Recreational fishery in the Netherlands: demographics and catch estimates in marine and fresh water

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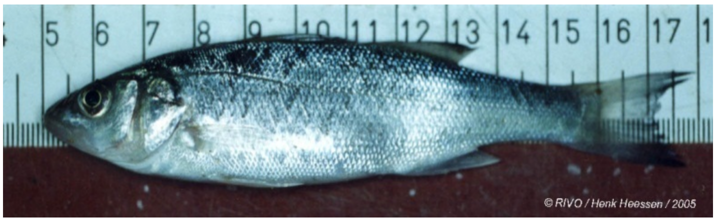
Report number C147/13



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Uitgebreide Nederlandse samenvatting

De Nederlandse overheid zijn 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. Sportvisserij Nederland (landelijke belangenorganisatie van Nederlandse sportvissers) was nauw betrokken bij de eerste surveys in 2010-2011 binnen het Recreatieve Visserij Programma. Het Recreatieve Visserij Programma is onderdeel van de Wettelijke Onderzoekstaken (WOT).

In december 2009 is een screening survey uitgevoerd onder ~50.000 huishoudens, wat leidde tot een schatting van het aantal vissers (~1.7 miljoen) in Nederland in zoet en marine wateren. In december 2011 is de screening survey opnieuw gedaan, waaruit berekend is dat er een kleine vermindering van het aantal vissers (~1.4 miljoen) in zowel zoet als zout water plaats heeft gevonden vergeleken met 2009.

Dit rapport geeft een overzicht van de vangstschattingen van de meest gevangen zout en zoetwatersoorten uit de eerste logboek survey van 2010-2011. Daarnaast gaat het in op de methodiek hoe deze inschattingen tot stand zijn gekomen. Deze zijn verbeterd ten opzichte van een eerdere rapportage (van der Hammen & de Graaf 2012) en ontwikkeld in samenwerking met internationale experts binnen de ICES Working Group on Recreational Fisheries (WGRF, 2010-2012). De resultaten van de tweede logboek survey uit 2012-2013 moeten nog worden geanalyseerd en zullen in 2014 worden gerapporteerd.

In zowel zout als zoet water wordt er bij de meeste vistrips niets gevangen. Echter, in sommige vistrips wordt wel veel gevangen. Gemiddeld worden er 6.6 vissen in zout water gevangen waarvan er 2.0 mee worden genomen. In zoet water worden er gemiddeld 3.9 vissen gevangen, waarvan slechts 0.3 vissen worden meegenomen. In zout water worden makreel, schar, schol, wijting en kabeljauw het meeste gevangen. In zoet water wordt blankvoorn, ruisvoorn, brasem en baars het meeste gevangen.
Voor enkele zoutwatervissen zijn ook de commerciële vangsten bekend. Hierbij valt op dat de recreatieve vangsten van vooral kabeljauw en zeebaars een aanzienlijk aandeel vormen van de totale vangsten (respectievelijk 19% en 26%). De berekende hoeveelheden onttrokken vis in het zoute en zoete water staan samengevat in Tabel 1-1.

Tabel 1-1 Hoeveelheid vangsten van maart 2010 tot februari 2011 in zout en in zoet water.

	Zout			**Zoet**			
Soort	Onttrokken vangst (aantallen)	Totale vangst (aantallen)	Onttrokken (kg) **	Soort	Onttrokken vangst (aantallen)	Totale vangst (aantallen)	Onttrokken vangst (kg) ***
Makreel	3 815 000	4 223 000	1048 000	Forel****	1 165 000	1 321 000	510 000
Schar	1 043 000	1 604 000	135 000	Aal	341 000	1 228 000	80 000
Schol	948 000	1 524 000	236 000	Baars	180 000	6 250 000	42 000
Wijting	705 000	1 251 000	67 000	Snoekbaarrs	170 000	1 859 000	312 000
Kabeljauw	527 000	697 000	637 000	Zeeforel/Zalm****	120 000	152 000	83 000
Bot	311 000	816 000	81 000	Blankvoorn	69 000	13 738 000	3 000
Zeebaars	234 000	366 000	138 000	Brasem	68 000	7 318 000	79 000
Tong	204 000	241 000	50 000	Snoek	47 000	2 381 000	118 000
Aal	180 000	297 000	37 000	Karper	45 000	2 945 000	55 000
Zeeforel/Zalm*	32 000	52 000	30 000	Ruisvoorn	44 000	8 379 000	4 000
Totaal	9 610 000	4 005 000		Totaal	2 560 000	53 645 000	

*Zeeforel en zalm zijn moeilijk te onderscheiden en zijn daarom samengevoegd. ** Gewichten zijn berekend aan de hand van lengtes in de onsite survey, behalve aal en zeeforel/zalm die aan de hand van de lengtes in de logboeken zijn berekend. *** Alle gewichten zijn berekend aan de hand van de lengtes in de logboeken. **** Waarschijnlijk is een groot deel van de gevangen forel, zeeforel en zalm in kweekvijvers gevangen

Het rapport behandelt ook de verdeling van het aantal vistrips over het jaar, de week en gedurende de dag. Hieruit blijkt dat in een jaar de zoetwatervissers gemiddeld 7.5 vistrips in zoet water hebben gedaan en de zoutwatervissers 1.6 vistrips. Voor het totale aantal vistrips komt dit neer op een totaal van 11 miljoen zoetwater vistrips en 132 duizend zoutwatervistrips per jaar.

Als laatste worden ook de uitgaven van vissers geanalyseerd. Per visser wordt er gemiddeld ongeveer 202 euro per jaar uitgegeven, waarbij sommige vissers niets, en anderen heel veel uitgeven. Dit resulteert in dat er in totaal per jaar 341 miljoen euro per jaar in de recreatieve visserij wordt besteed.

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 Economics, IMARES started the Recreational Fisheries Programme in 2009. The Recreational Fisheries Program is part of the WOT (Legal Research Tasks) and is managed and designed by IMARES, Wageningen UR. The first surveys were done in collaboration with the Royal Dutch Angling Association (Dutch: Sportvisserij Nederland).

In December 2009 the first screening survey was implemented, in order to estimate the number of recreational fishers fishing in fresh and marine waters. In December 2011 this survey was executed again (appendix 1 lists the questions in Dutch), resulting in slightly lower estimates of the number of fishers in fresh and marine waters in the Netherlands compared to 2009 (1.4 vs. 1.7). In March 2012 a new logbook survey was started, which ran until February 2013. The results of the screening survey are described in this report, the results of the logbook survey still have to be imported in the database and analysed.

This report is a follow up of the 2012 report (van der Hammen & de Graaf 2012). In the previous report, we focus on the methodology that was developed to determine recreational catches in the Netherlands, and presented results for cod (*Gadus morhua*) and eel (*Anguilla anguilla*), the two species for which the Netherlands is obliged to report the recreational catch estimates to the European Commission. In this report we describe small improvements that were made in the methodology and we apply these methods to estimate the catches of the most frequently caught fish species by recreational fishers in marine (mackerel, dab, plaice, whiting, cod, flounder, seabass, sole, eel) and in fresh (rainbow trout, eel, perch, pike-perch, roach, bream, pike, carp, rudd) water. We also present new results on the onsite survey, which has improved the length frequency distribution, and thereby also improves the weight estimates. In addition, we present results on expenditure and on the distribution of fishtrips over the week and during the day. The methods are developed in close collaboration with international experts within the ICES Working Group on Recreational Fisheries (WGRF, 2010-2012).

Summarizing, we focus on 1) the results of the December 2012 screening survey, 2) estimation of catch numbers of the most frequently caught fresh and marine species, 3) analysis of data on expenditure and 4) analysis of the distribution of the number of fishtrips over the year, the week and during the day.

1 Introduction

On behalf of the Ministry of Economic Affairs, IMARES started the Recreational Fisheries Program in 2009. The Recreational Fisheries Program is part of the 'Legal Research Tasks' (Dutch: wettelijke onderzoekstaken) and is managed and designed by IMARES, Wageningen UR in close co-operation with the Royal Dutch Angling Association (Dutch: Sportvisserij Nederland).

The Recreational Fisheries Program consists of three survey components following Lyle et al. (2002) and Henry and Lyle (2003):

(1) **Screening Survey**: identify fishing households, select participants for the logbook survey,
(2) **Logbook Survey**: monitoring fishing activity through regular contact (monthly), and
(3) **Onsite Survey**: monitoring catch sizes.

Screening Surveys and 12 month Logbook Surveys are planned every two years. The program covers all types of recreational fishery in the Netherlands but with an emphasis on angling and includes both marine and fresh water recreational catches.

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 in certain areas along the Dutch coast. The use of fykes or longline by recreational fishermen remains forbidden.

In 2014 a separate survey will be developed to provide insight in the catches of the recreational gill net fishery in the coastal waters.

This report is a follow up of the 2012 report (van der Hammen & de Graaf 2012). In the previous report, we focus on the methodology that was developed to determine recreational catches in the Netherlands, and presented results for cod (*Gadus morhua*) and eel (*Anguilla anguilla*), the two species for which the Netherlands is obliged to report the recreational catch estimates to the European Commission. In this report we describe the small improvements that were made in the analyses and we apply these methods to estimate the catches of the most caught fish species by recreational fishers in marine and in fresh water. We also present additional length frequency data from the onsite survey, which improved the weight estimates of retained fish. Finally, we present results on the expenditure of recreational fishers to determine the contribution of recreational fisheries to the economy.

2 Materials and Methods

2.1 Analyses screening / logbooks 2010

An extensive description of the material and methods can be found in Van der Hammen & De Graaf (2012) and will not be repeated here. In short, the screening is used to estimate the proportion of fishers in the Dutch population for several avidity groups and for fresh and marine waters. Official statistics by Statistics Netherlands (Dutch: centraal bureau voor de statistiek, CBS) are used to raise these proportions to the total number of fishers in the Netherlands per waterbody type and avidity group. Subsequently, the logbooks are used to estimate a catch rate per individual fisher (nr/fisher/year) for each fish species. Multiplying this number with the total number of fishers gives the total number of caught fish per species and avidity group. Summing these estimates results in the total catch estimate (Figure 2-1).

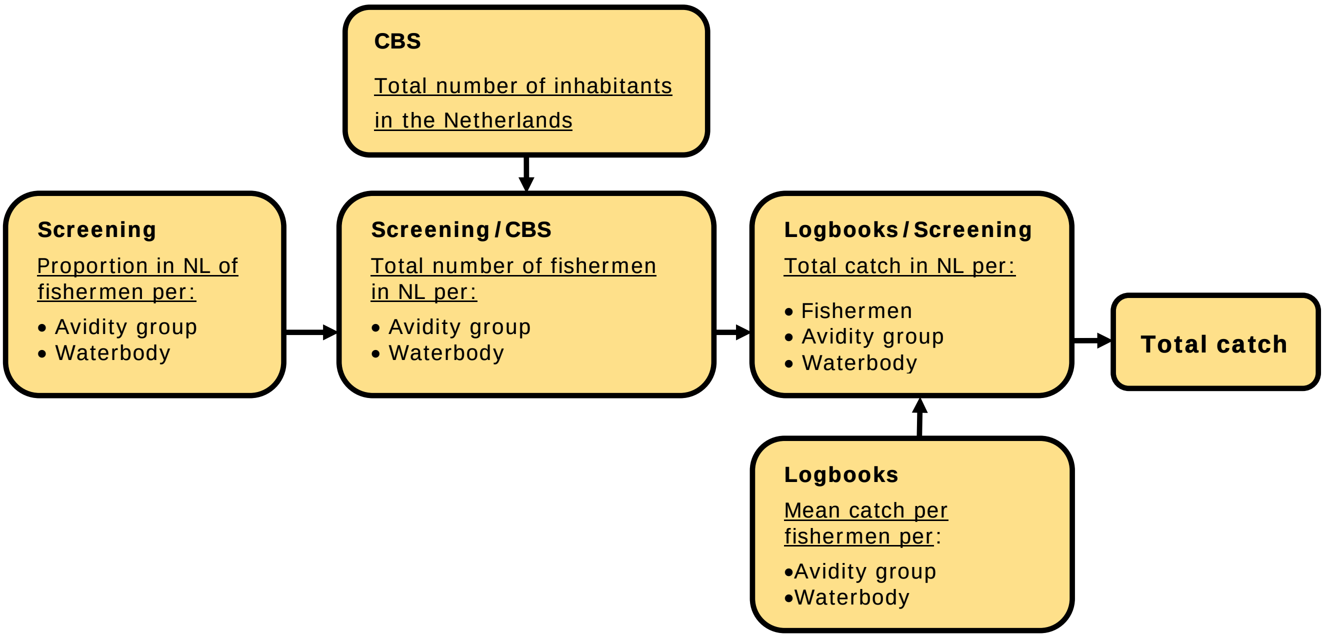

Figure 2-1 Catch estimation flow chart

The estimation method of the catches presented in this report differs in two aspects from the estimation method of cod and eel used in the previous report; the imputation method (hotdeck method, see Van der Hammen & De Graaf, 2012), which involves replacing missing values with data from other fishers in the same month and avidity group and the estimation of the weights. The changes in methods affect the catch estimates only slightly. Below, we shortly describe the changes in the methods. The raising procedure is listed in appendix 2.

2.1.1 Imputation: hotdeck method

In the estimation of the catches described in the previous report (van der Hammen & de Graaf 2012), we describe the use of the hotdeck method to impute missing values due to non-response. Previously we did 1000 iterations of hotdeck imputation and the mean of these imputed values was used to estimate the catches. This is almost the same as replacing the missing values with the mean of the values matching the imputation. Here, we only do a single hotdeck iteration, which is the more common use of the hotdeck imputation method (personal communication VanVoorhees, Sarndal and Lundstrom, 2005).

2.1.2 Weight estimation

The respondents from the logbook survey were asked to measure the length of each fish. Consequently, by using length weight relationships (Table 3-6 and Table 3-14), the weight of the fish can be calculated. However, for some species, the apportioned values of the lengths had strong biases to rounded measures (i.e. 10, 15, 20 cm etc.). In addition, some of the lengths in the logbooks seemed unrealistic, with very high or low measures. It is likely that part of the fishers did not measure the fish, but instead estimated the length. Therefore, it was decided that the length frequency distribution from the logbooks should be evaluated.
To obtain better length estimates, an onsite survey was done in marine waters. For this survey, IMARES employees trained a number of recreational fishermen in measuring fish lengths. Subsequently, the trained fishermen (observers, Table 2-1) approach fishermen in the field and measure the lengths of retained fish.
Pilots of onsite surveys in marine waters were done in 2009 and 2010 and in 2012 the survey was expanded. However, at present, only the most frequently caught fish (Table 3-5) have sufficient data for a reasonable length frequency distribution and the onsite sampling is done only for marine fish species. A pilot is done to collect lengths from catches in fresh water.
Because the onsite sampling is on-going, we expect better length frequency distributions and updated estimates of the catches in weight in the future. In addition, length frequency distributions for more species may become available.

Table 2-1 Number of observers, location and number of observer trips in the onsite survey.

	year	*Location*	*Nr observers*	*shore/boat*	*Nr days*
marine	2009	Middle (Zuid Holland, Noord Holland)	NA	shore	34
		Middle (Zuid Holland, Noord Holland)	NA	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
fresh	2012	Middle (Zuid Holland, Noord Holland)	2*	shore	12
		Middle (Zuid Holland, Noord Holland)	2*	boat	2

** 2 students*

2.2 Screening December 2011

In December 2011 a screening survey was executed by TNS-NIPO and IMARES. Similar to the 2009 survey, questions about fishing activities including their fishing avidity (number of fishtrips per year) and waterbody type were asked online to a large panel. The survey had 106 885 respondents. The methods for the screening survey did not differ from the survey in 2011 (Van der Hammen & De Graaf 2012). The survey questions in the screening survey are listed in appendix 1 (in Dutch).

3 Results

3.1 Screening December 2011

The total number of recreational fishers in the Netherlands decreased from approximately 1.7 million in 2009 to approximately 1.4 million in 2011 (Table 3-1). The proportion of fishers decreased from approximately 0.11 to 0.09. This is a small, but significant decrease due to the large sample size (chi-squared test, $\chi^2 = 216.97$, df = 1, p-value < 0.0001). The age distribution does not differ substantially between the 2009 and the 2010 surveys. Appendix 3 lists a full table with the proportion per age and sex of the fishers in the screening survey.

Table 3-1 Results screening survey (December 2009 and December 2011). Number of fishers in the Netherlands per avidity group; per waterbody type; and the total number of fishers.

		Dec. 2009			**Dec. 2011**		
	Dutch population*	15 456 763			15 625 804		
	Avidity (nr of fishtrips per year)	*Nr fishers in Screening Survey*	*Proportion of fisher in Screening Survey*	*Total nr of fishers in NL (±SE)*	*Nr fishers in Screening Survey*	*Proportion of fisher in Screening Survey*	*Total nr of fishers in NL (±SE)*
Marine	1-5	3 595	0.033	508 423 (8 339)	2 702	0.025	395 011 (7 503)
	6-10	584	0.0053	82 592 (3 409)	630	0.0059	92 101 (3 659)
	11-25	241	0.0022	34 083 (2 193)	290	0.0027	42 396 (2 486)
	26-50	62	0.0006	8 768 (1 113)	100	0.00094	14 619 (1 461)
	> 50	49	0.0005	6 930 (990)	44	0.00041	6 432 (970)
	total	4 531	0.041	640 797 (9 320)	3 766	0.035	550 562 (8 812)
Fresh	1-5	5 659	0.052	800 324 (10 360)	4 670	0.044	682 720 (9 770)
	6-10	2 451	0.022	346 633 (6 922)	1 965	0.018	287 269 (6 421)
	11-25	1 522	0.014	215 249 (5 478)	1 326	0.012	193 852 (5 290)
	26-50	613	0.0056	86 694 (3 492)	496	0.0046	72 512 (3 248)
	> 50	316	0.0029	44 690 (2 510)	242	0.0023	35 379 (2 272)
	total	10 561	0.097	1 493 589 (13 814)	8 699	0.081	1 271 730 (13 068)
	Total fresh+marine	11 943	0.109	**1 689 039** (16 664)	9 573	0.090	**1 399 502** (13 648)

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

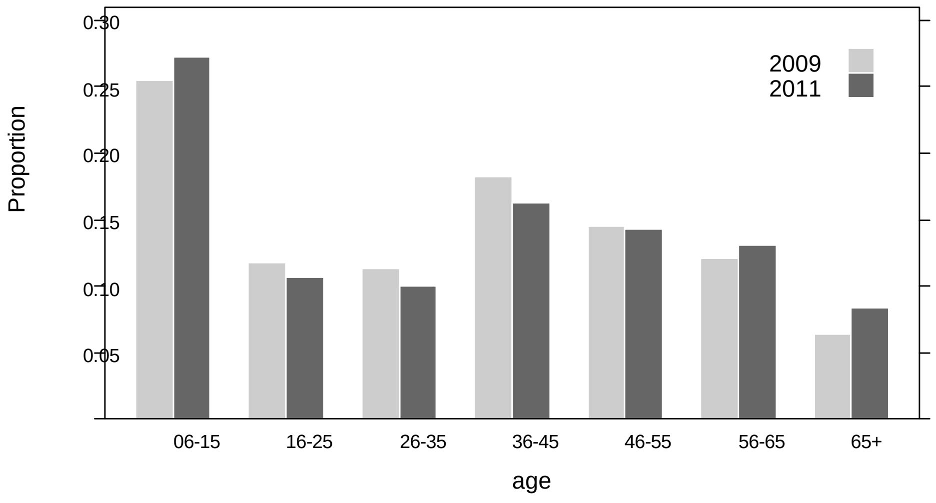

Figure 3-1 Age distribution of fishers in the 2009 and 2011 screening surveys

3.2 Logbooks 2010

3.2.1 Fishtrips

The average number of fishtrips per month per fisher increases in the spring and is highest in the summer to decrease again in the winter (Figure 3-2, Appendix 5). The number of fishtrips per fisher is much higher in fresh waters than in marine waters (Figure 3-2). The average yearly number of fishtrips per fisher = 7.5 (±0.44 se) trips in fresh water and 1.6 (±0.16 se) trips in marine water. Multiplying this number with the total number of fresh water fishers (1.5 million, Table 3-1) or marine fishers (83 thousand, Table 3-1), results in a total of 11 million fresh water fishtrips and 132 thousand marine trips on a yearly base. Some transitional waters between fresh and marine waters are considered as marine waters (e.g. Waddensea, Ooster- and Westerschelde, Eems and Dollard, whereas others are considered as fresh water (Biesbosch, Grevelingen, Haringvliet).

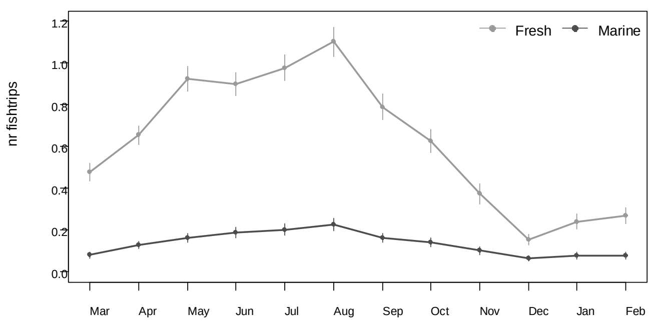

Figure 3-2 Mean number of fishtrips per fisher for marine (black) and fresh waters (grey) plus standard errors.

The proportion of fishtrips is highest in the weekends and especially on Saturdays for marine fishtrips (Figure 3-3, Appendix 5). Fishtrips start and end at all times during the day and night, although by far most fishtrips start in the morning and end in the afternoon (Figure 3-4). Fishtrips starting late or ending in the morning are assumed to be night trips.

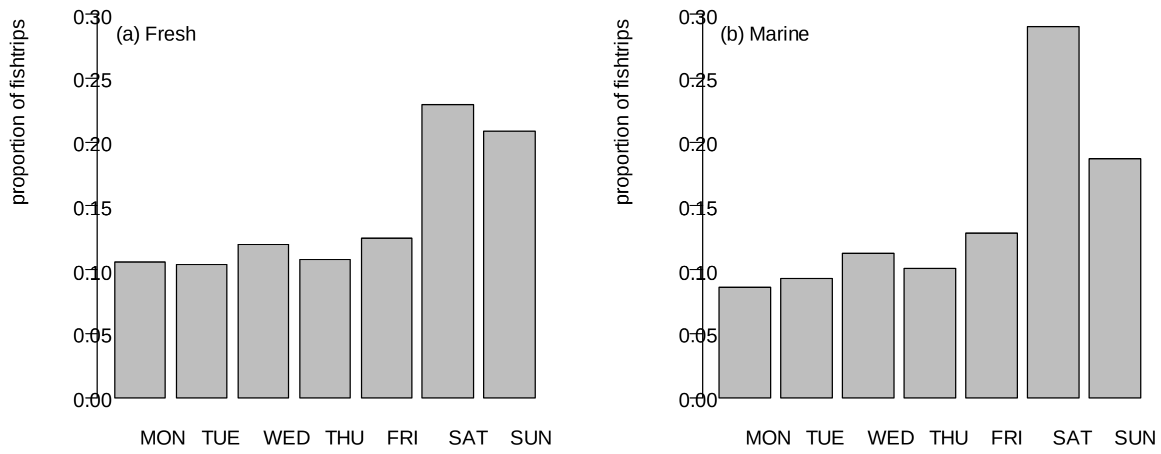

Figure 3-3 Proportion of fishtrips over the week in fresh water (a) or marine water (b)

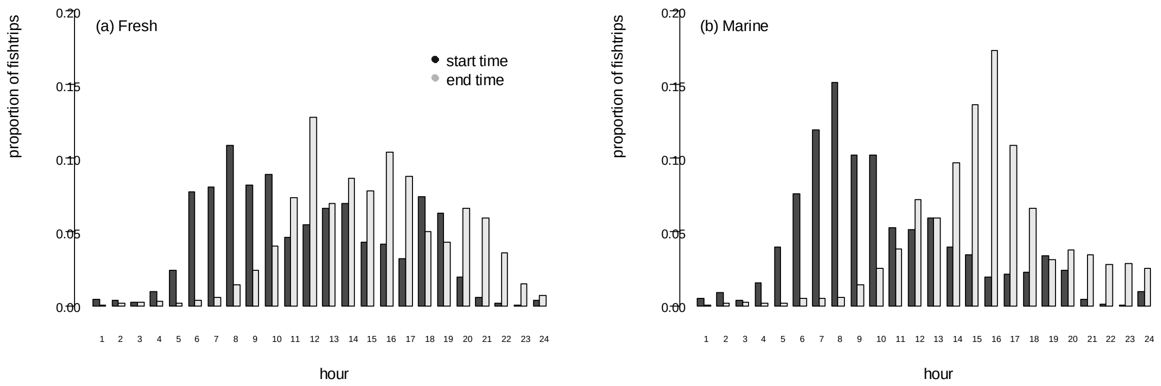

Figure 3-4 Start time and end time of fishing trips

3.2.2 Expenditure

Large amounts of money are spent on durables such as rods, books, clothes etc.: almost 60 euro's per fisher per year (Figure 3-5). Also large amounts are spent on bait, food/drinks and consumables such as hooks, twine and float. Almost 15% of the fishers did not spend any money at all (Figure 3-6). It should be noted that only those fishers who made at least one fishtrip during the timespan of the logbook survey are included in the analyses (drop-in = drop-out assumption). 17% spent 1-25 euro, 25% spent 26-100 euro, 32% spent 101-500 euro and 11% spent even more than 500 euro (Figure 3-6).

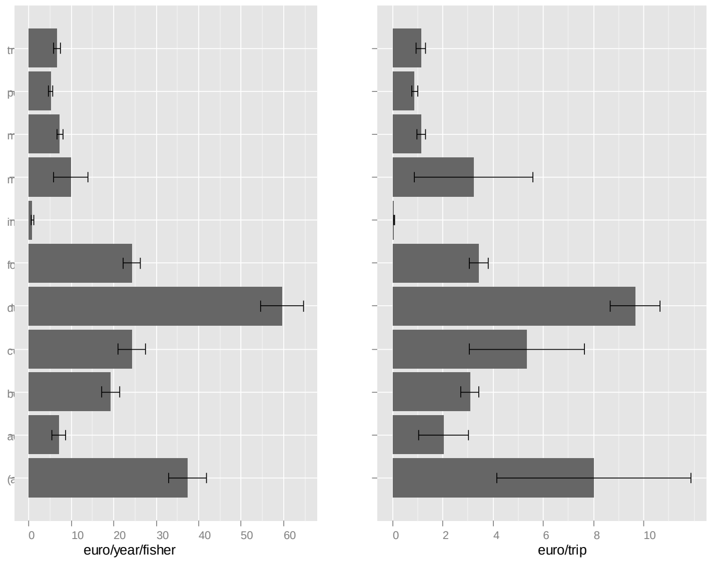

Figure 3-5 amount spent per fisher per year (left) and per trip (right).

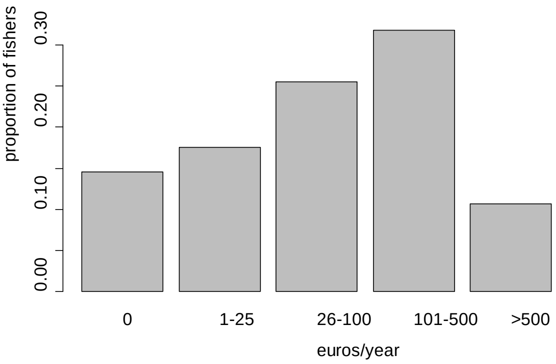

Figure 3-6 Amount spent per year per fisher

The total amount spent in recreational fisheries can be estimated by multiplying the mean amount spent per fisher per year (201.6 euro) with the total number of fishers in the Netherlands in 2009 (1.69 million, Table **3-1**), resulting in a total amount of 341 million euro spent per year. In the 2011 screening survey, questions about expenditure were not included in the questionnaire. If we assume that the amount spent per fisher in the 2012 survey is the same as in the 2010 survey, the total amount would result in 282 million euro spent per year (1.40 million fishers, Table 3-1).

3.3 catch estimation

3.3.1 Marine: numbers

In marine water, many fishtrips do not result in any catch at all, returned or retained (Figure 3-7). The mean catch per fishtrip is 6.6 fishes, of which 4.6 fishes are returned and 2.0 fish are retained on average. The catch rate (nr fish/fisher/year) of the most frequently caught marine species are listed in Table 3-2 and the catch estimates in numbers of the most frequently caught marine species are listed in Table 3-3. Seatrout/salmon were added to this table because they are protected species and they are grouped because they are difficult to distinguish. Officially it is not allowed to retain seatrout or salmon caught in the wild and only very few seatrout and salmon were recorded (16 seatrout and 22 salmon) in marine water in the complete logbook survey (Table 6-2). Mackerel is caught most, followed by dab, plaice, whiting and cod. Mackerel is also most often retained (90%), followed by sole (85%) and cod (76%). Flounder is most often returned; only 38% of flounder is retained. In total 13.6 million fish are caught, of which 71% is retained. These are 9.6 million fish.

Most fish is caught with a rod. The catch numbers caught with a rod are listed in Table 3-4. These numbers are only slightly lower than the number of fish caught with all gears.

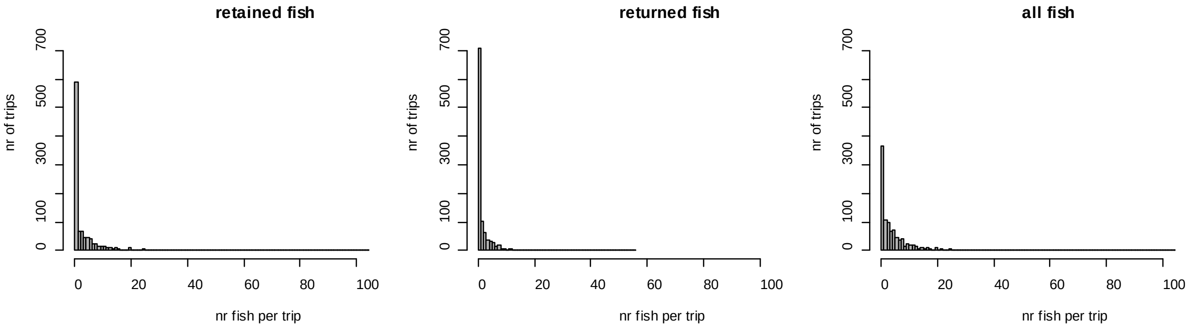

Figure 3-7 frequency distribution of nr of marine fish (all species) per trip for retained, returned and for all (retained and returned) fish.

Table 3-2 Catch rate (angling + passive gears) marine fishes (nr/fisher/year) per avidity group. Source: logbooks March 2010-February 2011.

	Retained						***Returned***					
nr fishers	287		93		52		287		93		52	
avidity	0-5		6-10		>10		0-5		6-10		>10	
	mean	**se**	**mean**	**Se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Mackerel	5.23	1.03	9.16	3.59	7.98	4.25	0.49	0.16	0.54	0.25	2.25	1.62
Dab	1.17	0.28	2.66	1.14	4.62	1.79	0.48	0.11	1.38	0.73	4.12	1.48
Plaice	0.97	0.18	2.26	0.75	5.37	3.89	0.43	0.13	0.76	0.20	5.96	3.66
Whiting	0.91	0.26	1.77	0.63	1.92	0.60	0.48	0.16	1.82	1.12	3.06	1.14
Cod	0.67	0.14	1.44	0.45	1.40	0.55	0.25	0.08	0.15	0.06	0.60	0.21
Flounder	0.23	0.07	0.82	0.26	2.54	1.05	0.35	0.16	1.74	0.60	3.73	1.33
Seabass	0.28	0.10	0.22	0.13	1.54	0.93	0.13	0.04	0.22	0.08	1.00	0.38
Sole	0.30	0.11	0.41	0.17	0.40	0.19	0.02	0.01	0.05	0.04	0.46	0.30
Eel	0.23	0.09	0.57	0.27	0.29	0.20	0.15	0.05	0.16	0.07	0.52	0.20
Seatrout/ Salmon*	0.06	0.04	0.03	0.02	0.02	0.02	0.03	0.01	0.03	0.03	0.02	0.02
Other	1.97	0.86	4.70	3.31	4.46	2.26	0.88	0.20	1.97	0.58	6.46	2.47
All	12.01	1.60	24.03	5.57	30.54	9.28	3.69	0.53	8.82	2.40	28.17	8.41

*Seatrout and salmon are difficult to distinguish and are therefore grouped in the analysis.

Table 3-3 Marine catch estimates (angling + passive gears) for March 2010 to February 2011 and standard errors (number x 1000).

species	*retained*	*Returned*	*Sum*	*% retained*
Mackerel	3 815 (526)	408 (119)	4 223 (573)	90
Dab	1 043 (185)	561 (115)	1 604 (263)	65
Plaice	948 (252)	576 (230)	1 524 (461)	62
Whiting	705 (137)	547 (122)	1 251 (228)	56
Cod	527 (84)	170 (45)	697 (104)	76
Flounder	311 (81)	507 (126)	816 (155)	38
Seabass	234 (88)	131 (35)	366 (110)	64
Sole	204 (59)	36 (25)	241 (67)	85
Eel	180 (50)	117 (28)	297 (60)	61
Seatrout/Salmon*	32 (19)	20 (7)	52 (23)	62
Other	1 611 (443)	932 (180)	2 544 (532)	63
Total	9 610 (654)	4 005 (351)	13 615 (865)	71

*Seatrout and salmon are difficult to distinguish and are therefore grouped in the analysis.

Table 3-4 Marine catch estimates (angling) from March 2010 to February 2011 and standard errors (numbers x 1000).

species	*retained*	*returned*	*sum*	*% retained*
Mackerel	3 750 (507)	388 (121)	4 138 (545)	91
Dab	1 041 (185)	547 (109)	1 588 (258)	66
Plaice	914 (223)	530 (198)	1 444 (396)	63
Whiting	694 (135)	547 (122)	1 241 (225)	56
Cod	522 (83)	168 (45)	690 (104)	76
Flounder	296 (80)	468 (112)	765 (144)	39
Seabass	227 (88)	127 (34)	354 (110)	64
Sole	191 (57)	22 (9.3)	213 (58)	90
Eel	172 (48)	114 (28)	286 (58)	60
Seatrout/Salmon*	22 (18)	19 (7)	41 (21)	54
Other	1 520 (439)	903 (168)	2 423 (517)	63
Total	9 350 (643)	3 833	13 183 (825)	71

*Seatrout and salmon are difficult to distinguish and are therefore grouped in the analysis.

3.3.2 Marine: weight

Length frequency distribution logbook survey (retained)

Participants of the logbooks were asked to measure the lengths of their catches. This resulted in length frequency distributions (Figure 3-8), which were in some cased biased to round numbers (e.g. ending on 0 or 5), which made us believe that many of the recorded lengths may have been estimated instead of measured.

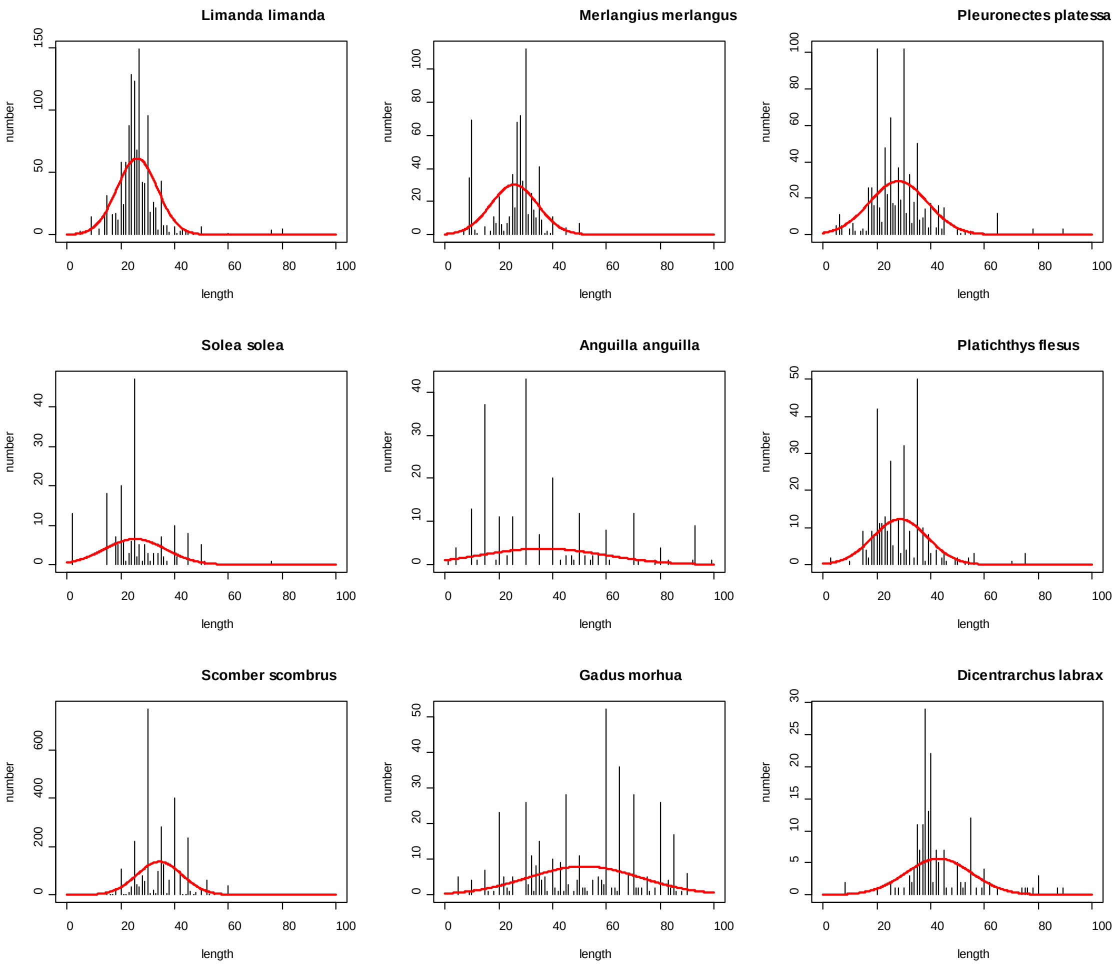

Figure 3-8 Length frequency distribution of retained fish from the logbook survey. The red line indicates the fitted normal distribution.

<u>Length frequency distribution onsite survey (retained)</u>

In order to obtain a more reliable length frequency distribution an onsite survey was executed (see methods, Figure 3-9). However, only for those species which are caught frequently, enough data was sampled. Comparing the mean length of the lengths recorded in the logbooks with the mean lengths from the onsite survey resulted in slightly lower values in the onsite survey (Table 3-5). This suggests that the lengths in the logbooks were slightly overestimated. However, it is also possible that differences in time or space have caused the differences. More onsite data should be collected to confirm the assumption that the data are overestimated.

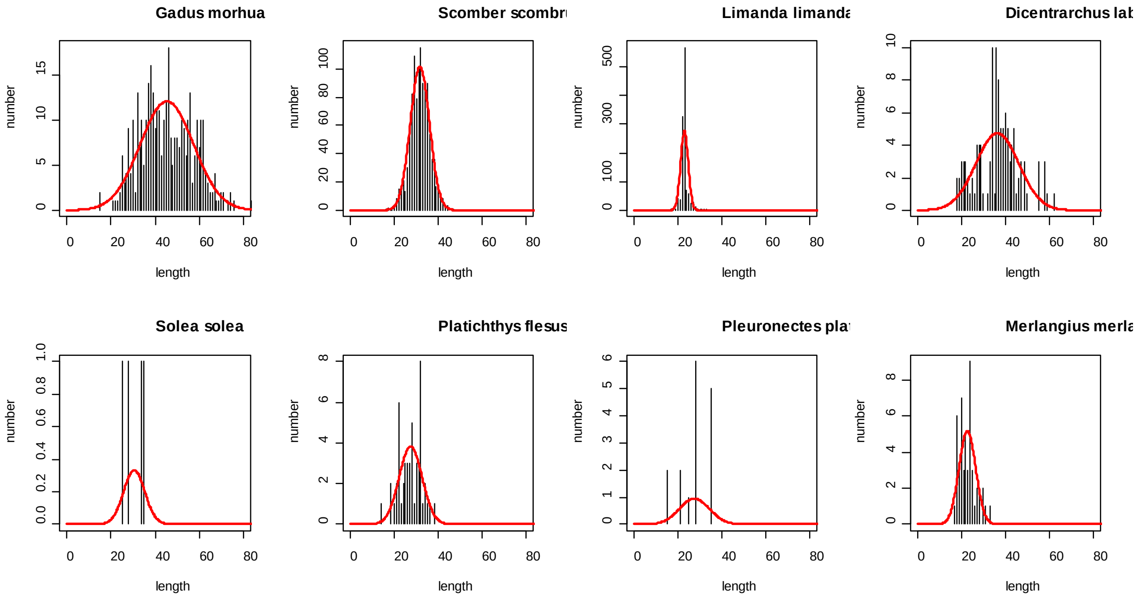

Figure 3-9 Length frequency distribution of retained fish from the onsite survey. The red line indicates the expected normal distribution.

Table 3-5 Mean lengths onsite survey (2009 and 2013) versus logbook survey in marine waters.

	Onsite (cm) (±SE)		***Logbook (cm) (±SE)***		
species	**retained**	**Returned**	**retained**	**returned**	**Difference retained onsite vs. logbook (%)**
Mackerel	31.5 (0.31)	-	34.4 (0.2) (n=2877)	30.0 (0.7) (n=314)	0.92
Dab	23.0 (0.05)	19.6 (0.41) (n=47)	25.8 (0.2) (n=1008)	19.1 (0.3) (n=516)	0.89
Plaice	22.8 (0.54)	31.5 (3.7) (n=10)	28.1 (0.4) (n=792)	18.5 (0.4) (n=527)	0.81
Whiting	25.4 (3.7)	-	28.7 (0.2) (n=554)	22.5 (0.4) (n=486)	0.89
Cod	45.4 (0.63)	23.2 (0.71) (n=30)	51.9 (1.0) (n= 419)	28.2 (1.3) (n=130)	0.87
Flounder	27.3 (0.74)	32.3 (3.1) (n=4)	28.6 (0.6) (n=312)	21.8 (0.4) (n=568)	0.95
Seabass	36.4 (0.91)	34.9 (0.63) (n=75)	43.0 (0.9) (n=173)	29.5 (1.0) (n=129)	0.85
Sole	30.5 (2.40)	-	27.0 (0.7) (n=173)	26.7 (1.4) (n=61)	1.13
Eel	-	-	39.3 (1.8) (n=180)	36.9 (1.7) (n=95)	-
Seatrout/Salmon*	-	-	35.5 (0.2) (n=2890)	24.6 (6.1) (n=18)	-

Weight estimation

To estimate the weight of the retained catches, lengths were assigned to fish randomly from fish from the onsite survey. Subsequently, length weight relationships were used to calculate the weights (Table 3-6). However, the onsite survey will be continued during the 2014 logbook survey and we expect to update the weight estimates when more length data will become available. Because the weights depend strongly on the length distribution, new estimations may differ from previous ones. It should be noted that the onsite data from 2009-2013 are grouped, thereby assuming that the length distribution does not differ between years. Differences in year class strength, which may cause differences in the length distribution between years, are therefore not taken into account. The weights were also estimated with the lengths from the logbooks (Table 3-7). Because the mean lengths in the logbooks are higher than in the onsite survey, except for sole (Table 3-6), the weights are also higher. For some species this almost doubles the weight. As we know that the lengths from the onsite survey are measured by trained fishers, these data are considered more reliable than the lengths from the logbooks.

Table 3-6 Length weight relationships

Scientific name	*A*	*b*	*reference*
Mackerel (*Scomber scombrus*)	0.003000	3.290	IMARES
Dab (*Limanda limanda*)	0.007129	3.119	Robinson et al (2010)
Plaice (*Pleuronectes platessa*)	0.009594	3.009	Robinson et al (2010)
Whiting (*Merlangius merlangus*)	0.010965	2.863	Robinson et al (2010)
Cod (*Gadus morhua*)	0.006800	3.101	Daan (1974)
Flounder (*Platichthys flesus*)	0.008700	3.098	IMARES
Seabass (*Dicentrarchus labrax*)	0.007400	3.096	IMARES
Sole (*Solea solea*)	0.031696	2.603	Robinson et al (2010)
Eel (*Anguilla anguilla*)	0.001070	3.133	IMARES

In weight, mackerel is retained most, followed by cod, plaice, seabass, dab, flounder, whiting and sole (Table 3-7).

Table 3-7 Marine: catches in tonnes and standard errors (SE). From March 2010 to February 2011.

	onsite survey		*logbooks*			
	Angling and passive gears	Angling	Angling and passive gears		Angling	
Species	**retained**	**retained**	**retained**	**returned**	**retained**	**returned**
Mackerel	1048 (144)	1029 (140)	1564 (274)	141 (41)	1500 (227)	139 (42)
Dab	135 (24)	135 (24)	256 (44)	73 (26)	255 (44)	72 (26)
Plaice	236 (61)	226 (54)	346 (93)	76 (19)	334 (85)	73 (18)
Whiting	67 (13)	65 (13)	124 (24)	55 (22)	122 (23)	55 (22)
Cod	637 (102)	631 (101)	1145 (228)	73 (41)	1145 (228)	70 (41)
Flounder	81 (21)	77 (21)	128 (36)	101 (29)	126 (37)	99 (29)
Seabass	138 (51)	129 (51)	272 (93)	57 (18)	270 (93)	57 (18)
Sole	50 (15)	47 (14)	43 (10)	3 (2)	41 (10)	3 (2)
Eel			37 (10)	24 (7)	36 (10)	24 (7)
Salmon/Seatrout*			30 (25)	6 (3)	28 (26)	6 (3)

*Seatrout and salmon are difficult to distinguish and are therefore grouped.

3.3.2.1 Commercial catches

For some species, recreational catches can be substantial compared to the total landings (commercial landings and recreational catches). As percentage of the total landings (including the Dutch commercial fishery), the percentage of seabass recreational catches is highest (26%, Table 3-8), followed by cod (19%), whiting (11%) and mackerel (4%). On the other hand, for sole and plaice, the proportion is quite low. Commercial catch statistics in fresh water are unavailable.

Table 3-8 Commercial catches vs. recreational catches (tonnes).

Species	**Commercial landings**	**Commercial landings**	**Recreational Landings***	**% recreational landings**
Mackerel	Dutch landings in the Northeast Atlantic (combined Southern, Western, and North Sea spawning components) in 2010.	23 089	1 048	4.3
Plaice	Dutch landings in Subarea IV in 2010	26 689	236	0.9
Whiting	Dutch landings in Subarea IV and Division VIId in 2010	528	67	11.3
Cod	Dutch landings from area IV in 2010 (ICES 2012).	2 657	637	19.3
Seabass	Dutch landings in area IVbc and VIId in 2010 (ICES	391	138	26.1
Sole	Dutch landings in Subarea IV in 2010	8 770	50	0.6

3.3.3 Fresh water fish: numbers

In fresh water, many fishtrips do not result in any catches, returned or retained (Figure 3-10). The mean catch per fishtrip is 3.9 fishes, of which 3.6 fishes are returned and 0.3 fish are retained on average. The catch estimates in numbers of the main fresh water species are listed in Table 3-10. Roach is the most frequently caught fresh water fish, followed by rudd, bream and perch. Rainbow trout is most often retained (88%), followed by seatrout/salmon (79%) and eel (28%). It is expected that most rainbow trout and seatrout is caught in commercial ponds. However, in the 2010 logbook survey, this was not added as an option for fishing location. Table 3-12 shows the number of seatrout/salmon caught in only the rivers and canals. This reduces the number of retained seatrout/salmon from 120 to 19 thousand fish, suggesting that most seatrout/salmon is indeed caught in (commercial) ponds. Almost all are caught by angling (Table 3-12).
Most fresh water species are returned. In total 53.6 million fish are caught, of which only 2.6 million (4.8%) are retained. Most fresh water species are caught by anglers: the numbers taken by anglers are only slightly smaller than the total catches Table 3-11).

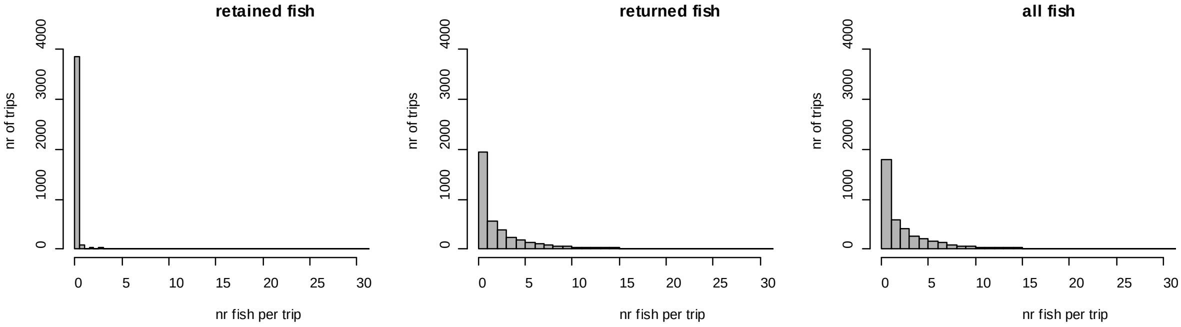

Figure 3-10 frequency distribution of nr of fish (all species) per trip for retained, returned and for all (retained and returned) fish.

Table 3-9 Catch rate (angling + passive gears) fresh water fishes (nr/fisher/year) per avidity group.

	Retained								*Returned*							
nr fishers	513		256		174		126		513		256		174		126	
avidity (fishtrips/ year)	0-5		6-10		11-25		>25		0-5		6-10		11-25		>25	
	mean	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**	**mean**	**se**
Rainbow Trout	0.93	0.20	0.39	0.12	0.99	0.57	0.53	0.44	0.15	0.05	0.07	0.04	0.00	0.00	0.06	0.04
Eel	0.21	0.07	0.07	0.03	0.55	0.28	0.25	0.14	0.34	0.10	0.87	0.42	1.05	0.42	0.70	0.29
Perch	0.93	0.20	0.39	0.12	0.99	0.57	0.53	0.44	2.63	0.38	4.51	1.33	6.52	1.38	7.60	2.02
Pike-perch	0.01	0.00	0.00	0.00	0.02	0.02	0.00	0.00	1.24	0.39	0.80	0.34	1.06	0.30	1.46	0.53
Seatrout/ Salmon	0.08	0.04	0.03	0.03	0.07	0.06	0.22	0.15	0.01	0.01	0.04	0.04	0.00	0.00	0.10	0.07
Roach	0.03	0.01	0.11	0.06	0.01	0.01	0.06	0.04	5.71	1.00	6.33	0.96	16.19	3.30	26.02	6.19
Bream	0.03	0.02	0.07	0.05	0.02	0.01	0.10	0.06	2.99	0.64	4.53	0.83	7.72	1.46	12.37	3.01
Pike	0.03	0.01	0.02	0.01	0.03	0.02	0.10	0.10	1.61	0.73	0.62	0.13	1.89	0.57	3.25	1.22
Carp	0.04	0.02	0.04	0.02	0.01	0.01	0.01	0.01	1.89	0.44	1.33	0.27	2.05	0.38	3.67	0.84
Rudd	0.02	0.01	0.07	0.06	0.01	0.01	0.05	0.03	3.79	0.72	4.96	0.95	8.34	1.68	13.57	3.30
Catfish	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.11	0.04	0.04	0.01	0.01	0.01	0.01
Silver Bream	0.01	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.42	0.10	0.82	0.29	2.43	0.90	2.99	0.90
Chub	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.28	0.24	0.08	0.72	0.32	1.44	0.49
Other	0.31	0.17	0.08	0.03	0.02	0.01	0.10	0.06	2.99	0.93	2.17	0.62	3.71	0.74	9.01	2.94
All	1.86	0.31	1.19	0.26	2.01	0.70	1.71	0.56	24.59	3.92	27.34	3.09	51.69	7.27	82.25	12.88

Table 3-10 Fresh water fish catch (angling and passive gears) from March 2010 to February 2011 and standard errors (nr x 1000).

Species	Retained	Returned	Sum	% retained
Rainbow Trout	1 165 (247)	156 (38)	1 321 (253)	88
Eel	341 (106)	887 (182)	1 228 (230)	28
Perch	180 (62)	6 070 (544)	6 250 (560)	2.9
Pike-perch	170 (42)	1 689 (326)	1 859 (336)	9.2
Seatrout/Salmon	120 (40)	32 (9)	152 (41)	79
Roach	69 (14)	13 668 (1 031)	13 738 (1 031)	0.5
Bream	68 (16)	7 250 (640)	7 318 (641)	0.9
Pike	47 (11)	2 334 (590)	2 381 (590)	2
Carp	45 (15)	2 900 (360)	2 945 (362)	1.5
Rudd	44 (13)	8 335 (709)	8 379 (709)	0.5
Catfish	11 (9)	175 (86)	186 (95)	5.9
Silver bream	8 (6)	1 539 (304)	1 547 (306)	0.5
Chub	0	919 (245)	919 (245)	0
Other	291 (126)	5 130 (720)	5 421 (732)	5.4
Total	2 560 (180)	51 085 (2 155)	53 645 (2 174)	4.8

* Salmon and Seatrout are combined because they are difficult to distinguish.

Table 3-11 Fresh catches (angling) from March 2010 to February 2011 and standard errors (nr x 1000).

Species	Retained	Returned	Sum	% retained
Rainbow Trout	1 165 (247)	154 (38)	1 319 (253)	88
Eel	294 (85)	862 (181)	1 156 (211)	25
Perch	178 (62)	6 064 (544)	6 243 (560)	2.9
Pike-perch	149 (39)	1 610 (323)	1 758 (333)	8.4
Seatrout/Salmon*	100 (39)	32 (9)	132 (35)	76
Roach	69 (14)	13 664 (1 031)	13 733 (1 031)	0.5
Bream	66 (16)	7 081 (634)	7 147 (635)	0.9
Pike	47 (11)	2 323 (590)	2 369 (590)	2
Carp	45 (15)	2 895 (360)	2 941 (362)	1.5
Rudd	44 (13)	8 305 (708)	8 349 (709)	0.5
Catfish	11 (9)	173 (86)	184 (95)	5.9
Silverbream	8 (6)	1 539 (304)	1 547 (306)	0.5
Chub	0	918 (245)	918 (245)	0
Other	276 (126)	5 109 (720)	5 384 (733)	5.1
All Fresh	2 472 (178)	50 729 (2157)	53 201 (2 175)	4.6

* Salmon and Seatrout are combined because they are difficult to distinguish.

Table 3-12 Fresh: catches in rivers and canals (nr x 1000).

Gear	Species	Retained	Returned	Sum	% retained
all	Rainbow trout	23 (23)	13 (6)	36 (24)	64
	Seatrout/Salmon*	19 (5)	15 (2)	34 (5)	56
	Catfish	0	57 (23)	57 (23)	0
angling	Rainbow trout	23 (23)	11 (5)	35 (24)	64
	Seatrout/Salmon*	19 (5)	15 (2)	34 (5)	56
	Catfish	0	56 (23)	56 (23)	0

* Salmon and Seatrout are combined because they are difficult to distinguish.

3.3.4 Freshwater fish: weights

<u>Length frequency distribution logbook survey (retained)</u>

The length frequency distributions in the logbooks for retained fresh water fish are shown in Figure 3-11.

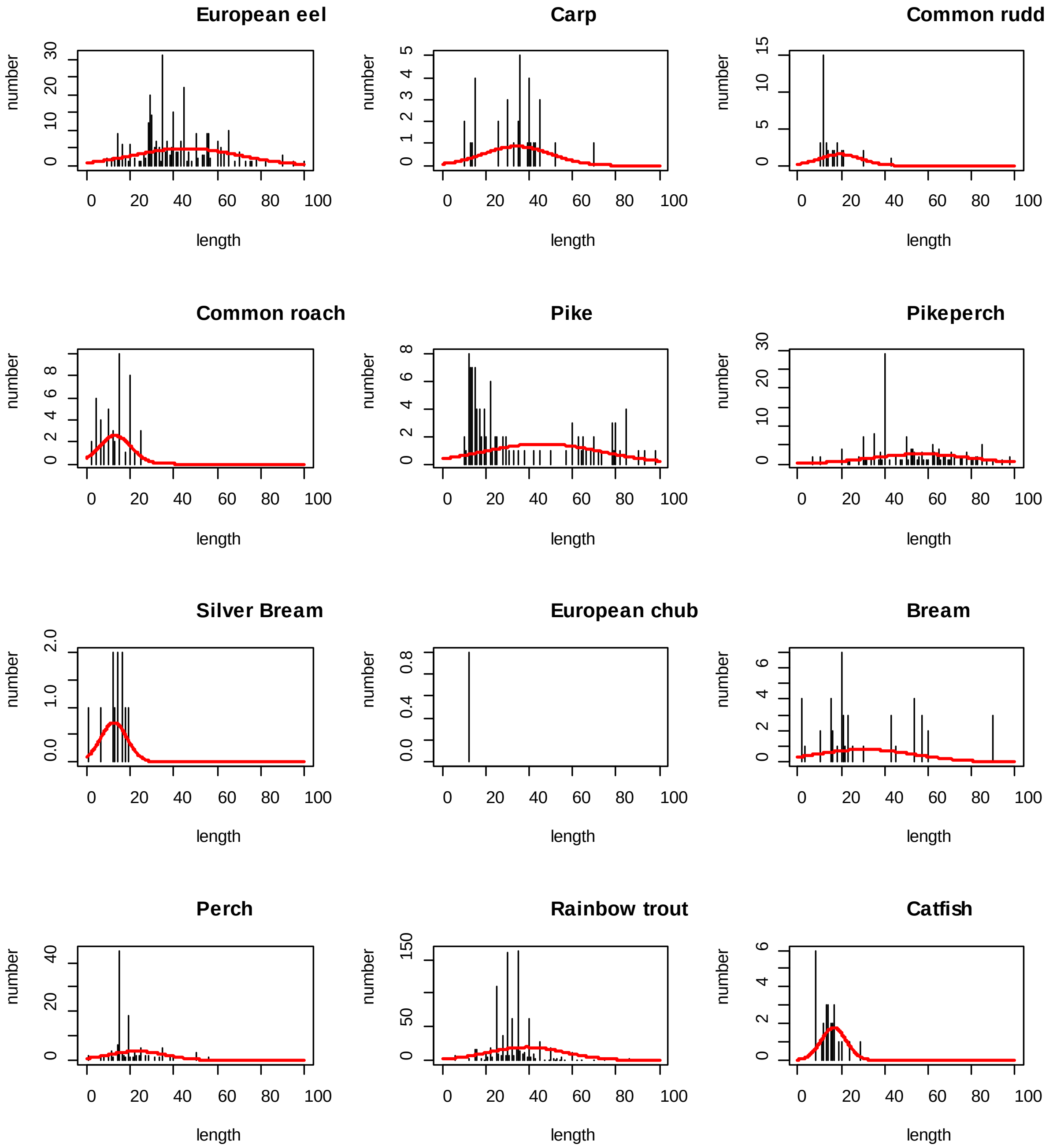

Figure 3-11 Length frequency distribution of retained fish from the logbook survey. The red line indicates the fitted normal distribution.

Length frequency distribution onsite survey (retained)

Only very few onsite data was sampled (Figure 3-12). The mean lengths were slightly higher for eel, flounder and perch and slightly lower for pikeperch and perch (Table 3-13) compared with the mean lengths in the logbooks. More onsite data is needed to draw conclusions on the quality of the logbook length data.

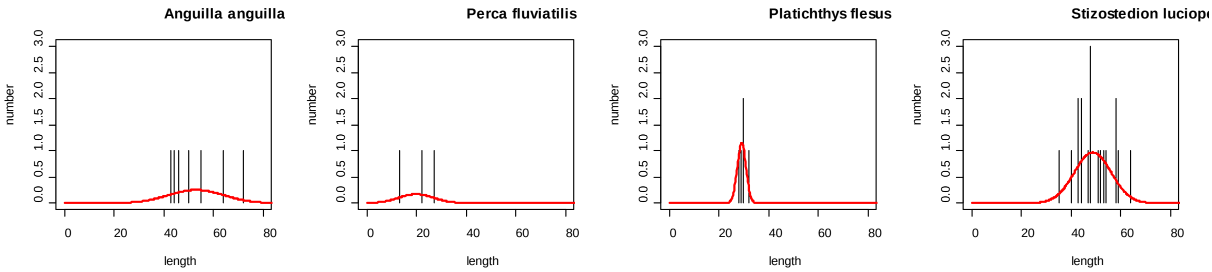

Figure 3-12 Onsite length frequency distribution fresh water.

Table 3-13 Mean lengths onsite survey versus logbook survey in fresh water.

	Onsite (cm) (±SE)	**Logbook (cm) (±SE)**		
Species	**Retained**	**Retained**	**Returned**	**Difference retained onsite vs. logbook**
Rainbow Trout	-	32.5 (0.3) (n=865)	27.4 (1.3) (n=109)	-
Eel	53.4 (4.2) (n=7)	40.7 (1.0) (n=293)	37.2 (0.7) (n=705)	1.3
Perch	19.9 (4.1) (n=3)	19.2 (0.8) (n=121)	17.9 (0.2) (n=4842)	1.0
Pike Perch	48.7 (1.6) (n=20)	51.9 (1.7) (n=147)	38.2 (0.5) (n=1294)	0.9
Seatrout/Salmon*	-	27.9 (0.8) (n=180)	22.5 (1.9) (n=52)	-
Roach	-	12.9 (1.0) (n=47)	16.6 (0.1) (n=10913)	-
Bream	-	31.3 (3.5) (n=46)	35.1 (0.2) (n=5883)	-
Pike	-	35.9 (2.7) (n=100)	45.0 (0.6) (n=1756)	-
Carp	-	32.8 (2.3) (n=34)	41.7 (0.4) (n=2224)	-
Rudd	-	15.7 (1.1) (n=37)	16.4 (0.1) (n=6505)	-
Catfish	-	14.2 (1.0) (n=26)	19.7 (1.5) (n=163)	-
Silver bream	-	12.8 (1.6) (n=11)	18.3 (0.2) (n=1349)	-
Chub	-	12.0 (-) (n=1)	20.9 (0.4) (n=694)	-

* Salmon and Seatrout are combined because they are difficult to distinguish.

Table 3-14 Length weight relationships

Species	**a**	**b**	**Reference**
Rainbow Trout	0.00981	3.012	IMARES
Eel	0.00107	3.133	IMARES
Perch	0.00500	3.335	IMARES
Pike-perch	0.00600	3.100	IMARES
Roach	0.00460	3.317	IMARES
Bream	0.00530	3.200	IMARES
Pike	0.00507	3.101	IMARES
Carp	0.01745	3.071	IMARES
Rudd	0.00460	3.352	IMARES
Catfish	0.00224	3.294	IMARES
Silver Bream	0.00800	3.285	IMARES
Chub	0.00624	3.168	IMARES

Table 3-15 Fresh: catches in tonnes and standard errors. From March 2010 to February 2011.

	Lengths from onsite survey		Lengths from logbook survey			
	Angling and passive gears	Angling	Angling and passive gears		Angling	
Species	**Retained**	**Retained**	**Retained**	**Returned**	**Retained**	**Returned**
Rainbow trout	-	-	510 (94)	58 (13)	510 (94)	55 (13)
Eel	105 (33)	91 (25)	80 (24)	139 (33)	75 (23)	132 (33)
Perch	27 (9)	27 (9)	42 (13)	1278 (261)	37 (12)	1270 (261)
Pikeperch	182 (43)	157 (41)	312 (76)	1352 (271)	300 (75)	1226 (252)
Salmon/Seatrout	-	-	83 (29)	12 (4)	83 (29)	12 (4)
Roach	-	-	3 (1)	2192 (358)	3 (1)	2192 (358)
Bream	-	-	79 (23)	5513 (464)	78 (23)	5222 (421)
Pike	-	-	118 (27)	3065 (522)	118 (27)	3057 (522)
Carp	-	-	55 (17	8339 (1235)	55 (17)	8338 (1235)
Rudd	-	-	4 (2)	1221 (233)	4 (2)	1220 (233)
Catfish	-	-	0.1 (0.1)	73 (30)	0.1 (0.1)	73 (30)
Silver Bream	-	-	1 (0.5)	269 (53)	1 (0.5)	269 (53)
Chub	-	-	0	175 (45)	0	175 (45)

* Salmon and Seatrout are combined because they are difficult to distinguish.

4 Catch and release in other European countries

Ferter et al. (in press) reviewed estimates of retained and released marine fish from several European countries. It shows that the release rates in European countries differ considerably (Table 4-1), from > 80% to only 1%. Release may also partly be due to legal restrictions, such as minimal landing sizes and bag limits (Table 4-2). In the Netherlands, there is a closed fishery for eel, salmon or seatrout. In addition, minimal landing sizes are set by the EU for cod, seabass and pollack. In June 2013 the Netherlands also introduced a bag limit for seabass and cod, restricting the combined possession of seabass and cod to 25 pieces or 20 kg.

Table 4-1 The most recent estimates of the number of retained and returned fish per year, and the calculated proportion released (in %) by European marine anglers listed by species and country. From: Ferter et al. (in press)

Species by country	Data collection year(s)	Number retained	SE	Number returned	SE	Proportion returned (%)
Atlantic cod (*Gadus morhua*)						
England	2012	-	-	-	-	**70**
Norway (tourists, north of 62°N)	2009-2011	530	118	-	-	**66**
Norway (tourists, south of 62°N)	2009-2011	13	5	-	-	**62**
Denmark	2010	986	-	1 548	108	**61**
Sweden	2010	372	-	346	-	**48**
Germany (Baltic Sea)	2012	2 480	-	1 034	-	**29**
The Netherlands	2010/2011	522	83	168	45	**24**
Poland	2010	1 367	-	14	-	**1**
Atlantic salmon (*Salmo salar*)						
Sweden	2010	41	-	23	-	**36**
European eel (*Anguilla anguilla*)						
The Netherlands	2010/2011	172	48	114	28	**40**
European sea bass (*Dicentrarchus labrax*)						
England	2012	-	-	-	-	**77**
France (excl. Mediterranean)	2009/2010	1 577	-	1 824	-	**54**
The Netherlands	2010/2011	227	88	127	34	**36**
Portugal (southern coast)	2006/2007	15	3	4	-	**19**
Pollack (*Pollachius pollachius*)						
England	2012	-	-	-	-	**82**
Norway (tourists, south of 62°N)	2009	17	3	-	-	**56**
Sea trout (*Salmo trutta*)						
Denmark	2010	317	-	725	58	**70**
Sweden	2010	149	-	132	-	**47**

Table 4-2 The presence/absence of recreational (angling) minimum landing sizes (MLS) and bag limits for the presented species when the country surveys were conducted. The "+" indicates that a regulation was implemented at the time of the survey, the "-" that it was not present, and "-/+" that the presence and absence of regulations differed regionally within the country. "Closed" means that the species was protected all year. From: Ferter et al. (in press).

	Atlantic cod (*Gadus morhua*)		**Atlantic salmon** (*Salmo salar*)		**European eel** (*Anguilla anguilla*)		**European sea bass** (*Dicentrarchus labrax*)		**Pollack** (*Pollachius pollachius*)		**Sea trout** (*Salmo trutta*)	
	MLS	Bag limit	MLS	Bag limit	MLS	Bag limit	MLS	Bag limit	MLS	Bag limit	MLS	Bag limit
Denmark	+	-	+	-	+	-	+	-	+	-	+	-
England	+	-	+	-	+	-	+	-	+	-	+	-
France (Atlantic)	+	-	+	-	+	-	+	-	+	-	+	-
Germany (Baltic Sea)	+	-	+	-/+	+	-	+	-	-	-	+	-/+
Netherlands	+	-*	closed	closed	closed	closed	+	-*	+	-	closed	closed
Norway (tourists)	+	+	+	-	closed	closed	-	+	-	+	+	-
Poland	+	+	+	+	+	+	-	-	-	-	+	+
Portugal	+	+	+	+	+	+	+	+	+	+	+	+
Sweden	+	-/+	+	-	closed	closed	-	-	-	-	+	-

* in June 2013 the Netherlands introduced a combined bag limit for cod and sea bass.

5 Conclusions

In this report we gave catch estimates of the most frequently caught fresh water and marine catches. In addition, we updated the raising methods and estimated weights with additional onsite data. We also did some additional analyses of the 2010-2011 logbook survey, such as the amount of money spent and we gave more detailed information about the number of fishingtrips per week and month. There are still a couple of issues that should be taken in consideration. These are listed below.

<u>Data quality</u>

Participants of the logbook survey were asked to record the number of retained and released fish and to measure the length of each individual fish. In addition, in 2009, 2011 and 2012 marine onsite sampling programmes were started to compare and correct the logbook length measurements with measurements collected on site by IMARES employees. A first analysis of length frequency distribution of the fish recorded by the logbook holders suggested that many logbook holders did not measure the fish accurately, but rather estimated the lengths of the fish. In the first place some logbook holders recorded unrealistic length estimates (very small or large). Secondly, the lengths recorded were biased towards 0s and 5s (e.g. 30, 35, 40 etc.). Thirdly, a comparison with onsite data suggests an overestimation of the sizes. Because length-weight relationships are used to estimate the total weight of the catches, overestimation of the lengths results in a significant overestimation of the total weight of retained fish. Length or weight data will need to be obtained in well designed (spatially and temporally) onsite surveys. In Denmark similar unreliable length and weight data were observed in their surveys (Sparrevohn, 2010).

In addition, it is unknown if every recreational fisher is able to distinguish between all fish species. For example salmon and seatrout, rudd and roach and bream and silver bream are difficult to distinguish.

<u>Online survey</u>

It is unknown to what extend the people in the TNS-NIPO panel are representative for the Dutch population with regards to their fishing behaviour. In theory, it is possible that people who like to participate in panel surveys, i.e. members of the TNS-NIPO database, deviate in the fishing behaviour from the average Dutch person. In 2013 a parallel online and random digit dialling screening survey is planned to verify the TNS_NIPO results.

In addition, panel participants match the demographics of the Dutch population in many aspects, such as age, location, gender and educational level, but not in all aspects. For example non-native residents (from Eastern Europe) or second generation immigrants are known to participate in recreational fisheries, but it is unknown how well they are represented by the TNS_NIPO database.

<u>Catch & Release mortality</u>

In this study, the issue of mortality among the released fish has not been accounted for. It is, however, highly likely that 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 53 release mortality studies of catch and release fishing. On average the mortality of catch and release fishing was 18%, ranging from 0% to 95% depending on the species. Therefore, the retained catches presented in this study are probably an underestimate of the mortality rate of the fish due to catch and release mortality.

<u>Foreign recreational fishers</u>

The catch estimates only represent the catches realised by Dutch recreational fishers, the catches of visiting recreational fishers are not accounted for. Based on information from The Dutch angling association (‘Sportvisserij Nederland’), ~ 5% of the fishers are from abroad. It is thus likely that the catch estimates presented here are slightly underestimated. In the near future, collaboration between the member states within ICES WGRF (Working Group on Recreational Fisheries) will provide better insight in the number of foreign recreation fishers in Dutch waters.

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References

Bartholomew, A., Bohnsack, J.A., 2005. A review of catch-and-release angling mortality with implications for no-take reserves. Reviews in Fish Biology and Fisheries 15, 129-154.

Ferter, K., Weltersbach, M.S., Strehlow, H., Vølstad, j.h., Alós, J., Arlinghaus R., Armstrong, M, Dorow M., de Graaf, M., Hammen van der T, Hyder, K., Levrel, H., Paulrud, A., Radtke, K., Rocklin, D., Sparrevohn, C.R. and Veiga, P. In press. Unexpectedly high catch-and-release rates in European marine recreational fisheries: implications for science and management. ICES Journal of Marine Science

Hammen van der, T and de Graaf, M 2012. Recreational fishery in the Netherlands: catch estimates of cod (*Gadus morhua*) and eel (*Anguilla anguilla*) in 2010. IMARES Wageningen UR, Report Number C014/12, 61 pp.

ICES 2012 Report of the Working Group on Assessment of New MoU Species (WGNEW), 5 - 9 March 2012, ICES CM 2012/ACOM:20. 258 pp.

Sarndal, C.E., Lundstrom, S., 2005. Estimation in Surveys with Nonresponse. Wiley. Sparrevohn, C.R.S.-P., M., 2010. Eel and cod catches in Danish recreational fishing.

Survey design and 2009 catches. DTU Aqua report no. 217-2010. Charlottenlund. National Institute of Aquatic Ressources, Technical University of Denmark, 23 p.

Justification

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The scientific quality of this report has been peer reviewed by a colleague scientist and the head of the department of IMARES.

Approved: drs. B. Griffioen
Researcher

Signature:

Date: 24th of October 2013

Approved: drs. J.H.M. Schobben
Head of Department

Signature:

Date: 24th of October 2013

Appendix 1. Vragen Screening survey December 2011

Heeft u vorig jaar, in 2011, gevist in Nederlands zee- en\of kustwater?
1 Ja
2 Nee

Hoe vaak heeft u in 2011 ongeveer gevist in Nederlands zeewater of kustwater?
1 1-5 keer
2 6-10 keer
3 11-25 keer
4 26-50 keer
5 Meer dan 50 keer

Met welk vistuig heeft u gevist in Nederlands zeewater of kustwater?
(V30_1) Hengel
(V30_2) Peur
(V30_3) Fuik
(V30_4) Staand want
(V30_5) Hoekwant
(V30_6) Anders, namelijk...

Heeft u vorig jaar, in 2011, gevist in Nederlands binnenwater?
1 Ja
2 Nee

Hoe vaak heeft u in 2011 ongeveer gevist in Nederlands binnenwater?
1 1-5 keer
2 6-10 keer
3 11-25 keer
4 26-50 keer
5 Meer dan 50 keer

Met welk vistuig heeft u gevist in Nederland s binnenwater?
1 Hengel
2 Peur
3 Fuik
4 Staand want
5 Hoekwant
6 Anders, namelijk...

Bent u een...
1 man
2 vrouw

Wat is uw leeftijd?

Wat is uw hoogst gevolgde opleiding? De opleiding hoeft niet afgerond te zijn
1 geen onderwijs\basisonderwijs
2 lbo\vbo\vmbo (kader- en beroepsgerichte leerweg)
3 mavo\eerste 3 jaar havo en vwo\vmbo (theoretische en gemengde leerweg)
4 mbo
5 havo en vwo bovenbouw\wo-propedeuse
6 hbo\wo-bachelor of kandidaats
7 wo-doctoraal of master
8 weet niet

(V110) Uit hoeveel personen bestaat uw huishouden (inclusief uzelf)?

Appendix 2. 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 returned fish per fishermen is estimated:

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

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.

The total catch number for each species, waterbody type and avidity group is calculated by multiplying the yearly mean catch rate 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).

Appendix 3

Numbers and proportions per age and sex of fishers in the 2009 and 2011 screening surveys

	Nfishers = 11944		***Nscreening = 109293***		***Nfishers = 9573***		***Nscreening = 106885***	
	2009				**2011**			
	women		men		women		men	
AGE	number	proportion	number	proportion	number	proportion	number	proportion
6	28	0.00234	58	0.00486	40	0.00418	99	0.01034
7	72	0.00603	184	0.01541	64	0.00669	135	0.01410
8	103	0.00862	264	0.02210	75	0.00783	189	0.01974
9	113	0.00946	266	0.02227	93	0.00971	204	0.02131
10	130	0.01088	298	0.02495	86	0.00898	282	0.02946
11	99	0.00829	284	0.02378	91	0.00951	264	0.02758
12	86	0.00720	247	0.02068	73	0.00763	253	0.02643
13	75	0.00628	212	0.01775	56	0.00585	211	0.02204
14	54	0.00452	226	0.01892	48	0.00501	167	0.01744
15	40	0.00335	201	0.01683	31	0.00324	145	0.01515
16	31	0.00260	165	0.01381	29	0.00303	123	0.01285
17	17	0.00142	148	0.01239	16	0.00167	109	0.01139
18	31	0.00260	143	0.01197	17	0.00178	107	0.01118
19	33	0.00276	115	0.00963	12	0.00125	72	0.00752
20	27	0.00226	93	0.00779	26	0.00272	80	0.00836
21	27	0.00226	98	0.00820	16	0.00167	83	0.00867
22	19	0.00159	108	0.00904	20	0.00209	65	0.00679
23	26	0.00218	92	0.00770	11	0.00115	64	0.00669
24	34	0.00285	94	0.00787	21	0.00219	73	0.00763
25	23	0.00193	86	0.00720	18	0.00188	61	0.00637
26	27	0.00226	90	0.00754	24	0.00251	63	0.00658
27	32	0.00268	105	0.00879	14	0.00146	52	0.00543
28	32	0.00268	89	0.00745	17	0.00178	77	0.00804
29	38	0.00318	98	0.00820	20	0.00209	68	0.00710
30	31	0.00260	86	0.00720	22	0.00230	69	0.00721
31	34	0.00285	110	0.00921	28	0.00292	61	0.00637
32	28	0.00234	116	0.00971	30	0.00313	75	0.00783
33	31	0.00260	120	0.01005	26	0.00272	84	0.00877
34	28	0.00234	111	0.00929	17	0.00178	97	0.01013
35	31	0.00260	117	0.00980	18	0.00188	100	0.01045
36	40	0.00335	140	0.01172	20	0.00209	96	0.01003
37	45	0.00377	165	0.01381	20	0.00209	97	0.01013
38	43	0.00360	151	0.01264	32	0.00334	109	0.01139
39	46	0.00385	198	0.01658	28	0.00292	115	0.01201
40	51	0.00427	191	0.01599	30	0.00313	136	0.01421
41	31	0.00260	208	0.01741	31	0.00324	150	0.01567
42	32	0.00268	176	0.01474	33	0.00345	144	0.01504
43	48	0.00402	213	0.01783	18	0.00188	165	0.01724
44	37	0.00310	171	0.01432	20	0.00209	132	0.01379
45	36	0.00301	160	0.01340	22	0.00230	161	0.01682
46	24	0.00201	170	0.01423	22	0.00230	132	0.01379
47	29	0.00243	164	0.01373	20	0.00209	128	0.01337
48	28	0.00234	168	0.01407	27	0.00282	121	0.01264
49	24	0.00201	151	0.01264	21	0.00219	126	0.01316
50	27	0.00226	142	0.01189	24	0.00251	123	0.01285
51	40	0.00335	152	0.01273	20	0.00209	113	0.01180
52	22	0.00184	122	0.01021	15	0.00157	103	0.01076
53	25	0.00209	133	0.01114	19	0.00198	119	0.01243
54	20	0.00167	139	0.01164	24	0.00251	108	0.01128
55	31	0.00260	127	0.01063	9	0.00094	98	0.01024
56	31	0.00260	122	0.01021	20	0.00209	94	0.00982
57	19	0.00159	132	0.01105	22	0.00230	98	0.01024
58	21	0.00176	118	0.00988	22	0.00230	93	0.00971

59	19	0.00159	125	0.01047	17	0.00178	112	0.01170
60	22	0.00184	118	0.00988	19	0.00198	100	0.01045
61	24	0.00201	154	0.01289	13	0.00136	95	0.00992
62	17	0.00142	119	0.00996	25	0.00261	113	0.01180
63	25	0.00209	149	0.01247	15	0.00157	129	0.01348
64	9	0.00075	107	0.00896	9	0.00094	107	0.01118
65	11	0.00092	107	0.00896	17	0.00178	133	0.01389
66	19	0.00159	81	0.00678	7	0.00073	89	0.00930
67	9	0.00075	87	0.00728	10	0.00104	90	0.00940
68	8	0.00067	65	0.00544	12	0.00125	81	0.00846
69	7	0.00059	61	0.00511	7	0.00073	73	0.00763
70	6	0.00050	78	0.00653	2	0.00021	55	0.00575
71	4	0.00033	74	0.00620	4	0.00042	52	0.00543
72	6	0.00050	44	0.00368	2	0.00021	75	0.00783
73	1	0.00008	33	0.00276	3	0.00031	42	0.00439
74	2	0.00017	47	0.00394	3	0.00031	36	0.00376
75	3	0.00025	36	0.00301	0	0.00000	29	0.00303
76	2	0.00017	18	0.00151	0	0.00000	29	0.00303
77	1	0.00008	13	0.00109	2	0.00021	25	0.00261
78	3	0.00025	17	0.00142	2	0.00021	18	0.00188
79	1	0.00008	9	0.00075	0	0.00000	12	0.00125
80	1	0.00008	11	0.00092	1	0.00010	9	0.00094
81	0	0.00000	8	0.00067	1	0.00010	4	0.00042
82	0	0.00000	3	0.00025	0	0.00000	8	0.00084
83	0	0.00000	4	0.00033	1	0.00010	6	0.00063
84	0	0.00000	1	0.00008	0	0.00000	3	0.00031
85	1	0.00008	1	0.00008	0	0.00000	3	0.00031
86	1	0.00008	1	0.00008	0	0.00000	0	0.00000
87	0	0.00000	2	0.00017	0	0.00000	0	0.00000
88	0	0.00000	0	0.00000	0	0.00000	0	0.00000
89	0	0.00000	2	0.00017	0	0.00000	0	0.00000
90	0	0.00000	0	0.00000	0	0.00000	0	0.00000
91	0	0.00000	0	0.00000	0	0.00000	1	0.00010
92	0	0.00000	0	0.00000	0	0.00000	0	0.00000
93	0	0.00000	0	0.00000	0	0.00000	0	0.00000
94	0	0.00000	0	0.00000	0	0.00000	0	0.00000
95	0	0.00000	0	0.00000	0	0.00000	0	0.00000
96	0	0.00000	0	0.00000	0	0.00000	1	0.00010

Appendix 4

Table 6-1 Fresh: Mean weight, mean length and number of fish in the logbook survey (2010).

Species		*mean weight (gram)*		*mean Length (cm)*		*Number*	
Dutch name	English name	retained	returned	retained	returned	retained	returned
Aal	Eel	195.0	160.5	40.7	37.2	293	704
Alver	Common bleak	-	19.9	-	12.8	0	246
Baars	Perch	215.5	281.2	19.2	17.9	121	4823
Barbeel	Barbus barbus	28.9	516.6	14.0	27.6	11	64
Bittervoorn	European bitterling	33.0	81.1	12.1	13.5	11	221
Blankvoorn	Common roach	44.4	186.8	12.9	16.6	47	10863
Bot	Flounder	170.4	178.8	23.0	23.3	6	6
Brasem	Common bream	1161.5	797.5	31.3	35.1	46	5822
Giebel	Prussian carp	57.2	3369.3	8.0	22.3	1	161
Goudvis	Goldfish	40.3	19.1	13.2	8.2	6	119
Graskarper	Grass carp	2138.4	1687.4	38.5	41.2	8	258
Karper	common carp	1199.6	2986.6	32.8	41.7	34	2213
Kolblei	Silver Bream	51.5	168.2	12.8	18.3	11	1340
Kopvoorn	European chub	16.4	202.1	12.0	21.1	1	673
Kroeskarper	Crucian carp	608.2	374.4	20.8	19.9	10	424
Meerval	Catfish	21.6	468.6	14.2	19.7	26	163
Pos	Ruffe	330.5	101.0	20.5	13.2	6	393
Puitaal	eelpout	-	31.4	-	18.5	0	2
Regenboogforel	Rainbow trout	449.1	415.3	32.2	27.7	709	97
Rivierdonderpad	Cottus perifretum	-	17.3	-	9.3	0	68
Riviergrondel	Gobio gobio	61.6	175.4	16.7	13.2	3	162
Roofblei	Asp	13.3	146.4	11.3	19.1	3	241
Ruisvoorn	Common rudd	97.9	159	15.8	16.4	36	6408
Serpeling	Common dace	18.0	97.5	13.0	20.3	1	59
Snoek	Pike	1094.7	1455.2	35.8	45.0	100	1754
Snoekbaars	Pikeperch	1873.6	921.2	51.8	38.2	145	1294
Spiegelkarper	Common carp	180.0	2069.0	19.0	35.4	2	232
Spiering	Smelt	-	7.6	-	10.4	0	12
Winde	Ide	17.8	177.3	12	21.8	10	377
Zalm	Salmon	89.0	176.3	18.7	19.4	104	34
Zeebaars	Sea bass	179.5	195.4	26.0	25.0	4	3
Zeeforel	Sea trout	705.4	275.3	39.7	28.4	62	18
Zeelt	Tench	1332.2	823.1	37.1	32.2	7	334
Zonnebaars	sunfish	23.2	53.3	11.0	10.5	1	75
Zwartbekgrondel	Round Goby	-	30.4	-	11.1	0	30
Onbekend	Unknown	-	-	-	-	1	371

Table 6-2 Marine: Mean weight, mean length and number of fish in the logbook survey (2010).

		mean weight (gram)		mean Length (cm)		Number	
species	English name	retained	returned	retained	returned	retained	returned
Aal	Eel	255.6	189.4	-	38.2	180	97
Bot	Flounder	420.3	209.9	28.6	21.8	312	568
Diklipharder	Thick-lipped grey	1377.9	185.9	48.8	23.0	12	38
Doornhaai	Spurdog	460.3	785	50.0	60.0	1	1
Dwergtong	Solenette	1007.8	2557.7	26.6	32.5	7	8
Fint	Twaite shad	14.2	1426.2	12.2	48.3	12	85
Geep	Garfish	196.5	98.0	47.9	34.7	129	72
Gladde haai	Smoothhound	12.0	755.5	7.9	48.0	10	6
Griet	Brill	88.8	44.8	18.7	13.3	17	7
Grote pieterman	Greater weever	123.8	48.9	21.3	13.9	8	14
Haring	Herring	174.1	90.7	22.3	15.1	35	46
Hondshaai	Lesser spotted dogfish	-	1133.1	-	62.0	0	3
Horsmakreel	Horse mackerel	156.3	205.2	28.9	31.1	87	51
Kabeljauw	Cod	2175.1	476.4	51.9	28.2	419	130
Makreel	Mackerel	424.8	390.9	34.4	30.0	2877	314
Puitaal	Eelpout	-	43.4	-	20.0	0	52
Rode poon	Tub gurnard	153.6	66.2	24.7	19.0	12	6
Schar	Dab	233.8	130.4	25.8	19.1	1008	516
Schelvis	Haddock	246.3	110.3	27.8	18.7	77	88
Schol	Plaice	335.7	145.0	28.1	18.5	792	527
Spiering	Smelt	5.7	35.4	9.2	16.5	145	6
Steenbolk	Bib	1038.7	293.0	35.0	19.7	103	251
Tarbot	Turbot	1277.2	208.2	31.9	21.6	21	9
Tong	Sole	218.9	150.9	27.0	20.9	173	36
Wijting	Whiting	180.9	133.4	28.7	22.5	554	486
Witte koolvis	Pollack	792.2	3.2	39.7	6.0	3	4
Zalm	Salmon	158.5	186.1	21.8	21.0	13	9
Zeebaars	Sea bass	1091.9	401.6	43.0	29.5	173	129
Zeedonderpad	Bull-rout	-	118.7	-	17.0	0	4
Zeeforel	Sea trout	2291.6	689.3	35.6	28.2	7	9
Zwarte koolvis	Saithe	300.8	231.1	30.0	21.5	5	13
Onbekend	Unknown	-	-	-	-	63	27

Appendix 5

Table 6-3 Mean number of fishtrips per fisher per month

Month	*Fresh*	*Marine*
March	0.48	0.08
April	0.66	0.13
May	0.93	0.16
June	0.90	0.19
July	0.98	0.20
August	1.10	0.23
September	0.79	0.16
October	0.63	0.14
November	0.37	0.10
December	0.16	0.07
January	0.24	0.08
February	0.27	0.08

Table 6-4 Proportion of fishtrips over the week in fresh water or marine water

	Mon	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*
marine	0.09	0.09	0.11	0.10	0.13	0.29	0.19
fresh	0.11	0.10	0.12	0.11	0.12	0.23	0.21