Photo courtesy of © Lars Fehlandt

Haas, Das, Hertwig, Bublies, Schulz-Schaeffer
A Guide to the Tadpoles of Borneo

Danum Valley canopy.

Alexander Haas, Indraneil Das, Stefan T. Hertwig,
Pia Bublies, Reinhard Schulz-Schaeffer

A GUIDE TO THE

TADPOLES OF BORNEO

tredition

IMPRESSUM

ISBN Softcover: 978-3-347-64345-1
ISBN E-Book: 978-3-347-64346-8

Printed and distributed in behalf of the authors by tredition GmbH, Halenreie 40-44, 22359 Hamburg.

The authors are responsible for the contents. Publication and distribution in behalf of the authors by tredition, to be reached at: "Impressumservice", Halenreie 40-44, 22359 Hamburg, Germany.

Printed Version 1.0

Cover: *Microhyla malang*
Cover Design: Reinhard Schulz-Schaeffer

Project and book creation sponsored by

VolkswagenStiftung

CONTENTS

1 PREFACE 13

ACKNOWLEDGMENTS 14

2 INTRODUCTION 16

General scope 16

Bornean frog species 18

Taxonomy 22

Who should use this book? 22

How to use this book? 23

3 AMPHIBIAN STUDIES ON BORNEO 24

Brief history of studies 24

Biogeography 26

4 NATURAL HISTORY 34

Natural history 34

Tadpole diets 38

Reproductive modes & larval habitat 42

Tadpole microhabitats 46

5 ETHNOBIOLOGY 49

6 METHODS TO STUDY TADPOLES 50

Finding & observing tadpoles 50

Describing & illustrating tadpoles 51

Tadpole photography 52

Measurements 54

DNA Barcoding 56

Vouchers and tissue preservation 57

7 MORPHOLOGY 58

Tadpole morphology 58

Variability in tadpoles 65

8 SPECIES ACCOUNTS **66**

Tadpole descriptions **66**

Flowing water bodies 69

Bufonidae **70**
Ansonia **70**
Ingerophrynus 86
Leptophryne 88
Phrynoidis 90
Rentapia 92

Dicroglossidae **94**
Limnonectes 94

Megophryidae **100**
Leptobrachella 100
Leptobrachium 114
Megophrys 122
Pelobatrachus 124

Ranidae **128**
Huia 128
Meristogenys 130
Odorrana 146
Staurois 148

Rhacophoridae **154**
Feihyla 154
Leptomantis 156

Stagnant water bodies 167

Bufonidae **168**
Duttaphrynus 168
Ingerophrynus 170
Pelophryne 172

Dicroglossidae **176**
Fejervarya 176
Hoplobatrachus 178
Limnonectes 180
Occidozyga 190

Microhylidae **196**
Glyphoglossus 196
Chaperina 198
Kaloula 200
Metaphrynella 204
Microhyla 206
Nanohyla 212
Kalophrynus 216

Ranidae **220**
Abavorana **220**
Chalcorana 224
Hylarana 226
Indosylvirana 228
Pulchrana 230

Rhacophoridae **234**
Feihyla **234**
Kurixalus 236
Leptomantis 238
Nyctixalus 244
Philautus 246
Polypedates 250
Rhacophorus *258*
Zhangixalus 266

Terrestrial sites **269**

Rhacophoridae **270**
Philautus 270

9. GLOSSARY 272

10 AUTHORS 276

11. INDEX OF SPECIES DESCRIPTIONS 279

Phrynoidis juxtasper

Ulu Temburong National Park, Brunei.
Photo courtesy of © Hanyrol H. Ahmad Sah.

WE WILL NEVER FORGET …

our first trip together in 2001 to the interior of Sarawak and the kind Kelabit people of the Bario Highlands. It was a joyful productive exploration of the beautiful forests of Bario. The morale was high, discussions on shared scientific interests were productive and soon showed that we should try doing a project together. Soon after, we applied to Volkswagen Foundation for a four-year project on an inventory of East Malaysian tadpoles. In the consecutive years, we conducted many field trips together and amassed data far beyond tadpoles. The idea of writing a book on tadpoles always lingered in our heads, fascinating and intimidating us at the same time. It was only after Stefan T. Hertwig, Pia Bublies, and Reinhard Schulz-Schaeffer had later strengthened our team that we started the book writing journey. The time was ripe for a summary of what had been achieved.

When thinking about writing a book on the tadpoles of Borneo, we found us confronted with some tricky questions. How can a book be written about a fauna that is incompletely known at the time of writing? How can we dare writing about the tadpoles of Borneo when many tadpoles have either not been discovered or not been described scientifically? Why would we try to assemble a book if current knowledge is so patchy? And why risk the publication of a book that might be outdated by new discoveries and progress in taxonomy and systematics at the time of its release? These are only the biological and scientific questions raised by such a project. Many more questions concern the format: printed book, e-book, app for tablet PC? What would be the most useful and appealing format of such a publication in times of major changes in the markets. Who would use the book and how would it be used? What value in usability could we deliver?

The excellent previous work of colleagues certainly humbled us, for example Wen-hao Chou and Jun-yi Lin's *Tadpoles of Taiwan* and Marion Anstis' *Tadpoles and Frogs of Australia,* and Tsi Ming Leong's publications on Peninsular Malaysia tadpoles. At the same time, books such as *Frogs of Borneo* by Robert F. Inger, Robert B. Stuebing, T. Ulmar Grafe, and T. Maximilian Dehling inspired us with their book on frogs. The work and high standards of all theses authors encouraged us to fill a gap and experiment with our own ways to approach a publication on a localized tadpole fauna.

Many years of field work in the beautiful rainforests of Sarawak and Sabah have enriched us with insights that we want to share. Many students, with their keen enthusiasm have convinced us that producing a publications that facilitates access to the exceptional and fascinating amphibian fauna of Borneo is an effort well spent. The faith of our major financial sponsor for this research project, the Volkswagen Foundation, certainly encouraged us to take this challenge. Last but not least, the numbers of visitors to our website on the frogs of Borneo (🌐www.frogsofborneo.org) surprised us; we had not expected that attention. On this site, a few clicks lead the user to most of the Bornean species. Although incomplete in coverage and information for each species rather minimalistic, it has proven useful for many users. University students and general naturalists downloaded our imagery to build their personal pocket field guides. It convinced us that there is a need for simplicity among users.

Knowledge on amphibians and the tools of the trade are in constant change. That should not keep us from communicating the current status in the field in an accessible form. Our team of authors has proposed some new avenues in this book. For us it has been a joyful learning experience.

— Alexander Haas & Indraneil Das —

→🔗 Author information p. 276

→🔗 🌐 www.frogsofborneo.org

ACKNOWLEDGMENTS

Over the years, numerous colleagues, friends, students, technicians, and field companions assisted in one way or another in our project to document the tadpoles of Borneo either by making the book a reality, working with us in the field, processing specimens in the laboratory, or just discussing Bornean amphibians with us. Needless to say that our endeavor was substantially motivated by previous groundbreaking scientific work on tadpoles by Robert F. Inger, Wen-hao Chou, Marion Anstis, and Tzi Ming Leong. Their wonderful work provided many inspirations for the present book.

First and foremost, we would like to thank the Volkswagen Foundation for enabling us with a grant to initiate our research on Bornean tadpoles, organize a symposium at Universiti Malaysia Sarawak in 2009, and produce this book. Furthermore, we would like to express our sincere gratitude to our scientific institutions for providing us with the possibility to conduct this research, namely the Institute for Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak; the Center for Natural History, Universität Hamburg, Leibniz-Institute for the Analysis of Biodiversity Change, and the Natural History Museum Bern. The Burgergemeinde Bern and German Academic Exchange Program (DAAD) generously provided funds for field assistants and travel expenses. We also gratefully acknowledge the generous support of our collaborating partners at the Universiti Sabah Malaysia, Charles Vairapppan and Kueh Boon-Hee.

Our research in protected areas of Sarawak and Sabah was only possible with the support and endorsement of the responsible authorities. We are indebted to the Economic Planning Unit, the Prime Minister's Department, Malaysia, and especially Munirah Abd. Manan. Sarawak Forest Department and Sarawak Forestry Corporation, especially (Datuk) Cheong Ek Choon, Engkamat Lading, Oswald Braken Tisen, Haji Azahari bin Omar, Zolkipli bin Mohamad Aton, Arabi Abang Aimran, (Datu) Haji Ali bin Yusop, Bolhan Budeng, Azahari bin Omar, Mohd. Shabudin Sabki, Nur Afiza Binti Umar, Dayang Nuriza binti Abang Abdillah, Mohamad bin Kohdi. We gratefully acknowledge the support of Sabah Biodiversity Center and Council, Abdul Fatah Amir, C.Y. Chung. Sabah Parks with our contact persons Jamili Nais, Maklarin Lakim, Paul Yambun, Nelly Majuakim. Yayasan Foundation and Maliau Management Committee, particularly Waidi Sinun, Rondy Milin, and Grace Pounsin supported our work at Maliau Conservation Area. Finally, we thank all local park managements and staff that we had the privilege to work with.

Many people contributed to our project. We needed support and assistance in the field, specimens had to be processed, tadpoles had to be barcoded, phylogenetically analyzed, and described. Some students produced Bachelor's or Master's Theses on tadpoles and frogs of Sarawak and Sabah as part of our project and moved on to make their own careers. First of all, our gratitude goes to Pui Yong Min who was our reliable, knowledgeable and kind partner and friend in many field trips. We thank him for his sustained support, his inter-cultural assistance, tremendous field work and endless enthusiasm.

Two species of *Abavorana* have been described, *A. luctuosa* and, recently, *A. decorata*. At present, the limited genetic data available does not allow a definitive identification of this remarkable specimen from Lambir Hills National Park.

Furthermore, we would like to thank our former students, field assistants, and technical staff for their participation in a multitude of different ways and for their good work, in no particular order: Elyas Eric Huil, Laurence Etter, Erina Balmer, Nathalie Reichen, Jana Flury, Hannes Baur, Beatrice Blöchlinger, Chris Sherry, Karin Eva Lilje, Toralf Keilholz, Tobias Einecke, Maximilian Dehling, André Jankowski, Jeet Sukumaran, Daniela Haarmeier, Melitta Wunderskirchner, Cindy Hefenbrock, Wencke Krings, Maria Grimm, Jana Pohlmeyer, Thorben Riehl, Johanna Wolter, Enzo Braskamp, Despina Chaluppa, Stine Griep, Helena Dobbeck, Stephan Senne, Julia Juchheim, Felix Meyer, Sandra James Tinggom, Castro Michael, Lily Sir, Mohd. Iqbal Makmor, Khairul Anuar bin Omar, Yolande Direp ak Michael Direp, Hairi bin Hedeir, Siti Shuhada bt Mustaffa, S. J. Tingsom, C. Michael, Mona Octavia Sulai, Lea Waser, Evelyne Oberhummer, Dario Neokleous, Catherin Barten, Dimitrij Trofimov, Anna Maria Vogt, Monika Hähnel, Angelika Taebel-Hellwig, Reto Hagmann, Masliadi bin Asri, Alvinus Joseph, and Elyas Eric Huil. Finally many thanks go to Jörg Hofmann, good friend and excellent partner in the field.

Ledlenser kindly provided some samples of their LED torches for field testing. Yeo Siew Teck (Cat City Holidays) provided valuable logistics support over the years. Nele Johannsen skillfully developed and contributed a sketched rainforest scenery (p. 46f) that shows where tadpoles live .

The authors hold copyrights for all photos in this book, except for several photos that were kindly provided by other photographers and are marked alongside with the photo. Especially Chien Lee, Hanyrol H. Ahmad, Lars Fehlandt, Pui Yong Min, Nikolay A. Poyarkov, Arne Schulze, and Wencke Krings. Marion Beeck gave some time-saving InDesign tips. We very much appreciate all their contributions!

Our colleagues Robert F. Inger, Ulmar Grafe, Julian Glos, Chan Kin Onn, Umilaela Arifin, Rafe Brown, Manuel Schweizer, Tzi Ming Leong, and Quah Evan have always been open for our questions and supported us when needed. We are grateful for all the discussions, interactions, and sharing of information we had with them and the help we received!

Many thanks to our friends and nature photographers Hanyrol H. Ahmad Sah,and Lars Fehlandt who joined us in field work, provided great images, connected us many times with people, helped us with logistics, and gave us valuable advice during expedition planning. We are grateful to Nadja Schilling for proof reading earlier versions and feedback. AH takes full responsibility for all remaining errors. Finally, AH wants to thank Roisin Murphy for her album *Róisín Machine*. Its steaming and stumping beats kept him going in this project and boosted his morale.

GENERAL SCOPE

Biodiversity research aims to uncover and understand the full biological richness of a given area. Southeast Asia includes several hotspots of biodiversity that are paralleled in species richness only by the Amazon river basin and adjacent regions in South America. One of the Asian hotspots is Sundaland, a shallow continental shelf on which Borneo, Sumatra, and Peninsula Malaysia are located (p. 26). Today's islands of Sundaland have been interconnected repeatedly during periods of low sea levels at former times.

The biodiversity of Southeast Asia has been vastly underestimated in the past and researchers are only beginning to comprehend the true richness of this region. Borneo is the largest island of Sundaland and plays a crucial role in the recording and understanding of the evolution of biodiversity in this region. In the past 20 years many species of frogs have been discovered on the island of Borneo. Some of these new species have been split from known taxa, acknowledging that known species had been complexes of several, closely related and morphologically similar, but genetically and ecologically distinct species. Progress is fast. A text like this can become outdated shortly after publication.

In this book we focus on species that we encountered in our own work in Sarawak and Sabah. For many known species, however, tadpoles have not been documented. The current list of Bornean frog species follows below (p. 18). Many more are likely to be described in the decades to come. It is unavoidable that the scientific information available for species and species' tadpoles (imagery, ecology) differs significantly. Some species are well known, widespread, and commonly found, others are restricted to certain areas, sometimes known only from their respective type localities and rarely seen. Our species accounts necessarily reflect that and are snapshots in an evolving field.

Feihyla kajau

While adults frogs live in numerous terrestrial habitats and niches, tadpoles are the larval aquatic stage in the biphasic life-cycle of frogs. The body shape, anatomy, and ecological requirements are completely different from the terrestrial frog. The tadpole eventually undergoes a metamorphosis to transform into a froglet. Metamorphosis is the process of physical transition from the aquatic larva to the terrestrial adult. The biology of tadpoles is just as fascinating as the biology of frogs and has been central in our own research. We believe that rather few publications have given tadpoles the attention they deserve. Clearly, understanding the ecology of tadpoles is essential for any conservation efforts. If an area does not provide proper habitats for tadpoles, there will be no frogs either! For the naturalist, ecologist or surveyor, tadpoles are an important indicator of the presence of a reproductively active population of that species.

After metamorphosis, the froglets leave the water and move to their different species-specific terrestrial habitats. Frogs occupy a large number of ecological niches, ranging from burrows in the forest floor to the canopy of the rainforests. This variety of living conditions is reflected by the adaptations of their body. Species that perch on shrubs or trees have slender bodies and long legs, while ground-dwellers often show a stocky body and short but strong legs.

All amphibian species from Borneo (and indeed from all over the world) have been described largely, if not entirely, on the basis of adult specimens, because frogs are found more often in the field than their larval stages. Tradition in herpetological research is another reason for the focus on adults and the neglect in tadpole research. Knowledge of tadpole descriptions has thus seriously lagged behind. Although many larval descriptions of species occurring on the island of Borneo have been published, we still lack information on the larval forms of many species. Larval de-

Tawau Hills National Park, Sungai Gelas Waterfall.

scriptions currently available are sometimes derived from non-Bornean populations that may eventually prove to be non-conspecifics. Several familiar species have been shown in recent years to include morphologically similar albeit biologically distinct species.

Data quality is another problem, as a significant proportion of traditional larval descriptions lack voucher specimen information. Voucher specimens are specimens deposited in accessible museum collections for future reference. Many previously published larval descriptions have neglected DNA barcoding techniques for unambiguous matching of tadpoles and frogs. Assigning an unknown tadpole to a frog is no easy task; it may require rearing the tadpole through metamorphosis. Even then, in studies that have done so, wrong assignments have occurred. The froglet may look very unlike the adult frog—the famous Wallace's Flying Frog *Rhacophorus nigropalmatus* is one example. With the advent of DNA barcoding techniques it is now possible to match any tadpole with a frog from the same region, stream, or pond with a high reliability. This technique is far superior, less time consuming and less error-prone than rearing experiments. The only drawback is the access to a lab and the need to collect, handle and preserve tissue properly. Once the match and correct assignment has been established by DNA barcoding, morphological features can be re-examined to extract features that might allow to identify a tadpole without DNA barcoding.

In this book, we present pertinent morphological information for common species (if their tadpole is known to science) as a tool for field identification of tadpoles. With the help of this book, tadpoles should be identifiable to the species or at least to the generic level. The continuing discovery of new species and their tadpoles makes the development of reliable, classical dichotomous identification keys very difficult. New discoveries can overthrow existing keys easily. Keys, that where valid at the time of their publication, are included in some of the literature mentioned in this book, most notably in Inger (1985).

LITERATURE

Inger, R.F. (1985) Tadpoles of the forested regions of Borneo. Fieldiana Zoology new series 26: 1–89.

BORNEAN FROG SPECIES

Taxonomy is in constant flux. The list below gives the 200 recognized species of Borneo by the end of 2021**.** Please refer to *Amphibian Species of the World (*ASW) database for taxonomic details and updates. Currently, dozens of genetically distinct lineages have been recognized in the genera *Limnonectes*, *Occidozyga* and *Nyctixalus*. They represent potential candidate species. Therefore, the following list is a conservative estimate of Borneo's true frog diversity. More discoveries are expected in the future, especially from the still little know areas of Kalimantan.

taxonomic reference:
http://research.amnh.org/vz/herpetology/amphibia/index.php

BOMBINATORIDAE: 1
Barbourula kalimantanensis Iskandar, 1978

BUFONIDAE: 35
Ansonia albomaculata Inger, 1960
Ansonia echinata Inger and Stuebing, 2009
Ansonia fuliginea (Mocquard, 1890)
Ansonia guibei Inger, 1966
Ansonia hanitschi Inger, 1960
Ansonia kanak Matsui, Nishikawa, Eto, and Hossman, 2020
Ansonia kelabitensis Matsui, Nishikawa, Eto, and Hossman, 2020
Ansonia latidisca Inger, 1966
Ansonia leptopus (Günther, 1872)
Ansonia longidigita Inger, 1960
Ansonia minuta Inger, 1960
Ansonia platysoma Inger, 1960
Ansonia spinulifer (Mocquard, 1890)
Ansonia teneritas Waser, Schweizer, Haas, Das, Jankowski, Min, and Hertwig, 2017
Ansonia torrentis Dring, 1983
Ansonia vidua Hertwig, Min, Haas, and Das, 2014
Duttaphrynus melanostictus (Schneider, 1799)
Ingerophrynus divergens (Peters, 1871)
Ingerophrynus quadriporcatus (Boulenger, 1887)
Leptophryne borbonica (Tschudi, 1838)
Pelophryne api Dring, 1983
Pelophryne guentheri (Boulenger, 1882)
Pelophryne linanitensis Das, 2008
Pelophryne misera (Mocquard, 1890)
Pelophryne murudensis Das, 2008
Pelophryne penrissenensis Matsui, Nishikawa, Eto, and Hossman, 2017
Pelophryne rhopophilia Inger and Stuebing, 1996
Pelophryne saravacensis Inger and Stuebing, 2009
Pelophryne signata (Boulenger, 1895)
Phrynoidis asper (Gravenhorst, 1829)
Phrynoidis juxtasper (Inger, 1964)
Pseudobufo subasper Tschudi, 1838
Rentapia everetti (Boulenger, 1896)
Rentapia hosii (Boulenger, 1892)
Sabahphrynus maculatus (Mocquard, 1890)

CERATOBATRACHIDAE: 3
Alcalus baluensis (Boulenger, 1896)
Alcalus rajae (Iskandar, Bickford, and Arifin, 2011)
Alcalus sariba (Shelford, 1905)

DICROGLOSSIDAE: 23

Fejervarya cancrivora (Gravenhorst, 1829)
Fejervarya limnocharis (Gravenhorst, 1829)
Hoplobatrachus rugulosus (Wiegmann, 1834)
Limnonectes asperatus (Inger, Boeadi, and Taufik, 1996)
Limnonectes cintalubang Matsui, Nishikawa, and Eto, 2014
Limnonectes conspicillatus (Günther, 1872)
Limnonectes finchi (Inger, 1966)
Limnonectes hikidai Matsui and Nishikawa, 2014
Limnonectes ibanorum (Inger, 1964)
Limnonectes ingeri (Kiew, 1978)
Limnonectes kenepaiensis (Inger, 1966)
Limnonectes kong Dehling and Dehling, 2017
Limnonectes leporinus (Andersson, 1923)
Limnonectes malesianus (Kiew, 1984)
Limnonectes moquardi (Mocquard, 1890)
Limnonectes palavanensis (Boulenger, 1894)
Limnonectes paramacrodon (Inger, 1966)
Limnonectes rhacodus (Inger, Boeadi, and Taufik, 1996)
Limnonectes sinuatodorsalis Matsui, 2015
Occidozyga baluensis (Boulenger, 1896)
Occidozyga laevis (Günther, 1858)
Occidozyga berbeza Matsui, Nishikawa, Eto, Hamidi, Hossman, and Fukuyama, 2021
Occidozyga sumatrana (Peters, 1877)

MEGOPHRYIDAE: 32

Leptobrachella arayai (Matsui, 1997)
Leptobrachella baluensis Smith, 1931
Leptobrachella bondangensis Eto, Matsui, Hamidy, Munir, and Iskandar, 2018
Leptobrachella brevicrus Dring, 1983
Leptobrachella dringi (Dubois, 1987)
Leptobrachella fritinniens (Dehling and Matsui, 2013)
Leptobrachella fusca Eto, Matsui, Hamidy, Munir, and Iskandar, 2018
Leptobrachella gracilis (Günther, 1872)
Leptobrachella hamidi (Matsui, 1997)
Leptobrachella itiokat Eto, Matsui, and Nishikawa, 2016
Leptobrachella juliandringi Eto, Matsui, and Nishikawa, 2015
Leptobrachella marmoratus (Matsui, Zainudin, and Nishikawa, 2014)
Leptobrachella maurus (Inger, Lakim, Biun, and Yambun, 1997)
Leptobrachella mjobergi Smith, 1925
Leptobrachella palmata Inger and Stuebing, 1992
Leptobrachella parva Dring, 1983
Leptobrachella pictus (Malkmus, 1992)
Leptobrachella sabahmontanus (Matsui, Nishikawa, and Yambun, 2014)
Leptobrachella serasanae Dring, 1983
Leptobrachium abbotti (Cochran, 1926)
Leptobrachium gunungense Malkmus, 1996
Leptobrachium hendricksoni Taylor, 1962
Leptobrachium ingeri Hamidy, Matsui, Nishikawa, and Belabut, 2012
Leptobrachium kanowitense Hamidy, Matsui, Nishikawa, and Belabut, 2012
Leptobrachium kantonishikawai Hamidy and Matsui, 2014
Leptobrachium montanum Fischer, 1885
Megophrys dringi Inger, Stuebing, and Tan, 1995
Pelobatrachus baluensis (Boulenger, 1899)
*Pelobatrachus edwardinae (*Inger, 1989)
Pelobatrachus kalimantanensis (Munir, Hamidy, Matsui, Iskandar, Sidik, and Shimada, 2019)
Pelobatrachus kobayashii (Malkmus and Matsui, 1997)
Pelobatrachus nasutus (Schlegel, 1858)

MICROHYLIDAE: 28

Chaperina fusca Mocquard, 1892
Gastrophrynoides borneensis (Boulenger, 1897)
Glyphoglossus brooksii (Boulenger, 1904)
Glyphoglossus capsus (Das, Pui, Hsu, Hertwig, and Haas, 2014)
Glyphoglossus flava (Kiew, 1984)
Glyphoglossus smithi (Barbour and Noble, 1916)
Kalophrynus baluensis Kiew, 1984
Kalophrynus barioensis Matsui and Nishikawa, 2011
Kalophrynus calciphilus Dehling, 2011
Kalophrynus dringi Fukuyama, Matsui, Eto, Hossman, and Nishikawa, 2021
Kalophrynus eok Das and Haas, 2003
Kalophrynus heterochirus Boulenger, 1900
Kalophrynus intermedius Inger, 1966
Kalophrynus meizon Zug, 2015
Kalophrynus nubicola Dring, 1983
Kalophrynus punctatus Peters, 1871
Kalophrynus puncak Fukuyama, Matsui, Eto, Hossman, and Nishikawa, 2021
Kalophrynus subterrestris Inger, 1966
Kaloula baleata (Müller, 1836)
Kaloula pulchra Gray, 1831
Metaphrynella sundana (Peters, 1867)
Microhyla berdmorei (Blyth, 1856)
Microhyla borneensis Parker, 1928
Microhyla maculifera Inger, 1989
Microhyla malang Matsui, 2011
Microhyla nepenthicola Das and Haas, 2010
Nanohyla perparva (Inger and Frogner, 1979)
Nanohyla petrigena (Inger and Frogner, 1979)

RANIDAE: 30

Abavorana luctuosa (Peters, 1871)
Abavorana decorata (Moquard, 1821)
Chalcorana megalonesa (Inger, Stuart, and Iskandar, 2009)
Chalcorana raniceps (Peters, 1871)
Huia cavitympanum (Boulenger, 1893)
Hylarana erythraea (Schlegel, 1837)
Indosylvirana nicobariensis (Stoliczka, 1870)
Meristogenys amoropalamus (Matsui, 1986)
Meristogenys dyscritus Shimada, Matsui, Yambun, and Sudin, 2011
Meristogenys jerboa (Günther, 1872)
Meristogenys kinabaluensis (Inger, 1966)
Meristogenys macrophthalmus (Matsui, 1986)
Meristogenys maryatiae Matsui, Shimada, and Sudin, 2010
Meristogenys orphnocnemis (Matsui, 1986)
Meristogenys penrissenensis Matsui, Nishikawa, Eto, and Hossman, 2017
Meristogenys phaeomerus (Inger and Gritis, 1983)
Meristogenys poecilus (Inger and Gritis, 1983)
Meristogenys stenocephalus Shimada, Matsui, Yambun, and Sudin, 2011
Meristogenys stigmachilus Shimada, Matsui, Yambun, and Sudin, 2011
Meristogenys whiteheadi (Boulenger, 1887)
Odorrana hosii (Boulenger, 1891)
Pulchrana baramica (Boettger, 1900)
Pulchrana glandulosa (Boulenger, 1882)
Pulchrana laterimaculata (Barbour and Noble, 1916)
Pulchrana picturata (Boulenger, 1920)
Pulchrana signata (Günther, 1872)
Staurois guttatus (Günther, 1858)
Staurois latopalmatus (Boulenger, 1887)
Staurois parvus Inger and Haile, 1959
Staurois tuberilinguis Boulenger, 1918