

## Jiří Peterka

### Feeding selectivity and efficiency of young-of-the-year fish – insight from field data and laboratory experiments

Presented Ph.D. thesis is based on four papers. One is already published in respected journal, one is submitted and two are manuscript prepared for publication, In the published and in the two other is J. Peterka listed among authors on the first place, which suggests that he has been the leader of the endeavors.

I do not find useful to repeat the main results of these investigation because this would repeat the statement of the author with partly changed formulations and perhaps different order. Moreover I am as investigator of the zooplankton – fish interactions much more familiar with the supposed effects of fish on zooplankton than on the behavior of fish as user of the zooplankton resources which is the topic of the present Ph.D. thesis.

The difference in sizes or differences in the movement of the food items can play role in the so called competition between fish species and their size classes. In the narrow sense the term competition is antagonistic use of the same resource. What kind of antagonism exist in the use of the different planktonic crustaceans by different fish species of the same size.? The presented papers of J Peterka show that the 0+ populations of roach as the most numerous representative of cyprinids and perch as the most frequent representative of percids do not really compete in the narrow sense of the term as they preferentially use different groups of zooplankton as food items. On the other side in the first years after a newly constructed reservoir is put in operation percids represented mainly by perch are the most important part of the fishstock. In the following years the frequency of percids in most cases decrease and cyprinids (mainly roach and bream) considerably increases (Vostradovský J., J. Křížek, O. Albertová, L. Růžička, and. M. Vostradovská: 1989). In my opinion the presented papers are important contribution as they clearly show that the competitive superiority of cyprinids in later development of fish populations in reservoirs cannot be simply explained by the competitive superiority of roach fry by the advantages in the exploitation of zooplankton as could be inferred from papers published earlier. I am convinced that the achieved results present the maximum which can be achieved by the methodical approach used to the understand the feeding selectivity between investigated fish species. On the other side in the literature and also by the author is mentioned better ability of the fry of cyprinids to exploit other particles (algae both planktonic and sessile, and even cyanobacteria) in addition to zooplankton has not been investigated in greater detail in the presented papers as it is difficult to evaluate this effect by the methods used.

In the present study also perspectives of the further investigations based on the presented results are mentioned. The subtle differences in the ability to use all the resources of the habitat cannot be in my opinion quantitatively disclosed by the relatively crude investigation of the differences in the stomach content of fish. The grow rate of fish in most natural habitat is more or less far from the optimal one. In my opinion the possibility to compare how far is the actual growth rate from the optimal one in different year classes and different fish species could be a more perspective approach than the approach mentioned by the author. The remote perspective would be to compare the measure of the nutritional state of fish with the measurement of the species composition and biomass of the food particles of zooplankton as

affected by the intensity of predation by fish. The specific composition of zooplankton mentioned by the author is not only influenced by fry predation but also by predation by older year classes as it is evident from their stomach content. Moreover it is influenced by the composition of phytoplankton which is again influenced in addition to filtrational and raptorial activity of zooplankton by the by concentration of nutrients and some further abiotic parameters of their habitats.

The presented thesis based on the attached original papers, partly published in a respected journal, shows that the candidate has contributed to the more detailed knowledge of the differences in the use of the food items by 0+ year class of perch and roach in the studied reservoir both in the field and in the laboratory. He has compared his results with the data in the literature and so generated some more general conclusions. I therefore propose to accept this thesis as a basis for the Ph.D. degree.

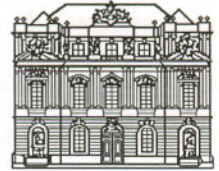


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Praha, 20. April 2006

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Mondsee, 24.04.06

**Regarding : Review of the PhD thesis “Feeding selectivity and efficiency of young-of-the-year fish – insights from field data and laboratory experiments” by Jiří Peterka.**

First of all the author of this thesis has to be congratulated for this exceptionally excellent piece of scientific work. The topic is timely but at the same time difficult to deal with because the topic has received considerable attention in the past and there has been a large number of outstanding papers published. Therefore it is not easy to stand up against this background and I think there was some risk involved in choosing this topic. There have been few very recent papers on this topic which shows that not many scientists are willing to dig even deeper into the questions of feeding selectivity of young zooplanktivorous fish than has been done previously. Anyhow, I think the author has reached a wise decision to work on this topic as there are still numerous open questions and even some inconsistencies in the literature which deserve further attention and will lead to deeper insight into the interesting relationships between young fish and their zooplankton prey.

I am particularly pleased with the fact that Mr. Peterka has chosen to study the behavioural components of the mentioned interactions as I think this is the most promising way to arrive at a deeper understanding of feeding selectivity – as this thesis has shown impressively. Therefore, I consider the laboratory experiments to represent the main strength of the thesis. To compare experimental work with field data is of course important, however, one could argue that feeding selectivity of 0+ perch and roach from various water bodies have already been presented by several previous papers (see Discussion section of part I). Therefore, I do not consider the parts

on field selectivity as innovative as the experimental part of the thesis. Anyhow, the experiments on feeding selectivity and efficiency have been well planned, they have been carried out to a sufficient extent and they have been performed to describe realistic feeding behaviour, especially in the time dimension. This is why they allow important conclusions to be drawn: Contrasting differences in the foraging behaviour of small roach and perch lead to differences in feeding efficiencies with regard to different zooplankton prey types. Especially the interplay between prey evasiveness and conspicuousness of movements forms an important part of the selection mechanism which I found to be convincingly developed in the first part of the thesis. Perch was found to be at least as effective compared to roach and often even more effective which contrasts previous, highly respected results by other authors. The consequences from that are really important as they challenge previous models of fish species composition and their shifts along productivity gradients.

The second part of the thesis explores the topic even deeper into the behavioural components of differences in feeding efficiency of young roach and perch and again I believe this is another highlight of the thesis leading to new scientific insights. The difference between various foraging modes (cruising vs. stop-and-go or “saltatory searching”) is emphasized and its positive and negative effects on capture success of evasive prey explored. This approach is not new per se but a more detailed evaluation as done previously is tremendously important and corrects some of the presumptions found in the literature, therefore, it truly represents a step forward in science.

Anyhow, I found one minor point in the second part misleading which is the term attack-force: As it is measured as a distance I suggest the values are a distance in reality and not a force in a physical sense. Therefore it should be termed attack distance and not force.

The third part of the thesis forms another very innovative aspect of our knowledge of young perch biology as there are no previous data published on the feeding of hypolimnetic young perch.

The fourth part of the thesis describes the feeding selectivity of another percid, the pikeperch. However, I found this part more descriptive and it has a different relevance compared to the previous parts. In the first three parts I see a clear ecological relevance extending deeply into our understanding of the functioning of freshwater ecosystems. In the fourth part I see the relevance for applied aquaculture, whereas I would have preferred to link the observations more tightly to the results for perch and to perform a true comparison as indicated in the general overview (page 6).

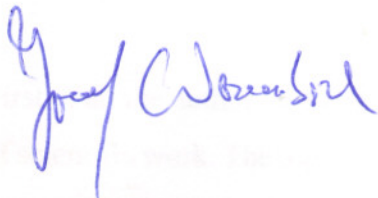
The formal aspects of the thesis and all of its parts are a shining example. The introductions

clearly describe the background against which the study was undertaken and convincingly explains the reason for the respective study to be undertaken. The Material and methods sections are easy to understand and detailed enough to allow repeating such studies by other scientists. The results are well represented including all figures and tables. Statistical exploration of the data seem adequate and were taken to a very high level. Discussions are concise and pinpoint the relevance of the results in the context of the present knowledge in the respective field.

Altogether, I recommend the acceptance of this thesis in its present form and (if required) to acknowledge this excellent piece of work with the highest mark available.

I hope to have contributed constructively to the decision process of the evaluation committee.

Sincerely

A handwritten signature in blue ink, appearing to read 'Prof. W. B. ...', is written in a cursive style.

## PhD Thesis Review

### „Feeding selectivity and efficiency of young-of-the-year fish – insights from field data and laboratory experiments“

Author **Jiří Peterka**, Faculty of Biological Sciences, University of South Bohemia

The PhD thesis of Jiří Peterka deals with feeding habits of YOY perch (*Perca fluviatilis*) and roach (*Rutilus rutilus*) both under experimental laboratory conditions and in narrow deep canyon-shaped dam reservoirs. Both fishes belong to the most common species in European water bodies and their progeny plays very often a crucial role in formation of YOY fish assemblages in their littoral zones, particularly in reservoirs with wide-ranging trophic levels. Thus, the deeper knowledge about their feeding habits and relating consequences in fisheries management and biomanipulation efforts is of special importance.

As stated in the PhD thesis annotation, the main focus was given to the assessment of differences and affecting factors in feeding success of larval and juvenile YOY fish preying on zooplankton with particular reference to cladocerans (*Daphnia*) and copepods (*Cyclops* and *Eudiaptomus*). A considerable part of research dealt also with feeding habits and food composition in juvenile zander (*Sander lucioperca*) fishpond culture and in a naturally occurring reservoir population.

The reviewed PhD thesis is based on two manuscripts, one paper submitted to peer review in Journal of Fish Biology and one paper, which has already been published in the Aquaculture International. It is to be stated that both papers and the short synthesis of published results present a range of significant new findings gained from the detailed studies during the extensive and very detail research on reservoirs and in the laboratory. The results and conclusions presented in author's papers are clearly presented and may considerably contribute to the level of knowledge in many issues applying to fisheries management, biomanipulation, environment control, modelling and related domains in freshwater reservoirs.

One of the main conclusions, which have been proved by author's field observations and laboratory experiments, was that perch fry are able to consume high amounts of evasive copepods and under specific circumstances, cyclopoids and calanoids are even subject of certain selectivity in comparison with slow-moving *Daphnia*. However, he also proved that the foraging on copepods is associated with increased energy expenditures in repeated feeding strikes, long attack distances, inspections for prey occurrence etc. So the question arises what

are, in author's opinion, the main reasons for such a behaviour. Might they be based on different nutritional values in copepods versus cladocerans or is it to be considered as a characteristic trait of perch feeding behaviour - to attack preferably the prey with stimulating movement pattern?

The way of presentation and thesis conclusions are very clear and based on sufficient study material. The scientific value of papers and manuscripts, making the framework of the thesis is undoubtedly high enough to allow reviewer's recommendation to accept the submitted thesis as a basis for PhD award.

Pohořelice, 13 April 2006



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