

Age Structure of the Endemic Fish *Phoxinellus pseudalepidotus* (Cyprinidae) from Mostarsko Blato (Neretva River Basin, Bosnia and Herzegovina)

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Abstract

*This study provides age structure information for *Phoxinellus pseudalepidotus*, a freshwater fish endemic to the Neretva River basin, which is classified by the IUCN as vulnerable. Fish sampling was carried out in 2009 by gill nets and „krtol“, traditional hunting tool in the area of Mostarsko Blato (Neretva River Basin, Bosnia and Herzegovina). In order to analyze age structure of the population, 70 units of various age categories were taken. Length range of all analyzed units was from 2,7 to 11,5 cm. By reading otoliths, a total of four age classes was established: 0+, 1+, 2+ and 3+. The largest part of the sample consisted of 2-year-old units (40%). There were 28,6% of 1-year-old units, 27,1% of 3-year-old units, and 4,3% of 4-year-old units. The mean estimated total length (TL) of 1-year-old *P. pseudalepidotus* was 4 cm; 2-year-old, 6,7 cm; 3-year-old, 9,15 cm; 4-year-old, 11,05 cm. The conducted study provides an insight into age structure of *P. pseudalepidotus* population, which represents new and original contribution to knowledge about this endemic fish.*

Keywords: *Phoxinellus pseudalepidotus*, age structure, Mostarsko Blato

1. Introduction

Basic life history information are essential in the study and analysis of population performance and in both theoretical ecology and fisheries management (Wootton, 1998). Moreover, the study of biological traits is an important element of the overall description of a species, and this information is essential for the appreciation of the role of biodiversity in the functioning of ecosystems. In the case of native fishes, there is a general need to increase the knowledge of their biological traits, because this information provides a necessary tool for conservation programmes (Cooke et al., 2012).

In waters of Bosnia and Herzegovina, 40 endemic species were detected so far, many of them widespread only on some locations. Diversity of species, particularly of endemic species classifies Bosnia and Herzegovina into a group with the highest ichthyological diversity among European countries. That fact can primarily be attributed to geographical position and isolation from other European river systems, complex geological history and climatic features (Glamuzina et al., 2010).

Phoxinellus pseudalepidotus (Bogutskaya & Zupančič, 2003) is a small-sized (< 15,0 cm TL) cyprinid endemic freshwater fish distributed in Mostarsko Blato in the Neretva catchment area in Bosnia and Herzegovina. In addition, it is considered to be distributed more widely in the River Neretva basin (Bogutskaya and Zupančič, 2003). Some authors considered this fish from the Mostarsko Blato as *Phoxinellus alepidotus* because of morphological similarity between *P. alepidotus* and *P. pseudalepidotus* (Heckel and Kner, 1858; Seeley, 1886 (as *Paraphoxinus alepidotus*); Vuković and Ivanović, 1971 (as *Paraphoxinus alepidotus*); Kottelat, 1997). Also, Zupančič and Bogutskaya (2002) the discovered undescribed species close to *P. alepidotus* which appears in Mostarsko Blato. *P. pseudalepidotus* inhabits streams or shallow canals with little current and clean water (Crivelli, 2006; Bogutskaya and Zupančič, 2003). During unfavorable periods, it lives in underground waters (Markotić et al., 2013; Markotić, 2013). This endemic fish is classified by the IUCN as vulnerable (Crivelli, 2006). It is endangered because of the extremely limited range of distribution, river system regulation and influence of non-indigenous species (Mihinjač et al., 2014).

This paper provides the first information on the age structure of the population of *P. pseudalepidotus* located in Mostarsko Blato in the Neretva River catchment area in Bosnia and Herzegovina.

Thorough knowledge of age structure of *P. pseudalepidotus* would be of assistance in attempts to conserve the species.

This information could prove to be extremely useful for other endangered small cyprinid species whose age structures are poorly understood.

2. Materials and methods

2.1. Study area

Mostarsko Blato (43°19'55"N 17°41'53"E) is a closed karstic field in the Neretva River catchment area, SW Bosnia and Herzegovina. The area of Mostarsko Blato is characterized by sub-Mediterranean climate, i.e. temperately warm humid climate with hot summers (Cfa), according to Köppen's climatic classification. In general, winters are mild and rainy, while summers are hot and relatively dry (there is no specific minimum like in Csa climatic zones, such as the neighboring littoral and insular part of Southern Croatia). Pluviometric regime is maritime with most of precipitation concentrated in autumn and winter (primary maximum), and in April and May (secondary maximum). The influence of the Adriatic Sea comes from three sides, southeast, east and south. The strongest inflow of air comes through the Neretva River valley, and over low Varda ridge, which separates lower alluvial plain of Mostarsko Blato from higher Mostarsko Blato Polje (Field). This inflow relieves the influence of colder air that comes from northern mountains.

During autumn, winter and spring, the most part of Polje is flooded, but during summer almost all water springs dry out (Studija izvodivosti HE Mostarsko Blato, EP HZHB, Salzburg, 2000).

The area of Mostarsko Blato, through which the Lištica River flows, is surrounded by limestone hills: Orlovac, Mikuljača, Virača, Trtla and Varda. The field is flooded on average 5-6 months during the year. In addition to permanent water sources in Mostarsko Blato, significant amounts of periodic water of Rivers Ugrovača, Orovnik, Mokašnica and a number of small torrents, are active during major rainfall seasons. In order to reduce the floods, the tunnel Varda was built in the year of 1947. Except for the Varda tunnel, water from Mostarsko Blato is managed also by the following sink holes: Krenica, Košina, Renkovača, Kruševo, and the Great Hole (Velika jama). These sink holes are important for *P. pseudalepidotus* life cycle (Bogut et al., 2007).

2.2. Sampling

Fish sampling was conducted in 2009 by gill nets (7 m length and 0.7 m height, with a 7 mm mesh size) and by „krtol“, traditional hunting tools. Sampling was conducted in spring, at the season of plant growth; in summer, the period of minimum flow; in autumn, at the beginning of the wet season periods; and in winter, during floods and high water levels. After sampling, a total of 70 units was obtained for age structure analysis. The study area with sampling sites is shown in Figure 1.

2.3. Age Determination

Each unit was measured for total length (TL) to the nearest mm, and otoliths were removed, cleaned and kept dry in small numbered plastic cuvettes for subsequent age-determination. The method used in the present study for preparing the otoliths was grinding the otoliths (Age_{ground}). The otoliths were ground with sandpaper to make the annuli more distinct for age reading, and examined with a dissecting microscope in whole view on a black background with reflected light. Age determination was done twice by the same reader, and without the reader knowing anything about the fish length or the previous age determination. This means that for each fish there are four corresponding age determinations.

3. Results

In order to analyze age structure of the population of *P. pseudalepidotus*, 70 units of various age categories were taken. Length range of all analyzed units was from 2,7 to 11,5 cm. By reading otoliths, a total of four age classes were established: 0+, 1+, 2+ and 3+. The largest part of the sample consisted of 2-year-old units (40%). There were 28,6% of 1-year-old units, 27,1% of 3-year-old units, and 4,3% of 4-year-old units. Age structure of the *P. pseudalepidotus* population is presented in Figure 2. Length range for the units belonging to age class 0+ was from 2,7 to 5,3 cm, and length range for the units belonging to age class 1+ was between 5,5 and 7,9 cm. For the units belonging to age class 2+ length range was from 8,0 to 10,3 cm. Length range for the units belonging to age class 3+ varied from 10,6 to 11,5 cm. The mean estimated total length (TL) of 1-year-old *P. pseudalepidotus* was 4 cm; 2-year-old, 6,7 cm; 3-year-old, 9,15 cm; 4-year-old, 11,05 cm. Annual growth zones (2^+) in otolith *P. pseudalepidotus* are presented in Figure 3.

4. Discussion and Conclusions

Bibliographical data about the age of species *P. pseudalepidotus* have not existed up till now. By analyzing the otoliths of *P. pseudalepidotus* it was established that all researched units reached the highest age of just under four years, i.e. that they belonged to age classes 0+, 1+, 2+ and 3+. The highest detected length for the units belonging to age class 0+ was 5,3 cm, while the highest detected length for the units belonging to age class 3+ was 11,5 cm. The mean estimated total length (TL) of 1-year-old *P. pseudalepidotus* was 4 cm; 2-

year-old, 6,7 cm; 3-year-old, 9,15 cm; 4-year-old, 11,05 cm. According to these results, *P. pseudalepidotus* is a short-living species which grows quickly in the first year of life. This fast growth enables fish to reach the size sufficient to migrate into underwater during unfavorable periods, as well as to increase their individual reproduction capacity to the maximum. Similar data on the highest age were found for species *Pelagus epiroticus*, an endemic species widespread in the Pamvotis Lake in Greece. This species grows up to 5-6 cm of their total body length in the first year of life, and the maximum detected age is 2 to 3 years (Prassa et al., 2003). On top of that, for species *Anaocypris hispanica*, widespread in the Guadiana River Basin in Spain and Portugal, the oldest registered age was 3 years (Kottelat and Freyhof, 2007). Krivokapić (1998) lists seven age classes for species *Telestes montenegrinus* from the Morača River in Montenegro. It was established for this species that the fish belonging age classes 0⁺ and 1⁺ have the highest growth rate. The growth rate reduces drastically after four years of life (Krivokapić, 1998). The most numerous established age class for *Telestes montenegrinus* is 1+ (Krivokapić, 1992a). By determining the age of *Telestes ukliva*, from the Cetina River, eight age classes were detected, from 0⁺ to 7⁺, which means that the oldest caught unit was in the eight year of life. For this type of species the highest number of age class 2⁺ was determined (Zanella, 2003). The highest noted age class in *Telestes souffia* from the Drina River was 7⁺. In this age class only females were detected (Vuković, 1985).

It can be concluded from the above that *P. pseudalepidotus* is a short-living species which leaves four years at the longest. The conducted study provides an insight into age structure of *P. pseudalepidotus* population, which represents new and original contribution to knowledge about this endemic fish.

Thorough knowledge of age structure of *P. pseudalepidotus* would be of assistance in attempts to conserve the species.

This information could prove to be extremely useful for other endangered small cyprinid species whose age structures are poorly understood.

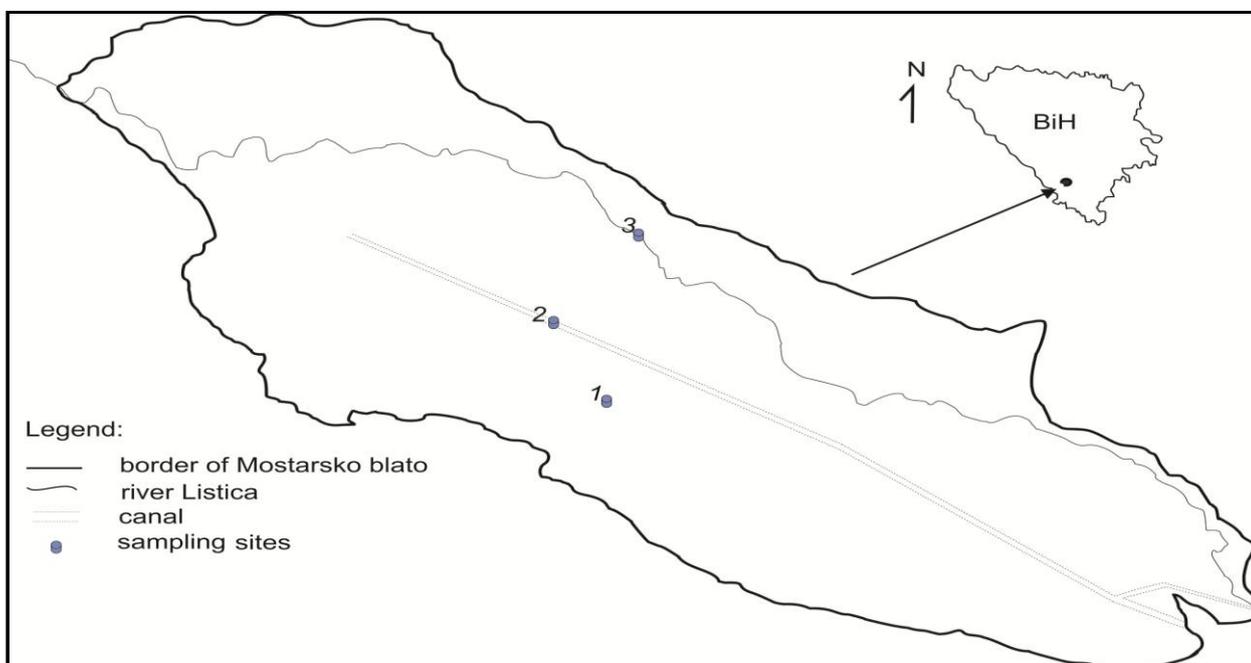


Figure 1. Map of the study area, showing the location of the sampling sites: 1. Pisak, 2. Međurić, 3. Pološki Gaz

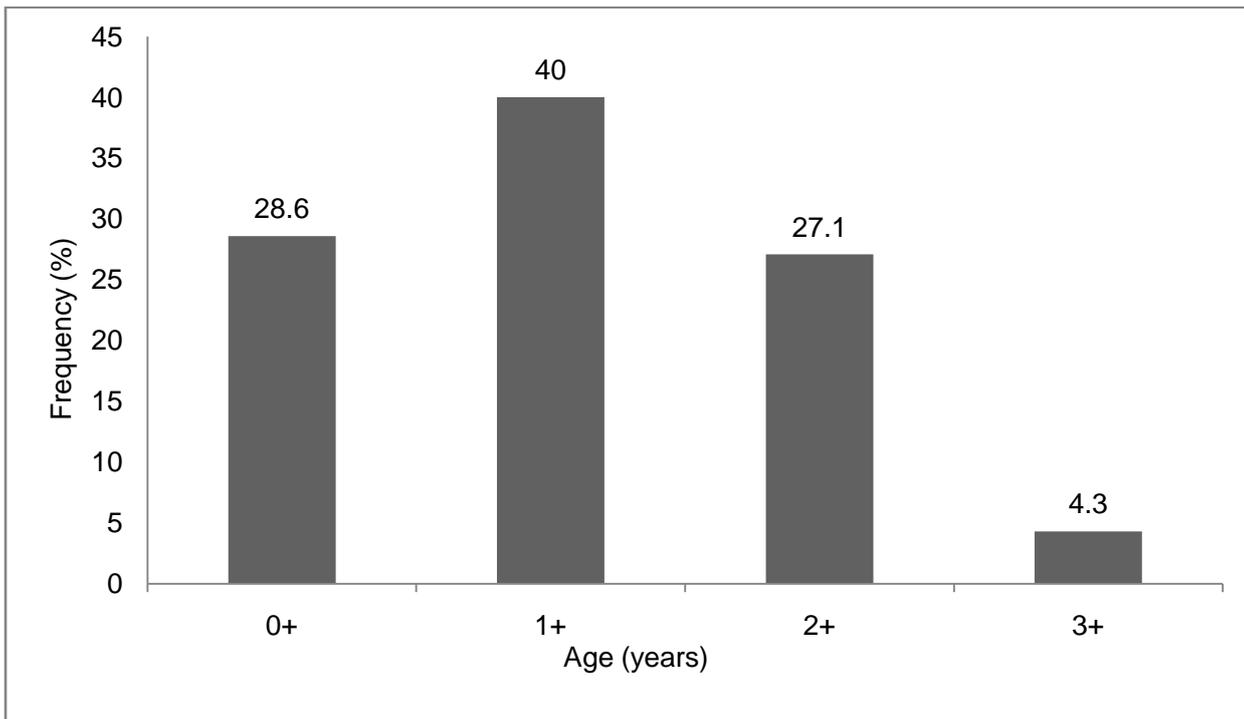


Figure 2. Age structure of the *Phoxinellus pseudalepidotus* population in the area of Mostarsko Blato during 2009



Figure 3. Annual growth zones (2^+) in otolith *Phoxinellus pseudalepidotus*

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