Macedonian Journal of Animal Science, Vol. **2**, No. 4, pp. 409–412 (2012)
136 In print ISSN 1857 – 6907
Received: June 26, 2012 On line ISSN 1857 – 7709
Accepted: December 15, 2012 UDC: 639.31.04:579.552.512 (479.714)
Original scientific paper

INFLUENCE OF A DIFFERENT WATER EXCHANGE RATE ON THE GROWTH OF RAINBOW TROUT (*Salmo truta)*

Rodne Nastova, Vasil Kostov, Nedeljka Nikolova

University "Ss. Cyril and Methodius" in Skopje, Institute of Animal Science, Bul. Ilinden 92-a, Skopje, Republic of Macedonia
rodne_nastova@yahoo.com

The objective of the experiments which were conducted in the fish ponds of the Bošava fisheries – Kavadarci, R. Macedonia, was to investigate the influence of a different number of water exchanges per day on the growth rate and food conversion. Based on the results obtained the following conclusions can be drawn: 1) The weight growth rate was affected by the quantity of fish in the pond. Most favourable results were achieved with 72 water exchanges per day. 2) The length growth rate of fish was also affected by the water flow but far less than the weight growth rate. The differences of the length growth rate of fish reared under the conditions of 40 and 72 water exchanges per day were insignificant. 3) The lowest value of food conversion was obtained with 72 water exchanges per day proving thereby that food was utilized most efficiently under these conditions. Mortality rate was lower and had no effect on the overall fish production.

Key words: rainbow trout; growth; food conversion; water exchange rate

ВЛИЈАНИЕ НА РАЗЛИЧНИТЕ НИВОА НА ПРОТОКОТ НА ВОДА ВРЗ РАСТЕЖОТ НА КАЛИФОРНИСКАТА ПАСТРМКА (*Salmo truta*)

Целта на експериментите извршени во рибникот Бошава – Кавадарци, Република Македонија, беше да се испита влијанието на разниот број протоци на вода на ден врз степенот на растежот и добивање на тежина на рибата. Врз основа на добиените резултати беа извлечени следниве заклучоци: 1) Нивото на зголемување на тежина беше под влијание на количеството на риба во рибникот. Најповолни резултати беа добиени со 72 протоци на вода на ден. 2) Нивото на растежот на рибата во должина беше исто така под влијание на протокот на водата, но далеку помалку од нивото на растежот во тежина. Разликите во нивото на растежот на рибите во должина одгледувани во услови со 40 и 72 протоци на вода на ден беа незначителни. 3) Најниската вредност на добивање на тежина беше добиена со 72 протоци на вода на ден имајќи предвид дека храната беше најуспешно користена под овие услови. Стапката на смртност беше пониска и немаше никакво влијание врз целокупното производство на риба.

Клучни зборови: калифорниска пастрмка; раст; добивање на тежина; проток на вода

INTRODUCTION

Most trout fisheries on Macedonian territory were built not observing the basic salmonid production principles. Namely, the fisheries are mostly designed on inadequate locations regarding quality and quantity of available water, and at the same time they are oversized which predetermines even lesser possibility of using already scarce resources (Piper, 1982; Sedgwick, 1978)

The objective of our research was a follow-up of the fish growth pace in the experiment, by varying the environmental physical factors or the available amount of water in units of time. It is known that environmental conditions in fisheries have a very clear impact on the fish population breed. Two techs no logical components are of crucial importance for trout production – water flow and fish load of the space.

This experimental work is an attempt the most optimal ecological factors for Californian trout production to be found, at which the best yields are obtained and the food and space are the most efficiently used.

MATERIAL AND METHODS

The experiment was conducted in the trout fishery in Bošava, near Kavadarci, in 2010 year. The trials were performed in 6 fishponds, each of 1,332 m^3 of volume.

In the experimental and control fishponds of the trial group "A", a flow of 72 water changes/ day was provided; of the trial group "B" – 40 water changes/day, and of the trial group "C" – 20 water changes/day (Liao, 1971). In the trial 5,604 units of 12 months old Californian trouts were led in, deployed under the same density index values, in 6 equal ponds and grouped, depending on water flow, in 2 times 2. Experiment's duration was 105 days. Daily meal's amount was calculated after test catches every 15 days, depending on the total fish mass in the pond, average length and weight of units as well as water temperature (Phillips, 1963).

Besides follow-up of fish growth rate (of average individual weight and total body length), during trials the following parameters were studied: conversion coefficients, total fish increments, condition factors and density and flow indexes. During the experiments the basic parameters of water quality were also followed up, by measuring the temperature, determining pH values and the concentrations of ammonia and oxygen dissolved in the water. Besides these indicators, the health condition of fish in the trial was followed up regularly, and also the daily noted units' mortality (Brett, 1969)

In this communication we shall pay attention only to the results related to the growth of fish in the trial that is to the obtained data on the average individual weight and the total units' body length in the experiment, as well as to the conversion coefficients' values.

RESULTS AND DISCUSSION

a) *Individual weight growth*

Statistic processing of obtained data on experimental and control fishponds of all the trial groups (A, B, C) has shown that there are no statistically significant deviations for any of the groups, therefore the results obtained in the experimental and control ponds may be regarded as unique.

By the comparative analysis of individual weight growth results it can clearly be seen that the fish from all the trial groups had the same initial body weight. In the first 15 days experimental units from all trial groups showed almost the same growth in weight. In the next 15 days the growth curves still go together, especially in trial groups A and B. After this period they start diverting from one another. By the comparative analysis of the diagrams of individual weight growth a time dislocation of attaining maximum growth can be noticed. In that way the growth peak in the trial group A was noticed at the 90^{th} day of the experiment, in the group B – 75^{th} day, and in the group C – 45^{th} day of the trial. The duration of the experiment (limitation factors were the appearance of massive mortality, as well as significant decrease of the amounts of food taken in) was also successively decreasing from the group A to the group C, within the interval from 105 days, through 90 days, and up to 60 days. If comparison of units' weight from trial groups A and B is performed, for the same time period (90 days), a 26.44% decrease of the average body weight of fish from the group B in comparison to the group A can be noted. For the same period (60 days) fish from the trial group C reached 23.44% less body weight than those from the group A, and 13.10% less body weight than fish from the group B.

During processing the data obtained, a statistical comparison of regression growth curve slopes was performed in trial groups with different numbers of water changes and statistically significant deviations were obtained. ($p<0.001$) (Diagram 1).

b) *Growth in length*

Statistic processing of the results obtained from experimental and control ponds of all trial groups haven't shown statistically significant differences.

The diagram which was used for the comparison of results shows that the initial lengths of the units from all trial groups were identical. Up to day 30 of the experiment no larger deviation in the fish growth in length from all the observed groups is noticeable. Starting from day 45 more obvious split of the graphs of the groups observed begins to be noticeable, in order to become even more noticeable after this period. By comparison of the final average total lengths of the units from the trial groups A and B, for the same period (90

days), we can find a better growth in length for only 2.7% in the group A. If we perform such comparison with the results obtained from the group C, in the period of 60 days as the units from this group were in the experiment, we can find a 10.7% better growth of the samples from the group A, and an 8% better growth of the samples from the group B (Diagram 2).

By statistic comparison of regression slopes between the experiments with different numbers of water changes, no statistically significant deviations in growth in length between groups A and B were found. Complementary comparisons of the other groups indicate the existence of statistically significant differences ($p<0.001$).

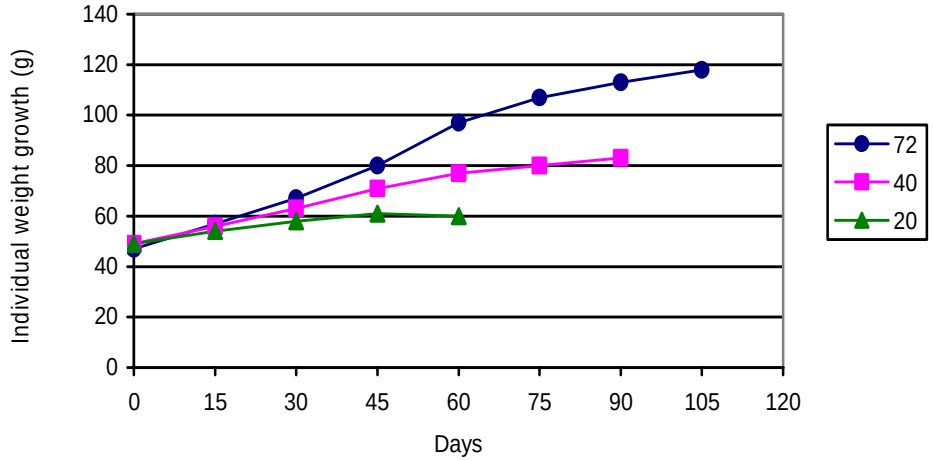

Diagram 1. Individual growth in weight of rainbow trout bred at 72, 40 and 20 changes of water daily

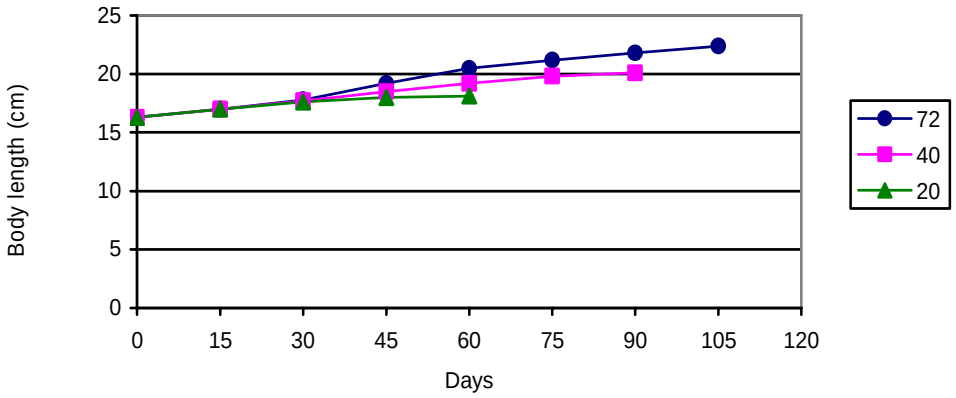

Diagram 2. Growth in length of rainbow trout bred at 72, 40 and 20 changes of water daily

c) Coefficient of conversion

The lowest values of the coefficient of conversion were registered in the trial group A. During the experiment these values were relatively low, which indicates the fact of exceptionally efficient food usage. In the trial group B these values were something higher than in the former, they constantly grew during the trial, however they can still be considered favourable from the aspect of feeding efficiency.

In the trial group C, in the first 15 days of the experiment a relatively low value of this coefficient was registered, in order after that period to come to its sudden increase as a consequence of reduction of meals and the appearance of massive mortality that had a significant impact on the obtained value of the total fish increment (Diagram 3).

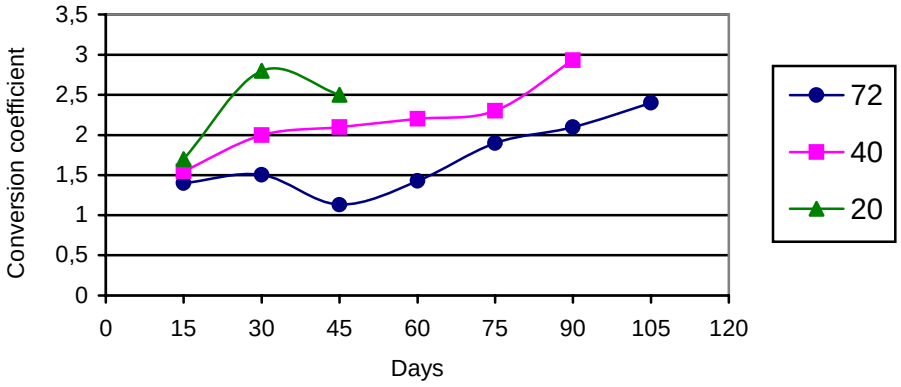

Diagram 3. Coefficient of conversion values in rainbow trout bred at 72, 40 and 20 changes of water daily

CONCLUSIONS

In the trout fishery Bošava, near Kavadarci, the influence of the number of water changes a day on the rate of growth in length and in weight of the Californian trout was examined, as well as on the coefficient of conversion and other parameters significant for salmonoid production.

Based on the results obtained we can find the following:

1. The growth in weight of the fish is directly dependent on the water flow, at which the indicators obtained indicate that the most optimal growth occurs in the conditions of 72 changes of water per day.

2. In the conditions of a higher number of water changes longer exploitation of fishponds (more rarely fish classification) is possible, as well as breeding fish in crowdier throngs without having negative impact on their growth in weight.

3. The growth in length is also directly dependent on the water flow in fishponds. However, this dependence is far less expressed than in growth in weight. It has also been noted that there aren't any more significant deviations in the growth in length of the units bred in the conditions of 72 or 40 water changes per day. More substantial lag in growth in length has been noted in the samples settled in ponds the water flow of which was 20 changes per day.

4. The lowest conversion coefficient values were registered in the fishponds with 72 water changes a day. In the trial group bred in the conditions of 40 water changes food utilization was slightly lower, however it could still be considered favourable from the aspect of feeding efficiency. The obtained values of conversion coefficient in the conditions of 20 water changes per day were extremely high as a consequence of the very small individual growth, meal quantity reduction and the appearance of massive mortality that had significant impact on the obtained value of the total fish increment.

5. The results obtained in the fishery Bošava, working methodology and norms can serve the fishing profession for the objective of improving the hygiene, technology and health conditions of fish, and with that itself to the overall production of Californian trout.

REFERENCES

[1] Brett, J. R., Shelbourn, J. E., Shoop, C. T. (1969): Growth rate and body composition of fingerling sockeye salmon, Onchorinchus nerka, in relation temperature and ration size. *J. Fisheries Res. Board Can.*, 26, 2363–2394.

[2] Liao, P. (1971): Water requirements of salmonoids, *Prog. Fish. Cult.*, 33, 210–216.

[3] Phillips, A. M. (1963): Effect of diet mixture and calorie sources on growth, mortality, conversion and chemical composition of brook trout, *Prog. Fish. Cult.*, 25, 8–14.

[4] Piper, R. G. (1982): *Fish hatchery management*, US Dep. of the Interior Fish and Wildlife Serv., Washington, D.C.

[5] Sedgwick, S. D. (1978): *Trout farming handbook*. London.