

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

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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.

| Soort          | Zout                          |                           |                    | Zoet              |                               |                           |                            |
|----------------|-------------------------------|---------------------------|--------------------|-------------------|-------------------------------|---------------------------|----------------------------|
|                | 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             | Snoekbaars        | 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.

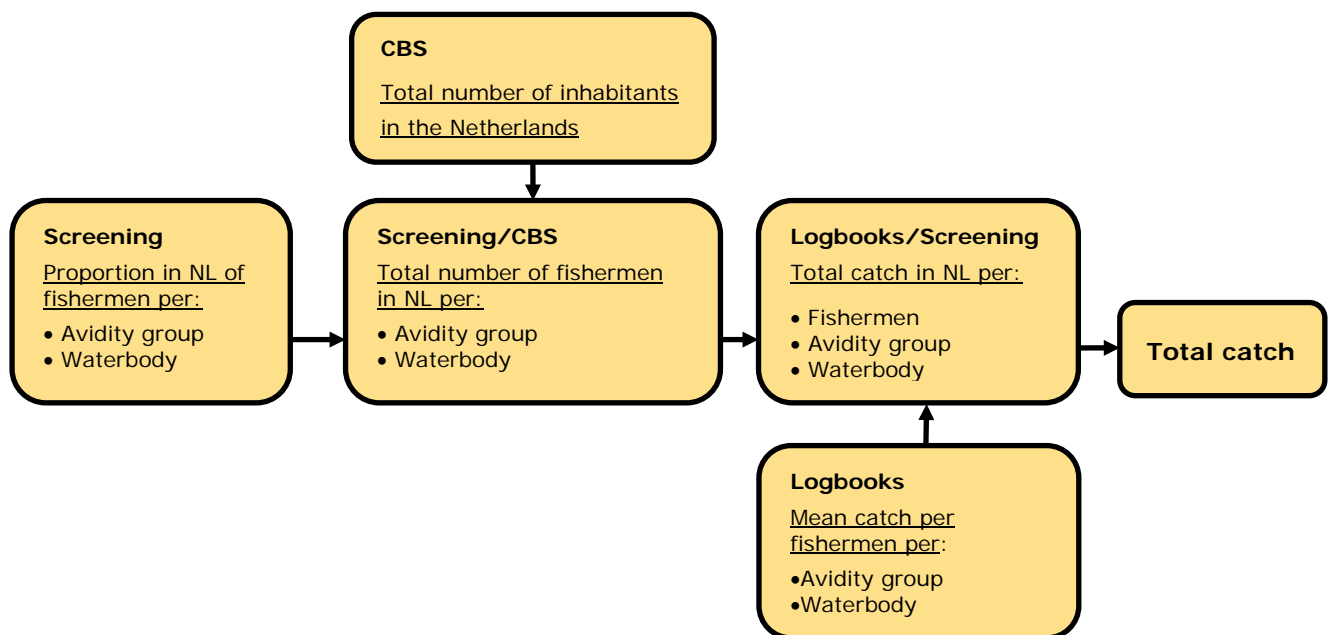
In 2014 a separate survey will be developed to provide insight in the catches of the recreational gill net fishery in the coastal waters.

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.

|        | <i>year</i> | <i>Location</i>                      | <i>Nr observers</i> | <i>shore/boat</i> | <i>Nr days</i> |
|--------|-------------|--------------------------------------|---------------------|-------------------|----------------|
| 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

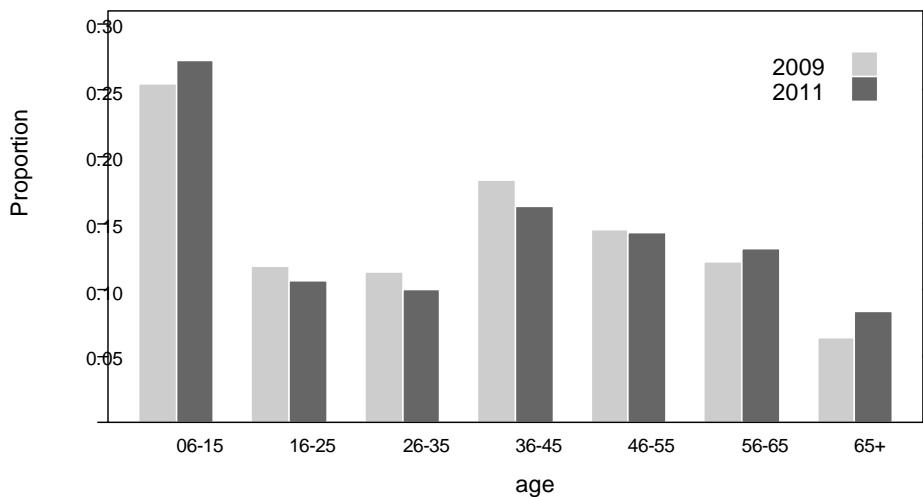
#### 3.1 Screening December 2011

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<br>(nr of fishtrips<br>per year) | Nr fishers in<br>Screening Survey | Proportion of fisher<br>in Screening Survey | Total nr of<br>fishers in NL ( $\pm$ SE) | Nr fishers in<br>Screening<br>Survey | Proportion of<br>fisher<br>in Screening<br>Survey | Total nr of fishers in<br>NL ( $\pm$ 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                                       | <b>1 689 039</b> (16 664)                | 9 573                                | 0.090   | <b>1 399 502</b> (13 648)                |

\* number of inhabitants  $\geq 6$  years in January 2010 or 2012 (source: CBS)

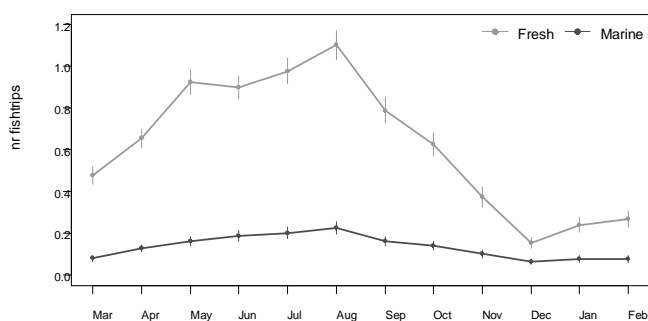


**Figure 3-1** Age distribution of fishers in the 2009 and 2011 screening surveys

## 3.2 Logbooks 2010

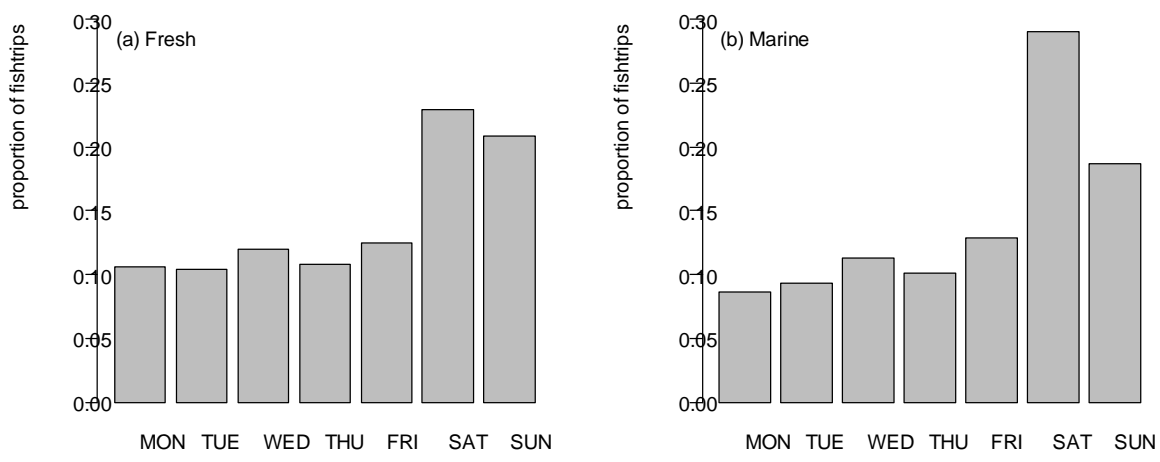
### 3.2.1 Fishtrips

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 ( $\pm 0.44$  se) trips in fresh water and 1.6 ( $\pm 0.16$  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).

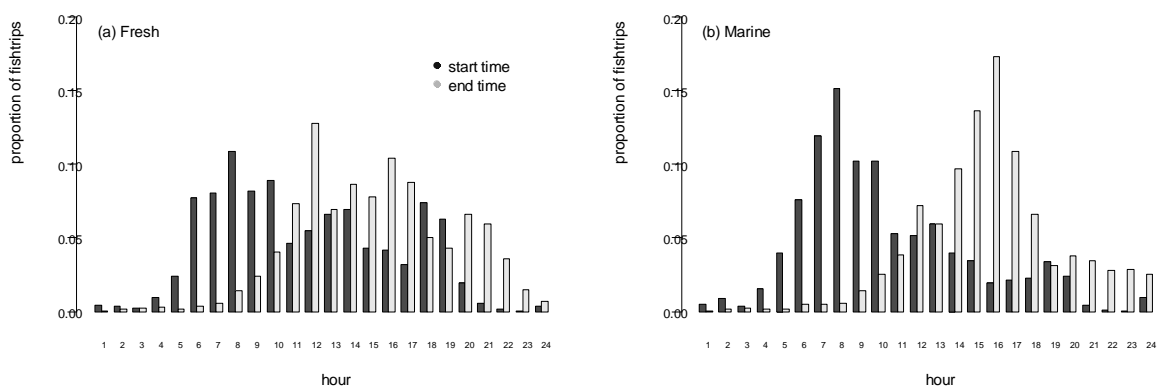


**Figure 3-2** Mean number of fishtrips per fisher for marine (black) and fresh waters (grey) plus standard errors.

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.



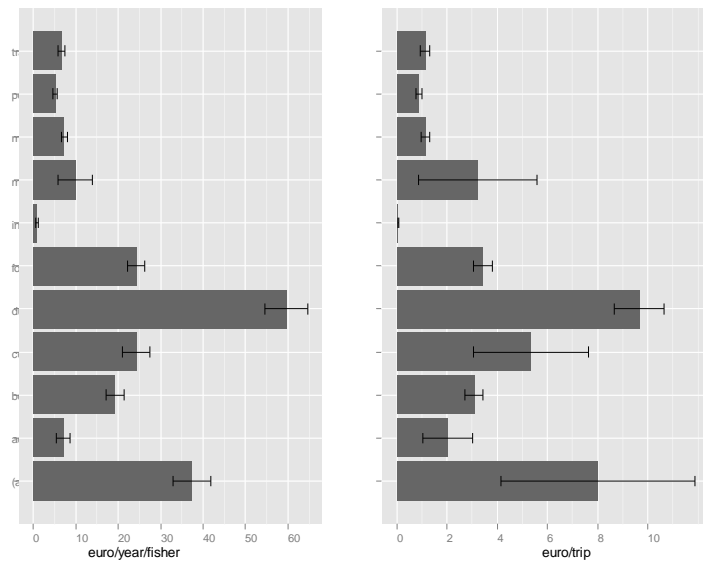
**Figure 3-3** Proportion of fishtrips over the week in fresh water (a) or marine water (b)



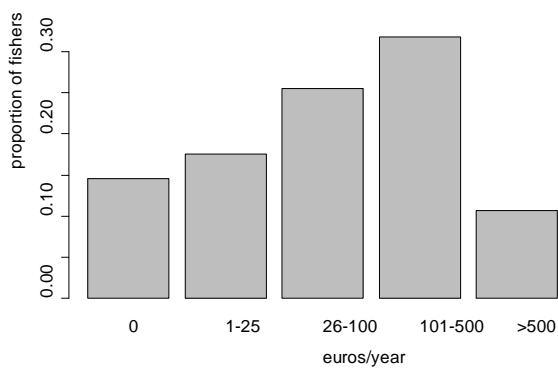
**Figure 3-4** Start time and end time of fishing trips

### 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).

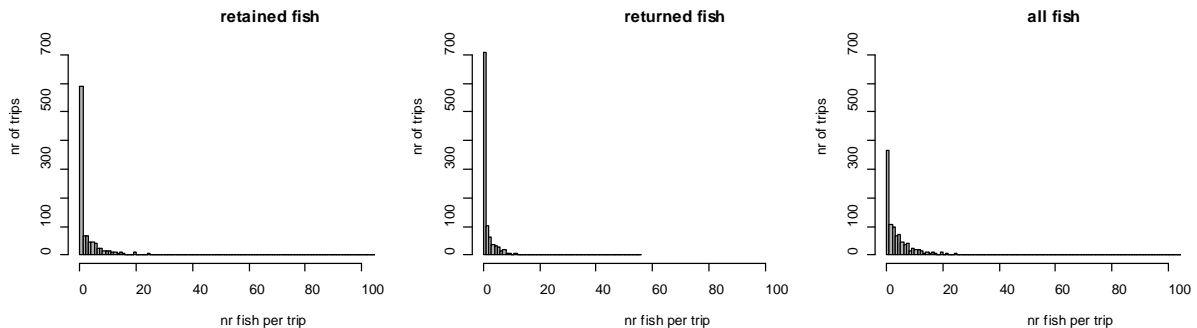
### 3.3 catch estimation

#### 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.

|                      | <i>Retained</i> |      |       |      |       |      | <i>Returned</i> |      |      |      |       |      |
|----------------------|-----------------|------|-------|------|-------|------|-----------------|------|------|------|-------|------|
|                      | 287             |      | 93    |      | 52    |      | 287             |      | 93   |      | 52    |      |
| nr fishers           |                 |      |       |      |       |      |                 |      |      |      |       |      |
| 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/<br>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         |

\*Sea trout 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).

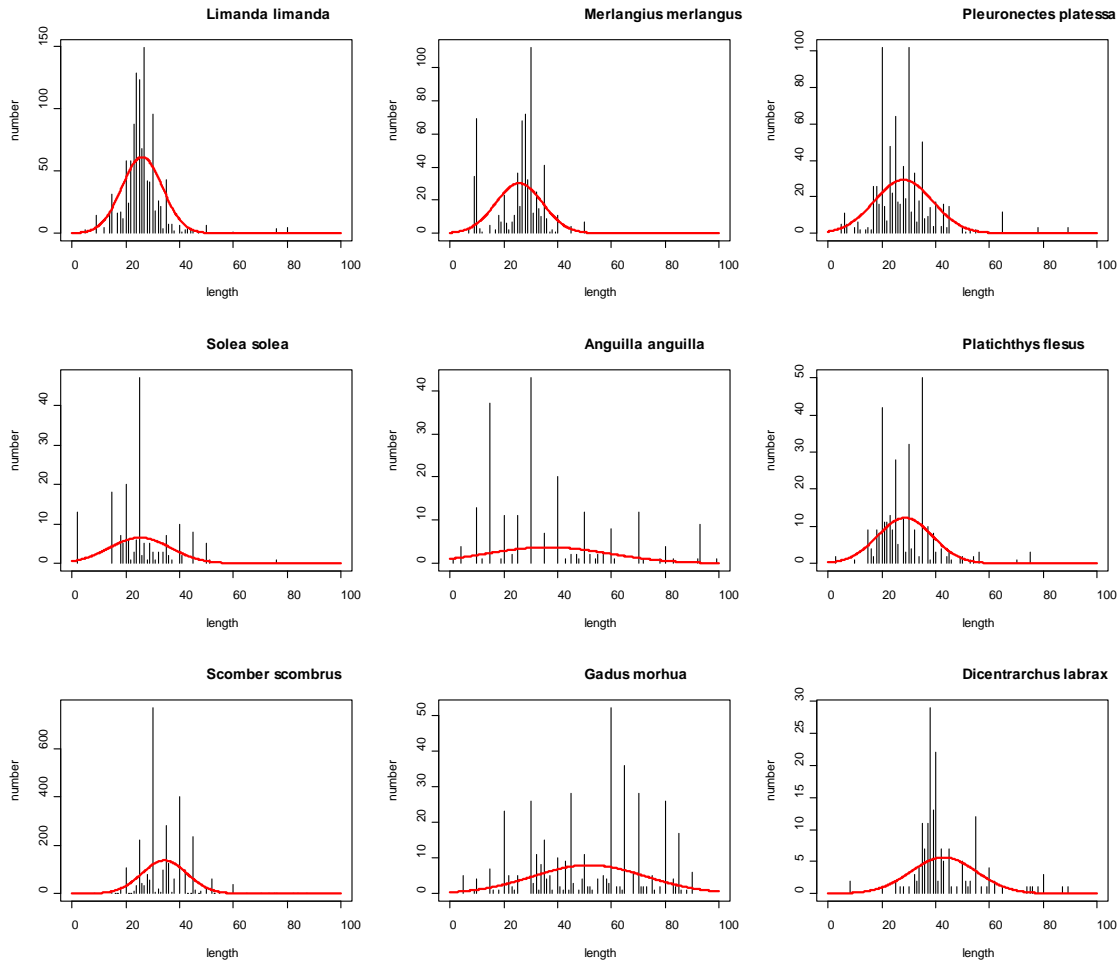
| <i>species</i>    | <i>retained</i> | <i>returned</i> | <i>sum</i>   | <i>% retained</i> |
|-------------------|-----------------|-----------------|--------------|-------------------|
| Mackerel          | 3 750 (507)     | 388 (121)       | 4 138 (545)  | 91                |
| Dab               | 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                |
| Sea trout/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                |

\*Sea trout and salmon are difficult to distinguish and are therefore grouped in the analysis.

### 3.3.2 Marine: weight

#### Length frequency distribution logbook survey (retained)

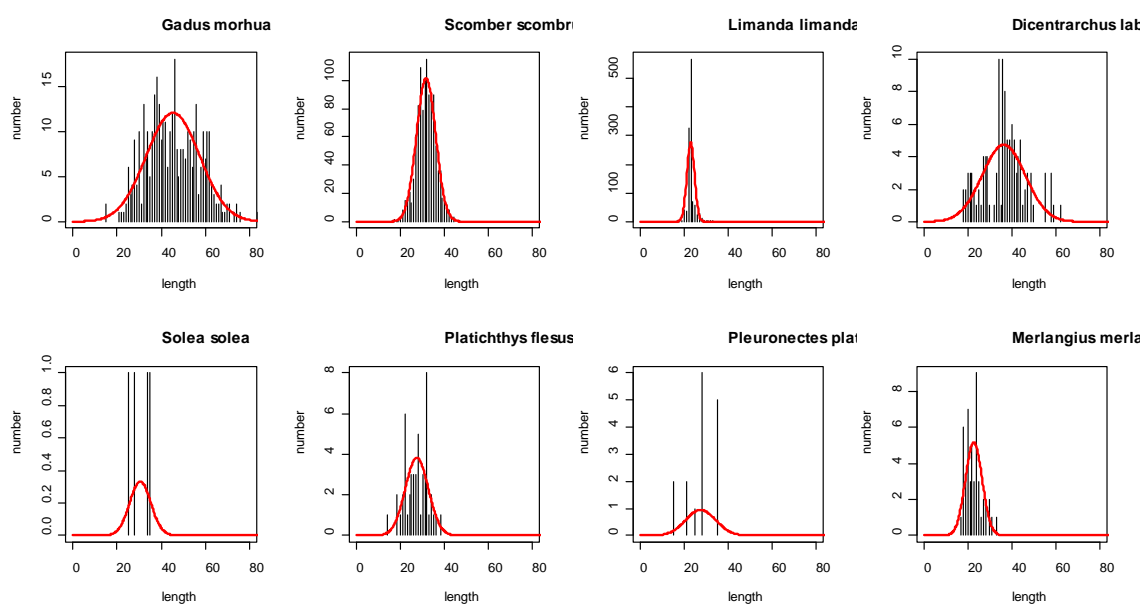
Participants of the logbooks were asked to measure the lengths of their catches. This resulted in length frequency distributions (Figure 3-8), which were in some cases biased to round numbers (e.g. ending on 0 or 5), which made us believe that many of the recorded lengths may have been estimated instead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



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

Length frequency distribution onsite survey (retained)

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.

| species           | Onsite (cm)<br>(±SE) |                    | Logbook (cm) (±SE)  |                    | Difference<br>retained<br>onsite vs.<br>logbook<br>(%) |
|-------------------|----------------------|--------------------|---------------------|--------------------|--|
|                   | retained             | Returned           | retained            | returned           |  |
| 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)  | -  |
| Sea trout/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

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

| <b>Species</b>   | <i>onsite survey</i>                         |                            | <i>logbooks</i>                              |                            |                            |                            |
|------------------|--|----------------------------|--|----------------------------|----------------------------|----------------------------|
|                  | Angling and passive gears<br><b>retained</b> | Angling<br><b>retained</b> | Angling and passive gears<br><b>retained</b> | Angling<br><b>retained</b> | Angling<br><b>retained</b> | Angling<br><b>returned</b> |
| 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.

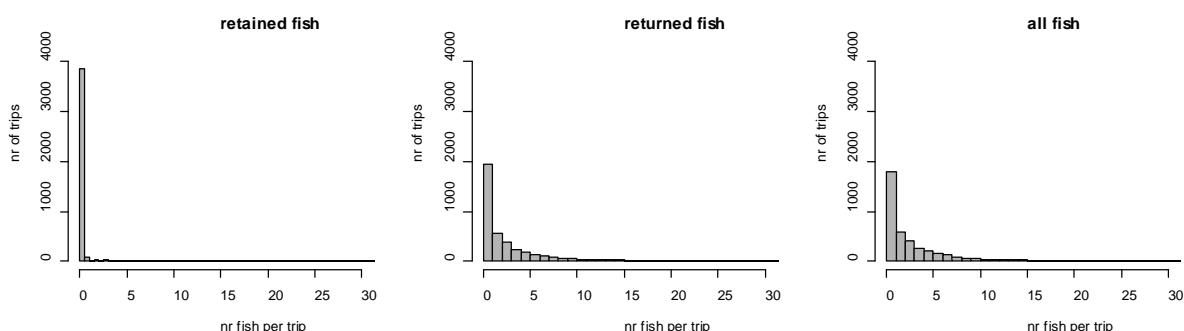
**Table 3-8** Commercial catches vs. recreational catches (tonnes).

| <b>Species</b> | <b>Commercial landings</b>  | <b>Commercial landings</b> | <b>Recreational Landings*</b> | <b>% recreational landings</b> |
|----------------|---|----------------------------|-------------------------------|--------------------------------|
| 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.

| nr fishers               | Retained |      |       |      | Returned |      |       |      |       |      |       |      |       |      |       |       |
|--------------------------|----------|------|-------|------|----------|------|-------|------|-------|------|-------|------|-------|------|-------|-------|
|                          | 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).

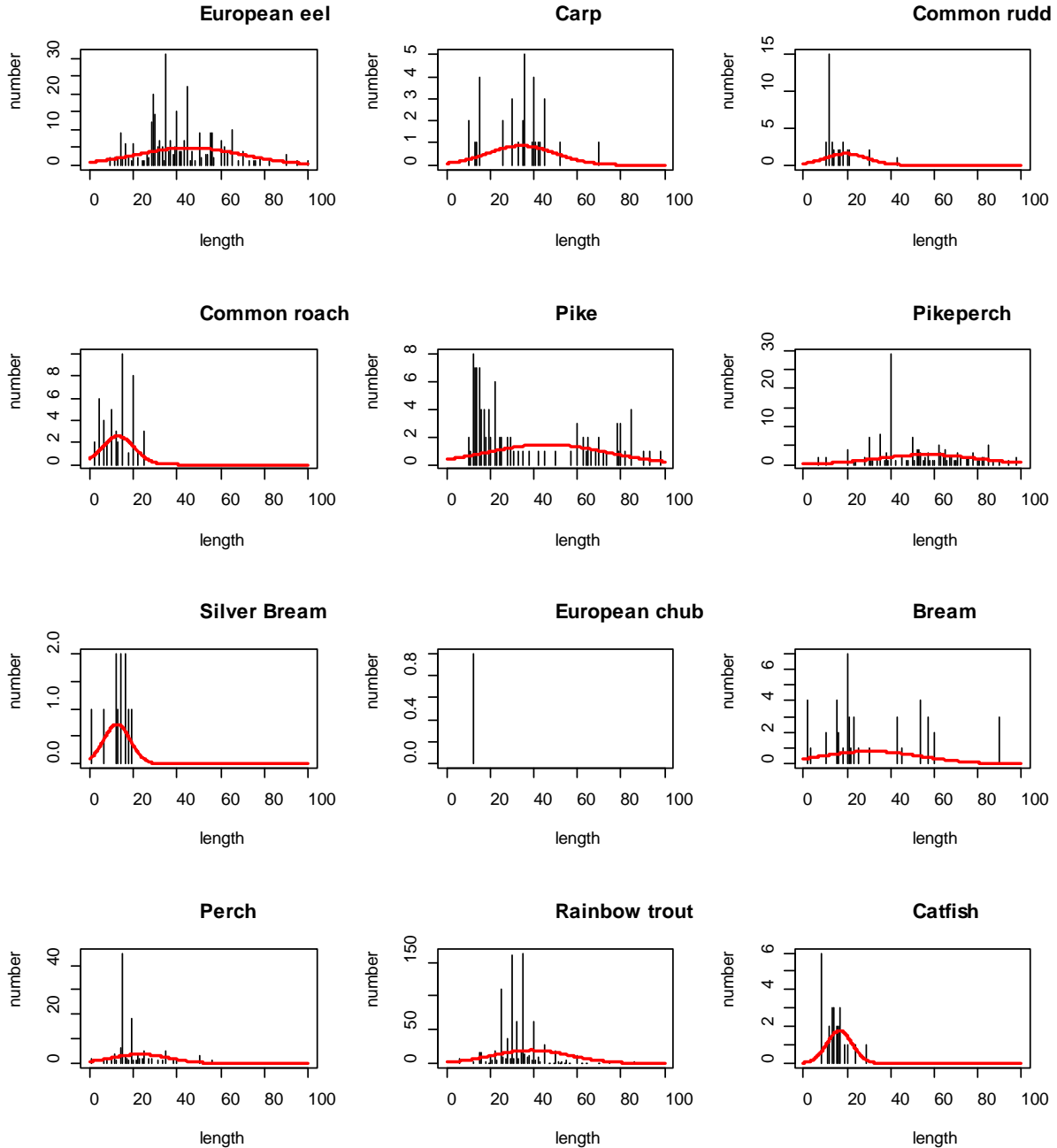
| Gear    | Species          | Retained | Returned | Sum     | % retained |
|---------|------------------|----------|----------|---------|------------|
| all     | Rainbow trout    | 23 (23)  | 13 (6)   | 36 (24) | 64         |
|         | Seatrout/Salmon* | 19 (5)   | 15 (2)   | 34 (5)  | 56         |
|         | 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

Length frequency distribution logbook survey (retained)

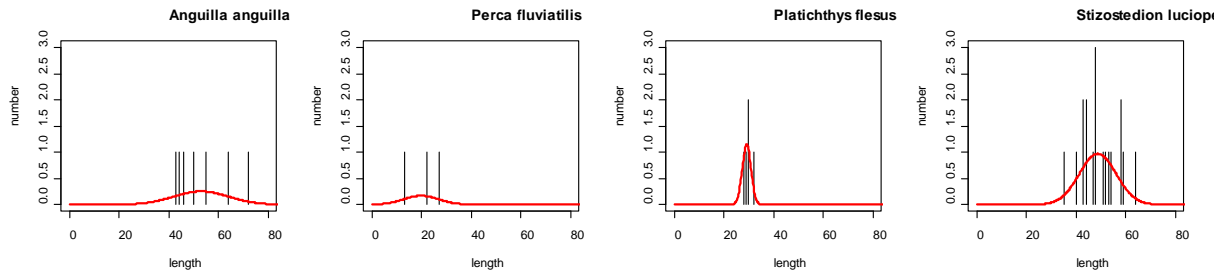
The length frequency distributions in the logbooks for retained fresh water fish are shown in Figure 3-11.



**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.

| Species           | Onsite (cm) ( $\pm$ SE) |          | Logbook (cm) ( $\pm$ SE) |                      | Difference retained onsite vs. logbook |
|-------------------|-------------------------|----------|--------------------------|----------------------|--|
|                   | Retained                | Returned | Retained                 | Returned             |  |
| 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                                    |
| Sea trout/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 Sea trout 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         |                 |
| <b>Species</b>   | <b>Retained</b>            | <b>Retained</b> | <b>Retained</b>             | <b>Returned</b> | <b>Retained</b> | <b>Returned</b> |
| 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/Sea trout | -                          | -               | 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 Sea trout 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 sea trout. 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 (%) |
|--|-------------------------|-----------------|-----|-----------------|-----|-------------------------|
| <b>Atlantic cod (<i>Gadus morhua</i>)</b>              |                         |                 |     |                 |     |                         |
| 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                       |
| <b>Atlantic salmon (<i>Salmo salar</i>)</b>            |                         |                 |     |                 |     |                         |
| Sweden   | 2010                    | 41              | -   | 23              | -   | 36                      |
| <b>European eel (<i>Anguilla anguilla</i>)</b>         |                         |                 |     |                 |     |                         |
| The Netherlands  | 2010/2011               | 172             | 48  | 114             | 28  | 40                      |
| <b>European sea bass (<i>Dicentrarchus labrax</i>)</b> |                         |                 |     |                 |     |                         |
| 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                      |
| <b>Pollack (<i>Pollachius pollachius</i>)</b>          |                         |                 |     |                 |     |                         |
| England  | 2012                    | -               | -   | -               | -   | 82                      |
| Norway (tourists, south of 62°N)                       | 2009                    | 17              | 3   | -               | -   | 56                      |
| <b>Sea trout (<i>Salmo trutta</i>)</b>                 |                         |                 |     |                 |     |                         |
| 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).

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

### Data quality

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 sea trout, rudd and roach and bream and silver bream are difficult to distinguish.

### Online survey

It is unknown to what extent 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.

### Catch & Release mortality

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.

### Foreign recreational fishers

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.

## 6 Acknowledgements

A. Dijkman-Dulkes, participants of the onsite-survey, B. Rombouts and B. Aarsman are thanked for onsite data collection, A. Klaassen and L. van Thiel from TNS\_NIPO for the online screening and logbook surveys, D. Benden for building the IMARES 'recfish' database and the participants of the logbook survey are thanked for filling in the monthly online logbooks.

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## Justification

Rapport C147/13

Project Number: 4301216004

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: 24<sup>th</sup> of October 2013

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

Signature:



Date: 24<sup>th</sup> 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 ( $n$ ), 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:

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

where  $C_{a,w,s,r}$  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.

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

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 ( $n$ ).

## Appendix 3

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

| AGE | <i>Nfishers = 11944</i> |            | <i>Nscreening = 109293</i> |            | <i>Nfishers = 9573</i> |            | <i>Nscreening = 106885</i> |            |
|-----|-------------------------|------------|----------------------------|------------|------------------------|------------|----------------------------|------------|
|     | <b>2009</b>             |            |                            |            | <b>2011</b>            |            |                            |            |
|     | women                   |            | men                        |            | women                  |            | men                        |            |
|     | 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).

| <i>Species</i>  |                     | <i>mean weight (gram)</i> |          | <i>mean Length (cm)</i> |          | <i>Number</i> |          |
|-----------------|---------------------|---------------------------|----------|-------------------------|----------|---------------|----------|
| 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).

| species         | English name           | <i>mean weight (gram)</i> |          | <i>mean Length (cm)</i> |          | <i>Number</i> |          |
|-----------------|------------------------|---------------------------|----------|-------------------------|----------|---------------|----------|
|                 |                        | 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

| <i>Month</i> | <i>Fresh</i> | <i>Marine</i> |
|--------------|--------------|---------------|
| 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

|        | <i>Mon</i> | <i>Tue</i> | <i>Wed</i> | <i>Thu</i> | <i>Fri</i> | <i>Sat</i> | <i>Sun</i> |
|--------|------------|------------|------------|------------|------------|------------|------------|
| 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       |