Biological monitoring of sprat (*Sprattus sprattus*),Horse macherel (*Trachurus mediterraneus ponticus*), red mullet (*Mullus barbatus*), Anchovy (*Engraulis encarsicolus*) Bluefish (*Pomatomus saltatrix*), Whiting (*Merlangius merlangus*) Picked dogfish (*Squalus acanthias*) landings

I.2 Sampling

I.2.1.1 Geographic area coverage

Data of present analysis were collected directly from landing ports (see Fig.1) main landing sites of Bulgarian active fisheries. The catches and landings were realized in the EEZ of Bulgaria in depths of 40 to 80m. Mean depth of the operating vessels were 45 m.

Picked dogfish samples were originated from Romanian EEZ.

I.2.1.2 Sampling period

All samples originated from active fishery with trawlers and using mid-water trawls (OTM). The fishery using mid water trawls is been carried out whole year round in suitable meteorological conditions. Samples from Picked dogfish were obtained from long line fishery in winter period (December-February, Romanian EEZ).

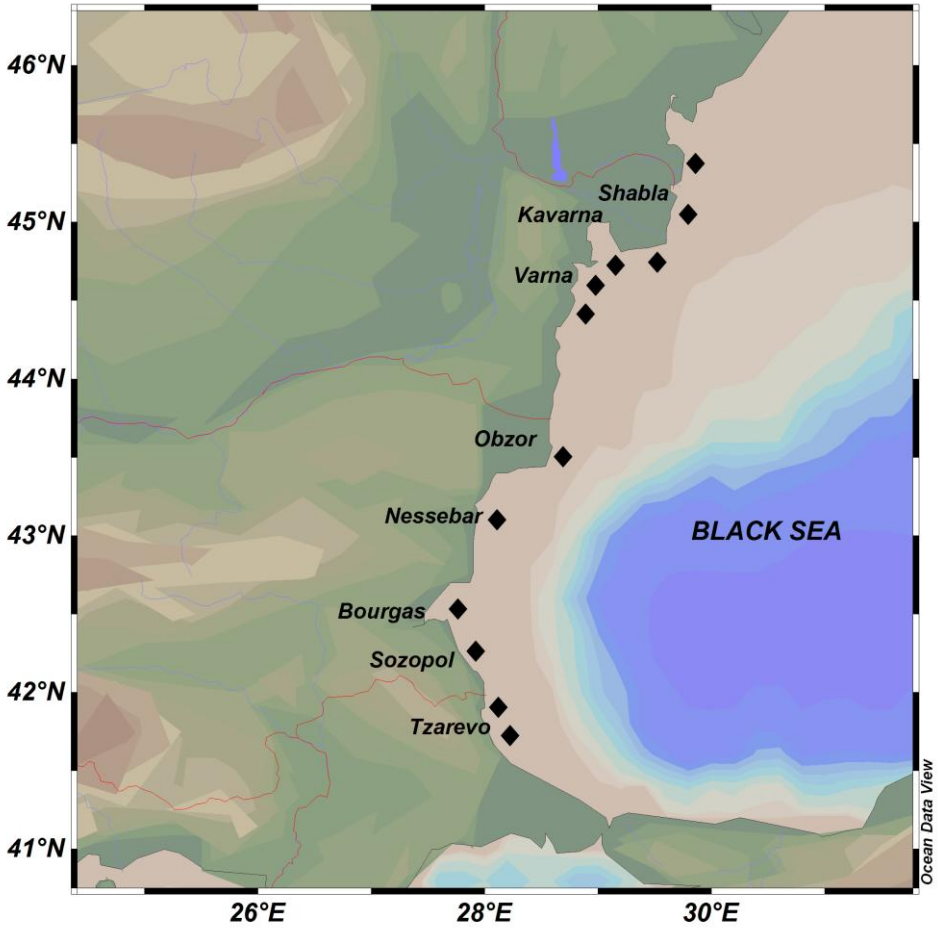

Figure 2.1.1.1 Map of sampling points

I.2.1.3 Statistical analysis of data

All samples tend to be collected in accordance with the variation statistics from significant landings in terms of quantity where is possible. Random sampling theory was followed when taking the sample. The samples were processed in laboratory conditions. Total length (TL, ±0.5 cm precision) was measured using an ichtyometer, and total fresh weight was measured using an electronic analytical balance (W, ±1g precision). The study used otoliths to determine age, which was determined from otolith rings. Otoliths were removed and dried in the laboratory and stored in labeled envelopes. Age was determined by microscope Olympus CX 31RTSF-6 and recorded. Thus, the yearly annulus was detected as hyaline and opaque zones, shifting active growing with period

of growth stagnation. Sections from the other otoliths were judged illegible and were excluded from this study. In order to check the accuracy of the age readings in the present study, an ageing intercalibration exercise was carried out between the authors. Age readings were compared using a signed rank statistical test. We found consistent agreement between readers with low average percentage error (APE) values.

The condition factor was obtained from Fulton´s equation (Ricker, 1975): where W is total weight (g) and L is length (cm) cubed, multiplied by 100 to represent values as percentages.

$$K = \frac{W}{L^3} * 100$$

The condition factor 'K' was computed for each age groups separately for different months. For all the samples "Age-Length" (Weight) Keys were created. Thus, the mean values of length, weight and condition factor were resulted. The share (in %) of individuals per age groups and length groups were reflected in the analysis as well.

The coefficient of variation (CV) is defined as the ratio of the standard deviation σ to the mean μ:

$$c_v = \frac{\sigma}{\mu}$$

The coefficient of variation is useful because the standard deviation of data must always be understood in the context of the mean of the data. In contrast, the actual value of the CV is independent of the unit in which the measurement has been taken, so it is a dimensionless number. For comparison between data sets with different units or widely different means, one should use the coefficient of variation instead of the standard deviation.

Estimation procedures

Age: Age compositions are generally estimated from two-stage sampling where random length samples are taken and length-stratified age samples are used to construct an age-length-key.

Length: Length distributions are obtained from random samples.

Weight: Individual weights are recorded for all fish that are aged. A length-weight relationship is fitted to estimate weight-at-length and weight-at-age is estimated from this using an age-length-key

Sex: Sex-at-age is estimated using a sex-age-length-key

Maturity: Maturity-at-age is estimated using a maturity-age-length-key or, if appropriate, a sex-maturity-age-length-key.

The estimation of the biological parameters will be made using analytical methods.

Data quality evaluation

According to the Commission Decision 2010/93/EU, Chapter III, section B2.4, the stock-related variables should be estimated with a precision level 3 - for the stocks that can be aged.

Sample sizes were calculated for selected list of species. CVs for maturity-at-age and size-at-age for all sampled species will be calculated annually at the GSA level.

Description of samplings:

Sprat (*Sprattus sprattus*)			
Black Sea	Length @age	market	Market: 1090
Black Sea	Weight @length	market	Market: 3682
Black Sea	Weight @age	market	Market: 1090
Black Sea	Sex-ratio @length	market	Market: 3682
Black Sea	Sex-ratio @age	market	Market: 1090

Horse mackerel (*Trachurus mediterraneus*)			
Black Sea	Length @age	market	Market: 2070
Black Sea	Weight @length	market	Market: 3751
Black Sea	Weight @age	market	Market: 2070
Black Sea	Sex-ratio @length	market	Market: 3751
Black Sea	Sex-ratio @age	market	Market: 2070

Anchovy (*Engraulis encrasicolus*)			
Black Sea	Length @age	market	Market: 2007
Black Sea	Weight @length	market	Market: 2959
Black Sea	Weight @age	market	Market: 2007
Black Sea	Sex-ratio @length	market	Market: 2959

Black Sea	Sex-ratio @age	market	Market: 2007

Whiting (*Merlangius merlangus*)			
Black Sea	Length @age	market	Market: 1630
Black Sea	Weight @length	market	Market: 2824
Black Sea	Weight @age	market	Market: 1630
Black Sea	Sex-ratio @length	market	Market: 2824
Black Sea	Sex-ratio @age	market	Market:1630

Red mullet (*Mullus barbatus*)			
Black Sea	Length @age	market	Market: 1840
Black Sea	Weight @length	market	Market: 3445
Black Sea	Weight @age	market	Market: 1840
Black Sea	Sex-ratio @length	market	Market: 3445
Black Sea	Sex-ratio @age	market	Market: 1840

picked dogfish (*Squalus acanthias*)			
Black Sea	Length @	survey	84
Black Sea	Weight @	survey	84
Black Sea	Sex-ratio @length	survey	84