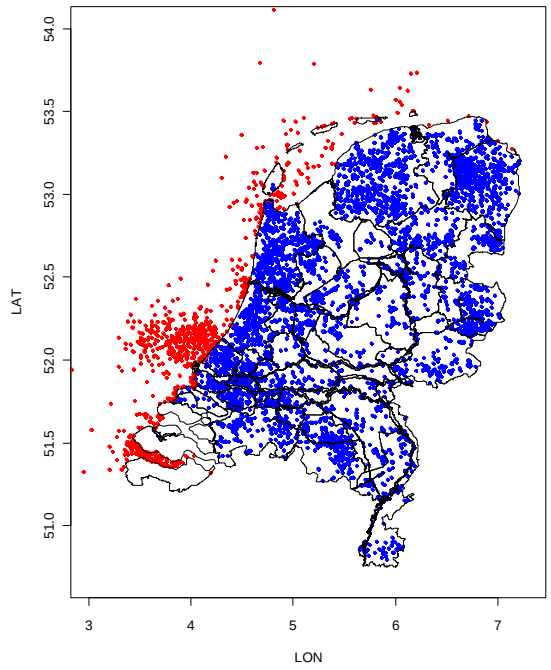

Figure 3-1 Fishtrip locations. Locations are approximate as they are obtained by clicking into google maps. Red are marine trips, blue are freshwater trips. Source: logbook survey.

Table 3-4 Number of fishing trips in the logbooks. Total number and number excluding respondents who returned their logbooks less than 8 times.

Number of fishing trips in the logbooks	*Number (total)*	*Number (respondents >= 8 logbooks)*
Marine	2 067	1 676
Fresh water	18 249	17 574

Table 3-5 Average number of trips per respondent (excluding respondents who returned their logbooks less than 8 times).

	Avidity	*Average no trips per respondent*
Marine	1-5	0.63
	6-10	2.05
	>10	1.10
Fresh water	1-5	3.59
	6-10	7.27
	11-25	8.74
	>25	12.81

3.3 Catch: marine

3.3.1 Cod (Gadus morhua)

Most anglers did not catch cod and those who did caught 1-5 cod during the survey. The percentage of marine anglers retaining one or more cod during the survey was 14%. The mean length of cod is 46.6 cm (based on the onsite survey, Figure 3-3). Cod is often caught close to Scheveningen/Den Haag, IJmuiden and in the Western Scheldt (Figure 3-2).

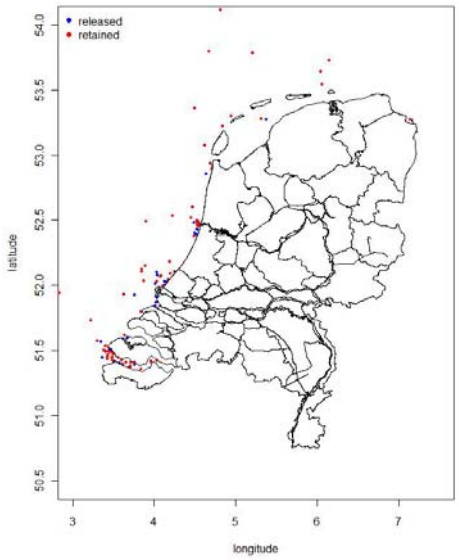

Figure 3-2 Trip locations with cod catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

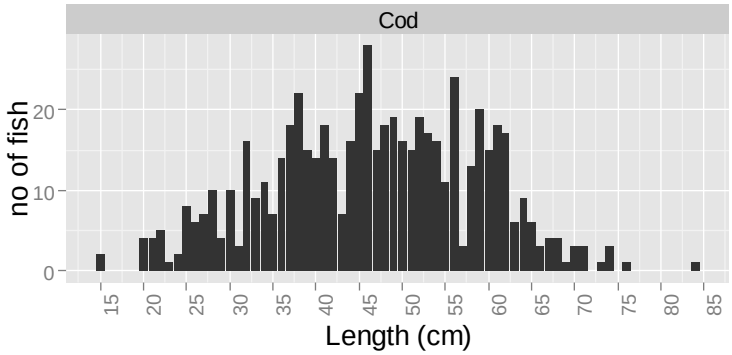

Figure 3-3 Length frequency distribution of retained cod lengths. Mean length: 46.6 cm (*SE* = 0.5), N=596. Source: onsite survey (2009-2014).

Catch

In total, 771 thousand cod were estimated to be retained and 534 thousand cod were released (Table 3-6). The percentage of retained cod is 59%. The total biomass of retained cod was estimated to be 945 tonnes (Table 3-6).

Table 3-6 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught cod (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	771	23	749	60	534	29	578	51	59%
Weight	945	22	749	60					

Time series

Numbers of retained and released cod have increased since 2010 (Table 3-7). The biomass of retained cod has also increased from 631 tonnes to 945 tonnes (Table 3-7). However, the percentage of retained cod has decreased from 76% to 59%, indicating that the numbers of released cod have increased at a higher rate than the numbers of retained cod.

Table 3-7 Trend in the catch estimates of cod since 2010 by marine anglers. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			Biomass (tonnes)		
	2010*	2012**	2014	2010*	2012**	2014
retained	522	609	771	631	737	945
released	168	392	534			
% retained	76%	61%	59%			
C&R mortality (14%)	24	55	75			
Total M	546	664	846			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.3.2 Mackerel (Scomber scombrus)

Most marine anglers caught either 1-5 mackerel or 11-20 mackerel during the survey, but also a large fraction caught 21-50 fish on a yearly basis. The percentage of marine anglers retaining at least one

mackerel during the survey was 17%. The length frequency distribution origins from the onsite survey with a mean length of 31.1 cm (Figure 3-5). Mackerel catches are reported all along the Dutch coast (Figure 3-4).

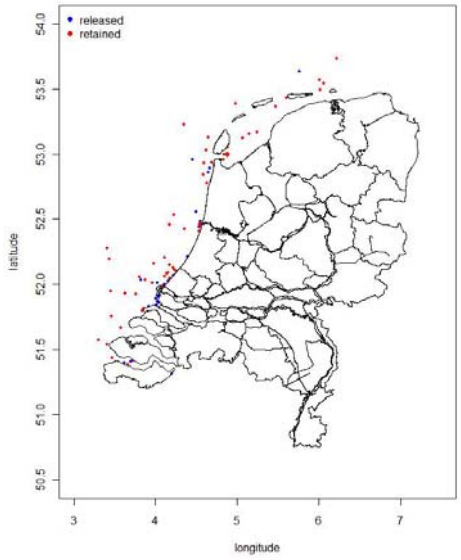

Figure 3-4 Trip locations with mackerel catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

In total, 1 320 thousand mackerel were retained and 479 thousand mackerel were released (Table 3-8). The percentage of retained mackerel is 73%. The total biomass of retained mackerel was estimated to be 339 tonnes (Table 3-8).

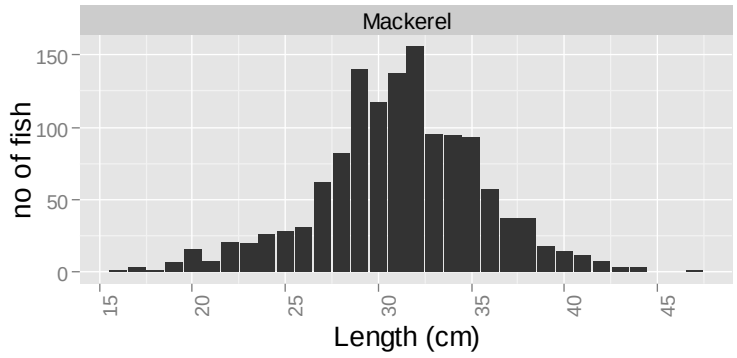

Figure 3-5 Length frequency distribution of retained mackerel lengths. Mean length: 31.1 (*SE* = 0.1), N = 1327. Source: onsite survey.

Table 3-8 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught mackerel (Nanglers).

	retained				released				
Species	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	1 320	16	985	71	479	31	457	44	73%
Biomass	339	16	985	71					

Time series

Numbers and biomass of retained mackerel have strongly decreased between 2010 (the beginning of the time series) and 2012 and have remained similar from 2012 to 2014 (Table 3-9).

Table 3-9 Trends in catch estimates of mackerel since 2010 by marine anglers. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			Biomass (tonnes)		
	2010*	2012**	2014	2010*	2012**	2014
retained	3 750	1 324	1 320	1 029	369	339
released	388	941	479			
% retained	91%	58%	73%			
C&R mortality (11%)	43	104	53			
Total M	3 793	1 428	1 373			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.3.3 Seabass (Dicentrarchus labrax)

Most marine anglers caught only 1-5 seabass during the survey. The percentage of marine anglers retaining one or more seabass during the survey was 11%. The length frequency distribution is based on 165 retained seabass and origins from the onsite survey (Figure 3-7). The mean length of retained seabass is 38.6 cm. Seabass is caught mainly in Sealand, South Holland and in IJmuiden (Figure 3-6).

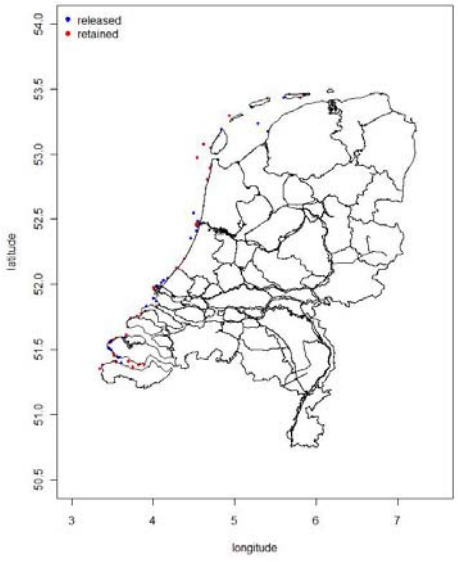

Figure 3-6 Trip locations with seabass catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

In total, 176 thousand seabass were retained and 499 thousand were released (Table 3-10). 26% Of the seabass is retained (in numbers). The total biomass of retained seabass was estimated to be 138 tonnes (lengths based on the onsite survey, Table 3-6).

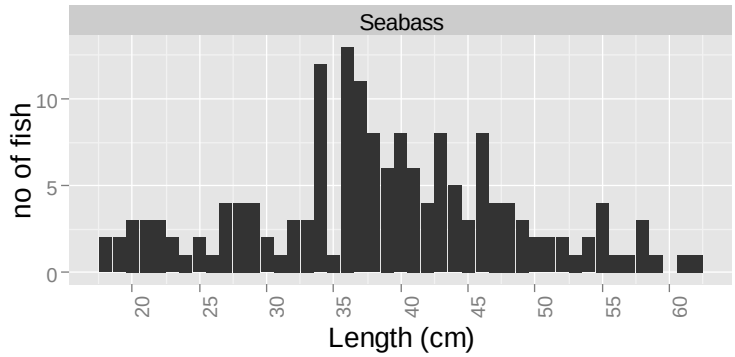

Figure 3-7 Length frequency distribution of retained seabass lengths. Mean length: 38.6 cm (*SE* = 0.8), N = 165. Source: onsite survey

Table 3-10 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught seabass (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	176	19	190	46	499	20	530	70	26%
Biomass	138	20	190	46					

Time series

Numbers and biomass of retained seabass have increased from 2010 to 2012 and decreased from 2012 to 2014. However, the percentage of retained seabass has decreased from 64% in 2010 to 26% in 2014, showing that the numbers of released seabass have increased at a higher rate than the numbers of retained seabass (Table 3-11).

Table 3-11 Trend in catch estimates of seabass by marine anglers since 2010. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			Biomass (tonnes)		
	2010*	2012**	2014	2010*	2012**	2014
retained	227	335	176	129	229	138
released	127	332	499			
% retained	64%	50%	26%			
C&R mortality (9%)	11	30	45			
Total M	238	365	221			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.3.4 Sole (Solea solea)

Most anglers caught only 1-5 sole during the survey. The percentage of marine anglers retaining at least one sole during the survey was 9%. The length frequency distribution origins from the onsite survey and has a mean length of 31.0 cm (Figure 3-9). Sole is reported mainly in the Wester Scheldt (Figure 3-8).

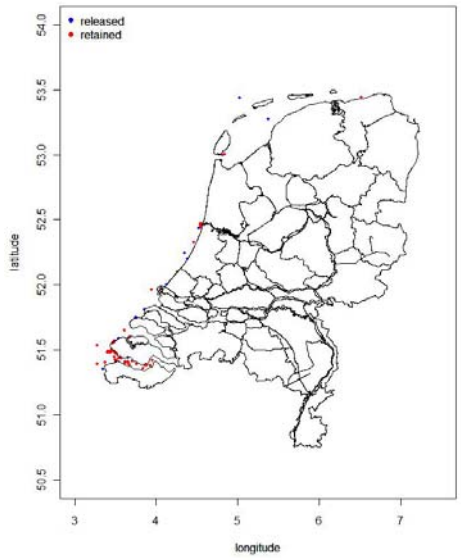

Figure 3-8 Trip locations with sole catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

In total, 230 thousand sole were retained and 143 thousand were released (Table 3-12). The percentage of retained sole is 62%. The total biomass of retained sole was estimated to be 47 tonnes (Table 3-12).

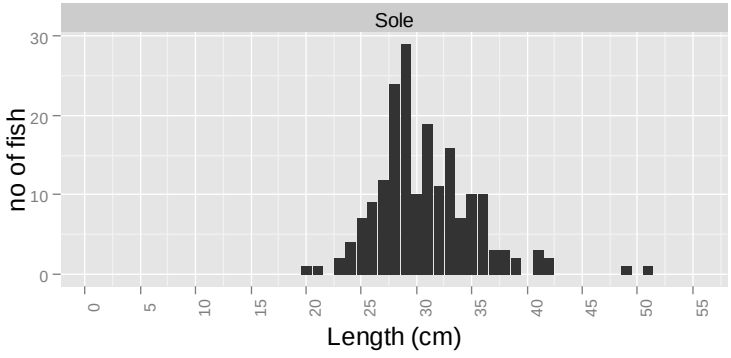

Figure 3-9 Length frequency distribution of retained sole lengths. Mean length: 31.0 cm (*SE* = 0.3), N=210. Source: onsite survey.

Table 3-12 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught sole (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	230	28	255	40	143	28	128	39	62%
Biomass	47	31	255	40					

Time series

Numbers of retained and released sole as well as biomass of retained sole have increased from 2010 to 2012 and decreased from 2012 to 2014. The return rate increased from 2010 to 2012 and remained similar from 2012 to 2014 (Table 3-13).

Table 3-13 Catch estimates in 2010, 2012 and 2014 by marine anglers. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			*Biomass (tonnes)*		
	2010*	2012**	2014	2010*	2012**	2014
retained	191	305	230	41	67	47
released	22	221	143			
% retained	90%	58%	62%			
C&R mortality (12%)	3	27	17			
Total M	194	332	247			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.3.5 Rays

In total 43 rays were reported in the 2014-2015 logbook survey by 6 anglers (Table 3-14). Most rays were released (35). This was not enough information to raise the data to the population level and only the raw data is presented here (Figure 3-10). In the 2014-2015 survey only thornback rays were caught. In the previous survey (2012-2013) both stingrays (4) and thornback rays (7) were caught (Table 3-14).

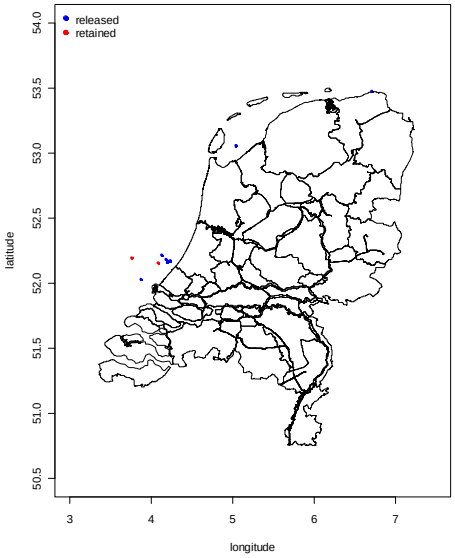

Figure 3-10 Trip locations with ray catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Table 3-14 Number of rays reported in logbook survey (including respondents returning less than 8 logbooks).

	2012		2014	
	retained	released	retained	released
Thornback ray	0	7	8	35
Stingray	0	4	0	0

3.3.6 Sharks

In total 222 sharks were reported in the 2014-2015 logbook survey by 20 anglers; 61 spurdogs, 57 Smoothhounds and 99 Lesser spotted dogfishes (Table 3-15). This was not enough information to raise the data to the population level and only the raw data are presented here. Most sharks were released. Most sharks are caught in Sealand (Figure 3-11). In the 2012-2013 and 2014-2015 surveys only Spurdog, Smoothhound and Lesser spotted dogfish recorded (Table 3-15).

Table 3-15 Number of sharks reported in the logbook survey (including respondents returning less than 8 logbooks).

	2012		2014	
Species	retained	released	retained	released
Spurdog	0	37	0	61
Smoothhound	0	16	5	57
Lesser spotted dogfish	0	6	26	73
sum	0	59	31	191

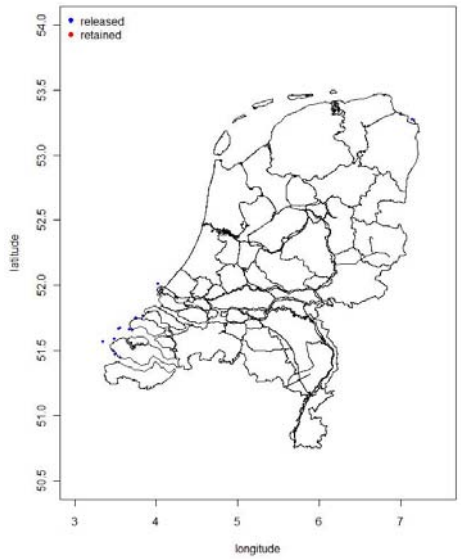

Figure 3-11 Trip locations with shark catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook.

3.3.7 Gadiformes (Trisopterus luscus, Merlangus merlangus, Pollachus virens, Pollachius pollachius, Melangrammus aeglefinus)

Gadiformes are mainly caught in the Western Scheldt, Hook of Holland and in IJmuiden (Figure 3-12). Most anglers caught only few, but some also reported catching more than 100 gadiformes during the survey. The percentage of marine anglers retaining at least one gadiform was 16%. The length frequency distribution is based on 555 gadiformes and origins from the logbook survey. The mean length is 28.0 cm (Figure 3-13).

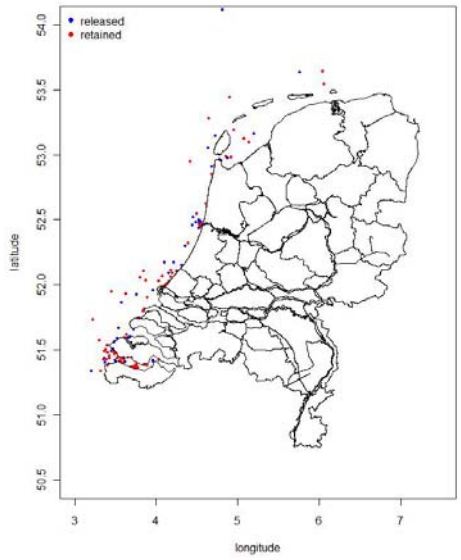

Figure 3-12 Trip locations with gadiformes catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

In total, 1 040 thousand gadiformes were retained and 1 227 thousand were released (Table 3-16). The percentage of retained gadiformes is 46%. The total biomass of retained gadiformes was estimated to be 260 tonnes (Table 3-16).

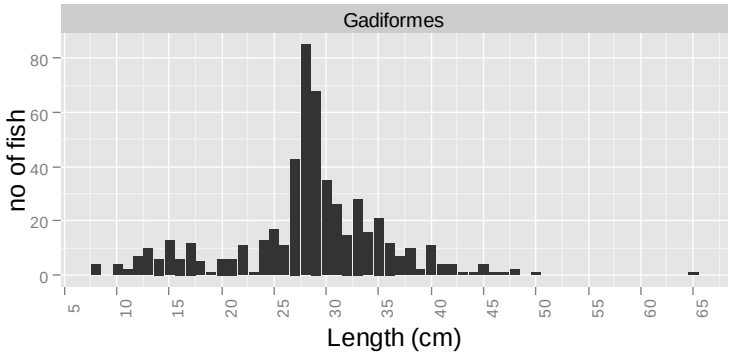

Figure 3-13 Length frequency distribution of retained gadiformes lengths. Mean length: 29.8 (*SE* = 2.0), N=42. Source: logbooks 2014-2015.

Table 3-16 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught gadiformes (Nanglers).

	retained				released				
Species	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	1 040	23	928	67	1 227	16	1 364	92	46%
Biomass	260	22	928	67					

Time series

Catch numbers of groups of species have not been calculated for the 2010 survey. Numbers and biomass of retained gadiformes have increased between 2012 and 2014 and numbers of released gadiformes have decreased (Table 3-17).

Table 3-17 Catch estimates from the logbook survey in 2012 and 2014. In 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)		Biomass (tonnes)	
	2012*	2014	2012*	2014
retained	907	1 040	81	271
released	1 927	1 227		
% retained	32%	46%		
C&R mortality (11%)	212	135		
Total M	1 119	1 175		

* Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.3.8 Flatfishes (Plaice - Pleuronectes platessa, Dab - Limanda limanda, Flounder - Platichthys flesus)

Flatfishes are caught everywhere along the coastline, mainly in Sealand, Hook of Holland, Scheveningen and IJmuiden (Figure 3-14). Most anglers caught only 1-5 fish from the flatfish group during the survey. The percentage of marine anglers retaining one or more flatfishes during the survey was 32%. The length frequency distribution is based on 1 720 flatfishes and origins from the logbook survey (Figure 3-15). The mean length is 24.3 cm.

Catch

In total, 2 830 thousand flatfishes were estimated to be retained and 2 242 thousand were released (Table 3-18). The percentage of retained flatfishes is 56%. The total biomass of retained flatfishes was estimated to be 412 tonnes (Table 3-18).

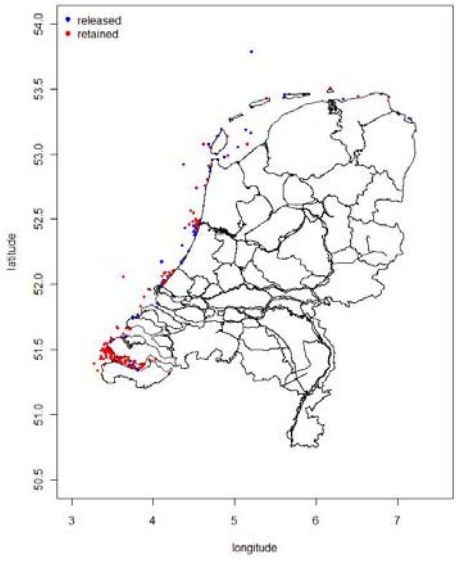

Figure 3-14 Trip locations with flatfish catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

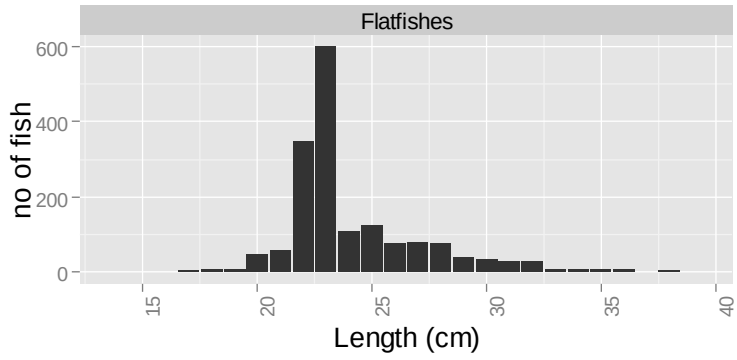

Figure 3-15 Length frequency distribution of retained flatfish lengths. Mean length: 24.3 (*SE* = 0.1), N=1720. Source: onsite survey.

Table 3-18 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught flatfishes (Nanglers).

	retained				released				
Species	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	2 830	23	3 131	137	2 242	14	2 369	151	56%
Biomass	412	23	3 131	137					

Time series

Catch numbers of groups of species have not been calculated for the 2010 survey. Numbers and biomass of retained fish in the flatfish group as well as numbers of released fish have decreased between 2012 and 2014. The percentage of retained fish remained similar (Table 3-19).

Table 3-19 Catch estimates in 2012 and 2014 by marine anglers. In 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)		Biomass (tonnes)	
	2012*	2014	2012*	2014
retained	3 255	2 830	587	412
released	2 521	2 242		
% retained	56%	56%		
C&R mortality (12%)	303	269		
Total M	3 558	3 099		

* Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.4 Catch: freshwater

3.4.1 Perch (Perca fluviatilis)

Perch is caught everywhere in the Netherlands (Figure 3-16). Most anglers caught only 1-5 perch during the survey. The percentage of fresh water anglers retaining one or more perch during the survey was 3%. The length frequency distribution origins from the logbook survey and the mean fish length is 25.2 cm (Figure 3-17).

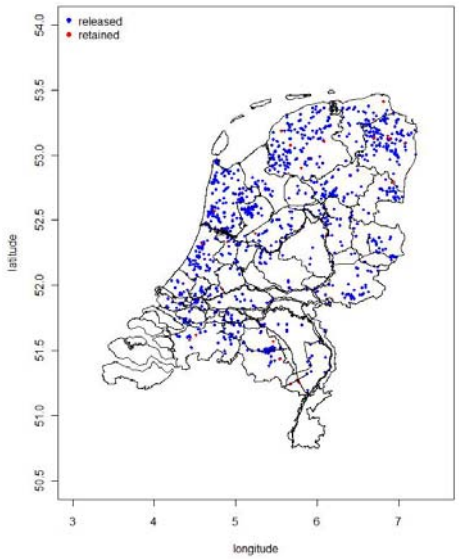

Figure 3-16 Trip locations with perch catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

The total number of retained perch was estimated to be 112 thousand fish and the number of released perch was 9 359 thousand (Table 3-20). The percentage of retained perch is very low (1%). The total biomass of retained perch was estimated to be 50 tonnes (Table 3-20).

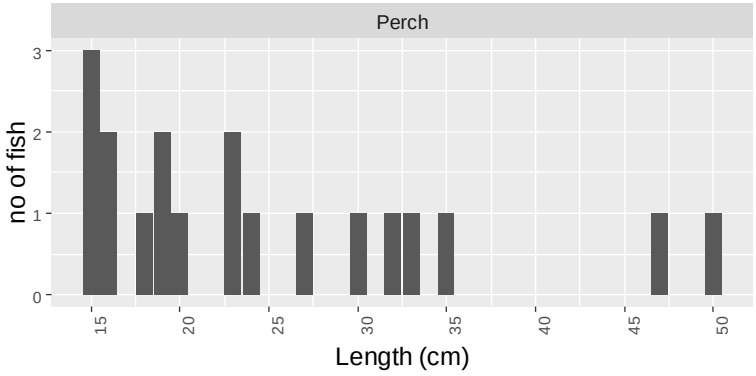

Figure 3-17 Length frequency distribution of retained measured perch lengths. Mean length: 25.2 (*SE* = 2.4), N= 19. Source: logbooks.

Table 3-20 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught perch (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	112	21	165	49	9 359	9	15 512	681	1
Biomass	50	28	165	49					

Time series

Numbers and biomass of retained perch have increased from 2010 to 2012 and decreased from 2012 to 2014. Numbers of released catches have increased since 2010 (Table 3-21).

Table 3-21 Catch estimates in 2010, 2012 and 2014 by fresh water anglers. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			Biomass (tonnes)		
	2010*	2012**	2014	2010*	2012**	2014
retained	178	415	112	37	173	50
released	6 064	7 174	9 359			
% retained	3%	5%	1%			
C&R mortality (10%)	606	714	936			
Total M	784	1 129	1 048			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.4.2 Pikeperch (Stizostedion lucioperca)

Pikeperch is caught everywhere in the Netherlands (Figure 3-18). Most anglers caught only 1-5 pikeperch in a year. The percentage of fresh water anglers retaining one or more pikeperch during the survey was 5%. The length frequency distribution origins from the logbook survey and has a peak around 50-60 cm (Figure 3-19). The mean length of retained pikeperch is 57.9 cm.

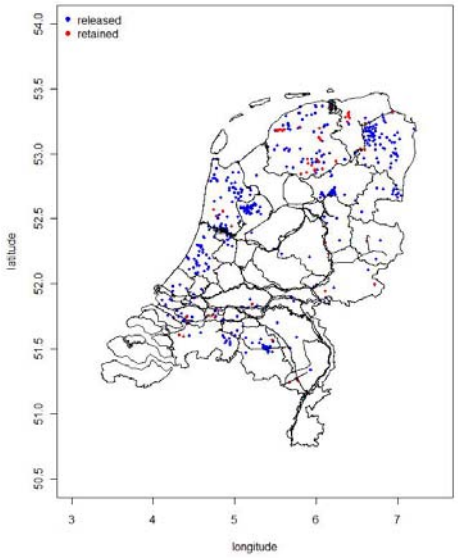

Figure 3-18 Trip locations with pikeperch catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

The total number of retained pikeperch was estimated to be 142 thousand fish and the number of released pikeperch was 3 931 thousand (Table 3-22). The percentage of retained pikeperch is low (3%). The total biomass of retained pikeperch was estimated to be 300 tonnes (Table 3-22).

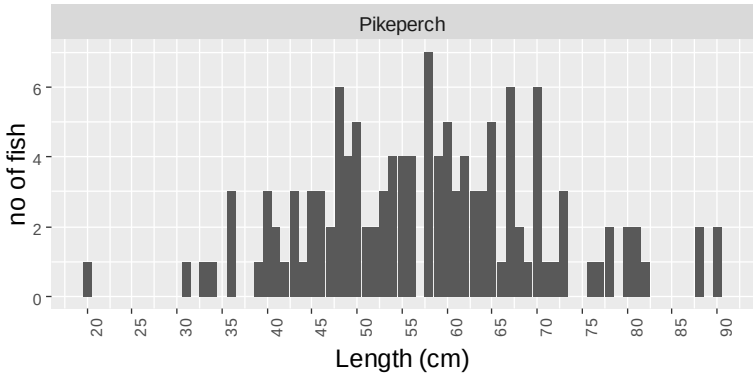

Figure 3-19 Length frequency distribution of retained and measured pikeperch lengths. Mean length: 57.9 cm (*SE = 1.2*), N=128. Source: logbooks 2014-2015.

Table 3-22 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught pikeperch (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	142	17	232	75	3931	16	6 498	273	3
Biomass	300	18	232	75					

Time series

Numbers and biomass of retained pikeperch have increased from 2010 to 2012 and decreased from 2012 to 2014. Numbers of released pikeperch have increased from 2010 to 2014 (Table 3-23).

Table 3-23 Catch estimates from the beginning of the logbook survey in 2010 by fresh water anglers. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			Biomass (tonnes)		
	2010*	2012**	2014	2010*	2012**	2014
retained	149	414	142	300	519	300
released	1610	2604	3 931			
% retained	8%	14%	3%			
C&R mortality (5%)	81	130	197			
Total M	180	544	339			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.4.3 Pike (Esox lucius)

Pike is caught everywhere in the Netherlands (Figure 3-20). Most anglers caught only 1-5 pikes during the survey. The percentage of fresh water anglers retaining one or more pike during the survey was 2%. The length frequency distribution origins from the logbook survey and showed a large peak around 23-30 cm, the mean length was 66.6 cm (Figure 3-21).

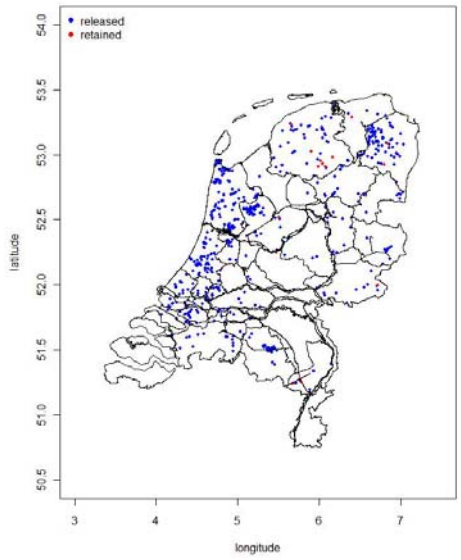

Figure 3-20 Trip locations with pike catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook.

Catch

The total number of retained pike was estimated to be 67 thousand fish and the number of released pike was 3 176 thousand (Table 3-24). The percentage of retained pike is low (2%). The total biomass of retained pike was estimated to be 165 tonnes (Table 3-24).

Table 3-24 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught pike (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	67	17	92	29	3 176	16	5103	346	2
Biomass	165	27	92	29					

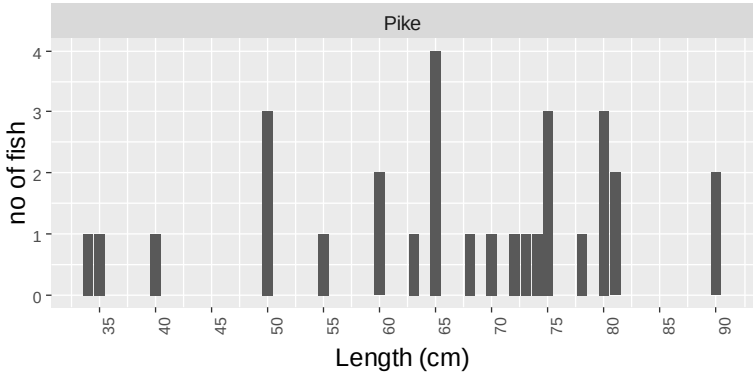

Figure 3-21 Length frequency distribution of retained pike lengths. Mean length: 66.6 cm, (*SE =2.7*), N= 30. Source: logbooks.

Time series

Numbers and biomass of retained pike have increased from 2010 to 2012 and decreased from 2012 to 2014. Numbers of released pike have decreased from 2010 to 2012 and increased again from 2012 to 2014 (Table 3-25).

Table 3-25 Catch estimates in 2010, 2012 and 2014 by fresh water anglers. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			Biomass (tonnes)		
	2010*	2012**	2014	2010*	2012**	2014
retained	47	236	67	118	187	165
released	2 323	1 790	3 176			
% retained	2%	12%	2%			
C&R mortality (5%)	116	90	159			
Total M	2626	2149	226			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.4.4 Bream (Abramis brama) and Silverbream (Blicca bjoerkna)

Bream and silverbream are caught everywhere in the Netherlands (Figure 3-22). Most anglers caught only 1-5 bream or silverbream during the survey. The percentage of fresh water anglers retaining one or more bream or silverbream during the survey was 3%. The length frequency distribution origins from the logbook survey and does not show a clear distribution (Figure 3-23). The mean length of retained and measured bream or silverbream is 31.8 cm.

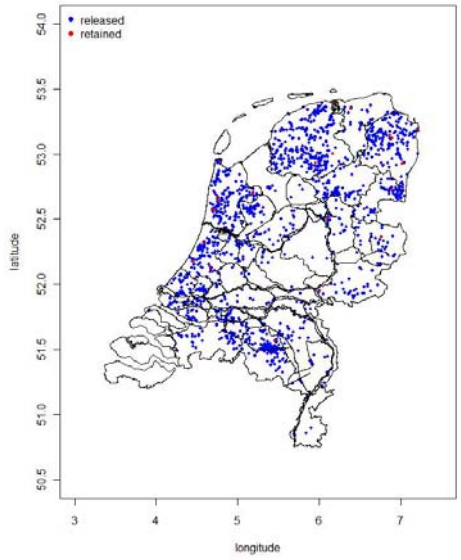

Figure 3-22 Trip locations with bream and silverbream catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

The total number of retained bream and silverbream was estimated to be 86 thousand fish and the number of released bream and silverbream was 12 887 thousand fish (Table 3-26). The percentage of retained bream and silverbream is very low (1%). The total biomass of retained bream and silverbream was estimated to be 55 tonnes (Table 3-26).

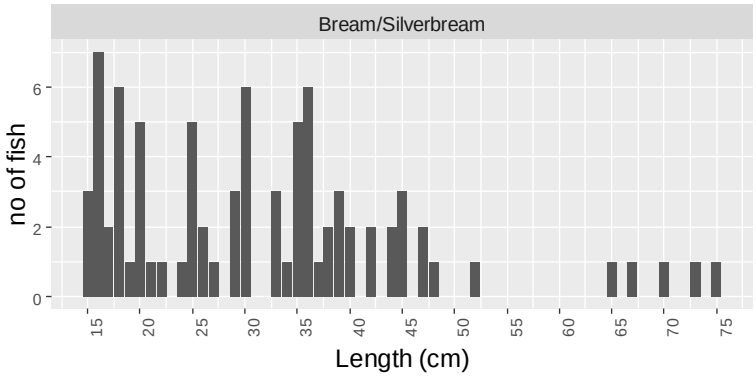

Figure 3-23 Length frequency distribution of retained and measured bream and silverbream lengths. Mean length: 31.8 cm, (*SE =1.5*), N=83. Source: logbooks 2014-2015

Table 3-26 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught bream or silverbream (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	86	26	136	41	12 887	10	22 895	661	1
Biomass	55	30	136	41					

Time series

Numbers and biomass of retained bream and silverbream have increased from 2010 to 2012 and decreased from 2012 to 2014. Numbers of released silverbream have increased since 2010 (Table 3-27).

Table 3-27 Catch estimates from the beginning of the logbook survey in 2010 by fresh water anglers. In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)			Biomass (tonnes)		
	2010*	2012**	2014	2010*	2012**	2014
retained	74	316	86	79	177	55
released	8620	10 619	12 887			
% retained	<1%	3%	<1%			
C&R mortality (3%)	359	319	387			
Total M	333	635	473			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.4.5 Carps (Cyprinus carpio, Carassius gibelio, Carassius carassius, Ctenopharyngodon idella)

Carps are caught everywhere in the Netherlands (Figure 3-24). Most anglers caught only 1-5 carps during the survey. The percentage of fresh water anglers retaining one or more carps during the survey was 2%. The length frequency distribution origins from the logbook survey and does not show a clear distribution (Figure 3-25). The mean length of retained and measured carps is 55.2cm.

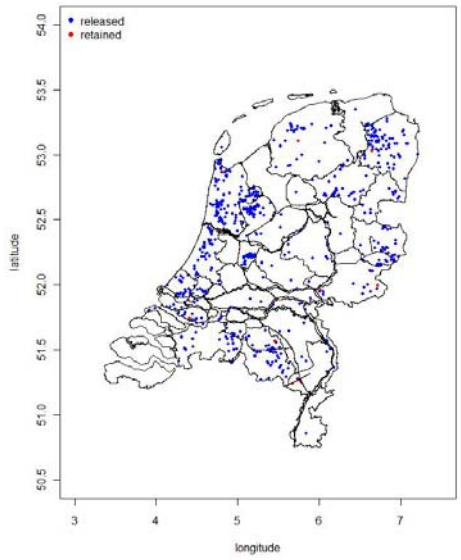

Figure 3-24 Trip locations with carps (*cypriniformes*) catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook 2014-2015.

Catch

The total number of retained carps was estimated to be 188 thousand fish and the number of released carps was 5 572 thousand fish (Table 3-28). The percentage of retained carps is low (3%). The total biomass of retained carps was estimated to be 675 tonnes (Table 3-28).

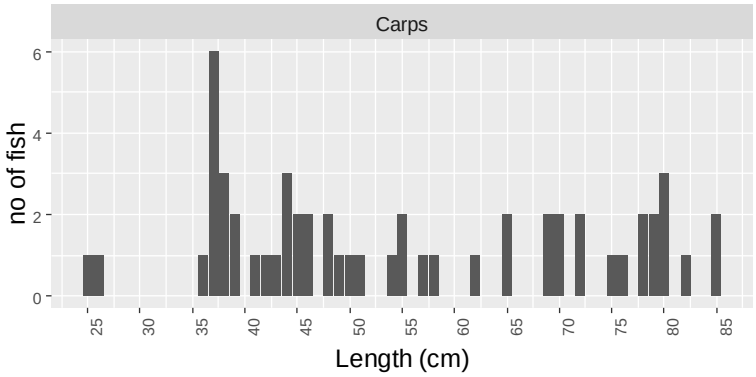

Figure 3-25 Length frequency distribution of retained carp lengths. Mean length: 55.2 cm (*SE = 2.3*), N=55. Source: logbooks 2014-2015.

Table 3-28 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught carps (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	188	27	250	37	5572	15	9937	505	3
Biomass	675	26	250	37					

Time series

Catch numbers of groups of species have not been calculated for the 2010 survey. Numbers of retained fish in the carps group have decreased and numbers of released fish have increased between 2012 and 2014. Also, the biomass increased (Table 3-29).

Table 3-29 Catch estimates in 2012 and 2014 by fresh water anglers. In 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)		Biomass (tonnes)	
	2012**	2014	2012**	2014
retained	583	188	531	675
released	3539	5 572		
% retained	14%	3%		
C&R mortality (0%)	0	0		
Total M	583	188		

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.4.6 Catfishes (Silurus glanis, Clarias gariepinus, Ameiurus nebulosus, Ameiurus melas)

Only few anglers reported catching catfishes (Figure 3-26). This did not result in enough data to raise the catches to the population level and only the raw data is shown here. The length frequency distribution origins from the logbook survey and is based on 4 measured fish. The mean length of these retained catfish is 34.0cm (Figure 3-27). In total 587 catfishes were reported to be released by 35 anglers.

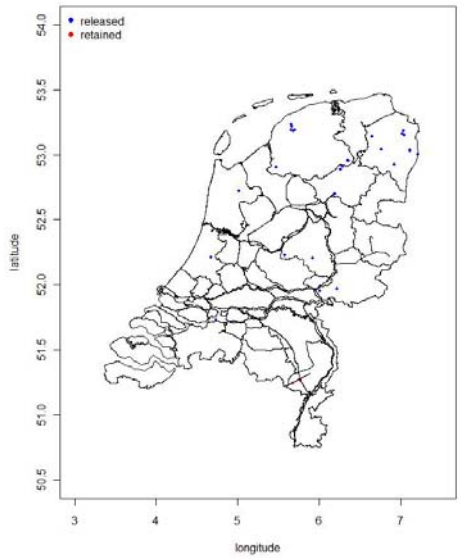

Figure 3-26 Trip locations with catfish catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook.

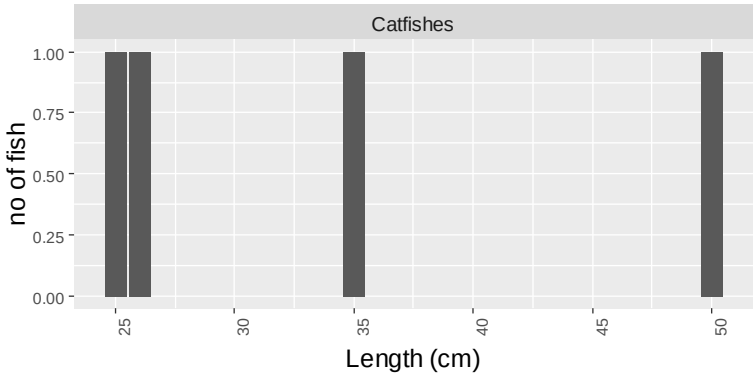

Figure 3-27 Length frequency distribution of retained and measured catfish lengths. Mean length: 34.0 cm, N=4. Source: logbooks 2014-2015

3.4.7 Cyprinids (Alburnus alburnus, Rhodeus amarus, Rutilus rutilus, Squalius cephalus, Scardinius erythrophthalmus, Leuciscus idus, Aspius aspius)

Cyprinids are caught everywhere in the Netherlands (Figure 3-28). Most anglers retained only 1-5 cyprinids during the survey. The percentage of fresh water anglers retaining at least one cyprinid during the survey was 5%. The length frequency distribution origins from the logbook survey and peaks between 15-20 cm. The mean length is 28.8 cm (Figure 3-29). Most anglers return their catch; the percentage of retained cyprinids is only 1%.

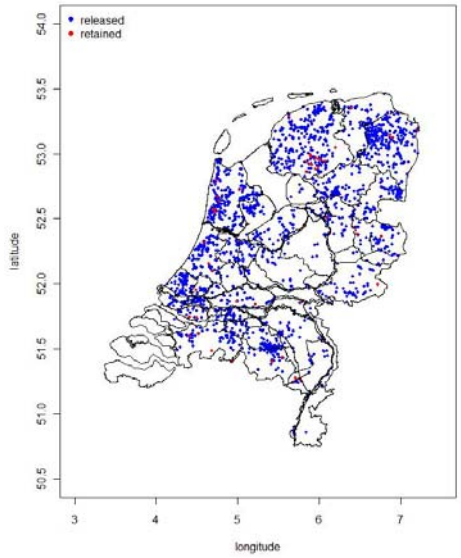

Figure 3-28 Trip locations with cyprinid catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook survey.

Catch

The total number of retained cyprinids was 362 thousand fish and the number of released cyprinids was 41 632 thousand (Table 3-30). The total biomass of retained cyprinids was estimated to be 481 tonnes.

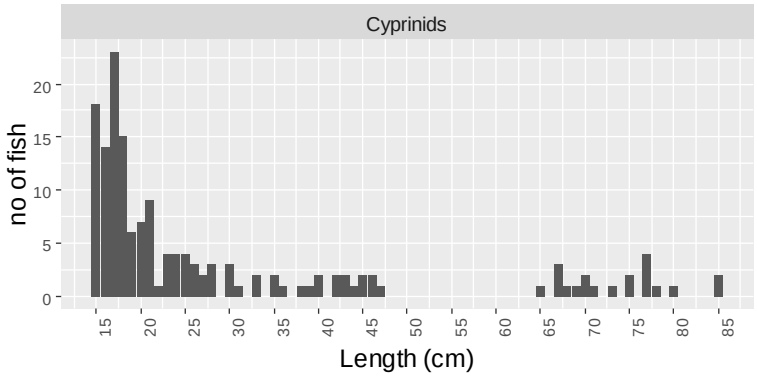

Figure 3-29 Length frequency distribution of retained cyprinids lengths. Mean length: 28.8cm (*SE = 1.5*), N = 156. Source: logbooks 2014-2015.

Table 3-30 Catch estimate (in thousands or in tonnes), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught cyprinids (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Number	362	18	545	73	41 632	8	74 673	924	1
Biomass	481	22	545	73					

Time series

Numbers of retained cyprinids have decreased from 2012 to 2014, whereas numbers of released cyprinids have increased. The biomass of retained cyprinids increased (Table 3-31).

Table 3-31 Catch estimates in 2012 and 2014 by fresh water anglers. In 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Numbers (x1000)		Biomass (tonnes)	
	2012*	2014	2012*	2014
retained	901	362	218	481
released	30 399	41 632		
% retained	3%	1%		
C&R mortality (11%)	3344	4 579		
Total M	4 245	4 942		

* Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.5 Catch: freshwater and marine

3.5.1 Eel (Anguilla anguilla)

Marine: Eel is mainly caught in freshwater, but also occasionally in marine (or brackish) water; 27 anglers reported retaining eel in marine water and 36 reported returning eel. In marine water there are not enough observations to show a clear distribution (Figure 3-31). Most anglers retained only 1-5 eels in marine waters. The percentage of marine anglers retaining at least one eel during the survey was 6%.
Fresh: In fresh water 47 anglers reported retaining eel and 187 anglers reported to return eel. The largest group retained only 1-5 eel, but also few anglers reported taking 21-50 eel home. The

percentage of fresh water anglers retaining at least one eel during the survey was 3%. The length frequency distribution of retained eel in fresh water shows a peak around 25-35 cm, but occasionally larger fish up till 80 cm are retained (Figure 3-31). Eel is caught everywhere in the Netherlands (Figure 3-30).

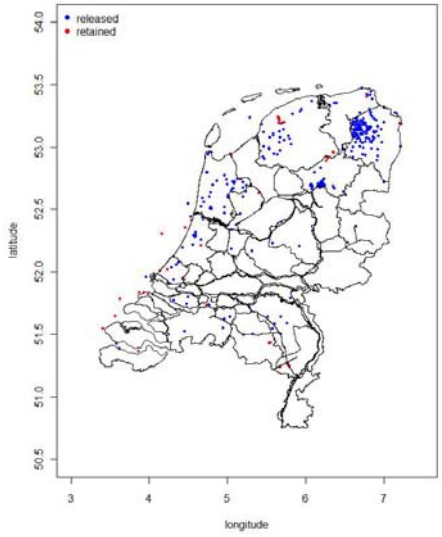

Figure 3-30 Trip locations with eel catches. Blue is released, red is retained. Locations are approximate as they are obtained by clicking into google maps. Source: logbook.

Catch

In marine waters, the total number of retained eel was estimated to be 193 thousand fish and the number of released eel was 247 thousand (Table 3-6). Around 44% is retained. In marine waters 40 tonnes were retained.

In fresh waters, only 10% was retained; 220 thousand were retained and 1 936 thousand were released. In fresh water 30 tonnes were retained.

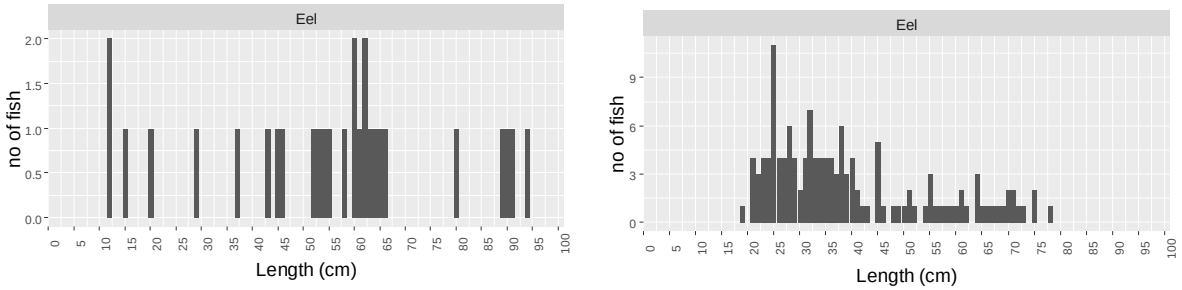

Figure 3-31 Length frequency distribution of retained eel lengths. Left: marine, right: fresh. Marine: mean length: 50.0cm (*SE* = 2.7), N=89. Source: logbook survey. Fresh: mean length: 39.4 cm (*SE* = *1.3*), N=135. Source: logbook survey.

Table 3-32 Catch estimates (in thousands), standard errors (SE, in thousands), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught the fish (Nanglers).

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Marine number	193	24	145	27	247	27	208	36	44%
Fresh number	220	37	227	47	1 936	21	3012	187	10%
Marine biomass	40	29	145	27					
Fresh biomass	30	25	227	47					

Time series

Numbers of retained eel remained more or less constant since 2010, whereas the number of released eel has increased. The weight of retained eel decreased between 2010 and 2014 (Table 3-33).

Table 3-33 Overview of retained and released eel in fresh and marine water by recreational anglers in 2010, 2012 and 2014. Estimates for which less than 25 anglers are involved or for which RSE > 40% are not shown (NA). In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

		Number (x1000)			Biomass (tonnes)		
		*2010**	*2012***	*2014*	*2010**	*2012***	*2014*
Retained	Marine	172	NA	193	36	NA	40
	Fresh	294	313	220	75	41	30
	Sum	466	NA	413	111	NA	70
Released	Marine	114	NA	247			
	Fresh	862	1 517	1 936			
	Sum	967	NA	2 183			
	% retained	33%	20%	10%			
	C&R mortality (11%)	106	NA	240			
	Total M	572	NA	653			

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.5.2 Salmon/Seatrout (Salmo salar, Salmo trutta)

There was not enough information to raise the data to the population level and therefore only the raw data is shown here.

Catch

Fresh: Salmon and seatrout in fresh water is mainly caught in (paid) trout ponds and ponds in cities. We do not report on these catches. Few salmon and seatrout were also reported in rivers and lakes; these were all returned (148 fishes, by 7 anglers) except for 1 retained fish of 35 cm.

Marine: In marine water there were 5 persons belonging to one family, who caught and retained large amounts of salmon/seatrout (~600 each), almost all of which were reported to be 11 cm. These are very small for salmon caught in the sea and are expected to be another species and excluded from the analysis. Apart from these, 29 salmon/seatrouts were retained in marine water by 18 fishers (Figure 3-32) and 42 fishes were returned by 11 fishers. These are smaller than those caught in the previous survey (mean length 2012-2013: 35.1cm, mean length 2014-2015: 21.8cm).

Figure 3-32 Length frequency distribution of retained salmon/seatrout lengths in marine water. Marine: mean length: 21.8cm, N=29. Source: logbook survey.

3.5.3 Total catch

Among marine anglers the number of retained fish decreased from 2010 to 2012, but remained similar between 2012 and 2014. The number of released fish, on the other hand, increased from 2010 to 2012 and remained similar between 2012 and 2014 (Table 3-35). The percentage of marine anglers retaining at least one fish during the survey was 58%.

In freshwater both the number of retained fish increased between 2010 and 2012 and decreased from 2012 to 2014. The number of released fish increased since the first survey in 2010 (Table 3-35). The percentage of fresh water anglers retaining at least one fish during the survey was 13%.

Table 3-34 Catch estimates (in thousands), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught the fish (Nanglers). Estimates for which less than 25 anglers are involved or for which RSE > 40% are in bold.

	retained				released				
	Catch	RSE	Nfish	Nanglers	Catch	RSE	Nfish	Nanglers	% retained
Marine number	7 298	15	7 134	246	6 695	12	6 834	259	52
Fresh number	1 258	13	1 797	205	79 396	9	136 802	1 190	2

Table 3-35 Overview of the total retained and released number of fish in marine and freshwater by recreational anglers (in thousands). In 2010 and 2012 estimates are for fishers aged 6 and older, in 2014 all ages are included.

	Marine				Fresh			
	retained	released	sum	% retained	retained	released	% retained	sum
2010*	9 350	3 833	13 183	71%	2 472	50 729	5%	53 201
2012**	7 176	7 661	14 837	48%	3 565	60 779	6%	64 344
2014	7 298	6 695	13 993	52%	1 258	79 396	2%	80 654

* Hammen, T. van der; Graaf, M. de - \ 2013. IMARES (Report / IMARES Wageningen UR C147/13) - 33 p.

** Hammen, T. van der; Graaf, M. de - \ 2015 IJmuiden. IMARES (Report / IMARES Wageningen UR C042/15) - 55 p.

3.6 Foreign angling trips

Participants of the logbook survey were also asked to report their foreign fishing trips. This resulted in 246 marine and 383 fresh water fishing trips made by the anglers in the logbook survey. Freshwater trips in paid waters like fishing ponds are excluded from the analysis. Most foreign fishing trips were in nearby countries (Belgium, France, Germany, Table 3-36). For these countries, the average number of fish per trip was calculated for the species that were caught most. The estimate was not raised to the population level because the sample size was too small (very few anglers catching specific fish species).

Table 3-36 Number of registered fishing trips by Dutch anglers in foreign countries from April 2014 to March 2015 and the estimated total number of fish trips by Dutch anglers. Between brackets are the number of anglers who made the trips.

	Trips in logbooks		Estimated total number of trips by Dutch Anglers	
Country	Marine	Fresh	Marine	Fresh
France	33 (16)	122 (42)	11789	65127
Belgium	67 (22)	67 (30)	23936	35766
Germany	4 (4)	86 (20)	1429	45909
Norway	49 (12)	15 (3)	17505	8007
Sweden	2 (1)	34 (9)	715	18150
Spain	26 (11)	4 (4)	9289	2135
Turkey	13 (3)	0	4644	0
Italy	2 (2)	9 (6)	715	4804
Vietnam	0	11 (3)	0	5872
Denmark	8 (7)	2 (2)	2858	1068
Croatia	8 (4)	0	2858	0
Slovenia	0	7 (3)	0	3737
United States	3 (2)	4 (2)	1072	2135
Portugal	5 (4)	1 (1)	1786	534
Luxemburg	0	5 (2)	0	2669
Scotland	2 (1)	3 (3)	715	1601
Thailand	1 (1)	4 (2)	357	2135
Greece	4 (3)	0	1429	0
Bonaire	3 (1)	0	1072	0
Cuba	3 (1)	0	1072	0
Other	13	9	4644	4804
Total	246	383	87 884	204 455

Belgium

In Belgium marine water, Dutch anglers catch mainly dab and sole, whiting, flounder, plaice, herring, cod, eel, seabass and mackerel (Table3-37). In fresh water almost all catches are released. Catches are bream, perch, eel, rainbow trout, carp, roach, pikeperch, pike and asp (Table 3-37).

Table 3-37 Main catches (number per trip) by Dutch anglers in Belgium.

	Marine			Fresh	
species	retained (per trip)	released (per trip)	species	retained (per trip)	released (per trip)
Dab	3.48	1.60	Bream	0.00	1.45
Sole	2.10	0.22	Perch	0.03	0.84
Whiting	0.81	0.64	Eel	0.00	0.73
Flounder	0.60	0.58	Rainbow trout	0.21	0.52
Plaice	0.57	0.48	Carp	0.00	0.45
Herring	0.84	0.09	Roach	0.00	0.42
Cod	0.46	0.36	Pikeperch	0.00	0.28
Eel	0.73	0.07	Pike	0.00	0.22
Sea bass	0.00	0.69	Asp	0.00	0.21
Mackerel	0.45	0.12			
Saithe	0.07	0.28			
Smelt	0.01	0.31			
Haddock	0.00	0.33			
Salmon	0.27	0.06			
Bib	0.07	0.22			
Lesser weaver	0.00	0.21			
Lesser sand-eel	0.00	0.15			

Germany

Only 4 marine trips were made in Germany, so only fresh water catches are presented. In fresh water all catches were released, apart from 6 pikeperches. Mostly caught are perch, roach, bream, rainbow trout, carp and pikeperch (Table 3-38).

Table 3-38 Main catches (number per trip) by Dutch anglers in Germany

Fresh		
species	retained (per trip)	released (per trip)
Perch	0.00	0.47
Roach	0.00	0.42
Bream	0.00	0.34
Rainbow trout	0.06	0.20
Common carp	0.00	0.17
Pikeperch	0.07	0.09

France

In French marine water, Dutch anglers catch mainly plaice, dab, flounder and saithe. In fresh water catches consist mainly of roach, perch, rainbow trout and bream (Table 3-39).

Table 3-39 Main catches (number per trip) by Dutch anglers in France

	Marine		*Fresh*		
Species	Retained (per trip)	Released (per trip)	Species	Retained (per trip)	Released (per trip)
Plaice	4.36	0.97	Roach	0.00	0.73
Dab	1.39	0.18	Perch	0.03	0.14
Flounder	0.88	0.64	Rainbow trout	0.12	0.04
Herring	0.12	0.55	Bream	0.00	0.11
Saithe	0.00	0.67			
Seabass	0.06	0.30			

Sole	0.12	0.21	

Norway

In Norwegian marine water, Dutch anglers catch mainly saithe, mackerel, cod, pollack, ling and tusk. In fresh water catches consist of rainbow trout, salmon and arctic charr (Table 3-40).

Table 3-40 Main catches (number per trip) by Dutch anglers in Norway

	Marine		Fresh		
Species	Retained (per trip)	Released (per trip)	Species	Retained (per trip)	Released (per trip)
Saithe	0.14	19.78	Rainbow trout	0.27	1.93
Mackerel	1.76	7.02	Salmon	0.13	0.87
Cod	0.96	5.53	Arctic charr	0.00	0.40
Pollack	0.53	2.31			
Ling	0.33	0.94			
Tusk/Cusk	0.12	0.47			
Dab	0.24	0.12			
Wolffish	0.12	0.22			
Haddock	0.08	0.14			

Sweden

In Swedish fresh water catches consist of roach, perch, pike, bream and pikeperch, which are all released (Table 3-41).

Table 3-41 Main catches (number per trip) by Dutch anglers in Sweden

Fresh		
species	retained (per trip)	released (per trip)
Roach	0.00	2.38
Perch	0.00	1.38
Pike	0.00	1.26
Freshwater bream	0.00	0.68
Pikeperch	0.00	0.38

Spain

In Spanish marine water, Dutch anglers catch mainly cod, wrasses and mackerel (Table 3-42).

Table 3-42 Main catches (number per trip) by Dutch anglers in Spain.

Marine		
species	Retained (per trip)	Released (per trip)
Cod	0.35	0.15
Wrasses	0.00	0.46
Mackerel	0.42	0.00

3.7 Recreational Gillnet survey

Participants

In 2013 713 gillnet fishers were given a permit to fish with gillnets. Of these, 107 gillnet fishers replied positively to join the gill net survey. Thirty-nine percent of these indicated that they fished 1-5 times per year with a gillnet and 6% indicated that they fished more than 50 times (Figure 3-33). Most participants released their logbook every month, others only replied 1-11 times (Figure 3-34).

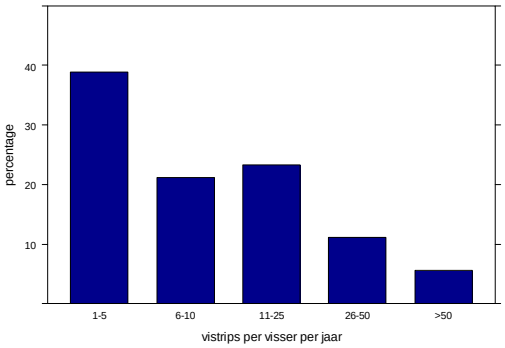

Figure 3-33 Avidity distribution (number of fishingtrips per gillnet fisher per year in 2013).

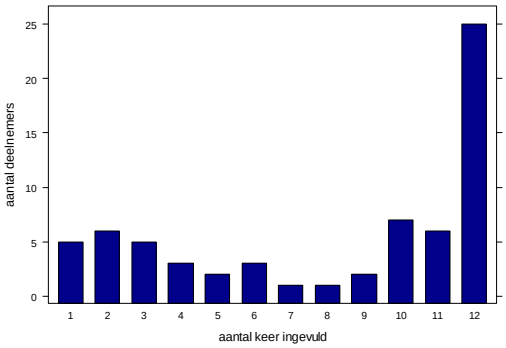

Figure 3-34 Logbook response rate.

Fish trip location

Most fish trips are registered in the Wester Scheldt, at Katwijk and on the Wadden Sea Islands Ameland and Schiermonnikoog (Figure 3-35).

Figure 3-35 Fishtrip locations of the gillnet survey. Locations are approximate as they are obtained by clicking into google maps.

Species composition

Flounder (32%) and seabass (28%) were caught most (Table 3-43). The percentages retained fish are high (Table 3-43).

Table 3-43 Species composition, % retained and average length of the retained catches in the gillnet survey.

Species	Catch	% retained	Average length
Flounder	32 %	89%	25.9
Seabass	28 %	95%	47.9
Dab	9 %	71%	23.2
Thicklip grey mullet	8 %	86%	53.8
Sole	4 %	92%	31.3
Cod	3 %	96%	43.1
Twait shad	3 %	48%	45.5
Horsemackerel	3 %	36%	25.1
Brown crab	2 %	89%	16.8
Thinlip mullet	2 %	100%	57.3
Seatrout	1 %	60%	51.1
Turbot	1 %	56%	27.5
Whiting	1 %	59%	24.7
Smelt	1 %	9%	14.0
Herring	1 %	56%	25.8
Salmon	<1%		
Brill	<1%		
Mackerel	<1%		
Plaice	<1%		
Allis shad	<1%		
Lemon sole	<1%		
Shorthorn sculpin	<1%		

Fishing frequency

The fishing frequency is highest in April, May, July, September and October (Figure 3-36). No one reported a fishing trip in January.

Catch

The highest numbers of catch per fish trip were reported in June, September, October and November (Figure 3-37).

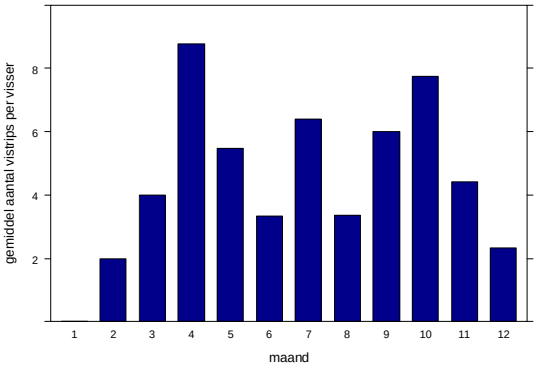

Figure 3-36 Fishing frequency (average number of fishingtrips per gillnetfisher per month). No one reported a fishingtrip in january.

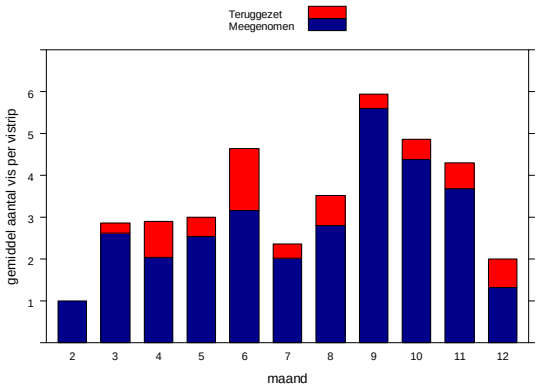

Figure 3-37 Average amount of catches per fishing trip per month. No one reported a fishingtrip in january.

Length frequency distribution

The length frequency distribution for flounder, seabass, dab and cod can be found in Figure 3-38.

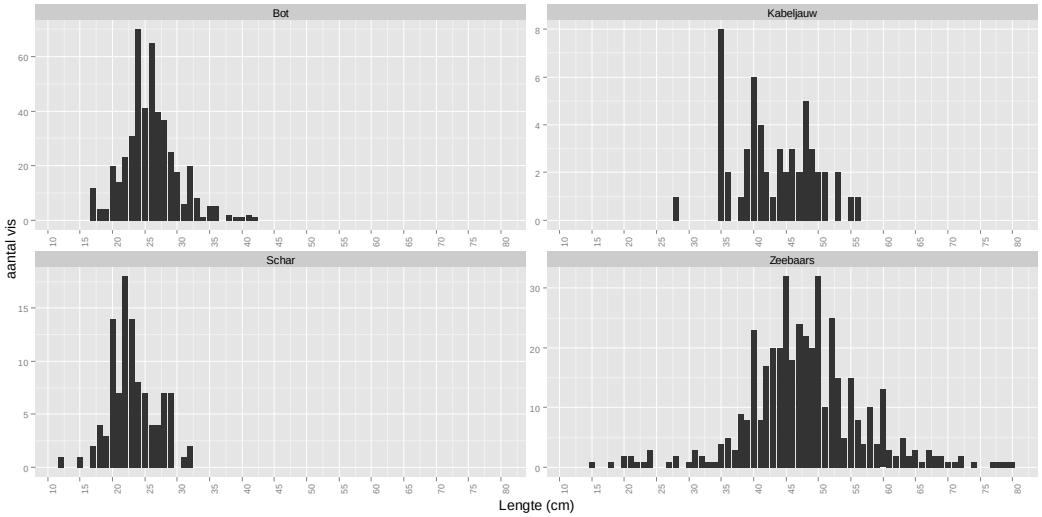

Figure 3-38 Length frequency distribution of retained flounder, cod, dab and seabass.

Table 3-44 Retained catches by gillnet fishers and by anglers (in numbers).

	Gillnet	*Anglers*
Number of fishers	716	491 936
	# retained	# retained
Seabass	~5 000	~176 000
Cod	~500	~771 000
Total	~15 000	~7 000 000

4. Discussion and recommendations

4.1 Screening survey: number of recreational fishers

Across the industrialised world, on average 10% of the population participates in recreational fishing (Arlinghaus et al., 2014). In the Netherlands, the participation rate in recreational anglers is similar to this average but has been slowly declining from 10.9% (1.7 million fishers) in 2009 to 7.2% (1.2 million fishers) in 2015. A possible explanation might be that since the financial crisis in 2008 resource limitation may be constraining participation in recreational fishing as was suggested by the negative correlation between participation rate and unemployment rate (Arlinghaus et al., 2014). The decline can be seen mostly fresh water anglers (Figure 4-1). The number of marine anglers declined between 2009 and 2013, but increased in 2015 (Figure 4-1).
Despite the decline in the participation rate, the number of purchased fishing licenses has remained relatively stable over the past six years (Figure 4-1). However, only half of the fresh water fishers actually obtain the obligatory fishing licence (Figure 4-1). The fishing behaviour and activities of recreational freshwater fishers *with* a license (~50% of the total fishers) may probably not be representative for the fishing behaviour and activities of the average Dutch freshwater recreational fisher as especially highly avid anglers purchase a freshwater license. In marine waters a license is voluntary and less than 1% of the marine recreational anglers actually purchases a fishing licence.

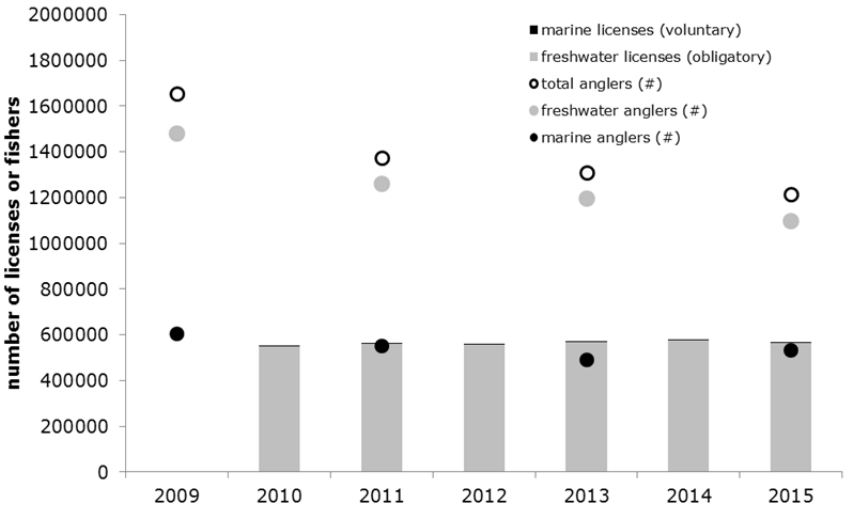

Figure 4-1 Overview of the number of recreational fishers (circles, WGM screening survey's) and the number of sold licenses (histogram). Source license sales: Sportvisserij Nederland.

4.2 Comparison with commercial catches, Cod, Seabass & Eel

As percentage of the total landings (including the commercial landings), the percentage of cod recreational catches (41%, Table 4-1) and seabass (35%) have increased since the start of the recreational estimates in 2010. An important reason for the increase as percentage of the total landings is the decrease of the commercial landings. The percentage of eel recreational catches has declined as percentage of total Dutch landings, from 14% in 2010 to 9% in 2014 (Table 4-1).

Table 4-1 Commercial catches vs. recreational catches (angling, catch & release mortality not included) (tonnes)

Species	*Comm. landings*	*year*	*Comm. landings*	*Recr. Landings*	*% recr. landings*	*reference*
Eel	Dutch landings inland waters	2010	452	75	14%	De Graaf and Bos (2016)
		2012	350	41	11%	De Graaf & Bos (2016)
		2014	317	30	9%	De Graaf & Bos (2016)
Cod	Dutch landings from area IV	2010	2 657	631	19%	ICES WGNSSK (2015)
		2012	1 955	737	27%	ICES WGNSSK (2015)
		2014	1 379	945	41%	ICES WGNSSK (2015)
Seabass	Dutch landings in IVbc, VIIa, and VIId–h	2010	399	129	24%	ICES WGCSE (2015)
		2012	376	229	38%	ICES WGCSE (2015)
		2014	253	138	35%	ICES WGCSE (2015)

4.3 Improving the accuracy of the recreational fisheries survey

Accuracy of catch estimates is determined by the amount of bias (systematic errors) and the precision (random errors) of estimates of key parameters. The precision of estimates can be improved by increasing the sample sizes in data collection programmes, this is generally not the case with bias. Bias is a systematic departure from the true values caused by non-representative data collections and other persistent factors, and can generally not be quantified because the true values seldom are known. The focus should be to minimize or eliminate sources of bias by developing and following sound field data collection procedures and analytical methods.

Species identification

Several freshwater and marine fish species are expected to be difficult to identify by most participants in the logbook survey. Misidentification of species could result in biased (under and/or over) estimates of catches. During the analysis of the 2012-2013 survey it was decided in cooperation with Sportvisserij Nederland that some difficult to distinguish species would be grouped (see paragraph 2.4.4) before analysis. The actual magnitude of species that may have been identified incorrectly is unknown. In 2015 an online fish ID test was developed in cooperation with Sportvisserij Nederland and Kantar–TNS (previously TNS-NIPO). It is our intention that the online fish ID test will be offered to participants of the logbook survey in order to quantify the extend of species identification issues when financial resources are available.

Commercial fishing ponds

In the 2010-2011 recreational fisheries survey, participants were not able to select “commercial fishing pond” as a fishing location in their diaries. This erroneous omission provided difficulties in distinguishing between wild catches and commercial pond catches of species such as trout, salmon and catfish (van der Hammen & de Graaf, 2013). In the 2012-2013 logbook survey, this was rectified and the option of ‘trout pond’ was included in the logbook form (Annex E). In the 2014-2015 logbook survey the option if there was paid for the fish pond was added. This addition improved the accuracy of the of “wild” caught salmon and trout species.

Length frequency and weight

In the 2010-2011 logbook survey many of the apportioned values of the lengths had strong biases to rounded measures (i.e. 10, 15, 20 cm etc.), which suggests that part of the fishers did not measure the fish, but instead estimated the length. Therefore, it was decided that in the 2012-2013 and 2014-2015

logbook surveys the fishers should indicate if they had ‘measured’ or ‘estimated’ the lengths of their retained fish. In the 2014-2015 survey, the ‘measured’ lengths had clearly less bias to rounded measures than the 2010-2011 survey. When the fishers indicated that the lengths of the fish were measured, we expect 20% of the recorded lengths to be 0’s and 5’s, while 20.4 % (marine) and 31.8% (fresh) was observed. When the fishers indicated that the lengths of the fish were estimated, the distribution was highly biased to 0’s or 5’s (58.9% and 54.5% of marine and fresh water fish respectively). This is an indication that the length frequency data of the 2014-2015 survey is more reliable than in the 2010-2012 survey. In the 2016 logbook survey the participants will also be asked again to report the length estimates of released fish in order to estimate both the number and weight of released fish.

If available, length data collected from the onsite sampling programme is preferred to convert number into biomass estimates. While over the past few years a reasonable data set of length measurements of landed marine fish species has been built-up, this is not the case for freshwater fish species. Unlike marine anglers who can easily be intercepted and interviewed on charter boats, harbours and along piers and dykes, freshwater anglers are widely distributed over many rivers and lakes. The lack of onsite measurements from retained fish like eel and pikeperch from inland waters remains to be solved.

Fishing foreigners and foreign fishing trips

The catch estimates only represent the catches realised by Dutch recreational anglers, the catches of visiting anglers are not accounted for. Based on information from The Dutch angling association, ~ 5% of the anglers are from abroad. It is thus likely that the catch estimates presented in this report are an underestimated. In the near future, collaboration between member states within ICES WGRFS (Working Group on Recreational Fisheries) could provide better insight in the number of foreign recreational fishers in Dutch waters. A first step in this process was made in the 2012-2013 logbook survey where participants were allowed to record their foreign fishing trips. The option of reporting foreign fishing trips is maintained in the 2014-2015 survey. These records allow estimating the total number of foreign fishing trips and the realised landings. If all member states would collect catch and effort data of foreign fishing trips in their survey design and share these estimates, this would improve total catch estimate of local and visiting fishers in each member state.

Improving precision

The relative standard error (RSE) is the standard error divided by the mean. It is especially useful to compare the magnitude of the error in relation to the estimate of the mean. The higher the number, the less precise is the estimate. According to the EU Council, the recreational harvest in each area should be expressed at a level 1 precision standard. This requires that the RSE of the catch estimates of the target species such as cod, eel, seabass, sharks and rays should be approximately below 21%. Many of the catch estimates for the different species and species groups presented in this report are around 21%. For some species, however, the catch estimates have an RSE >40% and these estimates should be used carefully. In most of these cases the high RSE was caused by a low number of fishers catching the specific fish species (for example seatrout, salmon, sharks etc.). In order to increase the precision: (1) separate (stratified) surveys could be executed designed for specific species (sharks, rays, salmon) or gears (e.g. current recreational gillnet pilot), and/or (2) the sample size of the number of participating fishers could be increased.

4.4 Catch & Release mortality

In this report, the potential issue of mortality among released fish has been addressed. A proportion of the released fish will not survive the ordeal of being caught due to injuries sustained in the hooking and

handling process and/or due to barotrauma. For each fish species an estimation of the C&R mortality has been given based on the literature. If no literature was available, the proportion was based on the median value in Bartholomew and Bohnsack (2005), where 123 release mortality studies of catch and release fishing were reviewed. Unfortunately hardly any C&R studies are available for key species such as cod, seabass and eel, and the C&R mortality estimates are therefore very rough estimates. Post release mortality studies to estimate total fishing mortality and to develop best practises guidelines to minimize the impacts of C&R on released marine fish in Europe are highly needed (Ferter et al. ,2013).

4.5 Gillnet survey

The recreational gill net fishery contributes only with small fraction of the total withdrawal of fish by the recreational fishery. The estimation of the withdrawal by anglers is ~7 000 000 (this report) and only ~15 000 by gill nets (Table 3-44). This is only 0.2% of the total withdrawal. This is also the case for seabass (3% of the total withdrawal) and cod (0.1% of the total withdrawal, Table 3-44).

The gillnet survey is based on a sample. It is unknown if this sample is representative for all gill net fishers. We lack information about the total group of gill net fishers.
The most important open questions are:

- Are the participants representative as to avidity? Maybe there is a bias towards more or less avid fishers which may cause an over or underestimation of the catches.
- How many gillnet fishers are active and what is their avidity? The total number of gillnet fishers is now based on the total number of permits. This may lead to an overestimation, because it is unknown if all fishers with a permit actually fish. On the other hand, the number of actual fishers may also be higher because some may fish without a permit, which may lead to an underestimation.

5. Quality Assurance

CVO utilises an ISO 9001:2008 certified quality management system (certificate number: 187378CC1-2015-AQ-NLD-RvA). This certificate is valid until 15 September 2018. The certification was issued by DNV GL Business Assurance B.V

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7. Signature

CVO Report: 17.005
Project number: 4311216005

Approved by: Ing. S.W. Verver
Head WOT, Centre for Fisheries Research

Signature: 

Date: 4 april 2017

Annex 1 Screening Questionnaire

Q10 : Vraag 1 - Vissen in zee- en/of kustwater eenpersoons huishouden — **Matrix**

Heeft u dit jaar, in 2015, gevist in Nederlands zee- en/of kustwater?

Onder vissen in Nederlands zee- en/of kustwater verstaan wij het vissen in: alle Nederlandse zee- en kustwateren, zoals Noordzee, Waddenzee, Ooster- en Westerschelde, Eems en Dollard, zowel vanaf strand, dijk en pier als vanaf een schip of een boot.

	ja	nee
inlezen gezinslid 1	○	○

Client notes: min leeftijd is 0; max leeftijd is 99

Q1 : Vraag 1 - Vissen in zee- en/of kustwater meerpersoons huishouden — **Matrix**

Wilt u voor elk lid van uw huishouden aangeven wie er dit jaar, in 2015, gevist heeft in Nederlands zee- en/of kustwater?

Onder vissen in Nederlands zee- en/of kustwater verstaan wij het vissen in: alle Nederlandse zee- en kustwateren, zoals Noordzee, Waddenzee, Ooster- en Westerschelde, Eems en Dollard, zowel vanaf strand, dijk en pier als vanaf een schip of een boot.

	ja	nee
inlezen gezinslid 1	○	○
inlezen gezinslid 2	○	○
inlezen gezinslid 3	○	○
inlezen gezinslid 4	○	○

Client notes: Als voorbeeld staan er nu 4 gezinsleden genoemd. Het is de bedoeling dat alle gezinsleden hier ingelezen worden.
min leeftijd is 0; max leeftijd is 99

Q2 : Vraag 1a - Frequentie — **Numeric**

Min 1 | Max 999

Hoe vaak heeft (inlezen persoon die bij vraag 1 op 'ja' staat) in 2015 ongeveer gevist in Nederlands zeewater of kustwater?

Aantal keer:

Client notes: Deze vraag wordt aan elk lid van het huishouden gesteld waarvoor bij vraag 1 'ja' gekozen is.

Q3 : Vraag 1b - Vistuig

Multi coded

Met welk vistuig heeft (inlezen persoon die bij vraag 1 op 'ja' staat) gevist in Nederlands zeewater of kustwater?

Meerdere antwoorden mogelijk

1 ☐ hengel
2 ☐ peur
3 ☐ fuik
4 ☐ staand want
5 ☐ hoekwant
6 ☐ anders, namelijk... *Open '

Client notes: Deze vraag wordt aan elk lid van het huishouden gesteld waarvoor bij vraag 1 'ja' gekozen is.

Q40 : Vraag 2 - Vissen in binnenwater eenpersoons huishouden

Matrix

Heeft u dit jaar, in 2015, gevist in Nederlands binnenwater?

Onder vissen in binnenwater verstaan wij het vissen in alle Nederlandse binnenwateren, zoals rivieren, meren en plassen, polderwateren, de Biesbosch, Grevelingen, het Veerse Meer, IJsselmeer en Haringvliet maar ook het vissen in karperputten, forelvijvers, sierwateren, vennen en dergelijke.

	ja	nee
inlezen gezinslid 1	○	○

Client notes: min leeftijd is 0; max leeftijd is 99

Q4 : Vraag 2 - Vissen in binnenwater meerpersoons huishouden

Matrix

Wilt u voor elk lid van uw huishouden aangeven wie er dit jaar, in 2015, gevist heeft in Nederlands binnenwater?

Onder vissen in binnenwater verstaan wij het vissen in alle Nederlandse binnenwateren, zoals rivieren, meren en plassen, polderwateren, de Biesbosch, Grevelingen, het Veerse Meer, IJsselmeer en Haringvliet maar ook het vissen in karperputten, forelvijvers, sierwateren, vennen en dergelijke.

	ja	nee
inlezen gezinslid 1	○	○
inlezen gezinslid 2	○	○
inlezen gezinslid 3	○	○
inlezen gezinslid 4	○	○

Client notes: Als voorbeeld staan er nu 4 gezinsleden genoemd. Het is de bedoeling dat alle gezinsleden hier ingelezen worden.
min leeftijd is 0; max leeftijd is 99

Q5 : Vraag 2a - Frequentie **Numeric**

Min 1 | Max 999

Hoe vaak heeft (inlezen persoon die bij vraag 2 op 'ja' staat) in 2015 ongeveer gevist in Nederlands binnenwater?

Aantal keer:

Client notes: Deze vraag wordt aan elk lid van het huishouden gesteld waarvoor bij vraag 2 'ja' gekozen is.

Q6 : Vraag 2b - Vistuig **Multi coded**

Met welk vistuig heeft (inlezen persoon die bij vraag 2 op 'ja' staat) gevist in Nederlands binnenwater?

Meerdere antwoorden mogelijk

1 ☐ hengel
2 ☐ peur
3 ☐ fuik
4 ☐ staand want
5 ☐ hoekwant
6 ☐ anders, namelijk... *Open

Client notes: Deze vraag wordt aan elk lid van het huishouden gesteld waarvoor bij vraag 2 'ja' gekozen is.

Q70 : Vraag 3 - Van plan te vissen in 2016? eenpersoons huishouden **Matrix**

Bent u van plan om volgend jaar, in 2016, te gaan vissen?

	ja	nee
inlezen gezinslid 1	○	○

Client notes: min leeftijd is 0; max leeftijd is 99

Q7 : Vraag 3 - Van plan te vissen in 2016? meerpersoons huishouden **Matrix**

Wilt u voor elk lid van uw huishouden aangeven wie van plan is om volgend jaar, in 2016, te gaan vissen?

	ja	nee
inlezen gezinslid 1	○	○
inlezen gezinslid 2	○	○
inlezen gezinslid 3	○	○
inlezen gezinslid 4	○	○

Client notes: Als voorbeeld staan er nu 4 gezinsleden genoemd. Het is de bedoeling dat alle gezinsleden hier ingelezen worden.
min leeftijd is 0; max leeftijd is 99

Q8 : Vraag 3a - Waar van plan te vissen in 2016? **Multi coded**

Waar is (inlezen persoon die bij vraag 3 op 'ja' staat) van plan om volgend jaar, in 2016, te gaan vissen?

Meerdere antwoorden mogelijk

1 ☐ binnenwateren
2 ☐ zeewater of kustwater

Client notes: Deze vraag wordt aan elk lid van het huishouden gesteld waarvoor bij vraag 3 'ja' gekozen is.

Q9 : Vraag 4 - Deelname hoofdonderzoek **Multi coded**

In 2016 wordt er voor de vierde keer een grootschalig project met betrekking tot recreatieve visserij uitgevoerd door IMARES (Institute of Marine Resources and Ecosystem Studies (www.imares.nl).

Het doel van dit project is:
- een goed overzicht te krijgen van de aantallen gevangen en meegenomen vis door recreatieve vissers;
- informatie te verzamelen over (veranderingen) in de visstand in Nederland.

Voor een onderzoek binnen dit project kunnen we uw hulp goed gebruiken. Het onderzoek bestaat uit het bijhouden van een logboekje en duurt een jaar (maart 2016 tot en met februari 2017). In het logboekje houdt u maandelijks bij of en hoe vaak u gevist heeft, hoeveel u heeft gevangen en waar u gevist heeft. Dit logboekje vult u maandelijks in via internet. Het maakt niet uit of u één keer, vijftig keer of helemaal niet gevist heeft in een maand. Wij zijn ook op zoek naar mensen die maar af en toe vissen.

Deelname aan dit onderzoek, levert u of een van uw gezinsleden, naast de gebruikelijke vergoeding in NIPOints, 5 euro op in de vorm van een cadeaubon.

Wie binnen uw huishouden is bereid om mee te werken aan dit onderzoek?

Meerdere antwoorden mogelijk

1 ☐ inlezen gezinslid 1, van plan te vissen in 2016
2 ☐ inlezen gezinslid 2, van plan te vissen in 2016
3 ○ niemand

Client notes: Hier worden alle personen ingelezen waarvoor bij vraag 3 'ja' gekozen is. min leeftijd is 0; max leeftijd is 99

Annex 2 Logbook Questionnaire

INSTRUCTIES LOGBOEK

Als u gaat vissen vergeet dan niet de zoekkaarten, een liniaal of rolmaat en een aantal logboekblaadjes mee te nemen.

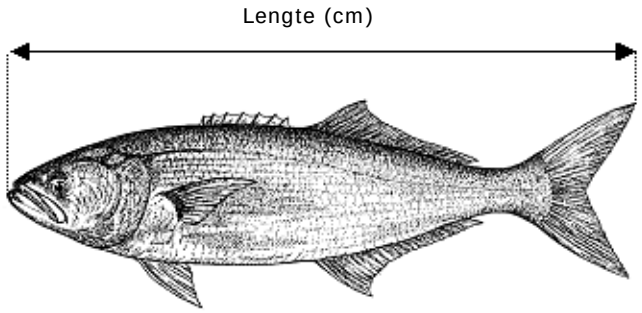
Het logboek is persoonsgebonden, vul daarom alleen uw **eigen** vangsten in en niet die van andere recreatieve vissers.
Als u bent wezen vissen maar u heeft niets gevangen, noteer dit door het vakje **GEEN VIS GEVANGEN** aan te kruisen rechtsboven op het logboekformulier. Noteer vervolgens de locatie, start en eind tijd en het vistuig dat u gebruikt heeft. Met andere woorden: het is uiterst belangrijk om ook de vistrips waar u **niets** heeft gevangen te registreren op een logboekformulier.

VANGSTEN PER VISTRIP

Een vistrip is een aaneengesloten periode van vissen in één en hetzelfde viswater met hetzelfde vistuig op één dag.
Wanneer u op dezelfde dag duidelijk wisselt van viswater (vislocatie) bijvoorbeeld van een plas naar een rivier of van het binnenwater naar zeewater, is het de bedoeling dat u voor elk viswater apart een logboekformulier invult.
Verplaatst u zich tijdens een vistrip *binnen* hetzelfde viswater (vislocatie), bijvoorbeeld u vist vanuit een boot of zoekt een nieuwe stek langs een kanaal een paar honderd meter van waar u uw vistrip begonnen bent, dan hoeft u geen nieuw logboekformulier in te vullen.
Vist u met twee verschillende vistuigen (bijvoorbeeld hengel en fuik), vul dan voor elke type vistuig een apart formulier in.

- Noteer van elke vistrip zo nauwkeurig mogelijk waar deze heeft plaatsgevonden. In het vak **Locatie** kunt u aangeven of u in Nederland of in het buitenland heeft gevist. Voor een Nederlandse vistrip kunt u aangeven hoeveel kilometer van huis u heeft gereisd en in welke provincie de vistrip heeft plaatsgevonden.
- In het vak **Viswater** kunt u aangeven of u heeft gevist in binnenwater of zee- en kustwater. Voor een vistrip in het binnenwater kunt u het type viswater (forelvijver, kanaal, sloot etc.) aangeven. Voor een vistrip in zee-of kustwater kunt u aangeven in welk “blok” u heeft gevist (zie Figuur 1). Indien u vanaf de kust heeft gevist, kunt u aangeven of dat vanaf het strand of vanaf een dijk of pier heeft gedaan.
- Onder **Viswater** kunt u verder aangeven of u vanaf de kant of vanaf een boot hebt gevist. Als u vanaf een boot heeft gevist dan kunt u aangeven wie de eigenaar van de boot is en hoeveel personen er maximaal op de boot kunnen vissen.
- Geef in het vakje **Vistuig** aan met welk vistuig u heeft gevist en hoeveel stuks u van dat vistuig heeft gebruikt. Heeft u meer dan één soort **vistuig** (bv. hengel en fuik) gebruikt tijdens een vistrip, vul dan alstublieft een apart logboekformulier in voor elk vistuig.
- **Begintijd** is de tijd waarop u daadwerkelijk begint te vissen, het moment waarop u een vislijn of een passief vistuig (fuik, staand want etc.) in het water laat. **Eindtijd** is het moment waarop u voor het laatst een vislijn of ander vistuig uit het water haalt. Als u met een boot vist, noteert u als **begintijd** het moment dat u de haven/aanlegsteiger verlaat en als **eindtijd** het moment dat u weer aan wal staat.

- Noteer van elke vis die u vangt welke **soort** (kabeljauw, schar, karper, brasem etc.) het is. Voor de identificatie van de gevangen vis kunt u gebruik maken van de zoekkaarten. Voor meer informatie over vissoorten kunt u een kijkje nemen op www.sportvisserijnederland.nl. Via Sportvisserij Nederland kunt u ook een gratis APP verkrijgen met een beschrijving van alle Nederlandse zee- en zoetwatervissen.
- Noteer per soort van elke gevangen vis of de vis is **meegenomen** of **teruggezet**.
- Meet alleen de **lengte** van **elke** vis die u **meeneemt**. De lengte van een vis meet u van de punt van de snuit tot de tip van de staart (zie Fig. 2).



Figuur 2 Meet de vis van de punt van de snuit tot de tip van de staart.

Vul het logboekformulier in tijdens elke vistrip en bewaar het formulier goed. Aan het begin van de maand wordt u door TNS NIPO benaderd om online de door u verzamelde gegevens van uw vistrips van de voorgaande maand op een online vragenlijst in te vullen. Als u niet heeft gevist gedurende een of meerdere maanden is het wel van belang dit in te vullen in de maandelijkse vragenlijst(en)..

In het informatiepakket vindt u een aantal voorbeelden van ingevulde logboekformulieren.

Mocht u nog vragen hebben over het invullen van de logboekformulieren neem dan gerust contact op met: **Martin de Graaf**, IMARES, Postbus 68, 1970 AB IJmuiden, telefoon: 0317 486826, Email: martin.degraaf@wur.nl

Voor vragen over het invullen van de maandelijkse online vragenlijsten kunt u contact opnemen met: **Lisanne van Thiel,** TNS NIPO, Grote Bickersstraat 74, 1013 KS Amsterdam, telefoon: 020 5225965, Email: lisanne.van.thiel@tns-nipo.com

LOGBOEK Vragenlijst

VRAAG 10

In de volgende vragenlijst wordt u gevraagd het logboek van <maand> in te vullen.

Heeft u in de maand <maand> gevist? Dit kan in Nederland zijn, maar ook in het buitenland.

1 ☐ ja
2 ☐ nee

INDIEN [Q10 , 2] GA VERDER NAAR 'EINDBLOK'

VRAAG 20 **MIN 1 MAX 30**

Hoeveel vistrips heeft u gemaakt in <maand>?

VRAAG 30 **FORMULIER VRAAG**

Nu volgt een aantal vragen over uw 1e vistrip.
Wilt u hieronder de datum, de begintijd en de eindtijd van deze vistrip invullen?

VRAAG 35 (controle)

INDIEN [1087L2 100 + 1089L2 >= 1091L2 100 + 1093L2]

De eindtijd is eerder dan de begintijd.

1 ☐ Ga terug en verbeter dit

VRAAG 40

In welk land heeft u gevist?

1 ☐ Nederland
2 ☐ België
3 ☐ Frankrijk
4 ☐ Duitsland
5 ☐ Noorwegen
6 ☐ Denemarken
98 ☐ ander land, namelijk …

VRAAG 50 **INDIEN GEVIST IN NEDERLAND (FORMULIER VRAAG)**

Hoeveel kilometer is de plek waar u gevist heeft in Nederland vanaf uw huis?

VRAAG 60 **INDIEN GEVIST IN NEDERLAND**

In welke provincie heeft u gevist?

1 ☐ Groningen
2 ☐ Friesland
3 ☐ Drenthe
4 ☐ Overijssel
5 ☐ Gelderland
6 ☐ Flevoland
7 ☐ Utrecht
8 ☐ Noord-Holland
9 ☐ Zuid-Holland
10 ☐ Zeeland
11 ☐ Brabant
12 ☐ Limburg

VRAAG 40

Waar heeft u gevist?

Indien in Nederland gevist (vraag 40, code 1) , onderstaande info geven:
Onder vissen in Nederlands zee- en/of kustwater verstaan wij het vissen in: alle Nederlandse zee- en kustwateren, zoals Noordzee, Waddenzee, Ooster- en Westerschelde, Eems en Dollard, zowel vanaf strand, dijk en pier als vanaf een schip of een boot.

Onder vissen in binnenwater verstaan wij het vissen in alle Nederlandse binnenwateren, zoals rivieren, meren en plassen, polderwateren, de Biesbosch, Grevelingen, het Veerse Meer, IJsselmeer en Haringvliet maar ook het vissen in karperputten, forelvijvers, sierwateren, vennen en dergelijke.

1 ☐ zee- en kustwater
PLAATS IN VIS_TYPE [1]
2 ☐ binnenwater
PLAATS IN VIS_TYPE [2]

VRAAG NEW

INDIEN [1 & Q40 , 1 ZOUT]

Kunt u met behulp van onderstaande kaart aangeven in welk bloknummer u gevist heeft?

PLAAT NOORDZEE LATEN ZIEN

<Bloknummer>

98 ☐ Andere locatie, plek staat niet op de kaart

VRAAG 70

INDIEN [1 & Q40 , 2 ZOET]

Kunt u hieronder aangeven in welk type binnenwater u gevist heeft?

1 ☐ Forelvijver
2 ☐ Stadswateren
3 ☐ Meren en plassen
4 ☐ Sloot
5 ☐ Kanaal
6 ☐ Grote rivier
7 ☐ Kleine rivier
98 ☐ Ander binnenwater, namelijk …

VRAAG 80

Heeft u vanaf de kant of vanaf een boot gevist?

1 ☐ vanaf de kant
2 ☐ vanaf een boot

VRAAG 90

INDIEN [Q80, 1 & Q40, 1 ZOUT]

U heeft gevist vanaf de kant. Kunt u aangeven vanaf waar u gevist heeft?

1 ☐ vanaf het strand
2 ☐ vanaf een dijk
3 ☐ vanaf een pier
4 ☐ vanaf een andere plek, namelijk…

VRAAG 95 **FORMULIER VRAAG**

INDIEN [Q80 , 2]

U heeft gevist vanaf een boot. Wat is het maximaal aantal passagiers van deze boot?

VRAAG 100

INDIEN [Q80 , 2]

Kunt u hieronder aangeven wat voor boot dit was?

1 ☐ eigen boot
2 ☐ boot van anderen
3 ☐ charterboot of huurboot

VRAAG 110 **SAVE TUIG**

Welk vistuig heeft u gebruikt tijdens deze vistrip?

1 ☐ hengel
2 ☐ peur
3 ☐ hoekwant
4 ☐ staand want
5 ☐ fuik
98 ☐ anders, namelijk...

VRAAG 1110 **FORMULIER VRAAG**

Met hoeveel <Question 110><mv> heeft u gevist tijdens deze vistrip?

VRAAG 140

Heeft u vis gevangen tijdens deze vistrip? Het gaat hierbij alleen om uw eigen vangst.

1 ☐ ja
2 ☐ nee

INDIEN [1 & Q140 , 2 geen vis gevangen] PLAATS IN VANGST_INGEVOERD "- Geen vis gevangen" GA VERDER NAAR 'EINDBLOK'

VRAAG 145

Wilt u nu de verschillende vangsten (soorten, teruggezet of meegenomen en lengtes van de meegenomen vissen) invoeren van deze vistrip?
U kunt steeds eerst een soort aangeven, en dan 1 voor 1 de lengtes bij die soort invullen.

LET OP: u moet eerst aangeven hoeveel vis(sen) u van de soort heeft meegenomen of teruggezet, daarna hoeft u alleen van de meegenomen vis(sen) de lengte in te voeren. U dient de lengte van elke meegenomen vis apart in te vullen.
Daarna kunt u hetzelfde doen voor eventuele volgende soorten die u gevangen heeft in deze vistrip.

VRAAG 150 **SAVE VIS_SOORT**

INDIEN [VIS_TYPE = 1 & 1 ZOUT]

Welke soort vis die u gevangen heeft tijdens deze vistrip wilt u nu invoeren?
(u kunt nu 1 soort vis invullen, daarna kunt u nog een soort vis in vullen etc.)
Wanneer deze soort er niet tussen staat, kun u 'andere soort' aanklikken.

1	☐	Aal of Paling
2	☐	Bot
3	☐	Diklipharder
4	☐	Doornhaai
5	☐	Dwergtong
6	☐	Fint
7	☐	Geep
8	☐	Gladde haai
9	☐	Griet
10	☐	Grote Pieterman
11	☐	Haring
12	☐	Hondshaai
13	☐	Horsmakreel
14	☐	Kabeljauw
15	☐	Koolvis
16	☐	Makreel
17	☐	Pollak
18	☐	Puitaal
19	☐	Rode Poon
20	☐	Schar
21	☐	Schelvis
22	☐	Schol
23	☐	Spiering
24	☐	Steenbolk
25	☐	Stekelrog
26	☐	Tarbot
27	☐	Tong
28	☐	Wijting
29	☐	Zalm
30	☐	Zeebaars
31	☐	Zeedonderpad
32	☐	Zeeforel
98	☐	Andere vissoort

VRAAG 160 **SAVE VIS_SOORT**

INDIEN [VIS_TYPE = 2 & 1 ZOET]

Welke soort vis die u gevangen heeft tijdens deze vistrip wilt u nu invoeren?
(u kunt nu 1 soort vis invullen, daarna kunt u nog een soort vis in vullen etc.)
Wanneer deze soort er niet tussen staat, kun u 'andere soort' aanklikken.

1 ☐ Aal of Paling
2 ☐ Alver
3 ☐ Baars
4 ☐ Barbeel
5 ☐ Bittervoorn
6 ☐ Blankvoorn
7 ☐ Brasem
8 ☐ Giebel
9 ☐ Goudvis
10 ☐ Graskarper
11 ☐ Karper
12 ☐ Kolblei
13 ☐ Kopvoorn
14 ☐ Kroeskarper
15 ☐ Meerval
16 ☐ Pos
17 ☐ Regenboogforel
18 ☐ Rivierdonderpad
19 ☐ Riviergrondel
20 ☐ Roofblei
21 ☐ Ruisvoorn of Rietvoorn
22 ☐ Serpeling
23 ☐ Snoek
24 ☐ Snoekbaars
25 ☐ Spiegelkarper
26 ☐ Spiering
27 ☐ Winde
28 ☐ Zalm
29 ☐ Zeelt
30 ☐ Zonnebaars
31 ☐ Zwartbekgrondel
98 ☐ Andere vissoort

VRAAG 170 **SAVE VIS_SOORT**

INDIEN [Q150 , 98 OR Q160, 98]

Andere vissoort, namelijk:

VRAAG 175

U kunt nu van de vissen van deze soort (<Vraag150/Vraag160/Vraag170>) invoeren hoeveel vis(sen) u heeft teruggezet en hoeveel u heeft meegenomen. Daarna kunt u van de meegenomen vis(sen) de afzonderlijke lengtes invoeren.

VRAAG 180

Wilt u nu noteren hoeveel vissen van de soort (<Vraag150/Vraag160/Vraag170>) u heeft teruggezet en hoeveel u heeft meegenomen?

Tot nu toe ingevoerd over de 1e vistrip:
<info over wat er tot nu toe is ingevoerd>

1 ☐ teruggezet: ……. stuks
2 ☐ meegenomen: ….. stuks

VRAAG 185 **FORMULIER VRAAG**

Wilt u nu de lengte van iedere **meegenomen** vis afzonderlijk noteren?

Tot nu toe ingevoerd over de 1e vistrip:
<info over wat er tot nu toe is ingevoerd>

Wilt u de lengte in hele centimeters invullen? U kunt dus geen komma gebruiken.
<Question 180, meegenomen vis> aantal (lengte in cm)

VRAAG 205

INDIEN [VANGST_NR <> 0]

Tot nu toe ingevoerd over de 1e vistrip:
<info over wat er tot nu toe is ingevoerd>

Geef hieronder aan wat u vervolgens wilt invoeren:

1 ☐ een volgende lengte invoeren (ga naar vraag 185)
2 ☐ een volgende soort invoeren (ga naar vraag 150/160)
3 ☐ alle soorten en lengtes van deze vistrip zijn ingevoerd (ga naar volgende vraag)

VRAAG 210

INDIEN [VANGST_NR <> 0]

Tot nu toe ingevoerd over de 1e vistrip:
<info over wat er tot nu toe is ingevoerd>

Kunt u hier aangeven of u de lengtes van de meegenomen vissen van deze vistrip heeft gemeten of heeft geschat?

1 ☐ ik heb de lengtes gemeten
2 ☐ ik heb de lengtes geschat

→ ga naar volgende vistrip of anders naar 'EINDBLOK')

Hierna worden vraag 30 t/m vraag 210 herhaald voor het aantal vistrips ingevoerd bij vraag 20

VRAAG 215 Controle

U heeft minder vistrips ingevoerd dan u gemaakt heeft.
- aantal gemaakt: <Question 20>
- aantal ingevoerd: <?>

1 ☐ Ga terug en verbeter dit

9 ☐ (toch doorgaan)

Het laatste blok krijgen de respondenten alleen als ze de voorgaande maand(en) de vragenlijst niet hebben ingevuld

EINDBLOK – Visgedrag voorgaande maanden

Vraag
U heeft in de maand(en) <maanden invoeren> de vragenlijst niet ingevuld. Zou u hieronder kunnen aangeven of u gevist heeft deze maand?

<matrixvraag, met maand(en) in de rij en wel gevist/niet gevist in de kolom>

Als respondent in voorgaande maand(en) wel heeft gevist
Vraag
Kunt u hieronder aangeven of u toen in zoet water, zout water, of beide heeft gevist?

<matrixvraag, met maand(en) waarin wel gevist in de rij en zoet water/zout water/zowel in zoet als in zout water>

EINDE VRAGENLIJST

Annex 3 Flow Chart

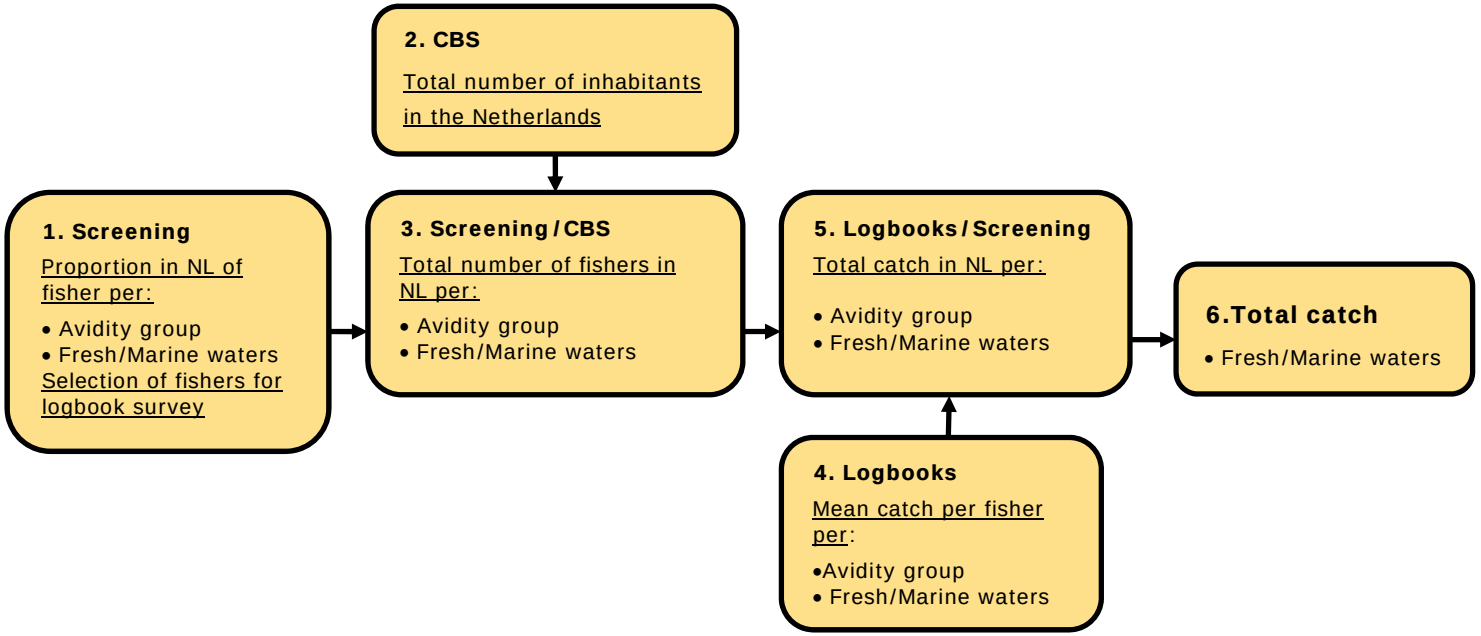


Figure 7-1 Flow chart to illustrate the different components of the recreational fishery survey to estimate total catch (in number or weight)

Annex 4 Raising

Raising

For each avidity group and waterbody type, the number of fishers is calculated. For this estimation, the fishers from the screening survey are used.

$$F_{a,w} = \frac{FS_{a,w}}{N_s} \times N_{nl}$$

where $F_{a,w}$ is the number of fishers per avidity group (a) and waterbody type (w), N_s is the total number of participants in the screening survey (s), $FS_{a,w}$ is the number of fishers in the screening survey per waterbody type and avidity group and N_{nl} is the total number of inhabitants >6 in the Netherlands (nl), obtained from statistics Netherlands (CBS).

Subsequently, for each avidity group, waterbody type and species, the mean number of retained and

$$\overline{C}_{a,w,s,r} = \frac{\sum_f C_{f,a,w,s,r}}{F_{a,w}}$$

released fish per fisher is estimated:

where $\overline{C}_{a,w,s,r}$ is the average yearly catch per fisher for each avidity group, waterbody type and species and r indicates released or retained fish. $C_{f,s,r}$ is the catch per fisher (f), species for released or retained fish (r).

The total catch number for each species, waterbody type and avidity group is calculated by multiplying the yearly mean catches per year with the number of fishers.

$$C_{a,w,s,r} = \overline{C}_{a,w,s,r} \times F_{a,w}$$

where $C_{a,w,s,r}$ is the total yearly catch per avidity group, waterbody type, species and for retained or released fish. Consequently, the values are summed over the avidities, to get to the total yearly catch per waterbody type, species and for retained or released fish ($C_{w,s,r}$).

$$C_{w,s,r} = \sum_a C_{a,w,s,r}$$

total number of participants in the screening survey (*s*), $FS_{a,w}$ is the number of fishers in the screening survey per waterbody type and avidity group and N_{nl} is the total number of inhabitants >6 in the Netherlands (*nl*).

Precision

Standard errors of the screening survey or the RDD survey were estimated as following:

$$SE = \sqrt{(p) * (1-p)/N_s} * N_{NL}$$

Where p is the proportion of fishers in the screening (or RDD) survey and (1-p) is the proportion of non-fishers, N_s is the total number of participants in the screening survey and N_{NL} is the total number of inhabitants in the Netherlands.

Standard errors of the final number of retained or released catches were estimated as following:

$$SE = \sqrt{\Sigma \left(F_{a,w}^2 * \frac{s_a^2}{f_a} \right)}$$

f_a is the number of fishers monitored in avidity group *a*. The sample estimate of the population variance per avidity group is s_a^2. For each avidity group, this sample variance is estimated by:

$$s_a^2 = \frac{\Sigma (f_a - \bar{f}_a)^2}{n_a - 1}$$

where f_a are the observations for each fisher in avidity group a. $\bar{f}_a$ is the mean number of fish caught per fisher in avidity group a and n_a is the number of fishers monitored in avidity group *a*.

Annex 5 Length weight relationships

Table 7-1 Length weight relationships ($W=a*L\hat{}b$, with W= weight in kg and L = length in cm)

	Species	a	b	reference
Marine	Atlantic Pollock	0.023800	2.737	Wageningen Marine Research
	Cod	0.006800	3.101	Daan (1974)
	Dab	0.007129	3.119	Robinson et al (2010)
	Eel	0.001070	3.133	Wageningen Marine Research
	Flounder	0.008700	3.098	Wageningen Marine Research
	Haddock	0.018200	2.827	Wageningen Marine Research
	Mackerel	0.003000	3.290	Wageningen Marine Research
	Plaice	0.009594	3.009	Robinson et al (2010)
	Pout	0.003800	3.367	Wageningen Marine Research
	Saithe	0.023800	2.737	Wageningen Marine Research
	Salmon	0.005300	3.122	Wageningen Marine Research
	Seabass	0.007400	3.096	Wageningen Marine Research
	Seatrout	0.009810	3.012	Wageningen Marine Research
	Sole	0.031696	2.603	Robinson et al (2010)
	Whiting	0.010965	2.863	Robinson et al (2010)
Fresh	Bream	0.00530	3.200	Wageningen Marine Research
	Carp	0.01745	3.071	Wageningen Marine Research
	Catfish	0.00224	3.294	Wageningen Marine Research
	Chub	0.00624	3.168	Wageningen Marine Research
	Eel	0.00107	3.133	Wageningen Marine Research
	Perch	0.00500	3.335	Wageningen Marine Research
	Pike	0.00507	3.101	Wageningen Marine Research
	Pike-perch	0.00600	3.100	Wageningen Marine Research
	Rainbow Trout	0.00981	3.012	Wageningen Marine Research
	Roach	0.00460	3.317	Wageningen Marine Research
	Rudd	0.00460	3.352	Wageningen Marine Research
	Silver Bream	0.00800	3.285	Wageningen Marine Research

Annex 6 number/species/angler/year

		retained				returned			
Marine	**Avidity (no. fishtrips per year)**	**1-5**	**6-10**	**>10**		**1-5**	**6-10**	**>10**	
Cod	number/angler/year	0.85	2.53	3.39		0.39	1.86	3.4	
Mackerel	number/angler/year	2.57	1.54	2.53		0.53	2.31	1.27	
Seabass	number/angler/year	0.13	0.6	1.12		0.42	1.09	3.58	
Sole	number/angler/year	0.13	1.29	1.14		0.2	0.34	0.53	
Rays	number/angler/year	0	0	0		0.01	0.02	0	
Sharks	number/angler/year	0	0	0		0.02	0.4	0.05	
Gadiformes	number/angler/year	1.43	3.45	2.92		0.78	3.99	8.79	
Flatfishes	number/angler/year	1.65	14.15	15.47		1.78	8.78	12.29	
Eel	Marine number/angler/year	0.36	0.56	0.09		0.38	0.84	0.43	
Salmon/ Seatrout	Marine number/angler/year	0	0.86	1.53		0.01	0.3	0.17	
Total	Marine number/angler/year	7.85	25.72	31.33		6.26	22.67	35.25	
Fresh	**Avidity (no. fishtrips per year)**	**1-5**	**6-10**	**11-25**	**>25**	**1-5**	**6-10**	**11-25**	**>25**
Perch	number/angler/year	0.06	0.05	0.23	0.12	3.29	8.64	8.12	25.33
Pikeperch	number/angler/year	0.05	0.08	0.19	0.36	1.42	3.70	3.03	10.87
Pike	number/angler/year	0.04	0.02	0.11	0.08	1.28	3.73	1.61	7.78
Bream	number/angler/year	0.04	0.01	0.12	0.26	3.10	7.49	16.01	44.58
Carps	number/angler/year	0.13	0.03	0.34	0.21	1.45	3.86	3.95	21.92
Cyprinids	number/angler/year	0.19	0.07	0.50	0.88	9.96	30.81	33.23	158.67
Eel	Fresh number/angler/year	0.23	0.08	0.15	0.09	1.01	0.51	1.46	6.45
Total	Fresh number/angler/year	0.76	0.33	1.85	2.30	23.84	61.81	69.42	260.56