



Confidential

Review of USB FFPW PhD Thesis

First name(s), surname, titles of the PhD student: Kateřina Francová, Dipl.-Ing.	First name(s), surname, titles of supervisor: prof. RNDr. Jaroslav Vrba, Ph.D.
Title of PhD thesis: Macrophyte assemblages in fishponds under different fish farming management	
REVIEWER:	
Surname: Lemmens	Institution: Katholieke Universiteit Leuven Belgium
Name: Pieter	
Titles: Dr.	E-mail: pieter.lemmens@kuleuven.be
Please describe your professional relationship to the PhD student: no professional relationship with the student	Please describe your field of expertise: Aquatic ecology, biodiversity conservation, meta-community ecology and food web ecology

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 presented PhD research investigates the characteristics of macrophyte communities in fish ponds in relation to major pond management practices. The overall quality of the work is good, which is also demonstrated by the fact that two of the three research chapters have been published in peer-review international journals. This study clearly highlights the potential of fish ponds for the conservation of aquatic biodiversity, more specifically aquatic plants. The findings are of high international importance since aquatic diversity is severely threatened at the global scale and increasingly restricted to human dominated landscapes in which anthropogenic ecosystems act as surrogate habitats for species of which the natural habitat has been lost. The study contributes to a better understanding of the factors underpinning macrophyte community composition and diversity in fish ponds. The conclusions of this study should be taken into account when developing biodiversity conservation programs for fish ponds.



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

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

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, logicity 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 structure of the PhD thesis is good and the ordering of the different chapters is logical. The methods used to address the specific objectives are not novel or very original, but are adequate and mostly correct. I very much appreciate the taxonomic and temporal resolution of the data collection. However, the list of objectives in the general introduction suggests an in depth comparison of the macrophyte diversity in fish ponds and wetlands, while this is actually only addressed in a relatively short paragraph in the first chapter and mainly based on a comparison with other types of man-made aquatic systems. I feel this could have been developed in more detail, especially because such comparison would stress the high international importance of fish ponds for biodiversity conservation. My major comments are related to the statistics. First, the statistical methods are not well enough explained. It is often difficult to fully understand what has been done and with which specific purpose or aim. In addition, it also seems that conclusions are sometimes made without statistical evidence. More detailed information and a few additional tests seem to be needed (see also my more detailed comments and suggestions below in this report).

OVERALL COMMENTARY ON THE PhD THESIS

Please write comments in extent of 1-2 pages:

The presented research is valuable because it contributes to a better understanding of the factors determining macrophyte community assembly and diversity in fish ponds. The study highlights the importance of fish ponds for biodiversity conservation in anthropogenic landscapes, and provides key information for effective biodiversity conservation management. However, I also feel that there are opportunities to further improve the quality of the work. Below, I provide more detailed comments and suggestions for each chapter separately. The PhD supervisor and PhD candidate should decide to what extent these suggestions can/should be implemented in the final version of the dissertation (especially with regard to chapter 2 as this manuscript is already published).

General introduction: The general introduction correctly highlights the different aspects of fish ponds in relation to macrophytes and also includes key aspects of fish pond management. However, I think the text could be improved by also discussing more in detail the ecology of macrophytes (and their importance for ecosystem integrity) and by elaborating a little bit more in detail on the relation between macrophytes and other pond biota. For example, it might be interesting to give a brief overview of the main factors (eutrophication, succession, disturbance, hydroperiod/regime,...) determining plant species distribution and diversity in aquatic systems (at different spatial scales), thus not only focussing on fish ponds. Related to this, the intermediate disturbance hypothesis is mentioned in the chapter 3, but it could actually already be included in the general introduction (my feeling is that this hypothesis actually applies strongly on macrophyte community dynamics in fish ponds). Including more aspects of the general ecology of aquatic vegetation in the introduction could also help to better position the current research into a broader, more general perspective. The use of the Kohler approach for vegetation assessment is mentioned, but I think the advantage compared to other approaches could be explained in more detail. Just using the technique for a first



time in fish ponds is not really novel, nor an argument for using it. On the other hand, it might even not be needed to mention the method in the general introduction already.

Chapter 1 (review paper): I very much like this chapter as it brings together important information on multiple aspects of fish pond management that, from my own experience, is highly scattered over different sources (including grey literature). Such central review paper is crucial to facilitate future research on fish ponds. My only minor comment on this chapter is that I was expecting a more in depth comparison of the plant communities in fish ponds and those in more natural systems. This expectation largely stems from the second objective listed in the general introduction of the dissertation. An exploration of how many species from the national (or European) aquatic species list occurs in fish ponds would be highly interesting, but might deviate too much from the original idea or aim.

Chapter 2: Although this chapter is published in a peer-review scientific journal, I had difficulties with fully understanding the statistics. First, the use of plant mass estimates is not clear to me because it seems that abundances are used in the analyses later on. Secondly, it was also not immediately clear to me whether the db-RDA has been done on species abundances or on abundances of functional groups (sum of species within each functional group). I only realized in the result section that multiple RDA's have been conducted based on species abundances belonging to different combinations of functional groups. Third, it would also be helpful to better explain the process of forward selection. Has a first preselection been done by the authors, followed by a statistical type of forward selection based on the double stopping criterion? In terms of visualization of results, I do not understand why only transparency is depicted on figure 4, while also fish density has been identified as an important variable determining variation in plant community composition. Related to this and based on table 4, it is still not entirely clear to me how the RDA's have been done. Showing the different species on the ordination plot might also be interesting in terms of interpreting variation in community composition in relation to management type, fish biomass and water transparency. In addition, it is not clear to me why a MRPP analysis has been applied rather than an ANOVA. Finally, it seems that differences in the number of functional groups has not been tested formally using any statistical test. It is thus very difficult to claim that rearing ponds have higher functional diversity compared to main ponds, although this indeed seems to be the case.

Chapter 3: This chapter is valuable in the sense that it looks in detail at compositional variation in two habitat types (reed beds and exposed bottom) in two major fish pond management types. The main problem with the current manuscript is that there is no formal analysis of the differences in taxonomic and functional richness between management types and habitats, and on the effect of land use and morphology (habitat width and slope) on variation in community composition. The overall pattern of variation in community composition is visualized using NMDS plots and ANOSIM analyses have been used to test for community similarity between main ponds and rearing ponds and between exposed and reed beds. The latter is however not clearly explained in the method section. It also seems that the effect of land-use, habitat width and shore slope on variation in community composition and diversity has not been formally tested. NMDS can indeed be used for visualization, but does not formally test for a relation. PERMANOVA could be used here to test for an effect of land use, shore slope and habitat width on compositional variation in plant community, whereas regression analysis might be useful to test for an effect of these variables on taxonomic and functional richness. Alternatively, a set of multiple RDA analyses could also be used: 1) RDA testing for the effect management type on compositional variation (can be done on different functional groups separately if warranted), 2) RDA testing effect of habitat on compositional variation, 3) RDA testing for effect interaction management type and habitat; 4) RDA testing effect



land use, 4) RDA testing effect morphometry (width and slope) on community composition. RDA 3 and 4 could be followed by a forward selection procedure to identify the significant variable of land use and morphometry. If management, habitat, land use and morphology indeed have an overall significant effect, a variation partitioning might be interesting to evaluate their relative importance. RDA ordination or PCA ordination can also be used for visualisation. In case of PCA based on species, one could visualize all species and the ponds (symbols based on type and habitat) with significant expl. variables (land use and morphology) as supplementary variables.

General Discussion: The text somehow reads as a summary of the different chapters. I believe that the key findings can be integrated a little bit more. It might also be interesting to have a paragraph on the future challenges of fish pond systems, including environmental degradation, socio-economical development and climate change. The latter is mentioned as being an important factor a few times throughout the thesis, but has not been explained very well to what extent and via which mechanisms (alterations of hydro-regimes?). An important limitation of the current discussion is the lack of a landscape perspective. I understand that this PhD research focusses on local diversity (pond level) but it might be interesting to acknowledge in the general discussion that current biodiversity conservation programs increasingly target landscapes and high levels of regional diversity, rather than only focussing on high diversity in local habitats (eg. ponds in this case). This can be especially relevant because the landscape scale allows the integration of effective biodiversity conservation and intensive fish farming.

FINAL RECOMMENDATION

- PhD Thesis can be recommended for defence
 PhD Thesis can be recommended with reservations for defence
 PhD Thesis can not be recommended for defence

10/12/2019, Leuven
Date and place

Pieter Lemmens
Name and signature



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Review of USB FFPW PhD Thesis

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Title of PhD thesis: Macrophyte assemblages in fishponds under different fish farming management	

REVIEWER:

Surname: Hrivnák	Institution: Institute of Botany SAS Slovensko
Name: Richard	
Titles: Ing., Ph.D.	E-mail: Richard.Hrivnak@savba.sk
Please describe your professional relationship to the PhD student: none	Please describe your field of expertise: Vegetation ecology (aquatic vegetation and alder-dominated forests)

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**):

PhD is based on study of fishponds in the Czech Republic, which have long-term history and tradition. In spite of, results obtained by PhD study will be of broad and international interest. Overlap between macrophyte vegetation, both fishpond management and ecology will be undoubtedly interesting for international readers/users. Taking into account my personal experiences, the level of the content of the thesis is comparable to similar theses in the international space. Generally, aims of the thesis are up to date and interesting not only for scientific community, but also for water management community and fisheries.



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, logicity 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**):

Structure of thesis is typical for PhD studies in ecology: short introduction, objectives, three chapters comprised of two published papers and one manuscript, as well as a short, general conclusion. Objectives of the study are clearly written, two papers were published in high-quality hydrobiological journals registered in the WOS and the manuscript was submitted into a qualitatively similar journal. The first paper presents comprehensive review focused on effect of fish farming on macrophytes in temperate carp ponds, other two papers bring original results focused on interaction between macrophytes and management/ecology in two types of fishponds and three types of vegetation, aquatic, reed beds and exposed bottoms. The presented objectives fully correspond with the results.

OVERALL COMMENTARY ON THE PhD THESIS

Please write comments in extent of 1-2 pages:

Personally, I am satisfied with the presented PhD thesis, its content, range and quality. All of the three areas of the thesis have comparable levels. Naturally however, I have some questions and notes to the thesis:

1) History, historical and recent management of fishponds could be more deeply described within the thesis. The main reasons why the studied fishponds were selected could be explained in more detail as well. I suppose that besides practical reasons, other important preferences such as representativeness of fishponds, etc were used for selection of studied fishponds. Could you please provide the reasons for selection of the studied fishponds?

2) PhD student's share is not presented for chapter 1 (review paper); I suppose that it is similar to the other studies. This review is very well done and it provides important material for scientists who study macrophytes in fishponds, mainly in carp ponds.

3) Selection of the three main types of macrophyte vegetation: aquatic, reed beds and exposed bottoms for the study of both species richness and composition of macrophytes in relation to the management and ecology of the ponds is interesting for the readers. However, these vegetation types are presented as two groups in two papers (aquatic vegetation as one group and reed beds together with exposed bottom vegetation as a second group). I think that conclusions for the three types could be interesting as well.

4) Within the studies the species richness of plants was determined within two types of fishponds: nursery and the main carp ponds. However, the area of the two types of fishponds was different; main fishponds were twice larger in average compared to nursery fishponds. This could influence the values of diversity (the differences could be greater than presented with same fishpond area). Nevertheless, nursery fishponds were richer in species than the main fishponds. Could you please



present your opinion about this?


5) From my point of view, I consider the discussion and conclusions generally important and useful. Mainly conclusion number 4 is very important and could be more highlighted in the published studies.

6) Provided PDF of the study published in Aquatic Botany journal was partially damaged, but version from AB web page was alright 😊

FINAL RECOMMENDATION

- PhD Thesis can be recommended for defence
 PhD Thesis can be recommended with reservations for defence
 PhD Thesis can not be recommended for defence

9.12.2019, Zvolen
Date and place

Richard Hrivnák 
Name and signature

