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POPULATION PARAMETERS OF CARP (C. CARPIO CARPIO) IN SHKODRA LAKE

Përmbledhje: Parametrat e popullatës së krapit janë llogaritur nga të dhënat e gjatësisë të mbledhura nga ekonomitë lokale të peshkimit. Kampionimi është kryer bazuar në zëniet dhe të dhënat e gjatësisë totale u bashkuan si një kampion i vetëm dhe u grupuan në klasë gjatësi. Të dhënat e gjatësi-frekuencës u përdorën për vlerësimin e parametrave të rritjes von Bertalanffy dhe mortalitetit. Përbërja moshore e popullatës së krapit varion nga 0.8 deri në 6.4 vjet. Parametrat e rritjes von Bertalanffy për popullatën e krapit në Liqenin e Shkodrës u vlerësuan: K=0.31 vjet^{-1}; L_{∞}=101.3 cm, t_0=-0.04 vjet. Mortaliteti total u llogarit 0.9 vjet^{-1}, mortaliteti natyror 0.49 vjet^{-1}, ndërsa mortaliteti nga peshkimi 0.51 vjet^{-1}. Krapi në Liqenin e Shkodrës ka krijuar një popullatë të qëndrueshme. Përbërja moshore e popullatës dominohet nga grupet me moshë të vogël që ruajnë popullatën e kësaj specie.

Fjalë kyçe: *krapi, Liqeni i Shkodrës, parametrat e rritjes*

Abstract: The population parameters of carp are described from total length data collected from the local commercial fishery. The samplings were made by catch and the total length data were composed together as a single time collection and grouped into length classes. The length-frequency data were used for estimating the von Bertalanffy growth parameters and mortality. The age composition of the population varied from 0.8 to 6.4 yr. The von Bertalanffy growth parameters of carp population in Shkodra Lake were estimated as: K=0.31 yr^{-1}; L_{∞}=101.3 cm, t_0=-0.04 yr. The total mortality rate as 0.97 yr^{-1}, the natural mortality was 0.49 yr^{-1} while fishing mortality was 0.51 yr^{-1}. Carp in Shkodra Lake have created a sustainable population. Age composition of the population is dominated mainly by young age group that conserve the species and its population.

Key words: *carp, Lake Shkodra, growth parameters*

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INTRODUCTION

The biodiversity of Shkodra Lake is developed in a unique physical environment where geology, hydrology and climate provide a wide variety of habitats. The total biodiversity of the Lake is high (species-area relationship = 0.875) (Keukelaar *et al*., 2006) and the region is considered to be a biogenetic reserve of European importance. Shkodra Lake is characterized by a high biodiversity of fish fauna. The ichthyological studies carried out by Albanian and Montenegrin researches show that the Lake has 56 fish species belonging to seventeen families (Raznatoviç & Dhora, 2001). Fish are the Lake's most significant natural resource in terms of contribution to local economies and employment. About ten species are commercially exploited, whiles Cyprinids as carp, bleak, chub, white roach and beak carp are the most exploited ones. The average annual production of lake in the Albanian side in the last years is calculated to be 4000 kv (MoEFWA, 2007). After the year 2000 the production of autochthonous fish species has grown up. In the last years carp production in the Albanian side of Lake Shkodra takes the first place with 99 ton/yr or 19% of the total Lake production (MoEFWA, 2007).

Despite the work on biological characteristics, especially morphological and morfometrical characteristics, systematic of carp (Rakaj, 1995; Kristo, 2001; Dhora, 2005; Dhora, *et al*., 2008) and some considerations given by Rakaj, 1995 on the growth characteristics, there is a lack of the data on growth characteristics of carp populations in the Albanian side of Lake Shkodra in the recent years. The aim of the study is to estimate age composition, growth parameters and mortality rates of carp (*Cyprinus carpio carpio*; Linnaeus, 1758) population in Lake Shkodra using length frequency analysis and length at age relationship. The data on populations' characteristics are essential for fish stock estimation and its variation, which are crucial for framing management plans for sustainable use of the fish reserve.

MATERIAL AND METHODS

The sampling of the fish was made by catch from the local commercial fishery of Shiroka and Zogaj. The samples were collected from October to December 2007. The length data of 188 fishes were composed together as a singe time collection. Carp were catched using trawl nets with mesh sizes 40, 50, 60, 70 and 80 mm. The total length (TL) of carp for each sample (once a week during the sampling period) were grouped into 5 cm size classes and graphed as length-frequency diagrams. It is assumed that the sample shown in the diagram is representative of the population that is, the gear used to collect the sample were totally unselective.

From the relative positions of the modes in a single length frequency sample, the growth curve of carp was estimated (Pauly & David, 1980). The von Bertalanffy growth curve was built and growth parameters were calculated based on the length-frequency data (von Bertalanffy, 1957) using non-linear least squares method, that involve a direct search of the values of K, L_{∞} and t_0, that best fit a curve through the length at age data (FiSAT II, 2005). Based on the calculated growth data, the length frequency distribution was converted to age frequency distribution by means

of the length converted catch curve (Pauly, 1983; Sparre *et al.*, 1989). The carp mortality rates in the Lake Shkodra were estimated through catch functions. The estimated natural and fishing mortality of carp population were also assessed based on Pauly, 1980.

RESULTS AND DISCUSSIONS

The total length (TL) of sample's individuals varies between 25.6 and 87.0 cm (Fig. 1). The calculated average total length was 47.3 cm and was close to the carp population length (TL=47 cm) of Lake Shkodra reported by Rakaj, 1995. Age composition of the individuals sampled varies from 1 to approximately 6.5 years, which corresponds to the exemplar with the larger length (87.0 cm). The extended age range indices the habitat richness with nutrients that compose carp diet.

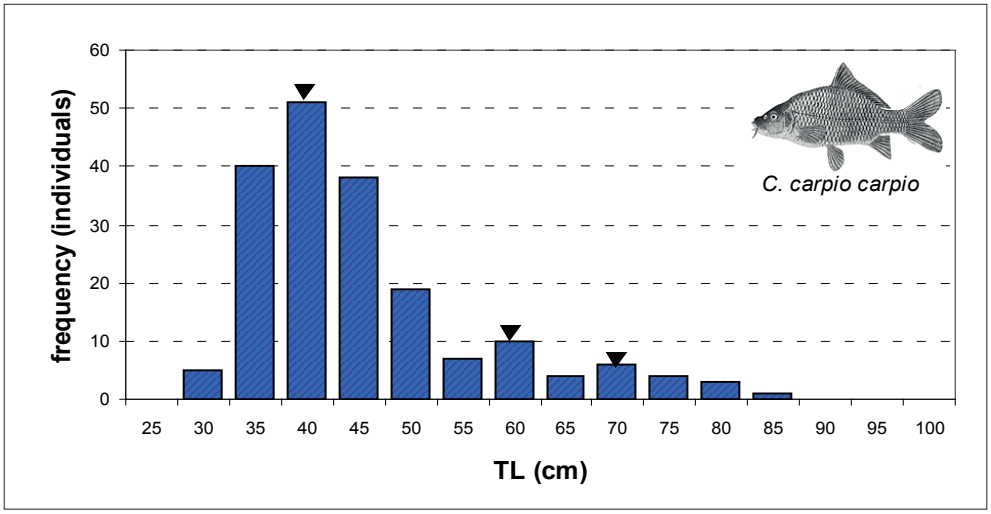

Figure 1. Length-frequency distribution of carp population in each 5 cm class (n=188). (The length modes are showed with arrows).

The carp population growth curve (Fig. 2) was estimated from the relative position of the modes in a single length frequency sample. Von Bertalanffy growth parameters were estimated as K=0.31 yr^{-1}, L_{∞}=101.3 cm and t_0=-0.04 yr; SSR=24.12. The growth rate (K= 0.31 yr^{-1}) as well as the growth curve show a stabile growth in length of the carp population. The mean lifespan (t_{max}), the time required for the fish to reach 95% of its asymptotic length (L_{∞}), was calculated 9.7 years.

The length converted catch curve (Fig. 3) is a plot of $\ln[F_{(L\ 1\text{-}L\ 2)}/\Delta t]$ against $[(t_{L\ 1} + t_{L\ 2})/2]$ and the length frequency data shown in Figure 1. The catch curve for carp population consists of the regression fitted through the descending data points. The initial ascending data points (diamond spots in Figure 3) are not included in the regression, because they represent younger age groups, which are subjected to a lower

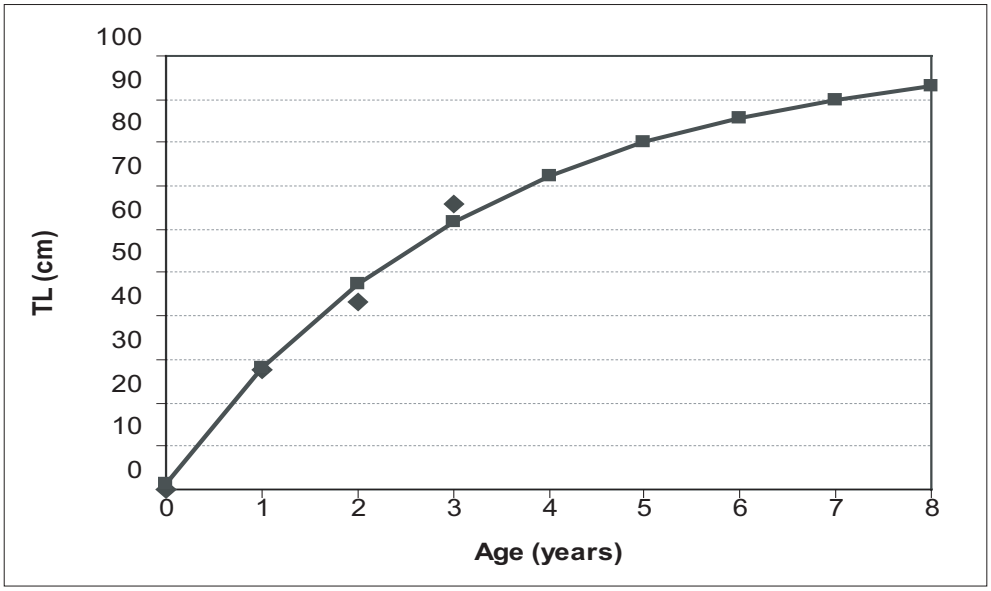

Figure 2. Von Bertalanffy growth curve of carp population. (Diamond spots show the observed length, whereas the quadrate spots show the estimated length at different ages).

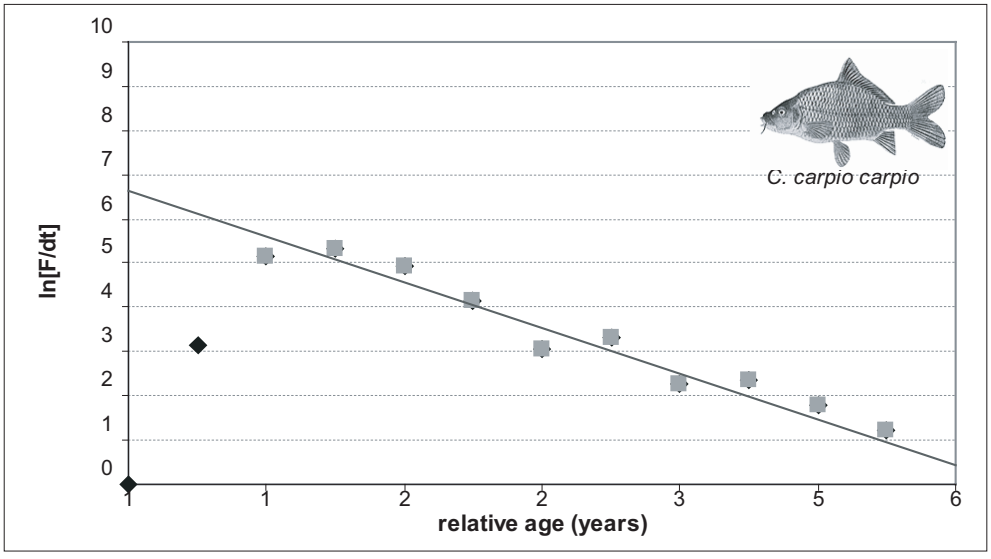

Figure 3. Length-converted catch curve of carp population.

fishing mortality since they are either not fully recruited or are not fully vulnerable to the fishing gear used (age under 1.03 years and length under 27.5 cm).

The exploitation rate of carp population in Shkrodra Lake was calculated as E=0.50. The total mortality rate (Z) of the population was estimated Z=0.97 yr^{-1} or

62.1%. Natural mortality (M) was calculated around 0.48 yr^{-1} and fishing mortality (F) 0.49 yr^{-1}. So there were no differences between natural and fishing mortality. Exploitation rate was calculated as 0.50 using mortality rates. The exploitation rate indicates that, there is not any fishing pressure on the carp population in Lake Shkodra.

CONCLUSIONS

Age composition of the carp population is dominated mainly by young age groups that conserve the species and its population. Considering the exploitation rate close to the optimal rate it can be concluded that the carp stock is exploited in the optimal manner. However, fishing mortality rate must be reduced, especially for immature ages, through better controlling of the fishing gear. This would secure the sustainable use of the carp population in the Lake Shkodra. Every increase of mortality rate, such as fishery, would seriously compromise the survival of the species.

The method of single time collection used in this study is easy, not expensive and convenient when a substantial number of individuals in the single time sampling can be provided. The length – frequency analysis used in the study can be applied also to reappraise the carp population's parameters in the past years when the historical data exist.

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