Dynamics of Fluctuations in the Indices of Species Diversity of Ichthyoplankton in the Northern Part of the Central-Eastern Atlantic

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Editorial

An integrated indicator of the condition of any community can be its species diversity, expressed by various indices [1-3]. In ichthyoplankton samples collected during complex expeditions at standard stations in the northern part of the Central-Eastern Atlantic (CEA), the number of species of eggs and larvae, as well as the number of each species, changed significantly from year to year. To assess the species diversity of ichthyoplankton, various indices of species diversity were used, widely used in ecological and faunal studies [1,3-6]. Changes in the indices of species diversity of ichthyoplankton in the northern part of the Central-Eastern Atlantic were analyzed using retrospective data and new materials.

Formula	Author
$\dfrac{W-1}{\text{h } N}$	Margalef, et al. [11]
$-\sum_{i=1}^{w} \dfrac{n_i}{N} \cdot \log_2 \dfrac{n_i}{N}$	Shannon, et al. [8]
$1-\sum_{i-1}^{w} \dfrac{n_i \cdot (n_i-1)}{N \cdot (N-1)}$	Simpson, et al. [10]
$\dfrac{-\sum_{i=1}^{w} \dfrac{n_i}{N} \cdot \log_2 \dfrac{n_i}{N}}{\log_2 W}$	Pielou, et al. [6]
W – number of species; n_i – number of the i-th species; N – total number of individuals.	

Table 1: Indices of species diversity.

The article uses the materials of ichthyoplankton surveys of 2000-2019 in the waters of the northern part of the CEA (32°-16° N) (exclusive economic zones of Morocco and Mauritania). Bongo-20 plankton net with gas No. 17-

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21 was used to collect materials. Stepwise oblique fishing was carried out at the horizons of 100, 50, 35, 25, 10 and 0 m for 1.5-3.0 minutes. on each horizon at the speed of the vessel 2.0-3.0 knots [7]. Plankton stations in the water areas of the survey were located above depths from 20 to 1000 m. Further processing of the materials was carried out under laboratory conditions under MBS-10 binocular microscopes (magnification 8 x 2, 8 x 4). During the cameral processing, the qualitative and quantitative compositions of fish eggs and larvae were determined. The species diversity of ichthyoplankton was estimated using the Shannon information and statistical imperative index, which is the most common in hydrobiology [8]. Although, as a measure of heterogeneity, the Shannon index takes into account the equalization of species abundance, very often, for a visual assessment of the degree of "polydominance", the equalization index (imperative index) proposed by Pielou E, et al. [9] is used separately and represents the ratio of the observed diversity (Shannon index) to the maximum. In addition, the imperative Simpson index [10] and the parametric Margalef index Margalef, et al. [11] were calculated. Imperative indexes are mainly borrowed from information theory and have the advantage over parametric ones that they are applicable even when the form of distribution of species diversity by stations and/or by years varies significantly. Parametric indices show the presence of a larger or smaller number of species in the compared biocenoses, regardless of the number of each species (Table 1).

To assess the contribution of each species to the composition of ichthyoplankton complexes, the Paliy-Kovnatsky dominance index was used [12,13].

$$D_i = 100 \times \frac{m_i}{M} \times \frac{n_i}{N}$$

D_i – the dominance index for the i-th specie (%), m_i - the number of samples in which the specie i was found, M - total number of samples, n_i - the number of individuals of the i-th species, N - total number of individuals.

A total of 25 ichthyoplankton surveys were performed and analyzed during the period under review.

We will consider the dynamics of fluctuations in the indices of species diversity of ichthyoplankton in the northern part of the Central-Eastern Atlantic. Changes in the indices occurred synchronously, and the greatest fluctuations were observed in the parametric Margalef index (5.79-10.00) (Figure 1), analyzing which we can note the general trend of increasing species diversity from the northern part of Morocco to the region of Mauritania. Fluctuations in imperative indices were more smoothed out. The Simpson index varied in the range from 0.32 to 0.87 (Figure 1), i.e. according to the Odum classification [14], the ichthyoplankton complex in the northern part of the CEA had medium (index higher than 0.2) and high (index higher than 0.7) biotic diversity. The equalization index Pielu varied in the range from 0.22 to 0.59 (Figure 1). Basically, a situation of a certain monodominance was observed (the equalization index was ≤ 0.5 in 13 out of 19 years of observations), in the remaining years there was a relatively equal abundance of all species in a relatively complex ichthyoplankton complex.
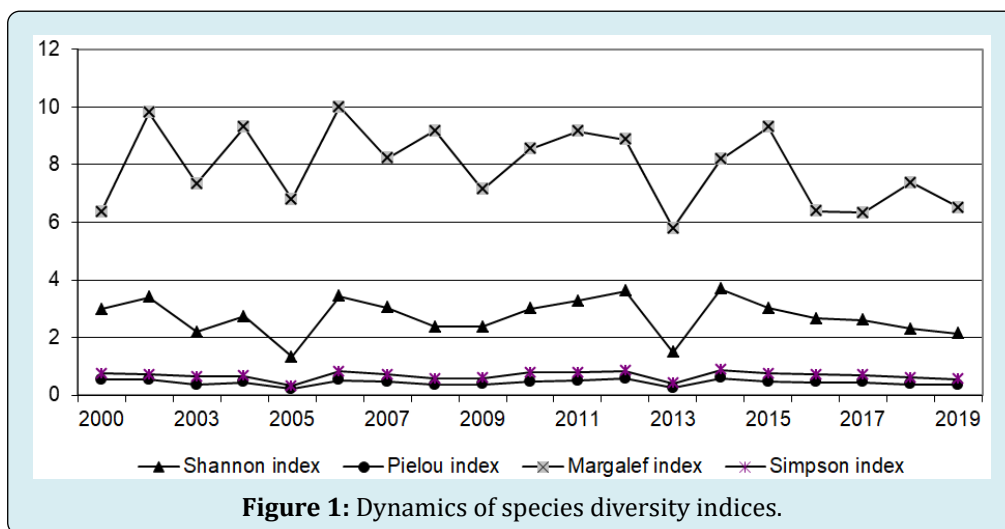

Figure 1: Dynamics of species diversity indices.

According to the assessment of the degree of dominance according to the Palia-Kovnatsky index, the dominant species in the ichthyoplankton in the considered areas were the european sardine (*Sardina pilchardus*) and round sardinella (*Sardinella aurita*), the subdominants were the european anchovy (*Engraulis encrasicolus*), spar (family Sparidae) and rhombus (family Bothidae) (Figure 2).

Figure 2: Meaning Palia-Kovnatsky index (%).
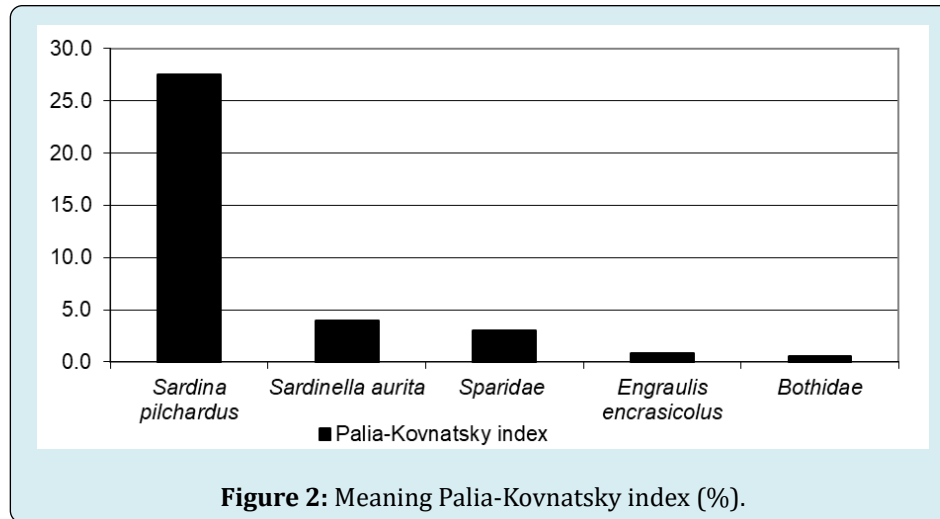
Moreover, the percentage of the contribution to the ichthyoplankton of the european sardine (subtropical species) decreased, and the percentage of the contribution of the round sardinella (tropical species) increased from Morocco to Mauritania.

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