

## **3.6 The assessment of precision levels for biological material collected during commercial fishing trips is part of the quality control process.**

### **3.6.1 Definition of Precision Levels**

The European Union Commission Regulation EC 1639/2001 with amendments EC 1581/2004, as well as the European Commission Decision EU 93/2010, require an annual assessment of the precision level of catch and discard data, as well as the calculation of the precision level of biological parameters at three-year intervals. These documents specify three precision levels:

- Level 1 - The assessable parameters can be estimated with a precision of  $\pm 40\%$  using a 95% confidence interval or achieving approximately 20% of the coefficient of variation.
- Level 2 - The assessable parameters can be estimated with a precision of  $\pm 25\%$  using a 95% confidence interval or achieving approximately 12.5% of the coefficient of variation.
- Level 3 - The assessable parameters can be estimated with a precision of  $\pm 5\%$  using a 95% confidence interval or achieving approximately 2.5% of the coefficient of variation.

The precision of catch length and age distribution, as well as biological parameter precision, for assessable fish stocks must be calculated by quarters and fishing gears. Afterward, the overall precision is calculated as the weighted average. The attainable precision level depends on the species under study.

### **3.6.2 Calculation of Precision Levels**

For the calculation of precision levels, two methods are employed: the bootstrap method and the analytical method.

#### **3.6.2.1 Bootstrap Method for Precision Level Calculation**

The bootstrap method is primarily used for calculating 95% confidence intervals and assessing precision levels. The bootstrap method assumes that the observed parameter, such as the distribution of fish lengths in a sample, represents the distribution of values for the entire population from which the sample was obtained. From the obtained sample dataset, 2000 random pseudo-samples are generated. For each of these pseudo-samples, the mean value for the specific parameter is determined. The 2.5th and 97.5th percentiles from these 2000 pseudo-samples are then used as the 95% confidence interval for the population parameter's mean value.

### 3.6.2.2 Analytical Method for Precision Level Calculation

For certain parameters, such as the mean weight of fish in each age class, the 95% confidence interval and, consequently, the precision levels were calculated analytically using the formula:

$$\hat{\mu} \pm t(n-1)_{\alpha} \cdot s / \sqrt{n},$$

Where:

- $\mu$  is the estimated parameter mean value,
- $n$  is the number of observations (fish) in the specific class,
- $t_{\alpha}$  is the two-tailed t-distribution value at the confidence level  $\alpha$ ,
- $\sigma$  is the standard error of the mean

This formula is used for certain parameters, such as the mean weight of fish in each age class, where  $t(n-1)_{\alpha}$  represents the two-tailed t-distribution value corresponding to the confidence level  $\alpha$  and  $n-1$  degrees of freedom, while  $\sqrt{n}$  represents the standard error of the mean.

### 3.7. The precision levels for biological material

The precision levels for biological material are defined by EU regulations. For assessing fish stock in terms of age and length, the requirement is to achieve the 2nd level of precision (a precision of 25% or better). For biological parameters like length, weight, gender, and stage within age classes, the requirement is to achieve the 3rd level of precision (a precision of 5% or better). In 2017, commercial fishing catch data was analysed by quarter and fishing gear type, if different. The analysis did not include discards. The information was analysed for 9 species (as shown in Table 3.7.1).

Table 3.7.1. Average weighted precision of individual species' biological parameters

| Species          | Sex within age classes | Length | Length within age classes | Stage within age classes | Mass within age classes | Age  |
|------------------|------------------------|--------|---------------------------|--------------------------|-------------------------|------|
| Sprat            | 18,1                   | 12,7   | 1                         | 11,1                     | 3,1                     | 16   |
| Herring          | 18,4                   | 25,3   | 1,2                       | 8                        | 5,1                     | 14,3 |
| Cod              | 16,1                   | 14,5   | 2,8                       | 5,3                      | 9,4                     | 19,8 |
| Flounder         | 33,3                   | 42,7   | 6,4                       | 10,8                     | 20,8                    | 39,4 |
| Turbot           | 18,8                   | 32,9   | 8,3                       | 0                        | 25,5                    | 33,3 |
| Perch            | 19                     | 21,8   | 2                         | 25,7                     | 7,4                     | 22,9 |
| Salmon           | 40,1                   | 82,1   | 3,6                       | -                        | 10,4                    | 20,8 |
| Brown trout      | 44,1                   | 91,3   | 6,3                       | -                        | 18,6                    | 32,2 |
| Pikeperch/Zander | -                      | 59,7   | 1,4                       | -                        | 5,8                     | 17,6 |

|  |                                       |
|--|---------------------------------------|
|  | 3 <sup>rd</sup> level of precision    |
|  | 2 <sup>nd</sup> level of precision    |
|  | 1 <sup>st</sup> level of precision    |
|  | Doesn't reach any of precision levels |

#### 3.7.1. Sprat (SPR)

For sprat, the 3rd level of precision was achieved in 2017 for length by age classes and weight by age classes, while for all other parameters, the average weighted precision corresponds to level 2. Compared to the previous year, there was a decrease in the number of fish for which age was determined, resulting in a slight decrease in the precision of all age-related parameters. The number of fish for which length was determined increased slightly in 2017 compared to the previous year, resulting in higher average weighted precision for length, although it did not reach the highest precision level. It should be noted that despite the relatively large number of analyzed sprat each year compared to other fish species, it should be considered that this species has a very large number of length and age classes, which means that the number of fish in each class is not sufficient to achieve the highest precision level (Table 3.7.1.1).

Table 3.7.1.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for sprat biological parameters.

| Year        | Count                            | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  | Count                           | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  |
|-------------|----------------------------------|-------------------|-------------|-------------|-------------|---------------------------------|-------------------|-------------|-------------|-------------|
|             | <b>Sex within age classes</b>    |                   |             |             |             | <b>Length</b>                   |                   |             |             |             |
| 2013        | 6566                             | 12,3              | 6,7         | 53,3        | 77,8        | 6836                            | 14,3              | 0           | 49,2        | 72,9        |
| 2014        | 6374                             | 15,8              | 10          | 52,9        | 67,1        | 14117                           | 12                | 0           | 58,9        | 72,2        |
| 2015        | 2439                             | 20,7              | 10          | 40          | 65          | 7971                            | 12,3              | 0           | 60,8        | 72,5        |
| 2016        | 5177                             | 14,1              | 13,2        | 56,6        | 66          | 5749                            | 18,5              | 0           | 47,4        | 64,1        |
| <b>2017</b> | <b>3269</b>                      | <b>18,1</b>       | <b>11,6</b> | <b>48,8</b> | <b>62,8</b> | <b>7322</b>                     | <b>12,7</b>       | <b>0</b>    | <b>47,3</b> | <b>67,3</b> |
|             | <b>Length within age classes</b> |                   |             |             |             | <b>Stage within age classes</b> |                   |             |             |             |
| 2013        | 6836                             | 0,7               | 86,7        | 93,3        | 93,3        | 6565                            | 4,5               | 55,6        | 84,4        | 88,9        |
| 2014        | 6546                             | 0,9               | 84,6        | 100         | 100         | 6374                            | 8,8               | 48,6        | 77,1        | 85,7        |
| 2015        | 2488                             | 1,2               | 84,2        | 97,4        | 97,4        | 2443                            | 13,5              | 45,2        | 83,3        | 90,5        |
| 2016        | 5384                             | 0,9               | 80          | 96          | 96          | 5384                            | 7,3               | 65,5        | 80          | 90,9        |
| <b>2017</b> | <b>3269</b>                      | <b>1,0</b>        | <b>87,5</b> | <b>97,5</b> | <b>100</b>  | <b>3629</b>                     | <b>11,1</b>       | <b>46,7</b> | <b>80,0</b> | <b>84,4</b> |
|             | <b>Mass within age classes</b>   |                   |             |             |             | <b>Age</b>                      |                   |             |             |             |
| 2013        | 6836                             | 2,2               | 60          | 91,1        | 91,1        | 6836                            | 11,5              | 2,1         | 51,1        | 63,8        |
| 2014        | 6546                             | 2,8               | 52,3        | 92,3        | 98,5        | 6546                            | 14,8              | 0           | 41,9        | 51,4        |
| 2015        | 2488                             | 3,4               | 60,5        | 92,1        | 94,7        | 2488                            | 18,1              | 0           | 35,7        | 47,6        |
| 2016        | 5384                             | 2,7               | 52          | 84          | 86          | 5384                            | 12,9              | 1,8         | 36,8        | 52,6        |
| <b>2017</b> | <b>3269</b>                      | <b>3,1</b>        | <b>52,5</b> | <b>95</b>   | <b>100</b>  | <b>3269</b>                     | <b>16,0</b>       | <b>0</b>    | <b>36,2</b> | <b>53,2</b> |

### 3.7.2. Herring (HER)

In 2017, herring achieved the 3rd level of precision only for length by age classes. All other parameters, except for length, reached the 2nd level of precision, meaning their average weighted precision was better than 25%. Moreover, for length and stage by age classes, the highest precision level was achieved in more than 50% of the analyzed combinations of fishing gear, quarter, and age classes. The number of herring for which age was determined in 2017 was only slightly higher than in 2016, resulting in similar precision for age-related parameters as in the previous year. Length data did not reach a high precision level due to the large number of possible length classes for herring. In the initial calculations, information for two herring populations was combined: Baltic Sea herring and Gulf of Riga herring (Table 3.7.2.1).

Table 3.7.2.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for herring biological parameters.

| Year        | Count                            | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  | Count                           | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  |
|-------------|----------------------------------|-------------------|-------------|-------------|-------------|---------------------------------|-------------------|-------------|-------------|-------------|
|             | <b>Sex within age classes</b>    |                   |             |             |             | <b>Length</b>                   |                   |             |             |             |
| 2013        | 5097                             | 17,5              | 4,3         | 44,9        | 63,8        | 15644                           | 17,5              | 0           | 43,6        | 64,1        |
| 2014        | 6004                             | 16,7              | 7           | 43          | 65,1        | 16800                           | 17,4              | 0,5         | 45,3        | 61,3        |
| 2015        | 4311                             | 19,7              | 6,3         | 44,3        | 67,1        | 19373                           | 15,8              | 0           | 49,2        | 67,2        |
| 2016        | 4980                             | 18,1              | 10          | 45          | 62,5        | 19638                           | 15,5              | 0           | 46,1        | 60,3        |
| <b>2017</b> | <b>5331</b>                      | <b>18,4</b>       | <b>6,2</b>  | <b>37,5</b> | <b>60,9</b> | <b>11529</b>                    | <b>25,3</b>       | <b>0</b>    | <b>17,4</b> | <b>28,9</b> |
|             | <b>Length within age classes</b> |                   |             |             |             | <b>Stage within age classes</b> |                   |             |             |             |
| 2013        | 7375                             | 1,6               | 74,1        | 96,3        | 96,3        | 5135                            | 7,9               | 65,8        | 91,8        | 94,5        |
| 2014        | 8066                             | 1,6               | 76,1        | 96,6        | 97,7        | 6012                            | 8,3               | 53,6        | 84,5        | 89,3        |
| 2015        | 6862                             | 1,8               | 75,3        | 96,3        | 96,3        | 4342                            | 8,1               | 66,3        | 90,4        | 91,6        |
| 2016        | 7342                             | 1,7               | 72,8        | 91,4        | 95,1        | 4998                            | 8,6               | 52,3        | 84,9        | 88,4        |
| <b>2017</b> | <b>7780</b>                      | <b>1,2</b>        | <b>81,7</b> | <b>97,2</b> | <b>98,6</b> | <b>5331</b>                     | <b>8,0</b>        | <b>56,5</b> | <b>82,6</b> | <b>91,3</b> |
|             | <b>Mass within age classes</b>   |                   |             |             |             | <b>Age</b>                      |                   |             |             |             |
| 2013        | 7375                             | 5,1               | 25,9        | 84          | 90,1        | 7375                            | 15,5              | 0           | 34,8        | 56,2        |
| 2014        | 8066                             | 5,5               | 22,7        | 81,8        | 90,9        | 8066                            | 15,3              | 1,1         | 37          | 58,7        |
| 2015        | 6862                             | 5,8               | 18,5        | 82,7        | 91,4        | 6862                            | 16,4              | 0           | 36,7        | 55,6        |
| 2016        | 7342                             | 5,1               | 24,7        | 84          | 87,7        | 7342                            | 15,7              | 0           | 37,2        | 53,2        |
| <b>2017</b> | <b>7780</b>                      | <b>5,1</b>        | <b>31,0</b> | <b>88,7</b> | <b>93,0</b> | <b>7780</b>                     | <b>14,3</b>       | <b>0</b>    | <b>50,7</b> | <b>64,0</b> |

### 3.7.2.1. Gulf of Riga Herring (HER\_GOR)

When analyzing information for separate herring populations from the Gulf of Riga and the Baltic Sea, it is evident that the average weighted precision of biological parameters for Gulf of Riga herring is very similar to the combined population values (Table 3.7.2.1.1). This is because more biological samples of herring are collected in the Gulf of Riga. From the combined populations (Table 3.7.2.1), more than 82% of length and 84% of age data are related to the Gulf of Riga (Table 3.7.2.1.1).

Table 3.7.2.1.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for herring biological parameters in the Gulf of Riga.

| Year | Count                            | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 % | Count                           | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 % |
|------|----------------------------------|-------------------|-----------|------------|------------|---------------------------------|-------------------|-----------|------------|------------|
|      | <b>Sex within age classes</b>    |                   |           |            |            | <b>Length</b>                   |                   |           |            |            |
| 2017 | 4087                             | 17,4              | 8,7       | 41,3       | 63,0       | 9476                            | 25,9              | 0         | 17,7       | 31,9       |
|      | <b>Length within age classes</b> |                   |           |            |            | <b>Stage within age classes</b> |                   |           |            |            |
| 2017 | 6526                             | 1,2               | 83,1      | 97,2       | 98,6       | 4087                            | 7,3               | 76,5      | 96,1       | 96,1       |
|      | <b>Mass within age classes</b>   |                   |           |            |            | <b>Age</b>                      |                   |           |            |            |
| 2017 | 6536                             | 5,0               | 32,4      | 85,9       | 91,5       | 6536                            | 15,2              | 0         | 41,3       | 56,0       |

### 3.7.2.2. Baltic Herring (HER\_OS)

Unlike in the Gulf of Riga, there is a significantly lower number of analyzed herrings in the Baltic Sea, resulting in lower average weighted precision. The highest precision level is achieved only for length in age classes. Weight and stage in age classes reach level 2 precision, while the lowest precision level is applicable to the remaining parameters (Table 3.7.2.2.1).

Table 3.7.2.2.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for herring biological parameters in the Baltic Sea.

| Year | Count                            | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 % | Count                           | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 % |
|------|----------------------------------|-------------------|-----------|------------|------------|---------------------------------|-------------------|-----------|------------|------------|
|      | <b>Sex within age classes</b>    |                   |           |            |            | <b>Length</b>                   |                   |           |            |            |
| 2017 | 1244                             | 30,7              | 2,8       | 22,2       | 55,6       | 2053                            | 36,8              | 0         | 7,1        | 24,3       |
|      | <b>Length within age classes</b> |                   |           |            |            | <b>Stage within age classes</b> |                   |           |            |            |
| 2017 | 1244                             | 2,3               | 78,4      | 97,3       | 97,3       | 1244                            | 12,7              | 34,2      | 68,4       | 84,2       |
|      | <b>Mass within age classes</b>   |                   |           |            |            | <b>Age</b>                      |                   |           |            |            |
| 2017 | 1244                             | 6,5               | 24,3      | 89,2       | 94,6       | 1244                            | 27,6              | 0         | 18,4       | 52,6       |

### 3.7.3. Cod (COD)

The number of fish for which age was determined for cod in 2017 was similar to the previous year, and consequently, the average weighted precision is mostly similar as well. As in previous years, in 2017, only the length in age classes corresponds to the highest precision level, while for all other parameters, the average weighted precision corresponds to level 2. The precision for age stages improved in 2017, similar to the previous year, as the number of fish in stages 1 and 2 is relatively small, resulting in reduced potential variability (Table 3.7.3.1).

Table 3.7.3.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for cod biological parameters.

| Year | Count                         | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 % | Count         | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 % |
|------|-------------------------------|-------------------|-----------|------------|------------|---------------|-------------------|-----------|------------|------------|
|      | <b>Sex within age classes</b> |                   |           |            |            | <b>Length</b> |                   |           |            |            |
| 2013 | 2061                          | 19,2              | 21,9      | 68,8       | 82,8       | 18853         | 7,7               | 6,2       | 44,4       | 56,8       |
| 2014 | 2239                          | 15,4              | 24,1      | 70,7       | 84,5       | 25328         | 6,2               | 9,1       | 48,1       | 59,7       |
| 2015 | 2728                          | 17,5              | 6,8       | 63,6       | 72,7       | 35200         | 6,6               | 9,9       | 50,5       | 58,4       |

|             |                                  |             |             |             |             |                                 |             |             |             |             |
|-------------|----------------------------------|-------------|-------------|-------------|-------------|---------------------------------|-------------|-------------|-------------|-------------|
| 2016        | 1637                             | 17,5        | 11,4        | 45,5        | 68,2        | 21016                           | 6,7         | 8,6         | 48,6        | 60          |
| <b>2017</b> | <b>1603</b>                      | <b>16,1</b> | <b>20,7</b> | <b>69,0</b> | <b>86,2</b> | <b>20640</b>                    | <b>14,5</b> | <b>0</b>    | <b>35,9</b> | <b>51,2</b> |
|             | <b>Length within age classes</b> |             |             |             |             | <b>Stage within age classes</b> |             |             |             |             |
| 2013        | 2061                             | 3,6         | 55,2        | 93,1        | 96,6        | 1898                            | 25,7        | 34,4        | 57,4        | 63,9        |
| 2014        | 2239                             | 3,6         | 57,4        | 90,7        | 94,4        | 2239                            | 22,9        | 38,2        | 65,5        | 72,7        |
| 2015        | 2728                             | 3,2         | 68,2        | 88,6        | 90,9        | 2728                            | 17,4        | 48,9        | 77,8        | 84,4        |
| 2016        | 1637                             | 3,8         | 53,7        | 87,8        | 90,2        | 1637                            | 6           | 64,4        | 91,1        | 91,1        |
| <b>2017</b> | <b>1603</b>                      | <b>2,8</b>  | <b>74,1</b> | <b>96,3</b> | <b>96,3</b> | <b>1603</b>                     | <b>5,3</b>  | <b>70,0</b> | <b>93,3</b> | <b>93,3</b> |
|             | <b>Mass within age classes</b>   |             |             |             |             | <b>Age</b>                      |             |             |             |             |
| 2013        | 2061                             | 13,1        | 0           | 65,5        | 81          | 2061                            | 26,5        | 0           | 25,8        | 51,5        |
| 2014        | 2239                             | 12,2        | 3,7         | 66,7        | 79,6        | 2239                            | 22,9        | 0           | 34,5        | 48,3        |
| 2015        | 2728                             | 11,7        | 2,3         | 75          | 79,5        | 2728                            | 20,1        | 0           | 43,8        | 62,5        |
| 2016        | 1637                             | 11,7        | 0           | 68,3        | 80,5        | 1637                            | 23,8        | 0           | 28,9        | 46,7        |
| <b>2017</b> | <b>1603</b>                      | <b>9,4</b>  | <b>3,7</b>  | <b>85,2</b> | <b>92,6</b> | <b>1603</b>                     | <b>19,8</b> | <b>0</b>    | <b>35,5</b> | <b>54,8</b> |

### 3.7.4. Flounder (FLE)

Flounder exhibits very poor precision indicators. The average weighted precision falls below 25% for length in age classes, stage in age classes, and weight in age classes. This can be explained by the vast number of age classes – in 2017, the ages ranged from 2 to 21 years. Furthermore, the current division of length classes used for precision in length distribution results in a very high number of classes, making it impossible to achieve the required precision level in any of them (length does not reach any of the precision levels). In contrast to previous years, there has been a significant improvement in the precision of stage in age classes, reaching the level 2 precision for the first time in the past 5 years (Table 3.7.4.1).

Table 3.7.4.1. Year, number of analysed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for flounder biological parameters.

| Year        | Count                         | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  | Count         | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 %  |
|-------------|-------------------------------|-------------------|-------------|-------------|-------------|---------------|-------------------|-----------|------------|-------------|
|             | <b>Sex within age classes</b> |                   |             |             |             | <b>Length</b> |                   |           |            |             |
| 2013        | 1148                          | 35,2              | 14,7        | 27,9        | 48,5        | 4902          | 25                | 0         | 20,4       | 32,5        |
| 2014        | 1006                          | 68                | 7,4         | 13          | 22,2        | 4029          | 30,3              | 0         | 17,6       | 34          |
| 2015        |                               |                   |             |             |             | 3695          | 31,1              | 0         | 13,4       | 34,8        |
| 2016        | 753                           | 41,4              | 20,8        | 37,5        | 52,1        | 2044          | 44                | 0         | 4,1        | 16,6        |
| <b>2017</b> | <b>776</b>                    | <b>33,3</b>       | <b>12,2</b> | <b>36,6</b> | <b>61,0</b> | <b>2129</b>   | <b>42,7</b>       | <b>0</b>  | <b>1,3</b> | <b>23,2</b> |





|             |                                |             |             |             |             |            |             |            |             |             |
|-------------|--------------------------------|-------------|-------------|-------------|-------------|------------|-------------|------------|-------------|-------------|
| 2016        | 299                            | 3,4         | 38,5        | 92,3        | 100         | 299        | 2,2         | 84,6       | 84,6        | 84,6        |
| <b>2017</b> | <b>201</b>                     | <b>8,3</b>  | <b>55,6</b> | <b>77,8</b> | <b>77,8</b> | <b>201</b> | <b>0</b>    | <b>100</b> | <b>100</b>  | <b>100</b>  |
|             | <b>Mass within age classes</b> |             |             |             |             | <b>Age</b> |             |            |             |             |
| 2013        | 210                            | 11          | 0           | 81,8        | 81,8        | 212        | 37,5        | 0          | 14,3        | 28,6        |
| 2014        | 207                            | 15,9        | 0           | 62,5        | 87,5        | 207        | 32,1        | 0          | 20          | 40          |
| 2015        |                                |             |             |             |             |            |             |            |             |             |
| 2016        | 299                            | 12,6        | 7,7         | 53,8        | 69,2        | 299        | 30,8        | 0          | 15,4        | 30,8        |
| <b>2017</b> | <b>201</b>                     | <b>25,5</b> | <b>0</b>    | <b>55,6</b> | <b>66,7</b> | <b>201</b> | <b>33,3</b> | <b>0</b>   | <b>22,2</b> | <b>44,4</b> |

### 3.7.6. Perch (FPE)

Perch achieves the highest precision level only for the parameter of length in age classes, while all other parameters have an average weighted precision corresponding to level 2, except for the parameter of stage in age classes (precision above 25%). With an increase in the number of measured fish, the precision for parameters related to length has improved. Perch has up to eight age classes, and there is a significant variation in length and weight. Therefore, the number of fish in each of the analyzed classes is insufficient to achieve high precision (Table 3.7.6.1).

Table 3.7.6.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for perch biological parameters.

| Year        | Count                            | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 % | Count                           | Average precision | Prec. 5 % | Prec. 25 %  | Prec. 40 %  |
|-------------|----------------------------------|-------------------|-------------|-------------|------------|---------------------------------|-------------------|-----------|-------------|-------------|
|             | <b>Sex within age classes</b>    |                   |             |             |            | <b>Length</b>                   |                   |           |             |             |
| 2013        | 328                              | 28,5              | 25          | 41,7        | 66,7       | 1190                            | 28                | 2,4       | 28,6        | 45,2        |
| 2014        | 322                              | 16,1              | 33,3        | 77,8        | 88,9       | 933                             | 28,7              | 0         | 21,1        | 34,2        |
| 2015        | 287                              | 27,3              | 33,3        | 60          | 60         | 739                             | 35,5              | 0         | 10,2        | 18,4        |
| 2016        | 315                              | 25,3              | 8,3         | 41,7        | 66,7       | 887                             | 31,1              | 0         | 12,2        | 20,4        |
| <b>2017</b> | <b>312</b>                       | <b>19,0</b>       | <b>12,5</b> | <b>62,5</b> | <b>75</b>  | <b>1425</b>                     | <b>21,8</b>       | <b>0</b>  | <b>31,2</b> | <b>46,9</b> |
|             | <b>Length within age classes</b> |                   |             |             |            | <b>Stage within age classes</b> |                   |           |             |             |
| 2013        | 328                              | 2,5               | 60          | 90          | 90         | 328                             | 30,8              | 0         | 22,2        | 44,4        |
| 2014        | 322                              | 1,8               | 77,8        | 100         | 100        | 322                             | 16,3              | 22,2      | 77,8        | 77,8        |
| 2015        | 287                              | 2,3               | 63,6        | 100         | 100        | 287                             | 20,6              | 46,7      | 60          | 73,3        |
| 2016        | 315                              | 3,3               | 72,7        | 81,8        | 90,9       | 315                             | 21,5              | 38,5      | 69,2        | 84,6        |
| <b>2017</b> | <b>312</b>                       | <b>2</b>          | <b>75</b>   | <b>87,5</b> | <b>100</b> | <b>312</b>                      | <b>25,7</b>       | <b>40</b> | <b>70</b>   | <b>90</b>   |
|             | <b>Mass within age classes</b>   |                   |             |             |            | <b>Age</b>                      |                   |           |             |             |
| 2013        | 328                              | 7,1               | 20          | 80          | 90         | 328                             | 25,8              | 0         | 23,1        | 38,5        |

|             |            |            |             |             |             |            |             |          |           |           |
|-------------|------------|------------|-------------|-------------|-------------|------------|-------------|----------|-----------|-----------|
| 2014        | 322        | 5,7        | 22,2        | 88,9        | 88,9        | 322        | 20,8        | 0        | 33,3      | 33,3      |
| 2015        | 287        | 7,3        | 36,4        | 81,8        | 81,8        | 287        | 29,4        | 0        | 25        | 37,5      |
| 2016        | 315        | 9,9        | 0           | 81,8        | 81,8        | 315        | 27,3        | 0        | 21,4      | 42,9      |
| <b>2017</b> | <b>312</b> | <b>7,4</b> | <b>12,5</b> | <b>87,5</b> | <b>87,5</b> | <b>312</b> | <b>22,9</b> | <b>0</b> | <b>30</b> | <b>50</b> |

### 3.7.7. Salmon (SAL)

With an approximate threefold increase in the number of analyzed fish in 2017, most parameters have seen an improvement in precision. The highest precision level is achieved only for the parameter of length in age groups. Parameters related to weight and age correspond to level 2 precision. Parameters related to gender in age groups and length do not reach any of the precision levels. Both weight and length for salmon exhibit a very wide range of values, necessitating a large number of analyzed fish to achieve high precision (Table 3.7.7.1).

Table 3.7.7.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for salmon biological parameters.

| Year        | Count                            | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  | Count                           | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  |
|-------------|----------------------------------|-------------------|-------------|-------------|-------------|---------------------------------|-------------------|-------------|-------------|-------------|
|             | <b>Sex within age classes</b>    |                   |             |             |             | <b>Length</b>                   |                   |             |             |             |
| 2013        | 795                              | 18,8              | 0           | 40          | 60          | 805                             | 25,1              | 0           | 17,2        | 31          |
| 2014        | 369                              | 21,3              | 37,5        | 50          | 50          | 486                             | 30                | 0           | 7,1         | 21,4        |
| 2015        | 228                              | 24,8              | 50          | 62,5        | 62,5        | 273                             | 47,3              | 0           | 5,9         | 11,8        |
| 2016        | 77                               | 27                | 16,7        | 50          | 50          | 111                             | 68,5              | 0           | 0           | 0           |
| <b>2017</b> | <b>332</b>                       | <b>40,1</b>       | <b>22,2</b> | <b>44,4</b> | <b>44,4</b> | <b>341</b>                      | <b>82,1</b>       | <b>0</b>    | <b>0</b>    | <b>0</b>    |
|             | <b>Length within age classes</b> |                   |             |             |             | <b>Stage within age classes</b> |                   |             |             |             |
| 2013        | 805                              | 1,1               | 66,7        | 88,9        | 88,9        |                                 |                   |             |             |             |
| 2014        | 486                              | 1,4               | 50          | 100         | 100         |                                 |                   |             |             |             |
| 2015        | 269                              | 3,2               | 40          | 80          | 90          |                                 |                   |             |             |             |
| 2016        | 110                              | 11                | 40          | 70          | 80          |                                 |                   |             |             |             |
| <b>2017</b> | <b>339</b>                       | <b>3,6</b>        | <b>54,5</b> | <b>81,8</b> | <b>90,9</b> |                                 |                   |             |             |             |
|             | <b>Mass within age classes</b>   |                   |             |             |             | <b>Age</b>                      |                   |             |             |             |
| 2013        | 804                              | 6,3               | 22,2        | 77,8        | 77,8        | 805                             | 12,9              | 0           | 21,4        | 42,9        |
| 2014        | 471                              | 5                 | 12,5        | 50          | 87,5        | 486                             | 13,2              | 16,7        | 16,7        | 41,7        |
| 2015        | 264                              | 9,4               | 20          | 60          | 70          | 269                             | 23,1              | 0           | 20          | 33,3        |
| 2016        | 110                              | 29,3              | 0           | 60          | 80          | 110                             | 42,3              | 0           | 7,1         | 21,4        |
| <b>2017</b> | <b>338</b>                       | <b>10,4</b>       | <b>9,1</b>  | <b>63,6</b> | <b>72,7</b> | <b>339</b>                      | <b>20,8</b>       | <b>15,4</b> | <b>30,8</b> | <b>61,5</b> |

### 3.7.8. Brown Trout (TRS)

Due to the decrease in the number of analyzed brown trouts, none of the parameters reach the highest precision level. Level 2 precision is achieved only for length in age groups and weight in age groups. Age corresponds to the lowest precision level (level 1). Gender in age groups and length do not reach any of the precision levels. The lowest average weighted precision is for the length parameter, mainly because the analyzed fish in 2017 had a wide length range from 45 to 92 cm, with only 292 fish included in the analysis, which is insufficient. This is also reflected in the fact that the precision for length classes, similar to salmon, is very low, and none of the precision levels are achieved (Table 3.7.8.1).

Table 3.7.8.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for brown trout biological parameters.

| Year        | Count                            | Average precision | Prec. 5 %   | Prec. 25 %  | Prec. 40 %  | Count                           | Average precision | Prec. 5 % | Prec. 25 %  | Prec. 40 %  |
|-------------|----------------------------------|-------------------|-------------|-------------|-------------|---------------------------------|-------------------|-----------|-------------|-------------|
|             | <b>Sex within age classes</b>    |                   |             |             |             | <b>Length</b>                   |                   |           |             |             |
| 2013        | 263                              | 31,5              | 33,3        | 53,3        | 73,3        | 337                             | 54,3              | 0         | 0           | 10,9        |
| 2014        | 103                              | 31                | 28,6        | 42,9        | 57,1        | 248                             | 50,4              | 0         | 2,9         | 11,4        |
| 2015        | 94                               | 28,8              | 42,9        | 42,9        | 85,7        | 242                             | 47,3              | 3,8       | 3,8         | 19,2        |
| 2016        | 83                               | 39,7              | 12,5        | 12,5        | 50          | 381                             | 44,5              | 0         | 5,1         | 17,9        |
| <b>2017</b> | <b>127</b>                       | <b>44,1</b>       | <b>12,5</b> | <b>12,5</b> | <b>50,0</b> | <b>292</b>                      | <b>91,3</b>       | <b>0</b>  | <b>0</b>    | <b>0</b>    |
|             | <b>Length within age classes</b> |                   |             |             |             | <b>Stage within age classes</b> |                   |           |             |             |
| 2013        | 334                              | 3,2               | 52,9        | 88,2        | 100         |                                 |                   |           |             |             |
| 2014        | 248                              | 4,6               | 53,8        | 76,9        | 76,9        |                                 |                   |           |             |             |
| 2015        | 238                              | 2,5               | 72,7        | 100         | 100         |                                 |                   |           |             |             |
| 2016        | 381                              | 4,8               | 50          | 83,3        | 91,7        |                                 |                   |           |             |             |
| <b>2017</b> | <b>292</b>                       | <b>6,3</b>        | <b>37,5</b> | <b>87,5</b> | <b>93,8</b> |                                 |                   |           |             |             |
|             | <b>Mass within age classes</b>   |                   |             |             |             | <b>Age</b>                      |                   |           |             |             |
| 2013        | 263                              | 14,2              | 0           | 64,7        | 76,5        | 334                             | 27,8              | 5,3       | 26,3        | 47,4        |
| 2014        | 229                              | 17,2              | 7,7         | 69,2        | 76,9        | 248                             | 22,8              | 13,3      | 40          | 53,3        |
| 2015        | 227                              | 9,9               | 0           | 72,7        | 81,8        | 238                             | 28,2              | 6,7       | 26,7        | 53,3        |
| 2016        | 376                              | 13,8              | 0           | 58,3        | 83,3        | 381                             | 23,8              | 0         | 15          | 35          |
| <b>2017</b> | <b>292</b>                       | <b>18,6</b>       | <b>0</b>    | <b>50</b>   | <b>68,8</b> | <b>292</b>                      | <b>32,2</b>       | <b>0</b>  | <b>16,7</b> | <b>38,9</b> |

### 3.7.9. Pikeperch (Zander)

Out of the four analyzed parameters for pikeperch, only length in age groups reaches the level 3 precision in all years. Weight in age groups achieves level 2 precision, while age corresponds to level 1 precision. Gender in age groups and length do not reach any of the precision levels. Similar to salmon and brown trout, pikeperch also faces challenges with precision in length classes because the number of analyzed fish is insufficient to achieve high precision, considering the wide range of length values (Table 3.7.9.1).

Table 3.7.9.1. Year, number of analyzed fish, average weighted precision, and percentage of classes (fishing gear, quarter, combination of parameter classes) where one of the precision levels was achieved for pikeperch biological parameters.

| Year        | Count                            | Average precision | Prec. 5 % | Prec. 25 % | Prec. 40 % | Count                           | Average precision | Prec. 5 % | Prec. 25 %  | Prec. 40 %  |
|-------------|----------------------------------|-------------------|-----------|------------|------------|---------------------------------|-------------------|-----------|-------------|-------------|
|             | <b>Sex within age classes</b>    |                   |           |            |            | <b>Length</b>                   |                   |           |             |             |
| 2013        |                                  |                   |           |            |            | 410                             | 45,1              | 0         | 7           | 9,3         |
| 2014        |                                  |                   |           |            |            | 505                             | 41,3              | 0         | 4,8         | 19          |
| 2015        |                                  |                   |           |            |            | 432                             | 46,9              | 0         | 2           | 16          |
| 2016        |                                  |                   |           |            |            | 411                             | 39,3              | 0         | 3,1         | 21,9        |
| <b>2017</b> |                                  |                   |           |            |            | <b>396</b>                      | <b>59,7</b>       | <b>0</b>  | <b>0</b>    | <b>7</b>    |
|             | <b>Length within age classes</b> |                   |           |            |            | <b>Stage within age classes</b> |                   |           |             |             |
| 2013        | 409                              | 1,4               | 87,5      | 100        | 100        |                                 |                   |           |             |             |
| 2014        | 503                              | 1,2               | 92,9      | 100        | 100        |                                 |                   |           |             |             |
| 2015        | 431                              | 1,8               | 70,6      | 94,1       | 94,1       |                                 |                   |           |             |             |
| 2016        | 410                              | 1,1               | 76,9      | 100        | 100        |                                 |                   |           |             |             |
| <b>2017</b> | <b>395</b>                       | <b>1,4</b>        | <b>90</b> | <b>90</b>  | <b>100</b> |                                 |                   |           |             |             |
|             | <b>Mass within age classes</b>   |                   |           |            |            | <b>Age</b>                      |                   |           |             |             |
| 2013        | 409                              | 6,1               | 18,8      | 87,5       | 93,8       | 409                             | 27,3              | 0         | 20          | 30          |
| 2014        | 491                              | 7,9               | 25        | 91,7       | 91,7       | 503                             | 23,3              | 0         | 27,8        | 33,3        |
| 2015        | 420                              | 6,9               | 31,2      | 81,2       | 81,2       | 431                             | 25,6              | 0         | 20          | 30          |
| 2016        | 410                              | 5,6               | 30,8      | 84,6       | 92,3       | 410                             | 24                | 0         | 22,2        | 33,3        |
| <b>2017</b> | <b>395</b>                       | <b>5,8</b>        | <b>20</b> | <b>90</b>  | <b>90</b>  | <b>395</b>                      | <b>17,6</b>       | <b>0</b>  | <b>21,4</b> | <b>28,6</b> |