

Review of Dissertation Thesis of Tomáš Jůza

Distribution and density of pelagic 0+ fish in canyon-shaped reservoirs and effectiveness of their sampling by fry trawls.

The presented dissertation attempts to solve the problem of fish fry sampling by trawls in canyon-shaped reservoirs. From a methodological point of view, qualitative and quantitative monitoring of fish communities in large reservoirs still presents great problems and the dissertation under review contributes to this topical problem. The author compares samples from trawls of different size and different colour, and attempts to describe longitudinal and horizontal fish fry distribution.

The dissertation concurs closely with the diploma thesis of the author.

The thesis includes four published papers and one submitted manuscript. The papers are introduced by a short introduction, followed by abstracts of all papers. The preview also includes a general discussion, conclusion and perspectives.

The thesis has an informal format and looks somewhat like a journal. It is almost all written in English (except paper I) and could be easily distributed by the author in a similar manner to reprints.

I have several comments and questions as regards the thesis:

General comments:

The author mentions in the introduction that the density of percid fry recorded by acoustic methods and by direct capture using ichthyoplankton nets, during the day and night, did not always correspond. I have seen this as an important statement and I expected that the author would try to explain such discrepancies in fry distribution in reservoirs in the present thesis.

Paper I is not published in an international journal, like the other papers, but in the proceedings of a national conference. I am persuaded that the author is aware of the different category of publication; nevertheless, it would be correct to indicate it in the thesis.

Paper II is more or less a published Masters thesis. It is more a question for the local Faculty jury as to how this work is evaluated, considering that the Masters work forms part of the PhD thesis. In the case of Tomáš Jůza's thesis, I do not see that the inclusion of this paper causes a problem as the topic fits well with the other original papers.

The author did not find any significant differences between the three sizes of trawl compared (1.5x3, 3x3, 6x3 m); nevertheless, he recommends in the conclusion that the 3x3 m trawl for quantitative night sampling is a good compromise between assured efficiency and relatively easy handling. In my opinion, considering that sampling efficiency is the same, I would expect that the smallest trawl (1.5x3 m) would be easiest to handle.

In **Paper III**, the significant drop in fry abundance in the Římov reservoir since 2000 is interesting. The author tested for various biotic and abiotic factors but no one factor proved significant. In my opinion, natural reproduction could also have been reduced by the very intensive sampling of adult fish from the spawning ground in the tributary zone using huge fyke nets between 2000 and 2005 during a

previous study (see Hladík 2005). What is the author's opinion as regards this purely management factor?

Paper IV was completed during the spring and produced rather different results than, for example, paper II (completed during late summer), which concerns the pelagic density of fry during the day and night. How do you explain this?

The experimental structure in **paper V** is the same as that in the previous paper (comparison of size and colour of trawls), the only difference being that sampling was undertaken during the day and at a greater depth (10-12 m), not sampled in the previous studies. Paper V is interesting; however, when comparing the results from all 5 presented papers (all of which sampled at different depths and at different times), instead of providing an explanation Paper V introduces new questions. Would it not have been more logical to also sample the bathypelagic layer at night, and in the same season, as the epipelagic layer?

General discussion, conclusion and perspectives

Fish distribution and migration in reservoirs is a very interesting, but also complicated, topic and, up to now, not very well explained.

While the author concentrated on one age class only, i.e. fish fry, he studied them over two seasons. Papers I-III present data from late summer (August-September), while the data in papers IV and V are from late spring (May-June); this has led to some inconsistencies in the results. How does the author explain that size of trawl has no effect on catchability of larger fry in late summer, but does have an effect in spring, when fry are much smaller? I would expect just the opposite.

As the author compares many parameters (season, daytime, longitudinal zone, depth, etc.), I had to read the whole thesis more than once just to understand seasonal and diurnal fry distribution pattern in reservoirs.

The author explains the longitudinal distribution of cyprinid and percid fry in reservoirs clearly. Horizontal and vertical distribution, however, was only clear to me up to the last paper. The author investigated a previously unsampled part of the reservoir, i.e. the deeper layers (10-12 m), and found, during the day, a four-times-higher density of perch fry than in the 3-6 m layer.

Where are perch fry during the day, in the deep layers or in the littoral zone?

Unfortunately, the general pattern of fry distribution in reservoirs remains a little hidden to me. I did not find a clear explanation in the thesis as to which season and at which time fish move between the littoral and pelagic zones. It is also a pity that the author did not include parallel littoral sampling of fry communities, even though its importance is mentioned in several papers. This would probably have helped explain the study topic better.

Formal comments:

It is very difficult to recognise which species is indicated in Figure 2. Next time, I would recommend using more clearly differentiated patterns in the bar chart.

The author wrote in the conclusion that "the pelagic fry community is a very important component of the fry community of whole reservoir..." Surely, there is only one fish fry community and its distribution within a reservoir changes during the day and night and between seasons?

Conclusion:

In my opinion, despite the comments mentioned above, the PhD thesis under review provides beneficial results for fisheries biology. In each case, the thesis widens our knowledge about fish fry in canyon-shaped reservoirs. In particular, I evaluated the clear results for horizontal fry distribution and the testing of different trawl sampling efficiencies as highly positive. Diurnal fry distribution in reservoirs will need more specific studies to provide a general explanation for this pattern.

In my opinion, the presented PhD thesis of Tomáš Jůza meets the criteria for dissertation work and, therefore, it is my pleasure to recommend this thesis for defence.

Brno June 6th 2011

Ing. Pavel Jurajda, Dr.



Opponent Report for the University of South Bohemia

Evaluation of the Ph.D. thesis of Thomas Juza: "Distribution and density of pelagic 0+ fish in canyon shaped reservoirs and effectiveness of their sampling by fry trawls".

The thesis comprises five closely interconnected articles and a short synthesis of these articles. Four of these articles have already been published whilst one article is a submitted manuscript. Three of the published articles have been published in high quality international journals. The candidate is the first author of all five papers. Candidates major and primary role in producing these papers indicate his marked creative intellectual input and good capacity to conduct scientific work. This clearly is an acceptable contribution for the PhD degree.

Paper I is published in Czech language in a national journal but it has an abstract and a table in English. This paper reveals some interesting although preliminary observations of the trawl sampling process of offshore fry fish communities in reservoirs. Cyprinids dominated in the upper 0-3 m surface water layer while percids usually prevailed in the 3-6 m depth layer. These observations are further clarified and elaborated in the following papers.

Paper II explores the avoidance reactions of the young-of-the-year (YOY) fish assemblages in the offshore zone of three reservoirs in late summer. Avoidance in relation to three different sizes of sampling trawls was studied. At night time (in the darkness) no avoidance was observed. This is an important observation and gives support to the view that night-time pelagic trawl sampling of fish fry is an effective quantitative method in reservoirs. The paper, although excellent and original as such, does not include an adequate assessment of the potential biases in the experimental arrangements. Some critical factors that could have affected in the capture efficiency of the sampling trawls may have remained unobserved (e.g. trawl rigging, bridle set up, trawl design, water flow patterns inside the trawls, variability in towing speed, vessel effect, fish abundance effect). The number of hauls was fairly low in each sub-experiment – the potential effect of this on the results would have deserved a deeper analysis.

Paper III presents an extensive, interesting and well-written seven years study of late summer pelagic YOY communities in a reservoir and of factors that affect the variability in these communities. The distribution of cyprinids and percids differed significantly and there was also a significant yearly variation. Cyprinids dominated the upper water layer (0-3 m) and percids the 3-6 m depth strata. No significant correlations were observed between fry density and biotic and abiotic factors. This is an interesting observation and it is reasonably well explained in the discussion. However, the total number of tows in this seven years study was only 81. That means that on average there were only some 11-12 tows (hauls) per year. The potential effect of this on the reliability of the results and conclusions has not been adequately enough analyzed, evaluated and discussed in the paper.

Paper IV presents a highly interesting and well-conducted study where the effect of the size and color of the sampling trawl on the catching efficiency on early fish stages was explored. The

study was made in May-June and the length of fish was only about 10-20 mm. Four different trawl sizes and two colors were studied. The effect of trawl size was very clear on perch: larger sampling trawl was more effective in catching them. For cyprinids the difference was not statistically significant (although it appears from the figures that there was a difference). The color of the trawl did not have any effect on sampling efficiency. For perch and cyprinids the daytime densities were significantly higher than night time densities (does this reflect some difference in day and night sampling efficiency?). There were 15 tows in each experimental category (in total 137 tows): this probably is adequate although no analysis was done whether the required accuracy was received. The effect of using two different boats in the experimental arrangement was not evaluated.

Paper V presents a study where the effect of the size and color of the sampling trawl on the catching efficiency of early stages perch in the bathypelagic layer (10-12 m) was explored with 92 experimental tows. The results show that neither the size nor the color of the sampling trawl has any effect on the capture efficiency (for perch). This result is really interesting because in the epipelagic zone the size of the sampling trawl had a significant effect for perch (Paper IV). The difference may be connected to visibility conditions and water temperature but there may be also other factors. The question arises whether the perch fry living in the deeper water are the same population as those living in the epipelagic zone?

The Synthesis of the thesis summarizes the results and main conclusions. It is relatively short and modest in the content and analysis. It could have provided a bit wider and deeper analysis of the state-of-art of this study and its place in the field of fisheries science. First of all, the background of the study could have been explained more thoroughly. For instance, for what purposes this study has been done? Who will use these results and how they will be used? Are the results being used directly in fisheries management or for instance in the prediction of the year-class strength of various species (to predict future catches)? Or is this study more connected to environmental protection and environmental monitoring? It would have been interesting to have a general assessment of the wider meaning of the results. For instance, the densities of YOY were relatively small in most places and in most years. Would it be possible to assess the total amount of fry in these lakes and evaluate the meaning of those numbers? Could the results of this study give any indication when the year-class strength of a fish species is determined, in early summer or in later summer, or perhaps after the first winter?

One obvious strength of this study is the development of the methodology for quantitative sampling of pelagic offshore fry in reservoirs. This knowledge certainly was taken forward and it is very likely that these papers will be cited in the future largely because of that aspect. The Synthesis, however, could have included an evaluation and assessment of the potential methodological weaknesses of the methods tested and developed. What could have been done better and what would be done differently in the future experiments? When speaking about the efficiency of a sampling trawl, how "good" efficiency is needed to be able to state that the sampling really is quantitative? How you measure that? Would quantitative acoustic assessment be a potential calibration tool? How much trawling effort is needed to adequately describe species and size composition of the pelagic fry fish communities? How to optimize sampling effort? Would it be possible to produce practical guidelines on this issue (number of

tows required, proper stratification schemes, appropriate sampling procedures, appropriate gear designs and riggings, appropriate towing speed, etc)?

Rome, 1 June 2011

A handwritten signature in blue ink, appearing to read "Petri Suuronen". The signature is fluid and cursive, with the first name "Petri" and the last name "Suuronen" clearly distinguishable.

Dr. Petri Suuronen