INTENSIVE REARING PERFORMANCE OF THREE PIKEPERCH (*SANDER LUCIOPERCA)* FINGERLING POPULATIONS FROM HUNGARY

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PERFORMANSE TRI POPULACIJE MLAĐI SMUĐA (*SANDER LUCIOPERCA*) IZ MAĐARSKE U INTENZIVNOM UZGOJU

Apstrakt

Zahvaljujući blagom ukusu i niskom sadržaju masti uz poželjan masno-kiselinski sastav smuđ (*Sander lucioperca*) je cenjen među potrošačima i uz pad izlova i povećanje potražnje dobija sve veću pažnju među uzgajivačima. S obzirom da su osnovni izvori matica smuđa iz ekstenzivnog uzgoja ili divljeg porekla, informacija o podobnosti mlađi pomenutog porekla sa svrhom intenzivnog uzgoja je od izuzetnog značaja. S tom svrhom, naša namera bila je da ovom studijom ocenimo performanse dve grupe mlađi poreklom od matica iz ekstenzivnog uzgoja i jedne grupe mlađi poreklom od divljih matica iz najveće vodene mase u državi, reke Dunav, kao i da ocenimo stepen zadržavanja NMT Alpha vidljivih oznaka u obraz riba. Iako bez statistički značajne razlike, mlađ poreklom iz ekstenzivnog uzgoja ispoljila je brži rast. Ovakav rezultat nagoveštava obimnu selekciju među maticama iz jezerskog uzgoja, posebno uzimajući u obzir stres rukovanja i suboptimalne uslove kvaliteta vode što sezonski karakteriše jezerski uzgoj. Kakogod, treba nagovestiti da je u svakoj grupi zabeležena određena količina iznurenih individua. Konačno, primanje NMT Alpha vidljivih oznaka je bilo visoko u sve tri grupe i bez statistički značajnih razlika.

Ključne reč: smuđ, poreklo, matice, NMT vidljive oznake.
Keywords: pikeperch, origin, broodstock,NMT Alpha visible tags

INTRODUCTION

Pikeperch, *Sander lucioperca*, has a wide range of distribution (both natural and artificially stocked) and is present throughout Europe, in Northern Africa and territory of former Soviet Union (Schlumberger and Proteau, 1996; Fuller, 2011). Due to its mild taste and low fat content with favourable fatty acid composition (Kowalska et al., 2011) it is respected among consumers and with decline of capture and increased demand it gets more attention among farmers. Production of this species in Hungary is mainly based on the extensive pond production but still it has considerable share in the total European production (Dill and Teletchea, 2008). This type of production is characterized by relatively low and variable yield, therefore increased interest is pointed towards intensive rearing technologies. Taking into account that main sources of breeders are pond reared and wild fish, it is of significant importance to get the information which breeders would be more suitable for fingerling production with purpose of intensive rearing. Therefore, in this study the intent was to evaluate intensive rearing performance of two groups of fingerlings originating from pond reared breeders and one group originating from the largest water body in the country, river Danube.

MATERIALS AND METHODS

Three batches of pikeperch fingerlings prepared for intensive on-grow were obtained from two producers from Hungary. Each batch consisted of 200 individuals of average mass of 10 g. Two batches obtained from H&H Carpio Ltd, Ócsárd, Hungary, were originating from pond reared breeders (Attalai Halászati és Értékesítő Kft, Hungary and ÖKO2000 Kft., Hungary). One batch obtained from SZAT Akvárium Bt., Vonyarcvashegy, Hungary, was originating from wild Danube breeders. With this respect, three populations were named Akaszto, Attala and Duna.

Upon arrival to the Research Institute for Fisheries and Aquaculture NARIC HAKI, Szarvas, Hungary, fish were stocked in the separated tanks with volume of 275 L in the recycling system equipped with trickling bio-filter and sedimentation tank where the two month quarantine was carried out. After the quarantine period, all fish were tagged in the right cheek with NMT Alpha visible tags (NMT INC Northwest Marine Technology, WA, USA) and individual weight was recorded. One week after fish were transported to the experimental recirculation system consisted of five 275 L tanks, mechanical screen filter, moving bead bioreactor and UV disinfection. After 10 days of acclimatization, 60 fish with similar masses from each group were distributed in three tanks in equal proportion 20:20:20 = Akaszto: Attala : Duna. Therefore, each tank was stocked with 60 individuals making a triplication of each origin.

At the beginning of the trial individual total length (TL ± 0.1 cm) and body weight (BW ± 0.05 g) was recorded. A week after, all the fish were retagged in left cheek and the individual BW was recorded. This was done in order to prevent the loss of the information. Further on, individual BW measurement was done on a two weeks period. At the end of the trial both BW and TL were recorded for each fish. Prior to each manipulation fish were anaesthetized in the clove oil solution (0.1 mL L^{-1}, 1:1, clove oil: 70% ethanol).

Assessed parameters: BW_i – initial body weight (g); CV BW_i – coefficient of variation for BW_i (%); TL_i - initial total length (cm); CV TL_i - coefficient of variation for TL_i (%); B_i

– initial stocked biomass (g); BW_f – final body weight (g); CV BW_f - coefficient of variation for BW_f (%); TL_f – final total length (cm); CV TL_f – coefficient of variation for TL_f (cm); B_f – final biomass (g); FBG – fish biomass gain per cubic meter of rearing volume (kg m^{-3}) calculated as $(B_f - B_i) V^{-1}$ (V- volume of rearing tank); DGR BW – daily growth rate for BW (g day^{-1}) calculated as $(BW_i - BW_f) \Delta T^{-1}$; DGR TL - daily growth rate for TL (mm day^{-1}) calculated as $(TL_i - TL_f) \Delta T^{-1}$; SGR – specific growth rate (% day^{-1}) calculated as 100 $(LnW_f - LnW_i) \Delta T^{-1}$; ΔT – rearing period in days; Starved fish – percentage of fish with negative SGR for minimum three consecutive weeks (%); Survival – survival during the trial (%); Tag retention – percent of retained tags (%).

During the trial fish were fed with SteCo PRE GROWER-14 2.0 mm (protein 50%, fat 14%, crude fibre 0.8%, ash 8.6%, total phosphorus 1.4%, Coppens International, The Netherlands) in first 10 weeks and SteCo SUPREME-10 3.0 mm (protein 49%, fat 10%, crude fibre 0.8%, ash 8.3%, total phosphorus 1.3%, Coppens International, The Netherlands) further on. Feed was distributed with mechanical FIAP belt feeder (4305 FIAP belt feeder; Aquacultur Fishtechnik, Germany) two feedings per day in excess. Each feeding lasted 6 hours. This has been done in order to maximize feed availability and eliminate the feed as the limiting factor for growth. Due to excessive feeding, unconsumed feed was siphoned twice per day, while tank walls were cleaned once per day (at 8 AM). Salinity was maintained between 1.5 and 3 g L^{-1} during the trial measured on the water conductivity basis. This was done in order to prevent parasitic infection (Németh et al., 2013) and to enhance the recovery of acute stress (Barton and Zitzow, 1995). Basic water quality parameters (nitrogen compounds and pH) were assessed twice per week. The ammonium nitrogen $N\text{-}NH_4^+$, nitrite nitrogen $N\text{-}NO_2$, and nitrate nitrogen $N\text{-}NO_3$ were kept under 0.3, 0.45 and 33 mg L^{-1}, respectively. Oxygen content, temperature and conductivity were measured at the outflow 5 times per week after the first feeding. Oxygen was kept above 67% satiation. Temperature and pH were kept on 21.6 ± 0.9 °C and 8.0 ± 0.1, respectively (mean ± standard deviation (SD)), while the conductivity ranged from 4.7 to 7.1 mS cm^{-1}.

Statistical analysis was based on one-way Analysis of Variance (ANOVA). All the percentage data were arcsine transformed prior to statistical analysis. Significant differences between treatments were estimated using a post-hoc Duncan's Multiple Range Test with a significance level at $P \leq 0.05$. Analyses were performed using SPSS 22.0 software (IBM, New York, NY, USA).

RESULTS AND DISCUSSION

Growth parameters are presented in Table 1. Higher growth was noticed in stocks originating from pond reared breeders but without statistically significant differences. Recorded SGR was below the previously reported growth for pikeperch of this size (Zakes et al., 2006; Schram et al., 2014). This can be explained by excessive handling due to tagging and recording of individual weight during the trial. Based on the growth curve (Figure 1), we can observe higher growth trend among the fish originating from pond reared breeders. This fact, together with higher achieved SGR might be the outcome of extensive selection process among the pond reared fish, especially with regard to handling stress and suboptimal water quality parameters which are seasonally characterizing pond on-grow.

Table 1. Performance of the three pikeperch populations based on the assessed parameters

Parameter	Akaszto	Atala	Danube
BWi (g)	22.4±0.1^{a}	22.3±0.2$^{a.b}$	22.7±0.2^{b}
CV BWi (%)	12.5±0.0^{a}	12.3±0.0^{a}	10.6±0.0^{b}
TL_i (cm)	14.5±0.1	14.3±0.1	14.6±0.3
CV TL_i (%)	4.1±0.5	4.1±0.4	3.5±0.2
B_i (g)	447.6±1.5	446.6±3.8	454.0±4.7
BW_f (g)	56.8±8.6	53.8±10.4	47.1±5.6
CV BW_f (%)	39.5±10.3	36.2±5.5	37.1±2.6
TL_f (cm)	19.6±0.8	19.1±1.0	18.5±0.6
CV TL_f (%)	11.5±2.5	10.0±0.3	10.0±0.3
B_f (g)	1136.5±171.1	1076.4±207.4	957.3±118.5
FBG (kg m^{-3})	2.8±0.7	2.5±0.8	2.0±0.5
DGR BW (g day^{-1})	0.33±0.08	0.30±0.1	0.23±0.05
DGR TL (mm day^{-1})	4.8±0.7	4.6±0.9	3.7±0.3
SGR (% day^{-1})	0.88±0.15	0.83±0.18	0.69±0.11
Starved fish (%)	16.7±15.3	16.7±16.1	21.7±12.6
Survival (%)	100±0	100±0	100±0
Tag retention (%)	94.2±1.4	92.5±4.3	88.3±7.6

Values (mean±SD) in the same row with different superscript (a, b) are significantly different ($P \leq 0.05$).

There were no observed mortalities during the trial period. However, among each batch emaciation by the fingerlings was noticed. Negative SGR for at least six consecutive weeks starting at the various times during trial was seen. Similar phenomenon has been previously reported by Schram et al. (2014), where the fish emaciation was not found to be the function of the tested factors. In our trial, observed ratio of starved fish was 16.7 ± 15.3, 16.7 ± 16.1, 21.7 ± 12.6 % (mean ± SD) for Akaszto, Attala and Duna respectively, without significant differences between the groups. Nevertheless, it is worth mentioning that as well as for growth parameters, more favourable results were noticed among pond origin fish. This is in agreement with previous indication of an early domestication process among pond reared breeders.

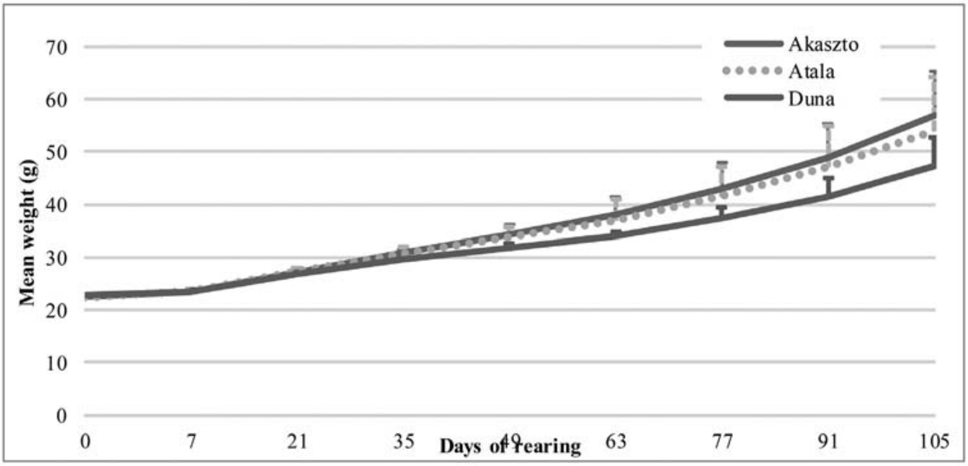

Figure 1. Mean weight + SD of fish throughout the 105 days of trail

Tagging the pikeperch fingerlings with NMT Alpha visible tags seems to yield rather favourable outcome in this size class of fish. Previous reports on tagging juvenile pikeperch considered higher size classes of fish (Hopko et al., 2010; Zakes and Hopko, 2013). These studies reported high rates of tag retention without significant impact of tagging on the growth of the fish. By our observations, tagging lower size classes with these visible implants presents rather fast and non-harmful procedure. Tag retention was 94.2 ± 1.4, 92.5 ± 4.3 and 88.3 ± 7.6 % (mean ± SD) for Akaszto, Attala and Duna respectively, without significant differences between the groups. Once more, we must point to the lower observed tag retention among the fish with wild origin which is indicating more aggressive and stressful behaviour of these fish.

CONCLUSIONS

Considering the small sample size used in this study, we may characterize this study as the preliminary. However, the indications of the more favourable results of intensive rearing with fish originating from pond reared breeders presents basis in which direction further studies could address. Including fingerlings originating from intensively reared breeders should generate significant conclusions. Considering the wide area of distribution of this species, more comprehensive program should yield the relevant answers in terms of suitability of traits of different populations for the circumstances of intensive on-grow. Finally, tagging the fish with NMT alpha implants may be suitable method for lower size classes in further similar studies.

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