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CONTENTS

Academy of Sciences of the Czech Republic

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Chairperson:	Doc. RNDr. Jaroslav Vrba, CSc.
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	Prof. Ing. Pavel Pitter, DrSc. Institute of Chemical Technology, Prague
	Doc. RNDr. Martin Rulík, Ph.D, Faculty of Science, Palacký University, Olomouc

INSTITUTE STAFF AND FIELD OF WORK

(visit www.hbu.cas.cz/staff.php for more information, email addresses and contacts)

SCIENTIFIC STAFF:

Department of Plankton and Fish Ecology:

Doc. RNDr. Jan Kubečka, CSc. (Head)	Fish population dynamics and scientific sonar techniques
Prof. RNDr. Zdeněk Brandl, CSc.	Ecology of predatory Cyclopidae, predatory food relations
RNDr. Martin Čech, Ph.D.	Fish behaviour in the open water
Ing. Jaroslava Frouzová, Ph.D.	Hydroacoustics and fish behaviour
Mgr. E. Hohausová, Ph.D.	Fish ecology and behaviour
Doc. RNDr. Jaroslav Hrbáček, DrSc. (Scientific Consultant)	Limnology of artificial water bodies, zooplankton, especially *Daphnia*
RNDr. Jiří Macháček, CSc.	Fish-zooplankton interactions, ecology of *Daphnia*
RNDr.Tomáš Mrkvička, Ph.D. (from March)	Statistical analyses
Doc. RNDr. Josef Matěna, CSc.	Feeding biology of fish, ecology of chironomids
RNDr. Jiří Peterka, Ph.D.	Fish feeding ecology; uw photo and video techniques
RNDr. Jaromír Seďa, CSc.	Zooplankton, especially seasonal dynamics of Cladocera and fish-zooplankton interactions
Mgr. Mojmír Vašek, PhD.	Fish feeding and spatial distribution, recruitment dynamics

(see also www.hbu.cas.cz/fishecu)

Department of Aquatic Microbial Ecology:

Prof. RNDr. Karel Šimek, CSc. (Head)	Aquatic microbiology, bacteria-protozoa interactions, bacterial community composition
RNDr. Karel Horňák, Ph.D.	Bacterioplankton community composition and activity
RNDr. Jan Jezbera, Ph.D.	Protozoan-bacterial interactions
RNDr. Jitka Jezberová, Ph.D.	Identification of cyanobacterial picoplankton
RNDr. Jaroslava Komárková, CSc.	Plankton primary production, phytoplankton analyses, taxonomy of algae
Prof. Ing. Miroslav Macek, CSc. (11 months UNAM México)	Protozoa-bacteria interactions, freshwater ciliates, biological waste water treatment
RNDr. Jiří Nedoma, CSc.	Microbial biochemistry, image analysis
RNDr. Klára Řeháková, Ph.D.	Phytoplankton analyses, polyphasic aproach of taxonomy of *Nostocales*
RNDr. Viera Straškrábová, DrSc.	aquatic microbiology, BOD, interactions with phyto- and zooplankton, long-term research
Doc. RNDr. Jaroslav Vrba, CSc.	Aquatic microbiology, extracellular enzyme activity
RNDr. Petr Znachor, Ph.D.	Phytoplankton and reservoir ecology, fluorescence techniques, microphotography

(see also www.fytoplankton.cz)

Department of Hydrochemistry and Ecosystem Modelling:

Doc. Ing. Josef Hejzlar, CSc. (Head)	Reservoir limnology and eutrophication
RNDr. Jakub Borovec, Ph.D.	Reservoir limnology, chemistry of sediments
RNDr. Jiří Kaňa, Ph.D.	Water and soil chemistry
Prof. Ing. Jiří Kopáček, Ph.D.	Analytical chemistry, soil-water interactions
Ing. Petr Porcal, Ph.D.	Aquatic dissolved organic matter
RNDr. Jiří Žaloudík, CSc.	GIS in hydrology and landscape ecology

TECHNICAL STAFF:

Jindra Bučková	Cleaner
Alena Fiktusová	Chemical analyses
Alena Hartmanová	Bacteriological analyses, cultivation
Ing. Vladimíra Hejzlarová	Chemical analyses
Vladimír Jirák	Building maintenance, electrician
Ing. Jitka Kroupová	Chemical analyses
Alena Kubátová (from April)	Cleaner
Marie Kupková	Phytoplankton analyses
Václava Lavičková	Documentalist
Ing. Radka Malá	Bacteriological analyses, cultivation of microbes
Ing. Petr Mautschka	Technical and financial management, computer maintenance, network administration
Mgr. Karel Murtinger	Analytical chemistry
Zdeněk Prachař	Field assistance, zooplankton analyses
Soňa Smrčková, DiS. (maternity leave)	Bacteriological analyses, data processing
Dagmar Šrámková	Secretary, accountant
Marie Štojdlová	Biochemical analyses, image analysis
Martina Vožechová	Secretary, laboratory analyses
MUDr. Jana Zemanová	Zooplankton analyses and culture maintenance

Ph.D. STUDENTS:

Mgr. Kateřina Bernardová	Molecular biology of cyanobacteria
Mgr. Martina Čtvrtlíková (from February)	Ecobiology of *Isoëtes* in acidified lakes
Mgr. Vladislav Draštík	Fish behaviour and community structure
Ing. Jiří Jarošík (till February)	Mathematical modelling of reservoirs
Mgr. Tomáš Jůza	Fish sampling and community structure
Mgr. Vojtěch Kasalický	Bacterial-algal interactions
Mgr. Michal Kratochvíl	Ecology of larval and juvenile fish, electrofishing
Mgr. Monika Krolová	Macrophyta in reservoirs
Mgr.Milan Muška (from April)	Fish distribution and scientific echosounder techniques
RNDr. Jindřich Novák	Fish ethology
RNDr. Marie Prchalová	Fish spatial distribution and gillnet selectivity
Mgr. Milan Říha	Fish biology
Mgr. Dagmar Sirová (maternity leave from June)	Benthic cyanobacterial mats
Mgr. Martina Štrojsová	Digestive enzymes of rotifers
Mgr. Jan Turek	Hydrology and water chemistry
Mgr. Eliška Zapomělová	Morphology of cyanobacteria

STUDENT HELP:

Oldřich Jarolím, Bc.

1 INTRODUCTION

1.1 Directors' Preface

Based upon Act No. 283/1992 Coll., on the Academy of Sciences of the Czech Republic, as subsequently amended, and upon Act No. 341/2005 Coll., on public research institutions, and in accordance with the Statutes of the Academy of Sciences of the Czech Republic issued on 24 May 2006, the Biology Centre of the ASCR changed its legal status to a public reserarch institution. This change had low impact on reserarch and particular scientists but significantly increased the amount of administrative.

The basic staff of the institute has remained unchanged as well as the research orientation of the institute. Regular long-term monitoring with some special investigations has continued in the Slapy and Římov reservoirs, and so has the research on lakes in the Bohemian Forest and in the Slovakian and Polish High Tatra Mts. Field research has been supplemented by focused laboratory experiments.

The work on the new Institutional Research Plan "Structure, functioning and development of aquatic ecosystems", approved for the years 2005–2010, continued according the planned schedule. The "Support Programme for targeted research in the AS CR" continues in the Institute of Hydrobiology (IHB) through another project "Limnological basis of sustainable management of reservoirs", approved for the period 2005–2009.

IHB is responsible for one site in the global LTER (long-term ecological research) and GTOS (global terrestrial observing system) networks – "Reservoirs in the Vltava River Watershed". The site is registered in the database of TEMS (Terrestrial Ecosystem Monitoring Site) on the website: www.fao.org/gtos/tems.

Close cooperation of the IHB with the Faculty of Biological Sciences, University of South Bohemia, has continued under similar conditions as in preceding years. Institute members have also been actively engaged supervising students' theses, lecturing and training students at other Faculties (Agriculture and Pedagogical) of the University of South Bohemia and at other Universities (Charles University, Prague, Institute of Chemical Technology, Prague). 1 Bachelor's and 6 MS theses supervised by staff members were completed in 2007 (see list at the end of chapter). Most staff members work part-time for the University of South Bohemia and vice-versa. Students are active in the IHB as student helpers and part-time staff members (see list of staff).

Josef Matěna

1.2 Projects

Institutional project

2005–2010 Reg. code AV0Z60170517, Structure, functioning and development of aquatic ecosystems (J. Matěna)

Program "Support of Targeted Research in the AS CR"

2005–2009 Reg. code 1QS600170504, Limnological basis of sustainable management of reservoirs (J. Matěna)

European Communities R&D Program (6th framework)

2004–2009 Reg. code GOCE-CT-2003-505298, ALTER-NET, A long-term Biodiversity, Ecosystem and Awareness Research Network (V.Straškrábová, coordinated by Natural Environment Research Council, UK)

2004–2009 Reg. code GOCE-CT-2003-505540, EURO-LIMPACS, Integrated Projects to Evaluate the Impacts of Global Change on European Freshwater Ecosystems (J. Kopáček, coordinated by University College London)

Project supported by the "Norwegian financial mechanism"

2007–2011 Reg. code EEA NFM CZ0051, The assesment of impact of the Gothenburg Protocol on acidified and eutrophied soils and waters (J. Kopáček, J. Matěna, coordinated by Czech Geological Survey, Praha)

Projects sponsored by the Grant Agency of the Academy of Sciences of CR

2005–2008 Reg. code IAA600170502, Sinusoidal foraging and the role of fish in reservoirs (J. Matěna)

2006–2008 Reg. code IAA600170602, Regulation of extracellular phosphatase activity in different morphotypes of natural bacterioplankton studied at the single-cell level (J. Nedoma)

2007–2009 Reg. code KJB600960703, Application of combined morphological, ecological and molecular approach in the classification of planktonic representatives of the genus *Anabaena* (Cyanobacteria) (E. Zapomělová)

Projects sponsored by the Grant Agency of CR

2005–2007 Reg. code 206/05/P520, Identification of temporal and spatial arangement of processes of phosphorus cycling (J. Borovec)

2005–2007 Reg. code 206/05/0007, Changes in bacterioplankton structure and functioning in a reservoir related to single-cell activities of major phylogenetic groups of bacteria (K. Šimek)

2006–2008 Reg. code 206/06/1371, Patterns and reasons of different pelagic behaviour of perch fry: novel insight into the declared ecological plasticity of a species (M. Čech)

2006–2008 Reg. code 206/06/P418, Seasonal dynamics of food consumption, growth and production of 0+ fish and their impact on zooplankton in a reservoir with a trophic gradient (M. Vašek)

2006–2008 Reg. code 206/06/0462, Competition relationships among dominant species of phytoplankton in the reservoirs (K. Řeháková)

2006–2008 Reg. code 206/06/0410, Photochemical transformation of metal and phosphorus species in natural waters (J. Kopáček)

2007–2010 Reg. code 206/07/1392, Horizontal acoustic surveys and fish behaviour in the open water(J. Kubečka)

2007–2011 Reg. code 206/07/1200, Constraints and limits of biological recovery from acid stress: What is the future of headwater ecosystems in the Bohemian Forest? (J. Vrba)

2007–2011 Reg. code 206/07/P407, Mixotrophic nutrition of summer phytoplankton species in the Římov Reservoir (P. Znachor)

Projects sponsored by the Ministry of education, youth and sports CR

2007–2008 Reg. code 6-07-2 (KONTAKT, Czech-Austria), Eco-physiological characteristics of two important groups of Betaproteobacteria (K. Šimek)

International projects

2006–2007 Reg. code A 310/06 (Nationalpark Neusiedler See-Seewinkel, Austria), Acoustic fish stock assessment of Neusiedler See (J. Kubečka)

2007 Reg. code 11-OK-07 (Aquason C./San Antonio Claret Barcelona, Spain), The monitoring of a spawning run of shad (*Alosa fallax*) on the River Ebro (J. Kubečka)

1.3 Consultancies

2004–2008 Reg. code 800003, Population monitoring of strictly protected animals (J. Kubečka), Vltava river authority

2006–2007 Reg. code 55/0/06/KUB, Fish stock assessment of Chabařovice coal mine lake, 2006 (J. Kubečka), Mining authority, Ústí nad Labem

2006–2007 Reg. code 56/0/06/KUB, Fish stock assessment of Žlutice, Římov and Nýrsko Reservoirs, 2006 (J. Kubečka), Vltava river authority

2007 The report on monitoring of the Mostiště Reservoir (J. Hezlar), Ministry of agriculture CR

2007 Complex assessment of the fish communities of the Klíčava, Římov and Nýrsko Reservoirs in the year 2007 (J. Kubečka), Vltava river authority

2007 Reg. code 4500039280, Biomanipulative harvest of fish using electroshocker in Bolevecky Pond during spawning period (J. Kubečka, J. Peterka), Plzeň city council

2007 Reg. code 4500039463, Review of the project of the biomanipulation of Bolevecky pond (J. Matěna, J. Hejzlar), Plzeň city council

2007 Reg. code OŽPR/Ra/094/2007, Expert stocking of pikeperch and wels including report elaboration (J. Kubečka, J. Peterka), Mining authority, Ústí nad Labem

2007 Reg. code 202/2007/58, Fish stock estimation in Labe river (J. Frouzová, J. Kubečka), VÚV TGM Praha

2007 Reg. code 1071620111, Analysis and evaluation of nutrient concentrations in aquatic ecosystem (J. Hejzlar, J. Kopáček), PřF UK Praha

2007 Reg. code 23/F/07, Římov reservoir sediments (J. Hejzlar, J. Matěna), 1. JVS České Budějovice

2007–2008 Reg. code OŽPR/Ra/084/2007, Complex estimation of Chabařovice lake fish stock in 2007 (J. Kubečka, J. Peterka), Mining authority, Ústí nad Labem

1.4 Report on Finances

(in thousands CZK)

INCOME	
Balance from preceding year	1 191
Support by the Czech Academy of Sciences (incuding the Priority research program)	17 128
Grants from Grant Agency AS CR	1 509
Grants from Grant Agency CR	7 050
Foreign grants	4 122
Consultancies	1 798
International Conference	1 135
Support by CAS for equipment	1 523
Depreciation	7 806
Dissaving from the "Norvegian funds" for equipment	122
special-purpose fund balance	1 719
TOTAL	45 104
EXPENSES	
SALARIES	14 825
CONSUMABLES	
Health and social insurance, social founds	5 380
Other obligatory insurance of persons and property	196
Energy	794
Gasoline	270
Maintenance of buildings	12
Maintenance of cars and equipment	532
Postage, telephone, and internet	182
Books and journals	608
Travelling and conference fees	1 454
Computing, software	133
Other consumables and small equipment	3 026
Others	1 346
Depreciation	7 806
Special-purpose fund	1 302
Subtotal	*37 864*
EQUIPMENT	
Car - Škoda Fabia Combi	428
Multibeam sonar	1556
Notebook computer	102
Pelagic trawl	106
Atomic absorbtion spectrometer	1803
Electroshocking booming boat	742
Fume hood	89
Multipurpose vehicle for Biology Centre (partial payment)	43
Subtotal	*4 869*
TOTAL	42 733
BALANCE (a fund for equipment)	
Special-purpose fund	1 302
Balance for investment	1 068

1.5 Presentations of Institute Members at International Conferences

10th Symposium on Aquatic Microbial Ecology, University of Algarve, Faro, Portugal, 2–7 Sep 2007. K. Horňák, J. Jezbera, K. Šimek: Potential negative effects of a cyanobacterial bloom on bacterial growth and activity in a eutrophic reservoir (lecture).

K. Šimek, K.M.G. Weinbauer, Horňák, J. Jezbera, J. Nedoma, J.R. Dolan: Synergistic and antagonistic effects of viral lysis and protistan grazing on bacterial production and diversity in a freshwater reservoir (lecture).

J. Jezbera, K. Horňák, K. Šimek: Bacteria belonging to Polynucleobacter cluster in a manipulation experiment versus their seasonal development in a freshwater reservoir (poster).

K.Šimek: New insights on selective feeding of protists (lecture).

J. Nedoma, K. Horňák, K. Šimek, A. Štrojsová, J. Vrba, and P. Znachor: Estimating microbial activity at the single-cell level using digital image analysis (poster).

11th Nordic-Baltic Symposium "Functioning of NOM in Environment", Joensuu, Finland, 10–13 Jun 2007. P. Porcal, A. Amirbahman, J. Kopáček, S.A. Norton: Photochemical release of metals complexing with dissolved organic matter (lecture)

137th Annual Meeting of the American Fisheries Society DIDSON workshop (Sound Metrics Corp), San Francisco, USA, 2–6 Sep 2007. M. Čech, J. Kubečka, V. Draštík, J. Frouzová, M. Kratochvíl, J. Peterka, T. Jůza, M. Prchalová, M. Říha, M. Vašek, E. Hohausová: Are diel vertical migrations of young-of-the-year European perch (*Perca fluviatilis* L.) under direct control of light intensity? Evidence from the large field experiment (lecture).

M. Čech, J. Kubečka, V. Draštík, J. Frouzová, M. Kratochvíl, J. Matěna, J. Jarošík, J. Hejzlar: Hydroacoustic monitoring of the bathypelagic layer of European perch (*Perca fluviatilis* L.) fry: from raw ecological characteristics to particular features of fish behaviour (lecture).

17th Symposium of the International Association for Cyanophyte Research, Merida, Mexico, 25–29 Jun 2007: K. Řeháková, K., J.R. Johansen, M.P. Martin, C.A. Sheil: The secondary structure of the 16S rRNA molecule in cyanobacteria.

K. Řeháková, E. Zapomělová, P. Znachor: Ecology of dominant species in cyanobacterial blooms in the Czech Republic.

E. Zapomělová, J. Komárková, K. Řeháková: Morphological variability of selected Anabaena strains with coiled trichomes in relation to varied light, temperature and N, P concentration.

46th Northeast Algal Symposium, Narragansett, USA, 20–22 Apr 2007. K. Řeháková, . Ecology of dominant species in cyanobacterial blooms in the Czech Republic

4th North American Reservoir Symposium – Balancing Fisheries Management and Water Uses for Impounded River Systems, June 6–9, 2007, Atlanta, USA. M. Prchalová, J. Kubečka, M. Čech, J. Frouzová, M. Hladík, E. Hohausová, J. Peterka, M. Vašek, V. Draštík, M. Říha, T. Jůza, O. Jarolím, M. Tušer: Handling of fish gradients: Towards the precise assessment of the fish assemblages in reservoirs (lecture).

V.Draštík, J. Kubečka, M. Tušer, T. Jůza, O. Jarolím: Spatial distribution of fish in cascade and non-cascade reservoirs in Central Europe (lecture).

7th Conference of fish telemetry, Silkeborg, Denmark, 17–21 Jun 2007, M. Říha, M. Prchalová, J. Kubečka, M. Čech, J. Peterka, M. Vašek, J. Frouzová, E. Hohausová, V. Draštík, T. Jůza, M. Kratochvíl, M. Tušer, O. Jarolím: Using telemetry for monitoring of fish inshore migration.

ALTERnet All Parties Conference, Palma Mallorca, Spain, 5–9 Feb 2007. J. Vrba, Z. Křenová, Z. Fajfr: CZ-LTER – Czech Long-Term Ecological Research Network (poster).

Petr Znachor: Scientific photography, an excellent tool for communication with public (poster).

ALTER-Net Summer School 2007, "Trends in Biodiversity: European Ecosystems and Policy", Haute Provence, France, 1–14 Sep 2007. V. Straškrabová: Biodiversity in aquatic systerms - what are the important drivers and pressures? (invited lecture).

Balaton LTER-Europe Conference & ALTER-net joint meeting: Scientific site-coordinator conference, LTER-Europe conference, Work Package I3 Plenary, Balaton, Hungary 10–15 Jun 2007. V. Straškrábová: AQUACLIM report (oral).

J. Vrba, Z. Křenová, Z. Fajfr: CZ-LTER – Czech Long-Term Ecological Research Network (poster).

COST Action 869: Working Group 3 Meeting: Building a framework where different types of mitigation options fit in. North Wyke, UK. J. Hejzlar, J. Mudruňková: Phosphorus retention in semi-natural and modified reaches of agricultural streams.

COST Action 869: Working Group 1 meeting – Localisation of critical source areas in catchments, Hamar, Norway. J. Hejzlar: Identification of P and N sources in mixed rural catchments.

EIFAC Cormorant Management Plan Workshop Bonn, Germany, 20–21 Nov 2007. M. Čech, P. Čech, J. Kubečka, M. Prchalová, V. Draštík: Size selectivity in summer and winter diets of great cormorant (*Phalacrocorax carbo*): Does it reflect a season dependent difference in foraging efficiency?

M. Čech Die Abschätzung des Fraßdruckes durch Kormorane (*P. carbo*) auf die Ichtyofauna der Flüße und Talsperren in der Tschechischen Republik (Assessment of the predation pressure of great cormorant (*P. carbo*) on fish fauna of rivers and reservoirs in the Czech Republic

Gordon Research Conference – Catchment Science: Interactions of Hydrology, Biology & Geochemistry, New London, NH, USA, 07–13 Jul 2007. J. Kopáček, H. Šantrůčková, M. Svoboda, K. Tahovská, K. Matějka, P. Culín: Nitrogen pools and fluxes in the catchment-lake ecosystem of Plešné Lake (Czech Republic) prior to and after a bark beetle infestation.

S.A. Norton, J. Kopáček, I.J. Fernandez, P. Porcal, A. Amirbahman, T. Wilson, B. Lake, M. SanClements, D. Huntress: Al-Fe-DOC-P Coupling in Forested Ecosystems.

NiRENA Workshop: Nitrogen Retention across Europe and North America, Durham, USA, 13–14 Jul 2007. Kopáček J.: Nitrogen fluxes in two central European mountain areas (the Bohemian Forest & the Tatra Mountains).

SEFS-5 Symposium for European Freshwater Sciences, Palermo, Italy, 9–13 July 2007. P. Znachor, J. Nedoma: Application of PDMPO technique in the study of silica deposition in natural diatom populations in a eutrophic reservoir (poster).

The Seventh Keele Meeting on Aluminium "Living and Life in the Aluminium Age"; 24–28 Feb 2007, Uxmal, Mexico. J. Vrba, J. Kopáček, J. Hejzlar, P. Porcal, S.A. Norton: Photochemical source of aluminum for lakes and its impact on phosphorus cyling (lecture).

J. Vrba, J. Kopáček, L. Nedbalová, J. Fott: A key role of aluminium in phosphorus availability, food web structure, and plankton dynamics in strongly acidified lakes (poster).

Workshop LTER-D St. Oswald, Germany, 26–28 Mar 2007. J. Vrba, Z. Křenová: LTER activities in the BR Šumava and proposals of an international LTSER platform (oral).

J. Vrba, Z. Křenová, Z. Fajfr: CZ-LTER – Czech Long-Term Ecological Research Network (poster).

1.6 Stays & Visits of Institute Members Abroad

J. Borovec, *TU München,* Germany, *UBA* Wien, Austria, 6–20 Jul 2007 (AlterNet workshop), *TU Delft,* The Netherlands, *UFZ* Magdeburg, Germany, 8–12 Oct 2007, *University of California,* Davis, USA, Prof. Eliška Rejmánková, 30 Nov 2006 – 25 Jan 2007 (project preparation).

M. Čech, *University of Vienna, Institute for Ecology,* Austria, 14–18 Apr, 6–11 Jun 2007 (Didson workshop, introduction to a new generation of echosounders), *Austrian Standards Institute*, Austria, 13–14 Jun 2007 (CEN, Possibilities of creating european standard for Fish monitoring using SEINING).

J. Draštík, *Biologische station Neusiedler See*, Illmitz, Austria, 30 Jul – 5 Aug 2007 (Nesider lake, sampling), *University of Vienna, Institute for Ecology*, Austria, 6–11 Jun 2007 (Didson workshop, introduction to a new generation of echosounders), *Austrian Standards Institute*, Austria, 13–14 Jun 2007 (Possibilities of creating european standard for Fish monitoring using SEINING).

E. Hohausová, *Estacion Biologica de Donana,* Sevilla, Spain, Dr. Jordi Figuerola, 8–22 Oct 2007 (project preparation).

J. Frouzová, *University of Oslo*, Norway, Dr. Helge Balk, 30–12 Jul 2007 (consultation, data processing, SONAR 5 software upgrade), *Biologische station Neusiedler See*, Illmitz, Austria, 30–5 Aug 2008 (sampling), *University of Vienna, Institute for Ecology*, Austria, 6–11 Jun 2007 (Didson workshop, introduction to a new generation of echosounders), *Austrian Standards Institute*, Austria, 13–14 Jun 2007 (CEN, Possibilities of creating european standard for Fish monitoring using SEINING).

J. Hejzlar, Greece, 12–17 Jun 2007 (CECILIA project workshop – 6th FW EU, No. 037005).

K. Horňák, *Zurich University, Limnological station, Institute of Plant Biology*, Switzerland, Prof. Jakob Pernthale, Dr. Thomas Posch, 31 Jan – 4 Feb 2007 (post-doc stay preparation).

O. Jarolím, *Biologische station Neusiedler See*, Illmitz, Austria, 30 Jul – 5 Aug 2007 (Nesider Lake sampling).

T. Jůza, *Biologische station Neusiedler See*, Illmitz, Austria, 30 Jul – 5 Aug 2007 (Nesider Lake sampling).

J. Kaňa, Germany, 3–5 Sep 2007 (lake sampling: Gr. Arbersee, Kl. Arbersee, Rachelsee), *Štátné Lesy TANAPu* Tatranská Lomnica, Slovakia, and *TPN*, Zakopane, Poland, 18–25 Sep 2007 (Tatra mountains lake sampling).

V. Kasalický, *Institute for Limnology of the Austrian Academy of Sciences*, Mondsee, Austria, Dr. Martin Hahn, 28 Nov – 4 Dec 2007, (phenotypic characterization of R-BT065 isolates) & 15–25 Oct 2007 (joint experiment), *Institute of Biology of Inland Waters, Russian Academy of Sciences* Russia, Dr. A. Kopylov, I. Stolbunov, D. Kosolapov, N. Mineeva, A. Litvinov, prof. Pyrina, 4–20 Aug 2007 (field expedition Volga River, Beloe ozero, Šeksninsk and Rybinsk reservoirs).

J. Kopáček, Germany, 3–5 Sep 2007 (lake sampling: Gr. Arbersee, Kl. Arbersee, Rachelsee), *KUBUS*, Leipzig, Germany, 16–20 Mar 2007 (Workshop), *Štátné Lesy TANAPu* Tatranská Lomnica, Slovakia, and *TPN*, Zakopane, Poland, 18–25 Sep 2007 (Tatra mountains lake sampling).

M. Kratochvíl, *Hans Grassl GmbH company*, Schönau am Königssee, Germany, (transport of electroshocking aggregate), *Biologische station Neusiedler See*, Illmitz, Austria, 30 Jul – 5 Aug 2007 (Nesider Lake sampling).

J. Kubečka, *University of Vienna, Institute for Ecology*, Austria, 6–11 Jun 2007 (Didson workshop, introduction to a new generation of echosounders), *Austrian Standards Institute*, Austria, 13–14 Jun 2007 (Possibilities of creating european standard for Fish monitoring using SEINING), *Biologische station Neusiedler See*, Illmitz, Austria, 30 Jul – 5 Aug 2007 (Nesider Lake sampling), *University of Vienna, Institute for Ecology*, Austria, 7–8 Dec 2007 (PhD thesis defence, G. Rakowicz).

M. Muška, *University of Vienna, Institute for Ecology,* Austria, 14–18 Apr, 6–11 Jun 2007 (Didson workshop, introduction to a new generation of echosounders), *Austrian Standards Institute*, Austria, 13–14 Jun 2007 (CEN, Possibilities of creating european standard for Fish monitoring using SEINING).

J. Peterka, *Hans Grassl GmbH company*, Schönau am Königssee, Germany (transport of electroshocking aggregate).

Z. Prachař, *Biologische station Neusiedler See*, Illmitz, Austria, 30 Jul – 5 Aug 2007 (Nesider Lake sampling).

V. Straškrábová, *At-Bristol, Bristol, Science Visitor Centrum Wildwalk,* Rachel Murray, UK, 11–14 Mar 2007 (Network Management Group meeting ALTER-net), *Institute of Biology of Inland Waters, Russian Academy of Sciences* Russia, Dr. A. Kopylov, I. Stolbunov, D. Kosolapov, N. Mineeva, A. Litvinov, Prof. Pyrina, 4–20 Aug 2007 (field expedition Volga River, Beloe ozero, Šeksninsk and Rybinsk reservoirs), *International Centre of Ecology, Polish Academy of Sciences, Department of Agriculture,* Turew, Poland, 8–11 May (Workshop R2 Alternet), *Polar Environment Center (Polarmiljøsenteret),* Tromsoe, Norway, 23–26 Mar 2007 (ALTERnet Council), *University of Bucharest, Station Sinaia*, Sinaia, Romania, 30–2 Jun 2007 (BIOLIM network, ALTERnet project).

K. Šimek, *Institute for Limnology, Austrian Academy of Sciences,* Mondsee, Austria, Dr. Martin W. Hahn, 15–25 Oct 2007 (joint experiments), *Institut de Ciències del Mar-CMIMA, CSIC,* Barcelona, Spain, Dr. Josep M Gasol, 5–11 Nov 2007 (paper preparation), *Zurich University, Limnological station, Institute of Plant Biology*, Switzerland, Prof. Jakob Pernthaler, Dr. Thomas Posch, 31 Jan – 4 Feb 2007 (post-doc stay preparation, joint experiment preparation, lecture: K. Šimek, K. Horňák, J. Jezbera, J. Nedoma, M. G. Weinbauer, J. R. Dolan: Synergistic and antagonistic effects of viral lysis and protistan grazing on bacterial production).

M. Tušer, AQUASON *Advanced Technology, Research and Consulting in Aquatic Habitats*, Barcelona, Spain, Dipl.-Biol. Patrick Schneider 1–17 Jun 2007 (Implementation of imaging sonar technology).

M. Vašek, *Biologische station Neusiedler See*, Illmitz, Austria, 30 Jul – 5 Aug 2007 (Nesider Lake sampling).

J. Vrba, Germany, 3–5 Sep 2007 (lake sampling: Grosser Arbersee, Kleiner Arbersee, Rachelsee), Germany, 9–10 Oct 2007 (benthos sampling: Grosser Arbersee, Kleiner Arbersee, Rachelsee).

1.7 Foreign Visitors to Hydrobiological Institute

Bernard Cosby, USA, University of Virginia.

Albrecht Gnauck, Germany, Brandenburgische Technische Universität, Cottbus.

Martin Hahn, Austria, Institute for Limnology, Austrian Academy of Sciences, Mondsee.

Natalya Mikhaylovna Mineeva, Russia, Institute of Inland Water Biology, Russian Academy of Sciences.

Filip Moldan, Sweden, Swedish Environment Research Institute (IVL).

Thomas Posch, Switzerland, University of Zurich, Department of Limnology, Kilchberg.

Richard Wright, Norway, NIVA.

1.8 Students' Theses Finished in 2007

Mgr. (M.Sc.)

Jiří Jan: Effects of Al^{3+} and Fe^{3+} treatment on phosphorus retention and fraction composition in the sediment of a shallow eutrophic reservoir (*Faculty of Science, University of South Bohemia, supervised by J. Borovec*).

Júlia Mudruňková: Transport and retention of phosphorus in small streams: the Radimovický stream study (*Faculty of Science, University of South Bohemia, supervised by J. Hejzlar*).

Milan Říha: Long-term development of fish populations in the Římov reservoir (*Faculty of Science, University of South Bohemia, supervised by J. Kubečka*).

Michal Šorf: Animal component in a diet of two *Eudiaptomus* species (Copepoda: Calanoida) (*Faculty of Science, University of South Bohemia, supervised by Z. Brandl*).

Michal Tušer: Fish orientation along the longitudinal profile of the Římov reservoir (*Faculty of Science, University of South Bohemia, supervised by J. Kubečka*).

Ivana Vaníčková: Spatial heterogeneity and species distribution of *Daphnia* resting eggs in sediment of reservoirs (*Faculty of Science, University of South Bohemia, supervised by J. Seďa*).

Bc. (B.A.)

Petr Kotas: Importance of benthic and epiphytic algae in the phosphorus budget in Nýrsko Reservoir (*Faculty of Science, University of South Bohemia, supervised by J. Hejzlar*).

2 RESERVOIRS

2.1 Regular Monitoring of the Reservoirs Slapy and Římov: Dissolved and Dispersed Substances in 2007

Annual and summer mean concentrations of chemical constituents dissolved and dispersed in the surface layers of the Slapy and Římov reservoirs (**Table 1**) were obtained by ***J. Hejzlar*** and ***J. Kopáček***. Samples were taken from 0.1 to 0.4 m depth at the deepest points of the reservoirs in three-week intervals, pre-filtered through a 200-µm polyamide sieve to remove large zooplankton, stored in the dark at 4°C, and analysed within 48 h after sampling. Dissolved constituents were analysed in samples filtered through a glass fibre filter with 0.4 µm nominal pore size.

Table 1: Mean values of main chemical constituents dissolved and dispersed in the waters of Slapy Reservoir and Římov reservoir in 2007. Abbreviations: TON, total organic nitrogen; DON, dissolved organic nitrogen; TN total nitrogen; TP, total phosphorus; TDP, total dissolved phosphorus; COD, chemical oxygen demand; DOC and POC, dissolved and particulate organic carbon, respectively. Summer: April–September.

VARIABLES	UNIT	MEAN VALUES			
		Slapy		Římov	
		Annual	Summer	Annual	Summer
NO_3-N	µg l^{-1}	1481	1455	1084	922
NO_2-N	µg l^{-1}	18	28	18	29
NH_4-N	µg l^{-1}	21	25	23	22
TON	µg l^{-1}	629	677	514	555
DON	µg l^{-1}	542	237	438	438
TN	µg l^{-1}	2149	2185	1639	1528
TP	µg l^{-1}	36.2	25.5	25.0	22.6
TDP	µg l^{-1}	26.6	13.7	16.5	11.6
COD	mg l^{-1}	22.9	23.5	18.5	17.7
DOC	mg l^{-1}	5.86	5.21	5.41	4.79
POC	mg l^{-1}	0.54	0.79	0.55	0.80
Ca^{2+}	mg l^{-1}	17.7	17.9	10.4	10.5
Mg^{2+}	mg l^{-1}	4.9	5.0	2.5	2.5
Na^{+}	mg l^{-1}	10.2	10.3	6.4	6.6
K^{+}	mg l^{-1}	3.6	3.4	2.2	2.2
SO_4^{2-}	mg l^{-1}	22.4	24.2	14.7	15.4
Cl^{-}	mg l^{-1}	13.0	13.9	5.7	6.2
Alkalinity (Gran titration)	meq l^{-1}	0.83	0.83	0.48	0.50
Conductivity at 25 °C	µS cm^{-1}	200	201	121	123

2.2 Regular Monitoring of the Reservoirs Slapy and Římov: Microbial Characteristics, Chlorophyll and Zooplankton Biomass in 2006

Annual and summer mean concentrations of bacteria, protozoans, microzooplankton, BOD_5 (total and after separating algae by filtration) as well as chlorophyll concentrations in the reservoirs and inflows to Římov Reservoir, and mesozooplankton biomass in the reservoirs, based on data by ***Z. Brandl, J. Komárková, M. Macek, R. Malá, A. Hartmanová, Z. Prachař, J. Seďa, K. Šimek, M. Štojdlová, V. Straškrábová, M. Štrojsová,*** and ***M. Vožechová*** are shown in **Table 2**.

Table 2: Mean values of microbial characteristics, zooplankton, chlorophyll and BOD in the Slapy and Římov Reservoirs and inflows. Abbreviations: S, Slapy Reservoir; R, Římov Reservoir; C, Černá River; M, Malše River (Římov Reservoir tributaries). Summer: April–September.

SITE	VARIABLE	LAYER	UNIT	MEAN VALUE	
				Annual	Summer
S	BOD_5	0 m	mg l^{-1} O_2	1.68	1.87
	BOD_5 filtered	0 m	mg l^{-1} O_2	–	1.19
	bacteria DAPI	0 m	10^6 ml^{-1}	3.57	4.89
	bact. beef-pept. agar	0 m	CFU ml^{-1}	170	209
	het. nanoflagellates	0 m	10^3 ml^{-1}	1.17	1.61
	ciliates	0–3 m	per ml	4.49	7.09
	chlorophyll *a*				
	total	0–3 m	mg m^{-3}	7.27	12.64
	>40 µm	0–3 m	mg m^{-3}	4.35	7.20
	zooplankton biomass, protein N				
	Cladocera herbiv.	0–41 m	mg m^{-2}	95.9	140.2
	Copepoda	0–41 m	mg m^{-2}	42.6	56.2
	total zooplankton	0–41 m	mg m^{-2}	143.5	205.4
R	BOD_5	0 m	mg l^{-1} O_2	1.78	1.82
	BOD_5 filtered	0 m	mg l^{-1} O_2	–	1.29
	bacteria DAPI	0 m	10^6 ml^{-1}	3.03	3.69
	bact. beef-pept. agar	0 m	CFU ml^{-1}	179	163
	bact. yeast ext. agar	0 m	10^3 CFU ml^{-1}	0.5	0.5
	het. nanoflagellates	0 m	10^3 ml^{-1}	1.02	1.59
	ciliates	0–4 m	per ml	7.56	7.88
	rotifers	0–4 m	per ml	0.323	0.548
	nauplii	0–4 m	per ml	0.023	0.036
	chlorophyll *a*				
	total	0–4 m	mg m^{-3}	8.54	14.54
	>40 µm	0–4 m	mg m^{-3}	4.88	8.07
	zooplankton biomass, protein N				
	Cladocera herbiv.	0–40 m	mg m^{-2}	66.8	80.1
	Copepoda	0–40 m	mg m^{-2}	49.5	73.4
	total zooplankton	0–40 m	mg m^{-2}	118.8	158.5
C	BOD_5	0 m	mg l^{-1} O_2	2.06	2.23
	chlorophyll *a*	0 m	mg m^{-3}	7.41	10.49
M	BOD_5	0 m	mg l^{-1} O_2	1.98	2.05
	chlorophyll *a*	0 m	mg m^{-3}	7.46	10.89

2.3 Regular Monitoring: Fish Stock Composition in the Římov Reservoir in 2007

In 2007, the fish stock of the Římov Reservoir was not sampled using night seining as in many previous years. The reason was on extremely low water level, which prevented seining due to exposure of thick layers of mud on most of the traditional sampling locations. Estimation derived from samples from locations without mud would result in biased findings due to distinct gradient of fish spatial distribution along the longitudinal axis of the reservoir [1, 2]. Therefore, ***M. Prchalová*** (*salmo@bf.jcu.cz*), ***M. Říha*** and ***J. Kubečka*** developed simple relationship between seine net catch and gillnet catch in adjacent littoral areas of the reservoir for fish older than 0+. This relationship was then used for the conversion of gillnet catch into results directly comparable to seining. Gillnet sampling has been used as standard monitoring method of the Římov Reservoir since 1999.

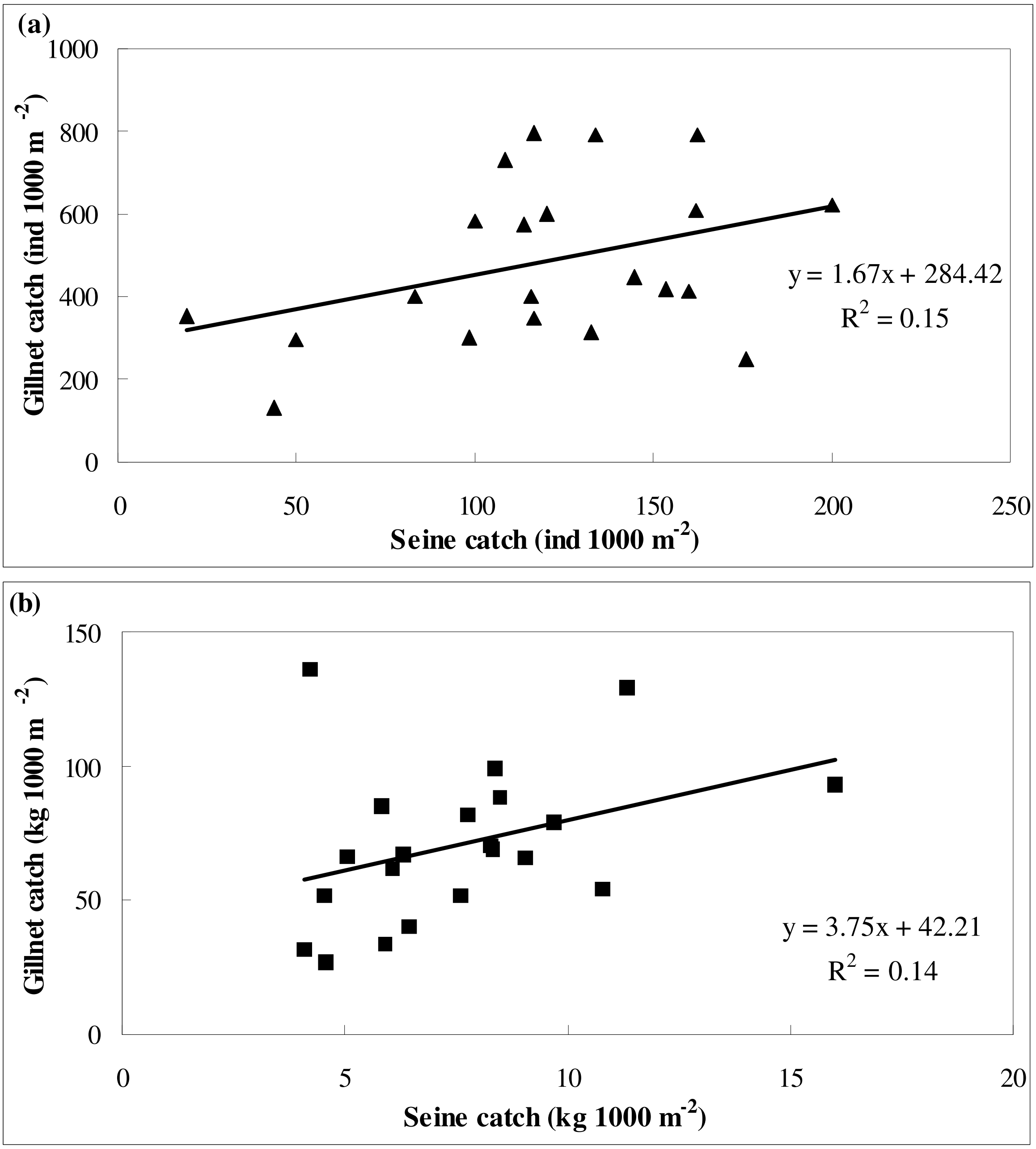

Fig. 1: Relationship between total seine and gillnet catch expressed as abundance (a; ind 1000 m^{-2} of sampled area and ind 1000 m^{-2} of gillnets) and as biomass (b; kg 1000 m^{-2} of sampled area and kg 1000 m^{-2} of gillnets).

Gillnet sampling was carried out on 7th August 2007. Fieldwork was performed by ***J. Kubečka, P. Blábolil, E. Bouše, M. Čech, V. Draštík, J. Frouzová, T. Jůza, O. Jarolím, M. Kratochvíl, J. Peterka, M. Prchalová, Z. Prachař, M. Říha, M. Vašek, L. Veselý*** and ***L. Vejřík.*** Benthic gillnets constructed according to European Standard Document EN 14 757 [3] were used. Gillnets consisted of 16 mesh sizes – 5, 6.25, 8, 10, 12.5, 15.5, 19.5, 24, 29, 35, 43, 55 mm (knot-to-knot) as in EN 14 757 and four larger mesh sizes 70, 90, 110 and 135 mm – panel length was 2.5 m. The depth of the installation, 2–3 m, was measured using a depth gauge. Gillnets were set shortly before dusk and lifted after dawn, i.e. the soak time was approximately twelve hours. Gillnet and seine data from the period 2004–2006 were used for developing the relationship between catches of the two gear.

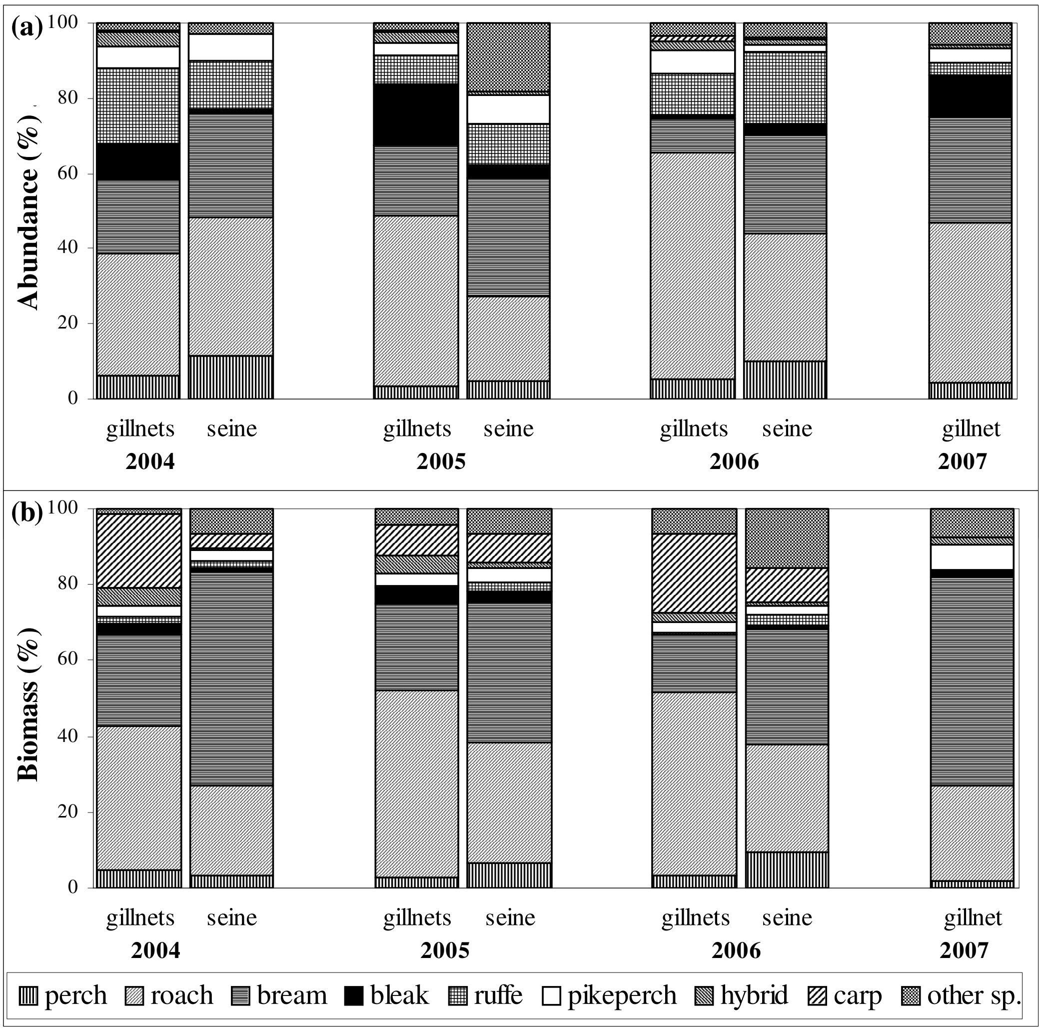

Fig. 2: Species composition of gillnet and seine catches in years 2004–2007 in terms of abundance (a) and biomass (b).

Data from seine and gillnet catches from individual sampling locations along the longitudinal reservoir axis were plotted against each other (**Fig. 1**). The equations of linear relationship were calculated and were displayed directly into the pictures together with the regression coefficient. The abundance and biomass of a hypothetical seine catch in 2007 were then derived using these equations. Consequently, composition of the fish stock was calculated using composition from the gillnet catch (**Table 3**). Proportions of species in gillnet catches were firstly corrected for species selectivity as perch has been found to be overestimated in gillnet sampling [4].

The total hypothetical abundance was 825 fish ha^{-1} and total hypothetical biomass was 77 kg ha^{-1}, which corresponded to the total gillnet catch of 422 fish 1000 m^{-2} of gillnets and 71 kg 1000 m^{-2} of gillnets. Total biomass was similar to biomasses derived from seine sampling in 2004 and 2005 (86 and 77 kg ha^{-1}, respectively). However, total abundance was much lower than abundances estimated using seine catches in the three previous years (2358, 1639 and 2050 in 2004, 2005 and 2006, respectively).

Table 3: Species composition of the hypothetical seine catch (column 3 and 4) and of real gillnet catch in the Římov Reservoir in 2007.

Common (Latin) name	Real gillnet catch		Calculated seine catch		Percentage	
	ind per 1000 m^{-2}	kg per 1000 m^{-2}	ind ha^{-1}	kg ha^{-1}	ind ha^{-1} %	kg ha^{-1} %
Perch *(Perca fluviatilis)*	17.4	1.4	34.1	1.5	4.1	2.0
Roach *(Rutilus rutilus)*	180.6	17.9	352.9	19.4	42.8	25.2
Bream *(Abramis brama)*	119.4	38.9	233.4	42.2	28.3	54.9
Chub *(Leuciscus cephalus)*	2.9	2.4	5.7	2.6	0.7	3.4
Asp *(Aspius aspius)*	2.9	0.5	5.7	0.6	0.7	0.7
Bleak *(Alburnus alburnus)*	46.6	1.2	91.1	1.3	11.0	1.7
Ruffe *(Gymnocephalus cernuus)*	14.6	0.1	28.5	0.1	3.4	0.2
Pikeperch *(Sander lucioperca)*	14.6	4.5	28.5	4.9	3.4	6.4
Hybrid *(Abramis × Rutilus)*	5.8	1.6	11.4	1.8	1.4	2.3
White bream *(Abramis bjoerkna)*	17.5	2.3	34.1	2.5	4.1	3.2
Total	422	71	825	77	100	100

Species composition of gillnet and seine catches was similar in terms of abundance as well as biomass in all the years compared (**Fig. 2**). In 2007, more than 70% of the abundance and more than 80% of the biomass was represented by roach and bream. The proportion of piscivorous species (asp, pike and pikeperch) was low and represented less than 5% in abundance and 8% in biomass.

The results of the assessment of the fish stock of the Římov Reservoir in 2007 have shown that no apparent change of the reservoir fish community was taken place and that the community persists in a climax state, which is characterized by the stable dominance of cyprinid species.

[1] Vašek, M., Kubečka, J., Peterka, J., Čech, M., Draštík, V., Hladík, M., Prchalová, M., Frouzová, J., 2004. Longitudinal and vertical spatial gradients in the distribution of fish within a canyon-shaped reservoir. Int. Rev. Hydrobiol. 89: 352–362.

[2] Vašek, M., Kubečka, J., Matěna, J., Seďa, J., 2006. Distribution and diet of 0+ fish within a canyon-shaped European reservoir in late summer. Int. Rev. Hydrobiol. 91: 178–194.

[3] European standard EN 14 757, 2005. Water quality – Sampling of fish with multimesh gillnets, CEN TC 230, March 2005.

[4] Prchalová, M., Kubečka, J., Říha, M., Litvín, R., Čech, M., Frouzová, J., Hladík, M., Hohausová, E., Peterka, J., Vašek, M., 2008. Overestimation of percid fishes in gillnet sampling. Fish. Res. 91: 79–87.

2.4. Changes in Bacterioplankton Structure and Functioning in a Reservoir Related to Single-Cell Activities of Major Phylogenetic Groups of Bacteria

During the period 2005–2007, ***K. Šimek*** *(ksimek@hbu.cas.cz)*, ***J. Hejzlar, K. Horňák***, ***J. Jezbera, V. Kasalický, J. Nedoma, V. Straškrabová*** (IHB) and ***M. Hahn*** (Institute for Limnology, Austrian Academy of Sciences, Mondsee, Austria) co-operated intensively on the GACR 206/05/0007 research project awarded to K. Šimek.

The project investigated linkages between diversity (i.e. community composition) and function (i.e. biogeochemical role) of bacterioplankton through specific studies of the dynamics, ecological role and processes mediated by key groups or species of bacteria in the canyon-shaped Římov reservoir. To significantly deepen our knowledge in this field and to characterize relevant members of bacterioplankton communities, we explored various isolation and cultivation techniques, approaches allowing analysis of single bacterial cells as well as advanced molecular biology approaches [1–3, 5, 7, 11]. Manipulating nutrient availability and grazing pressure *in situ* we conducted a large set of specific experiments where different size fractions of plankton were exposed in dialysis bags in nutrient distinctly limited parts of the reservoir [see 1–5, 7, 10, 15].

Overall, the project allowed: (i) to isolate and determine relevant and metabolically highly active members of the bacterioplankton community [5, 15], (ii) to examine the major eco-physiological traits determining their ecological relevance and competitiveness in situ [2, 4, 5, 10], and (iii) to analyze specific interactions of bacteria, algae, protists and cyanobacteria on a species, genus or phylotype level of taxonomic resolution [1–9, 11–15].

The results of the project contributed to our understanding why and under which environmental conditions particular bacterial groups or species overgrow others and take over the role of the principal dissolved organic carbon transformers and nutrient remineralizers in the reservoir [2, 5, 14, 15]. The project profited from broad international collaboration with five European scientific institutions (in Austria, France, Germany, Spain and Switzerland) and has resulted in 14 already published or accepted papers in the core journals in the field (see below [1–14]); another paper has been submitted [15]. Besides, the project supported 4 successful PhD theses.

The most important papers published in impacted journals with the support of the 206/05/0007 grant:

[1] Jezbera, J., Horňák, K., Šimek, K., 2005. Food selection by bacterivorous protists: insight from the analysis of the food vacuole content by means of fluorescence in situ hybridization. FEMS Microbiol. Ecol. 52: 351–363.
[2] Šimek, K., Horňák, K., Jezbera, J., Mašín, M., Nedoma, J., Gasol, J.M., Schauer, M., 2005. Influence of top-down and bottom-up manipulations on the R-BT065 subcluster of β-proteobacteria, an abundant group in bacterioplankton of a freshwater reservoir. Appl. Environ. Microbiol. 71: 2381–2390.
[3] Jezbera, J., Horňák, K., Šimek, K., 2006. Prey selectivity of bacterivorous protists in different size fractions of reservoir water amended with nutrients. Environ. Microbiol. 8: 1330–1339.
[4] Šimek, K., Horňák, K., Jezbera, J., Nedoma, J., Vrba, J., Straškrábová, V., Macek, M., Dolan, J.R., Hahn, M.W., 2006. Maximum growth rates and possible life strategies of different bacterioplankton groups in relation to phosphorus availability in a freshwater reservoir. Environ. Microbiol. 8: 1613–1624.
[5] Horňák, K., Jezbera, J., Nedoma, J., Gasol, J.M., Šimek, K., 2006. Bacterial leucine incorporation under different levels of resource availability and bacterivory in a freshwater reservoir. Aquat. Microb. Ecol. 45: 277–289.

[6] Weinbauer, M.G., Horňák, K., Jezbera, J., Nedoma, J., Dolan, J.R., Šimek, K., 2007. Synergistic and antagonistic effects of viral lysis and protistan grazing on bacterial biomass, production and diversity. Environ. Microbiol. 9: 777–788.
[7] Šimek, K., Weinbauer, M.G., Horňák, K., Jezbera, J., Nedoma, J., Dolan, J.R., 2007. Grazer and virus-induced mortality of bacterioplankton accelerates development of *Flectobacillus* populations in a freshwater community. Environ. Microbiol. 9: 789–800.
[8] Jezberová, J., Komárková, J. 2007. Morphological transformation in a freshwater *Cyanobium* sp. induced by grazers. Environ. Microbiol. 9: 1858–1862.
[9] Jezberová, J., Komárková, J. 2007. Morphometry and growth of three *Synechococcus*-like picoplanktic cyanobacteria at different culture conditions. Hydrobiologia 578: 17–27.
[10] Posch, T., Mindl, B., Horňák, K., Jezbera, J., Salcher, M.M., Sattler, B., Sonntag, B., Vrba, J., Šimek, K., 2007. Biomass reallocation within freshwater bacterioplankton induced by manipulating phosphorus availability and grazing. Aquat. Microb. Ecol. 49: 223–232.
[11] Grossart, H.P., Jezbera, J., Horňák, K., Hutalle, K.M.L., Buck, U., Šimek, K. 2008. Top-down and bottom-up induced shifts in bacterial abundance, production, and community composition in an experimen-tally divided humic lake. Environ. Microbiol. 10: 635–652.
[12] Znachor, P., Nedoma, J. 2008. Application of the PDMPO technique in studying silica deposition in natural populations of *Fragilaria crotonensis* (*Bacillariophyceae*) at different depths in a eutrophic reservoir. J. Phycol. 44: 518–525.
[13] Znachor, P., Zapomělová, E., Řeháková, K., Nedoma, J., Šimek, K., 2008. The effect of extreme rainfall on summer succession and vertical distribution of phytoplankton in a lacustrine part of a eutrophic reservoir. Aquat. Sci. 70: 77–86.
[14] Šimek, K., Horňák, K., Jezbera, J., Nedoma, J., Znachor, P., Hejzlar, J., Seďa, J., 2008. Spatio-temporal patterns of bacterioplankton production and community composition related to phyto-plankton composition and protistan bacterivory in a dam reservoir. Aquat. Microb. Ecol. 51: 249–262.
[15] Horňák, K., Jezbera, J., Šimek, K., 2008. Effects of a *Microcystis aeruginosa* bloom and bacterivory on bacterial abundance and activity in a eutrophic reservoir. Aquat. Microb. Ecol. 52: 107–117.

2.5 Bacterial Leucine and Glucose Incorporation in the Římov Reservoir

K. Horňák (*hornak@hbu.cas.cz*) analyzed bacterioplankton community composition and metabolic activity over the seasonal succession of dominant planktonic groups in the Římov reservoir in 2005. Untreated samples were collected from a depth of 0.5 m in 3-week intervals (29 March–15 November) from 3 different stations along the longitudinal axis of the reservoir. The stations were located close to the dam area, in the middle part and in the river inflow. They are further dessignated as Dam, Middle and River, respectively. The stations displayed a strong gradient in phosphorus concentrations, decreasing from River down to Dam, while water temperature showed the opposite trend. Fluorescence *in situ* hybridization was used to identify the major bacterial groups. Bacterial leucine and glucose incorporation was determined by microautoradiography.

The relative abundance and proportion of bacteria taking up leucine (Leu^+ cells) and/or glucose (Glc^+ cells) of *Betaproteobacteria* (BET), R-BT065 subcluster of BET (RBT), *Cytophaga-Flavobacterium* lineage (CF) and *Actinobacteria* (ACT) were followed. BET was the most abundant group in the total bacterial community and ranged from 15 to 40%. The percentage of the RBT cluster varied from 7 to 28%, forming the vast majority of total BET over the sampling campaign. The CF group accounted for 5 to 25% and dominated in all stations especially between March and August. The abundance of ACT ranged from 5 to 40%. Between August and November ACT temporarily became the most abundant group.

Overall, 65 to 72% of BET and 85 to 91% of RBT bacteria incorporated leucine but no significant seasonal or spatial differences were found. 56 to 92% of ACT and only 16 to 33% of the total CF incorporated leucine. In contrast to BET and RBT, the latter groups (ACT and CF), showed a strong spatial gradient with the highest fractions of Leu^+ cells in River. The incorporation of glucose demonstrated a significantly different pattern compared with leucine incorporation. ACT displayed the highest percentage of Glc^+ cells (77 to 87%) at all stations over the whole season. Members of BET, RBT and CF groups showed mutually similar trends in their fractions of Glc^+ cells, ranging from 15 to 56%. Interestingly, the latter three groups also revealed significant differences between the stations with maximal fractions of Glc^+ cells found in River.

The results show that fractions of Leu^+ and Glc^+ cells differ significantly even among the major bacterial groups. BET and RBT groups dominate in leucine incorporation while members of ACT are involved mainly in glucose uptake. Although the results revealed almost no seasonal variability in the uptake of both substrates by bacteria, clear differences were found between the stations pointing at the strong spatial variability in the canyon-shaped Římov reservoir.

2.6 Pelagic Bacterial Assemblages in the Upper Volga River Reservoirs

V. Straškrábová *(verastr@hbu.cas.cz)* and ***V. Kasalický*** participated in the expedition to the upper Volga River catchment (Beloye ozero, Sheksna and Rybinsk Reservoir), organized by ***A. Kopylov*** and co-workers from the Institute of Inland Waters, Russian Academy of Sciences in Borok (Yaroslavl District). The visit was supported by the Exchange Programme between the Czech and Russian Academy of Sciences. The main aim was to characterize pelagic food webs, especially microbial ones. The cruise on the research vessel ("Akademik Topchiev") took 8 days, 13 scientists plus the crew were on board and 33 sites were sampled.

Beloye ozero ("White Lake"), a large and shallow lake with an area of 1284 km^2 and mean depth of only 4.1 m (maximum depth 6.3 m) was the northern most part of the expedition. River Sheksna flowing out of the lake southwards is impounded before entering the Rybinsk Reservoir, and forms a narrow riverine reservoir, 167 km long with a mean depth 3.9 m (maximum depth 17 m). The southernmost part – Rybinsk Reservoir is a large impoundment (4550 km^2 area, mean depth 3.9 m, maximum depth 30.4 m) constructed on the Volga River at its confluence with two tributaries – Sheksna and Mologa (from north-east and north-west, respectively).

The large reservoir is heterogeneous, being influenced by the Volga River in its southern part only, whereas the tributaries form two long arms. The water masses of Beloye ozero and of the upper part of Sheksna had a conductivity of around 100–140 $\mu S\ cm^{-2}$, whereas in all other parts it was higher: 190–200 $\mu S\ cm^{-2}$.

Sampling was performed in August 2007, the weather was warm and sunny. Due to low depth and high exposition to wind, there was almost no thermal stratification (bottom layer 1–2°C colder than the surface) and the water column was rather homogeneous. Oxygen depletion above bottom was found at the deepest sites only: 50% of saturation. Only surface layer samples were analyzed from each site. At all sites, pH was above 7 and reached the value of 10 at sites measured at noon during high photosynthetic activity.

Our own data include total abundances of bacteria (DAPI counts), autotrophic picoplankton (APP – mostly cyanobacteria) and bacteria groups determined by the CARD-FISH method (fluorescence in situ hybridization). Up to now, only part of the samples have been elaborated microscopically. The following groups of bacteria were determined: beta-Proteobacteria with subgroups R-Bt and Polynucleobacter (Pnec), gama-Proteobacteria, Cytophaga-Flavobacterium (Cyto/Flavo) group, Actinobacteria, and Archea (**Table 4**).

Actinobacteria were the most numerous group throughout the whole survey, their percentage exceeded even that of beta-Proteobacteria. A considerable occurrence of Actinobacteria and also Archea in the whole investigated system, could be due to the high contact (wind mixing and water level fluctuation) of the shallow waters with sediment and surrounding soils and wetlands. The highest abundances of Archea were observed in the Mologa arm (surrounded by wetlands), and in deep places of the southern Rybinsk reservoir under the direct influence of the Volga River. Abundances of beta-Proteobacteria were directly, but insignificantly correlated with temperature and chlorophyll concentrations at the sites sampled.

Table 4: Chlorophyll (by N. Mineeva) and bacteria in different parts of the reservoirs' system. Bacterial groups determined by FISH are expressed as % of DAPI counts.

	Beloye ozero	Sheksna Res.	Rybinsk Res. Sheksna arm	Rybinsk Res. Mologa arm	Rybinsk Res. middle and South (Volga)
Chl *a* μg l^{-1}	5–22	3–14	5–24	6–26	6–12
APP 10^6 ml^{-1}	0.1–0.3	0.2	0.08–0.2	0.1–0.2	0.1–0.2
DAPI bact. 10^6 ml^{-1}	2.9–5.1	3.4–5.0	3.0–5.7	3.4–5.1	2.8–3.6
BetaProteob	6–15	5–24	12–20	15–20	13–17
R-Bt	2.5–8.5	2.0–8.0	4.0–8.5	4.0–5.0	3.0–5.0
Pnec	0.05–0.60	0.3–2.0	0.5–1.0	0.3–1.5	0.6–2.5
GamaProteob	0.2–1.0	0.2–2.0	0.2–1.0	0.5–1.5	0.9–1.4
Cyto/Flavo	2–7	2–9	2–9	3–11	2–7
Actinobac	17–31	24–39	19- 34	28–53	19–25
Archea	4–13	5–11	5–11	10–15	6–24

2.7 Late Summer Vertical Distribution of Five Fish Species within Epipelagic Waters of a Stratified Reservoir

M. Vašek (mojmir.vasek@seznam.cz) analysed gillnet data to evaluate vertical distribution of fish within epilimnetic/metalimnetic waters of the Římov Reservoir. The data were collected in late summer, when steep thermal and oxygen gradients had developed in the reservoir and the majority of pelagic fish were concentrated in the upper few meters of the water column. Two gillnet series containing nets of 12.5 to 70 mm bar mesh (made of polyamid monofilament) were set to cover the upper 7.5 m of the water column at two open water localities over the period of two days. The gillnets divided the sampled stratum into five depth layers of 1.5 m. Captured fish were removed from the nets in regular 2-h intervals.

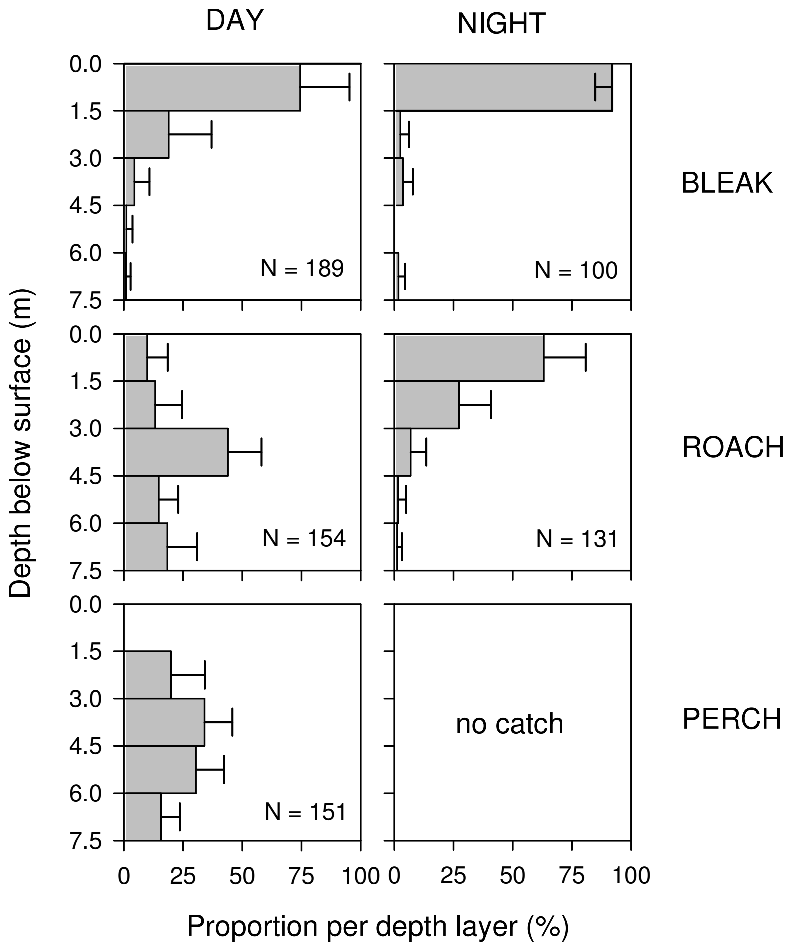

Fig. 3: Vertical distribution for three abundant fish species, expressed as the proportion of the total number of fish per depth layer (variance bars indicate 95% confidence limits).

The catches (containing age classes ≥1+) were numerically dominated by bleak (*Alburnus alburnus*), roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), bream (*Abramis brama*) and asp (*Aspius aspius*). Pronounced differences in the vertical distribution patterns of individual species were found (an example of day and night distributions for three species is given in **Fig. 3**). The majority of bleak and asp were captured in the surface water layer (0–1.5 m) irrespective of the diel period. During the daytime, roach were most abundant in the layer just above the thermocline (3–4.5 m), but at night they occupied the upper part of the epilimnion (0–3 m). No consistent pattern in vertical distribution of bream was found during the daytime. At night, however, most bream were caught in the surface water layer. Perch inhabited the lower part of the epilimnion and the upper metalimnion during the daytime and twilight. No perch were caught at night.

In general, catch rates of fish were much higher at twilight than during day and night. Decreased gillnet visibility and increased fish activity were likely responsible for the high gillnet catches at dusk and dawn periods. In roach and bleak, greater proportions of larger specimens were captured at daytime, while proportions of smaller fish increased in twilight and night catches, implying that individuals of these two species made diel migrations between littoral and pelagic habitats. Also the absence of perch catches at night suggested that perch might shift to littoral resting places. In conclusion, the above results clearly showed that fish were not distributed randomly within the epipelagic waters of the Římov Reservoir.

2.8 Distribution of the Bathypelagic Perch Fry Layer in Large Canyon-Shaped Reservoirs

(*study supported by the Czech Science Foundation, project No. 206/06/1371*)

M. Čech (*carcharhinusleucas@yahoo.com*), ***J. Kubečka***, ***J. Frouzová***, ***V. Draštík***, ***M. Kratochvíl***, ***J. Matěna***, ***J. Hejzlar***, and ***J. Jarošík*** finished their research dealing with the distribution of the bathypelagic perch *Perca fluviatilis* fry (BPF) layer and its qualitative and quantitative changes along the longitudinal profiles of the large canyon-shaped Slapy and Orlík Reservoirs (Czech Republic). For continuing acoustic scanning of the water column they used Ota Oliva and Dory 13 research vessels, SIMRAD EY500 echosounder, circular and elliptical split-beam transducers and Sonar5 post-processing software. In Slapy Reservoir (sampled in late May 2002; see also[3]), the BPF layer created by the mass of non-shoaling perch larvae and juveniles (mean L_T 10.4 mm) was recorded from the dam for 29 km upstream (**Fig. 4**). The BPF layer only vanished in the upper third of the reservoir due to the extremely cold hypolimnetic water discharged from Orlík Reservoir, which is situated

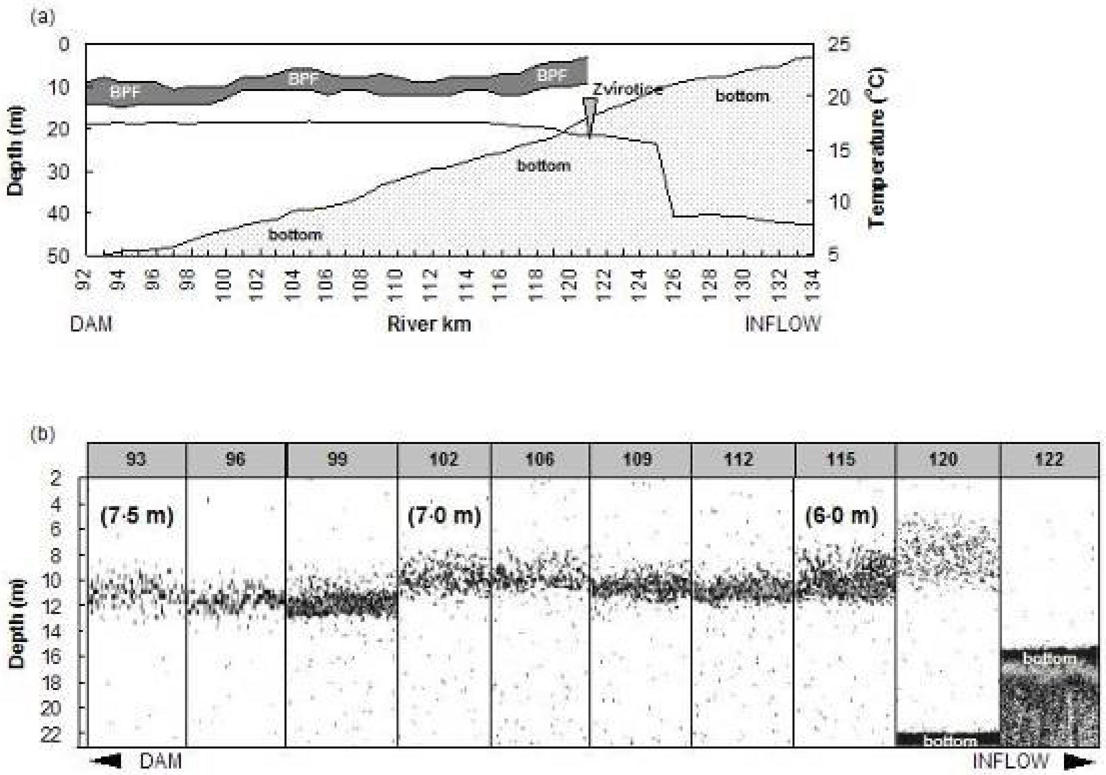

Fig. 4: (a) The shape and thickness of the bathypelagic perch fry layer and its position in the water column along the longitudinal profile of Slapy Reservoir in late May 2002. Surface temperature (black thick solid line) was continuously measured during acoustic sampling. (b) Sequence of raw 20 LogR TVG echograms illustrating the nature of the BPF layer in individual transects along the longitudinal profile of Slapy Reservoir in late May 2002. Numbers in labels indicate river km. Numbers in parenthesis show water transparency (depth of Secchi disc).

upstream in the cascade. Both abundance and size of BPF increased significantly upstream following, in Slapy Reservoir, the trophic gradient. In Orlík Reservoir (sampled in late June 1997), the BPF layer was created predominantly by shoaling perch fry individuals (mean L_T

31.8 mm), recorded along the whole longitudinal profile of the reservoir (over 50 km, filled with relatively warm water). Both the sizes of BPF and their shoaling activity again increased significantly from the dam towards the inflow following, in Orlík Reservoir, the trophic gradient. Pooling the data from both reservoirs, it was evident that the tendency to flock in a dense layer and, much later, to create distinct shoals, increased continuously with the size of BPF.

In the first half of June 2004, local flood hitting Orlík Reservoir completely flushed the existing fry community out from the 31 km long riverine part of the reservoir. The pelagic zone in this reach was then recolonized by cyprinid fry being of either littoral or riverine origin. Subsequently, the BPF layer was recorded only in the 22 km long lacustrine part of the reservoir. In the upper reach of this part where water current slowed down in large volume and fry originated from both riverine and central part of the reservoir flocked in high numbers, two distinct BPF layers were observed. During mid-day, the upper BPF layer, created predominantly by shoaling fish (abundance over 126000 individuals ha^{-1}) occurred between 6 and 10 m. A second, lower BPF layer created by non-shoaling fish exclusively (30000 individuals ha^{-1}) was recorded between 12 and 17 m depth. Both upper and lower BPF layer were composed of perch (69.6% and 66.8% in abundance respectively) and zander Sander lucioperca (29.8% and 28.6% in abundance respectively). In the lower BPF layer, ruffe *Gymnocephalus cernuus* also contributed considerably to the fry assemblage (4.0% in abundance). Perch from the upper BPF layer (mean L_T 25.1 mm) did not differ in size from perch from the lower BPF layer (mean L_T 25.0 mm). Similarly, zander from the upper BPF layer (mean L_T 27.2 mm) were almost the same size as those from the lower BPF layer (mean L_T 26.9 mm). However, perch from both BPF layers were noticeably smaller than zander. The results from acoustic survey and complementary net catches suggest that no epipelagic perch fry were found in the reservoir where thermal stratification had been destroyed by flooding and windy weather.

[1] Čech, M., Kubečka, J., Frouzová, J., Draštík, V., Kratochvíl, M., Matěna, J., Hejzlar, J., 2007. Distri-bution of the bathypelagic perch fry layer along the longitudinal profile of two large canyon-shaped reservoirs. J. Fish Biol. 70: 141–154.
[2] Čech, M., Kubečka, J., Frouzová, J., Draštík, V., Kratochvíl, M., Jarošík, J., 2007. Impact of flood on the distribution of bathypelagic perch fry layer along the longitudinal profile of large canyon-shaped reservoir. J. Fish Biol. 70: 1109–1119.
[3] Čech, M., Kratochvíl, M., Kubečka, J., Draštík, V., Matěna, J., 2005. Diel vertical migrations of bathypelagic perch fry. J. Fish Biol. 66: 685–702.

2.9 Phytoplankton Chlorophyll in the Slapy Reservoir

J.Hrbáček (jhrbacek@seznam.cz) evaluated two sets of chlorophyll *a* concentration data from integrated (0–4 m depth) samples collected in the Slapy Reservoir at the standard sampling station near the Živohošť bridge. For the first set of data, samples collected at three-week intervals were measured using the colorimetric method [1]. The second set of samples was collected weekly by J. Hrbáček and analysed fluorometrically [2] by ***J. Fott*** and ***L. Nedbalová*** (Faculty of Natural Sciences, Charles University, Prague). There was a three-day lag between sampling dates and integrated samples for each set were obtained using different types of equipment. **Fig. 5** demonstrates clear differences between the two

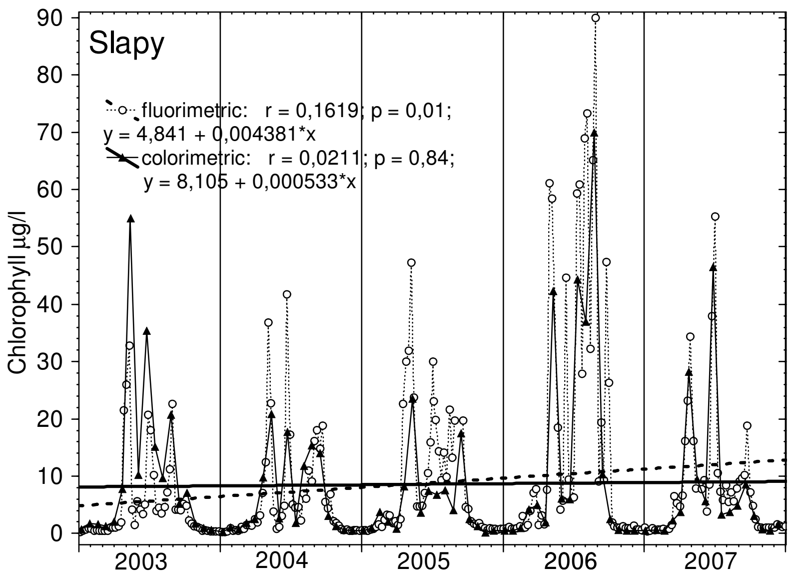

Fig. 5: The course of phytoplankton chlorophyll a concentration in Slapy Reservoir determined colorimetrically (full lines) and fluorometrically (dotted and dashed lines)

data sets both for chlorophyll a concentrations in individually comparable samples and for long-term chlorophyll a concentration trends evaluated by linear regression. Both sets indicate the existence of three chlorophyll a maxima throughout the summer season, with the third maximum not very pronounced in 2005 and especially in 2006.

[1] Lorenzen, C.J., 1967. Determination of chlorophyll and pheo-pigments – spectrophotometric equations. Limnol. Ocenogr. 12: 343–346.
[2] Fott, J., Blažo, J., Stuchlík, E., Strunecký, O., 1999. Phytoplankton in three Tatra Mountain lakes of different acidification status. J. Limnol. 58: 107–116.

3 LAKES

3.1 Constrains and Limits Of Biological Recovery from Acid Stress: What is the Future of Headwater Ecosystems in the Bohemian Forest?

This five-year project (206/07/1200 GA CR), co-ordinated by ***J. Vrba*** (*vrba@hbu.cas.cz*), started in 2007. It builds on a tradition of long-term complex research of catchment-lake ecosystems [1]. The IHB team co-operates closely with those of ***H. Šantrůčková*** (Faculty of Science, University of South Bohemia, České Budějovice), ***V. Sacherová*** (Faculty of Science, Charles University, Prague), ***M. Svoboda*** (Faculty of Forestry and Wood Sciences, Czech University of Life Sciences, Prague), including students.

The project is focused on possible mechanisms slowing biological recovery of the Bohemian Forest ecosystems from acid stress. We hypothesise that aluminium (Al) is the key element that largely controls the functional diversity of acidified ecosystems [2]; both through its toxicity and by controlling bioavailability of nitrogen (N) and phosphorus (P), i.e., stoichiometry of major nutrients in terrestrial and aquatic ecosystems, respectively. The following hypotheses are being tested:

(H1) The biological recovery of the Bohemian Forest ecosystems from acid stress will depend both on N input and on the fate of soil N cycling. The ionic Al and NO_3^- exports are linked and form positive feedback; they both affect and are affected by vegetation. Consequently, variables like forest health (pest) and climatic change can start to play a dominant role in future changes in acid deposition.

(H2) The level of Al discharge from the catchment represents a serious bottleneck in the lake recovery process. This key element acts on food web complexity both from top-down, i.e. through its toxicity on consumers and/or predators, and from bottom-up, i.e. by controlling P availability.

(H3) Reestablishment of complex food webs, in particular full success of zooplankton recovery will also depend on the dispersal potential of keystone species or top predators. Until fish return insect predators may cause biological resistance of a lake ecosystem.

Table 5: Selected characteristics of surface water of the Bohemian Forest lakes in September 2007. Abbreviations: CT – Čertovo L., CN – Černé L., RA – Rachelsee, PL Plešné L., PR – Prášilské L., KA – Kleiner Arbersee, GA – Großer Arbersee, LA – Laka L.

LAKE		CT	CN	RA	PL	PR	KA	GA	LA
pH		4.6	4.8	5.2	5.0	5.0	5.6	5.9	5.3
Alkalinity (Gran)	mmol l^{-1}	–31	–17	–5	–11	–10	10	18	3
DOC	mg l^{-1}	3.5	1.5	3.2	3.7	5.5	4.2	3.5	5.9
TP	μg l^{-1}	2.6	2.9	7.0	14.9	5.8	5.7	4.7	7.2
NO_3-N	mg l^{-1}	0.44	0.82	0.35	0.79	0.20	0.21	0.23	0.69
SO_4^{2-}	mg l^{-1}	3.3	3.1	2.5	2.9	1.7	2.7	2.5	1.7
Total reactive Al	mg l^{-1}	0.31	0.23	0.26	0.49	0.17	0.16	0.15	0.19
Chlorophyll *a*	μg l^{-1}	3.0	2.5	6.7	23.5	3.8	5.8	2.5	2.6

In September 2007, all eight lakes in the Bohemian Forest were sampled again after four years. The preliminary results of this sampling give a clear evidence of further chemical and biological recovery (note also chlorophyll *a* concentrations in **Table 5**) compared with past

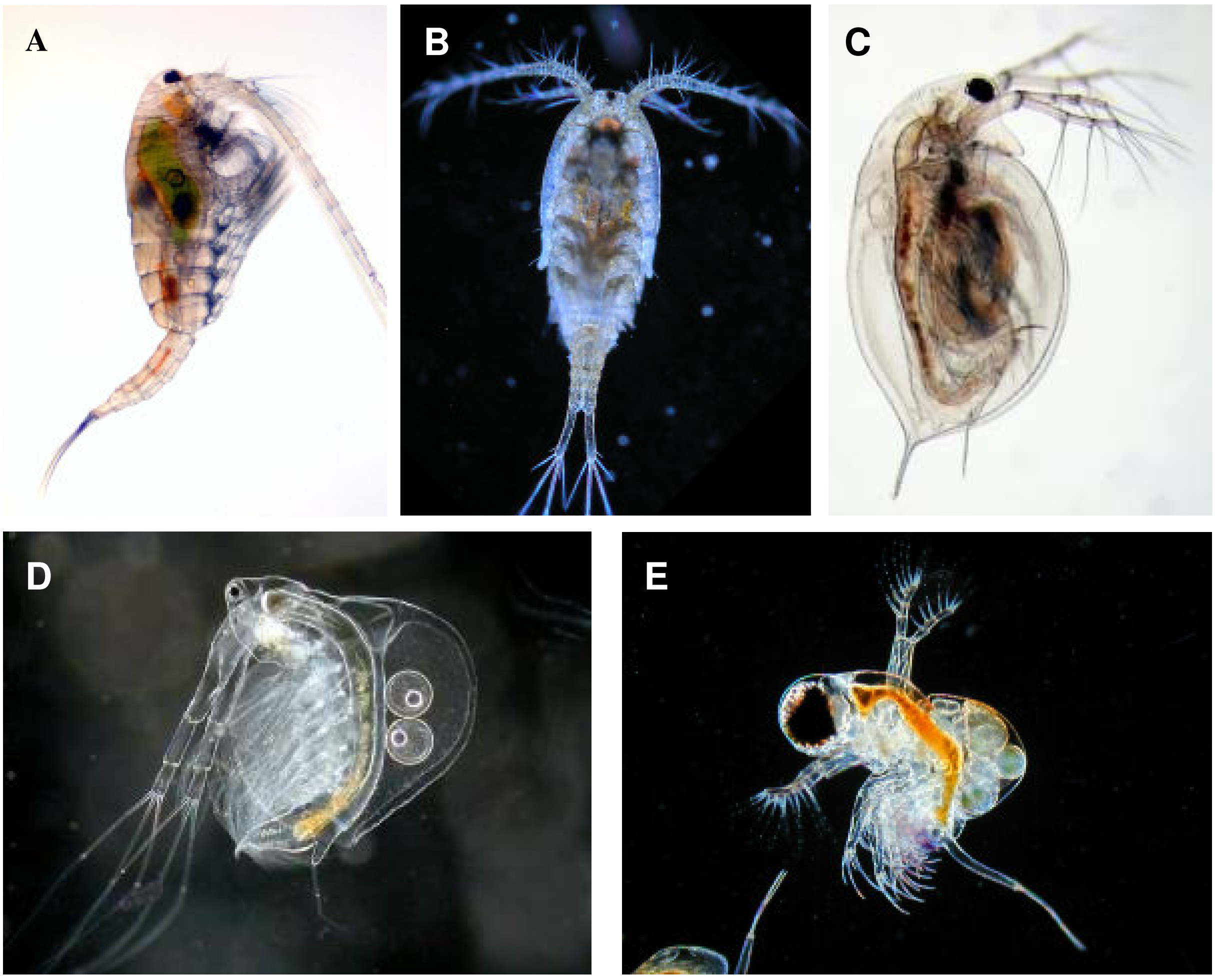

Fig. 6: Some Crustacea dwelling in the Bohemian Forest lakes (microphotograps by ***J. Fott***, Charles University, Prague): A – *Heterocope saliens*, B – *Cyclops abyssorum*, C – *Daphnia longispina*, D – *Holopedium gibberum*, E – *Polyphemus pediculus*.

sampling campaigns in 1999 [3] and 2003 [4]. The return of crustacean zooplankton is surprisingly in progress (see **Fig. 6**): e.g., an abundant population of *Polyphemus pediculus* in Kleiner Arbersee; massive occurrence of *Holopedium gibberum* in Großer Arbersee, and particularly the return of *Ceriodaphnia quadrangula* to Čertovo Lake after decades of complete absence of Crustacea in its zooplankton! Thus, Rachelsee currently remains the only lake in the Bohemian Forest without planktonic Crustacea. The current reproduction of the populations of both quillwort species is further evidence of biological recovery in Černé and Plešné lakes (see section 3.3).

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[3] Vrba, J., Kopáček, J., Fott, J., Kohout, L., Nedbalová, L., Pražáková, M., Soldán, T., Schaumburg, J., 2003. Long-term studies (1871–2000) on acidification and recovery of lakes in the Bohemian Forest (central Europe). Sci. Total Environ. 310: 73–85.
[4] Nedbalová, L., Vrba, J., Fott, J., Kohout, L., Kopáček, J., Macek, M., Soldán, T., 2006. Biological recovery of the Bohemian Forest lakes from acidification. Biologia 61, Suppl. 20: S453–S465.

3.2 Aluminium Toxicity, a Critical Bottleneck of Quillwort's (*Isoëtes*) Reproduction in Acidified Lakes

M. Čtvrtlíková (*sidlatka@email.cz*) studied both natural reproduction and the experimental effects of aluminium (Al) toxicity and acidity on the early ontogenesis of quillworts.

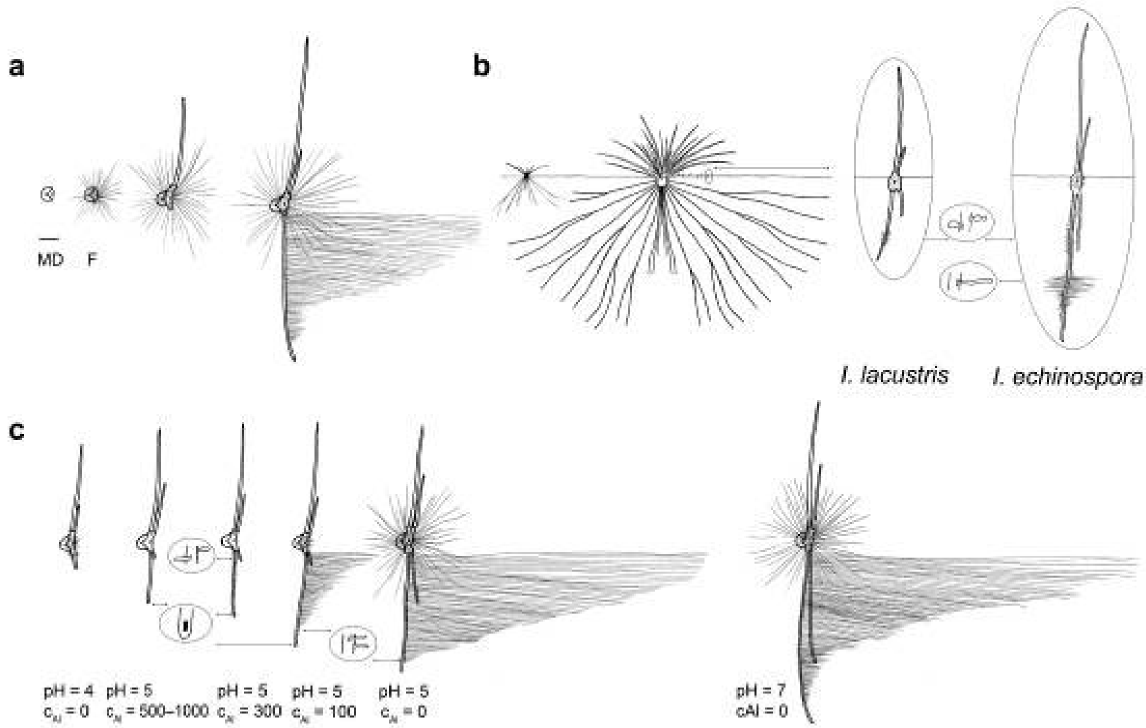

Fig. 7: Schematic early ontogenesis of quillworts (a), detected symptoms on lake sporelings of *Isoëtes echinospora* and *I. lacustris* (b), and schematic symptoms of *in vitro* sporelings induced by particular experimental treatments (c). All sporeling sketches are proportional in relative length units: 1 MD corresponds to a macrogametophyte diameter (ca. 0.4 mm for either species). Early ontogenesis (a): After fertilization (F) in quillworts, rhisoids rise from the macrogametophyte in the spore surrounding, sporeling sprouts rise at a later time. The root, which is reported to be the primarily inhibited organ by Al, is not the first germinating organ of a quillwort's sporeling, instead it is the first leaf. The first sporeling's leaf is fully dependent on utilising the rich storage tissue of macrogametophyte for weeks or months, until the first root develops. Lake sporelings develop in the sediment surface (b): The overlying acid, Al-rich lake water penetrates into the porous microhorizons and is harmful for sporelings. Detected symptoms on lake sporelings of *I. lacustris* (left ellipse) and *I. echinospora* (right ellipse) mitigated toward the root tip (see the forms of root hairs in small insets) and correspond with the effects of 100–300 µg l^{-1} of Al (at pH 5.0) in the experiments (see below). Al toxicity is unlikely to affect both juvenile and adult plants with extensive root systems buried deeper in the sediment as the toxic effect is mitigated by a higher pH in the deeper layers. In experiments (c): Al concentrations (c_{Al} in µg l^{-1}) at pH 5.0 induced stubby forms of rhizoids and root hairs, root-tip necrosis (details in small insets), and significant inhibition of sporelings' growth (long root hairs are drawn on the right side of roots only). In addition, pH ≤ 5.0 significantly inhibited the growth and should be considered as an important synergic factor of the overall Al toxicity.

The populations of two quillwort species, *Isoëtes lacustris* and *I. echinospora* have survived an approximately forty-year period of severe acidification of two Bohemian Forest lakes, Plešné and Černé respectively, under high concentrations of phytotoxic aluminium. Both populations decreased during the period and no sporelings were found. Sporeling survival and stand renewal in the lakes were examined between 2003 and 2007. In the laboratory, lake spores were exposed to (i) variable (0–1000 μg l^{-1}) Al concentrations at pH 5.0 and (ii) pH 4.0–8.0. Symptoms on experimental sporelings were evaluated and they were compared with those from the lakes (**Fig. 7**.). Sporelings occurred in the lakes every year. Some *I. echinospora* wintered in Plešné Lake and the population tripled within three years (**Fig. 10**.). Sporelings of *I. lacustr*is survived in Černé Lake for a maximum of 4–5 months and impaired

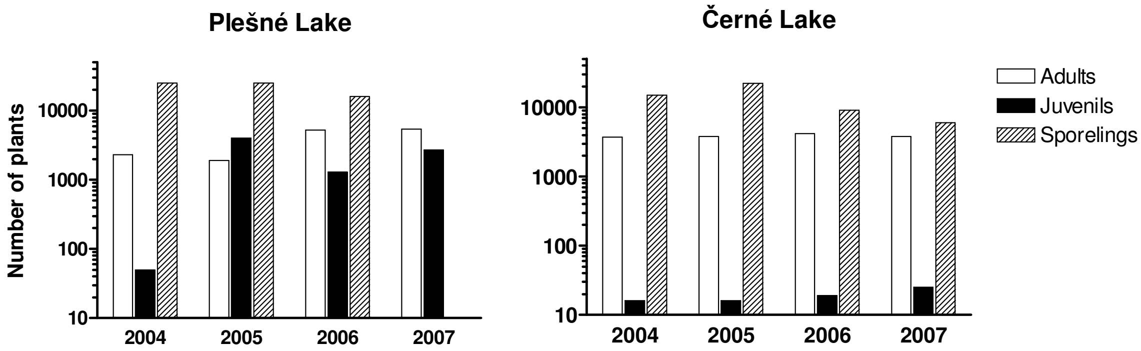

Fig. 8: Age structure of the population of *Isoëtes lacustris* in Černé Lake and the population of *Isoëtes echinospora* in Plešné Lake in the springs of 2004–2007. Abundances of adult and juvenile plants were counted exactly, abundances of sporelings were estimated from representative plots. In 2007 sporelings of *Isoëtes echinospora* appeared later, in the summer 2007.

reproduction continued (**Fig. 8**). At pH 5.0, experimetal Al concentrations induced stubby forms of rhizoids and root hairs, root-tip necrosis (**Fig. 7**), and significant inhibition of sporelings' growth (**Fig. 9**). In addition, pH≤5.0 significantly inhibited their growth (**Fig. 9**). The synergism of Al and acidity obviously prevents sporeling survival. Specific symptoms in lake sporelings, rooting in the sediment surface (**Fig. 7**), apparently reflect the ionic Al concentrations in lake water that represent a critical bottleneck of the quillworts' reproduction in the acidified lakes.

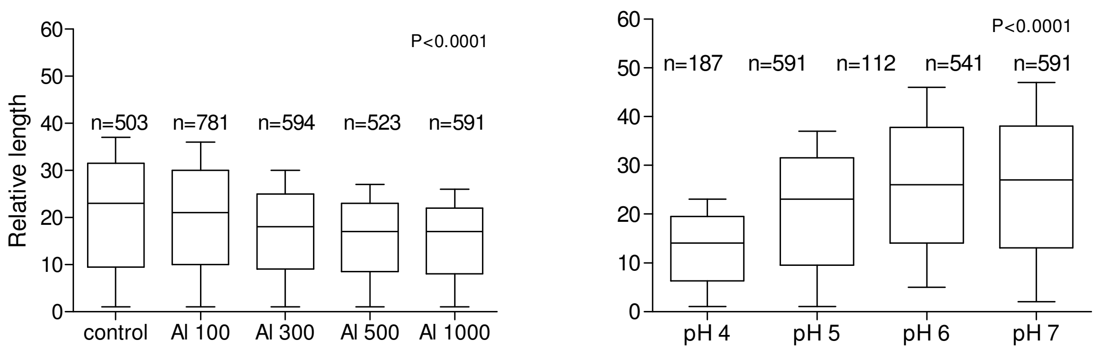

Fig. 9: Summary of the experimental effects of different Al concentrations at pH 5 (left) and different pH (right) on the relative total growth of *Isoëtes echinospora*; Kruskal-Wallis test followed by Dunn's multiple comparison test among the medians at alpha = 0.05. Total growth is calculated as the sum of relative sprout (leaves and roots) lengths, the relative length unit conforms to a macrogametophyte diameter (~0.4 mm). Boxes show median values and 25th and 75th quartiles, bars indicate minimum and maximum.

3.3 Photochemical Source of Metals for Sediments

J. Kopáček, J. Hejzlar, M. Marešová (Faculty of Science, University of South Bohemia, České Budějovice), and ***S.A. Norton*** (Department of Earth Sciences, University of Maine, Orono, USA) evaluated changes in the ability of Plešné Lake sediment to bind phosphorus (P) since the lake origin at the end of the last glaciation until the present times. Non-calcareous, P-rich lake sediments typically release P associated with iron hydroxide ($Fe(OH)_3$) during the development of hypolimnetic anoxia. High concentrations of aluminum hydroxide ($Al(OH)_3$) in such sediments (e.g., in Al-treated lakes) can prevent the P release. The sediment ability to bind P, however, can naturally develop during lake history due to changes of the $Al(OH)_3$ concentration and the $Al(OH)_3$ to $Fe(OH)_3$ ratio in sediment.

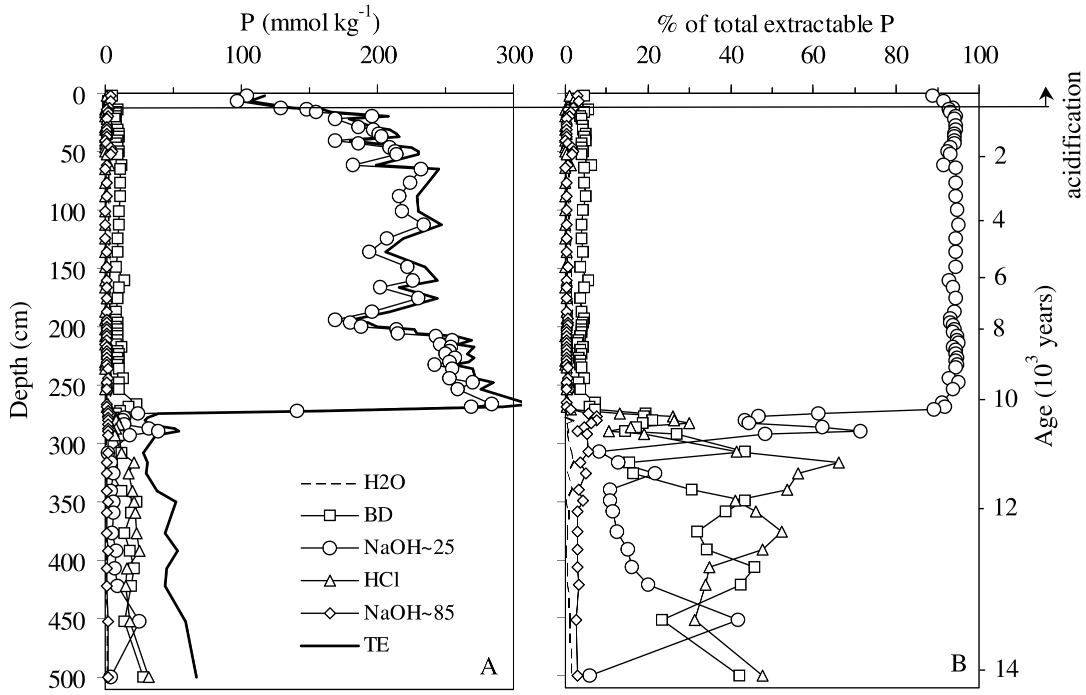

Fig. 10: Concentrations of P fractions (left) and relative P fractions (right) of Plešné Lake sediment. Wet sediment was sequentially extracted by phosphorus fractionation analysis according to Psenner and Pucsko [3]: (1) Distilled water (H_2O fraction), (2) 0.1 mol L^{-1} $NaHCO_3$-buffered 0.1 mol L^{-1} sodium dithionite ($Na_2S_2O_4$) at 40 °C (BD fraction), (3) 1 mol L^{-1} NaOH at 25 °C (NaOH~25 fraction), (4) 0.5 mol L^{-1} HCl (HCl fraction), and (5) 1 mol L^{-1} NaOH at 85 °C (NaOH~85 fraction). TE, total extractable. Solid horizontal line represents sediment layer affected by acidification (upper ~15 cm). Sediment age in 10^3 yr BP [4].

The development of sediment P-sorption characteristics was reconstructed through the Late Glacial and Holocene on the basis of sequential fractionation analysis of P, Al, Fe, Ca, and Mg in a ~14,000 yr long sediment record, fresh settling seston, and bedrock from Plešné Lake, Czech Republic [1]. The most significant change occurred at the Late Glacial–Holocene transition (~10,000 before present), when the watershed became forested [2] and soil erosion decreased (**Fig. 10**). The Late Glacial sediment was rich in mineral detritus, derived from the watershed till and bedrock, had most of its P associated with $Fe(OH)_3$ (37%) and calcite and/or apatite (42%), and was probably able to release P during anoxia. In contrast, the Holocene sediment was highly organic, the P release during anoxia was likely negligible, and

>90% of P was associated with $Al(OH)_3$. This $Al(OH)_3$ originated from photochemical liberation of Al from dissolved organically-bound Al (Al_o), exported to the lake from soils. Because the photochemical mechanism was a more efficient source for $Al(OH)_3$ than for $Fe(OH)_3$, the sediment became a P trap by the beginning of the Holocene. The sediment's ability to immobilize P increased further during the anthropogenic acidification era due to elevated terrestrial export of ionic Al (**Fig. 10**). Similar sediment fractionation results in cores from six lakes in Maine, U.S.A., suggest that this P-immobilizing mechanism is a general process that can occur in lakes with high Al_o inputs.

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[4] Pražáková, M., Veselý, J., Fott, J., Majer, V., Kopáček, J., 2006. The long-term succession of cladoceran fauna and palaeoclimate forcing: a 14,600 – year record from Plešné Lake, the Bohemian Forest. Biologia 61, Suppl. 20: S387–S399.

3.4 Microbial Food Web Dynamics in a Tropical Warm-Monomictic Hyposaline Lake

M. Macek *(mirek@campus.iztacala.unam.mx)* continued working at UNAM campus Iztacala, Mexico. Along with Salvador Hernández and Fernando Bautista, he studied the *top-down* and *bottom-up* control of picoplankton development in a maar crater, athalassohaline, warm-monomictic Lake Alchichica (Puebla, Mexico). Size fractionation (<2 µm, 2–100 µm and zooplankton enrichment) along with sample transplantation within the water column were applied in dialysis bags and PET bottles. To select the experimental layers, temperature, dissolved oxygen (D.O.) and photosynthetic active radiation (PAR) were measured *in situ.* Numbers and biomass of autotrophic picoplankton (APP) were evaluated via autofluorescence and/or flow cytometry and using image analysis, respectively; heterotrophic picoplankton (HPP) was analysed using FISH. DAPI staining was employed to count ciliates, heterotrophic (HNF) and mixotrophic flagellates.

During their stay, ***K. Šimek, K. Horňák*** and ***J. Jezbera*** (1 month) and ***J. Jezberová*** (3 months) lead an introduction of new methods for sample analyses, particularly CARD-FISH and HPP flow-cytometry counting (SYTO 13). We found an APP maximum of $\geq 3\times10^6$ cells ml^{-1} at the end of the mixing period. However, we observed APP even in the hypoxic metalimnion throughout the year. Within APP we analysed four different pigment composition populations; generally, in low light and experimental conditions, phycoerythrin-rich APP were favoured comparing to phycocyanin-rich APP. During the stratification period with an anoxic hypolimnion, we confirmed that the APP specific growth rate could reach of a maximum of 10% per day, which coincided with the maximum possible ciliate elimination. However, at the end of mixing and during the early stratification period we found flagellates to be the key factor in the elimination of APP. It was not possible to obtain the APP – 2µm-fraction without HNF; experimentally, HNF numbers up 10^4cells ml^{-1} were reached. On the other hand, metazooplankton mostly controlled the HNF development in the experiments with the exception of mixotrophic choanoflagellates.

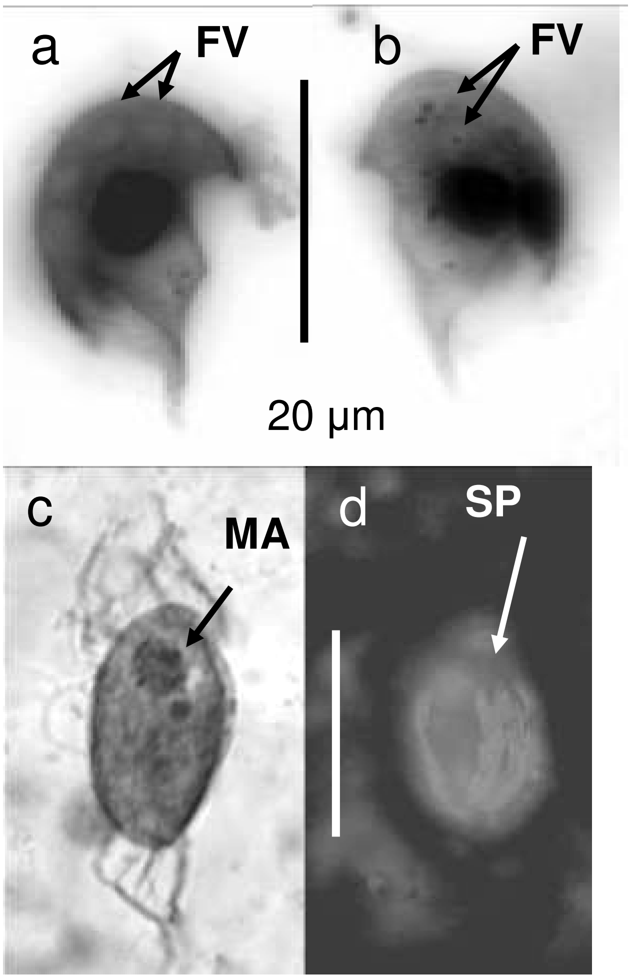

Fig. 11: Ciliates found in the anoxic hypolimnion of Lake Alchichica: *Caenomorpha* sp. in DAPI staining (a–b) with stained macronucleus, MA, and autofluorescing ingested prokaryotes in food vacuoles, FV; *Isocyclidim globosum* in protargol staining (c) and with CARD-FISH labelled bacterial symbionts (d).

Using a traditional FISH method we found maximum means of hybridization of about 40% and 1% of HPP for Bacteria and Archaea, respectively. Beta-subclass of Proteobacteria constituted the dominant fraction (18%) throughout the year, followed by Planctomycetales, Gram+, *Paracoccus* and sulphate-reducing bacteria, which had a major contribution under anoxic conditions in the hypolimnion. *Cytophaga-Flavobacterium* group was the less abundant. A significant reduction in the hybridization efficiency was found during the stratification.

We applied CARD-FISH to identify food source and symbionts of anoxic hypolimnion finding Archaea in anaerobic scuticociliate diet. Ectosymbiont (**Fig. 11**) hybridized with Eubacteria probe; however, we have not their taxonomical position, yet. Apparently, anaerobic ciliates were not related to higher HPP numbers in the environment.

4 SPECIAL INVESTIGATIONS

4.1 Morphological diversity of coiled planktonic types of the genus *Anabaena* (cyanobacteria) in natural populations

E. Zapomělová *(eliska.zapomelova@seznam.cz)*, ***K. Řeháková, P. Znachor*** and ***J. Komárková*** studied the morphology of 61 planktonic populations of the genus *Anabaena* with coiled trichomes under natural conditions [1]. The samples were collected from Czech reservoirs and fishponds, representing all the morphospecies of coiled *Anabaena* that have previously been reported from the Czech Republic. Using Principal Component Analysis (PCA) and paired t-tests applied to morphometrical data, the existence of clear morphological

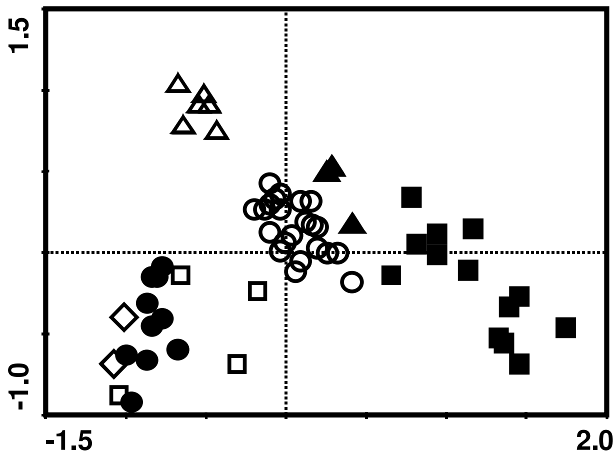

Fig. 12: PCA diagram based on morphological characteristics of *Anabaena* populations under natural conditions. Each symbol represents a single population. Preliminary morphospecies identification: △ *A. compacta,* ◇ *A. mendotae,* ● *A. sigmoidea,* ☐ *A. lemmermannii,* ▲ *A. spiroides,* O *A. flos-aquae,* ■ *A. circinalis / A. crassa* complex. The first and the second canonical axes explain together 74.7% of the total variance.

boundaries of these morphospecies was tested. The only clearly delimited morphospecies found was *A. compacta* (**Fig. 12**), which is defined by its vegetative cell width, the shape of akinetes and the regularity of trichome coiling. The other morphospecies formed a morphological continuum without clear-cut boundaries (**Fig. 12**). Moreover, the taxon *A. lemmermannii* appears to be morphologically heterogeneous and probably needs a thorough taxonomic revision.

[1] Zapomělová, E., Řeháková, K., Znachor, P., Komárková, J., 2007. Morphological diversity of coiled planktonic types of the genus *Anabaena* (cyanobacteria) in natural populations – taxonomic consequences. Cryptogamie-Algologie 28: 353–371.

4.2 Polyphasic study on cyanobacteria from the *Anabaena circinalis* Rabenh. ex Born. et Flah. 1888 / *A. crassa* (Lemm.) Kom.-Legn. et Cronb. 1992 complex

E. Zapomělová *(eliska.zapomelova@seznam.cz)*, ***K. Řeháková, J. Jezberová, J. Komárková, P. Znachor, J. Korelusová*** (BC AS CR, Institute of Hydrobiology) and ***D. Hisem*** and ***P. Hrouzek*** (Institute of Microbiology AS CR) conducted a collaborative investigation of environment-induced morphological plasticity, growth optima, 16S rRNA gene structure and production of secondary metabolites in two strains from the *Anabaena circinalis / A. crassa* complex. The aim was a better understanding of the continuous morphological transitions among various *A. circinalis* and *A. crassa* populations observed under natural conditions (**Fig. 13**) [1].

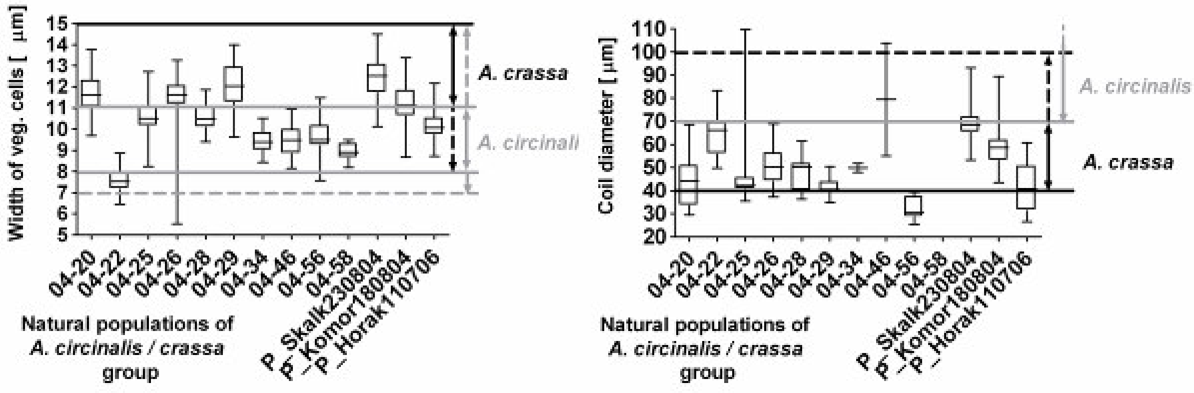

Fig. 13: Box-whisker plots of vegetative cell widths and coil diameters of *Anabaena circinalis* & *A. crassa* group. Whiskers represent minimal and maximal values, boxes symbolize ± standard deviation and lines inside boxes mean values. Limit values for both species accoding to Komárek [2] are indicated (solid line – common values, dashed line – extreme values).

The two strains were isolated from different localities in the Czech Republic. Field morphology of the strain 04–26 (Jesenice reservoir, western Bohemia) matched the description of *A. crassa* while the strain 04–28 (Hodějovický fishpond, southern Bohemia) was identified as *A. circinalis*. The range of morphological variability was determined experimentally in relation to different conditions (temperature, light intensity, concentration of nitrogen and phosphorus). Vegetative cell dimensions (temperature as the key factor; **Fig. 14**) and trichome coiling parameters (P concentration as the key factor) were the most variable.

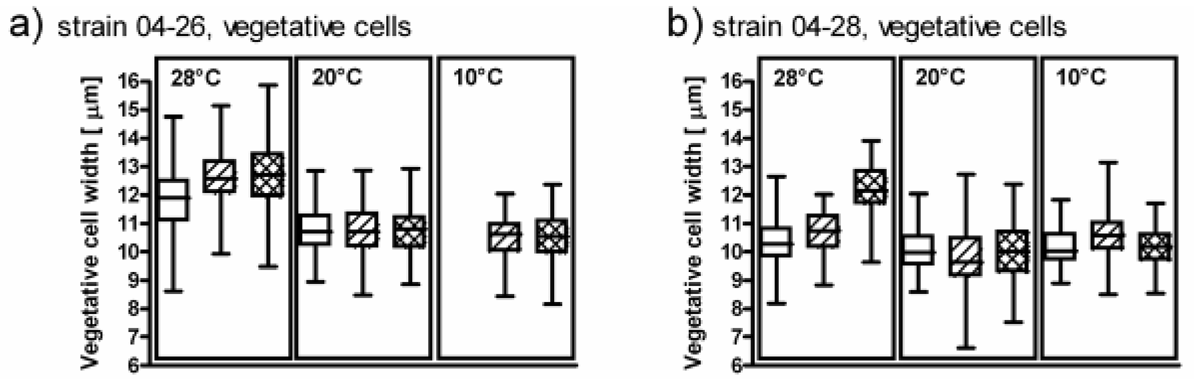

Fig. 14: Vegetative cell width of the strains under various culture conditions. Light intensity is symbolized by shading (750 µmol m^{-2} s^{-1} – plain boxes, 200 µmol m^{-2} s^{-1} – simple shading, 20 µmol m^{-2} s^{-1} – double shading). Whiskers represent minimal and maximal values, boxes symbolize 25% and 75% percentiles and lines inside boxes show mean values.

When observations from all the experimental conditions were summarized, the two strains studied covered the morphological features of both *Anabaena circinalis* and *A. crassa,* suggesting that no explicit morphological criterion exists to distinguish these species. These results are the first report on such a wide variability within the genus *Anabaena*.

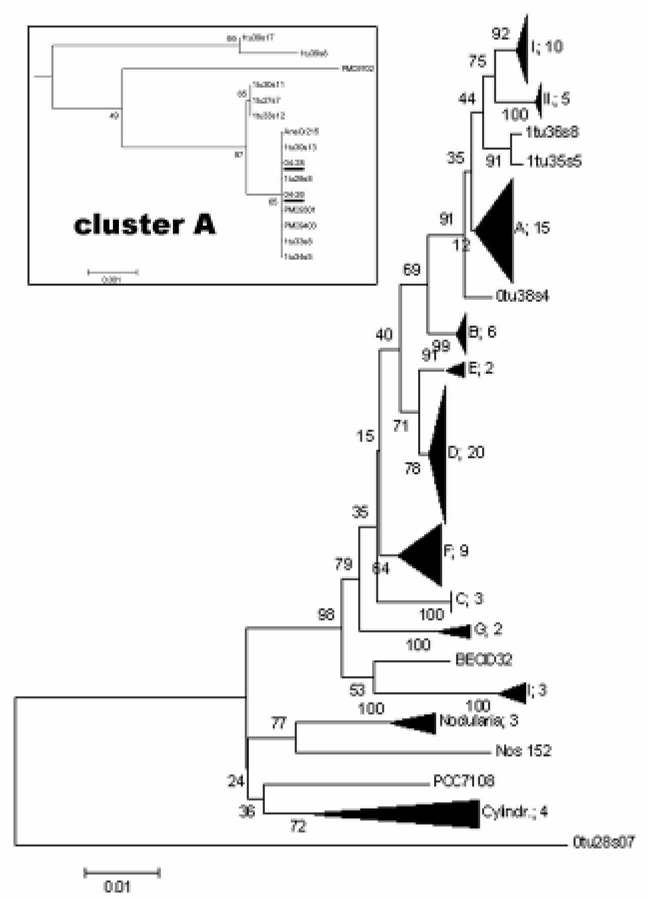

Fig. 15: Neighbour-joining tree based on 16S rRNA gene sequences (1311 bp), showing the clustering of studied strains 04-26 and 04-28 (underlined) together with Finnish *A. circinalis* strains in cluster A. Clusters A–I were previously published by [3], clusters I and II by [4], all of them contain planktonic *Anabaena* and *Aphanizomenon* strains. Numbers following cluster names indicate the number of strains included, numbers near nodes indicate bootstrap values.

The two strains differed in their temperature and light growth optima and in secondary metabolite content. However, the 16S rRNA gene sequence of both strains was 100% identical and showed 99.9–100% similarity to *A. circinalis* and *A. crassa* strains published from northern Europe (**Fig. 15**).

[1] Zapomělová, E., Řeháková, K., Znachor, P., Komárková, J., 2007. Morphological diversity of coiled planktonic types of the genus *Anabaena* (cyanobacteria) in natural populations – taxonomic consequences. Cryptogamie-Algologie 28: 353–371.

[2] Komárek, J., 1996. Klíč k určování vodních květů sinic v České republice [A key for determination of water-bloom-forming cyanobacteria in the Czech Republic]. In: Maršálek, B., Keršner, V. and Marvan, P. (eds), Vodní květy sinic [Cyanobacterial water blooms]. Nadatio flos-aquae, Brno (in Czech): pp. 22–85.

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[4] Beltran E.C., Neilan B.A. 2000. Geographical segregation of the neurotoxin-producing cyanobacterium *Anabaena circinalis.* Appl. Environ. Microb. 66: 4468–4474.

4.3 Comparison of Life History Traits of *D. galeata* and *D. ambigua* – Native and Invasive Species in Římov Reservoir in Laboratory Experiemnts

Daphnia galeata is one of the most common *Daphnia* species in the zooplankton of a broad spectrum of water bodies in our country and in Europe in general. As such it is considered a native species in this region. On the contrary, *D. ambigua* originates on the American continent and started being detected in our country only several decades ago. Its occurrence in our water bodies seems to have an increasing trend indicating a successful invasion of this species into the region. In the Římov Reservoir *Daphnia galeata* has been a common component of the zooplankton community since 1978 when the reservoir was filled with water. *D. ambigua* was first detected in this reservoir in 2001 when sampling focused on the vertical distribution of *Daphnia* species was performed.

In 2007 ***J. Macháček*** (*machacek@hbu.cas.cz*) carried out a preliminary experimental investigation of life history traits of two clonal lineages of *D. ambigua* isolated from Římov Reservoir in spring 2007. Three clonal lineages of *D. galeata* from the same reservoir were tested in the same experiment for comparison. One of these lineages had been isolated in spring 2003 and the other two in September 2004. For about one month *D. ambigua* lineages were gradually acclimated to laboratory conditions, i.e. aged tap water with a laboratory culture of *Scenedesmus subspicatus* as food, at a temperature of about 23°C. Then all five lineages of the two species were kept for 2–3 weeks under conditions identical to those in the forthcoming experiment. This meant semicontinuous culture with daily exchange of cultivation medium and food level adjusted to 2 mg of POC per litre. The average temperature of the culture medium was 23°C and fluctuated ±1°C. Neonates from the third clutch of their mothers were stocked in the experiment. Five neonates of each lineage were placed individually in the 50 ml beakers with the culture medium. Two contrasting food levels were tested in the experiment: high and low food levels with the amount of *S. subspicatus* corresponding to a concentration of 2.0 and 0.2 mg POC per litre, respectively.

The main goal of the experiments was to determine the total amount of matter incorporated into the body of the female and its progeny within both the period of postembryonic development up to the first adult instar and the period of the first three adult instars. Concurrently the proportion of the matter allocated to somatic growth of the female and that allocated to reproduction was distinguished. For this purpose body length and carapace lenght was measured at the beginning of the experiment and in the first three adult instars. These parameters were measured also in neonates from the first three clutches of experimental females. The time of deposition of the clutches was registered and used in calculations of further parameters. Body length values of experimental females and their offspring were converted into body weight using the length-weight relationship $W = 5.59 \times L^{2.2}$. The parameter called total individual growth rate (TIGR) was calculated for the maturation period as (body weight increment from neonata to primipara + body weight of offsprings in the first clutch) / (body weight of neonata × postembryonic development time). The same parameter for the first three adult instars was calculated analogically as (body weight increment from primipara to tercipara (third adult instar) + body weight of all offsprings in the second and third clutch) / (body weight of primipara × time period between the ovulation of the first and the third clutch). The parameter characterizing the ratio of somatic growth and reproductive investment (S/R ratio) was calculated for the maturation period as the body weight increment from neonata to primipara multiplied by PED time and related to body weight of the first clutch offsprings. The ratio thus takes into account not only the mass ratio of somatic to generative matter produced, but also the time to maturity (PED time) because a shorter time to maturity indicates earlier investment in reproduction at the expense of somatic growth and vice versa. The S/R ratio for the period of the first three adult instars was calculated as the body weight increment of the female from primipara to tercipara / body weight of all offsprings in the second and the third clutches. The time factor was not taken into account in this case because somatic growth and reproductive investments occur simultaneously within the same time period.

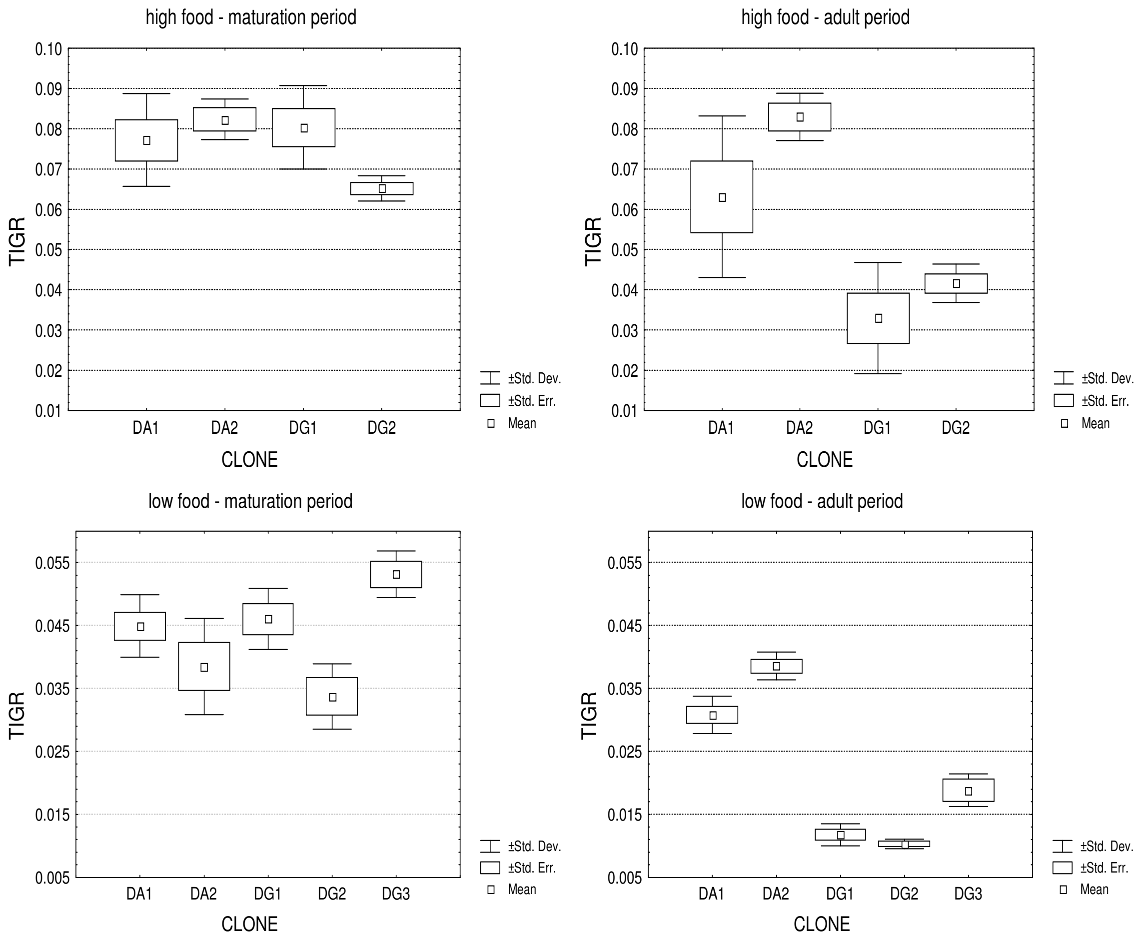

Fig. 16: Total individual growth rate (TIGR) in two clones of *D. ambigua* (DA) and three clones of *D. galeata* (DG) at two food levels. The maturation periods (from neonata to primipara) and the adult periods (from the first up to the third adult instar) were evaluated separately. (The DG3 clone in the high food variant did not complete the experiment.)

The results are presented in **Figs. 16** and **17**. It is apparent from **Fig. 16** that there is no difference in TIGR between the two species during the maturation period (from neonata to primipara) whereas it is remarkably lower in *D. galeata* clones in the adult period. This difference is even more pronounced under low food conditions. Data in **Fig. 17** indicate that *D. galeata* clones allocated proportionally more energy to somatic growth in relation to reproduction than *D. ambigua* clones. This is obvious during both maturation and adult periods, and at both high and low food levels. The presented data indicate that under the conditions of the experiment the *D. ambigua* clones exhibited very competitive features compared to the native *D. galeata* clones. There are, however, many other environmental factors which may strongly influence the outcome of competition in field conditions and which should be addressed in further experiments.

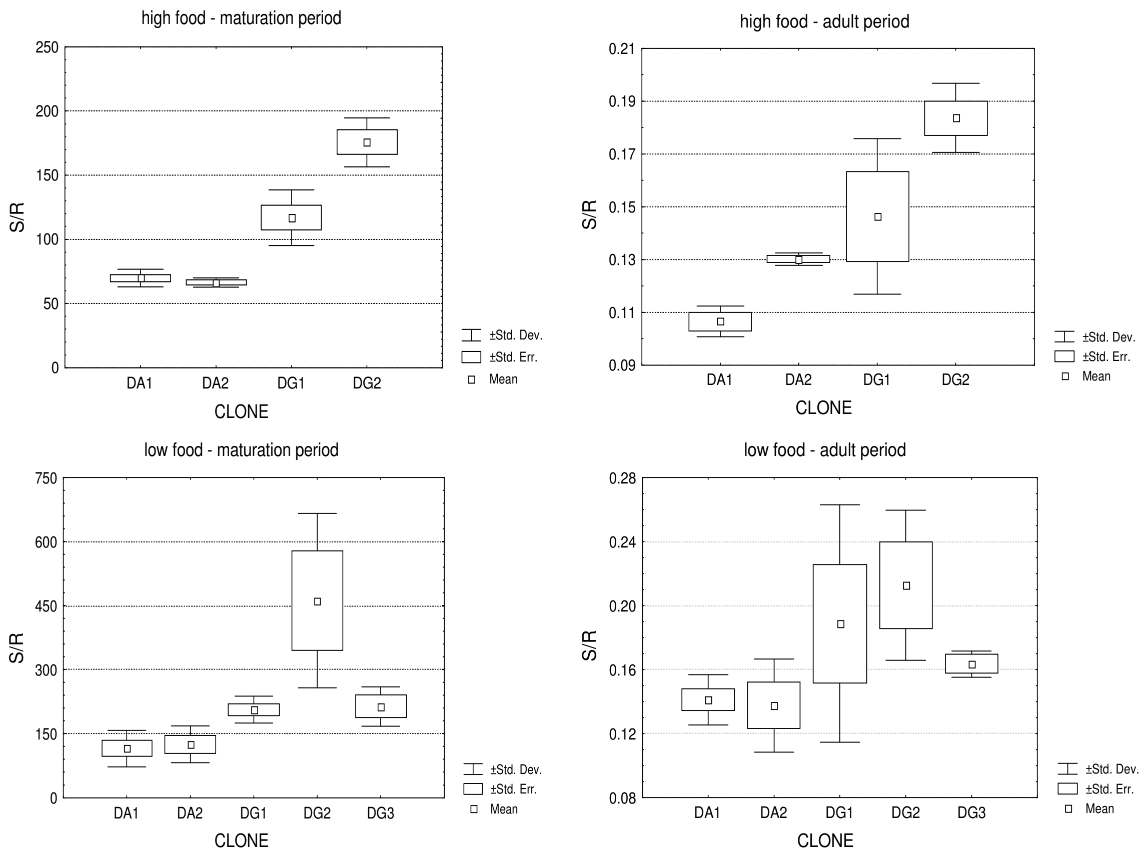

Fig. 17: Somatic growth and reproductive investment ratio (S/R) in two clones of *D. ambigua* (DA) and three clones of *D. galeata* (DG) at two food levels. The maturation periods (from neonata to primipara) and the adult periods (from the first up to the third adult instar) were evaluated separately. (The DG3 clone in the high food variant did not complete the experiment.)

4.4 Intra-Specific rDNA-ITS Restriction Site Variation and an Improved Protocol to Distinguish Species and Hybrids in the *Daphnia longispina* Complex

J. Seďa *(seda@hbu.cas.cz)* participated together with ***M. Skage*** (University of Bergen), ***A. Hobæk*** (Norwegian Institute of Water Research), ***Š. Ruthová*** and ***A. Petrusek*** (Charles University, Prague) and ***B. Keller*** and ***P. Spaak*** (EAWAG, Switzerland) in a collaborative research effort to evaluate the robustness of a recently developed genetic tool for species identification of members in the morphologically variable *Daphnia longispina* species complex. This genetic method [1], based on restriction fragment length polymorphism (RFLP) of the internal transcribed spacer region (ITS) of nuclear ribosomal DNA (rDNA) with restriction enzymes Mwo I and Sau96 I, was applied to many different European populations. Results were compared with two or more independently obtained characteristics (morphology, allozymes, mitochondrial DNA (mtDNA), or cloned rDNA-ITS sequences).

Individuals of most taxa were readily identified, but unexpected ITS-RFLP patterns were found in many individuals indicated by other markers to be *D. galeata* or one of its hybrids. Among 43 investigated *D. galeata* populations (902 specimens analysed by ITS-RFLP), deviant RFLP fragment patterns occurred in 26 (i.e., more than half) of the populations. The deviant patterns could be attributed to the loss of one single restriction site in the ITS2 region. This loss made the distinction of *D. galeata* from other species unreliable, and F1 hybrids could not be identified. Future users should be aware of this shortcoming of the protocol by Billiones et al. [1].

As a solution to this problem, we present an improved genetic identification protocol based on a simple double digestion of the rDNA-ITS region with restriction enzymes BsrB I and Eag I. Sequence analyses of rDNA-ITS clones and preliminary testing indicate that the new protocol is unaffected by the rDNA variation which troubled the Mwo I/Sau96 I protocol. Further, the new protocol identifies all European species of the *D. longispina* complex, as well as their F1 hybrids. However, a wider screening is required to verify its general utility for all species, since yet unknown variation may occur.

[1] Billiones, R., Brehm, M., Klee, J., Schwenk, K., 2004. Genetic identification of Hyalodaphnia species and interspecific hybrids. Hydrobiologia 526: 43–53.

4.5 Morphology of Filtering Structures as a Tool for Determination of *D. galeata* × *cucullata* Hybrids

J. Macháček (machacek@hbu.cas.cz) and ***J. Seďa*** studied the morphological parameters of filtering screens in parental and hybrid individuals of *D. galeata* and *D. cucullata* complex. Filtering screens in the third thoracic limb of typical phenotypes of both parental species as well as those of intermediate phenotypes were examined in individuals from formalin-preserved samples. So far about 150 mostly adult individuals from 7 localities (mostly reservoirs) and different sampling dates and locations within one reservoir have been included in the study.

The total number of samples equals 15. In most of the samples analysed the two parental species and intermediate forms occurred together. The following parameters were determined by means of the Lucia image analyser: the length of the filtering setae in the middle of the filtering screen and the area of the filtering screen as projected under the microscope. In a part of the animals the number of setae in the screen, and the width of the gap between the setae in the middle of the screen (intersetal distance) were determined. The size of the animals was measured as carapace length. The filtering setae length and the filtering screen area were expressed in relative figures. Relative filtering setae length (RFSL) is a percentage of the carapace length and relative filtering area (RFA) was obtained by dividing the area of the screen (μm^2) by the carapace length (µm). Within a specific taxonomical category the number of setae is known to be independent on the animal size, therefore absolute values of this parameter can be used for comparison. Intersetal distance is presented in absolute values as it provides some information on the size of the particles that can be retained by the filtering apparatus. The real mesh size, however, which is determined by the length and density of setules on the setae, was not measured in our study. The morphology of the filtering apparatus, especially the length of the filtering setae and the filtering area, are known to be flexible and closely related to the feeding conditions experienced by the animals. The set of the samples that we used in our analyses represented a wide range of feeding conditions. As all of the three taxonomical categories investigated were usually present in each of the samples analysed, we presume that they were all exposed to the same spectrum of feeding conditions and this factor did not affect the comparison of the three taxonomical categories when data from all of the samples were pooled.

Table 6: Relative filtering setae length (RFSL), relative filtering area (RFA), setae number (SN) and intersetal distance (ISD) in the two typical phenotypes of parental species and in an intermediate phenotype (potential hybrid) in the *D. galeata* × *cucullata* species complex. Different superscripts (a, b, c) indicate statistically significant difference of the means (Scheffé multiple comparisons, p≤0.05).

	RFSL (%)		RFA		SN		ISD (µm)	
phenotype	Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.
D. galeata	15.9 [a]	1.5	61.2 [a]	10.8	63 [a]	5	3.8 [a]	0.8
D. cucullata	14.5 [b]	1.6	37.6 [b]	8.9	38 [b]	6	4.8 [b]	0.9
intermediate	14.7 [b]	1.4	45.3 [c]	10.6	51 [c]	4	4.4 [ab]	0.9

The preliminary results presented in **Table 6** indicate that the most suitable parameter for the routine identification of the hybrid individuals in the *D. galeata* × *cucullata* species complex is the number of setae in the filtering screen of the third thoracic limb. This parameter exhibits the most apparent differences among the three taxa with variation ranges almost non-overlapping. Moreover it can be relatively easily determined. More data, however, are necessary to verify the reliability of this morphological trait especially in taxa concurrently categorized biochemically.

4.6 Variation in Secondary Structure of the 16S rRNA Molecule in Cyanobacteria with Implications for Phylogenetic Analysis

K. Řeháková (*klarakub@yahoo.com*) and ***J.R. Johansen, M.B. Bowen, M.P. Martin,*** and ***C.A. Sheil*** (Department of Biology, John Carroll University) collaborated on a study of the variation in secondary structure of 16S rRNA in cyanobacteria.

The phylogentetic impact of the secondary structure of the small subunit rRNA molecule in cyanobacteria was tested. We studied 180 different cyanobacterial sequences from all orders of the class Cyanobacteria. We examined the variability of structures in the rRNA molecule. We hypothesize that minor differences in secondary structure may have significance for understanding the phylogeny of cyanobacteria. In order to test this hypothesis a large number of sequences were examined, folded, and compared using a combination of two different approaches: (1) folding of sequences in the program Mfold, which is based on minimizing free energy [1] and (2) phylogenetic constraints, which hypothesize non-canonical base pairings to hold together the structure according to the crystallographic model of SSU of *Escherichia coli* [2].

Six variable regions were chosen for more detailed study. These variable domains are helix: H15, H17, H21, H22–23, H41, H44, named according to recently published structures on the Comparative RNA Web Site managed by Robin Gutell [3].

The secondary structure of the 16S rRNA molecule within the cyanobacteria is highly conserved. Only in a few of the variable loops were we able to note potential variation in structure. If non-canonical pairings are assumed to occur, the variation in structure is minimized. It is apparent that comparative sequence analysis is critical for deriving the most likely structure. While Mfold [1] is a very useful tool for the initial identification of the structure, it only assumes canonical base-pairing, and so structural motifs created in the program must be checked against hypothesized structures to see if these exist.

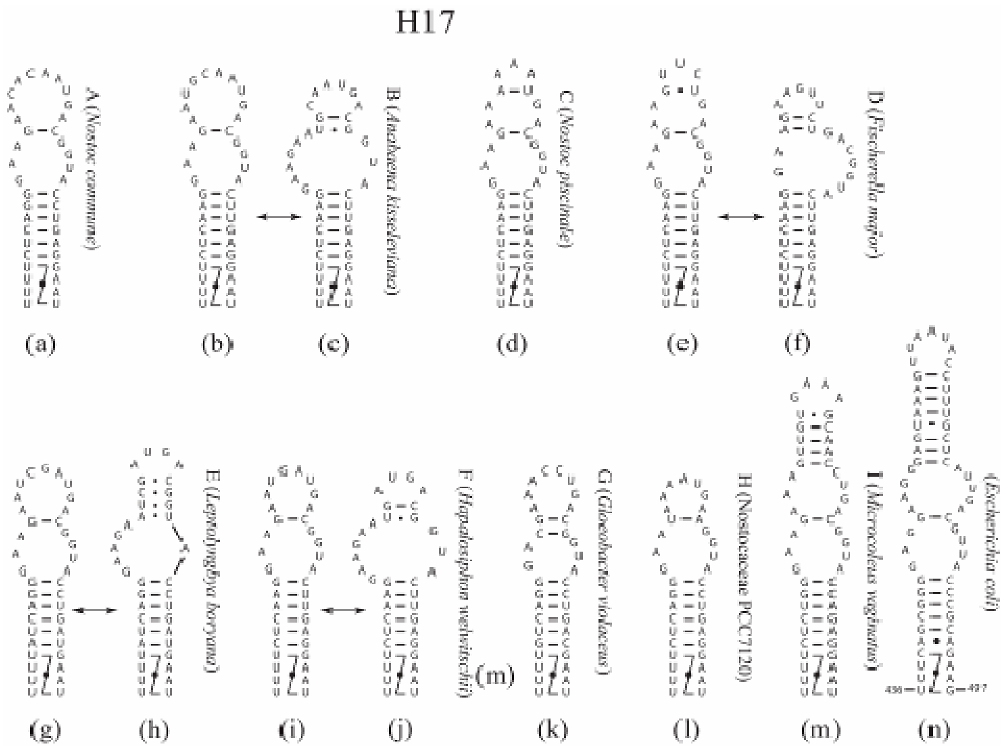

Fig. 18: Secondary structure of variable regions Helix 17. a) *Nostoc commune* NC1 showing type *A* structural motif. b, c) *Anabaena kisseleviana* NIES74 (type *B*). d) *Nostoc piscinale* CENA21 (type *C*). e, f) *Fischerella major* NIES592 (type *D*). g, h) *Leptolyngbya boryana* UTEX485 (type *E*). i, j) *Hapalosiphon welwitschii* (type *F*). k) *Gloeobacter violaceus* PCC7421 (type *G*). l) Nostocaceae PCC7120 (type *H*). m). *Microcoleus vaginatus* PCC9802. n) *Escherichia coli* Arrows indicate alternative stable structures. Numbers in *E. coli* indicated position of nucleotide in 16S rRNA.

Our primary intent in this paper was to see if phylogenetic signal was apparent in the secondary structure of the small subunit rRNA molecule. The clearest signal appeared in the highly variable H17 (**Fig. 18**), particularly with regard to the insert in *Microcoleus vaginatus*. The Stigonematales also had some distinctive patterns (H17, H21). However, the pattern with secondary structure was in most cases not clearly informative. Often the change in just one or two nucleotides can lead to differences in structure, and the same motifs can appear (apparently independently) in separate clades. It is also difficult to know whether or not changes observed are due to sequencing error, which seems at least possible. Sequences with many single base insertions or deletions are certainly suspect.

Changes in primary structure, even if minor, could potentially have a great evolutionary significance in secondary structure and might be accompanied by changes in ribosomal proteins, on the other hand numerous neutral changes in sequence may not create a different secondary structure and the function of a structure will be remain the same.

[1] Zuker, M., 2003. Mfold web server for nucleic acid folding and hybridization prediction. Nucleic Acids Res. 31: 3406–3415.

[2] Gutell, R.R., Gray, M.W., Schnare, M.N., 1993. A compilation of large subunit (23S and 23S-like) ribosomal RNA structures. Nucleic Acids Res. 21: 3055–3074.

[3] Cannone, J.J., Subramanian, S., Schnare, M.N., Collett, J.R., D'Souza, L.M., Du, Y., Feng, B., Lin, N., Madabusi, L.V., Müller, K.M., Pande, N., Shang, Z., Yu, N., Gutell, R.R., 2002. The comparative RNA web (CRW) site: an online database of comparative sequence and structure information for ribosomal, intron, and other RNAs. BMC Bioinformatics 3: 2.

4.7 A New Procedure to Estimate the Size Adaptation of Zooplankton to Fish Predation

J. Hrbáček (*jhrbacek@seznam.cz*) developed a new index, "length of average biomass" (LeBi; mm), characterising the size structure of zooplankton communities. The value of LeBi is calculated from data obtained by size fractionation of zooplankon on sieves of different mesh sizes. Numerically, LeBi equals the theoretical mesh size through which exactly 50% of zooplankton biomass would pass. Size fractionation of zooplankton is performed sequentially on sieves of 0.93, 0.71, 0.42 and 0.20 mm, biomass in individual size classes is measured by the biuret method. Before the size fractionation, Copepoda and Cladocera are separated by manual shaking in a separatory funnel via differring adhesion to the surface film. **Fig. 19** shows the graphical estimation of LeBi. The sequence of percentages of the total biomass retained on sieves of certain mesh sizes are plotted as a function of the mesh sizes in millimeters. LeBi [mm] is defined as the intersection point of the line connecting the plotted data as described above and of the level of 50% of the biomass. Numerically, LeBi is calculated using the equation:

$$\mathrm{LeBi} = \frac{(\mathrm{Y}_1 - 50) \times (\mathrm{X}_2 - \mathrm{X}_1)}{(\mathrm{Y}_1 - \mathrm{Y}_2)} + \mathrm{X}_1$$

where Y_1 and Y_2 are the biomass percentages closest to 50%: Y_1 is the closest value higher than 50% and Y_2 is the closest value lower than 50%; X_1 and X_2 (mm) are the mesh sizes pertaining to these percentages. The mesh size which would enable 50% of zooplankton biomass to pass through represents the length of the average biomass of Cladocerans and Copepods in millimetres.

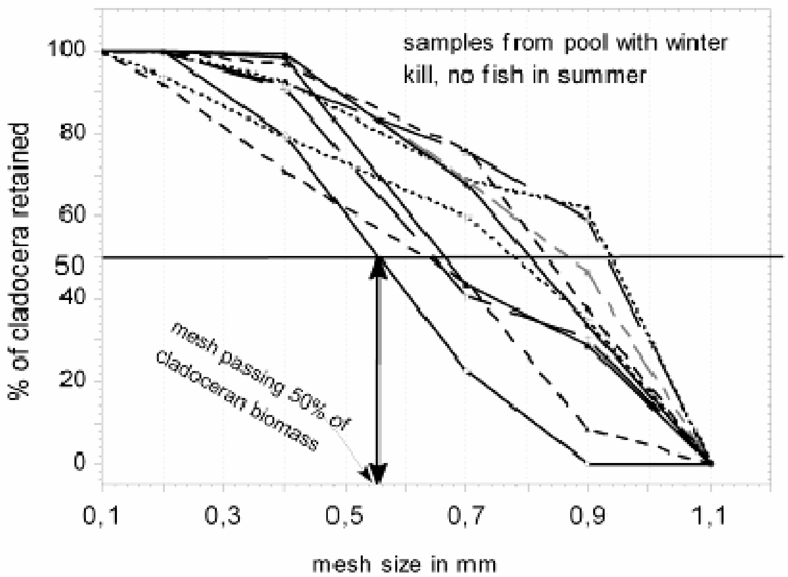

Fig. 19: Graph illustrating the estimation of the length of average biomass (LeBi), which equals mesh size enabling passage of 50% of the biomass.

Fig. 20 presents seasonal LeBi changes in localities in the Czech Republic with differing fish stock. The data used were obtained by ***Z. Brandl, J. Seďa*** and ***J. Hrbáček*** during the past several decades. T3 is a pool in the inundation area of the river Lužnice south of the town of Třeboň, with no fish due to microanaerobic conditions in winter. Hubenov Reservoir, west of the town of Jihlava, is heavily stocked with trout and has a growing population of perch. Římov Reservoir, south of the city of České Budějovice, has stunted populations of cyprinids and percids. Data in **Fig. 20** show individual estimations in different years, full symbols connected by lines indicate average values calculated for identical periods of different years. Two periods are apparent in the seasonal development of LeBi, characterised by different

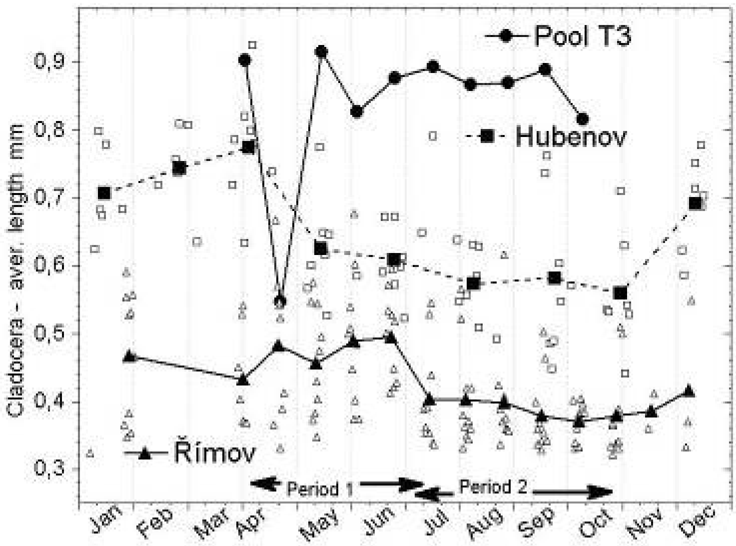

Fig. 20: Seasonal pattern of average length of cladocerans in the T3 pool without fish, in Hubenov Reservoir with trout and perch stock, and in Římov Reservoir with stock of stunted cyprinid and percid populations. Period 1 is characterized by spawning and large fluctuations of cladoceran populations, period 2 by growth of fry.

predation pressure of the fish stock on zooplankton. In period 1 (approximately April – June, see **Fig. 20**) the fish are occupied by spawning and the Cladocera biomass fluctuates strongly, this in turn leads to strong fluctuation of the ratio of newborn and sub- adult stages to mature individuals. In addition to fish predation, the fluctuation of this parameter is another mechanism strongly influencing the values of LeBi. The mechanism is most apparent in fishless habitats. During period 2 (approximately July – October, **Fig. 20**), characterised by fish fry growth, the predation pressure of fish on zooplankton is at its most intensive.

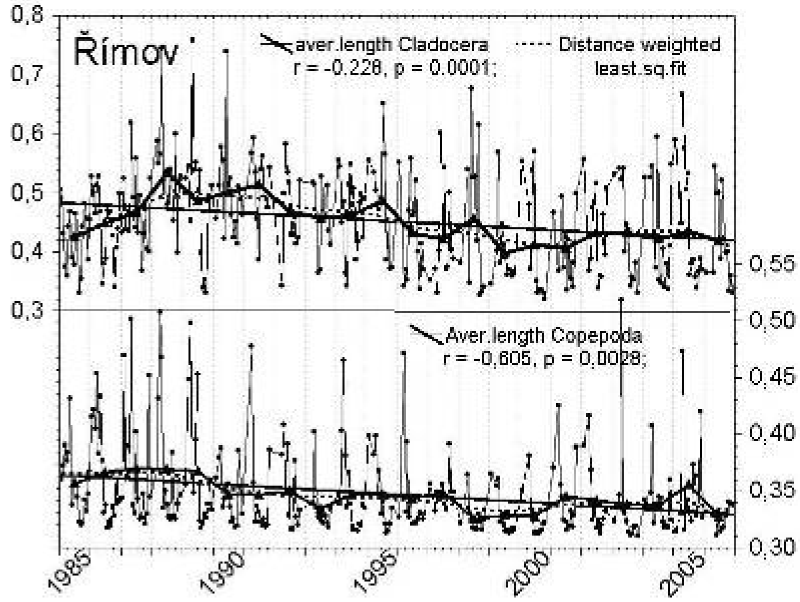

Fig. 21: Length of average Cladocera and Copepoda biomass (LeBi) in mm in Římov Reservoir between 1985–2006.

Fig. 21 presents long-term trends in the value of LeBi of Cladocera and Copepoda in the Římov Reservoir. Samples were taken at three-week intervals, with the exception of the winter months, when sampling was less frequent in some years. The LeBi index decreased significantly within the period studied (evaluated by linear regression). The LeBi decrease indicates higher fish predation pressure and probably also an increase in fish stock numbers with zooplankton biomass remaining unchanged. The courses of yearly averages and of distance-weighted least-square fit of LeBi for both Cladocera and Copepoda are only partly parallel.

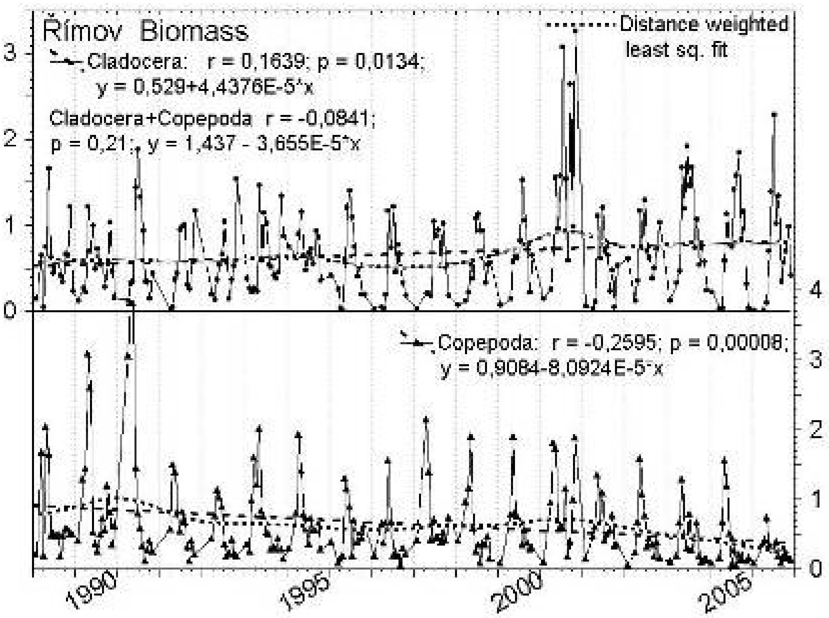

Fig. 22: The biomass of Cladocera and Copepoda in Římov reservoir in the years 1989–2006.

In attempting to infer information on fish stock from zooplankton size structure, we also need to take into account the dependence of fish numbers on planktonic crustacean biomass. Long-term trends in zooplankton biomass in the Římov Reservoir in the years 1989–2006 (**Fig. 22**) showed a statistically significant decrease of Cladocera biomass and growth of Copepoda biomass (linear regression), while long-term changes in the sum of both biomass values demonstrated a small and statistically insignificant increase. These data might indicate

Table 7: Selected zooplankton parametres in Římov and Slapy Reservoirs in the period 1989–2000. Clad = Cladocera, Cop = Copepoda, Cru = sum of the biomass of the Cladocera and Copepoda; Cl/Co = ratio of the cladoceran and copepodan biomass. LeBi = length of average biomass.

	Biomass			LnBiomass					LeBi	
	Clad	Cop	Cru	Clad	Cop	Cru	Cl/Co	Ln Cl/Co	Clad	Cop
Slapy	0.87	0.72	1.59	3.73	3.86	4.63	1.40	4.47	0.47	0.36
Římov	0.64	0.65	1.29	3.72	3.82	4.64	1.76	4.51	0.45	0.35
diff.	0.23	0.06	0.30	0.00	0.04	–0.01	–0.36	–0.04	0.02	0.01
diff. %	26.7	8.67	18.6	0.11	1.03	–0.21	–26.1	–0.81	3.65	3.03

a slight increase in total biomass and number of smaller fish. In the Slapy Reservoir, long-term trends of LeBi and biomass for both copepods and cladocers demonstrated an approximately parallel increase (evaluated by linear regression, data not shown). Similarly, distance weighted least square fits, which were close to a unimodal course, were approximately parallel.

Table 7 shows zooplankton parametres from the Slapy and Římov Reservoirs in the period 1989–2000. There were distinct differences between biomass averages for both Cladocera and Copepoda in both the Římov and the Slapy Reservoirs in the givern period, more pronounced in the case of the copepods. The average of the ratio between Cladocera and Copepoda biomass also differed between the two reservoirs in the period covered. On the other hand, no differences were found between the two reservoirs in averages of LeBi for Cladocera or for Copepoda. This changed after logarithmic transformation of the data: the long-term averages of all the parametres followed demonstrated a negligible difference between the two reservoirs in the period 1989–2000. This might be caused by the data distribution (**Fig. 23**), which was approximately log-normal. Thus prior to logarithmic transformation the data distribution was very far from normality. In view of great difference in scale, inflow, nutrient input and fish management between the two reservoirs the lack of difference in the long term-averages of the parametres followed is remarkable and indicates the usefulness of similar comparisons in other reservoirs.

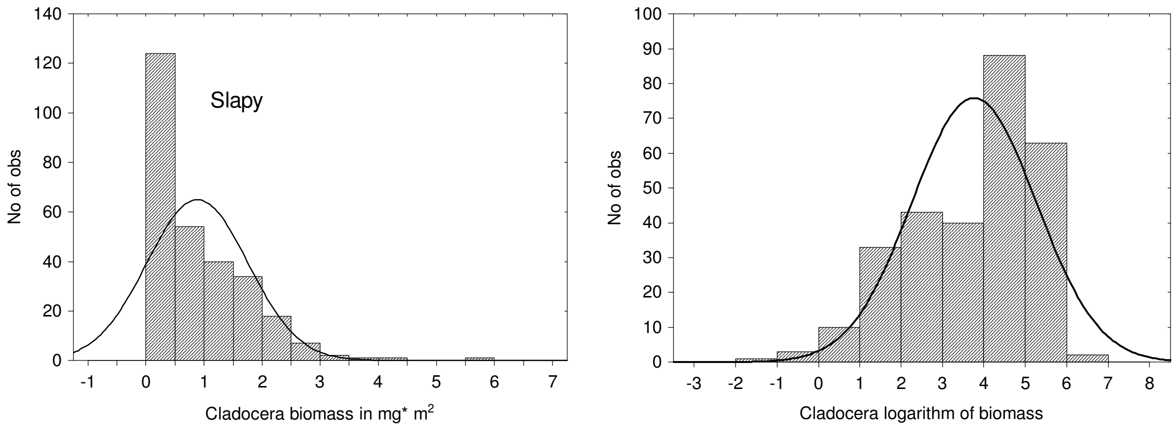

Fig. 23: Distribution of Cladoceran biomass in mg. m^{-2} in Slapy reservoir in the years 1989–2006 in histograms of linear and logarithmically transformed data.

The dramatic influence of logarithmic transformation of the data on the outcomes of comparing long-term averages (1989–2000) of different zooplankton parametres in two reservoirs raises the question of the impact of logarithmic transformation on the long-term trends of these parametres mentioned earlier. In the Římov Reservoir, the slopes of the long-term linear biomass trends and their statistical significance remain unchanged. In the Slapy Reservoir, the slopes of the trends evaluated by linear regression and the unimodality of the weighed least-square fit resemble those obtained before the data transformation, but the upward linear trend of Copepoda biomass is not statistically significant.

4.8 International Conference "Fish Stock Assessment Methods for Lakes and Reservoirs: Towards the True Picture of Fish Stock"

On 11–15 September 2007 the international conference "Fish stock assessment methods for lakes and reservoirs: towards the true picture of fish stock" was held in České Budějovice. It was co-ordinated by ***J. Kubečka*** *(kubecka@hbu.cas.cz)* and administrated by ***E. Hohausová*** *(ehoh@centrum.cz)* of the Fish Ecology Unit (FishEcU), Institute of Hydrobiology. The conference was held in co-operation with the European Inland Fisheries Advisory Commission (EIFAC), European Commission for Normalisation (CEN) and the University of South Bohemia.

The scope of the conference reflected several aspects of the announced topic: Although the methodology of studying large inland waters such as lakes and reservoirs has been rapidly developing during recent years, obtaining sound qualitative and quantitative information on all significant ecospecies of fish still represents a challenging task. Such a task is difficult to achieve in many localities and a range of improvements in sampling and stock assessment techniques is still required. Also, fish stock assessment approaches differ considerably among countries and work groups and thus broader international co-operation and standardization of methods is very desirable.

At the same time, the conference was the result of several-year hard work of the FishEcU research group. The group's research effort has been focused on the use, improvement and *in situ* application of methods of fish stock assessment and on understanding the overall fish ecology of large water bodies.

The conference hosted 110 guests from 34 countries and five continents. Among the participants, there were scientists and researchers as well as representatives of fisheries organisations, environmental agencies, water authorities, government/state and private agencies and consultancies. The conference programme included 62 oral contributions and 34 posters. In addition, five specialized workshops complemented the programme, which was rated overall as very successful by the participants.

The conference showed that the true picture of fish stock in freshwaters is still of interest to the broad scientific community and to representatives of many other public bodies. From this point of view, mainly those contributions that critically assessed the potential and limitations of currently "fashionable" methodical approaches, such as gillnets and hydroacoustic techniques were appreciated. On the other hand, the conference revealed that very little attention has been devoted to so-called "active gear", i.e. sampling by trawls, seine nets, electrofishing and visual techniques. The contributions presented on these topics, few but of high quality, showed the indispensability of such approaches to derive the complete true picture. Especially trawl samplings appear to be a promising approach for obtaining an undistorted picture of the fish stock in lakes and reservoirs.

It was unanimously decided that the Institute of Hydrobiology in view of its large contribution to the study of fish stock assessment by active gear, will co-ordinate the preparation of European standards for seining use as well as the European project for the development of trawling in freshwaters. These topics were also chosen as carrying themes for future meetings.

At the conference, broad attention was also devoted to the standardization of sampling methods as a way of reaching more comparable results among research teams, study sites, countries, etc. As the standardization had been developing independently in the EU, the USA and Russia, the conference meant an important step toward interconnecting these standards.

At the same time the conference helped to break down some existing barriers between government institutions on one side and the academics on the other.

The conference participants showed considerable interest in the sampling approaches developed in the Czech Republic. A positive response to the 15 Czech contributions presented during the programme on our current research was a real satisfaction for our research group pointing that the way of finding the "true picture" launched some years ago was not a lost investment. Our interest in fish stock data arises mainly from our effort at understanding all the major aspects of the functioning of a water ecosystem. The importance of the true picture in this case is obvious. Understanding the processes happening under the water surface also has many practical benefits, e.g. in the sphere of water quality, fisheries management, environmental protection, etc.

As a result of the joint effort concentrated at the conference a special issue of the scientific journal Fisheries Research with 15 of the best papers submitted at the conference will be published within a year of the meeting.

5 PUBLICATIONS

(visit www.hbu.cas.cz/papers.php for the Institute bibliography 1993–2007)

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