

The collection of flounder biological material from commercial fishing trips

Flounder biological samples are collected on the deck of the ship during commercial fishing or in port. Samples are taken during specialized flounder fishing or commercial fishing for cod when flounder is caught as bycatch. Samples are collected at least once every quarter in each fishing subarea, if fishing activities are conducted there, and based on fishing conditions. The choice of the vessel for sample collection is determined using a random selection principle, and the selection procedure is recorded in a special protocol. During commercial fishing trips, biological analyses and mass measurements are performed on flounder.

Biological analyses

Biological analyses include the following information for each fish:

- Maximum length, cm
- Total weight in grams
- Sex
- Stage of sexual maturation (according to a 7-point scale)
- Otoliths for age determination
- Notes

Otoliths are collected in logbooks. Each logbook includes information such as species, fishing date, trip number, fishing gear, fishing report number, vessel, fishing subdivision, catch fraction, and individual fish numbers within each logbook (from - to).

Each page of the logbook specifies the unique fish species number, as well as fish length in centimeters, fish weight, gender, and maturation stage. Later, the information from the logbooks is transferred to biological analysis forms.

Mass measurements

Mass measurements are taken for unsorted, randomly selected fish, separately for each catch fraction (landings or discards). The maximum length in centimetres is noted for the measured fish. Mass measurements are conducted based on the size of the haul. The measured portion of the sample must be indicated in kilograms.

Quality control of trip data

Quality control of trip data involves entering each trip's data into a separate Excel database file. The data file contains restrictions (minimum and maximum allowable values) for the following biological parameters:

- Fish total length in cm
- Total weight in grams
- Age

The data file already has predefined values that can be assigned to the following biological parameters:

- Gender
- Stage of sexual maturation

Once the data for the respective trip is entered, an analysis of fish length and weight data is performed. A linear regression model is established, determining the trendline and forecast confidence intervals. Entries that fall outside the confidence intervals are marked as erroneous and rechecked, and if necessary, corrected. Biological data is rechecked when age determination is conducted. The age determiner compares the records for each specific fish with the information in the logbooks and entries on the biological analysis form. Any errors found are corrected in the Excel database file and on the biological analysis form.

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

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.

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.

1.7.2.2. 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 level were calculated analytically using the formula:

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

Where:

μ is the estimated parameter mean value,

n is the number of observations (fish) in the specific class,

t_{α} is the two-tailed t-distribution value at the confidence level α ,

σ 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 α and $n-1$ degrees of freedom, while \sqrt{n} represents the standard error of the mean.