REVIEW OF PHD THESIS

INFO

Title: Study of surface layers of water bodies using hydroacoustic method
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Affiliation of Consultant: Department of Physics, University of Oslo, Norway
Oponent: prof. Ing. Lukáš Kalous, Ph.D.
Affiliation of opponent: Department of Zoology and Fisheries, Czech University of Life Sciences Prague

ANNOTATION

Presented PhD thesis of Mgr. Roman Baran connects the technology of sound devices surveys with the biology of the target objects for obtaining reliable data. Upper layers of the water column in lake and reservoirs are the environment of the thesis focus. Four various parts of the PhD, corresponding to three already published articles and one manuscript. All of them are connected to the overall goal of the thesis - to make better the study of fish and invertebrates by non-destructive method near the water surface. PhD thesis deals with technical peculiarities of sound beam survey data, the mobile upward-looking system, and its estimation. The work is an important step towards the improvement of studies of animals quantification and behaviour in water surface layer.

FORMAL EVALUATION

The dissertation is in the form of a modern smaller book with an illustrative and representative image on the cover. I like it. The first 22 pages contain all the essentials and a general summary, along with a well-written introduction. The next chapters consist of embedded published articles and one manuscript. However, articles in a reduced size are not well readable for older eyes. The rest of this light book contains the presentation of achieved results and academic life history of Roman. The most important information is that he is the co-author of eight other works that are not part of the dissertation. The graphic accompanying text is modest but meaningful. The language in the main text is basically error-free but the text in acknowledgements seems to be without obvious language check. Anyway, the important parts of the thesis are linguistically appropriate to the PhD thesis format. Formally I evaluate the thesis as well-presented.

SCIENTIFIC CONTENT EVALUATION

The presented work of Roman shifting the edge of knowledge in methodological approaches. The results do not bring answers to breathtaking questions from animal biology but his contribution to the knowledge can make these answers possible. It is a bit sad to oppose the dissertation, of which the core (here the individual chapters) have already undergone a demanding reviewer procedure by experienced professionals in the research field. On the other, it is much less work for me, as a reviewer, if we believe in peer review procedure and scientific metrics. If we do so, then my role is much more negligible. But I did my bit and after reading the dissertation work I am in agreement with those who read the manuscripts (here the individual chapters) and evaluated them before me. I consider the scientific content of the thesis satisfactory.

CONCLUSION AND RECOMMENDATION

In conclusion, I can state that Roman wrote and compiled a comprehensive dissertation, based on a solid knowledge of the specific area of research. The work brings new knowledge gained in a methodologically correct manner. I recommend the dissertation for defence and if successful, I recommend awarding Mgr. Roman Baran by the academic title "Philosophiae doctor" in abbreviation PhD.

In Únětice 25. 8. 2020

prof. Ing. Lukáš Kalous, Ph.D.

Organizacja Narodów Zjednoczonych do Spraw Oświaty, Nauki i Kultury

ERCE
Europejskie Regionalne Centrum Ekohydrologii pod auspicjami UNESCO

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Evaluation of the PhD Thesis
Study of surface layers of water bodies using hydroacoustic method
by mgr Roman Baran (School of Doctoral Studies in Biological Sciences, University of South Bohemia in České Budějovice, Faculty of Science)

The thesis consist of 3 published papers and one submitted. The rationale behind this work was, that applications of hydroacoustic methods developed so far, do not provide reliable information about the very surface layer of the water column, which is densely populated by fish and invertebrates and thus is very important. This is because of the depth of transducer deployment (usually 0.5 m), very small sampling volume close to the transducer due to narrow beam and the blind zone of the transducer, where acoustic beam is not fully formed. As a result, the upper 3 m of water column are not reliably sampled. To overcome these difficulties usually the horizontal beam was used so far. However, this method also has some disadvantages. The most serious one is unknown position of the fish in relation to transducer beam, which affects target strength determination. In the first paper authors show that horizontal beam causes also other problems, such as un-proper determination of the TS and depth of the targets due to the multipath sound interference. As the alternative to horizontal beaming authors suggest to use upward-looking transducer, which can ensonify surface water much more effectively. The other three papers are devoted to the hydroacoustic results received with this new mobile upward-looking system. The paper 2 is concentrated on monitoring juvenile fish and comparison of acoustic results with fry trawl. In paper 3 two frequencies were used to differentiate between juvenile fish and *Chaoborus* larvae in the surface layer. In paper 4 hydroacoustic estimates of fish abundance and size distributions were compared with gillnet catches. The results of all 3 papers confirmed usefulness of the new methodology to study surface water layer, although the authors did not point at least two important problems connected with this new methodology: the lack of the TS-length relationships for the dorsal aspect (the majority of existing regressions were received either for dorsal or horizontal aspects) and the influence of weather conditions, such as wind and rain on quality of the results, often excluding their possible use. I also found difficult to estimate what was the original contribution of mr Baran to this work. All 4 papers have many coauthors (often more than 10), and although mr Baran was the first author in three of them, his contribution was not clearly stated in the thesis. His leading role in the publications can be doubted, as he was not a

corresponding author in none of them. The other problem is poor English. Since thesis are in English, in my opinion a native speaker should read and correct the text. It is also very clear that the thesis were written in a hurry, without proper attention to the content. There are numerous mistakes, such as description of axes in meters instead of centimeters (Fig. 3 and 6 in paper 4), "deepth" instead of depth (Fig. 3 in general text), lack of spaces before citations, style errors, etc.

I am not going to review 3 first papers, since they are published, so they have been already evaluated by at least three reviewers with positive result. I will concentrate on the paper 4, which has a status of "submitted".

1. I do not understand why authors compare abundance estimated acoustically (half an hour survey along 100 m distance) with the number of fish caught in gillnets through the night (12 hours). Why do they assume that equality of these two values justifies the reliability of the upward-looking system? There are publications, not cited by the authors, showing that gill net catch is a poor predictor of acoustically derived abundance (Donald E. Dennerline, Cecil A. Jennings, Donald J. Degan, Relationships between hydroacoustic derived density and gill net catch: Implications for fish assessments, Fisheries Research 123– 124 (2012) 78– 89). I agree with what was written in discussion that the effective sampling volume of gillnets is not known, therefore, it is not possible to compare absolute abundances directly. The observed agreement could be purely accidental.
2. The Love's (1977) TS-TL regression, although the most popular in acoustic literature, definitely was not developed for the ventral aspect. The authors do not provide any literature justification for using this regression. Also, for unknown reasons do not refer to the publication of Wanzenböck et al. 2020 (Josef Wanzenböck, Jan Kubecka, Zuzana Sajdlova, Jaroslava Frouzova, Hydroacoustic target strength vs. fish length revisited: Data of caged, free swimming European whitefish (Coregonus lavaretus L.) suggest a bi-phasic linear relationship under a limited range of tilt angles, Fisheries Research 229 (2020) 105620, which they must know, as 3 of the authors are the same in both publications). In this paper great differences between the ventral and dorsal TS-TL length regressions were observed and this should be discussed in a manuscript.
3. Sometimes the authors use "standard length", SL (lines 26, 65), sometimes "total length", TL (line 149), or "theoretical" fish length, whatever it means (line 114). It is not clear which fish lengths were used in calculations. One should be consistent and use always the same length.
4. English editing is necessary, at present the language is really poor.
5. Correct figures, please. In Fig 2 indicate the location, where profiles were taken, in Fig 3 and 6, depth axis should be in centimeters, not meters

Summarising, the presented PhD thesis are not of very high quality (to which I am used to based on previous thesis from this research group), but good enough to fulfill the requirements for the title of Doctor of Philosophy. There are three published papers as a part of the dissertation and mr Baran is coauthor of 6 other publications in journals with high impact factors, which is quite high achievement at the European level. Publishing of the results in high quality journals is the best proof of the importance of the undertaken studies and their high scientific value, already evaluated by the reviewers. Also conferences activity of mgr Baran was quite high.

In conclusion, I am convinced that presented PhD Thesis together with the scientific achievements of the candidate present an important contribution to the field of environmental sciences and mgr Baran deserves the degree of Doctor of Philosophy. However, I must underline, that if mgr Baran is going to continue his scientific carrier, he must be more accurate in his work and pay attention to all the details.

Prof dr hab. Małgorzata Godlewska

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