Recreational fisheries in the Netherlands:

analyses of the 2012-2013 online logbook survey, 2013 online screening survey and 2013 random digit dialing screening survey

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IMARES C042/15

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Bascode WOT-05-406-009
Projectnummer 4301216005

Publication date: 1 April 2015

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Recommended format for purposes of citation: de Graaf, M., Simal, F. (2015). 'Quick scan' to assess the prevalence of dermal parasites among coral reef fishes of Bonaire. IMARES Report C055/15, pp. 13

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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, IMARES 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 IMARES, 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 fishers fishing in fresh and marine waters, a biennial online screening survey (about 50.000 households) was implemented in December 2009. In December 2011 and 2013 the screening survey was repeated. The 2009 survey resulted in an estimate of 1.7 million recreational fishers being present in the Netherlands. Since, the number of recreational fishers in both fresh and marine waters in the Netherlands has been declining (1.4 and 1.3 million for 2011 and 2013 respectively). In order to validate the estimates from the screening survey, an additional Random Digit Dialling (RDD) survey was carried out in December 2013, with the objective of comparing the results between survey methods. The number of recreational fishers in 2013 estimated by the RDD survey was slightly lower (1.1 million) than the number of fishers estimated by the online screening survey in 2013 (1.3 million). However, because both estimates are within the same order of magnitude and the difference was small, we conclude that the fishing behaviour of the participants of the TNS-NIPO database is representative of the Dutch population. In the future, the online screening survey will continue to be used for the estimation of the number of recreational fishers in the Netherlands.

To estimate the mean catches per year per fisher, a logbook survey was conducted in March 2010, which ran until February 2011. The logbook survey was repeated from March 2012 until February 2013. Participants for the logbook survey were recruited from the 2009 or 2011 screening survey (~2400) and for the 2012-2013 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 2012-2013. In addition, the methodology of the calculation of these estimates is described. The estimates of the retained and returned fish are summarized in Table 1-1. Catches from commercial fish ponds are excluded in these calculations.

Table 1-1 Amount of retained and released catches of recreational fishers (anglers) from March 2012 to February 2013 in marine and fresh water. Estimates of underlined species are less precise and should be used with caution.

	Marine			***Fresh***			
	Number (x1000)		Weight (ton)		Number (x1000)		Weight (ton)
Species	Retained	Returned	Retained	Species	Retained	Returned	Retained
Eel	91	67	18	Eel	313	1517	41
Cod	609	392	737	Perch	415	7174	173
Mackerel	1324	941	369	Catfishes	86	96	26
Seabass	335	332	229	Bream/Silverbream	316	10619	177
Sole	305	221	67	Rainbow/Brown trout	12	74	2
Seatrout/Salmon	27	13	12	Carps	583	3539	531
Gadiformes	907	1927	81	Cyprinids	901	30399	218
Flatfishes	3255	2521	587	Pike	236	2026	187
Sharks	0	15	0	Pikeperch	414	2604	519
Rays	0	15	0	Seatrout/Salmon	2	5	0.2
Total (all species)	7176	7661		Total (all species)	3565	60779	

1 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 IMARES 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 vissers (~1.7 miljoen) in Nederland in binnenwateren en zee- en kustwateren. In december 2011 en 2013 is de online screening survey opnieuw uitgevoerd. In vergelijking tot de 2009 screening survey is het aantal recreatieve vissers gedaald in 2011 (1.4 miljoen) en in 2013 (1.3 miljoen). De daling vond plaats onder recreatieve vissers in zowel binnenwateren als in zee- en kustwateren. Om de uitkomsten van de online screening survey te controleren is er in december 2013 en januari 2014 een telefoon survey uitgevoerd. Deze 'Random Digit Dialing (RDD) Survey' werd net als de online screening survey uitgevoerd door TNS-NIPO. Het opwerken van de RDD survey resulteerde in een schatting van een vergelijkbaar, maar iets lager aantal recreatieve vissers in 2013, namelijk 1.1 miljoen. We concluderen hieruit dat het visgedrag van de deelnemers van de database representatief is voor Nederlands bevolking. In de toekomst zal de online screening survey gebruikt blijven worden voor het schatten van de hoeveelheid recreatieve vissers in Nederland.

In 2012 en 2013 is de tweede logboek survey uitgevoerd. Deelnemers van dit onderzoek 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 2012-2013. 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.

Tabel 1-1 Hoeveelheid onttrokken en teruggezette vangsten van recreatieve vissers (hengelaars) van maart 2012 tot februari 2013 in zee- en kustwateren en in binnenwateren. De schattingen van de onderstreepte soorten zijn minder nauwkeurig en dienen voorzichtig te worden geïnterpreteerd.

	Zee- en kustwateren			***Binnenwateren***			
	Aantal (x1000)		Gewicht (ton)		Aantal (x1000)		Gewicht (ton)
Soort	Onttrokken	Teruggezet	Onttrokken	Soort	Onttrokken	Teruggezet	Onttrokken
Aal	91	67	18	Aal	313	1517	41
Kabeljauw	609	392	737	Baars	415	7174	173
Makreel	1324	941	369	Meervallen	86	96	26
Zeebaars	335	332	229	Brasem/kolblei	316	10619	177
Tong	305	221	67	Regenboog/ Beekforel	12	74	2
Zeeforel/Zalm	27	13	12	Karpers	583	3539	531
Gadiformes	907	1927	81	Witvis	901	30399	218
Platvis	3255	2521	587	Snoek	236	2026	187
Haaien	0	15	0	Snoekbaars	414	2604	519
Roggen	0	15	0	Zeeforel/Zalm	2	5	0.2
Totaal (alle soorten)	7176	7661		Totaal (alle soorten)	3565	60779	

2 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 (Coleman et al., 2004, Van der Hammen and de Graaf, 2012). 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 (ICES, 2010, ICES, 2011, ICES, 2012). While catch and effort of marine (and freshwater) commercial fisheries have been documented for dozens of years in most European countries, insight into the recreational catches is sparse and relatively new.
Recently, 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 cod, eel, sharks and rays. On behalf of the Ministry of Economic Affairs, IMARES 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 IMARES, Wageningen UR 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. In recent years several estimates of the total catch of cod (*Gadus morhua*) by angling recreational fishers have been reported: 264-1037 tonnes (Van Keeken et al. 2007) based on phone and mail recall survey, ~1650 tonnes in 2006 (Wijnstroom, 2006) based on a phone recall survey. Due to the methods (recall surveys) the accuracy of these catch estimates are doubtful as recall surveys have been demonstrated to overestimate recreational catches by as much as a factor two (Baharthah, 2006). 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; Baharthah 2006).

Non-response bias occurs when the fishing behaviour of the group that returns the questionnaires is different from the group that does not return the questionnaires (i.e. non-respondents). Highly active recreational fishers are more likely to participate and return questionnaires often causing an overestimation of catches. Recall bias, caused by the error in remembering the catches from the past, is a complex issue that is influenced by factors such as the recall period and levels of activity but as a general rule fishers tend to overestimate their catch and effort if the timespan between the event and reporting of the activity is large, e.g. surveys with recall periods of two or more months (Lyle et al., 2002). Recall bias can be reduced by limiting reporting periods to the recent past and/or through the use of logbooks, where respondents are expected to document their fishing activities and catch details shortly after they occur. Digit preference can cause bias when survey participants have a preference for round numbers (e.g. ending on 0's or 5's). Prestige bias is bias caused by participants being more likely to report their 'most interesting' catches, e.g. the biggest fish or the most special fish and not reporting the less interesting catches.

In order to keep these potential biases as low as possible, it was necessary to develop a survey design which supports respondent participation and encourages accurate and complete data reporting as well as tracking and follow-up of non-respondents. 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

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.

The ICES Working Group on Recreational Fisheries Surveys advised the Netherlands to determine if the fishing behaviour (participation rate) of members of the TNS-NIPO data base is representative for the average Dutch recreational fishers. In theory it is possible that people who like to participate in regular market surveys, i.e. members of the TNS-NIPO database, deviate in the fishing behaviour from the average Dutch person. Therefore in December 2013 a random digit dialling (RDD) screening survey was conducted parallel to the online screening survey.

In this report, we describe the estimation method to raise the logbook data to the yearly catch estimates. These methods are similar to methods in earlier reports (Van der Hammen and de Graaf 2012, 2013), but differ in two main aspects. First, the participants in the 2012-2013 logbook survey originate from two sources: the first source is the TNS-NIPO database and the second source is set of high avidity fishers recruited from recreational fisher's websites. The TNS-NIPO database is the same as was used in the first (2010-2011) survey. Secondly, in this report we only present the estimates for catches by recreational anglers, not from any other fishing gear used by recreational fishers. It is not allowed to use non-angling fishing gear for recreational purposes in inland waters. In 2011 the use of non-angling fish gear (gill nets, fyke nets and long-lines) by recreational fishers in marine waters was also forbidden. However, the use of passive gears in marine waters by recreational fishers was reviewed by Min EZ and a recreational gill net fishery has been allowed again since 2012 in certain areas along the Dutch coast. A separate survey has been developed as part of the 2014 logbook to provide insight in the catches of the recreational gill net fishery in the coastal waters. The results of the 2014 survey will be reported in 2016.

We present the outcome of the 2012 logbook survey (which ran from March 2012 to February 2013) and the 2013 online and RDD screening surveys. The results are compared and discussed with the previous logbook (2010) and screening surveys (2009, 2011). The third logbook survey started in April 2014 and will run till March 2015. The results of the latest logbook survey will be presented in a follow-up report.

3 Methods

3.1 Number of recreational fishers: Online Screening Survey

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 (TNS-NIPO). The demographics of the panel such as age, gender, education level and place of residence are controlled by commercial marketing company (TNS-NIPO) to ensure that it does not deviate from the demographics of the Dutch population.

The questions about recreational fishing were offered in December 2013 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 2014 and if they would be interested in participating in a 12 month logbook survey starting in 2014. In addition, they were asked to indicate how many fishing trips they had made in 2013 to determine their level of fishing 'avidity'. The design of the screening survey was similar to 2009 and 2011. The questions of the 2013 screening survey are listed in Appendix A.

3.2 Number of Recreational fishers: Random Digit Dialling Phone Survey

The random digit dialling (RDD) phone survey was conducted only once to compare the estimated number of fishers with the number estimated by the screening survey. These fishers were not included in the logbook survey.

The first step in the random digit dialling (RDD) phone survey was to generate a random sample of 30.000 telephone numbers. In this sample 10% were cell phones and 90% were fixed connections. Next, from this sample numbers were phoned randomly until there were 1500 succeeded interviews. If there was no response, the phone number went back into the pool of uncalled numbers until the number was called 10 times, when it was removed from the group. This did not always result in that the number was called 10 times, but stopped when the total number of successful calls was made.

The questions were asked to the family member who had its birthday soonest and was home at the time of the phone call. There was no minimal age to answer the phone, but if the person answering was too young, an adult would take over. The interviewer asked if this family member had time to answer a few questions about hobbies, sport and leisure. If the respondent agreed, the interview started with questions about socio-demographics (age, gender, family size) of every family member. Subsequently, the interviewer asked questions about the fishing activity that resembled the questions of the screening survey and included the questions if the respondent has fished in fresh or marine waters in 2013 and how often. The questions are listed in Appendix B.

The RDD Survey resulted in some non-response, which was mainly caused by unanswered phone calls and refusals. If the non-respondents had the same behaviour regarding fishing activities as responding persons, non-response is not a problem. However, if the group of non-responders deviated in terms of fishing behaviour non-response may result in bias. Therefore, from the pool of unanswered phone numbers and refusals, a sample of 1500 numbers was drawn (750 from unanswered numbers and 750 of refusals) which were called again. This resulted in 153 additional successful interviews. These were compared with the original 1504 interviews. The number of fishers in the Dutch population calculated by

the RDD was done in the same way as the number of fishers in the screening survey. For comparison with earlier years, ages younger than 6 were excluded from the analysis.

3.3 Onsite survey

To convert numbers to weights the lengths of the fish were 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, IMARES employees trained a number of recreational fishers in accurately measuring fish lengths. Subsequently, the trained fishers approached fishers in the field and measured the lengths of retained fish. Observers collected data from fishers fishing from the shore, and fishers fishing from boats. An overview of the number of locations and sampling days in the different years is presented in Table 3-1.

Table 3-1 Number of observers, location and number of observer trips in the onsite survey.

	year	Location	Nr observers	shore / boat	Nr 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

3.4 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.

Because the number of fishers in the higher avidity groups was much lower than in the lower avidity groups, it was decided that the number of high avid fishers 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 screening survey differed from that of the logbook 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 number of high avid fishers is low, especially for marine fishers; 0.2% (fresh, >50 fishing trips per year), <0.1% (marine, >50 trips per year, Table 4-2), the screening survey did not recruit sufficient high avid fishers to join the logbook survey. Therefore, (high avid) fishers were also recruited by advertisements on recreational fisheries websites (www.vangstenregistratie.nl, www.sportvisserijnederland.nl, www.topvisser.nl). Interested fishers 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 353 applications of which 105 were selected to participate in the logbook survey. In contrast to the 2010-2011 logbook survey, in the 2012-2013 logbook survey, participants were not selected such that the avidities matched the ratios found in the screening survey. In the 2012-2013 survey, higher avidities were overrepresented, with the objective that the higher avidity groups also had sufficient numbers of participants (4 groups in fresh water; 1-5,

6-10, 11-25, >25 fishing trips per year and 3 in marine water 1-5, 6-10, >10 fishing trips per year). It remained difficult to recruit sufficient participants in the higher avidity groups. However, the higher avidity groups were somewhat overrepresented (Table 3-2).

Table 3-2 Number of logbook survey participants in each avidity group.

	Avidity	Logbook participants	Screening (%)	Logbook (%)
Marine	1-5	1175	72	65
	6-10	361	17	20
	>10	275	12	15
Fresh	1-5	1059	54	49
	6-11	575	23	26
	11-25	300	15	14
	>25	236	8	11

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 Appendix C for the logbook instructions and the logbook questionnaire). Fishers were also asked to report their fishing trips in foreign countries. Participants were contacted online once a month by TNS-NIPO 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.

3.5 Analysis

A simplified scheme of the raising procedure is visualized in Figure 3-1. The screening survey is used to estimate the proportion of recreational fishers in the Dutch population for each avidity group and for fresh and marine waters (Figure 3-1, 1). The total number of inhabitants in the Netherlands was obtained from Statistics Netherlands (CBS, Figure 3-1, 2), which are used to raise these proportions to the total number of fishers in the Netherlands for fresh and marine waters, for each avidity group (Figure 3-1, 3). Subsequently, the logbooks are used to estimate the catches per year per individual fisher (number or weight of fish/fisher/year for each avidity group) for each fish species (Figure 3-1, 4). Multiplying the catches per year with the total number of fishers gives the total number or weight of caught fish per species and avidity group (Figure 3-1, 5). Summing these estimates for each avidity group results in the total catch estimate per species (Figure 3-1, 6). The raising procedure is listed in more detail in appendix D.

3.5.1 Non-response logbooks

Almost half of the logbook survey participants (1168, 48%) 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 fishers 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 returned, it was known whether a fisher had fished in a specific month and how many fishing trips were

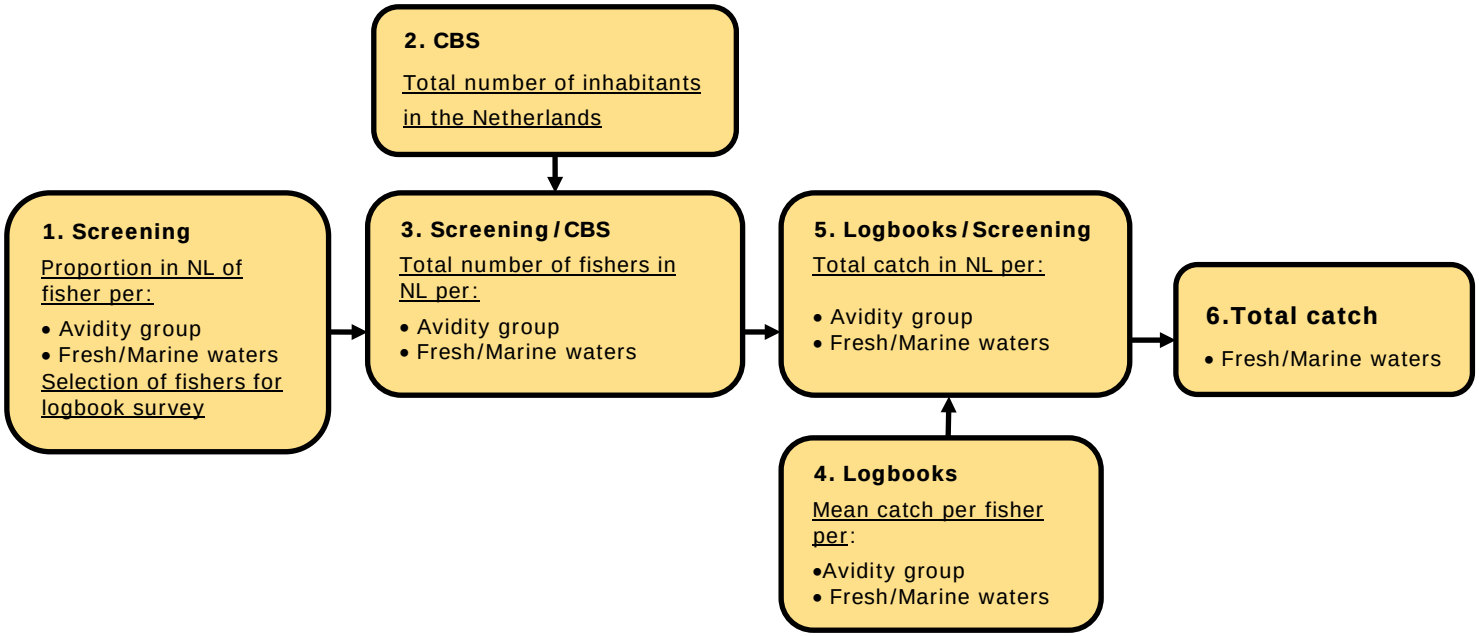


Figure 3-1 Flow chart to illustrate the different components of the recreational fishery survey to estimate total catch (in number or weight)

made, but information about the catches was absent. Fishers 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 rather than rely on recalled (longer than 4 weeks) and potentially unreliable information, we sought to impute their fishing activity for the missing months using hot deck 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 and month were expected to affect the amount of catches, because the more fish trips, the higher will be the total catch. The season 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.

3.5.2 Drop-out removal

The population of fishers changes over time, with fishers leaving or entering recreational fishery, the so called 'drop-ins' and 'drop-outs'. Drop-outs are defined as those fishers 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).

3.5.3 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 3-3).
For the following species catch estimates were calculated at species level: (marine) cod, eel, seabass, mackerel, sole, (fresh water) eel, perch, pike, and pikeperch.

3.5.4 Converting numbers to biomass

During analysis there were two options to estimate biomass of retained fish using numbers of retained fish and length weight relationships (Table 3-4). If more than a hundred individual fish were measured during the onsite surveys (2009-2014 pooled) the length data from the onsite survey were used for the number to biomass conversion. Lengths were randomly assigned to individual fish in the logbooks from the pool of onsite length measurements. Assigning the mean weight of the onsite measurements would have resulted in a similar result, but different standard errors. 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, if participants had measured the fish length. Instead, if participants had estimated the fish lengths, lengths were replaced by randomly assigning lengths from the pool of measured lengths. In groups of species, the length weight relationship of the species that was specified in the logbook was used.

3.5.5 Precision

The estimation procedure of standard errors of the estimates of the screening survey, the RDD survey and the catch estimates are described in Appendix D. Some species were caught frequently by many fishers and some species were rarely caught by very few fishers. In addition, sometimes only few fishers caught many fish, in which case exclusion of these fishers would make a large difference for the catch estimate and thus decreasing the precision. Those extreme fishers tend to increase the standard error and the relative standard error (RSE, the standard error expressed as a fraction of the estimate, see for estimation of standard errors Appendix D). Here, estimates with a RSE of 40% or greater are flagged (personal communication J. Lyle). In addition, the estimates originating from fewer than 25 fishers who caught a specific fish species are also flagged (personal communication J. Lyle).

Table 3-3 Grouped species

	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*

Table 3-4 Length weight relationships ($W=a*L^b$, with W= weight in kg and L = length in cm)

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

4 Results

4.1 Number of recreational fishers: online screening survey

The percentage of freshwater fishers (7.4%, Table 4-2) and of marine water fishers (3.2%, Table 4-2) were estimated using the screening survey. Extrapolation to the population level by multiplying with the total number of inhabitants resulted in an estimation of 1.2 million fresh water fishers and 500 thousand marine fishers in The Netherlands. In total there were approximately 1.3 million fishers in the Netherlands (Table 4-2). Compared to 2009 and 2011 this is a decrease (1.7 & 1.4 million for 2009 and 2011 respectively, Table 4-2).

The trend in the proportion of fishers in the Netherlands was analysed using binomial generalized linear models (GLMs) with a logit link fitted to the screening data from 2009, 2011 and 2013. The proportion of fishers (p) in year (t) was modelled as following: $logit(p) = \beta_0 + \beta_1 \times t$. The proportion of fresh water fishers and marine fishers was analysed in the same way. This resulted in $\beta_0 = 159.78$, $\beta_1 = -0.081$ ($p < 0.0001$) for the model with all fishers included, $\beta_0 = 133.66$, $\beta_1 = -0.068$ ($p < 0.001$) for marine fishers and $\beta_0 = 145.19$, $\beta_1 = -0.073$ ($p < 0.001$) for fresh water fishers. The models thus predict significant declining trends in the proportion of fishers, for fresh water fishers, marine fishers and for all (fresh + marine) fishers.

4.2 Number of Recreational fishers: random digit dialling (RDD) phone survey

Of the original sample of 30 000 phone numbers, 2 526 were on the black list (a list were people indicate that they do not want to be approached by market surveys) and 9 550 were incorrect numbers or technical issues caused the phone number to be unable to reach, which left the 'usable' sample of numbers at 17 924. Of these, 9 702 numbers were called. These resulted in 1 504 (15.5%) successful interviews; 3 832 calls were unanswered (39.5%); 889 (9.2%) voicemails or answering machines; 177 (1.8%) times the line was busy; 2 972 (30.6%) times the interview was refused and 226 (2.3%) times the interview could not take place because of language issues (Table 4-1). The non-response is calculated as the sum of the unanswered phone calls, the refusals, voicemails, answering machines, busy lines and language issues, resulting in 83.4% of non-response, most of it coming from unanswered calls and refusals (Table 4-1). The 1504 succeeded interviews resulted in succeeded information of 3 452 persons. The 153 successful non-response interviews resulted in information on fishing activity of 364 persons.

Table 4-1 Overview response RDD Survey.

	# persons	%
Original sample	**30 000**	
Wrong number/error	*9 550*	
Blacklist	*2 526*	
Working sample	**17 924**	
Unused	*8 222*	
Call back appointment (unused*)	*101*	
Used sample	**9 702**	
Successful interviews	*1 504*	15.5%
Unanswered	*3 832*	39.5%
Voicemail/answering machine	*889*	9.2%
Busy line	*177*	1.8%
Refusal	*2 972*	30.6%
Language issue	*226*	2.3%
Non-response analysis (750 unanswered, 750 refusal)	**1 500**	
successful interviews (97 refusal and 56 unanswered group)	153	10.2%

** unused because the number of successful telephone calls was already reached.*

Table 4-2 Results screening survey (December 2009, 2011 and 2013). Number of fishers in the Netherlands per avidity group; per waterbody type; and the total number of fishers (six years and older). SE between brackets.

		Dec. 2009			**Dec. 2011**			**Dec. 2013**		
No participants screening (>= 6y)		109 293			106 885			96 961		
Dutch population*		15 456 763			15 625 804			15 741 969		
	Avidity (nr fishtrips per year)	*No fishers in Screening Survey*	*% of fishers in Screening Survey*	*No of fishers in NL(±SE)*	*No fishers in Screening Survey*	*% of fishers in Screening Survey*	*No of fishers in NL(±SE)*	*No fishers in Screening Survey*	*% of fishers in Screening Survey*	*No of fishers in NL(±SE)*
Marine	1-5	3 595	3.3%	508 423 (8 339)	2 702	2.5%	395 011 (7 503)	2 286	2.4%	371 140 (7 670)
	6-10	584	0.5%	82 592 (3 409)	630	0.6%	92 101 (3 659)	446	0.5%	72 410 (3 421)
	11-25	241	0.2%	34 083 (2 193)	290	0.3%	42 396 (2 486)	253	0.3%	41 075 (2 579)
	26-50	62	0.1%	8 768 (1 113)	100	0.1%	14 619 (1 461)	82	0.1%	13 313 (1 470)
	> 50	49	0.1%	6 930 (990)	44	<0.1%	6 432 (970)	38	<0.1%	6 169 (1 001)
	total	4 531	4.1%	640 797 (9 320)	3 766	3.5%	550 562 (8 812)	3 105	3.2%	504 108 (8 901)
Fresh	1-5	5 659	5.2%	800 324 (10 360)	4 670	4.4%	682 720 (9 770)	3 927	4.1%	637 563 (9 966)
	6-10	2 451	2.2%	346 633 (6 922)	1 965	1.8%	287 269 (6 421)	1 547	1.6%	251 161 (6 335)
	11-25	1 522	1.4%	215 249 (5 478)	1 326	1.2%	193 852 (5 290)	1 107	1.1%	179 725 (5 371)
	26-50	613	0.6%	86 694 (3 492)	496	0.5%	72 512 (3 248)	447	0.5%	72 572 (3 425)
	> 50	316	0.3%	44 690 (2 510)	242	0.2%	35 379 (2 272)	170	0.2%	27 600 (2 115)
	total	10 561	9.7%	1 493 589 (13 814)	8 699	8.1%	1 271 730 (13 068)	7 198	7.4%	1 168 621 (13 253)
Total fresh+marine		11 943	10.9%	**1 689 039** (16 664)	9 573	9.0%	**1 399 502** (13 648)	7 974	8.2%	**1 294 608** (13 889)

* Number of inhabitants >= 6 years in January 2010, 2012 or 2014 (source: CBS)

Number of fishers RDD

The results of the RDD are that 1.7% of the participants fished in marine water and 6.0% fished in fresh water. The non-respondent survey resulted in slightly higher estimates; 2.8% and 6.8% for marine and fresh water respectively. A binomial *glm* was fitted to model differences in proportion of fishers between the RDD and the RDD non response analyses, which resulted in that the non-respondents did not differ significantly from the RDD (*logit(p)* = -2.45 - 0.20, p=0.35) and therefore, they were grouped.

This resulted in 6.7% of the respondents being fishers, which is somewhat lower than the estimate of the screening survey, which was 8.2% in 2013 (Table 4-3). Especially in marine waters, the number is lower than in the screening survey (1.8% vs. 3.2%). The RDD resulted in a total number of marine fishers of around 300 thousand. In fresh water the difference is smaller (6.1% vs 7.4% in the RDD and screening survey respectively). The results of the RDD would suggest an amount of almost 1 million fresh water fishers, whereas the screening would estimate 1.2 million fishers (Table 4-3).

Table 4-3 Results RDD survey (December 2013, January 2014). Number of fishers in the Netherlands per avidity group; per waterbody type; and the total number of fishers (six years and older).

Dutch population (≥ 6y)*		15 741 969				
		RDD 2013-2014			**Screening 2013**	
No participants (>= 6y)		3806			96 961	
	Avidity	*No fishers*	*% of fishers in RDD*	*No of fishers in NL (SE)*	*% of fishers in Screening Survey*	*No of fishers in NL(SE)*
Marine	1-5	58	1.5%	239 893 (34 285)	2.4%	371 140 (7 670)
	6-10	7	0.2%	28 953 (31 259)	0.5%	72 410 (3 421)
	11-25	4	0.1%	16 544 (10 933)	0.3%	41 075 (2 579)
	26-50	0	0.0%	0	0.1%	13 313 (1 470)
	> 50	1	<0.1%	4 136 (4 136)	<0.1%	6 169 (1 001)
	total	70	1.8%	*289 526 (63 797)*	3.2%	*504 108 (8 901)*
Fresh	1-5	126	3.3%	521 148 (45 653)	4.1%	637 563 (9 966)
	6-10	47	1.2%	194 396 (28 180)	1.6%	251 161 (6 335)
	11-25	34	0.9%	140 627 (24 009)	1.1%	179 725 (5 371)
	26-50	17	0.4%	70 314 (17 015)	0.5%	72 572 (3 425)
	> 50	8	0.2%	33 089 (11 686)	0.2%	27 600 (2 115)
	total	232	6.1%	*959 574 (61 049)*	7.4%	*1 168 621 (13 253)*
Total fresh + marine		255	6.7%	**1 054 704** (63 797)	8.2%	**1 294 608** (13 889)

* number of inhabitants >= 6 years in January 2014 (source: CBS)

4.3 Logbooks

Avidity

The distribution of avidities observed in the screening survey was dominated by the low avidity groups (Table 3-2). The avidity distribution of the logbook participants did not deviate much from the distribution observed in the screening survey, although the higher avidity groups were somewhat oversampled. 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 survey in 2010. Weighting for avidity was therefore needed to estimate the total amount of catches.

Participation

Almost half of the logbook participants responded every month of the logbook survey, the remainder responding 1-11 times. Of the group of fishers that responded 1-11 times, most fishers responded 8-11 times, which means that they were included in the analysis.

4.4 Marine: catch and effort

4.4.1 Numbers

In marine waters, most fishers had low yearly catches, independent of the species. However, in some cases, few fishers had very high catches per year (Figure 4-1).

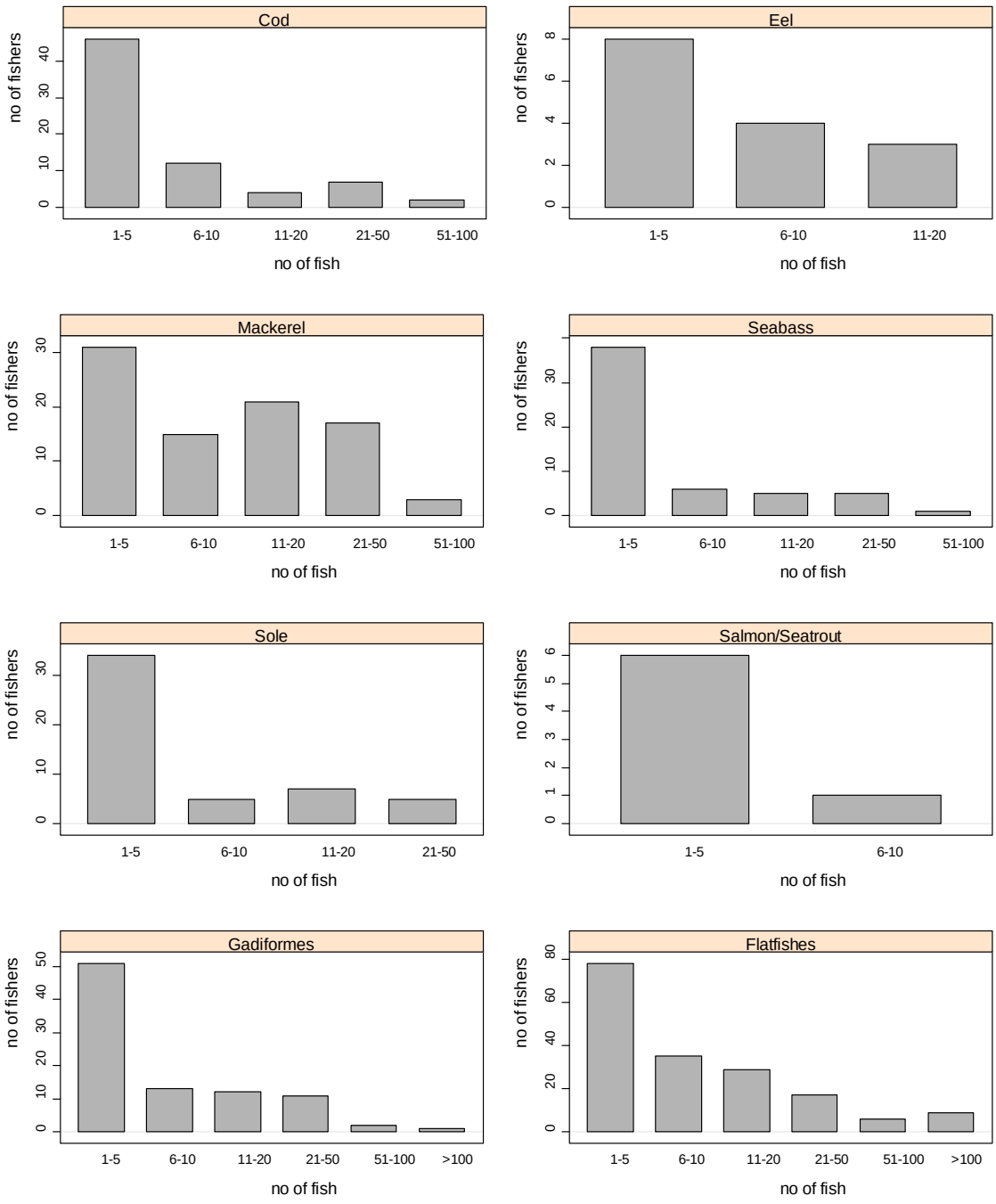


Figure 4-1 Yearly retained catch per fisher and species. Fishers that did not catch the specific species are not shown in this graph. Source: logbooks.

As expected, higher avidity groups had higher mean annual catches per year (Table 4-4). This trend was not observed for retained and returned catches for every species, some species had higher catches per year in lower avidity groups than in higher avidity groups. For example, the middle avidity group with 6-10 trips per year retained and returned on average more mackerel per fisher than the fishers from the highest avidity group (Table 4-4).

The total number of retained fish was estimated to be 7.2 million fish and the number of returned fish was 7.7 million fish (Table 4-5). Overall, the percentage of retained fish is high (>50%) for most species among marine anglers.

Table 4-4 Catch per year for marine fishes (anglers, catch numbers/fisher/year) per avidity group. Source: logbooks March 2012-February 2013.

	retained			**returned**		
Avidity (nr fishtrips per year)	1-5	6-10	>10	1-5	6-10	>10
Cod	0.98	0.81	2.32	0.48	0.64	2.22
Eel	0.17	0.26	0.02	0.09	0.09	0.33
Mackerel	2.17	3.27	2.59	1.70	1.86	1.56
Seabass	0.43	0.32	2.15	0.36	0.18	2.76
Sole	0.29	0.53	2.20	0.28	0.59	0.85
Salmon/Seatrout	0.05	0.06	0.03	0.02	0.00	0.06
Gadiformes	1.23	1.26	4.79	1.36	2.98	17.57
Flatfishes	3.04	3.98	26.61	1.90	4.15	21.88
Sharks	0.00	0.00	0.00	0.02	0.04	0.03
Rays	0.00	0.00	0.00	0.03	0.01	0.03
Total	8.90	10.83	41.98	7.94	12.39	53.36

Table 4-5 Catch estimates (in thousands), standard errors (SE, in thousands), relative standard errors (RSE), sample size of fish (Nfish) and sample size of fishers that caught the fish (Nfishers). RSE > 40%. Estimates for which less than 25 fishers are involved are highlighted in bold.

					retained					returned	
Species	Catch	SE	RSE	Nfish	Nfishers	Catch	SE	RSE	Nfish	Nfishers	% retained
Cod	609	140	23	615	71	392	91	23	439	67	61%
Eel	91	29	32	83	**15**	67	26	40	71	25	58%
Mackerel	1 324	191	14	1 294	87	941	281	30	881	50	58%
Seabass	335	88	26	376	55	332	71	21	397	61	50%
Sole	305	63	21	368	51	221	48	22	239	47	58%
Seatrout/ Salmon	27	12	**42**	25	**7**	13	7	**52**	13	**5**	68%
Gadiformes	907	155	17	987	90	1927	334	17	2487	111	32%
Flatfishes	3 255	639	20	3 990	174	2521	341	14	3211	194	56%
Sharks	0	-	-	0	**0**	15	5	32	15	**11**	0%
Rays	0	-	-	0	**0**	15	6	**42**	13	**7**	0%
Total	7 176	916	13	8 060	287	7661	849	11	9082	305	48%

4.4.2 Length frequency distribution

The weights of individual fish are calculated with a length weight relationship (Table 3-4) on the lengths as stated by the fishers in their logbooks, or on the lengths of the onsite survey if it contained at least 100 measured fish. These are cod, mackerel, seabass, the gadiformes group and the flatfishes group (Table 4-6).

Length measurements were only available for measured fish. The length frequency distribution of the 'measured' fish in the logbooks (Figure 4-2, eel, sole, seatrout/salmon and the gadiformes) shows that

for some species the variation in caught lengths is much higher than in other species. For cod, mackerel, seabass and the flatfishes, the used length frequency distribution comes from the onsite survey (Figure 4-2). The mean length, number of measured fish and the standard error for each fish species are listed in Table 4-6.

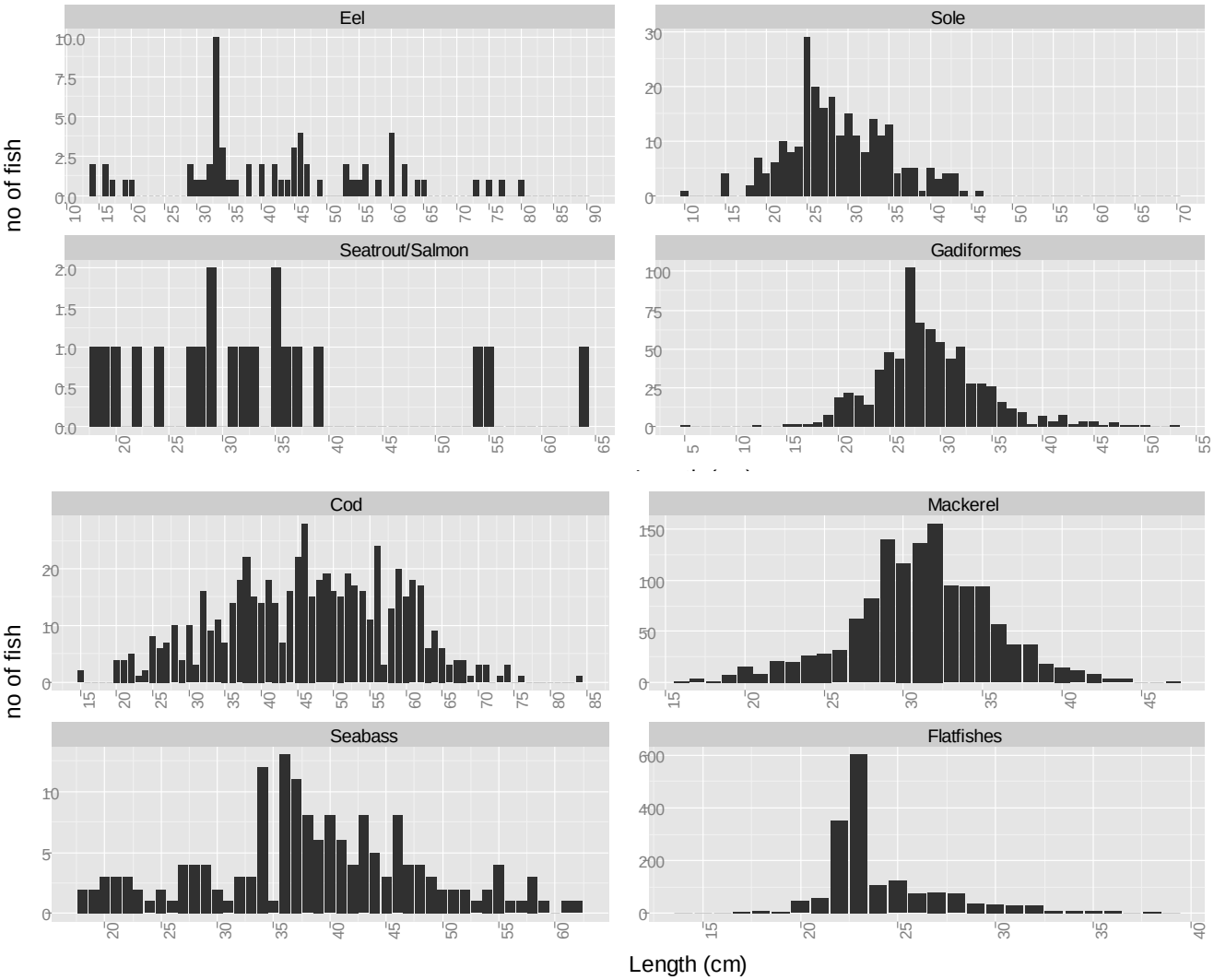


Figure 4-2 Length frequency distribution of retained and 'measured' fish lengths. Eel, Sole, Gadiformes and Seatrout/Salmon originate from the logbook survey, Cod, Mackerel, Seabass and Flatfishes from the onsite survey.

Table 4-6 Mean lengths (cm) of retained fish in marine waters. The underlined species or groups of species have more than 100 length measurements in the onsite survey.

Species	Mean length	*SE*	*N*	Onsite or Logbook
Cod	46.6	0.5	596	Onsite
Eel	42.7	1.9	65	Logbooks
Mackerel	31.1	0.1	1327	Onsite
Seabass	38.6	0.8	165	Onsite
Sole	27.0	0.7	173	Logbooks
Seatrout/Salmon	33.4	3.5	20	Logbooks
Flatfishes	24.2	0.1	1720	Onsite
Gadiformes	29.0	0.2	763	Logbooks

4.4.3 Biomass

Biomass estimates are only available for retained fish, because the lengths were not available for returned fish. The catches per year per fisher for each avidity group shows that in most cases the higher avidity groups have higher catches per year (Table 4-7). For eel, only 15 fishers caught eel in marine water. Also the number of fishers catching seatrout or salmon is quite low (7). These estimates are therefore considered as less reliable. In terms of biomass, cod has the highest absolute catches, followed by flatfishes and Mackerel (Table 4-7).

Table 4-7 Marine yearly catch estimates per fisher 2012-2013 (kg/fisher/year, retained, angling) per avidity group and total marine catch estimates (retained, agling, tonnes). RSE greater than 40% or estimates based on less than 25 fishers catching the fish species are in bold.

	Yearly catches per fisher (retained)			Total catch estimates (retained)			
avidity	1-5	6-10	>10	Catch	RSE	Nfish	Nfishers
Cod	1.20	0.96	2.77	737	22	615	71
Eel	0.04	0.05	<0.01	18	39	83	**15**
Mackerel	0.55	0.85	0.67	369	14	1 294	87
Seabass	0.27	0.24	1.55	229	26	376	55
Sole	0.07	0.13	0.46	67	21	368	51
Salmon/Seatrout	0.02	0.02	0.06	12	**42**	25	**7**
Flatfishes	0.58	0.79	4.49	587	18	3 990	174
Gadiformes	0.27	0.24	0.99	193	19	987	90

4.5 Fresh water: catch

4.5.1 Numbers

Yearly retained catch per fisher

The yearly retained catch per fisher results in a large group of fishers having low yearly catches: most fishers catch and retain only 0-5 fish per year. In many cases few fishers have high yearly catches per year (Figure 4-3).

Catches per year

In fresh water, the avidity group with 11-25 yearly fishing trips had the higher mean catches per year for retained fish than the highest avidity group (>25 yearly fishing trips, Table 4-8). For returned catches, the catches per year increases when the avidity increases. The highest avidity group apparently hardly retained their catch. The total number of retained fish is 3.6 million fish and the total number of returned fish is 6.1 million fish (Table 4-9). Two fishers caught and returned a large share of the total amount of pikeperch, which causes this species to have a large RSE (Table 4-9). The percentage retained fresh water fish is much lower than the percentage of retained marine fish (6% vs 48%, Table 4-9, Table 4-5).

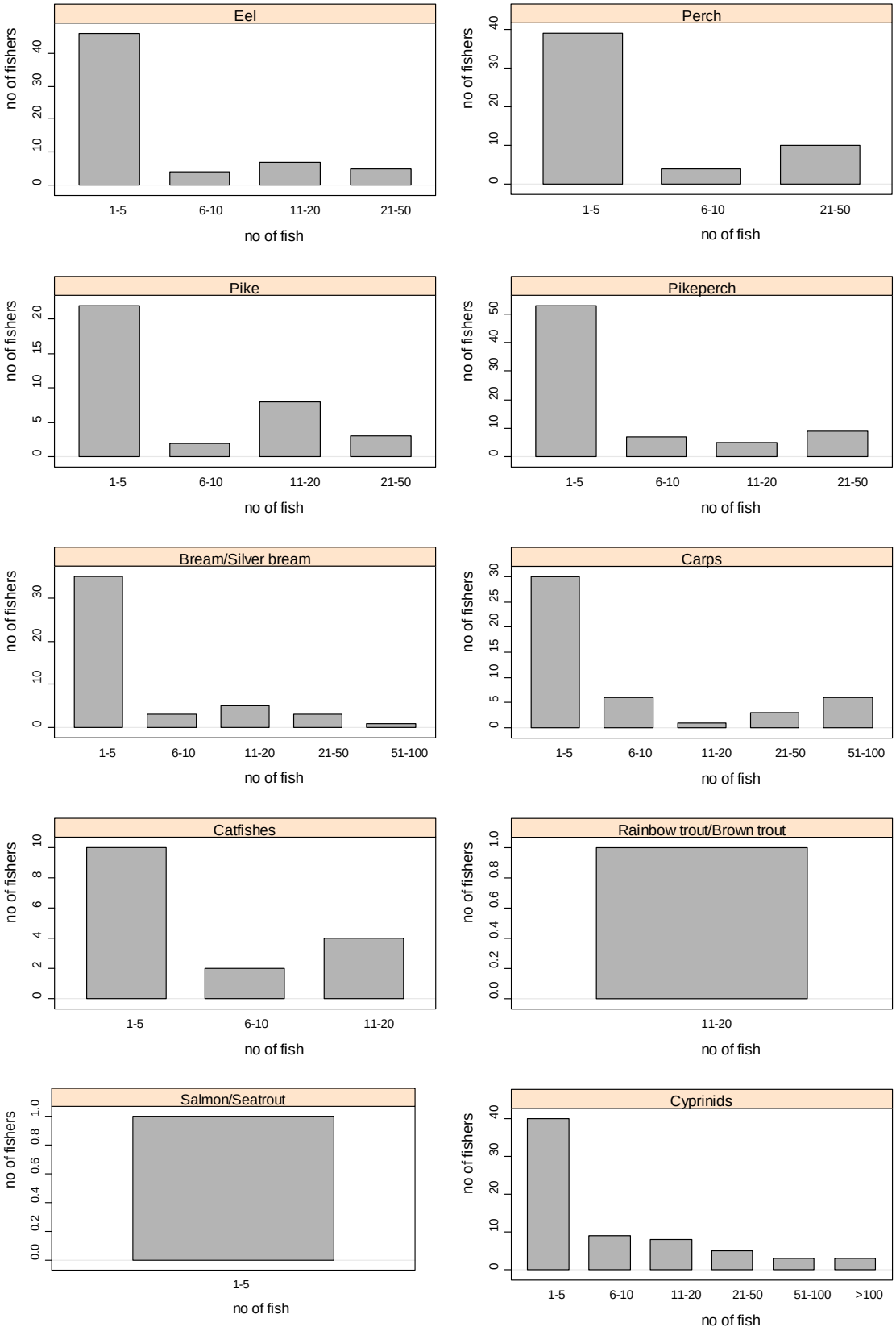


Figure 4-3 Yearly retained catch per fisher and species for the final dataset (NIPO & WEB).

Table 4-8 Catches per year (angling) fresh water species (catch in number/fisher/year) per avidity group. Source: logbooks March 2012-February 2013.

	retained				*returned*			
Avidity	1-5	6-10	11-25	>25	1-5	6-10	11-25	>25
Eel	0.08	0.37	0.64	0.28	0.58	2.31	1.54	1.46
Perch	0.13	0.22	1.30	0.07	1.71	5.58	7.90	26.65
Pike	0.11	0.12	0.64	0.00	0.50	1.09	2.87	5.39
Pikeperch	0.14	0.36	1.03	0.17	0.41	1.66	2.63	12.40
Bream/Silverbream	0.06	0.20	1.03	0.14	2.68	8.07	16.1	31.10
Carps	0.14	0.53	1.73	0.01	1.35	2.54	7.84	3.42
Catfishes	0.03	0.08	0.20	0.00	0.07	0.09	0.09	0.05
Rainbowtrout/Browntrout	0.00	0.00	0.06	0.00	0.01	0.03	0.28	0.04
Seatrout/Salmon	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
Cyprinids	0.28	0.44	2.80	0.40	8.90	18.0	42.2	101.8
Total	1.04	2.52	9.28	3.08	16.9	40.8	85.9	193.4

Table 4-9 Fresh water catch estimates 2012-2013 by anglers. Catch estimates (thousands), standard errors (SE), relative standard errors (RSE), total number of fish used for the raising and number of fishers that caught the fish. RSE > 40% and estimates for which less than 25 fishers are involved are in bold.

	retained					*returned*					
Species	Catch	SE	RSE	Fish	Fishers	Catch	SE	RSE	Fish	Fishers	% retained
Eel	313	63	20	376	62	1517	218	14	1840	195	17%
Perch	415	98	24	466	53	7174	1820	25	9149	573	5%
Pike	236	55	23	259	35	1790	370	21	2209	317	12%
Pikeperch	414	79	19	478	74	2604	1306	**50**	3415	253	14%
Bream/Silver Bream	316	87	27	364	47	10619	1735	16	13213	624	3%
Carps	583	148	25	670	46	3539	453	13	4099	436	14%
Catfishes	86	29	34	98	**16**	96	21	22	108	46	47%
Rainbow/Brown trout	12	NA	**NA**	13	**1**	74	53	**72**	85	**9**	14%
Salmon/Seatrout	2	NA	**NA**	3	**1**	5	4	**82**	5	**2**	30%
Cyprinids	901	238	26	1019	68	30399	5697	19	37823	786	3%
Total	3565	687	19	4143	231	60779	9297	15	75669	1169	6%

4.5.2 Length frequency distribution

Length measurements were only available for measured fish. The length frequency distribution of 'measured' fish shows high variation in caught lengths (Figure 4-4). The length frequency distribution is only slightly biased to round numbers (ending on a 5 or 0); 24% of the lengths are 0's and 5's, whereas 20% is expected. The mean length was estimated per fish species for measured and estimated lengths separately (Table 4-10). For eel, perch and pikeperch we also have some onsite data available, although the sample sizes are low. The mean lengths of measured fish are listed in Table 4-10.

Table 4-10 Mean lengths (cm) of retained measured fish in logbook survey in fresh water.

Species	Mean length	SE	N
Eel	35.4	0.8	333
Perch	28.1	0.4	389
Pike	37.4	1.0	261
Pike Perch	45.5	0.8	463
Bream/Silver Bream	32.0	0.8	258
Carps	31.3	0.3	601
Catfishes	29.4	1.1	102
Rainbow/Brown Trout	21.0	1.6	16
Seatrout/Salmon	16.6	0.4	55
Cyprinids	24.0	0.4	675

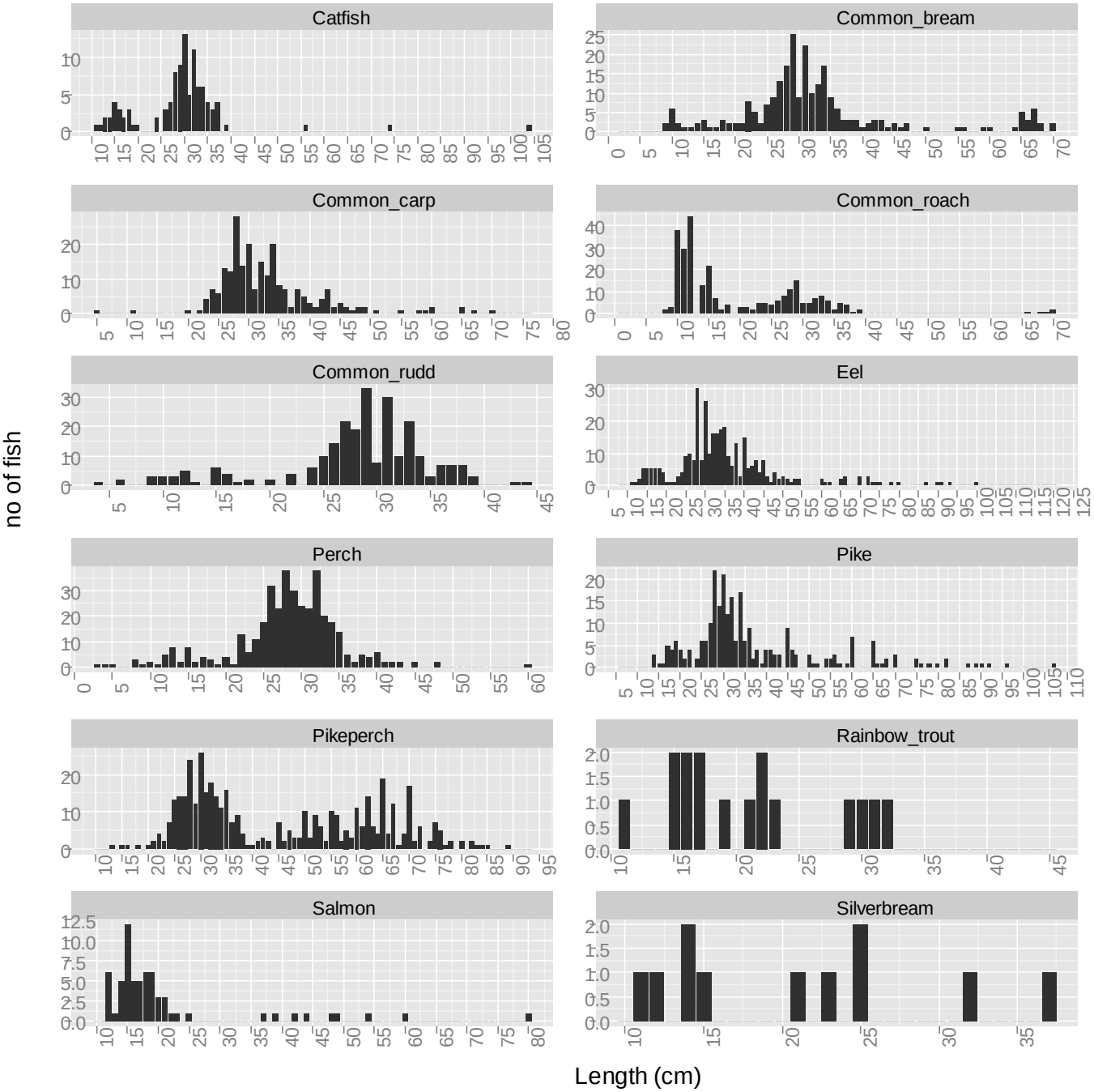


Figure 4-4 Length frequency distribution of 'measured' and retained fish in the logbook survey

4.5.3 Biomass

Biomass estimates are only available for retained fish, because the lengths were not available for returned fish. Catches in tonnes are estimated with weights derived from lengths from the measured lengths in the logbooks (Table 4-11).

Table 4-11 Fresh water yearly catch estimates 2012-2013 per fisher (kg/fisher/year, retained, angling) per avidity group and total fresh water catch estimates (retained, angling, tonnes). RSE greater than 40% or estimates based on less than 25 fishers catching the fish species are in bold.

	Catches per year (retained)				Total catch estimates (retained)			
Avidity	1-5	6-10	11-25	>25	Catch	RSE	Nfish	Nfishers
Eel	0.01	0.05	0.08	0.02	41	20	376	62
Perch	0.06	0.07	0.56	0.03	173	25	466	53
Pike	0.12	0.09	0.41	<0.00	187	27	259	35
Pikeperch	0.19	0.53	0.98	0.42	519	20	478	74
Bream/Silverbream	0.02	0.22	0.50	0.02	177	22	364	47
Carps	0.01	0.05	0.04	<0.01	531	23	670	46
Catfishes	0.27	0.39	1.22	0.01	26	23	98	**16**
Rainbowtrout/Browntrout	0.01	0.05	0.04	<0.01	2	**NA**	13	**1**
Seatrout/Salmon	<0.01	<0.01	<0.01	<0.01	0.2	**NA**	3	**1**
Cyprinids	0.06	0.15	0.65	0.06	218	28	1019	68

4.6 Foreign trips

Participants of the logbook survey were also asked to report their foreign fishing trips. This resulted in 757 marine and 1076 fresh water fishing trips made by the fishers in the logbook survey. Most foreign fishing trips were in neighbouring countries (Belgium, Germany, France, Table 4-12).

Table 4-12 Number of fishing trips by Dutch fishers in foreign countries from March 2012 to February 2013.

Country	**Marine**	**Fresh**	**Country**	**Marine**	**Fresh**
Austria	0	19	Italy	2	22
Belgium	152	312	Luxemburg	0	15
Bonaire	10	0	Norway	78	43
Canada	6	11	Portugal	11	0
Croatia	25	0	Russia	0	13
Curacao	5	0	Scotland	4	19
Denmark	70	3	Spain	39	23
England	4	6	Sweden	3	45
France	112	278	Turkey	16	3
Germany	124	203	United States	25	17
Greece	34	0	Other	28	38
Ireland	9	6	Total	757	1076

5 Discussion

5.1 Screening survey: number of recreational fishers

5.1.1 Participation rate

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 fishing is similar to this average but has been slowly declining from 10.9% (1.7 million fishers) in 2009 to 8.2% (1.3 million fishers) in 2013 (Table 4-2 and Figure 5-1). 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).

Despite the decline in the participation rate, the number of purchased fishing licenses has remained relatively stable over the past four years. Note, however, that only half of the fresh water fishers actually obtain the obligatory fishing licence (Figure 5-1). 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 (Boer et al., 2010). In marine waters a license is voluntary and less than 1% of the marine recreational anglers actually purchases a fishing licence.

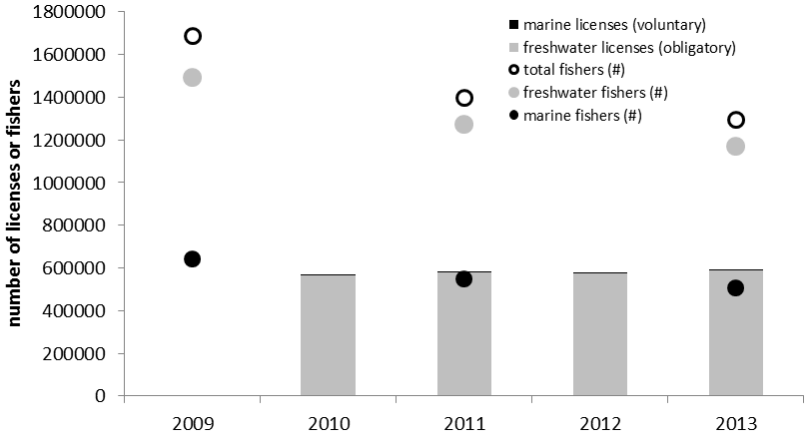


Figure 5-1 Overview of the number of recreational fishers (circles) and the number of sold licenses (histogram). Source license sales 2010-2014, Sportvisserij Nederland.

5.1.2 Online vs. RDD screening survey

The ICES Working Group on Recreational Fisheries Surveys advised the Netherlands to determine if the fishing behaviour (participation rate) of members of the TNS-NIPO data base is representative for the population of Dutch recreational fishers. TNS-NIPO recruits panel members to ensure that the demographics of its database match the demographics of the Dutch population in many aspects, such as age, location, gender and educational level. In theory it is possible that people who like to participate in regular market surveys, i.e. members of the TNS-NIPO database, deviate in fishing behaviour from the average Dutch person.

To test if the online screening survey of the TNS-NIPO data base is representative for the Dutch population, a random digit dialling phone survey was conducted parallel to the 2013 online screening survey. The sample size of the RDD survey (1500 interviews; 255 fishers in the survey) was small compared to the online survey (50 000 interviews; 7974 fishers in survey). The estimated population of Dutch fishers of both surveys was similar (Table 4-3). Based on the outcome of the online and RDD surveys there seems to be little concern regarding representativeness of the online screening survey for the estimation of the number of Dutch recreational fishers.

The online screening survey is relatively cost-effective (€15k) and high numbers of fishers can be contacted (large panel; ~50 000 household, ~100 000 people). Therefore, the online survey method will be continued in the future and the next screening survey is planned for December 2015.

5.2 Logbook survey: catches

5.2.1 Cod, seabass, eel and pikeperch

For some species, recreational catches can be substantial compared to the total landings (commercial landings and recreational catches combined). As percentage of the total landings, the percentage of seabass recreational catches is highest (38%, Table 5-1), followed by cod (27%). On the other hand, for sole and other flatfishes, the proportion is quite low (~1%). Commercial catch statistics for fresh water species are unavailable with the exception of eel.

Table 5-1 Commercial catches vs. recreational catches (tonnes) in 2012.

Species	***Commercial landings***	***Commercial landings***	***Recreational Landings***	***% recreational landings***
Eel	Dutch landings inland waters in 2012	350	41	11%
Cod	Dutch landings from area IV in 2012 (ICES 2014c)	1 955	737	27.4%
Seabass	Dutch landings in IVbc, VIIa, and VIId–h in 2012 (ICES 2014e)	372	229	38.1%
Sole	Dutch landings in Subarea IV in 2012 (ICES 2014d)	9 089	67	0.7%
Plaice	Dutch landings in Subarea IV in 2012 (ICES 2014f)	32 201		
Dab	Dutch landings in Subarea IV in 2012 (ICES 2015b)	4 130		
Flounder	Dutch landings in Subarea IV in 2012 (ICES 2015b)	1 673		
Flatfishes		38 004	587	1.5%

Both the retained and released catches of cod and seabass increased from 2010 to 2012 (Table 5-2). The percentage of released fish also increased for both species, stressing the urgent need for studies on post-harvest mortality to estimate total fishing mortality and to develop best practises guidelines to minimize the impacts of C&R on released fish (Ferter et al. 2013). In addition to minimal landing sizes for cod and seabass, a bag limit, restricting the combined possession of seabass and cod to 25 pieces or 20 kg was introduced in June 2013 (Staatscourant, 2013). Towards the end of 2014 an international discussion was initiated by the EU to determine if further size and/or bag limit restriction will need to be implemented for commercial and recreational seabass fisheries.

Overall, the retained catches of eel declined while the amount of released eel increased between 2010 and 2012. In marine waters both the number and biomass of retained and released eel declined roughly by 50%. However, the number of eel caught in marine waters is uncertainty due to only a small number of fishers catching eel in marine waters. The number of retained eel in freshwater only slightly increased in number but did markedly change in biomass due the reported smaller average size in the logbooks of retained eel in 2012 compared to 2010. Unfortunately, no onsite length data are available for eel. In freshwater the number of released eel by recreational anglers increased with more than 50%, from

roughly 0.9 to 1.5 million eels. Similar to cod and seabass, these changes stress the urgent need for studies on post-harvest mortality.

In 2012 the amount of retained pikeperch increased compared to 2010. The amount of released pikeperch also increased, but this data point has a high uncertainty due to a few fishers catching and releasing a large amount of pikeperch, resulting in an RSE of 50% (Table 4-9).

Table 5-2 Overview of the retained (number and biomass) and released (number) cod, seabass, eel and pikeperch by recreational anglers in 2010 (van de Hammen & de Graaf, 2013) and 2012 (this report).

				2010				***2012***
		retained	**released**	**% retained**		**retained**	**released**	**% retained**
	tonnes	**numbers**	**numbers**		**tonnes**	**numbers**	**Numbers**	
Cod	631	522 000	168 000	76%	737	609 000	392 000	61%
Seabass	129	227 000	127 000	64%	229	335 000	332 000	50%
Eel	111	466 000	967 000	32%	59	404 000	1 584 000	20%
fresh	*75*	*294 000*	*862 000*	*25%*	*41*	*313 000*	*1 517 000*	*17%*
marine	*36*	*172 000*	*114 000*	*60%*	*18*	*91 000*	*67 000*	*58%*
Pikeperch	300	149 000	1 610 000	8%	519	415 000	2 604 000	14%

In Table 5-3 an overview is presented of the most recent marine recreational harvest estimates for several European countries (ICES 2014a). Note that these estimates are limited to marine waters and include catches of angling and/or passive gears such as fykes or gill nets. At present estimates of recreational harvest are only available for a limited amount of countries. For seabass the Dutch harvest is in the same order of magnitude as reported for the Basque country and UK (England only). The harvest of cod is considerably lower in the Netherlands compared to most other European countries bordering the North Sea.

In the Netherlands most eel is retained by freshwater recreational fishers, unfortunately few estimates of freshwater harvest of eel are currently available for other EU member states (*see Table 2.9 WGEEL 2014b, page 53-55*). In many countries the harvest of eel by recreational anglers is banned and only catch & release fishery for eel is allowed. In countries such as Denmark, Germany, Portugal, Spain and France the amount of harvested and/or released eel by recreational anglers in inland waters is not recorded to date. In the UK (England) very few eel were found to be retained by recreational anglers in marine waters compared to the Netherlands. The Danish harvest estimate of retained eel (49 t) in marine waters is from passive gears (fykes) and does not include the harvest by marine anglers.

In the Netherlands the use of gill nets for recreational purposes is allowed in certain coastal waters (Staatscourant 2011, 2012). In addition, recreational gill net fishers need to register in appropriate coastal municipalities. The coastal municipalities that allow a recreational gill net fishery were approached to estimate the number of registered fishers. In 2013, ~700 recreational gill net fishers were registered in the Netherlands. Most of these registered gill net fishers were approached and invited to participate in the 2014 logbook survey and eventually 100 gill net fishers agreed to participate the survey. Preliminary results of the 2014 survey demonstrate that in gill net fishery, seabass is an important target species (30% of the retained fish) compared to for example cod (3% of the retained fish). However, considering the low number of registered recreational gill net fishers (~700 individuals), a rough estimate of the total harvest of seabass (~5000 specimen) and cod (~500 specimen) by these fishers is relatively small (unpublished results) compared to the harvest of these two species (~335 000 seabass; ~609 000 cod) by the large (~500 000) group of marine anglers. The final harvest estimates of the recreational gill net fishery will be presented in a follow up report.

Table 5-3 Overview of the most recent marine recreational harvest (angling and/or passive gears) estimates in tonnes (t) and/or numbers (#) for seabass, cod and eel (sources ICES 2014a, b). RSE is the relative standard error.

	Seabass		***Cod***		***Eel***	
Country	**Retained**	**Released**	**Retained**	**Released**	**Retained**	**Released**
Norway (2003, 2009)			24 600 t			
Sweden (2010)			368 t	276 t		
Finland (2012)			3 t	0 t	2 t	0 t
Lithuania (2013)			10 t; 6700 #		3 t	
Denmark (2013)			1600 t	1 430 000 #	49 t	68 000 #
Poland			850 t			
			1 545 454 #			
Germany			3206 t	924 t		
			2 377 215 #	2 146 471 #		
UK (England only)	230-440 t	150-250 t	430-820 t	50 t	5300 #	32 000 #
(2012)	243 000#	467 000#	281 000 #	201 000 #		
France (2012*)	3922 t	776 t.				
Spain (Basque country)	166t (2011)				1.5 t**	
					(2012-13)	
Netherlands (2012)	335 000 (#)	332 000 (#)	609 000 (#)	392 000 (#)	404 000 (#)	1 584 000 (#)
	229 t		737 t		59 t	

*provisional, **recreational glass eel catch

5.2.2 *Salmon, sharks and rays*

In 2009 the EU Action Plan for the Conservation and Management of sharks was adopted (EC 2009). This Action Plan pursues three specific objectives: 1) to improve knowledge of fisheries and shark species, as well as their role in the ecosystem, 2) to introduce sustainable exploitation of shark stocks and to reduce by-catches, and 3) to enhance a coherent approach between the internal and external community policy for sharks. The need for more knowledge on the occurrence of elasmobranchs in the North Sea and the interaction with the commercial and recreational fishery has increased. An overview of shark and ray landings by the Dutch commercial fishing fleet was recently published by Overzee et al. (2014). One of the recommendations of Overzee et al. (2014) was the improvement and cooperation with regards to data collection of shark and ray catches of the recreational fishery. The first estimates of shark and ray catches by Dutch recreational anglers are presented in Table 5-4. Shark & ray fishery by recreational anglers appears to be strictly a catch & release fishery in the Netherlands as no retained catches were reported by the participants of the logbook survey. The number of released sharks and rays are roughly the same (15 000#) but these estimates need to be interpreted with caution as the number of fishers in the logbooks who caught sharks or rays is very low (11 fishers who caught 15 sharks and 7 fishers who caught 13 rays). Three shark species (spurdog, smooth hound and lesser spotted dogfish) and two ray species (thornback ray and stingray) were reported by the participants of the logbook survey (Table 5-5).

Table 5-4 Overview of the most recent marine recreational harvest estimates in tonnes (t) and/or numbers (#) for salmon, sharks & rays (source ICES 2014).

	Salmon		***Sharks & Rays***	
Country	**Retained**	**Released**	**Retained**	**Released**
Sweden (2013)	73 t			
Finland (2012)	36 t	3 t		
Lithuania (2013)	0.5 t; 120 #			
Denmark (2013)	3000 #			
Germany (2011)			50-100 # (mainly tope shark)	
UK (2012)			41 000 # skates & rays 4 200 # smooth-hound 20 # tope shark 46 000 # dogfish spp.	39 000 # skates & rays 190 000 # smooth-hound 6800 # tope shark 448 000 # dogfish spp.
Netherlands*	27 000 #	13 000 #	0 # rays	15 000 # rays
(marine, 2012)	12 t		0 # sharks	15 000 # sharks
Netherlands*	2 000 #	5 000 #		
(freshwater,	0.2 t			
2012)				

*angling only, salmon and seatrout pooled

Table 5-5 Status of some ray and shark stocks as defined by ICES Working Group of Elasmobranch Fishes based on survey and landings data (ICES 2013).

Species (UK)	***Species (NL)***	***Species***	***ICES area***	***Status***
Spurdog	Doornhaai	*Squalus acanthias*	NO Atlantic	possibly below reference points
Smooth hound	(gevlekte) gladde haai	*Mustelus mustelus & M. asterias*	Iva,b,c; VIId	Increasing
Lesser spotted dogfish	Hondshaai	*Scyliorhinus canicula*	Iva,b,c; VIId	Increasing
Thornback ray	Stekelrog	*Raja clavata*	IVc; VIId	Stable/increasing
			IVab	uncertain

5.2.3 *Total retained catch*

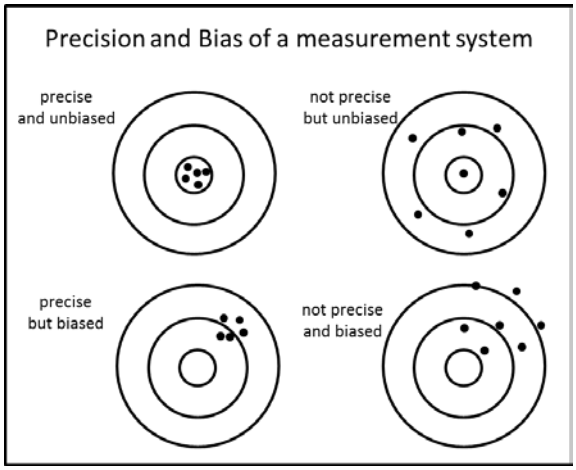
In freshwater the number of retained fish, released fish and the percentage of retained fish have all increased compared to the 2010 survey (Table 5-6). Between 2010 and 2012 the number of freshwater anglers declined. In other words: in 2012 fewer anglers caught and retained more fish than in 2010.

Among marine anglers the patterns are a bit more complicated. The number of retained fish decreased but the number of released fish increase between 2010 and 2012. Hence, the percentage of retained fish decreased markedly. The total (retained + released) catch of marine and freshwater anglers increased between 2010 and 2012 with 12% (1.7 million fish) and 20% (11.1 million fish), respectively.

Table 5-6 Overview of the total retained and released number of fish in marine and freshwater by recreational anglers in 2010 (van de Hammen & de Graaf, 2013) and 2012 (this report).

	2010			***2012***		
	retained	**released**	**% retained**	**retained**	**released**	**% retained**
Freshwater	2 472 000	50 729 000	5%	3 565 000	60 779 000	6%
Marine	9 350 000	3 833 000	71%	7 176 000	7 661 000	48%

5.3 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 figure to the right illustrates bias and precision for a parameter of interest, where the target, true value is the smallest circle in the middle, the bull's-eye. Precise and unbiased estimates of the target values are accurate (top left corner). It should be noted that accurate estimates cannot be obtained from significantly biased sampling schemes (i.e. recall bias, non-response bias, digit preference and/or prestige bias). Whereas 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.

5.3.1 Minimizing bias

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 similar looking species would be grouped (Table 3-3) before analysis. The actual magnitude of species that may have been identified incorrectly is unknown. Therefore, an online fish ID test was developed in cooperation with Sportvisserij Nederland and TNS-NIPO. It is our intention that the online fish ID test will be offered to participants of the 2016 logbook survey in order to quantify the extend of species identification issues.

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 (Appendix E). This addition simplified the analysis and improved the accuracy of the estimate of "wild" caught salmon and trout species, although these estimate still have a low precision.

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 logbook survey the fishers should indicate if they had 'measured' or 'estimated' the lengths of their retained fish. In the 2012-2013 survey, the 'measured' lengths had clearly less bias to rounded measures. 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 24% was observed (marine or fresh). When the fishers indicated that the lengths of the

fish were estimated, the distribution was highly biased to 0's or 5's (49% and 50% of marine and fresh water fish respectively). This is an indication that the length frequency data of the 2012-2013 survey is more reliable than in the 2010-2012 survey. The option of reporting whether the lengths are 'measured' or 'estimated' is maintained in the 2014-2015 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. These records will 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.

5.3.2 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% (Table 4-5 and Table 4-9). For some species, however, the catch estimate 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.

5.4 Catch & Release mortality

In this report, the potential issue of mortality among released fish has not been addressed. However, 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 example, 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. The retained catches presented in this report are an underestimate of the true mortality rate of recreational angling due to unaccounted catch and release mortality.

A recent publication by Ferter et al. (2013) demonstrated high release rates (>60%) for Atlantic cod (*Gadus morhua*) and European seabass (*Dicentrarchus labrax*) in different European countries, suggesting that post-release mortalities of released fish should be accounted for in estimated fishing mortalities. Similar high release rates occur in the Netherlands for cod (40%), seabass (35%) and eel (80%). Unfortunately, hardly any C&R studies are available for these three species. 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 5-7 a rough estimate of C&R mortality is presented for cod, seabass and eel in the Netherlands. Only one study for cod is 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% C&R mortality for cod caught by charter boats in the North Sea is possibly conservative.

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 Massachusetts Division of Marine Fisheries estimated that the mean hooking mortality of striped bass was 19% based on 40 different experiments by 16 different authors (ICES 2015). Experiments are needed to estimate hooking mortality for seabass for conditions and angling methods typical of local recreational fisheries. However, until these experiments are conducted, the C&R mortality rate for striped bass can be used as an proxy for seabass C&R mortality rates.

The C&R mortality rates of eel by the recreational fishery was not accounted for during the evaluation of the Dutch Eel Management plan in 2012. However, because more than 1.5 million eel are released annually by recreational anglers, this could result in a considerable amount of additional and unquantified mortality. Unfortunately, to date no active gear C&R mortality studies exist for European eel. Only 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 van Economische Zaken, 1940). After six weeks eel caught by the trawl (control) was still alive, but 18% of the eel caught by the longline had died. Nine eels had lost the hook, 15 eels contained a hook in the stomach, 2 eels had a hook in the guts and 1 eels had a hook in gills. The author suspected that eels with a hook remaining in their body after six weeks would eventually die because of the hook, which would result in a total estimated mortality of 72%. Another study took place in the Lough Neagh eel fishery (Evans & Rosell, 2008), which showed that of 600 released undersize eels, 45% had hooks deep inside in the oesophagus, stomach or penetrating the stomach and of roughly 20% of the released eels the hook was considered to result in potentially lethal effects (Evans & Rosell, personal communication). Furthermore, their study demonstrated that hooks baited with earthworm resulted in more potentially lethal hooking locations than hooks baited with fish (Evans & Rosell, 2008).
Using mortality rates from passive gears (~20%) as a proxy for C&R mortality of active gears (angling) may, however, 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. Passive fishing using set lines had higher mortality rates for lake trout (Persons and Hirsch, 1994) and rainbow trout (Schisler and Bergersen, 1996) than actively fished lines.
We propose a practical solution for the percentage of eel C&R mortality by recreational anglers. Based on the review of Bartholomew and Bohnsack (2005) and the available studies on the C&R mortality of eel in

passive gears we suggest a C&R mortality range for recreational angling between a minimum of 7% ('mode' in Bartholomew and Bohnsack (2005)) and a maximum of 18% ('mean in Bartholomew and Bohnsack (2005) and similar to passive gear mortality studies). Until future studies provide more accurate insight we suggest for eel a C&R mortality of 12% (similar to the 'median' in Bartholomew and Bohnsack (2005)) to be used for recreational anglers. From a precautionary point of view high estimates of C&R mortality are more precautionary than low estimates. Insight in post-release survival and best practise guideline for eel are urgently needed in the Netherlands and the rest of Europe. In 2015 a C&R mortality study for eel is being planned in co-operation with German scientists.

In conclusion, until future studies provide more accurate insight into C&R mortality rates, we suggest to use the following C&R mortality rates for estimations of total mortality by recreation angling for cod, seabass and eel (Table 5-7):

- Cod: C&R mortality of 11% following Weltersbach and Strehlow (2013),
- Seabass: C&R mortality of 19% following ICES (2015 and references therein), and
- Eel; C&R mortality of 12% based on the median value of mortality rates presented in Bartholomew and Bohnsack (2005).

Table 5-7: Estimate of total mortality in numbers induced by recreational angling in the Netherlands.

		Retained (#)	***Released (#)***	***C&R mortality (%)***	***C&R mortality (#)***	***Total mortality (retained + C&R)***
Cod		609 000	392 000	11%*	43 000	652 000
Seabass		335 000	332 000	19%**	63 080	398 080
Eel	*total*	404 000	1 584 000	12%***	190 080	594 080
	freshwater	*313 000*	*1 517 000*	*12%****	*182 040*	*495 040*
	marine	*91 000*	*67 000*	*12%****	*8 040*	*99 040*

*Weltersbach & Strehlow 2013, **ICES 2015, *** Bartholomew & Bohnsack 2005

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7 Appendix A

Questionnaire screening survey December 2013 (in Dutch).

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

Heeft u dit jaar, in 2013, 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.

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 2013, 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	○	○

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

Min 1 | Max 999

Hoe vaak heeft (inlezen persoon die bij vraag 1 op 'ja' staat) in 2013 ongeveer gevist in Nederlands zeewater of kustwater?

Aantal keer:

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 *Position fixed*

Q40 : Vraag 2 - Vissen in binnenwater eenpersoons huishouden — **Matrix**

Heeft u dit jaar, in 2013, 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.

Q4 : Vraag 2 - Vissen in binnenwater meerpersoons huishouden **Matrix**

Wilt u voor elk lid van uw huishouden aangeven wie er dit jaar, in 2013, 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	○	○

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

Min 1 | Max 999

Hoe vaak heeft (inlezen persoon die bij vraag 2 op 'ja' staat) in 2013 ongeveer gevist in Nederlands binnenwater?

Aantal keer:

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 *Position fixed*

Q70 : Vraag 3 - Van plan te vissen in 2014? eenpersoons huishouden **Matrix**

Bent u van plan om volgend jaar, in 2014, te gaan vissen?

	ja	nee
inlezen gezinslid 1	○	○

Q7 : Vraag 3 - Van plan te vissen in 2014? meerpersoons huishouden **Matrix**

Wilt u voor elk lid van uw huishouden aangeven wie van plan is om volgend jaar, in 2014, te gaan vissen?

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

Q8 : Vraag 3a - Waar van plan te vissen in 2014? **Multi coded**

Waar is (inlezen persoon die bij vraag 3 op 'ja' staat) van plan om volgend jaar, in 2014, te gaan vissen?

Meerdere antwoorden mogelijk

1 ☐ binnenwateren
2 ☐ zeewater of kustwater

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

In 2014 wordt er voor de derde keer een grootschalig project met betrekking tot recreatieve visserij uitgevoerd door IMARES (Institute of Marine Resources and Ecosystem Studies).

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. In het logboekje houdt u maandelijks bij of en hoe vaak u gevist heeft, hoeveel u heeft gevangen, waar u gevist heeft enz. 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?

1 ☐ inlezen gezinslid 1, van plan te vissen in 2014
2 ☐ inlezen gezinslid 2, van plan te vissen in 2014
3 ○ niemand

8 Appendix B

Questionnaire Random Digit Dialing (RDD) Survey.

Q1 : Introductie, meedoen aan onderzoek — Single coded

Goede[morgen/middag/avond], u spreekt met ... van TNS NIPO.
Ik zou graag enkele vragen willen stellen aan het eerst jarige gezinslid dat momenteel thuis is.

(ENQ.: Indien deze persoon niet aanwezig of te jong om de telefoon te beantwoorden, lees op...).
Dan zou ik deze vragen graag stellen aan het gezinslid dat na deze persoon het eerst jarig is en momenteel thuis is.
TNS NIPO houdt momenteel een onderzoek over hobby's, sport en vrijetijdsbesteding.
Heeft u nu 1 a 2 minuten tijd om enkele vragen te beantwoorden?

1 ○ er kan nu met het vraaggesprek begonnen worden
2 ○ er kan een afspraak gemaakt worden met de respondent
3 ○ gesprek kan geen doorgang vinden/weigering

B1 : Achtergrondgegevens — Begin block

Q2 : Huishoudgrootte — Numeric

Min 1 | Max 99

Nu zou ik, om te beginnen, eerst graag wat achtergrondgegevens van uw huishouden in kaart brengen.
Uit hoeveel personen bestaat uw huishouden, uzelf meegerekend?

Een huishouden bestaat uit één of meer personen die alleen of samen wonen en een gezamenlijk huishouden voeren.

Q3 : — Numeric

Max 99

Wat is uw leeftijd?

Q4 : Geslacht van persoon — Single coded

Wat is uw geslacht?

1 ○ man
2 ○ vrouw

B2 : herhaalblok — Begin block

Q5 : — Numeric

Max 99

Wat is de leeftijd van gezinslid <2>?

Q6 : Geslacht van persoon — **Single coded**

Wat is het geslacht van deze persoon?

1 ○ man
2 ○ vrouw

B2 : herhaalblok — **End block**

Q16 : — **Single coded**

Beschikt uw huishouden over een internetverbinding?

1 ○ ja
2 ○ nee

B1 : Achtergrondgegevens — **End block**

Q7 : — **Single coded**

De volgende vragen gaan over hobbies en vrijetijdsbesteding van u en uw gezinsleden.

Heeft u of iemand anders in uw huishouden in 2013 gevist in Nederland?

1 ○ ja
2 ○ nee
3 ○ weet niet **Position fixed*

B3 : Visgedrag — **Begin block**

Q8 : Visgedrag zee- en/of kustwater eenpersoons — **Matrix**

Heeft u dit jaar, in 2013, 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	○	○

Q9 : Frequentie zee- en/of kustwater eenpersoons **Numeric**

Min 1 | Max 999

Hoe vaak heeft u in 2013 ongeveer gevist in Nederlands zeewater en/of kustwater?

Aantal keer:

Q10 : Visgedrag zee- en/of kustwater meerpersoons **Matrix**

Wilt u voor elk lid van uw huishouden, inclusief uzelf, aangeven wie er dit jaar, in 2013, 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	○	○

Q11 : Frequentie zeewater en/of kustwater meerpersoons **Numeric**

Min 1 | Max 999

Hoe vaak heeft (inlezen persoon die bij vraag 10 op 'ja' staat) in 2013 ongeveer gevist in Nederlands zeewater en/of kustwater?

Aantal keer:

Q12 : Visgedrag binnenwater eenpersoons **Matrix**

Heeft u dit jaar, in 2013, 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	○	○

Q13 : Frequentie binnenwater eenpersoons **Numeric**

Min 1 | Max 999

Hoe vaak heeft u in 2013 ongeveer gevist in Nederlands binnenwater?

Aantal keer:

Q14 : Visgedrag binnenwater - meerpersoons | **Matrix**

Wilt u voor elk lid van uw huishouden, inclusief uzelf, aangeven wie er dit jaar, in 2013, 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	○	○

Q15 : Vraag - Frequentie binnenwater meerpersoons | **Numeric**

Min 1 | Max 999

Hoe vaak heeft (inlezen persoon die bij vraag 14 op 'ja' staat) in 2013 ongeveer gevist in Nederlands binnenwater?

Aantal keer:

B3 : Visgedrag | **End block**

T1 : | **Text**

Dan heb ik verder geen vragen meer voor u. Ik wil u hartelijk danken voor uw tijd.
Een fijne dag gewenst.

9 Appendix C

INSTRUCTIES LOGBOEK

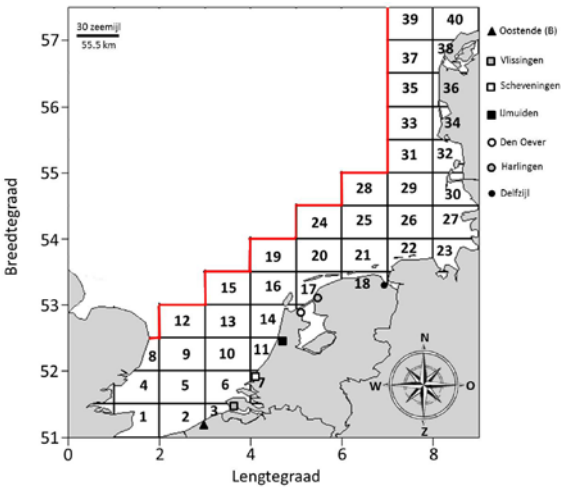
Als u gaat vissen vergeet dan niet de zoekkaarten, een liniaal of rolmaat en een aantal logboekblaadjes mee te nemen.

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

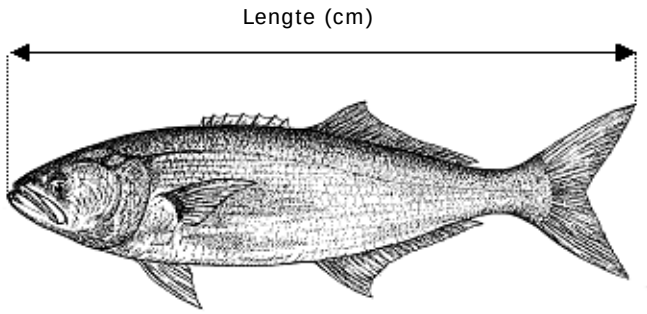
Een vistrip is een aaneengesloten periode van vissen in één en hetzelfde viswater met hetzelfde vistuig op één dag.
Wanneer u op dezelfde dag duidelijk wisselt van viswater (vislocatie) bijvoorbeeld van een plas naar een rivier of van het binnenwater naar zeewater, is het de bedoeling dat u voor elk 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.



Figuur 1 Een overzicht van de indeling van de internationale opdeling van de kustwateren rond Nederland in "blokken". Als u heeft gevist in zee-en kustwater noteert u dan het juiste bloknummer.

- **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 (maart 2012-february 2013)

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

10 Appendix D

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

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

returned 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 returned 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*.

11 Appendix E

Logboek Recreatieve Visser Nederland

DATUM: | BEGINTIJD: | EINDTIJD: | GEEN VIS GEVANGEN ☐

LOCATIE

Nederland ☐ ▶ KM van huis: ▶ ▶

Provincie

Groningen	Friesland	Drenthe	Overijssel	Flevoland	Gelderland	Utrecht	Noord-Holland	Zuid-Holland	Zeeland	Noord-Brabant	Limburg
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Buitenland ☐ ▶

VISWATER

Zee-en kustwater ☐ ▶ Bloknummer: ▶ ▶ Indien vanaf de kant gevist: Strand ☐ Dijk of Pier ☐

Binnenwater ☐ ▶ Forelvijver ☐ Stadswateren ☐ Meren en plassen ☐ Sloot ☐ Kanaal ☐ Grote rivier ☐ Kleine rivier ☐

Kant ☐

Boot ☐ ▶ max. aantal passagiers: eigen boot ☐ boot van anderen ☐ charterboot/huurboot ☐

VISTUIG

hengel ☐ ▶ | hoekwant ☐ ▶ | fuik ☐ ▶

peur ☐ ▶ | staand want ☐ ▶ | Anders nl.: ▶

VANGST SOORT	**TERUGGEZET** (AANTAL)	**MEEGENOMEN** (vul hier de lengte (cm) voor elke vis apart in)

Signature

Report: C042/15
Project number: 4301216005

Bascode: WOT-05-406-009
Approved:

dr. J.J. Poos
Senior Researcher

Signature:

Date: 1 April

drs. J. Schobben
Head of Department

Signature:

Date: 1 April