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**Review for the PhD-thesis:**  
**„Gradients of fish distribution in reservoirs“**  
submitted by Marie Prchalova

Due to their longevity, their mobility as well as their species-specific autecology fish have been considered as suitable indicators of the ecological integrity of water bodies. On this basis, they have been nominated for instance as one quality element in the European Water Framework Directive. In order to receive a representative and realistic picture of fish assemblages in water bodies of different types, detailed knowledge about distribution patterns of species and specific selectivity of sampling gears are of crucial importance. In particular large and deep water bodies like reservoirs and lakes are complicated in terms of sampling due to a variety of differing habitats and therefore differing fish assemblages. In this context, the PhD-thesis by M. Prchalova is focusing on highly relevant issues like vertical and longitudinal distribution patterns of fish species in reservoirs of different morphological and limnological types, the evaluation of the driving forces for fish assemblage structures as well as selectivity patterns of widely used multimesh-gillnets in terms of species and size classes.

The thesis contains five different papers. Three of them were already accepted by or published in international peer-reviewed journals. The main findings of all papers are generally discussed in a broader context at the beginning of the thesis and major conclusions are drawn. Both, the general chapter as well as the papers are clearly and usefully structured and fluently written. Materials and methods for all studies are properly selected and described. Results are presented in a clear way including very informative tables and figures. The discussion is based on a broad knowledge of current literature and conclusions are always backed up by the results achieved.

Papers I-III are focusing on fish distribution and habitat selection in stratified and shallow reservoirs. In general the results demonstrate that fish are not evenly distributed in water bodies between dusk and dawn. Independent of thermal stratification, depth is the major

driving factor for species abundance, biomass and fish assemblage structure. Generally abundance, biomass as well as species number decreased with the depth – although in a species specific way. In canyon-shaped reservoirs the gradient in morphological and limnological characteristics between the tributary and the dam area turned out to be a second major factor structuring fish assemblages. In addition, habitat preferences were important. The studies give a detailed insight in structuring processes of fish assemblages in reservoirs and add knowledge on ecological preferences of several species. Accordingly, the results call for proper sampling schemes considering both vertical and spatial distribution patterns of different species when assessing fish assemblages – independent from the sampling method used.

Papers IV and V are dealing with selectivity problems of multimesh-gillnets. In terms of species composition in the catch, a regular overestimation of percids against cyprinids compared to seine hauls was observed. This finding was not only documented but used as a basis for developing a correction factor. In addition, the candidate searched for possible reasons and explanations for the overestimation of perch against roach by analyzing catch mechanisms and retention probabilities. Strange enough, these important aspects had not received much attention in fisheries research in the past, therefore the thesis of M. Prchalova has to be judged as very innovative in this respect. In a very convincing way she is drawing the conclusion that the overestimation of perch must be caused primarily by higher activity rates and therefore a higher encounter probability of the species. With respect to size-selectivity of multimesh-gillnets, the results of the studies laid down in this thesis confirm an underestimation of young year classes and an overestimation of large specimen for common species like roach, perch and rudd. It is of importance that the size selectivity patterns for these species were detected in a direct way by comparing catches from multimesh-gillnets and seine hauls, which gives a higher degree of confidence. As an approach to overcome size selectivity of multimesh-gillnets, two corrections were introduced for perch and roach. In summary, the corrections for species and size selectivity developed in this thesis improve the possibilities to receive realistic pictures of fish assemblages when using multimesh-gillnets for sampling.

Overall, the studies carried out and published in the thesis by M. Prchalova are a reasonable contribution to fisheries science and add valuable knowledge to the understanding of fish distribution and sampling in large water bodies. I recommend the thesis to be accepted.



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Remarks and questions

1. How consistent in terms of abundance, biomass and species composition are the data when comparing gillnets in the same depth zone and the same locality?
2. Catches obtained from multimesh-gillnets and seine hauls were compared in terms of species and size selectivity. Gillnets were placed in the water all night, seine hauls were temporarily restricted to some minutes and were not repeated several times between dusk and dawn. Can this be of importance for the differences in perch abundance found?
3. Does beach seining with a net 50m long give a realistic picture of the fish community in a certain area? Wouldn't one have to expect that actively and fast swimming species as well as larger sized individuals may have a higher probability to escape and therefore cause the differences found in comparison with multimesh-gillnets?
4. From your experience with using multimesh-gillnets: do these nets give sufficiently reliable and reproducible results to be used as the standard procedure for sampling fish in the context of the European Water Framework Directive?

## Posudek oponenta na PhD disertaci

RNDr. Marie Prchalové

### Gradients of fish distribution in reservoirs

Předložená disertace je složena z celkem pěti publikací z nichž tři byly publikovány, nebo přijaty do tisku, dvě odeslány do redakcí. Ve všech těchto pracích je Dr. Prchalová prvním autorem, všichni spoluautoři podepsali prohlášení, že předložené publikace napsala a hlavní podíl na nich měla dr. Prchalová.

Ve společném úvodu jsou shrnuty hlavní důvody, které vedly k tomu, že právě tyto publikace byly vybrány do disertace. V prvních třech pracích otázky vlivu ryb na ekosystémy nádrží a význam jejich prostorové distribuce, v posledních dvou zda je možno a za jakých podmínek používat data z často používaných tenatních sítí.

Výsledky jednotlivých publikací jsou shrnuty v další části. Ve dva roky lovené velké a hluboké nádrži (Želivka) byla hlavním faktorem ovlivňujícím rybí společenstvo hloubka, u dlouhodobě lovené nádrže (Římov) hloubka, vzdálenost od hráze, a typy habitatů (hodnoceno pomocí mnohorozměrné lineární RDA).

Ve třech menších holadských nádržích bez teplotní a kyslíkové stratifikace byly odlišnosti ve složení rybího společenstva méně nápadné, ryby využívaly všechny typy habitatů, variabilita ve složení společenstev byla významně ovlivněna preferencí habitatů jednotlivými druhy ryb.

Dvě publikace zabývající se selektivitou používaných tenat konstatují vysoké zastoupení okounů v tenatech ve srovnání s jejich zastoupením v zátazích konaných na stejných místech v noci. Rozdíly v zastoupení okouna jsou až 10 násobné, přitom převaha okounů byla nejvyšší v nádržích s nízkou početností okounů? Nemohl lov sítí způsobit hromadný „útěk“ okounů do tenat tj. jak vzdáleny byly obě místa lovu?

Elegantní vývody Baranova (1914) o interakcích mezi rybami a oky sítí včetně tenat naznačily, že lze dobře použít do modelů výlovu. V jednotlivostech jsou však ovlivněny živými rybami, které pak lze lovit i v jiných poměrech než stanoví teorie. Kritika a dočasná nepřístupnost Baranova originálu jistě způsobily že k oživení problematiky došlo až v 60 a 70tých letech. Dynamika modální délky plotice v Klíčavě, tvar selekční křivky a její ovlivnění délkovým složením lovené populace a dobou lovu (tření, podzimní aktivita) ukázaly, že zjištěné parametry, modalita tenat, selektivita vůči jednotlivým délkovým skupinám patrně nemají obecnou platnost.

#### Další poznámky

Experimenty v 70-80tých letech (Magnuson) ukázaly na skutečnost, že ryby jsou ochotny se zdržovat i v prostředí nevýhodném pokud je tam např. potrava.

Pelagiál bez ryb byla pravděpodobně pouze záležitost některých tropických a velkých nádrží a ještě časově omezená.

Vážené odhady početnosti a složení rybích společenstev vycházející ze znalosti jejich počtu v tenatech a jejich selektivity a příslušných objemů předem vytypovaných habitatů, je dobrý praktický příklad využití originálních výsledků.

Nejsem si jist zda pouze vysoká aktivita okounů stačí jako důvod k vysvětlení jejich odlišného počtu v tenatech a sítích.

## Závěr

Z vlastní zkušenosti vím jak fyzicky i jinak je náročné získávat data z tak velkých prostorů a po tak dlouhou dobu. Vzhledem k současnému charakteru vědecké práce je nemožné, aby publikace byla napsána jedním autorem. Ostatní spoluautoři tak mohou mezi sebou sporné věci i představy o fungování přírody dosyta diskutovat, což se jistě stalo.

Tři z prací již byly podrobeny kritice oponentů a následně i ichtyologické veřejnosti. Konstatuji proto, že práce jednoznačně splňuje požadavky kladené na doktorskou disertaci a doporučuji, aby po úspěšné obhajobě byl dr. Marii Prchalové přiznán titul doktora filosofie.

V Praze dne 26.5.2008

  
Prof. RNDr. Karel Pivnička, DrSc

## **Reviewer's comments to Ph.D. dissertation „Gradients of fish distribution in reservoirs“**

**Author: Marie Prchalová**

The reservoirs represent a special type of the water environment requiring a different approach to the monitoring of environmental determinants including fish assemblages. Particularly in the Czech Republic, the country almost missing the natural lakes, the reservoirs play indisputable multipurpose role in water management, recreation, drinking water supply, angling and many other commercial activities. Obviously, water quality determinants and their dynamics are subject to special attention from the institutions responsible for the reservoir management. As fish are of extraordinary importance for the formation of water ecosystem parameters, the studies of various issues determining their determinants are currently one of quite frequent topics surveyed by fish biologists with special interest. Since it is very difficult or rather impossible to use and/or transfer simply the experience and knowledge from common-type waterbodies to the reservoirs with different area, morphology, water retention rate, water quality etc., the information on the issues associated with functioning of their ecosystems with respect to fish assemblage composition is of particular value and relevance for future research activities.

As stated in the title of Ph.D. thesis assignment, the main focus was given generally to the gradients of fish distribution in reservoirs, represented obviously by two types – two Czech narrow (often canyon-shaped) reservoirs and Dutch artificial reservoir system. Submitted Ph.D. thesis are completed by two papers of rather methodological background, based on the figures obtained during the regular ichthyological monitoring of several other water reservoirs.

The thesis consists of one paper published and four ones accepted and/or submitted for publication in highly reputable peer reviewed ichthyological journals. Both the papers and short synthesis of published results present a range of significant new findings gained from the detailed studies during the extensive research with substantial contribution of the author. The results and conclusions presented in the papers are exploitable not only by the other members of the research team of the Institute of Hydrobiology in České Budějovice but also by all experts involved in issues of reservoir fisheries management, ichthyological surveys, modelling, biomanipulation and related domains.

Three of the four papers, on which is the Ph.D. thesis based, have already either appeared or have been accepted by peer reviewed periodicals and thus, they had already been submitted to hard critical review. This is undoubtedly an efficient and clear proof of their

scientific value and I cannot contribute considerably to these reviews, of course. I would rather concentrate upon certain issues with deep interest to know the author's opinion and to contribute to scholarly debate:

- 1) What changes in distributional patterns of the fish assemblage should be expected with reservoir ageing, if any? How to consider the reservoir age with respect to future fish community development, let's say on the example of the Želivka and Římov reservoirs, both well known to the author?
- 2) The paper IV is entitled as the "overestimation of percid fishes" but as declared, the overestimation was proved just for perch but not for pikeperch and ruffe. However these species belong also to percids don't they? Despite the paper was already accepted, it seems that the title should be correct as "Overestimation of percid fishes in night gillnet sampling". Since the overestimation is encountered to their greater activity during dusk and dawn, it cannot be generalized. In my opinion and with respect to my practical experience with their quite difficult removal from gillnets, the surface structures of percid opercula and fins may be the reason of their overestimation also in the daylight gillnetting. What is the author's opinion?
- 3) Regarding one of the conclusions (p.6) that "...fish size distribution from gillnets and beach seine nets indicated that .....juvenile roach, perch and rudd were underrepresented in gillnet catches ...and larger fish were slightly overrepresented in gillnets.", I would like to add, that this conclusion must be claimed with certain caution in my opinion. The beach seine netting covers much shallower parts of the littoral which are known as nursery areas for these fish species, and these shallow habitats <0.5m certainly were not surveyed by gillnets installation but were subject to beach seine netting.

There is no doubt that the submitted Ph.D. thesis proved an excellent ability of the author Marie Prchalová to master both various methodological approaches to the survey of reservoir fish assemblages and results evaluation. The conclusions are found on high value results and findings and as such may contribute to our knowledge in the field of reservoir limnology. My recommendation to the appropriate commission is to accept the submitted Ph.D. thesis for further reading without any substantial remarks.