

# An updated checklist of the amphibian diversity of Maliau Basin Conservation Area, Sabah, Malaysia

Alexander Haas<sup>1</sup>, Kueh Boon-Hee<sup>2</sup>, Alvinus Joseph<sup>2</sup>, Masliadi bin Asri<sup>3</sup>, Indraneil Das<sup>4</sup>, Reto Hagmann<sup>5</sup>, Loraine Schwander<sup>6</sup>, Stefan T. Hertwig<sup>5,6</sup>

1 *Centrum für Naturkunde, Universität Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany*

2 *Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia*

3 *Maliau Basin Conservation Area, Pusat Kraftangan Sabah, Peti Surat 961, 89008 Keningau, Sabah, Malaysia*

4 *Institute for Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia*

5 *Naturhistorisches Museum Bern, Bernastrasse 15, CH-3005 Bern, Switzerland*

6 *Institute of Ecology and Evolution, University of Bern, Baltzerstrasse 6, CH-3012 Bern, Switzerland*

<http://zoobank.org/1E21338D-E8BB-4961-B7E9-7350D3156B4C>

Corresponding author: *Alexander Haas* (alexander.haas@uni-hamburg.de)

## Abstract

Received 28 May 2018

Accepted 4 July 2018

Published 13 July 2018

Academic editor:

*Andreas Schmidt-Rhaesa*

## Key Words

regional inventory

rapid assessment

anuran

biodiversity

visual encounter

genetic barcode

The current account presents the results of a 14-day amphibian survey at Maliau Basin Conservation Area (MBCA). With a total of approximately 170 man-hrs, 44 species were detected at four study sites during the field period; four more species were later discovered outside the two-week campaign. The results are compared to the results of previous surveys. Apart from adults, we present the first photographic documentation of the larval stages of *Chiromantis inexpectatus* and Bornean *Phrynoidis juxtaspera*, along with a brief tadpole description; the better-known tadpoles of four more species were recorded. The results of our expedition suggest that nine more species are present at MBCA than reported by previous studies. We present an updated list of known species in the MBCA, comprising 61 species. The species accumulation curve over the 14 days period of the core survey did not show signs of asymptotic saturation. We conclude that the definitive species number for MBCA amphibians has the potential to increase with more thorough surveys in the future.

## Introduction

To the general public, the amphibian species of East Malaysia (Sabah and Sarawak, Borneo) may seem to be relatively well-known. Particularly, the books by Inger (1966), Inger and Tan (1996), Malkmus et al. (2002), Imbun (2014), and Inger et al. (2017) give excellent summaries on the frogs of East Malaysia. Additionally, a widely-used internet resource provides an illustrated introduction to Bornean frogs and tadpoles (Haas et al. 2018). In the late 20<sup>th</sup> and early 21<sup>st</sup> centuries, several workers have contributed to our knowledge of the frogs of Sabah (for example, Inger 1966, Matsui 1979, Inger and Tan 1996, Malkmus et al. 2002, Kueh 2004,

Kueh et al. 2004, Kueh and Maryati 2005, 2008, Shimada et al. 2007, 2008, 2011a,b, Matsui et al. 2007a,b, 2013a,b, Imbun 2014, Dehling et al. 2016). In recent years, research on East Malaysian amphibians, however, has not only redefined species and discovered new species (Waser et al. 2016, Dehling and Dehling 2017), or described their larval forms (Oberhammer et al. 2014, Shimada et al. 2015), but furthermore, revealed a substantial underestimation of alpha-diversity by uncovering cryptic species (e.g., McLeod 2010, Matsui et al. 2016). The emerging pattern of high diversity on a relatively small geographic scale includes high levels of micro-endemism, i.e., species with small distributional range, these are often montane species (Dehling 2008, Hertwig et al.