Journal of Limnology

2016 - vol. 75(s1)

Editor-in-Chief: Roberto Bertoni, Italy

www.jlimnol.ite

Proceedings of the 6th National Congress of Limnology, Ciudad Universitaria, Universidad Nacional Autónoma de México, D.F.

11-14 November 2014

Istituto per lo Studio degli Ecosistemi Verbania Pallanza, Italy

Journal of Limnology formerly *Memorie dell'Istituto Italiano di Idrobiologia*

The Journal of Limnology publishes peer-reviewed original papers, review papers and notes about all aspects of limnology. The scope of the Journal of Limnology comprises the ecology, biology, microbiology, physics, and chemistry of freshwaters, including the impact of human activities, management and conservation. Coverage includes molecular-, organism-, community-, and eco-system-level studies both applied and theoretical. Proceedings of workshops, specialized symposia and conferences, may also be accepted for publication. The Journal of Limnology is published in three issues per year, open access online and each article is available for downloading for free. A printed version is also available at the annual subscription rate of \in 160,00. For further information on subscription terms, rates, methods of payment and shipping, *etc.*, please contact the Publisher at info@pagepress.org

Editor-in-Chief

Roberto Bertoni, CNR-ISE Institute of Ecosystem Study, Verbania, Italy

Associate Editors

Esteban Balseiro, Laboratorio de Limnología, Universidad Nacional del Comahue, Bariloche, Argentina Rossano Bolpagni, Department of Life Science, Inland water Ecology Lab, University of Parma, Italy Mariano Bresciani, CNR-REA, Milano, Italy Cristiana Callieri, CNR-ISE Verbania, Italy Laurence Carvalho, Scottish Freshwater Ecosystems Group, Centre for Ecology & Hydrology, Midlothian, UK Gianluca Corno, CNR-ISE Verbania, Italy Stefano Fenoglio, University of Piemonte Orientale "Amedeo Avogadro", Alessandria, Italy Diego Fontaneto, CNR-ISE Verbania, Italy Franz Hoelker, Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany Andrea Lami, CNR-ISE Verbania, Italy Bernard Laval, Department of Civil Engineering, University of British Columbia, Vancouver, Canada David M. Livingstone, EAWAG, Dübendorf, Switzerland Marina Manca, CNR-ISE Verbania, Italy Aldo Marchetto, CNR-ISE Verbania, Italy Federico Marrone, University of Palermo, Italy Giuseppe Morabito, CNR-ISE Verbania, Italy Michela Rogora, CNR-ISE Verbania, Italy Giampaolo Rossetti, University of Parma, Italy John P. Smol, Paleoecological Environmental Assessment and Research Lab, Queen's University, Kingston, Canada Dietmar Straile, Limnological Institute, University of Konstanz, Germany Marco Toffolon, University of Trento, Italy Pietro Volta, CNR-ISE Verbania, Italy Yunlin Zhang, Chinese Academy of Sciences, Nanjing, China

Editorial Board

Miguel Alonso, Departament d'Ecologia, Universitat de Barcelona, Spain Jean Christophe Auguet, Centre National de la Recherche Scientifique, France Marco Bartoli, Dipartimento di Scienze Ambientali, Università di Parma, Italy Stefan Bertilsson, Dept. of Ecology & Genetics, Limnology, Uppsala University, Sweden Angela Boggero, CNR ISE, Verbania, Italy Reinaldo L. Bozelli, Departamento de Ecologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Brazil George S. Bullerjahn, Department of Biological Sciences, Bowling Green State University, USA Lluis Camarero, Centre de Recerca d'Alta Muntanya, Vielha, Spain Marco Cantonati, MTSN Sezione Limnologia e algologia, Trento, Italy Manuela Coci, CNR-SE, Verbania, Italy William R. DeMott, Indiana-Purdue University, Fort Wayne, USA Claudia Dziallas, Department of Stratified Lake, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Stechlin, Germany Walter Geller, Centre for Environmental Research - UFZ, Freiburg, Germany Claudia Giardino, CNR IREA, Milano, Italy Niels Jepsen, Section for Freshwater Fisheries Ecology, Technical University of Denmark, Silkeborg, Denmarck Ora Johannsson, Dept. of Fisheries and Oceans, Great Lakes Laboratory for Fisheries and Aquatic Sciences, Hamilton, Canada Christian Kamenik, Geographisches Institut - Physische Geographie, Universität Bern, Switzerland Suzanne N. Levine, Rubenstein School of Environment and Natural Resources, University of Vermont, Burlington, USA Steven Loiselle, Dipartimento Farmaco Chimico Tecnologico, Università di Siena, Italy Gian Marco Luna, CNR - Istituto di Scienze Marine, Venezia, Italy Hugh MacIsaac, Great Lakes Institute for Environmental Research, University of Windsor, Canada Paco Melià, Dipartimento di Elettronica e Informazione, Politecnico di Milano, Italy Beatriz E. Modenutti, Laboratorio de Limnología, Universidad Nacional del Comahu, Bariloche, Argentina Luigi Naselli-Flores, Dipartimento di Biologia ambientale e Biodiversità, Università di Palermo, Italy Liisa Nevalainen, Department of Geosciences and Geography, University of Helsinki, Finland Michaela Salcher, Limnological Station, Institute of Plant Biology, University of Zurich, Switzerland Nico Salmaso, IASMA - Centro Ricerca e Innovazione, Fondazione Mach-Istituto Agrario di S. Michele all'Adige, Italy Hugo Sarmento, Departament de Biologia Marina i Oceanografia, Institut de Ciències del Mar, Barcelona, Spain Ruben Sommaruga, Institute of Ecology, University of Innsbruck, Austria Mauro Tonolla, Istituto Cantonale Batteriosierologico, Bellinzona, Switzerland Pierluigi Viaroli, Dipartimento di Scienze ambientali, Università di Parma, Italy Jaroslav Vrba, Dept. of Ecosystem Biology, Faculty of Science, University of South Bohemia, Ceske Budejovice, Czech Republic Brian Whitton, School of Biological and Biomedical Sciences, University of Durham, UK Ian J. Winfield, Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster, UK

Editorial Assistant

I. Cerutti, CNR-ISE, Verbania, Italy

Managing Editor

Nadia Moscato, Pavia, Italy

Editor-in-Chief Roberto Bertoni, CNR-ISE Verbania, Italy

Autorizzazione Cancelleria del Tribunale di Verbania N. 58 del 7 Ottobre 1959



Istituto per lo Studio degli Ecosistemi, Verbania Pallanza, Italy

Cover Photo

Lago Alchichica, Puebla, Mexico (from a photo of Germán Daniel Silva Varilla)

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

INSTRUCTIONS TO AUTHORS

Manuscript language and ethical compliance

Manuscripts must be submitted in English language and should conform to standard rules of British English grammar and style. Manuscripts submitted must not have been published or accepted for publication in any other journal and must not be under consideration for publication anywhere else. The manuscript publication must have been approved by all co-authors, if any, as well as by the responsible authorities – tacitly or explicitly – at the institute where the work has been carried out. The publisher will not be held legally responsible should there be any claims for compensation.

Permissions

Authors wishing to include figures, tables, or text passages that have already been published elsewhere are required to obtain permission from the copyright owner(s) for both the print and online format and to include evidence that such permission has been granted when submitting their papers. Any material received without such evidence will be assumed to originate from the authors.

The manuscript has to be prepared and structured as follows:

Manuscripts must be written in English language only. Authors whose native language is not English are strongly advised to have their manuscript checked by a language editing service, or by an English mother-tongue colleague prior to submission. The manuscript must be prepared with a standard word processor (preferably Microsoft Word or OpenOffice). Pages should be in A4 format and numbered. Times New Roman 12 pt is the advised font. Lines should be left numbered *in continuum*, to make the referees' work easier, and double-spaced.

Page 1: title of the contribution, full given name(s) and surname(s) of the author(s), mail address(es) and e-mail address for corresponding author, up to six key words, a condensed running head, number of tables and figures.

Page 2: abstract (between 350-400 words).

The body of the text beginning on page 3 should be organized as follows:

INTRODUCTION METHODS RESULTS Sub-heading 1 Sub-heading 2 DISCUSSION CONCLUSIONS ACKNOWLEDGMENTS REFERENCES Tables Figures Figure legends

Particular attention should be taken to ensure that manuscripts exactly adhere to the journal style. In particular, take into account the following notes:

- Names of plants and animals and occasional expressions in Latin, Greek or languages other than English should be typed in italics.
- · Authors must comply with the rules of biological nomencla-

ture, as expressed in the International Code of Zoological Nomenclature, the International Code of Botanical Nomenclature, and the International Code of Nomenclature of Bacteria. When a species name is used for the first time in an article, it should be stated in full, and the name of its describer should also be given. Descriptions of new taxa should comprise official repository of types (holotype and paratypes), author's collections as repositories of types are unacceptable.

- Genus and species names should be in italics.
- Formulas should be centered, marked in the margin with an Arabic numeral in brackets, and separated from the text above and below by a blank line.
- References to figures and tables should be indicated, for example, as follows: (Fig. 1); (Figs. 1 and 2); (Tab. 1); (Tabs. 1 and 2).
- Symbols and combined expressions must be presented using negative exponents. Examples are given below:

Tables

Each table should be numbered with Arabic numerals. It should have a title or explanatory legend at the top. Data may not be presented in both tabular and graphical form. Tables must fit the page vertically with a printed width of either 80 or 170 mm. Tables must be formatted as text, not as embedded images, and placed at the end of the manuscript.

Figures

The number of figures should be reasonable and justified: no more than 20% of the article. They must be numbered with Arabic numerals and placed at the end of the manuscript. Figures that are grouped together must be numbered using lowercase chronological letters. Figures should be a maximum final width of either 80, 130 or 170 mm. Lettering must be provided by the author(s). Letters, numbers and symbols must appear clearly, but not oversized. A suitable final size for lettering is 2 mm after reduction of the figure. It is recommended that one uniform lettering size be used throughout the manuscript. Graphs and histograms should be two-dimensional and scale marks provided. All lines (including boxes) should be clear, but not too thick and heavy. Black and white figures, including drawings and maps, must be originals executed in black on a clean white background. Photographs should be of excellent quality, with clear details and sufficient contrast. Coloured figures and graphs will be accepted; the printed version of the journal will have black-and-white figures, thus Authors must pay particular attention to the figures/graphs formatting and captions, in order to be understandable without solely referring to colours into the illustration itself (i.e. make graphs differentiation by colour and symbols).

Figures and graphs must be submitted as .tif or .jpg files, with the following digital resolution:

Color (saved as CMYK): minimum 300 dpi Black and white/grays: minimum 600 dpi

MS Office files are also acceptable. Each figure should be clearly identified with figure number and author(s) name(s). Cite literature in the text in chronological, followed by alphabetical order and formatted like these examples: Campbell (1983, 1987b), (Smith *et al.*, 1984; Karl and Craven, 1988; Korobi, 1997, 1998). In the References section, list citations in alphabetical, followed by chronological order.

Scientific names: give the Latin names of each species in full and in italics.

Abbreviations

Abbreviations should be defined at first mention and used consistently thereafter.

Acknowledgments

Acknowledgments of people, grants, funds, etc. should be placed in a separate section before the reference list. The names of funding organizations should be written in full.

References

All publications cited in the text should be listed, alphabetically after first author.

- For a single author, references are to be arranged chronologically. If an author published several papers in the same year, they should appear as: White JH, 1970a. ... - White JH, 1970b. ...
- If all authors are identical for two or more citations, chronological order of publication should dictate the order of citations.
- Papers which are in press should be cited only if formally accepted for publication. In this case the year should be that of the acceptance and indicated in brackets: White H, Brown J (1990). (in press).
- Journal citations should be abbreviated based on 'World List of Scientific Periodicals' published by Butterworths, London. If the title of the journal is a single word do not abbreviate.
- Notations such as Vol., n., nr. are superfluous and should be dropped.

Some examples of correct citations are given below:

Callieri C, Stockner JG, 2002. Freshwater autotrophic picoplankton: a review. J. Limnol. 61:1-14.

- Hutchinson GE, 1975. A treatise on limnology. 3. J. Wiley & Sons, New York: 660 pp.
- 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.

We recommend the use of a tool such as EndNote or Reference Manager for reference management and formatting.

EndNote reference styles for J Limnology is available here: http://www.jlimnol.it/public/jlimnol.ens Reference Manager reference styles can be searched for here: http://www.refman.com/support/rmstyles.asp

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).

The Journal of Limnology is indexed by: Journal Citation Reports, Scopus, CrossRef, DOAJ, Aqualine Abstracts; Aquatic Sciences and Fisheries Abstracts (ASFA); Freshwater Biological Association (FBA); Geobase - Ecological Abstracts, Geographical Abstracts; Zoological Record; U.S. Fish and Wildlife Service - Wetland Values Database; NISC's FISHLIT database.

Impact factor 2014: 1.178



Proceedings of VI CONGRESO NACIONAL DE LIMNOLOGÍA

November 11-14, 2014

Instituto de Ciencias del Mar y Limnología, Ciudad Universitaria, Universidad Nacional Autónoma de México, Ciudad de México

Proceedings Guest Editors

Javier Alcocer

(Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México, Ciudad de Mexico, Mexico)

Martín Merino-Ibarra

(Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Ciudad de Mexico, Mexico) Elva Escobar-Briones

(Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Ciudad de Mexico, Mexico)

INTRODUCTION TO THE PROCEEDINGS

The sustainable use of water and its resources requires a better understanding and management than has been so far achieved. However, the accurate integration of updated scientific knowledge and information on water distribution, drainage, and supply is not an easy task due to the poorly integrated information gathered and the agencies levels dealing at the federal, state and local levels responsible of the planning and management of water. Updated information is seldom available, and when accessible, it has not been collected, validated or analyzed by the capable scientific community specialized in inland waters and it often shows some inconsistencies.

This situation is particularly relevant in the tropical region where most developing countries are located. This region shows severe quality and supply problems in the water resources. Limnology has not developed in the tropics at the same level achieved in the temperate region, where most developed countries are located and where limnology evolved since the end of the 19th century. However, tropical limnology cannot be fully understood through applying directly the same principles that rule in the tempered aquatic bodies. A baggage of knowledge related to the particular function and structure of tropical aquatic ecosystems needs to be generated. Tropical Limnology scientific records have only been generated since the second half of the 20th century and therefore new scientific paradigms related to the understanding of both kinds of inland waters require to be generated.

The first limnological records from the tropical American region originated from the 'Peruvian-Amazon Limnological Expedition' and the 'Cambridge Expedition to British Guiana'. The Brazilian Amazonia was studied by H. Sioli, a former director of the Max Planck Institute of Limnology, during almost 20 years. Limnologists like C. Juday, C.S Carter and L.C. Beadle also carried out regional studies. The 'Limnological studies in Middle America, including a Chapter on Aztec Limnology' (1957) were summarized by E.S. Deevey Jr.

Despite a considerable amount of literature on American tropical limnology has been generated, most of it remains fragmented and requires to be updated. Aiming to contribute to the Mexican and Latin American limnological knowledge, the Asociacion Mexicana de Limnología A.C. and the Instituto de Ciencias del Mar y Limnología (ICML), Universidad Nacional Autónoma de México (UNAM), with the support of the Facultad de Estudios Superiores Iztacala and the Facultad de Ciencias, held the VI Congreso Nacional de Limnología at Ciudad Universitaria in Mexico City on November 11 to 14, 2014.

This special issue of the Journal of Limnology gathers a selection of the talks presented during the congress as well as invited contributions from distinguished key speakers with the objective to reach the interest of limnologist from the international community. It comprehends diverse ecosystems such as rivers and streams, lakes and reservoirs, as well as wetlands. Both field and laboratory (experimental) studies are included covering a great variety of approaches (*e.g.*, morphometric, physical, chemical, biological). This issue provides a glimpse of the diversity of limnological studies being developed nowadays in tropical Latin America.

Peer reviewing is an essential and poorly recognized assignment indispensable to guarantee the high standards that scientific contributions must fulfill to be included in outstanding scientific journals. We want to express our most deep gratitude and recognition to the excellent work carried out by the numerous referees that contributed to safeguard the high level and quality of the papers included in the current volume.

Acknowledgements refer to: Adriana Villa Navia, Alfonso Esquivel-Herrera, Alfonso Lugo Vázquez, Álvaro Alonso, Amedeo Fadda, Anatoliy E. Filonov, Andrea Sundermann, Arnoldo Valle Levinson, Berta Riaño Irazábal, Bettina Sonntag, Blanca Pérez-Uz, Brian Timms, Carolina Noreña Janssen, Carolina Ocón, Cecilia Vanegas, César Tamaris, Christopher Filstrup, Daniel L. Tufford, Daniele Longhi, Danny Ionescu, David Montagnes, David Salas de León, David Salas Monreal, Dmitry Beletsky, Elisa Soana, Elizabeth Ortega Mayagoitia, F.X. Tao, Federico Páez Osuna, Fernando W. Bernal Brooks, Francesc Mesquita-Joanes, François G. Schmitt, Gabriela Vázquez Hurtado, Gloria Vilaclara Fatjo, Gustavo A. Montejano Zurita, Henri Dumont, Inia Soto Ramos, Irina Chubarenko, Irina Yu. Feniova, Iwona Jasser, J. Thad Scott, Jaroslava Komárková, Javier Carmona Jiménez, Jinliang Huang, Jiri Komarek, Jitka Jezberova, John Berry, Jorge Celi, Juan Carlos Rodríguez-Murillo, Jurek Kolasa, K. Benjamin Woodward, Karel Hornak, Kenneth W. Cummins, Laura Dávalos-Lind, Liliana García, Luciana Cibils Martina, Luis Javier Plata, Manuel Leira, Mari Cruz García González, Marieke Anna Frassl, Marina S. Suzuki, Miroslav Macek, Moshe Gophen, Nikolai Korovchinsky, Noel Carbajal Pérez, Norman Mercado Silva, Paulo Roberto Pagliosa, Pavel García, Ramesh Gulati, Ricardo Miguel Pérez Munguía, Robert Wallace, Rosa Luz Tavera, Rosa María Prol Ledesma, Sergio Cerdeira Estrada, Silvia Haydée Otaño, Stéphanie Fayolle-Sanna, William M. Lewis and Xuezhi Bai.

Finally, we want to express our most sincere gratitude to the authors and to all the people who directly or indirectly contributed to this effort, particularly to Drs. Fernando González Farías, Martín López Hernández and Javier Carmona Jiménez, who, together with the editors of the present special number, were part of the Organizing Committee of the VI Congreso Nacional de Limnología. We are widely grateful for the interest and sponsorship of the CIC-UNAM, CONACYT and the FEMSA foundation that allowed the publication of this special issue.



PAGEPress Publications - www.pagepress.org