

## **NUTRITIONAL REQUIREMENTS OF JUVENILE PIKE (*ESOX LUCIUS*) REARED IN RECIRCULATING AQUACULTURE SYSTEM**

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### **POTREBE U ISHRANI MLAĐI ŠTUKI (*ESOX LUCIUS*) GAJENE U RECIRKULACIONOM SISTEMU**

#### *Apstrakt*

Zahvaljujući napretku tehnologije, danas je moguće intenzivno gajenje juvenilne štuke u recirkulacionom sistemu korišćenjem formulisane komercijalne hrane (Wolnicki i Górný 1997). Komercijalna hrana koja se trenutno koristi za ishranu štuke je formulisana za druge vrste kao što su pastrmka, som i jesetra. Ova hrana se veoma razlikuje po sastavu proteina i sadržaju energije, što može da utiče na parametre proizvodnje. Smanjivanje odnosa svrarljivosti proteina/energetska efikasnost (DP/DE) u smešama može dovesti do većeg zadržavanja proteina, međutim može imati efekte na zdravlje riba i kvalitet proizvoda. Prvi cilj ove studije je bio da se istraži efekat komercijalnih smeša sa različitom koncentracijom proteina i lipida na juvenilne štuke manje od 20g (eksperiment I) i preko 70g (eksperiment II). Današnji trendovi u proizvodnji hrane za ribe su usmereni u pravcu zamene ribljeg brašna alternativnim izvorima proteina kao što su biljke, suvozemne životinje i nus-proizvodi. Ovi trendovi su dirigovani kako ekonomskim tako i etičkim pitanjima (Brinker and Reiter 2011). Drugi cilj ovog rada je bio da se istraži delimična zamena ribljeg brašna u smešama. U trećem eksperimentu, ispitivana je delimična zamena ribljeg brašna sa pšeničnim glutenom i živinskim brašnom.

#### **INTRODUCTION**

Thanks to advancements in rearing technologies, it is now possible to conduct intensive rearing of juvenile pike in RAS using commercial, formulated feed (Wolnicki and Górný 1997). Commercial diets which are currently used for pike are developed for other species including trout, catfish, sturgeon etc. These diets are greatly differing in protein and energy

content, which can influence the production parameters. Decreasing dietary DP/DE ratio the diet can result in an increase of protein conservation, however it could have many implications on fish health and product quality. The first aim of this study was to investigate the effects of commercial diets containing different protein and lipid concentration in case of rearing pike juveniles less than 20g (trial 1) and over 70g bodyweight (trial 2). Current trends in fish feed production are seeking for the replacement of fishmeal by alternative protein sources such as plant, terrestrial animal and by-products. These trends are being driven by both economic and ethical concern (Brinker and Reiter 2011). The second aim of this study was to investigate the partial substitution of fishmeal in the diet. In trial 3 the effects of partial replacement of fish meal with wheat gluten and poultry meal were studied.

## MATERIALS AND METHODS

### *Trial 1*

Four different commercial diet (Aller Aqua Poland) with different protein and lipid concentration were compared: 488 EX with CP (Crude protein) 54%, CF (crude fat) 12%; 505 EX CP 50%, CF 16%; SAFIRCP 45%, CF 20% and AVANTCP 42%, CF 24%. 12 sets of 350 fish ( $w_0=3.01\pm 0.1$ ) were distributed into 250L tanks linked to recirculating system. The daily feed portion were determined as 3.5% of biomass until day 24; 3% until day 42; 2% until day 50 and 1.5% until day 71 when the trial was finished.

### *Trial 2*

Three different commercial diet (Aller Aqua Poland) with different protein and lipid ratio were compared: STURGEON REP EX with CP (Crude protein) 52%, CF (crude fat) 12%; METABOLICACP 52%, CF 15% and PRIMO CP 37%, CF 12%. 9 sets of 23 fish ( $76.1\pm 13.4g$ ) were distributed into 250L tanks linked to recirculating system. Fish were fed two to three times a day by hand until visual satiation was achieved. The duration of the trial was 9 weeks.

### *Trial 3*

Three different protein content experimental diets were compared. The diet C contained 100% fishmeal as the protein source, diet P 25% of fishmeal was replaced with wheat gluten, and diet A 25% of fishmeal was replaced with poultry meal. All diets were isonitrogenous and isoenergetic. The 9 sets of 25 fish ( $w_0: 11.3\pm 1.6g$ ) were distributed into 80L tanks linked to recirculating system. Fish were fed once a day by hand until visual satiation was achieved. The duration of the trial was 4 weeks.

## RESULTS AND DISCUSSION

### *Comparison of different protein and energy content of commercial diets*

In both cases, in trial 1 and trial 2, where fish were fed with high protein and low fat content diet had better SGR (Specific Growth Rate) and FCR (Fed Conversion Rate) values (see Table 1). The low protein concentration can decrease the growth and feed utilization. The increased energy intake through increasing the dietary lipid concentration from CL16% to

CL 20% in trial 1 could improve the PER (protein efficiency ratio). However, in trial 2 the increased lipid concentration does not provide significantly better protein utilization with bigger size pike.

**Table 1.** Summary of growth and feed utilization in Trial 1 and Trial 2

	488 EX	505 EX	Safir	Avant	Primo	Stur.Rep. Ex.	Metabolica
	Trial 1				Trial 2		
SGR	3.01±0.04 <sup>a</sup>	2.87±0.12 <sup>ab</sup>	2.83±0.1 <sup>b</sup>	2.39±0.06 <sup>c</sup>	0.37±0.11 <sup>a</sup>	0.88±0.06 <sup>b</sup>	0.86±0.08 <sup>b</sup>
FCR	0.69±0.01 <sup>a</sup>	0.75±0.01 <sup>b</sup>	0.78±0.04 <sup>bc</sup>	0.93±0.04 <sup>c</sup>	2.53±0.45 <sup>a</sup>	0.97±0.01 <sup>b</sup>	0.97±0.01 <sup>b</sup>
PER	2.67±0.6 <sup>a</sup>	2.86±0.14 <sup>b</sup>	2.66±0.02 <sup>a</sup>	2.57±0.11 <sup>a</sup>	1.08±0.17 <sup>a</sup>	2.02±0.34 <sup>b</sup>	1.97±0.03 <sup>b</sup>

Where SGR: specific growth Rate (%/day), FCR: Feed conversion rate (g/g), PER protein efficiency ratio (g/g). The different letters indicate significant differences between the groups (ANOVA  $p < 0.05$ )

#### *Effects of the partial fishmeal replacement*

The 25% replacement of the fishmeal with alternative protein sources did not have a significant effect (ANOVA  $p < 0.01$ ) on growth and feed utilization (see Table 2). The slightly lower growth in case of fish fed with diet P could be caused by the lower feed intake which may result in decreasing growth in longer term period.

**Table 2.**

	diet C	diet P	diet A
SGR (%/day)	2.78±0.17	2.53±0.13	2.75±0.18
FCR (g/g)	0.83±0.04	0.80±0.01	0.77±0,08
Feedintake/group (g)	215.3±17.2	181.4±5.3	215.4±8.4

Where SGR: specific growth Rate (%/day), FCR: Feed conversion rate (g/g), Feed intake / group: total amount feed fed in each aquaria (g) – uneaten feed (g).

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