

PIKEPERCH CULTURE IN AQUAPONICS: PRODUCTIVITY AND WELFARE IN MONO- AND POLYCULTURE

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Introduction

Interest is growing for aquaponics as a way to reduce environmental negative impact of running aquaculture and hydroponics systems separately. The PERCIPONIE project (Interreg GR) aims to develop percid fish culture in aquaponic systems. Intensive pikeperch (*Sander lucioperca*) aquaculture is still in its infancy. Moreover, this species is considered as a good prospect for the European market due to its fast growth rate and economical expectation. Those characteristics made it a perfect candidate for the « Perciponie » project. The main risk of an aquaponic system regarding water quality and fish welfare is the accumulation of high concentration of nutrients (particularly nitrate) into the system in order to support the best growth of the plants.

The aim of the work was to assess the welfare and production performances (growth and survival) of pikeperch in aquaponic water quality conditions.

The study was performed in two steps: first we experimentally test the effects of different nitrate concentrations on growth performances, survival rate and welfare of pikeperch. Secondly, we evaluate these parameters in a coupled aquaponics pilot system in pikeperch monoculture and pikeperch/sturgeon polyculture

Material and Methods

First, we exposed pikeperch to increasing concentrations of nitrates (354 mg/L to 2655 mg/L NO₃⁻) and measured growth indicators such as weight gain, specific growth rate and feed conversion ratio. 20 juveniles (194.3±28.3 g) were randomly distributed in 250 L aquarium with an individual filtration system. Nitrate solutions were added to the water with a peristaltic pump to maintain nitrate concentrations at 6 different experimental values. Fish were fed at 1% of biomass/day. Fish growth and survival were measured and welfare was evaluated at the end of the experimental period (60 days) on 5 fish by measuring plasma cortisol, brain serotonin and dopamine levels by ELISA assays.

Secondly, pikeperch was reared in real aquaponic conditions to assess the productivity of the system. The aquaponics facility surface: 100 m², total volume: 18 m³) allows to assess the productivity in real production conditions. Pikeperch were reared at 23°C. Average pH

and oxygen levels were 6.9 and 8.2 mg/L respectively. Stoking densities varied between 30 to 88 kg/m³ depending on the size of fish.

Initially, the aquaponic pilot was exclusively stocked with pikeperch and the vegetal production consisted solely in lettuce. In a second time, a polyculture approach was tested with pikeperch and sterlet (*Acipenser ruthenus*). Fish and vegetable productivity were assessed on a 74-day experimental period. Pikeperch welfare was evaluated by measuring cortisol, serotonin and dopamine levels.

Results and discussion

Pikeperch exposed to increasing nitrate concentrations showed a decrease in survival rate when NO₃⁻ concentrations exceeded 354 mg/L (Figure 1). This indicates that the toxicity threshold value is between 354 mg/L and 708 mg/L. Survival rate was close to 100% and similar between 150 mg/L, 354 mg/L NO₃⁻ and the control. Growth indicators tend to decrease with the increase in nitrate concentrations. However, only the highest concentration (2655 mg/L NO₃⁻) led to a statistical reduction in growth compared to control. Plasma cortisol levels were similar in all groups. Dopamine and serotonin analysis are in progress.

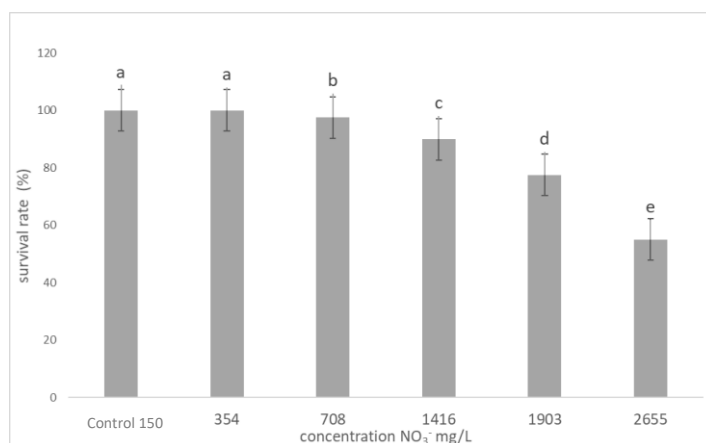


Figure 1. Survival rate in function of nitrate concentration. Different letters indicate a statistical difference ($p < 0.05$).

First productivity results of pikeperch monoculture in real aquaponic conditions were assessed during 74 days. Mean nitrate concentration in the system during the experimental period was 321 mg/L, which is under the toxicity threshold previously assessed for growth and survival. Pikeperch annual production reached 160 kg with a mortality rate of 7.8%. Lettuce mean weight reached 267.2 g \pm 54.6 g. Seven weeks are needed to fully grow a lettuce, 1 week of germination on rockwool followed by 6 weeks of deep water culture on hydroponics rafts. Based on those data, we estimated an annual production of 1282 kg/year. Welfare analysis and comparison with pikeperch-sturgeon polyculture are still in progress.

Final results will be very helpful to guarantee pikeperch welfare and support the development of pikeperch culture in aquaponics.