POLISH JOURNAL OF NATURAL SCIENCES
Abbrev.: Pol. J. Natur. Sc., Vol 23(4): 850–857, Y. 2008

DOI 10.2478/v10020-008-0068-1

EFFECT OF STOCKING DENSITY AND THREE VARIOUS DIETS ON GROWTH AND SURVIVAL OF EUROPEAN CATFISH (*SILURUS GLANIS* L.) LARVAE UNDER INTENSIVE REARING CONDITION

Marta Jamróz, Dariusz Kucharczyk, Roman Kujawa, Andrzej Mamcarz

Chair of Lake and River Fisheries
University of Warmia and Mazury in Olsztyn

K e y w o r d s: European catfish (*Silurus glanis* L.) larvae, stocking density, body weight, survival.

A b s t r a c t

Catfish frays were distribute on three groups: *A* – fish fed artificial diet, *B* – fish fed combined diet, *C* – fish fed natural food, during three weeks stocking under controlled condition. Two variants of density were applied in each experimental group – 7.5 (1) and 15 (2) ind dm^{-3}. Combine diet (natural food and trout starter) appeared the most effective. The mean body weight on termination of the experiment in these groups was 1203.5 and 815 mg (respectively in B_1 and B_2). Commercial trout starter was utilized readily and enough to obtain by larvae the mean body weight 848 mg and 966 mg in A_1 and A_2 respectively. Cumulative mortality was lowest in groups fed natural food, but poor growth ratio made impossible efficient intensive rearing. The experiment proved that 1) preliminary phase of rearing of European catfish larvae could relay on artificial food only, 2) natural food addition elevates survival and growth ratio, 3) Low initial stocking density limits cannibalism.

WPŁYW GĘSTOŚCI OBSADY I RODZAJU OFEROWANEGO POKARMU NA WZROST I PRZEŻYWALNOŚĆ LARW SUMA EUROPEJSKIEGO (*SILURUS GLANIS* L.) W WARUNKACH INTENSYWNEGO WYCHOWU

Marta Jamróz, Dariusz Kucharczyk, Roman Kujawa, Andrzej Mamcarz
Katedra Rybactwa Rzecznego i Jeziorowego
Uniwersytet Warmińsko-Mazurski w Olsztynie

S ł o w a k l u c z o w e: larwy suma europejskiego (*Silurus glanis* L.), gęstość obsady, masa ciała, przeżywalność.

Address: Dariusz Kucharczyk, University of Warmia and Mazury, ul. Oczapowskiego 5, 10-718 Olsztyn, Poland, phone: +48 (089) 523 42 15, dariusz.kucharczyk@uwm.edu.pl

A b s t r a k t

Podczas 3-tygodniowego podchowu w warunkach kontrolowanych w temperaturze 28°C larwy suma europejskiego podzielono w zależności od oferowanego pokarmu na trzy grupy: *A* – karmione paszą komercyjną, *B* – karmione pokarmem mieszanym, *C* – karmione pokarmem naturalnym. W każdej z nich zastosowano dwa warianty gęstości obsady – 7,5 i 15 osobn. dm^{-3}. Najefektywniejsza okazała się dieta mieszana. Średnia masa osobników po zakończeniu podchowu wynosiła 1203,5 i 815 mg (odpowiednio B_1 i B_2). Stosowany w doświadczeniu starter pstrągowy okazał się wystarczający do osiągnięcia przez ryby średniej końcowej masy w gr. A_1 – 848 mg, a w grupie A_2 – 966 mg. Śmiertelność skumulowana była najniższa w grupach karmionych pokarmem naturalnym, ale osiągnięte przez ryby tempo wzrostu nie pozwoliło na efektywny intensywny podchów. Wyniki doświadczenia dowodzą, że we wstępnej fazie kontrolowanego podchowu karmienie może opierać się na pokarmie komercyjnym. Dodatkowe stosowanie pokarmu naturalnego poprawia przeżywalność i przyspiesza tempo wzrostu. Stosowanie rzadszych obsad początkowych pozwala natomiast uniknąć strat spowodowanych kanibalizmem.

Introduction

European catfish become popular commercially fish in Poland during through last years. As a valued consumption fish catfishes are farmed in policulture with carp or in monoculture in warm – water facilities. To support its occurrence in rivers and lakes catfishes are also farmed at the age 1–3 in fish farms and then restocked.

Great requirement for stocking material for further culture caused necessity of getting in hand artificial reproduction and production of good quality fry. First efforts of generation based on natural spawning of catfish in carp ponds. At present artificial reproduction based on hormonal stimulation with CPE or Ovopel injection and the procedures are similar to hormonal stimulation using in cyprinid species.

Production of larvae was tilled recently limited by feeding. For many years catfish larvae were rearing in policulture with a carp or in monoculture in simple facilities. To elevate growth ratio larvae were fed zooplankton (HOROSZEWICZ 1971). Occurrancy of good quality starters has brought new and satisfactory possibilities of feeding the catfish larvae HAMÁČKOVÁ, KOUŘIl 1996, SCHLUMBERGER et al. 1995, WOLNICKI, KAMIŃSKI 1998 , WOLNICKI et al. 1998). It has also enabled intensify the production of stocking material by increased of stocking density.

The aim of this study was to rear the European catfish larvae in controlled condition with particular including stocking density and sort of offering food and their effect on growth and survival of the larvae.

Materials and Methods

Materials and condition of culture

European catfish larvae in number of about 10 000 individuals were obtained from Experimental Fish Hatchery "Dgał" in Pieczarki Inland Fisheries Institute in Olsztyn, 5 days after hatching with the yolk sac still present.

Fish were reared under controlled condition in twelve 40 dm^3 tanks with closed and purification system. The temperature of water at the first day was 23°C. In the course of the 36 hours she was elevated to 28?o?C and keep till the termination of the experiment. The oxygen level did not drop below 6 mg dm^{-3} and ammonium did not cross 0.1 mg dm^{-3}. The fish were kept in darkness.

Feeding

Larvae were distributed into 3 groups according to offering food: *A* – artificial diet (Aller Möller commercial trout starter) (Table 1, Table 2), *B* – mixed diet (trout starter and natural food), *C* – natural food (Artemia salina, frozen zooplankton, frozen Chironomidae). Each group involved 2 variants of density – 7.5 (1) and 15 (2) ind. dm^{-3}. Fish were fed 3 times a day during the first and 4 times during last two weeks of experiments.

Table 1
Composition of trout starter

Ingredient	Contents (%)
Protein	53
Fat	14
Carbohydrates	14
Cellulose	1
Ash	10

Table 2
Composition of trout starter

Ingredient	Contents per kilo
Vitamin A	10 000[a]
Vitamin D	800[a]
Vitamin E	300[b]
Cu	5[b]
Energy	16.5 MJ

a – IU per kilo; *b* – mg

Sample collection

The experiment lasted 21 days. Before the beginning of feeding a sample of 10 fish was taken and preserved in 4% formaldehyde solution. Fish were also sampled after 7, 14 and 21 days of rearing (20 ind. from each tank) and they were weighted and measured with 0.1 mg and 0.1 mm accuracy (anaesthetized using 2 – phenoxyethanol).

The tanks were cleaned once a day and died fish were counted. Every week fish were bathed in FMC solution (1 cm^3 100 dm^{-3}).

The differences among the groups were tested using Duncan's test at $p < 0.05$.

Results

Growth

Initial fray weight before feeding was 6.4 mg. From the onset of exogenous feeding significant higher ratio growth was observed in group B_1 and it was generally higher during the experiment. On the 14 day of the trial differences among the groups were much more visible (Figure 1). At the termination of rearing the highest average weight 1203.5 mg was achieved in group fed mixed diet with rare stocking density – B_1. Considerably lower final body weight was noticed in groups fed natural food either

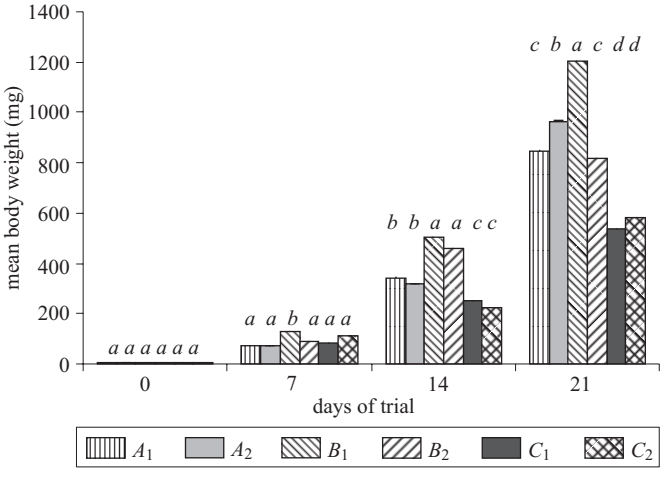

Fig. 1. The mean body weight (± SD) of catfish larvae reared at different densities and feeding regimes at the end of the experiment. Groups marked with the same letter did not differ statistically ($P = 0.05$)

in first and second variant of density and did not go beyond 600 mg. Groups A_1 and A_2, fed commercially trout starter obtained individual final weight 848 and 966 mg (respectively for A_1 and A_2).

Average body length and differences among the groups during next weeks are shown at Figure 2.

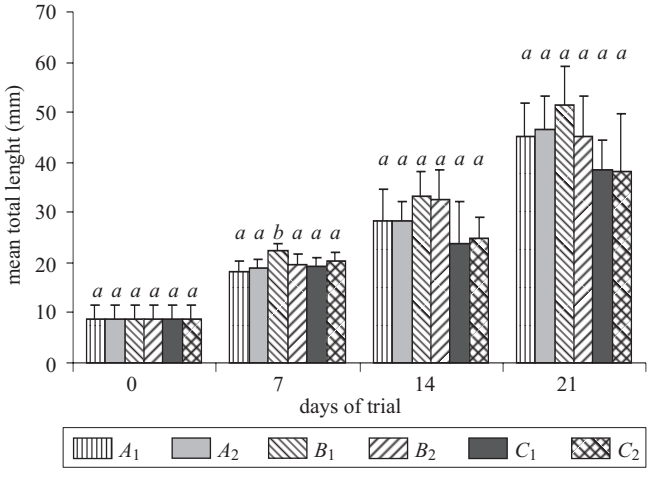

Fig. 2. The mean body length (± SD) of catfish larvae reared at different densities and feeding regimes at the end of the experiment. Groups marked with the same letter did not differ statistically ($P = 0.05$)

Fish behavior

Trout starters as well as natural food were eaten readily by larvae. At onset of feeding the fish grouped together and feeding only below the water surface. The unfed particles lying on the tanks bottom were ignored by the fish. During next weeks of feeding fish in all experimental groups were dispersed over the tanks and active during and between feeding.

Mortality

At the termination of the trial the highest cumulated mortality was found in groups fed trout starter 16.33 and 15.08%, A_1 and A_2 respectively (Figure 3). In those groups survival rates was lowest from the onset of the experiment. The best final survival rates were achieved in groups fed natural food – C_1 and C_2. It did not go below 10%.

From the beginning of the second week increase of mortality and injuring fish was observed in all of the groups. The losses were caused by cannibalism. Figure 4 shows the balance of stocks at the end of the trial. The highest per cent of losses was found in groups fed natural food in each variants of stocking density.

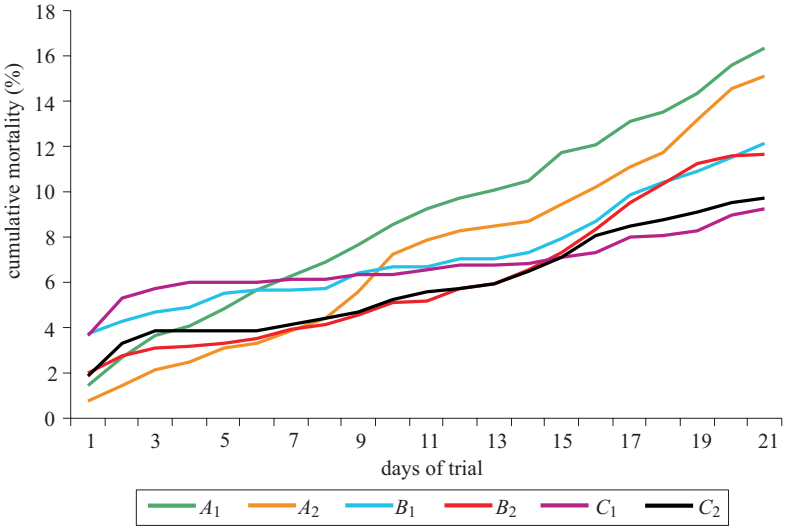

Fig. 3. Cumulative mortality (%) of catfish larvae in each experimental group under intensive rearing

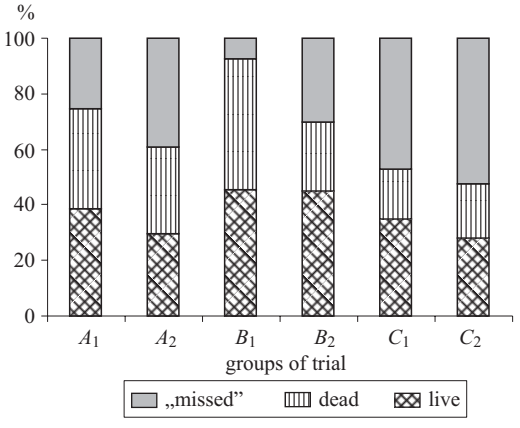

Fig. 4. The percentage of live, dead and “missed” fish on the end of the experiment

Discussion

There are three most popular methods that intensive rearing of European catfish stocking material may be carrying out. The first and the easiest one are placing in plastic or concrete tanks with recylculating and purification system. Fish are fed artificial food only. In second way of rearing fish are farming in tanks at first and then they are carrying over into small ponds with natural thermal conditions. First step of the last method is the same as in second but then fish are cultured in warm – water facilities ULIKOWSKI 2003. In spite of good tank stocking results farming in ponds with natural feeding is still prevailing method of rearing of European catfish larvae in Poland. It is caused by lower costs of rearing and aversion of farmers to use commercial feeding staffs because of many unsuccessful efforts of farming.

Our results with artificial feeding are comparable with data published by HAMÁČKOWÁ, KOUŘIl 1996, HAMÁČKOWÁ et al. 1997, WOLNICKI, MYSZKOWSKI 1998, WOLNICKI et al. 1998. According to data presented by WOLNICKI, KAMIŃSKI 1998 short – term (10–15 days), intensive rearing with trout feeding allow to obtain fray with average individual body weight equal 0.2 g. However, further reports of WOLNICKI, MYSZKOWSKI 1998, showed that average body weight of larvae might be lower and the highest ratio growth in their studies was achieved in control groups fed Artemia naupli – 202 mg. In our studies during three weeks rearing larvae fed trout starter obtained average body weight equal 848 and 966 mg (resp. A_1 and A_2).

There is no confirmation of data's published by HAMÁČKOWĂ, KOURIL 1996, WOLNICKI, MYSZKOWSKI 1998, that better ratio growth were achieved on natural food, in our studies. Both groups (C_1 and C_2) in our trial represented considerably lower ratio growth and the balance of stock at the termination of experiment was the worst. It seems that in case of mass rearing natural food is not enough diet.

The best ratio growth was found in groups fed mixed diet. The weight and length of the larvae from this group was greater after first week of our trial.

Conclusions

1. Preliminary phase of European catfish larvae rearing in controlled condition could relay on artificial diet only. Growth ratio and survival are satisfactory.

2. Addition of live food improves growth ratio and survival of larvae.

3. Effective intensive rearing is not possible with only using the natural food because of poor survival.

4. Low initial stocking density limits cannibalism.

Translated by MARTA JAMRÓZ

Accepted for print 29.01.2008

References

HAMÁČKOVÁ J., KOUŘIL J. 1996. *Production aspects of various diets application and technological arrangements in wels* (*Silurus glanis* L.) *fry culture.* Proceedings of Scienific Papers to the 75th. Anniversary of Foundation of the Research Institute of Fish Culture and Hydrobiology. Ed. M. Flajšhans, Vodnany: 61–68.

HAMÁČKOVA J., SZLAMIŃSKA M., KOUŘIL J., KOZAK P. 1997. *Żywienie larw suma europejskiego paszą sztuczną w trzech temperaturach*. Komun. Ryb., 3: 10–11.

HOROSZEWICZ L. 1971. *Sum*. PWRiL, Warszawa.

SCHLUMBERGER O., PROTEAU J.P., GREVET B., ARNAL A. 1995. *Alimentation des juvéniles de Silurus glanis en élevage intensif.* Aquat. Living Resour, 8: 347–350.

ULIKOWSKI D. 2003. *Wybrane aspekty rozrodu i wstępnego podchowu suma europejskiego* (*Silurus glanis* L.). *Ryby drapieżne. Rozród, podchów, profilaktyka.* Red. Z. Zakęś, IRS, Olsztyn.

WOLNICKI J., KAMIŃSKI R. 1998. *Technologia produkcji materiału zarybieniowego suma europejskiego na paszach przemysłowych. Rybactwo jeziorowe*. Red. A. Wołos. Wydaw. IRS, Olsztyn, ss. 91–96.

WOLNICKI J., MYSZKOWSKI L. 1998. *Survival, growth and food conversion in European wels*, *Silurus glanis* L., *larvae fed commercialy dry diets at 28°C*. Pol. Arch. Hydrobiol., 4: 531–538.

WOLNICKI J., PRZYBYŁ A., STARZONEK I. 1998. *Evaluation of five dry diets for initial feeding of European wels*, *Silurus glanis* L., *larvae under controlled conditions*. Arch. Ryb. Pol., 6(1): 123–133.