

SUPPLEMENTS PUBLISHED

(continued from inside cover)

9. Kurahashi H & Magpayo FR (2000). Blow flies (Insecta: Diptera: Calliphoridae) of the Philippines. Raffles Bulletin of Zoology, Supplement 9: 1–78.
10. Jefferson TA & Smith BD (eds.) (2002) Facultative freshwater cetaceans of Asia: Their ecology and conservation. Raffles Bulletin of Zoology, Supplement 10: 1–187.
11. Ng PKL, Wowor D & Yeo DCJ (eds.) (2002) Scientific results of the Anambas Expedition 2002. Raffles Bulletin of Zoology, Supplement 11: 1–130.
12. Yeo DCJ, Ng PKL & Pethiyagoda R (eds.) (2005) Contributions to biodiversity exploration and research in Sri Lanka. Raffles Bulletin of Zoology, Supplement 12: 1–434.
13. Kottelat M & Yeo DCJ (eds.) (2005) Southeast Asian freshwater fish diversity. Raffles Bulletin of Zoology, Supplement 13: 1–208.
14. Tan H & Jan R-Q (eds.) (2007) Proceedings of the 7th Indo-Pacific Fish Conference. Raffles Bulletin of Zoology, Supplement 14: 1–434.
15. Wang LK & Hails CJ (2007) An annotated checklist of birds of Singapore. Raffles Bulletin of Zoology, Supplement 15: 1–179.
16. Tan SH & PKL Ng (eds.) (2007) Crustacean Supplement I. Raffles Bulletin of Zoology, Supplement 16: 1–357.
17. Ng PKL, Guinot D & Davie PJF (2008) Systema Brachyurorum: Part 1. An annotated checklist of extant brachyuran crabs of the world. Raffles Bulletin of Zoology, Supplement 17: 1–286.
18. Bieler R, Chalermwat K, Mikkelsen PM, Tan KS & Wells E (eds.) (2008) Molluscs of Eastern Thailand: Proceedings of the International Marine Bivalve Workshop, Chantaburi, Thailand, August–September 2005, with contributions on other molluscan groups. Raffles Bulletin of Zoology, Supplement 18: 1–264.
19. Tan SH & Chen I-S (eds.) (2008) Aquatic biodiversity of the South China Sea. Raffles Bulletin of Zoology, Supplement 19: 1–292.
20. Tan SH & MEY Low (eds.) (2009) Crustacean Supplement II. Raffles Bulletin of Zoology, Supplement 20: 1–307.
21. De Grave S, Pentcheff ND, Ahyong ST, Chan T-Y, Crandall KA, Dworschak PC, Felder DL, Feldmann RM, Fransen CHJM, Goulding LYD, Lemaitre R, Low MEY, Martin JW, Ng PKL, Schweitzer CE, Tan SH, Tshudy D & Wetzler R, 2009. A classification of living and fossil genera of decapod crustaceans. Raffles Bulletin of Zoology, Supplement 21: 1–109.
22. Tan KS (ed.) (2009) Fourteenth International Marine Biology Workshop 2006: The marine flora and fauna of Singapore. Raffles Bulletin of Zoology, Supplement 22: 1–294.
23. Low MEY & SH Tan (eds.) (2010) Checklists of anomuran decapod crustaceans of the world (exclusive of the Kiwaoidea and families Chirostylidae and Galatheidae of the Galatheoidea) and marine lobsters of the world. Raffles Bulletin of Zoology, Supplement 23: 1–181.
24. Davison GWH & Chia CSW (eds.) (2011) Proceedings of the fifth International Hornbill Conference, Singapore, 22–25 March 2009. Raffles Bulletin of Zoology, Supplement 24: 1–176.
25. Koh LP, Lee TM & Lim MLM (eds.) (2012) Special Memorial Issue: Navjot S. Sodhi (1962–2011). Raffles Bulletin of Zoology, Supplement 25: 1–289.
26. Kottelat M (2013) *Conspectus cobitidum*: An inventory of the loaches of the world (Teleostei: Cypriniformes: Cobitoidei). Raffles Bulletin of Zoology, Supplement 26: 1–199.
27. Kottelat M (2013) The fishes of the inland waters of Southeast Asia: A catalogue and core bibliography of the fishes known to occur in freshwaters, mangroves and estuaries. Raffles Bulletin of Zoology, Supplement 27: 1–663.
28. Belant JL & Wilting A (eds.) (2013) Methods for detecting and surveying tropical carnivores. Raffles Bulletin of Zoology, Supplement 28: 1–113.
29. Davison GWH, Wells DR & Yong HS (2013) Special volume in honour of the 80th birthday: Gathorne Garthorne-Hardy, 5th Earl of Cranbrook. Raffles Bulletin of Zoology, Supplement 29: 1–279.



Published by the Lee Kong Chian Natural History Museum, National University of Singapore

Articles appearing in this journal are indexed in: SCIENCE CITATION INDEX® CURRENT CONTENTS® AGRICULTURE, BIOLOGY & ENVIRONMENTAL SCIENCE; SCISEARCH® RESEARCH ALERT® BIOLOGICAL ABSTRACTS® CAMBRIDGE SCIENTIFIC ABSTRACTS® AQUATIC SCIENCES & FISHERIES ABSTRACTS

Layout by Photoplates Pte Ltd

THE RAFFLES BULLETIN OF ZOOLOGY 2014

SUPPLEMENT NO. 30

The Raffles Bulletin of Zoology



An International Journal of Southeast Asian Zoology

Christmas Island and Cocos (Keeling) Islands: Biodiversity and Management Challenges



Tan Heok Hui, Max Orchard, Peter F. Davie & Peter K. L. Ng
(Editors)

Supplement No. 30

25 December 2014

The Raffles Bulletin of Zoology | R B Z |

The Raffles Bulletin of Zoology (RBZ) is an online, peer-reviewed journal which publishes high quality papers in Taxonomy, Systematics, Ecology, and Conservation Biology of animals from Southeast Asia and its adjacent areas. The Journal aims to build up quality information on the “animal diversity” of Southeast Asia in particular. Papers from outside the stated geographic range that deal with material deposited in the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum (LKCNHM), National University of Singapore (NUS) will also be published. Both descriptive and experimental papers will be considered. Single species descriptions and ecosystem studies will be considered for publication. Papers outside the stated policy will be accepted at the discretion of the Editors/Editorial Board.

EDITORIAL BOARD

Barry W. Brook (Charles Darwin University, Australia) • **Chou Loke Ming** (NUS, Singapore) • **Indraneil Das** (Universiti Malaysia Sarawak, Malaysia) • **R. A. I. Drew** (Griffith University, Australia) • **Hugh A. Ford** (University of New England, Australia) • **Fabian Herder** (Zoologisches Forschungsmuseum Alexander Koenig, Germany) • **Michel Jangoux** (University of Brussels, Belgium) • **Maurice Kottelat** (Cornol, Switzerland) • **Damir Kovac** (Senckenberg Museum, Germany) • **Kelvin K. P. Lim** (NUS, Singapore) • **John E. Randall** (Bernice P. Bishop Museum, USA) • **Fred Sheldon** (Louisiana State University, USA) • **Daniel Simberloff** (University of Tennessee, USA) • **S. H. Tan** (NUS, Singapore) • **Y. Tsubaki** (Center for Ecological Research, Kyoto University, Japan) • **E. O. Wilson** (Harvard University, USA) • **S. Yamagishi** (Kyoto University, Japan) • **H. S. Yong** (University of Malaya, Malaysia)

MANAGING EDITORIAL BOARD

EDITOR-IN-CHIEF: Peter K. L. Ng (NUS, Singapore)

MANAGING EDITOR: Tan Heok Hui (NUS, Singapore)

ASSOCIATE EDITORS: Kevin Conway (Texas A&M University, USA) • Hwang Wei Song (NUS, Singapore) • Zeehan Jaafar (NUS, Singapore) • Sebastian Klaus (Johan Wolfgang Goethe-Universität Biologikum, Germany) • Jeffrey Kwik Teik Beng (NUS, Singapore) • Leong Tzi Ming (NUS, Singapore) • Li Daiqin (NUS, Singapore) • Norman Lim T-Lon (University California, Davis, USA) • Rudolf Meier (NUS, Singapore) • Jose Christopher E. Mendoza (NUS, Singapore) • Tohru Naruse (University of Ryukyus, Japan) • James Reimer (University of Ryukyu, Japan) • Frank E. Rheindt (NUS, Singapore) • Tan Koh Siang (TMSI, Singapore) • Tan Siong Kiat (NUS, Singapore) • Peter A. Todd (NUS, Singapore) • Tran Anh Duc (Hanoi University of Science, Vietnam) • Darren C. J. Yeo (NUS, Singapore) • Martyn Low (NUS, Singapore) • Marcus A. H. Chua (NUS, Singapore) • John S. Ascher (NUS, Singapore)

COPY EDITOR: Jeremy W. L. Yeo (NUS, Singapore)

COPY EDITOR: Hazelina H. T. Yeo

PRODUCTION EDITOR: Jeremy W. L. Yeo (NUS, Singapore)

EDITORIAL ADMINISTRATOR: Greasi Simon (NUS, Singapore)

WEBMASTER: Chua Keng Soon (NUS, Singapore)

PUBLICATION DETAILS

The Raffles Bulletin of Zoology will consist of a single volume each year, continuing the sequence of its two predecessors, **Bulletin of the Raffles Museum** (1928–1960) and **Bulletin of the National Museum of Singapore** (1961–1970). A separately numbered supplement series will be published as and when manuscripts and funding permit. About 14 hard-copies of the Journal will be deposited in major publicly accessible libraries to satisfy Article 8.6 of the Fourth Edition of the International Code of Zoological Nomenclature (1999) so that all new names published in the RBZ are considered to be published and available. The new names are also registered with Zoobank.

COPYRIGHT AND EXCHANGES

All articles published by the RBZ may be downloaded from <http://lkcnhm.nus.edu.sg/nus/index.php/publications/rbz> for research purposes. A condition of publication is that authors assign publication rights to **The Raffles Bulletin of Zoology**. After publication, authors may use the article without prior permission from the Journal provided acknowledgement is given to the Journal as the original source of publication. It is the responsibility of authors to obtain permission to use copyright material from other sources. For permissions and copyright matters, please contact the Managing Editor at nhmthh@nus.edu.sg. For queries on the purchase of back issues or journal exchanges, please contact the Editorial Administrator at nhmgs@nus.edu.sg.

PUBLISHER’S ADDRESS

The Raffles Bulletin of Zoology • Lee Kong Chian Natural History Museum • National University of Singapore • Block S6 : Level 3 • Science Drive 2 • Singapore 117546 • Republic of Singapore

The Raffles Bulletin of Zoology is online at <http://lkcnhm.nus.edu.sg/nus/index.php/publications/rbz>

ISSN 2345-7600 (electronic)

ISSN 0217-2445 (print)

INSTRUCTIONS TO AUTHORS

Submission of manuscripts. All manuscripts are to be submitted via email to RBZ@nus.edu.sg, with a list of at least two potential reviewers. Where possible, authors are encouraged to deposit representative material from papers published in the RBZ with the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum (LKCNHM), National University of Singapore.

Presentation. Documents produced with Microsoft® Word (.doc) are preferred. Text must be double-spaced throughout. The title page should contain the full title, author’s name, professional affiliation and email address, and a short running title of not more than 35 characters. All articles should be accompanied by an abstract of not more than 300 words and 4–8 key words. All scientific names used or proposed must be in accordance with the 4th Edition of the International Commission of Zoological Nomenclature (1999). Telegraphic style is recommended for descriptions, diagnoses, and keys in taxonomic papers. The holotype must be clearly designated and depositories for all type specimens must be clearly stated, including catalogue numbers if possible. Descriptions of new taxa by one author in a paper under another’s name are strongly discouraged (e.g., Lim, in Tan & Ong, 1986). Synonymies must be cited in the short form (taxon, author, year, page), with full references at the end of the paper.

Literature cited. All references cited in the text, including taxonomic authorities for any scientific names, should be included in the LITERATURE CITED section. References are to be cited in the text by the author’s family name or surname and year of publication, e.g., (King et al., 1975; Nakasone & Agena, 1984; Murphy, 1990). Citations are listed at the end of the manuscript in alphabetical and chronological order. Journal references should include year of publication, title of paper, **full title of journal**, volume number, and page numbers. Book references should include year of publication, title of book chapter, editor (if any), title of book, publisher, city of publication, and the page numbers of the chapter or the book.

Review. All manuscripts will be sent to an Associate Editor who will have them reviewed by two referees. The Associate Editor decides on provisional acceptance or rejection based on comments submitted by the referees. After acceptance, the manuscript must be revised and emailed to the Associate Editor for verification.

Page and colour page charges. There are no page or colour page charges. Authors with papers longer than 20 pages are advised to write to the Managing Editor before submission.

Proofs and reprints. Proofs in PDF format are emailed to authors for correction and approval, together with the copyright transfer and reprint order forms. Reprint orders are taken with returned proofs. Authors will receive an electronic reprint in PDF format for personal use (note that copyright remains with the publisher). Hard copy reprints cost S\$1.00 per page without colour plates, and S\$2.00 for a page with colour plates.

Detailed instructions to authors are available at <http://lkcnhm.nus.edu.sg/nus/index.php/instructions>

SUPPLEMENTS PUBLISHED

1. Wee DPC & Ng PKL (1995) Swimming crabs of the genera *Charybdis* De Haan, 1883 and *Thalamita* Latreille, 1829 (Crustacea: Decapoda: Brachyura: Portunidae) from Peninsular Malaysia and Singapore. *Raffles Bulletin of Zoology*, Supplement 1: 1–128.
2. Deeleman-Reinhold CL (1995) The Ochyroceratidae of the Indo-Pacific region (Araneae). *Raffles Bulletin of Zoology*, Supplement 2: 1–103.
3. Ng PKL & Chuang CTN (1996) The Hymenosomatidae (Brachyura) of Southern Asia, with notes on other species. *Raffles Bulletin of Zoology*, Supplement 3: 1–82.
4. Morioka H & Yang CM (1996) A catalogue of the bird specimens in the Singapore Zoological Reference Collection Part I. Struthioniformes–Charadriiformes. *Raffles Bulletin of Zoology*, Supplement 4: 1–141.
5. Kurahashi H, Benjaphong N & Omar B (1997) Blow flies (Insecta: Diptera: Calliphoridae) of Malaysia and Singapore. *Raffles Bulletin of Zoology*, Supplement 5: 1–88.
6. Sodhi NS, Yong HS & Ng PKL (eds.) (1999) The biodiversity of Pulau Tioman, Peninsular Malaysia. *Raffles Bulletin of Zoology*, Supplement 6: 1–288.
7. Allwood AJ, Chinajariyawong A, Drew RAI, Hamacek EL, Hancock DL, Hengsawad C, Jipanin JC, Jirasurat M, Kong Krong C, Kritsaneepaiboon S, Leong CTS & Vijaysegaran S (1999) Host plant records for fruit flies (Diptera: Tephritidae) in Southeast Asia. *Raffles Bulletin of Zoology*, Supplement 7: 1–92.
8. Ng PKL & Tan KS (eds.) (2000) The biodiversity of South China Sea. *Raffles Bulletin of Zoology*, Supplement 8: 1–673.

(continues on back cover)