RESEARCH ARTICLE **(Open Access)**

Preliminary Biological Characterisation of Pumpkinseed (*Lepomis Gibbosus*, Linnaeus1758) in an Albanian Lake (Dega Lake, Belsh, Dumre, Elbasan) and Dumre Region Aquaculture Farmers Perception

RIGERS BAKIU[1]*, DRILON MOLLOSMANI[1]

[1]Department of Aquaculture and Fisheries, Faculty of Agriculture and Environment, Agricultural University of Tirana, Koder-Kamez, Tiranë, Albania

*Corresponding author; E-mail: rigers.bakiu@ubt.edu.al

Abstract

The North America fish species, commonly known as pumpkinseed (Lepomis gibbosus), represents a small-bodied, warm-water fish that has been introduced firstly in Europe as an ornamental fish in the 19th century from North America, while in Albania, it was introduced in 1994. The aim of the study is not only to add another country to the long list of European countries, where pumpkinseed has shown the highest establishment success, but also to start evaluating the growth and abundance, which can be important for the interactions with local fish species. In addition, following the Local Ekological Knowledge approach, it was conducted a questionnary based survey in all the aquaculture farms of Dumrea region. In one of Belshi Lakes of Dumre region (Elbasan), for a time-period of 1 year, weight and morphological parameters were determined for every individual fished by using fixed fishing net once a month, while it was registered the abundance of the other fished species. The analysed catch composition and the abundance values indicated remarkable difference along the year. It was also estimated the length-weight relationship and the relative parameters (a and b coefficients). Generally, the results showed that during the December and January almost all pumpkinseed individuals were frequenting higher depth areas in the lake (confirmed by using sonar fish finder), while the abundance seems to be consistent during the remaining months, thought its pumkinseed individuals showed negative allometric growth characteristics.

Keywords: length-weight estimation; pumkinseed; Local Ecological Knowledge; Dumre region; freshwater ecosystem.

1. Introduction

Generally, non-native species(NNS) have moved, survived, and reproduced in a variety of settings, exerting pressure on native wildlife. Such species are known to have negative environmental, economic, and societal consequences, such as changes in native species populations, disease transmission, and severe irreversible changes in the natural environment [1]. As a result, worldwide treaties, efforts, rules, and conservation methods have been formed to prevent their spread and to remove and manage established populations in a timely manner, therefore maintaining biodiversity [2].

The North America fish species, commonly known as pumpkinseed (Lepomis gibbosus), represents a small-bodied, warm-water fish that has been introduced firstly in Europe as an ornamental fish in the 19th century from North America [3].

In the Balkans, pumkinseed fish, it was accidentally (with a high level of uncertainty) introduced into some trans-boundary river systems in central North Macedonia and northern Greece, as well as into Lake Kastoria, Prespa (north-west Greece), River Alfios (Peloponnesus) and Lake Tavropos (central Greece), while in Albania, it was introduced in 1994 [4]. This inhabitants of both lentic and lotic environments reported to be found in several Albanian aquatic

*Corresponding author: Rigers Bakiu; E-mail: rigers.bakiu@ubt.edu.al
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ecosystems, which are represented by Drini basin, Prespa lakes, Mati river, Ishmi river, Erzeni river, Shkumbini river, Semani river and Vjosa river [4, 5].

The aim of the study is not only to add another country to the long list of European countries, where pumpkinseed has shown the highest establishment success, but also to start evaluating the growth and abundance, which can be important for the interactions with local fish species. In addition, following the Local Ekological Knowledge (LEK) approach, it was conducted a questionnary based survey in all the aquaculture farms of Dumrea region.

2. Material and Methods

The presented scientific work was conducted in one of the lakes of the Dumre region (mainly known as Belshi lakes), which is represented by the Dega lake. It is located in the territory, which belong to the Municipality of Belsh, inside the Elbasan County of the Republic of Albania, as it is shown in the Figure 1 A. In the Figure 1 are also shown photos of species individuals fished in the lake (Figure 1 B).

The total surface of the lake is about 27 hectars (ha), while it is important to note that the sampling was conducted in the coastal areas of the lake, up to a depth of 2 m. It means that the estimated area populated by the species is about 24178 m^2.

For fishing the pumpkinseed individuals and other fish species populating the lake, it was used a trammel net, which length was 25 m.

During the summer, the average surface temperature is goes from 17 up to 28◦C, whileduring the winter the average temperature is about 7-8◦C. The sampling started in 20 May 2022 and ended in 20 April 2023.

The weight and total length (TL) was determined for every individual fished by using fixed fishing net once a month, while it was registered the abundance of the other fished species.

A regression analyses was performed by using the Excel program of Office Package, where it was also possible to calculate a and b coefficients, respectively. It was also conducted the T-test for equal and/or unequal variances in the comparisons between average TL and weight values, respectively.

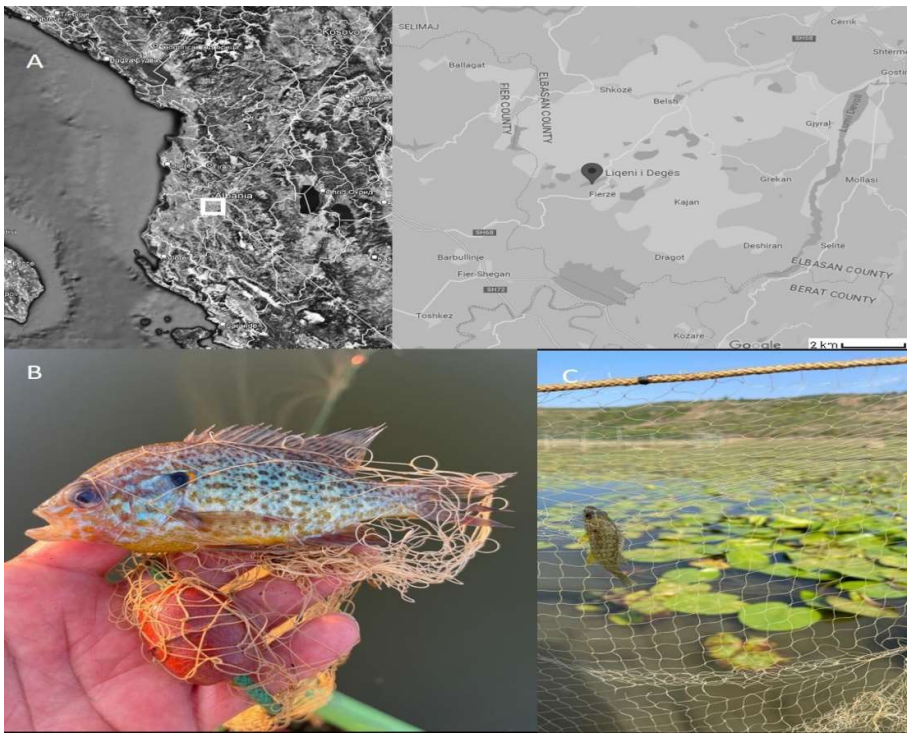


Figure 1. Geographical location of the area of study, represented by Dega lake in the Municipality of Belsh (A) and photos of the species (B) fished in this lake.

The used questionnaire was very similar to the questionnaire created by the project experts in the frame of RiskMan (Educational Capacity Strengthening for Risk Management of Non-native Aquatic Species in Western Balkans (Albania, Bosnia and Herzegovina and Montenegro) Project, an ERASMUS+ CBHE Project funded by the EACEA within the 2020 program.

3. Results and Discussion

Pumpkinseed favors shallow pools with minimal water movement and plenty of flora, and it dwells in temperatures ranging from 4 °C to 30 °C [6]. It thrives and reproduces in a wide range of habitats [7], and its presence may have a significant influence on the biodiversity of the ecosystems where it settles [8]. Pumpkinseed breeding season begins as the water temperature rises, which is normally approximately 20 °C, however the duration and particular time may vary depending on the location [9]. Males can reproduce with many females in succession. Following spawning, the male guards the eggs in the nest and then defends the juveniles until they absorb their yolk sac [10]. The species normally achieves sexual maturity at the age of 1-2 years [10].

In terms of feeding preferences, the pumpkinseed prefers worms, crustaceans, and insects. It also eats small fish, fish eggs, and other vertebrates [11]. There are significant differences between North American and European populations of pumpkinseed [12].

In this study case, it is shown that during the sampling period, it was not possible to fish only pumpkinseed fish individuals, but togetheri with it, we found individuals of common carp (Cyprinus carpio), bleak (Alburnus spp.), bigheaded carp (Hypophthalmichthys nobilis) and grass carp (Ctenopharyngodon idella). In the Figure 2, it is shown the catch composition in percentage about all the fished species. The mosta abundant species during May is represented by the common carp, while during June, pumpkinseed is the most abundant of all the fished species. Bleak and gras carp represent the most abundant species in July and August, respectively. In September, October (together with bigheaded carp) and November, bleak is again the most abundant, while in December and January, bigheaded carp is the most abundant fish. In February, it was possible to fish only bleak and pumpkinseed in equal quantity, while this scenario was repeated again in April, though in the fishing net appeared even other fish species. During March, bleak resulted to be the most abundant species of all the present species in the lake.

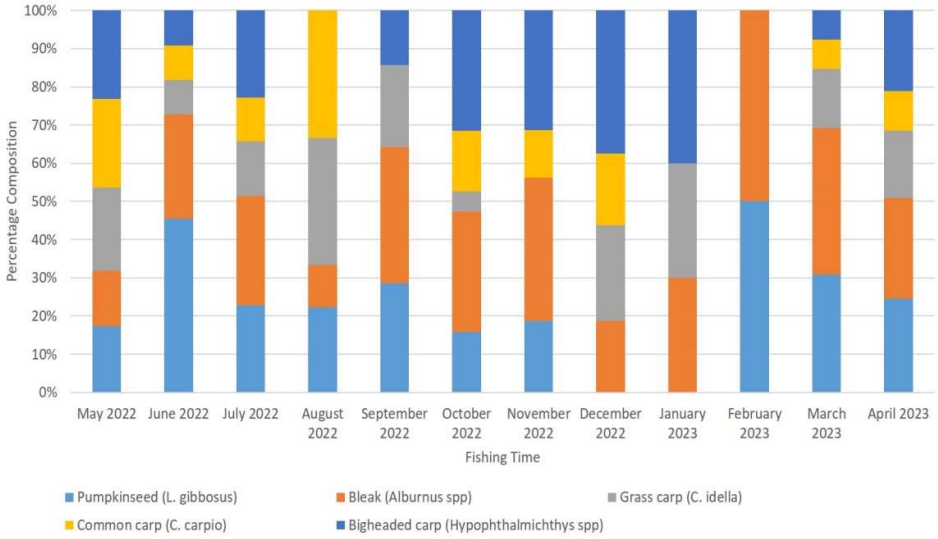


Figure 2. Graphical presentation of the monthly catch composition in percentage, regarding the fished species in the Dega lake in 1 year of sampling (2022-2023).

In addition, it was possible to calculated the Catch per Unit of Efforts (CPUE), which values are expressed as number of fished individuals in 25 m fixed fishing nets. The monthly CPUE values are shown in Figure 3. As it is shown in the graphic, the highest CPUE value was registered in April 2023, while the lowest CPUE value was reported in February 2023. It is also important to note that in Decemebr 2022 and January 2023, no fish belonging to this species was found in the fishing net. It happened, because most probably during these months, in the coastal areas of the lakes were present just larvae, fingerlings and juveniles, which dimensions were smaller than the used fishing net mesh size. In fact, it resulted to be true, because by using sonar fish finder we found that the big individuals were frequenting higher depth (more than 2 m) during these months.

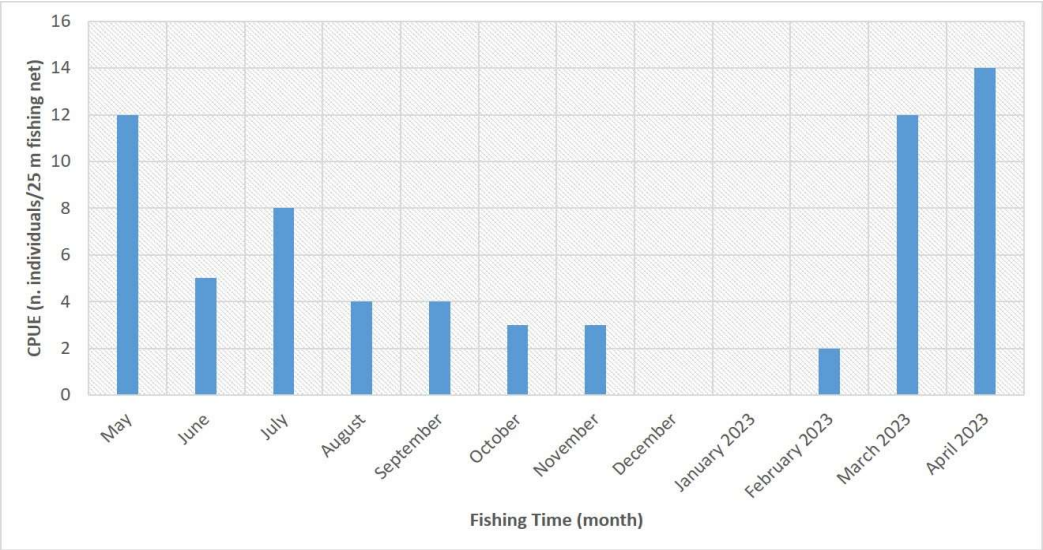


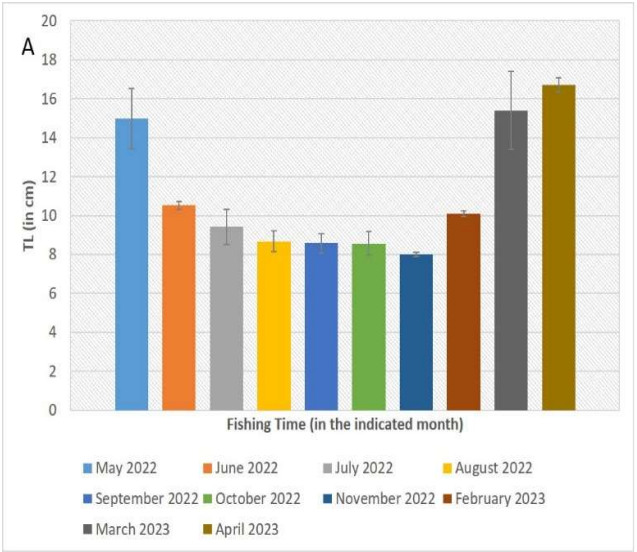
Figure 3. Graphical presentation of the estimated monthly CPUE values of fished pumpkinseed in 1 year of sampling (2022-2023) in Dega lake, Belsh, Elbasan (Albania).

The measured monthly TL and weight values were used to calculate the average values, which are reported in the graphics of Figure 4 A and B, respectively. As it shown in both graphics, the average TL and weight value immediately decreased from May to June 2022, while the lowest value of TL and weight was reached in November. The average value of TL and weight started to increase rapidly from February to March 2023.

In order to know if the difference between the average values were statistically significant, we performed a T-test and the relative results are shown in Table 1.

The only statistically significant differences in the average TL values comparsions resulted to the be the comparison between May vs. June and June vs. July for $p < 0.05$ during the year 2022, while during the next year months, all the differences resulted to be statistically significant for $p<0.05$.

In the comparison between the average weight values, the only statistically significant differences resulted to be in the comparison between May vs. June and July vs. August for a $p < 0.05$, while for the considered months of the year 2023, only the comparison between February vs. March presented a statistically significant difference, for $p < 0.05$.



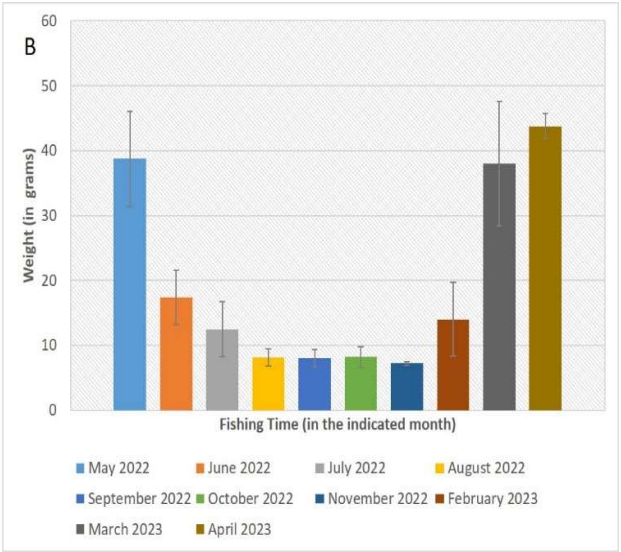


Figure 4. Graphical presentation of the pumpkinseed monthly average TL (expressed in cm) (A) and weight values (in grams), respectively.

Table 1. T-test results in the comparisons between average total length and average weight values, respectively.

Average total length Comparisons	p-value	Stat. significant	Average weight Comparisons	p-value	Stat. significant
May vs June	4.57434E-07	p < 0.05	May vs June	4.40685E-06	p < 0.05
June vs July	0.010375017	p < 0.05	June vs July	0.064734065	No
July vs August	0.103447828	No	July vs August	0.02713266	p < 0.05
August vs September	0.396564698	No	August vs September	0.45935747	No
September vs October	0.492320436	No	September vs October	0.439843146	No
October vs November	0.121504644	No	October vs November	0.192719912	No
February vs March	7.23309E-07	p < 0.05	February vs March	0.016717542	p < 0.05
March vs April	0.043431404	p < 0.05	March vs April	0.063429149	No

A regression analyses was conducted in order to show the relations between length and weight of the measured pumpkinseed individuals (Figure 5). As it shown in the graphic, the weight increased exponentially with the increase of the total length of the fish. The estimated a and b coefficients were 0.045 and 2.467, respectively. The b coefficient resulted to be lower than 3, which indicate that the fish growth is negatively allometric. It indicates also that the large specimens have changed body shape, i.e., become more elongated, or the small specimens were in better nutritional condition at the time of sampling [12].

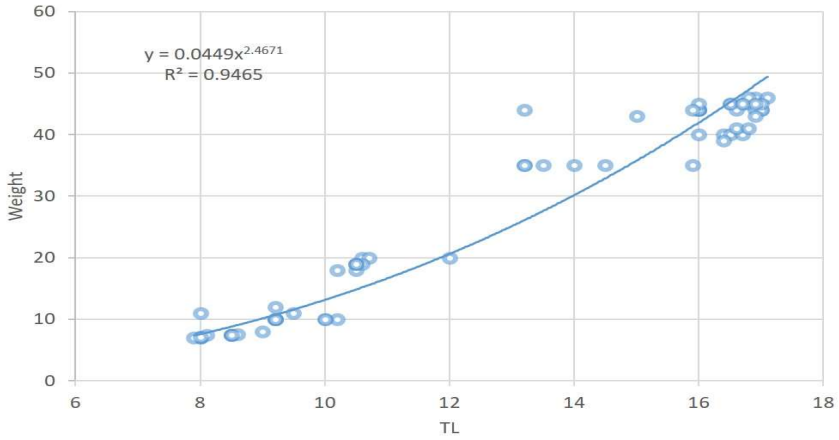


Figure 5. Graphical presentation of pumpkinseed length-weight relationship.

In addition, it was also performed the regression analyses for the most complete seasons in fish individuals samplings, which correspond to summer and autumn of year 2022 (Figure 6). It is interesting to note that regarding the individuals fished during the months of summer season (Figure 6 A), the b coefficient resulted to be higher than 3, which means that their relative growth is positively allometric [12]. It suggests that the nutritional conditions of these pumpkinseed individuals could be better than the ones characterised by smaller body size during the summer season. Contrary happened to the pumpkinseed individuals during the autumn season (Figure 6 B). It means that during the summer season, these individual growth could be favoured by the higher temperatures. In the face of the climate change effects and mostly due to the increased average temperature effects, the freshwater species (salmonids and cyprinids) are faceing difficulties in surviving in aquatic ecosystems and aquaculture ponds (Bakiu, personal observation). It means that the pumpkinseed presence and dominance toward these species will be favoured by the climate change effects, as predicted by [4].

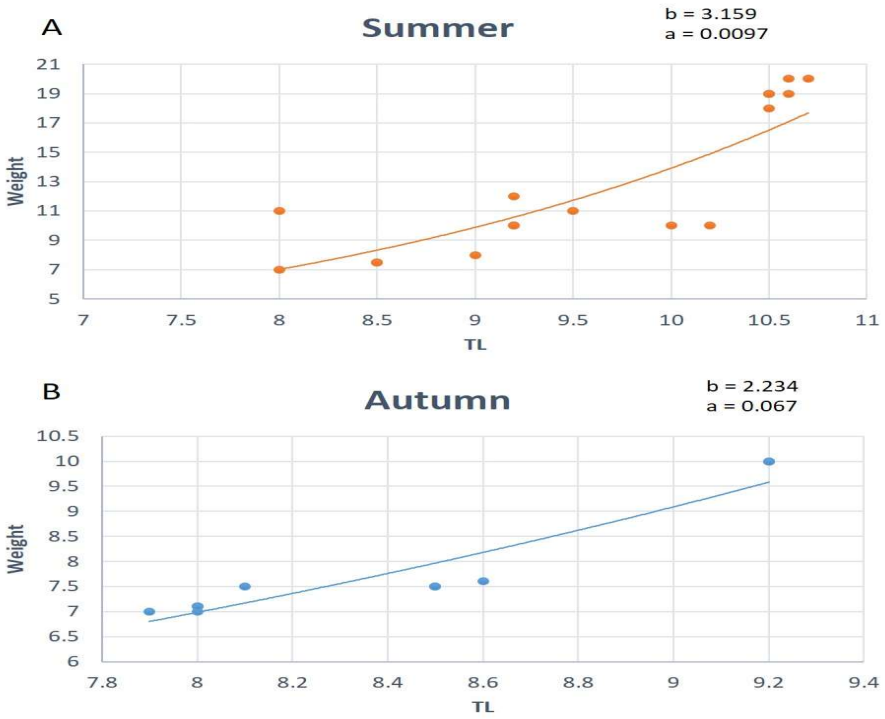


Figure 6. Graphical presentation of pumpkinseed length-weight relationship for the individuals sampled during summer (A) and autumn (B) 2022 together with the estimated a and b cofficients.

From the interviews with the 7 aquaculture farmers, it resulted that except one of them, all the others knew about the entrance of the fish species in the lakes used for aquaculture purposes, while half of them decalred that the presence of pumkinseed in the lakes was a conseguence of fingerlings entrance, while the farmers were releasing in the lakes the fingerlings of the commercial fish species. In particular, according to their declarations, its presence became more evident in smaller lakes with a lower depth in comparison to the others. During the last 8 years, its presence has been more frequent in the fishing nets; most probably because its reproduction seems to be more efficient in comparison to the other fish species present in the lakes, according to the interviews results.

Due to the increasing trend, the production of the commercial species has been subject to yearly decreases, according to the aquaculture farmers. This result is also confirmed by the results presented in the graphic of Figure 2. This is particularly evident for common carp (*Cyprinus carpio*) and crucian carp (*Carassius* spp), according to the farmers. In addition, the farmers declared that it can be due to predatory habits to other fish fingerlings or as an important competitor for food.

All the farmers declared that due to its characteristics in relation to the other commercial fish species, none of them has economic interests to let this species grow in the lakes. In addition, they declared that they are actually paying more attention during the release of the commercial fish fingerlings in the lakes, because the prevention is the best method and it could reduce the presence and relative effects toward the biota in the lakes.

In conclusion, this is one of the rarest studies conducted based on the LEK approach [13] and it is important to highlight that this is the first study conducted in Albania about this species, while it represents one of the few ones in the region, together with the study of [14] in Greece. Other studies would be required to further elucidate the life history of this NNS and contribute to evaluate its impact toward other organisms, including the other fish species, which were encountered during the sampling conducted in this study.

4. Acknowledgements

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5. References

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