

Journal of Limnology

2013 - vol. 72(s2)

Editor-in-Chief: Roberto Bertoni, Italy

www.jlimnol.it

Freshwater Invertebrates of Southeast Asia: biodiversity and origin

Taksila Hotel (Maha Sarakham province), Northeast of Thailand

July 30th-August 4th, 2012

Guest Editors:

K. Van Damme, M. Hołyńska, L. Sanoamuang



Istituto per lo Studio degli Ecosistemi

Verbania Pallanza, Italy

Journal of Limnology

formerly *Memorie dell'Istituto Italiano di Idrobiologia*

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Cover Photo

Otranto lake, Italy (courtesy of R. Bertoni)

Online Publication by

PAGEPress Publications

via G. Belli 7

27100 Pavia, Italy

Tel. +39.0382.1751762

Fax +39.0382.1750481



www.pagepress.org

ISSN: 1129-5767 eISSN 1723-8633 – www.jlimnol.it

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RESULTS

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Abbreviations

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Acknowledgments

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de Bernardi R, Giussani G, Lasso-Pedretti E, 1979. Food suitability and availability, demographic parameters and population growth in *Daphnia obtusa* Kurz under laboratory conditions. In: R. de Bernardi (Ed.), Proc. Symp. Biological and Mathematical aspects in population dynamics. Mem. Ist. Ital. Idrobiol. Suppl. 37:233-242.

Muyzer G, Brinkhoff T, Wawer C, 1998. Denaturing gradient gel electrophoresis (DGGE) in microbial ecology, p. 1-27. In: A.D.L. Akkermans, J. D. van Elsas and F. J. Bruijn (eds.), Molecular microbial ecology manual. Kluwer Academic Publishers.

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Biodiversity data publication

Authors are warmly encouraged to place all species distribution records in a publicly accessible database such as the national *Global Biodiversity Information Facility* (GBIF) nodes (www.gbif.org) or data centers endorsed by GBIF, including BioFresh (www.freshwaterbiodiversity.eu).

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Impact factor 2012: 1.473



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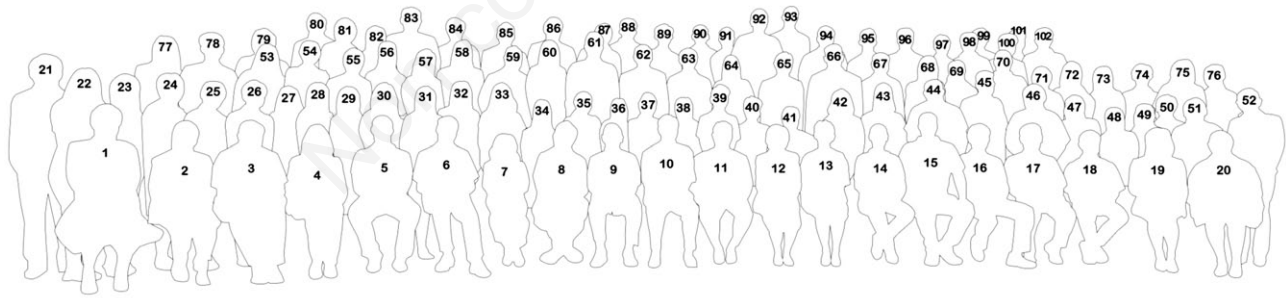
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FRESHWATER INVERTEBRATES OF SOUTHEAST ASIA: BIODIVERSITY AND ORIGIN

Taksila Hotel (Maha Sarakham province), Northeast of Thailand
July 30th-August 4th, 2012

The participants

- | | | |
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INTRODUCTION TO THE PROCEEDINGS

Southeast (SE) Asia, which covers about 4% of the earth's land area, harbours nearly one fourth of the planet's plant and animal species. Southeast Asia is understood as a region with high biodiversity and endemism in freshwater invertebrates, comprising ancient lakes that are considered model systems for evolution (von Rintelen *et al.*, 2010, 2012). This year has seen a revival of interest in evolution and biogeography in SE Asia, in honour of A.R. Wallace (2013 is exactly a century since his death). At the same time, it is a region with a large (600+ million) and rapidly growing human population (annual growth rate *ca.* 1.4 %), which causes habitat destruction to proceed at twice the rate of other humid tropical areas (Woodruff, 2010). As a result, SE Asia is recognised as currently facing a severe biodiversity crisis (Sodhi *et al.*, 2004, 2010). Even though most research on biodiversity and conservation in the region relates to plants and vertebrates, observations on the global decline of biodiversity warn that freshwater biota is most endangered, as species extinction rates are much higher in continental waters when compared to terrestrial habitats (Lévêque *et al.*, 2005). Freshwater invertebrates have huge impacts on humans (*e.g.* as food or vector), yet they belong to the lesser studied portion of the aquatic faunas in the tropics. In most cases we lack the basic knowledge on their diversity, geographic distribution and biology. In the waterfleas (Crustacea: Cladocera) for instance, more than 75% of the species recorded from SE Asia need taxonomic revision (Korovchinsky, 2013). Well-equipped natural history museums with representative zoological collections, the basis of biodiversity studies, are still rare in SE Asia, which makes research on the SE Asian freshwater fauna hard for local specialists. Research collaborations between external (Europe, North America, *etc.*) and Asian scientists have been around (and are doing well) since long and a meeting that would bring specialists of different fields together was much needed. The impetus to organise such a meeting was given by the programme *ASEAN-EU Science, Technology & Innovation 2012 (European Commission's, Seventh Framework Programme for Research and Technological Development)* which created the basis as well as provided significant financial support for our initiative.

The Freshwater Invertebrates of Southeast Asia workshop

The first workshop *Freshwater Invertebrates of Southeast Asia: Biodiversity and Origin* was held in Northeast Thailand (Maha Sarakham, Taksila Hotel) from 30 July to 4 August, 2012. This volume contains the contributions of the FISA workshop. Ninety three participants from 18 countries (Belgium, China, Germany, India, Indonesia, Laos, Malaysia, Oman, Philippines, Poland, Russia, Slovenia, South Korea, Taiwan, Thailand, Vietnam, UK, USA) attended the meeting. A strength of this workshop was its interdisciplinary character. The 36 oral presentations delivered during the workshop were grouped around five large themes (presented below) each of which contained keynotes.

Geological and climatic evolution of Southeast Asia

An overview of the geological history of Sundaland and Wallacea since the Late Jurassic by Robert Hall (Royal Holloway, University of London, UK) (Hall, 2013); *Evolution of the Southeast Asian flora and vegetation: new perspectives* and *Mid Tertiary freshwater wetlands in the Sunda region* by Robert Morley (Royal Holloway, University of London, UK) (Morley, 2013; Morley and Morley, 2013); *Pleistocene sea-level change and Holocene marine transgression – land connections of Sundaland* by Edlic Sathiamurthy (University Malaysia Terengganu, Malaysia); *How a dynamic climate and landscape in Southeast Asia during the Neogene directed the evolution and diversification of freshwater vertebrates* by Harold K. Voris (Field Museum of Natural History, Chicago, USA).

Connection of the Southeast Asian fauna to other zoogeographic regions

Zoogeographic patterns in the Indo-Australian Archipelago by Mark de Bruyn (Bangor University, Bangor, UK).

Fauna relationships within the Oriental region

Aquatic insects in Asian wetlands – molecular biodiversity assessment, evolutionary history and why molecules might really help us out by Michael Balke (Zoological state Collection and GeoBio-Center Ludwig Maximilians University, Munich, Germany) (Balke *et al.*, 2013).

Insular speciation

Insular diversification in SE Asian freshwater invertebrates: a case study from Sulawesi, Indonesia by Thomas von Rintelen (Museum für Naturkunde, Humboldt-Universität, Berlin, Germany).

Ecology, pests and nature conservation

Does the diapause trait affect evolution of SE Asian biota by Hans-Uwe Dahms (Sangmyung University, Seoul, Korea).

In a less formal round-table session the participants could pose questions to the keynote lecturers R. Hall and R. Morley about the geological and climatic evolution of SE Asia. A second evening session, organised by Alexey A. Kotov (University of Moscow, Russia) and Kay Van Damme (University of Birmingham, UK) was devoted to a discussion about the northern boundaries of tropicopolitan species in East Asia and the northernmost limit of the Oriental region. Initiator of the discussion (A.A. Kotov) demonstrated that the *border* between the Palearctic (temperate) and the Oriental (tropical) zoogeographic regions, found in waterfleas, does not follow the classical pattern based on plants and vertebrates, and he invited specialists of different invertebrate groups to do more research in this field, indicating that biogeography in SE Asian zooplankton in particular is relatively weakly developed. Thirty seven posters, authored in great majority by young Asian researchers, discussed the biodiversity, zoogeography, genetics and biology of micro-crustaceans, insects and other freshwater invertebrates of SE Asia. A highly inspirational part of the programme was represented by the afternoon identification sessions, where students and early career researchers could show biological specimens to experts, with the opportunity to identify specimens and exchange ideas on the morphology and ecology of the invertebrate group they were working on. For many of the young colleagues this was the first occasion to meet the top authorities in their research fields, hopefully inspiring their future efforts in freshwater invertebrate research.

We received a very positive feedback from the participants, and we do hope that the first FISA workshop in Maha Sarakham will be succeeded by the next meeting(s) held in SE Asia. The results of the above meeting, materialised in a selection of manuscripts, 19 in total, can be found in this special issue of *Journal of Limnology*.

The Freshwater Invertebrates of Southeast Asia volume

Highly unusual for a limnological issue, the special issue starts off with geological papers written by top experts on the region (Hall, 2013; Morley, 2013; Morley and Morley, 2013), providing a historical framework for biogeography, thorough enough for geologists, yet not too technical for biologists to read, and containing decades of insights and work. The issue further contains a significant number of taxonomical works, describing taxa that are new to science, mainly zooplankton. Trinh Dang *et al.* (2013) describe a new rotifer species of the genus *Ploesoma* Herrick, 1885 from Vietnam. New taxa in the Copepoda comprise a new subgenus of *Tropocyclops* Kiefer, 1927, new species in *Eucyclops* Claus, 1893, *Mesocyclops* Sars, 1914 and *Fierscyclops* Karanovic, 2004, and a new subspecies in *Phyllodiptomus* Kiefer, 1936 (Alekseev *et al.*, 2013, Boonyanusith *et al.*, 2013, Papa and Hołyńska, 2013). In the Cladocera, a new endemic genus with a peculiar ecology is described (Van Damme and Maiphae, 2013), new species in the genera *Leydigiopsis* Sars, 1901, *Karualona* Dumont and Silva-Briano, 2000 and *Notoalona* Rajapaksa and Fernando, 1987 (Van Damme *et al.*, 2013; Van Damme and Sinev, 2013), and in the large branchiopods, a new *Cyzicus* Audouin, 1837 (Rogers *et al.*, 2013). The fact that the latter species was discovered coincidentally in a fish farm during a brief

excursion in the FISA conference, illustrates how useful basic surveys in the region can be for biodiversity assessments and how far we are from a realistic understanding of the true diversity in the region (Rogers *et al.*, 2013).

Besides descriptions of new taxa, new morphological notes are provided for several poorly known species in need of revision, as well as new checklists, biogeographical notes, new keys and faunistics, in freshwater sponges (Manconi *et al.*, 2013), copepods (Alekseev *et al.*, 2013; Boonyanusith *et al.*, 2013; Papa and Hołyńska, 2013), cladocerans (Kotov *et al.*, 2013; Korovchinsky, 2013; Sinev and Korovchinsky, 2013; Van Damme *et al.*, 2013; Van Damme and Maiphae, 2013; Van Damme and Sinev, 2013), large branchiopods (Rogers *et al.*, 2013), stygobionts (Boonyanusith *et al.*, 2013; Brancelj *et al.*, 2013) and rotifers (Trinh Dang *et al.*, 2013; Saardrit *et al.*, 2013). To many researchers in limnology, these relatively descriptive works may seem as unimportant, yet such basic studies are absolutely necessary and too often forgotten by researchers in applied sciences. Such studies provide a firm basis within each group for researchers to build on, and in several countries taxonomical efforts spur limnological research. For example, with Korovchinsky (2013) and Rogers *et al.* (2013), we now have a complete overview of all crustacean branchiopods known in literature to date in SE Asia and an idea of what needs to be done, and the same can be said for the freshwater sponges (Manconi *et al.*, 2013) and cave faunas (Brancelj *et al.*, 2013). Alekseev *et al.* (2013) provide a key for *Eucyclops* in SE Asia, and Van Damme *et al.* (2013) and Van Damme and Sinev (2013) provide new worldwide keys for several cladoceran genera. Kotov *et al.* (2013) and Sinev and Korovchinsky (2013) provide the first thorough and comprehensive faunistics of cladocerans in Laos and Vietnam respectively, as do Papa and Hołyńska (2013) and Alekseev *et al.* (2013) for the cyclopoid copepods of the Philippines and Indonesia, or Saardrit *et al.* (2013) for the rotifers of Thailand. Brancelj *et al.* (2013), Van Damme *et al.* (2013) and Van Damme and Maiphae (2013) illustrate how attention to micro-crustaceans in *unusual* habitats (such as epikarst, temporary pools or swamps), are important for our understanding of biodiversity in SE Asia, as these habitats contain truly hidden diversities and endemics. Such findings can open discussions on biogeography in a group, as illustrated by the tropical Amphi-Pacific link in the cladoceran *Leydigioopsis*, disjunct between SE Asia and the Neotropics (Van Damme and Sinev, 2013).

The picture is far from complete, yet gaps become clearer and the right questions are being formulated. Most authors in this volume agree on the lack of knowledge and the need for continuous (taxonomical and molecular) efforts in SE Asia in order to assess biodiversity and biogeography of aquatic invertebrates, the need for enhancing local limnological capacity building and training (including surveys of different habitats), as well as the importance of increased awareness on the protection of freshwater habitats (such as freshwater swamps; Van Damme *et al.*, 2013). Morley and Morley (2013) illustrate the longevity of wetland habitats throughout the Cenozoic in SE Asia, which gives their importance a historical dimension. In many aquatic invertebrate groups and even complete countries in SE Asia, comprehensive surveys or taxonomical revisions are still to be carried out, while new methods are now available for biodiversity research. There is a species richness that remains to be assessed using both classical and molecular methods, as Balke *et al.* (2013) argument for freshwater beetles. The latter authors suggest molecular biodiversity surveys for SE Asian invertebrates using barcoding as an objective tool adding to alpha taxonomy. In many tropical zooplankton groups, such molecular efforts still need to start and often simply lack a firm taxonomical basis or training, a situation which can hopefully be improved in the future. Together with a future increase in our understanding of biodiversity and the arrival of new methods, the geological reviews of the region since the early eras (Hall, 2013; Morley and Morley, 2013), up to the Quaternary (Morley, 2013) that are presented in this volume can help us to interpret biogeographical patterns in the region and to recognise areas of endemism and relictual freshwater habitats in a historical framework. Indeed, as most of the major biodiversity and conservation studies in SE Asia are based on vertebrates and plants (Sodhi *et al.*, 2004, 2010; Turner *et al.*, 2001) rather than aquatic invertebrates, most invertebrate freshwater groups yet need to enter the wider

discourse. We hope that the realisation of this volume can contribute to a certain extent to our knowledge of freshwater invertebrate biogeography and biodiversity in SE Asia, a diverse and fascinating region. In addition, we believe that the workshop and the proceedings may stimulate further international collaboration in aquatic invertebrate research, providing opportunities for promising and talented young Asian scientists.

GUEST EDITORS

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Acknowledgments

We would first of all wish to thank the *Journal of Limnology* for allowing this special issue with a significant number of taxonomical papers, and the support of the team throughout a year of work (Nadia Moscato, Lucia Zoppi, Claudia Castellano, Michele Moscato, Dr. Roberto Bertoni). Many thanks to all the colleagues and friends who helped to make the workshop (both its scientific and social part) a success. It was a great joint effort of many people from SE Asia and Europe. The international organising committee included Dr. Henri Dumont (Jinan University, Guangzhou, China), Dr. Maria K. Hołyńska (Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw, Poland), Dr. Thomas von Rintelen (Museum für Naturkunde, Humboldt-Universität, Berlin, Germany), Dr. Christopher Rogers (Kansas University, Lawrence, KS, USA), Dr. La-orsri Sanoamuang (Mahasarakham University, Maha Sarakham, Thailand), Dr. Hendrik Segers (Royal Belgian Institute of Natural Sciences, Brussels, Belgium), and Dr. Kay Van Damme (University of Birmingham, Birmingham, UK). The local organising committee consisted of staffs from following universities: i) Mahasarakham University (La-orsri Sanoamuang, Komsorn Lauprasert, Pairot Pramual, Isara Thanee, Jolyn Dodgson, Wipavee Thaimuangphol, Chanidaporn Tumpeesuwan, Bang-on Kong-im, Pornchai Uttaruk, Piyatida Pimwichai, Ajin Pairiron, Jeeranan Suttijan, Kriangkrai Namputtha, Natenapid Srinnoi); ii) Khon Kaen University (La-orsri Sanoamuang, Niwat Sanoamuang, Phuttapunnee Boonmark, Sujeophon Athibai, Chaichat Boonyanusith, Prapatsorn Dabseepai, Supatra Tiang-nga, Lalida Chaoraungrit, Dang Mau Trinh, Somepong Siboulapha); iii) Nakhon Phanom University (Santi Watiroyram); iv) Burapha University (Jitra Teeramaethee); v) Suphanburi College of Agriculture and Technology (Nukul Saengphan); vi) Rajamangala University of Technology Isan (Kosit Sriputhorn); vii) Buriram Rajabhat University (Bancherd Sornsupharp, Sairung Sornsupharp); and viii) Ubon Ratchathani University (Sutthana Plodsoomboon).

We are obliged to all colleagues who reviewed the papers for the Proceedings and to all Authors for their participation and patience. We very much appreciate the generous help of the sponsors [ASEAN-EU Science, Technology & Innovation 2012 (EC FP7); Mahasarakham University, Thailand; Applied Taxonomic Research Center, Khon Kaen University, Thailand; and Science Society of Thailand under the Patronage of His Majesty the King, Northeastern Branch] that allowed us to organise the meeting. Last but not least, special thanks to Dr. Supachai Samappito (President of Mahasarakham University) and the Polish project manager of ASEAN-EU Science, Technology & Innovation 2012, Ms. Renata Kuskowska (Polish Academy of Sciences), who ensured smooth organisation of the finances of the workshop between Europe and SE Asia.

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