ABREEDING OF TENCH FISH (*TINCA TINCA*) IN LABORATORY

ALEKSANDRA MILOŠKOVIĆ[1], MILENA PAVLOVIĆ[1], SNEŽANA SIMIĆ[1],VLADICA SIMIĆ[1], SIMONA KOVAČEVIĆ[1], NATAŠA RADOJKOVIĆ[1]
[1]*Univerzitet u Kragujevcu, Prirodno-matematički fakultet, R.Domanovića 12, 34000 Kragujevac*

UZGOJ LINJAKA (*TINCA TINCA*) U LABORATORIJSKIM USLOVIMA

Abstrakt

Istraživanja biodiverziteta kopnenih voda Srbije sa ciljem konzervacije u in situ i/ili ex situ uslovima spovode se u proteklih 10 godina u okviru više istraživačkih projekata. Kao rezultat ovih istraživanja formirana je aplikaciono-informativna baza podataka pod nazivom: Biodiverzitet akvatičnih ekosistema Srbije-ex situ konzervacija „BAES ex situ". Na osnovu podataka iz baze, „BAES ex situ", sprovedena su istraživanja tokom 2008. godine sa ciljem izrade Programa za unapređenje ribarstva u slivu Velike, Zapadne i Južne Morave (i dela toka Dunava, Save, kanala hidrosistema DTD i voda Pančevačkog rita). Dobijeni podaci jasno ukazuju da je linjak (Tinca tinca) u odnosu na istraživanja od pre 10 i 20 godina znatno manje zastupljen u slivu Velike Morave. Svi nalazi linjaka južno od Save i Dunava tokom ovog istraživanja su iz hidroakumulacija Srbije (Vlasina, Ćelije) i uneseni su poribljavanjem iz uzgajališta ili prirodnih voda sa područja Vojvodine. Stanje populacija linjaka prema literaturnim podacima Kirchhofer & Hefti (1996), Kottelat & Freyhof (2007) ukazuju da bez obzira na njegovo široko geografsko rasprostranjenje svuda su u manjem ili većem opadanju, a kao osnovni uzrok se navodi degradacija i uništavanje vodenih staništa, pre svega onih koja su bogata makrovegetacijom. Konstatovano stanje populacija linjaka u vodenim ekosistemima Srbije nameće potrebu konzervacije, veštačkog mrešćenja i repopulacije ugroženih prirodnih populacija. Cilj rada jeste istražiti mogućnosti uzgoja linjaka u laboratorijskim uslovima, u pogledu različite ishrane, u cilju uspešne konzervacije.

Istraživanje je sprovedeno u Akvarijumu ″Kragujevac″, koji je deo Instituta za biologiju i ekologiju Prirodno-matematičkog fakulteta u Kragujevcu. Eksperiment je trajao 11 meseci (januar-novembar 2010.). Nasadni materijal činile su jedinke donete iz ribnjaka ″Mošorin″, uzrasne kategorije 0^{+}.

Formirane su tri eksperimentalne grupe sa po tri akvarijuma, dimenzija 100 x 40 x 40 cm, zapremine 160 l. Ukupan broj nasađene riblje mlađi iznosio je 30 individua (≈160

g) po grupi, odnosno 10 jedinki po akvarijumu, prosečne telesne mase 5,52 g. Ishrana je vršena na sledeći način: prva grupa hranjena je kombinovanom hranom - peletirana i *Tubifex*, druga grupa animalnom hranom – *Tubifex* sp. i treća grupa peletiranom hranom. Peletirana hrana, korišćena u ishrani riba, proizvedena je u fabrici Royal optima 1P, uvoz iz Italije. Animalna hrana - Tubifex sp.donošena je iz toka reke Lepenice. Na početku eksperimenta po akvarijumu nasađeno je 10 riba prosečne mase 5,52 g, odnosno 30 jedinki po formiranoj odgovarajućoj grupi ishrane. Ishrana riba zasnivala se na količini hrane koja iznosi 1-3 % ukupne mase riba u formiranoj grupi. Premda je masa riba u akvarijumima svih formiranih grupa bila ista, bila je predviđena ishrana istom količinom hrane.

Prema literaturnim saznanjima, ali i iz godišnjih statističkih pregleda gotovo je sigurno da je proizvodnja linjaka u potpunosti potisnuta. Najčešće se ističe da je razlog za napuštanje gajenja slaba konverzija hrane.

Poređenje dužinskih i težinskih parametara na početku i na kraju eksperimenta pokazuje značajno povećanje mase riba, kao i njihove totalne dužine. Na osnovu dobijenih rezultata konstatovano je da je linjak riba koja se može uspešno gajiti u laboratorijskim uslovima, kao i da su najbolji prirast ostvarile jedinke hranjene kombinovanom hranom - peletiranom i animalnom.

***Ključne reči*:** *Tinca tinca, uzgoj, dužinski i težinski prirast, laboratorija.*

INTRODUCTION

Tench, *Tinca tinca* (L. 1758) is one of the cyprinid fish species widespread in Europe and surrounding regions (Ćirković et al., 2009). It lives in the waters of the Danube Basin, and it is artificialy transmitted in an basin of the Beli Drim (Simonović, 2001).

Research of biodiversity of inland waters of Serbia with the aim of preserving the in situ and / or ex situ conditions were implemented in the past 10 years across multiple research projects. As a result of these studies the application-information database called: Biodiversity of aquatic ecosystems of Serbia-ex situ conservation „BAES ex situ" was formed (Simić et al., 2006). Analysis of data from the database, changes were seen in the number of populations and ranges of distribution of macroalgaes, macroinvertebrates and fishes. Based on data from the database, „Baes ex situ", research were conducted in 2008. years, to complete a program to promote fishing in the basin of Velika, Zapadna and Južna Morava (and part of the Dunav, Sava, channels DTD hydro and water of Pančevački rit). The data clearly indicate that the tench (*Tinca tinca*) with respect to research from 10 and 20 years, much less represented in the basin of the Morava. All findings of tench south of the Sava and Danube rivers in this study were from the accumulations of Serbia (Vlasina, Ćelije) and included the stocking of farms and natural waters in Vojvodina. State of populations of tench to literature data shows that regardless of its wide geographic distribution everywhere are a greater or lesser decline, and as the main cause states degradation and destruction aquatic habitats especially those that are rich macrovegetation (Kirchhofer & Hefti, 1996; Kottelat & Freyhof, 2007).

Stated condition of tench populations in aquatic ecosystems of Serbia imposes the necessity to implement conservation projects, artificial spawning and repopulating endangered natural populations (Simić et al., 2009).

The aim of this paper is to explore the possibility of breeding tench under laboratory conditions, in terms of different nutrition, in order to successful conservation.

MATERIALS AND METHODS

The research was conducted in the Aquarium „Kragujevac", which is part of the Institute of Biology and Ecology of Faculty of Science in Kragujevac. The experiment lasted 11 months (january-november 2010). Material consisted of specimens taken from the pond „Mošorin", age groups 0^{+}.

Three experimental groups with three tanks, measuring 100 x 40 x 40 cm, capacity 160 l were formed. Set on the total number of juvenile fish was 30 individuals (≈ 160 g) per group, and 10 individuals per tank, average body mass of 5,52 g. Nutrition is performed as follows: the first group was fed with combined food - pelleted and *Tubifex* sp., another group with animal food - *Tubifex* sp. and the third group with pelleted feed.

Pelleted food, used in fish nutrition, was produced by the factory of Royal Optima 1P, imported from Italy. Animal food - *Tubifex* sp. (Oligochaeta) was taken from the river Lepenica.

The percentage composition of pelleted food is shown in Table 1. Energy value of Tubifex varies depending on season and sampling location (Bakrač – Bećiraj, 2008). Considering that Tubifex we used for feeding tench is not always being taken from the same location, it is not possible to express the true energy value of foods and therefore analysis of animal food - *Tubifex* sp. is not done.

Table 1. Analytical value of pelleted food

Percentages of food	Components (%)
Crude protein	47,0
Crude fat	24,0
Crude ash	8,0
Crude fiber	1,0
Phosphorus	1,1

During the experiment, according to the plan, we have measured the following parameters:

a) chemical composition and nutritive value of food was established at the beginning of the experiment. Food consumption was recorded daily. Once a month was determined conversion of food and nutrients based on food consumption and performance measurement of weight gain in length of individuals of tench,

b) control of growth is carried out once a month and included all individuals from each of the experimental tank. Each individual was measured body weight (W) and total length (SL),

c) fish health was monitored daily and mortality noted,

d) once a month physico-chemical parameters of water (water temperature, pH, conductivity, water hardness, oxygen saturation and oxygen concentration, the concentration of phosphate, nitrate and ammonia) were measured.

RESULTS AND DISCUSSION

Satisfactory growth of fish can be achieved by proper diet and knowledge of the needs of fish for certain nutrients to their maximum utilization. In addition to quality fish food is necessary good water too. That quality includes a series of physical-chem-

ical parameters whose values must not deviate from the boundary of the specified type (Ivance et al., 2007).

During the experiment, the physico-chemical characteristics of water have been successfully maintained in the optimal values for the tench. The values shown in Table 2 were proved as suitable for the breeding of tench. Although the values of measured parameters during the year were relatively uniform and no major variations should be noted that the tench fish which in certain conditions may be submitted by the adverse physical and chemical environmental factors. In winter, holding up to pH 4.6 and decrease the concentration of O_2 to 0.3 mg/l (Ćirković et al., 2009).

Table 2. The average annual value of physico-chemical parameters of water

Physico-chemical parameters	Values
T°	20,19
Ph	7,68
Ep (μS)	402,78
Dh (ppm)	201,45
O_2 (mg/l)	7,28
O_2 (%)	81,92
NO_3 (mg/l)	6,58
PO_3 (mg/l)	4,37
NH_4 (mg/l)	0,27

At the beginning of the experiment the tank was set on 10 fish of average weight 5.52 g as for 30 individuals per group, formed an appropriate diet. Fish feeding was based on the quantity of food which is 1-3% of the total weight of fish in the formed group. Although the mass of fish in tanks of all formed groups was the same, food was provided the same amount of food. At the end of the experimental part, the following results were related to the total length (SL) and weight (W) growth of tench (Table 3).

Table 3. The movement of the average total length and weight of fish

Date	Group I		Group II		Group III	
	length	mass	length	mass	length	mass
January	6,18	8,37	8,15	5,83	7,45	4,52
February	8,49	9,05	8,46	6,8	7,55	4,96
March	9,6	10,3	8,62	7,53	7,88	5,94
April	10,34	13,5	9,6	11,32	8,22	7,16
May	11,63	19,66	10,84	15,09	8,73	8,07
June	11,34	21,06	10,48	12,93	8,43	9,27
July	11,91	21,88	10,65	16,63	8,44	7,93
August	12,28	21,19	11,0	15,51	8,93	8,35
September	12,53	23,04	10,9	17,1	9,0	9,67
October	12,63	25,6	11,03	19,05	9,49	10,7
November	12,96	25,54	11,27	18,74	9,39	10,72

The next part presents the charts in length and weight growth of fish in the experimental groups (Fig. 1, 2, 3, 4, 5).

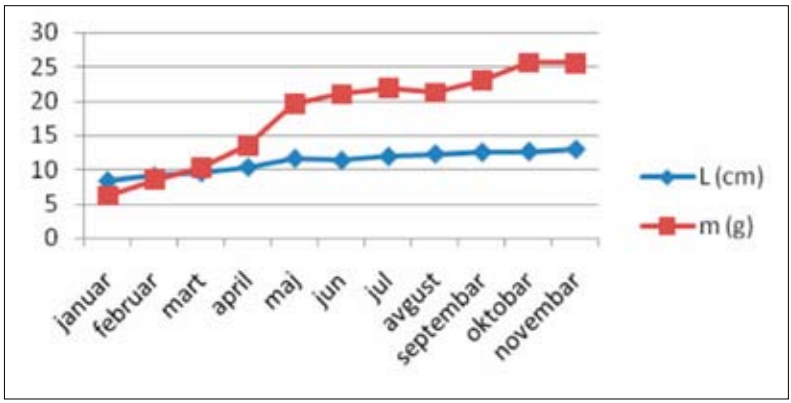

Figure 1. Graphic representation of growth in total length (SL) and weight (W) of fish in the first group (combined food - peletted and *Tubifex* sp.)

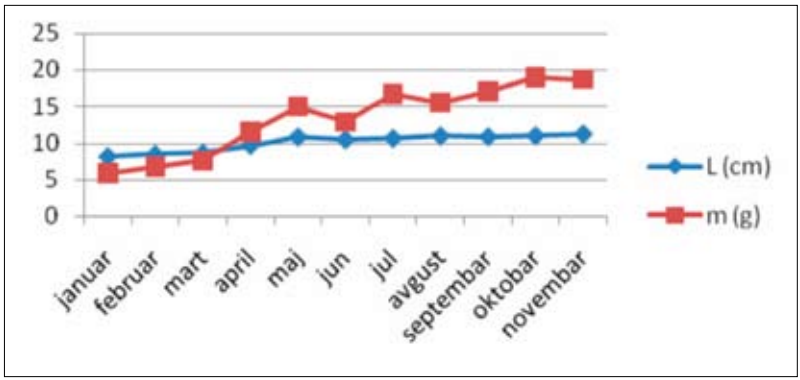

Figure 2. Graphic representation of total length (SL) and weight (W) of fish growth in the second group (animal food - *Tubifex* sp.)

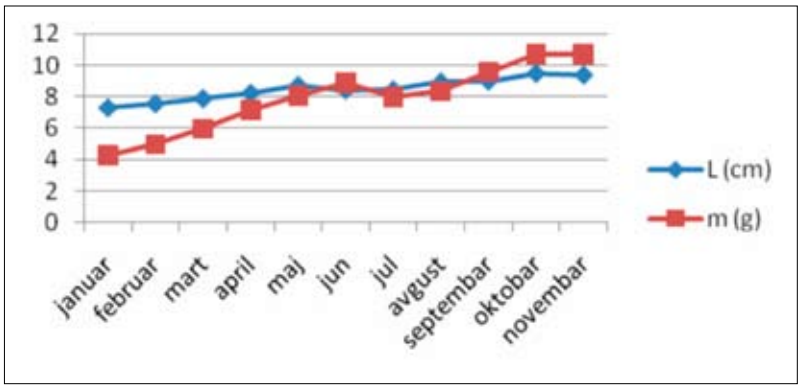

Figure 3. Graphic representation of total length (SL) and weight (W) of fish growth in the third group (pelleted food)

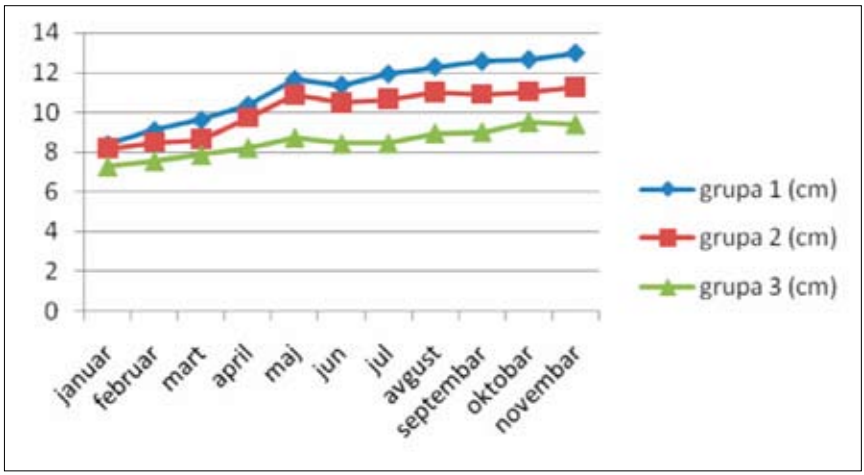

Figure 4. Comparative graphic of total length growth of fish in the experiment groups

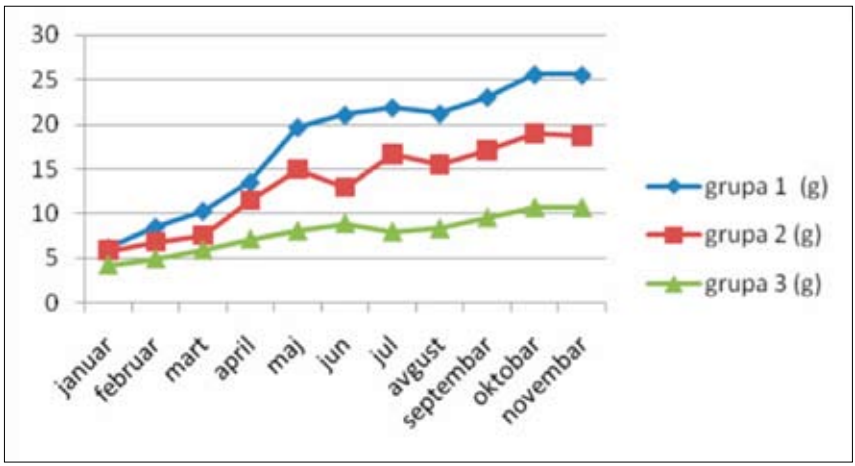

Figure 5. Comparative graphic of weight increase of fish in the experiment groups

According to information from the annual statistical review, the production of tench is almost completely suppressed. The most common stresses that the reason for leaving the poor feed conversion of growing (Ćirković et al., 2009). Comparison of lenght and weight parameters at the beginning and the end of the experiment shows a significant increase in weight of fish, and their total length. On the basis of individual and comparative graphical length and weight growth of fish (Fig. 1, 2, 3, 4, 5), it can be concluded that the greatest length and weight gain was recorded in the first experimental group, where it was applied a combined diet – pelleted and animal food.

CONCLUSIONS

During the period of eleven months an experiment aimed to determine the best type of food which affects weight gain and length of tench (*Tinca tinca*) in laboratory conditions was performed. Based on these results it was concluded that the tench can be successfully grown in laboratory conditions, and that the best gain is achieved in individuals fed with combined food - pelleted and animal. In our opinion, considering the successful breeding in laboratory conditions, we have to work on the reintroduction of tench in the aquaculture of our country.

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