

16TH INTERNATIONAL  
**CHIRONOMID**  
SYMPOSIUM

25th - 28th July 2006  
Casa da Luz Museum  
Funchal | Madeira | Portugal



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## INTRODUCTION

Welcome to the 16<sup>th</sup> International Chironomid Symposium, hosted by the Centre for Macaronesian Studies (CEM) of the University of Madeira.

The organizers would like to thank you for your contribution to this event, held in Funchal, Madeira between the 25<sup>th</sup> and the 28<sup>th</sup> of July, 2006. We have made every effort to make your visit a pleasant and hopefully memorable one; we sincerely hope you enjoy your stay here.

Islands have always held a special fascination for natural scientists. Madeira, part of the fascinating and beautiful biogeographical region of Macaronesia is no exception. The island houses the world's largest remaining area of laurel forest, which is fully protected and has UNESCO World Heritage Status. We hope you will have time to explore this lush and verdant vegetation via the many paths and levadas that cross the heart of this island and make (authorized!) collections.

The chironomid symposia traditionally bring together scientists from around the world that work in different areas of research on this fascinating group, and provide a fantastic opportunity to present, discuss and share ideas, not only during the symposium but also "after hours".

The theme of the Thienemann lecture and the opening day is the use of chironomids in monitoring environmental and climate change, as we feel that chironomid research has an important role in these pressing and highly relevant issues. We would like to thank Professor Ian Walker for accepting our invitation to open the symposium by talking on "Chironomids: the past, present, and our future".

We would also like to thank all of our Sponsors for their extraordinary generosity and cooperation in helping to make this event a success.

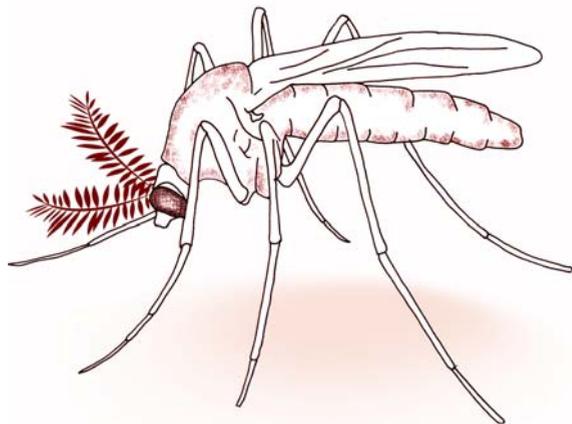
A handwritten signature in cursive script, reading "Samantha Jane Hughes", written in black ink. The signature is positioned above a thin, horizontal black line.

Samantha Jane Hughes

July 2006  
The President of the 16<sup>th</sup> International Chironomid Symposium



# GENERAL PROGRAMME





## MONDAY 24<sup>TH</sup> JULY 2006

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09:00-17:30 Registration and Documentation

Casa da Luz Museum

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## TUESDAY 25<sup>TH</sup> JULY 2006

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09:00-09:30 Registration

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09:30-10:00 Inaugural Ceremony

10:00-10:45 The Thiennemann Honorary Lecture

Chairman:  
Dr. Samantha J. Hughes

10:45-11:00 Morning Coffee Break

11:00-12:30 Oral Communications  
Palaeolimnology (PL) - Page 26

Chairman:  
Professor Ian Walker

12:45-14:00 Lunch Break

14:00-15:30 Oral Communications  
Toxicology & Biomonitoring 1 (TBM) - Page 39

Chairman:  
Professor Len Ferrington

15:30-16:00 Afternoon Coffee Break

16:00-17:15 Oral Communications  
Toxicology & Biomonitoring 2 (TBM) - Page 45

Chairman:  
Dr. Keith White

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17:15-18:15 Poster Session

From 18:30 Madeira de Honra and Welcome Reception

Funchal Town Hall

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## WEDNESDAY, 26<sup>TH</sup> JULY 2006

09:00-10:30 **Oral Communications**  
Ecology 1 (EC) - Page 57

Chairman:  
**Professor Meir Broza**

10:30-11:00 **Morning Coffee Break**

11:00-12:15 **Oral Communications**  
Taxonomy, Morphology & Systematics (TMS) - Page 83

Chairman:  
**Professor Torbjørn Ekrem**

12:15-14:00 **Lunch Break**

14:00-15:30 **Oral Communications**  
Ecology 2 (EC) - Page 63

Chairman:  
**Dr. Jon S. Olafsson**

15:30-16:00 **Afternoon Coffee Break**

16:00-17:00 **Oral Communications**  
Physiology & Physiological Responses (PH) - Page 101

Chairman:  
**Dr. Valeria Lencioni**

17:00-18:00 **Poster Session**

From 20:00 **Symposium Banquet**

Quinta Magnólia

## THURSDAY, 27<sup>TH</sup> JULY 2006

09:00-10:30	<b>Oral Communications</b> Biogeography & Biodiversity (BGD) - Page 108	Chairman: <b>Dr Susan E. Gresens</b>
10:30-11:00	<b>Morning Coffee Break</b>	
11:00-12:15	<b>Poster Session</b> Prizes for the best poster and the best oral presentation	
12:15-14:00	<b>Lunch Break</b>	
14:00-15:30	<b>Debate &amp; Forum - Page 119</b> Divulging Chironomid Research: Bibliography and Data Bases	Chairman: <b>Dr. Odwin Hoffrichter</b>
15:30-16:00	<b>Afternoon Coffee Break</b>	
16:00-17:30	<b>Closing Session</b>	Chairman: <b>Professor Ole Seather</b>
18:00-21:00	<b>Cocktail &amp; Informal Talks</b>	Casa da Luz Museum

## FRIDAY, 27<sup>TH</sup> JULY 2006

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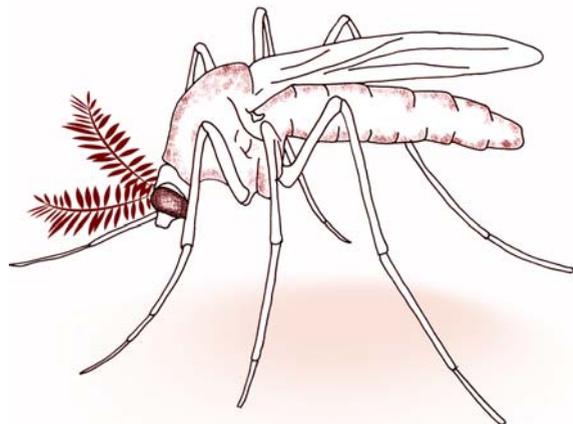
09:30-18:00 Post Symposium Excursions

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## SATURDAY, 28<sup>TH</sup> JULY 2006

From 09:30	Chironomid Workshop

# ABSTRACTS





THE THIENNEMAN  
HONORARY LECTURE

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*Professor Ian Walker*



## Chironomids: the past, the present, and our future

Walker, I.R.

Department of Biology and Earth & Environmental Sciences, University of British Columbia-Okanagan,  
3333 University Way, Kelowna, British Columbia, Canada V1V 1V7, Tl. (250) 807 9559, Fax (250) 807  
8004, ian.walker@ubc.ca

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A personal perspective on the history of chironomid research from the work of Thienemann through to the present day, emphasizing the use of midges as environmental indicators, especially in palaeoecology. The lecture will critically evaluate palaeoecological research of the past decade considering how the science can be used to society's benefit. A potential research agenda will be proposed where chironomid ecologists, physiologists, palaeoecologists and systematists can work together to address key unresolved issues in chironomid research.



*Session 1*

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**PALAEOLIMNOLOGY (PL)**

# ORAL COMMUNICATIONS INDEX

## Palaeolimnology (PL)

PL	Communication	Pages.
01	130,000 years of chironomid remains: climate change research at Arctic sites  <u>Francis, D.R.</u> ; Axford, Y.; Walker, I.R.; Miller, G.H.; Briner, J.P. & Wolfe, A.P.	26
02	Population dynamics in Slavonian grebes and chironomid midges  <u>Brooks, S.J.</u> & Benn, S.	27
03	From chironomids to palaeo-meteorology – with help from the isotopes!  <u>Lang, B.</u> ; Marshall, J.D.; Bedford, A.; Jones, R.T.; Brooks, S.J.; Fisher, E.H.; Gibbons, H.; Kiriakoulakis, K. & Richardson, N.	28
04	Chironomids in Icelandic lakes – community structure and environment  <u>Hrafnisdottir, Th.</u> ; Langdon, P.G. & Malmquist, H.J.	29
05	A chironomid record of last ice-age conditions from an unusual location: Finnish Lapland  <u>Engels, S.</u> ; Bohncke, S.J.P.1; Bos, J.A.A.; Helmens, K.F.; & Heiri, O.H.	30
06	A late Quaternary chironomid-inferred temperature record from the Sierra Nevada, California, with connections to Northeast Pacific sea surface temperatures  <u>Potito, A.P.</u> ; Porinchi, D.P.; MacDonald, G.M. & Moser, K.A.	31

# POSTERS INDEX

## Palaeolimnology (PL)

PL	Communication	Pages
<b>P1</b>	Past climate and environmental changes in the Aa river valley (Northern France), reconstructed using chironomid remains from a Late glacial - Holocene sedimentary record  <b>Gandouin, E.; <u>Maasri, A.</u>; Ponei, P.; Franquet, E.; Van Vliet-Lanoë, B.; Andrieu-Ponei, V.; Keen, D.H.; Brulhet, J. &amp; Brocandel, M.</b>	<b>32</b>
<b>P2</b>	High resolution analysis of sub-fossil chironomids from the Inter-Mountain Region of the Western United States provides evidence of 20 <sup>th</sup> Century warming  <b><u>Porinchu, D.F.</u>; Potito, A.P.; MacDonald, G.M.; Moser, K.A. &amp; Bloom, A.M.</b>	<b>33</b>
<b>P3</b>	Namakan Lake: a challenging lake for paleolimnological studies  <b><u>Serieyssol, C.A.</u>; Edlund, M.B. &amp; Ferrington, L.C.Jr.</b>	<b>34</b>

## 130,000 years of chironomid remains: climate change research at Arctic sites

Francis, D.R.<sup>1</sup>; Axford, Y.<sup>2</sup>; Walker, I.R.<sup>3</sup>; Miller, G.H.<sup>2</sup>; Briner, J.P.<sup>4</sup> & Wolfe, A.P.<sup>5</sup>

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General circulation models predict that climate warming will be most intense in Arctic regions, and in fact, evidence of this is already mounting. To understand and predict future climate change it is essential to place current climate in the context of past natural climate variation. Lake sediments provide us with archives of climate change records, and allow terrestrial conditions to be compared with marine records. The distribution of suitable lake sites across the landscape also facilitates an understanding of the spatial variability of climate conditions. Remains of chironomid larvae have proven to be an effective tool for estimating past temperatures. Using models derived from the modern distribution of chironomid taxa, past temperatures can be quantitatively estimated from fossil assemblages.

Analysis of lacustrine sedimentary records at many sites across the Arctic will improve our understanding of the spatial variability of climate in this sensitive region. We are developing temperature records from lake sites on Baffin and Ellesmere Islands, Greenland, and Iceland. The pattern of temperature change during the Holocene is similar at Baffin Island and Greenland sites. Midge-inferred temperatures consistently show early Holocene warmth, followed by cooling up until recent time. This pattern reflects the intensity of solar insolation during the Holocene. At Lake CF8 on Baffin Island, high resolution analysis has shown the same overall pattern of temperature change during the Holocene, but also cooling of 3-4°C that corresponds to the 8,2ka event, and another abrupt cooling event at about 9ka.

In addition to Holocene-age sediments, Fog Lake, Brother of Fog Lake, and Lake CF8 contain sediments deposited during the previous interglacial period (about 130 000 to 90 000 years BP). Midge-inferred temperatures for this period are 5 to 10°C warmer than present. The warm early Holocene period and the previous interglacial may be appropriate analogues for future climate warming.

## Population dynamics in Slavonian grebes and chironomid midges

Brooks, S.J.<sup>1</sup> & Benn, S.<sup>2</sup>

<sup>1</sup>Department of Entomology, Natural History Museum, Cromwell Road, London SW7 5BD, UK, Tl. (44) (0) 207 942 5198, Fax (44) (0) 207 942 5229, s.brooks@nhm.ac.uk

<sup>2</sup>Royal Society for the Protection of Birds, North Scotland Office, Etive House, Beechwood Park, Inverness IV2 3BW

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The Slavonian Grebe (*Podiceps auritus*) is a rare breeding bird in Britain, restricted to just a few Scottish lochs within 40 miles of Inverness. Annual monitoring since 1970 has revealed major fluctuations in the population and productivity of the birds. Habitat change does not appear to be significant and predation by American mink is not a problem this far North. Recent studies in Iceland have suggested that the grebe's productivity may be influenced by the numbers of small fish, which are themselves driven by changes in the abundance of chironomid midges. To investigate this possible link, we have used palaeolimnological techniques to reconstruct the size of the chironomid population at Loch Ruthven on an annual to biannual basis. Fluctuations in the midge population have been compared with changes in the Grebe population. Our results indicate a close relationship between the population dynamics of both the grebes and the midges. Attempts to implicate a climatic driver to the system have been less conclusive.

## From chironomids to palaeo-meteorology – with help from the isotopes!

Lang, B.<sup>1,2</sup>; Marshall, J.D.<sup>1</sup>; Bedford, A.<sup>2</sup>; Jones, R.T.<sup>3,2</sup>; Brooks, S.J.<sup>4</sup>; Fisher, E.H.<sup>1</sup>; Gibbons, H.<sup>1</sup>; Kiriakoulakis, K.<sup>1</sup> & Richardson, N.<sup>2</sup>

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<sup>2</sup>Natural Geographical and Applied Sciences, Edge Hill College, Ormskirk L39 4QP, UK., Tl. (44) (0) 169 558 4528, Fax (44) (0) 169 558 4559, bedforda@edgehill.ac.uk

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<sup>4</sup>Department of Entomology, Natural History Museum, Cromwell Road, London SW7 5BD, UK, Tl. (44) (0) 207 942 5198, Fax (44) (0) 207 942 5229, s.brooks@nhm.ac.uk

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Chironomid analysis from carbonate successions at Hawes Water in NW England demonstrates the variability of terrestrial climates in the early Holocene (~11 500 – 5 000BP) and Late glacial periods (~11 500 – 14 500BP). Whilst the Devensian/Late-glacial/Younger Dryas/Holocene boundaries are marked by major taxonomic shifts in the chironomid assemblages, a number of smaller climatic events are indicated by the more subtle changes in relative abundance of warm, intermediate and cold taxa within the assemblages. Chironomid inferred temperatures (CI-T) for the early Holocene produced using the Norwegian training set (Brooks & Birks unpublished) indicate a rapid warming from the Younger Dryas stadial into the Holocene followed by a more gradual warming towards the mid Holocene. Overlying this warming, from the beginning of the Holocene to ~8000BP, CI-T indicate a series of cooler climatic oscillations. The two largest of these events at 8 200 and 9 200BP show temperatures to have cooled by about 1.6°C. The similarity of the Hawes Water record to oceanic and ice core records shows both the sensitivity of the site and the robustness of the Norwegian inference model with regard to hard water lakes. The use of CI-T together with oxygen isotopic records from Hawes Water has enabled the  $\delta^{18}\text{O}$  of rainfall to be calculated. Shifts in this parameter indicate a direct downstream response to the freshening of the North east Atlantic and partial shutdown of the thermohaline circulation caused by sudden discharges from melting ice-sheets. Examination of earlier sediments from Hawes Water and several other carbonate lakes in the region has identified several small scale climatic shifts within the Late-glacial interstadial period. Calculation of  $\delta^{18}\text{O}$  of rainfall during these events has enabled us to identify further terrestrial responses to oceanic change and to start to map the spatial effects of rapid climate events.

## Chironomids in Icelandic lakes – community structure and environment

Hrafnisdottir, Th.<sup>1,2</sup>; Langdon, P.G.<sup>2</sup> & Malmquist, H.J.<sup>1</sup>

<sup>1</sup>Natural History Museum of Kopavogur, Hamraborg 6a, IS-200 Kopavogur, Iceland, Tl. (354) 570 0434, Fax (354) 570 0431, thora@natkop.is

<sup>2</sup>Department of Geography, School of Geography, Archaeology and Earth Resources, University of Exeter, Amory Building, Rennes Drive, Exeter EX4 4RJ, UK, Tl. (44) (0) 139 226 3341, Fax (44) (0) 139 226 3342, p.g.langdon@ex.ac.uk

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Compared to similar latitudes in Europe and North America the fauna and flora of Iceland is young and species poor. In particular this applies to the chironomids and other aquatic taxa and hence, the lake ecosystems are relatively simple. Icelandic lakes are often referred to as pristine and most are probably in the oligotrophic range, though studies are scarce on the trophic state of Icelandic lakes. The estimated number of lakes in Iceland larger than 10ha is 1 850 and a rough estimate for smaller lakes and ponds (1-10ha) is around 7 000. Iceland's position at the divergent tectonic plate boundaries of the Mid-Atlantic Ridge means that Iceland is geologically young although a range of different geologies occur which have proved to have influence on the lake ecosystems through their catchment areas.

The aim of this research is twofold. Firstly, to analyse chironomid communities in a range of Icelandic lakes in relation to geological, topographical and biological parameters. Secondly, to determine the principal environmental parameters influencing the structure of the chironomid communities. The potential environmental parameters tested are e.g. bedrock type in catchment area, altitude, lake area and volume, mean and maximum depth, temperature, major nutrients and predation.

Initial analyses are based on profundal chironomids from a subset of 28 lakes (>1km<sup>2</sup>) included in the ESIL database (Ecological Survey of Icelandic Lakes). The database also includes information on the biology, limnology and hydrogeology of 83 lakes country-wide where samples and measurements are acquired by standardised sampling methods. Future work will attempt to extend these analyses to include more lakes from the database.

Preliminary results of the analysis of 28 lakes will be presented and the implications of the setting on the ecology of the lakes and their chironomid communities will be discussed.

## A chironomid record of last ice-age conditions from an unusual location: Finnish Lapland

Engels, S.<sup>1</sup>; Bohncke, S.J.P.<sup>1</sup>; Bos, J.A.A.<sup>1</sup>; Helmens, K.F.<sup>2</sup>; & Heiri, O.H.<sup>3</sup>

<sup>1</sup>Faculty of Earth and Life Sciences, Vrije Universiteit Amsterdam, De Boelelaan 1085, 1081 HV, Amsterdam, The Netherlands. Tl. (31) 20 598 7265, Fax (31) 20 598 9941, stefan.engels@falw.vu.nl  
<sup>2</sup>Department of Physical Geography and Quaternary Geology, Stockholm University, Svante Arrhenius väg 8C, 106 91 Stockholm, Sweden, Tl. (46) 816 4775, karin.helmens@natgeo.su.se

<sup>3</sup>Palaeoecology, Laboratory of Palaeobotany and Palynology, Institute of Environmental Biology, Utrecht University, Budapestlaan 3, 3584CD Utrecht, The Netherlands, Tl. (31) 30 253 2647, Fax (31) 30 253 5096, O.Heiri@bio.uu.nl

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Fossil chironomid-remains have been widely used in climate reconstructions and reconstructions of lacustrine environments. The majority of these reconstructions involved sediments from the Holocene and Late-Glacial periods. However, chironomid-based palaeoenvironmental reconstructions on materials older than ca. 15 000 yearsBP are still sparse. In Finnish Lapland, a remarkable long and nearly continuous sedimentary sequence spanning the last 130 000 years has been found in a small sedimentary basin (67°48'N, 29°18'E). In this record, fossil-rich lacustrine sediments alternate with glacial-deglacial series in the sequence. The uppermost lake-deposit is dated to the middle part of the last ice-age (or Weichselian), ca 50 000 years ago.

In this section, fossil chironomid remains were analyzed in order to reconstruct the climate evolution during the sedimentation history of the lake. The lower part of the record shows a low chironomid-productivity and this part of the record is interpreted as the pioneer-stage of the lake. *Procladius*, *Chironomus anthracinus*-type and *Tanytarsus lugens*-type are the first taxa to become dominant in the fossil record. Subsequently, the assemblages are dominated by taxa typical for temperate and subarctic regions such as *Polypedilum nubeculosum*-type and later *Microtendipes*, suggesting a comparatively warm climate at the study site. In the upper part of the record, taxa indicative of colder conditions such as *Paracladius*-type appear, suggesting declining summer temperatures. The chironomid assemblages typical of subarctic and temperate regions suggest that the lake sediments were deposited during a warmer interval during the last ice-age (possibly a so-called Dansgaard/Oeschger-event), making this location a unique high-latitude terrestrial palaeoenvironmental record.

## A late Quaternary chironomid-inferred temperature record from the Sierra Nevada, California, with connections to Northeast Pacific sea surface temperatures

Potito, A.P.<sup>1</sup>; Porinchu, D.P.<sup>2</sup>; MacDonald, G.M.<sup>3</sup> & Moser, K.A.<sup>4</sup>

<sup>1</sup>Department of Geography, National University of Ireland, Galway, University Road, Galway, Ireland, TI. (353) 91 493 936, Fax (353) 91 495 505, aaron.potito@nuigalway.ie

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Chironomid remains from a mid-elevation lake in the Sierra Nevada, California, were used to quantitatively reconstruct summer surface water temperatures during the past ~15 000 years. There was a general trend of increasing temperatures (~3°C) from lake initiation until ~11 000 cal yr BP (calibrated years before present). Temperatures reached a plateau by ~11 000 cal yr BP, and remained relatively steady until just before 8 000 cal yr BP. At ~8000 cal yr BP summer surface water temperatures dipped, then sharply rose 3.4°C to their Holocene maximum at ~6500 yr BP. There were a series of peaks and troughs in temperature through the remainder of the chronology, though there was a gradual cooling in millennial-scale temperatures from the Holocene thermal maximum to the present. A comparison of this record to reconstructed Santa Barbara Basin (SBB) sea surface temperatures suggests that Sierra Nevada temperatures are linked to Northeastern Pacific Ocean phenomena through much of the Holocene. Evidence of higher climate variability in the Sierra Nevada and the SBB during the warm middle Holocene suggests that California climate may become more variable as the Northeast Pacific Ocean continues to warm. This study provides the first quantitative temperature reconstruction in the Sierra Nevada spanning the late Pleistocene and Holocene.

## Past climate and environmental changes in the Aa river valley (Northern France), reconstructed using chironomid remains from a Late glacial – Holocene sedimentary record

Gandouin, E.<sup>1</sup>; Maasri, A.<sup>1</sup>; Ponel, P.<sup>1</sup>; Franquet, E.<sup>1</sup>; Van Vliet-Lanoë, B.<sup>2</sup>; Andrieu-Ponel, V.<sup>1</sup>; Keen, D.H.<sup>3</sup>; Brulhet, J.<sup>4</sup> & Brocandel, M.<sup>4</sup>

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A core about 21m long extracted from the Aa river valley (Northern France) in the St Omer subsident basin (30km inland, 2m a.s.l.) has been submitted to chironomid analysis. 111 chironomid taxa have been identified for the whole sequence, which includes 92 chironomid assemblages (samples). Assemblages were divided into 16 faunal units (SMch-1 to SMch-16) regrouped into 3 main zones according to the variation of ecological categories: cold water adapted taxa, warm water adapted, lotic (rheophilous) and lentic (limnophilous) taxa. Faunal assemblage succession throughout this sequence provides a detailed reconstruction of palaeoenvironment and palaeotemperature changes in a region almost totally unknown from a palaeoentomological point of view. Zone 1 corresponds to chironomid assemblages typical of a shallow, oligotrophic and slow-flowing freshwater stream, with abundant aquatic macrophytic vegetation. The climate was cold as suggested by the dominance of cold-water adapted taxa. Mean summer water temperatures reconstructed with modern thermal preferences of taxa were probably close to 10°C at that time. Zone 2 is marked by deep ecological changes, associated with a strong climate warming with summer temperatures oscillating probably between 18°C to 21°C. Very eutrophic and shallow stagnant-water conditions occur throughout the basin. This zone is attributed to the first part of the Holocene (Preboreal to Atlantic) and the beginning of the flandrian marine transgression which strongly influences the river hydrological regime. Zone 3 corresponds to chironomid assemblages marked by alternation of dominant rheophilous or limnophilous fauna as a probable consequence of fluctuations of hydrological regime and thus probably in the regional precipitation rate. The climate was temperate, as suggested by the dominance of warm-water adapted taxa.

## High resolution analysis of sub-fossil chironomids from the Inter-Mountain Region of the Western United States provides evidence of 20<sup>th</sup> Century warming

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High-resolution chironomid stratigraphies were developed for five sub-alpine lakes in the Inter-Mountain region of the Western United States to assess whether these lakes have been affected by recent climate change evident in regional instrumental records for the 19<sup>th</sup> and 20<sup>th</sup> Centuries. Indirect gradient analysis of the chironomid fauna indicates that the lakes have experienced similar unidirectional change in community composition over the 20<sup>th</sup> Century with the lakes showing particularly sharp gradients of change since the 1980's. A previously developed chironomid-based transfer function for surface water temperature, applied to the chironomid assemblages preserved in these lakes, provided quantitative temperature estimates of surface water temperatures spanning the 20<sup>th</sup> Century. The data indicate that the sites experienced temperature changes during the 20<sup>th</sup> Century; specifically, above average water temperatures characterized the late 20<sup>th</sup> Century and below average surface water temperatures occurred between A.D. 1910 and 1980. Close correspondences exist between the chironomid-inferred temperature profiles and mean July temperatures as measured at sites for which long-term NCEP re-analysis data is available during the period A.D. 1895-2005. It appears that climate change has an overriding influence on the composition of the chironomid communities within these lakes. This study demonstrates that sub-fossil chironomid analysis can provide detailed records of community response to regional climatic changes at sub-decadal time scales, and also reveals that the midge communities in sub-alpine lakes in the Inter-Mountain region of the Western United States have already been affected by recent climate change.

## Namakan Lake: a challenging lake for paleolimnological studies

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Namakan Lake, a multi-basin lake located in Northeastern Minnesota in Voyageur's National Park, has been subject to a variety of historical impacts. The lake has been impacted by European settlements starting the 1800s and damming in 1914, and since then, managers have regulated the lake through various water level manipulations. Paleolimnological studies are one key tool quantifying how these various anthropogenic influences have impacted Namakan Lake. We retrieved one core from Namakan Lake near Junction Bay and South of Namakan Island. This core was dated, tested for Loss on Ignition to distinguish carbon content and processed for diatom and chironomid analysis. Loss on Ignition indicated a distinct change in sediment composition when the dam was built in 1914. Variations in subfossil diatom and chironomid communities are being used to determine biological response to natural and manipulated lake conditions and under different land-use patterns. Analysis of diatom communities indicate that a diverse diatom community (>40 genera) is preserved throughout the cores. Distinct species shifts have occurred in the centric and fragilarioid groups. However, chironomid analysis has been challenging. Initial analysis has revealed low head counts in the sample. Even though more sediment was used for subsequent analyses, head counts are still low. Could this be a taphonomic problem?

*Session 2*

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**TOXICOLOGY & BIOMONITORING  
(TBM)**

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## Comparison and significance of chironomidae (Diptera) emergence from Lake Erie and Presque Isle Bay, Erie, Pennsylvania, USA

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Presque Isle Bay in Lake Erie has a long history of sediment and water contamination related to industries along lakeshore areas of Erie, Pennsylvania. Recent remediation efforts and other water quality and landscape management programs have improved water conditions in the bay; however biological responses by aquatic insects have not been intensively studied. Our objective was to determine if collections of surface-floating pupal exuviae (SFPE) could be employed as a cost-effective method to estimate and quantify variation in emergence of Chironomidae. For comparative purposes, SFPE were collected on three consecutive days in June 2005 from lake-side and bay-side areas of Presque Isle to determine composition and relative abundances of species emerging from Lake Erie (lake-side) and Presque Isle Bay (bay-side), and to quantify day-to-day variation in emergence estimates. Day-to-day similarity was high for bay-side/bay-side and lake-side/lake-side estimates, but was lower for lake-side/lake-side comparisons when compared to bay-side/bay-side similarities. Comparisons of lake-side to bay-side emergence showed lowest similarities. Emergence from Lake Erie was dominated by species of Orthocladiinae and Tanytarsini and consisted primarily of species that are relatively intolerant of low dissolved oxygen at the sediment-water interface. By contrast, emergence of Chironomidae from Presque Isle Bay was dominated by Chironomini, including several abundant species that are highly tolerant of low dissolved oxygen. Biotic index values calculated for daily collections were consistently higher for samples from Presque Isle Bay relative to Lake Erie, providing support for the interpretations based on dominant species. These results suggest that although water quality improvements have occurred in Presque Isle Bay, dissolved oxygen conditions at the sediment-water interface are still strongly constraining the species of Chironomidae to a community structure more characteristic of eutrophic conditions. We also conclude that lake-side estimates using SFPE are less precise in determining emergence patterns relative to bay-side estimates.

## Emergence patterns of Chironomidae in Southern Finland – implications for river biomonitoring

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Emergence patterns of Chironomidae were investigated by sampling two rivers at approximately two-week intervals from spring to autumn, using Chironomid Pupal Exuvial Technique (CPET). Special emphasis was placed on the emergence patterns of intolerant taxa, as these are suggested to be used in CPET-based assessment. Chironomid emergence started in late April and ceased in late September-early October. Total number of taxa in the samples was highest in late July (~40% of the detected taxa). Many intolerant chironomids emerged during only a certain season and some had an emergence period of only a few weeks. Furthermore, species within a genus also showed differing emergence patterns. The relative proportion of intolerant individuals in the samples varied significantly among consecutive samples, and the highest proportions were found in the spring and autumn samples. The shift in taxonomic composition of the samples within a season was highest in spring, decreasing towards autumn. To obtain a representative picture of the local (intolerant) chironomid fauna, samples should be allocated to different seasons.

## The response of chironomids to water and sediment chemistry in urban canals

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Forty-six sites on canals in the Midlands region of the UK were sampled using the Chironomid Pupal Exuviae Technique (CPET). Species data was associated with water and sediment chemistry at each site. Separate CCA analyses were carried on (i) all species and all chemical variables, (ii) water chemistry and epibenthic species and (iii) sediment chemistry with enbenthic species. Dissolved lead, chromium and TON, together with sediment lead and fines were the best variables discriminating between sites for (i); dissolved chromium, lead and Chlorophyll A best discriminated sites for (ii) and sediment fines, lead and nitrogen were the best discriminating variables for (iii). Biological classifications constrained by each of the significant variables were used to calculate indicator species scores. These scores were used to reveal indicator species assemblages characterising groups of samples produced by the constrained classifications. Mean body size was also assessed between different constrained classifications to determine whether there were any significant differences between groups. It was concluded that the CPET method was an effective biomonitoring tool to determine water and sediment quality in what has previously been a difficult habitat system to assess.

## Chironomids as water quality indicators in Italian lakes

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Chironomids are considered indicators of oxygen levels and trophic conditions, but there is little information about South European lakes. Benthic macroinvertebrates have been collected in 52 Italian lakes since the seventies. Species abundances and environmental variables (lake morphometry and physico-chemistry) were filed in a relational database. Multivariate analyses (principal component, multidimensional scaling, artificial neural networks) were carried out to separate species assemblages in relation to environmental factors. A preliminary benthic quality index for these lakes was proposed. Species composition was mainly forced by water conductivity and oxygen concentration, while depth and trophic variables (total phosphorous, nitrates) resulted of minor importance. Furthermore, different lake types were analyzed separately and indicator species associated to each lake type were detected. This index could be useful in fulfilling the WFD requests. The thoracic horn morphology and the hemoglobin content were also analyzed in some Chironomid taxa (*Chironomus plumosus*, *Chironomus riparius*, *Glyptotendipes* sp., *Polypedilum nubeculosum*) in relation to the level of tolerance to ipoxia.

## Indication potential of chironomid larvae evaluated within the response of macroinvertebrate community to degradation of small streams

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Development of assessment methods for monitoring programmes required by EU Water Framework Directive was associated with evaluation of indication power of individual elements of aquatic fauna and flora. Chironomids are one of macroinvertebrate groups their detailed investigation tends to be limited due to relatively high time and expertise requirements needed for processing and identification. They are frequently excluded from the monitoring programmes or recorded at family level only.

The response of benthic fauna to gradients of organic pollution and hydromorphological degradation were studied within 30 small stream sites (divided into two datasets according to dominant impairment). Gradients of anthropogenic degradation were described by environmental characteristics of water chemistry, channel/floodplain hydromorphology and landuse in catchment.

Taxonomic structure of chironomid taxocoenoses were compared with structure of other macroinvertebrate groups and whole benthic community. Bray-Curtis dissimilarity index was used for evaluation of differences among samples which were plotted in ordination space using Multidimensional scaling. Macroinvertebrate autecological database was used for evaluation of characteristics based on sensitivity and ecological species traits. Updates and extensions of this database was/is supported by AQEM (EVK1-CT-1999-00027), STAR (EVK1-2001-00034) and EURO-LIMPACS (GOCE-CT-2003-505540) projects.

It was found that chironomid larvae respond to gradients of landuse (cropland percentage within floodplain and catchment), nutrient concentration and characteristics of riparian zone affecting light conditions, organic matter input and morphology of stream banks. Information about functional and sensitivity characteristics of macroinvertebrate community is not complete without including chironomids, ecologically heterogeneous family. Structure of chironomid communities can improve understanding of biotic response to complex stressors interactions operating at various spatial scales (channel-floodplain-catchment characteristics).

## A comparison of two methods for sampling Chironomidae in a disturbed stream

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Hardwood Creek near Hugo, Minnesota USA has been dredged throughout much of its length for approximately 100 years. Ditching practices allowed us to compare two methods for sampling the Chironomidae community in a disturbed stream. Surface floating pupal exuviae were collected approximately monthly, from April through November of 2004 at eight sites. Three dipnet samples were taken in June 2004 at each habitat stratification unit (bank, bottom, wood, and riffle) when present at each site. All chironomids were identified to the genus level. Each site was apart of a disturbance gradient, ranging from four months since the last dredging event to being dredged decades ago. We tested the null hypothesis that both sampling methods will capture an equal percentage of the Chironomidae community at the most disturbed sites. The difference in the percentage of the community captured by both methods ranged from 12,5 to 55,6%, at the most disturbed sites. The difference ranged from 4,5 to 22,2% at the least disturbed sites. When examining the data across all sites and dates, the pupal exuviae and dipnet methods collected 85,3 and 70,6% of the community respectively. We reject the null hypothesis and conclude that pupal exuviae collected approximately monthly best capture the composition of the Chironomidae community in Hardwood Creek.

## The effect of aqueous aluminium on the structure and function of the polytene chromosomes in *Chironomus* species

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The genotoxicity of aqueous aluminium to *Chironomus riparius* Mg. and *Chironomus acidophilus* Keyl larvae was assessed by analyzing structural and functional changes in the salivary gland polytene chromosomes under laboratory conditions and in natural populations. Exposure of *Chironomus riparius* over three generations to aluminium at neutral pH in the laboratory revealed numerous structural and functional alterations in the salivary gland chromosomes. Exposure to 500µg added Al for 24-25 days resulted in a significantly higher frequency of structural somatic rearrangements in the F1 generation, while no aberrations were found in controls and only few in the F2 and F3 generations. A decrease in the functional activity of key structures such as the Balbiani rings (BRs) and the nucleolar organizer (NOR) was also observed. *Chironomus acidophilus* from a site in the UK (Afon Goch, Anglesey) containing high concentrations of soluble aluminium mobilized by acid mine drainage (AMD; average pH 2.4) showed increased frequency of somatic rearrangements (heterozygous inversions, deletions, deficiencies) and a greater degree of asynapsis between chromosome homologues compared to the sibling species *C. luridus* Str. from a non-acidified unpolluted site in Bulgaria (South Park Lake, Sofia). The degree of activity of the (BRs) and the NOR also differed between the two species. Long term metal pollution arising from AMD result in changes in gene expression in *C. acidophilus* as demonstrated by specific enlargement of a new Balbiani ring and puff in the telomere region of chromosome G. These structural and functional changes to chironomid chromosomes support the hypothesis that aluminium binds DNA, destabilizing the genetic material and consequently affecting transcription and gene expression. The solubility of aluminium is highly pH-dependent and our data reveals that the metal is genotoxic to chironomids both when predominantly in solution at acidic pH and in particulate form at near-neutral pH.

We suggest that analysis of the structure and function of chironomid polytene chromosomes represents a sensitive end-point for the assessment of the genotoxicity of aluminium in the aquatic environment.

## The chironomid communities of groyne fields of a large lowland river in Central Europe (Elbe, Germany) and their potential use for ecotoxicological field studies (pupal exuviae)

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Groynes enhance the morphology of a regulated river, although they frequently represent the sole riparian mesohabitat. On the other hand, this ecological system reduced in heterogeneity helps to trace the effects of contaminants on the life communities in ecotoxicological studies. These habitats are rarely studied.

In this paper, a short introduction of the distribution patterns of chironomids in the groyne field is given. After that, a study of chironomid communities of the groyne fields from a stretch of the Middle Elbe River is presented aiming a screening on potential effects of potentially contaminated tributaries stretch:

From 6 groyne field areas distributed over a stretch of 85km, a total of 134 species (average 65) were recorded in 3 sampling campaigns in 2005 comprising a series of typical potamal species. For community analysis, several parameters of diversity (taxa richness, Shannon index, evenness), distribution profile, PCA etc. were used and related to other indicators as diatom assemblages and conductivity. The results from the data evaluated so far, show significant differences of the chironomid communities between the sites studied, however, depending on very few species known as tolerant (e.g. *Nanocladius bicolor*).

## Chironomid emergence in urban lakes with contrasting trophic states and sampling frequency required for community resolution

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In order to resolve the chironomid communities in lakes of contrasting trophic states, it is first necessary to determine the sampling frequency needed. We collected Surface Floating Pupal Exuviae for 10 minutes duration in five lakes monthly from April to November 2005 (ice-free season). All lakes were located in highly urbanized catchments in the Twin Cities Metro Area of Minnesota, USA. In four of the lakes, the mean total epilimnetic phosphorus to mean depth ratio ( $\mu\text{g/L/m}$ ) ranged from 1,1 (mesotrophic) to 14,5 (eutrophic). The fifth lake was hypereutrophic, with  $106\mu\text{g/L/m}$ . Generic richness and the ratio of Orthoclaadiinae to Chironominae by abundance was higher in the mesotrophic lakes than the eutrophic and hypereutrophic lakes. For sampling frequency, our results demonstrate that more samples are required to characterize a given percent of the chironomid community in a mesotrophic lake than a eutrophic lake. In the eutrophic and hypereutrophic lakes, just two monthly samples collected at least 85% of the cumulative generic richness, while in the mesotrophic lakes, three monthly samples were needed to reach at least 85% of the cumulative generic richness.

## Incidence of larvae mouthpart deformities in *Chironomus plumosus* and *Procladius* sp. from Piediluco Lake, Italy

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Morphological deformities of Diptera - Chironomidae, an important group of freshwater macrobenthic communities, represent a monitoring tool with a substantial potential among bioindicators. Toxicants accumulate in the sediments of water bodies, primarily in lakes, and Chironomid larvae are exposed to these sediment-associated chemicals both directly through contact and via food intake. Numerous studies examined deformities in the head capsules of Chironomid larvae in response to a variety of contaminants, and a positive relationship between frequency of deformities and severity of contamination has been pointed out. This study aims to analyse the frequency and the severity of larval mouthpart deformities in Piediluco Lake in littoral stations (5 sampling sites, 2004-2005) and to make a comparison with data observed in the Southern area, which is not so influenced by waters' refill due to hydroelectric energy production and which has already been object of an experimental action of removal of the sediments. Three reference categories have been defined thereupon deformities: Class1 - normal morphology; Class2 - slight deformity; Class3 - heavy deformity. *C. plumosus* and *Procladius* sp. have respectively showed deformities with a frequency of 32% on 2291 specimens (7% Class3) and of 19% on 230 specimens (9% Class3) in the littoral area. Deformities of *C. plumosus* and of *Procladius* sp. respectively amounted to 57% on 704 specimens (8% Class3) and to 24% on 384 specimens (15% Class3) in the Southern area of the lake. Most of deformed *C. plumosus* specimens belong to fourth instar in both investigations. Results show a substantial incidence of deformities in the littoral area and mostly in the Eastern zone which is less influenced by waters' refill. Therefore these results extend the probable condition of sediments pollution to the whole lake, pointing out an incidence of deformities correlated with the hydrologic regime of the different lacustrine areas.

## Cellular targets of cadmium toxicity

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Cadmium is a widespread environmental pollutant that has a severe impact on organisms. Although the effects of cadmium on aquatic insects have been studied in terms of their toxicity and changes in developmental parameters, little is known about its molecular and genetic effects. To assess the cellular damage potential of cadmium in the midge *Chironomus riparius* we have studied the cytotoxic effects of acute doses of cadmium in fourth instar larvae. Early cellular response was analysed after 10mM cadmium treatments. No significant effect on larvae mortality was detected until after 36h of exposure while a cell response can be detected after 12h of treatment. A modification in nucleolar architecture and inhibition of rDNA transcription were observed, suggesting that cadmium exposure results in the lowering of the level of functional activity of the nucleolus. However, the Balbiani ring genes, whose products are the giant polypeptides that constitute the silk-like secretion for constructing housing tubes, remain active. Simultaneously, there are changes in the gene expression pattern observed as decondensation and activation at some chromosomal regions, especially at the centromeres. These changes do not resemble those found after heat shock or other cell stressors. Alterations in the cytoskeleton are the most remarkable effect in the cytoplasmic compartment. Cadmium induces changes in the distribution pattern of both microtubules and actin filaments, while lisosomes and mitochondria do not appear to be drastically affected even at longer times of exposure. Our results indicate that the nucleolus and the cytoskeleton appear to be early cellular targets for toxicity and cell death induced by cadmium.

## Midge response to nutrient enrichment in Everglades National Park: a preliminary search for indicator species

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To determine midge community response to nutrient enrichment and identify possible indicators of water quality, midge pupal exuviae (MPE), water, soil, and plant tissue samples were collected along 5 nutrient gradients in Everglades National Park (ENP) produced by canal outflows. We then tested the reliability of nutrient-sensitive and nutrient-tolerant indicator species groups derived from our ENP gradient study and King's (2001) study in Water Conservation Area 2A (WCA-2A) by examining their responsiveness to low levels of phosphorus-dosing in 3 flume arrays in ENP. At each of the 3 flume arrays, randomly selected channels were dosed to elevate total-P loadings to 0, 5, 15, and 30 ppb above ambient levels, and MPE were collected 10m, 45m, and 75m downstream of the dosers in each channel 5 months and 2 years after dosing started.

Community abundance, richness, and diversity showed no consistent relationship with relative proximity to inflows or to P-dosing levels in the flumes. Eight species were significantly associated with interior ENP marshes far from inflows; 7 of these species were also sensitive to enrichment in WCA-2A. Seven species were significantly associated with marshes near canal inflow; none of these species were significantly tolerant to enrichment in WCA-2A. This discrepancy in tolerant species between the two studies probably represent differences in species responses to low gradients in ENP versus the much steeper gradient in WCA-2A.

ENP nutrient sensitive species were more responsive to P-enrichment than WCA-2A nutrient-sensitive species. ENP tolerant species were rare at the flume sites and inconsistently responsive to P-dosage, whereas WCA-2A tolerant species showed increases in abundance in high-dose channels relative to controls at all flumes, except Flume C in 2001. The greater responsiveness of ENP-sensitive species and WCA-tolerant species may reflect differences in the nutrient gradients sampled in the process of selecting these species as indicators.

## Chironomidae (Diptera) population survey and control studies in wetlands of a country club in Northeast Florida, USA

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A Qualitative and quantitative population survey of immature and adult Chironomidae was conducted for one year in a country club wetlands (lined with waterfront residences) located in Northeast Florida, USA. *Glyptotendipes paripes* and *Geoldichironomous carus* were the two major chironomid species in the wetlands. Adults of these two species emerged at nuisance levels from April through June and in August, September. Species of *Polypedilum*, *Cryptochironomous*, Tanytarsini, and Tanypodinae were also collected during the survey. In laboratory bioassays, technical grade temephos, s-methoprene, and a technical powder of *Bacillus thuringiensis* serovar. *israelensis* (*Bti*), respectively resulted in LC<sub>90</sub> values of 0,01ppm (*G. paripes*) and 0,009ppm (*G. carus*), 0,082ppm (*G. paripes*) and 0,055ppm (*G. carus*), and 1,056ppm (*G. paripes*) and 0,467ppm (*G. carus*). In experimental field plots in the wetlands, 5% AI Skeeter Abate® pellets at 0,1 and 0,2kg AI/ha, gave 52-86% (0,1kg AI/ha) and 74-92% (0.2 kg AI/ha) total midge larval reductions during the four weeks of evaluation. The technical powder of *Bti*, formulated on sand at 1,000,000 and 2,000,000 ITU (International Toxic Units), *Bti*/m<sup>2</sup> gave 47-52% (low rate) and 82-88% (high rate) total reductions of midge larvae during 6-20 days posttreatment. Methoprene (4,25% AI STRIKE® pellets) at 0,14 and 0,28 kg AI/ha induced a maximum of 80% suppression of adult emergence of total Chironomidae at 7 days posttreatment (low rate) and at the high rate, 92% suppression for up to 15 days posttreatment. Temephos and *Bti* were more economical and provided more extended midge control than s-methoprene in these field evaluations.



*Session 3*

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**ECOLOGY (EC)**

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## Chironomids and cholera, 2006

Broza, M.

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The association between chironomids and the bacterium *Vibrio cholerae* was presented first at the 15<sup>th</sup> Chironomid Symposium (2003). We claimed that Chironomini egg-masses serve as natural reservoir of environmental (non pathogenic) *V. cholerae* bacteria in freshwater bodies. We also mentioned shortly the possible role of the adult midges in transporting the bacteria, both intra- and inter-continently, as an aero-plankton. In the current presentation this topic will be reviewed and early report on a scientific mission to India, toward cholera outbreak, will be presented. Two adjacent area in South India were explored; The area around Chennai-Vellore, where the new pathogenic *V. cholerae* O139, was emerged and the Kaveiry River Delta where the Tsunami marine waves hit India in 2004. In those regions and in various types of water -bodies, both chironomids and the attached cholera bacterium, were sampled and now being under powerful DNA typing. The SSR typing adapted in our lab is both fast and able to discriminate intra-population biotypes. In this sampling we examined the merit of sampling the chironomid's pupa exuviae which was found earlier, to be heavily loaded with *V. cholerae*.

## Epilithon quality or quantity, are chironomid larvae so selective?

Maasri, A.<sup>1</sup>; Fayolle S.<sup>1</sup>; Gandouin, E.<sup>1</sup>; Garnier, R.<sup>1</sup> & Franquet, E.<sup>1</sup>

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Impacts of nutrient enrichment on the rheophilic chironomid larvae and algal communities were examined for a restrained spring period in a Mediterranean stream. Three stations representing three different degrees of enrichment were chosen for this purpose. In each of them, water chemistry, epilithic algae and epilithic chironomid larvae were analysed at six dates. The epilithon biomass developing upon pebbles was estimated and the epilithic algae were identified as well as the epilithic chironomid larvae. Kendall's coefficient of rank correlations and a CCA were used to compare correlations between chironomid taxa and algal communities. Chironomid community was dominated by *Eukiefferiella claripennis*, particularly, in the station with the highest degree of enrichment. Significant correlations were found between the chironomid larval densities and the algal cell densities, while correlations were not significant with the total biomass of the epilithon. The CCA results and correlations between chironomid species and different algal classes suggest different responses of chironomid larvae interacting with the different algae classes. Fixed tube scrapers as *Eukiefferiella claripennis* and *Cricotopus bicinctus* had the highest significant correlations to Rhodophyceae and Diatomophyceae. *Diamesa* sp. was correlated to Cyanophyceae and free living scrapers like *Thienemaniella* spp. and *Corynoneura* spp. had no significant correlations to algae classes. The bottom up effect of the organic enrichment on the epilithic algal and chironomid communities in the riffle sections seems to be an important factor structuring the epilithic chironomid communities. Further investigations taking in account the ingestion rates of some selected taxa have to be done to elucidate the trophic relationships between these taxa and the epilithic algae.

## Usefulness and problems of larval rearing in assessing lotic chironomid assemblage: a case study in a riffle/pool section at the middle reaches of the Shinano River, Japan

Inoue, E.<sup>1</sup>; Kimura, G.<sup>1</sup>; Denda, M.<sup>2</sup>; Tokioka, T.<sup>2</sup>; Amano, K.<sup>2</sup> & Hirabayashi, K.<sup>1</sup>

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Species composition and density of chironomid larvae were investigated at a fifth order river. By using construction machinery, we dammed off the flow and lower the water level at a riffle/pool section in order to replicate quantitative larval sampling by Surber sampler (30×30cm) or Ekman grab (15×15cm). Samples were collected at 22 sampling points in the section on January 30-31, 2006. Each point has four sampling replications: three for fix and one for larval rearing. A total of 855 imagines, 397 males and 458 females, emerged from rearing sample. The males were identified to 31 species in total, of which 14 and 9 species belong to Chironomini and Tanytarsini, respectively. A Canonical Correspondence Analysis (CCA), where current velocity, depth, ignition loss, chlorophyll-a and feofitin content on the riverbed were used as the main environmental variables, showed that distribution of some species were biased in riffle/pool gradient. *Polypedilum (Uresipedilum) paraviceps* and *Rheopelopia maculipennis* showed positive association whereas *Polypedilum (Polypedilum) asakawaense*, *Stictochironomus akizukii* and four *Tanytarsus* species showed negative association with riffle. The fixed samples have been under sorting, however, larval density ranged from 8 722,2 to 26 566,7 indiv.m<sup>-2</sup> at riffle and from 1 988,9 to 12 288,9 indiv.m<sup>-2</sup> at pool. Estimated ratio of successful emergence ranged 0,3-1,9% at riffle and 1,3-3,9% at pool. These results indicate that larval rearing is a useful method to assess the relationship between chironomid assemblage and environmental factor at species level, although density and/or distribution range of species would be highly underestimated.

***Prosilocerus lacustris* Kieffer 1923 (Chironomidae,  
Diptera) in a hypertrophic polish lake – habitat  
characteristics, history of occurrence and bioindicative  
value**

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Larvae of *Prosilocerus lacustris* were found in the bottom sediments at the edge of the reed belt a shallow, small and extremely fertile Lake Syczyńskie - the first location of the genus in Southern Poland. The larvae burrowed the top 5cm sediment layers. The sediments were beige in colour, soft and well decomposed, with low contribution of organic matter (21,5- 33,8 %) and of neutral pH (6,8-7,5). The larval density ranged from 30 to 150ind/m<sup>2</sup>. As evidenced by analyses of subfossil remains, the larvae have inhabited the lake since the middle 1970. When the system switched from eutrophy to hypertrophy due to poor agricultural practices and discharge of manure from located near-by livestock farm. Some lakes in Northern part of Poland support *P. lacustris*, too, but their trophic status varies from mezotrophy to hypertrophy, which puts in doubt values of the larvae as bioindicators of highly fertile conditions.

## Distribution and abundance of Chironomidae (Diptera) in tropical rice agroecosystem

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Investigation on the distribution and abundance of chironomid larvae (Chironomidae : Diptera) in a rice field in Bukit Merah Agricultural Research Station, Seberang Perai, Pulau Pinang Malaysia, has shown that the larval population fluctuated following the dynamic changes in rice field ecosystem. Bi-weekly sampling of larvae over two rice growing seasons of 2004/2005 revealed that *Chironomus kinesis* (Chironominae) was the most abundant species while four other species *Polypedilum trignonus*, *Tanytarsus formosanus*, *Tanytus punctipennis* and *Clinotanytus* sp were found in low numbers although they occurred during all rice wet phases. The mean larval population was 120,95 larvae m<sup>-2</sup> and varied significantly among sampling occasions and seasons (Kruskal-Wallis,  $\chi^2=174,29$ : df=16; P=0,000 and Mann-Whitney test, p=0,00 respectively). More larvae were found in plough phase in the absence of rice plants in the field. The population was observed to increase approximately two weeks after herbicides applications. Insecticides and fertilizers as well as the onset of emergence of larvae to adults probably accounted for reduction of population numbers through out the seasons. Five physicochemical variables, water level, height of rice plants, conductivity of water, nitrate-nitrogen and phosphate weakly influenced the larval density at P<0,05. The pH, dissolved oxygen, temperature, total organic matter and total suspended solids showed no significant interaction with the population of chironomid larvae in this rice field.

## Taxonomy and ecology of Chironomidae (Diptera) larvae of Isfahan province rivers, Iran

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To date, no comprehensive study has been carried out on the chironomid larval identification in running waters of Iran, in particular in large rivers. Therefore, this is the first article of its kind in Iran published in English. Samples were collected in selected sites from Zayandehrood (1998-1999), Golpayegan (2003-2004) and Marbor (2004-2005) Rivers. The samples were hand sorted in the laboratory and the larvae were identified to generic level. To study the effect of sites and seasons, and selected ecological factors on chironomid larval abundance and distribution, data were analyzed using one-way and two-way ANOVA, Duncan, Regression, Man-Whitney and Anderson-Darling tests. Fifty five genera were identified in four subfamilies including Chironominae (23), Diamesinae (3), Orthocladiinae (20) and Tanypodinae (9). The results also revealed that the mean number of the larvae was significantly different according to sites, seasons, oxygen, temperature, current velocity and vegetation cover ( $P < 0,05$ ).

## *Tanytarsus gracilentus* as an ecosystem engineer in a lentic environment

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The abundance of chironomid larvae may reach the point where the larvae significantly affect the physical and chemical properties of the sediment. In some years the larvae of *Tanytarsus gracilentus* occur in enormous densities (some hundred thousands per m<sup>2</sup>) in Lake Mývatn, N.E. Iceland. On those occasions the larvae modify the top 2cm of the sediment, which is then packed with larval tubes and forms a crust on top of liquefied sediment. The larvae, therefore, may influence the chemical fluxes at the water-sediment interface. Also, by the tube building activities, the larvae alter the physical properties of the sediment. The shear strength and the erodibility of sediment change significantly by this activity. I will present results where the effect of larval densities was studied in relation to physical properties of soft sediment (i.e. its shear strength, erodibility and flow). The results are based on laboratory experiments as well as direct measurements in the field. Shear strength of the sediment was positively correlated with larval density. The erodibility of the sediment indicated that the erosion was highest in low to moderate larval densities.

## Selection of habitat by chironomids females and the detection of polarized light

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Observation in waste stabilization ponds indicated that females of Chironomids can detect changes in the BOD level of a pond within a sewage plant and within days the impact of water quality will influence the population size as detected by adult females trapped offshore. Our first interpretation was that adults may sense chemical differences while flying above water. In field experiments this possibility was denied and attractiveness of different colors led us to our current study, showing that females select the habitat by using polarized light as reflected from water surface. In the oral presentation we will discuss the phenomenon in general and the more detail set up of experiments will be presented in poster.

## Chironomidae assemblages in reference conditions from Mediterranean streams

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Water Framework Directive (WFD) requires obtaining the good ecological status for all European surface waters by 2015. Establishment of reference condition is necessary in order to obtain very good ecological status for each ecotype defined previously. Guadalmed project wants to assess the ecological status of Mediterranean streams in Spain, and one of the associated objectives of this project is to study Chironomidae assemblages in reference sites.

In this work, Chironomidae composition was studied during spring and summer of 2003 at 32 reference sites in 8 Mediterranean river basins in NE Spain. A total of 131 species of Chironomidae larvae have been identified, being the most abundant taxa in sampled rivers: *Orthocladius-Cricotopus*, *Tvetenia bavarica-calvescens*, *Rheotanytarsus* sp. and *Rheocricotopus chalybeatus*. Two taxa, *Rheocricotopus fuscipes* and *Diamesa zerny-thienemanni* group, were more abundant in spring, whereas in summer an increase of *Tvetenia discoloripes*, *Polypedilum laetum* gr.sp1 and *Thienemannimyia* were detected.

At subfamily resolution, dominance varied depending on season, with Diamesinae and Orthocladiinae more abundant in spring, and Chironominae and Tanypodinae increasing in summer.

Chironomidae assemblage composition was related to 35 environmental variables included in the study, through a redundancy analysis (RDA). This analysis showed that main factors affecting midges distribution were: altitude, basin area, basin geology and substrate composition. Then, both local and regional scale factors play an important role structuring these communities in reference conditions in Mediterranean rivers.

We tested the agreement between Chironomidae assemblages and “a priori” river types defined using the WFD approach. Non metric multidimensional scaling (NMDS) showed that there was a great assemblages overlapping, each of them characterized by a low number of indicator taxa. Communities belonging to the ecotype “Siliceous headwaters and high altitude streams” appeared as the most different from the rest of ecotypes studied.

## Distribution of Chironomidae in Alpine lakes in Switzerland: a study based on subfossil assemblages in lake surface sediments

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The chironomid fauna of high-altitude lakes in the Alps is still poorly studied, probably largely due to logistic problems associated with sampling benthic organisms in alpine lakes. Sediments deposited in the deepest part of lakes typically contain subfossil chironomid remains originating from the entire lake basin. Since these remains are identifiable, usually to genus or species-group level, subfossil chironomids in lake surface sediments provide a time- and cost-effective way of studying lacustrine chironomid assemblages. We analyzed subfossil remains of chironomid larvae in the surface sediments of 45 lakes between 1809 and 2815m a.s.l. in the Swiss Alps and examined their distribution in respect to selected environmental variables. High alpine lakes (>2400m a.s.l.) were typically dominated by taxa such as *Pseudodiamesa*, *Micropsectra radialis*-type, *Paracladius* and *Tanytarsus lugens*-type. At lower elevations (2000-2400m a.s.l.) subfossils of chironomids such as *Psectrocladius sordidellus*-type, *Procladius*, *Heterotrissocladius marcidus*-type, *Chironomus* and *Zavrelimyia* increased in relative abundance. Chironomid taxa almost exclusively restricted to the lowermost lakes (1800-2000m a.s.l.) include *Stictochironomus*, *Cladopelma*, *Dicrotendipes*, and *Pagastiella*. Detrended Correspondence Analysis (DCA) ordered chironomid assemblages along a gradient (first axis) strongly related to elevation ( $r=-.57$ ) and associated variables such as July temperature ( $r=0.61$ ), and dissolved organic carbon (DOC) ( $r=0.71$ ). This suggests that temperature and related limnological variables had a strong influence on chironomid assemblages. However, some chironomids showed distributions that seemed distinctly influenced by other parameters. For example, remains of *Stictochironomus* were largely restricted to lakes with low sedimentary organic matter content, *Chironomus* and *Psectrocladius sordidellus*-type to lakes with high DOC content, *Heterotrissocladius grimshawi/scutellatus*-type and *Paracladopelma* to deep lakes, and *Procladius* showed the highest percentages in shallow lakes. The results indicate that the analysis of lake surface sediments has great potential for examining the relationship between chironomid assemblages and key environmental factors in remote and poorly accessible areas.

## The response of chironomid larvae to hydraulic conditions: *Synorthocladius semivirens* (Kieffer, 1909) in two rivers

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Communities of benthic invertebrates are highly influenced by environmental conditions and hydraulic conditions, water temperature, oxygen content and food supply being some of the most important. In this study we examined the effect of hydraulic conditions on the whole chironomid community and on a single species within two reaches of different rivers.

In total 55 samples (the area 25x25 cm, mesh size 250 $\mu$ m) were taken on two rivers in the Czech Republic: 27 samples on the Svatka River (Uncin site) and 28 on the Beca River (Cernotin site). At each sampling point the depth and current velocity were measured from which Froude number was calculated as the measure of hydraulic conditions. At both sites the Froude number was the best explanatory variable of the direction of the largest variability found in chironomid data (PCA results).

Since the hydraulic conditions influence the community structure one would expect them to influence spatial distribution of particular species too. But is the response of particular species to hydraulic conditions identical at two different sites?

Linear regression models of the relationship between Froude number and the abundance of *Synorthocladius semivirens* for both sites were computed. For the Uncin site the response of *S. semivirens* to the Froude number was unimodal with the peak at Froude number 0,12 whereas at the Cernotin site the response was linear with increasing abundance of the species along with increasing Froude number. In this case the difference between the models could be explained by different substrate characteristics: at the Cernotin site the substrate was covered with filamentous algae which enlarge the surface area and also act as a trap for suspended particles.

These results confirm that hydraulic conditions are of a great influence on benthic macroinvertebrates although need not be of the same effect at different localities.

This study was supported by international projects Eurolimpacs (GOCE -CT-2003-505540) and STAR (EVK1-CT 2001-00089).

## Chironomid community structure of high altitude streams in Serra da Estrela (Portugal)

Chaves, M.L.<sup>1</sup>; Rieradevall, M.<sup>2</sup>; Costa, J.L.<sup>1</sup>; Chainho, P.<sup>1</sup>; Costa, M.J.<sup>1,3</sup> & Prat, N.<sup>2</sup>

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Intermittent flow regimes are common in high altitude streams around the world. The purpose of this study was to characterise chironomid larvae communities of intermittent Portuguese headstreams located above 1400 m by analyzing temporal and spatial data and by determining which environmental conditions were responsible for structural differences. Five proximal headstreams with different annual stream flow permanence and very low levels of human disturbance were chosen. Kick-net macroinvertebrate samples and environmental data were collected at each stream in six sampling occasions during the snow-free period (eight months). Chironomids dominated the invertebrate community of these streams during most sampling occasions, with exception of the driest campaign (July). During the study, four chironomid sub-families were identified but only Orthocladiinae and Chironominae (Tanytarsini) were collected in every stream during all sampling occasions. Orthocladiinae included 23 genera, Tanytopodinae 9, Chironominae (Tanytarsini and Chironomini) 8 and Diamesinae only 2. *Tanytarsus* and *Heterotrissocladius* were the most abundant genera, considering total captures, but *Corynoneura* and *Eukiefferiella* were the most frequent, being present in 21 and 18 samples, respectively (n=22). Six genera were common to all headstreams, while 18 genera were limited to a single stream. Chironomidae genera richness and diversity were inversely related to the length of the dry period. A spatio-temporal ordination analysis (Correspondence Analysis - CA) was performed considering 28 Chironomidae genera. Subsequently, 28 environmental variables were related to the pattern obtained in the CA showing that climatic characteristics such as day-light length and precipitation (a temporal gradient) explained most of the Chironomidae structure variability of these high altitude headstreams. Chironomidae diversity and genera richness seem to depend on the length of the dry period, while the chironomid community structure appears to be more conservative.

## Effects of land use on lotic Chironomidae: emphasis to the sugar cane cultivation in adjacent areas (State of São Paulo, Brazil)

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With the objective to evaluate the influence of the agricultural activity on the Chironomidae fauna of the adjacent streams, a study on 9 streams was conducted. All streams analyzed are of low order and located on Jacaré-Guaçu River Basin (State of São Paulo, Brazil): four are located in extensive areas with sugar cane cultivation, three on forested areas and two in pasture areas. The Chironomidae fauna were collected using a D-frame aquatic net (250 $\mu$ m) including riffle and pools areas. Samples were taken to the laboratory, washed in a sieve of 0,21mm of mesh, selected on illuminated tray and fixed with 70% alcohol. In all, 54 Chironomidae taxa were identified, 37 of them were observed in forested streams. In sugar cane and pasture areas 32 and 11 taxa were identified, respectively. In general, the data show that the values of the community index (richness index Margalef -  $I_{Mg}$ , diversity index Shannon -  $H'$  and taxa richness) were high in streams with riparian vegetation. Among the 54 taxa, *Chironomus* spp. larvae were most frequent and abundant in streams located on agricultural areas. In contrast, in forested areas, there is a major richness of taxa. Moreover, *Beardius* sp., *Stenochironomus* spp., *Endotribelos* spp. and *Caladomyia* spp. larvae were taxa exclusive of these systems. Overall our results indicated that deforestation of the riparian vegetation was the principal aspect that influenced in the Chironomidae fauna structure in these streams. The loss of the riparian vegetation in the streams with agriculture activity (sugar cane and pasture) shows clearly the necessity of a suitable management of the hydric resources in the Southeast region of Brazil where the sugar cane culture is a very extensive activity.

## How females of non biting midges (Chironomidae, Chironomini) choose habitats for laying their eggs?

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Adult chironomids create swarms for mating. Females return to water for egg laying, occurring mostly during sunset. Females attach their gelatinous egg mass to objects at water level. The current objectives were to verify whether and how females select the breeding habitat. The effect phytoplankton and organic matter for female's choice was investigated. Sixty L. plastic barrels were used for experiment in 2 locations; in Elroi spring (ES) and Tiv'on waste ponds (TWP). Replicated (X4) four to six treatments replicated (X4) as follow: black barrels (BB) with water and cane stem → BB with water and cane extract, BB tap water only, (GB) green barrels with tap water. In TWP barrels covered inside by aluminum foil (AFB) were added. Significant differences of numbers of eggmass per treatment were found in daily observations. The choice order of oviposition was; BB > GB > AFB. Organic matter did not change the choice by females, but phytoplankton flourish did so. Phytoplankton can intensified a reflection and polarization rate of water surface itself. It was concluded that chironomid females in our experimental conditions seems to use optical orientation for habitat choice. It seems that they recognize different rates of polarized light, reflected from water surface and select the water bodies, with the most intensive reflected polarized light.

## Change of chironomid fauna (Diptera) in eutrophic Lake Kawaguchi, Japan

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Lake Kawaguchi is an eutrophic lake in central Japan. Benthic macroinvertebrate distribution was studied on March 5, 1993, and March 7, 2006. The average density of the benthic community for the entire lake was 6745 ind.m<sup>-2</sup>, comprising principally oligochaetes (81,4%) and chironomids (18,6%) in 1993. In 2006, the benthic community for the entire lake was 1609 ind. m<sup>-2</sup>, principally consisting of oligochaetes (70,5%) and chironomids (29,5%). In 1993, the larval density of *Prosilocerus akamusi* was 1.9 times that of *Chironomus plumosus* and in 2006 the figure was 3,5 times. Moreover, the larval biomass of *P. akamusi* was 0.9 times greater than that of *C. plumosus* in 1993 and 2.4 times greater in 2006. The larval density of Tanypodinae increased, by about 1.6 times, from 1993 to 2006. Oligochaetes were particularly abundant at the Northeastern in 1993, but they inhabited the entire lake bottom in 2006. *C. plumosus* and *P. akamusi* larvae showed the widest distribution pattern in 1993, whereas *C. plumosus* larvae had inhabited the Western parts and the lake center in 2006. The density of Tanypodinae spp. and water depth showed negative correlations.

Recently, the number of *C. plumosus* and *P. akamusi* larvae in Lake Kawaguchi is tending to decreased, especially *C. plumosus*, drastically. On the other hand, the organic matter in the upper layer of the sediment has been increasing. This suggested that the basic conditions necessary for *C. plumosus* larvae habitats, especially the quality of food (flora of phytoplankton), seem to be changing as the lake water quality improves.

## Hyporheic chironomids in Alpine streams

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The hyporheic zone (0-30cm depth) of two Alpine streams (2270m a.s.l., NE Italy) with different origin (the glacial Noce Bianco and the non glacial Larcher) was investigated with a Bou-Rouch pump and several types of artificial substrates. Sampling occurred from 2003 to 2005, frequency was every 15 days in summer and from one to three months in the other seasons. About 1500 specimens were collected, mainly belonging to the Orthocladiinae subfamily (60%), followed by Diamesinae (27%), Chironominae (11%) and Tanypodinae (1%). In all, 27 genera were identified, among which *Diamesa*, *Pseudodiamesa*, *Chaetocladius*, *Corynoneura*, *Eukiefferiella*, *Parakiefferiella*, *Parametricnemus*, *Stilocladius*, *Tvetenia* and *Micropsectra* were the most frequent and abundant ones. Higher abundance and richness was recorded in the non glacial stream, especially during the ice melt period when the environmental conditions in the glacial stream were particularly harsh (high and highly variable discharge, high sediment transport, high substrate instability, etc.), hampering benthos colonization. Young larvae (first and second instar) prevailed in all samples. Nevertheless, mature larvae (fourth instar) were found down to -30cm in the substrate, feeding (e.g. *Pseudodiamesa branickii*) or migrating upstream (e.g. *Eukiefferiella brevicealcar*). Some pupae and few adults were also found. Results highlighted as, in both streams, the hyporheic was visited by the benthic chironomids for several reasons: as refuge from spates, droughts, freezing, hunting ground for predators, egg deposition and nursery, trophic resource and as migratory corridor.

## Mid-summer emergence of chironomid taxa in streams spanning a gradient of watershed urbanization

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Twenty-five Baltimore (Maryland, USA) area streams were surveyed to determine the response of chironomid communities to environmental changes associated with urbanization. Surface-floating chironomid pupal exuviae were collected on twelve dates in 2002 (a year of severe drought). Concurrent measurements were also made of attached algal biomass, sediment particle size distribution, concentration of sediment-bound metals, and standard water quality parameters, including concentrations of nitrate and total phosphorus. An initial analysis of 15 streams is presented, focusing on emergence during June, of eleven select chironomid genera/species. Canonical Correspondence Analysis was used to quantify the relationships between the pattern of chironomid distribution and environmental variables. The first CCA axis represented 38% of the inertia in the chironomid data, and contrasted the abundance of fine sand and silt sediments, predominant in rural streams with high values (in urban streams) for total phosphorus, maximum algal biomass and sediment-bound zinc and lead. Along the first axis, abundances of *Tanytarsus* c.f. *glabrescens*, *T. sepp*, *Micropsectra polita* and *Rheotanytarsus* spp. were associated with rural streams. The second CCA axis, representing 16% of inertia in the biotic data, emphasized the variability among urban streams in concentration of metals, total phosphorus and conductivity. *Paratanytarsus* nr. *inopertus* and *Cryptochironomus* sp. appeared moderately tolerant of eutrophication, but intolerant of high zinc and lead concentrations. The total abundance of *Cricotopus* was strongly associated those urban sites with the highest concentration of metals, as well as large seasonal blooms of the alga *Cladophora*.

## Chironomid communities in different vegetation types in backwater of the Upper-Tisza, Hungary

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Chironomid-fauna and the distribution of the species in Hungary are not widely known. The majority of Hungarian researches were about the sediment of open water and chironomids were collected rarely among the vegetations.

Although backwaters of Tisza are special, unique waters, a very little survey tends to their chironomid fauna. The aim of our research is to study the distribution of chironomids in different vegetation types of the backwater Nagy-morotva (Rakamaz and Tiszanagyfalu).

Quantitative samplings were carried out in August 1999 by close-and-harvest method. The samples were taken from five vegetation types. These are *Ceratophyllum demersum*, *Trapa natans*, *Stratiotes aloides*, *Nymphaea alba* dominated vegetation types and marshy vegetation (*Typha angustifolia*, *Schoenoplectus lacustris*, *Carex* spp.).

26 chironomid taxa belonging to three subfamilies (Tanypodinae, Orthocladiinae, Chironominae) were identified. The highest number of species was found in Chironominae subfamily. The highest number of species and the highest number of individuals were found in *Stratiotes aloides* dominated vegetation type and in the marshy vegetation. Mining chironomid larvae (*Endochironomus tendens*, *Glyptotendipes cauliginellus*, *Glyptotendipes pallens*) occurred predominantly in these vegetation types. Both of them have thick leaves and a lot of partly or total dead plant tissues, which ensure food and living space to larvae. The lowest number of individuals were found in *Ceratophyllum demersum* dominated vegetation type. The lowest number of species were found also in *Ceratophyllum demersum* and in *Nymphaea alba* dominated vegetation types. So species occurred from *Nymphaea* dominated vegetation type too, which probably stemmed from troubled sediment.

## The conjugacy of chromosomal and ecological differentiation by various speciation modes in evolution of chironomids. Is it possible?

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From the modern standpoint speciation is the change of genetic apparatus in the cell, its genome. By the example of chironomids the leading of chromosomal differentiation of species in comparison with genetic one and its non-correlatedness with morphologic differentiation has been shown. Besides, the conjugacy of chromosomal and ecological differentiation by various speciation modes is not study heretofore. The ways of chromosomal and ecological speciation in species of *Chironomus*, *Microtendipes*, *Glyptotendipes* and *Endochironomus* (Polukonova, Beljanina, 2002; Beljanina *at al.*, 2003; Beljanina, Durnova, 2004) by our group have been studied.

By allopatric speciation of *Chironomus* from groups *plumosus*, *riparius* and *Microtendipes* from group *pedellus benthos* species (Polukonova, 2005, 2006), the habitation of daughter species in different conditions in comparison with assumed ancestor has positive correlation with change of pericentromeric heterochromatin quantity and localization. By sympatric speciation the ways of chromosomal evolution are linked with change of basis chromosomal sequences on basis of para- or pericentric inversions. There are ecological factors, which, evidently, play the main part by sympatric speciation of *Chironomus usenicus* on basis of hybridogenesis (Polukonova, 2005, 2006 in press). At the same time, the ways of chromosomal speciation of *Chironomus usenicus* are determined as the ways of "mixed type" and are linked with change of pericentromeric heterochromatin quantity and with change of basis bands sequence in F arm of chromosome. By parapatric speciation of phytophilous species like *Glyptotendipes pallens* and *Gl. glaucus* (there is a lot of hybrid populations between them), the divergence by biotopes is accompanied by basis of sequences of chromosome discs (SCD) change in B and D arms (Durnova, Beljanina, 2001). So, by cohabitation of these two species in one water body, *Glyptotendipes glaucus* choose putrescent timber, living plant leaves and caulis and *Gl. pallens* – sponge's tissues.

The microevolutional differentiation by parapatric type of others phytophilous *Glyptotendipes* species – *Gl. gripekoveni gripekoveni* and *Gl. gripekoveni paragripekoveni* is determined by joint action of processes – developing of various biotopes (*Gl. gripekoveni* mines living plant tissues, but *Gl. gripekoveni paragripekoveni* – putrescent timber, leaves and caulis) and chromosomal divergence by "mixed type" (basis SCD change in B, E, F, G arms and change of pericentromeric heterochromatin quantity). The same situation by benthos species *Chironomus usenicus*, which speciation has as basis the interspecific hybridization, has been shown. Evidently, the hybrid population's formation between species *Gl. gripekoveni gripekoveni* and *Gl. gripekoveni paragripekoveni* may lead the new third

specie's formation. Its biotope limits will be larger because hybrids *Gl. gripekoveni* X *Gl. paragripekoveni* inhabit both living and putrescent plant tissues. The intraspecific differentiation of phytophilous species *Endochironomus tendens* has the same type as *Glyptotendipes* – different “cytotypes”, which are differ from each other by range of basal SCD and pericentromeric heterochromatin quantity, strict correlate with different biotopes in the limits of one water body (Beljanina, Durnova, 2006, in print).

## Emergence of *Ablabesmyia monilis* (Diptera: Chironomidae) from Findley Lake during warm and cold years

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*Ablabesmyia monilis* were collected in floating emergence traps on oligotrophic Findley Lake in the coniferous forest of the Cascade Mountains, USA, from 1972 to 1975. In 1972 when there was a maximum surface temperature of 21,0°C, but cold temperatures below the surface, *A. monilis* only emerged within one meter of shore. In 1973 when there was a maximum surface temperature of 19,25°C, but warmer temperatures below the surface than during other years, *A. monilis* emerged from the 0 to 5,6m deep sites. In 1974 when there was a maximum surface temperature of only 12,4°C, only one individual emerged and that was from the 1,8 m deep detritus near a small tributary. In 1975 when there was a maximum surface temperature of 17,4°C, *A. monilis* emerged from the 0,5 and 1,8m deep sites. Over the four year period, the maximum emergence of *A. monilis* was in 1975 from the 1.8m deep site where there was the most organic detritus from the surrounding forest. Except for a few individuals from the 5,2 and 5,6m deep sites in 1973, no *A. monilis* emerged from the 5 to 15m depths of maximum phytoplankton production.



*Session 4*

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**TAXONOMY, MORPHOLOGY &  
SYSTEMATICS (TMS)**

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## DNA barcoding of Chironomidae: a useful tool for taxonomy and freshwater biomonitoring?

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Chironomids have a great potential as biological indicators in assessments of freshwater ecosystems, but are rarely taken full advantage of. The main reasons for this is the limited knowledge of larval taxonomy, the restricted access to taxonomic expertise, and the need for time and resource demanding procedures for the required species level identification. Consequently, a system for species identification and life stage association by comparisons of short gene sequences (i.e. DNA barcoding) could be a useful tool to profit from Chironomidae in ecological studies of freshwaters to a greater extent. To explore the possibility of identifying chironomids with partial COI gene sequences, we conducted a study on 97 specimens of 47 species in the tribe Tanytarsini. Our results show that COI from 98% of the specimens could be amplified from different life stages using the standard barcode primers (LCO1490 & HCO2198) and that interspecific genetic distances exceeded intraspecific distances for all species. All con-specific individuals grouped with 91-100% bootstrap support in parsimony analyses. This indicates that DNA barcodes are practicable tools to identify species that are already in a COI library. However, the results from the neighbour joining and parsimony analyses did not otherwise reflect trustworthy phylogenetic relationships between the species examined. Thus, although DNA barcodes might be effective in associating life stages and delineating species, they are unreliable for approximate identification when sequences of the unknown taxon are absent from the COI library. Nevertheless, as gene amplification and sequencing is becoming more affordable and regular practice, it would be relatively quick and inexpensive to create a COI library of the most common chironomid species. Once established, a library of DNA barcodes will not only assist in rapid and accurate identification of chironomid larvae, but also in identifying taxonomic entities that deserve more thorough morphological, ecological and genetic analyses.

## Genome instability of *Chironomus riparius* Mg. and *Chironomus piger* Strenzke (Diptera, Chironomidae) from anthropogenic polluted regions

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Genotoxic damage of trace metals was evaluated by analyzing structural and functional alterations in salivary gland polytene chromosomes of two sibling species of the genus *Chironomus* (*Chironomus riparius* Mg. and *Chironomus piger* Strenzke) collected from polluted localities of Bulgaria. The two species can be distinguished by their genome organization. Phylogenetically *C.piger* is older than *C. riparius*. High concentrations of heavy metals (Cu, Cr, Ni, Zn, Pb, Mn, Al and Fe) were found in sediments sampled from the polluted sites. Trace metals in the larval bodies have generally a lower concentration than in sediments. In both species a high level of genotoxic damage was demonstrated, which was expressed by different structural somatic and functional alterations. In both species the structural somatic aberrations occurred at a low frequency and in all chromosome arms. However, somatic rearrangements appeared at a significantly higher frequency in the phylogenetically younger species *C. riparius* (51,92% of *C. riparius* larvae and 20,05% in *C. piger* larvae). In *C. riparius* populations living in polluted sediments, somatic aberrations were distributed at many different points along the chromosomes. In *C. piger* somatic aberrations were concentrated in the pericentromeric regions of chromosomes CD, EF and in proximal part of arms D and F. The localization of repetitive DNA clusters (Alu and Hinf repeats and of the NLRc1 TE insertions sites) were analyzed by FISH. The majority of the breakpoints appeared to be located in sections containing blocks of repetitive DNA clusters.

Our data suggest that the analysis of structure and function of the polytene chromosomes may represent a sensitive end-point for the detection of genotoxic environmental contaminants. The polytene chromosomes provide information not only on the mechanism of action of environmental stress agents, but they are also very useful in applied investigations on environmental quality.

## Genetic diversity in *Clunio marinus* Haliday 1855

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The marine chironomid *Clunio marinus* Haliday 1855 is mainly known as a model organism for life cycle adaptations to tidal rhythms (Neumann 1966 & 1976). These studies suggest a strong isolation and local adaptations of *Clunio* populations (Neumann 1967). Additionally, the species is distributed one-dimensionally along the Atlantic coasts of Europe, and therefore its suitability as a model organism in population genetics seems obvious and needs to be tested.

For a preliminary exploration of the species and its close relatives we established several genetic markers (mitochondrial and genomic sequences, AFLP fingerprints). In accordance with the existing morphological data and crossing experiments, we found that the Mediterranean species *Clunio mediterraneus* Neumann 1970 is differentiated from *Clunio marinus*, while the Baltic species *Clunio balticus* Heimbach 1976 is identical with *Clunio marinus* in all gene sequences examined. Within *Clunio marinus* the populations are very similar on the sequence level, but nevertheless the few existing differences in sequence and the finer-scaled AFLP fingerprints suggest a very strong isolation between the populations.

The findings support the idea that *Clunio* midges have colonized the Northern European coasts – including the Baltic Sea – just after the last ice age from one single source located somewhere in the Southern Atlantic Ocean. Therefore, *Clunio balticus* must have developed its own peculiar life cycle strategy within the last 8 000 years. The fact that it is still fertile in crosses with *Clunio marinus* opens great opportunities to investigate the genetic basis of the ecological adaptations of both species.

## The identity of *Dactylocladius commensalis* revealed

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Commensalism involving chironomid larvae and other aquatic insects is very common and globally widespread: evidently at least some cases involve ectoparasitism. Host organisms include Odonata, Ephemeroptera, Megaloptera and Hemiptera. Dipteran hosts are rather rare and the description by Tonnoir (1923) of a commensal chironomid, *Dactylocladius commensalis* Tonnoir, on New Zealand larval Blephariceridae remains an unusual observation. Since the first report and description, our understanding of the genus *Dactylocladius* Kieffer has altered and the identity and relationships of the taxon is unclear. With material collected in the recent past by Peter Zwick and Greg Courtney, and in the light of recent revisionary studies of some 'more obscure' Southern hemisphere Orthoclaadiinae (e.g. *Kaniwhaniwhanus* Boothroyd, *Naonella* Boothroyd, *Botryocladus* Cranston & Edward, *Pirara* Boothroyd & Cranston) and it is timely to redescribe the species emphasising features to allow assessment of its relationships, and thus its generic placement. Molecular and morphological analyses suggest that it is close to the genus *Eukiefferiella* Thienemann, but highly autapomorphic, perhaps justifying higher rank.

## A structural hermaphrodite example of *Micropsectra atrofasciata* (Kieffer)

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A pharate imago *Micropsectra atrofasciata* from the River Chew, England, possessing well-developed male and female genitalia is described. The head bears male antennae, but the pupa possesses both male and female genital sheaths, the male dorsal to the female. Seminal capsules, spermathecal ducts, notum and vagina are followed by superior, median and inferior volsellae, and complete male claspers: gonocoxites and gonostyles. The simultaneous expression of male and female structures is possible, because those of the male hypopygium are primarily dorsal, whereas those of the female are mainly ventral in origin. Maceration of the specimen before mounting precludes detection of ovaries and testes, so it is unknown whether the specimen was a true hermaphrodite capable of producing both male and female gametes.

***Polypedilum (Pentapedilum) sp. A*, a new species from USA  
(Diptera: Chironomidae)**

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*Polypedilum (Pentapedilum) sp. A* is a new species reared from larvae collected from water lily *Nymphaea odorata* in Florida and Ohio. Males, females, pupal exuviae and larval exuviae are described here. The male is distinct from other *Polypedilum* species, though it has a simple superior volsella with a strongly curved projection bearing 1 dorso-lateral seta and 2-5 inner setae on the basal microtrichia portion. The pupa is distinguished from Nearctic and Western Palaearctic *Polypedilum* species by having shagreen on tergite IV-VI separated into fields, with median field entirely separated from anterior band and with paired posterolateral fields as well having spines on conjunctives III/IV and IV/V. Larvae can be distinguished from other known larvae by having the fifth lateral teeth slightly higher, than the fourth, sixth and seventh.

## A new orthoclad genus from Brazil, with seven new species (Chironomidae: Orthoclaadiinae)

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The new genus is described based on male imagines only and can be separated from all other orthoclads by the combination of bare eyes, wing membrane and squama, costa not to moderately extended, weak, decumbent acrostichals, long anal point with strong lateral setae, and a gonostylus split in 2 or 3 lobes with row of strong, hooked setae along inner margin of the median lobe. The genus apparently belongs in the *Pseudosmittia* group of genera. The seven new species were collected with sweep nets, malaise traps and light traps in various locations in the costal Atlantic Rainforest and in the Amazon. The holotypes will be deposited in the Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo, Brazil.

## New Neotropical species of *Nilothauma* Kieffer, 1921 (Diptera, Chironomidae)

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*Nilothauma* was recently revised, and 25 species placed into four species groups, are recognized from the Holarctic, Oriental, Australian and Afrotropical regions. Two species from Peru described as *Nilothauma* are now considered to belong in *Paratendipes* Kieffer, as they both lack any projection on tergite IX. No species of *Nilothauma* from the Neotropical region has so far been described, although pupae and larvae have been recorded. The genus groups with *Paranilothauma* Sopenis and *Neelamia* Sopenis, both restricted to the Neotropical region.

Seven new species from Brazil are described and figured, and *Paranilothauma strebulosa* Adam & Sæther, 2000 from Costa Rica is transferred to *Nilothauma*. The new species fall in three species groups; two species in the *duminola* group, two in the *babiyi* group, while three new species and *N. strebulosa* are placed in a new species group. The new species group can be distinguished on the combination of an inferior volsellae with simple setae, pediform superior volsella and two setose tubercles on tergite IX.

## Larval generic diagnosis of *Schineriella* Murray & Fittkau, 1988 (Diptera: Chironomidae, Tanypodinae) and a description of the larva of *S. schineri* (Strobl, 1880)

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During a study of storage ponds for motorway run-off water near Darmstadt-Dieburg (Hesse, Germany) Dr P.M. Andreas Dettinger-Klemm, Phillips-University Marburg, collected a pre-pupal last instar tanypodine larva with a visible pupal thoracic horn which allowed determination of the specimen as that of the unknown larva of *Schineriella schineri* (Strobl, 1880). A larval generic diagnosis is given for *Schineriella* together with a description of the larva of *S. schineri*.

## A new genus and species of Orthocladiinae (Diptera: Chironomidae) from Sulawesi, Indonesia

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The adult male of a new genus and species of Orthocladiinae is described and figured from material collected in the Dumoga-Bone National Park, Sulawesi, Indonesia. A single specimen of the distinctive male was collected in a Malaise trap which was located on a rock ledge close to a waterfall associated with a stream flowing through pristine rainforest. The male antenna has no setal plume, only 6 flagellomeres and the apical flagellomere has two strongly developed apical setae; the legs and wings are normally developed; the gonocoxite is very broad; inferior volsella strongly developed and bears two large setae.

## Taxonomic review and phylogenetic position of *Lithotanytarsus emarginatus* (Diptera: Chironomidae)

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Non-biting midges of the genus *Lithotanytarsus* live in rapid, calcareous springs and spring brooks in Europe and North Africa. There are two known species in the genus, *Lithotanytarsus dadesi* and *Lithotanytarsus emarginatus*, the latter having widest distribution. The larvae and pupae of *L. emarginatus* live in lime stone tufa, and the pupae exit the encrusted tubes just before adult emergence. The genus *Lithotanytarsus* has been difficult to place phylogenetically due to reduced morphological characters in the immature stages, and molecular approaches has not yet been attempted. The project presented here aims to revise the species *Lithotanytarsus emarginatus* (Goetghebuer, 1933) and to use morphological and molecular data to analyse the genealogical relationship of *Lithotanytarsus* within the tribe Tanytarsini. The following hypotheses will be tested: 1) The genus *Lithotanytarsus* belongs to subtribe Zavreliina of the tribe Tanytarsini; 2) The sister group of *Lithotanytarsus* is the genus *Neozavreliia*.

## A new species of *Kiefferulus* (Diptera: Chironomidae) from Western United States

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*Kiefferulus smichowski* n. sp. from Western United States is described and illustrated as a male imago. The new species is similar to *Kiefferulus (Wirthiellia) modocensis* (Sublette 1960). Characters are given that separate these species. The new species has drought tolerant larval stages and has been reared from sediments collected from playa lakes in Western Texas. Playa lakes are temporary water bodies that form at unpredictable intervals. Larva found in playa lakes are known to be able to survive drought periods of at least 3 years. After flooding larva became active within 48 hours and emerged in less than 2 weeks.

## Assessment of the status of *Cricotopus oceanicus* (Packard)

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A. S. Packard, Jr. described *Chironomus oceanicus* in 1869 based upon adult and immature specimens collected from the harbor at Salem, Massachusetts, USA. It has since been infrequently reported in the literature, and usually not based upon new material. The species has been most recently recognized as *Cricotopus oceanicus* (Packard). Some recently collected adult and pupal specimens from the Massachusetts coastline, tentatively identifiable as this species, prompted further study to resolve their identity. Some questions as to the actual date of description and source, as well as possible location of type specimens were addressed. Additional adult specimens were examined from Massachusetts, as well as a very similar and apparently closely related species from Maine, Canada, and Norway locations to assess possible synonymy and variation. Close morphological similarity as well as ecology and life history details indicate that *C. oceanicus* is a junior synonym of *Halocladus variabilis* (Staeger).

## Description and DNA barcodes of the Alpine *Micropsectra oberaarensis*, a new species in the *attenuata* group

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Several of the species in the *Micropsectra attenuata* group are associated with mountain ranges in Central Europe, and are potential indicators for cold-stenothermic habitats. We recently collected a hitherto unknown species in this group, *Micropsectra oberaarensis* sp. n., from high elevation in the Berner Alps (Switzerland). The male and pupa of the new species, and the larva of *Micropsectra seguyi* Casas & Laville, are here described and diagnosed. These two species and *Micropsectra auvergnensis* Reiss are morphologically similar as adult males, but can easily be separated in their pupal life stage. Partial COI gene sequences indicate sufficient interspecific haplotype variation to separate the most similar species, *M. oberaarensis* and *M. seguyi*, by their DNA barcodes.

## New species of *Pelomus* Reiss, 1989 (Diptera: Chironomidae) from Southeastern Brazil, with the description of immature stages

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*Pelomus*, a genus of *Harnischia* complex was erected by Reiss (1989) based on specimens from Amazon region (Brazil). The hypopygium of *P. notabilis*, unique species whose adult is known, presents unusual features into the *Harnischia* complex. Nevertheless, the characteristics of its pupa, together with the other two described species (*P. secundus* Reiss, 1989 and *P. tertius* Reiss, 1989) justified the inclusion of this genus within the *Harnischia*-complex. The occurrence of unnamed species of this complex living on sand sediments of artificial ponds in the state of São Paulo, Southeastern Brazil, was recorded by Strixino & Trivinho-Strixino, 1998. Based on the material from this previous study, and on reared larvae and associated pupal exuviae and adults, we describe here a new species of *Pelomus* including the first description of larval stage for the genus.

The larva of this new *Pelomus* species resembles the larvae of the genera *Harnischia*, *Paracladoplema* and *Saetheria* differing from them by the number of antennal segments (6), by the number of premandibular teeth (2+1), and by the presence of premandibular brush and labral lamella. The larvae of *Pelomus* sp. n. are relatively common in small rural reservoirs in the middle of the state of São Paulo. These, among others that probably belong to the same genus (*Harnischia* (?) sp. 1, *Harnischia* (?) sp. 3 Trivinho-Strixino & Strixino, 1995) live on sand sediments of small reservoirs or on sand littoral of larger ones (Strixino & Trivinho-Strixino, 1998).



*Session 5*

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**PHYSIOLOGY & PHYSIOLOGICAL  
RESPONSES (PH)**

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## Thermal tolerance and expression of Hsp70 in larvae of *Diamesa* spp.

Lencioni, V.<sup>1</sup>; Boschini, D.<sup>1</sup>, Maiolini, B.<sup>1</sup> & Rebecchi, L.<sup>2</sup>

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Air temperature and precipitation patterns are likely to change under a scenario of global climate warming, with consequent effects on water temperature and hydrology of running waters, especially of those fed by glaciers. Invertebrates living in these habitats (mainly Chironomidae Diamesinae) are extremely specialised and have developed unique survival strategies to face environmental constraints. The ability to survive heat-shocks was investigated in cold stenothermal species, threatened of extinction by global warming. IV instar larvae of *Diamesa cinerella* gr. were collected seasonally (from March 2005 to March 2006) in the Noce river (Trentino, NE Italy) at two altitudes (1300 and 2600m a.s.l.). Larvae were acclimated in a thermostatic chamber for 24h at 4°C and then exposed for 1 h to heat-shocks from 26 to 35°C. Survival was recorded 1 h after the shock and thermal tolerance was evaluated as LT<sub>50</sub>. *D. cinerella* gr. resulted thermotolerant (LT<sub>50</sub> varied from 30,1 to 32,9°C). Hsp70 were detected and quantified both in heat-shocked and un-shocked larvae of *D. cinerella* gr and in un-shocked larvae of other *Diamesa* species by means of SDS-Page and immunoblotting. An increase of Hsp70 expression was detected in shocked larvae of *D. cinerella* gr. collected in summer. Constitutive stress proteins were found in all species maintained at 4°C. This could explain the high resistance to brief heat-shocks found in *D. cinerella* gr.

## Respiration and distribution of midges (Diptera) in British Columbian lakes

Brodersen, K.P.<sup>1</sup>; Pedersen, O.<sup>1</sup>; Walker, I.R.<sup>2</sup>; Tranekjaer, M.<sup>1</sup> & Barley, E.<sup>3</sup>

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We measured the specific respiration rates of 13 chironomid taxa and *Chaoborus* from lakes near Kelowna, British Columbia. We hypothesized that there was a relation between the species' ability to regulate their oxygen uptake, and their distributional patterns among study lakes in Canada. The respiration was measured in custom made respiration chambers by means of oxygen microelectrodes. The respiration patterns of individual taxa was modeled using piecewise linear regression with break point and simple hyperbolic functions. Three types of respiration curves were found: 1) the classical oxy-conformer (e.g., littoral *Cricotopus*) which cannot sustain a sufficient oxygen uptake with decreasing oxygen availability; 2) the oxy-regulator (e.g., *Chironomus*) which can regulate and maintain a constant respiration rate until a certain critical point; 3) the oxy-stressor (*Micropsectra*) which increases the respiration rate with decreasing oxygen availability until a critical point. The respiration rates were measured at two different temperatures and mean  $Q_{10}$  values between 1,3 and 2,5 were found.  $Q_{10}$  increased with the species temperature optima calculated from Canadian paleo-reconstruction data sets. The critical point value increased with temperature for 5 taxa, decreased with temperature for 2 taxa, and were unchanged for 4 taxa. The species oxy-regulatory capacity was not significantly related to habitat preferences expressed as species temperature- and depth optima. The results illustrate that interpretations of factors determining chironomid distributions and indicator values are complex.

## Thermal preferences of Chironomidae in two Northern temperate streams with contrasting thermal regimes

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Water temperature and thermal regime are major regulators of the life history, phenology, and taxonomic composition of macroinvertebrate communities in lotic waters. Thermal preference patterns have been identified at the subfamily level, with Diamesinae, Prodiamesinae, and Orthocladiinae tending to be more cool water adapted while Chironominae and Tanytopodinae are more warm water adapted. In Minnesota, surface-water dominated (SWD) streams have greater annual thermal heterogeneity compared to groundwater dominated (GWD) streams. Using chironomid surface floating pupal exuviae, one GWD and one SWD stream was sampled for the duration of one year to assess the phenologies of chironomid taxa at the subfamily and generic levels. Concurrent with sampling, temperature loggers were deployed in each stream to record temperature every 15 minutes. Emergence patterns as they relate to mean daily water temperature at the time of sampling were compared using violin plots. Overall, Diamesinae, Prodiamesinae, and Orthocladiinae were more likely to emerge at cooler water temperatures while Chironominae and Tanytopodinae were more likely to emerge at warmer temperatures. However, this pattern was not completely consistent as some genera emerged at temperatures different than most other genera in the subfamily (e.g., *Thienemanniella*, *Micropsectra*). At the species level, most congeners emerged within similar temperature ranges, but again there were exceptions to this pattern. Although subfamilies and genera typically demonstrate predictable thermal preferences, at finer resolutions (i.e., species and genera) some have less typical thermal preferences. These results suggest that thermal preference is a relatively rigid characteristic within higher chironomid taxonomic groupings, but taxa with atypical preferences may reflect apomorphic characteristics. Thus, thermal preference differences allow some species to coexist by partitioning the habitat temporally, but many are constrained by and reflect evolutionary history of the higher taxonomic grouping.

## Respiration rate and temperature in cold stenothermal chironomids

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The relationships between respiration rate and water temperature was examined in *Diamesa cinerella* gr. IV instar larvae were collected seasonally during 2005 in a glacio-rhithral habitat (mean annual water temperature 4°C, % sat.O<sub>2</sub> >90%) in the Southern Alps (Noce river basin, NE Italy). In spring, IV instar larvae of *Pseudodiamesa branickii* were also analyzed. The respiration rate (ml O<sub>2</sub> g<sup>-1</sup>h<sup>-1</sup>) was measured with a Clark's electrode between 0 and 14°C on 1h-intervals. *Diamesa* larvae showed a similar pattern of oxygen consumption velocity in all seasons, decreasing from 4 to 8°C and increasing at higher temperatures. This trend was confirmed by measurements performed with the Winkler's method. The highest values were recorded in autumn, at each experimental temperature. *Pseudodiamesa* larvae showed a different trend, with respiration rate linearly increasing with temperature. Higher values of oxygen consume velocity were found at temperature >4°C in the carnivorous *Pseudodiamesa* than in the detritivorous *Diamesa*. In *Pseudodiamesa* higher values of Q<sub>10</sub> were also found. Both species appeared to be conformer, but *Pseudodiamesa* only at pO<sub>2</sub> higher than a critical value (p<sub>c</sub>).

*Session 6*

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**BIOGEOGRAPHY & BIODIVERSITY (BGD)**

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## Diversity and taxonomic distinctness of chironomid assemblages from an urban stream in Minnesota

Gresens, S.E.<sup>1</sup> & Ferrington, L.C.Jr.<sup>2</sup>

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Collections of chironomid pupal exuviae, from four sites on upper Minnehaha Creek (in the Minneapolis, MN area) were used to compare the performance of traditional diversity indices with measures of taxonomic distinctness. Whereas diversity indices emphasize species richness and/or evenness, taxonomic distinctness quantifies variation in the distribution of species among higher taxa. Average taxonomic distinctness,  $\Delta^*$ , represents the average distance, within a taxonomic hierarchy, between 2 randomly chosen individuals, given that they are not of the same species. A similar index,  $\Delta+$ , is calculated from only a species list, and represents taxonomic “breadth” of a sample. An advantage of these indices is that estimates are independent of sample size, however they have had limited application to freshwater communities. The total number of exuviae collected per site, representing the sum of ten sampling dates, ranged from 18, 975 (on the mainstem of Minnehaha Creek) to 961 (from a small sandy tributary). The number of chironomid species observed per site varied from 100 to 40. The site with the highest number of exuviae had the lowest values for estimated species richness (via rarefaction), Simpson’s diversity, and  $\Delta^*$ . In contrast the site with the lowest number of exuviae had the highest value of  $\Delta^*$ . In general,  $\Delta^*$  strongly reflected the evenness of distribution of species across higher taxa:  $\Delta^*$  was decreased by the extreme dominance of *Thienemanniella* and *Corynoneura* spp. in the largest collection, whereas  $\Delta^*$  was highest for the collection where abundances of Orthocladiinae (e.g., *Nanocladius* spp.) and Tanytarsini (i.e., *Micropsectra nigripila*) were most similar. In contrast  $\Delta+$  strongly reflected observed species richness. Average taxonomic distinctness,  $\Delta^*$ , did measure a unique aspect of diversity of these chironomid assemblages.

## Contrasting trends of chironomid assemblages in two high-Arctic streams, Svalbard

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The chironomid communities were investigated in a glacier-fed stream (Bayelva) and a smaller non-glacial stream, drained by snowmelt and rainfall (Londonelva) in July and August 1997. Environmental conditions were harsher for the fauna in glacial system than in the non-glacial one. A total of 32 species were identified considering larvae, pupae and male adults material. Contrasting trends were noted in the distribution of *Diamesa* species between the two streams. *Diamesa aberrata* and *D. bohemani* were characteristic of the glacial stream while *D. arctica* and *D. bertrami* colonised the snowmelt one. Total abundance of chironomid larvae was ten times greater in Londonelva than in Bayelva. The prevailing very harsh conditions, as high discharge, sediment transport and substrate instability influenced mainly the abundance of the chironomid fauna.

## New island records of macaronesian Chironomidae (Diptera) from the Azores (Pico, Faial) and Madeira, Porto Santo and Deserta Grande

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Collections of Chironomidae made in 2003 on the islands of Pico and Faial (Azores) and Deserta Grande (Madeiran archipelago) together with earlier collections by the authors on Porto Santo and Madeira and slide mounted material made available by O.A. Sæther (University of Bergen, Norway) from collections on Madeira in 1986 have been examined. New data on Macaronesian chironomid distribution, including some new island records and the first record of a chironomid species from Deserta Grande are reported in this presentation.

## Faunistic particularities of the chironomid assemblages of the Upper-Tisza, NE Hungary

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The chironomid assemblages were investigated at a sandy section of the Upper-Tisza by drift net, and this sampling method was used at first in Hungary. Pupal exuviae were collected in July 2003 during a 20-days period and 3 times in 2005 (June, July and August). Sampling was carried out at midday and midnight. Because of the high density of exuviae, it was necessary to take subsamples, and 18 249 exuviae were identified from some 53 000 collected ones. Total of 85 taxa were found (7 Tanypodinae, 1 Diamesinae, 15 Orthoclaadiinae, 62 Chironominae), among which 27 proved to be new to the fauna of Hungary. Compared with other European rivers – Rhône, Garonne, Loire (France), Rhine (Germany), Vistula (Poland) – many differences were detected in the composition of the fauna: many species were restricted to only River Tisza; all dominant species (*Beckidia zabolotzskyi*, *Chironomus* cf. *balatonicus*, *Cryptochironomus rostratus*, *Kloosia pusilla*, *Lipiniella moderata*, *Rheotanytarsus rhenanus*) belonged to Chironominae; orthoclad species were represented in relatively low number; both day and night samples were dominated by Chironominae. We detected a diversified and unique chironomid population in this section of River Tisza, as it was also found in the cases of other sandy rivers in Europe.

## The chironomid (Diptera) fauna of Morocco

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A complete inventory of data on Chironomidae (Diptera) reported up to the year 2006 is presented together with the distribution of certain species within the Moroccan territory. The total number of species or taxa now recorded for Morocco is 355.

The distribution of this fauna over the different areas of Morocco is distinct. More recent collections from various rivers in the Rif in North Morocco have now increased the number of chironomid species recorded this area to 179. The majority are Othocladiinae and Chironomini which have a broad palearctic distribution.

The Atlas mountains and South Morocco still contain 256 species dominated by Orthocladiinae and Chironomini. Their biogeographic tendency is mainly afrotropical.

Diamesinae appear more abundantly in the Medium Atlas and in High Atlas while Tanypodinae are more represented in Rif.

The subfamily of Buchonomyinae with the species *Buchomyia thienemanni* is collected for the first time in Morocco in the Rif at 400m of altitude.

In general, the Moroccan chironomid fauna can be considered as rich and diversified in relation with a large diversified habitats and biotopes.

## Chironomid species richness of a permanent and a temporary Mediterranean stream: a long-term comparative study

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Chironomid species richness and rarity were compared between a permanent and a temporary Mediterranean mountain stream located in the same basin. Samples of pupal exuviae were collected biweekly in both streams during the period March-1996 to March-2000. During the previous period, 1991-95, the permanent stream was sampled without marked periodicity whereas the temporary stream was dry due to a long lasting drought in the region. Temporal gamma diversity was similar between the 2 streams and similar to others low order streams in humid-temperate Europe and North America, but likely lower than in tropical streams. In contrast to other studies finding more species in permanent streams, our 2 streams supported similar temporal gamma and alpha diversity during the period 1996-2000. This may be explained by the relatively long time the temporary stream was flowing. Additionally, the temporary stream showed higher temporal beta diversity compared to the permanent one, likely due to the higher thermal and temporal substrate heterogeneity in the first one. Spates events scarcely affected alpha diversity and favoured the collection of new species at both streams, a fact in agreement with the path-dynamic concept of streams. A long period lacking spates also propitiates the collection of new species in the permanent, but in the temporary this leads to a pool phase that extremely impoverish alpha diversity.

Overall, the temporary stream had similar chironomid species richness and rarity to the permanent, and both exhibited high faunal complementarity (20 %). These results support the view that temporary aquatic habitats deserve consideration in conservation plans designed to protect species and their habitats.

## *Cladopelma* Kieffer from Sino-Indian Region (Diptera: Chironomidae)

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The genus *Cladopelma* Kieffer from Sino-Indian region is reviewed. One new species, *C. costa* sp. n. is described and illustrated from males. The males of *C. edwardsi* (Kruseman) and *C. virescens* (Meigen) from China are re-examined. *C. sibaabeus* (Sasa) from Japan and *C. indica* Bhattacharyay, Duta & Chaudhuri from India are regarded as synonym novum of *C. edwardsi*. *C. onogawaprima* Sasa is identified as synonym novum of *C. hibaraprima* Sasa. *C. hibaraprima* is transferred to the genus *Cryptotendipes* as a new combination. *Cladopelma kamalanagari* Maheshwari & Agarwal from India is transferred to the genus *Paracladopelma* as a new combination. The generic diagnosis for males is emended. A key to known males in the world is given.

## Chironomid biodiversity in an Alpine glacial-fed alluvial system (Rhône, Switzerland)

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Chironomid communities were investigated in two glacial streams (Rhône and Mutt) and a small spring-fed tributary in the upper Rhône catchment (Swiss Alps). Chironomid distribution was examined in relation to channel characteristics, substratum, water chemistry, hydraulic variables and primary production. Ninety species were recorded from twenty sites (altitudinal range: 1800-2600m a.s.l.) sampled at three periods (snowmelt, icemelt and low water in late summer) from 1996 to 2000. Twenty species are new for Switzerland. Despite harsh environmental conditions thorough the year, the Rhône/Mutt system exhibited a great diversity of chironomid communities. The spatio-temporal heterogeneity is certainly of major importance for the faunal differentiation and the maintenance of diverse benthic assemblages.



*Session 7*

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**DEBATE & FORUM (D&F)**



## The Chironomidae bibliography - a first CD version

Hoffrichter, O.

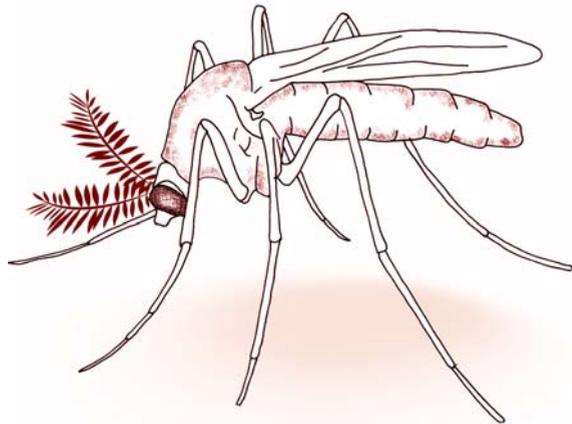
Institute of Biology (I), University of Freiburg, Hauptstr. 1, D-79104 Freiburg, Germany, Tl. (49) 761 203 2582, Fax (49) 761 203 2544, odwin.hoffrichter@biologie.uni-freiburg.de

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The bibliography goes back to a collection of literature by August Thienemann. He has included a larger part of it in his papers and monographs, especially in the voluminous "Chironomus" from 1954. Thienemann did not collect literature entirely systematically, but received most publications directly from the authors. Ernst Josef Fittkau and Friedrich Reiss continued the tradition of collecting titles. Together with Odwin Hoffrichter "A bibliography of the Chironomidae" was published in a Norwegian series (*Gunneria* 26) in 1976. This first bibliography comprises ca. 6400 titles; it was followed by a supplement (*Gunneria* 37) in 1981. After resuming publishing *Chironomus: Newsletter of Chironomid Research*, in 1995, the "Current Bibliography" is an integrative part for the previous year's published research on chironomids. The demand for earlier papers, too, has resulted in the plan to publish a comprehensive, general bibliography of the Chironomidae comprising the years from 1665/66 to the present. It will be available on CD in PDF files, providing presumably best use for keyword searching. Currently, the bibliography contains over 25 000 titles. A first version shall be demonstrated.



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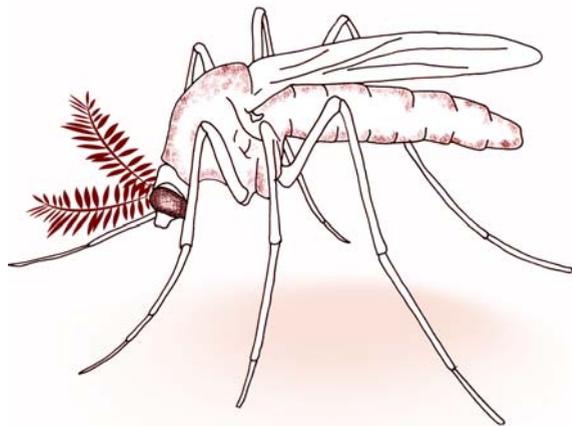
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