

# **Guidelines for Coastal Fish Monitoring**

**L. Briekmane, M. Plikšs**

## Guidelines for Coastal Fish Monitoring

Below are the main guidelines for conducting coastal fish monitoring in Jūrkalne, Papē, Daugavgrīva, Pliņciems, Salacgrīva, and Liepāja. To ensure compliance with coastal monitoring guidelines and data quality, representatives from BIOR participate in fishing activities twice a year at each location, having previously agreed on the timing. Monitoring results (collected data) for each fish count are documented in fishing protocols (see Annex 1), which are provided upon signing the contracts. These protocols, in their compiled and printed form, must be submitted to the Fisheries Department of the Institute of Food Safety, Animal Health, and Environment "BIOR" (see Section 6).

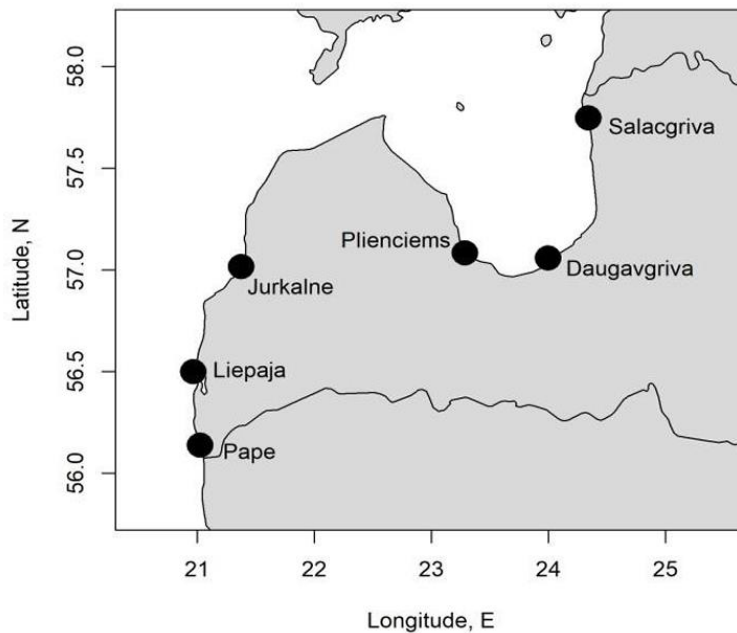


Figure 1. Locations of coastal fish monitoring

### 1. Fishing Gear and Stations

For coastal fish monitoring, Nordic Coastal research nets are used. One such net is 45 meters long, 1.8 meters high, and consists of nine 5-meter-long net panels with different mesh sizes - 30, 15, 38, 10, 48, 12, 24, 60, and 19 mm. One such net is placed at each fishing station. The total number of stations at one monitoring site is six. Nets are placed in the sea at a depth of 3-5 meters. In three stations, the nets are placed parallel to the shore, while in three stations, they are placed perpendicular to the shore. The minimum distance between nets is at least 200 meters. When conducting fish counts, it is not recommended to change the net placement. The net placement must also be indicated in the fishing protocol for each station, highlighting the respective information. Information about each station is recorded on a new page of the fishing protocol. The depth at which each net station is located is also recorded in the fishing protocol.

When fishing, minimal net damage is allowed. The suitability of the nets for the next count should be assessed after each count, with the fishing protocol (in the "Special Notes and Other Information" section) also indicating any damage to the nets caused by seals, if any. If any of the mesh size sections in the net are significantly damaged, for example, with many small holes or one larger than 0.5 m<sup>2</sup> (50x50 cm), then the net should be replaced with a new one.

## **2. Fishing Time**

Coastal fish monitoring is typically conducted from February to December. The number of fishing sessions per month and the months during which fishing is performed depend on the conditions specified in the agreement with "BIOR." Each monitoring session lasts for one night, and the duration in hours depends on the length of the day (season). Usually, placing the nets in the sea occurs during the time period from 16:00 to 18:00, while retrieval takes place the next morning from 06:00 to 8:30. In each monitoring session, the fishing protocol records the date of net retrieval, as well as the times of net placement and retrieval.

## **3. Meteorological Conditions and Water Parameters**

In each monitoring session, meteorological conditions and water parameters are recorded in the fishing protocol, both during net placement and retrieval, specifying the respective stations where measurements were taken on the protocol page. A hydrological probe is used to determine water temperature (in degrees Celsius, with an accuracy of 0.1°) and water salinity (in parts per thousand, ‰) in both the surface and subsurface layers of the water. Water clarity is measured using a Secchi disk, which is lowered into the water on the shadow side of the boat and slowly raised until the maximum depth at which the disk is visible is noted (expressed in meters with an accuracy of 0.1 m).

The fishing protocol also indicates possible changes in water quality (such as algal "blooms"), which are noted in the lower section of the fishing protocol page under "Special Notes and Other Information."

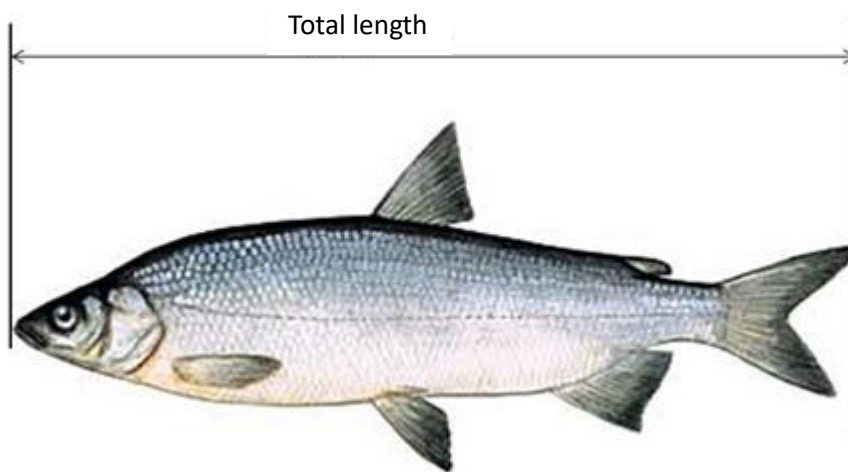
Hydrological parameters (temperature, salinity, clarity) are determined at one station (preferably the deepest) in all fishing sessions throughout the fishing season. During net placement and retrieval, the following meteorological parameters are also recorded - wind direction and speed (m/s). All of the information mentioned in this section should be indicated on one of the fishing protocol pages.

#### 4. Processing the catch:

The captured fish are removed from the nets and analysed individually at each fishing station. A new fishing protocol page is used for each station. For each fish, its species, length, and weight are determined individually. The length of the fish is measured from the snout to the tip of the tail fin. The fish's mouth must be closed, and the tail fin should not be stretched (see Figure 1). The length is measured in centimetres with an accuracy of 0.1 cm (e.g., 24.7 cm), and the weight of the fish is measured in grams with an accuracy of 1 gram (e.g., 169 grams).

Any deviations from the norm (visually apparent diseases, such as ulcers or deformities) are recorded alongside the specific fish parameters in the protocol, under the "Notes" section. For salmon and trout, the sex is determined, and the stage of sexual maturity (juveniles, maturing, spawning, post-spawning) is described. This information is also recorded in the "Notes" section for the respective fish.

Figure 2. Length measurement of fish



## 5. Recording of Other Animals, Rare Fish Species, and Seal Damage:

Seal Damage: During each fishing operation, the number of seals observed should be noted when setting and retrieving the nets. If any damage to the catch by seals is observed (e.g., only fish heads remain in the nets), this should also be recorded in the protocol, specifying the fish species that have been damaged and the approximate quantity at each station. If damaged fish, such as pikeperch, salmon, trout, smelt, or perch, are found in the nets, only the length of the head from the snout to the outer edge of the gill cover should be measured (see Figure 2). In the "Notes" section of the protocol, it should be noted that the fish has been damaged by a seal.

Birds: Captured birds in the nets should be photographed in a way that clearly shows their head and upper wing. One bird can appear in multiple photographs. Information about the captured birds should be recorded in the fishing protocol, and the photographs should be sent to "BIOR" through one of the following methods: printed form (see address in section 6), electronically ([ivars.putnis@bior.lv](mailto:ivars.putnis@bior.lv))

Rare Fish Species, Crabs: If crabs or lesser-known and rare fish species (such as mackerel, anchovy, haddock, sea cucumbers, barbel, fathead minnow, stickleback, etc.) are caught in the nets or if it is impossible to determine the fish's species, they should be frozen (with a note indicating the fishing date and station number) and later handed over to "BIOR" staff. All this information must also be recorded in the "Special Notes and Other Information" section of the fishing protocol.

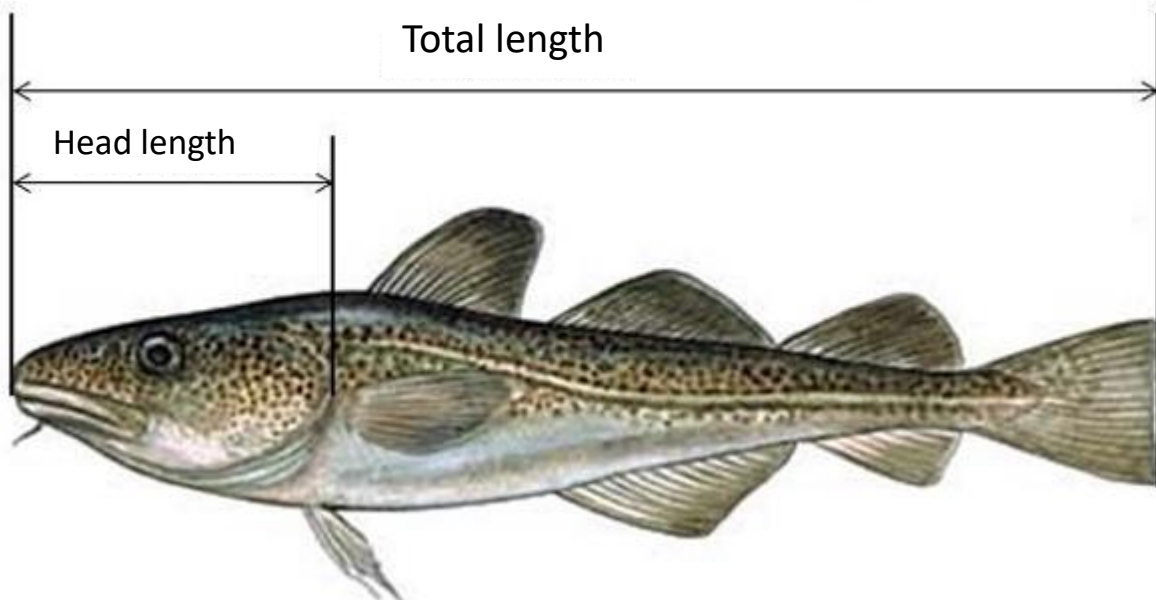


Figure 3. Measuring the head length of pikeperch, salmon, trout, whitefish, and cod in cases of damage caused by seals.

## 6. Data Documentation and Submission:

All the mentioned information for each fishing operation should be documented in a fishing protocol. The fishing protocol consists of at least 6 pages (one for each station), and each page is numbered with the total number of pages for that specific fishing operation. An example of a completed protocol is provided in Appendix 2. Fishing protocols should be submitted to the "BIOR" Fisheries Research Department, Marine Division (address: Lejupes street 3, Rīga, LV – 1076) no less than once every quarter. Photographs can be submitted using one of the following methods: in printed form along with the fishing protocols, electronically to [ivars.putnis@bior.lv](mailto:ivars.putnis@bior.lv). Frozen rare and lesser-known fish species, as well as crabs, should be handed over to "BIOR" staff after prior arrangement.

## 7. Determining the Data Accuracy Level

To determine data accuracy, three levels of precision are used:

- 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.

### Calculation of Precision Levels

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

### 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.

### 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 level 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.

Appendix 1. Example of completed fishing protocol page.

**Zivju uzskaites protokols** Tīklu izņemšanas datums 03.08.2017 Stacijas nr. 4 Dziļums 4,5m

Vieta DAUGAUGRĪVA Tīklu novietojums: Paraleli/perpendikulāri krastam Lapas Nr. 4  
Kopējais lapu skaits 6

Laiks	Tīklu ielikšana	Tīklu izņemšana	Ūdens t° (grunts)	Tīklu ielikšana	Tīklu izņemšana
Vēja virziens	18:00	06:00	20,52	20,51	
Vēja stiprums	DR	DR	20,64	20,71	
Seki dziļums	4 m/s	5 m/s	4,07	4,05	
	3,3 m	3,2 m	3,23	3,19	

Nr.	Suga	Garums, cm	Svars, g	Piezīmes	Nr.	Suga	Garums, cm	Svars, g	Piezīmes
1	Vīze	14,1	26		51	Vīze	12,1	14	
2	-"-	14,5	23		52	-"-	10,5	8	
3		14,4	27		53		11,1	12	
4		13,2	18		54		14,5	25	
5		13,0	17		55		14,5	24	
6		13,0	15		56		13,0	16	
7		11,4	11		57		14,5	27	
8		13,5	21		58		14,2	25	
9		13,2	17		59		14,0	22	
10		11,3	11		60		11,7	11	
11		12,0	11		61		13,8	22	
12		12,0	12		62		12,6	15	
13		13,7	21		63		11,8	13	
14		12,0	11		64		11,5	13	
15		12,5	15		65		13,5	18	
16		12,8	16		66		12,0	12	
17		13,5	18		67		11,7	13	
18		12,0	13		68		12,5	13	
19		11,5	10		69		14,0	18	
20		13,0	20		70		13,7	21	
21		11,0	11		71		12,1	14	
22		13,3	20		72		11,0	9	
23		12,5	15		73		14,0	17	
24		14,5	26		74		13,3	17	
25		13,0	16		75		13,0	18	
26		12,4	13		76		13,7	22	
27		13,0	15		77		12,7	14	
28		14,0	25		78		13,1	18	
29		11,3	9		79		12,0	15	
30		12,9	18		80		11,5	10	
31		16,8	30		81		15,3	27	
32		13,6	21		82		14,0	21	
33		14,0	23		83		13,6	16	
34		13,7	24		84		12,8	15	
35		14,7	25		85		12,2	13	
36		11,0	10		86		11,3	11	
37		15,4	31		87		12,3	12	
38		11,0	10		88		15,0	24	
39		15,4	31		89		12,7	18	
40		11,0	10		90		11,5	13	
41		12,9	18		91		15,3	27	
42		14,0	20		92		10,6	8	
43		11,0	10		93		12,6	16	
44		13,0	18		94		12,3	13	
45		12,3	20		95		11,0	8	
46		12,0	11		96		11,1	10	
47		14,1	24		97		13,0	17	
48		13,5	21		98		11,2	11	
49		11,5	11		99		12,0	14	
50		13,7	20		100		13,0	15	