

PELAGUS NATIONAL PARK

Biodiversity Above the Rapids





Life from Headwaters to the Coast

PELAGUS NATIONAL PARK

Biodiversity Above the Rapids

Edited by

Andrew Alek Tuen, Indraneil Das
Karen Lee Suan Ping and Jayasilan Mohd-Azlan



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Pelagus National Park: Biodiversity Above the Rapids

Andrew Alek Tuen, Indraneil Das, Karen Lee Suan Ping and Jayasilan Mohd-Azlan

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Half-title page: The Rapids of Pelagus, as seen in August 2003. Photo: I. Das
Frontispiece: *Megophrys nasuta*, the Bornean Horned Frog. Photo: Pui Yong Min
Foreword page and across: Aerial view of Pelagus Kaki Wong. Photo: Tonny Ganyai.

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FOREWORD

Prof. Datuk Dr. Mohamad Kadim Suaidi
Vice Chancellor, Universiti Malaysia Sarawak

Since its humble beginnings in 1992, Sarawak's first public university, Universiti Malaysia Sarawak (UNIMAS), has put natural resource management and biodiversity conservation at the forefront of its research agenda. This includes the setting up of the Faculty of Resource Science and Technology and the Institute of Biodiversity and Environmental Conservation. The



location of UNIMAS on the island of Borneo has given us a unique opportunity to study its biodiversity, one of the most diverse in the world. Over the years, university researchers have discovered new species and uncovered new facets of the biology of numerous threatened species and landscapes, contributing to the conservation of species and habitats in Sarawak and beyond.

To be globally relevant and forward looking, UNIMAS has established linkages and collaborated with like-minded individuals and institutions within Malaysia and overseas. On 24 September 2013, we formalised a research collaboration with Sarawak Energy, to embark on the first in-depth study of the 2,041-hectare Pelagus National Park. As a result of this collaboration, significant new findings have come to light and have been featured in this book.

I would like to congratulate the authors, editors and publishers for their hard work and perseverance, to help unravel the wonders of biodiversity of Pelagus, and make this place of magic and mystery accessible to the world.

MESSAGE

Datu Haji Sharbini Suhaili

Group Chief Executive Officer, Sarawak Energy Berhad

Congratulations to all those who are part of this important publication. Your contribution will enhance knowledge and understanding of Sarawak's biodiversity areas in general and the Pelagus National Park in particular.

In mid-2020, it was announced by the Sarawak government that Sarawak will become a high-income economy by 2030 through the two core principles of a digital economy and environmental sustainability, and Sarawak Energy is fully aligned to this vision.

We are developing our energy resources sustainably to deliver greater access to affordable, reliable and sustainable energy for Sarawak and its people, in alignment with Goal #7 of the United Nations Sustainable Development Goals (SDG) 2030.

Just over a decade ago, Sarawak made a strategic decision to reduce our dependence on thermal resources of coal, gas and diesel through the Sarawak Corridor of Renewable Energy.

As a result, Sarawak Energy is now the largest renewable energy developer and provider in Malaysia through our investments in large renewable hydropower as well as solar and micro-hydro for remote areas.

As a member of the International Hydropower Association, we are a strong advocate of sustainable hydropower and are working to integrate a robust sustainability agenda into our business. It is estimated that less than 2% of our land area will be affected when we fully harness our hydropower potential to ensure a sustainable energy future for our state and beyond.

To conserve biodiversity in line with SDG #15, we are working with various state agencies, higher learning institutions, local communities and stakeholder groups on efforts to mitigate any negative impact and maximise the positive impact of our projects and operations.

Initiatives include the implementation of sustainable management of forest types which are important water catchments. We also contribute to



MESSAGE

the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services. Our partnerships so far have yielded encouraging successes.

1. The Batang Ai National Park and catchment area, located within the area of the 35-year-old Batang Ai Hydroelectric Plant (HEP), serve as a buffer zone that supports the regeneration of the surrounding environment. The area is now home to a sustainable population of the Bornean orangutan in Sarawak and forms part of the transboundary conservation area with Indonesia's Betung Kerihun National Park.
2. For the Murum HEP project, the Wildlife Monitoring and Rescue (WiMoR) operation with the Sarawak Forestry Corporation rescued and relocated wildlife in significant numbers to safer areas before impoundment.

To ensure we understand the effectiveness of our efforts, research and development is an important part of our business. This creates greater understanding of the impact of our projects by enhancing the body of knowledge and enables us to make informed decisions in environmental management and conservation.

In 2013, we partnered with Universiti Malaysia Sarawak (UNIMAS) and rolled out the Hydropower Environmental Sustainability Programme with a focus on three objectives:

- i. To identify critical local environmental issues that warrant closer attention;
- ii. Collect necessary data in forming baseline knowledge particularly in the areas of aquatic and terrestrial ecology and biodiversity; and
- iii. Support the development of local research capability and capacity within Sarawak on related environmental topics.

The 2,041-hectare Pelagus National Park was identified as one of the study locations under this programme given its importance as a protected area. Significant findings have been established and are featured in this book.

We are pleased to support this book publication together with Universiti Malaysia Sarawak (UNIMAS) in line with SDG #17 which calls for multi-stakeholder partnerships that mobilise shared knowledge, expertise, technology and financial resources.

On behalf of Sarawak Energy, I would like to thank UNIMAS for this research collaboration and for sharing your expertise and resources.

MESSAGE

We are also fortunate to have collaborated with and gauged the support from like-minded organisations such as our higher learning institutions, Forest Department Sarawak and Sarawak Forestry Corporation in enabling Sarawak Energy to play a greater role in local environmental conservation efforts.

I would also like to congratulate Sarawak Energy's Research and Development team. I am confident that you have gained valuable experience and further exposure through this research as part of Sarawak Energy's hydropower development journey.



PREFACE

*Andrew Alek Tuen, Indraneil Das,
Karen Lee Suan Ping and Jayasilan Mohd-Azlan*

Sarawak's vast protected areas network, including its National Parks, are home to many of the State's natural wonders- floral, faunal, geological and at the level of landscapes. Central Sarawak, in particular, is an important area for biodiversity conservation, being home to uncountable Bornean endemics.

Its thriving National Parks vindicate the commitment of the State Government as a responsible caretaker of Sarawak's biodiversity. Halting biodiversity loss is one of the top State agendas, whereby Sarawak is determined to conserve and protect its wildlife and natural ecosystem. This project sits in line with the University's niche area of biodiversity and environmental conservation. This book, based on extensive field research by the staff of our two organisations, brings together new information on species, their habitats and other aspects of natural history.

Little has been written about Pelagus National Park. Scientific understanding of biodiversity intended for conservation is crucial for our advancement to preserve the State's natural heritage. Identifying the distribution, richness and habitat use of animals in tropical rainforest are essential for understanding their ecology, and in facilitating management of such biodiversity-rich areas. This book attempts to enumerate selected zoological groups, many of which had hitherto remained undetected in these dense tropical rainforests. The faunal studies reported here include inventories of mammals, birds, reptiles, amphibians, fishes and macroinvertebrates, a critical first step towards understanding the biodiversity of Pelagus National Park.

The work targets local stakeholders, management authorities, naturalists, researchers and the general public. Most enthusiasts continue to see protected areas as a parade of natural wonders, to be appreciated and protected for future generations. An understanding of our biodiversity may thus support complex needs of conservation. It is hoped that nature enthusiasts and those who are interested in tropical biodiversity will find this book beneficial. Acknowledgement is here made to the authors who have gathered these data, substantially increasing our knowledge and awareness of an important part of our national heritage.

PREFACE

Foremost, we thank Sarawak Energy Hydropower Environmental Sustainability Program for a research grant to conduct the activities mentioned in this work. We are grateful to the Resident of Kapit Division for welcoming us to the area under his jurisdiction, and to the longhouse folks from Rumah John at Nanga Benin (John anak Asun and family), Rumah Bujah at Nanga Pelagus (Bujah anak Ijau and family) and Rumah Laja at Nanga Peraran (Laja anak Sandak and family), for assisting with the research.

Prof. Dr. Wan Hashim bin Wan Ibrahim, the Deputy Vice Chancellor for Research and Innovation, Prof. Dr. Lo May Chiun and her staff at the Research Innovation and Enterprise Centre facilitated the research on the UNIMAS side. We also thank the staff of the Institute of Biodiversity and Environmental Conservation, and the Faculty of Resource Science and Technology, UNIMAS, for logistic and field assistance: Isa Sait, Rahah Mohd. Yakup, Mohd. Hasri Al-Hafiz Haba, Ketty Daun, Pasey Lissus, Mohsin bin Zainalabidin, Siti Maimunah binti Ibrahim and Felicia Reyap, besides our many research assistants and graduate research students.

The Sarawak Forest Department provided research permits for the individual projects reported here. Entry to Pelagus Resort area was provided by Pelita Holdings Sdn. Bhd, and we thank its manager, Netty Haji Narawi. We thank Mohd. Tajuddin Abdullah, Qammil Muzzammil Abdullah, Amirruddin Ahmed, Faisal Ali Anwar Ali, Aaron M. Bauer, Henry Bernard, Chan Kin Onn, Stuart James Davies, Ulmar Grafe, Suhaila binti Abdul Hamid, Kelvin Lim, Lo May Chiun, Suhaili Mokhtar, Mustafa Abdul Rahman, Abdullah Samat and Tan Heok Hui for reviews of the chapters, and Genevieve V. A. Gee for copy editing. We are thankful to Chien C. Lee for images of birds, Faisal Ali Anwar Ali for the images of bats and to the family of the late Brian Houldershaw for the images of the Rapids from the 1960s, made possible through the kindness of Albert Field.

We dedicate this book to the kind-hearted folks of the Rajang Basin, who offered us their homes and carried the burden and joy of discovery.

MACROINVERTEBRATES

*Jongkar Grinang, Brian Haessler Delim,
Lee Nyanti, Teck-Yee Ling, Siong-Fong Sim,
Tonny Ganyai and Karen Lee Suan Ping*

The drainage system of the Pelagus area comprises first to sixth order streams, with slow to fast flowing water and moderate gradient channels. The tributaries are important feeder streams in sustaining hydrological functions of the main Rajang River, especially as a result of the construction of two hydroelectric dams in the upper stream, the Bakun Dam and Murum Dam.

Macroinvertebrates sampling was conducted twice at 27 tributaries between 2013 and 2016. Three replicates of kick-net sampler (30 × 32 cm, 400-micron mesh size) were made for each visit, yielding a total of 162 samples. Hand collecting at night along riverbanks and forest trails was carried out for semiterrestrial crabs. Specimens caught from local fishing tools, such as castnet ('jala') and traps ('bubu') were also recorded. The multiple sampling techniques used have produced a macroinvertebrate inventory for the Pelagus area, which shows over 79 species in 52 families and 12 orders, comprising aquatic insects, crustaceans, molluscans and aquatic worms. All crabs and some taxa of aquatic insects are endemic to Borneo. Macroinvertebrates were assigned to functional feeding groups, and field observations of species occurrence on major substrate types were recorded.

Analysis of functional feeding groups shows that predators and gathering-collectors are common in all stream orders. Macroinvertebrates are well represented in third order streams, which imply that the stream order is the most productive. High beta diversity (dissimilarity) between lower order stream (1st order) and higher orders (> 3rd order) suggests that conservation management of river basin should be inclusive in all stream orders. Macroinvertebrates are good indicator for stream condition in the Pelagus area. Low taxa richness of sensitive orders such as Ephemeroptera, Plecoptera and Trichoptera (EPT) may indicate that effects of logging activities persist after 30 years. EPT-values also show low adaptation to new and unstable substrates originating from the logged catchment area.

Some larger species, such as shrimps, prawns (e.g., *Macrobrachium rosenbergii*), snails and crabs are important sources of protein for the local people.



Fig. 1. Geomorphological features of river systems in the Pelagus area, showing that the substrates are new and unstable, originating from the logged catchment area. (a) 1st order stream, Sg. Preran Mit; (b) 3rd order stream, Sg. Buya; (c) 5th order stream, Sg. Sama; (d) macroinvertebrate sampling.

MACROINVERTEBRATES

Table 1. Streams sampled at the Pelagus region and the geographical coordinates.

Stream/order	Coordinates	Stream/order	Coordinates
Sg. Amang/2 nd order	113.06214°E 2.17458°N	Sg. Lebau/3 rd order	113.09391°E 2.19306°N
Sg. Beluli/2 nd order	113.08227°E 2.14826°N	Sg. Ensawie/4 th order	113.09364°E 2.25170°N
Sg. Senyamok/2 nd order	113.07238°E 2.16102°N	Sg. Sebingol/4 th order	113.08325°E 2.19797°N
Sg. Sap/3 rd order	113.06472°E 2.16408°N	Sg. Serau/4 th order	113.09391°E 2.19306°E
Sg. Benin/3 rd order	113.07344°E 2.16480°N	Sg. Sama/5 th order	113.16602°E 2.26629°N
Sg. Raya/4 th order	113.08778°E 2.15193°N	Sg. Pangau Kecil/1 st order	113.5090°E 2.47619°N
Sg. Nguan/4 th order	113.04612°E 2.17892°N	Sg. Mia/2 nd order	113.37469°E 2.38230 N
Sg. Mejau/4 th order	113.04945°E 2.17615°N	Sg. Pangau Besar/2 nd order	113.50418°E 2.46814°N
Sg. Kapit Ulu/5 th order	113.07381°E 2.13777°N	Sg. Mikai/3 rd order	113.30665°E 2.3469°N
Sg. Mella/5 th order	113.08595°E 2.13233°N	Sg. Sangaya/3 rd order	113.34744°E 2.37779°N
Sg. Serian/2 nd order	113.13624°E 2.19265°N	Sg. Benatu/3 rd order	113.38378°E 2.39877°E
Sg. Buya/3 rd order	113.12754°E 2.24911°N	Sg. Bon/3 rd order	113.46943°E 2.44425°N
Sg. Rarai/3 rd order	113.14646°E 2.22040°N	Sg. Lahanan/4 th order	113.44247°E 2.42856°N
Sg. Preran Mit/3 rd order	113.12221°E 2.19025°N		



Fig. 2. Example of taxa from the Pelagus area. (a) Whirligig beetle, *Porrhorrhynchus marginatus*; (b) Water strider, *Ptilomera* sp.; (c) Stonefly family, Perlidae; (d) Larva of fishfly, *Protothermes* sp.; (e) giant freshwater prawn, *Macrobrachium rosenbergii*; (f) male *Ibanum* aff. *bicristatum*; (g) *Bakousa* cf. *kenepai*; (h) *Arachnothelphusa* sp. inside a tree-hole. Images are not to scale. Taxonomic investigations of the three crab species are currently ongoing.

MACROINVERTEBRATES

A Checklist of Macroinvertebrates

Macroinvertebrates with their functional feeding groups. *endemic to Borneo.

Taxon	Functional Feeding Groups
ANNELIDA	
Haplotaxida (aquatic worms)	
Lumbricidae	Scraper
MOLLUSCA	
Gastropoda (snails)	
Buccinidae	
<i>Clea nigricans</i> A. Adams, 1885	Scraper
Pachychilidae	
<i>Sulcospira pageli</i> (Thiele, 1908)	Scraper
Pomatiopsidae	
<i>Robertsia</i> sp. (1 morphospecies)	Scraper
MALACOSTRACA	
Decapoda (crabs and shrimps)	
Gecarcinucidae	
<i>Arachnothelphusa</i> cf. <i>merarapensis</i> *	Shredder
<i>Bakousa</i> cf. <i>kenepai</i> *	Shredder
Potamidae	
<i>Ibanum</i> aff. <i>bicristatum</i> *	Shredder
<i>Isolapotamon nimboni</i> Ng, 1987*	Shredder
Palaemonidae	
<i>Macrobrachium callirrhoe</i> (De Man, 1898)	Shredder
<i>Macrobrachium rosenbergii</i> De Man, 1879	Shredder
Isopoda (sowbugs)	
Cirolanidae	
<i>Anopsilana</i> sp. (1 morphospecies)	Shredder
INSECTA	
Odonata (damselflies and dragonflies)	
Chlorocyphidae	
<i>Libellago</i> cf. <i>hyalina</i> *	Predator
Coenagrionidae	
<i>Pericnemis</i> sp. (1 morphospecies)	Predator
Euphaeidae	
<i>Euphaea</i> aff. <i>subcostalis</i> *	Predator
Lestidae	

MACROINVERTEBRATES

Taxon	Functional Feeding Groups
<i>Orolestes</i> cf. <i>wallacei</i>	Predator
Platycnemididae	
<i>Copera</i> sp. (1 morphospecies)	Predator
Platystictidae	
<i>Drepanosticta</i> sp. (1 morphospecies)	Predator
Aeshnidae	
<i>Indaeschna</i> cf. <i>grubaueri</i>	Predator
<i>Heliaeschna</i> sp. (1 morphospecies)	Predator
Chlorogomphidae	
<i>Chlorogomphus</i> cf. <i>dyax</i> *	Predator
Corduliidae	
<i>Epopthalmia</i> sp. (1 morphospecies)	Predator
<i>Macromia</i> cf. <i>westwoodii</i>	Predator
Gomphidae	
<i>Heliogomphus</i> sp. (1 morphospecies)	Predator
<i>Ictinogomphus decoratus</i> (Selys, 1854)	Predator
<i>Megalogomphus</i> sp. (1 morphospecies)	Predator
<i>Sieboldius japonicus</i> (Selys, 1854)	Predator
Libellulidae	
<i>Crocothermis servilia</i> (Drury, 1773)	Predator
Ephemeroptera (mayflies)	
Baetidae	
<i>Baetis</i> spp. (2 morphospecies)	Gathering-Collector
<i>Platybaetis</i> sp. (1 morphospecies)	Gathering-Collector
Caenidae	
<i>Caenis</i> sp. (1 morphospecies)	Gathering-Collector
Euthyplocidae	
<i>Polyplacia</i> sp. (1 morphospecies)	Gathering-Collector
Heptageniidae	
<i>Camponeuria</i> sp. (1 morphospecies)	Scraper
<i>Epeorus</i> sp. (1 morphospecies)	Scraper
<i>Thalerosphyrus</i> sp. (1 morphospecies)	Scraper
Isonychiidae	
<i>Isonychia</i> sp. (1 morphospecies)	Gathering-Collector
Leptophlebiidae	
<i>Choroterpes</i> sp. (1 morphospecies)	Gathering-Collector
<i>Habrophlebiodes</i> sp. (1 morphospecies)	Gathering-Collector

MACROINVERTEBRATES

Taxon	Functional Feeding Groups
<i>Thraulius</i> sp. (1 morphospecies)	Gathering-Collector
Potamanthidae	
<i>Pothamantus</i> sp. (1 morphospecies)	Gathering-Collector
<i>Rheonanthus</i> sp. (1 morphospecies)	Gathering-Collector
Tricorythidae	
<i>Tricorythus</i> sp. (1 morphospecies)	Gathering-Collector
Plecoptera (stoneflies)	
Nemouridae	
<i>Amphinemura</i> sp. (1 morphospecies)	Predator
Perlidae	
<i>Phanoperla</i> spp. (2 morphospecies)	Predator
Trichoptera (caddisflies)	
Hydropsychidae	
<i>Hydropsyche</i> sp. (1 morphospecies)	Filtering-Collector
<i>Macrostenum</i> sp. (1 morphospecies)	Filtering-Collector
Philopotamidae	
<i>Dolophilodes</i> sp. (1 morphospecies)	Filtering-Collector
Hemiptera (aquatic bugs)	
Gerridae	
<i>Esakia</i> sp. (1 morphospecies)	Predator
<i>Rhagadotarsus</i> sp. (1 morphospecies)	Predator
<i>Rheumatogonus</i> sp. (1 morphospecies)	Predator
<i>Ptilomera</i> spp. (2 morphospecies)	Predator
Nepidae	
<i>Cercometus asiaticus</i> (Amyot and Serville, 1843)	Predator
Veliidae	
<i>Pseudovelgia</i> sp. (1 morphospecies)	Predator
<i>Rhagovelgia</i> sp. (1 morphospecies)	Predator
Coleoptera (aquatic beetles)	
Chrysomelidae	
<i>Donacia</i> sp. (1 morphospecies)	Predator
Dryopidae	
<i>Dryops</i> sp. (1 morphospecies)	Predator
Dytiscidae	
<i>Copelatus</i> sp. (1 morphospecies)	Predator
<i>Hydaticus</i> sp. (1 morphospecies)	Predator
<i>Laccophilus</i> sp. (1 morphospecies)	Predator

MACROINVERTEBRATES

Taxon	Functional Feeding Groups
Elmidae	
<i>Grouvellinus</i> sp. (1 morphospecies)	Scraper
<i>Pseudamophilus</i> sp. (1 morphospecies)	Scraper
Eulichadidae	
<i>Eulichas</i> sp. (1 morphospecies)	Predator
Gyrinidae	
<i>Porrhorrhynchus marginatus</i> Laporte, 1835	Predator
Haliplidae	
<i>Haliplus</i> sp. (1 morphospecies)	Scraper
Hydrophilidae	
<i>Berosus</i> sp. (1 morphospecies)	Scraper
<i>Coelostoma</i> sp. (1 morphospecies)	Scraper
<i>Hydrophilus</i> sp. (1 morphospecies)	Scraper
Lamprolaimidae	
Indetermined (1 morphospecies)	Scraper
Noteridae	
<i>Noterus</i> sp. (1 morphospecies)	Scraper
Psephenidae	
<i>Eubrianax</i> sp. (1 morphospecies)	Scraper
Scirtidae	
<i>Cyphon</i> sp. (1 morphospecies)	Scraper
Megaloptera (alderflies and fishflies)	
Corydalidae	
<i>Protothermes</i> sp. (1 morphospecies)	Predator
Diptera (true flies)	
Athericidae	
<i>Atherix</i> sp. (1 morphospecies)	Gathering-Collector
Chironomidae	
<i>Chironomus</i> spp. (2 morphospecies)	Gathering-Collector
Culicidae	
<i>Culex</i> sp. (1 morphospecies)	Filtering-Collector
Simuliidae	
<i>Simulium</i> sp. (1 morphospecies)	Filtering-Collector
Tipulidae	
<i>Tipula</i> sp. (1 morphospecies)	Gathering-Collector

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