CHARACTERIZATION OF NEUROPHYSIOLOGICAL AND IMMUNE RESPONSES OF PIKEPERCH JUVENILES TO MAJOR STRESS FACTORS UNDER INTENSIVE CULTURE CONDITIONS

Baptiste Redivo 1*, Syaghalirwa N.M. Mandiki 1†, Thibaut Bournonville 1*, Sébastien Baekelandt 1*, Pascal Fontaine 2*, Yannick Ledoré 2*, Patrick Kestemont 1*

1Research Unit of Environmental and Evolutionary Biology, University of Namur, Rue de Bruxelles 61, 5000 Namur-Belgium.

2Research Unit on Animal and Functionalities of Animal Products, University of Lorraine, Boulevard des Aiguillettes, Nancy, France.

ABSTRACT
Pikeperch Sander lucioperca has been identified as a valuable candidate species for diversification of European freshwater aquaculture but the development of its culture is still limited by a high mortality rate or impairment in growth rate during the juvenile stage. A low welfare status may be related to high stress responsiveness since the rearing conditions for pikeperch are not yet optimized; and it has been shown that percid species are more sensitive to aquaculture stressors than salmonids (Jentoft et al, 2005). It has been also shown that exposure of the latter species to handling, emersion, and moderate hypoxia may impair significantly growth related parameters and various physiological pathways including changes in some key immune gene proteins (Strand et al, 2007; Douxfils et al, 2014). The objectives of this study were (1) to determine the main stressful husbandry and environmental conditions for pikeperch juveniles, and (2) to characterize the relative physiological and immune responses. Eight factors considered as relevant for the welfare of pikeperch were compared in two modalities using a fractional multifactorial design (2^8-4) in order to account for the interactions between the tested factors. So, each experimental unit represented a combination of sixteen variants including grading, stocking density (15 vs 30 kg/m^3), food type (floating vs sinking), light intensity (10 vs 100 lux or spectrum (red vs white), short vs long photoperiod, dissolved oxygen (60 vs 90%), temperature (21 vs 26°C). After 63 days of stress challenges, growth rate was significantly affected by the type of food with the highest values for fish receiving sinking food, while survival rate was improved by low intensity and red light. The latter light characteristics were also associated to a low stress response in terms of plasma cortisol and glucose but various interactions were observed between light intensity and some husbandry factors. Moreover, the highest values for the expression of glucocorticoid receptor-1 were observed for fish reared at 26°C and 90% dissolved oxygen. A decrease in the stress response was observed after 2 months, and this was associated to an improvement in the immune status in terms of lysozyme and ACH50 activities. The available results indicate that low light intensity and red spectrum in combination with appropriate food type may improve the welfare of pikeperch but other endpoints are still under analysis such as brain neurotransmitter responses (serotonin,, etc) and expressions of key-immune genes (C3-1, TNF-α, IL-1β, etc) for final recommendations.

KEYWORDS
Stress sensitivity, immunity, welfare status, and pikeperch
These authors have contributed equally to this work.

Corresponding author. Tel.: +3281724284; Fax: +3281724362.
E-mail address: robert.mandiki@unamur.be