Fakulta rybářství
a ochrany vod
Faculty of Fisheries
and Protection
of Waters

Jihočeská univerzita
v Českých Budějovicích
University of South Bohemia
in České Budějovice
Czech Republic

Confidential

Review of USB FFPW PhD Thesis

First name(s), surname, titles of the PhD student: Dipl.-Ing. Miroslav Blecha	**First name(s), surname, titles of supervisor:** Assoc. Prof. Dipl.-Ing. Tomáš Policar, Ph.D.
Title of PhD thesis: Innovative methods in culture and reproduction of pikeperch (*Sander lucioperca*)	

REVIEWER:

Surname: Fontaine	**Institution:** UR AFPA University of Lorraine Faculty of Sciences and Technologies Boulevard des aiguillettes, BP 236 F-54 506 Vandeouvre-lés-Nancy France
Name: Pascal	
Titles: Dr.	**E-mail:** p.fontaine@univ-lorraine.fr
Please describe your professional relationship to the PhD student: No relationship	**Please describe your field of expertise:** Fish biology, fish reproduction and domestication, percids, eggs and larvae quality

QUESTIONNAIRE

Originality, scientific importance, perspectives and impacts of results presented in the PhD thesis for basic and/or applied research

Evaluate competitiveness of the PhD thesis in the international context and compare its level with the current state of the art in the field **(extent ¼ – ½ page)**:

The PhD thesis of M. Blecha deals with the diversification of the inland aquaculture in Europe and the domestication of a new species, the pikeperch *Sander lucioperca*, a percid fish. The improvement of the production of aquatic products in Europe becomes more and more as a real challenge for the European Union in terms of food safety, because its importations of aquatic products represent around 65% of the consumption of European citizens. Also the development of the aquaculture sector has been identified as a major objective by the EU (see Horizon 2020 priorities). In that overall framework, the culture of percids is one the scarce opportunities that has been targeted to promote the development of inland aquaculture in Europe. Over last decade, more than twenty farms (mainly intensive productions using recirculating aquaculture systems RAS) have been built to support such production (see the book "Biology and culture of percid fishes", 900 p, published in 2015 by Spinger).
Consequently, the PhD thesis of M. Blecha focused on „Innovative methods in culture and reproduction of pikeperch (*Sander lucioperca*)" is a very interesting contribution in the field of the applied research aiming to promote the diversification of European aquaculture. These original researches aim mainly to reduce a major bottleneck : how to increase the availability of weaned juveniles of good quality for ongrowing farms and to reduce their production cost ?

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Elaboration of the PhD thesis, objectives of the work and deliverables

Evaluate the overall level of elaboration of the PhD thesis (structuring of the main text, comprehensibility, logicality of the chapters and their ordering) and the originality of the selected approaches to solve the objectives; evaluate publications and whether the results described correspond to objectives of the PhD thesis **(extent ¼ – ½ page)**:

The PhD thesis is compounded by 10 chapters including a general introduction (chapter 1), eight chapters corresponding to eight different experiments with clear and well separate scientific objectives related to different specific bottlenecks observed in pikeperch culture (improvement of reproductive performances, eggs incubation and, larvae and juveniles production) and finally a last chapter for a general discussion (chapter 10). Logically the thesis is a compilation of scientific articles published over 2015 or 2016 in peer-reviews often well known in the field of aquaculture (Aquaculture, Aquaculture Research, Journal of Applied Ichthyology) or animal sciences (Czech Journal of Animal Sciences). The results obtained in each experiment have been efficiently published. My main critic is the fact that too different topics were studied in this thesis, meaning that any specific topic is examined in details.

OVERALL COMMENTARY ON THE PhD THESIS

Please write comments in extent of 1-2 pages:

The first chapter (20 pages) concerns a general introduction in which successive parts deal with pikeperch rearing systems, reproduction techniques, domestication, sex manipulation and polyploidisation. This chapter is well documented and written with numerous and recent bibliographical references. However as very various subjects are concerned, the analysis of each topic and corresponding bottlenecks is not really examined in details. Somewhere it is a global weakness of the work.

The second chapter concerns the quality and quantity of pikeperch spermatozoa after varying cold water treatements. The main applied objective is to extend sperm availability (from late March to mid-June, 2.5 months) in order to improve pikeperch reproduction management. It was observed that temperature manipulations are suitable to maintain the production of a good quality of sperm by males, even if the quantity of sperm is not maintained because lower volumes of sperm are obtained in March. However, in my opinion, the real question at that level is what about females?

Is-it possible to have a similar approach with females?
The third chapter demonstrates that an optimization of pikeperch reproductive performances during the spawning season needs hormonal injections of both sexes, that improves fertilization and hatchings rates, and the number of larvae obtained. The hormonal injection of females only is related to lower performances.
The fourth chapter aims to evaluate the effectiveness of Alcalase enzyme to remove the adhesive layer of pikeperch eggs compared to a traditional milk/talc treatment. The application of Alcalase successfully eliminates stickiness in less time than traditional methods (few minutes *vs* one hour). Results appears particularly interesting using 1.5 or 2.0 $mL.L^{-1}$ of dilution solution considering fertilization and hatching rates, and unsticking success.
The fifth chapter is focused on the evaluation of post-ovulatory oocyte ageing on egg quality in order to identify the reliable and best stripping time for the artificial reproduction of pikeperch. Fertilization and hatching rates are not modified when oocytes are retained in ovarian cavity until 18 hours after ovulation. Considering this duration, post-ovulatory oocyte ageing doesn't affect embryo mortality or the occurrence of larval deformities. Such informations will be very useful for pikeperch hatchery manager.
The sixth chapter shows that a thermal shock (31°C) can be used to produce all-triploid pikeperch populations. However hatching rates remain low and malformed larvae rates are often too high. In the future, the gain related to the breeding of triploid populations of pikeperch (growth) must be really proved. It is not the case at that time?
The seventh chapter deals with the improvement of larval rearing protocol in order to increase the rate of the swim bladder inflation, an important phase during the steps of larvae development. The efficiency of three techniques (fan, air bubbles and spray) is compared in a context of intensive rearing conditions. It is shown that fan system increases the survival rate of larvae, without effect on growth and swim bladder inflation rates.
The eightth and ninth chapters concerning the adaptation of pikeperch previously reared in pond system to RAS sytem in order to combine two different rearing systems and reduce production costs for juvenile production. It must be indicated that such way seems particularly interesting for some eastern European countries where many ponds exist. The adaptation of pond reared juveniles to RAS conditions is good, any problem of survival or growth is observed. Consequently a combination of pond and RAS systems is promoted to support pikeperch production. I agree with the interest of such approach, however the dependence of the pond systems to variable climate conditions and the risk to introduce pathology in the RAS remain major problems in my opinion.
Finally, a short discussion (4 pages) concludes the PhD thesis.

My general point of view of the PhD thesis of M. Blecha is that it corresponds to **a very important applied research in the field of percid culture** which will highly help and support pikeperch farmers to take some crucial decisions (choice of rearing system, zootechnical practices ...). I would like to congratulate M. Blecha for his work.

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15th June 2016, at Nancy (France)

Pascal FONTAINE

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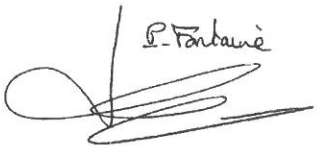
Pascal FONTAINE



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