



BAKO — Biodiversity Between Land and the Sea

Edited by Mohd-Azlan, Suaidi & Das

Life from Headwaters
to the Coast

BAKO

Biodiversity Between Land and the Sea

Edited by

Jayasilan Mohd-Azlan
Mohamad Kadim Suaidi
Indraneil Das


UNIMAS
UNIVERSITI MALAYSIA SARAWAK

UNIMAS PUBLISHER



BAKO

Biodiversity Between Land and the Sea





Life from Headwaters to the Coast

BAKO

Biodiversity Between Land and the Sea

Edited by

Jayasilan Mohd-Azlan
Mohamad Kadim Suaidi
and Indraneil Das



UNIMAS PUBLISHER



Natural History
Publications (Borneo)

2023

Published by

UNIMAS Publisher

Universiti Malaysia Sarawak
94300 Kota Samarahan
Sarawak, Malaysia.
Website: www.unimas.my

in association with

Natural History Publications (Borneo) Sdn. Bhd. (216807-X)

A913, 9th Floor, Wisma Merdeka Phase 1
P.O. Box 15566, 88864 Kota Kinabalu, Sabah, Malaysia.
Tel: 088-233098 Fax: 088-534502
Website: www.nhpborneo.com

Life from Headwaters to the Coast:

Bako. Biodiversity Between Land and the Sea

Edited by Jayasilan Mohd-Azlan, Mohamad Kadim Suaidi and Indraneil Das

ISBN 978-967-0054-16-2

First published 2023.

Copyright © 2023 UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd.

Photographs copyright © 2023 with respective photographers.

Copy Editor: Genevieve V. A. Gee

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior permission of the copyright owner.

Half-page: Sea Stack. Photo: Hans Hazebroek

Front cover: Silvered Langur. Photo: Chien C. Lee

Frontispiece: Sandstone gate at Telok Tajor. Photo: Hans Hazebroek

Printed in Taiwan

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Life from Headwaters to the Coast : BAKO : Biodiversity Between Land and the Sea / Edited by Jayasilan Mohd-Azlan, Mohamad Kadim Suaidi and Indraneil Das. ISBN 978-967-0054-16-2

1. Biodiversity--Malaysia--Sarawak.
2. National parks and reserves --Malaysia--Sarawak.
3. Taman Negara Bako (Sarawak, Malaysia).
4. Government publications--Malaysia.

I. Jayasilan Mohd-Azlan. II. Mohamad Kadim Suaidi. III. Indraneil Das.
333.950959522

CONTENTS

Foreword	vii	Faunal Accounts	
by YB Dato Sri Haji Abdul Karim Rahman Hamzah		Mosquitoes	37
Preface	ix	by Wong Siew Fui, Ichiro Miyagi, Takako Toma and Takao Okazawa	
Introduction	1	Dragonflies and Damselflies	41
<i>Introduction</i>		by Rory Dow and Graham T. Reels	
General Section		Butterflies	47
Reminiscences of Bako	3	by Pang Sing Tyan, Ratnawati Razali and Wan Nurainie Wan Ismail	
by Gathorne Cranbrook		Land Snail	53
Geology and Geomorphology	5	by Mohd Zacaery Khalik and Mohammad Effendi Marzuki	
by Hans Hazebroek		Crabs and Shrimps	57
Floral Accounts		by Jongkar Grinang	
The Vegetation	19	Inland Fishes	60
by Meekiong Kalu, Stephen Teo Ping, Mohd Effendi Wasli, Nursafinas Jelani, Mohd Akmal Mohd Raffi and Yazid Kalbi		by Kelvin K. P. Lim	
Two Endemic Herbs	25	Amphibians	65
by Wong Sin Yeng		by Indraneil Das, Ramlah Zainudin, Pui Yong Min, Elvy Quatrin Deka and Taha Wahab	
Carnivorous Plants	29	Reptiles	69
by Chien C. Lee		by Indraneil Das, Pui Yong Min, Sabariman Hassan and Taha Wahab	
Mushrooms	35	Birds	77
by Mohamad Hasnul Bolhassan, Mohd Haqim Mohd Haizar Nazry, Nur Atiqah Asiqin Sulaiman Khan, Mohamad Nurfazillah Mohamad Ramzie Faizal and Fatimah Daud		by Mohamad Fizl Sidq Ramji, Nurul Ashikeen Ab Razak, Ivana Berlinda Bilang, Rahah Mohd. Yakup, Isa Sait and Badiozaman Sulaiman	

Bats	91	Proboscis Monkey.....	114
by Faisal Ali Anwarali Khan, Muhd Amsyari Morni, Julius William-Dee, Norfarhana Mazlan, Wan Nur Syafinaz Wan Azman, Emy Ritta Jinggong, Nur Afiqah Aqilah Azhar, Roberta Chaya Tawie Tingga, Mohd Ridwan Abd Rahman and Isham Azhar		by Bolhan Budeng, Joan Bentrupperbäumer and David Gillieson	
Non-volant Small Mammals	95	Silvered Langur.....	117
by Faisal Ali Anwarali Khan, Julius William-Dee, Muhd Amsyari Morni, Nor Al-Shuhadah Sabarudin, Muhammad Amin Iman Azmi, Syamzuraini Zolkapley, Roberta Chaya Tawie Tingga, Mohd Ridwan Abd Rahman and Isham Azhar		by Bolhan Budeng, Joan Bentrupperbäumer and David Gillieson	
Large Mammals	99	Sunda Colugo.....	120
by Mohd-Azlan Jayasilan and Sally Soo Kaicheen		by Dzulhelmi Nasir and Nursyereen Mohd Nasir	
Species Highlights		Bearded Pig.....	123
Saltwater Crocodile.....	106	by Mohd-Azlan Jayasilan and Sally Soo Kaicheen	
by Engkamat Lading and Indraneil Das		Human Dimensions	
Bornean Green Pit-viper	111	Ecotourism.....	125
by Veronica Martin and Indraneil Das		by Arianti Atong, Abang Norizan Abang Median, Jalani Kelat and Suhaili Mokhtar	
		Contributor Affiliations.....	131

FOREWORD

Sarawak retains some of the richest biodiversity in the world. It is home to many endemics and species of conservation importance. Some of the best examples can be found in the State's extensive network of protected areas. Many of us here in the Ministry continuously explore the exquisiteness of biodiversity in the hopes of harnessing and sharing of information with the general public, to appreciate such elements present in our protected areas. This book represents but a sample of the work done by academics in the realm of biodiversity from Universiti Malaysia Sarawak and experts from various other agencies. I would like to commend the efforts by these researchers who supported us in collecting information on the biodiversity in such species-rich areas as Bako, which forms the material for the book.



The work is also expected to be important for local communities, to enhance their understanding, appreciation and perhaps eventually, guide their use of such resources sustainably, acting as an interpretation tool to guide ecotourists and naturalists.

As will be evident to the readership, a variety of approaches have been taken by the authors of the volume. Sections, starting with reminiscences from the early days by the Earl of Cranbrook, and on geology and geomorphology, are divided along taxonomic and thematic lines. These include a general account of the tree flora and selected herbaceous flora, a review of carnivorous plants and one on the mushrooms. The faunal accounts include both invertebrates and vertebrates, ranging from mosquitoes to monkeys. A section highlights the biology of Bako's charismatic species, that attract so many tourists to the Park. Finally, the section on human dimensions round up the volume, with a chapter on ecotourism in Bako National Park.

FOREWORD

It is my hope that this book will contribute in a significant way by encouraging more people to appreciate nature, explore our biodiversity and win more supporters. I anticipate that this volume will be useful to stakeholders to whom we remain connected through our common views on biodiversity conservation for the future generation.



Yang Berhormat Dato Sri Haji Abdul Karim Rahman Hamzah
Minister of Tourism, Creative Industry, Performing Arts;
Minister of Youth, Sports & Entrepreneur Development Sarawak



CRABS AND SHRIMPS

Jongkar Grinang

Research on decapod crustaceans of Sarawak dates back to the Brooke era and continued during the Japanese occupation of the State. Nonetheless, the fauna of Bako has not received as much attention as the Santubong region and Sarawak River. The reasons may be due to the relatively isolated location of the Bako Peninsula, being further from Rajah Brooke's administrative centre (present day Kuching City), the more complex logistical requirements for a cruise along the seasonally rough seas off the rocky coastline, and the risk of pirate attack.

The earliest Bornean crustacean records, including the collections made by the late Michael Wilmer Forbes Tweedie in 1948 included no material from Bako. The first collection of crustaceans from Bako was made in July 1994 by researchers from the Sarawak Museum and National University of



Fig. 1. The arboreal *Scandarma splendidum* perched on fern leaves.



Fig. 2. The beautiful semiterrestrial *Thelphusula cristicervix*.



Fig. 3. Burrow of *Thelphusula cristicervix*.



Fig. 4. Close-up of *Thelphusula cristicervix*.

CRABS AND SHRIMPS

Checklist

Inland crustaceans recorded at Bako National Park. Abbreviations: FS – freshwater streams; SL – swampy land; MG – mangrove; SB – sandy beaches; MB – mud-sandy beaches, and RC – rocky coast. Sources: Tweedie (1950); Naruse & Ng (2007); Ng (1995, 2021); Yii (1997); Lee & Lim (2003); Junirah (2012); Grinang (2016).

Taxon	FS	SL	MG	RY	MB
Caridea Dana, 1852					
Palaemonidae Rafinesque, 1815					
<i>Macrobrachium callirrhoe</i> (De Man, 1898)	●				
<i>Macrobrachium pilimanus</i> (De Man, 1879)	●				
<i>Macrobrachium rhodochir</i> Ng, 1995	●				
<i>Macrobrachium sintangense</i> (De Man, 1898)	●				
Atyidae De Haan, 1849					
<i>Caridina bakoensis</i> Ng, 1995	●				
<i>Caridina typus</i> H. Milne Edwards, 1837	●				
Brachyura Linnaeus, 1758					
Gecarcinucidae Rathbun, 1904					
<i>Arachnothelphusa bako</i> Ng, 2021		●			
<i>Bakousa sarawakensis</i> Ng, 1995	●				
<i>Perithelphusa borneensis</i> (Von Martens, 1868)	●				
<i>Thelphusula cristicervix</i> (Ng & Grinang, 2004)		●			
Grapsidae MacLeay, 1838					
<i>Grapsus albolineatus</i> Latreille in Milbert, 1812				●	
Ocypodidae Rafinesque, 1815					
<i>Austruca annulipes</i> (H. Milne Edwards, 1837)			●		●
<i>Gelasimus tetragonon</i> (Herbst, 1970)			●		●
<i>Gelasimus vocans</i> (Linnaeus, 1758)			●		●
<i>Ocypode ceratophthalmus</i> (Pallas, 1772)			●		●
Sesarmidae Dana, 1851					
<i>Pseudosesarma bocourti</i> (A. Milne Edwards, 1869)		●	●		
<i>Scandarma splendidum</i> Naruse & Ng, 2007		●	●		



Fig. 5. Close-up of the semiterrestrial *Pseudosesarma bocourti*.

Singapore, who described a new genus and species of crab, and two new species of shrimps. In 2007, an arboreal crab, *Scandarma splendidum*, was discovered from the park, and more recently, in 2021, another new species of a semi-terrestrial crab, *Arachnothelphusa bako* was described. In 2014, the likely presence of the beautiful *Thelphusula cristicervix* was documented by researchers from the Universiti Malaysia Sarawak.

This note presents only the inland crustaceans of Bako National Park, which comprise 17 species in six families of crabs and shrimps (see Checklist). This list will serve as a preliminary reference, with many marine and intertidal taxa under study.



BAKO NATIONAL PARK

This work takes the readers through a journey through several unique ecosystems within Bako National Park, highlighting many inhabitants on the way, from humble insects, such as mosquitoes and dragonflies, to the charismatic species, including the Proboscis Monkey and a rich assemblage of shorebirds that draw tourists by the thousands to the Park.

Bako is rich in biodiversity and accessible throughout the year via a short boat ride to the Park headquarters. From this vantage point, an eager tourist will be able to easily access the various habitats represented, including mixed dipterocarp forests, mangrove forests, cliff forest, beach forests, Kerangas, as well as mudflats, each with its unique biodiversity. The Park is also home to several endemic species, as well as species of conservation importance, upon which substantial ecotourism activities are based.

Bako National Park's rich ecosystems are presented through images and text accounts in this volume, which is based on field research, that reiterates their value for naturalists, tourists, as well as researchers. This book aims to enlighten stakeholders and present information on species biology and distribution to nature enthusiasts.

The chapter on geology and geomorphology sets the scene for the book. The wildlife aspects cover species from an array of taxa that includes plants and invertebrates, to fishes, herpetofauna, birds and mammals, rounded up with the ecotourism potential of the Park.

Research in Bako National Park was possible thanks to the generosity of various government agencies through research grants to Universiti Malaysia Sarawak. The project is aimed at assessing the area's biotic diversity, examine anthropogenic elements, and finally, to develop an applicable environmental model for ecotourism.



The Editors



Jayasilan Mohd-Azlan (left) earned his doctoral degree from Charles Darwin University for his work on mangrove avifauna of Australia. He is currently the Director of the Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak.

Mohamad Kadim Suaidi (middle) is the Vice Chancellor of Universiti Malaysia Sarawak since 2013, and hails from Kampung Bako. He is passionate about community engagement and sustainable development in relation to biodiversity conservation. The university's visibility and recognition at the global stage is one of his main achievements.

Indraneil Das (right) received his doctoral degree from the University of Oxford, and was a Fulbright Fellow at the Museum of Comparative Zoology, Harvard University. Currently, he is Professor at the Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak.