

# Stichting Wageningen Research Centre for Fisheries Research (CVO)

## **Recreational fisheries in the Netherlands: Analyses of the 2017 screening survey and the 2016 – 2017 logbook survey.**

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## Summary

The legal framework for the collection of recreational fisheries data by EU Member States was given by the EU Data Collection Framework (Council Regulation EU 1004/2017 and Commission Decision EU 1251/2016). The Netherlands are obliged to report on landings of cod, European sea bass, pollack, sharks and rays in marine water and on eel and salmon by recreational fishers in marine and fresh water. On behalf of the Ministry of Agriculture, Nature and Food Quality, the Recreational Fisheries Programme was started in 2009 under the Statutory Tasks Programme (WOT visserij). The Recreational Fisheries Programme consists of four surveys: (1) screening survey, (2) logbook survey, (3) onsite survey and (4) gillnet survey. Results of the gillnet survey were presented in a separate report.

In order to estimate the number of recreational anglers fishing in fresh or marine waters, a biennial online screening survey (~ 50,000 households) was conducted in December 2009, 2011, 2013, 2015 and 2017. Results show that since 2009, the number of recreational anglers in the Netherlands has been declining (1.7, 1.4, 1.3, 1.2 and 1.1 million for 2009, 2011, 2013, 2015 and 2017 respectively). After 2013, the decline can be attributed to a decreasing number of fresh water anglers (1.2 million in 2013 to 1.0 million in 2017). The number of marine anglers slightly increased between 2013 and 2017 (492 thousand in 2013 and 529 thousand in 2017).

To estimate the yearly catches, logbook surveys were conducted in 2010-2011 (March 2010 to February 2011), 2012-2013 (April 2012 to March 2013), 2014-2015 (April 2014 to March 2015) and 2016-2017 (March 2016 to February 2017). Participants for the 2016-2017 logbook survey (2,672) were recruited from the 2015 screening survey (n=2,607) and additional (high avid) anglers were recruited through recreational fishing websites (n=65). This report provides an overview of the catch estimates of cod, European sea bass and eel resulting from the logbook survey of 2016-2017. Estimates of catches of eel and cod are much lower than in previous years. The estimates of retained eel are based on very low numbers of anglers reporting eel, resulting in very low precision (high confidence intervals). The catch estimates of cod, sea bass and eel are summarized in Table 1-1A. Only few pollack, salmon, rays and sharks catches were reported. These have not been raised to the population number, but only the absolute number of reported fish are presented in this report (Table 1-1B).

**Table 1-1A** Amount of retained and released catches (in numbers and in tonnes) of recreational anglers from March 2016 to March 2017 in marine and fresh water and the 95% confidence intervals (%95 CI). Estimates in bold are inaccurate.

|          |                  | Number (x1000)    |         |                   |           | Biomass (t)         |         |
|----------|------------------|-------------------|---------|-------------------|-----------|---------------------|---------|
|          |                  | Retained          |         | Released          |           | Retained            |         |
| Species  | Marine/<br>Fresh | Number<br>(x1000) | 95% CI  | Number<br>(X1000) | 95%CI     | Biomass<br>(tonnes) | 95%CI   |
| Cod      | Marine           | 165               | 101-223 | 324               | 122-475   | 191                 | 117-257 |
| Sea bass | Marine           | 108               | 40-161  | 778               | 481-1,034 | 95                  | 35-141  |
| Eel      | Marine           | 55                | 3-89    | 76                | 41-108    | 14                  | 1-24    |
| Eel      | Fresh            | 48                | 8-80    | 166               | 111-213   | 10                  | 2-16    |

**Table 1-1B** Retained and released catches of recreational anglers from March 2016 to March 2017 in actual numbers caught in the survey.

|          | Pollack | Rays | Sharks | Salmon/Seatrout |
|----------|---------|------|--------|-----------------|
| Retained | 7       | 0    | 4      | 8               |
| Released | 27      | 0    | 3      | 30              |

## 1 Introduction

The legal framework for collection of recreational fisheries data by EU Member States was given by the EU Data Collection Framework (Council Regulation EU 1004/2017 and Commission Decision EU 1251/2016). The Netherlands are obliged to report on recreational catches (retained and released) of cod, eel, pollack, salmon, sharks and rays in marine waters and eel and salmon in inland waters. On behalf of the Ministry of Agriculture, Nature and Food Quality, the Recreational Fisheries Programme was started in 2009 under the Statutory Tasks Programme (WOT visserij). The Recreational Fisheries Programme is managed and designed by Wageningen Marine Research (WMR).

Angling is a popular activity worldwide and although most recreational anglers make few fishing trips per year, collectively they catch substantial quantities of fish. For some fish species, recreational fisheries have a significant impact on stocks and therefore there is an increasing need to provide reliable estimates of the recreational catch (Coleman et al., 2004). The dynamic nature of participation in recreational fisheries in terms of activity levels makes it challenging to accurately assess the number of people that are engaged in recreational fisheries. In order to keep the potential biases as low as possible, a survey design was used which encourages accurate and complete data reporting as well as tracking and follow-up of non-respondents (van der Hammen et al. 2016, 2017). The design of the current recreational fisheries survey comprises of four components; (1) screening survey, (2) logbook survey, (3) onsite survey and (4) gillnet survey. The screening survey is used to estimate the total population of anglers and their demographic profiles. The logbook survey is used to estimate the yearly catch per angler. A total of 2,672 participants were recruited for a 12 month logbook survey which originated from the screening survey (n=2,607) and from recreational fisheries websites (n=65). Participants were contacted online once a month by a market research company (Kantar) and requested to transfer the data recorded in their logbooks to online questionnaires. The onsite survey was used to collect additional, accurate length data of retained fish by marine anglers for the conversion of catches in numbers to biomass. Results of the gillnet survey were published in a separate report.

In this report, we present the results from the screening surveys in December 2017 and the catch estimates from the latest logbook survey, which ran from March 2016 to February 2017. The results are compared with the previous logbook and screening surveys.

## 2 Materials and methods

### 2.1 Number of recreational anglers: Online Screening Survey 2017

The screening survey is used to estimate the number of recreational anglers. It is a panel survey, which was conducted by a commercial marketing company (Kantar). The demographics of the panel such as age, gender, education level and place of residence are controlled by Kantar to ensure that it resembles the demographics of the Dutch population as much as possible.

The questions about recreational fishing were offered in December 2017 in an online omnibus questionnaire containing questions of different topics. Participants did not know the topics before filling in the questionnaire and were not allowed to skip topics. This is assumed to lower possible non-response that is directed to fisheries questions. One member of the family filled in the questionnaire for the whole family.

In the screening survey, respondents were asked if they had fished recreationally the year before, what gear(s) they had used, if they were intending to participate in freshwater and /or marine recreational

fisheries in the year before and if they would be interested in participating in a 12-month logbook survey. In addition, they were asked to indicate how many fishing trips they had made the year before to determine their level of fishing 'avidity' (number of trips per year). The design of the screening survey was similar to the previous screening surveys. The questions of the latest (2017) screening survey are listed in annex 1.

## 2.2 Logbook survey

Participants for the logbook survey were recruited from the screening survey (December 2015) from the pool of participants who planned to fish in 2016. They were selected with a probability of inclusion based on an analysis of demographics including age, gender and region of residence such that it matched ratios found in the screening survey as much as possible. This was done on an individual basis, i.e. some members of the same household could be included in the survey, whereas others were not. The screening survey was based on a database from Kantar. This database has a turnover rate of ~ 10% per year. This means that several participants have joined multiple surveys.

It was attempted to make each avidity group of equal size. However, the screening survey did not recruit sufficient high avid anglers. Therefore, (high avid) anglers were also recruited by advertisements on recreational fisheries websites. Interested anglers were asked the same questions online as the participants of the screening survey about fishing avidity, as well as some of their demographics (age, gender etc.). This resulted in 65 external participants ('web' participants) joining the logbook survey. In marine water, three avidity groups were made and for fresh water, four groups were made (Table 2-1).

**Table 2-1** Number of logbook survey participants per avidity group starting the logbook survey.

|        | Avidity | Logbook participants |     |       |
|--------|---------|----------------------|-----|-------|
|        |         | Kantar               | Web | Total |
| Marine | 1-5     | 895                  | 21  | 916   |
|        | 6-10    | 282                  | 3   | 285   |
|        | >10     | 321                  | 16  | 337   |
|        | Total   | 1,498                | 40  | 1,538 |
| Fresh  | 1-5     | 1,110                | 4   | 1,114 |
|        | 6-11    | 560                  | 2   | 562   |
|        | 11-25   | 478                  | 13  | 491   |
|        | >25     | 264                  | 43  | 307   |
|        | total   | 2,412                | 62  | 2,474 |

Participants of the logbook survey were asked to maintain a logbook in which they record per fishing trip information on catch and effort. The information in the logbooks included among other questions: fishing location, water body type, start and end date and time of the fishing trip, gear used, catch (number of fish, species, size in cm), whether a fish was retained or released and whether the recorded length of fish was measured or estimated (see annex 2 for the logbook questionnaire). Participants were contacted online once a month by Kantar and requested to transfer the data recorded in their logbooks to online questionnaires. The participants were also expected to indicate if they had not fished during that month. If a participant did not return a logbook, in the next month questions would be asked about their fishing activity in the previous month (the 'blanks' questions), which would not comprise questions about the catches, but only about whether the participant had fished or not, in order to avoid recall bias. The logbook survey started in March 2016. However, Kantar experienced technical problems, resulting in that the logbooks could not be transferred online before May 2016. In May, the logbooks from March and April could be transferred. Kantar extended the logbook survey with two months to compensate for the

problems. However, only the answers to the blanks questionnaires for the months in the regular survey were used (March 2016-February 2017).

### **2.3 Onsite survey**

Fish lengths are used to convert numbers to weights. In marine water, an onsite survey was conducted at the same time as the logbook survey to obtain length data. In order to obtain this data, a number of recreational anglers were trained in measuring fish lengths. Subsequently, the trained anglers approached anglers in the field and measured the lengths of retained fish. Observers collected data from anglers fishing from the shore, and anglers fishing from boats. The length data from the onsite survey were used for the number to biomass conversion for sea bass and cod. Only the lengths measured during the same period as the logbook survey (March 2016-February 2017) were used (133 cod and 91 sea bass, Table 2-2). For eel, there were no length samples in the onsite survey and lengths from the logbook survey were used to convert length to biomass.

### **2.4 Analysis**

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

#### *2.4.1 Participation*

Some participants did not respond all 12 months. If a participant in the logbook survey had not responded in one or more of the months, in the next month additional questions about their fishing activity in those missing months were asked. For those missing months only questions about the number of fishing trips were asked, questions about the catches were not asked to order to avoid recall bias. A proportion of anglers, who did not fill in their logbooks every month, filled in these additional questions about their fishing activities in these months. If they did, the missing months of non-respondents from the logbooks were completed with the information about their fishing activity. Participants had to return their logbooks (supplemented with this information) at least eight times to be included in the analysis. In the months where logbook data was absent, but the additional questions were released, it was known whether an angler had fished in a specific month and how many fishing trips were made, but information about the catches was absent. Anglers indicating that they did not fish in a specific month were assigned zero catch and effort and treated as having fully responded in that month. If respondents indicated they had fished, we sought to impute their fishing activity for the missing months using hotdeck imputation (Sarndal and Lundstrom, 2005). This is a method where a missing value is imputed from a randomly selected similar record, where the donors come from the same dataset as the recipients. The donor values were chosen from respondents with the same stated avidity as the recipient and who had fished in the same month as the missing value of the recipient. Usually only a very small amount of data is imputed in this manner. Imputation was done in R (R\_Development\_Core\_Team, 2018), library StatMatch, function NND.hotdeck.

#### *2.4.2 Data cleaning*

Data was checked and cleaned if records or respondents were considered unreliable. The respondents who were excluded from the analyses are listed in annex 4.



#### 2.4.3 Drop-out removal

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

#### 2.4.4 Species recognition

The participants of the survey were provided with a species recognition card and a free smart phone app developed by the Dutch Angling Association (Sportvisserij Nederland) to assist with identification of the catch. However, several fish species are difficult to distinguish, which will cause some bias in the results.

#### 2.4.5 Converting numbers to biomass

Biomass of retained fish is estimated in different ways. For sea bass and cod the length data from the onsite survey from 2016-2017 (see Table 2-2) were used for the number to biomass conversion using length weight relationships ( $W=a*L^b$ , with  $W$ = weight in kg,  $L$  = length in cm, sea bass:  $a = 0.0074$ ,  $b = 3.096$ , cod:  $a=0.0068$ ,  $b=3.101$ ). The mean weight of all cod or sea bass from the onsite survey was assigned to each retained cod or sea bass reported in the logbooks. For eel, the length data from the logbooks were used for the number to biomass conversion, by using the length that were assigned to the individual fish by the angler if participants had stated that they measured the fish length. If participants had stated that they estimated the fish lengths, lengths were replaced by randomly assigning lengths from the pool of measured lengths. The length weight relationships used for eel was:  $a = 0.00107$  and  $b = 3.133$ . Rays, sharks, pollack, salmon/seatrout were only reported in small amounts and only the number of recorded fish are presented in this report.

**Table 2-2** Number of measured retained fish in the onsite survey.

|          | 2010-2011 | 2012-2013 | 2014-2015 | 2016-2017 |
|----------|-----------|-----------|-----------|-----------|
| Cod      | 113       | 238       | 232       | 133       |
| Sea bass | 4         | 112       | 49        | 91        |

#### 2.4.6 Precision

Standard errors and confidence intervals were estimated by bootstrapping (10,000 iterations). If the RSE is larger than 40 or if the number of anglers that caught a specific fish species during the entire logbook survey is below 25 the record is marked as imprecise.

### 2.5 Catch & Release mortality

A proportion of the released fish will not survive the ordeal of being caught due to injuries sustained in the hooking and handling process and/or due to barotrauma.

In the Netherlands, fish are often released. In the previous report, rough estimates of C&R mortalities are presented for the species studied in this report. In this report we do not give estimates of the C&R mortalities.

### 3 Results

#### 3.1 Number of recreational anglers: online screening survey

In 2017, the participation rate of freshwater and marine anglers among the Dutch population was 6.2% and 3.3%, respectively (Table 3-1). Extrapolation to the population level resulted in an estimation of 1.0 million fresh water anglers and 529 thousand marine anglers in The Netherlands. In total, there were approximately 1.1 million anglers in the Netherlands (7%). The total of marine and fresh water anglers is lower than the sum, because most marine anglers are also fresh water anglers. The number of anglers continued to decline from 1.7 million (2009), 1.4 million (2011), 1.3 million (2013), 1.2 million (2015) to 1.1 million (2017). Note that in 2009, 2011 and 2017 only the number of recreational anglers with ages  $\geq 6$  were estimated, while in 2013 and 2015 anglers of all ages are estimated (Table 3-1).

The decrease in anglers was caused by a decrease in the participation rate of fresh water anglers, from 6.5% in 2015 to 6.2% in 2017. The percentage of marine anglers increased slightly from 3.1% in 2015 to 3.3% in 2017. In Annex 5 the numbers and percentages per avidity group are listed.

**Table 3-1** Results screening survey (December 2009, 2011, 2013, 2015 and 2017). Number of anglers in the Netherlands per avidity group; per waterbody type; and the total number of anglers. SE between brackets. The number of marine and fresh water anglers do not sum up to the total, because most marine anglers also fish in fresh water.

|       |              | No. screening | % screening  | No. in NL ( $\pm$ SE)     | Selection |
|-------|--------------|---------------|--------------|---------------------------|-----------|
| 2009* | Marine       | 4,271         | 3.9%         | 604,026 (9,060)           | $\geq 6$  |
|       | Fresh        | 10,478        | 9.6%         | 1,481,851 (13,765)        |           |
|       | <b>Total</b> | <b>11,703</b> | <b>10.7%</b> | <b>1,655,097 (14,457)</b> |           |
| 2011* | Marine       | 3,594         | 3.4%         | 525,417 (8,615)           | $\geq 6$  |
|       | Fresh        | 8,624         | 8.1%         | 1,260,766 (13,017)        |           |
|       | <b>Total</b> | <b>9,409</b>  | <b>8.8%</b>  | <b>1,375,527 (13,542)</b> |           |
| 2013  | Marine       | 2,982         | 2.9%         | 491,936 (8,876)           | All ages  |
|       | Fresh        | 7,242         | 7.1%         | 1,194,702 (13,531)        |           |
|       | <b>Total</b> | <b>7,932</b>  | <b>7.8%</b>  | <b>1,308,530 (14,110)</b> |           |
| 2015  | Marine       | 3,012         | 3.1%         | 532,620 (9,551)           | All ages  |
|       | Fresh        | 6,214         | 6.5%         | 1,098,838 (13,481)        |           |
|       | <b>Total</b> | <b>6,871</b>  | <b>7.2%</b>  | <b>1,215,017 (14,123)</b> |           |
| 2017* | Marine       | 2,889         | 3.3%         | 529,498 (9,719)           | $\geq 6$  |
|       | Fresh        | 5,481         | 6.2%         | 1,004,561 (13,140)        |           |
|       | <b>Total</b> | <b>6,129</b>  | <b>7.0%</b>  | <b>1,123,327 (13,840)</b> |           |

\*In 2009, 2011 and 2017 the number of anglers from 6 years or older was estimated.

#### 3.2 Logbooks

##### 3.2.1 Participation

Around 41% of the logbook survey participants responded fully for the twelve months of the survey, the remainder participants responded between 1 and 11 times. After inclusion of the blanks, 94% responded 8-12 times, which means that 94% of the participants were included in the analysis (Table 3-2). The response rate is somewhat higher than in previous survey rounds. This is probably because the survey was extended for 2 months. Even though the data of the extended period (March and April 2017) is not used in the analyses, it gave respondents more time to fill in their logbooks from the regular survey or

blanks questionnaire for the missing months. Only a small proportion of the data (in months) was imputed; 2.9% for marine water and 3.4% for fresh water (Table 3-3).

**Table 3-2** Logbook (logbook + blanks) survey response (number of participants)

| response (months) | <i>Marine</i> |     | <i>Fresh water</i> |     | <i>Total</i> |     |
|-------------------|---------------|-----|--------------------|-----|--------------|-----|
|                   | number        | %   | number             | %   | number       | %   |
| 1-7               | 80            | 5%  | 143                | 6%  | 153          | 6%  |
| 8-12              | 1,458         | 95% | 2,331              | 94% | 2,519        | 94% |
| total             | 1,538         |     | 2,474              |     | 2,672        |     |

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

| <i>Data (in total months)</i> | <i>Marine</i> | <i>Fresh water</i> |
|-------------------------------|---------------|--------------------|
| Not Imputed                   | 16,899        | 26,358             |
| Imputed                       | 501           | 918                |
| % imputed                     | 2.9%          | 3.4%               |

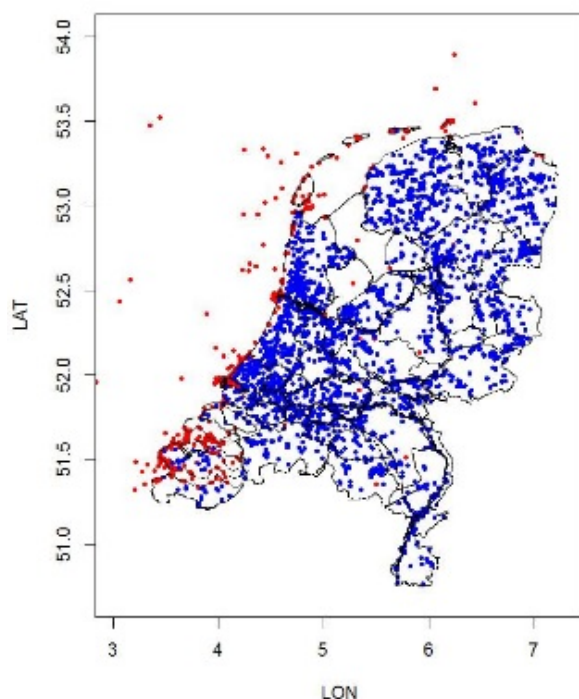
### 3.2.2 Drop out removal

The percentage of marine anglers that planned to fish, but did not fish (drop-outs) was 73% (n=1126). This is higher than the previous round (64%). The number of fresh water anglers who planned to fish but did not fish was much lower, 27% (n=675). However, this percentage is also much higher than in the previous round (19%). The drop-outs were removed before the analysis. The percentage and number of dropouts presented here are calculated before the removal of the respondents who returned less than eight logbooks.

### 3.2.3 Fish trips

Participants of the logbook survey were asked to locate their fishing trip by clicking into google maps or by typing in a place or address. This step could not be skipped and resulted in approximate locations. This also results in occasional mistakes, for example marine trips in inland areas and trips located abroad (were the country was recorded to be the Netherlands). Participants also regularly mentioned that they found it difficult to locate their fish trip in this manner. Visualisation of the fish trips was done by including only the fish trips in the Netherlands (Figure 3-1).

In total 1,164 (marine) and 9,974 (fresh water) trips were included in the analysis (Table 3-4). In both marine and fresh water, the average number of fish trips is lower than the stated avidity from the year before (Table 3-5).



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

**Table 3-4** Number of fishing trips in the logbooks by anglers from March 2016-February 2017. Total number and number excluding respondents who returned their logbooks less than 8 times and excluding imputed data. In fresh water, fishing ponds and paid water bodies are excluded

| <i>Number of fishing trips in the logbooks</i> | <i>Number (total)</i> | <i>Number (respondents &gt;= 8 logbooks)</i> |
|--|-----------------------|--|
| Marine   | 1,213                 | 1,164  |
| Fresh water                                    | 10,283                | 9,974  |

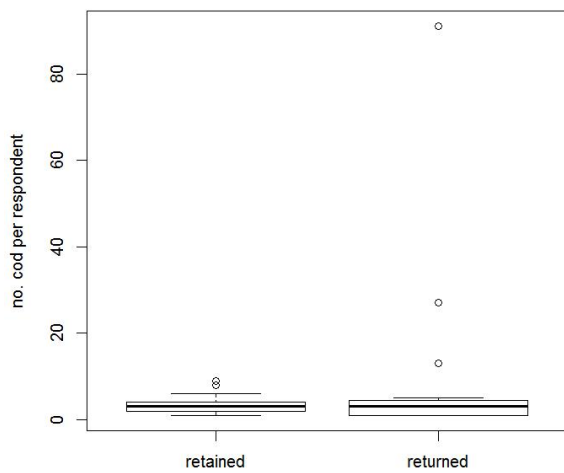
**Table 3-5** Average yearly number of trips per respondent, from March 2016-February 2017, excluding respondents who returned their logbooks less than 8 times, excluding imputed trips and excluding drop-outs.

|             | <i>Avidity</i> | <i>Number of trips</i> | <i>Number of respondents</i> | <i>Average no trips per respondent (95% CI)</i> |
|-------------|----------------|------------------------|------------------------------|---|
| Marine      | 1-5            | 334                    | 191                          | 1.7 (1.5-2.0)                                   |
|             | 6-10           | 277                    | 89                           | 3.1 (2.3-4.0)                                   |
|             | >10            | 553                    | 96                           | 5.8 (3.6-7.9)                                   |
| Fresh water | 1-5            | 1679                   | 631                          | 2.7 (2.4-2.9)                                   |
|             | 6-10           | 1629                   | 416                          | 3.9 (3.5-4.3)                                   |
|             | 11-25          | 2656                   | 388                          | 6.8 (6.1-7.6)                                   |
|             | >25            | 4010                   | 247                          | 16.2 (13.9-18.6)                                |

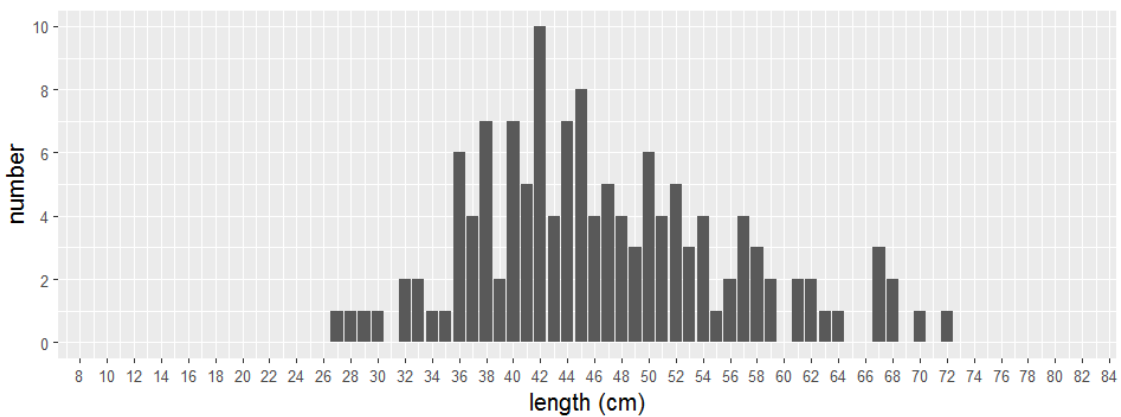
### 3.3 Catch estimates

### 3.4 Cod (*Gadus morhua*)

Most anglers did not catch cod, the percentage of marine anglers retaining one or more cod during the survey was 3.0%. Most of those who did catch cod, caught only 1-5 cod with a few outliers of which one angler caught and returned > 80 cod during the survey (Figure 3-2). The mean length of retained cod is 46.6 cm (based on the onsite survey, Figure 3-3).



**Figure 3-2** Boxplot of the yearly retained and released cod catches per respondent. Only respondents who caught at least 1 cod are included.



**Figure 3-3** Length frequency distribution of retained cod lengths. Mean length: 46.6 cm, N=133. Source: onsite survey (2016-2017). Minimal landing size is 35 cm.

#### Catch

In total, 165 thousand cod (95% CI 101-223) were estimated to be retained and 324 (95% CI 122-475) thousand cod were released (Table 3-6). The percentage of retained cod is 34%. The total biomass of retained cod was estimated to be 191 tonnes (95% CI 117-257, Table 3-6).

**Table 3-6** Catch estimate (in thousands or in tonnes), 95% confidence intervals (CI), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers who caught cod (Nang).

|         |          | Catch | CI      | RSE | Nfish | Nang | % retained |
|---------|----------|-------|---------|-----|-------|------|------------|
| Numbers | Retained | 165   | 101-223 | 19  | 115   | 39   | 34%        |
|         | Released | 324   | 122-475 | 28  | 255   | 39   |            |
| Biomass | Retained | 191   | 117-257 | 19  | 115   | 39   |            |

#### Time series

Numbers of retained and released cod have increased from 2010 to 2014 and strongly decreased from 2014 to 2016 (Table 3-7). The biomass of retained cod follows the same trend, with an increase between 2010 and 2014 and a decrease from 2014 to 2016 (Table 3-7). A reason for the decrease could be that the cod stock in the North Sea and English Channel is very low and still decreasing (ICES advice 2018), in contrast with more northern regions where the cod stock is increasing (ICES advice 2018). The percentage of retained cod has decreased from 76% to 34% since the first survey.

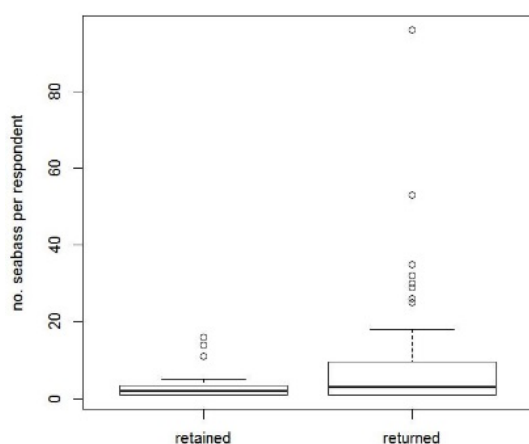
**Table 3-7** Trend in the catch estimates of cod since 2010 by marine anglers. In 2010, 2012 and 2016 estimates are for anglers aged 6 and older, in 2014 all ages are included.

|                         |            | Year       |            |            |           |
|-------------------------|------------|------------|------------|------------|-----------|
|                         |            | 2010-2011* | 2012-2013* | 2014-2015* | 2016-2017 |
| <i>Numbers (x1000)</i>  | retained   | 522        | 609        | 771        | 165       |
|                         | released   | 168        | 392        | 534        | 324       |
|                         | sum        | 690        | 1,001      | 1,305      | 489       |
|                         | % retained | 76%        | 61%        | 59%        | 34%       |
| <i>Biomass (tonnes)</i> | retained   | 631        | 737        | 945        | 191       |

\* Hammen, T. van der; Graaf, M. de - \ 2017 IJmuiden. CVO Report (17.005) <http://dx.doi.org/10.18174/409681>

### 3.5 European sea bass (*Dicentrarchus labrax*)

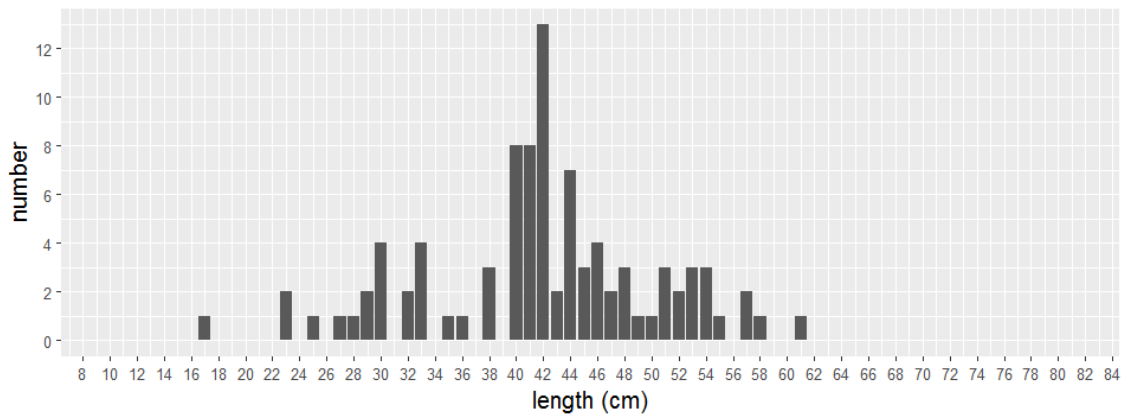
The percentage of marine anglers retaining one or more sea bass on a yearly basis was 2.4%. Most of those who did catch sea bass, caught only 1-5 sea bass with a few outliers (Figure 3-4). The mean length of retained sea bass is 41.9 cm (based on the onsite survey, Figure 3-5).



**Figure 3-4** Boxplot of the yearly retained and released sea bass catches per respondent. Only respondents who caught at least 1 sea bass are included.

### Catch

In total, 108 (95% CI 40-161) thousand sea bass were retained and 778 (95% CI 481-1,034) thousand were released (Table 3-8). The percentage of retained sea bass is 12%. The total biomass of retained sea bass was estimated to be 95 tonnes (95% CI 35-141).



**Figure 3-5** Length frequency distribution of retained sea bass lengths. Mean length: 41.9 cm, N=91. Source: onsite survey 2016-2017. The minimal landing size is 42 cm.

**Table 3-8** Catch estimate (in thousands or in tonnes), 95% confidence intervals, relative standard errors (RSE), sample size of fish (Nfish) and the number of anglers that caught sea bass (Nang).

|         |          | Catch | CI        | RSE | Nfish | Nang | % retained |
|---------|----------|-------|-----------|-----|-------|------|------------|
| Numbers | Retained | 108   | 40-161    | 29  | 100   | 31   | 12%        |
|         | Released | 778   | 481-1,034 | 18  | 717   | 98   |            |
| Biomass | Retained | 95    | 35 - 141  | 29  | 100   | 31   |            |

### Time series

Numbers of retained sea bass have increased from 2010 to 2012 and decreased from 2012 to 2016. The biomass of retained sea bass follows the same trend, with an increase from 2010 to 2012 and a decrease since 2012. A reason for the decrease could be the recent management measures. The percentage of retained sea bass decreased each survey from 64% in 2010 to 12% in 2016 (Table 3-9).

**Table 3-9** Trend in catch estimates of sea bass by marine anglers since 2010. In 2010 and 2012 estimates are for anglers aged 6 and older, in 2014 and 2016 all ages are included.

|                         |            | Year       |            |            |           |
|-------------------------|------------|------------|------------|------------|-----------|
|                         |            | 2010-2011* | 2012-2013* | 2014-2015* | 2016-2017 |
| <i>Numbers (x1000)</i>  | retained   | 227        | 335        | 176        | 108       |
|                         | released   | 127        | 332        | 499        | 778       |
|                         | sum        | 354        | 667        | 675        | 886       |
|                         | % retained | 64%        | 50%        | 26%        | 12%       |
| <i>Biomass (tonnes)</i> | retained   | 129        | 229        | 138        | 95        |

\* Hammen, T. van der; Graaf, M. de - \ 2017 IJmuiden. CVO Report (17.005) <http://dx.doi.org/10.18174/409681>

### 3.6 Pollack (*Pollachius pollachius*)

Pollack is rarely caught in Dutch waters. In total 34 pollack were reported in the 2016-2017 logbook survey by seven anglers (Table 3-10). Most pollack were released (27). The number of records in the logbooks was too small to raise the data to the population level.

**Table 3-10** Total number of pollack reported in each survey round.

|                 | 2012-2013 | 2014-2015 | 2016-2017 |
|-----------------|-----------|-----------|-----------|
| <i>Retained</i> | 5         | 26        | 7         |
| <i>Released</i> | 2         | 30        | 27        |

### 3.7 Rays

No rays were reported in the 2016-2017 logbook survey (Table 3-11).

**Table 3-11** Total number of rays reported in each survey round.

|               | 2012-2013       |                 | 2014-2015       |                 | 2016-2017       |                 |
|---------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|               | <i>retained</i> | <i>released</i> | <i>retained</i> | <i>released</i> | <i>retained</i> | <i>released</i> |
| Thornback ray | 0               | 7               | 8               | 35              | 0               | 0               |
| Stingray      | 0               | 4               | 0               | 0               | 0               | 0               |

### 3.8 Sharks

Sharks are rarely caught in Dutch waters. In total seven sharks were reported in the 2016-2017 logbook survey by four anglers (Table 3-12). The numbers are very low compared to previous years. The number of records in the logbooks was too small to raise the data to the population level.

**Table 3-12** Total number of sharks reported in each logbook survey.

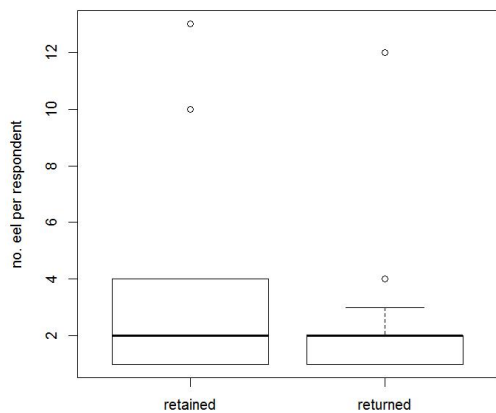
|                 | 2012-2013 | 2014-2015 | 2016-2017 |
|-----------------|-----------|-----------|-----------|
| <i>Retained</i> | 0         | 31        | 4         |
| <i>Released</i> | 59        | 191       | 3         |

### 3.9 Eel (*Anguilla anguilla*)

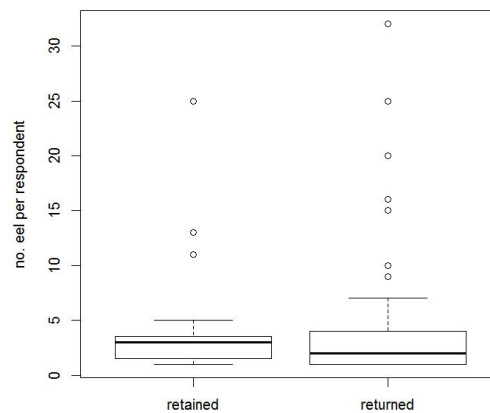
**Marine:** Most anglers did not catch eel in marine water, the percentage of marine anglers retaining one or more eel during the survey was 1.2%. Most of the participants who caught eel, caught only 1-5 eel (Figure 3-6). The mean length of retained eel in marine water was 49.8cm (based on measured lengths from the logbook survey, Figure 3-8).

**Fresh water:** Most anglers did not catch eel in fresh water, the percentage of freshwater anglers retaining one or more eel during the survey was 0.9%. Most of those who did catch eel, caught only 1-5 eel, with some outliers (Figure 3-7). The mean length of retained eel in fresh water was 44.6cm (based on measured lengths from the logbook survey, Figure 3-9).





**Figure 3-6** Marine: boxplot of the yearly retained and released eel catches in marine water per respondent. Only respondents who caught at least 1 eel are shown.

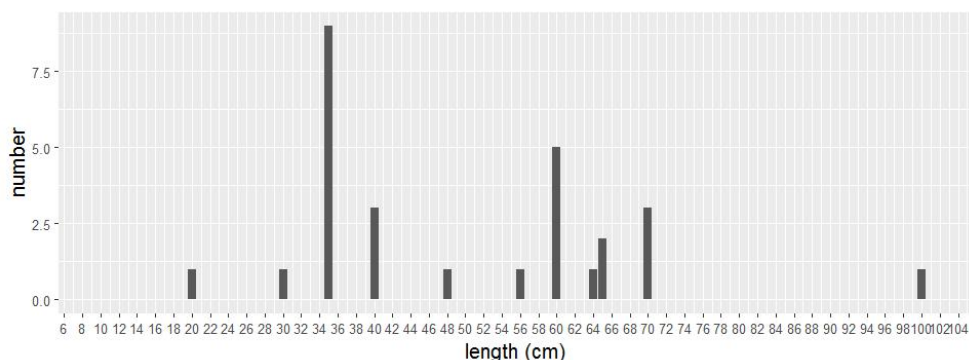


**Figure 3-7** Fresh water: boxplot of the yearly retained and released eel catches per respondent. Only respondents who caught at least 1 eel are shown.

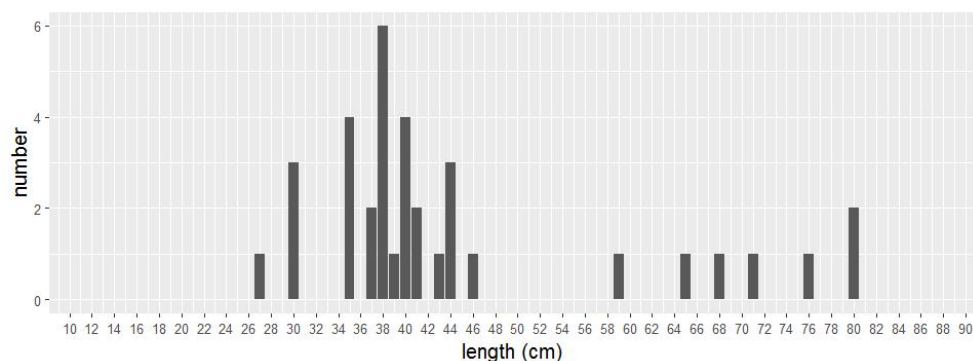
#### Catch

**Marine:** In total, 55 (95% CI: 3-89) thousand eel were retained and 76 (95% CI: 41-108) thousand were released (Table 3-8). The percentage of retained eel in marine water was 42%. The total biomass of retained eel was estimated to be 14 tonnes (95% CI: 1-24). The estimates of retained eel have high RSE's (> 40) and are based on only 15 anglers recording to retain eel. These estimates are therefore inaccurate.

**Fresh water:** In total, 48 (95% CI: 8-80) thousand eel were retained and 166 (95% CI: 111-213) thousand were released (Table 3-8). The percentage of retained eel in fresh water was 22%. The total biomass of retained eel was estimated to be 10 tonnes (95% CI: 2-16). The estimates of retained eel have very high RSE's (RSE = 39) and are based on only 17 anglers recording to retain eel. These estimates are therefore inaccurate.



**Figure 3-8** Length frequency distribution of retained measured marine eel lengths. Mean length: 49.8 cm, N=28. Source: logbook survey.



**Figure 3-9** Length frequency distribution of retained measured eel lengths in fresh water. Mean length: 44.6cm, N=35. Source: logbook survey.

**Table 3-13** Catch estimates (in thousands or in tonnes), 95% Confidence intervals (95%CI), standard errors (SE), relative standard errors (RSE), sample size of fish (Nfish) and sample size of anglers that caught eel (Nanglers).

|                    |         |          | Catch | 95%CI   | RSE | Nfish | Nanglers | % retained |
|--------------------|---------|----------|-------|---------|-----|-------|----------|------------|
| <i>Marine</i>      | Numbers | Retained | 55    | 3-89    | 42  | 40    | 15       | 42%        |
|                    |         | Released | 76    | 41-108  | 22  | 48    | 27       |            |
| <i>Fresh water</i> | Biomass | Retained | 14    | 1-24    | 40  | 40    | 15       | 22%        |
|                    |         | Released | 166   | 111-213 | 16  | 341   | 103      |            |
|                    | Biomass | Retained | 10    | 2-16    | 38  | 79    | 17       |            |

#### Time series

**Marine:** Numbers of retained and released eel have decreased between 2014 and 2016, with the current catch estimates being the lowest in the time series. The low number of recorded eel and anglers recording eel also results in very imprecise estimates (Table 3-13). The cause of the decrease is unknown. It could be that compliance to the obligation to release eel, which came into place in 2009, has increased over the years. However, the precision of the estimates of previous years is also very low. For example, in the previous round (2014-2015) a few anglers returned many catches, who were very influential for the catch estimate.

**Fresh water:** Numbers of retained and released eel in fresh water have drastically decreased from 2014 to 2016. The biomass of retained eel in fresh water decreased as well (Table 3-14). The low number of recorded eel and anglers recording eel also results in imprecise estimates. The cause of the decrease is unknown. It could be that compliance to the obligation to release eel, which came into place in 2009, has increased over the years. The very strong decrease in catches seems unlikely and may be an effect of a lack of eel anglers in the logbook survey.

**Table 3-14** Overview of retained and released eel in fresh and marine water by recreational anglers between 2010-2016. In 2014 all ages are included, whereas in the other years ages aged six and older are included. Estimates in bold have either a RSE larger than 40% or the estimate is based on less than 25 anglers and are therefore imprecise.

|          |             | <i>Number (thousands)</i> |               |              |             | <i>Biomass (tonnes)</i> |              |              |             |
|----------|-------------|---------------------------|---------------|--------------|-------------|-------------------------|--------------|--------------|-------------|
|          |             | <i>2010*</i>              | <i>2012**</i> | <i>2014*</i> | <i>2016</i> | <i>2010*</i>            | <i>2012*</i> | <i>2014*</i> | <i>2016</i> |
| Retained | Marine      | 172                       | <b>91</b>     | 193          | <b>55</b>   | 36                      | <b>18</b>    | 40           | <b>14</b>   |
|          | Fresh water | 294                       | 313           | 220          | <b>48</b>   | 75                      | 41           | 30           | <b>10</b>   |
|          | Sum         | 466                       | <b>404</b>    | 413          | <b>103</b>  | 111                     | <b>59</b>    | 70           | <b>24</b>   |
| Released | Marine      | 114                       | <b>67</b>     | 247          | 76          |                         |              |              |             |
|          | Fresh water | 862                       | 1,517         | 1,936        | 166         |                         |              |              |             |
|          | Sum         | 967                       | <b>1,584</b>  | 2,183        | 242         |                         |              |              |             |
|          | % retained  | 33%                       | 20%           | 16%          | 30%         |                         |              |              |             |

\* Hammen, T. van der; Graaf, M. de - \ 2017 IJmuiden. CVO Report (17.005) <http://dx.doi.org/10.18174/409681>

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

### 3.10 Salmon/Sea trout

Salmon and sea trout are difficult to distinguish and are therefore grouped. Salmon and sea trout are migratory species and are reported in both fresh and marine waters. The variation in the number of salmon and sea trout reported per angler is high and usually only a low number of anglers reports catching salmon or sea trout.

#### Catch

**Marine:** In marine water, seven anglers reported 34 salmon or sea trout in the 2016-2017 survey. Of these, 26 are released and eight were retained (Table 3-16).

**Fresh water:** Salmon and sea trout in fresh water are mainly caught in (paid) trout ponds. For this report we are only interested in wild salmon and sea trout and we therefore only report on salmon and sea trout reported to be caught in rivers and canals. In the 2016-2017 survey two salmons/sea trout were reported in fresh water by two anglers, which were released.

**Table 3-15** Total number of anglers reporting salmon and/or sea trout.

|                          | <i>2016-2017</i> |
|--------------------------|------------------|
| Nr anglers – fresh water | 2                |
| Nr anglers – marine      | 7                |

**Table 3-16** Total number of salmon and sea trout reported in the 2016-2017 logbook survey. In fresh water, only rivers and canals are included.

|                                  | <i>2016-2017</i> |                 |
|----------------------------------|------------------|-----------------|
|                                  | <i>retained</i>  | <i>released</i> |
| Salmon & sea trout – fresh water | 0                | 2               |
| Salmon & sea trout – marine      | 8                | 26              |
| sum                              | 8                | 30              |

## 4 Discussion

### 4.1 Screening survey: number of recreational anglers

Across the industrialised world, on average 10% of the population participates in recreational fishing. In the Netherlands, the participation rate in recreational angling is similar to this average but has been slowly declining from 10.9% (1.7 million anglers) in 2009 to 7.0% (1.1 million anglers) in 2017. The decline can be seen mostly in the number of fresh water anglers. The number of marine anglers declined between 2009 and 2013, but increased slightly in 2015 and 2017.

### 4.2 Commercial catches

As percentage of the total cod landings (including the commercial landings), the percentage of recreational cod catches (12%, Table 4-1) decreased compared to 2014 (43%). This is caused by a strong decrease in cod recreational catches. A reason for the decrease could be that the cod stock in the North Sea and English Channel is very low and still decreasing (ICES advice 2018). The percentage of sea bass recreational catches remained in the same order of magnitude (35% in 2014 and 39% in 2016). Both the commercial landings and the recreational landings decreased between 2014 and 2016. The percentage of eel recreational catches in fresh water has declined as percentage of total Dutch landings, from 14% in 2010 to 3% in 2016 (Table 4-1).

**Table 4-1** Commercial catches (discards not included) vs. recreational catches (angling, catch & release mortality not included) (tonnes). The most recent recreational estimate of eel (in bold) is considered to be inaccurate.

| <b>Species</b> | <b>Comm. landings</b>                     | <b>Year</b> | <b>Comm. landings</b> | <b>Recr. Landings</b> | <b>% Recr. landings</b> | <b>Reference (commercial)</b> |
|----------------|---|-------------|-----------------------|-----------------------|-------------------------|-------------------------------|
| Cod            | Dutch landings from area IV               | 2010        | 2,657                 | 631                   | 19%                     | ICES (2018)                   |
|                |   | 2012        | 1,955                 | 737                   | 27%                     | ICES (2018)                   |
|                |   | 2014        | 1,242                 | 945                   | 43%                     | ICES (2018)                   |
|                |   | 2016        | 1,365                 | 191                   | 12%                     | ICES (2018)                   |
| Sea bass       | Dutch landings in IVbc, VIIa, and VIIId-h | 2010        | 399                   | 129                   | 24%                     | ICES (2017b)                  |
|                |   | 2012        | 376                   | 229                   | 38%                     | ICES (2017b)                  |
|                |   | 2014        | 253                   | 138                   | 35%                     | ICES (2017b)                  |
|                |   | 2016        | 151*                  | 95                    | 39%                     | ICES (2017b)                  |
| Eel            | Dutch landings inland waters              | 2010        | 452                   | 75                    | 14%                     | Bos (2018)                    |
|                |   | 2012        | 350                   | 41                    | 10%                     | Bos (2018)                    |
|                |   | 2014        | 317                   | 30                    | 9%                      | Bos (2018)                    |
|                |   | 2016        | 303                   | <b>10</b>             | 3%                      | Bos (2018)                    |

\* Preliminary

### 4.3 Accuracy

#### Bias

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

focus should be to minimize or eliminate sources of bias by developing and following sound field data collection procedures and analytical methods.

#### Precision

The 95% confidence intervals (CI's) shows the range of values in which the real value lies with 95% certainty. The relative standard error (RSE) is the standard error divided by the mean. The RSE is especially useful to compare the magnitude of the error in relation to the estimate of the mean. The higher the number, the less precise is the estimate. The CI's and the RSE of the catch estimates for the different species presented in this report are quite high, especially for eel. Estimates with high CI's or RSE's should be used carefully. In order to increase the precision: (1) separate (stratified) surveys could be executed designed for specific species, and/or (2) the sample size of the number of participating anglers could be increased.

#### Species identification

Several freshwater and marine fish species are difficult to identify. Misidentification of species could result in biased (under and/or over) estimates of catches. The actual magnitude of species that may have been identified incorrectly is unknown.

#### Length frequency and weight

If available, length data collected from the onsite sampling programme is preferred to convert number into biomass estimates. While length measurements of retained marine fish species are being collected during the onsite survey, this is not the case for freshwater fish species. Unlike marine anglers who can easily be intercepted and interviewed on charter boats, harbours and along piers and dykes, freshwater anglers are widely distributed over many rivers and lakes.

For eel, the lengths from the logbooks are used to estimate the weight. In the 2010-2011 logbook survey many of the apportioned values of the lengths had strong biases to rounded measures (i.e. 10, 15, 20 cm etc.), which suggests that part of the anglers did not measure the fish, but instead estimated the length. Therefore, in the following surveys anglers are asked to indicate if they had 'measured' or 'estimated' the lengths of their retained fish. The 'measured' lengths had clearly less bias to rounded measures compared to the 2010-2011 survey. Therefore, only the 'measured' lengths are included and missing lengths are randomly given a length from the pool of measured lengths.

#### Foreign anglers

The catch estimates only represent the catches realised by recreational anglers living in the Netherlands, the catches of visiting anglers from abroad are not accounted for. Based on information from The Dutch Angling Association (Sportvisserij Nederland), ~ 5% of the anglers are from abroad. The catch estimates presented in this report do not include the catches by visiting foreign anglers.

### **4.4 Catch & Release mortality**

A proportion of the released fish will not survive the ordeal of being caught due to injuries sustained in the hooking and handling process and/or due to barotrauma. In the previous report (van der Hammen & de Graaf 2017), rough estimates for C&R mortality were used. Since the latest report, research in C&R mortality estimates for eel and European sea bass was published (Weltersbach et al. 2018, Lewin et al., 2019). For eel, a field experiment was conducted to investigate impacts of C&R. This resulted in estimates of mortality rates depending on hook type, hook location (deep or shallow) and whether the line was cut or the fish was attempted to be removed (Weltersbach et al. 2018). In the Dutch logbook surveys from 2016-2017 and the one currently running in 2018-2019, questions on hook location and hook type were asked. These data will be analysed to investigate if a catch and release mortality based

on the logbook data can be estimated. For European sea bass, there is a recent paper by Lewin et al. (2019), investigating post-release mortality of sea bass with different bait types, air exposure time and deep/shallow hooking. This resulted in an estimation of 5% (95%CI: 2.8%-9.1%) C&R mortality. This seems like a reasonable estimate for the Dutch recreational sea bass releases. In the latest logbook surveys (2016-2017, 2018-2019), also questions about hook location, hook type and bait types are asked for released sea bass. These will be analysed, to investigate if these can be used to estimate a more accurate C&R mortality based on the logbook data.

## 5 Literature

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## 6 Quality assurance

CVO utilises an ISO 9001:2015 certified quality management system (certificate number: 268632-2018-AQ-NLD-RvA). This certificate is valid until 15 September 2021. The certification was issued by DNV GL Business Assurance B.V

## Justification

CVO Report: 18.025

Project number: 4311216011

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

Approved by: P. Molenaar Msc  
Fisheries researcher

Signature:

A handwritten signature in black ink, appearing to be 'PM', with a long horizontal stroke extending to the right.

Date: 25 April, 2019

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

Signature:

A handwritten signature in blue ink, appearing to be 'S.W. Verver', enclosed within a large, loopy oval shape.

Date: 25 April, 2019

Annex 1 Screening Questionnaire (December 2017)

1. Heeft u dit jaar, in 2017, gevist in Nederlands zee- en/of kustwater? (Ja, Nee)  
Onder vissen in Nederlands zee- en/of kustwater verstaan wij het vissen in: alle Nederlandse zee- en kustwateren, zoals Noordzee, Waddenzee, Ooster- en Westerschelde, Eems en Dollard, zowel vanaf strand, dijk en pier als vanaf een schip of een boot.
2. Wilt u voor elk lid van uw huishouden aangeven wie er dit jaar, in 2017, gevist heeft in Nederlands zee- en/of kustwater?
3. Hoe vaak heeft (inlezen persoon die bij vraag x op 'ja' staat) in 2017 ongeveer gevist in Nederlands zeewater en/of kustwater?
4. Met welk vistuig heeft (inlezen persoon die bij vraag 1 op 'ja' staat) gevist in Nederlands zeewater en/of kustwater?  
hengel  
peur  
fuik  
staand want  
hoekwant  
net  
anders, namelijk... \*Open \*
5. Heeft u dit jaar, in 2017, gevist in Nederlands binnenwater?  
Onder vissen in binnenwater verstaan wij het vissen in alle Nederlandse binnenwateren, zoals rivieren, meren en plassen, polderwateren, de Biesbosch, Grevelingen, het Veerse Meer, IJsselmeer en Haringvliet maar ook het vissen in karperputten, forelviijvers, sierwateren, vennen en dergelijke.
6. Wilt u voor elk lid van uw huishouden aangeven wie er dit jaar, in 2017, gevist heeft in Nederlands binnenwater?
7. Hoe vaak heeft (inlezen persoon die bij vraag x op 'ja' staat) in 2017 ongeveer gevist in Nederlands binnenwater?
8. Met welk vistuig heeft (inlezen persoon die bij vraag 2 op 'ja' staat) gevist in Nederlands binnenwater?  
hengel  
peur  
fuik  
staand want  
hoekwant  
net  
anders, namelijk... \*Open \*
9. Heeft [persoon die in 2017 gevist heeft) afgelopen jaar (2017) wel eens gebruikgemaakt van een alternatief voor een loodgewicht?  
nee  
ja, glas  
ja, steen  
ja, een ander metaal (ijzer, messing, tungsten/wolfraam)  
ja, iets anders namelijk ... \*Open
10. Hoe vaak (bij hoeveel vistrisps) in het afgelopen jaar (2017) heeft [persoon inladen die in 2017 gevist heeft Q001 OR Q004 = ja] een alternatief voor een loodgewicht gebruikt? Indien u dit niet meer weet, kunt u dan een schatting maken?
11. Was [persoon die in 2017 gevist heeft] in 2017 in het bezit van een VISpas (VISpas, JeugdVISpas, Kleine VISpas, ZeeVISpas)?



ja  
nee  
weet niet/wil niet zeggen

12. Bent u van plan om volgend jaar, in 2018, te gaan vissen?  
Ja, nee
13. Wilt u voor elk lid van uw huishouden aangeven wie van plan is om volgend jaar, in 2018, te gaan vissen?
14. Waar is (inlezen persoon die bij vraag 3 op 'ja' staat) van plan om volgend jaar, in 2018, te gaan vissen?  
binnenwateren  
zeewater en/of kustwater
15. In 2018 wordt er voor de vijfde keer een grootschalig project met betrekking tot recreatieve visserij uitgevoerd door Wageningen Marine Research (voorheen IMARES).  
Het doel van dit project is:
- een goed overzicht te krijgen van de aantallen gevangen en meegenomen vis door recreatieve vissers;
  - informatie te verzamelen over (veranderingen) in de visstand in Nederland.

Voor een onderzoek binnen dit project kunnen we uw hulp goed gebruiken. Het onderzoek bestaat uit het registreren van uw vistrips gedurende een jaar (1 maart 2018 tot en met 28 februari 2019). U houdt bij of en hoe vaak u gevist heeft, hoeveel u heeft gevangen en waar u gevist heeft.

U kunt de gegevens van uw vistrips op twee manieren aan ons doorgeven:

- 1 - U houdt uw vistrips bij op een logboekformulier en voert de gegevens 1 keer per maand in via internet.
- 2 - U registreert uw gegevens direct na of tijdens de vistrip via uw smartphone (of tablet of pc). U kunt dus op ieder gewenst moment een vistrip registreren.

Het maakt niet uit of u één keer, vijftig keer of helemaal niet gevist heeft in een maand. Wij zijn ook op zoek naar mensen die maar af en toe vissen.

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

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

## 7 Annex 2 Logbook Questionnaire

1. Heeft u in de maand **[MAAND]** gevist? Dit kan in Nederland zijn, maar ook in het buitenland. (Ja, Nee)
2. Nu volgt een aantal vragen over **vistrip nummer [nummer]** die u heeft gemaakt in de maand **[MAAND]**.  
Op het volgende scherm kunt u de begindatum, begintijd, einddatum en eindtijd van deze vistrip invullen.  
Gebruikt u voor het invullen van de tijd in uren en minuten in totaal 4 cijfers (24-uursklok) zoals in onderstaand voorbeeld.

Voorbeeld 1:

Begindatum: 4 [MAAND]                      Begintijd: 16:15  
Einddatum: 4 [MAAND]                      Eindtijd: 22:30

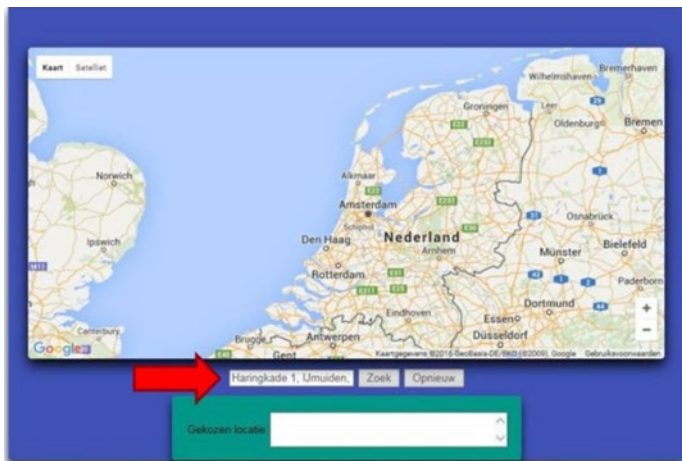
3. Wilt u hieronder de begindatum, begintijd, einddatum en eindtijd van deze vistrip invullen?  
Begindatum [MIN MAX VISPERIODE] [MAAND]                      Begintijd: 00:00  
Einddatum [MIN MAX VISPERIODE] [MAAND]                      Eindtijd: 00:00  
Begintijd en/of -datum liggen na de eindtijd en/of -datum, verbeter dit alstublieft.
4. In welk land heeft u gevist?  
Nederland  
België  
Frankrijk  
Duitsland  
Noorwegen  
Denemarken  
Ander land, namelijk \*Open
5. Waar heeft u gevist?  
Zee- en kustwater  
Binnenwater

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

Onder vissen in binnenwater verstaan wij het vissen in alle Nederlandse binnenwateren, zoals rivieren, meren en plassen, polderwateren, de Biesbosch, IJsselmeer, Volkerak-Zoommeer en Haringvliet maar ook het vissen in karperputten, forelvijvers, sierwateren, vennen en dergelijke, zowel vanaf de kant als vanaf een boot.

6. Op welke locatie heeft u gevist?  
Op het volgende scherm verschijnt een kaart. Wij willen u vragen op deze kaart aan te geven waar u gevist heeft.

U kunt in het eerste witte invulscherf (zie pijl) onder de kaart een locatie intypen, bijvoorbeeld een concreet adres (Haringkade 1, IJmuiden); een plaatsnaam (Katwijk) of een land (Noorwegen).



Wanneer u vervolgens op de Zoek-knop drukt verschijnt er een markering op de locatie die u eerder ingetypt heeft.

Door te navigeren op de kaart, zoals hieronder wordt uitgelegd, kunt u de markering vervolgens plaatsen op de exacte locatie van uw vistrip. Onder de kaart verschijnt dan het precieze adres van uw locatie, deze kunt u eventueel kopiëren (met de rechtermuisknop) voor de invoer van uw volgende vistrip.

Navigeren op de kaart

Klik en sleep de markering om de markering te verplaatsen. Zorg ervoor dat de punt van de markeringsballon op de juiste plaats staat. Klik en sleep de kaart om rond te kijken. Druk op de (+ en -) rechts op de kaart om steeds meer in of uit te zoomen.

#### 7. Heeft u gevestigd in betaald water of onbetaald water?

In betaald water

In onbetaald water

Een 'betaalwater' is een specifiek water waar entree wordt geheven om er te kunnen vissen. Betaald vissen met bijvoorbeeld een charterboot wordt hier dus niet onder verstaan. Het 'betaalwater' (b.v. forelvijver) kan particulier eigendom zijn en tegen commercieel tarief kan er worden gevestigd. De visstand wordt via regelmatige uitzettingen onderhouden en kent meestal een specifieke visstand. Vaak gaat het om (regenboog)forel, meerval, steur en in sommige wateren ook karper. Het 'betaalwater' kan ook eigendom zijn van een hengelsportvereniging en een visser kan een dagkaart als schriftelijke toestemming kopen voor een niet-commercieel tarief. De visstand wordt in deze wateren ook vaak via uitzettingen onderhouden.

#### 8. Kunt u hieronder aangeven in welk type binnenwater u gevestigd heeft?

Forelvijver

Stadswateren

Meren en plassen

Sloot

Kanaal

Grote rivier

Kleine rivier

Ander binnenwater, namelijk \*Open

9. Heeft u vanaf de kant of vanaf een boot gevist?  
Vanaf de kant  
Vanaf de boot
10. U heeft gevist vanaf de kant. Kunt u aangeven vanaf waar u gevist heeft?  
Vanaf het strand  
Vanaf een dijk  
Vanaf een pier  
Vanaf een andere plek, namelijk \*Open
11. U heeft gevist vanaf een boot. Wat was het maximaal aantal passagiers van deze boot?  
Capaciteit: [numeric field] passagiers
12. Kunt u hieronder aangeven wat voor boot dit was?  
Eigen boot  
Boot van anderen  
Charterboot of huurboot
13. Welk vistuig heeft u gebruikt tijdens deze vistrip?  
Hengel  
Peur  
Hoekwant  
Staand want  
Fuik  
Anders, namelijk \*Open
14. Met hoeveel [vistuig plural1] heeft u gevist tijdens deze vistrip?  
[numeric answering field] [vistuig plural2]
15. Heeft u vis gevangen tijdens deze vistrip? Let op: het gaat hierbij alleen om uw eigen vangst.  
(Ja, Nee)
16. Welke soorten vis heeft u gevangen tijdens deze vistrip (zout)?  
Op de volgende schermen kunt u de verschillende vangsten (soorten, teruggezet of meegenomen en lengtes van de vissen) invoeren. U kunt steeds eerst de vissoort(en) aangeven, die u gevangen heeft in deze vistrip.

Vervolgens kunt u per vissoort aangeven wat de lengte (per vis) was van de vissen die u van deze soort gevangen heeft en hoeveel vis(sen) u van deze vissoort heeft meegenomen of teruggezet.

Voor de meegenomen vissen is het verplicht de lengtes in te vullen.

Voor de teruggezette vissen kunt u de lengtes noteren, indien u deze bijgehouden heeft. Dit is niet verplicht, behalve voor de Aal, Paling, Kabeljauw en Zeebaars.

Wilt u de lengte in hele centimeters invullen? U kunt dus geen komma gebruiken.

|                 |             |                                 |
|-----------------|-------------|---------------------------------|
| Aal of Paling   | Hondshaai   | Spiering                        |
| Bot             | Horsmakreel | Steenbolk                       |
| Diklipharder    | Kabeljauw   | Stekelrog                       |
| Doornhaai       | Koolvis     | Tarbot                          |
| Dwergtong       | Makreel     | Tong                            |
| Fint            | Pollak      | Wijting                         |
| Geep            | Puitaal     | Zalm                            |
| Gladde haai     | Rode Poon   | Zeebaars                        |
| Griet           | Schar       | Zeedonderpad                    |
| Grote Pieterman | Schelvis    | Zeeforel                        |
| Haring          | Schol       | Andere vissoort, namelijk *Open |

17. Welke soort(en) vis heeft u gevangen tijdens deze vistrip (zoet)?

|                                 |                        |                                 |
|---------------------------------|------------------------|---------------------------------|
| Aal of Paling                   | Graskarper             | Snoek                           |
| Afrikaanse meerval              | Karper                 | Snoekbaars                      |
| Alver                           | Kolblei                | Spiegelkarper                   |
| Baars                           | Kopvoorn               | Spiering                        |
| Barbeel                         | Kroeskarper            | Winde                           |
| Bittervoorn                     | Pos                    | Zalm                            |
| Blankvoorn                      | Regenboogforel         | Zeeforel                        |
| Brasem                          | Rivierdonderpad        | Zeelt                           |
| Bruine Amerikaanse dwergmeerval | Riviergrondel          | Zonnebaars                      |
| Europese meerval                | Roofblei               | Zwartbekgrondel                 |
| Giebel                          | Ruisvoorn of Rietvoorn | Zwarte Amerikaanse dwergmeerval |
| Goudvis                         | Serpeling              | Andere vissoort, namelijk *Open |

18. U kunt nu voor de soort [vissoort] de volgende zaken invoeren:

- wat de lengte per vis van deze meegenomen vis(sen) was;
- hoeveel vis(sen) u heeft meegenomen;
- wat de lengte per vis van deze teruggezette vis(sen) was (optioneel);
- hoeveel vis(sen) u heeft teruggezet;

19. Dit is een overzicht van wat u over deze vistrip heeft ingevuld:

| Meegenomen  |        | Teruggezet  |        |
|-------------|--------|-------------|--------|
| Lengte (cm) | Aantal | Lengte (cm) | Aantal |
| X           | X      | X           | X      |
| X           | X      | X           | X      |

Zijn alle soorten en lengtes van deze vistrip ingevoerd?

Ja

Nee, soort(en) weghalen of toevoegen

Nee, aantallen of lengtes niet volledig

20. Kunt u hier aangeven of u de lengtes van de **meegenomen** vissen heeft gemeten of geschat?

Ik heb de lengtes gemeten

Ik heb de lengtes geschat

21. Kunt u hier aangeven of u de lengtes van de **teruggezette** vissen heeft gemeten of geschat?

Ik heb de lengtes gemeten

Ik heb de lengtes geschat

22. U kunt nu voor de [Aal or Kabeljauw or Zeebaars] van [lengte] cm de volgende zaken van uw logboek invoeren:

- op welke visdiepte (in meters) heeft u deze vis gevangen;
- welk type aas heeft u gebruikt;
- welk type haak heeft u gebruikt;
- wat was de haakgrootte (nummer);
- is de haak diepgehaakt (in kieuwen, keelholte of ingeslikt)
- heeft u de vislijn afgeknipt en de haak laten zitten.

Visdiepte: [diepte] m

Type aas: (kunstaas , natuurlijk aas)

Type haak: (enkele haak, meertandige haak (dreg))

Haakgrootte: [haaknummer]

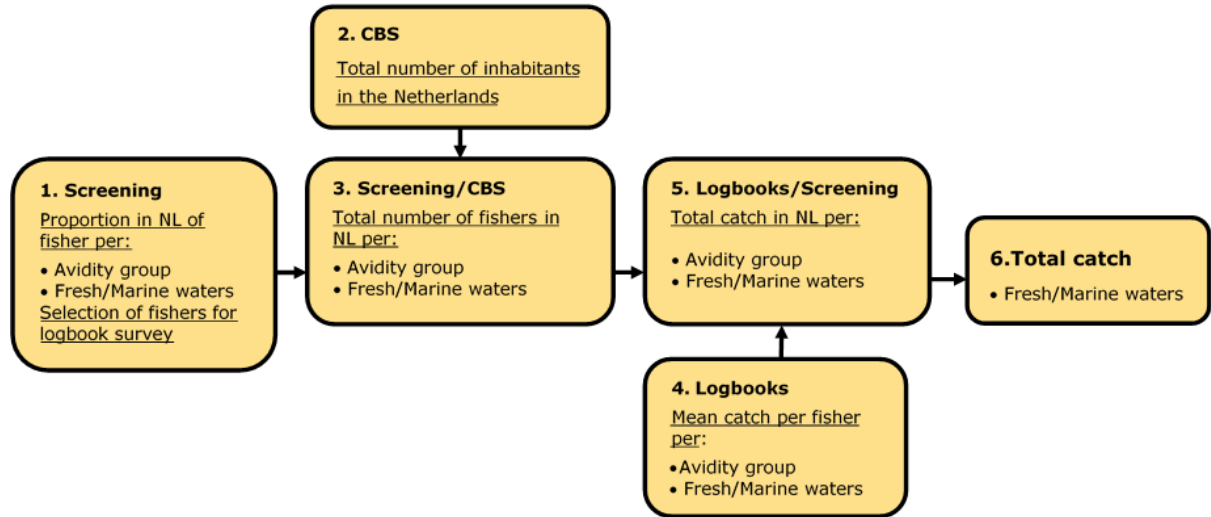
Diepgehaakt: (Ja, Nee)

Afgeknipt en laten zitten: (Ja, Nee)

23. Wilt u nog een vistrif invullen? (Ja, Nee)

24. Zijn alle vistrifs ingevuld? (Ja, Nee)

8 Annex 3 Flow chart



**Figure A3** Flow chart to illustrate the different components of the recreational fishery survey to estimate total catch (in number or weight)

## 9 Annex 4 Data cleaning

In the database Kantar sometimes detects unreliable respondents. When these are found, we exclude them from the analyses and remove them from our database. In addition, individuals in the logbook survey who reported unrealistic lengths or catches are removed before analysis. In some cases the record is trusted, but the length is considered unreliable. In these cases the lengths are not used. Below the respondent numbers and the reason for the data cleaning are listed.

| Family        | Measure | Reason                           |
|---------------|---------|----------------------------------|
| 3079023401-05 | Removed | Detected as unreliable by Kantar |
| 3089389201-05 | Removed | Detected as unreliable by Kantar |

| Respondent | species      | measure                                    | reason  |
|------------|--------------|--|---|
| 3087537401 | Sea bass     | Removed from analysis                      | 94 small sea bass (1cm, retained) said to be measured. Family of 3087537402.                                |
| 3087537402 | Sea bass     | Removed from analysis                      | 90 small sea bass (1 or 2 cm, retained) said to be measured. Family of 3087537401.                          |
| 3050268401 | Cod          | Lengths are set from measured to estimated | 4 cods in one trip of 165 cm (retained). Said to be measured. Unrealistic size and exactly the same length. |
| 3085867401 | Eel (marine) | Removed from analysis                      | 23 eel of 1 cm (retained and released). Said to be measured eel. Unrealistic size and number.               |



## 10 Annex 5 Screening results per avidity group

**Table 11-1** Results screening survey (December 2009, 2011, 2013, 2015 and 2017). Number of anglers in the Netherlands per avidity group; per waterbody type; and the total number of anglers. SE between brackets. In 2009, 2011 and 2017 the number of anglers from 6 years or older was estimated.

|      | Marine                |               |              | Fresh                     |               |             | Selection                 |                 |
|------|-----------------------|---------------|--------------|---------------------------|---------------|-------------|---------------------------|-----------------|
|      | Avidity               | No. screening | % screening  | No. in NL (±SE)           | No. screening | % screening |                           | No. in NL (±SE) |
| 2009 | 1-5                   | 3 378         | 3.1%         | 477 734 (8 092)           | 5 614         | 5.1%        | 793 960 (10 321)          | >=6             |
|      | 6-10                  | 560           | 0.5%         | 79 198 (3 338)            | 2 435         | 2.2%        | 344 370 (6 901)           |                 |
|      | 11-25                 | 234           | 0.2%         | 33 093 (2 161)            | 1 514         | 1.4%        | 214 117 (5 465)           |                 |
|      | 26-50                 | 61            | 0.1%         | 8 627 (1 104)             | 604           | 0.6%        | 85 421 (3 466)            |                 |
|      | > 50                  | 38            | <0.1%        | 5 374 (872)               | 311           | 0.3%        | 43 983 (2 491)            |                 |
|      | <b>Total</b>          | <b>4 271</b>  | <b>3.9%</b>  | <b>604 026 (9 060)</b>    | <b>10 478</b> | <b>9.6%</b> | <b>1 481 851 (13 765)</b> |                 |
|      | <b>fresh + marine</b> | <b>11 703</b> | <b>10.7%</b> | <b>1 655 097 (14 457)</b> |               |             |                           |                 |
| 2011 | 1-5                   | 2 558         | 2.4%         | 373 960 (7 305)           | 4 618         | 4.3%        | 675 118 (9 718)           | >= 6            |
|      | 6-10                  | 614           | 0.6%         | 89 762 (3 612)            | 1 953         | 1.8%        | 285 514 (6 401)           |                 |
|      | 11-25                 | 285           | 0.3%         | 41 665 (2 465)            | 1 320         | 1.2%        | 192 974 (5 279)           |                 |
|      | 26-50                 | 97            | 0.1%         | 14 181 (1 439)            | 493           | 0.5%        | 72 073 (3 239)            |                 |
|      | > 50                  | 40            | <0.1%        | 5 848 (924)               | 240           | 0.2%        | 35 086 (2 262)            |                 |
|      | <b>Total</b>          | <b>3 594</b>  | <b>3.4%</b>  | <b>525 417 (8 615)</b>    | <b>8 624</b>  | <b>8.1%</b> | <b>1 260 766 (13 017)</b> |                 |
|      | <b>fresh + marine</b> | <b>9 409</b>  | <b>8.8%</b>  | <b>1 375 527 (13 542)</b> |               |             |                           |                 |
| 2013 | 1-5                   | 2 177         | 2.1%         | 359 136 (7 615)           | 3 973         | 3.9%        | 655 420 (10 194 )         | All ages        |
|      | 6-10                  | 446           | 0.4%         | 73 576 (3 476)            | 1 553         | 1.5%        | 256 196 (6 451)           |                 |
|      | 11-25                 | 251           | 0.2%         | 41 407 (2 610)            | 1 104         | 1.1%        | 182 125 (5 452)           |                 |
|      | 26-50                 | 79            | 0.1%         | 13 033 (1 466)            | 446           | 0.4%        | 73 576 (3 476)            |                 |
|      | > 50                  | 29            | <0.1%        | 4 784 (888)               | 166           | 0.2%        | 27 385 (2 124)            |                 |
|      | <b>Total</b>          | <b>2 982</b>  | <b>2.9%</b>  | <b>491 936 (8 876)</b>    | <b>7 242</b>  | <b>7.1%</b> | <b>1 194 702 (13 531)</b> |                 |
|      | <b>fresh + marine</b> | <b>7 932</b>  | <b>7.8%</b>  | <b>1 308 530 (14 110)</b> |               |             |                           |                 |
| 2015 | 1-5                   | 2 126         | 2.2%         | 375 946 (8 063)           | 3639          | 3.8%        | 643 494 (10 463)          | All ages        |
|      | 6-10                  | 442           | 0.5%         | 78 160 (3 709)            | 1183          | 1.2%        | 209 193 (6 045)           |                 |
|      | 11-25                 | 310           | 0.3%         | 54 818 (3 108)            | 898           | 0.9%        | 158 796 (5 274)           |                 |
|      | 26-50                 | 90            | 0.1%         | 15 914 (1 676)            | 335           | 0.3%        | 59 239 (3 232)            |                 |
|      | > 50                  | 44            | < 0.1%       | 7781 (1 173)              | 159           | 0.2%        | 28 116 (2 228)            |                 |
|      | <b>Total</b>          | <b>3 012</b>  | <b>3.1%</b>  | <b>532 620 (9 551)</b>    | <b>6214</b>   | <b>6.5%</b> | <b>1 098 838 (13 481)</b> |                 |
|      | <b>fresh + marine</b> | <b>6 871</b>  | <b>7.2%</b>  | <b>1 215 017 (14 123)</b> |               |             |                           |                 |
| 2017 | 1-5                   | 2 108         | 2.4%         | 386 356 (8,314)           | 3262          | 3.7%        | 597 861 (10 272)          | >= 6            |
|      | 6-10                  | 420           | 0.5%         | 76 978 (3,747)            | 1063          | 1.2%        | 194 827 (5 939)           |                 |
|      | 11-25                 | 260           | 0.3%         | 47 653 (2,951)            | 749           | 0.9%        | 137 277 (4 994)           |                 |
|      | 26-50                 | 76            | 0.1%         | 13 929 (1,597)            | 294           | 0.3%        | 53 884 (3 137)            |                 |
|      | > 50                  | 25            | <0.1%        | 4 582 (916)               | 113           | 0.1%        | 20 710 (1 947)            |                 |
|      | <b>Total</b>          | <b>2 889</b>  | <b>3.3%</b>  | <b>529 498 (9,719)</b>    | <b>5481</b>   | <b>6.2%</b> | <b>1 004 561 (13 140)</b> |                 |
|      | <b>fresh + marine</b> | <b>6 129</b>  | <b>7.0%</b>  | <b>1 123 327 (13 840)</b> |               |             |                           |                 |