Mohd Tajuddin Abdullah
Candyrilla Vera Bartholomew
Aqilah Mohammad
Editors

Resource Use and Sustainability of Orang Asli

Indigenous Communities in Peninsular Malaysia

Springer

Resource Use and Sustainability of Orang Asli

Mohd Tajuddin Abdullah
Candyrilla Vera Bartholomew
Aqilah Mohammad
Editors

Resource Use and Sustainability of Orang Asli

Indigenous Communities in Peninsular Malaysia

Springer

Editors
Mohd Tajuddin Abdullah
Institute of Tropical Biodiversity and Sustainable Development
Universiti Malaysia Terengganu
Kuala Nerus, Terengganu, Malaysia

Candyrilla Vera Bartholomew
Institute of Tropical Biodiversity and Sustainable Development
Universiti Malaysia Terengganu
Kuala Nerus, Terengganu, Malaysia

Aqilah Mohammad
Institute of Tropical Biodiversity and Sustainable Development
Universiti Malaysia Terengganu
Kuala Nerus, Terengganu, Malaysia

ISBN 978-3-030-64960-9 ISBN 978-3-030-64961-6 (eBook)
https://doi.org/10.1007/978-3-030-64961-6

Cover illustration: Two members of the Semaq Beri tribe fish in the Kenyir Lake for their daily needs. Compared to other communities, Orang Asli fishing is sustainable for livelihoods by taking just enough for the family to eat for the day. Photograph by Suzairi Zakaria.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

In 2013, the Universiti Malaysia Terengganu took bold steps and conceptualised the first idea of a new Kenyir Lake Geopark. This large regional landscape is diverse in the faunas and floras that are important for the societal wellness of the indigenous people called Orang Asli.

Some 100,000 years ago, our ancestors walked through the coastal plains of East Africa to the Arabian Peninsula and entered the western flank of the Indo-Malayan geographic region. By about 75,000 years ago, they emerged into Southeast Asia. Their migration was halted by a thousand years of volcanic winter from the massive eruption of the Toba in Sumatra, Indonesia. Form an estimated 10,000 survivors, they migrated out of the Sunda Shelf land mass to populate the world from Indochina, China, and biogeographic regions into Americas by crossing the Bering Sea.

Geopark is a regional sustainable development tool for the development of rural territory with special heritage resources. Geopark aims at balancing the need to conserve natural and cultural heritage, community empowerment as well as sustainable use of earth resources. The emphasis is given to local community, particularly the indigenous people and their cultural heritage. Geopark promotes the co-management principle whereby all stakeholders can actively participate in projects and decision-making processes. Local community and indigenous leaders are also encouraged to take part in the management of the geopark and co-design of activities.

In Malaysia, there are more than three episodes of ancestral migration and evolutionary changes leading to three major Orang Asli groups. Among the Orang Asli groups, they are split into 18 sub-ethnic groups. The majority of the Orang Asli are now sedentary in government-designed resettlement villages. Some are still nomadic in Taman Negara and a few are semi-nomadic around the Kenyir Lake and Gua Musang landscapes. Despite various social development programmes by many experts, the Orang Asli remains marginalised compared to 40 other ethnic groups, mainly the Malays, Chinese, Indian, Kadazan-Dusun, Melayu-Melanau, and Iban ethnics.

This book has successfully documented the information on the Orang Asli for decision makers and planners and as academic reference for researchers and

graduate students on indigenous people and local knowledge. This book amplifies our local understanding to contribute to the global agenda of Sustainable Development Goals 2030. Various stakeholders have contributed to enriching of databases and research funding in the Kenyir Lake region and Orang Asli, including the Ministry of Higher Learning, Universiti Malaysia Terengganu, Universiti Kebangsaan Malaysia, and the Department of Mineral and Geoscience. Let's hope that the Orang Asli are able to perpetually sustain their forest-dependent livelihoods through practical regional planning to protect the resources from over-exploitation.

Emeritus Professor Dato' Dr Ibrahim Komoo
Chairman, Implementation Committee,
National Geoparks Malaysia,
Founder Coordinator, Asia Pacific Geoparks Network
Vice President, Global Geoparks Network Association

Ibrahim Komoo

Preface and Acknowledgements

Known as the Indigenous People or Orang Asli in Malay, with a total of 18 sub-ethnic communities, they live in Peninsular Malaysia, carrying out their traditional occupations such as hunting, fishing and collecting of forest resources. They are known as forest people due to their dependency on forest resources for their subsistence and livelihoods. Around Kenyir Lake, the Orang Asli belong to the Semaq Beri ethnic group, which can be found living in other parts of the eastern coast of Peninsular Malaysia.

Forest resource is highly intertwined with the life of the Orang Asli for their sustainable livelihoods. Various types of plants (ethnobotany) and animals (ethnozoology) are known to be important as their use supports the life of the Orang Asli. As such, many herbs are used as medicine to treat illnesses. Besides that, some of the resources become their source of income to buy their daily necessities. Their traditional and ecological knowledge on the tropical rain forests are passed down from their ancestors to their future generations.

Nevertheless, rapid development negatively influences the Orang Asli's life in terms of their culture and tradition, beliefs, and carefree lifestyles. One of the significant visible effects is that forest resources utilised by the Orang Asli for their livelihood are cleared and destroyed for our national buildings, socio-economic development as well as large-scale infrastructure projects to support the exponentially growing populations. This depletion of resources and serious competition

University's Non-academic Staffs and Postgraduate Students
We thank the sustained support from the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu, Universiti Sultan Zainal Abidin and the University of Malaya. The next gratitude goes to our administrative editors, namely, Amera Hanna Mohd Tajuddin, Norsyarinie Binti Young Rockie, Mohd Noor Afiq Bin Ramlee and Muhamad Aidil Zahidin, who have been a helping hand in the compilation of the articles for the book. Our sincere thanks also go to the Springer Nature Editorial Team and Book Project Coordinator for their cooperation and prompt response to our emails.
Photo Credit
The photograph used for the cover of this book is taken by Mr. Suzairi Zakaria (Dome).

occurring with outsiders and poachers are further marginalising the Orang Asli to the brink of extreme poverty. As a result, it is hard for the Orang Asli to search for the required forest resources or put good food on the table. With very poor levels of education, their upcoming generations are facing bleak future prospects.

The compilation of chapters for this book on the Orang Asli is made possible by the significant contributions from many stakeholders, including the Ministry of Higher Education, Malaysia, which granted funds to conduct research on the Orang Asli (most studies are funded through KPT TRGS/2014/49373; Characterising the ethno and biodiversity of Kenyir to safeguard Terengganu's natural resources); the Department of Orang Asli Affair for giving the ethical approval; Orang Asli communities for their cooperation, friendship and willingness to give responses; and dedication of many field assistants, undergraduate and postgraduate students, researchers, and lecturers at several local universities and institutions. The Department of Wildlife and National Parks and KETENGAH for research and entry permits into Kenyir Lake. We hope this book could inspire deep affection and understanding of our ancestral DNA connectedness in the Orang Asli communities in Peninsular Malaysia.

Kuala Nerus, Terengganu, Malaysia
April, 2021

Mohd Tajuddin Abdullah
Candyrilla Vera Bartholomew
Aqilah Mohammad

Introduction

Orang Asli (indigenous community) are unique communities in terms of their cultures, lifestyles, languages, beliefs and heritage. The sub-ethnic groups are diverse in Malaysia and are economically marginalised, living in extreme poverty in our biodiversity-rich country. They are traditionally and culturally forest-dependent people who move in a nomadic and semi-nomadic manner acquiring various resources in the tropical forests for subsistence and livelihood in a sustainable manner.

About 200,000 years ago, their African ancestors migrated eastward from the Arabian Peninsula to the Indian subcontinent and Southeast Asia. The earliest Orang Asli communities occupied the Malay Peninsula about 50,000 years ago, before the establishment of the Malay Kingdom. There are three main groups of Orang Asli consisting the Senoi, Negrito and Proto-Malay. A total of 18 sub-ethnic groups, each group represent 6 Orang Asli sub-ethnic communities. They can be found along the coasts, within urban areas and in the alluvial plains. All Orang Asli sub-ethnic groups share a common behaviour toward the tropical rainforest where they engage in at least hunting, collecting and gathering forest resources.

Today, most Orang Asli communities have been resettled in villages outside forests. However, a large number of them still practise their unique lifestyle inherited from their ancestors. In terms of the law governing their rights as original people of the land, several legislation affecting the use of natural resources by Orang Asli in Peninsular were implemented comprises of Aboriginal Peoples Act (1954), Wildlife Conservation Act (2010), National Forestry Act (1984), National Fisheries Act (1985), National Land Code (1965) and National Parks Act (1980).

Orang Asli communities utilise the tropical rainforest as their main home. Interestingly, this community has great traditional knowledge in many aspects, such as the use of plants and animals for medicinal purposes, which make them a great source of information. Due to their immense knowledge of the flora and fauna within the forest, they have been regarded as forest people. Orang Asli use a variety of natural resources in their daily life. For instance, several animal species are hunted by them as their main source of protein, and various types of plants species are used as medicine to treat illnesses. Nevertheless, the Orang Asli's ritualistic

practices are strongly related to their belief in spirits that guide their lives, which are still being followed. For instance, the Semaq Beri Orang Asli strongly believe in *Semaq hala*, which are spirits that they obey. They are responsible for safeguarding the forest and its component to ensure sustainability. As such, the Orang Asli traditionally believe that the forest resources must be extracted when in need and in a sustainable manner to avoid wastage. In terms of forest resource utilisation, the Orang Asli communities are known to use simple tools and methods. For instance, they dig to look for tubers and use blowpipes to hunt arboreal animals.

There are various types of important forest resources used by the Orang Asli for their livelihood, that is, food, medicine, income and building materials. Therefore, there is a need to conserve the existing resources that significant to the Orang Asli community. This is because, while the clearance of forest aims to approach modernisation for economic development, the Orang Asli's livelihood seems to be threatened. After all, the available resources for them will be all gone. It is important to identify the extent to which the external and internal factors affect the Orang Asli's life to safeguard their sustainable livelihood. By understanding the Orang Asli community's lifestyle, their well-being can be improved through suitable approaches.

Perhaps it could be due to lack of extensive studies in particular aspects which are likely to be ignored. As such, it is important to look deeper at the use and sustainability of the resources of the Orang Asli through research and documentation. Additionally, we may able to bridge the gap in research relating to Orang Asli communities and provide a medium for more studies on them. As the population of some of the Orang Asli sub-ethnic communities (e.g., Bateq, Semoq Beri, Lanoh, Che Wong, Kintak and Orang Kanaq) is decreasing, there is an urgent need to document studies towards the well-being of their communities to ensure knowledge transfer for their future generations.

The *Orang Asli: Resources and Sustainable Livelihood* book presents deeper information on the Orang Asli with illustrations to capture the hearts and minds of the general and serious readers. This book is special as it provides the reader with various aspects of the study, including science, applied science, social science, economics and modelling. Furthermore, this book provides explanation and information on the genetic structure of the Orang Asli. The natural sciences examine the usage and importance of forest resources as one of the components to sustain the Orang Asli livelihood. From aquatic to terrestrial components, various resources become an important part of the life of the Orang Asli. Apart from that, their traditional knowledge was included as an important aspect of their resource use and sustainability. Meanwhile, social science and management look at the Orang Asli culture, lifestyle and practices.

Another challenge to creating a sustainable livelihood for the Orang Asli is our lack of understanding of their behaviour. Therefore, this book is aimed to provide information and bridge with the gaps in research regarding the sustainability of the Orang Asli. It is intended for researchers and graduate students to understand more about the Orang Asli. We hope that by introduce the Orang Asli to the public, this community will be recognised and become a part of society. Also, based on the

information delivered, we hope that it leads to more research on the Orang Asli in various aspects and be used by responsible bodies to achieve the sustainable development goals of the community including the 178,197 Orang Asli people in Peninsular Malaysia.

Contents

About the Editors

Mohd Tajuddin Abdullah, PhD, is a professor and former director of the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu (UMT), and former dean of the Foundation Studies, Universiti Malaysia Sarawak. He has conducted his fieldworks in Malaysia, Indonesia and Thailand with a broad interest in biodiversity, biogeography, molecular ecology, mammalogy, Orang Asli, and zoological park and wildlife conservation. Professor Abdullah received the best zoological and ecotourism book awards at the Malaysia National Book Award 2017 and 2019, respectively. He has published about 100 indexed journal manuscripts and co-edited nine books, two of which by Springer Nature. Currently, he is an active independent researcher affiliated to the Academy of Sciences Malaysia, of which he is a fellow, and has found a new hobby as a YouTuber (Taj Abdullah).

Candyrilla Vera Bartholomew graduated with MSc in zoology from the Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu. She completed her BSc in zoology at the Universiti Malaysia Sarawak. Candyrilla has been involved in scientific research and conducted social surveys of the Orang Asli to characterise their forest resource–use patterns and determining factors affecting the involvement of Orang Asli to hunt and collect forest resources. She has also co-authored journals and conference manuscripts and a local book and two book chapters which characterise resource utilisation by the Orang Asli.

Aqilah Mohammad, PhD, is a senior lecturer and a mycologist at the Universiti Malaysia Terengganu. She currently holds a dual appointment position in the Faculty of Science and Marine Environment and acts as the Head of Program at the Institute of Tropical Biodiversity and Sustainable Development. Aqilah has been involved in fungal ecology, fungal diversity and ethnomycology studies and conducted fieldworks in several states in Malaysia. She is currently engaged in the post-Covid19 industry-community project on mushroom cultivation for low-income communities nearby UMT main campus area. She has been actively publishing works on her field in both local and international journals and academic books since 2011 until present and has co-edited two international books by Springer Nature.

Contributors

Mohd Tajuddin Abdullah Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Muhammad Fuad Abdullah Institute of Advanced Studies, University of Malaya, Kuala Lumpur, Malaysia

Ramle Abdullah Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

Muhammad Abu Bakar Abdul-Latiff Centre of Research for Sustainable Uses of Natural Resources, Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Pagoh, Johor, Malaysia

Albert Abee National Coordinator Sustainable Development, United States Department of Agriculture Forest Services, Washington, DC, USA

Mohd Ayub Afiqah Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Muar, Johor, Malaysia

Abu Talib Ahmad School of Humanities, Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia

Muhammad Syamsul Aznan Ariffin Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Nurul Faezah Noor Azizan Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Nerus, Terengganu, Malaysia

Candyrilla Vera Bartholomew Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Geoffrey Keith Chambers School of Biological Sciences, Victoria University of Wellington, Wellington, New Zealand

Hisham Atan Edinur Forensic Science Programme, School of Health Sciences, Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia

Juli Edo Department of Anthropology, Faculty of Arts and Social Sciences, University of Malaya, Kuala Lumpur, Malaysia

Harizah Nadiah Hamzah Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Hidayah Haris Centre of Research for Sustainable Uses of Natural Resources, Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Muar, Johor, Malaysia

Mohd Hasdi Husin Jabatan Perlindungan Hidupan Liar dan Taman Negara Negeri Terengganu, Kuala Terengganu, Terengganu, Malaysia

Mohd Fadli Hussin Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu Malaysia, Kuala Terengganu, Terengganu, Malaysia

Rohana Jani Ungku Aziz Centre for Development Studies, Faculty of Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia

Nasha Rodziadi Khaw Centre for Global Archaeological Research, Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia

Hairul Nizam Mohd Khori Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Nerus, Terengganu, Malaysia

Muhamad Safiih Lola Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu Malaysia, Kuala Nerus, Terengganu, Malaysia

Norhayati Ab Manaf Institute of Tropical Biodiversity and Sustainable Development (Bio-D Tropika), Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

Badrul Munir Md-Zain Department of Biological Sciences and Biotechnology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia

Mohamed Nor Zalipah Faculty of Science and Marine Environment, Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

Aqilah Mohammad Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Mahani Musa School of Humanities, Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia

Mohd Faudzir Najmuddin Centre of Research for Sustainable Uses of Natural Resources, Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Muar, Johor, Malaysia

Azmah Othman Department of Development Studies, Faculty of Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia

Nursyuhada Othman Centre of Research for Sustainable Uses of Natural Resources, Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Muar, Johor, Malaysia

Muhamad Na'eim Abdul Rahman Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu Malaysia, Kuala Nerus, Terengganu, Malaysia

Mohd Noor Afiq Ramlee Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu Malaysia, Kuala Terengganu, Terengganu, Malaysia

Muhamad Razali Salam Faculty of Science and Marine Environment, Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

Jamilah Mohd Salim Institute of Tropical Biodiversity and Sustainable Development (Bio-D Tropika), Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

Jumadil Saputra Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

Faizah Mohamad Shaharom Faculty of Fisheries and Food Science, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Mahfuzatul Izyan Zainir Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Fatin Zahari Centre of Research for Sustainable Uses of Natural Resources, Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Muar, Johor, Malaysia

Nazarudin Zainun School of Humanities, Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia

Suzairi Zakaria Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Part I
Social and Demography

A Journey of Incremental Steps for the Orang Asli

Albert Abee

Abstract The human quest for sustainable development impacts public health and social welfare as well as the endurance of plant and animal species that humans share space with. Environmental policies designed to mitigate the negative impacts of developmental activities on the environment, more often than not emerge from critical needs rather than foresight. This paper characterizes the context of environmental law in play during implementation of the first and second Malaysian development plans (1966–1975). The paper characterizes the approach used to convert mature forest landscapes into productive palm oil and rubber tree plantations. The paper reflects incremental policy changes made to mitigate the negative impacts of development on the Orang Asli environment.

Keywords Orang Asli · Sustainability · Development · Ecosystem · Conservation · Human health · Ecology

Purpose The year was 2017, and with reference to the Orang Asli, I had been invited to share my perspective and experience in Malaysia from 1973 to 1976. Historical context is important to gain perspective of the content of my remarks. Understanding the dependence of Orang Asli on the health of forest systems they occupy is key. Similarly, country knowledge of ecosystem functions and mitigation options for reducing negative effects of economic development on social health and values were at a different place than they are today. My reflections are a high-altitude snapshot of the implementation of the Second Malaysia Plan (1971–1975) in Pahang state, Peninsula Malaysia, *which most affected the Orang Asli lifestyle.* I noted the unwanted environmental consequences of development affecting Orang

"There is Nothing New Under the Sun: What Has Been Will Be and What Will Be Has Been" King Solomon, 450-180 BCE

A. Abee (✉)
National Coordinator Sustainable Development, United States Department of Agriculture Forest Services, Washington, DC, USA
e-mail: aabee@msn.com

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_1

Asli at the time, and new strategies employed to mitigate those effects. However, all observations noted here are germane to all Malaysians today.

Background

Generally, and internationally speaking, the time the First (1966–1970) and Second (1971–1975) Malaysia Plans were implemented was an interesting period of time in the evolution of environmental awareness (Government of Malaysia 1966, 1971). In the United States (US), for example, the 1960s and early 1970s were times of great idealism, tragedy and social unrest (King 1963; Woodstock Festival 1969; Beetles 1970; Young 1972). In 1962, Rachel Carson's book *Silent Spring* documented the effects of pesticides in the food chain (Carson 1962a, 1962b); Martin Luther King Jr made his famous "I Have a Dream" speech advancing civil rights in August 1963 and president John F. Kennedy, who established the Peace Corps, was assassinated in November the same year; humans set foot on the moon in 1969; Earth Day was established in 1970 (The History of Earth Day 2019) ; and multiple social gatherings, such as the legendary Woodstock, are examples of watershed events that transformed environmental awareness and activism around the world. Environmental concerns were also addressed in music: The Beetles, Joni Mitchell, and Neil Young to mention a few.

Prior to the 1960s, most developed countries were primarily concerned with wilderness and conservation of resources, such as timber. But this emphasis changed as the 1960s loomed! Countries began to fully understand the relationship between pollution, environmental integrity, and human health and social welfare. Political activism increased with the aim of preventing environmental degradation. This led to an intensifying call by people and the media for governments to reduce and/or mitigate negative effects of development on the environmental, and to reduce pollution, besides regulating developments closely.

Of course, people have adjusted to changing environmental realities since creation. This is true for all people, including the Orang Asli. Nevertheless, it was during the 1960s and early 1970s that social consciousness was greatly advanced. For example, in the US, more benchmark environmental legislation was passed during these two decades in the country's history, and it has remained so ever since. The Multiple Use and Sustained Yield Act (1960), Clean Air (Clean Air Act 1970), Clean Water (Clean Air Act 1972), Soil and Water Conservation Act (Soil and Water Conservation Act 1977), Threatened and Endangered Species Act (Endangered Species Act 1973), NEPA (National Environmental Policy Act 1978) and scores of other "green" legislations were among those enacted. The important thing is that such legislation flowed NOT out of foresight, but of hindsight — being mostly triggered by adverse effects of development on environmental hygiene, health and social wellbeing.

Despite the global progress in understanding the relationship between human health and the integrity of ecological systems, as in the US, most policymakers in developing countries believed that ecology was a luxury that could not be afforded from the onset. The approach was to develop first, generating economic opportunity

and wealth, and then subsequently fix and repair unwanted environmental consequences. This approach and worldview were much at play in Malaysia during the Second Malaysia Plan. The country was excited about economic opportunities, about providing jobs for people and about wealth redistribution, thus giving Malays a foothold in the national economy. Tun Abdul Razak, who was the prime minister at that time, had many issues to deal with, but was very focused in creating economic opportunities for the people. It was an exciting time, filled with hope and anticipation. However, from the onset, the lifestyle of the Orang Asli had been the most negatively affected by implementation of the Stategic Malaysia Plans for economic development through forest conversion.

One year after completing graduate school (forest ecology), my wife and I joined the Peace Corps in January 1973, and I was offered a teaching position at Institut Teknologi MARA (ITM) in Shah Alam in Selangor state. It was a privilege to teach the first forestry class at ITM, in which I taught Basic Forestry and Silviculture. The young men and women in my class were among the brightest I have ever worked with. The students were well informed about world events, environmental issues and enjoyed much of the same music (noted) that I thought I had left behind in the US (Fig. 1).

Fig. 1 The first Forestry Class of 1973 at Institut Technology MARA (ITA) in Shah Alam, Selangor, Malaysia
Standing from left: Basri, Shahrulzaman, Ahmad Mohamed, Ismail Ahmad, Ariffin Abdullah, Zainal Abidin Hashim, Che Aziz Che Ali, Rosni, Halib, Zubair, Adnan, Zaaba, Samsudin Sueet, Zulkifly Harun, Zulkifli, Aziz Awang Tera and Jubri Mahmud
Seated from left: Ismail Nawari, Ismariah, Awalludin Ramlee, Zahriah Anis, Ahmad Shamsuddin, Bakar Daud, Azizun Karim, Kamarudin, Shiela Abee and Jamaliah Mahmud

Methods

There were no textbooks, so I developed manuscripts for the two courses I taught. From the onset, my students, friends, and colleagues asked difficult questions related to the environment and ongoing developments. Hours were invested in researching available literature, talking to multiple interdisciplinary specialists both locally and abroad (Forest Institute researchers, university colleagues, bank officials, venture capitalists, consultants, and government officials). Many field trips were taken in Land Rovers and helicopter flights over Pahang Tenggara (southeast of Pahang state in Peninsular Malaysia). Orang Asli families were also interviewed in the forests of Pahang. Virtually everyone was "hungry" for knowledge and ideas to address emerging environmental issues. In retrospect, no one really understood the full impact of ongoing activities on environmental systems, but everybody was hoping for the best.

I taught and consulted at Institut Technology MARA (ITM) for 1 year and was invited to join the newly established Southeast Pahang Development Authority (Lembaga Kemajuan Pahang Tenggara or DARA) as a Developmental Ecologist. The federal government agency was formed under the Southeast Pahang Development Authority Act 1972 and was put in charge of all developments in southeast Pahang, spanning four districts (Rompin, Pekan, Bera and Maran) with an area of 1,002,197 hectares. After completing my Peace Corps assignment, I continued working with DARA via the Asian Development Bank.

Observations

All societies have scenarios for human development. Social constructs and "regulatory" frameworks vary from country to country. As noted, the constructs for safeguarding the environment concurrent to development emerge over time and are usually formulated in response to perceived needs. During the implementation of the Second Malaysia Plan, the country did not have a ministry for the environment, and there was an absence of environmental laws, regulations, and standards related to soil erosion, protection of aquatic and riparian areas, air quality and effluent emission. The main yardstick for measuring developmental success was acres of forest converted to productive land and the jobs it created. In the massive land conversion and economic developmental process, no one meant to do harm to the ecological systems or people, the Orang Asli in particular, but environmental harm nevertheless was committed. This is the story of human development in all developed and developing countries.

From the onset of implementing the First and Second Malaysia Plans, the Orang Asli were caught up in the industrialisation of Malaysia. The Orang Asli Act was established in 1950 and while it was a work in progress, the initial idea was to provide safe and stable reservations for displaced natives to reside in, and presumably

benefit them through the national development programme that uprooted them in the first place. Basic infrastructure like housing, health services and schooling were provided at the reservations.

In 1972, the Orang Asli represented only 2–3% of the total population in Malaysia (about 11.5 million). Little science-based information was available on the population's diversity, languages, and lifestyle attributes. They were a small population group with no money, status or influence. They practiced shifting cultivation and many family units were diffusly scattered throughout the Malaysian Forests. The government could not sacrifice the economic needs of the nation for a handful of people, so it provided a reservation system for displaced Orang Asli and hoped for the best.

Land conversion and related development then proceeded at a rapid pace, often encroaching on native land. With the rapid population growth of other races (indigeneous Malay, Chinese, Indian), the Orang Asli could not thrive and would end up becoming fewer as a percentage of the whole. The hope was that and with any success of the Orang Asli transitioning into adjacent cash economies, they would all but disappear as an underserved, undeveloped people.

In Pahang Tenggara, however small and diffusely scattered the Orang Asli populations were, they primarily occupied the gently rolling lowland forests. Shifting cultivation in small units was evident in certain areas, while individual home structures near rivers could be observed from the air. For the most part, the Orang Asli were land security dependent — being hunter-gatherers, and fishermen, with incidental agricultural subsistence in their lifestyle. Depending on cash economies and being wage security dependent were exceptions to the rule. The Orang Asli "earned" their living from the forests and river systems they live in. Protecting their designated land and associated river systems and integrating the Orang Asli into cash and wage security economies engulfing them was the challenge.

One interesting thing is that while visiting an Orang Asli reservation, some of my Malay colleagues did not want to have their pictures taken next to an Orang Asli. I am not sure why this was so. Perhaps they did not want to be mistakenly identified as "one of them". The Orang Asli bathed and fished in rivers and their tributaries. Often, I would come across the Orang Asli washing their clothes and bathing in rivers near forest clearings or plantations (Figs. 2 and 3).

While it may not be a scientific survey, through multiple interviews conducted with Orang Asli families, it was learned that their average lifespan was less than 50 years, and child mortality was high. Some small huts built for them by the government had holes burnt through the floors because someone had started a fire for heating or cooking.

At a reservation in Tasik Chini, Pahang, there were no permanent gardens seen in or around the Orang Asli huts. A nurse practitioner noted that many of the resident Orang Asli that came to stay in the reservation often returned to the jungle after a while (Figs. 4, 5 and 6).

Ecological realities that affected all Malaysians, the Orang Asli in particular, included concern over the pace of development and its negative environmental effects. Newspapers in the nation's capital of Kuala Lumpur often featured

Fig. 2 Local residents washing clothes at a river in Pahang, Malaysia (1974)

Fig. 3 A local washing and bathing in a river in Pahang, Malaysia (1974)

Fig. 4 Orang Asli children in Tasik Chini, Pahang, Malaysia (1974)

Fig. 5 An Orang Asli family outside their hut at a reservation in Pahang, Malaysia (1974)

numerous articles about small particles from mining activities, fish deaths in rivers, "smelly" waterways poisoned by palm oil mill effluent and wildlife conflicts in newly established plantations. I remember being very impressed with the quality of reporting and that the newspapers had truthfully reported on emerging issues.

Fig. 6 An Orang Asli family waiting for their meal to cook in Pahang, Malaysia (1974)

Lack of Sequential Clearing for Towns

When my wife (Sheila K (Holcomb) Abee) and I arrived back in Malaysia to work in ITM, we were provided a new house in Shah Alam (Fig. 7). While it was a beautiful house, the environmental setting was tragically and unnecessarily hostile — the landscape was baking under the hot sun! Concurrently, multiple monsoons eroded all but the subsoil away thus not only creating a hostile living environment but also choking river systems and estuaries with erosion sediment. Basically, more land was cleared for town development in a year, but the structures and facilities could not be built fast enough, leaving denuded soils exposed to the elements for years.

Due to the massive forest conversion programme, the market for timber became depressed. Huge trees of unknown species were cut down and left behind. Out of the 2,000 stems per hectare of standing biomass in lowland forest systems, less than 25 trees were removed for utilisation. The rest were bulldozed and burned on site, making way for palm oil plantations (Fig. 8).

The soil in Pahang is mostly infertile, being useful mainly for root support and water movement. Basically, available nutrients for forest growth were "juggled" aboveground by the standing biomass. Nutrients were recycled above the soil profile. Thus, with the forest liquidation process, the majority of the nutrient biomass was immediately lost, leading to the need for large amounts of fertiliser being used per oil palm tree to establish and maintain plantation growth.

Fig. 7 New homes for ITM lecturers in Shah Alam, Malaysia (1973)

Fig. 8 Cleared land for oil palm plantation in Pahang, Malaysia (1974)

Flooding and Landform Stability

Pahang river systems are very mature, snaking slowly with oxbows through the landscape. Deforestation occurred in large blocks across landscapes with no provision to avoid or protect tributaries and wet areas that flooded biannually with each monsoon. Consequentially, tributaries became choked with erosion sediments and new channels were often formed 100 m from the original, stable channel (Fig. 9). Related aquatic resources were diminished. In areas that flooded twice per year and were planted with oil palm, chemicals like fertilizer, herbicides and pesticides would wash into streams, thus negatively affecting water quality and related aquatic life.

In the 1970s, there was no technology available to treat palm oil mill effluents. The mill effluents were directly discharged into river systems (Fig. 10). In certain places, local residents would construct small dykes along the effluent canals to capture the waste and extract any leftover palm oil (Fig. 11). Numerous complaints were noted from local residents about fish deaths and foul water in the rivers they used for food subsistence and to bathe or wash their clothes in.

Tasik Chini and Tasik Bera were the only two fresh water lakes in Peninsular Malaysia that were recognised as United Nations Education, Scientific and Cultural Organisation (UNESCO) research sites. Both areas contain Orang Asli reservations. Aside from small units of historic shifting cultivation, in 1974, the water catchment areas and lakes there were largely pristine (Fig. 12). There was very little inventory information about wildlife and biodiversity in the surrounding areas, which were about to be deforested for development.

Fig. 9 New oil palm plantation in Pahang, Malaysia (1974)

Fig. 10 An effluent discharge canal at a palm oil mill in Pahang, Malaysia (1974)

Fig. 11 Palm oil effluents captured in an effluent discharge canal in Pahang, Malaysia (1974)

Fig. 12 A 1974 picture of a landscape in Tasik Chini, Pahang, which is a UNESCO research site

Role and Contributions of DARA

Mohd Saufi Abdullah was the director of DARA when I was working there in 1974. The agency was then responsible for providing oversight in implementing the Second Malaysia Plan in Pahang Tenggara. Basically, thousands of hectares of lowland forest were converted to palm oil and rubber plantations, and 27 new townships had been planned or were under some level of construction to house the workforce. Saufi was the pointman for everything, including resolving complaints from the people. He had a phenomenal team that I was privileged to be a member of. Saufi and his staff coordinated with the Asian Development Bank, the Federal Land Development Authority (Felda), the Malaysian Agricultural and Research Development Institute (Mardi), and many other organisations to ensure that development could proceed smoothly in the vast area under DARA's jurisdiction. He and his staff were active listeners and knew how to influence people for a good outcomes. He believed in the old adage that an ounce of prevention is worth a pound of cure.

A healthy river fishery, good water quality for drinking and bathing, landform stability, effluent control and forest conservation were key to helping ensure a less painful transition for the Orang Asli into stable reservations. In general, DARA was concerned about the environmental hygiene of all Pahang citizens. Under Saufi's leadership, the staff developed the following vision.

DARA encouraged the development of Malaysia's first-ever microbial treatment system to break down and render palm oil effluent less harmful to the environment.

Fig. 13 Enlarged palm oil effluent holding tank in Pahang, Malaysia (1974)

The size of the mill discharge holding tanks were enlarged, enabling more utilization of palm oil and less discharge into rivers (Fig. 13). Additionally, discharge effluent was designed to flow through a series of large anaerobic and facultative ponds. Through these holding ponds and related mocrobial activity, the biochemical oxygen demand (BOD) was significantly reduced to 500 ppm — still considerably high by today's standards — but that level was the best that technology could allow at that time, and it was very much lower than the raw effluent (Fig. 14).

Land clearing for the development of new towns was done sequentially. If a new town was not scheduled or if the infrastructure was not timely built up, the land would not be cleared. The goal was to coordinate the pace of clearing with development, and not the other way round, thus reducing offsite effects caused by erosion of bare ground. DARA also encouraged leaving strips of trees, green belts for parks within the townships developed (Fig. 15). These treeded areas would cool and filter the air around the communities. It was also hoped that such would create employment in urban forestry.

When developing human settlements, DARA recommended that buffer zones of mature forest — three to five times the height of mature trees of about 100–170 m — be left undisturbed on each side of perennial tributaries. This was to help ensure landform stability and protect related aquatic systems (Figs. 16 and 17).

DARA recommended that areas with biannual floods during the monsoon be left alone with their native vegetation. This ensured the stability of the land and prevented pesticides and fertiliser run-offs from entering rivers.

Fig. 14 Anaerobic and facultative ponds to break down palm oil effluent in Pahang, Malaysia (1975)

Fig. 15 New sites for a township with green belts developed by DARA in Pahang, Malaysia (1975)

Fig. 16 Forested buffer zone around riparian areas in Pahang, Malaysia (1975)

Fig. 17 Forested buffer zone left adjacent to a perennial stream in a development site in Pahang, Malaysia (1975)

Fig. 18 The condition of the Tasik Chini watershed catchment area in Pahang, Malaysia, after the land was cleared in 1976

In Tasik Chini, DARA recommended that the catchment area draining into the lake be left undisturbed and, in any event, that native forest areas should be no less than five times the height of mature forests. Unfortunately, in 1976, perhaps an unintended consequence of rapid development, an oversight occurred when the forest was cut down right to the edge of Tasik Chini itself — the UNESCO research site and Orang Asli reservation. This was a sad thing (Figs. 18 and 19). DARA also documented the existing baseline air quality at various locations.

DARA recommended that innovative efforts be undertaken to integrate the Orang Asli into the national development programme, specifically to employ and train them to do forest work (harvesting of minor forest products, timber, forest stand development work, reforestation, etc). DARA envisioned such work would occur in both virgin, undisturbed stands, as well as in protective green belts, as defined above.

Fast forward to 2000, I returned to Malaysia and presented a paper at the International Union of Forest Research Organisations (IUFRO) World Congress. Subsequently, I returned to Pahang Tenggara and went to see the Tasik Chini catchment area that had been cleared to the water's edge in 1976. As I stood there 24 years later under the canopy of mature oil palm trees, I reflected on the status of the lake's watershed and the whole of Pahang Tenggara in general. I thought of the history of man and his efforts to "sustainably develop" his life through time. While much had changed in Tasik Chini, with visible effects (eutrophication rate, reduced diversity, reduced size and function of the Orang Asli reserve), I was amazed at the resiliency of the watershed in light of rapid developments in the area. The productivity

Fig. 19 Tasik Chini water edge in Pahang, Malaysia (1976)

of the oil palm plantations and jobs they created had impressively contributed to the nation's economy.

I also wondered how the Orang Asli fared during those last 24 years. Were they also resilient and did they assimilate into the new reality? Of course, shifting of cultivation openings in mature forests had occurred in the past, but these quickly reverted to their original diverse forests. Now, a sea of intensively managed mono crops dominated the landscape, where the Orang Asli had once roamed and made their subsistence living.

Currently, there is no such "living" anymore in the new "forested" plantations of palm oil and rubber trees. I asked myself, what could "we" have done differently to better protect the river systems and riparian areas of Pahang in general, and the watershed of Tasik Chini in particular? In the final analysis, does it matter? Yes, I still think it does!

Conclusion

King Solomon once said there is nothing new under the sun: what has been will be and what will be has been. What continues to change over time is not the drive to sustainably meet human needs to ensure respective definitions of well-being, but the way we characterise our needs, wants and desires. It is the way we approach our work — sustainable development. However else defined, sustainable development is an enduring ability to create jobs in rural communities; the availability of commodities to support life functions and aspirations; and a healthy and productive environment, providing a host of essential features (clean air, clean water, fisheries,

landform stability, etc.), and which is home to and inclusive of our heritagr of plant and animal species. It is vital to ensure that our home and heritage of plants and animal species will survive throughout generations to come. Of course, there are multiple ideas of what sustainable development means, what it looks like on the ground, and how it should be achieved. We see that in the emerging conversations today about climate change and how to maintain viable populations of threatened and endangered species.

The day after I visited Tasik Chini in 2000, I was invited to visit DARA's office. Old friends, not forgotten, were there — Tuan Haji Samsudin Othman, Tuan Haji Mohd Zin Abd Karim, Tuan Haji Ab Ghani Mustaffa, Tuan Haji Mohd and Tuan Yunus Haji Hussain. The conversation flowed easily and was heartfelt. Just before we parted ways, director Othman asked what I thought about sustainable development in Malaysia. Being so far removed, I told him that I did not know how to answer the question, but I suggested this: If people in the new towns, along rivers or in the forest could still catch fish, wash their clothes, bathe and safely drink the water supply, then I think Malaysia has done well. If not, a problem well defined is just half solved.

Acknowledgements I thank the first Forestry Class of 1972 students in ITM for asking thought-provoking questions and their heartfelt commitment in preserving Malaysia's environment and the people's way of life. I thank Saufi and my former colleagues at DARA for providing leadership and support in all my work activities. They included financial support, high-level discussions to develop technical strategies, air and ground transport, technical support and inter-governmental coordination with multiple agencies (1972–1976). I thank the US Peace Corps Programme for its initial enablement and support of my work at DARA, including cross-cultural and language training (1972–1974). I thank the Asian Development Bank for their support during my employment as a Development Ecologist (1974–1976). I thank Freeman Fox Associates International (England) for the volumes of technical documents they provided DARA in characterizing the physical environmental attributes of Pahang, Malaysia. I thank the wonderful people of Malaysia for their hospitality and heartfelt kindness. I also want to thank the social worker Bot Bot and his wife for showing my wife and I the good "heart" of the Orang Asli at Tasik Chini. Finally, my utmost gratitude to my wife, Sheila (Holcomb) Abee, who has tirelessly supported me in producing my publications, such as accompanying me to Orang Asli villages to take dictation during interviews.

References

Beetles 1970. Let It Be; Joni Mitchell 1970. Big Yellow Taxi; Neil Young 1972. Heart of Gold; James Taylor 1976. Traffic Jam.

Carson, R. (1962a). *Silent spring.* Houghton Mifflin Harcourt.

Rachel Carson, Rachel. 'Silent spring', Houghton Miffin Publisher, September 1962b.

Clean Air Act. 42 USC #7401 et seq. 1970.

Clean Water Act. 33 U.S.C. #1251 et seq. 1972.

Endangered Species Act. 16 U.S.C. #1531 et seq. 1973.

Government of Malaysia. (1966). *First Malaysia Plan 1966–1970*. Kuala Lumpur: Government Printing Office.

Government of Malaysia. (1971). *Second Malaysia Plan 1971–1975*. Kuala Lumpur: Government Printing Office.

Martin Luther King, Jr., speech, I Have A Dream. August 28, 1963.
National Environmental Policy Act (NEPA), 40 CFR Parts 1500–1508, First issued in 1978.
Soil and Water Conservation Act. P.L. 95–192, Nov. 16, 1977.
The History of Earth Day, 2019. retrieved from https://www.earthday.org/history/
Woodstock Festival. Aug 15–18, 1969. New York. Attracted more than 400,000 people.

Albert Abee is an interdisciplinary forest ecologist. His education includes: Henager Business College, 1965, Salt Lake City, UT; BSc 1970, Forest Management, (having minors in range, wildlife, and soils), Utah State University, Logan, UT; MSc in Forest Ecology (with minor in statistics), 1973, Oregon State University, Corvallis, OR. Work history includes: Developmental Ecologist, 1973−1976, US Action & Asian Development Bank, Malaysia; Research Forester, 1976−1978, USDA Forest & Range Exp Sta, Corvallis, OR; Agency Range Conservationist, 1978−1979, USDI BIA, Zuni, NM; Agency Administrative Forester, 1979−1980, USDI BIA, Umatilla, OR; District Ecologist, 1980−1985, USDI BLM, Medford, OR; Area Manager, 1985−1990, USDI BLM, North Bend, OR; Area Manager, 1990−1993, USDI BLM, Albuquerque, NM; Natural Resource Specialist, 1993−1996, USDI BLM, Washington DC; National Coordinator Sustainable Development, 1996−2007, USDA FS, Washington, DC. From 2000−2007 Mr. Abee was the US Representative to the International Montreal Technical Advisory Committee responsible for refinement and implementation of national criteria and indicators for sustainable forest management, boreal and temperate forests. Mr. Abee has given papers throughout the world on social, ecological, and economic criteria and indicators for sustainable forest management.

Orang Asli Anecdotal Reflections

Albert Abee

Abstract Albert Abee worked for the Kemajuan Pahang Tengarra (DARA) as a Developmental Ecologist 1973–1976. He characterizes his approach in familiarizing himself with emerging environmental issues that affected the Orang Asli concurrent to implementation of Malaysian Development Plans (1966–1975). He shares stories of personal observations and encounters he had with the Orang Asli and how such influenced the development of policy affecting the Orang Asli.

Keywords Orang Asli · Indicators · Watershed · Landscape · Forest · River · Development

Introduction

Trying to "fit" in was an ongoing challenge. Just like the American expression, I "dressed for success" as a developmental ecologist in the Southeast Pahang Development Authority (Lembaga Kemajuan Pahang Tenggara or DARA) and lecturer at Institut Technology MARA (ITA), as did all my professional counterparts. Well-dressed, professional-looking people, especially from another country, were respected and given unnecessary deference by labour workers and many others.

To add to that deference, language barriers, where what is said was not always heard or understood, caused awkwardness and misunderstandings. One had to practice active listening to be sure one understood what was being said or meant and even then it was still difficult at times. Furthermore, this was compounded by my height. I am slightly over 2 m tall and generally towered over most Malaysians, especially the Orang Asli people, which could be intimidating. My Malay friends affectionately referred to me as Abdul Panjang!

A. Abee (✉)
National Coordinator Sustainable Development, United States Department of Agriculture Forest Services, Washington, DC, USA

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_2

Field Reconnaissance Was Intensive

I spent the better part of 3 years in a Land Rover doing onsite reviews of Pahang state, in particular, and of Malaysia in general. On three occasions, I did reconnaissance via helicopter of the Pahang region (Fig. 1). In summary, I familiarised myself with the ecology throughout the Pahang landscape and related river systems. Observations included undisturbed forest areas (Fig. 2); Orang Asli dwellings (Figs. 3 and 4); river communities (Fig. 5); lowland forest scheduled for conversion (Fig. 6); site preparation activities (Fig. 7); new town developments (Fig. 8); and off-site impacts of development activities on landform stability. Generally, the river systems in Pahang are very mature and slowly meander with multiple oxbows through the landscape (Fig. 9).

Orang Asli family units observed in the forest or along river tributaries were low in density, isolated and diffusely located in the landscape (Figs. 10, 11 and 12). Flyover and site visitations included the United Nations Education, Scientific and Cultural Organisation (UNESCO) Tasik Chini research site. The watershed of Tasik Chini was very fragile. The waters were pristine, and while lakeshore eutrophication was ongoing, it was slow. I noted that any permanent disturbance of the catchment area would adversely affect all aspects of the Tasik Chini ecosystem in general and the Orang Asli in particular. In my mind, the integrity and protection of Tasik Chini and Tasik Bera watersheds would be key indicators of developmental success.

Fig. 1 Tasik Chini, Pahang, Malaysia, 1973

Fig. 2 Pristine forest and river systems in Pahang, Malaysia, 1973

Fig. 3 An Orang Asli dwelling deep in a forest area scheduled for conversion in Pahang, Malaysia, 1973

Fig. 4 Orang Asli houses in a Pahang forest, Malaysia, 1973

Fig. 5 A community along a tributary of Rompin River, Pahang, Malaysia, 1973

Fig. 6 Site preparation activities for planting oil palm in Pahang, Malaysia, 1974

Fig. 7 Site preparation activities from oil palm planting in Pahang, Malaysia, 1974

Fig. 8 New township in Shah Alam, Selangor, Malaysia, 1973

Fig. 9 A mature river system with multiple oxbows, Pahang, Malaysia, 1974

Fig. 10 Orang Asli huts by the river, Pahang, Malaysia, 1974

Fig. 11 Orang Asli's shifting cultivation, Pahang, Malaysia, 1974

Fig. 12 Orang Asli homes in the forest, Pahang, Malaysia, 1974

The Nurse Practitioner

My first aerial reconnaissance in 1974 included a stop at Tasik Chini. We landed in a clearing right in front of the health center (Fig. 1). Several children quickly came out to see us (Fig. 13). They were amazed by it all. After landing, the nurse practitioner (Fig. 14) showed me around the Tasik Chini compound. We had a good visit and enjoyed watching the children, who were captivated by the helicopter. The nurse practitioner shared her thoughts about Orange Asli child mortality and the average age of the Orang Asli that she was familiar with. She noted that most of the Orang Asli, who initially came to the Chini reservation, would leave again.

While I observed several Orang Asli huts (homes) within a several mile radius of Tasik Chini, there were not many permanent residences at the Chini reservation itself. I noted that the reservation had a few government structures (Fig. 15), but an absence of sustained yield gardens, which might explain why the Orang Asli had to leave in order to produce food in the traditional way.

Helping the Orang Asli Collectively

In 1975, my wife Sheila and I were scheduled to take a brief vacation back to the United States. The same week we were to fly home, I had arranged to take another survey of the Orang Asli people in and around the Tasik Chini area. I hired an Orang

Fig. 13 Children at the Tasik Chini reservation, Pahang, Malaysia, 1974

Fig. 14 The nurse practitioner at Tasik Chini, Pahang, Malaysia, 1974

Asli I had previously met who called himself Bot. In Malay, he said "you can call me Bot, or Bot Bot" (Fig. 16). My objective was to interview family units around the lake area, adjacent tributaries, all the way down to where Chini drains into Rompin River. Anyway, I hired Bot to guide us around to the family units in the area. We had provisions with us for a long day (Fig. 17). The four of us loaded the two skiffs and left fairly early in the morning.

Fig. 15 Government housing for Orang Asli in Tasik Chini reservation, Pahang, Malaysia, 1974

Fig. 16 Orang Asli 'Bot' or 'Bot Bot', Pahang, Malaysia, 1974

My wife Sheila, and Bot's wife, were in one skiff (Fig. 18) and Bot and I in another (Fig. 19). Sheila and I did not know a lot about Orang Asli customs, but right or wrong, we figured we would "do as they do" so as not to make anyone feel uncomfortable. Our strategy was simple: we did not want to offend or intimidate people.

Fig. 17 Provisions for a day's journey, Pahang, Malaysia, 1974

Fig. 18 Sheila and guide, Tasik Chini, Pahang, Malaysia, 1974

Fig. 19 A Tasik Chini tributary, Pahang, Malaysia, 1974

Bot and his wife were barefooted; Bot had on shorts and his wife a simple dress. Sheila and I dressed very casually and while we had shoes with us, we did not wear them when we approached an Orang Asli family unit. We tried to fit in as best we could with the people that we were with and who we would be interviewing.

To engage family units, we walked along narrow trails through the forest; we boated through a narrow tributary or water channels; and we talked to people living on floating huts. Some of the Orang Asli family units had small, permanent huts built several feet above ground on top of stilts; some huts were on logs floating on water; other times, family units occupied a makeshift lean-to of sorts right on the ground. I was under the impression that some family units had several encampments, depending on season. Mostly, we boated through the area in the skiffs, stopping here and there. Bot would approach a family unit and explain that I wanted to ask some questions and that we had a small gift for them. (During that time, I smoked, and in previous meetings with Orang Asli, I learned that they appreciated a cigarette). Then Bot would motion for us to approach; and if the families were sitting, we would immediately sit down as well. If the home was a standing structure, we would stand outside unless invited in. If people were standing, I would crouch down so as not to tower over them (Fig. 20).

We were always made to feel welcome. With each family unit visited, before we started talking, I would offer the man a cigarette and give him the remaining package (Figs. 21 and 22). Sometimes, when we approached a family unit occupying a lean-to structure in the forest, the woman would pull her sarong up to cover her bare breasts. Most times, the women were covered. We would talk and I would ask them their age, how many children they had, how long they had stayed in the very place

Fig. 20 Orang Asli men, Pahang, Malaysia, 1974

Fig. 21 Visiting an Orang Asli family under a lean-to structure, Pahang, Malaysia, 1974

we were at, how many fish they caught in a day, etc. Bot was very helpful. His wife and Sheila pretty much remained silent.

It was interesting to try to tease out what was being said between the different dialects, for lack of a better term. My Malay was very rudimentary; Bot had a different dialect even though we could communicate somewhat; and the people we interviewed seemed to have a different dialect as well. But we did our best and all

Fig. 22 Orang Asli under a lean-to structure, Pahang, Malaysia, 1974

were treated with dignity and respect. On this particular day with Bot and his wife, we spent about 12 h going from place to place. Really, it was an amazing experience!

During the day, Bot and I spoke in between stops. At the end of the day, we went back to where our car was parked. Bot and his wife got in the backseat, and I drove several miles through the mature forest to an inconspicuous place where I had picked up Bot and his wife earlier (Fig. 23). I stopped alongside the road and got out of the car. Sheila stayed in the front seat. Bot and his wife got out of the car; and without a word, his wife immediately went into the forest. I paid Bot the money promised (RM80); and as he took the money, Bot asked me to wait, and then he proceeded to walk into the forest. It was twilight and the end of the day. I could see no conspicuous trail, but Bot and his wife seemed to know exactly where they were going. After a while, and about the time we thought about leaving, Bot emerged out of the forest with a young boy, his son. His son looked to be 14 or 15 years old. The boy had sneakers on, was dressed in new jeans, a white shirt, and had a new ball cap on. The boy also had a small duffle bag. He looked just like a "city" boy — but out of place. The well-dressed boy really took us by surprise. Bot and his boy approached me as I was standing alongside our vehicle. It was so quiet I could hear myself breathe. It was a solemn moment. I said nothing and did not know what was going on. Then Bot started speaking quietly to his boy. He reached into his pocket and took out the money that I had given him for his day's work. Bot put the money into the boy's hand and proceeded to tell the boy that he was going to go with me and that I would help get him a job. Ugh! In that moment, a great shock and sadness overcame me.

During the day, Bot had asked me if I would help his boy get a job. I had said yes. What I did not realise is that in saying yes, in Bot's eyes, it meant that I would take

Fig. 23 An inconspicuous forest opening in Pahang, Malaysia, 1974

his son with me, and that his son would live with us until he got a job. That would have been fine except for the fact that Sheila and I were scheduled to leave for the United States in 3 days! We could not take the boy in at that moment. I looked at Bot and with a lump in my throat, I shook my head and almost whispered, "No, we cannot take your boy," and then I tried to explain to him that we were leaving the country to fly back to the United States.

But all that did not seem to matter. Bot's face became ashen with embarrassment or rejection — I do not know what it was, but it was the most awful experience we had ever had! Then Bot and his boy quietly turned away and walked back into the forest. That image would forever be seared in my mind. I got back in the car, and we did not make it but a mile when I stopped, and both Sheila and I wept. It was so very sad. It was heart-wrenching. After collecting ourselves, I started to drive off again and Sheila said, "Al, you cannot help these people individually; you have to help them collectively."

We went back to the United States for a few weeks, and while home, I wrote a paper, "Integrating the Orang Asli into the National Development Program", which advocated training Orang Asli to do forestry work in extended forest reserve areas that DARA recommended. When I returned to Malaysia, I gave Mohamed Saufi, who was then director of DARA, my working paper. He reviewed it and suggested that the areas identified for sustained timber management also be included as a possibility for Orang Asli training or employment. Mohamed Saufi empowered me to take our recommendations to the director of Orang Asli Affairs in Kuala Lumpur. I met the director, showed him many pictures, and gave him the DARA

recommendation and working paper. The director and I also talked about the American experience with Native Indian Reservations.

A Fish Eye for Dinner

On another occasion to interview an Orang Asli, I located him via a Chinese vendor. The vendor sold rattan (Figs. 24 and 25).

The Orang Asli who cut the rattan from the forest was paid 70 cents per 100, 2.5 m sections. Clearly the middleman was making a huge profit at the Orang Asli's expense. The Orang Asli would have been better off had he had his own outlet to the commercial market. I made a mental note of this. In talking to the Orang Asli man, he invited me to follow him home.

I may have asked him if I could go to his house. In any event, his hut was in the forest and built on stilts and was about 1.5 m off the ground. The dwelling was one room about 4.5 square meters. His wife was in the dwelling when we got there. I detected a slight smell of sewerage and noted that the room had a small hole in the floor at one end, which served as a place to relieve oneself. Also, while it was too dark for me to see, there was a small cooking fire in the dwelling, where the woman was warming a pot of stew. There was no light, except from the fire inside. The three of us sat there, while the wife was making us something to eat. Language was most awkward, but they were kind and very welcoming to my efforts of conversation. There was not much talking: we just enjoyed each other's company. The woman gave me a bowl of what appeared to be stew — some kind of tapioca mixed with fish. The stew tasted excellent. Then my tongue discovered what appeared to be a capsule in my mouth. It was a fisheye that had come out of the fish head in my bowl! I had never eaten a fish eye — let alone include a fish head in my stew! Really, just

Fig. 24 Orang Asli rattan gathered from the forest, Pahang, Malaysia, 1974

Fig. 25 Rattan ready for commercial sale, Pahang, Malaysia, 1974

the thought of chewing up a fish eye made me gag! I was not about to offend this wonderful family, so I swallowed it whole. The meal was very satisfying and tasty! After the meal, I walked back to the road and made my way home.

Fish Cooked on a Stick

On another occasion, along with some colleagues from DARA, we got into several larger canoes for a recreational outing (Fig. 26). Our guide took us to a place at the lake's edge for lunch.

A fire was burning on the ground just out from a lean-to. When we got there, some fresh fish had been caught (Fig. 27).

I wondered how the fish would be cleaned and prepared. At home in the United States, I fished a lot and we clean the fish by cutting it open from the anus to the gills. We then remove all the entrails and most often cut the fish head off as well. Many times we filet the fish meat off of the skeleton and remove the skin before preparing the meat. Thus the meat is truly skinless and boneless. If a fisherman leaves the skin on, for sure he would remove all the scales before preparation. So to say the least, I was amazed how the Orang Asli prepared my fish. They took the fresh fish, stuck a stick deep into the cavity through its mouth, and held the fish over open fire (Fig. 28).

Fig. 26 DARA staff on a field trip at Tasik Chini, Pahang, Malaysia, 1975

Fig. 27 DARA staff members showing off a fish, Tasik Chini, Pahang, Malaysia, 1975

To my amazement, the scales curled back and the fish was cooked as is! I was handed the fish to eat. The skin with scales easily peeled off, and it was easy to break large chucks of cooked meat from the skeleton, leaving the entrails undisturbed. The fish was delicious and cooked to perfection!

Fig. 28 Bot Bot cooking fresh fish, Tasik Chini, Pahang, Malaysia, 1975

Acknowledgements I thank Mohamed Saufi and my multiple colleagues at DARA (South-East Pahang Development Authority) for providing the leadership and support for all my work activities. This included financial support; high-level discussions to develop technical strategies; air and ground transportation; technical support; and, intergovernmental coordination with multiple agencies (1972–1976). I thank the United States Peace Corp Program for their initial enablement and support of my work at DARA, including cross-cultural and language training (1972–1974). I thank the Asian Development Bank for their support in continuning my employment as a Development Ecologist (1974–1976). I thank Freeman Fox Associates International (England) for the volume of technical documents they provided to DARA characterizing the physical environmental attributes of Pahang, Malaysia. I thank the wonderful people of Malaysia for their hospitality and heartfelt kindness. I thank the Social Worker and Bot Bot and his wife, for showing Sheila and I the good 'heart' of the Orang Asli at Tasik Chini. I thank my wife Sheila (Holcomb) Abee, for her support in taking dictation during interviews with Orang Asli and for her tireless support in "cleaning" up professional work papers submitted.

Albert Abee is an interdisciplinary forest ecologist. His education includes: Henager Business College, 1965, Salt Lake City, UT; BSc 1970, Forest Management, (having minors in range, wildlife, and soils), Utah State University, Logan, UT; MSc in Forest Ecology (with minor in statistics), 1973, Oregon State University, Corvallis, OR. Work history includes: Developmental Ecologist, 1973−1976, US Action & Asian Development Bank, Malaysia; Research Forester, 1976−1978, USDA Forest & Range Exp Sta, Corvallis, OR; Agency Range Conservationist, 1978−1979, USDI BIA, Zuni, NM; Agency Administrative Forester, 1979−1980, USDI BIA, Umatilla, OR; District Ecologist, 1980−1985, USDI BLM, Medford, OR; Area Manager, 1985−1990, USDI BLM, North Bend, OR; Area Manager, 1990−1993, USDI BLM, Albuquerque, NM; Natural Resource Specialist, 1993−1996, USDI BLM, Washington DC; National Coordinator Sustainable Development, 1996−2007, USDA FS, Washington, DC. From 2000−2007 Mr. Abee was the US Representative to the International Montreal Technical Advisory Committee responsible for refinement and implementation of national criteria and indicators for sustainable forest management, boreal and temperate forests. Mr. Abee has given papers throughout the world on social, ecological, and economic criteria and indicators for sustainable forest management.

The Importance of Forest Resources as a Source of Income for the Orang Asli of Kampung Sungai Berua, Hulu Terengganu, Malaysia

Norhayati Ab Manaf, Ramle Abdullah, Jumadil Saputra, Nurul Faezah Noor Azizan, and Hairul Nizam Mohd Khori

Abstract The indigenous community known as the Orang Asli peculiarly chooses to live in isolated areas of Peninsular Malaysia. They are often associated with poverty and a traditional way of life in spite of the country's rapid development. The poverty rate of Orang Asli communities is the highest in Malaysia. Therefore, the government has prioritized their needs in its 5-year development plans. Nevertheless, the living standard of the Orang Asli has yet to improve with regard to income, employment prospects and education status. This study identifies the sources of income and forest conservation practices of Orang Asli in a village in the state of Terengganu, Malaysia. Four respondents were chosen to in this study and data were collected through interviews and observations, which were then analyzed qualitatively. The results found that the main source of the Orang Asli's income in the village is from the sale of forest products, such as agarwood, rattan and herbs, besides occasional hunting yields.

Keywords Forest resources · Income · Orang Asli · Sustainability · Semoq Beri

N. Ab Manaf (✉)
Institute of Tropical Biodiversity and Sustainable Development (Bio-D Tropika), Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia
e-mail: yati.manaf@umt.edu.my

R. Abdullah
Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

Research and Publishing Centre, National Academy of Arts Culture and Heritage, Kuala Lumpur, Malaysia

J. Saputra
Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

N. F. Noor Azizan · H. N. Mohd Khori
Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_3

Introduction

The indigenous community in Peninsular Malaysia, known as the Orang Asli, are poor minorities who usually live in isolated forest areas. Although some have been resettled in villages with basic facilities, they still do not fully adopt modern life despite the nation's rapid development, and are accustomed to their traditional way of life (Abdul Talib et al. 2003). However, they are living in a better socioeconomic environment compared to previous decades. Today, the Orang Asli are no longer relying solely on traditional economies, such as collecting forest products. They have adapted to new markets like making and selling handicraft; *bubu* (fish traps), *mengkuang* mats (*Pandanus odoratissimus* weaving), self-adornment accessories, blowpipes and *mengkuang* baskets (Omar 2008).

The government includes all tribes in its indigenous community development programmes. The various efforts are intended to ensure that socioeconomic development of indigenous communities may progress well without compromising their welfare. There are general and specific development programmes implemented to improve their quality of life. Specific development programmes include the organisation of settlements, economic and social exertions. General development programmes, on the other hand, refer to holistic implementations at the national level (Ramle 2014). The Semoq Beri and Bateq sub-tribes in Kampung Sungai Berua, Hulu Terengganu, in Terengganu state of Peninsular Malaysia are directly benefiting from these developments. However, despite the many programmes that have been carried out, their standard of living is still low. Most residents are dependent on forest harvests as a main source of household needs and income.

Traditionally, the forest provides essential resources in the daily lives of Orang Asli communities. Their dependence on forest harvests have been widely discussed in previous research (Choy et al. 2010; Kamarudin and Ngah 2007; Ali et al. 1991; Dunn 1975; Kuchikura 1988; Gomes 1986).

A study by Dunn (1975) discussed the economic activities of the indigenous communities. It sytated that their source of income was mainly from selling forest products, such as rattan and agarwood, to outside communities. Endicott (1974) studied the Bateq sub-tribe and found that they were also highly dependent on forest resources. A similar study carried out by Gomes (1986) found that the economic activities of the Semai sub-tribe were closely related to forest resources, such as gathering rattan, agarwood and fruits.

In addition, a study by Kuchikura (1988) had discovered that the Semoq Beri sub-tribe exploited more than 70% of forest products as their source of food, while the remainder was obtained from outside communities. Furthermore, Choy et al. (2010) had studied the dependency level of the Temuan sub-tribe. They found that 91% of the indigenous community depended on forest resources in fulfilling their daily needs. They also asserted that the dependence on forest resources was not only to get food sources such as fruits, vegetables, plants and animals, but also for non-food sources, such as agarwood, rattan, rubber, *bertam* leaves, *lempek*, *tongkat ali* and frankincense.

The indigenous communities practise unique cultural methods in conserving the sustainability of their surrounding forests. Hood (2004) had observed that the indigenous community, while exploiting the forests to fulfil their daily needs, delicately selected their harvests with due consideration to the optimal maturity of the plants. Interestingly, in so doing, they were abiding by their belief system, which pays homage to supernatural beings in the jungle. Those beings, according to the communities' belief, forbade the wastage of jungle resources.

There are many studies on the high dependency of the indigenous community on forest resources in the literature. However, reliance of forest resources as the main economic activities and the conservation efforts on the forests' sustainability by the Sungai Berua indigenous communities have yet to be conclusive. This study aims to identify the sources of income of Kampung Sungai Berua villagers and study their approach in preserving the sustainability of their surrounding forests. This study is based on the following questions; (i) what is the main source of income for the indigenous community in Sungai Berua? and, (ii) how does the community conserves forests for the benefit of present and future generations?

Methods

The qualitative method had been selected to drive this research. Its advantages in producing rich complex description on contradictory human behaviours were conducive to this study's investigation. It had the ability to describe the data and its details in depth (Marshall and Rossman 1989). This method was also suitable for understanding a phenomenon. It delivered a form of social inquiry that focused on how to clarify an individual's belief, which was logical to their life experiences and environment (Yeap 2000; Holloway 1997).

Wherein, the compositions of this investigation were delivered in the form of case studies. The approach involved a study of a case or several related cases involving the observation of an individual or unit, a group of humans, family, a class, school, community, critical events, culture, project, or part of a programme (Merriam 1998; Burn 1995; Yin 2014). Case studies were used to gain deep understanding on the real life of respondents, which focused more on the process in exploiting the output. Emphasis was towards the heterogeneity discovery and not a validation of a theory, or findings (Merriam 1998; Patton 1990). Case data included interviews, observations, archives and statements from any testimony intake on the case. The main techniques expedited were by way of field observations, interviews and document analysis. The ATLAS.ti software Version 7 was used for qualitative analysis of data gathered from fieldwork (Lewins and Silver 2007).

Information related to the study problems were obtained through fieldwork on an ongoing basis from June 2015 to June 2016. Kampung Sungai Berua in Hulu Terengganu, Terengganu, was chosen because the average monthly income of the indigenous community there was lower compared to other indigenous villages in the state. Table 1 shows a comparison of average monthly income of Kampung

Table 1 Average income and poverty category of indigenous villagers in Terengganu

No.	Villages	Average monthly income	Category
1	Sungai Berua	<RM 400	Hardcore poor
2	Sungai Sayap	RM 450	Hardcore poor
3	Sungai Pergam	RM 850	Poor

Table 2 Types of plants and animals

	Local name	*Common name*	*Scientific name*
Types of plants	*Herba*	Herbs	
	Rotan	Rattan	*Calamus* spp.
	Gaharu	Agarwood	*Aquilaria malaccensis*
Types of animals	*Ikan*	Fish	*Chordata* spp.
	Rusa	Barking deer	*Rusa unicolor*
	Kancil	Mousedeer	*Tragulus napu*
	Kijang	Sambar deer	*Muntiacus muntjak*
	Landak	Porcupine	*Hystrix brachyura*
	Tenggiling	Pangolin	*Manis javanica*

Sungai Berua villagers with two other Orang Asli villages in Terengganu (Kampung Sungai Sayap and Kampung Pergam). The villagers in Kampung Sungai Berua and Kampung Sungai Sayap had an average monthly income of RM400 to RM450, which were categorised as hardcore poor. On the other hand, the villagers of Kampung Sungai Pergam were slightly better off with an average monthly income of RM850, which put them in the poor category (JAKOA 2016).

Results and Discussion

Initial interviews with two respondents were used as a gauge to achieve the research objectives. The focus was to identify the main sources of income of the indigenous community and to determine approaches used by the villagers in Kampung Sungai Berua in conserving the sustainability of the forests. Content analysis was used to examine the correlated study's questions and objectives. Based on the interview results, it was found that the indigenous community harvests two main sources of forest products: plants and animals. Excerpts from the interview with Shidki (not a real name) stated that:

> *The types of animals hunted are porcupines, pangolins and fish. There are also other types of animals, such as deer and sambar deer, but both of these animals are hard tofind. Other forest products from plants that are often collected are agarwood. Herb trees are taken if there is a need or the price is worth it.*

The following interviews with Fahmi (not their real names) had also reaffirmed that the forest products harvested by the indigenous community, as stated in Table 2.

Hunting of animals such as mousedeer and porcupines are strictly on when needed. The same applies for collecting agarwood, while collecting herbs for medicinal purposes is only for one's own use or their family's use.

Table 2 illustrates the details of the main sources of forest products harvested by the indigenous community and the amount of income derived from the resources based on the interviews with the respondents. The income from the sales of forest products (plants and animals) for a period of 1 month amounted to RM1,000 at the most. If harvesting was carried out for 1 week, the villagers could earn RM500 to RM600. For a 2–3 days' work, the earnings would only be RM40 to RM60.

In an extract from the interview with Shidki, he stated that:

> Income generated from the sales of forest products such as plants and animals would be RM1,000 at the most, but if one enters the forest for a week he could earn about RM500 to RM600 (current exchange rate RM1 is about USD0.25).

In addition, they also earned side income from the sale of herbal plants for medicinal purposes. The results of interviews with Fahmi revealed the daily and weekly income total from selling agarwood (Table 3).

> Income earned from the sales of agarwood is at the most RM13 per day, but if one enters the forest two to three days in a week he could earn RM40 to RM60.

From the interviews, the results indicated that the indigenous community had inherent traditional modus to conserve the forests for the benefit of their future generation. The respondents seemed to have intricate knowledge about agarwood. They had deep biogeography acumen that enabled them to identify harvest-ready plants. For instance, to ensure that a tree was ready to harvest, a thorough inspection was done on the core of the tree bark. If there was no sign of an aloe core or resin content, the tree would be left for 3–6 years. Only trees with matured resin content were harvested. This due diligence showcased their approach in conserving forests for future generations. From the interview with Shidki:

To identify the right agarwood, the method is to cut to see the inside of the tree to ensure it has a core. If there is no core, the tree will be left (intact) and will need another five to six years before we can come back here to collect it.

The interviews with Fahmi also confirmed the same description:

> To identify the right agarwood, the method is to cut to see the inside of the tree to ensure it has a core. If there is no core, the tree will be left (intact) and will need another three to four years before we can come back here to collect it.

Table 3 Average income of the indigenous community from selling forest products

Description	Income
Plants and animals in a month	RM1,000.00
Agarwood in a week	RM40.00 to RM60.00
Agarwood in a day	RM13.00

Conclusion

From the results of this study, the main source of income of the indigenous community in Kampung Sungai Berua, Hulu Terengganu, came from the sale of forest products such as herbs, rattan and agarwood, as well as hunted animals like fish, barking deer, mouse deer, sambar deer, porcupines and pangolins. The indigenous community had their own traditional in-depth knowledge in preserving the sustainability of forest plants and animals. Plants were only harvested after careful inspection and consideration of its maturity. Whereas, hunting was carried out only when needed.

Acknowledgements This study is supported by Trans Disciplinary Research Grant Scheme (TRGS/2015/59373) led by Professor Dr Mohd Tajuddin Abdullah. Deepest appreciation also goes to the Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu (UMT) and the Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin (UniSZA). Our deepest thanks to the Orang Asli Development Department (JAKOA) for their permission to carry out this study.

References

Abdul Talib, B., Md Akbal, A., Hussain, O., Berhanuddin, M. S., Shariman, M., Rathiah, H., Mohd Yusof, A. H., & Abdullah, S. (2003). *Kenali kami masyarakat Orang Asli di Malaysia*. Batu Pahat: Penerbit Kolej Universiti Teknologi Tun Hussein Onn.

Ali, O., Shamsuddin, Z., & Khalid, B. A. (1991). Socioeconomic, social behaviour and dietary patterns among Malaysian aborigines and rural native Malays. *Medical Journal of Malaysia, 46*, 221–229.

Burn, R. B. (1995). *Introduction to research methods*. Melbourne: Longman.

Choy, E. A., Ariffin, Z. C. M., & Pereira, J. J. (2010). Sosioekonomi Masyarakat Orang Asli: Kajian Kes di Hutan Simpan Bukit Lagong, Selangor, Malaysia. *Jurnal Melayu, 5*, 295–314.

Dunn, F. L. (1975). *Rain-forest collectors and traders: A study of resource utilization in modern and ancient Malaya*. Kuala Lumpur: Percetakan Mas.

Endicott, K. (1974). *Bateq-Negrito economy and organization*. Ph.D dissertation. Harvard University.

Gomes, A. G. (1986). *Things are not what they seem: Semai economy in the 1980s*. A paper for Simposium ke-2, Kehidupan dan pembangunan masyarakat Orang Asli di Semenanjnng Malaysia. Universiti Kebangsaan Malaysia, 22–23 September 1986.

Holloway, I. (1997). *Basic concepts for qualitative research*. Oxford: Blackwell Science.

Hood, S. (2004). *Dunia peribumi dan alam sekitar: Langkah ke hadapan*. Bangi: Penerbit Universiti Kebangsaan Malaysia.

JAKOA. (2016). *Laporan JAKOA: Purata pendapatan komuniti Orang Asli negeri Terengganu 2016*. Jabatan Kemajuan Orang Asli.

Kamarudin, K. H., & Ngah, I. (2007). *Pembangunan mapan Orang Asli*. Skudai: Universiti Teknologi Malaysia.

Kuchikura, Y. (1988). Efficiency and focus of blowpipe hunting among Semaq Beri hunter-gatherers of peninsular Malaysia. *Human Ecology, 16*(3), 271–305.

Lewins, A., & Silver, C. (2007). *Using software in qualitative research: A step-by-step guide*. London: Sage.

Marshall, C., & Rossman, G. B. (1989). *Qualitative research*. London: Sage.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

Omar, M. (2008). Rancangan pengumpulan semula (RPS) masyarakat Orang Asli: pencapaian dan cabaran. In M. Redzuan & S. S. Gill (Eds.), *Orang Asli; Isu, Transformasi dan Cabaran* (pp. 189–190). Serdang: Universiti Putra Malaysia Press.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. London: Sage Publications.

Ramle, A. (2014). *Orang Asli pembangunan dan transformasi*. Kuala Terengganu: Universiti Sultan Zainal Abidin.

Yeap, K. L. (2000). Kajian kualitatif: Satu pengenalan. *Jurnal Keningau. Jabatan KajiSosial. Bil, 3*, 25–27.

Yin, R. K. (2014). *Case study research design and methods* (5th ed., 282 p.). Thousand Oaks, CA: Sage. https://doi.org/10.3138/cjpe.30.1.108.

Norhayati Ab Manaf is a lecturer at Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu. Before this, she worked as Social Research Officer in this Institute from 2011. She is a Ph.D. holder in Social Anthropology. Her Bachelor's degree in Business Administration at Universiti Utara Malaysia and completed her degree in 2008. She continued her study for a Master's degree in Integrated Coastal Zone Management at Universiti Malaysia Terengganu and completed her studies in 2010. On September 2016, she registered for a Ph.D. program in the Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin. Her field of interest is Anthropology, Sociology, Indigenous Studies (Orang Asli) and Community Development.

Ramle Abdullah is a Professor at Research and Publishing Centre, National Academy of Arts Culture and Heritage, Kuala Lumpur, Malaysia. Before this he is a Professor at Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin. His expertise is in Social Anthropology and Indigenous Studies (Orang Asli).

Jumadil Saputra is a senior lecturer at Department of Economics, School of Social and Economic Development, Universiti Malaysia Terengganu. He is a Ph.D. holder in Financial Economics. He studied from the elementary school until senior high school in Aceh and finished his studies in 2003. Further, he continued his Bachelor's degree in the Faculty of Management and Economics at Malikulssaleh University and completed his degree in 2008. He continued his study for a Master's degree in Economics at Syiah Kuala University, Aceh and completed his studies in 2012. At the end of September 2013, he registered for a Ph.D. program in the Faculty of Social Development and Economics at Universiti Malaysia Terengganu, Malaysia. He is a member Indonesian Operations Research Association (IORA). His research areas are Insurance and Takaful, specifically financial economics (Islamic) and mathematics and modelling finance (Actuarial).

Nurul Faezah Noor Azizan is a master's degree holder in social sciences at Universiti Sultan Zainal Abidin. Her bachelor's degree in Anthropology and Dakwah at Universiti Sultan Zainal Abidin and completed her degree in 2013.

Hairul Nizam Mohd Khori is a master's degree holder and Ph.D candidate in Social Anthropology (traditional knowledge) at Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin. He is also active in research, writing and presentations related to the Orang Asli community, especially traditional knowledge, sustainability of nature and land development.

Spending Habits of the Orang Asli in Kampung Sungai Berua, Hulu Terengganu, Malaysia

Norhayati Ab Manaf, Ramle Abdullah, Jumadil Saputra, and Nurul Faezah Noor Azizan

Abstract Poverty eradication is an important agenda in developing countries like Malaysia. Although the government has implemented various development programmes, the indigenous community of wellbeing level is still low compared to other communities in Malaysia. The Orang Asli community in Kampung Sungai Berua, Hulu Terengganu, rely on forest resources as their income, which is unstable and plunges them into poverty. They have to struggle to gather resources just to feed their family for the day, and the concept of saving money is almost non-existent. This study aims to identify the patterns of Orang Asli expenditure. It is based on three questions; (i) what do the Orang Asli spend on? (ii) what are their daily expenditures? and, (iii) how is the attitude of the Orang Asli towards money? This study was conducted using a qualitative method and data were collected through observations and interviews with seven respondents. Their selection was organised using the purposive sampling approach, which consisted of three merchants and the remainder being Orang Asli villagers. The findings indicated that the Orang Asli spent most of their income on food, with the balance going to transport, bills, educa-

N. Ab Manaf (✉)
Institute of Tropical Biodiversity and Sustainable Development (Bio-D Tropika), Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia
e-mail: yati.manaf@umt.edu.my

R. Abdullah
Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

Research and Publishing Centre, National Academy of Arts Culture and Heritage, Kuala Lumpur, Malaysia

J. Saputra
Faculty of Business, Economics and Social Studies, Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

N. F. Noor Azizan
Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_4

tion and communication. It was also noted that most of the Orang Asli spent all their money without allocating any for the future.

Keywords Poverty · Expenditure pattern · Savings · Orang Asli · Sustainable livelihoods · Semoq Beri

Introduction

Orang Asli are a minority in Peninsular Malaysia. According to the Orang Asli Development Department (JAKOA) under the Rural Development Ministry, the natives are divided into three main tribes, namely the Negrito, Senoi and Proto-Malays. The tribes are further divided into six sub-tribes each. The Negrito tribe consists of the Kensiu, Kintak, Lanoh, Jahai, Mendriq and Bateq, while the Senoi comprises the Che Wong, Mahmeri, Jahut, Semoq Beri, Semai and Temiar. The Proto Malays are made up of the Kuala, Kanaq, Seletar, Jakun, Semelai and Temuan people (Carey 1976). Their communities are scattered all over the peninsular, with some living in the fringe of the jungle near civilisation, while others live deep within the forests and highlands. Their occupations, cultures and beliefs vary among sub-tribes, and they even speak different languages (JAKOA 2011). In Terengganu, two aboriginal tribes may commonly be encountered, namely the Semoq Beri and Bateq, which belong to the Senoi and Negrito tribes, respectively (Ramle 2014).

Aboriginal communities are often afflicted by poverty and live a hard life. They choose to live in rural areas and practise a traditional way of life, and many have been left out from the nation's development (Ramle 2014). Based on the report by JAKOA (2014), the number of Orang Asli living in poverty in 2013 was 11,423 people out of 178,197 people. Of which, 4102 were categorised as poor and the other 7321 as extremely poor. This circumstance is brought about by numerous factors like absence of viable strategies to improve their lives, exploitation and threats to their way of living (Sabran 2003).

Poverty in Aboriginal Communities

The issue of poverty among the Orang Asli is not a new phenomenon. Previously, there were many studies conducted in relation to poverty issues of the Orang Asli (Mcgrath et al. 2006; Agostini et al. 2008). A study by Agostini et al. (2008) indicated that the poverty rate of the Orang Asli is higher than mainstream society, and there is a significant socioeconomic gap and quality of life.

The poverty issue among the Orang Asli has been studied by Jamiran et al. (2013), who directed hands-on work on the economy of the Orang Asli in Kampung Peta in the state of Johor, which is in the south of Peninsular Malaysia. They believed

that the Orang Asli is poor because of their choice to live in isolation from the rest of society. This is a similar circumstance with the Orang Asli in Terengganu state in the peninsula's northeast. In 2011, the poverty rate of the Orang Asli in the state was 32.45%, with 11.70% classified as poor and the other 20.74% as hardcore poor (JAKOA 2011). In 2014, 61 individuals were identified as living in poverty, with 22 classified as poor and 39 as hardcore poor (JAKOA 2014). Noor Zamani (1999) and Ramle (2014) identified the Orang Asli's way of life as a reason for their destitution. The natives are solitary people who do not readily embrace development and interaction with other societies, besides being reluctant to take risks.

The main source of income of the Orang Asli in Kampung Sungai Berua, Hulu Terengganu, are forest products, such as rattan (*Calamus spp*.) and dividends from palm oil companies for the use of their land (Ramle 2014). From these sources of income, this study tries to track how they spend it to satisfy their daily needs.

Literature Review

The indigenous communities live in isolated regions and some of the members still practised their traditional beliefs and lifestyle (Ramle 2014). According to Todaro (1977), development is defined as an arrangement process and reorienting of social and economic systems. This opinion is in the line with Frank (2004), which indicated that development involves a change in the structure of the economy, society, politics and culture. In addition, according to Seers (1979), development results can be seen from a decrease in poverty, unemployment and inequality. Five indicators are commonly used to measure progress among the Orang Asli i.e. poverty indicators, education achievement, occupation status, housing and facilities (Khor 1988).

In the structure of a national improvement programme, particularly for the urban network, data would be acquired for consumption design. Studying consumption trends like family expenditure is vital to improve lives in an economic sense. Family income is usually limited and will be utilised proficiently to satisfy needs and prerequisites (Masud 1982). According to Maslow's Hierarchy of Needs, people will prioritise expenditure on basic needs, for example, sustenance, clothing and housing for their family and themselves, before being able to satisfy psychological and self-fulfillment needs. This is bolstered by the study by Nordin (1976), who found that family needs, in order of importance, are nourishment, lodging, transport and clothing.

Methodology

The qualitative method had been selected to drive this research. This method was suitable for understanding a phenomenon. It delivered a form of social inquiry that focused on how to clarify an individual's belief, which was logical to their life

experiences and environment (Yeap 2000; Holloway 1997). Marshall and Rossman (1989) also stated that qualitative methods are capable of depicting and clarifying information in detail and profundity.

This inquest was planned as a case contextual investigation regarding cases that included observing individuals or units as afamily, in class, school, social network and occasions (Merriam 1998; Burn 1995; Yin 2014). The design of this research was aimed as acquiring in-depth understanding about the respondents, focusing on the process rather than the output, and accentuating new findings and not verification of the theory or outcome (Merriam 1998). This approach also reflected the real life of respondents, which depicted a detailed overview on how they interacted in life (Patton 1990). Case data included interviews details, observations, records and statements, which could be obtained from any source. Fieldwork was conducted from August 2016 to July 2017 in the Semoq Beri village of Kampung Sungai Berua in Hulu Terengganu, Terengganu state. The ATLAS.ti software Version 7 was used for qualitative analysis of data gathered from fieldwork (Lewins and Silver 2007).

Results

Socio-economic survey found that the Orang Asli in Kampung Sungai Berua earned their income through the sale of forest products like rattan and agarwood, as well as receiving dividends from oil palm plantations for the use of their land (Ramle 2014). Table 1 shows the employment details of villagers in 2017.

Furthermore, this study also found that the Orang Asli spent most of their income on rice, eggs and sugar. When buying assets such as motorcycles and cars, they usually pay cash and did not utilise loans. The pattern of the Orang Asli family expenditures are stated in Table 2.

Moreover, the purchasing patterns of the Orang Asli were mostly dependent on what the suppliers, who were willing to travel far to their village, could offer them. Sometimes, they would make orders through the suppliers if they had a specific need. This study observed the suppliers coming to the village daily between 7.30 am and 7.30 pm. Majority of the traders had been doing business with the villagers

Table 1 Semoq Beri community employment details in Kampung Sungai Berua, Hulu Terengganu, in 2017

Type of employment	Percent %
Management/administration	1.0
Agriculture	2.9
Collecting forest resources	90.4
Traditional medicine practitioner/ midwife	1.9
Unemployed	3.8
Total	100.0

Table 2 Spending habits of the Semoq Beri community in Kampung Sungai Berua, Hulu Terengganu

Matter	Description
Expenditure	Buying basic needs and assets by cash.
Buying method	Mostly paid cash in one transaction.
Items often bought	Basic food items like rice, sugar and tea, besides household items like detergent, soap and mobile phone reload cards.

Table 3 Pattern of Orang Asli expenditure gathered from interviews with suppliers

	Informant 1	Informant 2	Informant 3
Pattern of spending	Frequent buying	Frequent buying	Frequent buying
The style of buyer	Likes to buy individually	Likes to buy individually	Likes to buy individually
	Buying only for current need.	Buying only for current need.	Buying only for current need.
Buyers' attitude	Customers will purchase on credit when they don't have enough money	Customers will purchase on credit when they don't have enough money	Customers will purchase on credit when they don't have enough money
Financial education	Understands the amount of money	Understands the amount of money	Understands the amount of the money
Type of items sold	Rice with gravy, sweet drinks, fried chicken, fried bananas, tobacco, detergent and soap	Rice with gravy, fried noodles, fried chicken and sweet drinks	Rice with gravy, sweet drinks, fried chicken, fried bananas, fried fish, snacks, spices, jewellery, tobacco, phone reload cards, detergent, soap, school clothes and rice.
Item in demand	Fried chicken	Fried chicken	Detergent

since 2010. As usual, they would supply products individually to families and the average daily expenditure of the villagers was RM10.00. But that depended on how much money they had on the particular time. This study also found that the Orang Asli frequently bought breakfast and lunch instead of cooking their own meal. Table 3 describes the Semoq Beri villagers buying habits gathered through interviews with three suppliers. All respondents described a similar pattern of expenditure.

The Semoq Beri villagers in Kampung of Sungai Berua frequently lived by the day, in which they spent all their income at once. Most of them spent on food, and the remainder was used for transport, bill payments, education and mobile phone reload cards. Figure 1 shows the business activities taking place in the village.

Fig. 1 Selling and buying activities in Kampung Sungai Berua, Hulu Terengganu

Conclusion

The Orang Asli community spent most of their income on basic needs, and the balance for expenditures such as transport, bill payments, education and communication. Moreover, most of them habitually spent their income all at once without saving any for future. But some of them were observed trying to make an effort to save their money. Thus, from the results of this study, we suggest an initiative by the government to help the Orang Asli by setting up mobile financial services in their village, and encouraging the villagers to open bank or investment accounts. In addition, the government could also teach them financial planning for future endeavours. However, the most important aspect is still to uplift the economic status of the Orang Asli. In order to save money, the villagers must be given opportunities to earn decent income so they would have more purchasing power, besides surplus money to set aside as savings.

Acknowledgements This research is supported by the Trans Disciplinary Research Grant Scheme (TRGS/2015/59373) led by Professor Dr Mohd Tajuddin Abdullah. The authors appreciate the support shown by the Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu (UMT), and the Faculty of Social and Applied Sciences, Universiti Sultan Zainal Abidin (UniSZA), to undertake this study. The authors also thank the Orang Asli Development Department for permission to conduct this study.

References

Agostini, C. A., Brown, P. H., & Roman, A. (2008). *Estimating poverty for indigenous groups in Chile by matching census and survey data* (William Davidson Institute working papers series wp932). Ann Arbor: William Davidson Institute at the University of Michigan.

Burn, R. B. (1995). *Introduction to research methods*. Melbourne: Longman.

Carey, I. (1976). *Orang Asli: The aboriginal tribes of peninsular Malaysia*. Oxford University Press. Caunselling practice. Summer Intensive 2011: 1–11.

Frank, A. G. (2004). *The development of underdevelopment* (The sustainable urban development reader) (pp. 38–41). London: Routledge.

Holloway, I. (1997). *Basic concepts for qualitative research*. Oxford: Blackwell Science.

JAKOA. (2011). *Pelan strategik kemajuan Orang Asli. 2011–2015*. Kuala Lumpur: Jabatan Kemajuan Orang Asli.

JAKOA. (2014). *Bilangan kemiskinan penduduk Orang Asli mengikut negeri bagi tahun 2013*. Retrieved from http://beta.data.gov.my/data/ms_MY/dataset/jabatan-kemajuan-orang-asli-jakoa-551

Jamiran, M.N.S, Seow, T.W. & Mohamed, M. 2013. Sosioekonomi Masyarakat Orang Asli: Kajian Kes di Kampung Peta, Johor. Simposium Kebudayaan Indonesia-Malaysia, 12-14 November 2013, Universitas Padjadjaran, Bandung, Indonesia.

Khor, G. L. (1988). Malnutrition among Semai children. *The Medical Journal of Malaysia, 43*, 318–326.

Lewins, A., & Silver, C. (2007). *Using software in qualitative research: A step-by-step guide*. London: Sage.

Marshall, C., & Rossman, G. B. (1989). *Qualitative research*. Newbury Park: Sage.

Masud, J. (1982). Corak perbelanjaan dan pengurusan di kalangan beberapa keluarga melayu dan cina di Wilayah Persekutuan. *Pertanika Journal Social Science and Humanities, 5*, 45–52.

Mcgrath, N., Armstrong, R., & Marinova, D. (2006). *Reframing poverty of Indigenous Australians.* Proceedings of the Anti-Poverty Academic Conference with International Participation, Institute for Sustainability and Technology Policy, Murdoch University, Perth.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. Revised and expanded from "Case study research in education". Jossey-Bass Publishers, 350 Sansome St, San Francisco, CA 94104.

Noor Zamani, M. N. (1999). *Peranan jabatan hal ehwal Orang Asli dalam perubahan sosio-ekonomi masyarakat Orang Asli : kajian kes terhadap suku Semai di Pos Dipang, Sahom, Kampar, Perak*: Akademi Pengajian Melayu, Universiti Malaya.

Nordin, S. (1976). *Satu kajian perkembangan gaya hidup kelas menengah pentadbir*. Kuala Lumpur: Melayu Utusan Print.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. London: Sage Publications.

Ramle, A. (2014). *Orang Asli pembangunan dan transformasi*. Kuala Terengganu: Universiti Sultan Zainal Abidin.

Sabran, M. S. (2003). Model pembangunan komuniti. *Pertanika Journal Social Science and Humanities, 11*, 135–145.
Seers, D. (1979). The birth, life and death of development economics: (Revisiting a Manchester conference). *Development and Change, 10*(4), 707–719.
Todaro, M. P. (1977). *Economic development in the third world*. London: Longman Group Limited.
Yeap, K. L. (2000). Esei penyelidikan kajian kualitatif: satu pengenalan. *Jurnal Keningau, 3*, 25–27.
Yin, R. K. (2014). *Case study research design and methods* (5th ed., 282 p.). Thousand Oaks, CA: Sage. https://doi.org/10.3138/cjpe.30.1.108.

Norhayati Ab Manaf is a lecturer at Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu. Before this, she worked as Social Research Officer in this Institute from 2011. She is a Ph.D. holder in Social Anthropology. Her Bachelor's degree in Business Administration at Universiti Utara Malaysia and completed her degree in 2008. She continued her study for a Master's degree in Integrated Coastal Zone Management at Universiti Malaysia Terengganu and completed her studies in 2010. On September 2016, she registered for a Ph.D. program in the Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin. Her field of interest is Anthropology, Sociology, Indigenous Studies (Orang Asli) and Community Development.

Ramle Abdullah is a Professor at Research and Publishing Centre, National Academy of Arts Culture and Heritage, Kuala Lumpur, Malaysia. Before this he is a Professor at Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin. His expertise is in Social Anthropology and Indigenous Studies (Orang Asli).

Jumadil Saputra is a senior lecturer at Department of Economics, School of Social and Economic Development, Universiti Malaysia Terengganu. He is a Ph.D. holder in Financial Economics. He studied from the elementary school until senior high school in Aceh and finished his studies in 2003. Further, he continued his Bachelor's degree in the Faculty of Management and Economics at Malikulssaleh University and completed his degree in 2008. He continued his study for a Master's degree in Economics at Syiah Kuala University, Aceh and completed his studies in 2012. At the end of September 2013, he registered for a Ph.D. program in the Faculty of Social Development and Economics at Universiti Malaysia Terengganu, Malaysia. He is a member Indonesian Operations Research Association (IORA). His research areas are Insurance and Takaful, specifically financial economics (Islamic) and mathematics and modelling finance (Actuarial).

Nurul Faezah Noor Azizan is a masters degree holder in social sciences at Universiti Sultan Zainal Abidin. Her bachelor's degree in Anthropology and Dakwah at Universiti Sultan Zainal Abidin and completed her degree in 2013.

Part II
Sustainability of Resource Use

Sustainable Utilisation of Forest Plant Resources by the Bateq and Semoq Beri Sub-Tribes in Kelantan and Terengganu States of Peninsular Malaysia

Jamilah Mohd Salim, Suzairi Zakaria, Muhamad Razali Salam, and Mohd Tajuddin Abdullah

Abstract The Central Forest Spine (CFS) complex in Peninsular Malaysia supports two indigenous sub-tribes — the Semoq Beri and Bateq. Opportunistic ethnobotanical fieldwork and observation were conducted to document the utilisation of forest plant resources by these two tribes. More than 30 species of plants, which are used as food, ornament, herbs, alternative water source and craft, were documented. The grooming practice using plant parts is unique to the Bateq and Semoq Beri subtribes. Plant tubers (*ubi* in Malay) should be examined further for food security and conservation purposes. The consumption practices by the Orang Asli in the tropical rain forest of Kelantan and Terengganu for their livelihood are ecologically sustainable.

Keywords Orang Asli · Tropical rain forest · Ethnobotany · Sustainable livelihood · Ecological knowledge

J. Mohd Salim, PhD (✉)
Institute of Tropical Biodiversity and Sustainable Development (Bio-D Tropika), Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia
e-mail: jamilah@umt.edu.my

S. Zakaria
Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

M. R. Salam
Faculty of Science and Marine Environment, Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

M. T. Abdullah
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_5

Introduction

The east coast of Peninsular Malaysia, consisting of three states, forms the main part of the backbone of Peninsular Malaysia, which also fall within the Central Forest Spine (CFS) forest complex (Fig. 1). Conservation of the CFS is initiated by The United Nations Development Programme (UNDP) and Global Environment Facility (GEF), with cooperation from the Malaysian government, to protect the country's biodiversity and ecosystem services. It also focuses on providing a basis for ecological linkages and connectivity of the forests fragmented by plantations and development. This pristine forest complex supports the main watershed (providing 90% of the country's water supply) and harbours the remaining population of the threatened but iconic Malayan tiger (UNDP 2017).

Besides providing numerous essential ecosystem services, the primary forests in the CFS complex also supported the existence of three indigenous tribes, or Orang Asli, in Peninsular Malaysia, specifically the Senoi, Proto-Malay and Negrito as shown in Fig. 1. The Negrito, or Semang, is the earliest and smallest indigenous tribe in Malaysia, known to be living in isolation, and mainly scattered in the northern and middle parts of the peninsula. Most of them are concentrated in the highlands of Kelantan and Terengganu state. The Bateq is a sub-tribe of the Negrito, and they inhabit remote areas in northern Pahang, western Terengganu and southern Kelantan. Another sub-tribe is the Semoq Beri of the Senoi tribe, who live in the state border of Pahang and Terengganu. Some of them lead a nomadic lifestyle and forage for food in nearby forests. It is reported that this community had migrated to Terengganu as early as 1897, coinciding with early British occupation of Peninsular Malaysia (Roslina 2017).

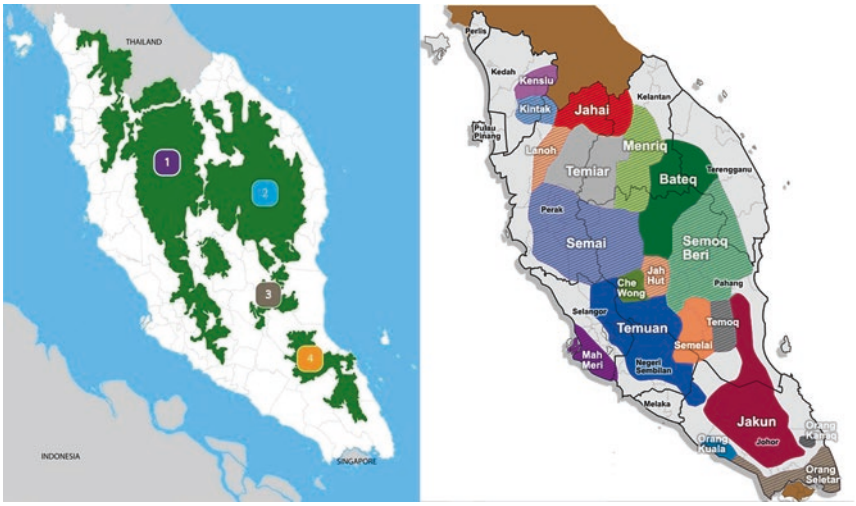

Fig. 1 The map of the Central Forest Spine complex in Peninsular Malaysia is overlaid with the distribution of indigenous tribes in Peninsular Malaysia in red outline. Three Orang Asli settlements in Terengganu are marked with stars. The map is modified from a UNDP Project Document: Central Forest Spine and Gomes (2004)

Fig. 2 The Orang Asli settlement in Sungai Berua, Hulu Terengganu, with houses (left) and a school football field for sport (right)

In Terengganu, there are three major Orang Asli settlements, namely Kampung Sungai Pergam (Kemaman district), Kampung Sungai Berua (Hulu Terengganu district, near Tasik Kenyir, the largest man-made lake in Southeast Asia) and Kampung Sungai Sayap (Hulu Besut district, upnorth of Terengganu) (Fig. 1). Kampung Sungai Berua was established in 1977 to provide a permanent settlement for the Semoq Beri and Bateq communities living near the Kenyir forest complex during the construction of the Sultan Mahmud hydroelectric dam (Fig. 2). This settlement is nestled within more than 50 hectares of oil palm estates managed by the Federal Land Consolidation and Rehabilitation Authority (FELCRA), meant to support a settlement of 330 villagers (JAKOA 2009). Currently, Kampung Sungai Berua has a population of about 530–550 people from the Bateq and Semoq Beri tribes, consisting of 80 men and 53 women (Abdullah et al. 2016; JAKOA 2015). The village comprise 60 brick houses with zinc roofing, a primary school, kindergarten, clinic, mini mosque, community hall and two units of government quarters, which are all equipped with clean water and electricity supply. Various basic services are also provided there, including healthcare, maternity and infant care, dental care, security, education and communication facilities. Another population of Orang Asli, mostly the Bateq sub-tribe, live inside a national park in Kelantan, specifically in Kuala Koh. Although located more than 150 km apart, the Bateq and Semoq Beri in these two villages are well-connected, and members of both communities have been known to travel on foot between two sites. Some of the villages are related through marriage.

This paper aims to document the utilisation of unusual minor plant resources by the Bateq and Semoq Beri. We are hopeful that this effort will highlight the significance of those minor plant resources and the strong cultural and spiritual connections between these tribes with their ancestral forests and ecosystems in Terengganu and Kelantan.

Data Collection and Documentation

The data and images of plant resources presented in this study were based on ethnobotanical work conducted opportunistically during cultural and spiritual events in 2009 and 2015. Documentation was carried out by capturing good quality

photographs and taking notes on resource utilisation through direct interviews and fieldwork. Forest visits were conducted concurrently with the onset of fruiting or flowering seasons of those particular plants. The documentation was mostly based in Kuala Koh, Kelantan, and each visit was conducted opportunistically by following the Bateq in their foraging activities. Some of the plant resources were also available in the forests of Kenyir and used by both tribes. The utilisation of plant resources was confirmed with Semoq Beri villagers in Kampung Sungai Berua and Kuala Koh. The plant species were identified in situ if possible, but further identification was confirmed by referring to Kiew et al. (2011, 2012, 2013) and an online database provided by the Forest Research Institute of Malaysia (FRIM), the Malaysia Biodiversity Information System (MyBIS 2015). Only selected examples of minor plant resources were presented here as an effort to highlight how the Bateq and Semoq Beri relied on these minor forest resources.

Dependency of Orang Asli on Forest Resources

Although indigenous community resettlement were gaining momentum and being enforced by the government of Malaysia, the dependency of the indigenous community on forests, their ecosystem and resources was still strong. This was not only supported by the observations in this study, but other studies as well (Amjad et al. 2017; Khaled et al. 2016; Rasethe et al. 2013). The forests were vital to the lives of indigenous people, and they were not only in terms of harvesting tangible products like *gaharu* (agarwood), rattan and animals for trade and consumption. They also carried intangible benefits that sustained the existence of the Orang Asli culture, heritage and lifestyle (Abdul-Hamid and Gan Christopher 2012). Although facilities provided in villages were adequate in supporting their basic needs, their connection with the forests still remained strong. A study conducted in their resettlement areas indicated that the majority of the Orang Asli still preferred to return and spend time in the forests (Jamalunlaili et al. 2016).

Because of their strong dependency on forests, issues related to the Orang Asli were usually ignored. Legally, the indigenous communities of Malaysia had the right to collect minor forest products for their own utilisation through the Aboriginal Peoples Act 1954, but this permission was regulated by the Forestry Act 1935, whereby the Forestry Department would monitor their collection activities. This was meant to avoid manipulation of the Orang Asli by outsiders and prevent the over-collection of forest resources.

Utilisation of Forest Resources by the Bateq and Semoq Beri

Bateq and Semoq Beri tribes utilised forest resources for food, water and medicinal herbs, besides making ornaments and handicraft (Table 1). Few examples of fruits used by the Bateq and Semoq Beri were wild variants of domesticated fruits, such

Table 1 Selected minor forest plant resources utilised by the Bateq and Semoq Beri tribes in Kelantan and Terengganu, Peninsular Malaysia

	Bateq/Malay local name[a]	Scientific name (Family)	Type of plant; use
Food/fruit	*Tawes*	*Artocarpus* sp. (Moraceae)	Tree; seed with aril, which is boiled and eaten
	Bakong/ Cempedak liar	*Artocarpus* sp. (Moraceae)	Tree; seed with very thin aril, which is boiled and eaten
	Ubi Woh	NA	Climber
	Ubi Takop	NA	Climber; a traditional staple which is roasted and eaten before being replaced by rice
	Ubi Cengel/Ubi Pasir	NA	Climber; grows near rivers, with latex in tuber
	Jabong	*Baccaurea* sp. (Euphorbiaceae)	Tree; fruits on upper part of stem
	Setambun Bagol	*Baccaurea* sp. (Euphorbiaceae)	Tree; fruits on lower part of stem
	Tawong	*Hodgsonia macrocarpa* (Cucurbitaceae)	Gourd; cotyledons eaten by cooking or roasting
	Rambutan liar	*Nephelium* (Sapindaceae)	Tree; fruits with sweet-sour aril
	Balong	*Nephelium* (Sapindaceae)	Tree; fruits with sweet-sour aril
	Durian Daun	*Durio* sp. (Bombacaceae)	Tree; thorny fruit is peeled and the flesh may be eaten
Ornaments in grooming	*Tenlang*	Fabaceae	Tree; flower used as head and/or hand band
	Tapak kuda	*Bauhinia* sp. (Caesalpiniaceae)	Tree; flower use as head and/or hand band
	Akar Kait	NA	Tree; flower use as head and/or hand band
	Bunga Waq	NA	Tree; flower use as head and/or hand band
	Cembeng/ Mempisang	*Polyalthia* sp. (Annonaceae)	Tree/shrub; flower use as head and/or hand band
	Nyarum	Rubiaceae	Shrub/tree; flower use as head and/or hand band
	Kapih/Gapis	*Saraca cauliflora* (Fabaceae)	Tree; riverside tree, flower use as head and/or hand band
	Bunga Emping		Shrub; flower use as head and/or hand band and the most fragrant of all flowers used in grooming
Herbs	*Napir/Leban/ Kacip Fatimah*	*Labia pumila* (Myrsinaceae)	Herb; leaves crushed and mixed in water for bathing newborns

(continued)

Table 1 (continued)

	Bateq/Malay local name[a]	Scientific name (Family)	Type of plant; use
	Patah Sayap	NA	Herb; used to treat dislocations, dry material soaked in oil for massaging dislocated part
	Akar Sikang	NA	Woody climber; cooling effect of red exudate, which is harvested in the morning to ensure higher concentration
	Jeel	NA	Shrub; shoot and young leaves are used to treat worm infestation in children
	Akar Makuk/ ginseng Malaysia	NA	Woody climber; root and bark used to enhance female fertility
	Daun Cucuh	NA (Arecaceae)	Palm; leaf used to make the roofs huts, mats and other knitted products.
Water source	*Akar Derian*	NA	Woody climber; stem is cut and water is collected in bamboo containers (Buluh Padi)
Craft	*Mengkuang Bukit*	*Pandanus* sp. (Pandanaceae)	
	Kercut	*Lepironia articulata* (Cyperaceae)	Aquatic sedge; whole culm is processed for craft work
	Buluh Padi	*Bambusa* sp. (Poaceae)	Bamboo; material for building rafts to fish or travel along rivers
Dart poison	*Ipoh*	*Antiaris toxicaria* (Moraceae)	Tree; exudate used to prepare the poison of blowpipe darts

NA (Not available): Remarks plant scientific name is not able to be determined yet at the time of submission of this manuscript

[a]Local name given by the Bateq/Semoq Beri in their dialect, some are similar to Malay names. (NA = data or information are not available.

wild jackfruit (*Artocarpus* spp., Moraceae), rambutan (*Nephelium* spp., Sapindaceae), durian (*Durio* spp.) and rambai (*Baccaurea* spp., Moraceae) (Fig. 3). Apart from fruits, seeds or parts of the seed were eaten, either raw or cooked, such as the *Hodgsonia macrocarpa* (Cucurbitaceae) (Fig. 3).

The daily activities of the Bateq sub-tribe in Kuala Koh appeared to be very simple, but were strongly associated with the forest. Bateq men commonly went into the forest as early as dawn to hunt or search for in-demand resources, like agarwood (*chandan* and *gaharu*) and plant roots with medicinal properties, such as *ubi jaga* (*Smilax* spp.), *tunjang bumi* or *Tongkat Ali* (*Eurycoma longifolia*), Kacip Fatimah (*Labisia purmila*) and *hempedu bumi* (*Andrographis paniculata*). They also looked for *Areca* leaves (*daun cucuh*) to make roofs for their huts (Fig. 4). The hunting activities could last several days. Sometimes, the hunters would spend the night in the forest before continuing for another day or two. If the men did not go into the forest, they would usually spend their time preparing their hunting equipment and making poison for blowpipe darts (Fig. 4).

Fig. 3 (Top) A Bateq woman harvesting wild fruits known as jabong (*Baccaurea* sp.); (middle) edible seeds of *Hodgsonia macrocarpa* (cucurbitaceae); and, (bottom) a Bateq woman showing the tawes or wild jackfruit

While men hunted or searched for upper-end plant resources, Bateq or Semoq Beri women fish or forage for food and plants for other uses. Fishing was done by moving along a nearby river and it would sometimes take the whole day. They would return home only in the evening to prepare meals for their families. Foraging in the forest occured daily (Fig. 5), and the harvesting of plant products was greatly influenced by season and availability. For leisure, the women spend time making handicraft and ornaments which they could use at home, such as a bamboo comb (*sikat buluh*). Sometimes, the women also knitted mats and and hats from *Areca* leaves (*daun cucuh*) collected by the men.

Fig. 4 (Left) A Bateq woman processing palm leaves collected from the forest for hut maintenance and roof replacement and (right) a Bateq man preparing poison for blowpipe darts

Fig. 5 Foraging by the Bateq in Kuala Koh, Kelantan

Among the most sought-after plant food by Bateq women were tubers (*ubi* in Malay). The women of Bateq or Semoq Beri were responsible for collecting *ubi*, which used to be a staple before being replaced by rice. *Ubi* could be a tuber or root of forest plants, commonly a climber species (woody or non-woody) (Table 1). A few examples of tubers largely sought after were ubi woh, ubi takop and ubi cengel or ubi pasir (Fig. 6). Ubi takop was the sub-tribe's staple long before rice. The tuber wast prepared by grilling over a fire. The harvesting of tubers often involved deep excavation of the soil and the taste could range from sweet to bitter. However, this food was among the most promising source for their survival and deserved to be conserved and investigated further. The utilisation of tubers and other food plant resources by the Bateq and Semoq Beri were strongly guided by traditional or indigenous knowledge inherited from their ancestors. This gave them the ability to differentiate between edible and poisonous parts of plants and animals.

Fig. 6 The harvesting plant tubers by Bateq women in Kuala Koh, Kelantan. *Ubi woh* (top row), *ubi cengel* (middle row) and *ubi takop* (bottom row)

Another significant leisure activity of Bateq women was the collection of in-season flowers, leaves or vines to be used as head, neck or wrist ornaments and accessories. This was related to the uniqueness of the Bateq sub-tribe in practising their "grooming", and it was not only restricted to women. Among the plants commonly used for grooming were tenlang (Fabaceae), akar kait, bunga wak and gapis (*Saraca cauliflora*) (Table 1) (Fig. 7).

An example of ecological knowledge was reflected in how these two tribes sourced drinking water in the jungle (Fig. 8). Clean drinking water could be obtained by tapping the *akar derian* trees and extracting it into bamboo containers. The indigenous communities of Malaysia were recognised for their broad traditional knowledge in forest resources and survival skills (Kardooni et al. 2014), and these

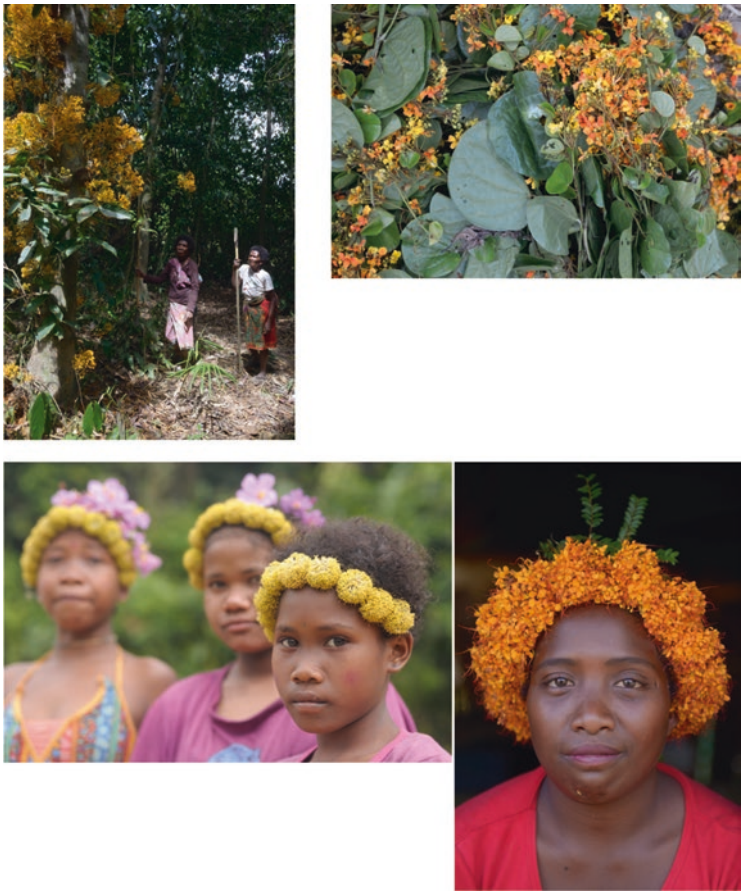

Fig. 7 The grooming of Bateq women using plant resources; (left, top row) Gapis flower (*Saracca cauliflora*); (right, top row) the *Bauhinia* sp. flower; (left, bottom row) girls wearing *akar kait* flower headbands; and, (right, bottom row) a woman wearing a headband made of *gapis* flower

knowledge could play a role in the conservation of forests, which sustained the indigenous tribes (Nimachow et al. 2011).

Conclusion

Tropical rainforest plant utilisation by the Bateq and Semoq Beri sub-tribes could encourage more research on the importance of forests to the indigenous people, their traditional knowledge and the potentials of a "natural hypermarket". Forest plant sources deserve more scrutiny so that these valuable species may be conserved. In general, the utilisation of forest resources by the Bateq and Semoq Beri

Fig. 8 A Bateq woman collecting drinking water by tapping the *akar derian* and collecting the water in bamboo containers

in Kenyir and Kuala Koh is carried out in a sustainable manner according to their traditional knowledge.

Acknowledgements The study is supported by the Trans-disciplinary Research Grant (TRGS/2015/59373). The authors wish to thank the Forestry Department, Wildlife and National Parks Department, Forestry Department, Terengganu State Park Management Council, KETENGAH and JAKOA for permission and cooperation to conduct this study in the forests and Orang Asli villages.

References

Abdullah, M. T., Abdullah, M. F., Bartholomew, C. V., & Jani, R. (2016). *Kelestarian masyarakat Orang Asli Terengganu*. Kuala Terengganu: Penerbit Universiti Malaysia Terengganu.

Abdul-Hamid, M. I., & Gan Christopher, E. C. (2012). Valuing orang asli dependency on forest: A Malaysian case. *International Journal of Ecology and Development, 23*, 1–24.

Amjad, M. S., Qaeem, M. F., Ahmad, I., Khan, S. U., Chaudhari, S. K., Zahid Malik, N., Shaheen, H., & Khan, A. M. (2017). Descriptive study of plant resources in the context of the ethnomedicinal relevance of indigenous flora: A case study from Toli Peer National Park, Azad Jammu and Kashmir, Pakistan. *PLoS One, 12*(2), e0171896. https://doi.org/10.1371/journal.pone.0171896.

Gomes, A. G. (2004). Orang Asli of Malaysia. *IAAS Newsletter, 35*, 10.

JAKOA. (2009). *Laporan Tahunan 2009, Jabatan Kemajuan Orang Asli (JAKOA)*. Kuala Lumpur: Jabatan Jabatan Kemajuan Orang Asli.

JAKOA. (2015). *Laporan Tahunan 2015, Jabatan Kemajuan Orang Asli (JAKOA)*. Kuala Lumpur: Jabatan Jabatan Kemajuan Orang Asli.

Jamalunlaili, A., Nazura, M. S., Afiza Azura, M. A., & Mohd Ruzed, E. (2016). Living conditions in orang asli resettlement project (PROSDET) of Pantos, Pahang, Malaysia. *Procedia – Social and Behavioral Sciences, 222*, 143–150.

Kardooni, R., Kari, B. F., Yahaya, S. R., & Yusuf, S. H. (2014). Traditional knowledge of Orang Asli on forests in Peninsular Malaysia. *Indian Journal of Traditional Knowledge, 13*, 283–291.

Kiew, R., Chung, R. C. K., Saw, L. G., Soepadmo, E., & Boyce, P. C. (Eds.). (2011). *Flora of Peninsular Malaysia. Series II: Seed plants. Vol. 2. Malayan forest records no. 49*. Kepong: Forest Research Institute Malaysia.

Kiew, R., Chung, R. C. K., Saw, L. G., Soepadmo, E., & Boyce, P. C. (Eds.). (2012). *Flora of Peninsular Malaysia. Series II: Seed plants. Vol. 3. Malayan forest records no 49*. Kepong: Forest Research Institute Malaysia.

Kiew, R., Chung, R. C. K., Saw, L. G., Soepadmo, E., & Boyce, P. C. (Eds.). (2013). *Flora of Peninsular Malaysia. Series II: Seed plants. Vol. 4. Malayan forest records no 49*. Kepong: Forest Research Institute Malaysia.

Khaled, M. S., Fatimah, K., & Azmah, O. (2016). Income dependency on non-timber forest products: An empirical evidence of the indigenous people in Peninsular Malaysia. *Social Indicators Research, 135*, 215–231.

Malaysia Biodiversity Information System (MyBIS). (2015). *Ministry of Natural Resource and Environment*. Retrieved from https://www.mybis.gov.my/one/

Nimachow, G., Joshi, R. C., & Dai, O. (2011). Role of indigenous knowledge system in conservation of forest resources-a case study of the *Aka* tribes in Arunachal Pradesh. *Indian Journal of Traditional Knowledge, 10*, 276–280.

Rasethe, M. T., Sebua, S. S., Potgieter, M. J., & Maroyi, A. (2013). The utilization and management of plant resources in rural areas of the Limpopo Province, South Africa. *Journal of Ethnobiology and Ethnomedicine, 9*, 1. https://doi.org/10.1186/1746-4269-9-27.

Roslina, I. (2017). *Tasik Kenyir: Cultural heritage of indigenous community*. Kuala Terengganu: Penerbit Universiti Malaysia Terengganu.

UNDP. (2017). *Project document: Improving connectivity in the Central Forest Spine, Malaysia*. Retrieved from http://www.my.undp.org/content/malaysia/en/home/operations/projects/environment_and_energy/improving-connectivity-in-the-central-forest-spine%2D%2Dcfs%2D%2Dlandsca.html

Jamilah Mohd Salim is a Associate Professor in Forest Ecology, as well as a Research Fellow attached to the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu (UMT). Her research mainly focuses on the coastal vegetation in the east coast of Peninsular Malaysia. She has published her research findings in various journals, books and chapters in a book.

Suzairi Zakaria is a freelance and self-trained photographer, where he seriously focuses into nature photography since 2004. Motivated by his strong interest in plants and deep appreciation towards biodiversity and nature, he learned plant taxonomy and systematic botany from various reknown professors and taxonomists from Malaysia and worldwide, mostly using online communication. He shares his 'soulful' images of plant and nature with the larger public via social media. He always post an impactful message to his followers to support nature and biodiversity conservation. He has a special connection with the Bateq and Semoq Beri tribes in Malaysia. He is now appointed as a Citizen Scientist in Faculty of Science and Marine Enviornment, University Malaysia Terengganu (UMT).

Muhamad Razali Salam is a senior field botanist and laboratory technician in Universiti Malaysia Terengganu (UMT). He is jovially known as Wak Salam among his colleagues and university students for his Javanese blood. He is highly motivated employee and has a vast experience in describing and naming plants through various floristic surveys and botanical expeditions. He has published his work in journals, books and book chapters. He has also awarded with various recognition from the university and the goverment for his works.

Mohd Tajuddin Abdullah, PhD is a professor and was the former Director of the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu (UMT). He has conducted his fieldworks in Malaysia, Indonesia and Thailand with a broad interest in biodiversity, biogeography, molecular ecology, mammalogy, park and wildlife conservation. Recently, he received the best zoological and ecotourism book awards in the Malaysia National Book Award 2017 and 2019 respectively. He has published about 100 indexed journal manuscripts and co-edited nine books, two of which by Springer Nature Publisher. Currently, he is an active independent researcher affiliated to the Academy of Sciences Malaysia of which he is a fellow and a new found hobby as a YouTuber (Taj Abdullah).

A Study of Wild Mushrooms Utilised for Food and Medicine by the Orang Asli Communities of Sungai Berua, Terengganu

Harizah Nadiah Hamzah and Aqilah Mohammad

Abstract The traditional knowledge on the utilisation of wild mushrooms by the Orang Asli in Kampung Sungai Berua, Hulu Terengganu, in Terengganu state of Peninsular Malaysia has yet to be documented. Therefore, a study was conducted to identify the mushroom species consumed as food and used as medicine, besides documenting the traditional knowledge of the Orang Asli in Kampung Sungai Berua. Information was gathered through interviews, observations, mushroom collection and laboratory analysis. A total of 11 mushroom species were recorded, where nine species, namely *Auricularia auricula- judae*, *Clavulina* sp., *Lentinus* sp., *Schizophyllum commune*, *Termitomyces heimii*, *Termitomyces microcarpus*, *Panus giganteus, Hygrocybe conica* and *Cookiena* sp., were utilised as food. Three species, namely *Lignosus rhinoceros, Pycnoporus* sp. and *Cookeina* sp., were utilised for medicinal purposes. Although wild mushrooms are not the main source of food in the daily lives of the Orang Asli, their occurrence is much anticipated by the villagers, and their utilisation is part of the traditional knowledge that has been passed down for generations.

Keywords Wild mushrooms · Food · Medicine · Orang Asli · Terengganu · Traditional knowledge

H. N. Hamzah
Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

A. Mohammad (✉)
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia
e-mail: aqilahmohammad@umt.edu.my

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_6

Introduction

Malaysia has approximately 3.5 million indigenous people, which is 12% of the total population (Kardooni et al. 2014). Locally known as "Orang Asli", the indigenous people in Peninsular Malaysia make up approximately 0.6% of the population. They can be classified into three major tribes, namely the Negrito, Senoi and Proto-Malay, based on linguistic, physical and anthropological characteristics (Aghakhanian et al. 2015). Each tribe is made up of several sub-tribes. For the Negrito, there are the Kensiu, Kintak, Lanoh, Jahai, Mendriq and Bateq sub-tribes, among others. Meanwhile, the Temiar, Semai, Semoq Beri, Jahut, Mah Meri, Che Wong are the sub-tribes of Senoi, while the Kuala, Kanaq, Seletar, Jakun, Semelai, Temuan are the sub-tribes of Proto-Malay. The Orang Asli communities are scattered around the peninsula and most of them are found in the outskirts and forests in Kelantan, Terengganu, Pahang, Selangor, Kedah, Perak, Johor and Negeri Sembilan (JAKOA 2016).

There are records of wild mushrooms being utilised by the Orang Asli and other rural communities for various purposes, including food and medicine (Chin 1981, 1988; Christensen 2002; Chang et al. 2005; Lee and Chang 2007; Lee et al. 2009). Wild mushrooms are macrofungi, or large fungi, found on trees or the ground of forest floors, that have unique fruiting bodies (Mueller et al. 2007). Wild mushrooms mostly belong to two of the most common phyla, the Basidiomycota, which can grow above the soil surface (epigeous), and Ascomycota, which grow below the soil surface (hypogeous). It has been recorded that there are 1000 species of edible wild mushrooms, and they are collected in 80 countries for food or trade (Boa 2004; Semwal et al. 2014). However, no records have been documented in the east coast of Peninsular Malaysia, including Terengganu and Kelantan. Thus, this study was conducted with the objectives of identifying the wild mushroom species and documenting the traditional knowledge on the utilisation of wild mushrooms for food and medicine by the Orang Asli in Kampung Sungai Berua, Hulu Terengganu, in Terengganu state of Peninsular Malaysia.

Materials and Methods

The study was conducted at Kampung Sungai Berua, Hulu Terengganu (5°4′49.79″N, 102°53′2.85″E), which is located 18 km from Kuala Berang town. The village was established in 1977 by the Orang Asli Development Department (JAKOA) under the Rural Development Ministry (Appendix 1). Permission to access the village was obtained from JAKOA. The villagers mainly comprised the Semoq Beri and Bateq subtribes. A qualitative approach and in-depth interviews were carried out to collect data on the species and traditional knowledge on wild mushrooms. The interviews were conducted individually, as shown in Fig. 1a, or in groups, as shown in Fig. 1b, with further hands-on discussions with the communities using semi-structured

Fig. 1 Interviews with Kampung Sungai Berua villagers are conducted in two ways; (**a**) individual and (**b**) group discussions

questionnaires, along with photos of edible mushrooms in Malaysia. Any specimen available during the survey was collected and brought to the laboratory for further identification. The morphological aspects of the collected mushrooms, such as shape, colour, cap, gills and stipe, were described by referring to a local guide for fungi, such as those by Lee et al. (2012), Pegler (1997), Zainuddin et al. (2010) and Thi et al. (2012).

Results and Discussion

A total of 20 respondents, comprising 12 men and eight women with experience of collecting wild mushrooms and/or using them for food and/or medicinal purposes between age 30 and 70, were chosen in this study. Knowledge-wise, the women were likely better in identifying mushrooms compared with the men. The women of this community were often observed foraging in the nearby forest for edible resources, including wild plants, seasonal fruits and vegetables, including mushrooms and ferns. They would spend hours in the forest and return to prepare meals for the family. On the other hand, men normally explored deeper into the forest for days to collect herbs, agarwood (gaharu and chandan) and wild mushrooms, if they came across the fruiting bodies.

From this study, we were able to document 11 species of wild mushrooms belonging to 10 genera. A total of nine species of wild mushrooms are consumed as food, namely *Auricularia auricula-judae, Clavulina* sp., *Lentinus* sp., *Schizophyllum commune*, *Termitomyces heimii*, *Termitomyce microcarpus*, *Panus giganteus, Hygrocybe conica* and *Cookeina* sp. Three species were utilised as medicine, namely *Cookeina* sp., *Pycnoporus* sp. and *Lignosus rhinocerus*. *Cookeina* sp. was the only species utilised as both food and medicine. Most of the species recorded were under the phylum Basidiomycota and only one species (*Cookeina* sp.) was under the phylum Ascomycota. Studies by Wasser (2002) found that Basidiomycetes

Table 1 Details of wild mushrooms utilised by the indigenous community in Kampung Sungai Berua, Hulu Terengganu

Family/Scientific name	Modes of utilisation	Vernacular name	Fungi characteristics
Auriculariaceae *Auricularia auricula- judae* (bull.) Quel.	Food	*Kulat telinga kera, Kulat telinga beruk, Kulat gelebe, Kulat teng tadik, Kulat kayu.*	It is known by many names, such as the Judas ear, Jew ear, jelly fungus, and *kulat telinga kera*; (in Malay). *Auricula* is a Latin word that means ear, and *Judae* means Judas. The outer surface of the lobed fruiting body is brownish and the surface is smooth. It has a chewy texture. It grows on decaying hardwood, stick and logs. It grows throughout the year after rain. The indigenous communities cook the mushroom with curry (soup) or by stir-frying it (with anchovies/canned sardines/forest vegetables).
Clavariaceae *Clavulina* sp.	Food	*Kulat merbau*	It's a coral-like mushroom, is white and yellow in colour, and has thick, smooth and sharp points. It changes colour from grayish to brownish when dried. In Kampung Sungai Berua, this mushroom is cooked with anchovies, canned sardines or fish. The mushroom is boiled first before being added to a dish. However, it is hard to find because it grows on the ground near the "merbau" tree (*Intsia palembanica*), which is why it is called *kulat merbau*.
Polyporaceae *Lentinus* sp.	Food	*Kulat sepah tebu, Kulat tepah tebu, Kulat lidah katak*	The mushroom is white and eaten when it is still a young fruiting body as it is tough when matured (Fig. 2a). This mushroom can be found on dead branches. It is sometimes cooked in soup (with anchovies/sardines/forest vegetables). Sometimes, it is stir-fried with other vegetables, like wild young ferns and *pokok tepus* (*Amomum* spp.).
Lignosus rhinocerus (Cooke)	Medicine	*Kulat susu harimau*	It is widely known as a medicinal mushroom (Fig. 2b). It is known as the Tiger's Milk. It is prepared by thinly slicing and boiling the sclerotium (the part with more medicinal value) is. The boiled water is used for treating sore eyes, itchy skin, asthma, stomachache and fever.
Hygrophoraceae *Hygrocybe conica*	Food		The cap is yellow to orange in colour. It is sharply conical when young, but will expand to being broadly conical or broadly convex when matured. The gill colour is yellowish. The stem is yellowish to orange-yellowish in colour, and the base is white. The stem is dry and fragile, its surface is fibrillose, and it is hollow with no volva. It is prepared similar to other species: It is stir-fried with anchovies or canned food (sardines).

(continued)

Table 1 (continued)

Family/Scientific name	Modes of utilisation	Vernacular name	Fungi characteristics
Sarcoscyphaceae *Cookiena* sp.	Food Medicine		This mushroom is called the bowl mushroom or cup mushroom because of its cup-like shape, and it is furry. It can be found on decaying wood at moist and undisturbed areas. It is utilised as food and medicine. As food, it is stir-fried with anchovies and *daun kesing*. As medicine, the fruiting body is boiled and drunk to cool fevers.
Lyophyllaceae *Termitomyces heimii* Natarajan	Food	*Kulat tahun*	In Malaysia, the *Termitomyces heimii* is one of the *Termitomyces* spp. that is commonly encountered in the wild and is considered a delicacy (Vikineswary et al. 2007; Abd Malek et al. 2012). It is scattered on the ground once a year, and the indigenous communities call it *kulat tahun*. Local communities call it *kulat busut* or *kulat pusu* because it grows near termite nests. It has a large fleshy agaric fruit body with a whitish cap, broad greyish brown umbonate, pale pinkish gills, long stipe with annulus and pseudorhiza. This mushroom is prepared by cutting it into smaller pieces, then boiled with water and mixed with anchovy or canned food (sardines or coconut milk and curry powder).
Termitomyces microcarpus (Berk. & Broome) R. Heim	Food	*Kulat bintang, Kulat babi, Kulat bebe*	This mushroom belongs to the same genus as the *Termitomyces heimii*. However, it is medium in size. It has a fleshy agaric with whitish cap and gills, acute umbonate and small to long central stipe without a pseudorhiza. Like the *T. heimii*, this mushroom is prepared by cutting it into smaller pieces, then boiled with water and mixed with anchovies or canned food (sardines)/curry.
Pycnoporus sp.	Medicine		This is a kind of hard bracketed fungi that is orange to red in colour and it grows on decaying wood. The fruiting body is stalkless and hard. It is utilised as medicine for itchy skin. The flesh is teased and the dust is rubbed to the itchy skin.
Panus giganteus	Food		The flesh is light cream in colour, and is thick in the centre of the pileus, as well as thin, fleshy, firm and rather succulent, becoming tougher in the stem and pileus. The centre of the flesh and the stem of the mushroom are brownish in colour. It grows on the ground, mostly solitary but sometimes in groups, and apparently on dead roots. The fruiting body of this species is found to have a high level of carbohydrates, dietary fibre, potassium, phenolic compounds and triterpenoids (Acton 2012). This species is prepared by stir frying it with anchovies or canned sardines.

(continued)

Table 1 (continued)

Family/Scientific name	Modes of utilisation	Vernacular name	Fungi characteristics
Schizophyllaceae *Schizophyllum commune* Fr.	Food	*Kulat sisir*	It grows on the dead bark of rubber trees or oil palm fronds. It has a fan-shaped fruit body. It can be found throughout the year after raining. The dried mushroom is soaked into the water before it is ready to be cooked. Normally, it is stir fried (mixed with anchovies/ canned sardines/forest vegetables).

Fig. 2 Wild mushrooms utilised by villagers of Kampung Sungai Berua, (**a**) *Lentinus* sp. and (**b**) *Lignosus rhinocerus* (Tiger's milk mushroom)

mushrooms represented an unlimited source of therapeutic value, among them being potential anti-cancer characteristics.

In terms of utilisation for food (Table 1), none of the wild mushrooms were eaten raw. Typically, the mushrooms were shredded and washed. They were then mixed with curry and anchovies, canned food (sardines) or other vegetables. The mushrooms contained 90% water and 10% dry matter, of which between 27% and 48% were protein, less than 60% were carbohydrates, and between 2% and 8% were lipids (Crisan and Sands 1978; Thatoi and Singdevsachan 2015). They were highly nutritious and could be compared to eggs, milk and meat (Oei 2003; Kulshreshtha et al. 2014). By utilising mushrooms, the Orang Asli communities consumed food

that could help prevent malnutrition. Apart from food, they also had therapeutic uses. Their potential anti-cancer characteristics were believed to promote positive factors and eliminate negative factors from the body, and thus, could be regarded as the fourth principal form of conventional cancer treatment (Yang et al. 1993: Wani et al. 2010). Wild edible mushrooms provide good nutritional values to the indigenous communities besides plants, herbs and animals.

The opening of oil palm plantations had caused the loss of many wild mushroom species, and it getting harder for the Orang Asli to find them unless they ventured deep into the forest. Besides, fungi might also be sensitive to changes in physical and chemical properties of the soil caused by logging, such as compaction, loss of organic carbon and other labile nutrients and decreased water infiltration (Hartmann et al. 2012; McGuire et al. 2015). Mushrooms needed a moisture humidity level of between 95% and 100%, and a substrate moisture level of between 50% and 75% to grow (Miles and Chang 2004). This traditional knowledge was important and needed to be preserved and recorded. It was also important to study the mushrooms in terms of their chemical composition and nutritional values, as they benefited the consumers, especially the Orang Asli communities that consumed the wild mushrooms. The study of their traditional knowledge was important not only as a reference, but for understanding the chemical and nutrition values of the mushrooms as well.

Conclusion

This study documents 11 species of wild mushrooms utilised by the Orang Asli in Kampung Sungai Berua, Hulu Terengganu, for food and medicine. A total of nine species were consumed as food, namely, *Auricularia auricula-judae, Clavulina* sp., *Lentinus* sp., *Schizophyllum commune*, *Termitomyces heimii*, *T. microcarpus*, *Panus giganteus, Hygrocybe conica* and *Cookeina* sp. Three species were utilised as traditional medicine, namely, *Pycnoporus* sp., *Cookeina* sp. and *Lignosus rhinocerus*. From this study, the connection between mushrooms and humans could be reflected by the relationship between mushrooms and the Orang Asli. Thus, it is important to document the traditional knowledge on the utilisation of wild mushrooms by the Orang Asli in Kampung Sungai Berua before they were lost to time. Further studies on the chemical composition and nutritional contents were required to prove that the wild mushrooms contained health benefits.

Acknowledgements This research is supported by the Higher Education Ministry and Universiti Malaysia Terengganu research grant (RAGS2014 Vot No: 57116). The authors extend their gratitude to JAKOA, KETENGAH, Terengganu State Park Management Council and Forestry Department for their cooperation and the permission to carry out this study. Special thanks also go to Khairul Abrar Abdul Rahman and Muhammad Abdullah Ibrahim for their help during this study.

Appendix

Appendix 1 Facilities at Kampung Sungai Berua (**a**) Houses (**b**) Clinic (**c**) JAKOA Office (**d**) Primary school (**e**) Ritual Place (**f**) Prayer room

References

Abd Malek, S. N., Kanagasabapathy, G., Sabaratnam, V., Abdullah, N., & Yaacob, H. (2012). Lipid components of a Malaysian edible mushroom, *Termitomyces heimii* Natarajan. *International Journal of Food Properties, 15*, 809–814.

Acton, Q. A. (2012). *Issues in biologicals, therapist and complimentary and alternative medicine engineering research and application*. Georgia: ScholarlyEditions.

Aghakhanian, F., Yunus, Y., Naidu, R., Jinam, T., Manica, A., Hoh, B. P., & Phipps, M. E. (2015). Unravelling the genetic history of Negritos and indigenous populations of Southeast Asia. *Genome Biology and Evolution, 7*, 1206–1215.

Boa, E. R. (2004). *Wild edible fungi: A global overview of their use and importance to people*. Rome: Food and Agriculture Organization of the United Nation.

Chang, Y. S., Lee, S. S., & Noraswati, M. N. R. (2005). Ethnomycology in Malaysia. *Clusiana, 44*, 67–72.

Chin, H. F. (1981). Edible and poisonous fungi from the forests of Sarawak. Part I. *Sarawak Museum Journal, 29*, 211–225.

Chin, H. F. (1988). Edible and poisonous fungi from the forests of Sarawak. Part II. *Sarawak Museum Journal, 60*, 195–201.

Christensen, H. (2002). *Ethnobotany of the Iban and Kelabit*. A joint publication of the Forest Department Sarawak, Natural Ecology and People Consult & University of Aarhus, Denmark. Sarawak: Forest Department Sarawak.

Crisan, E. V., & Sands, A. (1978). A nutritional value. In S. T. Chang & W. A. Hayes (Eds.), *The biology and cultivation of edible mushrooms* (pp. 172–189). New York: Academic.

Hartmann, M., Howes, C. G., VanInsberghe, D., Yu, H., Bachar, D., Christen, R., Henrik, N., Hallam, R., J, S., & Mohn, W. W. (2012). Significant and persistent impact of timber harvesting on soil microbial communities in northern coniferous forests. *Multidisciplinary Journal of Microbial Ecology, 6*, 2199–2218.

Kardooni, R., Kari, F. B., Rohani, S., Yahaya, B., & Yusup, S. H. (2014). Traditional knowledge of orang asli on forests in peninsular Malaysia. *Indian Journal of Traditional Knowledge, 13*, 283–291.

Kulshreshtha, S., Mathur, N., & Bhatnagar, P. (2014). Mushroom as a product and their role in mycoremediation. *Applied Microbiology and Biotechnology Express, 4*, 1.

JAKOA. (2016). *Tribes/Nation*. Retrieved from http://www.jakoa.gov.my/en/orang-asli/info-orang-asli/suku-kaumbangsa/. 21 June 2016.

Lee, S. S., Chang, Y. S., & Noraswati, M. N. R. (2009). Utilization of macrofungi by some indigenous communities for food and medicine in peninsular Malaysia. *Forest Ecology and Management, 257*, 2062–2065.

Lee, S. S., & Chang, Y. S. (2007). Ethnomycology. In E. B. G. Jones, K. D. Hyde, & S. Vikineswary (Eds.), *Malaysian fungal diversity* (pp. 307–317). Kuala Lumpur: Mushroom Research Centre, University of Malaya and Ministry of Natural Resources and Environment Malaysia.

Lee, S. S., Alias, S. A., Jones, E. G. B., Zainuddin, N., & Chan, H. T. (2012). *Checklist of fungi of Malaysia* (Research pamplet no. 132). Malaysia: Forest Reserch Institute Malaysia (FRIM).

McGuire, K. L., D'Angelo, H., Brearley, F. Q., Gedallovich, S. M., Babar, N., Yang, N., Gillikin, C. M., Gradoville, R., Bateman, C., Turner, B. L., Mansor, P., Leff, J. W., & Fierer, N. (2015). Responses of soil fungi to logging and oil palm agriculture in southeast Asian tropical forests. *Microbial Ecology, 69*, 733–747.

Miles, P. G., & Chang, S. T. (2004). *Mushrooms: Cultivation, nutritional value, medicinal effect, and environmental impact* (2nd ed.). New York: CRC press.

Mueller, G. M., Schmit, J. P., Leacock, P. R., Buyck, B., Cifuentes, J., Desjardin, D. E., Halling, R. E., Hjortstam, K., Iturriaga, T., Larsson, K. H., Lodge, D. J., May, T. W., Minter, D., Rajchenberg, M., Rehdead, S. A., Ryvarden, L., Trappe, J. M., Wtling, R., & Wu, Q. (2007). Global diversity and distribution of macrofungi. *Biodiversity and Conservation, 16*, 37–48.

Oei, P. (2003). *Mushroom cultivation: Appropriate technology for mushroom growers* (No. Ed. 3). Leiden: Backhuys Publishers.

Pegler, D. N. (1997). *Larger fungi of Borneo*. Kota Kinabalu: Natural History Publications.

Semwal, K. C., Lemma, H., Dhyani, A., Equar, G., & Amhare, S. (2014). Mushroom: Nature's treasure in Ethiopia. *Momona Ethiopian Journal of Science, 6*, 138–147.

Thatoi, H., & Singdevsachan, S. K. (2015). Diversity, nutritional composition and medicinal potential of Indian mushrooms: A review. *African Journal of Biotechnology, 13*, 523.

Thi, B. K., Lee, S. S., Zanuddin, N., & Chan, H. T. (2012). *A guidebook to the macrofungi of Fraser's Hill* (Siri Alam dan Rimba No. 14). Malaysia: Forest Research Institute Malaysia (FRIM).

Vikineswary, S., Noorlidah, A., Normah, I., Tan, Y. H., Fauzi, D. & Jones, E. B. G. (2007). Edible and medicinal mushrooms. In E. B. G. Jones, K. D. Hyde, & S. Vikineswary (Eds.), *Malaysian Fungal Diversity. Mushroom Research Centre, University of Malaya and Ministry of Natural Resources and Environment, Malaysia*. pp 287–305.

Wani, B. A., Bodha, R. H., & Wani, A. H. (2010). Nutritional and medicinal importance of mushrooms. *Journal of Medicinal Plants Research, 4*, 598–604.

Wasser, S. (2002). Medicinal mushrooms as a source of antitumor and immunomodulating polysaccharides. *Applied Microbiology and Biotechnology, 60*, 258–274.

Yang, Q. Y., Hu, Y. J., Li, X. Y., Yang, S. X., Liu, J. X., Liu, T. F., Xu, G. M., & Lio, L. M. (1993). A new biological response modifier – PSP. In S. T. Chang, J. A. Buswell, & S. W. Chiu (Eds.), *Mushroom biology and mushroom products* (pp. 247–259). Hong Kong: The Chinese University Press.

Zainuddin, N., Lee, S. S., Chan, H. T., & Thi, B. K. (2010). *A guidebook to the macrofungi of Tasik Bera* (Siri Alam No 13). Malaysia: Forest Research Institute Malaysia (FRIM).

Harizah Nadiah Hamzah, graduated from Universiti Malaysia Terengganu with Bachelor of Applied Science (Biodiversity Conservation & Management). She manages to gain experience and developed her research skills while competing her final year project on floral biology and its relation to its pollination by bats at mangrove area. Harizah has been involved in inter-disciplinary research which encompasses fungal ecology and social science for her master study on utilisation of wild mushroom for food and medicine by indigenous communities. She has years of experience in field work and teaching experience as a laboratory demonstrator for Mycology subject.

Aqilah Mohammad, PhD is a senior lecturer and a mycologist in the Universiti Malaysia Terengganu. She currently holds a dual appointment position in the Faculty of Science and Marine Environment and acts as the Head of Program in the Institute of Tropical Biodiversity and Sustainable Development. Aqilah has been involved in fungal ecology, fungal diversity and ethnomycology studies and conducted fieldworks in several states in Malaysia. She is currently engaged in the post-Covid19 industry-community project on mushroom cultivation for low-income communities nearby UMT main campus area. She has been actively publishing works on her field in both local and international journals and academic books since 2011 until present and as co-editor two international books by Springer Nature Publisher.

Ethnoichtyological Survey of the Orang Asli in Tasik Kenyir, Terengganu

Muhammad Syamsul Aznan Ariffin, Faizah Mohamad Shaharom, and Mohd Tajuddin Abdullah

Abstract Tasik Kenyir and its surrounding rainforests in Terengganu, Peninsular Malaysia, are home to a rich biological diversity that support the livelihood of an Orang Asli community, which depends heavily on the ecosystem. The Orang Asli there have an excellent, sustainable way of utilising wildlife resources. Based on this survey of acquatic species, a total of 32 fish from 14 families and six other species (reptiles, amphibians) living in and around the lake are observed to be utilised by the community. These fish and aquatic resources are eaten as food and medicine, kept as pets, or traded for income. The data and usage information of these acquatic fauna are important for the documentation of traditional knowledge and to understand gaps and issues related to the sustainable livelihood of the Orang Asli in Tasik Kenyir.

Keywords Orang Asli · Tasik Kenyir · Fish · Biodiversity · Sustainable livelihood

Introduction

Ethnozoology has become a popular field around the world due to its versatility and multi-disciplinary knowledge. It is derived from the field of ethnoscience, which includes the knowledge, perception and classification of the world according to culture (Paz and Begossi 1996). Basically, ethnozoology is a study of the relationship between certain cultures and animals, as well as their surroundings (Jaroli et al. 2010; Henderson and Harrington 1914). It may also be defined as the study of human knowledge in the utilisation of animals (Overal 1990) besides the

M. S. A. Ariffin (✉)
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

F. M. Shaharom
Faculty of Fisheries and Food Science, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

M. T. Abdullah
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_7

perception, management and classification of human-faunal interactions (Badge and Jain 2013). On the other hand, Marques (2002) considered it as a trans-disciplinary study of the knowledge and beliefs, sentiments and behaviours linking relationships between human populations and animal species. Alvez and Souto (2015) concluded that ethnozoology is a discipline that examines the historical, economic, sociological, anthropological and environmental aspects between humans and animals. This means that it combines the elements of natural and social sciences. Ethnozoology can be classified into different disciplines according to the animal taxon; ethnoentomology (insects), ethnoichthyology (fish), ethnoornithology (birds), ethnomastozoology (mammals), ethnoherpetology (amphibians, reptiles) and ethnoprimatology (primates) (Alves and Souto 2015).

Ethnoichthyology deals with the utilisation of fish resources by indigenous communities. Historically, various animals, including fish, have been utilised by indigenous people for many purposes, such as for protein and medicine, as well as rituals. Indigenous people are recognised for having elaborate knowledge about the resources they exploited (Badge and Jain 2013; Nishida et al. 2006; Seixas and Begossi 2001; Paz and Begossi 1996; Ankei 1989). This knowledge is important because it may be used as additional information in perfecting scientific knowledge, such as resource management and sustainable development (Sillitoe 1998; Posey 1984). In Peninsular Malaysia, fishing is part of the lifestyle of indigenous communities known as the Orang Asli. The Orang Asli are one of the earliest people to live in Peninsular Malaysia, with their history going back to at least 25,000 years (Nicholas 2000). The Orang Asli in Peninsular Malaysia are divided into three major tribes, which are the Semang (Negrito), Senoi and Proto-Malay (Department of Statistics Malaysia 1997; Nicholas and Raajen 1996; Carey 1976). The Orang Asli are commonly regarded as hunter-gatherers and they collected natural resources from the forest for sustenance. The Semoq Beri sub-tribe in Terengganu state (part of the Senoi tribe) regards the forest as a "bank", in which their sources of livelihood are safely stored (Ramle et al. 2014).

There are several scientific studies that have been done on fish and aquatic resource utilisation by the Orang Asli as listed in Table 1. However, some information on the resources are outdated, especially on fish, with some species not mentioned. This is exacerbated by frequent taxonomic revisions (Chong et al. 2010).

The Orang Asli utilised aquatic resources like fish, frogs, snails and turtles, in some instances, purely for food (Sharma 1999). Fish seemed to be their main source of protein (Sok 2003; Low 2000; Alias 1999; Ali et al. 1991). The Orang Asli also utilised aquatic resources for medicine (Yahaya 2015; Azliza et al. 2012), besides fulfilling their belief and tradition (Yahaya 2015; Meyer-Rochow 2009; Ali and Isa 2005).

This paper aims to provide information on the aquatic resources and fish utilised by the Orang Asli living near Tasik Kenyir, which is the biggest man-made lake in southeast Asia. In addition, their sustainability of their livelihood in using those resources will also be discussed.

Table 1 Aquatic resources utilised by the Orang Asli (Yahaya 2015; Azliza et al. 2012; Ramakrishna 2005; Kuchikura 1996)

Family	Species	Common/ Malay name
Dicroglossidae	*Limnonectes macrodon*	*Katak gergasi*
Geoemydidae	*Cyclemys dentate*	*Kura-kura Daun Asia*
Trionychidae	*Trionyx cartilaginous*	*Labi-labi*
Anabantidae	*Anabas testudineus*	*Puyu*
Bagridae	*Hemibagrus nemurus*	*Baung*
Channidae	*Channa gachua*	*Haruan*
	Channa lucius	*Bujuk*
	Channa macropeltes	*Toman*
	Channa striatus	*Haruan*
Clariidae	*Clarias batrachus*	*Keli*
	Clarias macrocephalus	*Keli*
Cobitidae	*Acanthophthalmus kuhilii*	*Kuhlii loach*
Cyprinidae	*Acrossocheilus* sp.	*Tengas*
	Acrossocheilus sp.	*Kejor*
	Cyclocheilichthys apogon	*Chemperas*
	Hampala macrolepidota	*Sebarau*
	Mystacoleucus marginatus	*Sia*
	Osteochilus spilurus	*Toros*
	Osteochilus vittatus	*Terbul*
	Osteochilus hasseltii	*Terbul*
	Puntius lateristriga	*T-spanner*
	Puntius partipertazona	*Tiger barb*
	Barbonymus gonionotus	*Lampam Jawa*
	Puntius sp.	*Barb*
	Puntius sp.	*Barb*
	Puntius sp.	*Barb*
	Rasbora elegans	*Seluang*
	Tor tambroides	*Kelah*
Mastacembeloidae	*Mastacembelus armatus*	*Spiny eel*
Pristolepidae	*Pristolepis fasciatus*	*Patung*
Siluridae	*Wallago leerii*	*Tapah*

Methods

Study Area

The survey was conducted in the Orang Asli village of Kampung Sungai Berua, Hulu Terengganu (N 5.0805 E 102.8841), which was near Tasik Kenyir in Terengganu, Peninsular Malaysia (Fig. 1). The village population was 533, and the majority were from the Semoq Beri sub-tribe (Abdullah et al. 2016). Due to migration and intermarriage, Kampung Sungai Berua was also inhabited by the Bateq,

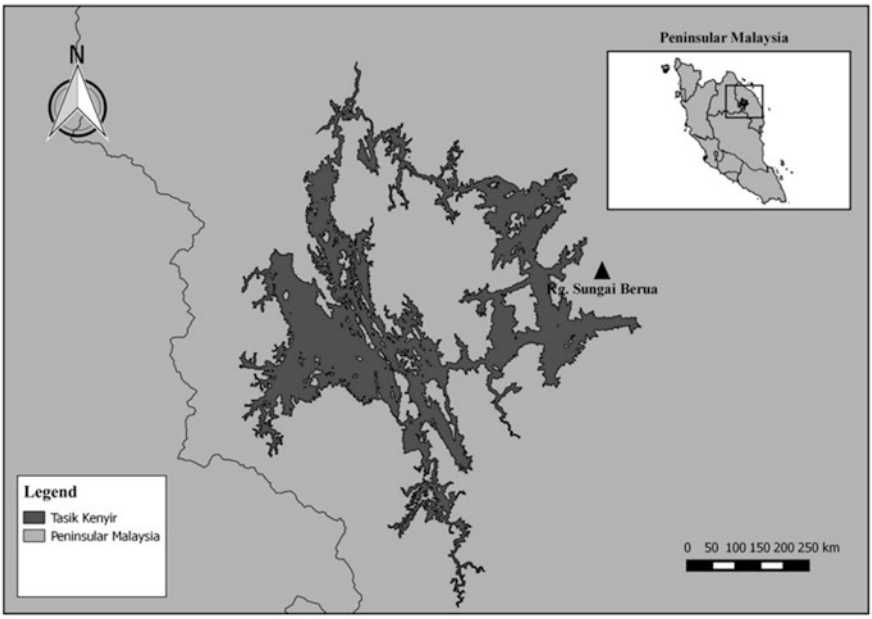

Fig. 1 A map showing the location of Kampung Sungai Berua, Hulu Terengganu

Jahai and Jakun sub-tribes. The settlement was located between three strategic locations, namely Kuala Berang town, which was the administrative centre of Hulu Terengganu district, the Sultan Mahmud hydroelectric dam and Sungai Chomo, an Aquaculture Industrial Zone (AIZ). A road was constructed to connect these important locations, thus indirectly benefiting Kampung Sungai Berua and allowing the villagers to interact with the outside world. Besides road accessibility, the village was also provided with electricity and clean water supply.

Data Collection

Data was collected from August 2015 to February 2016. Primary and secondary data were collected during the study period. The collection of primary data involved field surveys; in-depth interviews and observation by participating in the activities of the Orang Asli. Permission to interview villagers was obtained from the Orang Asli Development Department (JAKOA) and the village headman. A total of 96 respondents, including hunter-gatherers, family heads, traditional medicine practitioners and elders, were interviewed. Information on aquatic resources were acquired with the aid of pictures to facilitate confirmation. In-situ observation on the daily activities of Orang Asli involved recording and taking pictures of them acquiring the resources. Identification of aquatic resources was performed using

field guides on reptiles (Indraneil 2010) and fish (Ambak et al. 2012). Data obtained were recorded in a prepared datasheet. Meanwhile, secondary data were obtained from various resources, including books, journals and documented reports.

Results and Discussion

Thirty-two known species of fish from 14 families and six species of other animals used by the Orang Asli were recorded in the survey and compiled in Table 2. The animals were categorised according to their taxonomic order and purposes.

Figure 2 shows the aquatic resources that the Orang Asli utilised. Of the common pool of 96 respondents, fish seemed to be the most utilised in Tasik Kenyir, followed by reptiles and amphibians. Other than those, 42 and 29 respondents said they also consumed gastropods and mussels found in Tasik Kenyir.

Most respondents, at a percentage of 97.91%, caught the aquatic resources for household consumption. Apart from that, the Orang Asli mentioned that there was a species that was hunted due to its economic value. Eighty-seven respondents, or 90.63%, hunted acquatic life as a source of income as shown in Fig. 3. The highest number of aquatic resources sold by 64 and 84 respondents was frog and tortoise at 66.67% and 87.50%, respectively, as shown in Fig. 4. They were sold for consumption at exotic restaurants in the nearest city. The low percentage of fish being sold, like the kelah (Malayan mahseer), indicated that the Orang Asli caught fish mainly for household consumption.

Severals methods and tools were used to catch the aquatic resources. The common items included fishing rods, nets, traps and spear guns, besides using their bare hands. Most of the respondents used a fishing rod as it was easy to handle and not as costly as a net. On the other hand, hand-made spear guns were still frequently used, especially by the elders, as it required a great deal of experience in using it. According to Kuchikura (1996), the Semoq Beri sub-tribe identified the rivers around the lake based on their depth and width, as well as the location and topography. Table 3 summarized that the rivers were divided into three parts — *pahog* was the upper stream with a width less than 5 m and depth less than 1 m. *Lawog* were small rivers with a width of between 10 m and 30 m, and a depth of less than 3 m. Downstream from the *pahog* and *lawog,* was the *geradu*, which had a width of between 50 m and 250 m, and a depth of more than 10 m. The type of river would affect the Orang Asli's choice of tools and methods. Fishing rods and hooks were often used in small rivers that were not deep, like the *pahog* and certain stretches of the *lawog*. The fish trap, or *bubu*, was also used in the *paho*g, where the current was gentler. Nets were used in the *geradu* that had deeper water and fast currents. The Semoq Beri also fished and obtained other aquatic resources by diving into the rivers and using spear guns. Animals like frogs (*balio*) and turtles (*Pa'as*) were caught by hand on the riverbanks.

Nine species of animals were recorded as being used for medicine or spiritual purposes as listed in Table 4. These practices only applied to certain people and the

Table 2 The taxonomic lists of aquatic resources utilised by the Orang Asli in Tasik Kenyir, Hulu Terengganu

Order	Species	Local name	Purposes
Cypriniformes	**Cyprinidae**		
	Barbonymus schwanenfeldi	*Lampam Sungai*	Food
	Ctenopharyngodon idella	*Kap Rumput*	Food
	Cyclocheilichthys apogon	*Temperas*	Food
	Epalzeorhynchos kalopterus	*Rong Batu*	Food
	Hampala macrolepidota	*Sebarau*	Food
	Hypsibarbus malcolmi	*Kerai*	Food
	Labiobarbus leptocheilus	*Kawan*	Food
	Mystacoleucus marginatus	*Sia*	Food
	Neolisocheilus soroides	*Tengas*	Food/ trading
	Osteocheilus spilurus	*Rong*	Food/ trading
	Osteochilus vittatus	*Terbul*	Food
	Oxygaster anomalura	*Lalang/ Parang/ Aur*	Food
	Probarbus jullieni	*Temoleh*	Food
	Propontius deauratus	*Daun*	Food
	Rasbora sp.	*Seluang*	Food
	Tor tambra	*Kelah*	Food/ trading
Osteoglossiformers	**Notopteridae**		
	Chitala lopis	*Belida*	Food
Perciformers	**Anabantidae**		
	Anabas testudineus	*Puyu*	Food/ spiritual
	Channidae		
	Channa lucius	*Bujuk*	Food/ medicine
	Channa micropeltes	*Toman*	Food/ medicine
	Channa striata	*Haruan*	Food/ medicine
	Cichlidae		
	Tilapia sp.	*Talapia Merah*	Food
	Eleotridae		
	Oxyeleotris marmorata	*Ubi/ Ketutu*	Food
	Osphronemidae		
	Osphronemus goramy	*Kalui*	Food
	Trichopodus trichopterus	*Sepat*	Food
	Osteoglossidae		
	Scleropages formosus	*Kelisa*	Food/ trading
	Pristolepididae		
	Pristolepis fasciatus	*Patung*	Food

(continued)

Table 2 (continued)

Order	Species	Local name	Purposes
Siluriformers	**Bagridae**		
	Hemibagrus capitulum	*Baung*	Food/ spiritual
	Clariidae *Clarias macrocephalus*		
	Pangasiidae		
	Pangasius nasutus	*Patin*	Food
	Siluridae		
	Wallago leerii	*Tapah*	Food
Synbranchiformes	**Synbranchidae**		
	Monopterus albus	*Belut*	Food/ medicine
Hirudinida	**Hirudinidae**		
	Hirudo sp.	*Lintah*	Medicine
Anura	**Dicroglossidae**		
	Limnonectes macrodon	*Katak gergasi/ Balio*	Trading/ medicine
Squamata	**Varanidae**		
	Varanus salvator	*Biawak/ Sereng*	Food/ trading
Testudines	**Emydidae**		
	Trachemys scripta	*Kura telinga merah/ kura merah*	Medicine/ pet/ trading
	Geoemydidae		
	Siebenrockiella crassicollis	*Kura-kura pipi-putih/ Yo*	Food/ pet
	Trionychidae		
	Dogania subplana	*Labi-labi/ Pa'as*	Trading

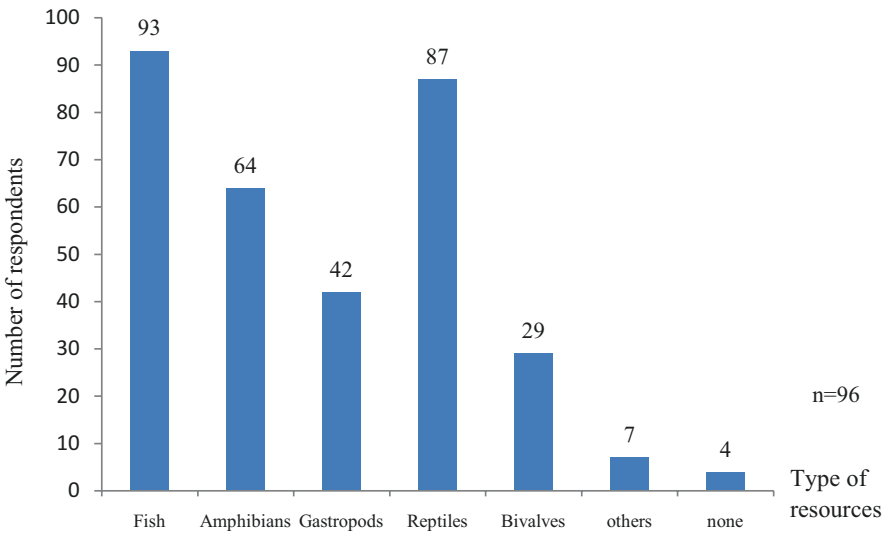

Fig. 2 The aquatic resources consumed by the Orang Asli in Kampung Sungai Berua, Hulu Terengganu, as measured by the responses of interviewed subjects

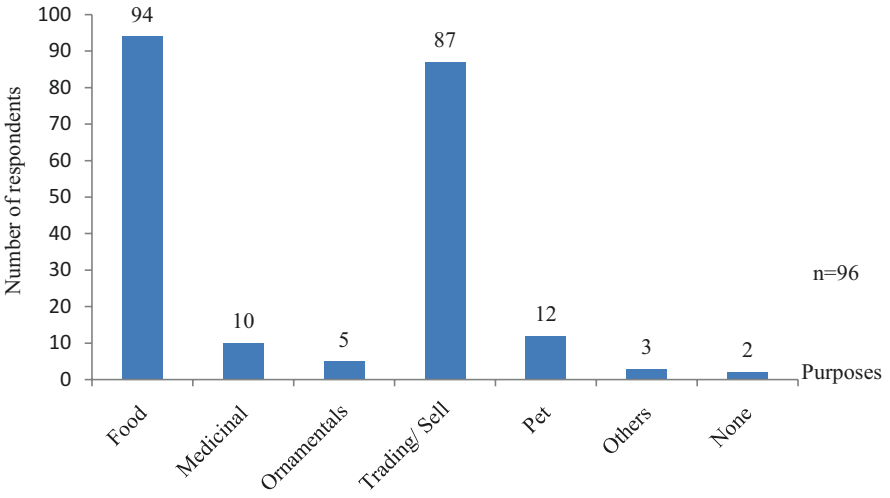

Fig. 3 Aquatic resource utilisation as measured by the response of interviewed subjects

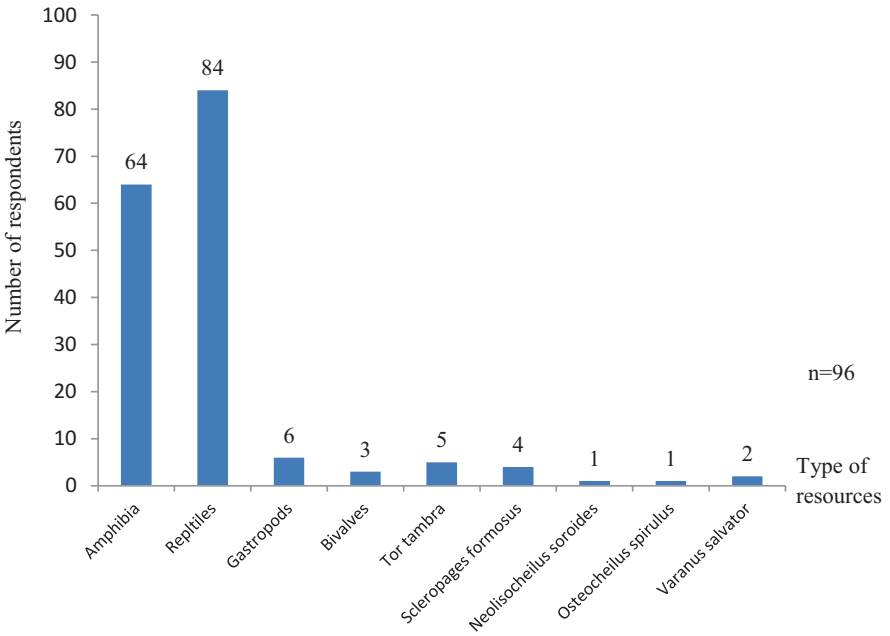

Fig. 4 The aquatic resources sold by the Orang Asli as measured by the response of interviewed subjects

Table 3 The methods and tools used by the Orang Asli of Kampung Sungai Berua to hunt for aquatic and fish resources

Methods/ Tools	River term	River characteristics
Fishing rod and hook	*Pahog/ lawog*	Small and intermediate depth
Nets	*Lawog / geradu*	Wide with intermediate or deep depth
Traps	*Pahog*	Small but fast stream
Diving and spear gun	*Lawog*	Intermediate size and depth
Hand	*Pahog*	Small and shallow

Table 4 List of animals used for medicinal and spiritual purposes

Species	Local name	Part used	Mode of uses	Purposes
Anabantidae				
Anabas testudineus	Puyu		Kept as pets	To ward off evil spirits or bad luck
Hemibagrus capitulum	Baung	Barbels	Nailed to the tree	To promote flowering and fruiting of plants
Channidae				
Channa lucius	Bujuk	Meat	Consumed	To accelerate wound healing
Channa micropeltes	Toman	Meat	Consumed	To accelerate wound healing
Channa striata	Haruan	Meat	Consumed	To accelerate wound healing
Dicroglossidae				
Limnonectes macrodon	Katak gergasi/ Balio	Meat	Grilled and consumed	To treat back pain
Emydidae				
Trachemys scripta	Kura-kura merah/ kura merah	Heart	Grilled and consumed	To treat cough
Hirudinidae				
Hirudo sp.	Lintah	Meat	Oil extracted from grilling	To give energy
Synbranchidae				
Monopterus albus	Belut	Meat	Consumed	To give energy

elders of the sub-tribe as most of the villagers preferred to seek medical treatment at a clinic or the nearest hospital.

The use of wildlife by Orang Asli in Tasik Kenyir could be considered sustainable. This was possible because their way of life was connected to the forest and the lake. The Semoq Beri sub-tribe regarded the forest as a “bank”, in which their sources of livelihood were safely stored (Ramle et al. 2014). From this connection, their surroundings were considered as an entity born of supernatural powers after the birth of man to meet the needs of human biology. The subtribe believed the forest and lake had the same status as human life and were treated with respect.

The resources were used for different purposes and utilised as much as possible so that there would be no wastage, and the resources could be maintained for future generations. Normally, the Orang Asli would utilise forest resources only when necessary. The resources were consumed as food for protein, medicine, as well as to earn income.

Conclusion

In conclusion, the local practices of the Orang Asli in Tasik Kenyir were manageable and aligned with sustainability. Their knowledge and practices reflected their way of life and appreciation of their surroundings. The subsistence way of living in terms of fishing and hunting supported the fact that they lived in a sustainable manner without affecting much of their surroundings.

Acknowledgements This research was funded by the Trans Disciplinary Research Grant Scheme (TRGS/2015/59373). The authors wish to thank JAKOA, KETENGAN, Terengganu State Park Management Council, Forestry Department and the Wildlife and National Parks Department for permission to carry out the study. Special thanks, too, to the villagers of Kampung Sungai Berua and staff of the Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, for participating and assisting in this study.

References

Abdullah, M. T., Abdullah, M. F., Bartholomew, C. V., & Jani, R. (2016). *Kelestarian Masyarakat Orang Asli Terengganu*. Kuala Terengganu: Penerbit Universiti Malaysia Terengganu.

Ali, O., & Isa, Z. M. (2005). *Kehidupan dan Kesihatan Orang Asli di Malaysia*. Kota Kinabalu: Universiti Malaysia Sabah.

Ali, O., Shamsudin, Z., & Khalid, B. A. K. (1991). A socioeconomics, social behaviour, and dietary pattern among Malaysian aborigines and rural native Malays. *Medical Journal of Malaysia, 46*.

Alias, I. Z. (1999). The supplementation of lerothyroyine among indigenous people in endemic goitre areas: The impact of the Rcpy. *Asia Pasific Journal of Clinical Nutrition, 7*, 1–3.

Alves, R. R. N. & Souto, W. M. S. (2015). Ethnozoology: A Brief Introduction. *Ethnobiology & Conservation, 4*(1): 1–13. http://doi:10.15451/ec2015-1-4.1-1-13.

Ambak, M. A., Isa, M. M., Zakaria, M. Z., & Ghaffar, M. A. (2012). *Fishes of Malaysia*. Kuala Terengganu: Penerbit Universiti Malaysia Terengganu.

Ankei, Y. (1989). Folk knowledge of fish among the Songola and the Bwarj. *African Study Monographs, 9*, 1–88.

Azliza, M. A., Ong, H. C., Vikineswary, S., Noorlidah, A., & Haron, N. W. (2012). Ethno medicinal resources used by the Temuan in Ulu Kuang village. *Studies on Ethno Medicine, 6*, 17–22.

Badge, N., & Jain, S. (2013). An ethnozoological studies and medicinal values of vertebrate origin in the adjoining areas of Pench National Park of Chhindwara District of Madhya Pradesh, India. *International. Journal of Life Sciences, 1*, 278–283.

Carey, I. (1976). *Orang Asli: The aboriginal tribes of peninsular Malaysia*. Kuala Lumpur: Oxford University Press.
Chong, V. C., Lee, P. K. Y., & Lau, C. M. (2010). Diversity, extinction risk and conservation of Malaysian fishes. *Journal of Fish Biology, 76*, 2009–2066.
Department of Statistics Malaysia. (1997). *Profile of the orang Asli in peninsular Malaysia. Population census monograph*. Kuala Lumpur: Department of Statistics Malaysia.
Henderson, J., & Harrington, J. P. (1914). *Ethnozoology of the Tewa Indians*. Washington: Bureau of American Ethnology.
Indraneil, D. (2010). *A field guide to the reptiles of South-East Asia*. London: New Holland Publishers.
Jaroli, D. P., Mahawar, M. M., & Vyas, N. (2010). An ethnozoological study in the adjoining areas of Mount Abu wildlife sanctuary, India. *Journal of Ethnobiology and Ethnomedicine, 6*, 1–8.
Kuchikura, Y. (1996). Fishing in the tropical rain forest: Utilization of aquatic resources among the Semaq Beri hunter-gatherers of peninsular Malaysia. *Senri Ethnological Studies, 42*, 147–174.
Low, A. C. (2000). *Penilaian taraf pemakanan warga tua semelai di Kampung Sungai Sampo, Jempol. B.S. Graduation Exercise*. Serdang: Universiti Putra Malaysia.
Marques J. G. W. (2002). O Olhar (Des) Multiplicado. O Papel do Interdisciplinar e do Qualitativo na Pesquisa Etnobiológica e Etnoecológica*. Métodos de coleta eanálise de dados em etnobiologia, etnoecologia e disciplinas correlate,* 31–46*.*
Meyer-Rochow, V. B. (2009). Food taboos: Their origins and purposes. *Journal of Ethnobiology and Ethnomedicine, 5*.
Nicholas, C. (2000). *The orang Asli and the contest for resources: Indigenous politic, development and identity in peninsular Malaysia*. Copenhagen: International Work Group for Indigenous Affairs and Center for Orang Asli Concerns (COAC).
Nicholas, C., & Raajen, S. (1996). *Indigenous peoples of Asia many peoples, one struggle*. Asia Indigenous Peoples Pact: Lincoln.
Nishida, A. K., Nordi, N., & Alves, R. R. N. (2006). Mollusc gathering in Northeast Brazil: An ethnoecological approach. *Human Ecology, 34*, 33–45.
Overal, W. L. (1990). Introduction to ethnozoology: What it is or could be. *Ethnobiology: Implications and Applications*, 127–129.
Paz, V. A., & Begossi, A. (1996). Ethnoichthyology of Galviboa fishermen of Sepetiba Bay. *Brazil. Journal of Ethnobiology, 16*, 157–168.
Posey, D. A. (1984). Etnoecology as applied anthropology in Amazonian development. *Humanities Organisation, 43*, 95–107.
Ramakrishna, S. (2005). Conservation and sustainable use of peat swamp forests by local communities in South East Asia. *Suoseura, 5*, 27–38.
Ramle, A., Greg, A., Nur Hafizah, R., & Mohd Sukhairi, M. R. (2014). Forest significant and conservation among the Semaq Beri tribe of orang Asli in Terengganu state. *Malaysia. Australian Journal of Basic and Applied Sciences, 8*, 386–395.
Seixas, C., & Begossi, A. (2001). Ethnozoology of caiçaras from Aventureiro. *Ilha Grande. Journal of Ethnobiology, 21*, 107–135.
Sharma, D. S. K. (1999). Tortoise and freshwater turtle trade and utilisation in Peninsular Malaysia. *TRAFFIC Southeast Asia Report*.
Sillitoe, P. (1998). The development of indigenous knowledge. *Current Anthropology, 39*, 223–252.
Sok, K. M. (2003). *Latar belakang sosio-ekonomi dan taraf pemakanan Orang Asli lelaki desa di Sungai Sampo*. Serdang: Universiti Putra Malaysia.
Yahaya, F. H. (2015). The usage of animals in the lives of the Lanoh and Temiar tribes of Lenggong, Perak, *SHS Web of Conferences* 18*, 04006 (2015).*

Muhammad Syamsul Aznan Ariffin was a postgraduate research assistant studying on the fisheries resources in Setiu Wetlands, Kenyir Lake and off-shore islands in Terengganu. He published his data in journals and book chapters on the distribution and utilisation of fish.

Faizah Mohamad Shaharom is a Professor Emerita at UMT specialising in the parasites of fish.

Mohd Tajuddin Abdullah, PhD, is a professor and was the former Director of the Institute of Tropical Biodiversity and Sustainable Development (BIO-DTROPIKA), Universiti Malaysia Terengganu (UMT). He has conducted his fieldworks in Malaysia, Indonesia and Thailand with a broad interest in biodiversity, biogeography, molecular ecology, mammalogy, protected areas and captive wildlife conservation. Recently, he received the best zoological and ecotourism book awards in the Malaysia National Book Award 2017 and 2019 respectively. He has published about 100 indexed journal manuscripts and co-edited nine books, two of which by Springer Nature Publisher. Currently, he is an active independent researcher affiliated to the Academy of Sciences Malaysia of which he is a fellow since 2013 and a new found hobby as a YouTuber (Taj Abdullah).

Ethnozoological Survey of the Orang Asli of Terengganu, Peninsular Malaysia

Candyrilla Vera Bartholomew, Nurul Faezah Noor Azizan, Mohd Tajuddin Abdullah, and Ramle Abdullah

Abstract The forest-dependent, indigenous people of Peninsular Malaysia are known as the Orang Asli. Few studies on animal resource utilisation among the Orang Asli have been done, and this study aims to characterise the animals utilised by them. A survey was conducted in Kampung Sungai Berua, Kenyir, during a seven-month period using the qualitative approach. This study found that the Orang Asli depend significantly on animals for their well-being and sustaining their livelihood. A total of 32 species of wildlife, comprising 13 mammals, 10 reptiles and nine birds, were recorded. Data obtained from the survey provide a clearer view of the use of wildlife among the Orang Asli in terms of household consumption, medicinal purposes, trading and companionship. This study provides the information to generate knowledge on animal utilisation by the Orang Asli in Kenyir, Hulu Terengganu, Terengganu.

Keywords Orang Asli · Livelihood · Ethnozoology · Animal utilisation

C. V. Bartholomew
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

N. F. N. Azizan
Faculty of Applied Social Sciences, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

M. T. Abdullah (✉)
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

R. Abdullah
Pusat Penataran Ilmu, Universiti Sultan Zainal Abidin, Gong Badak, Terengganu, Malaysia

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_8

Introduction

Ethnozoology refers to the study of the relationship between humans and animals in their environment. It highly reflects the importance of animals in the life of man (Alves 2012). Historically, various animals have been utilised for many purposes, and have provided significant support to humans in terms of livelihood. For instance, wildlife products that are readily available, such as ivory, bones, antlers and feathers, have been used by humans as tools and ornaments since prehistoric times (Pederson 2004).

In Peninsular Malaysia, the forest-dependent community belongs to one of the minority groups, which are the indigenous people. The indigenous people (or Orang Asli in Malay) are the earliest inhabitants of Peninsular Malaysia. Some of the subtribes have lived in Peninsular Malaysia for at least 25,000 years (Nicholas 2000), and they have been called the "first people" or "original people". The three major groups of the Orang Asli are the Senoi, Negrito and Proto Malay, and they are made up of 18 sub-ethnic groups (Carey 1976). Each sub-tribe has a distinctive culture, belief, language, tradition and lifestyle. The Negrito consists of the Kintak, Kensiu, Jahai, Medrik, Batek and Lanoh, while the Senoi consists of the Semai, Temiar, Jah Hut, Mah Beri, Che wong and Semoq Beri. The Temuan, Jakun, Semelai, Orang Seletar, Orang Kuala and Orang Kanaq, meanwhile, are Proto Malays.

Today, many Orang Asli communities have been resettled in villages outside of forests. Traditionally, the Orang Asli lived in and around forests in bamboo and rattan huts. They live a nomadic and semi-nomadic life, acquiring various resources in and around their surrounding forests to survive (Kuchikura 1986). Their high dependency on forest resources and products has been widely studied (Ramle et al. 2014), particularly among the Batek communities (Tuck-Po 1998). It appears that poverty is one likely reason for this high dependency. According to a report from the Statistics Department (2010), 1.4% of indigenous people nationwide were classified as poor. In Pahang, 35.2% of the Orang Asli were classified as hardcore poor.

Only a few studies have documented the use of animals by the Orang Asli in Peninsular Malaysia. At least 12 species are known to be utilised by the Orang Asli for various purposes (Yahaya 2015; Azliza et al. 2012, Howell et al. 2010). In Sarawak, however, up to 52 species of animals have been utilised by the indigenous people for medicinal purposes (Mohd Azlan and Muhammad Faisal 2006). Thus, this survey aims to compile a list of wildlife utilised by the Orang Asli community living near Tasik Kenyir (the largest man-made lake in southeast Asia) in Terengganu. The uses of the wildlife will also be discussed.

Methods

Background of Study Area

The survey was conducted at Kampung Sungai Berua (5° 4′ 49.8″ N 102° 53′ 2.76″ E), an Orang Asli village in Kenyir, Hulu Terengganu, Terengganu (Fig. 1). The majority of the Orang Asli in the village were from the Semoq Beri sub-tribe of the Senoi. The

estimated population of the village was 533 people, comprising 104 families (JAKOA 2015). Kampung Sungai Berua had undergone major developments resulting from the construction of two new roads. One of the roads connected Kampung Tapah to Tasik Kenyir via Kampung Sungai Berua, while the other was from Kuala Berang to Gua Musang in the neighbouring state of Kelantan. The Orang Asli village is located just by the side of the road from Kampung Tapah to Tasik Kenyir, making the village easily accessible. Therefore, there was frequent interaction between the villagers and outsiders, such as government officials, middlemen and local traders.

Data Collection

Data was collected during a seven-month period (August 2015 to February 2016). An official approval for the study was obtained from the Orang Asli Development Department (JAKOA). Next, permission was obtained from the village head, or Tok Batin, to interview the villagers. Primary and secondary data were both collected. The secondary data were obtained from various resources, including books, journals and documented reports. The collection of primary data involved field surveys, in-depth interviews and participatory observations. Face-to-face interviews were conducted with hunters and traditional medicine practitioners in the village on

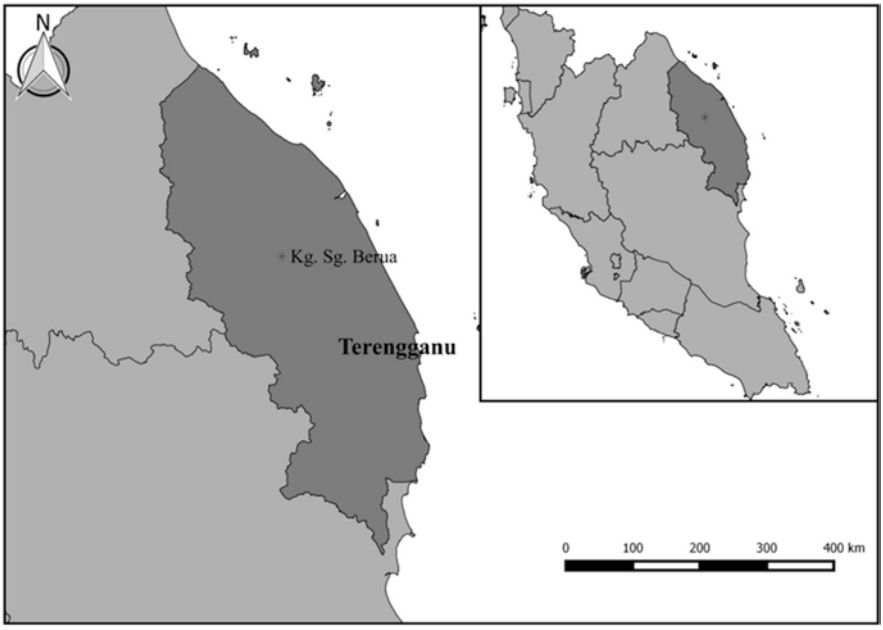

Fig. 1 Map showing the location of Kampung Sungai Berua in Kenyir, Hulu Terengganu, Terengganu

information of their hunted wildlife. The animals were also identified with the aid of pictures that were shown to the villagers. Pictures of available hunted animals were also photographed for in-situ identification purposes, according to the field guide of mammals (Francis 2008), reptiles (Indraneil 2010) and birds (Robson 2000). Besides that, other related data, such as the purpose of utilisation, method of catching and trading activities were also recorded.

Results and Discussion

In this survey, a total of 39 species from 22 wildlife families were recorded to have been utilised by the Orang Asli in Kampung Sungai Berua for the past 12 months (Table 1). The animals were categorised according to taxonomic order. The most utilised animals were mammals with 20 species, followed by reptiles (10 species) and birds (nine species). Of the total, 65% and 35% were listed as protected (P) and totally protected species (TP), respectively, under the Wildlife Conservation Act 2010. Four species of critically endangered animals (the river terrapin, red-eared slider, helmeted hornbill and Sunda pangolin) were found to have been utilised. One species categorised as an endangered — the spiny hill turtle — was also recorded. Six species of vulnerable animals were also hunted, which were the Malayan box turtle, black marsh turtle, Asian brown turtle, straw-headed bulbul, southern pig-tailed macaque and Sambar deer.

The Orang Asli used several methods to hunt wildlife, with blowpipes, snares, traps and spearguns. They mostly tracked the animal by their footprints. The Orang Asli were known for their traditional survival knowledge and familiarity with the forest terrain, and they possessed specific strategies in hunting wildlife (Table 2).

The survey revealed that hunted wildlife was for household consumption, medicinal purposes, as a source of income or kept as pets. Most animals were utilised for household consumption (Fig. 2). Based on the interviews, the three top animals considered as delicacies among the Orang Asli were porcupines, turtles and squirrels.

Economic and commercial activities also occurred between the Orang Asli and middlemen. Outsiders were no strangers to the Orang Asli as their trading relationship had long existed since the fifteenth century (Gianno & Bayr, 2009). High demand in the wildlife trade also drove the Orang Asli to become excellent hunters. Some of the prized animals caught could fetch a good price and significantly contribute to their wellbeing. Based on interviews with a few key informants, they get paid by middlemen based on the prices shown in Table 3.

This study identified eight species of animals used by the Orang Asli as traditional medicine (Table 4). Knowledge on how to use the animals for medicinal purposes was mainly held by traditional practitioners and elders. In this survey, three traditional practitioners were interviewed.

Based on our findings, it could be noted that wildlife hunting remained an important subsistence for the Orang Asli and it played an important role in many aspects

Table 1 A list of wildlife utilised by the Orang Asli in Kenyir, Terengganu

Order	Scientific Name	Common name	Semoq Beri name	Uses	WCA (2010)	IUCN
REPTILES						
Testudines	**Geoemydidae** *Batagur affinis*	River terrapin	*Pa'as*	a, c, d	TP	CR
	Cuora amboinensis	Malayan box turtle	*Kerak keban*	a, d	P	VU
	Heosemys spinosa	Spiny hill turtle	*Ga'de*	c	P	EN
	Siebenrockiella crassicollis	Black marsh turtle	*Yo*	a, b, c	P	VU
	Manouria emys	Asian brown tortoise	*Sel*	c, d	P	VU
	Emydidae					
	Trachemys scripta	Red-eared slider	*Mong*	b, c	NA	CR
	Trionychidae					
	Dogania subplana	Malayan softshell turtle	*Pa'as*	c	P	LC
Squamata	**Gekkonidae**					
	Gekko gecko	Tokay gecko	*Che'eh*	c	P	NE
	Varanidae					
	Varanus salvator	Monitor lizard	*Sereng*	a	P	LC
	Pythonidae					
	Python reticulatus	Reticulated python	*Tijo*	b, c	P	NE
AVES						
Psittaciformes	Phasianidae					
	Lophura ignita	Crested fireback	*Burung pegar*	a	TP	NT
	Gallus gallus	Junglefowl	*Ayam hutan*	a, d	P	LC
Gruiformes	Rallidae					
	Amauromis phoenicurus	Waterhen	*Itik air*	a, b	P	NT
AVES						
Bucerotiformes	**Bucerotidae**					
	Rhinoplax vigil	Helmeted hornbill	*Burung melilin*	a, b, c	TP	CR
	Buceros rhinoceros	Rhinoceros hornbill	*Terang*	a, c	TP	NT
Columbiformes	**Columbidae**					
	Chalcophaps indica	Emerald dove	*Kawah kukur*	a	P	LC
Psittaciformes	Psittaculidae					
	Psittinus cyanurus	Blue-rumped parrot	*Kawah Serindit*	c, d	TP	NT

(continued)

Table 1 (continued)

Order	Scientific Name	Common name	Semoq Beri name	Uses	WCA (2010)	IUCN
	Sturnidae					
	Gracula religiosa	Common hill myna	*Kawah Tiong*	c, d	P	LC
Pycnonotidae	**Passeriformes**					
	Pycnonotus zeylanicus	Straw-headed bulbul	*Kawah Barau*	a	TP	VU
MAMMALS						
Pholidota	**Manidae**					
	Manis javanica	Sunda pangolin	*Pantuai*	b, c	TP	CR
Primates	**Cercopithecidae**					
	Trachypithecus obscurus	Dusky leaf monkey	*Basing*	c, d	P	NT
	Macaca nemestrina	Southern pig-tailed macaque	*Tadik*	c, d	P	VU
	Macaca fascicularis	Long-tailed macaque	*Penrok*	c, d	P	LC
Carnivora	**Viverridae**					
	Viverra tangalunga	Malayan civet	*Musang*	a	P	LC
	Paradoxurus hermaphroditus	Common palm civet	*Musang*	a	P	LC
Artiodactyla	**Suidae**					
	Sus scrofa	Wild boar	*Jalu*	a, c	TP	LC
MAMMALS						
Artiodactyla	**Tragulidae**					
	Tragulus sp.	Mouse deer	*Pelanduk*	a	P	LC
	Cervidae					
	Rusa unicolor	Sambar deer	*Rusa*	a	P	VU
	Muntiacus muntjak	Barking deer	*Bohol*	a	P	LC
Rodentia	**Sciuridae**					
	Callosciurus notatus	Plantain squirrel	*Cedek*	a, b	NA	LC
	Callosciurus erythraeus	Pallas's squirrel	*Lebir*	a, d	NA	LC
	Callosciurus caniceps	Grey-bellied squirrel	*Gahui*	a, d	NA	LC
	Ratufa bicolor	Black giant squirrel	*Daguan*	a	TP	NT
	Petaurista petaurista	Red giant flying squirrel	*Menuk*	d	TP	LC
	Petaurista elegans	Lesser giant flying squirrel	*Pawor*	d	TP	LC
	Aeromys tephromelas	Black giant flying squirrel	*Pati*	d	TP	DD

(continued)

Table 1 (continued)

Order	Scientific Name	Common name	Semoq Beri name	Uses	WCA (2010)	IUCN
	Spalacidae					
	Rhizomys sumatrensis	Indomalayan bamboo rat	*De'kan*	d	NA	LC
	Hystricidae					
	Hystrix brachyura	Malayan porcupine	*Landak*	a, b, c	P	LC
	Atherurus macrourus	Brush-tailed porcupine	*Landak*	a, b, c	P	LC

Uses = a: Food, b: Medicine, c: Trading, d: Pet), (Wildlife Conservation Act (2010) status = TP: Totally Protected Animal, P: Protected Animal, NA: Not Available), IUCN Red List categories = CR: Critically Endangered, E: Endangered, VU: Vulnerable, NT: Near Threatened, LC: Least Concern, NE: Not Evaluated, DD: Data Deficient

Table 2 List of tools and methods used by the Orang Asli to hunt for wildlife

Tools/ Weapon	Method	Wildlife
Blowpipe	Blowpipes are used alongside poison darts. They are used to hunt arboreal animals and birds. The longer the blowpipe, the farther its reach.	Squirrel Hornbill Deer
Snare	They are made of bamboo and nylon strings. Usually, snares will be left overnight and checked on the following day.	Porcupine
Speargun	Used to hunt larger animals.	Wild boar
Trap	Simple contraptions that are left overnight.	Deer Wild boar
Bare hands	Animals are tracked by following their footprints.	Pangolin Turtles

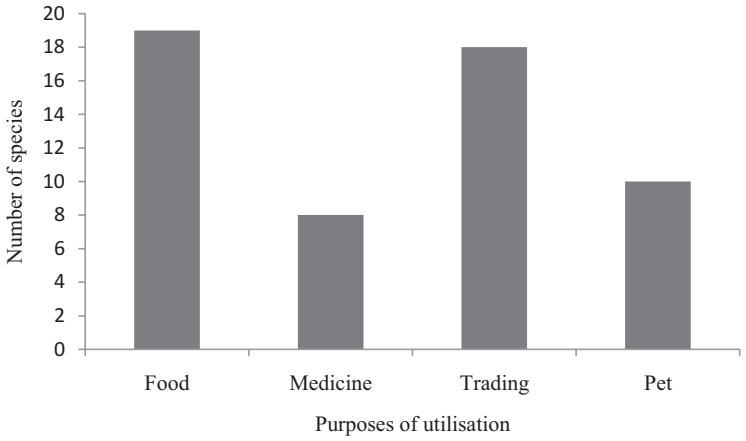

Fig. 2 The utilisation of hunted animals by the Semoq Beri sub-tribe in Kampung Sungai Berua, Hulu Terengganu

Table 3 The prices of animals paid by middlemen to Semoq Beri hunters in Kampung Sungai Berua, Hulu Terengganu

Animal	Price (RM)	Part used
Frogs	20 per kg	Meat
Turtles	4–8 per kg*	Meat
Monitor lizard	*	Whole body
Snake	18 per kg	Meat
Birds (hornbill, common hill myna, parrot)	*	Whole body
Pangolin	180–200 per kg	Meat, scale
Squirrel	20–30 per kg*	Whole body
Wild boar	*	Whole body
Deer	80 per kg	Whole body
Porcupine	10,000–30,000 per kg *	Black stone

*Price depending on animal size

of their life (Howell et al. 2010). Therefore, the survival of wildlife species should also be taken into consideration to maintain their heritage and existence. Conservation efforts were needed to maintain wildlife populations and its habitat so that the livelihood of the Orang Asli would not be compromised. As addressed by Benneth, by considering resource sustainability, the balance between short-term economic needs and long-term developmental and conservation needs could be evaluated.

Conclusion

This study has provided information on the wildlife utilised by the Orang Asli in Kampung Sungai Berua in Hulu Terengganu, Terengganu. Several wildlife species were identified as important to the Orang Asli for food, medicine, source of income and as pets. The Orang Asli had great traditional knowledge regarding the flora and fauna within the forests. The knowledge is practiced until now, and it has become their "bible" to ensure their livelihood and maintain their identity. The Orang Asli communities are hunter-gatherers and collectors of many types of forest resources. In the richness of the tropical forests with high biodiversity, the relationship between the wildlife and Orang Asli should be explored, as the social and economic well-being of the Orang Asli highly depends on good resource management. In addition, the sustainable management of the wildlife used by the Orang Asli must be considered. Therefore, future research should address the factors and resolve issues affecting wildlife utilisation by the Orang Asli.

Table 4 List of animals used for medicine

Scientific name	Common name	Uses	Part used	Mode Of uses
Emydidae				
Trachemys scripta	Red-eared slider	To treat internal pain.	Black stone	The black stone is boiled with water. The water is then drunk.
Pythonidae				
Python reticulatus	Reticulated python	Relieves heat in the body and fever.	Gall bladder	The gall bladder can be eaten raw or cooked until it becomes golden brown.
Elapidae				
Ophiophagus hannah	King cobra	Treat venomous bites.	Snake's venom	The snake's venom is applied on the affected area.
Rallidae				
Amaurornis phoenicurus	Waterhen	Gives energy.	Meat	The meat is grilled and consumed.
Bucerotidae				
Rhinoplax vigil	Helmeted hornbill	To treat internal pain and also used as an antidote.	Beak	The beak is scraped and mixed with boiling water. The water then is drunk.
Manidae				
Manis javanica	Sunda pangolin	Prevents illnesses caused by bad weather.	Scales and claws	The pangolin scales or claws are used as a necklace, aided with a spell.
Sciuridae				
Callosciurus notatus	Plaintain squirrel	Relieves heat in the body and maintain health and vitality.	Black stone	The black stone is boiled with water. The water is then drunk.
Hystricidae				
Hystrix brachyura	Porcupine	To treat various illnesses.	Black stone	The stone is soaked in water. The water is then drunk.

Acknowledgements We would like to acknowledge the Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu. This research was supported by the Ministry of Higher Education, Trans Disciplinary Research Grant Scheme (TRGS/2015/59373) led by M.T. Abdullah. Many thanks to Department of Orang Asli Development (Jabatan Kemajuan Orang Asli, JAKOA), Terengganu State Park Management Council, Forestry Department, KETENGAH and villagers of Kampung Sungai Berua for their cooperation and sharing of the traditional knowledge.

References

Alves, R. R. N. (2012). Relationships between fauna and people and the role of ethnozoology in animal conservation. *Ethnobiology and Conservation, 1*, 1–69.

Azliza, M. A., Ong, H. C., Vikineswary, S., Noorlidah, A., & Haron, N. W. (2012). Ethnomedicinal resources used by the Temuan in Ulu Kuang Village. *Journal of Ethnobiology and Ethnomedicine, 6*, 17–22.

Carey, I. (1976). *Orang Asli: The aboriginal tribes of peninsular Malaysia*. Kuala Lumpur: Oxford University Press.

Francis, C. M. (2008). *A field guide to the mammals of South-East Asia*. New Holland United Kingdom.

Gianno, R., & Bayr, K. J. (2009). Semelai agricultural patterns: Toward an understanding of variation among indigenous cultures in southern peninsular Malaysia. *Journal of Southeast Asian Studies, 40*, 153–185.

Howell, C. J, Schwabe, K. A. & Abu Samah, A, H. (2010). Non-timber forest product dependence among the Jah hut subgroup of peninsular Malaysia's orang Asli. Environment, Development and Sustainability, 12,1–8.

Indraneil, D. (2010). *A field guide to the reptiles of South-East Asia*. United Kingdom: New Holland.

Kuchikura, Y. (1986). *Subsistance ecology of a Semaq Beri community, hunting and gathering people of peninsular Malaysia*. Hokkaido: Hokkaido University.

Mohd Azlan, J., & Muhammad Faisal, F. (2006). Ethnozoological survey in selected areas in Sarawak. *The Sarawak Museum Journal, 10*, 184–200.

Nicholas, C. (2000). The orang Asli and the contest for resources: Indigenous politics, development and identity in peninsular Malaysia. In *International work Group for Indigenous Affairs, Copenhagen, Denmark and Center for Orang Asli Concerns (COAC)*. Subang: Jaya.

Pederson, M. C. (2004). *Gem and ornamental materials of organic origin*. Elsevier Butterworth-Heinemann.

Ramle, A., Greg, A., Ramle, N. H., & Mat Rasat, M. S. (2014). Forest significant and conservation among Semaq Beri tribe of orang Asli in Terengganu state, Malaysia. *Australian Journal of Basic and Applied Sciences, 8*, 386–395.

Robson, C. (2000). *A field guide to the birds of South-East Asia*. United Kingdom: New Holland.

Tuck-Po, L. (1998). Həp: The significance of forest to the emergence of Batek knowledge in Pahang. In *Malaysia*. Universiti Sains Malaysia: Penang.

Wildlife Conservation Act. (2010). *Act 716. Percetakan Nasional Malaysia Berhad*. Retrieved from http://www.gunungganang.com.my/pdf/MalaysianLegislation/National/Wildlife%20Conservation%20Act%202010.pdf.

Yahaya, F. H. (2015). *The usage of animals in the lives of the Lanoh and Temiar tribes of Lenggong, Perak*. Retrieved from http://www.shs-conferences.org/articles/shsconf/abs/2015/05/shsconf_icolass2014_04006/shsconf_icolass2014_04006.html.

Candyrilla Vera Bartholomew received her BSc from the Universiti Malaysia Sarawak and MSc fron the Universiti Malaysia Terengganu (UMT). She had co-edited a book and coauthored journal and book chapters manuscripts related on the livelihoods and sustainability of Orang Asli. She is interested to pursue her PhD on ethnozoology using next generation sequencing method.

Nurul Faezah Noor Azizan received her MSc from the Universiti Sultan Zainal Abidin (UniSZA), Malaysia. Her research was focussed on use of resources in traditional Orang Asli medicine in Kampung Sungai Berua, Hulu Terengganu, Malaysia.

Mohd Tajuddin Abdullah received his diploma in forestry from the Institut Teknologi MARA; BSc and MSc on wildlife resource management from the West Virginia University USA and PhD

in zoology from the University of Queensland, Australia. He was a wildlife officer at the Department of Wildlife and National Parks (1977 to 1991); a Zoo Melaka director (1992–1993); as a lecturer (1994–2007) and professor at the Universiti Malaysia Sarawak (2008 to 2014); a director and professor at the Universiti Malaysia Terengganu (2014 to 2021). His research areas and publications are in zoology, biodiversity, phylogenetics, biogeography, zoonoses, protected area conservation and recently on the Orang Asli livelihoods and sustainability. In 2017 and 2019, his books won both the prestigious National Book Award and UMT science book awards. He is a lead editor of two international Springer Nature books. He is a Fellow of the Academy of Sciences Malaysia.

Ramle Abdullah was a professor on Social Anthropology and Ethnography of Orang Asli) at the Faculty of Applied Social Sciences, UniSZA. An Orang Asli expert who published several academic books and research papers on their culture and heritage.

The Ethnozoology, Wildlife Utilisation and Hunting Practices of the Semoq Beri Tribe in Pahang

Muhammad Abu Bakar Abdul-Latiff, Mohd Ayub Afiqah, Fatin Zahari, Nursyuhada Othman, Hidayah Haris, Mohd Faudzir Najmuddin, and Badrul Munir Md-Zain

Abstract The Semoq Beri tribe in Pahang is one of the sub-groups of the Senoi Orang Asli in Peninsular Malaysia. They are largely dependent on natural resources, especially wildlife, for their livelihood. However, no documentation has been made regarding their interactions with wildlife, such as hunting practices, and wildlife consumption and utilisation. In this paper, we provide an ethnozoological study on their cultural knowledge of wildlife utilisation by using a questionnaire and interviews as our instruments. We found that the Semoq Beri people can be categorised into five types of lifestyle, from totally nomadic to modern citizens, which are based on the types of their houses, hunting skills, food sources, income sources, and access to education. A total of 68 wildlife species, consisting of mammals, birds, reptiles, and insects, consumed by this community were documented. Their hunting tools and the uses of these tools were also documented. Due to their abundance, mammals are most frequently consumed by this community. Generally, we can conclude that the hunting lifestyle of the Semoq Beri people in Pahang is sustainable as they largely hunt for their own consumption, and not to participate in the trading of wildlife. However, we are concerned about the numerous endangered and threatened wildlife species being consumed by them. It is also apparent that their hunting

M. A. B. Abdul-Latiff (✉) · F. Zahari · N. Othman · H. Haris · M. F. Najmuddin
Centre of Research for Sustainable Uses of Natural Resources, Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Muar, Johor, Malaysia
e-mail: latiff@uthm.edu.my

M. A. Afiqah
Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Muar, Johor, Malaysia

B. M. Md-Zain
Department of Biological Sciences and Biotechnology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_9

activities are decreasing because of the changes to their lifestyle due to modernisation.

Keywords Orang Asli · Sustainable livelihood · Wildlife · Malaysia

Introduction

The Semoq Beri people are a sub-group of the Senoi Orang Asli, who are estimated to have reached Peninsular Malaysia about 8000 years ago during the second wave of migration from the mountainous areas of Cambodia and Vietnam (Zahidin et al. 2018; Baer 1999). Currently, Semoq Beri tribes can be found in few areas of Peninsular Malaysia, namely in Jerantut, Kuantan, the Maran district in Pahang, and the Hulu Terengganu and Kemaman districts in Terengganu (Abdullah et al. 2016, 2017; Masron et al. 2013) (Fig. 1). They speak the Semoq Beri language, which is an Austroasiatic language. Their primary religion is an ethnic religion, which is more closely associated to people's ethnic identity and cultural assimilation. Some of them have embraced Islam, Christianity and Evangelicalism. They used to live as nomads, but the government (the Orang Asli Development Department or JAKOA) provides them with permanent settlement, education, and healthcare.

Most of them live close to or within forested areas as they depend on natural resources to survive. This enables them to engage in rice cultivation and the trading of natural resources, such as petai, durian, resins, and rattan, mainly to generate income (Nicholas 2003). Since the forest is their source of food and income, they place importance on it. They are known to live as hunter–gatherers, consuming wildlife and largely depending on forest products to survive, resulting in them having a more developed olfaction in terms of locating food resources (Majid and Kruspe 2018). With their technological efficiency and skills in using the blowpipe, the Semoq Beri people heavily consume meat in a strategic manner, which results in them leading an active hunter–gatherer life (Kuchikura 1988). They also fish and harvest forest resources, such as wood, *chandan*, rattan, and bamboo (Kuchikura 1996). Those who still hunt tend to live in settlements located in the forests of Jerantut, Kuantan, the Maran district in Pahang, and the Hulu Terengganu and Kemaman districts in Terengganu.

Ethnozoology comes from the Greek words *ethno*, which means ethnic, and *zoology*, which means animals (Castetter 1944). Thus, ethnozoology can be simply understood as the study of the interrelationship between animals and humans of certain ethnic groups. The study of the interrelationships between the cultural knowledge of a particular ethnic group and biology is known as ethnobiology (Anderson 1988). There are three main classifications of ethnobiological study, namely ethnozoology, ethnobotany, and ethnoentomology (Fig. 2). However, it is a complex field involving different approaches and theoretical problems, which also comprise ethnoecology and ethnomedicine, among others. Besides ethnozoology,

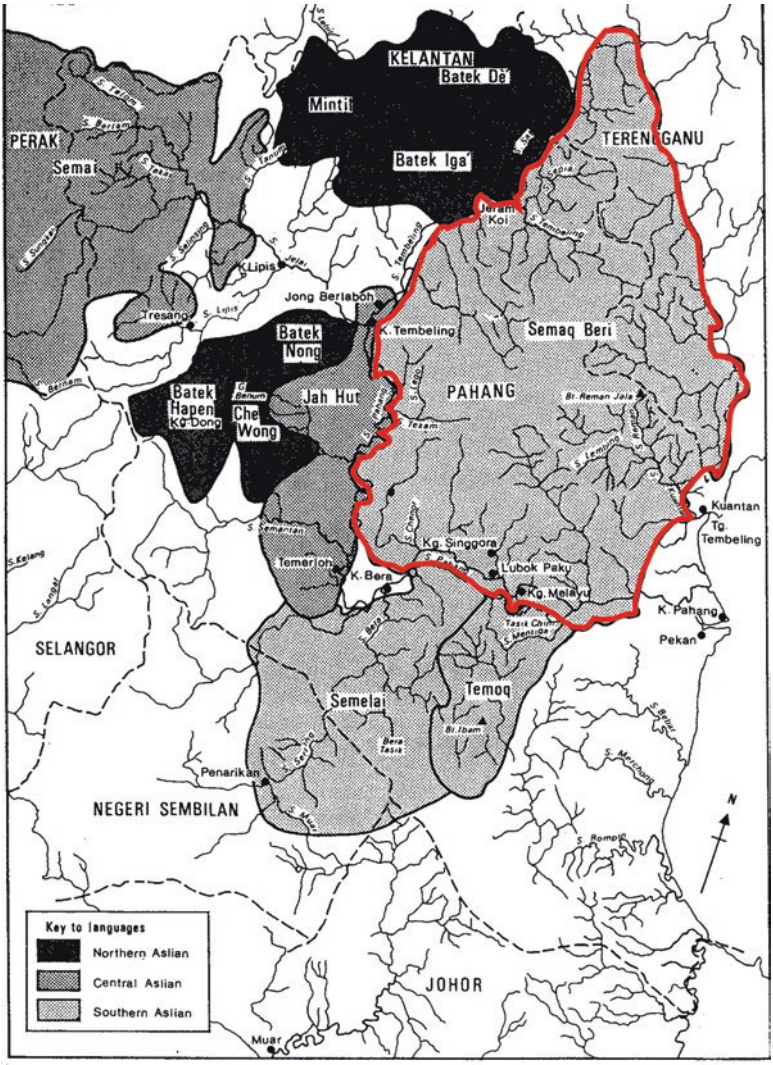

Fig. 1 Semoq Beri settlements in Peninsular Malaysia (Benjamin 1997)

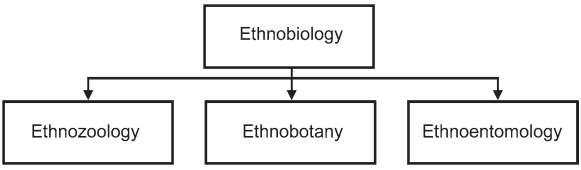

Fig. 2 The main classifications of ethnobiology

there is another discipline under ethnobiology that has emerged from anthropology, namely ethnography (Naidoo 2012). It is a study that interprets the collected data on the beliefs, social interactions, and behaviors of small societies, which involve participation and observation over a period of time (Denzin 2011; Reeves 2008; Berry 2011).

Waters et al. (2011) stated that humans have practiced hunting since at least 13,800 years ago. This is supported by the discovery of rock paintings that portray the hunting practices of prehistoric people through the drawings of human figures hunting wild animals, such as bison, horses, and deer (Alves and Souto 2011). Lim (1900) stated that the Temiar and Lanoh tribes eat python meat to remove excess body heat. However, the Semai people eat python to treat ailments. To eliminate excess body heat, the Semai people in Perak instead eat bear hearts, whereas the Semai people in Pahang eat woodworms. Some believe that pangolin meat contains certain nutrients and has medicinal value (Lim 1900). A widespread folklore about an elephant that died because of a pangolin is the source of their belief that a burned scale of a pangolin can ward off elephants due to its strong odour (Yahaya 2015). According to Azliza et al. (2012), the Temuan people use 12 animal species as traditional medicine to treat diabetes, hypertension, asthma and cold. The Orang Asli tend to consume the meat of large mammals because of the nutrient contents and the quantity of meat. Therefore, we can conclude that these tribes have their own reasons for consuming wildlife species, especially as a source of protein and cure for illnesses.

Generally, in Orang Asli hunting practices, men were the ones responsible for hunting for forest resources. Most elderly men are experts in hunting animals because of their broad experience. The knowledge of hunting among the younger generation is not practiced and it is proven by Kardooni et al. (2014) because the older indigenous people possess more knowledge in hunting skills. The Orang Asli usually capture different animals using different types of hunting tools (Bartholomew et al. 2017). Wild junglefowl are captured using snares, whereas arboreal animals, such as monkeys, squirrels, and birds, are captured using blowpipes. Birds are also caught using slingshots, not just blowpipes. Pangolins are captured using spears (Yahaya 2015). The hunting tools that are generally used are blowpipes with poisoned darts, spears, snares, slingshots and traps.

Ethnozoological Survey

We conducted a survey in a few Orang Asli Semoq Beri villages in Pahang and successfully gathered 30 respondents for interviews and questionnaires. The study was approved by JAKOA, and the community agreed to share their cultural knowledge. They were asked to sign the Free, Prior and Informed Consent (FPIC) and Access and Benefit-Sharing (ABS) forms. The documents were written in the Malay as it could be easily understood by the respondents, enabling them to date and sign the survey with the presence of one witness. We focused on male respondents, owing to

Fig. 3 An interview session with members of the Semoq Beri community

their hunting expertise. The interviews were conducted using a semi-structured questionnaire (Fig. 3). There were 29 wildlife species listed in the questionnaire as the targeted species that may have been consumed by the Semoq Beri people based on the potential distribution of the species in the area. If they provide extra information related to wildlife utilisation during the interview session, it was recorded as a species not listed in the questionnaire. Visual aids were used to help the respondents understand the questionnaire since there may be some confusion between the species name and the local name. All the information obtained from the interviews was recorded in jotter books, and in audio and video forms.

The Ethnography of the Semoq Beri

Background

The Semoq Beri people practiced nomadic living behaviors entirely before engaging with modern civilisation. Even after the independence of Malaysia, most Semoq Beri people practiced a nomadic way of living. They usually did not reside in one place in the forest for more than a few days. However, they did have permanent and fixed refuge areas, which are the caves (Fig. 4). The caves served as temporary homes or areas for family gatherings, and for customary and religious rituals.

The exposure and assimilation of the Semoq Beri people to the Malay, Chinese, and Indian communities were more active after independence. As much as the exposure helped the Semoq Beri people adapt to the industrial and technological advancements in Malaysia, most of them remained in forests and closed their doors

Fig. 4 The caves used by the ancestors of the Semoq Beri people in Pahang for refuge and religious purposes

Fig. 5 The people of the Semoq Beri in Pahang

to foreigners. Much of its people did not go outside of their forests due to several reasons, such as physical distance, customary prohibition, and a lack of interest in the outside world. Due to a lack of records and literature on the Semoq Beri people in Pahang, much is unknown about their history.

Physical Appearance

The skin color of the Semoq Beri people varies widely compared with the Negrito and Proto-Malay tribes (Fig. 5). A study conducted by Ang et al. (2012) on the skin variations of the Orang Asli in Peninsular Malaysia based on a molecular approach revealed that the Senoi tribes have the widest distribution of skin color compared with the Negrito and Proto-Malay tribes. Below are the faces of the Semoq Beri people at our study site. They are of different ages and gender. Their hair varies from curly and wavy, to straight (Ang et al. 2012).

Lifestyle

Modernisation and assimilation have changed how the Semoq Beri people in Pahang live. While they still practice hunting, the frequency of wildlife consumption has decreased. Their lifestyle has shifted to a modern way of living, which had a great impact on the types of their houses, hunting skills, food sources, income sources, and education. Based on our study, we categorised the Semoq Beri people in Pahang into five types of lifestyle (Table 1). On this note, we classified the education received by them into two, formal and informal education. Formal education is defined as "an institutionalised, chronologically graded and hierarchically structured educational system, spanning lower primary schools and the upper reaches of universities," whereas informal education is "the lifelong process by which every person acquires and accumulates knowledge, skills, attitudes and insights from daily experiences and exposure to the environment" (La Belle 1982).

The first category of lifestyle is the nomadic lifestyle, where they are almost entirely hunter–gatherers. Most of their food sources come from hunting wildlife and gathering non-timber forest products (NTFP), such as herbs, wood, and mushroom. They do not have permanent homes, and they also have never resided in one place for more than 3 days. They forage as a means to survive. One of the philosophies of the Semoq Beri people is "*Suap tara, yukdoi untuk uincha*," which translates to: "Start working in the morning to find food and return in the evening." Men in this category hunt for food to feed their families, whereas women in the family search for staple food, such as sweet potato, herbs, and mushrooms. People in this group remain highly skillful. They eat only wild animals, depending on the availability and the level of difficulty in capturing those animals. The limiting factor

Table 1 The classification of the Semoq Beri people's lifestyle

Level	Type of houses	Hunting skills	Food source	Income source	Education
1	None, hut	High	Hunting, gathering	None, wildlife and NTFP trading	Informal
2	Hut, cottage	High	Horticulture, hunting, gathering	Horticulture product, land rental	Informal
3	Village houses,	Moderate, (hobbyist)	Agriculture, horticulture, hunting, gathering	Agriculture product, horticulture product, land rental	Formal, informal,
4	Rural houses, aided by the government	Moderate, low (hobbyist)	Horticulture, trading, market	Horticulture product, government aid, small business, industrial worker, government servant	Formal, informal,
5	Rural houses, urban houses	Low	Market, retails	Business, public and private service worker, land rental	Formal

associated with their hunting activities is the decreasing number of available species and how abundant of each species is. The lifestyle explained here is almost similar to the Semoq Beri people in Terengganu as narrated by Kuchikura (1988). Their source of income is only from the trading of wildlife species (if any) and non-timber forest products. Most of the individuals who have remained in this group have barely received any formal education and depend largely on the informal survival knowledge passed down from the elders.

The second lifestyle category of the Semoq Beri people is those who have permanent homes. Their homes are in the form of huts or cottages made from rubber wood and nipah leaves (Fig. 6). The huts are built above the ground to avoid being attacked by wild boars. Permanent homes allow those in this category to start families, and the women stay at home to take care of the children. Huts or cottages signify a basic form of society. However, they are scattered and not built close to each other. Hunting and gathering are still widely practiced by this group. The common trait between the first and second groups is that their levels of hunting skills remain high, and they regularly hunt in groups. Their food source have diversified as they have ventured into horticulture in a small scale, as well as raise chicken and ducks as an extra source of food. This group also relies largely on the informal education passed from the elders of the family or society. Their sources of income varied, from horticulture products and NTFPs products, to land rentals (if any). Their hunting strategies would be discussed in the hunting behavior segment later in the chapter.

The third lifestyle category is those that have advanced further into an agricultural life, which have increased their income as they have moved from being forest-dependent to agricultural-dependent. Their houses are now in the form of standard Malay village houses, equipped with basic home supplies and facilities, such as sanitary facilities, water supply, gas stoves, beds, and other household appliances

Fig. 6 A typical hut used by the second category of the Semoq Beri people

Fig. 7 A normal Malay village house used by a Semoq Beri family in the third lifestyle category

(Fig. 7). However, with regard to electricity, only a few of the houses have their own solar panels. Based on observation, when we stayed in the villages of the people in this category, the facilities described above was available, but not all houses have it all completely. For them, the necessity for hunting has been reduced, as well as the level of their hunting skills. The people in this category view hunting as a mere hobby or recreational activity, rather than a means of survival. Since the implementation of the Aboriginal Peoples Act 1954, in which certain designated lands are put under the protection of the Orang Asli, some of the Semoq Beri people have rented out their plots of land for agricultural purposes. Thus, their sources of food have also expanded to agricultural products in addition to horticultural and forest products. This group also works in the agricultural sector and some have even hired foreign laborers for this purpose. In terms of education, they were exposed to formal education, mostly up to the secondary school level, which directly reduced the necessity for informal education on ethnozoological practices.

The fourth category consists mainly of those who live in JAKOA-initiated villages. The villages are designed to be built at the edge of a town, where other public facilities, such as police stations, schools, clinics, and mosques, are near and available. The houses are built close to each other for easier management by JAKOA. Their houses are equipped with water and electrical supplies, telecommunication coverage, and proper sewage management. The main difference between the people in this group and those in previous categories is their hunting skills, which has been reduced from a moderate level to a low level. Hunting is viewed only as a hobby or recreational activity. Their source of food has shifted to the market place and horticulture, although they occasionally consume wildlife species they obtained from recreational hunting. They work in different sectors, such as in agriculture, retail, services, industrial factories, and public agencies. Their source of income has

diversified further, and they no longer depend on forest products, except for additional income. They also receive incentives from the government through JAKOA, leading to an increased standard of living. The people in this group can easily gain access to formal education, and based on our observation, a school bus passed through one of the villages daily to transport students to school. The people in this group are also less focused on informal education compared with formal education.

The fifth category consists of those who migrated to towns, cities, or Federal Land Development Authority (FELDA) settlements. Their houses are built completely from bricks and are located in residential areas, where public facilities are near and available. The level of hunting skills ranges from relatively low to none, as they have left the forests and the traditional ways of living. Their source of food has shifted to markets and retailers. They largely depend on businesses, and the private and public sectors as their source of income. Additional income may come from land rentals (if any), and not from trading forest products. The education they receive is almost entirely formal, while informal education is limited between parents and children (if any). All of the lifestyles explained here are still practiced by the Semoq Beri people in Pahang, but the numbers varied between villages and district.

Wildlife Utilisation

Hunting Tools

As hunter–gatherers, the Semoq Beri people use their own specific tools to hunt animals. The hunting tools are part of their heritage and traditional knowledge. The tools are hand-made and using them requires extensive and detailed knowledge from the elders. The hunting tools mostly used by the Semoq Beri people are blowpipes, locally known as *sumpit*, with poisoned darts, or *damak beracun*; spears, or known as *tombak* or *lembing*; snares, or known as *jerat*; slingshots, or known as *lasik*; and, fish cages, or *bubu*. The use of the hunting tools depends on the targeted size and types of animals. Semoq Beri hunters usually use machetes (Fig. 8) as their main weapon for self-protection and handling the wildlife while hunting in forests. The Semoq Beri people practice a sustainable way of hunting, in which they kill only certain targeted animals that are matured enough to be consumed, and they will not disturb other animals.

The most common hunting tool used by the Semoq Beri people is the traditional blowpipe, which is used to hunt all species of animals. The blowpipes are made from bamboo and are used together with darts coated with the poisonous secretions of certain trees, such as the ipoh tree (*Antiaris toxicaria*) (Kuchikura 1988). They are silent and effective for the hunters to aim at arboreal animals, such as the long-tailed macaque *(Macaca fascicularis*), white-thighed surili (*Presbytis siamensis*), and dusky leaf monkey (*Trachypithecus obscurus*). A study by Kuchikura (1988)

Fig. 8 The machete is used as a general weapon in the forest

also stated that the leaf monkey was among the mammals targeted by the Semoq Beri people during their hunting activities. These animals provide a good quantity of meat and since they are social animals, several members of one group can be captured at once. One of the respondents was able to demonstrate how to call for different types of primates, indicating how immense their hunting skills are. The hunters determine the direction the targeted primates are travelling, and they position themselves under a troop as they attempt to shoot using blowpipes. The length of the blowpipes is kept at about 6 ft. (1.8 m) so it would be convenient to carry them around. The poisonous darts are stored in a canister made from bamboo and rattan. Figure 9 presents a flowchart that shows the process of making the poisonous darts.

A variety of traps and snares are used to target different groups of mammals. The hunter–gatherers prefer to capture animals like the barking deer (*Muntiacus muntjac*) and lesser Javanese mouse-deer, or kanchil, (*Tragulus javanicus*) using snares. Traps are more commonly used to capture small mammals, such as the brush-tailed porcupine (*Atherurus macrourus*) (Fig. 10), which will be consumed if no other sources of food are available. Spears are used to kill large mammals, including the bearded pig (*Sus barbatus*). Bearded pigs are targeted as they are quite numerous and their considerable size makes for a good source of food. The distinctive sound of pigs crunching on roots, and the grunts and squeals of the young make them easier to spot. On rare occasions, a sun bear, a tapir, or even an elephant may be killed. Malayan tapirs (*Tapirus indicus*) are captured with the help of dogs, and spears are used to kill them by aiming them toward the vital organs. Asian elephants are also captured using spears. The hunting of elephants involves about 20 hunters led by an experienced leader, with each hunter carrying at least four spears.

The slingshot is used to catch birds that are to be food. The frequency of consumption of white-breasted waterhens (*Amaurornis phoenicurus)* is higher than that of emerald doves (*Chalcophaps indica*). According to the respondents, doves are

Fig. 9 The making of poisonous darts to be used with the blowpipe

Fig. 10 A brush-tailed porcupine caught using a trap

fast fliers, but waterhens only fly when it is necessary, but at a slow rate due to its size and heavy feet. The Semoq Beri people also fish to fulfill their protein needs. They capture fish using fish cages made from bamboo (Fig. 11), or using a fishing line, with baits, like earthworms (Fig. 12). These tools are used by the Semoq Beri

Fig. 11 A fish cage, locally known as "bubu"

Fig. 12 One of the tools used to catch fish

people as the food sources they depend on are determined by two factors, which are availability and ease of acquisition (Kuchikura 1988).

Wildlife Consumption

The study on wildlife consumption was conducted using a questionnaire and interviews. A total of 30 respondents from the Semoq Beri community were involved in the study. Information related to the sociodemographics of the respondents was collected through the questionnaire (Table 2). The Semoq Beri people are familiar with most of the mammal species, including tigers and elephants. Based on the

Table 2 The sociodemographic characteristics of the respondents

Profile		n	(%)
Gender	Male	15	50.00
	Female	15	50.00
Age	15–20	8	26.67
	21–30	10	33.33
	>30	12	40.00
Marital status	Married	20	66.67
	Single	10	33.33
Occupation	Yes	19	63.33
	No	11	36.67

Table 3 The number of animal species consumed and utilised by the Semoq Beri people according the class

No	Classes of animals	No. of species
1	Mammals	35
2	Reptiles	8
3	Birds	22
4	Insects	3
	Total	68

questionnaire and interviews, about 68 wildlife species have been consumed and utilised by the tribe. Of the total number, mammals are consumed the most at 35, followed by birds (22), and reptiles (8), with the lowest being insects at only 3 species (Table 3).

Twenty-nine animals were listed in the questionnaire, and the majority of them can be found in Pahang. The results of the questionnaire show that of the 29 listed animals, 25 species of mammals (Table 4) and two species of birds (Table 5) have been consumed by the Semoq Beri people. None of the respondents was recorded to have consumed or utilised the remaining two listed species, which are the tropical swallowtail moth (*Lyssa zampa*) and the empress cicada. The details of wildlife utilisation are presented according to the frequency of wildlife consumption (Fig. 13). While conducting the survey, the respondents were also interviewed. The results of the interviews showed that the Semoq Beri people consumed animals not listed in the questionnaire, including 14 species of mammals (Table 4), 20 species of birds (Table 5), eight species of reptiles (Table 6), and two species of insects (Table 7).

The class of animals consumed the most by the Semoq Beri people are mammals. The results of the questionnaire are presented in the form of frequency of consumption and it shows the species that are most consumed, which are the barking deer, lesser mouse-deer, Malayan tapir, bearded pig, sambar deer, white-thighed surili, Malay civet, Sunda pangolin, and dusky leaf monkey. The species listed can be considered as those that are commonly eaten by the Semoq Beri people, probably because of their abundance and finding them in Maran, Pahang, are relatively easy. The least consumed mammal species are the Malayan gaur, oriental small-clawed

Table 4 The list of mammals consumed by the Semoq Beri people

Family	Scientific name	Common name	Local name	Uses	Notes
Felidae	*Panthera tigris*	Malayan Tiger	Harimau	d	I
	Panthera sp.	Leopard	Harimau Bintang	d	I
	Panthera pardus	Black panther	Harimau Mengkung	d	I
	Prionailurus planiceps	Flat-headed cat	Kucing Hutan	a	I
Ursidae	*Helarctos malayanus*	Sun bear	Beruang	a, d	I
Murids	*Rattus norvegicus*	Brown rat	Tikus Mondok	a	I
	Rattus argentiventer	Ricefield rat	Tikus Tedung	a	I
	Rattus tiomanicus	Malayan field rat	Tikus Ladang	a	I
Elephantidae	*Elephas maximus*	Asian elephant	Gajah	a	I
Viverridae	*Viverra zibetha*	Malay civet	Tenggalong	a, d	Q
	Arctogalidia trivirgata	Small-toothed palm civet	Musang ayam	a, c	Q
	Paradoxurus hermaphroditus	Asian palm civet	Musang Pandan	a	I
	Arctictis binturong	Binturong	Musang Tenggalong	a	I
Emballonuridae	*Emballonura monticola*	Lesser sheath-tailed bat	Kelentot/Burung asal	a	Q
Tapiridae	*Tapirus indicus*	Malayan tapir	Badak murai	a, d	Q
Cercopithecidae	*Macaca nemestrina*	Sundaland pigtail macaque	Tadik	a, c	Q
	Macaca fascicularis	Long-tailed macaque	Terau	a, c	Q
	Trachypithecus obscurus	Dusky leaf monkey	Basing	a	Q
	Presbytis siamensis	White-Thighed Surili	Cenglai	a	Q
Cervidae	*Rusa unicolor*	Samba deer	Rusak	a, d	Q
	Muntiacus muntjac	Barking deer	Kijang	a, d	Q
Tragulidae	*Tragulus javanicus*	Lesser mouse-deer	Kanchil	a	Q
	Tragulus napu	Large mouse-deer	Napuh/Pelanduk	a	Q
Bovidae	*Capricornis sumatraensis*	Serow	Kambing gurun	a, b	Q
	Bos gaurus	Malayan gaur	Seladang	a, d	Q
Tupaiidae	*Tupaia glis*	Common Treeshrew	Tupai gohoi/ curing	a, c	Q
Molossidae	*Tadarida plicata*	Wrinkled-lipped bat	Kelentot	a	Q
Pteropodidae	*Pteropus vampyrus*	Large flying fox	Kelentot/ Keluang	a	Q

a food, *b* medicine, *c* pet, *d* ornament, *e* black magic, *f* myth, *Q* questionnaire, *I* interview.

Table 5 The list of birds consumed by the Semoq Beri people

Family	Scientific name	Common name	Local name	Uses	Notes
Rallidae	*Amaurornis phoenicurus*	White-breasted Waterhen	Kawo Guak	a	Q
Columbidae	*Chalcophaps indica*	Emerald dove	Punai Tanah	a, c	Q
	Spilopelia chinensis	Spotted dove	Burung Tekukur	c	I
Psittacidae	*Loriculus galgulus*	Blue-crowned hanging-parrot	Burung Serindit	c, e	I
	Psittinus cyanurus	Blue-Rumped parrot	Burung puling	a	I
	Psittacula longicauda	Long-tailed parakeet	Burung Bayan	a	I
Bucerotidae	*Buceros* sp.	Hornbill	Burung Enggang	a, c, d	I
	Anthracoceros malayanus	Black hornbill	Burung Enggang	c	I
Pycnonotidae	*Pycnonotus goiavier*	Yellow-vented bulbul	Burung Merbah	a	I
Accipitridae	*Elanus caeruleus*	Black-winged kite	Helang	e	I
Tytonidae	*Tyto alba*	Barn owl	Burung Hantu	e	I
Sturnidae	*Acridotheres javanicus*	Javan myna	Raja Kerbau	a	I
Alcedinidae	*Alcedo atthis*	Common kingfisher	Raja Udang	g	I
Turdidae	*Copsychus malabaricus*	White-Rumped Shama	Burung Murai Batu/ Murai Temu	b, c	I
	Copsychus saularis	Oriental magpie Robin	Burung Murai Padang	a, b	I
Nectariniidae	*Nectarinia jugularis*	Olive-backed sunbird	Burung Kelicap	a, b	I
Caprimulgidae	*Lyncornis temminckii*	Malaysian-eared nightjar	Burung Tukang	e	I
Dicruridae	*Dicrurus macrocercus*	Black Drongo	Burung Cecawi	a, e, g	I
Phasianidae	*Argusianus argus*	Great Argus	Burung Kuang Raya	a, d	I
Hirundinidae	*Hirundo tahitica*	Pacific swallow	Burung Layang-layang	a, b	I
Paradisaeidae	*Paradisaea minor*	Common Aorora	Burung Cenderawasih	e	I
Cuculidae	*Centropus sinensis*	Greater Coucal	Burung but but	a, b	I

a food, *b* medicine, *c* pet, *d* ornament, *e* black magic, *f* myth, *g* indicator, *Q* questionnaire, *I* interview.

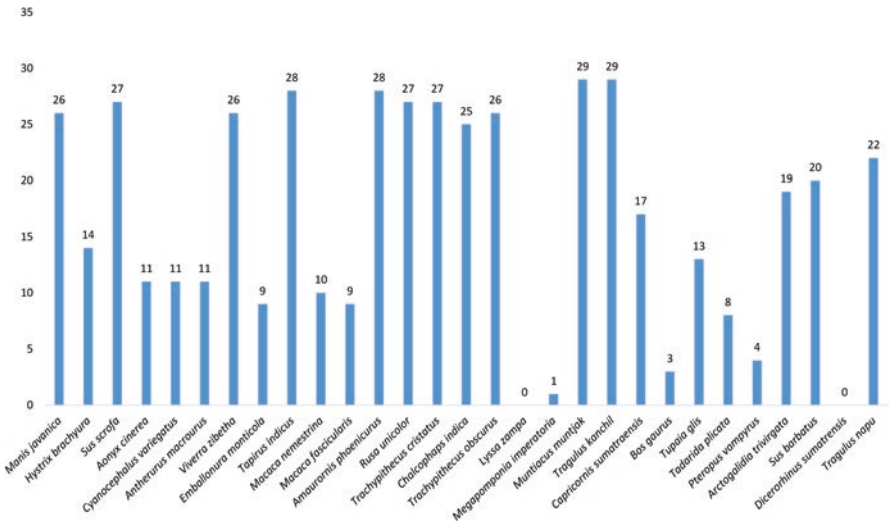

Fig. 13 The frequency of consumption by the Semoq Beri people of wildlife listed in the questionnaire according to species

Table 6 The list of reptiles consumed by the Semoq Beri people

Family	Scientific name	Common name	Local name	Uses	Notes
Trionychidae	*Dogania subplana*	Malayan softshell turtle	Labi-labi	a, b	I
Pythonidae	*Python* sp.	Python	Ular Sawa	a, b	I
Elapidae	*Ophiophagus hannah*	King cobra	Ular Tedung Selar	b	I
Testudinidae	*Manouria emys*	Brown Asian Giant tortoise	Kura-kura Baning	a	I
Varanidae	*Varanus salvator*	Asian water monitor	Leben/Cawoi	a	I
	Varanus dumerili	Dumeril's monitor		a, b	I
	Varanus nebulosus	Clouded monitor		a	I

a food, *b* medicine, *c* pet, *d* ornament, *e* black magic, *f* myth, *g* indicator, *Q* questionnaire, *I* interview.

Table 7 The list of insects consumed by the Semoq Beri people

Family	Scientific name	Common name	Local name	Uses	Notes
Cicadidae	*Megapomponia imperatoria*	Empress Cicada	Wohnyeng	f	Q
Rhinotermitidae	*Reticulitermes* sp.	Subterranean termite	Anai-anai	b	I
Apidae	*Apis* sp.	Honey bee	Lebah (pupa)	b	I

a food, *b* medicine, *c* pet, *d* ornament, *e* black magic, *f* myth, *Q* questionnaire, *I* interview.

otter, flying lemur, brush-tailed porcupine, serow, and small-toothed palm civet. This is because these species are harder to find and concerning decline in the number of consumed species. One of the respondents stated that the meat of the small-toothed palm civet makes her feel nauseous, and she felt sickened by its odour. Bats, such as the lesser sheath-tailed bat, wrinkled-lipped bat, and large flying fox, are also less consumed because of the odour of the meat, and it is claimed to trigger allergic reactions.

Surprisingly, as discovered from the interviews, the Semoq Beri hunters used to hunt for animals from the *Felidae* family, such as the Malayan tiger, leopard and black panther, as well as the Asian elephant. All these large mammals were consumed and shared by the hunters and their family with the rest of the community. However, these endangered species could no longer be found in these areas. According to them, illegal poaching by trespassers and mining activities in the nearby quarry are the primary reasons for the decline of these species. In addition, it is uncertain whether or not the binturong can still be found near the villages. Rodents, such as the brown rat, ricefield rat, and Malayan field rat, are among the least consumed species. They are not listed in the Wildlife Conservation Act 2010. Even if a lot of these animals are captured, their total population would not be affected. This is because these animals reproduce at a faster rate with higher fecundity. Presumably, the Semoq Beri people ate almost all animals found in their habitat.

As for birds, two bird species have been emphasised in the questionnaire. The most consumed bird species is the white-breasted waterhen, and the least consumed bird species is the emerald dove, as presented in Fig. 13. The rest of the bird species consumed by the Semoq Beri people were recorded during the interviews. Reptiles were not included in the questionnaire, but the interviews revealed that they were also consumed.

None of the respondents were recorded to have consumed or utilised the tropical swallowtail moth (*L. zampa*). The tropical swallowtail moth is said to have poisonous scales and is fatal when consumed. The Semoq Beri people also do not consume the empress cicada due to its poisonous scales, which can be fatal if consumed. The species is related to a myth that warns people not to imitate the sound of the cicadas as it will bring them bad luck, or locally called as *tulah*. The presence of cicadas is also believed to indicate certain things, such as the presence of paranormal entities.

Wildlife Utilisation

For the Orang Asli, wildlife is not just a source of food. Wildlife may also be used as ornaments, pets, or for medical purposes (Fig. 14). From the 68 wildlife species they were recorded to have consumed, most were utilised as a source of food, and some as medicine, especially among the older generation. The rest of the wildlife species are taken care of as pets, or made into ornaments, among others.

The Semoq Beri people have retained their knowledge and utilisation of natural resources in terms of treating ailments. Based on the interviews, the respondents

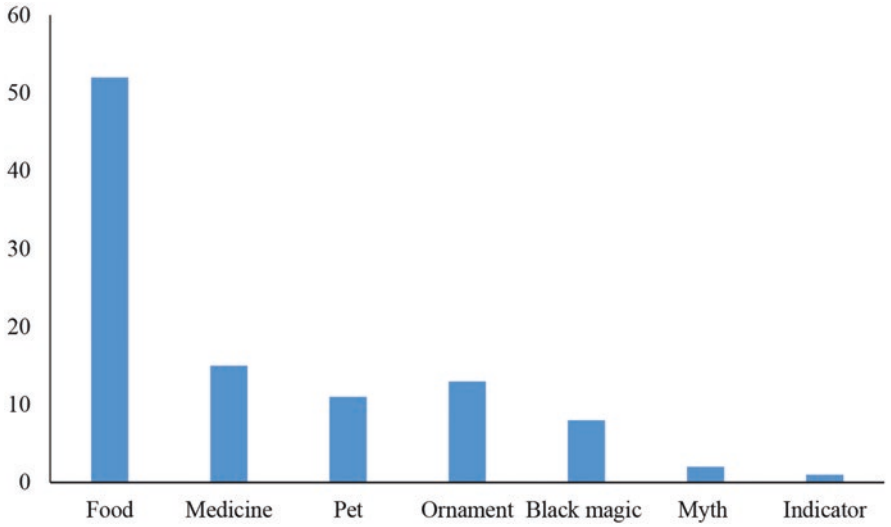

Fig. 14 The rate of the purpose of wildlife consumption and utilisation by the Semoq Beri people in Pahang

Table 8 Utilisation of animals according to parts used, uses, and mode of application

Classes	Common name	Scientific name	Part used	Uses	Mode of application
Mammals	Sun bear	*Helarctos malayanus*	1. Bile	1. Asthma	Eat
			2. Meat	2. Improve blood circulation	
	Malayan porcupine	*Hystrix brachyura*	Tail	Protection from getting sick	Amulet
	Sunda pangolin	*Manis javanica*	1. Meat	Protection from getting sick	1. Eat
			2. Scales		2. Dried and burned
	Flying Lemur	*Cyanocephalus variegatus*	Genitals	Increase woman's fertility	Eat
	Serow	*Capricornis sumatraensis*	1. Bile	Healing wounds and protection from getting sick	Grilled/boiled and drink
			2. Meat		
Reptiles	King cobra	*Ophiophagus hannah*	Bile	Asthma	Eat
	Clouded monitor	*Varanus nebulosus*	Meat	Internal body cooling	Eat

explained some of the recipes of the medicine that they use to cure their illnesses by utilising some of the wildlife species. Seven wildlife species that have been utilised for medical purposes and the methods of preparation are presented in Table 8. For example, reptiles, such as *V. nebulosus*, are usually chewed for a healthy body. They can be either grilled or cooked in a spicy curry, or locally called *masak kari pedas*. In addition, the bile of the serow is consumed to aid in wound recovery and to ward

off illnesses as they believe the animal only eats from sources that contain medicinal values and are healthy for the human body. Serow meat, especially the legs, usually contains more carbohydrates, which helps maintain steady levels of energy.

Wildlife were also used to heal diseases and balance of sex hormones. As an example, the genitals of the flying lemur can help boost the fertility of women. The bile of the sun bear and king cobra are consumed to treat asthma sufferers. Their meat is also considered as everyday food. One of the respondents said the meat of the *O. hannah* tasted like that of the common cat fish (*Clarias* sp.). Five species of mammals and two species of reptiles have been utilised for traditional medicine (Table 8). The Semoq Beri people believe that animal parts, internal or external, can cure illnesses. They have an intimate knowledge of their territory, and they believe that the forest provides ample resources for adequate nutrition. This is why the Semoq Beri people obtain most of their food requirements from the forest. Several studies have revealed that their intake of proteins and carbohydrates far exceeds the minimum requirements (Kuchikura 1988)

The Sunda pangolin and Malayan porcupine are also utilised by the Semoq Beri people for different purposes. The tail of the Malayan porcupine is used as an amulet to ward off illnesses in children. Their meat is boiled in water, and the water is used in spells, specifically for treating certain diseases. There is an enduring myth among the Semoq Beri people related to the Sunda pangolin, which says that its scales can ward off elephants when dried and burned. This myth is the same to that of the ones told by the Lanoh and Temiar tribes (Yahaya 2015), as pangolins are considered to have supernatural powers. The ways of cooking the Sunda pangolin and Malayan porcupine are pretty much the same. The scales or quills are removed, and then they can either be boiled to make a soup or grilled so that it won't get spoiled easily. Back then, the *P. tigris* was hunted by Semoq Beri hunters for its claws and fangs. They believe that the claws or fangs have mythical power, and they used them as amulets against bad luck. Every part of the Malayan tiger has medicinal values according to the Semoq Beri people, including their teeth, bones, and whiskers.

The Semoq Beri people call a solitary *S. scrofa* as *babi tunggal,* and a group of wild boars are known as *babi kawan*. Wild boar fangs are associated with handcraft accessories and superstitious beliefs, such as black magic. The meat of the wild boar contains more fat than other animals, and the meat of the Asian small-clawed otter (*A. cinerea*) is said to be an excellent source of stamina. The Semoq Beri people also consume the Malay civet as food. The meat is grilled or cooked with curry or soy sauce.

In addition, wildlife is also utilised in the production of ornaments. The antlers of the barking deer (Fig. 15) and the beak of the great hornbill are used as trophies among the Semoq Beri people (Fig. 16). The skin of the barking deer is also used to make a traditional musical instrument called *gendang*. The skin of the Malayan tapir is also used for the same purpose. But this tradition is not practiced anymore due to the erosion of traditional knowledge (TK) and the declining availability of the species. One of the bird species, the black drongo, is used as an indicator for the presence of the langur while hunting in forests.

Fig. 15 The carcass of the *M. muntjac*

Fig. 16 The beak of the *Buceros* sp. is used as a decoration in one of the houses

The Semoq Beri people also keep wildlife as pets. They prefer not to care for animals that would put them at risk of disease and physical harm, such as those that are venomous or aggressive. Usually, the Semoq Beri people keep birds as pets because of their beauty and vibrant colours, as well as ease of care compared with other animals. Examples of birds that were kept as pets are the blue-crowned hanging parrot and black hornbill (Fig. 17). They also keep as pets the young of animals they have killed, such as the pigtail macaque (Fig. 18). Some of the respondents stated that they don't consume any wildlife species they keep as pets.

Sustainable Use of Wildlife by the Semoq Beri People

The Orang Asli traditionally believe that natural resources must be harvested in a sustainable manner (Hood 1995). However, over the years, we cannot deny that there have been some changes to their livelihood strategies, which have affected the wildlife population. Generally, based on observation of the Semoq Beri people in Pahang, we can say that their hunting lifestyle is still sustainable, considering that

Fig. 17 The *L. galgulus* and *A. malayanus* being kept as pets

Fig. 18 Pigtail macaques tied with a chain and rope

they hunt for only what they need and in small quantities. For example, if they are trying to hunt for social animals, such as the white-thighed surili (*P. siamensis*) and dusky leaf monkey (*T. obscurus*), which travel together in one group, making it easy for all of them to be captured at once, only one or two will be shot. Apart from that, based on the interviews, the Semoq Beri people only hunt as much as their hands can carry, and the traditional hunting tools that they use are also one of the limiting factors.

The Wildlife Conservation Act 2010 (WCA 2010) governs the protection and management of wildlife in Malaysia, and these animals are also subjected to the International Union for Conservation of Nature (IUCN) Red List classification and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) appendices. WCA 2010 came into effect in December 2010, and Section 51 of this act grants permission to the Orang Asli to hunt wildlife for their sustenance. However, only 10 species listed under the Sixth Schedule are allowed to be

hunted, namely the wild boar, sambar deer, lesser mouse-deer, pig-tailed macaque, silvered leaf monkey, dusky leaf monkey, Malayan porcupine, brush-tailed porcupine, white-breasted waterhen, and emerald dove. The IUCN Red List provides a comprehensive list of the conservation status of plants and animals all around the globe. CITES, meanwhile, regulates the international trade of certain selected species, imposing certain controls, and the species covered are listed under different appendices, depending on the level of threat and needed protection.

It is important to recognise the information regarding the wildlife species consumed by the Orang Asli and the conservation status of the species. This is because with enough data, several alternatives may be provided to the Orang Asli to reduce their need to hunt the wildlife species. Referring to Table 9, there are a few threatened wildlife species that are consumed by the Semoq Beri people in Pahang. Three of the species are considered critically endangered in the IUCN Red List, including the charismatic species, the Malayan tiger, and it is alarming. The Malayan tiger and Sunda pangolin are also classified as totally protected species in the WCA 2010 and belong to the Appendix I in CITES. This is because in Malaysia, the two species are examples of wildlife species that are highly threatened by poaching due to the high demand for their parts (Clements et al. 2010). The scales and meat of the Sunda pangolin are in demand because of their uses in traditional Chinese medicine (Challender et al. 2019), and this is in accordance with the practices of the Semoq Beri people, as they use it for ward off illnesses.

Apart from that, other charismatic large mammals that are considered as endangered in the IUCN Red List but are consumed by the Semoq Beri people are the Asian elephant and Malayan tapir. They are also categorised under Appendix I of CITES because they are poached and traded for several reasons. Even though some male and all female Asian elephants lack tusks, they are heavily poached, and this is threatening their long-term survival (Choudhury et al. 2008). While the primary threat for the Malayan tapir is deforestation, they are increasingly being hunted as a food source (Traeholt et al. 2016). However, the frequency of the hunting of the two species among the Semoq Beri people has decreased as it is time-consuming and requires a lot of preparation and the participation of a large number of experienced hunters. Furthermore, more than 10 wildlife species consumed by the Semoq Beri people in Pahang are vulnerable, and only a few of the species are allowed to be hunted by them, namely, the *M. nemestrina* and *R. unicolor*. According to Simcharoen et al. (2014), the sambar deer is one of the most preferred prey species for tigers, and it is important in the tiger diet, as well as for the conservation of tigers. Unfortunately, this threatened species is one of the most consumed species among the Semoq Beri people in Pahang. In addition, several other species that are allowed to be hunted by the Orang Asli are mostly listed under the least concern group.

With the high number of threatened wildlife species being hunted by the Orang Asli that are not included in the Sixth Schedule of Wildlife Conservation Act 2010, certainly there is an urgent need to reevaluate how the species selection is made, and more study is needed to know how legislations on natural resources may affect their

Table 9 List of wildlife consumed by the Semoq Beri people and their conservation status

Scientific Name	Common Name	WCA 2010	IUCN	CITES
Panthera tigris	Malayan Tiger	TP	CR	I
Manis javanica	Sunda pangolin	TP	CR	I
Manouria emys	Brown Asian Giant tortoise	P	CR	
Elephas maximus	Asian elephant	TP	EN	I
Tapirus indicus	Malayan tapir	TP	EN	I
Prionailurus planiceps	Flat-headed cat	TP	EN	I
Orlitia borneensis	Malaysian Giant turtle		EN	II
Sus barbatus	Bearded pig	TP	VU	
Aonyx cinerea	Oriental small-clawed otter	TP	VU	I
Macaca nemestrina	Pigtail macaque	P/AC	VU	II
Rusa unicolor	Samba deer	P/AC	VU	
Capricornis sumatraensis	Serow	TP	VU	I
Bos gaurus	Malayan gaur	TP	VU	I
Arctictis binturong	Binturong	TP	VU	III
Panthera pardus	Black panther	TP	VU	I
Helarctos malayanus	Sun bear	TP	VU	I
Ophiophagus hannah	King cobra	P	VU	II
Buceros sp	Hornbill	TP	VU	II
Anthracoceros malayanus	Black hornbill	TP	VU	II
Acridotheres javanicus	Javan myna		VU	
Argusianus argus	Great Argus	TP	NT	II
Trachypithecus obscurus	Dusky leaf monkey	P/AC	NT	II
Presbytis siamensis	White-Thighed Surili	P	NT	II
Pteropus vampyrus	Large flying fox	P	NT	II
Psittinus cyanurus	Blue-Rumped parrot	P	NT	II
Psittacula longicauda	Long-tailed parakeet	TP	NT	II
Hystrix brachyura	Malayan porcupine	P/AC	LC	
Atherurus macrourus	Brush-tailed porcupine	P/AC	LC	
Sus scrofa	Wild boar	P/AC	LC	
Cyanocephalus variegatus	Sunda flying Lemur		LC	
Viverra zibetha	Malay civet	TP	LC	III
Arctogalidia trivirgata	Small-toothed palm civet	TP	LC	
Emballonura monticola	Lesser sheath-tailed bat		LC	
Macaca fascicularis	Long-tailed macaque	P	LC	II
Tupaia glis	Common Treeshrew	P	LC	II
Tadarida plicata	Wrinkled-lipped bat		LC	
Amaurornis phoenicurus	White-breasted Waterhen	P/AC	LC	
Chalcophaps indica	Emerald dove	P/AC	LC	
Paradoxurus hermaphroditus	Asian palm civet	P	LC	III
Muntiacus muntjac	Barking deer	P	LC	
Tragulus javanicus	Lesser mouse-deer	P/AC	LC	
Tragulus napu	Large mouse-deer	P	LC	

(continued)

Table 9 (continued)

Scientific Name	Common Name	WCA 2010	IUCN	CITES
Rattus norvegicus	Brown rat		LC	
Rattus argentiventer	Ricefield rat		LC	
Rattus tiomanicus	Malayan field rat		LC	
Python sp.	Python	TP	LC	
Pycnonotus goiavier	Yellow-vented bulbul		LC	II
Elanus caeruleus	Black-winged kite		LC	II
Spilopelia chinensis	Spotted dove		LC	
Tyto alba	Barn owl	TP	LC	II
Copsychus malabaricus	White-Rumped Shama	P	LC	
Copsychus saularis	Oriental magpie Robin	P	LC	
Nectarinia jugularis	Olive-backed sunbird	TP	LC	
Lyncornis temminckii	Malaysian-eared nightjar		LC	
Dicrurus macrocercus	Black Drongo	TP	LC	
Hirundo tahitica	Pacific swallow	TP	LC	
Paradisaea minor	Common Aorora		LC	II
Centropus sinensis	Greater Coucal	TP	LC	
Dogania subplana	Malayan softshell turtle	P	LC	II
Varanus salvator	Asian water monitor	P	LC	II
Loriculus galgulus	Blue-crowned hanging-parrot	P	LC	II
Varanus dumerili	Dumeril's monitor	TP	NE	II
Varanus nebulosus	Clouded monitor	TP	NE	I
Panthera sp	Leopard	TP	NE	

TP Totally Protected, *P* Protected, *AC* Aborigines Consumption, *CR* Critically Endangered, *EN* Endangered, *VU* Vulnerable, *NT* Near Threatened, *LC* Least Concern, *NE* Not Evaluated, *I* Trade in specimens of these species is permitted only in exceptional circumstances, *II* Trade must be controlled in order to avoid utilisation incompatible with their survival, *III* contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

livelihood (Aziz et al. 2013). Besides, the Semoq Beri people in Pahang are unaware of the risk of extinction faced by some of the animals they hunt, such as the Sunda pangolin and the brown Asian giant tortoise, which are now critically endangered. A general lack of awareness regarding wildlife conservation may also be a contributing factor. Hence, an effective awareness program and exposure through education among the Orang Asli need to be done extensively. This is to ensure that the Orang Asli, especially the Semoq Beri people in Pahang, can continue to practice their heritage and culture, but at the same time help in the conservation efforts in line with the vision of the National Policy on Biological Diversity.

Conclusion

In this chapter, we have discussed the ethnography of the Orang Asli Semoq Beri in Pahang, especially the classification of their lifestyles into five categories, which are connected to the pattern of wildlife consumption. Although the number of wildlife species consumed is high, we believe that we need more intensive studies on the interactions between the Semoq Beri people and wildlife to gain a deeper understanding on their needs, culture, and heritage. We reject the notion of blaming the Semoq Beri people in Pahang as the cause of animal extinction due to their lifestyle, but, rather, we believe that intensive awareness and educational programs, especially on the conservation status of the threatened and endangered wildlife species, will be a win–win strategy for conservation.

Acknowledgments The authors acknowledge Ministry of Higher Education Malaysia, Universiti Tun Hussein Onn Malaysia, Universiti Kebangsaan Malaysia, Department of Orang Asli Development Malaysia (JAKOA) and Department of Wildlife and National Parks (PERHILITAN) for providing the necessary funding, facilities, and assistance. This research was supported by Fundamental Research Grant Scheme FRGS/1/2018/WAB13/UTHM/03/2 provided by Ministry of Higher Education Malaysia, GPPS-UTHM-2019-H553 postgraduate grant by Universiti Tun Hussein Onn Malaysia (UTHM), UKM-ST-2018-020 and UKM-GUP-2019-037 by Universiti Kebangsaan Malaysia (UKM). We are also thankful to Department of Orang Asli Development Malaysia (JAKOA) and Department of Wildlife and National Parks (PERHILITAN) for providing research permit (JAKOA/PP.30.032Jld 44 (48) & KATS 600-2/2/21 JLD.9 (7)–B-00266-16-19) We also acknowledge all respondents for their cooperation and knowledge sharing in this study as well as local guides that assisted us throughout this research.

References

Abdullah, M. T., Abdullah, M. F., Bartholomew, C. V., & Jani, R. (2016). *Kelestarian masyarakat Orang Asli Terengganu*. Kuala Nerus: Penerbit Universiti Malaysia Terengganu.

Abdullah, M. T., Aznan, S., Zainir, M., Ramlee, M., Bartholomew, C. & Pesiu, E. (2017) Resources use by Orang Asli in Tasik Kenyir, Terengganu. In *3rd International Conference on Indigenous and Social Sciences (ICISS) 2017*, Kuala Nerus: Universiti Sultan Zainal Abidin.

Alves, R. R., & Souto, W. M. (2011). Ethnozoology in Brazil: Current status and perspectives. *Journal of Ethnobiology and Ethnomedicine, 7*, 22.

Anderson, E. N. (1988). *The food of China*. Yale University Press.

Ang, K. C., Ngu, M. S., Reid, K. P., The, M. S., Aida, Z. S., Koh, D. X. R., Beg, A., Oppenheimer, S., Salleh, H., Clyde, M. M., & Md-Zain, B. M. (2012). Skin color variation in Orang Asli tribes of peninsular Malaysia. *PLoS One, 7*, e42752.

Aziz, S. A., Clements, G. R., Rayan, D. M., & Sankar, P. (2013). Why conservationists should be concerned about natural resource legislation affecting indigenous peoples' rights: Lessons from peninsular Malaysia. *Biodiversity and Conservation, 22*, 639–656.

Azliza, M. A., Ong, H. C., Vikineswary, S., Noorlidah, A., & Haron, N. W. (2012). Ethnomedicinal resources used by the Temuan in Ulu Kuang Village. *Journal of Ethnobiology and Ethnomedicine, 6*, 17–22.

Baer, A. (1999). *Health, disease and survival: A biomedical and genetic analysis of the orang Asli of peninsular Malaysia*. Subang Jaya: Center for Orang Asli Concerns.

Bartholomew, C. V., Azizan, N. F. N., Abdullah, M. T. & Abdullah, R. (2017). *Ethnozoological survey among the Orang Asli of Kenyir, Terengganu, Peninsular Malaysia*. 8th Biodiversity Seminar 2017.

Benjamin, G. (1997). Issues in the ethnohistory of Pahang. In N. H. S. Nik-Abd-Rahman, M. M. Abu-Bakar, A. H. Khairuddin, & J. Baharuddin (Eds.), *Pembangunan Arkeologi Pelancongan Negeri Pahang* (pp. 82–121). Pahang Malaysia: Lembaga Muzium Negeri Pahang.

Berry, K. (2011). The ethnographer's choice: Why ethnographers do ethnography. *Cultural Studies - Critical Methodologies, 11*, 165–177.

Castetter, E. F. (1944). The domain of ethnobiology. *American Naturalist, 78*, 158–170.

Challender, D., Willcox, D. H. A., Panjang, E., Lim, N., Nash, H., Heinrich, S. & Chong J. (2019). *Manis javanica*. The IUCN Red List of Threatened Species 2019.

Choudhury, A., Lahiri Choudhury, D. K., Desai, A., Duckworth, J. W., Easa, P. S., Johnsingh, A. J. T., Fernando, P., Hedges, S., Gunawardena, M., Kurt, F., Karanth, U., Lister, A., Menon, V., Riddle, H., Rübel, A. & Wikramanayake, E. (2008). *Elephas maximus*. The IUCN Red List of Threatened Species 2008.

Clements, R., Rayan, D. M., Zafir, A. W. A., Venkataraman, A., Alfred, R., Payne, J., & Sharma, D. S. K. (2010). Trio under threat: Can we secure the future of rhinos, elephants and tigers in Malaysia? *Biodiversity and Conservation, 19*, 1115–1136.

Denzin, L. (2011). *The sage handbook of qualitative research*. USA: Sage Publications.

Hood, S. (1995). Dunia peribumi dan alam sekitar: Langkah ke hadapan. *Inaugural Lecture, 30*, 1995.

Kardooni, R., Fatimah, K., Siti Rohani, Y., & Siti Hajar, Y. (2014). Traditional knowledge of orang Asli on forests in peninsular Malaysia. *Indian Journal of Traditional Knowledge, 13*, 283–291.

Kuchikura, Y. (1988). Efficiency and focus of blowpipe hunting among Semaq Beri hunter-gatherers of peninsular Malaysia. *Human Ecology, 16*, 271–305.

Kuchikura, Y. (1996). Fishing in the tropical rain forest: Utilization of aquatic resources among the Semaq Beri hunter-gatherers of peninsular Malaysia. *Senri Ethnological Studies, 42*, 147–174.

La Belle, T. J. (1982). Formal, nonformal and informal education: A holistic perspective on life-long learning. *International Review of Education, 28*, 159–175.

Lim, K. H. (1900). *Pemakanan Orang Asli: Suatu penyelidikan empat kampung Semai dan Temuan*. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Majid, A., & Kruspe, N. (2018). Hunter-gatherer olfaction is special. *Current Biology, 28*, 409–413.

Masron, T., Masami, F., & Ismail, N. (2013). Orang Asli in peninsular Malaysia: Population, spatial distribution and socio-economic condition. *Ritsumeikan Journal of Social Sciences and. Humanities, 6*, 75–115.

Naidoo, L. (2012). *Ethnography: An introduction to definition and method*. An ethnography of global landscapes and corridors. BoD – Books on Demand, 1–8.

Nicholas, C. (2003). The orang Asli: First on the land, last in the plan. *Kajian Malaysia, 21*, 315–329.

Reeves, K. H. (2008). Qualitative research methodologies: Ethnography. *British Medical Journal, 337*, a1020.

Simcharoen, A., Savini, T., Gale, G. A., Roche, E., Chimchome, V., & Smith, J. L. (2014). Ecological factors that influence sambar (*Rusa unicolor*) distribution and abundance in western Thailand: Implications for tiger conservation. *Raffles Bulletin of Zoology, 62*.

Traeholt, C., Novarino, W., Saaban, S., Shwe, N. M., Lynam, A., Zainuddin, Z., Simpson, B. & Mohd, S. (2016). *Tapirus indicus*. The IUCN Red List of Threatened Species 2016.

Waters, M. R., Stafford, T. W. j., McDonald, H. G., Gustafson, C., Rasmussen, M., Cappellini, E., Olsen, J. V., Szklarczyk, D., Jensen, L. J., Gilbert, T. P., & Willerslev, E. (2011). Pre-Clovis mastodon hunting 13,800 years ago at the Manis site, Washington. *Science, 334*, 351–353.

Yahaya, F. H. (2015). *The usage of animals in the lives of the Lanoh and Temiar tribes of Lenggong, Perak*. In SHS Web of Conferences, 18:04006. EDP Sciences.

Zahidin, M. A., Omar, W. B. W., Taib, W. R. W., Japning, J. R. R., & Abdullah, M. T. (2018). Sequence polymorphism and haplogroup data of the hypervariable regions on mtDNA in Semoq Beri population. *Data in Brief, 21*, 2609–2615.

Muhammad Abu Bakar Abdul-Latiff, PhD., is a lecturer at the Department of Technology and Natural Resources, Faculty of Applied Sciences and Technology (FAST), and Principal Researcher at Oasis Integrated Group (I^3E), Universiti Tun Hussein Malaysia (UTHM). He received his Bachelor, Master of Science and Ph.D. degree from the National University of Malaysia (UKM) in Genetics. His expertise is on Wildlife Genetics, Ethnozoology and Mammalogy. His current research interest are molecular systematic and population genetic of wildlife in Malaysia as well as Next Generation Sequencing of Malaysia's Wildlife focusing on metagenomics and mitogenomic study. He also worked on Ethnozoological study especially among aborigines in protected areas in Malaysia.

Nurul Afiqah Binti Mohd Ayub, B.Sc., received her Bachelor degree (Biodiversity and Conservation) from, Universiti Tun Hussein Malaysia (UTHM). She developed keen interest on ethnozoology and traditional knowledge study among indigenous people in Peninsular Malaysia and Sabah.

Fatin Zahari, BSc., is a Master of Sciences candidate at the Faculty of Applied Sciences and Technology (FAST), Universiti Tun Hussein Onn Malaysia. She received her Bsc. from Universiti Tun Hussien Onn Malaysia (UTHM) in Biodiversity and Conservation. Her current research area now is focusing on ethnozoology, taxidermy and museology of wildlife in Malaysia.

Nursyuhada Othman, M.Sc., is a PhD candidate at at the Department of Technology and Natural Resources, Faculty of Applied Sciences and Technology (FAST), Universiti Tun Hussein Malaysia. She received her Bachelor degree (Biological Sciences) from Universiti Malaysia Terengganu (UMT) and Master degree (Conservation Biology) from the National University of Malaysia (UKM). Her current research is focusing on molecular study of wildlife in Malaysia through environmental DNA (eDNA) as well as Next Generation Sequencing of Malaysia's Wildlife focusing on metagenomics and mitogenomic study.

Hidayah Haris, BSc., is a Master of Sciences candidate at the Faculty of Applied Sciences and Technology (FAST), Universiti Tun Hussein Onn Malaysia. She received her Bsc. from Universiti Tun Hussien Onn Malaysia (UTHM) in Biodiversity and Conservation. Her current research is focusing on ecology of primates in Malaysia which include the practice of molecular and ethnoprimatological approach. Her study interests include Next Generation Sequencing (NGS) of primates, focusing on the metabarcoding for their diet analysis.

Mohd Faudzir Najmuddin M.Sc., is a PhD candidate at the Department of Technology and Natural Resources, Faculty of Applied Sciences and Technology (FAST), Universiti Tun Hussein Malaysia. He received his Bachelor degree (Zoology) from the National University of Malaysia (UKM) and Masters degree (Biodiversity) from Universiti Tun Hussein Onn Malaysia (UTHM). While previously focussing on Ethology, his current research interest are wildlife ecology and ethnozoology in Malaysia. He developed keen interest in photography as a complementary skills to academic portfolio.

Badrul Munir Md Zain, Ph.D., is a Professor at the Department of Biological Science and Biotechnology, Faculty of Science and Technology (FST), UKM. He received his Bachelor and Master of Science degree from the Universiti Kebangsaan Malaysia (UKM) and a Ph.D. degree from Columbia University in the city of New York, USA. His main field of expertise are molecular systematics and primatology. He has been conducting research on molecular systematics of the Malaysian endangered wildlife species, including ethnozoological study and research on phylogenetics of aborigines in Malaysia since 2004.

Wildlife Hunting Practices by the Indigenous People of Terengganu, Peninsular Malaysia

Candyrilla Vera Bartholomew, Mahfuzatul Izyan Zainir, Mohamed Nor Zalipah, Mohd Hasdi Husin, and Mohd Tajuddin Abdullah

Abstract In Peninsular Malaysia, the indigenous people (Orang Asli) depend on the forest for subsistence. Hunting wildlife and collecting forest products are part of their cultural practices and lifestyle. However, little is known about how the Orang Asli hunt wildlife. As such, it is important to monitor the wildlife hunting patterns of the Orang Asli to safeguard natural resources and help in animal conservation. Using both qualitative and quantitative methods, we investigated how wildlife is perceived by the Orang Asli and the traditional hunting practices of the Semoq Beri sub-tribe at a forest reserve in the state of Terengganu, Malaysia. We found that 53 wildlife species are hunted by the Orang Asli for various purposes. They tracked the animals by their footprints and used snares, traps and blowpipes to capture them. It was also noted that they do not hunt big animals, but the lucrative wildlife market has encouraged them to hunt small protected animals for better income. The findings of this study may be important to help sustain the natural resources in the forest for the Orang Asli.

Keywords Orang Asli · Wildlife hunting · Cultural practices · Sustainability

C. V. Bartholomew (✉) · M. I. Zainir · M. T. Abdullah
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Mohamed N. Z.
Faculty of Science and Marine Environment, Universiti Malaysia Terengganu (UMT), Kuala Nerus, Terengganu, Malaysia

M. H. Husin
Jabatan Perlindungan Hidupan Liar dan Taman Negara Negeri Terengganu, Kuala Terengganu, Terengganu, Malaysia

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_10

Introduction

In Peninsular Malaysia, the indigenous people are a minority known as the Orang Asli. They are made up of three major tribes (Negrito, Senoi and Proto-Malay) divided into 18 sub-tribes (Carey 1976), and their history may be traced back to at least 25,000 years (Nicholas 2000). The Orang Asli have been called the "first people" or "original people" of Malaysia. Across the peninsula, all sub-tribes partake in similar activities in their daily lives, which include hunting, foraging and gathering forest resources (Rambo 1979).

Being primarily forest-dependent people, the Orang Asli are nomadic and semi-nomadic, acquiring various resources in and around tropical forests (Kuchikura 1986). Their high dependency on forest resources and products has been widely studied, particularly among the Semoq Beri and Batek communities (Ramle et al. 2014a; Tuck-Po 1998). Historically being land-security dependent and unaccustomed to cash economies, coupled with the lack of education and intermediate technology, these are likely reasons for their high dependence on forest resources for generations. Failure to fully assimilate into contemporary economic systems has resulted in them being plagued by perennial poverty. Recently, based on the report by the United Nations Development Programme, around 34% of the Orang Asli households lived in poverty (Balakrishnan 2016). Previous studies on forest resource utilisation by the Orang Asli have been conducted in the west coast of Peninsular Malaysia involving the Jah Hut, Semelai, Lanoh, Temiar, Temuan and Semang sub-tribes (Yahaya 2015; Milow et al. 2013; Azliza et al. 2012; Ong et al. 2012a, b; Howell et al. 2010; Samuel et al. 2010). However, hardly any study has documented Orang Asli communities living in the east coast. The sub-tribes mainly found in east coast states of Pahang, Kelantan and Terengganu are the Semoq Beri and Batek.

Based on what we know on the resources used by the Orang Asli, they harvested a variety of non-timber forest products (NTFPs) from terrestrial and aquatic sources (Arnold and Ruiz 1996). According to Burkill (1935), the Malayan rainforest contained more than 1700 species of plants and animals that have more than 5000 uses. Examples of NTFPs harvested in Peninsular Malaysia include agarwood, rattan, honey, bamboo, fruits and a variety of herbs, besides bushmeat like deer, porcupine and wild boar. Apart from using NTFPs for medicinal purposes, the Orang Asli also heavily relied on them for subsistence and materials for building their houses. In recent times, the Orang Asli have begun to harvest NTFPs in exchange for cash to purchase daily necessities. For instance, Jah Hut communities derived income from selling NTFPs, such as bamboo, fruits, vegetables, rattan and agarwood (Howell et al. 2010). In addition, NTFPs are increasingly being used by the Orang Asli as ornaments, like chenille plants (*Acalypha hispida*) and ferns (*Asparagus africanus*) (Milow et al. 2013).

The Orang Asli use a number of plant species for medicinal purposes. Recent ethnobotanical studies in Peninsular Malaysia indicated that the Orang Asli utilised more than 200 plants to treat illnesses, such as hypertension, diabetes, stomachache, diarrhoea and fever (Azliza et al. 2012; Ong et al. 2012a, b; Samuel et al. 2010;

Howell et al. 2010). The most common plants include petai (*Parkia speciosa*), tongkat ali (*Eurycoma longifolia*) and agarwood (*Aquilaria malaccensis*). The Orang Asli also use animals for a variety of purposes. However, only a few studies have documented the use of animals by the Orang Asli. At least 12 species of animals have been utilised for medicinal purposes (Yahaya 2015; Azliza et al. 2012; Howell et al. 2010). In Sarawak, however, up to 52 species of animals are utilised by the indigenous people for medicinal purposes (Azlan and Faisal 2006). Species regarded to have medicinal value by the indigenous people of Malaysia, including the peninsular Orang Asli, are the reticulated python (*Python reticulatus*), Malayan porcupine (*Hystrix brachyura*) and black giant squirrel (*Ratufa bicolor*). At least 10 terrestrial and aquatic animal taxa are consumed by the Orang Asli of the peninsula: the river terrapin (*Batagur baska*), tortoise (*Testudo* spp.), monitor lizards (*Varanus* spp.), Malayan porcupine (*Hystrix brachyura*), Sunda pangolin (*Manis javanica*), wild pig (*Sus scrofa*), macaques (*Macaca* spp.), barking deer (*Muntiacus muntjak*), plaintain squirrel (*Callosciurus notatus*) and mousedeers (*Tragulus* spp.). In some Orang Asli communities, animals are commercially traded or kept as pets (Yahaya 2015; Howell et al. 2010). Unfortunately, some animal species utilised by the Orang Asli (e.g. the Sunda pangolin) are considered critically endangered in the IUCN Red List (IUCN 2016) and are totally protected under the Malaysian Wildlife Conservation Act (2010).

Traditionally, the Orang Asli communities are known to exploit natural resources to sustain their livelihood. Today, many of the communities have been resettled in villages outside forests. Under the Sixth Schedule of the Wildlife Conservation Act (2010), the Orang Asli are permitted to hunt 10 species of wildlife for their own consumption. Nevertheless, there is a lack of information on the present state of wildlife being hunted by the Orang Asli and their hunting practices.

The Semoq Beri was chosen in this study because previous studies of this subtribe have only explored their concept of the forest and traditional knowledge (Ramle et al. 2014a, b), but did not look into their hunting practices. This has important implications for the conservation of threatened wildlife species. Therefore, by using qualitative and quantitative methods, we aim to: (1) determine the animals hunted by the Semoq Beri people living in the east coast of Peninsular Malaysia, (2) elucidate their hunting practices and (3) identify the favourite mammals hunted by this sub-tribe.

Methods

In a period of 6 months (between August 2015 to January 2016), information was gathered on the wildlife perceived and hunted by the Orang Asli in Kampung Sungai Berua (5° 4′ 49.8″ N 102° 53′ 2.76″ E) in Kenyir, Terengganu (Fig. 1). The majority of the Orang Asli people in the village belonged to the Semoq Beri sub-tribe. Ethic approval was obtained from the Orang Asli Development Department (JAKOA) of the Rural Development Ministry, and consent was requested from the village head.

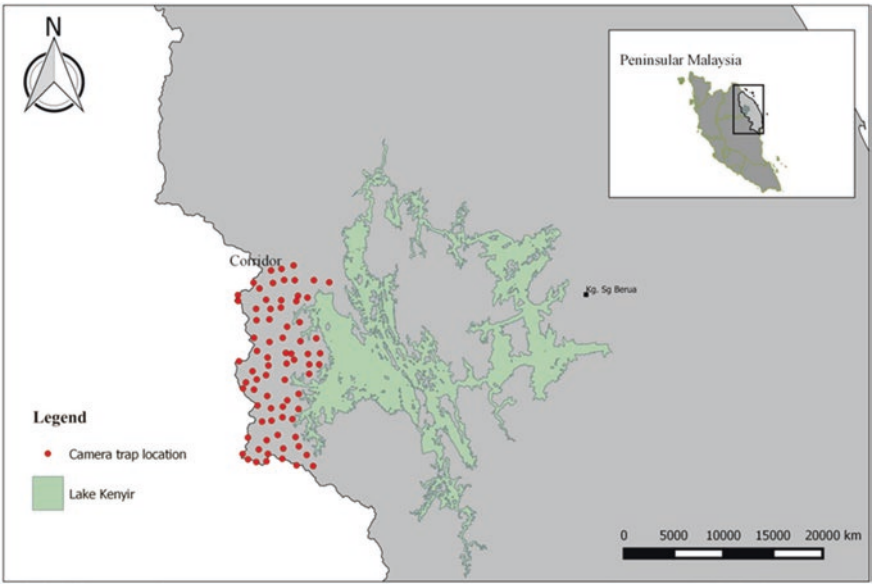

Fig. 1 Map showing the Orang Asli settlements in Kenyir, Terengganu, and locations of camera traps within the Kenyir forest reserve

Qualitative approach using face-to-face interviews was conducted on key informants comprising traditional medicine practitioners and hunters. Wildlife observed during the survey was photographed for *in-situ* identification purposes according to Francis (2008) for mammals, Robson (2000) for birds and Indraneil (2010) for reptiles. A series of questionnaires were employed to determine the wildlife hunted by the Semoq Beri folk.

Relatively abundant data on mammals in Kenyir Forest Reserve (Fig. 1) was collected from April to November (eight months). In order to obtain mammal detection/non-detection data, 78 camera traps were fixed on metal poles (in the absence of trees) that were cemented to the ground. Camera traps were installed close to underpass columns to prevent mammals from passing behind the camera. The surrounding vegetation was cleared to provide optimal fields of detection for each camera trap. Camera traps were checked to retrieve data and replace the batteries every two months. The relative abundance of mammal species was defined using the Photographic Capture Rate Index (PCRI). The estimates were averaged across all camera placements within each study area to produce respective mean PCRIs. Independent photos were defined as photos being captured 30 minutes apart from a previous photo with the next at the same location.

Results

Our findings identified 53 animal species utilised by the Semoq Beri Orang Asli as shown in Table 1. The animals comprised 10 species of reptiles, nine birds and 34 mammals. All reptiles and birds had been hunted by the Semoq Beri in the last 12 months. However, for mammals, 14 species including the sun bear, Malayan tiger, Asian elephant and tapir were not hunted. This was because the natives only utilised animals that provided significantly for their livelihood. Among all the identified wildlife game, four species were critically endangered: the river terrapin (*Batagur affinis*), red-eared slider (*Trachemys scripta*), helmeted hornbill (*Rhinoplax vigil*) and Sunda pangolin (*Manis javanica*). Additionally, there were seven endangered species, 12 vulnerable species and six near threatened species (Table 1).

Camera traps captured a relative abundance of 10 large mammals using the viaducts over 6 months (Table 2). The relative abundance, a PCRI for all large mammals, were defined as the number of independent photos (detections) captured. These estimates were averaged across all camera placements within each study area to produce respective mean PCRIs. Many of the large mammals observed were herbivores and omnivores. Carnivores were relatively rare.

Discussion

In Southeast Asia, indigenous communities had been hunting wildlife mainly for subsistence for at least 40,000 years (Zuraina 1982). In Peninsular Malaysia, the Orang Asli were known to hunt and utilise various species, including endangered ones. Wildlife hunting was considered an important subsistence activity for Orang Asli communities. Regarded as forest people, the Orang Asli could hunt animals easily using traditional knowledge and methods.

Among all the species, 53% were used for household consumption while 40% were utilised for trading and 26% were kept as pets. Besides that, the Orang Asli still relied on animals for medicinal purposes (8%). The parts of a few species were used for traditional treatment, such as pangolin scales and meat, the hornbill's casque and porcupine bezoars (onion-shaped masses of undigested plant material in the animal's gut). This finding was supported by a previous study conducted on a similar sub-tribe (Bartholomew et al. 2016).

For data validation, information on actual wildlife had been documented based on secondary data. Table 2 shows the taxonomic list of mammals recorded in the Kenyir forest area. Besides that, data of animals present in Kenyir forest area were also obtained from previous studies (Yong 2015; Clements 2013; Hedges et al. 2013). There were around 44 species of mammals, one of which was critically endangered, six endangered, nine vulnerable and six near threatened under the IUCN Red List (2016). The animals were also categorised as totally protected (64%) or protected (36%) under the Malaysian Wildlife Conservation Act (2010).

Table 1 Wildlife hunted by the Orang Asli in the last 12 months

Species	Scientific name	Common name	Orang Asli name	Uses	WCA (2010)	IUCN status
Reptiles	**Geoemydidae**					
	Batagur affinis	River terrapin	*Pa′ as*	F, P, T	TP	CR
	Cuora amboinensis	Malayan box turtle	*Kerak keban*	F, P	P	VU
	Heosemys spinosa	Spiny hill turtle	*Ga′ de*	T	P	EN
	Siebenrockiella crassicollis	Black marsh turtle	*Yo*	F, M, T	P	VU
	Manouria emys	Asian brown tortoise	*Sel*	P, T	P	VU
	Emydidae					
	Trachemys scripta	Red-eared slider	*Mong*	M, T	NE	CR
	Trionychidae					
	Amyda cartilaginea	Asiatic softshell turtle	*Pa′ as*	T	P	VU
	Gekkonidae					
	Gekko gecko	Tokay gecko	*Che' eh*	T	P	NA
	Varanidae					
	Varanus salvator	Monitor lizard	*Sereng*	F	P	LC
	Pythonidae					
	Python reticulatus	Reticulated python	*Tijo*	M, T	P	NA
Birds	**Phasianidae**					
	Lophura ignita	Crested fireback	*Kawah pegar*	F, P	TP	NT
	Gallus gallus	Junglefowl	*Ayam hutan*	F, P	P	LC
	Rallidae					
	Amaurornis phoenicurus	Waterhen	*Itik air*	F	P	NT
	Bucerotidae					
	Rhinoplax vigil	Helmeted hornbill	*Burung lilin*	F, M, T	TP	CR
	Buceros rhinoceros	Rhinoceros hornbill	*Terang*	F, T	TP	NT
	Columbidae					
	Chalcophaps indica	Emerald dove	*Kawah kukur*	F, P	P	LC
	Psittaculidae					
	Psittinus cyanurus	Blue-rumped parrot	*Kawah serindit*	P, T	TP	NT

(continued)

Table 1 (continued)

Species	Scientific name	Common name	Orang Asli name	Uses	WCA (2010)	IUCN status
	Sturnidae					
	Gracula religiosa	Common hill myna	*Kawah tiong*	F, P, T	P	LC
	Passeriformes					
	Pycnonotus zeylanicus	Straw-headed bulbul	*Kawah barau*	F	TP	VU
Mammals	**Manidae**					
	Manis javanica	Pangolin	*Pantuai*	F, T	TP	CR
	Cynocephalidae					
	Galeopterus variegates	Sunda colugo	*Kubung*	NA	TP	LC
	Lorisidae					
	Nycticebus coucang	Slow Loris	*Relung*	NA	TP	VU
	Cercopithecidae					
	Trachypithecus obscurus	Dusky leaf monkey	*Basing*	F, T	P	NT
	Macaca nemestrina	Southern pig-tailed macaque	*Tadik*	F, T	P	VU
	Macaca fascicularis	Long-tailed macaque	*Penrok*	F T	P	LC
	Hylobatidae					
	Symphalangus syndactylus	Siamang	*Batiu*	NA	TP	EN
	Hylobates lar	White-handed gibbon	*Tawo*	NA	TP	EN
	Canidae					
	Cuon alpines	Dhole	*Cho*	NA	TP	EN
	Ursidae					
	Helarctos malayanus	Sun bear	*Mol*	NA	TP	VU
	Mustelidae					
	Martes flavigula	Yellow-throated marten	*Sawot*	NA	TP	LC
	Aonyx cinerea	Oriental small-clawed otter	*Memerang*	NA	TP	VU
	Viverridae					
	Viverra tangalunga	Malayan civet	*Musang*	F, T	P	LC
	Paradoxurus hermaphroditus	Common palm civet	*Musang*	F, T	NE	LC
	Felidae					
	Panthera tigris	Tiger	*Gayi*	NA	TP	EN
	Panthera pardus	Leopard	*Gayi*	NA	TP	VU

(continued)

Table 1 (continued)

Species	Scientific name	Common name	Orang Asli name	Uses	WCA (2010)	IUCN status
	Neofelis nebulosa	Clouded leopard	*Gayi*	NA	TP	VU
	Elephantidae					
	Elephas maximus	Asian elephant	*Gajah*	NA	TP	EN
	Tapiridae					
	Tapirus indicus	Asian tapir	*Badak kampung*	NA	TP	EN
	Suidae					
	Sus scrofa	Bearded pig	*Jalu*	F	TP	LC
	Tragulidae					
	Tragulus spp.	Mousedeer	*Kancil*	F	P	LC
	Cervidae					
	Rusa unicolor	Sambar deer	*Pelanduk*	F	P	VU
	Muntiacus muntjak	Barking deer	*Bohol*	F	P	LC
	Bovidae					
	Capricornis sumatrensis	Southern serow	*Kambing gurun*	M	TP	NA
	Sciuridae					
	Callosciurus notatus	Plantain squirrel	*Cedek*	F, P, M	NE	LC
	Callosciurus erythraeus	Pallas's squirrel	*Lebir*	F, P	NE	LC
	Callosciurus caniceps	Grey-bellied squirrel	*Gahui*	F, P	NE	LC
	Ratufa bicolor	Black giant squirrel	*Daguan*	NA	TP	NT
	Sciuridae					
	Petaurista petaurista	Red giant flying squirrel	*Menuk*	P	TP	LC
	Petaurista elegans	Lesser giant flying squirrel	*Pawor*	P	TP	LC
	Aeromys tephromelas	Black giant flying squirrel	*Pati*	P	TP	DD
	Spalacidae					
	Rhizomys sumatrensis	Hoary bamboo rat	*De' kan*	F, T	NE	LC
	Hystricidae					
	Hystrix brachyura	Porcupine	Landak	F, M, T	P	LC
	Atherurus macrourus	Brush-tailed porcupine	Landak	F, M, T	P	LC

Uses: (*F* = Food; *P* = Pet; *M* = Medicine; *T* = Trading; *NA* = Not Available); (*TP* = Totally Protected; *P* = Protected; *NE* = Not Evaluated); (IUCN Red List Status 2016: *CR* = Critically Endangered; *EN* = Endangered; *VU*=Vulnerable; *NT* = Near Threatened; *LC* = Least Concern; *NA* = Not Available; *DD* = Data Deficient

Table 2 Summary statistics of 10 mammal species expected to occur at viaducts in Tembat Forest Reserve

Diet	Common name	Species	N	PCRI	IUCN
H	Muntjac	*Muntiacus muntjac*	91	17.01	LC
H	Asian tapir	*Tapirus indicus*	48	8.98	EN
O	Wild pig	*Sus scrofa*	14	2.62	LC
H	Asian elephant	*Elephas maximus*	12	2.24	EN
O	Sun bear	*Helarctos malayanus*	2	0.374	VU
C	Banded linsang	*Prionodon linsang*	1	0.187	LC
O	Long-tailed macaque	*Macaca fascicularis*	1	0.187	LC
O	Pig-tailed macaque	*Macaca nemestrina*	1	0.187	VU
O	Yellow throated marten	*Martes flavigula*	1	0.187	LC
C	Leopard cat	*Prionailurus bengalensis*	1	0.187	LC

Diet = herbivorous (H), omnivorous (O), carnivorous (C). N = independent detections (0.5 hr. intervals); *PCRI* = Photographic Capture Rate Index (N/1000*trap nights). *IUCN status checked via iucnredlist.org website

The respondents reported hunting at least 11 of the 42 mammals sighted in the forest reserve (26%). According to the interviews, the Semoq Beri basically caught the animals using snares (89%) and blowpipes (73%). For instance, bigger animals such as wild boars, sambar deers and barking deers were hunted using blowpipes, but sometimes, they were also caught in snares. For birds, the Orang Asli mainly used traps to hunt them. Most of the birds were eaten while a few species, such as the blue-rumped parrot (*Psittinus cyanurus*) and common hill myna (*Gracula religiosa*), were kept as pets because of their aesthetic features. Other species, such as turtles and tortoises, were captured using bare hands. These species are used for food, trading and, in some cases, for traditional medicine (e.g. red-eared slider). According to some interview respondents, the Orang Asli communities hunted wildlife based on traits of the particular animals. For instance, they will go out and hunt nocturnal animals at night. They preferred to hunt during the rainy season because it was easier to track the animals' footprints on the wet ground.

The hunting practices of the Orang Asli was highly related to their culture and belief. For instance, the certain communities did not hunt snakes because of cultural restrictions or taboos that prohibited its consumption (Endicott 2010). With a large number of the Orang Asli adopting Islam as their religion, they had also forgone the consumption of wild pigs or animals that were not considered halal. But although the Orang Asli communities in Kampung Sungai Berua had converted to Islam, some of them still hunted wild boars to sell for subsistence.

The Orang Asli practices were strongly related to their belief in spirits that guided their lives, and those practices could actually allow them to hunt wildlife in a sustainable manner. For instance, the Semoq Beri communities strongly believed in their *Semoq Hala* (Ramle et al. 2014a), which were spirits that they obeyed. In relation to that, their concept of the forest and its significance, particularly to the Semoq Beri in Terengganu, had been documented (Ramle et al. 2014b). The Semoq Beri community considered themselves responsible for safeguarding the forests

around them. They believed that supernatural beings dwelled in the forests and they were responsible for providing and protecting all its resources. As such, the Orang Asli traditionally believed that forest resources must be extracted with a purpose (Hood 1995). The forest was considered as their "bank", where they could withdraw its wealth when needed, and in a sustainable manner to avoid wastage. The resources must be carefully managed so that the next generation would also be able to make use of the wealth (Ramle et al. 2014b). Several taboos in forest resource harvesting were adhered to by the Orang Asli. For instance, permission or consent must be requested from supernatural beings prior to exploiting any plant or animal for their subsistence. They believed that failure to do so would incur the wrath of the forest spirits, which would lead to punitive consequences befalling their community, such as disease and natural disasters. Wildlife was an important forest resource that contributed to the well-being of the Orang Asli. In this study, we documented that the Orang Asli had utilised wildlife for both consumptive (74%) and non-consumptive (26%) purposes. Similarly in Sabah and Sarawak, the hunting of wildlife by the natives there was also observed to be largely for household food consumption (Azlan and Faisal 2006). This indicated that wildlife played an important role in sustaining the Orang Asli life.

Nevertheless, deforestation, complicated by poaching and lack of legal and positive economic incentives, were main threats to the livelihood of the people that relied on forest resources, including the Orang Asli (Milner-Gulland 2012). The Orang Asli's livelihood was very vulnerable to developments that encroached on the forests where they used to hunt and earn their living. Based on interviews, the Semoq Beri respondents claimed that animals were increasingly hard to hunt and that they had to spend more time and go deeper into the forest. This could be attributed to the decline in animal populations caused by the loss of habitat due to the high rate of deforestation in nearby Orang Asli settlements. Historically, Orang Asli populations occupying vast acreages of forest had a negligible impact on wildlife. Permanent settlements with limited forests, coupled with the lack of sustainable economic opportunities, had changed the lifestyle of the Orang Asli for the worse and increased their burden. Additionally, poaching by locals and foreigners had been reported in the forests of Peninsular Malaysia (Loh 2016). The threat of paoching had become severe when the Wildlife and National Parks Department (PERHILITAN) reported large hauls of wildlife parts being seized from foreign poachers between 2010 and 2015, all of which had been obtained from protected areas in Terengganu (Fig. 2).

The Orang Asli did not hunt big game animals such as the Asian elephant, but there were cases where locals and foreigners had been detained for killing the elephants (Dasgupta 2017). In Tasik Pedu, Kedah, an elephant carcass was found two weeks after it was belived to have been killed by poachers for its tusks (Anon 2016). In Borneo, two rare elephants were also killed for their tusks (Anon 2017). Meanwhile, the critically endangered Malayan tiger was reportedly in grave danger due to illegal hunting for its meat and body parts (Rosli 2016; Zarina 2016). The Orang Asli were hardly involved in poaching cases. However, there were incidents where they had been used as guides and paid to hunt smaller protected animals

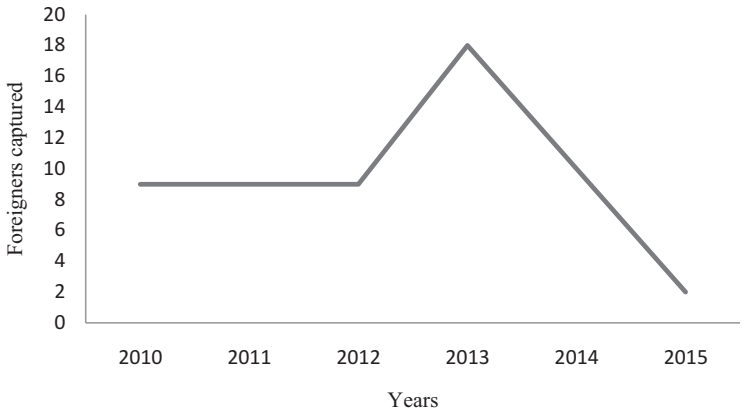

Fig. 2 Number of poaching cases by foreigners in Taman Negara (PERHILITAN 2016)

(Anon 2011; Yeng 2010). As noted, one of the main reasons that drove the Orang Asli to get involved in poaching was the good money paid by buyers, which could alleviate the burden of supporting their families (Azrina et al. 2011). Several studies had found a positive relationship between illegal harvesting of natural resources and poverty (Mainka and Trivedi 2002). For instance, in Palawan province in the Philippines, poverty was cited as a likely reason for hunting endangered species to sell at high prices among the rural communities there (Shively 1997).

To our knowledge, continuous hunting of protected wildlife might undermine viable populations and the overall survival of targeted species. As wildlife is one of the important components of the tropical forest ecosystem, it would be crucial to conserve and safeguard Malaysia's heritage for the future generation. Much progress had been made, with laws strictly enforced to prevent the extinction of animals. In Peninsular Malaysia, wildlife was protected under the Wildlife Conservation Act (2010), while Sabah and Sarawak had their own Wildlife Conservation Enactment (1997) and Wild Life Protection Ordinance (1998), respectively.

On the Orang Asli's right to hunt protected wildlife, the law forbade them from trading or selling animals or parts listed in the Sixth Schedule. Nevertheless, our study documented the hunting of pangolins by the orang Asli. Previous studies had addressed the involvement of the Orang Asli in poaching and trading of several species of animals, including the pangolin (Azrina et al. 2011). Historically, contact between the Orang Asli and outsiders had been established in the fifteenth century through economic activities (Gianno and Bayr 2009). Basically, Orang Asli were paid a nominal sum by commercial outfitters seeking wildlife products. The demand for wildlife products had increased over time. For example, pangolins, turtles, porcupines and pythons had lucrative value in traditional Chinese medicine (Brooks et al. 2010; Clements et al. 2010). Today, the huge market had encouraged the Orang Asli to hunt threatened or endangered species even though they knew about the wildlife protection laws. Based on personal communication, more than 50% of the respondents in this study were aware about which animal they could and could not

hunt. However, the hunting of protected animals still occurred due to lack of economic opportunities or incentives. Therefore, the low socioeconomic status of the orang Asli that led to a high illiteracy rate and lack of marketable skills had left them desperate and vulnerable (Azrina et al. 2011).

There was some disparity between the species that the Orang Asli were allowed to hunt and those that they actually hunted. For instance, even though Orang Asli communities hunted critically endangered species like the sunda pangolin and red-eared slider, they also hunted small arboreal animals like squirrels, which were not in the Sixth Schedule. According to Aziz et al. (2013), there were weaknesses in the law such as the rights given to the Orang Asli and how the animals were chosen. As such, it was important to review the law to make it more relevant and prevent the Orang Asli from getting into trouble. This was supported by previous studies on poaching by rural communities in Sarawak, which identified lax enforcement as one of the causes that encouraged the activity (Kishen et al. 2012).

Conclusion

The Orang Asli community hunted wildlife for both consumption and non-consumption purposes. The community did not cause wildlife depletion or extinction because they did not hunt in an unsustainable manner. While it was vital to conserve the survival of threatened species, efforts should be implemented to sustain the livelihood of the Orang Asli. The current findings showed that wildlife provided a significant livelihood to the Orang Asli, particularly the Semoq Beri in Kenyir, Terengganu. While they were known to hunt in a sustainable manner, more studies should be conducted to address the issue of wildlife hunting not only by the Orang Asli, but also by non-native locals. New economic opportunities for the Orang Asli, alternative incentives to reduce poaching, and maintaining suitable amounts of virgin forest together with increased law enforcement would help secure Malaysia's wildlife heritage and sustainable lifestyle of the Orang Asli.

Acknowledgements This research is supported by the Trans Disciplinary Research Grant Scheme (TRGS/2015/59373). We acknowledge the permission and assistance provided by the Management Council of Terengganu State Park, Lembaga Kemajuan Terengganu Tengah (KETENGAH), Forestry Department and the Wildlife and National Parks Department (PERHILITAN) [Permit No: 100-34/1.24 Jld 4 (10)]. Many thanks to the Orang Asli Development Department (JAKOA) and all villagers of Kampung Sungai Berua, Terengganu, for their cooperation. Last but not least, the authors thank Muhammad Fuad Abdullah, Muhamad Aidil Zahidin, Muhammad Syamsul Aznan Ariffin, Hairul Nizam Mohd Khori and Nurul Faezah Azizan for helping in the field work.

Apendix 1 List of mammals Recorded in Kenyir Forest (Yong 2015; Clements 2013; Hedges et al. 2013)

Family	Species	Common Name	WCA (2010)	IUCN
Manidae	*Manis javanica*	Sunda pangolin*	TP	CR
Cercopithecidae	*Presbytis siamensis*	White-thighed leaf monkey	P	NT
	Trachypithecus obscurus	Dusky leaf monkey*	P	NT
	Macaca nemestrina	Pig-tailed macaque*	P	VU
	Macaca fascicularis	Long-tailed macaque*	P	LC
Hylobatidae	*Symphalangus syndactylus*	Siamang	TP	EN
	Hylobates lar	White-handed gibbon	TP	EN
Canidae	*Cuon alpines*	Dhole	TP	EN
Ursidae	*Helarctos malayanus*	Sun bear	TP	VU
Mustellidae	*Martes flavigula*	Yellow-throated Marten	TP	LC
	Lutrogale perspicillata	Smooth-coated otter	TP	VU
	Aonyx cinereus	Oriental small-clawed otter	TP	VU
Viverridae	*Viverra zibetha*	Large Indian civet	TP	VU
	Viverra tangalunga	Malay civet*	P	LC
	Prionodon linsang	Banded linsang	TP	LC
	Paradoxurus hermaphrodites	Common palm civet	P	LC
	Paguma larvata	Masked palm civet	TP	LC
	Arctictis binturong	Binturong	TP	VU
	Arctogalidia trivirgata	Small-toothed palm civet	TP	LC
	Hemigalus derbyanus	Banded palm civet	TP	NT
Herpestidae	*Herpestes urva*	Crab-eating mongoose	TP	LC
Felidae	*Pantera tigris jacksoni*	Malayan Tiger	TP	EN
	Panthera pardus	Leopard	TP	NT
	Neofelis nebulosa	Clouded leopard	TP	VU
	Pardofelis marmorata	Marbled cat	TP	NT
	Catopuma temminckii	Golden cat	TP	NT
	Prionailurus bengalensi	Leopard cat	TP	LC
Elephantidae	*Elephas maximus*	Asian elephant	TP	EN
Tapiridae	*Tapirus indicus*	Asian tapir	TP	EN
Suidae	*Sus scrofa*	Wild pig*	P	LC
Tragulidae	*Tragulus* spp.	Mousedeer*	P	LC
	Tragulus kanchil	Lesser mouse-deer*	NA	LC
Cervidae	*Rusa unicolor*	Sambar deer*	P	VU
	Muntiacus muntjak	Barking deer*	P	LC
Bovidae	*Capricornis sumatraensis*	Serow	TP	VU

(continued)

Family	Species	Common Name	WCA (2010)	IUCN
Sciuridae	*Callosciurus prevostii*	Prevost's squirrel	TP	LC
	Callosciurus caniceps	Grey-bellied squirrel	NA	LC
	Lariscus insignis	Three-striped ground squirrel	NA	LC
Muridae	*Rattus* spp.	Rats	NA	LC
Hystricidae	*Hystrix brachyura*	Malayan porcupine*	P	LC
	Atherurus macrourus	Brush-tailed porcupine	P	LC
	Echinosorex gymnura	Moonrat	NA	LC

Note: *indicate animals being hunted by the Orang Asli

References

Anon. (2011). *Orang Asli lured into trapping rich pickings.* Retrieved from https://news.asiaone.com/News/AsiaOne+News/Malaysia/Story/A1Story20110530-281387.html on 14th April, 2017.

Anon. (2016). *Carcass of de-tusked elephant found near Tasik Pedu.* Retrieved from https://www.thestar.com.my/news/nation/2016/05/03/carcass-of-de-tusked-elephant-found-near-tasik-pedu/ on 14th April, 2017.

Anon. (2017). *Two rare elephants killed for ivory in central Sabah.* Retrieved from http://www.channelnewsasia.com/news/asiapacific/two-rare-elephants-killed-for-ivory-in-central-sabah/3407282.html on 14th April, 2017.

Arnold, J. E. M. & Ruiz, P. M. (1996). *Framing the issues relating to non-timber forest products research. Current issues in non-timber forest products research*. Proceedings of the Workshop "Research on NTFP" Hot Springs, Zimbabwe 28 August-2 September 1995.

Aziz, S. A., Clements, G. R., Rayan, D. M., & Sankar, P. (2013). Why conservationists should be concerned about natural resource legislation affecting indigenous peoples' right: Lessons from peninsular Malaysia. *Biodiversity and Conservation, 22*, 639–656.

Azlan, J. M. & Faisal, F. M. (2006). Ethnozoological survey in selected areas in Sarawak. *The Sarawak Museum Journal*.

Azliza, M. A., Ong, H. C., Vikineswary, S., Noorlidah, A., & Haron, N. W. (2012). Ethnomedicinal resources used by the Temuan in Ulu Kuang Village. *Journal of Ethnobiology and Ethnomedicine, 6*, 17–22.

Azrina, A., Or, O. C., & Kamal, S. F. (2011). *Collectors and traders: A study of orang Asli involvement in wildlife trade in the Belum-Temengor complex, Perak*. Kuala Lumpur: University of Malaya.

Balakrishnan, N. (2016). *Why are the Orang Asli community some of the poorest in Malaysia?* Retrieved from http://says.com/my/news/1-in-5-sabah-bumiputera-households-are-poverty-stricken. Accessed on 4th March, 2017.

Bartholomew, C. V., Muhammad Syamsul, A. A., & Abdullah, M. T. (2016). Orang Asli dan sumber alam. In M. T. Abdullah, M. F. Abdullah, C. V. Bartholomew, & J. Rohana (Eds.), *Kelestarian Masyarakat Orang Asli* (pp. 45–69). Kuala Nerus: Penerbit Universiti Malaysia Terengganu.

Brooks, E. G. E., Roberton, S. I., & Bell, D. J. (2010). The conservation impact of commercial wildlife farming of porcupines in Vietnam. *Biological Conservation, 143*, 2808–2814.

Burkill, I. H. (1935). *A dictionary of the economic products of the Malayan peninsula*. Kuala Lumpur: Department of Agriculture.

Carey, I. (1976). *Orang Asli: The aboriginal tribes of peninsular Malaysia*. Kuala Lumpur: Oxford University Press.

Clements, G. R. (2013). *The environmental and social impacts of roads in Southeast* Asia. In *PhD thesis*. Cairns: James Cook University.

Clements, G. R., Mark Rayan, D., Ahmad Zafir, A. W., Venkataraman, A., Alfred, R., Payne, J., Ambu, L. N., & Sharma, D. S. K. (2010). Trio under threat: Can we secure the future of rhinos, elephants and tigers in Malaysia? *Biodiversity and Conservation, 19*, 1115–1136.

Dasgupta, S. (2017). *Seven most wanted elephant poachers arrested in Malaysia*, Retrieved from https://news.mongabay.com/2017/02/seven-most-wanted-elephant-poachers-arrested-in-malaysia/ on 14th April, 2017.

Department of Statistics Malaysia. (2010). *Population and housing census of Malaysia 2010: Preliminary count report*. Putrajaya: Department of Statistics Malaysia.

Endicott, K. (2010). The hunting methods of the batek negritos of Malaysia. *The Asia Pacific Journal of Anthropology, 2*, 7–22.

Francis, C. M. (2008). *A field guide to the mammals of South-East Asia*. London: New Holland.

Gianno, R., & Bayr, K. J. (2009). Semelai agricultural patterns: Toward an understanding of variation among indigenous cultures in southern peninsular Malaysia. *Journal of Southeast Asian Studies, 40*, 153–185.

Hedges, L., Clements, G. R., Aziz, S. A., Yap, W., Laurance, S., Goosem, M., & Laurance, W. F. (2013). The status of small mammalian carnivores in a threatened wildlife corridor in peninsular Malaysia. *Small Carnivore Conservation, 49*, 9–14.

Hood, S. (1995). *Dunia pribumi dan alam sekitar: Langkah ke hadapan*. Bangi: Universiti Kebangsaan Malaysia.

Howell, C. J., Schwabe, K. A., & Abu Samah, A. H. (2010). Non-timber forest product dependence among the Jah hut subgroup of peninsular Malaysia's orang Asli. *Environment, Development and Sustainability, 12*, 1–8.

Indraneil, D. (2010). *A field guide to the reptiles of South-East Asia*. United Kingdom: New Holland.

IUCN. (2016). *IUCN red list of threatened species*. Retrieved from http://www.iucnredlist.org/ Accessed on 8th August, 2015.

Kishen, B., Madinah, A., & Abdullah, M. T. (2012). *Review and validation of selected materials on illicit hunting in Malaysia. Regional sustainable development in Malaysia and Ausralia*. Bangi: Universiti Kebangsaan Malaysia.

Kuchikura, Y. (1986). *Subsistence ecology of a Semoq Beri community, hunting and gathering people of peninsular Malaysia*. Hokkaido: Hokkaido University.

Loh, F. F. (2016). *Highways open doors to poaching*. Retrieved from http://www.thestar.com.my/news/nation/2016/06/29/highways-open-doors-to-poaching-roads-that-cut-across-vital-habitats-pose-a-danger-to-protected-wild/ on 25th June, 2016.

Mainka, S. A. & Trivedi, M. (2002). *Links between biodiversity conservation, livelihoods and food security: The sustainable use of wild species for meat*. United Kingdom: Switzerland and Cambridge.

Milner-Gulland, E. J. (2012). Interactions between human behavior and ecological systems. *Philosophical Transaction of the Royal Society of London. Biological Sciences, 367*, 270–278.

Milow, P., Malek, S., Nur Shahidah, M., & Ong, H. C. (2013). Diversity of plants tended or cultivated in orang Asli homogardens in Negeri Sembilan, peninsular Malaysia. *Human Ecology, 41*, 325–331.

Mohd Azlan, J., & Muhammad Faisal, F. (2006). Ethnozoological survey in selected areas in Sarawak. *Sarawak Museum Journal, 10*, 184–200.

Muhammad Syamsul, A. A., Bartholomew, C. V., & Abdullah, M. T. (2016). Keterancaman dan kelestarian kehidupan masyarakat Orang Asli. In M. T. Abdullah, M. F. Abdullah, C. V. Bartholomew, & J. Rohana (Eds.), *Kelestarian masyarakat Orang Asli* (pp. 71–84). Kuala Nerus: Penerbit Universiti Malaysia Terengganu.

Nicholas, C. (2000). *The Orang Asli and the contest for resources: indigenous politics, development and identity in Peninsular Malaysia*. International Work Group for Indigenous Affairs, Copenhagen, Denmark and Center for Orang Asli Concerns (COAC), Subang Jaya.

Ong, H. C., Faezah, A. W., & Milow, P. (2012a). Medicinal plants used by the Jah hut orang Asli at Kampung Pos Panderas, Pahang, Malaysia. *Journal of Ethnobiology and Ethnomedicine, 6*, 11–15.

Ong, H. C., Lina, E., & Milow, P. (2012b). Traditional knowledge and usage of edible plants among the Semai community of Kampung Batu 16, Tapah, Perak, Malaysia. *Scientific Research and Essays, 7*, 441–445.

Rambo, A. T. (1979). Human ecology of the orang Asli: A review of research on the environmental relations of the aborigines of peninsular Malaysia. *Federation Museum Journal, 24*, 40–71.

Ramle, A., Greg, A., Ramle, N. H., & Mat Rasat, M. S. (2014a). Forest significant and conservation among Semoq Beri tribe of orang Asli in Terengganu state. *Malaysia. Australian Journal of Basic and Applied Sciences, 8*, 386–395.

Ramle, A., Asmawi, I., Mohamad Hafis, A. S., Ramle, N. H., & Mat Rasat, M. S. (2014b). Forest conservation and the Semoq Beri community of Terengganu. *Malaysia. Malaysian Journal of Society and Space, 10*, 113–114.

Robson, C. (2000). *A field guide to the birds of South-East Asia*. United Kingdom: New Holland.

Rosli, Z. (2016). *Fading roar: only 23 tigers left in Terengganu*. Retrieved from http://www.nst.com.my/news/2016/12/199678/fading-roar-only-23-tigers-left-terengganu on 14th April, 2016.

Samuel, A. J. S. J., Kalusalingam, A., Chellappan, D. K., Gopinath, R., Radhamani, S., Husain, H. A., & Promwichit, P. (2010). Ethnomedical survey of plants used by the orang Asli in Kampung Bawong, Perak. *West Malaysia. Journal of Ethnobiology and Ethnomedicine, 6*, 1–6.

Shively, G. (1997). Poverty, technology, and wildlife hunting in Palawan. *Environmental Conservation, 24*, 57–63.

Tuck-Po, L. (1998). *Həp: The significance of forest to the emergence of Batek knowledge in Pahang, Malaysia*. Penang: Universiti Sains Malaysia.

Wildlife Conservation Act. (2010). Act 716. Percetakan Nasional Malaysia Berhad. Retrieved fromhttp://www.gunungganang.com.my/pdf/MalaysianLegislation/National/Wildlife%20Conservation%20Act%202010.pdf.

Wildlife Conservation Enactment. (1997). Retrieved from http://www.lawnet.sabah.gov.my/lawnet/SubsidiaryLegislation/WildlifeConservation1997(Regulations1998).pdf. on 28th March, 2016.

Wildlife Protection Ordinance. (1998). Retrieved from http://www.sarawakforestry.com/pdf/laws/wildlife_ protection_ordinance98_chap26.pdf.

Yahaya, F. H. (2015). *The usage of animals in the lives of the Lanoh and Temiar tribes of Lenggong, Perak*. Retrieved from http://www.shs-conferences.org/articles/shsconf/abs/2015/05/shsconf_icolass2014_04006/shsconf_icolass2014_04006.html on 16th September, 2015.

Yeng, A. C. (2010) *WWF: Orang Asli being used*. Retrieved from http://www.thestar.com.my/news/nation/2010/02/10/wwf-orang-asli-being-used/ on 20th April, 2016.

Yong, D. L. (2015). Persistence of primate and ungulate communities on forested islands in Lake Kenyir in northern peninsular Malaysia. *Natural History Bulletin of the Siam Society, 61*, 7–14.

Zarina, A. (2016). Three man arrested after discovery of tiger carcasses in toilet, Retrieved from http://www.nst.com.my/news/2016/01/123320/three-men-arrested-after-discovery-tiger-carcass-toilet.

Zuraina, M. (1982). The west mouth, Niah, in the prehistory of south-East Asia. *Sarawak Museum Journal, 31*, 1–20.

Candyrilla Vera Bartholomew received her BSc from the Universiti Malaysia Sarawak and MSc from the Universiti Malaysia Terengganu (UMT). She had co-edited a book and coauthored journal and book chapters manuscripts related on the livelihoods and sustainability of Orang Asli. She is interested to pursue her PhD on ethnozoology using next generation sequencing method.

Mahfuzatul Izyan Zainir received her BSc in Conservation Biology at Universiti Malaysia Terengganu. She has involved in volunteer work with RIMBA by doing questionnaire surveys for Project Pteropus.

Mohamed Nor Zalipah is a senior lecturer in the Faculty of Science and Marine Environment, Universiti Malaysia Terengganu. Her skills and expertise includes animal ecology, community ecology and applied ecology.

Mohd Hasdi Husin is the Department of Widlife and National officer conducting law enforcement and is interested on the utilisation of wildlife in Malaysia.

Mohd Tajuddin Abdullah received his diploma in forestry from the Institut Teknologi MARA, BSc and MSc on wildlife resource management from the West Virginia University USA and PhD in zoology from the University of Queensland, Australia. He was a wildlife officer at the Department of Wildlife and National Parks (1977 to 1991); a Zoo Melaka director (1992−1993); as a lecturer (1994−2007) and professor at the Universiti Malaysia Sarawak (2008 to 2014); a director and professor at the Universiti Malaysia Terengganu (2014 to 2021). His research areas and publications are in zoology, biodiversity, phylogenetics, biogeography, zoonoses, protected area conservation and recently on the Orang Asli livelihoods and sustainability. In 2017 and 2019, his books won both the prestigious National Book Award and UMT science book awards. He is a lead editor of two international Springer Nature books.

Part III
Governance, Administration and Management

A Multidisciplinary Account of the Orang Asli in Peninsular Malaysia

Abu Talib Ahmad, Mahani Musa, Nazarudin Zainun, Nasha Rodziadi Khaw, Hisham Atan Edinur, and Geoffrey Keith Chambers

Abstract This review aims to present contemporary scholarship relating to Orang Asli in the context of their ancestral relationships. Its begins by drawing a clear picture of present-day Orang Asli groups in Peninsular Malaysia, followed by a synthetic account of Orang Asli ancestry that emerges from the fields of archaeology, anthropology, linguistics and genetics. The whole survey contains detailed information about our own work and that of others, which together, forms the basis of our "Genetic Layer Cake Model" for human settlement in Peninsular Malaysia. In this review, we also present new and compelling evidence about material cultures and beliefs to expand the original model so as to make it a more inclusive, if not yet fully complete, account of human prehistory in Peninsular Malaysia. This new multidisciplinary account of the Orang Asli in Peninsular Malaysia not only highlights the latest views of ancient indigenous dipersals and settlements across the region, but also suggests how better understanding of the Orang Asli's origins may improve their prospects like health and socio-economic status.

Keywords Orang Asli · Semang · Senoi · Proto-Malays · Genetic layer cake model

A. T. Ahmad · M. Musa · N. Zainun
School of Humanities, Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia
e-mail: atalib@usm.my; mahani@usm.my; naza@usm.my

N. Rodziadi Khaw
Centre for Global Archaeological Research, Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia
e-mail: rnasha@usm.my

H. A. Edinur (✉)
Forensic Science Programme, School of Health Sciences, Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia
e-mail: edinur@usm.my

G. K. Chambers
School of Biological Sciences, Victoria University of Wellington, Wellington, New Zealand
e-mail: geoff.chambers@vuw.ac.nz

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_11

Introduction

The term Orang Asli specifically refers to three ancient tribes of indigenous people in Peninsular Malaysia, namely the Semang (Negrito), Senoi and Proto-Malays. These natives are a minority who constitute just 0.8% of total population in Peninsular Malaysia (Population and Housing Census of Malaysia, 2010 and Centre for Orang Asli Concern). They have distinct cultures and lifestyle from the Malays, Chinese and Indians, which are other races in mainstream society. The Orang Asli have retained much of their cultural heritage and today, they are represented by many sub-groups, such as the Kensiu, Kintaq, Lanoh, Mendriq and Orang Kanaq. The sub-tribes generally persist as small collections of families numbering between 80 and 600 people. Table 1 shows the population statistics of Orang Asli sub-tribes and Fig. 1 shows the geographic distribution their settlements in Peninsular Malaysia.

The Orang Asli either live in their "original homeland" or have relocated to settlements equipped with electricity and clean water supply, and modern education and healthcare systems (Figs. 2, 3, and 4). The relocation programmes are carried out under various socio-economic development plans by the Orang Asli Development Department (JAKOA) – the government agency under the Rural Development Ministry responsible for their welfare (http://www.jakoa.gov.my). It is without doubt that these efforts are much needed by Orang Asli communities. It is equally important that all such development schemes should properly consider the identities, cultures and lifestyle of Orang Asli sub-tribes. Otherwise, such well-intentioned intervention schemes may lead to the loss of a priceless heritage that has long been at the heart of Orang Asli communities.

The following sub-sections discuss the multidisciplinary perspectives of Orang Asli origins that shaped the socio-cultural milieu of their descendants. We also review and evaluate data from new genetic surveys conducted on several loci associated with resistance to diseases. This information is crucial because most Orang Asli villages are located in the interior with improper and/or poor healthcare (Phua 2015; Michael and Chuen 2012). Thus, they frequently suffer from treatable diseases like skin diseases, worm infection, amoebiasis and malaria (Hotez 2014; Hotez et al. 2015).

A Contemporary Inventory Plus Brief Pre-historical and Historical Account, Including Summary of Previous Theories and Models

Census on the Orang Asli were first conducted in Pahang from the 1890s (Annual Report of the British Resident Pahang 1891). In subsequent years, they were grouped under the "Malaysian" category by colonial administrators. This category also included Malays, Indonesians and other natives, which lasted until after World

Table 1 Orang Asli tribes and sub-tribes in Peninsular Malaysia

Groups[a]	Sub-groups[a]	Locations[a]	ID on map[b]	Language[c]	Population size[d]
Semang	Kensiu	Baling, Kedah	1	Austro-Asiatic	232
	Kintak	Gerik, Hulu Perak	2	Austro-Asiatic	157
	Lanoh	Perak	3	Austro-Asiatic	350
	Jahai	Remote areas of Perak and Kelantan	4	Austro-Asiatic	1843
	Bateq	Pahang, Kelantan and Terengganu	5	Austro-Asiatic	1255
	Mendriq	Gua Musang, Kelantan	6	Austro-Asiatic	164
Senoi	Semai	Pahang, Perak and Selangor	7	Austro-Asiatic	43,892
	Temiar	Perak, Kelantan, and Pahang	8	Austro-Asiatic	25,725
	Mah Meri	Coastal areas of Selangor, Putrajaya, and Negeri Sembilan	9	Austro-Asiatic	2986
	Jahut	Temerloh and Jerantut, Pahang	10	Austro-Asiatic	5104
	Semoq Beri	Pahang and Terengganu	11	Austro-Asiatic	3545
	Che Wong	Raub and Temerloh, Pahang	12	Austro-Asiatic	664
Proto-Malay	Temuan	Negeri Sembilan, Selangor and Johor	13	Austronesian	22162
	Jakun	Southern parts of Peninsular Malaysia	14	Austronesian	27448
	Semelai	Pahang, Negeri Sembilan and Johor	15	Austro-Asiatic	6418
	Orang Kuala	Batu Pahat and Pontian, Johor	16	Austronesian	4067
	Seletar	Coastal regions of Johor	17	Austronesian	1407
	Orang Kanaq	Kota Tinggi, Johor	18	Austronesian	83

[a]Jabatan Kemajuan Orang Asli (JAKOA; http://www.jakoa.gov.my)
[b]Labelling of Orang Asli settlements on Fig. 1
[c]Ethnologue Languages of the World (http://www.ethnologue.com)
[d]Population size of Orang asli group were obtained from Center for Orang Asli Concern (COAC; http://www.coac.org.my)

War 2. Since the 1930s, three groups of Orang Asli have been identified; namely the Semang who usually lead a nomadic life, the Proto-Malays who plant cash crops and live in permanent dwellings, and the Senoi whose mode of life is an extension of the Proto-Malays (Noone 1972). In 1947, Malayan authorities recorded an Orang

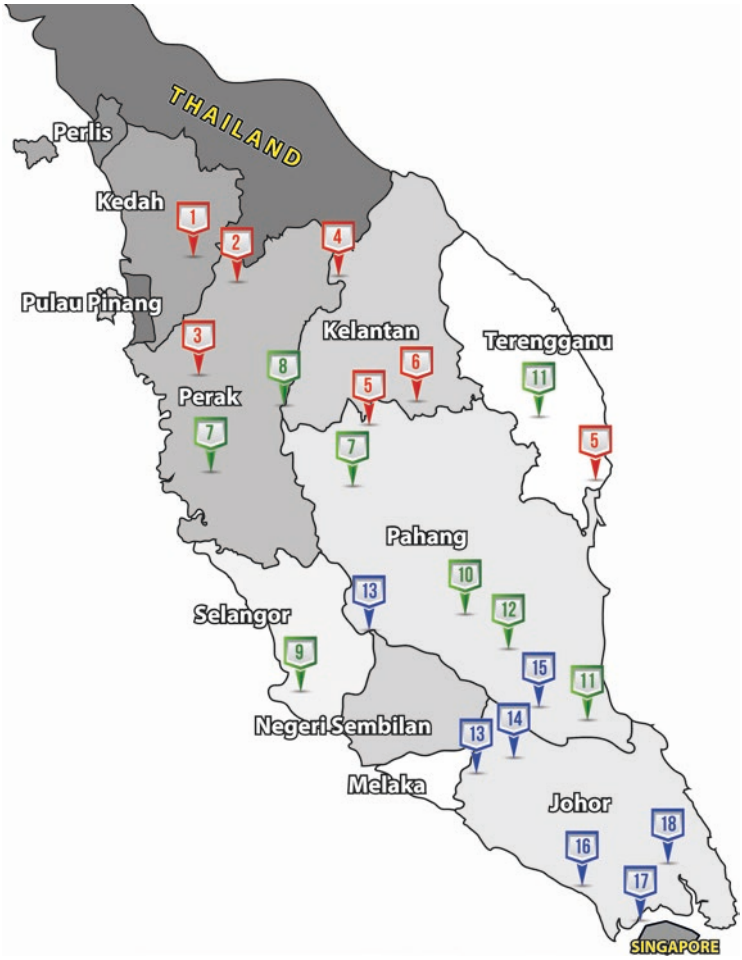

Fig. 1 Approximate locations of Orang Asli settlements in Peninsular Malaysia. Refer Table 1 for their ID on the map

Fig. 2 (**a**) Children from the Jahai sub-tribe, which belongs to the Semang tribe. (**b**) They live in Kampung Sungai Tiang, Gerik, Perak. (Photo: Z. Yusof)

Fig. 3 (**a**) The village of the Bateq sub-tribe, which belongs to the Semang tribe, in Pos Kuala Lah, Gua Musang, Kelantan. (**b**) Bateq women participating in a traditional performance. (Photo: Z. Yusof)

Fig. 4 A Temiar man of the Senoi tribe in his hut in Pos Bering, Gua Musang, Kelantan. (Photo: Z. Yusof)

Asli population of 4.7 million, of which the majority were Senoi (62%), followed by Proto-Malays (33%) and the Semang (5%) (Leary 1995).

The Semang consists of the Jahai, Bateq, Kensiu, Kintak, Lanoh and Mendriq sub-tribes (see Table 1 and Fig. 1). Their social structure still reflects their nomadic way of life, with a leader heading a small number of community members. The Senoi includes the Temiar, Semai, *Semoq* Beri, Mah Beri, Che Wong and Jah Hut sub-tribes. They have a loose form of leadership, where a headman is in charge of a few kin groups. The Proto-Malays comprise the Temuan, Jakun, Semelai, Temoq, Orang Kanaq, Orang Seletar and Orang Kuala sub-tribes. Their social organisation is more complex, with village elders owing allegiance to a headman who, in turn, is placed under a chief who owes allegiance to an even higher chief. The tripartite division of the Orang Asli reflects their spatial distribution, with the Semang mostly living in the north and northeast of Peninsular Malaysia, whereas the Senoi may be found in the main range, while the Proto-Malays are in the central and southern parts of the peninsula (Fig. 1).

The Orang Asli population continued to increase in later years and by 1965, their population was recorded at 45,895 people (Dunn 1975). This study provides the following numerical breakdown of Orang Asli subgroups: Semang at 1447; Temiar at 9326; Semai at approximately 12,748; other Senoi groups (Semoq Beri, Mah Beri, Che Wong and Jah Hut) at 4791; Temuan with 7221; Jakun at 7331 and other Proto-Malays (Semelai, Temoq, Orang Kanaq, Orang Seletar and Orang Kuala) at approximately 3032. By 1994, their population had increased to 95,529 (Lim 1997) with the greatest numbers located in Pahang (Nik Hussain 2007).

Theories and Models Relating to the Orang Asli

In 2012, well-known Malaysian anthropologist Hood Mohd Salleh gathered and surveyed the existing literature on the Orang Asli. The writings were first produced by non-Malaysians in the mid-nineteenth century, and Malaysian scholars only began contributing to the subject almost a century later (Salleh 2012). The wider literature covers general ethnographic studies and the natives' belief, modernisation and linguistics. Salleh stated that there has been broad specialisation among scholars, with the first two topics becoming the preserve of foreign scholars, while Malaysians seemed to dominate the remaining two. Our brief review of the literature (see following) bears this observation in many respects. Salleh's survey covered all fields relating to the Orang Asli, namely history and historical change, linguistics, general ethnography, cultural ecology, religion and belief systems, kinship and social organisation, psychological anthropology, economic anthropology, demography and development, assimilation and inter-ethnic relations.

On history and historical change, Salleh (2012) particularly cited the works of G. Benjamin (1966, 1968) and his diachronic approach to discovering the internal structures of a society without generating new theoretical principles. This is the first of three major models proposed for understanding Orang Asli societies. Salleh found that Benjamin's work fell more or less entirely within the realm of historical anthropology. He was not agreeable with Benjamin for advancing theories based on speculation, but to be fair, this latter scholar did refer to linguistics and other evidences. There is nothing new in this approach as scholars, including the respected historian O.W. Wolters (1982), have made similar attempts to unravel the nature of state and society in Southeast Asia before the onset of Indian influence, using evidence drawn from various disciplines, including linguistics and art history. Recently, archaeologists working in Southeast Asian historical sites have pointed to the importance of developments that took place at the end of the Iron Age between the early and mid-first millennium CE (Murphy and Stark 2016). In general, historians do seem to be quite comfortable with Benjamin's diachronic approach.

A second model is known as the development, assimilation, and interethnic relations model. It has received much input from Malaysian researchers, with most of them arguing for the integration of the Orang Asli into mainstream societal development. This view is held despite the Orang Asli's unhappiness with the effects of proposed developments, notably due to encroachment on their native

lands or *saka* without adequate compensation (Alias and Daud 2011). They are also concerned about recognition of their indigenous rights. By the 1960s, the Semelai of Tasik Bera were no longer averse to change, including the concept of wealth accumulation and use of outside goods such as matches, knives, machetes, bicycles and even radios. But the headman found his position less attractive after the government imposed control on his people following the communist insurgency, also known as the Emergency, from 1948 to 1960 (Hoe 2001). Based on his study of four Orang Asli villages (three in Pahang and one in Perak), Lim (1997) reached a similar conclusion that the Orang Asli were not opposed to development per se. Resettled natives enjoyed health services and had greater ownership of assets like motorcycles, radios and televisions compared with others in the interior. The author also observed that the Orang Asli have assimilated well with other Malaysians, although a small number had reservations about their new situation due to lack of freedom, open country living environment, domination by Malays and fear of losing their identity, besides having to bear indignities and criticism on their lifestyle. Elsewhere, in Kota Tinggi in the southern state of Johor, the Orang Kanaq were relocated north to Gombak in the central state of Selangor in the early 1950s, where many lived until the end of their lives. Few survivors managed to return to Johor and are now adjusting to an agricultural life with official assistance (Musa 2011).

The third and much discussed theory is known as the "Dream People" theory, which came into vogue through Noone (1936), who wrote about the Temiar. Under this theory, the author claimed that the Temiar confined crime and legal procedures to marriage disputes (Leary 1995), although such incidents could end in violence. He first presented his ideas on "dream manipulation" among the Senoi as an outline of his PhD thesis. Even though he left no tangible records of his research on dream manipulation, Noone's contributions were complemented by American anthropologist K.R. Stewart (1951, 1962), who was interested in the investigation of traditional psychiatric systems. Stewart highlighted Noone's non-violence hypothesis among the Orang Asli in general. However, the importance of dreams varies in Orang Asli culture and religion, with the Semai and Temiar placing more importance on the interpretation of dreams (Leary 1995). Experts on Orang Asli hold that these dreams are an outlet for feelings of hostility and aggression, and may act as a psychological safety valve (e.g. see Stewart 1951, 1962).

The Dream People model has inspired a number of writings on the Orang Asli, notably by Noone's younger brother, Richard, who became an adviser to the Malayan government on Orang Asli affairs in the 1950s (Noone 1972). The myth that the Orang Asli are intrinsically non-violent has been debunked during the Emergency through the way they responded toviolence perpetrated on them by government and communist forces (Leary 1995). The logging blockade that took place in Gua Musang, Kelantan, in September 2016 had demolished whatever remained of the image and concept of the Orang Asli as non-violent "dream people" (The Star 2016). The blockade was erected by the Orang Asli and social activists to prevent loggers from accessing the area despite the latter being granted permission to harvest timber by the state authorities. The Orang Asli and activists claimed that logging would destroy the forest and threaten their livelihood.

The Orang Asli During the Prehistoric and Historic Period

Looking at the Orang Asli over a much longer period, say from 500 AD, the seminal study by Dunn (1975) has been widely influential on later research. It has provided crucial insight into the Orang Asli and their economic relationship with the Malays right up to the nineteenth century. This author used archaeology, anthropology, history and ecology to study human adaptation in tropical rainforest ecosystems in southern Peninsular Malaysia during protohistoric and prehistoric periods. He highlighted the importance of the Orang Asli in the exploitation of forest products over this period. He discerned four phases in their developing role in collecting and trading natural resources – periods between the fifth and fourteenth centuries, the fifteenth century, sixteenth and eighteenth centuries, and the nineteenth century. During the first phase, the Orang Asli were almost exclusively forest collectors, who sold their products to Indianised coastal Malays acting as conduits to international markets. In phase two, the Orang Asli were still major collectors of forest products, of which demand had risen considerably. The middlemen were still Malays, including those from Indonesian islands who were based in Melaka, which was the gateway to the international market. In phase three, Orang Asli collectors included those living in the interior of Peninsular Malaysia. Malays now functioned as either secondary or tertiary traders. In phase four, the Orang Asli were no longer exclusive collectors of forest products as they were joined by Malays and even the Chinese. Malays remained as secondary traders and the Chinese were tertiary traders.

Dunn (1975) suggested one further recent phase in the twentieth century, with the Orang Asli as major collectors and primary traders working with Chinese secondary and tertiary traders. The basis of exchange was no longer bartering, but by cash and credit. By then, the relationship between the Orang Asli and the outside world had changed considerably. In fact, this transformation had started to take place much earlier. During the Melaka Sultanate (1400–1511), some Semang people were sold into slavery by Malays. In the late nineteenth century, British officials in Pahang had noted the age-old animosity of Orang Asli towards Malays (Annual Report Pahang 1890). For the twentieth century, Andaya (2008) aptly summarised the situation:

> The pressure of modernity, the nation state and the competitive global economy made the lifestyle and economic pursuits of the forest and hill people increasingly irrelevant and undervalued.

First, it was Benjamin (1997), and later Andaya (2008), who pushed this date further back to 3000 YBP by stressing the traditional role of the Orang Asli and their enduring economic relationship with the Malays. As highlighted by Benjamin, the Orang Asli in Ulu Tembeling, Pahang, were the only people capable of extracting forest products besides working in gold mines that the area was well known for. Ulu Tembeling was also linked to Muar, Johor, in the west through the "Penarikan" route, and with Tasek Bera, Pahang, and onwards to Pattani, Thailand, in the north through the Lebir Valley. In this relationship, the Orang Asli were the suppliers of forest products while the Malays offered them access to international markets,

besides providing them with basic needs from the outside world. Initially, trading with Malays involved exchanging rattan, tree bark and stones with sea shells to be used for various purposes like utensils. During the Melaka Sultanate, the range of these forest products had expanded to include camphor, dammar, rattan, gaharu and beeswax, which were exchanged for iron, salt, ceramics and other domestic needs. So, over a long period, the Orang Asli were able to keep their tribal secrets regarding the location of their forest products. However, by the nineteenth century, there was pressure on ethnic boundaries as forests were increasingly cut down to open plantations geared for the export market. Meanwhile, Malay attitude towards the Orang Asli began to change for the worse, although their support was keenly sought during times of local power contest (Andaya 2008).

Prehistory and History of Orang Asli: Archaeological and Oral History Evidence

The existence of prehistoric communities in Peninsular Malaysia from late Pleistocene onwards is proven by the discovery of cave and rock shelters. Gua Sagu and Gua Tenggek in the state of Pahang are the oldest cave sites in Peninsular Malaysia. There is evidence of Gua Sagu being occupied by humans between 14,000 years to 1000 years ago, while Gua Tenggek was occupied from about 10,000 years ago. Another cave, Gua Kechil which is also located in Pahang, has indications of a three-phase human occupation, with the first phase (12,000–8000 years ago) dominated by Hoabinhian stone tools, while the second (8000–4800 years ago) is characterized by the use of plain pottery, polished adzes, shell and animal bones. In the third phase (4800 years ago), the use of pottery became predominant, while bones and shells declined. That phase is regarded by many scholars as the beginning of the Neolithic age and also evidence of horticulture, according to Bellwood (1998).

Gua Cha in the state of Kelantan (8000–9000 years ago) is probably the best-known rock shelter in Peninsular Malaysia. An excavation in 1979 discovered two main periods of habitation – the Hoabinhian and Neolithic periods. The Hoabinhians were most probably hunter-gatherers. They were followed by the Neolithic people, although there was no convincing evidence for any chronological overlap. This means that it is also difficult to determine with certainty if the Neolithic period evolved locally from Hoabinhian in Gua Cha. The absence of marked differences in physical features between the Hoabinhians and Neolithics indicates a common origin. Taha (1985a) suggested that the evolution from Hoabinhian to Neolithic culture took place elsewhere, with the Gua Cha Hoabinhians acquiring new tools and pottery from people domiciled in the coastal region of Peninsular Malaysia and southern Thailand. The relative scarcity of Neolithic occupation materials in Gua Cha shows that it may just have been used as a burial ground. The site contains substantial amount of complete pottery items, including those related to southern Thailand's Ban Kao Neolithic culture of the second millennium B.C.

Elsewhere, the limestone caves and rock shelters in Lenggong Valley have been inhabited 13,000 years ago and were still in use until 2000 years ago. The caves include Gua Teluk Kelawar, Gua Ngaum, Gua Kajang, Gua Gunung Runtuh, Gua Dayak, Gua Badak, Gua Harimau, Gua Batu Tukang and Gua Batu Dinding. Stone tools, pottery, faunal remains, riverine shells and human skeletons have been found in these caves. They are more than adequate proof of the existence of prehistoric communities in situ (Isa 2015). One of the most important discoveries was made in 1990, when the "Perak Man" was found in Gua Batu Runtuh (Majid 1994). At this prehistoric burial site, a human skeleton dating back to 10,120 YBP was found, and it is the most complete Paleolithic skeletal remains unearthed so far in Southeast Asia. The ancestry of present inhabitants of Peninsular Malaysia can be traced back to this period, and this attracted much scholarly attention. Benjamin (1989) claimed that the archaeology done in Malaysia was really "Orang Asli archaeology" most of the time. The study by Andaya and Andaya (2001) supported this claim. Hence, the discovery of the "Perak Man" and other skeletal remains, plus their associated prehistoric tools, suggests that the early inhabitants of Peninsular Malaysia were genetically linked to smaller sized and dark skin northern Orang Asli (Semang) and the Senoi, with the latter displaying stronger connections with the Neolithic society in southern and central Thailand. However, scholars are divided between those who see cultural and biological shifts as occurring locally (Solheim 1980), and those who place greater emphasis on immigration (Andaya and Andaya 2001; Bellwood 1985).

Under the traditional viewpoint, it is believed that the Orang Asli arose from the migration of two major races – the Australoids and Southern Mongoloids – although in situ evolution might have played a role (Bellwood 1985). The Semang have their roots from the Australoids, while the Senoi and Proto-Malay were descendants of the Southern Mongoloids. Hoabinhian sites dated 18,000 and 10,000 YBP provided more details on hunting and gathering activities of the inhabitants, who were the cultural ancestors of the Semang and Senoi to a certain extent, although the latter's biological affinity laid more with the Neolithic Southern Mongoloid population that migrated into Peninsular Malaysia about 4000 YBP (Norhalifah et al. 2016a, b).

Andaya (2008) stressed that there seemed to be a sharp transition from Hoabinhian to Neolithic period as attested by the introduction of agriculture and Austroasiatic languages. In contrast, the other wave of Southern Mongoloid expansion (i.e. the Austronesian–speaking populations) took place from 5000 YBP in Taiwan and occupied most of the Island of Southeast Asia (ISEA) region by 3500 YBP. The descendants of this layer of Southern Mongoloid expansion are now numerically dominant in most Pacific countries and are related to the Proto-Malays and Deutro-Malays in Peninsular Malaysia (Norhalifah et al. 2016a, b; Chambers and Edinur 2015).

Andaya (2008) also explained an alternative reconstruction of the Orang Asli population prehistory long advocated by Benjamin, who emphasized local adaptation rather than migration in explaining group differentiation. Benjamin believed that until 2500–2000 YBP, the wet-zone Southeast Asian Neolithic people combined hunting and gathering with vegeculture of root crops, sago and bananas. A small number of people remained nomadic and the use of readily available cane,

bamboo or wood made intercommunity trade unnecessary at this time. Populations slowly increased and their self-sufficient communities had simple social organisations. From about 2000 YBP, some sub-groups became more efficient at farming, and as they moved down to lower ground with foraging confined to the foothills and at the edge of farmed areas. With the intensification of hunting and gathering, the residual upland foragers gradually reduced their reliance on swidden farming. The rise in importance of trans-isthmian/trans-peninsular routes at about this time encouraged the collection of forest produce, which complemented the agricultural pursuits of their lowland neighbours.

Archaeologists and others have claimed the forest people have an ancient tradition of trading with the outside world (Dunn 1975). During the Hoabinhian period, the Orang Asli were already involved in the trade of coastal shells for forest products like rattan, resin, tree bark and stone for making tools. By about 5000 YBP, this trade extended to communities as far away as northwestern and central Thailand. Maritime trade in forest products between Orang Asli and their trading partners, such as Malays and Thais, continued to be strong from about 2500 YBP to the founding of Melaka in/around the fifteenth century. Undoubtedly, this was spurred by polities in southern Thailand, the Isthmus of Kra, and the northern part of the Malay Peninsula (Andaya 2008). Until the nineteenth century, the forest aboriginals were the only people available to extract most of Malaya's forest produce. They were armed with the necessary experience and knowledge to seek out and exploit forest resources. Forest products that were exported from the Peninsula between the fifth and early nineteenth centuries must have been supplied mostly by them although after the nineteenth century, Chinese and Malays began joining the industry.

Based on archaeographic evidence, Dunn (1975) reiterated that trading links had existed between the peninsula's coasts and remote interior during the Hoabinhian and Neolithic age. Species of marine molluscs have been found regularly at all levels of inland caves, indicating that these shells must have been traded for. From these pieces of evidence, Dunn provided a hypothetical reconstruction that from 20,000 YBP (at which time the Peninsular Malaysia was united with Sumatera, Java, Borneo and Indochina in the greater Sundaland area), the people probably subsisted as hunter-fisher-gatherers, and trading exchanges must have been exclusively *internal* and primarily *inland-inland*.

At 10,000 YBP, roughly the end of the Pleistocene period, rising sea levels had isolated the Malay Peninsula from surrounding regions of Southeast Asia. Limestone caves of the interior were occupied by Hoabinhian people, although not for long after the end of the Pleistocene age. For the next few thousand years, their subsistence lifestyle was probably based on hunting, fishing and gathering, together with subsidiary cultivation of root crops and other plants. Crop cultivation at this time may have been quite casual, while the swidden form of "agriculture" may not have evolved until much later, around 5000 YBP. Dunn insisted that trading must have been almost exclusively internal, but despite the predominance of *inland-inland* trading, *inland-coastal* trading was now on the rise.

Between 5000 and 4000 YBP, the Neolithic people were dependent on hunting, fishing and gathering, but root crops had assumed an important place in their

subsistence economy. These early Neolithic famers preferred to live in caves, although open living sites (e.g. Gua Kepah) were also inhabited (Dunn 1975). This particular Hoabinhian site continued to be occupied or at least visited occasionally by the later Neolithic people. Overseas trade was growing by 4000 YBP. This economy involved coastal aboriginal peoples supplying products from the forests for sea shells. According to Dunn (1975), there was also an exchange of ideas and techniques among the Malayan coastal people, who served as information and commodity filters for inland people, as seen in the diversity in form, colour and decorative experimentation of coastal ceramics compared with those found in Gua Cha and Gua Kechil. Between 5000 and 4000 YBP, *internal* (inland-inland) trading continued as before, but coastal-inland exchanges had developed into an *external* trade from the perspective of the forest people. It is possible that *maritime* trade had begun during this period due to the rapid expansion in seafaring activities in insular Southeast Asia (Dunn 1975).

It is interesting to note that Gua Cha is situated at the boundary between the Temiar Senoi to the west, and the Semang to the north and east. Both these tribes speak Aslian languages within the Austroasiatic family, like the Mons in Myanmar and Khmers in Cambodia. These languages have an ancestry within southern mainland Southeast Asia, which is much older than either Thai or Malay. In this sense, Taha (1985a, b), a Malaysian archaeologist involved in the excavation of Gua Cha, believed that the prehistory of the cave's settlement was almost certainly related to the Orang Asli. The Gua Cha site contained 27 burials dated between 10,000 and 2000 YBP, spanning both the Hoabinhian and Neolithic periods (Bellwood 1985). The discovery of Hoabinhian artefacts throughout this region proved that in Peninsular Malaysia, they were made by population ancestral to the present Austro-Asiatic-speaking Semang and Senoi. These ancestral groups had stopped making flaked stone tools long before recorded history, but the Negritos, according to Bellwood (1985), have preserved hunting and gathering, and may thus be regarded as modified descendants of the original inland Hoabinhian economy. Hoabinhian sites are found mostly in rock shelters, but there are a few coastal shell middens in Sumatra, Peninsular Malaysia and northern Vietnam. In Peninsular Malaysia, a number of inland Hoabinhian caves and shelters have been excavated in the northern states of Perlis, Kedah, Perak, Pahang and Kelantan (Bellwood 1985).

From the 1979 excavation, Taha (1985a, b) concluded that there was no apparent hiatus in the occupation of the Gua Cha rock shelter between the Hoabinhian and Neolithic periods. He also argued that the Hoabinhian and Neolithic cultures in Gua Cha and other sites with similar remains are closely related to the Orang Asli. The Indianised civilisations and maritime trade of coastal Peninsular Malaysia had no real impact on people in this part of the peninsula, and neither did the Malays, at least not until recent times. Based on these archaeological discoveries, prehistoric society in Peninsular Malaysia was a creative one, hardworking, innovative and imbued with logical thinking that enabled improvement, which was no different from similar societies in other parts of the world (Saidin 2011). As emphasised by Majid (2003), these findings showed Southeast Asia was not part of "the backwaters of civilization".

A Review of Anthropological Studies

The broad descriptive term "Orang Asli" refers to the 18 tribes of ancient indigenous people who live in Peninsular Malaysia, and who are believed to be among the oldest inhabitants of the country. As explained earlier, they have conventionally all been seen as belonging to one of three main groups, namely the Semang, Senoi and Proto-Malays (Table 1). They were first classified according to their morphology, language, culture and geographical distributions for administrative purposes by the British and Malayan authorities (Masron et al. 2013). The Semang generally have frizzy hair and dark skin. In contrast, the Senoi have a range of skin colours and curly hair, while the Proto-Malays have lighter average skin colour, straight hair and epicanthal folds. The Senoi are the most populous and they are widely distributed across the central part of the Peninsular Malaysia. Unlike the Semang and Senoi, who mostly live in the hinterlands, the Proto-Malays are seafarers who established their settlements in coastal and riverine areas (Andaya 2002). They possess agricultural skills as well as advanced knowledge in acquiring maritime commodities. Most of the Orang Asli have retained their old form of economic subsistence, which include hunter-gathering and swidden-agriculture. A small number of Semang still retains a semi-nomadic lifestyle. Their culture and technology revolve around utilising surrounding resources. The Orang Asli have existed side-by-side with the predominant Malay community for centuries, with continuous cultural and economic interactions. Trade relations involve jungle products being exchanged for salt, iron tools, cloths, etc. (Andaya 2002). In certain cases, the Orang Asli became part of the Malay political organisation and often became intermediaries between the Malay rulers and their chieftains in the hinterland (Tuck-Po 2011). In Perak, various headmen of the Semai sub-tribe to have been conferred titles and awards by the sultan as recognition for being representatives of people in the state's interior. The Temiar have a history of interacting with the Thais (Masron et al. 2013). Such economic and political relationship show that in spite of differences in language, culture and distribution, the Orang Asli were not entirely isolated from the dominant Malays.

Early references regarding the Orang Asli were made in the sixteenth century in literature like *Sejarah Melayu*, the accounts of the French Catholic missionaries as well as British adventurers (Tuck-Po 2011). More complete accounts about them started to surface in the nineteenth century, especially in the works of Abdullah (1960), Clifford (1897) and Logan (1847a, b, c, d, e, f, g, 1848a, b), as well as other European scholars and travellers such as Borie (1865, 1886, 1887), Mikluho-Maclay (1878) and Saint-Pol Lias (1883). From the early twentieth century, there were more systematic observations of Orang Asli, especially through the work of Skeat and Blagden (1906) entitled *The Pagan Races of the Malay Peninsula*. This work contained detailed descriptions about the Orang Asli and their way of life, as well as classifications regarding their ethnic divisions and nomenclature. Systematic fieldwork-based research on the indigenous tribes have been done by a few specialised scholars, such as Vaughan-Stevens (1892–1894), Winstedt (1922), Evans (1923, 1927), Noone (1936, 1939, 1954), Wilkinson (1971) and Schebesta (1952).

All through this period, new discoveries were made, including the names and locations of indigenous tribes that were previously unknown to the Western scholars. These researchers also managed to revisit the tribes themselves and refined earlier classifications of the Orang Asli. Among the many contributions are those of Schebesta (1952, 1954, 1957, 1973), which give in-depth insights into the Semang he encountered, as well the first grammatical accounts of the Aslian language.

After World War 2, more scholars started to show keen interest in the Orang Asli, especially with the establishment of the Department of Aborigines by the colonial administration to document personal, historical and political accounts of the natives. One of the most prominent writers during this period was P.D.R. Williams-Hunt, who produced an overall survey on Orang Asli tribes, focusing on their cultures and societies in 1952. In the 1960s and 1970s, the researchers who made major contributions were Needham (1956, 1974, 1976, 1984), Hood (1974, 1978), Dunn (1975), Carey (1976) and Howell (1982, 1989, 2011) and Endicott and Endicott (2008). Aside from anthropological and ethnographical studies which focus on the culture and lifestyle of the Orang Asli, new studies on ethno-archaeology have also been carried out recently. Systematic research in this field was done by A.H. Taha, especially in Upper Kelantan and Pahang (Taha and Jaafar 2015; Taha 1983, 1985a, b, 1988, 1991). Currently, Ethno-Archaeological research is being carried out by the archaeological team of Universiti Sains Malaysia led by Dr Hamid Mohd Isa. His research involves the study of the cultural materials of the Orang Asli in comparison with prehistoric societies in the Malay Peninsula, as well as remapping of the Orang Asli settlements in Kelantan, Perak and Pahang (Isa 2007, 2010a, b, 2015; Isa and Ramli 2015; Isa et al. 2015). The Orang Asli revolves around what they can get from their immediate surroundings. For the Semang and Senoi groups, economic activities revolve around hunting and gathering forest products, either for self-consumption or trade. They also plant several types of crops, and work for Malay paddy planters. Their staple includes wild yams, dry rice, bushmeat, maize, tubers and fish. Their traditional hunting equipment includes blowpipes, spears, hooks and lines. They also use knives, machetes, pots through trading with the Malays.

The Semang practise conjugal marriage and marriages among relatives are discouraged (Benjamin 2001). The marriage ceremony involves bestowing gifts to the bride's family with a small feast. Couples may live with the bride's family or vice versa, or even alternate between them, as there is no specific rule governing this matter. In most cases, divorce is acceptable when couples stop living together. Such separation is done on good terms and often, the separated couples still continue to live in the same village. Children are raised by both parents, though the wife plays a more important role. The children learn their skills through participation and observation rather than formal training. As for the Senoi, marriage is a casual practice and sometimes brothers may swap wives. After marriage, the couple first live with the bride's family and later move in with the groom's relations. Apparently, divorce among Senoi couples is quite common (Benjamin 2001).

The Semang form egalitarian societies, which are made up of units of conjugal families, which come together and break up in the village camps according to their

convenience and necessity. They do not traditionally have any form of social hierarchy, and with the absence of headmen, each individual has his own autonomy in making decisions on daily matters. Disputes are settled through amicable negotiations or public discussion, and individuals who are not on friendly terms with one another can join different social groups. The Senoi live in settlements of up to 200 people, usually located near a stream or river. They usually live in one area for few years before moving to family homes built around a long house, known as the *balai sewang,* which serves as a community meeting place. Their dwellings are made of bamboo, wood bark and thatch. The Senoi live in semi-permanent settlements, moving on from one place to another as they practised slash-and-burn agriculture (Masron et al. 2013). As for Proto-Malays, the Jakun and Temuan sub-tribes have similar lifestyle with the Senoi and live in the interior, while the Orang Kanaq, Kuala and Seletar people live along coastlines, exploiting the maritime resources.

One of the important aspects of research regarding the Orang Asli is their religion. Their belief system revolves around spirits which dwell in animate and inanimate objects (Masron et al. 2013). Most Semang sub-tribes perceive the world as a disk placed at the back of a snake, with trees and flowers growing abundantly in paradise above, which is connected to the living world by stone pillars. They believe in the existence of immortal things living in the stone pillar below the earth. They were once humans and occasionally appear in people's dreams. The occurrence of natural phenomena, such as wind, rain, thunder etc. is believed to be related to the spirits' powers. These supernatural beings include the Thunder God, Grandmother of the Underworld and the Snake of the Underworld. The shaman is the medium through which humans can communicate with the supernatural world. They are known as the *Halak,* who presides over religious ceremonies (Carey 1970). Their view about life after death involves the soul linger around as malevolent spirits before eventually departing to an afterlife in the western horizon. They bury their dead in shallow graves (Skeat 1902), conducting rituals to protect the living from the spirits of their departed.

The Senoi take great efforts to make offerings to appease spirits and gods, and practising taboos as they viewed mankind as vulnerable. Communication with the supernatural, especially to cure illness in the temporal world, is done through dreams and trances in ceremonies that may easily last up to six nights. The Senoi bury their dead with their possessions but, unlike the Semang, they do not have clear idea about the afterlife. They believe that human beings have a few souls, including those which may be malevolent spirits capable of harming others. The mourning may last for an entire month and involves elaborate ceremonies.

For Proto-Malays, their beliefs, too, revolve around gods and ancestors. The Temuan believe they were placed on the earth to assume a sacred duty of protecting the rainforest. For them, every inanimate object contains a guardian spirit, while rivers are guarded by snakes and dragons. Their rituals include practising magic and spiritual ceremonies, taboos and healing. Their healers and shamans will lead an annual rite to appease their ancestors and guardian spirits (Sam 2015; Masron et al. 2013).

Comparative Linguistics of the Orang Asli

Linguistically, the Orang Asli are broadly classified as Austroasiatic or Austronesian, with the former further subdivided into northern Aslian (Mintil, Batek Nong, Che Wong), central Aslian (Semai, Jah Hut) and southern Aslian (Besisi, Semaq Beri, Semelai and Temoq) (Benjamin 1997). The Northern, Central and Southern subdivisions were previously known as Jahaic, Senoic and Semelaic, respectively (Burenhult 1999). These linguistic differences are the result of two influences in Peninsular Malaysia – one coming from the north (i.e. Austroasiatic) and the other from the south (Austronesian) – several millennia ago (Benjamin 1997). The Senoi from the north came with Mon-Khmer influence, as seen in the more than 15 Aslian languages which are still spoken in south Thailand. In Peninsular Malaysia, more than half of these speakers are found in Pahang (Mintil, Bateq, Che Wong, Semai, Jah Hut, Besisi, Semaq Beri, Semelai and Temoq). It is believed that the early civilisation in Peninsular Malaysia was Mon and Mahayana-Buddhism until 1200–1300, and these were later replaced by the Malay language and Islam. In Pahang, we still have Mon-Khmer names for places like Benom, Reman, Kampong Singhora and Dong (Benjamin 1997). This can also be readily be seen among Semang foragers, who once have their own original aboriginal language, but had since undergone a language shift because of prehistoric contact with the sedentary Senoi people (Blust 2013). Language shifts are relatively common among indigenous populations. For example, as observed among Negritos in Philippines and Melanesians, who both adopted Austronesian languages but have predominantly Australoid genetics (Bellwood 1997). Nonetheless, research has shown some evidence of an ancient common culture and language. For example, the thunder complex (a set of beliefs about punitive thunderstorms) is shared between the Semang and Philippine Negritos. This preceded the colonisation of ISEA by the agricultural Austroasiatic- or Austronesian-speaking populations (Blust 2013). Another example is Cham people in Indochina, who speak the Austronesian language, but whose maternal and paternal genetics are closely affiliated to Austroasiatics and Thai-Daics, respectively (Peng et al. 2010; Li et al. 2008). These people established the Cham Empire between sixth and twelfth centuries in Southern Vietnam, which slowly declined due to continuous pressure from the Kinh people. They then migrated to Cambodia, and only few small groups remained in Southern Vietnam (Musa 2006). In 1975, large numbers of Cham refugees sought asylum in Malaysia (mostly in the north-eastern states of Kelantan and Terengganu) following the turmoils in Vietnam and Cambodia (Wong 2013).

In contrast to Austroasiatic, the Austronesian language came from the south and is spoken by the Malays and Proto-Malays like the Temuan and Jakun. The Proto-Malays still keep their animistic beliefs and their influence have travelled far north into the Mon-Khmer areas, which may be seen from the appearance of Austronesian loan words in Aslian languages. Various recent accounts of Austronesian prehistory have been proposed and some of these are in conflict with the views espoused earlier by others. This has led to some degree of academic tension among scholars in this area of research. Interestingly, several earlier models of Austronesian expansion

were hard to evaluate and not fully supported by established evidence (Donohue and Denham 2011) The key point of difference is the ultimate source of proto-Austronesian genes and/or languages; i.e. Taiwan or ISEA as the original ancestral source of their roughly 387 million descendants today (Norhalifah et al. 2016a; Donohue and Denham 2011). In the "Out of Taiwan" model, Malaysia holds just one of the descendant Austronesian populations, first received well within the last 3000–4000 YBP. The Southern (Zhejiang, Fujian or Guangdong province) or eastern coast of China (Shandong province) are the most probable potential homelands of Pre-Austronesian speakers before this language differentiated into the Formosan and Malayo-Polynesian sub-groups in Taiwan and ISEA, respectively (Andaya 2002; Bellwood 1997). The former is exclusively spoken by the aboriginals of Taiwan, while the latter is by the descendants of Austronesian populations in Polynesia and ISEA, including Malaysia (Blundell 2011). This view of the pattern of Austronesian language spread has been supported by dating languages across the Pacific and Indian Oceans (Gray et al. 2011). However, the inferences of migration events that took place several millennia ago solely based on a single evidence (linguistic study in this case) seem vulnerable. Any chronology of human settlement should be integrated with those appearing from multidisciplinary studies – e.g. see Donohue and Denham (2011) for different ideas about the origins of language and genes in ISEA. In this context, the classification of Orang Asli based on their current language affinities (Austroasiatic or Austronesian) only ignores their other features (genetics and physical characteristics) that are unique only to either Semang, Senoi or Proto-Malays.

The Genetic Trail in Malaysia

The preceding sections provide an account of the ancestral original origins of the three major Orang Asli groups. This raises expectations about their genetic affinities with one another and with other populations. In this sub-chapter, the literature is surveyed to present an analysis of these expectations. For the first time, we integrated our own data from autosomal loci of medical significance (transfusion and transplant genes) into the wider account. The emergent picture suggests that haplotype distributions from sex-limited markers are equivocal in their ability to resolve the "Out of Taiwan vs. Out of ISEA" debate (Chambers and Edinur 2015) In particular, we point to the difficulties that may arise if one puts too much faith in molecular clock estimates of divergence dates, which are often in conflict with archaeological chronology and linguistic relationships.

Our understanding of population history in ISEA, including Peninsular Malaysia, is informed by the composite picture revealed by earlier and widespread analyses of mtDNA and Y-chromosome markers, which leads to the introduction of several models of population expansion to the Asia-Pacific region. These sex-limited data suggest Pleistocene colonisation of ISEA by Anatomically Modern Humans, who later spread north and south, including to Taiwan and remote Oceania (Soares et al. 2016; Donohue and Denham 2011). Supporters of this single wave colonisation of

ISEA agree that material culture and linguistic changes did take place during the Holocene through acculturation process, rather than involving population movements and changes. This view is well supported by molecular dating of the frequently revised molecular clock of maternally inherited mtDNA haplogroups, and it indicated Pleistocene colonisation and evolution of people already settled in ISEA. The indigenous origins suggest ISEA as the major source of people in Asia-Pacific region, including Austronesians, based on the age of several candidate "Out of Taiwan" mtDNA haplotypes (e.g. E and B4a1a), which appear to be older than those in Taiwan aboriginals. Or, it may also be the most probable homeland of Malayo-Polynesians (the Batanes Islands) to interpret as indigenous evolution in ISEA before Neolithic expansion in Southern China/Taiwan (Soares et al. 2016), but receive no support from linguistic, archaeological and anthropological studies (Ross 2005; Bellwood 1997). In this context, the molecular clock should be validated using archaeological records, which is sparse in ISEA. This is not the case in Southern China, Vietnam, Philippines and Oceania, where a relatively large number of archaeological specimens are available for validation (Bellwood 1997).

In contrast, genetic data from autosomal markers are much more credible to support various ancestries in ISEA compared with the uniparentally inherited mtDNA haplotypic data, which are more affected by the founder effects and sex-biased gene flow, especially in ISEA, which is occupied by either matrilocal- or patrilocal-marriage practice societies. The effects on mtDNA and male-specific uniparental Y-chromosome markers may mean the ancestry components revealed from both mtDNA and Y-chromosome analyses do not directly parallel what has been demonstrated in the genome-wide studies; see Soares et al. (2016) for an attempt to directly link information derived from uniparental and genomic ancestral fractions. Our own findings on various immune systems and genes that determine tissue compatibility in transfusion and transplantation showed various ancestral fractions in Malaysian sub-populations. Even though these genes are more affected by selective pressure, they still yield relatively strong ancestral signals from the loci of their immune cells, such as the killer-cell immunoglobulin-like receptor (KIR) in natural killer cells and other genes in platelets, neutrophils, leukocytes and lymphocyres. . These can differentiate the Semang, Senoi and Proto-Malays (Manaf et al. 2016; Norhalifah et al. 2016b; Syafawati et al. 2016; Tasnim et al. 2016; NurWaliyuddin et al. 2015) (Table 2 and Fig. 5). For example, there is high frequency of KIR haplotype B (KIR2DL1, KIR2DL3, KIR3DL1, KIR3DL3, KIR2DS4, KIR2DL2, KIR2DL5, KIR3DS1, KIR2DS1, KIR2DS2, KIR2DS3, KIR 2DS5, KIR2DP1, KIR3DP1, KIR3DL2 and KIR2DL4) and KIR haplotype A (KIR2DL1, KIR2DL3, KIR3DL1, KIR3DL3, KIR2DS4, KIR2DP1, KIR3DP1, KIR3DL2 and KIR2DL4) among the Semang (Lanoh, Bateq and Kensiu) and Senoi (Semai and Che Wong). The KIR haplotypes A and B are frequently found in descendants of Africans and Indochinese populations (NurWaliyuddin et al. 2015) and play a vital role in fighting infectious diseases and reproduction, respectively (Chambers et al. 2016). The possible clinical consequences of these ancestral fractions in Orang Asli are important future subjects for disease association studies as has previously been conducted by Edinur et al. (2013) and Chambers et al. (2016) in Polynesians.

We also observed a unique pattern of allele frequency spectra in Orang Asli of similar sub-tribes; HNA alleles (i.e. HNA-4 and HNA-5) and several single nucleotide polymorphisms (SNP) in pro-inflammatory (IL12-1188A/C and IL2+166G/T) and anti-inflammatory (IL-10-819C/T and IL-10-1082A/G) cytokine genes distributed differently in Proto-Malays (i.e. the Orang Kanaq) as compared with their other Austronesian relatives, the Malay subethnic groups (Norhalifah et al. 2016b; Manaf et al. 2016). Genetic differences between these Austronesian groups may be due to isolation and bottleneck events that took place in the Orang Kanaq. The Orang Kanaq currently live as a small group in the interior of Peninsular Malaysia (Musa 2011) as opposed to Malay subethnic groups. The latter group is numerically larger and have admixed with other major sub-populations including with the modern Malays (i.e. Deutro-Malays), Chinese and Indians. Similar effects were observed for the HLA loci, the most polymorphic region in human genome, where only 43 alleles were recorded across the HLA-A, HLA-B and HLA–DRB1 genes of the Kensiu and Semai people. These Orang Asli sub-tribes also have fixed human platelet antigen (HPA) (HPA-2a, HPA-4a, HPA-6a) and TGF-β1 +915G cytokine systems. Only 10 and 9 KIR genotypes were detected in Kensiu and Semai, respectively (Norhalifah et al. 2016b; Syafawati et al. 2016; Tasnim et al. 2016; NurWaliyuddin et al. 2015). Overall, these apparently distinctive genepools of Orang Asli are the result genetic refinement via admixture, founder effects and selective pressure after multiple settlements and long periods of isolation since they settled in Peninsular Malaysia.

The current trends in genetic ancestry studies focus on large scale SNP surveys and whole genome sequencing because they generate large volumes of data (Wong et al. 2013; Lipson et al. 2014). This new development contributes towards our present understanding of ancestral and admixture fractions in ISEA and includes representative Orang Asli in Peninsular Malaysia and Taiwanese aborigines. The ancestry pattern revealed by the SNP surveys and whole genome sequencing supports our inferences using immune and histocompatibility genes. In addition, the indigenous evolution model for ISEA was not supported from other biological data – dental and craniometric analyses showed distinct patterns of variations between ancient and modern human specimens in ISEA, which indicated demographic changes in the region associated with several human settlements (i.e. Austronesian and Austroasiatic speakers) in the region from Pleistocene to 2500 YBP (Matsumura and Oxenham 2014). Skeletal analysis showed morphological similarities between pre-Neolithic samples in ISEA (Gua Niah in Sarawak and Tobon in the Philippines) and those from Australian Aborigines and Papuans, which correlated with the late Pleistocene colonisation of Asia-Pacific region by anatomically modern humans (Matsumura and Oxenham 2014). In Peninsular Malaysia, this is related to the Semang, who are genetically and physically distinct from the other two language families (Austronesians and Austroasiatics) of food-producing populations, who migrated to the region in the Neolithic period (Matsumura and Oxenham 2014; Bellwood 1997). Nonetheless, admixture did occur between these populations and is evident in whole genome SNP analyses (Soares et al. 2016; Deng et al. 2015; Lipson et al. 2014).

Table 2 List of genetic systems screened in Orang Asli and alleles/haplotypes/genotypes that are unique to a particular tribe/sub-tribe

Marker	Gen/hap/allele	Semang			Senoi		P-M
		Bateq	Kensiu	Lanoh	CW	Semai	OK
KIR	Gen. AA	0.00	0.18	0.12	0.21	0.46	0.09
	Gen. AB	0.33	0.55	0.65	0.61	0.41	0.82
	Gen. BB	0.67	0.26	0.23	0.18	0.14	0.09
	Hap. A	0.17	0.46	0.44	0.52	0.66	0.50
	Hap. B	0.83	0.54	0.56	0.48	0.34	0.50
HPA	1a	1.00	0.96	1.00	1.00	0.99	100
	1b	0.00	0.04	0.00	0.00	0.01	0.00
	2a	1.00	1.00	1.00	1.00	1.00	1.00
	2b	0.00	0.00	0.00	0.00	0.00	0.00
	3a	0.50	0.88	0.64	0.42	0.67	0.82
	3b	0.50	0.13	0.36	0.58	0.33	0.18
	4a	1.00	1.00	1.00	1.00	1.00	1.00
	4b	0.00	0.00	0.00	0.00	0.00	0.00
	5a	0.85	0.85	1.00	0.79	0.89	1.00
	5b	0.15	0.15	0.00	0.21	0.11	0.00
	6a	1.00	1.00	1.00	1.00	1.00	1.00
	6b	0.00	0.00	0.00	0.00	0.00	0.00
	15a	0.00	0.36	0.26	0.5	0.52	0.91
	15b	1.00	0.64	0.74	0.5	0.48	0.09
HNA	1a	0.44	0.54	0.82	0.56	0.58	0.77
	1b	0.56	0.46	0.14	0.44	0.35	0.23
	1c	0.00	0.00	0.00	0.00	0.00	0.00
	1null	0.00	0.00	0.04	0.00	0.07	0.00
	3a	0.93	0.95	0.86	0.74	0.94	0.91
	3b	0.07	0.05	0.14	0.26	0.06	0.09
	4a	1.00	0.99	0.90	0.87	0.93	0.86
	4b	0.00	0.01	0.10	0.13	0.07	0.14
	5a	0.76	0.79	0.86	0.85	0.77	1.00
	5b	0.24	0.21	0.14	0.15	0.23	0.00
CytokineTGF-β1 +869/+915 gene SNPs	CC	0.00	0.00	0.00	0.00	0.00	0.00
	CG	0.82	0.50	0.62	0.75	0.70	0.55
	TG	0.18	0.50	0.38	0.25	0.30	0.41
	TC	0.00	0.00	000	0.00	0.00	0.05
CytokineTNF-α -308/-238 gene SNPs	GG	1.00	0.93	0.98	0.86	1.00	0.91
	AG	0.00	0.04	0.02	0.10	0.00	0.00
	GA	0.00	0.03	0.00	0.02	0.00	0.00
	AA	0.00	0.00	0.00	0.02	0.00	0.09
CytokineIL-2-330/+166 gene SNPs	TG	0.64	0.60	0.62	0.73	0.55	0.77
	GG	0.26	0.18	0.18	0.25	0.33	0.23
	GT	0.00	0.00	0.00	0.00	0.03	0.00
	TT	0.10	0.22	0.20	0.02	0.09	0.00

(continued)

Table 2 (continued)

Marker	Gen/hap/allele	Semang			Senoi		P-M
		Bateq	Kensiu	Lanoh	CW	Semai	OK
CytokineIL-4-1098/-590/-33 gene SNPs	TTT	0.80	0.51	0.72	0.74	0.61	0.64
	TTC	0.00	0.00	0.00	0.00	0.09	0.00
	TCT	0.00	0.00	0.00	0.00	0.00	0.09
	TCC	0.18	0.43	0.16	0.02	0.17	0.23
	GTT	0.00	0.00	0.00	0.00	0.00	0.00
	GTC	0.00	0.00	0.00	0.00	0.00	0.00
	GCT	0.000	0.00	0.00	0.00	0.01	0.00
	GCC	0.02	0.06	0.12	0.24	0.13	0.05
CytokineIL-6-597/-174 gene SNPs	GG	0.72	0.88	0.62	0.64	0.73	0.64
	CG	0.24	0.11	0.34	0.19	0.26	0.36
	GA	0.00	0.01	0.00	0.05	0.00	0.00
	CA	0.04	0.00	0.04	0.12	0.01	0.00
CytokineIL-10-1082/-819/-592 gene SNPs	GCC	0.05	0.07	0.06	0.27	0.10	0.50
	GCA	0.00	0.00	0.00	0.00	0.00	0.00
	GAC	0.00	0.00	0.00	0.00	0.00	0.00
	ACC	0.57	0.47	0.20	0.06	0.23	0.00
	ACA	0.00	0.01	0.00	0.02	0.02	0.00
	ATC	0.04	0.00	0.02	0.02	0.00	0.00
	ATA	0.31	0.44	0.72	0.64	0.66	0.50
	GTA	0.01	0.00	0.00	0.00	0.00	0.00
	GTC	0.02	0.00	0.00	0.00	0.00	0.00
$^{\delta}$HLA-A	02:01	•	0.41	0.26	•	0.07	0.15
	11:01	•	0.14	0.04	•	0.04	0.27
	24:02	•	0.07	0.12	•	0.20	0.10
	24:07	•	0.24	0.32	•	0.41	0.21
	33:03	•	0.00	0.08	•	0.00	0.17
$^{\delta}$HLA-B	13:01	•	0.14	0.08	•	0.00	0.08
	15:02	•	0.00	0.02	•	0.17	0.06
	15:13	•	0.19	0.10	•	0.16	0.13
	15:25	•	0.02	0.00	•	0.00	0.15
	18:01	•	0.19	0.28	•	0.17	0.15
	35:05	•	0.05	0.14	•	0.15	0.06
$^{\delta}$HLA-DRB1	09:01	•	0.19	0.32	•	0.15	0.19
	12:02	•	0.14	0.14	•	0.29	0.15
	15:01	•	0.19	0.04	•	0.11	0.10
	15:02	•	0.14	0.30	•	0.16	0.08
	16:02	•	0.00	0.00	•	0.16	0.21

There are many genetic similarities and differences observed between Orang Asli tribes across the five genetic loci. In addition, differences were also recorded between Orang Asli of similar tribe (e.g. refer KIR genotype profiles between Bateq, Kensiu and Lanoh of the Semang). Evidence of reduced genetic variability in Orang Asli is shown by several monomorphic loci (bold) and largely observed in small Orang Asli subtribes, such as the Bateq and Orang Kanaq. The population data for KIR, HPA, HNA, cytokine and HLA listed here were compiled from Jinam et al. (2012), NurWaliyuddin et al. (2015), Manaf et al. (2016), Norhalifah et al. (2016b), Syafawati et al. (2016) and Tasnim et al. (2016). *Gen* genotype, *hap* haplotype, *CW* Che Wong, *OK* Orang Kanaq, • no data available, δ only the most frequent HLA types in Kensiu, Jahai, Semai and Temuan were listed

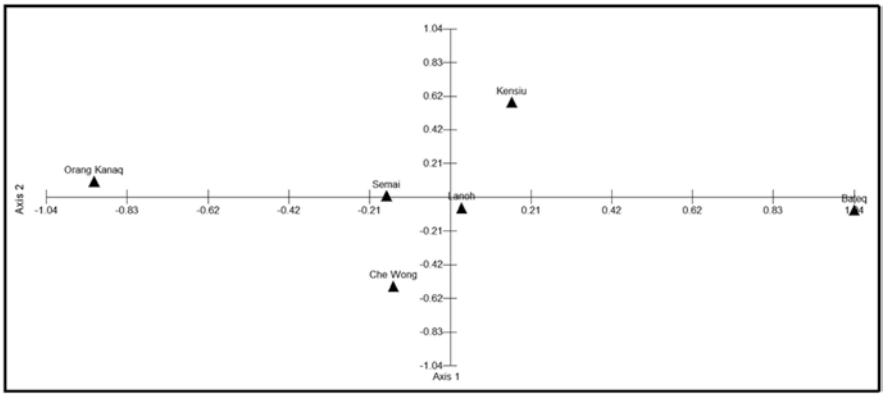

Fig. 5 Principal coordinate plot constructed using allele frequencies (except for HLA, where data is not available for all reference populations) listed in Table 2 and methodology described by Edinur et al. (2009). The plot illustrate the diverse genepools of the three Orang Asli groups with evidence of admixture between the Semang (Lanoh) and Senoi (Semai and Che Wong)

A Multidisciplinary Synthetic Model: Including Evaluation of the Evidence and Relation of Our Model to Earlier Ones

The emerging picture of ancestries in Peninsular Malaysia was first described by Lipson et al. (2014) and followed by Norhalifah et al. (2016a). The Genetic Layer Cake Model proposed by Norhalifah et al. (2016a) included pre-historical and historical migration events and socio-economic relationships (e.g., between Orang Asli and Malays, and between Orang Asli tribes and sub-tribes) since the first century among sub-populations in Peninsular Malaysia. Kusuma et al. (2016) demonstrated the same approach taken by others to interpret the origins and migration patterns of other genetically admixed Austronesian populations. Figure 6 shows three waves of settlements in Peninsular Malaysia (Semang, Senoi and Proto-Malays) and was inferred from linguistic, archaeological data discussed earlier, besides the latest evidence from genome wide studies (Lipson et al. 2014; Bellwood et al. 2011). The Semang (also known as Australo-Papuan or Negrito) are the first to settle in Peninsular Malaysia before migrating south and east towards Australia, Papua New Guinea and the Philippines. The pre-Neolithic settlements of the Semang in Peninsular Malaysia was followed by the Austroasiatic-speaking agricultural population (i.e. Senoi), who migrated from Indochina and the Asian part of their genome came in with Austroasiatic languages (i.e. a branch of Mon–Khmer of Austro-Asiatic language family) about 4000 YBP (Norhalifah et al. 2016a; Blust 2013; Andaya 2002; Saha et al. 1995).

This language was then adopted by the already settled Semang group but never spread into Indonesia as far as we know. In contrast, Proto-Austronesian Neolithic speakers of Southern China migrated and dispersed throughout Asia-Pacific region as far as Madagascar in the west, and New Zealand in the east, via Taiwan, Philippines and Borneo (Kusuma et al. 2016; Bellwood 1997). Austronesians migrated from west to east along the northern coast and offshore islands of New

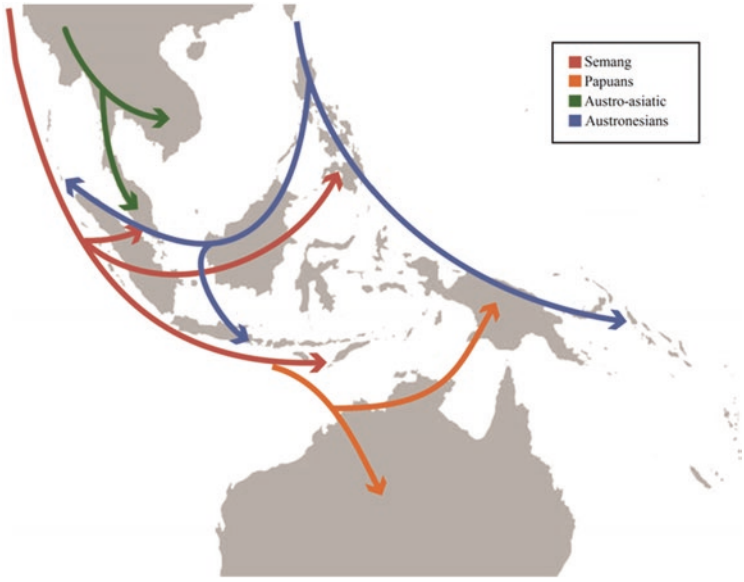

Fig. 6 Historical patterns of migration and settlement of Semang (red), Senoi (green) and Proto-Malay (blue) ancestors in Peninsular Malaysia. This figure is edited from Lipson et al. (2014), with permission from Macmillan Publishers Ltd

Guinea (Marianas, Palau, Admiralties and Bismarck Islands), but certainly not anywhere through the central highlands of Papua New Guinea (PNG); cf. as originally shown in the diagram by Lipson et al. (2014). Therefore, while it is likely true that the modern Malays are descendants of indigenous Proto-Malays, the admixed component from Indians, Arabs and East Asian components should not be overlooked and has been well demonstrated by the growing number of genome wide studies (Soares et al. 2016; Hoh et al. 2015; Aghakhanian et al. 2015; Deng et al. 2015; Deng et al. 2014, Liu et al. 2014; Jinam et al. 2012; Hatin et al. 2011).

We agree that the genepools of contemporary Orang Asli in Malaysia and those in Philippines, Australia, Taiwan and PNG are different, and this is related to local adaptation, admixture and socio-economic interactions. But they are all descendants of the earliest settlers in ISEA and represent several genetic lineages of people settled in the Asia-Pacific region in prehistoric time. This is what one may expect since these ancient populations split around 30–50,000 years ago as shown by Soares et al. (2016), the HUGO Pan-Asian SNP Consortium (2009) and Deng et al. (2015) using mtDNA, Y-chromosome and whole genome-wide data. The authors also proposed migration patterns and timelines in ISEA/Peninsular Malaysia. This is totally different from other populations, such as the Taiwanese aboriginal tribes who are the ancestors of the Proto-Malays and Malays, but not thought to have been in extensive or extended contact with genetically distinct populations (Norhalifah et al. 2016a). Several ancient settlements and polities (e.g. Pan Pan, Dan, Kataha, Chi Tu and Kalah) existed in Peninsular Malaysia between fifth and eleventh centuries and received strong influences from external Hindu-Buddhist civilisation. They became distribution hubs for forest products (rattan, resins and aromatic wood, such

as camphor and gaharu) collected by different Orang Asli groups in Peninsular Malaysia and for other trade items (silk and spices) from Chinese, Arab, Persian and Maluku traders (Hussein et al. 2007; Musa 2006; Andaya 2002; Manguin 1993). This period was followed by the arrival of Islam (largely via trading and intermarriage between Indian traders and local people) as early as from the eleventh century in the northeast (Pahang and Terengganu) of Peninsular Malaysia (Nor et al. 2012; Hussein et al. 2007; Hussin 2004;). During the Melaka Sultanate, the Chinese admiral, trader and explorer Cheng Ho, representing the Ming Emperor, led an expedition to Malacca and many of the members settled down with the locals, marking the beginning of a unique Chinese-Malay melange in Melaka called the Baba-Nyonya culture (Lee 2008). This has also proved that the Chinese had arrived in Peninsular Malaysia long before the European colonisation from the fifteenth to nineteenth century. The effects of the European colonial era can also be readily seen with the existence of Portuguese–Eurasian influence in Melaka (Pillai et al. 2015). Both, Baba-Nyonya and Portuguese–Eurasian cultures are products of socio-economic interactions in Melaka that emerged as unique ethnicities with socio-cultural characters that closely resembled a hybrid of their original populations (Chinese, European and Malay). Later in the nineteenth century, even larger numbers of Chinese and Indian labourers were brought to Peninsular Malaysia during the British administration to supply the workforce at tin mines, rubber plantations and timber mills. It was also at this time that the role of Orang Asli as main suppliers of jungle products began to decrease (Andaya 2002). These are all the contributing factors to not only on the observed complex genetic make-up, but also on the demographic changes in the Peninsular Malaysia.

Overall, the demographic history in Peninsular Malaysia matches well with the Malaysian Genetic Layer Cake Model we proposed (Norhalifah et al. 2016a), which includes waves of prehistoric migrations (by the Semang, Senoi and Proto-Malays) and socio-economic relationships since the first century in Peninsular Malaysia. In this review, new and compelling evidences from material cultures and beliefs are also included in the revised and expanded version of the model make it more inclusive, if not yet fully complete, account of human prehistory in Peninsular Malaysia.

Summary and Conclusions: Future Prospects for the People and Recommendations for Further Studies

In preceding sections, an account was presented with hope that it properly reflects the totality of received wisdom on the biology and culture of the Orang Asli. The picture that emerged is one of three distinct lineages of people who arrived at different times from three different directions – ancient Semang from the south, Senoi with Asian affinities from the north and Proto-Malays from the east. This ancestral history and geographic dispersal pattern have resulted via a direct set of causal mechanisms in the suite of genes, languages and culture that can be observed in these groups today. Thus, we hold that the extensive genetic, linguistics,

anthropology and archaeology research in this region, including historical data on cultural materials and trading activities, support our view of several waves of migrations occuring into ISEA (Morseburg et al. 2016; Matsumura and Oxenham 2014; Xu et al. 2012; Bellwood 1997). This model of ISEA settlements is in contrast to those supporting a single common origin of various populations in this region, as a result of one migration wave without major demographic changes since the Pleistocene – see Donohue and Denham (2011) and Soares et al. (2016) and for a discussion of these ideas. In particular, archaeological and linguistic data showed two or more sources for the major spread of Neolithic culture in this region after the Pleistocene. First settlements by the ancient Semang people followed by one from north (Southern China/Indo-China) associated with the Austroasiatic Senoi 5000–6000 years ago and finally one more related to Austronesian-speaking population, who presently form the majority across the Asia-Pacific region (Blust 2013; Xu et al. 2012; Bellwood 1997). These archaeological and linguistic reconstructions of human dispersals in ISEA have received some new support from large-scale genomic studies; i.e. that the genetic dating of Asian components observed in ISEA populations does not predate population migration and expansion during the Neolithic era (Lipson et al. 2014; Xu et al. 2012) and from morphological analysis of dental traits; i.e. that the dental morphology variations observed between mid-Holocene to Neolithic populations were the result of demographic changes since they are robust to environmental pressure, which is not consistent with the a common source of ancestral population in Peninsular Malaysia (Matsumura and Oxenham 2014).

In more recent time, these earlier settlers in Peninsular Malaysia have been genetically and linguistically influenced by contact with traders (Arab and Indians) and by the large number of Chinese and Indian labourers brought in by the British administration (Hussein et al. 2007). All these demographic changes appeared in the genepools of modern inhabitants in Peninsular Malaysia (Morseburg et al. 2016; Deng et al. 2015) and are captured in our Malaysian Genetic Layer Cake Model of human settlement in Peninsular Malaysia. Population history may not always be as accurately reflected in the genepools of descendants as one might expect (Fix, 2000), but our extensive genetic research has effectively revealed traces of various ancestral fractions in the DNA samples collected from Orang Asli sub-populations in Peninsular Malaysia (Manaf et al. 2016; Norhalifah et al. 2016b; Syafawati et al. 2016; Tasnim et al. 2016; Deng et al. 2015; NurWaliyuddin et al. 2015). This genetic complexity cannot be generated from a single wave of migration and contradicts any hypothesis that claims that the Orang Asli tribes, with their distinct languages and material cultural heritages, are differentiated from a single ancestral population. This is in marked contrast with the situation in Taiwan, where aboriginal populations are genuinely derived from a single source but have become linguistically and culturally diverse while remaining genetically homogeneous. Another valuable prospect towards greater understanding of demographic history in this region should come from analyses of ancient DNA (cf. current data from possibly admixed modern human DNA) and new archaeological records.

In other contexts, our emerging view of genetic complexity in ISEA should be seen from any perspective, which may bring benefits to these people, for example, including but not limited to, economic, socio-cultural and health aspects. We have previously demonstrated a symbiosis between understanding genetic ancestry and health in Asia-Pacific region populations of Orang Asli and Polynesians (Edinur and Chambers 2017), while Blundell (2011) had highlighted the value of sharing a common heritage as a motivating drive to attain improved socio-economic status among the Austronesian speaking countries. All these cannot eventuate simply from a single field of study but can best be visualised from multidisciplinary data. We strongly feel that this is the leading lesson that we have taken from preparing this article.

Acknowledgements The author wishes to thank Victoria University of Wellington for its alumnus scholar support.

References

Abdullah, A. K. (1960). *Hikayat Abdullah. Siri kesusasteraan Melayu 4* (Chronicle of Abdullah. Malay Literature Series 4). Singapore: Malaya Publishing House Ltd.

Aghakhanian, F., Yunus, Y., Naidu, R., Jinam, T., Manica, A., Hoh, B. P., & Phipps, M. E. (2015). Unravelling the genetic history of Negritos and indigenous populations of Southeast Asia. *Genome Biology and Evolution, 7*, 1206–1215.

Alias, A., & Daud, M. N. (2011). *Saka: Adequate compensation for Orang Asli native land*. Kuala Lumpur: Universiti Tun Hussein Onn Malaysia Publisher.

Andaya, L. Y. (2002). Orang Asli and the Melayu in the history of the Malay Peninsula. *Journal of the Malaysian Branch of the Royal Asiatic Society, 75*, 23–48.

Andaya, L. Y. (2008). *Leaves of the same tree: Trade and ethnicity in the Straits of Melaka*. Honolulu: University of Hawai'i Press.

Andaya, B. W., & Andaya, L. Y. (2001). *A history of Malaysia*. Basingstoke: Palgrave Publisher Ltd..

Annual report on the state of Pahang for the year 1890. Pekan: British Resident Pahang.

Annual report on the state of Pahang for the year 1891. Pekan: British Resident Pahang.

Bellwood, P. (1985). *Prehistory of the Indo-Malaysian Archipelago*. Sydney: Academic.

Bellwood, P. (1997). Taiwan and the prehistory of the Austronesian-speaking peoples. *The Review of Archaeology, 18*, 39–48.

Bellwood, P. (1998). Prehistoric settlement patterns. In N. H. S. Nik Abdul Rahman (Ed.), *Early history, the Encyclopedia of Malaysia* (pp. 10–19). Kuala Lumpur: Archipelago Press.

Bellwood, P., Chambers, G., Ross, M., & Hung, H. C. (2011). Are 'cultures' inherited? Multidisciplinary perspectives on the origins and migrations of Austronesian-speaking peoples prior to 1000 BC. In B. W. Roberts & M. V. Linden (Eds.), *Investigating archaeological cultures* (pp. 321–354). New York: Springer.

Benjamin, G. (1966). Temiar social groupings. *Federation Museums Journal New Series, 11*, 1–25.

Benjamin, G. (1968). Headmanship and leadership in Temiar society. *Federation Museums Journal New Series, 13*, 1–43.

Benjamin, G. (1989). Achievements and gaps in Orang Asli research. *Akademika, 35*, 7–46.

Benjamin, G. (1997). Issues in the ethnohistory of Pahang. In N. H. S Nik Abdul Rahman (Ed.), *Pembangunan arkeologi pelancongan Negeri Pahang* (Development of Archaeological Tourism in the state of Pahang) (pp. 82–121). Pekan: Pahang State Museum Board.

Benjamin, G. (2001). Process and structure in Temiar social organisation. In R. Rashid & W. J. Karim (Eds.), *Minority cultures of Peninsular Malaysia: Survival of indegenious heritage* (pp. 125–149). Kuala Lumpur: Malaysian National Library.

Blundell, D. (2011). Taiwan Austronesian language heritage connecting Pacific Island peoples: Diplomacy and values. *International Journal of Asia-Pacific Studies, 7*, 75–91.

Blust, R. (2013). Terror from the sky: Unconventional linguistic clues to the negrito past. *Human Biology, 85*, 401–416.

Borie, H. (1865). On the wild tribes of the interior of the Malay Peninsula. *Transactions of the Ethnological Society of London, New Series, 3*, 72–83.

Borie, H. (1886). *La Presqu'île de Malacca, les Malais et les Sauvages*. Tulle: Imprimerie De J. Mazeyrie.

Borie, H. (1887). An account of the Mantras, a savage tribe in the Malay Peninsula. In R. Rost (Ed.), *Miscellaneous papers relating to Indo-China and the Indian Archipelago* (pp. 286–307). London: Trübner and Hill, Ludgate Hill.

Burenhult, N. (1999). A bibliographical guide to Aslian linguistics. *Mon-Khmer Studies, 29*, 133–141.

Carey, I. (1970). The Kensiu Negrito of Baling, Kedah. *Journal of the Malaysian Branch of the Royal Asiatic Society, 43*, 143–154.

Carey, I. (1976). *Orang Asli: The aboriginal tribes of Peninsular Malaysia*. London: Oxford University Press.

Chambers, G. K., & Edinur, H. A. (2015). The Austronesian diaspora: A synthetic total evidence model. *Global Journal of Anthropology Research, 2*, 53–65.

Chambers, G. K., Edinur, H. A., & Dunn, P. P. J. (2016). New insights into ancestry and health of Polynesians and New Zealand Maori. *New Zealand Science Review, 73*, 3–10.

Clifford, H. C. (1897). *In court and kampong: Being tales and sketches of native life in the Malay Peninsula*. London: Grant Richards.

de Mikluho-Maclay, M. (1878). Dialects of the Melanesian tribes in the Malay Peninsula. *Journal of the Straits Branch of the Royal Asiatic Society, 1*, 38–44.

Deng, L., Hoh, B. P., Lu, D., Fu, R., Phipps, M. E., Li, S., et al. (2014). The population genomic landscape of human genetic structure, admixture history and local adaptation in Peninsular Malaysia. *Human Genetics, 133*, 1169–1185.

Deng, L., Hoh, B. P., Lu, D., Saw, W. Y., Ong, R. T. H., Kasturiratne, A., et al. (2015). Dissecting the genetic structure and admixture of four geographical Malay populations. *Scientific Report, 5*, 14375.

Donohue, M., & Denham, T. (2011). Language and genes attest different histories in Island Southeast Asia. *Oceanic Linguistics, 50*, 536–542.

Dunn, F. L. (1975). *Rainforest collectors and traders: A study of resource utilization in modern and ancient Malaya*. Kuala Lumpur: Malaysian Branch of the Royal Asiatic Society.

Edinur, H. A., & Chambers, G. K. (2017). Genetic ancestry and health. *MOJ Immunology, 5*, 00151.

Edinur, H. A., Zafarina, Z., Spinola, H., Nurhaslindawaty, A. R., Panneerchelvam, S., & Norazmi, M. N. (2009). HLA polymorphism in six Malay subethnic groups in Peninsular Malaysia. *Human Immunology, 70*, 518–526.

Edinur, H. A., Dunn, P. P., Hammond, L., Selwyn, C., Brescia, P., Askar, M., et al. (2013). HLA and MICA polymorphism in Polynesians and New Zealand Maori: Implications for ancestry and health. *Human Immunology, 74*, 1119–1129.

Endicott, K. M., & Endicott, K. L. (2008). *The headman was a woman: The gender egalitarian Batek of Malaysia*. Long Grove: Waveland Press Inc..

Evans, I. H. N. (1923). *Studies in religion, folk-lore, and custom in British North Borneo and the Malay Peninsula*. Cambridge: Cambridge University Press.

Evans, I. H. N. (1927). *Papers on the ethnology and archaeology of the Malay Peninsula*. Cambridge: Cambridge University Press.

Fix, A. G. (2000). Genes, language and ethnic groups: Reconstructing Orang Asli prehistory. *Bulletin of the Indo-Pacific Prehistory Association, 19*, 11–16.

Gray, R. D., Atkinson, Q. D., & Greenhill, S. J. (2011). Language evolution and human history: What a difference a date makes. *Philosophical Transactions of the Royal Society B: Biological Sciences, 12*, 1090–1100.

Hatin, W. I., Nur-Shafawati, A. R., Zahri, M. K., Xu, S., Jin, L., Tan, S. G., et al. (2011). Population genetic structure of Peninsular Malaysia Malay sub-ethnic groups. *PLoS One, 6*, e18312.

Hoe, B. S. (2001). *Semelai communities at Tasek Bera: A study of the structure of an Orang Asli society*. Subang Jaya: Centre for Orang Asli Concern.

Hoh, B. P., Deng, L., Julia-Ashazila, M. J., Zuraihan, Z., Nur-Hasnah, M., Nur-Shafawati, A. R., et al. (2015). Fine-scale population structure of Malays in Peninsular Malaysia and Singapore and implications for association studies. *Human Genomics, 9*, 1–9.

Hood, M. S. (1974). *An ethnographical investigation of the Semelai of Malaysia*. Undergraduate dissertation, Oxford University.

Hood, M. S. (1978). *Semelai rituals of curing*. PhD thesis, University of Oxford.

Hotez, P. J. (2014). Aboriginal populations and their neglected tropical diseases. *PLoS Neglected Tropical Diseases, 8*, e2286.

Hotez, P. J., Bottazzi, M. E., Strych, U., Chang, L. Y., Lim, Y. A., Goodenow, M. M., et al. (2015). Neglected tropical diseases among the association of Southeast Asian Nations (ASEAN): Overview and update. *PLoS Neglected Tropical Diseases, 9*, e0003575.

Howell, S. (1982). *Chewong myths and legends. Monograph no. 11*. Kuala Lumpur: Malaysian Branch of the Royal Asiatic Society.

Howell, S. (1989). *Society and cosmos: Chewong of Peninsular Malaysia*. Chicago: University of Chicago Press.

Howell, S. (2011). Sources of sociality in a cosmological frame: Chewong, Peninsular Malaysia. In T. Gibson & K. Sillander (Eds.), *Anarchic solidarity: Autonomy, equality, and fellowship in Southeast Asia* (pp. 40–61). New Haven: Yale Southeast Asia Studies.

HUGO Pan-Asian SNP Consortium, Abdulla, M. A., Ahmed, A., Assawamakin, A., Bhak, J., Brahmachari, S. K., et al. (2009). Mapping human genetic diversity in Asia. *Science, 326*, 1541–1545.

Hussein, T., Alias, R., & Jibril J. (2007). *Malaysia negara kita* (Our country Malaysia). Kuala Lumpur: MDC Publishers.

Hussin, H. (2004). Orang Melayu Kelantan dari sudut budaya dan perspektif sejarah lampau (The Kelantan Malays from cultural aspect and the perspective of ancient history). *Jebat: Malaysian Journal of History, Politics and Strategic Studies, 31*, 15–38.

Isa, H. M. (2007). Material culture transformation and its impact on cultural archaeological change: The case study of the Lanoh in Upper Perak. *Archaeology Heritage of Malaysia, 1*, 131–151.

Isa, H. M. (2010a). Masyarakat Jahai Temenggor: satu penilaian terhadap status pemburu pemungut (The Jahai Temenggor society: An evaluation of their hunter-gatherer status). *Jurnal Warisan Arkeologi, 3*, 82–93.

Isa, H. M. (2010b). Keturunan masyarakat pemburu pemungut Lanoh Lenggong: satu perspektif etnoarkeolgi (Descendants of the hunter gatherer society of Lanong Lenggong: An ethnoarchaeological perspective). *Jurnal Arkeologi Malaysia, Ikatan Ahli Arkeologi Malaysia, 23*, 1–12.

Isa, H. M. (2015). *The last descendants of the Lanoh hunters and gatherers in Malaysia*. Pulau Pinang: Penerbit USM.

Isa, H. M., & Ramli, N. (2015). Tradisi pengebumian masyarakat Temiar dari sudut etnoarkeologi (The burial tradition of Temiar society from etnoarchaelogical aspect). *Jurnal Arkeologi Malaysia, 28*, 64–72.

Isa, H. M., Ahmad, A., & Wan Sulaiman, W. N. H. (2015). Pemburu pemungut Chewong: satu perspektif sejarah dan etnografi (The Chewong hunter gatherer: From the perspectives of history and ethnography). *Jurnal Arkeologi Malaysia, 28*, 112–127.

Jinam, T. A., Hong, L. C., Phipps, M. E., Stoneking, M., Ameen, M., Edo, J., et al. (2012). Evolutionary history of continental southeast Asians: "Early train" hypothesis based on genetic analysis of mitochondrial and autosomal DNA data. *Molecular Biology and Evolution, 29*, 3513–3527.

Kusuma, P., Brucato, N., Cox, M. P., Pierron, D., Razafindrazaka, H., Adelaar, A., et al. (2016). Contrasting linguistic and genetic origins of the Asian source populations of Malagasy. *Scientific Report, 6*, 26066.

Leary, J. D. (1995). *Violence and the dream people. The Orang Asli in the Malayan emergency, 1948–1960* (Ohio RIS Southeast Asia Series). Athens: Ohio University Press.

Lee, S. K. (2008). The Peranakan Baba Nyonya culture: Resurgence or disappearance? *SARI: Jurnal Alam dan Tamadun Melayu, 26*, 161–170.

Li, H., Wen, B., Chen, S. J., Su, B., Pramoonjago, P., Liu, Y., et al. (2008). Paternal genetic affinity between Western Austronesians and Daic populations. *BMC Evolutionary Biology, 8*, 146.

Lim, H. F. (1997). *Orang Asli, forest and development*. Kepong: Institut Penyelidikan PerhutananForest Research Institute Malaysia.

Lipson, M., Loh, P. R., Patterson, N., Moorjani, P., Ko, Y. C., Stoneking, M., et al. (2014). Reconstructing Austronesian population history in Island Southeast Asia. *Nature Communications, 5*, 4689.

Liu, X., Saw, W. Y., Ali, M., Ong, R. T., & Teo, Y. Y. (2014). Evaluating the possibility of detecting evidence of positive selection across Asia with sparse genotype data from the HUGO Pan-Asian SNP consortium. *BioMed Central Genomics, 15*, 332.

Logan, J. R. (1847a). The Orang Binua of Johore. *Journal of the Indian Archipelago and Eastern Asia, 1*, 242–293.

Logan, J. R. (1847b). Physical characteristics of the Mintira. *The Journal of the Indian Archipelago and Eastern Asia, 1*, 294–295.

Logan, J. R. (1847c). The Orang Sabimba of the extremity of the Malay Peninsula. *Journal of the Indian Archipelago and Eastern Asia, 1*, 295–298.

Logan, J. R. (1847d). The Orang Biduanda Kallang of the River Pulai in Johore. *Journal of the Indian Archipelago and Eastern Asia, 1*, 299–302.

Logan, J. R. (1847e). The Orang Sletar of the rivers and creeks of the old strait and estuary of the Johore. *Journal of the Indian Archipelago and Eastern Asia, 1*, 302–304.

Logan, J. R. (1847f). Table of measurements illustrative of the physical peculiarities of the Mintira, Biduanda Kallang and Sabimba. *Journal of the Indian Archipelago and Eastern Asia, 1*, 305.

Logan, J. R. (1847g). Superstitions of the Mintira, with some additional remarks on their customs. *Journal of the Indian Archipelago and Eastern Asia, 1*, 307–331.

Logan, J. R. (1848a). Range of the Gutta Taban collectors, and present amount of imports into Singapore. *Journal of the Indian Archipelago and Eastern Asia, 2*, 529–533.

Logan, J. R. (1848b). Journal of a voyage to the eastern coast and islands of Johore. *Journal of the Indian Archipelago and Eastern Asia, 2*, 616–624.

Majid, Z. (1994). An introduction to the excavation and analyses of the Gua Gunung Runtuh remains. In Z. Majid (Ed.), *The excavation of Gua Gunung Runtuh and the discovery of the Perak Man in Malaysia* (pp. 1–8). Pulau Pinang: Department of Museums and Antiquity Malaysia.

Majid, Z. (2003). *Archaelogy in Malaysia*. Pulau Pinang: Centre for Archaelogical Research Malaysia, Universiti Sains Malaysia.

Manaf, S. M., Panneerchelvam, S., Norazmi, M. N., Zafarina, Z., & Edinur, H. A. (2016). HNA diversity in six subgroups of Orang Asli in Peninsular Malaysia. *Transfusion Medicine, 26*, 305–307.

Manguin, P.-Y. (1993). Palembang and Sriwijaya: An early Malay harbour-city rediscovered. *Journal of the Malaysian Branch of the Royal Asiatic Society, 66*, 23–46.

Masron, T., Masami, F., & Ismail, N. (2013). Orang Asli in Peninsular Malaysia: Population, spatial distribution and socio-economic condition. *Journal of Ritsumeikan Social Sciences and Humanities, 6*, 75–115.

Matsumura, H., & Oxenham, M. F. (2014). Demographic transitions and migration in prehistoric East/Southeast Asia through the lens of non-metric dental traits. *American Journal of Physical Anthropology, 155*, 45–65.

Michael, E., & Chuen, E. M. (2012). Education and health awareness among indigenious people: A study in Perak, Malaysia. *ARPN Journal of Science and Technology, 2*, 745–749.

Mohd Nor, M. R., Berahim Ibrahim, A. Z., Yusof, A., Zakaria, M. F., & Mhd Ramli, M. F. (2012). Early history of islamic education and its expansion in the state of Kelantan, Malaysia. *Middle-East Journal of Scientific Research, 11*, 1153–1160.

Mohd Salleh, H. (2012). Social, historical trends and issues in Orang Asli studies. In Z. Zainuddin (Ed.), *Genetic and dental profiles of Orang Asli of Peninsular Malaysia* (pp. 13–27). Pulau Pinang: Penerbit USM.

Mohd Sam, S. A. (2015). *Kajian amalan budaya Orang Asli Suku Jakun di Kampung Peta* (A study of cultural practices of the Jakun in Peta village). Master thesis, Universiti Tun Hussein Onn Malaysia.

Morseburg, A., Pagani, L., Ricaut, F. X., Yngvadottir, B., Harney, E., Castillo, C., Hoogervorst, T., et al. (2016). Multi-layered population structure in Island Southeast Asians. *European Journal of Human Genetics, 24*, 1605–1611.

Murphy, S. A., & Stark, M. T. (2016). Introduction: Transitions from late prehistory to early historic periods in mainland Southeast Asia, c. early to mid-first millenium CE. *Journal of Southeast Asian Studies, 43*, 333–340.

Musa, M. Z. (2006). Petempatan Masyarakat Melayu-Cam di Indochina berasaskan prasasti kuno (Malay-Cam settlement in Indochina based on old inscriptions). *Jurnal Arkeologi Malaysia, 19*, 72–88.

Musa, M. (2011). The socioeconomic history of the Orang Kanaq of Johor. *Kajian Malaysia, 29*, 47–74.

Needham, R. (1956). Ethnographic notes on the Siwang of central Malaya. *Journal of the Malayan Branch of the Royal Asiatic Society, 29*, 49–69.

Needham, R. (1974). Some ethnographic notes on Semelai in northern Pahang. *Journal of the Malaysian Branch of the Royal Asiatic Society, 47*, 123–129.

Needham, R. (1976). Minor reports concerning Negritos in northern Pahang. *Journal of the Malaysian Branch of the Royal Asiatic Society, 49*, 184–193.

Needham, R. (1984). Chewong (Siwang) in perspective. *Journal of the Malaysian Branch of the Royal Asiatic Society, 57*, 105–112.

Nik Hussain, N. H. (2007). Writing on Orang Asli into Malaysian history. In C. B. Cheah Boon Kheng (Ed.), *New perspectives and research on Malaysian history* (pp. 211–228). Kuala Lumpur: Malaysian Branch of the Royal Asiatic Society.

Noone, H. D. (1936). Report on the settlements and welfare of the Ple-Temiar Senoi of the Perak-Kelantan watershed. *Journal of the Federated Malay States Museums, 19*, 1–85.

Noone, H. D. (1939). Chinchem: A study of the role of dream-experience in culture-contact amongst the Temiar Senoi of Malaya. *Man, 39*, 57.

Noone, H. D. (1954). Notes on the trade in blowpipes and blowpipe bamboo in north Malaya. *Federation Museums Journal, 1*(2), 1–18.

Noone, R. (1972). *Rape of the dream people*. London: Hutchinson.

Norhalifah, H. K., Syaza, F. H., Chambers, G. K., & Edinur, H. A. (2016a). The genetic history of Peninsular Malaysia. *Gene, 586*, 129–135.

Norhalifah, H. K., Syafawati, W. U., Che Mat, C. F., Chambers, G. K., & Edinur, H. A. (2016b). Distribution of cytokine gene polymorphisms in six Orang Asli subgroups in Peninsular Malaysia. *Human Immunology, 77*, 338–339.

NurWaliyuddin, H. Z. A., Norazmi, M. N., Edinur, H. A., Chambers, G. K., Panneerchelvam, S., & Zafarina, Z. (2015). Ancient genetic signatures of Orang Asli revealed by killer immunoglobulin-like receptor gene polymorphisms. *PLoS ONE, 10*, e0141536.

Peng, M. S., Quang, H. H., Dang, K. P., Trieu, A. V., Wang, H. W., Yao, Y. G., et al. (2010). Tracing the Austronesian footprint inmainland Southeast Asia: A perspective from mitochondrial DNA. *Molecular Biology and Evolution, 27*, 2417–2430.

Phua, K. L. (2015). The health of Malaysia's "Orang Asli" peoples: A review of the scientific evidence on nutritional outcome, parasite infestations, and discussion on implications for clinical practice. *Malaysian Journal of Public Health Medicine, 15*, 83–90.

Pillai, S., Soh, W.-Y., & Yusuf, Y. Q. (2015). Perceptions about one's heritage language: The case of the Acehnese in Kampung Aceh and Malacca Portuguese–Eurasians in the Portuguese settlement in Malaysia. *Kemanusiaan, 22*, 67–92.

Ross, M. (2005). The Batanic languages in relation to the early history of the Malayo-Polynesian subgroup of Austronesian. *Journal of Austronesian Studies, 1*, 1–23.

Saha, N., Mak, J. W., Tay, J. S., Liu, Y., Tan, J. A., Low, P. S., et al. (1995). Population genetic study among the Orange Asli (Semai Senoi) of Malaysia: Malayan aborigines. *Human Biology, 67*, 37–57.

Saidin, M. (2011). *Dari zaman batu ke tamadun awal di Malaysia* (From stone age to early civilisation). Pulau Pinang: Penerbit Universiti Sains Malaysia (Universiti Sains Malaysia Press).

Saint-Pol Lias, B. D. (1883). *Perak Et Les Orangs-Sakeys*. Paris: Plon.

Schebesta, P. (1952). *Die Negrito Asiens: Geshichte, demographie und anthropologie*. Mödling: St. Gabriel-Verlag.

Schebesta, P. (1954). *Die Negrito Asiens: Wirtschaft und soziologie*. Mödling: St. Gabriel-Verlag.

Schebesta, P. (1957). *Die Negrito Asiens: Religion und mythologie*. Mödling: St. Gabriel-Verlag.

Schebesta, P. (1973). *Among the forest dwarfs of Malaya*. Kuala Lumpur: Oxford University Press.

Skeat, W. W. (1902). The wild tribes of the Malay Peninsula. *The Journal of the Anthropological Institute of Great Britain and Ireland, 32*, 124–141.

Skeat, W. W., & Blagden, C. O. (1906). *Pagan races of the Malay Peninsula*. London: MacMillan and Co..

Soares, P. A., Trejaut, J. A., Rito, T., Cavadas, B., Hill, C., Eng, K. K., et al. (2016). Resolving the ancestry of Austronesian-speaking populations. *Human Genetics, 135*, 309–326.

Solheim, W. G. (1980). Searching for the origins of the Orang Asli. *Federation Museum Journal, 25*, 61–75.

Stewart, K. R. (1951). Dreams in Malaya. *Complex, 6*, 21–23.

Stewart, K. R. (1962). The dreams come of age. *Mental Hygiene, 46*, 230–237.

Syafawati, W. U., Zefarina, Z., Zafarina, Z., Hassan, M. N., Norazmi, M. N., Panneerchelvam, S., et al. (2016). Human platelet antigen allelic diversity in Peninsular Malaysia. *Immunohematology, 32*, 143–160.

Taha, A. H. (1983). Recent archaeological discoveries in Peninsular Malaysia 1976–1982. *Journal of the Malaysian Branch of the Royal Asiatic Society, 56*, 4763.

Taha, A. H. (1985a). *The re-excavation of the rockshelter of Gua Cha, Ulu Kelantan, West Malaysia*. Kuala Lumpur: Museums Department.

Taha, A. H. (1985b). *The re-excavation of the rock shelter of Gua Cha, Kelantan, West Malaysia*. Master thesis, National University of Australia.

Taha, A. H. (1988). Penyelidikan arkeologi di Kota Balai, Jerantut, Pahang – laporan awal (Archaeological research at Kota Balai, Jerantut, Pahang – preliminary report). *Jurnal Arkeologi Malaysia, 1*, 1–11.

Taha, A. H. (1991). Gua Cha and the archaeology of Orang Asli. *Bulletin Indo-Pacific Prehistory Association, 11*, 363–372.

Taha, A., & Jaafar, Z. (2015). Preliminary report on archaeological research and excavation at Gua Kelawar, Sungai Siput, Perak. *Jurnal Arkeologi Malaysia, 3*, 111–124.

Tasnim, A. R., Allia, S., Edinur, H. A., Panneerchelvam, S., Zafarina, Z., & Norazmi, M. N. (2016). Distribution of HLA-A, -B and -DRB1 alleles in the Kensiu and Semai Orang Asli sub-groups in Peninsular Malaysia. *Human Immunology, 77*, 618–619.

The Star. (2016). *Showdown – Orang asli vs men with guns and chainsaws*. https://www.thestar.com.my/news/nation/2016/09/30/showdown-orang-asli-vs-men-with-guns-and-chainsaws. Accessed 30 Sept 2016.

Tuck-Po, L. (2011). A history of Orang Asli studies: Landmarks and generations. *Kajian Malaysia, 29*, 23–52.

Vaughan-Stevens, H. (1892–1894). *Materialien zur kentniss der wilden stamme auf der halbinsel Malaka, parts 1 and 2*. Berlin: Königliche Museen zu Berlin.

Wilkinson, R. J. (1971). A history of Peninsula Malaysia with chapters on Perak and Selangor. In R. J. Wilkinson (Ed.), *Papers on Malay subjects* (pp. 13–151). London: Oxford University Press.

Winstedt, R. O. (1922). The aboriginal races. In J. E. Nathan (Ed.), *The census of British Malaya 1921*. London: Waterloo and Sons Ltd..

Wolters, O. W. (1982). *History, culture and region in Southeast Asian perspectives*. Singapore: Institute of Southeast Asian Studies.
Wong Tze Ken, D. (2013). The Cham arrivals in Malaysia: Distant memories and rekindled links. *Archipel, 85*, 151–165.
Wong, L. P., Ong, R. T., Poh, W. T., Liu, X., Chen, P., Li, R., et al. (2013). Deep whole-genome sequencing of 100 southeast Asian Malays. *American Journal of Human Genetics, 92*, 52–66.
Xu, S., Pugach, I., Stoneking, M., Kayser, M., Jin, L., & HUGO Pan-Asian SNP Consortium. (2012). Genetic dating indicates that the Asian-Papuan admixture through Eastern Indonesia corresponds to the Austronesian expansion. *Proceedings of the National Academy of Sciences USA, 109*, 4574–4579.

Abu Talib Ahmad was a Professor of Southeast Asian history at the School of Humanities, Universiti Sains Malaysia (USM). His current research interest is Pahang state history. Major publications include Museum, History and Culture in Malaysia (2014) and Malay Muslims, Islam and the Rising Sun, 1942-45 (2003).

Mahani Musa is a Professor of Malaysian History at the School of Humanities, Universiti Sains Malaysia, Penang. Her research interest is in the sociopolitical history of Malaysia

Nazarudin Zainun is an Associate Professor in the School of Humanities, Universiti Sains Malaysia. He received his Bachelor's Degree in history from Universitas Indonesia, Jakarta, and Master's Degree and Ph.D Degree in History from Universiti Sains Malaysia. He specializes in Socio-economic history of Southeast Asia. His field of research involves the study of early Malay Kingdoms as well as socio-economic history of Malaysia and Indonesia.

Nasha Rodziadi Khaw, PhD, is a senior lecturer in the Centre for Global Archaeological Research, Universiti Sains Malaysia. He received his Bachelors Degree in Chemistry (minor in Archaeology) and Master's Degree in Archaeology from Universiti Sains Malaysia, and Ph.D Degree in Archaeology from University of Peshawar, Pakistan. He specializes in Archaeohistory, Archaeology and Epigraphy-Palaeography. His research interests cover the topics on early history and cultures of Malay Polities as well as material culture of late-prehistoric societies of the Malay Peninsula.

Hashim Atan Edinur is a Senior Lecturer at Universiti Sains Malaysia, Malaysia. He has completed his Ph.D. in Cell and Molecular Biology from Victoria University of Wellington, New Zealand. He has supervised 1 graduate student and currently supervising 2 MSc and 2 PhD students. His research has focused on using new and existing Molecular Technologies to survey Immune Systems (HLA, KIR, cytokine and MICA), blood group, HNA and HPA genes in several populations including Polynesians, Orang Asli and Malays, the data collected have significant value in ancestry and health including tissue matching for transfusion and transplant surgery, disease resistance and the relative incidence of autoimmune disease in these populations. He has also proposed several studies to search for candidate genes associated with Systemic Lupus Erythematosus, Hypertensive Preeclampsia and Spina Bifida. He has published 28 research articles in journals contributed as author and co-author. He also completed 3 international grants.

Geoffrey Keith Chambers is a Senior Research and Teaching Fellow at the Victoria University of Wellington, New Zealand, and Visiting Professor at Universiti Sains Malaysia, Penang. His general teaching interests include evolution, genetics and molecular biology. He teaches special topics in comparative genomics, molecular biology of human disease, population genetics and molecular evolution, as graduate level subjects at USM.

Orang Asli Health and Mortality in Hulu Terengganu, Malaysia

Muhammad Fuad Abdullah, Azmah Othman, Rohana Jani, Juli Edo, and Mohd Tajuddin Abdullah

Abstract Environmental degradation and poverty are the main causes of health problems and malnutrition among the Orang Asli in Malaysia. The objective of this paper is to examine the impact of modernisation processes on the health and well-being of the Orang Asli. We also explored the level of acceptance of the Orang Asli to modern medicine. This study was conducted in Kampung Sungai Berua in Hulu Terengganu, where the Semaq Beri and Bateq sub-tribes live. A total of 93 household heads were surveyed, whereas in-depth interviews were conducted with Orang Asli Development Department officers, staff of Sungai Berua rural clinic, officials in Hulu Terengganu district health office and village authorities. It was observed that modernisation had raised the Orang Asli's health status. Their birth rates were under control although child mortality rates seemed constant. There was also a reduction in vector-borne diseases in the community. Our analysis showed that the Orang Asli were receptive to modern healthcare.

M. F. Abdullah
Institute of Advanced Studies, University of Malaya, Kuala Lumpur, Malaysia
e-mail: fuad87@um.edu.my

A. Othman (✉)
Department of Development Studies, Faculty Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia
e-mail: g3azmah@um.edu.my

R. Jani
Ungku Aziz Centre for Development Studies, Faculty Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia
e-mail: rohanaj@um.edu.my

J. Edo
Department of Anthropology, Faculty of Arts and Social Sciences, University of Malaya, Kuala Lumpur, Malaysia
e-mail: juli@um.edu.my

M. T. Abdullah
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia
e-mail: mohd.tajuddin@umt.edu.my

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_12

Keywords Health · Orang Asli · Disease · Mortality · Natality

Introduction

Health is the most crucial element of well-being for societies in this modern world. The transition from an agricultural economy to industrialised nation has transformed the culture, jobs, lifestyle and disease patterns in societies. Technological advancement, along with development growth, is occuring at different paces as some countries developed faster than others. This phenomena is ongoing and continues to manifest itself in Malaysia. Since independence in 1957, Malaysia has experienced robust socio-economic development. However, this has not brought the same overall effects on the health and lifestyle of the Orang Asli compared to mainstream society. According to the United Nations (2009), health disparities between the Orang Asli and other races are wide. In the past, the natives did not receive good healthcare and they still suffered from common diseases that are easily treatable with modern medicine. Nicholas et al. (2010), looking at Malaysia as a whole, stated that although there have been significant improvements in population health since 1957, the overall health status of the Orang Asli has been left behind to a certain degree. Nutritional deficiencies, helminthic infections, malaria and tuberculosis continue to afflict the community persistently.

Education and belief are factors that guide behaviours in maintaining good health. The Orang Asli strongly embrace their ancestral traditions, believing that all actions will affect their everyday life, marriage and economic activities. According to Chen et al. (1979), there the Orang Asli have lots of taboo that may affect their health. For example, in the Temuan sub-tribe, pregnant women are not allowed to eat red fish to avoid miscarriage. They are prohibited from going into the forest if they did not dream of their ancestors, and only certain animals can be hunted for food (Sam and Aminah 2015).

The government's approach on Orang Asli healthcare involves campaigns to prevent illnesses and encourage the sick to seek treatment and rehabilitation. It differs from modern practices that are integral and more holistic. According to the World Health Organisation (1986), traditional health concept of natives includes the entire body of ideas, beliefs, myths and rituals that connect to the maintenance of health or health restoration through the treatment of physical and mental illness, or social imbalance in a particular individual, community or people. This documents the importance of education and the availability of medical practitioners.

Compared to the other ethnic groups, the Orang Asli are socio-economically poor, hence their health and nutritional problems are always poverty-related. There is high prevalence of malnutrition due to inadequate dietary intake and diseases, besides inappropriate beliefs and practices that adversely affects health (Zalilah and Tham 2002; Khor 1988; Norhayati et al. 1995; Osman and Zaleha 1995; Osman et al. 1991). The Orang Asli diet is highly dependent on forest produce and seasonal

crops. However, deforestation has severely limited their food source and income. Their rights to live on traditional land have always courted controversy because such land is not legally recognised with permanent tenure. This makes them vulnerable to exploitation from outside entities (Phua 2015). The loss of rights to live on their own land has had a large effect on their traditional way of life.

The United Nations (2009) stated that the Orang Asli suffered from malnutrition because of environmental degradation and contamination of their food sources. Kasim et al. (1987) found that 56% of all the Orang Asli children were underweight and 65.7% had stunted growth. The findings were supported by Idrus (2013), who reported that 50–80% of the Orang Asli children in Malaysia were malnourished. According to Burgess and Musa (1950), there is a significant relationship between poverty and poor nutrition among the poor, especially those living in rural areas. Ungku Aziz (1964) and Ahmad (1964) also noted that there is strong relationship between protein diet and poverty in rural societies. All the studies observed that good nutrition seems to be related to income potential of rural residents. However, mainstream rural communities do not severely lack calories as they can still afford to consume staples (i.e. rice). But such privilege is not available to the Orang Asli, and unless they find other sources of food and income, continued deforestation will reduce their ability to eke out a living and increase their health risks. Ironically, population growth and modernisation have resulted in higher consumption of the earth's resources. Land clearing to open palm oil and rubber plantations, and construction of hydroelectric dams and airports have displaced minorities from their traditional land. Nicholas and Baer (2007) stated that land development was the reason for the loss of the Orang Asli's legacy.

According to the United Nations (2009), geographical and financial barriers prevent the Orang Asli from getting adequate healthcare. Therefore, the Orang Asli Development Department (JAKOA), under the Rural Development Ministry, has introduced resettlement schemes to improve the standard of living among the Orang Asli. This approach aimed to bring together scattered communities in remote areas to permanent settlements that can be easily accessed. This move is coincidental with Malaysia's policy to bring them into mainstream society (Gomes 2004). The resettlement villages are provided basic facilities, such as brick houses, clean water supply, proper sanitation, electricity, primary schools and clinics. The government is attempting a holistic approach to improve healthcare for the orang Asli that is in line with modernisation and development. There are many initiatives to enhance this minority group. JAKOA has carried out three initiatives in the Ninth Malaysia Plan (2006–2010), such as the Structured Settlements Development Programme, Economic Development Programme and Social Development Programme. These three initiatives have been further empowered in the 10th Malaysia Plan (2011–2015).

It is hoped that through those initiatives, the Orang Asli's quality of life will be upgraded and assimilated into surrounding economies and development. To date, the government has built 20 health treatment stations, four health transit centres, one Orang Asli specialist hospital and two rural clinics, which are located near resettlement areas. These infrastructure will benefit more than 20,000 Orang Asli families. Additionally, government agencies have established complementary health

Table 1 Common vector diseases among the Orang Asli in Kampung Sungai Berua from 2011 to 2015 (District Health Office of Hulu Terengganu 2015)

	Viral Hepatitis	Tuberculosis	Syphilis	Pertussis	Malaria	Leptospirosis	Dysentery	Dengue
2011	35	2	9	1	1	36	2	0
2012	0	1	8	1	0	0	2	0
2013	0	0	0	0	0	0	0	0
2014	0	1	1	2	0	0	1	1
2015	0	0	0	0	0	0	0	0

programmes, such as health camps, mobile clinics, dentistry services and air doctors, to ensure that the Orang Asli received healthcare services on a par with other communities (JAKOA 2011).

The government continues to respond to the needs of the Orang Asli. While progress has been slow, nevertheless, it is being realised. Cases of vector-borne diseases are declining among the Orang Asli in Hulu Terengganu. According to JAKOA (2011), the Orang Asli who live in the forest normally suffer from malaria, tuberculosis, leprosy, skin problems and worm infection. According to the district health office of Hulu Terengganu (2015) (Table 1), there was a significant improvement in the health of the Orang Asli community from 2011 to 2015. Initially, Orang Asli were resistant to seek medical treatment. The key to success in helping the Orang Asli is to have good relationship with them. Trust and understanding must be built because they are not receptive to outside influence over fears of compromising their ancestral beliefs and way of life. Health issues remain as obstacles in empowering people (WHO 1986). More effective low-cost strategies are needed to educate the community and provide them with decent healthcare. To promote health awareness among the Orang Asli, there must be effective action encompassing education, organisation and socio-economic support systems to persuade them to lead a better life. Therefore, this paper aims to examine the impact of modernisation on the health of the Orang Asli and to explore their acceptance of modern medicine.

Methodology

This study seeks to gauge the receptivity of the Orang Asli to modern medicine and evaluate their health history. This study focused on the Semaq Beri and Bateq subtribes living in Kampung Sungai Berua in Hulu Terengganu, Terengganu state, Malaysia. The resettlement area has a population of 510, with 98 heads of household (HoH). Quantitative assessment was conducted through the use of questionnaires distributed to 93 HoHs. The data were extracted and analysed using IBM SPSS version 21 (IBM Corp, Armonk, New York, USA). Every question was analysed descriptively to obtain the percentage of accumulated mean. The highest percentage represented the highest volume of Orang Asli acceptance towards modern

medical practices. The Orang Asli health data were obtained from the Sungai Berua rural clinic and Hulu Terengganu district health office.

Results and Discussion

The bar chart shows the natality and birth mortality in Kampung Sungai Berua from 2011 to 2015 (Fig. 1). Following the United Nation Convention the Rights of the Child, an infant is defined as a child age 0–1 year old while children are from above 1 year old to below 18 years old (United Nations 2010). Generally, while infant mortality seemed to be consistent, there was a higher percentage of birth in 2011, which then declined over the years. This trend might indicate acceptance of family planning among the Orang Asli, or it might be caused by a shift in population dynamics – a reduction of women in child-bearing age. The highest number of births (25 cases) were in 2011, with two deaths recorded, followed by 2012 and 2013, with 19 births and four deaths each year. The year 2014 showed the lowest record at 10 births and two deaths. In 2015, the number of births went up to 12 with four deaths.

Besides that, the bar chart also shows the mortality of Orang Asli children in Kampung Sungai Berua. It could be seen that there were fewer child deaths compared with infants. The differences annually were not many, but when combined, they could indicate quite a high rate of mortality compared with the number of births. For example, 2013 seemed to be the most fatal year, with seven deaths among youngsters compared with 19 births. The situation might become dire if youngsters kept dying at a constant rate annually and births continued to drop. The

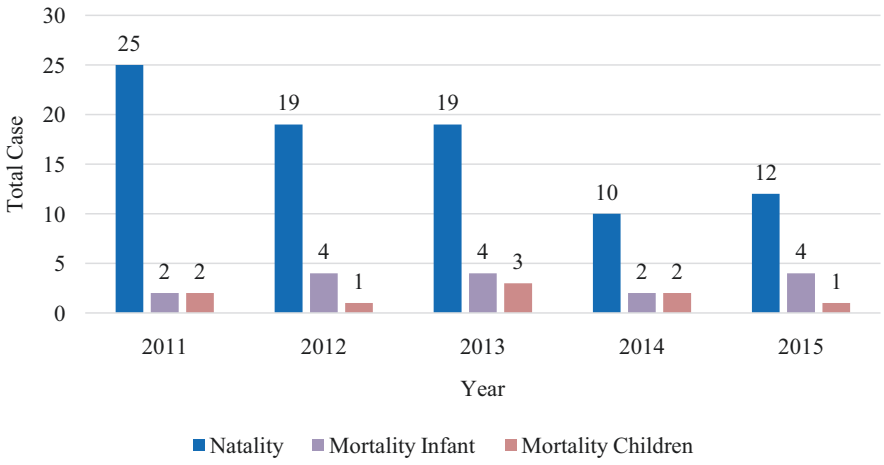

Fig. 1 Total case of natality and mortality for Orang Asli infant and children in Kampung Sungai Berua, Hulu Terengganu from 2011 to 2015

sustainability of the village population might come into question. In 2014 and 2015, there were four and five young deaths compared with only 10 and 12 births, respectively.

A good healthcare system should be able to reduce childhood deaths, but this was not reflected in the village, which only had a small population of 510. However, the data indicated a 5-year trend only, and further studies should include a longer period as population dynamics could rise and decline over decades.

In order to control sexually-transmitted diseases like HIV/AIDS and syphilis among the Orang Asli, family planning and sexual health awareness would be effective tools. Preventing unwanted pregnancies might help improve the socio-economic condition of Orang Asli families as they would not be burdened by the cost of raising many children.

Generally, the Orang Asli did not care about the size of their families. They did not consider that a huge family would cause inequality among members. Having more children than they could support would lower their standard of living and make them poorer. However, family planning had been introduced to the Orang Asli and this had decreased their poverty level (JAKOA 2011). The number of women who volunteered to participate in an annual family planning programme from 2008 to 2015 are shown in Fig. 2. Most of the women probably joined because they were ready to become mothers and wanted to learn how to raise a family according to their affordability. However, for others, the lack of awareness on the benefits might be a contributing factor to poor participation.

Malnutrition was the most common disorder among the Orang Asli. Nutritional status is a prominent indicator of health status in countries as well as their economic prosperity. According to the United Nations Children's Fund (2015), malnutrition among children was one of the key elements that determined a country's poverty condition. According to the same agency in 2013, nearly half of all child mortality

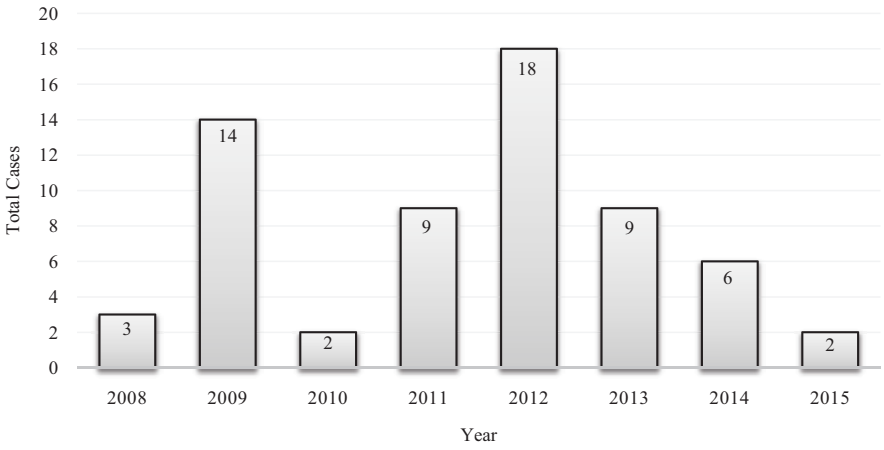

Fig. 2 Number of women who joined the annual family planning programme in Kampung Sungai Berua, Hulu Terengganu, from 2008 to 2015

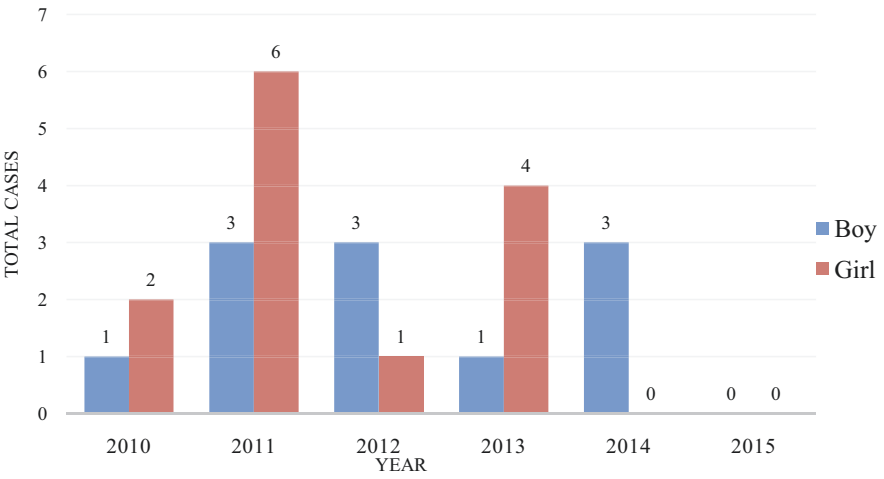

Fig. 3 Number of malnourished Orang Asli Children in Kampung Sungai Berua from 2010 to 2015

under age 5 could be attributed to under-nutrition. This was because malnourished children were at risk of dying from common infections. The condition would slow down the body's metabolism and suppress the immune system. Malnourished children were more likely to suffer infections because of this immune deficiency (Rayhan & Khan, 2006). The number of malnutrition cases among the Orang Asli children in Kampung Sungai Berua from 2010 to 2015 are shown in Fig. 3. The incidences were fluctuative during the last 5 years. However, if the data in 2015 could be maintained and were truly reflective of the village's children, then much progress had been achieved. The highest cases were usually recorded among girls.

Modern Medical Practises and Orang Asli Perception

The Orang Asli response towards modern medical treatment provided by the government to enhance their health are shown in Table 2. The chart shows that most of the Orang Asli in Kampung Sungai Berua were aware about the availability of modern medical services in their village. The data showed that the Orang Asli had a favourable response to healthcare. The highlighted figures in Table 2 shows the number and the percentage of Orang Asli who "strongly agree" with obtaining modern medical services. The results also indicated that most of the Orang Asli preferred to go for modern medical treatment than traditional healing.

Table 2 The Orang Asli perception on modern medical practices

No	Questions	SD	D	NS	A	SA
1.	I am really concerned about my family's health	1 (1.1%)	0	0	17 (18.3%)	75 (80.6%)
2.	Family planning is good for my family	19 (20.4%)	32 (34.4%)	0	39 (41.9%)	3 (3.2%)
3.	My family and I never had malnutrition	0	22 (23.7%)	0	(59 (63.4%)	12 (12.9%)
4.	My family and I always go to clinic for treatment	0	0	0	18 (19.4%)	75 (80.6%)
5.	None of my family members are starving	0	0	1 (1.1%)	35 (37.6%)	57 (61.3%)
6.	I will always ensure that my family has enough food at home	0	1 (1.1%)	5 (5.4%)	57 (61.3%)	30 (32.3%)
7.	My family and I prefer to go to clinic for medical treatment	0	0	3 (3.2%)	52 (55.9%)	38 (40.9%)
8.	I realise that, my family's health status is getting better	0	0	0	25 (26.9%)	68 (73.1%)
9.	I realise that we are not hungry anymore	0	3 (3.2%)	19 (20.4%)	57 (61.3%)	14 (15.1%)
10.	I realise that the family planning programme is good for my family	19 (20.4%)	32 (34.4%)	0	39 (41.9%)	3 (3.2%)
11.	I feel that my family's health is getting better	0	0	0	18 (19.4%)	75 (80.6%)

SD- Strongly disagree, D- disagree, NS- Not sure, A- Agree, SA- Strongly agree

Conclusion

There were still plenty of room for improvement in the health status of the Orang Asli. In order to enhance their healthcare, many efforts had been implemented by the government. It had provided modern healthcare facilities to improve the lives of the Orang Asli. Modern healthcare was making inroads in the lives of the Orang Asli and cured many of their diseases. This study provided compelling evidence that the Orang Asli of Kampung Sungai Berua had been receptive to the availability of modern medical treatment, and not just relying solely on traditional healing.

Acknowledgements This study was supported by the Higher Education Ministry through the Trans-disciplinary Research Grant Scheme (TRGS): Characterising the ethno and biodiversity of Kenyir to safeguard Terengganu's natural resources (Reference number: KPT TRGS/2015/49373). Special thanks to the Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, for permission to use all the facilities and equipment needed. The authors also thank the village authorities, Orang Asli Development Department (JAKOA), Forestry Department, KETENGAH,Terengganu State Park Management Council, Sungai Berua rural clinic and Hulu Terengganu district health office for their cooperation.

References

Ahmad, A. (1964). The twin problems of rural poverty and ill health. *The Medical Journal of Malaysia, 18*, 235.

Burgess, R. C., & Musa, L. B. A. (1950). *A report on the state of health, the diet and the economic conditions of groups of people in the lower income Levels in Malaya* (Vol. 80). Institute for Medical Research.

Chen, P. C., Noordin, R. A., & Ngor, L. Y. (1979). Food beliefs of rural Malay women of Terengganu. *Medical Journal of Malaysia, 34*, 100–107.

Department of Orang Asli Development. (2011). *Strategic development plan of indigenous people 2011–2015*. Kuala Lumpur: Department of Orang Asli Development.

District Health Office of Hulu Terengganu. (2015). *Common vector diseases infecting among Orang Asli in Sungai Berua village from 2011 to 2015*. Hulu Terengganu (Unpublished report).

Gomes, A. (2004). *Looking for money: Capitalism and modernity in an Orang Asli village*. Retrieved from http://arrow.latrobe.edu.au:8080/vital/access/manager/Repository/latrobe:4214

Idrus, R. (2013). *Left behind: Orang Asli under the new economic policy – The new economic policy in Malaysia: Affirmative action, ethnic inequality and social justice*. Singapore: NUS Press and ISEAS Publication.

Kasim, M. S., Ismail, Z., & Ibrahim, L. (1987). Nutritional status of children of aboriginal communities in Peninsular Malaysia. *Journal of the Singapore Paediatric Society, 29*, 96–100.

Khor, G. L. (1988). Mulnutrition among Semai children. *Medical Journal of Malaysia, 43*, 318–325.

Nicholas, C., & Baer, A. (2007). Health care for the Orang Asli: Consequences of paternalism and non-recognition. In *Health care in Malaysia: The dynamics of provision, financing and access* (pp. 119–136). Abingdon: Routledge.

Nicholas, C., Engi, J., & Teh, Y. P. (2010). *The Orang Asli and the UNDRIP: From rhetoric to recognition*. Subang Jaya: Center for Orang Asli Concern.

Norhayati, M., Oothuman, P., Fatmah, M. S., Muzain, M. Y., & Zainuddin, B. (1995). Hookworm infection and reinfection following treatment among Orang Asli children. *Medical Journal of Malaysia, 50*, 314–319.

Osman, A., & Zaleha, M. I. (1995). Nutritional status of women and children in Malaysian rural populations. *Asia Pacific Journal of Clinical Nutrition, 4*, 319–324.

Osman, A., Shamsuddin, Z., & Khalid, B. A. K. (1991). Socioeconomic, social behaviour and dietary patterns among Malaysian aborigines and rural native Malays. *Medical Journal of Malaysia, 46*, 221–229.

Phua, K. L. (2015). The health of Malaysia's "Orang Asli" peoples: A review of the scientific evidence on nutritional outcome, parasite infestation, and discussion on implication for clinical practice. *Malaysian Journal of Public Health Medicine, 15*, 83–90.

Rayhan, M. I., & Khan, M. S. H. (2006). Factors causing malnutrition among under five children in Bangladesh. *Pakistan Journal of Nutrition, 5*, 558–562.

Sam, M., & Aminah, S. (2015). *Kajian amalan budaya orang asli Suku Kaum Jakun di Kampung Peta*. Doctoral dissertation, Batu Pahat: Universiti Tun Hussein Onn Malaysia.

Ungku Aziz, A. (1964). Poverty, proteins and disguised starvation. *Jurnal Kajian Ekonomi Malaysia*, *2*.

United Nations. (2009). *State of the world's indigenous people*. New York: Economic and Social Affairs. Retrieved from http://www.un.org/esa/socdev/unpfii/documents/SOWIP_web.pdf

United Nations. (2010). *Convention on the Right of the Child*. New York: The Policy Press. Retrieved from http://www.hakani.org/en/convention/Convention_Rights_Child.pdf

United Nations Children's Fund. (2015). *Progress for Children beyond Averages: Learning from the MDGS*. eSocialSciences.

World Health Organisation. (1986). *Ottawa charter for health promotion.* Ottawa: World Health Organization/Health and Welfare Canada.
Zalilah, M. S., & Tham, B. L. (2002). Food security and child nutritional status among Orang Asli (Temuan) households in Hulu Langat, Selangor. *Medical Journal of Malaysia, 57*, 36–50.

Dr. Muhammad Fuad Abdullah currently is a senior lecturer in the Faculty of Business and Management, University Technology Mara (UiTM), Raub Campus, Pahang. He graduated from University of Malaya, Kuala Lumpur for his bachelor's degree in economics, Master of Development Studies (MDS) and Doctor of Philosophy (Ph.D). His master's dissertation is on the Impact studies of the Agropolitan project in Sarawak and Sabah, Malaysia and PhD thesis is on the MPI poverty measurement of Orang Asli communities in Terengganu. His research interest are Economics, Development Studies, and Community Development.

Dr. Azmah Binti Haji Othman, Ph.D (Malaya), M.Phil. (Wales), M.Sc. (Wales) and B.Ec. (Malaya) is currently a senior lecturer in the Department of Development Studies, Faculty of Economics and Administration, University of Malaya. Formerly she was Deputy Dean for Undergraduate and Postgraduate degree. She has 30 years experience in teaching, research, and supervising students in areas related to economic development, economic growth, cooperative movement, poverty alleviations, inequalities, agriculture, rural development and human traffickings. She have published papers on subjects related to Orang Asli and poverty, human trafficking, cooperative development and performance, cooperative banking, climate change and aquaculture development. She was appointed as the Consultative Council member by the Malaysia Cooperative Society Commission, Malaysia from 2005 to 2019. She have contributed and presented papers on the Malaysian cooperative at the EURISCE and ICA international cooperative research conferences and webinars sessions.

Dr. Rohana Jani is currently a Senior Research Fellow at Ungku Aziz Center for Development Studies, Faculty of Economics and Administration, University of Malaya, Kuala Lumpur. She holds a BSc (Mathematics) from Ohio University, Athens, USA; MSc in Statistics from West Virginia University, USA and a Phd in Statistics from Macquarie University, Sydney, Australia. She has more than two decades of teaching experience in mathematics, statistics and data analysis. Her areas of expertise include Statistical Data Analysis using Multivariate Techniques, Quantitative Research Methodology, Market Research, Statistical Package for the Social Sciences (SPSS) applications. Migration of Human Capital (Brain-Drain); Capacity Building Among Youths: Development of A Smoke Free Generation Towards Smoke Free Malaysia 2045, Border Security: border security along the eastern coastal areas of Kudat and Sandakan Sabah, Malaysia; the Financial Adequacy and Well-Being of University Malaya Students, Graduates Unemployment in Malaysia, the Social and Economic Impact of covid-19 on deaf community in Malaysia, are some of her current research projects.

Professor Dr. Juli Edo is currently the Director-General of the Department of Orang Asli Development (JAKOA). Prior to this post, he was an academician from 1989 – 2017. He holds Ph.D from the Australian National University, MPhil and BA from Universiti Kebangsaan Malaysia (UKM). His expertise is ethnography (Indigenous-Minority SEA), ethno-historical, and Orang Asli Studies. He was Professor and Head of Department of Anthropology and Sociology, Faculty of Arts and Social Science, University of Malaya. He has researched, written and published extensively on subjects related to the Indigenous minority population and Orang Asli in many refereed Journals, book chapters and books.

Mohd Tajuddin Abdullah, PhD is a professor and was the former Director of the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu (UMT). He has conducted his fieldworks in Malaysia, Indonesia and Thailand with a broad interest in biodiversity, biogeography, molecular ecology, mammalogy, park and wildlife conservation. Recently, he received the best zoological and ecotourism book awards in the Malaysia National Book Award 2017 and 2019 respectively. He has published about 100 indexed journal manuscripts and co-edited nine books, two of which by Springer Nature Publisher. Currently, he is an active independent researcher affiliated to the Academy of Sciences Malaysia of which he is a fellow and a new found hobby as a YouTuber (Taj Abdullah).

Socio-economic Development and Sustainable Livelihood of the Orang Asli

Muhammad Fuad Abdullah, Azmah Othman, Rohana Jani, Juli Edo, and Mohd Tajuddin Abdullah

Abstract Traditionally, the Orang Asli have exemplified the qualities of good stewardship in their interaction with the environment. They have obliged to a vital role in managing and developing the environment through their inherited knowledge and traditional tutelage practices. The assessment of Orang Asli sustainability is commonly related to low socio-economic development indicators. The purpose of this study is to investigate the extant of socio-economic development on the Orang Asli and their perception towards modern development. This research was conducted in Kampung Sungai Berua, Hulu Terengganu, Malaysia, where the Orang Asli were resettled during the construction of the Sultan Mahmud dam that gave rise to Tasik Kenyir, the largest man-made lake in Peninsular Malaysia. The result showed that

M. F. Abdullah
Institute of Advanced Studies, University of Malaya, Kuala Lumpur, Malaysia
e-mail: fuad87@um.edu.my

A. Othman
Department of Development Studies, Faculty Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia
e-mail: g3azmah@um.edu.my

R. Jani (✉)
Ungku Aziz Centre for Development Studies, Faculty Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia
e-mail: rohanaj@um.edu.my

J. Edo
Department of Anthropology, Faculty of Arts and Social Sciences, University of Malaya, Kuala Lumpur, Malaysia
e-mail: juli@um.edu.my

M. T. Abdullah
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia
e-mail: mohd.tajuddin@umt.edu.my

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_13

83.9% of the Orang Asli agreed that development growth had changed their social, economic and cultural lifestyle. However, this scenario had sparked great concern among them in continuing their traditional practices and cultures in future. It is found that the young Orang Asli were already influenced by the modern world and refused to practice their heritage cultures and traditions. This study recommended ecotourism as a means of preserving Orang Asli culture while maintaining their traditional practices.

Keywords Orang Asli · Sustainability · Socio-economic · Development · Ecotourism · Tasik Kenyir

Introduction

The Orang Asli are a minority in Peninsular Malaysia who are generally poor. They are defined as the original or "first people" who are different from the mainstream population (Md. Salleh 2004). In Malaysia, there are three main tribes of Orang Asli, namely the Senoi, Negrito and Proto-Malay. These main tribes are divided into 18 sub-tribes as in Fig. 1, which is a general classification by the Orang Asli Development Department (JAKOA) under the purview of the Rural Development Ministry. The Orang Asli sub-tribes can be distinguished by their socio-culture and cognitive psycho-socio characteristics.

The Orang Asli usually live in remote areas near brooks, far from mainstream populations, economic activities and approximate development support. The areas they live in are characterised by a lack of basic infrastructure, such as road access, electricity, sanitation, schools and clinics. They customarily live in huts with many households in a village. Their lives are characterised by poverty, far from the quality of life enjoyed even by those living in mainstream rural villages. Poverty among the Orang Asli is the main cause that greatly contributed to their under-development in

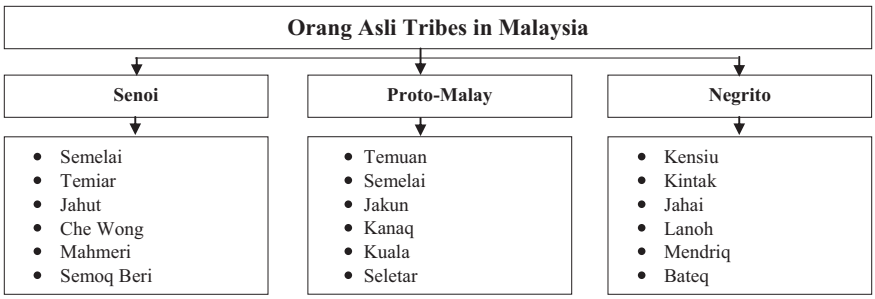

Fig. 1 Orang Asli tribes and sub-tribes in Peninsular Malaysia. (JAKOA 2011)

health, education and well-being issues. They still depend on forest products and traditional activities that bring very little income. According to Kamarudin et al. (2015), most of the Orang Asli are still living in extreme poverty because of their subsistence economic activity. They normally collect rattan and resin to sell to outsiders, besides hunting wild animals for food, such as porcupines, fowl, birds, deer and others (JAKOA 2011; Omar 2004; Ali 1999; Ishak 1998; William Hunt 1998). According to Emby et al. (1996), the Orang Asli are unable to earn a good living from traditional activities because of unstable economic situation and exploitation by middlemen.

Since independence, the government, through its various Malaysia Plans, has been implementing holistic development programmes. The programmes have created a huge impact on societies in the country, including the Orang Asli. According to the report by then Rural and Regional Development Ministry (2013), the government was aware that the Orang Asli are the poorest community in the country. As early as 1978, it has initiated comprehensive socio-economic development programmes to uplift their social well-being that included providing basic infrastructure like clean water supply, electricity, houses, primary schools, clinics and jobs, among others. Those actions eventually resulted in the transformation of the Orang Asli's lifestyle in the country (JAKOA 2011).

The Rural Development Ministry and JAKOA have worked hard to eradicate poverty among the Orang Asli. There are many socio-economic development programmes in Malaysia that specifically tried to empower the Orang Asli. In the first phase of the transformation plan (1957 to first quarter of 1994), the government had enhanced their socio-economic growth and equity through the New Economic Policy (NEP). In the early years, when the nation was facing the communist threat, the government had tried to prevent them from being influenced by the insurgents' ideology by nurturing integration, educational opportunities, in situ resettlement programmes and new agricultural activities, besides provision of basic facilities and healthcare.

In the second phase (second quarter of 1994–2020), the National Development Policy emphasised a balanced growth that covered commercial land development, smart communities, development of education and technical skills, entrepreneurship guidance and empowering the quality of services and public amenities. In addition, within that period, the government also implemented the National Vision Policy, which emphasised on sustainable developments that included human and community programmes, poverty eradication, action plans for Orang Asli education, delegation of power, access to information and communication technology, eco-tourism and land ownership. Through this framework, the government strongly believes that the socio-economic status of the Orang Asli will change for the better.

Currently, the lifestyle of the Orang Asli community has evolved because of influence from surrounding developments. The Orang Asli are no longer fully dependent on forest products and traditional subsistence economic activities (JAKOA 2011). Some of them have migrated out of their villages to look for better jobs in cities. They are involved in business, manufacturing, agricultural and

tourism industries. According to JAKOA (2011), the government had opened new land for the Orang Asli to get involved in agriculture, such as planting rubber, oil palm, bamboo and rattan, besides livestock production. On top of that, new projects like the Agropolitan Project, eco-tourism projects and herbs project were introduced in the 10th Malaysia Plan. To lift the Orang Asli out of poverty, the government has provided business courses to teach them good business skills, besides providing premises and equipment to support them. Therefore, they can earn their living without being exploited by middlemen.

Ironically, not all Orang Asli are willing to embrace development as they are used to living in their traditional ways (Jamiran and Ta Wee 2013). The main challenge towards Orang Asli development is the geographical factor and awareness of a civilised environment. Most of the Orang Asli in the east coast of Peninsular Malaysia are still living in their native environments. This factor has always been the main obstacle in providing them assistance. Furthermore, their scattered and isolated villages made it difficult to conduct outreach programmes.

Another factor that has always been a concern to the Orang Asli is the impact of transformational development on their livelihood and preservation of their ancestral beliefs. They believe that by embracing development, it will ruin their relationship with nature, which has the power to control their livelihood. Thus, the Orang Asli believe that their days may be reckoned if they do not practice what have been taught by their ancestors. They are also worried that the development will forever change their future generations' view on their ancestral beliefs which, in turn, will result in a decline of their heritage. These thoughts make them shy away and avoid any form of development to support and sustain their livelihood (Jamiran and Ta Wee 2013; Choy et al. 2010). According to Zuriatunfadzlia et al. (2009) and Choy et al. (2010), changes to the Orang Asli's socio-economic status and sustainability of livelihood are related to development programmes implemented by the government.

Sustainable development programme is crucial as the majority Orang Asli are still poor and lagging behind other ethnic groups in Malaysia. The future lives of Orang Asli are dependent on effective implementation of development programmes.

Methods

This research examined the Orang Asli resettlement process at Kampung Sungai Berua, Hulu Terengganu. The village was near Tasik Kenyir, where the new Sultan Mahmud Dam was built. The number of displaced Orang Asli who resided in that village was 510 in 95 households. The majority of them were from the Semoq Beri and Bateq sub-tribes. Quantitative and qualitative methods were used. Questionnaires were distributed to 93 household heads in the village to obtain the socio-economic background of the families and assess their perception towards development implemented by the government.

Descriptive data were analysed by calculating the accumulated mean of each likert scale question. The highest number of percentage represented the Orang Asli's

perception towards development in their community. Qualitative approach was done by interviewing and observing the activities of eight informants. They comprised JAKOA officers, government agencies, teachers at Sekolah Kebangsaan Sungai Berua and Sekolah Menengah Kebangsaan Jenagor in Hulu Terengganu, and health officers at the Sungai Berua clinic and Hulu Terengganu district health office.

Results and Discussion

Socio-economic Status

One of the survey results indicated the occupation of the Orang Asli villagers. Table 1 shows that there were three jobs only that the villagers were involved in: 97.8% were collectors of forest products, followed by clerks and officers in government sector (1.1%), and traditional shamans (1.1%).

Despite the many initiatives to enhance quality of life, no drastic changes could be observed in the village to compare with the time before the programmes were initiated. JAKOA, together with the Federal Land Consolidation and Rehabilitation Authority (FELCRA), were making efforts to provide the Orang Asli there with more job opportunities to earn a stable income by expanding and opening new areas near their village for oil palm cultivation. Apart from that, JAKOA was also working with the Fisheries Development Authority of Malaysia (LKIM) to help the Orang Asli participate in aquaculture projects in a nearby river. The objective of these projects was to ensure that the villagers could earn a fixed monthly income. However, these initiatives did not met their goals. The Orang Asli of Kampung Sungai Berua preferred to remain in their traditional livelihood as forest collectors. They collected rattan, sandalwood and herbs to sell at the local market or to middlemen. Other than that, they also hunted wild fowl, deer, porcupine and fish for food.

Interviews found the reason why the government's efforts had failed to bear fruit. It was actually more profitable for the Orang Asli villagers to work in the forest compared to oil palm plantations. They could earn about RM300 to RM500 by selling rattan in a week, whereas selling sandalwood could fetch between RM800 and RM5000 in 2 weeks. However, their pay was not fixed as it depended on the weather. Sometimes, their collection would be very little, and if they were unfortunate, they would get nothing at all, especially during the monsoon from November to February.

The monthly income earned by the Orang Asli community in Kampung Sungai Berua are shown in Table 2. The survey indicated that 46.2% of the Orang Asli there

Table 1 Job specifications of Orang Asli villagers in Kampung Sungai Berua

Job specification	Percentage (%)
Clerks or officers	1.1
Forest yield collectors	97.8
Traditional shamans	1.1

earned between RM500 and RM999, followed by 32.3% earning between RM1000

Table 2 Income of the Orang Asli in Kampung Sungai Berua

Income class (RM)	Percentage (%)
< 499	11.8
500–999	46.2
1000–1499	32.3
1500–1999	8.6
> 3000	1.1

Table 3 The education level of Orang Asli villagers in Kampung Sungai Berua

Education level	Percentage (%)
Primary school	54.8
Secondary school	17.2
No schooling at all	28.0

and RM1499. This study found that 11.8% of the Orang Asli still lived in extreme poverty, earning less than RM499 a month. However, 1.1% of the community was earning more than RM3000 a month.

Education

Research on the education level of villagers in Kampung Sungai Berua, Hulu Terengganu, found that 54.8% had attended primary school. However, not many finished their Year Six education, which was compulsory for all Malaysian pupils. Most of them had only finished Year Two or Three, and they were now in the middle-aged group. Although they were aware about the importance of education, their upbringing and environmental factors had influenced them to neglect their education – 28.0% of the respondents did not even attend school. This group of the Orang Asli villagers were the elderly who lived in remote areas of the village. They did not have any access to a better education while they were young. The geographical factor was the main obstacle that they had to overcome to attend the nearest school. They did not believe in the importance of formal education. Secondary school education had the lowest ratio among respondents, which was 17.2%. In summary, it could be concluded that only a few of the Orang Asli respondents were interested to continue their education in secondary school (Table 3). This could be seen as a failure in the part of Orang Asli education strategy.

Education was one of the main agendas in the development programmes for the Orang Asli in the country, and a key mechanism towards achieving quality of life (Tap 1990). There were holistic development programmes that had been implemented inclusively for the Orang Asli children by the government. According to JAKOA (2011), the village had been provided with a kindergarten and primary school to reduce the dropout rate and increase the enrolment of the Orang Asli children. There were other incentives by the government, such as pocket money, books,

stationery and food. With all these education enrichment programmes, there had been significant improvements in overall school attendance and enrolment of the Orang Asli children. Several Orang Asli children have furthered their studies to tertiary level. In 2008, there were only 63 Orang Asli children entering public universities. However, this number increased to 370 in 2010 and 408 in 2011 (JAKOA 2011).

The enrolment of the Orang Asli children in SMK Jenagor in Hulu Terengganu, which was the nearest secondary school to the natives' village are shown in Table 4. Generally, from 2004 to 2015, this table indicates that the number of enrolment had increased, especially for Form 1 in 2012 to Form 3 in 2015. However, none of the students had finished Form 5. They would normally stop attending school between Form 1 and Form 2. Therefore, the education level of the Orang Asli in Kampung Sungai Berua was still low and needed to improve in line with the country's development.

The children could not even acquire basic education, such as reading, writing and counting. In-depth interviews with JAKOA officers revealed that this issue would become a barrier for the Orang Asli villagers when communicating with outsiders. The lack of education made them easy targets of exploitation by the middlemen buying their forest products. A similar finding by Kamarudin and Ngah (2007) stated that it was the middlemen who dictated the price for the Orang Asli's products, which were much lower compared to the market price. The high illiteracy rate among the Orang Asli had caused them to become ignorant of the market pricing. Furthermore, without good education, the Orang Asli did not stand a chance of getting better jobs.

Health

Secondary data recorded a number of diseases afflicting the villagers in Kampung Sungai Berua, Hulu Terengganu. However, Table 5 indicates an overall improvement in healthcare among the Orang Asli villagers. The number of diseases had decreased from 2011 to 2015. There had been a drastic decrease in viral hepatitis and leptospirosis. It was also important to note that tuberculosis, syphilis, pertussis, dysentery and dengue were detected in the community in 2014. Although the data

Table 4 Number of enrolled Orang Asli children in secondary school (SMK Jenagor)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Form 1	6	3	10	8	0	0	5	0	2	15	14	19	82
Form 2	0	6	1	4	0	0	0	0	2	14	12	15	54
Form 3	0	0	4	0	0	8	0	1	2	12	11	14	52
Form 4	0	0	0	0	0	0	0	0	0	0	0	0	0
Form 5	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6	9	15	12	0	8	5	1	6	41	37	48	188

Table 5 Diseases treated among the villagers of Kampung Sungai Berua, Terengganu (district health office of Hulu Terengganu, 2015)

	Viral Hepatitis	Tuberculosis	Syphilis	Pertussis	Malaria	Leptospirosis	Dysentery	Dengue
2011	35	2	9	1	1	36	2	0
2012	0	1	8	1	0	0	2	0
2013	0	0	0	0	0	0	0	0
2014	0	1	1	2	0	0	1	1
2015	0	0	0	0	0	0	0	0

was obtained from the district health office, it could be possible that there were many more cases that had not been treated at the government clinic due to the Orang Asli's ignorance and complacency to seek medical treatment.

Acceptance of Change

The questionnaire that had been designed according to the likert scale, which was then circulated to 93 Orang Asli household heads (97.9%) in Kampung Sungai Berua, Hulu Terengganu are shown in Table 6. In general, the Orang Asli was coping well with the development implemented by the government. This was proven when 83.9% of the respondents answered "Strongly Agree" (SA) on the satisfaction with changes that occurred in their lives compared with before. This results were supported by the positive likert scale response. It showed that most of the Orang Asli villagers "Agree" and "Strongly Agree" with the initiatives implemented, except for a few indicators. They were the education indicator, which most answered "Disagree", and waste management, standard of living, and livestock to generate income for wealth indicators, to which most answered "Strongly Disagree". The percentages in grey showed indicators with highest positive and negative responses.

Formal education was one of the difficult effort to carry out in enhancing the social status of the Orang Asli. Based on the results of this study, the Orang Asli seemed to take their children's formal education for granted. Awareness about the importance of formal education was still low. The government had implemented several programmes to uplift the socio-economic lifestyle of the Orang Asli since a decade ago. Yet, the impact of formal education was still minimal. Many parents chose to live with the norms of their simple ancestral lifestyle instead of sending their children to complete secondary school. The Orang Asli in Kampung Sungai Berua were not ambitious people and they had nothing to worry about as long as their lives could go on as usual. Moreover, traditional knowledge and skills were vital for the survival of the Orang Asli in the forest, and the villagers saw these skills as the most important to teach their children first. According to Kardoomi et al. (2014), traditional knowledge included knowledge of the forest and its components, ecology and wildlife. Moreover, according to Kai et al. (2014), traditional knowledge

Table 6 The response of the Orang Asli in Kampung Sungai Berua towards socio-economics changes

No.	Question	SD	D	NS	A	SA
	Education					
1	I found that my children love to go to school lately	22.6	40.9	9.7	26.9	0
2	I realise that my children's level of education has increased	23.7	34.4	30.1	11.8	0
	Standard of Living					
3	I have 24 hours electricity supply at my house	0	0	0	10.8	89.2
4	Our village is now connected to other areas by better road access	0	0	0	11.8	88.2
5	There is clean water supplied directly to my house	0	0	0	15.1	84.9
6	I prefer to use a liquefied petroleum gas (LPG) stove to cook rather than wood and charcoal	0	1.1	0	21.5	77.4
7	I have better sanitation system in my house	0	0	0	45.2	54.8
8	I realise that my house is in good condition compared to before	0	0	3.2	46.2	50.5
9	I love to use modern appliances at my house	0	2.2	3.2	83.9	10.8
10	I realise that family planning programmes are good to control my cost of living	20.4	34.4	0	41.9	3.2
11	I realise that good waste management can help live a better life	45.2	28	25.8	0	1.1
	Wealth					
12	I realise that source of income is a crucial element to live	0	0	1.1	36.6	62.4
13	I realise that wealth accumulation is important for my family's future	0	1.1	18.3	60.2	20.4
14	I realise that owning livestock can help me raise more income	57	43	0	0	0
	Overall					
15	I am really satisfied with all changes that have occurred in my life after all	0	0	0	16.1	83.9

Indication:

*SD-Strongly Disagree*D-Disagree*N-Not Sure*A-Agree*SA-Strongly Agree

was a belief about the relationship between life and its surroundings. The Orang Asli parents depended on school teachers to provide their children with a formal education. Unfortunately, without commitment to ensure that their children completed secondary school, positive results could not be seen until they understood the importance of formal education. Thus, the children in Kampung Sungai Berua preferred to just stay at home rather than go to school.

Poor waste management was a perennial problem even though their resettlement area was equipped with good infrastructure and amenities. Based on observation, there was no proper waste management system for the Orang Asli in Kampung Sungai Berua. They normally disposed of their household waste by burning, burying or dumping them in a nearby river. These improper methods were an environmental health hazard.

Poor waste management practices often led to environmental contamination, therefore, increasing the risk of infection and diseases among the villagers. Diseases and infestations that were related to poor waste management included fly-transmitted diseases (myiasis, diarrhoea, typhoid and cholera), rodent-transmitted diseases (lassa fever leptospirosis and typhoid) and mosquito-borne diseases (malaria, yellow fever, filariasis and dengue) (Adogu et al. 2015). And some of these diseases had been detected in Kampung Sungai Berua. There were many factors that contributed to the awareness and knowledge of waste disposal. According to Banga (2011),

waste management would significantly improve with household income and educational level. That observation concurred with this study, as poor waste management practised by the Orang Asli community in the village was likely related to a lack of formal education and low-income status.

Livestock ownership had been a wealth indicator since the olden days. According to Che Mat et al. (2012), a person could be categorised as poor if he did not own any livestock, as the animals could generate side income. According to JAKOA (2011), the government had tried to introduce agricultural activities to the Orang Asli. Some examples included crop planting, livestock and poultry breeding, and aquaculture. However, the Orang Asli community in Kampung Sungai Berua were not interested in those programmes. From observation, none of the villagers reared chicken or were involved in freshwater aquaculture even though they lived near Tasik Kenyir. It was possible that they had no traditional knowledge on how to farm or manage livestock.

Sustainability of the Orang Asli Livelihood

The rapid development in a country was a positive attribute, especially for developing countries like Malaysia. However, the means should be in line with sustainable development. The Orang Asli, who were normally isolated from mainstream populations, were also affected by the development process. However, they were not ready for drastic modern changes as they preferred to live in their native environment. The Orang Asli were known to be experts in forest hunting and survival skills. For them, the forest was the basis of their survival and its resources had to be harvested in a sustainable manner. Hence, when development programmes were introduced by the government, this had led to many conflicts between many parties. Land degradation and plantation expansions had caused a huge upheaval for the Orang Asli. These development activities posed a real threat to them because they did not only deny them the use of their natural resources, but it also destroyed the natural ecosystem that sustained their lives.

This study does not deny the importance of development and the efforts to improve the lives of the Orang Asli in the country. The development efforts were planned with sustainability of the Orang Asli's lifestyle in mind. The Orang Asli's culture and heritage were national treasures that reflected the country's historical identity, besides serving as an important attraction for tourism.

Threats to Nature and Their Impact on the Orang Asli Community

For the Orang Asli, the forest could be perceived as an important "institution" like what a bank does for the urban dweller. According to Abdullah et al. (2014), the forest was an important source of food supply and income for the Orang Asli. A

recent study by Bartholomew et al. (2016) showed that there were at least 21 plants used by the Orang Asli in Kampung Sungai Berua as medicine and food. This dependence had made the Orang Asli people really concerned about forest sustainability and they would not compromise that with development growth. They would accept development only as long as they could live in and off the forest. From unstructured interviews, it was discovered that logging and dam construction were the major activities initiated by the government that affected sustainability of the Orang Asli's livelihood.

Logging was the leading cause of forest destruction around Tasik Kenyir. Malaysia is rich in biodiversity and according to the International Tropical Timber Organisation (ITTO) (2014), Malaysia is ranked 21st for biodiversity in the world. However, the country was also one of the world's biggest timber producers from 2012 to 2014. Malaysia had become well known for its *Neobalanocarpus heimi*, *Shorea acuminata* and *Aquilaria malaccensis* products. The World Bank (2015) had estimated that trees would be cut down four times the sustainable rate in Malaysia.

Logging did not have to be a destructive practice in Malaysia. In the past two decades, Malaysia had moved towards diversifying its economy although the logging industry was still in the picture. Forest destruction was partially the result of high demand in the timber industry, besides pressure from palm oil producers to open more plantations. According to Gripne (2008), Malaysia produced 85.0% of the global supply of palm oil. The expansion of oil palm plantations had caused land degradations, and indirectly affected the Orang Asli community. The destruction of their prime resources had brought adverse effects to their traditional way of life. As the forests disappear, so would their culture. The Orang Asli community in Kampung Sungai Berua seemed to be affected by land developments. Most of the forest where they used to roam had been taken over by developers. The land status had been changed from Orang Asli reserve to agriculture land. The developers hoped to get the Orang Asli to work in their plantations but these changes were not accepted. For the Orang Asli, they were more content to forage in the forest than labour in palm oil plantations.

As development projects expanded into their territory, they had to go deeper into the woods to find products, and some were even forced to cross state borders into Kelantan and Pahang. They had to spend more time in the forest and leave their families for a long time. Sometimes, they also took their children along with them, causing them to skip school or drop out entirely. The interview also found that the Kenyir dam had also made the Orang Asli's life unsustainable. According to Abdullah et al. (2016), the Sultan Mahmud dam and power station had changed the Orang Asli way of life. Decades ago, the area had been populated by the Semoq Beri and Bateq tribes. In 1978, the government identified that the river flow was suitable for generating the nation's hydroelectric power. Unfortunately, the dam's construction had put tremendous pressure on the Orang Asli by submerging large areas of their forest. With fewer resources and the pressure of limited space, the Orang Asli community were forced to move and find other places to live (Khori et al. 2016). Fortunately, the government had tried to relocate them to Kampung Sungai Berua under the Ninth Malaysian Plan (2006–2010) (9MP). The village was provided with

the basic necessities to enhance their standard of living. They were provided with modern houses that were connected with good road access, a primary school, a clinic and other practical infrastructure.

Conclusion

The close relationship between the Orang Asli and the forest made it hard for them to accept modern changes by the government. The forest was not only part of their culture and tradition inherited from their ancestors, but it was also where they got their food and income. This study revealed that the Orang Asli were vulnerable to the rapid developments in the country. The shrinking of land resources and destruction of surrounding biodiversity were main causes that made them shy away from society and fall back further from mainstream development. The limitation of hunting and collecting forest products had further aggravated the situation, particularly on their economy and culture. This scenario would cause problems to the continuity of their culture, traditions and belief in future generations. In order to merge development and sustainability for the Orang Asli, socio-economic activities should take into account the forest as a basic component of this community. Due to this, ecotourism would be recommended as the best solution to by complementing development growth and culture of the Orang Asli community, particularly in the case of Kampung Sungai Berua in Hulu Terengganu. According to the National Ecotourism Plan (NEP) (1996), eco-tourism could promote environmental conservation, had little negative impact and might benefits local communities greatly. It could bring socio-economic and environmental benefits when implemented wisely. The most beneficial economic improvements would be the employment and income for the Orang Asli community. They could become tourist guides, make handicraft from forest products and provide homestay services for those interested in exploring their culture. These economic activities were valuable and acceptable assets for the Orang Asli to showcase the uniqueness of their traditional way of life.

Acknowledgements This study was supported by the Higher Education Ministry through the Trans-disciplinary Research Grant Scheme (TRGS): Characterising the ethno and biodiversity of Kenyir to safeguard Terengganu's natural resources (Reference number: KPT TRGS/2015/49373). Special thanks to the Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu (UMT), for providing the facilities and equipment for this research. The authors also thank the local authorities, Orang Asli Affairs Department (JAKOA), Sekolah Kebangsaan Berua, Hulu Terengganu, Sekolah Menengah Kebangsaan Jenagor, Hulu Terengganu, Sungai Berua rural clinic and the Hulu Terengganu district health office for their cooperation.

References

Abdullah, R., Acciaioli, G., Ramle, N. H., & Mat Rasat, M. S. (2014). Forest significant and conservation among the Semoq Beri tribe of orang Asli in Terengganu State, Malaysia. *Australian Journal of Basic and Applied Sciences, 8*, 386–395.

Abdullah, M. F., Jani, R., & Abdullah, M. T. (2016). Orang Asli di Terengganu. In M. T. Abdullah, M. F. Abdullah, C. V. Bartholomew, & R. Jani (Eds.), *Kelestarian masyarakat Orang Asli Terengganu* (pp. 21–44). Kuala Nerus: Universiti Malaysia Terengganu.

Adogu, P. O. U., Uwakwe, K. A., Egenti, N. B., Okwuoha, A. P., & Nkwocha, I. B. (2015). Assessment of waste management practices among residents of Owerri Municipal Imo State Nigeria. *Journal of Environmental Protection, 6*, 446.

Ali, N. (1999). *Keberkesanan Program penswastaan dalam melaksanakan projek rancangan petempatan semula (RPS) masyarakat Orang Asli. Kajian kes: Rezab Orang Asli Labis, Bekok, Segamat*. Unpublished thesis, Universiti Teknologi Malaysia, Malaysia.

Banga, M. (2011). Household knowledge, attitudes and practices in solid waste segregation and recycling: The case of urban Kampala. *Zambia Social Science Journal, 2*, 4.

Bartholomew, C. V., Ariffin, M. S. A., & Abdullah, M. T. (2016). Orang Asli dan sumber alam. In M. T. Abdullah, M. F. Abdullah, C. V. Bartholomew, & R. Jani (Eds.), *Kelestarian masyarakat Orang Asli Terengganu* (pp. 45–70). Kuala Nerus: Universiti Malaysia Terengganu.

Che Mat, S. H., Hakim, R. A., & Jumali, S. N. (2012). Indeks kemiskinan pelbagai dimensi sebagai alternatif pengukuran kemiskinan: Kajian kes di daerah Baling, Kedah. *Jurnal Ekonomi Malaysia, 46*, 3–12.

Choy, E. A., Ariffin, Z. C. M., & Pereira, J. J. (2010). Sosioekonomi masyarakat Orang Asli: Kajian kes di Hutan Simpan Bukit Lagong, Selangor, Malaysia. *Jurnal Melayu, 5*, 295–314.

Emby, Z., Redzuan, M., Basri, G., & Hamid, A. H. (1996). *Rancangan pengumpulan semula: kesannya ke atas masyarakat dan budaya Orang Asli di Perak*. Serdang: Penerbit Universiti Putra Malaysia.

Gripne, S. L. (2008). *Markets for biodiversity delivering returns from emerging environmental markets*. PERC Reports, 26.

International Tropical Timber Organization (ITTO). (2014). *Biennial review and assessment of the world timber situation 2013–2014, Yokohama, Japan*. Retrieved January 6, 2017, from http://www.itto.int/

Ishak, H. (1998). Orang Asli dan cabaran pembangunan masa kini: Usaha dan tindakan yang direncanakan oleh JHEOA. *Kertas Kadangkala Bil, 8*, 2011–2015.

Jabatan Kemajuan Orang Asli (JAKOA). (2011). *Pelan strategik kemajuan Orang Asli 2011–2015*. Kuala Lumpur: Jabatan Kemajuan Orang Asli.

Jamiran, M. N. S., & Ta Wee, S. (2013). *Kelestarian transformasi pembangunan sosioekonomi Orang Asli*.

Kai, Z., Woan, T. S., Jie, L., Goodale, E., Kitajima, K., Bagchi, R., & Harrison, R. D. (2014). Shifting baselines on a tropical forest frontier: Extirpations drive declines in local ecological knowledge. *PLOS One, 9*, 1–8.

Kamarudin, K. H., & Ngah, I. (2007). *Pembangunan mapan orang asli*. Skudai: Penerbit Universiti Teknologi Malaysia.

Kamarudin, K. H., Ngah, I., Wahid, S. N. A., & Razak, K. A. (2015). Readiness of Orang Asli communities in Royal Belum-Temengor Forest Complex, Perak towards sustainable eco-culture tourism (ECT) programme. *Journal of Human Capital Development, 8*, 59–72.

Kardoomi, R., Kari, F., Yahaya, S. R., & Yusup, S. H. (2014). Traditional knowledge of Orang Asli on forests in Peninsular Malaysia. *Indian Journal of Traditional Knowledge, 13*, 283–291.

Md. Salleh, H. (2004). *Dunia peribumi dan alam sekitar: Langkah ke hadapan*. Bangi, Selangor: Penerbit Universiti Kebangsaan Malaysia.

Ministry of Rural and Regional Development. (2013). *Orang Asli development programs*. Retrieved January 4, 2017, from http://www.rurallink.gov.my/fakta-kklw

Mohd Khori, H. N., Abdullah, R., Amat Simin, M. H., & Ibrahim, A. (2016). *Kelestarian alam sekitar Taman Negara Tasik Kenyir dan impak kesejahteraan kepada masyarakat Orang Asli*. International conference on education and regional development 2016 (ICERD 2016): Cross-cultural education for sustainable regional development. Bandung, Indonesia.

Mohd Tap, S. (1990). *Planning and administration of development programmes for tribal peoples (the Malaysian setting)*. Kuala Lumpur: Department of Orang Asli Affair.

National Ecotourism Plan Malaysia (NEP). (1996). *Part 2: The Malaysia ecotourism plan*. Petaling Jaya: Ministry of Culture, Arts and Tourism.

Omar, M. (2004). *Dampak ekonomi daripada rancangan penempatan semula komuniti jakun di mukim Bekok, Segamat, Johor*. Seminar Hasil Penyelidikan Peringkat Kebangsaan. 21 Februari 2004, Unit of Research Development & Commercialization (URDC), UiTM Johor.

Pejabat Kesihatan Daerah Hulu Terengganu (PKD). (2015). *Data penyakit berjangkit bagi penduduk Orang Asli Kampung Sungai Berua, Hulu Terengganu* (Unpublished data). Hulu Terengganu.

William, H. A. (1998). *Orang Asli dan Cabaran Pembangunan* (Kertas Kadangkala, Bil.8). Bangi: Penerbit Universiti Kebangsaan Malaysia.

World Bank. (2015). *Working for a world free of poverty*. Retrieved January 5, 2017, from http://www.worldbank.org/en/country/malaysia

Zuriatun, F. S., Rosniza, A. C. R., & Habibah, A. (2009). Cultural changes of Batek people in the situation of ecotourism in national park. *Journal of Social Sciences and Humanities, 4*, 159–169.

Mohd Tajuddin Abdullah, PhD is a professor and was the former Director of the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu (UMT). He has conducted his fieldworks in Malaysia, Indonesia and Thailand with a broad interest in biodiversity, biogeography, molecular ecology, mammalogy, park and wildlife conservation. Recently, he received the best zoological and ecotourism book awards in the Malaysia National Book Award 2017 and 2019 respectively. He has published about 100 indexed journal manuscripts and co-edited nine books, two of which by Springer Nature Publisher. Currently, he is an active independent researcher affiliated to the Academy of Sciences Malaysia of which he is a fellow and a new found hobby as a YouTuber (Taj Abdullah).

Ecological Balance Towards Sustainable Index of Tasik Kenyir

Muhamad Na'eim Abdul Rahman, Muhamad Safiih Lola, Mohd Noor Afiq Ramlee, Mohd Tajuddin Abdullah, and Muhammad Syamsul Aznan Ariffin

Abstract The assessment of ecological sustainability index for Tasik Kenyir is always related to selection of indicators for sustainable development. There are few initiatives to integrate indicators from various sectors to become an ecological index for Tasik Kenyir, where issues of sustainable development are interrelated. The purpose of this study is to develop a set of criteria, indicators and indices for sustainability assessment of Tasik Kenyir. The focus is on ecological indicators and a framework that has been developed. The results determined the suitable indicators to monitor the ecological balance in the largest man-made lake in Peninsular Malaysia.

Keywords Urban sustainable development · framework · indicators index · Tasik Kenyir

M. N. A. Rahman (✉) · M. S. Lola
Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu Malaysia, Kuala Nerus, Terengganu, Malaysia
e-mail: safiihmd@umt.edu.my

M. N. A. Ramlee · M. T. Abdullah · M. S. A. Ariffin
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia
e-mail: mohd.tajuddin@umt.edu.my

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_14

Introduction

Tasik Kenyir is the biggest man-made lake in Southeast Asia that was inundatedin 1986 as a result of the construction of the Sultan Mahmud hydroelectric dam. It contains more than 340 islands in a flooded area of 38,000 hectares (Lola et al. 2019; Yusof et al. 2011), which is almost as big as Singapore. Tasik Kenyir derives its name from Sungai Kenyir, where the dam was built. The islands in Tasik Kenyir host diverse forms of flora and fauna which may be unique. Sustainability involves taking different factors like economic, social, environmental, political and financial aspects into consideration to ensure continuity of resources and survival of an environment for the long term (Siche et al. 2008). The term "sustainability" was introduced as an international issue in the World Conservation Strategy summit in 1980. Since then, the term has been used with increased frequency to debate decisions on economic, social and environmental dimensions, besides searching for alternative forms of development that are environment-friendly (Siche et al. 2008). Many experts agreed that the sustainable urban concept must retain economic development, social development and environmental development success where the concept of sustainable exists as a complete entity and can also be independent (Drakakis-Smith 1997).

Ecology is an inherent interdisciplinary science with physical and biological components. However, ecologists do engage social scientists, economists, planners and policy-makers in working together to develop the country. Ecological knowledge has greatly contributed to our understanding of the natural world and impact of humans on the ecosystem. Ecological sustainability refers to the capacity of the biosphere to meet the needs of the present generation, without hindering future generations from being able to meet their needs (Houda and Lamia 2016).

Chapter 40 of the United Nations' Agenda 21 (United Nations Commission on Sustainable Development 1996) emphasises the development of indicators for Sustainable Development (SD).It is a non-binding action plan for countries to achieve sustainable development, and government and non-governmental organisations are encouraged to formulate indicators to monitor such development (United Nations 1993). That agenda has since evolved into the newer Agenda 2030, which contains 17 Sustainable Development Goals.

Indicators have long been used to obtain information on human health, weather and economic welfare. Compared to economic and social aspects, environmental and sustainable development indicators are a fairly new phenomenon. Indicators are useful tools for decision-makers and provide information on major issues of development as well as the distinct image on progress towards sustainable development. Moreover, sustainable decision-making involves political will at local, national and regional levels to create and promote a balanced environment (Huang et al. 2008). The measurement of urban sustainability becomes crucial and its indicators, through results input, must be integrated as an index. The index is an aggregation of indicators that is readily understandable in the context of sustainability, and it plays a distinctive role. A composite index can be obtained from all dimensions, objectives,

indicators and variables used (Munda 2005). Indicators and indices provide communication tools that provide a common framework for scientists and the authorities to work together (Malkina-Pykh 2002).

This study aims to define the ecological sustainability indicators for Tasik Kenyir to develop an index. Ecological sustainability index (ESI) is an effective tool to determine whether the developments in the lake area are being carried out in a sustainable manner. It monitors the ecological achievements in Tasik Kenyir and provides guidance for decision-makers to develop the lake in a right manner.

Methods

Study Area

The study was conducted in Tasik Kenyir in the state of Terengganu in Peninsular Malaysia (Fig. 1). The islands in Tasik Kenyir were actually high grounds and hilltops that were not submerged by the construction of the Sltan Mahmud hydroelectric dam. There were now 30 rivers flowing into the lake, with 25 waterfalls at

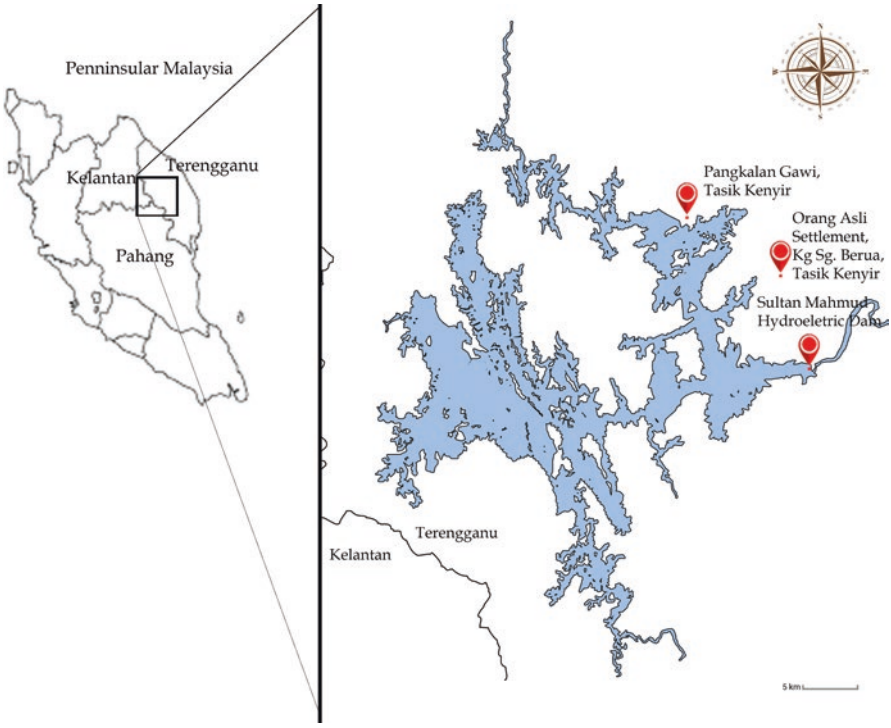

Fig. 1 Map of Tasik Kenyir (Google Map)

various points. It had been identified as a habitat for 25 species of fish (Kenyir Lake 2009), which made it a popular angling destination. The lake also offered fascinating views of surrounding waterfalls, limestone caves and lush tropical forests that host more than 8000 species of flowers, 2500 species of plants and trees, and 300 species of fungi. Furthermore, 800 species of butterflies, 370 species of orchids, 1000 species of birds and 200 species of animals had been observed in the area (Yusof et al. 2011).

Data Collection

The potential indicators were based on data obtained from questionnaires, interviews and surveys at Tasik Kenyir. The questionnaires were distributed among the local residents of Tasik Kenyir. They comprise questions on demographic characteristics (composition, age, education and migration). Respondents were also asked about their livelihood status and subjective evaluation towards environmental aspects in Tasik Kenyir according to the sustainable livelihood framework by the International Development Department (1999). Data on the water quality and air pollution in the lake were gathered from federal agencies like the Environment Department, Orang Asli Development Department (JAKOA) and Wildlife and National Parks Department (DNWP), besides state agencies like the Terengganu Economic Planning Unit (UPEN) and Terengganu Tengah Development Board (KETENGAH).

Index Calculation

In this study, the index calculation involved some choices during data processing. This study chose the standard method [0, 1] using the minimum and maximum values for each objective indicator. Using the values from 0 to 1 was simple and more understandable. All indicators chosen were given a positive or negative sign to show the impact they had on achieving a sustainable ecological outcome. A higher positive indicator refers to better sustainability. The standard formula is stated in Eq. 1:

$$\text{Index} = \frac{X - \min_{i=1} X}{\max_{i=1} X - \min_{i=1} X} \qquad (1)$$

The X indicate the relative value of indicator where min of X is the lowest value of indicator X at i time and max X are the highest value of X indicator of i time. The highest value and lowest value of each indicator achieved in the study areas were chosen as the maximum and minimum value in the standardisation process. The value of indices fell within 0 to 1, where a value closer to 1 denoted better sustainable development and closer to 0 denoted the opposite.

According to several studies, different indicators should have equal weight (Esty et al. 2005, 2006; Barrera-Roldán and Saldıvar-Valdés 2002). Differently-weighted determination would introduce a subjective component to indice development. For indicator aggregation, the averaging method was used. Sensitivity analysis was a measure of how far the composite index had developed that depended on information and assumptions. It was necessary to conduct this analysis due to a lack of theory in allowing the aggregation of different categories into an index. A change in weightage was used to observe changes in the composite index. Sensitivity analysis for uncertainty in weighted selection was used to prevent conflicts in policies. According to previous research, this study assumed an equal weightage system, which meant every criterion and sub-criterion was considered equally important. Then, the indicators were tested in the sensitivity level sustainable index.

Criteria Selection

The framework of ecological sustainability for Tasik Kenyir was a combination and modification based on the theme indicators of a framework by the United Nations Commission on Sustainable Development (1996) and the Barometer of Sustainability (Kunasekaran et al. 2017; IUCN 1996). The "barometer" was divided into four aspects, namely the environment, management, natural resources and politics.

Reflective

Based on Goldberg (2002), indicators did not cater to scientific demands only, but must also be seen as a symbol of achievement of the best knowledge or idea. Therefore, only indicators that described sustainable development were selected.

Availability, Continuity and Trustworthiness

Good development index and application played important roles to ensure that the data was available. According to Barrera-Roldán and Saldıvar-Valdés (2002), the availability and trustworthiness of data were very important factors in the methodology stated by Agenda 21 and the Organisation for Economic Cooperation and Development (OECD). Empirical success depended on the availability of a series of continuous and significant data. For this study, chosen indicators were depended on what was available in Tasik Kenyir.

Affordability and Simplification

Data on affordability was important to develop an index and its application. All sustainability index formation must be in cost-effective. Referring to Atkinson et al. (1997), no matter how good the theoretical construction of an index, it would only be useful if the key indicator development was at reasonable cost. According to Lee and Huang (2007), indicators should be easily understood by respondents without professional knowledge, and also precise and easy to apply.

Quantifiable and the Framework Ecological Sustainable Index (ESI)

According to Roldan and Valdes (2002), indicators should be based on data that has sufficient and high-quality information. The framework is stated in Fig. 2.

Results and Discussion

The urban methodology was used to analyse the ecological sustainability index in Tasik Kenyir. The method by Pearce and Giles (1995), through classification of the sustainability index, were used as shown in Table 1. This classification was also adopted from a study in China study by van Dijk and Mingshun (2005).

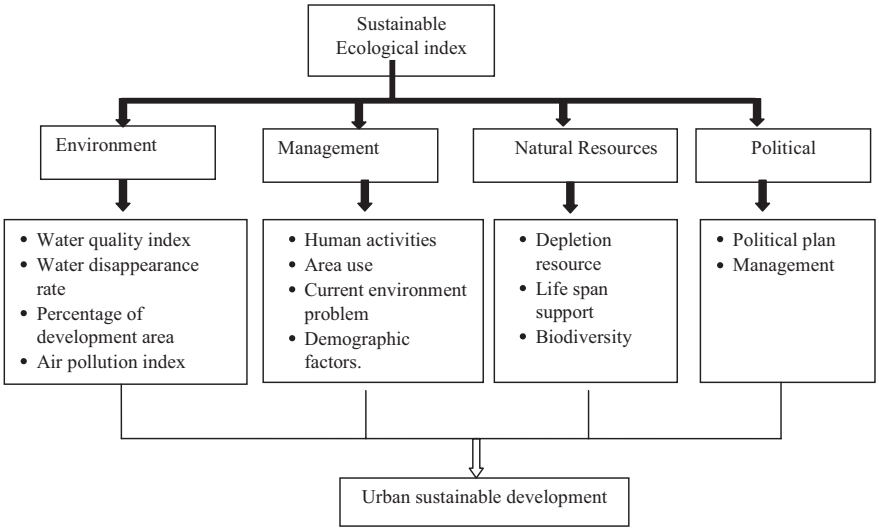

Fig. 2 The framework of an ecological sustainable index (ESI)

Table 1 The classification of an ecological sustainability index (Pearce and Giles 1995)

Score	Definition
≥ 0.75	Sustainable
≥ 0.5, < 0.75	Moderate
≥ 0.25,<0.5	Weak
< 0.25	Unsustainable

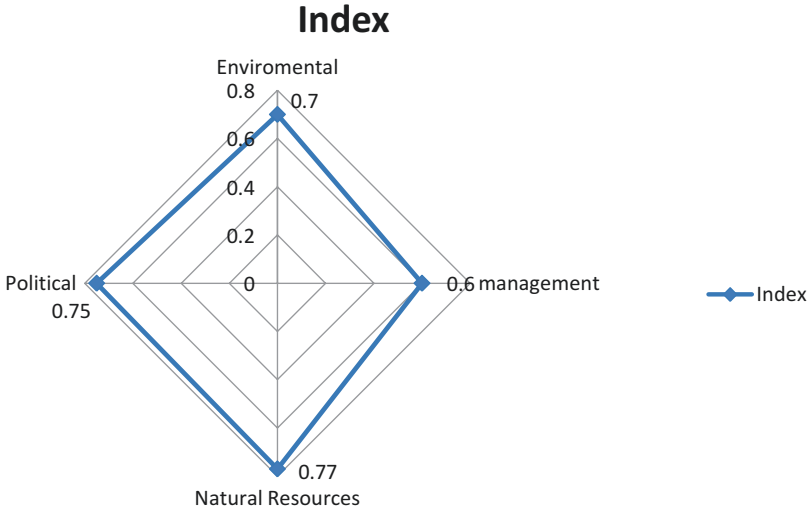

Fig. 3 Average performance of sub-criteria for ecological sustainability index

Figure 3 shows the average of sustainability index on sub-criteria for management with average value of about 0.6, followed by an environmental index of 0.7. The political average was 0.75 and natural resources was 0.77. The average of all sub-criteria was moderate according to the classification of the ecological index by van Dijk and Mingshun (2005). Sustainability index indicated a moderate level of performance, and the sustainability criteria were not within reach, hence indicating the need for more action. Therefore, from the measurement of ESI, we propose that the local authorities in Tasik Kenyir should strengthen their action plan to empower management, while conserving natural resources and the environment. However, the political will for sustainability should be imposed rather than letting it remain idle towards nature to meet both ends in sustainability development.

Conclusion

Sustainability measurements indicated that Tasik Kenyir was moderate in all four aspects of sustainability – political will, environment, natural resources and management aspect as a whole. There were some actions that could be taken to promote

the ESI of Tasik Kenyir, such as; (1) promoting a balanced usage of natural resources from surrounding water catchment areas e.g.catch-and-release fishing, limiting catchment by introducing the Tagal system and reduce hunting of animals; (2) implementing sustainable visits for tourists e.g. counting their litter when exiting Tasik Kenyir and penalising them for throwing too much rubbish; (3) empowering the management by regular surveillance and maintenance to promote a vibrant surrounding and provide comfortable amenities; and, (4) local politicians pledging to promote sustainable developments in the lake. Hence, by residing to this alternative, we hypothesise that Tasik Kenyir could achieve a high index rating in 5–10 years' time, and boosts its economy with better development and tourist experience.

Acknowledgements This study was supported by the Tran-disciplinary Research Grant Scheme (TRGS/UMT/2015/59373). Special thanks to all participants from KETENGAH, UPEN, DWNP and Universiti Malaysia Terengganu.

References

Atkinson, G., Dubourg, R., Hamilton, K., Munasinghe, M., Pearce, D., & Young, C. (1997). *Measuring sustainable development: Macroeconomics and the environment*. London: Edward Elgar Publishing.

Barrera-Roldán, A., & Saldıvar-Valdés, A. (2002). Proposal and application of a Sustainable Development Index. *Ecological Indicators, 2*, 251–256.

David, P., Giles, A., & Kirk, H. (1995). *Theory and implementation of economic models for sustainable development* (Economy and Environment) (Vol. 15). Dordrecht: Kluwer Academic Publishers.

Department for International Development. (1999). *Sustainable livelihoods guidance sheets*. London: Department for International Development.

Dijk, M. P., & Zhang, M. S. (2005). Sustainability indices as a tool for urban managers, evidence from four medium-sized Chinese cities. *Environment Impact Assessment Review, 25*, 667–688.

Drakakis-Smith, D. (1997). Third world cities: Sustainable urban development III-basic needs and human rights. *Urban Studies, 34*, 797–823.

Esty, D. C., Levy, M. A., Srebotnjak, T., & de Sherbinin, A. (2005). *Environmental sustainability index: Benchmarking national environmental stewardship*. New Haven: Yale Center for Environmental Law and Policy.

Esty, D. C., Levy, M. A., Srebotnjak, T., de Sherbinin, A., Kim, C. H., & Anderson, B. (2006). *Pilot 2006 environmental performance index*. New Haven: Yale Center for Environmental Law and Policy.

Goldberg, E. (2002). *Aggregated environmental indices: Review of aggregation methodologies in use*. Paris: Organisation for Economic Co-operation and Development.

Google Maps. (2014). Tasik Kenyir, Terengganu, Malaysia. Retrieved from https://www.google.com/maps/place/Kenyir+Lake/@4.9975358,102.5101097,11z/data=!3m1!4b1!4m5!3m4!1s0x31b62bfa9e9475cd:0x250d30b733b4ae9e!8m2!3d5.0039622!4d102.6388451

Houda, B., & Lamia, M. J. (2016). Interaction between financial development and sustainable development, evidance from developing countries: A panel data study. *International Journal of Economics and Finance, 8*, 243–255.

Huang, S. L., Chia, T. Y., Budd, W. W., & Chen, L. L. (2008). A sensitivity model (SM) approach to analyze urban development in Taiwan based on sustainability indicators. *Environment Impact Assessment Review, 29*, 116–125.

IUCN. (1996). *Barometer of sustainability: What it's for and how to use it*. Bern: World Conservation Union.

Kenyir Lake. (2009). Kenyir Lake. Retrieved from http://www.kenyirlake.com/home.htm

Kunasekaran, P., Gill, S. S., Ramachandran, S., Shuib, A., Baum, T., & Herman Mohammad Afandi, S. (2017). Measuring sustainable indigenous tourism indicators: A case of Mah Meri ethnic group in Carey Island, Malaysia. *Sustainability, 9*, 1256–1275.

Lee, Y. J., & Huang, C. M. (2007). Sustainability index for Taipei. *Environmental Impact Assessment Review, 27*, 505–521.

Lola, M. S., Ramlee, M. N. A., Hussin, M. F., Abdullah, M. T., Kamil, A. A., Mohamad Yusof, I., Ibrahim, Y., & Khadar, N. Z. A. (2019). Sustainable development of Tasik Kenyir eco-tourism using system dynamis. In: M. Abdullah, A. Mohammad, M. Nor Zalipah, M. Safiih Lola (eds.), *Greater Kenyir landscapes: Social development and environmental sustainability: From ridge to reef* (pp. 257–270).

Malkina-Pykh, I. G. (2002). Integrated assessment models and response function models: Pros and cons for sustainable development indices design. *Ecological indicators, 2*, 93–108.

Munda, G. (2005). Measuring sustainability – A multi-criterion framework. *Environment, Development and Sustainability, 7*, 117–134.

Pearce, D., & Giles, A. (1995). Measuring sustainable development. In B. Daniel (Ed.), *Handbook of environmental economics*. Cambridge: Blackwell Publishers.

Peterson, P. J. (1997). *Indicators of sustainable development in industrializing countries: Management response strategies*. Bangi: National University of Malaysia.

Peterson, P. J., Sham, S., & Nordin, M. (1999). *Indicators of sustainable development in industrializing countries: Key indicators for tropical cities*. Bangi: National University of Malaysia.

Roldan, A. B., & Valdes, A. S. (2002). Proposal and application of a sustainable development index. *Ecological Indices, 2*, 251–256.

Siche, J. R., Agostinho, F., Ortega, E., & Romeiro, A. (2008). Sustainability of nations by indices: Comparative study between environmental sustainability index, ecological footprint and the energy performance indices. *Ecological Economics, 66*, 628–637.

Smith, D. (1997). Third world cities: Sustainable urban development III-basic needs and human rights. *Urban Study, 34*, 797–823.

United Nations. (1993). *Agenda 21: The United Nations programme of action from Rio*. New York: United Nations.

United Nations Commission on Sustainable Development. (1996). *Indicators of sustainable development: Framework and methodologies*. United Nations: United Nations Commission on Sustainable Development.

van Dijk, M. P., & Mingshun, Z. (2005). Sustainability indices as a tool for urban managers, evidence from four medium-sized Chinese cities. *Environmental Impact Assessment Review, 25*, 667–688.

Yusof, N. A., Said, I., & Rahman, F. A. (2011). Sustainable attributes in Lake Kenyir, Malaysia: Expectation and experience of ecotourists. *Journal of Environmental Sciences, 5*.

Muhamad Safiih Lola, currently an Associated Professor in Department of Mathematics, Faculty of Ocean Engineering Technology and Informatics (FTTKI) and a research fellow in Institute of Biodiversity and Sustainable Development (BIOD TROPIKA), Universiti Malaysia Terengganu. His research interest is Econometric, Applied Statistics, Community Development, Green Economy and Utilization and Application of Big Data. Muhamad Saffih also actively involved in several nonprofits association (NGO) as a technical advisor and actively acts as reviewers in several journals.

Mohd Noor Afiq Ramlee, is a researcher in Institute of Biodiversity and Sustainable Development (BIOD TROPIKA), Universiti Malaysia Terengganu and Head Coordinator in ESC Group Malaysia. He actively participates in several social enterprise movement and currently acting as a chairman elect of KOPERMA T BHD. His research interest is Green Economic, Applied Statistics, Business Development, Environmental Protection, Big Data and Analytical.

Mohd Tajuddin Abdullah, is a professor and was the former Director of the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu (UMT). He has conducted his fieldworks in Malaysia, Indonesia and Thailand with a broad interest in biodiversity, biogeography, molecular ecology, mammalogy, park and wildlife conservation. Recently, he received the best zoological and ecotourism book awards in the Malaysia National Book Award 2017 and 2019 respectively. He has published about 100 indexed journal manuscripts and co-edited nine books, two of which by Springer Nature Publisher. Currently, he is an active independent researcher affiliated to the Academy of Sciences Malaysia of which he is a fellow and a new found hobby as a YouTuber (Taj Abdullah).

Muhammad Syamsul Aznan Ariffin, is a researcher in Institute of Biodiversity and Sustainable Development (BIOD TROPIKA), Universiti Malaysia Terengganu. His research interest is in freshwater fish, Orang Asli anthropology and utilization of resources, sustainable development and environmental protection.

Redefine Green Economy and Sustainable Development: A Trade-Off Analysis Approach on Tasik Kenyir, Terengganu, Malaysia

Mohd Noor Afiq Ramlee, Muhamad Safiih Lola, Muhamad Na'eim Abdul Rahman, Mohd Fadli Hussin, Mohd Tajuddin Abdullah, Muhammad Syamsul Aznan Ariffin, and Candyrilla Vera Bartholomew

Abstract This paper discusses the assessment of a green economy in Tasik Kenyir using trade-off analysis to uncover its potential as an eco-tourism attraction. Trade-off analysis is a statistical method composing many tools for identifying optimal solutions to solve complex problems, and is commonly used in decision-making; utilising statistical formulas combined with soft science, policy studies and economics. Considering certain aspects and dynamics of variables in Tasik Kenyir and its development policies, trade-off analysis should play an important role in planning formulations for its "trading-path", and determine the most sustainable approach in handling its development, ecology and other resources. Hence, using

M. N. A. Ramlee (✉) · M. F. Hussin · M. S. A. Ariffin · C. V. Bartholomew
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu Malaysia, Kuala Terengganu, Terengganu, Malaysia

M. S. Lola
Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu Malaysia, Kuala Nerus, Terengganu, Malaysia
e-mail: safiihmd@umt.edu.my

M. N. A. Rahman
Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu, Kuala Terengganu, Terengganu, Malaysia

M. T. Abdullah
Institute of Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia
e-mail: mohd.tajuddin@umt.edu.my

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6_15

numerical research, this study aims to develop a number of strategies for sustainable development to meet stakeholder values, instead of presenting alternatives with inherent benefits. This will assist stakeholders in terms of promoting conservational benefits of nature-based development activities without neglecting the ecosystem's balance in Tasik Kenyir.

Keywords Green economy · Trade-off analysis · Policy · Sustainable development · Tasik Kenyir

Introduction

The green economy and sustainable development concepts have emerged in recent years to counter adverse changes in the environment (e.g. climate change and decrease in non-renewable resources). Due to this, many scholars are convinced that we cannot continue to utilise the world's resources without consequences (Lynn and Eda 2013; Ottman 1998; Wasik 1996). Lynn and Eda (2013) defined "green economy" as a method that aims to reduce the use of ecological scarcities, environmental risks and ultimately promote sustainable development without degrading the environment. The United Nations Environment Programme (UNEP) task force, environmentalists, researchers and many organisations have conducted research and talks regarding the green economy to orchestrate a better understanding. However, the discussions cover a wide range of subjects, including fiscal reforms (Markandya et al. 2013; Ekins and Speck 2000; Kosquela and Schob 1999), financing, energy transition, greening of agriculture or aquaculture (Safiih et al. 2015; Mu'tamar et al. 2013), green jobs promotion, economic modelling and green economy indicators.

According to experts, the most complements for green economy initiatives come from green tourism, also known as eco-tourism (Maharaj and Keith 2015). Terengganu has the most abundant green tourism sites in the east coast of Peninsular Malaysia. The rich biodiversity and unique natural places, such as islands (Pulau Redang, Pulau Perhentian, Pulau Bidong, Pulau Yu Kechil/Besar and Pulau Kapas), wetlands (Setiu Wetlands), cascades (Tembakah cascade, Sekayu cascade, Belatan cascade and Payung cascade) and Tasik Kenyir (the largest man-made lake in the country) may be explored to discover their full potential as green tourism sites. Tasik Kenyir still has plenty of room for future growth and development in terms of facilities and services to meet the state's vision on eco-tourism (KETENGAH 2012, 2013, 2014; Zakaria et al. 2000). However, to uncover its potential, there is a need to understand the value of Tasik Kenyir as a tourist attraction. To evaluate the values, its existence may be categorised into two as shown in Fig. 1, which are use value and non-use value (Rusli et al. 2008; Munasinghe 1993).

From Fig. 1, we may conclude that there are different types of economic valuation that describe each and everything in green economic valuation. Eugine and Miller (1974) indicated three, namely bequest value, existence value and option value, which have been amended by Munasinghe (1993) into direct and indirect

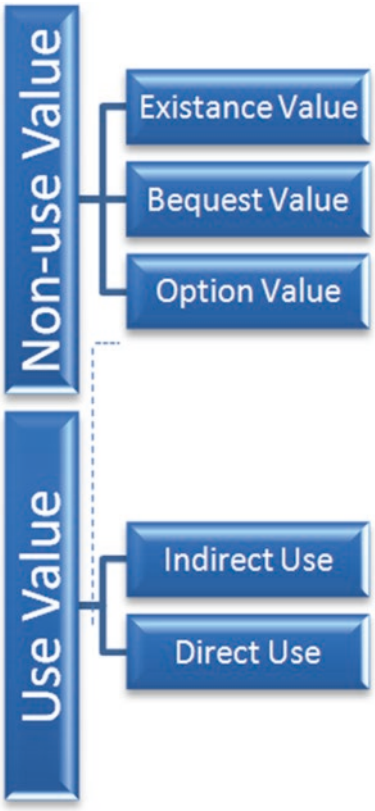

Fig. 1 Total economic value, concept and value in application of Tasik Kenyir as a tourist attraction. (Rusli et al. 2008; Munasinghe 1993)

values. The bequest value, in economics, is the value of satisfaction from preserving a natural or historic environment. In other words, the natural heritage or cultural heritage for future generations. It is often used when estimating the value of an environmental service or product. Existence values are an unusual and somewhat controversial class of economic values, reflecting the benefits people receive from knowing that a particular environmental resource, such as the Antarctica, the Grand Canyon in the United States, and even endangered species or any other new organisms that exist. The option value refers to what is placed on private willingness to pay for maintaining or preserving a public asset or service, even if there is little or no likelihood of the individual actually ever using it.

Furthermore, we need to look at other dimensions of common valuations in economics, the direct and indirect values (Rusli et al. 2008). The most common explanation of direct value is the primary spillover of a development. This amplifies the direct use or value of the first cluster of people or organisation that directly benefits from economic spillover (Fig. 2). Thus, the subsequent groups may be defined as the indirect value.

All related values are simple to be determined as it only consists of singular dimensional valuation. However, in green economy, we face difficulty in this study because some variables are hard to determine its value as the perception changes

Fig. 2 Total economic value, or general spillover for direct and indirect tourism expenditure. (WTTC 2016; Dwyer et al. 2010)

according to conditions (multi-dimensional); e.g. the value of bees is different when presumed for making honey or being used to pollinate flowers. Therefore, to fill the gap, many researchers have come up with mathematical methods to estimate the values of nature; and one of those used in this study is known as trade-off analysis (Lola et al. 2019).

Green Development

Valor (2008) believed that perceptions of green consumption practices are more time-consuming, costly and stressful. This is true in some sense as we observed that majority of the green products compared to non-green products are priced significantly higher, making them niche products targeted mainly to people with higher disposable income (Markkula and Moisander 2012). This principle also applied onto tourism development, especially in green tourism (eco-tourism) that are one of the many sub-system in the green economy. Menning (1995) indicated that tourism development is not as easy as matching product and supply with tourists, but it must also consider the locals' acceptability. Local acceptability of tourism development is the outcome of what Telfer and Sharpley (2008) called the "development dilemma," i.e., for tourism development to be successful, communities in the destination must perceive that the benefits from tourism will outweigh its costs. Since resident support for tourism development is essential, it is also important to

understand the type of tourism that is most likely to succeed in the development region (Suess and Mody 2016). Therefore, there is a need to explore the potential trade off that includes different perspectives of development to satisfy the above dilemma. Since residents, stakeholders and others are involved in the development region, Suess and Mody (2016) suggested the involvement of all participants to gather the clear view of trade off. By accessing Table 1, we can gather enough data regarding trade-off analysis that are needed in the study (Brown et al. 2001).

By relying on verbal or written descriptions of product attributes, it can be presumed that all behaviour being modelled is cognitive, because the process of understanding a verbal or written description is itself a cognitive behaviour (McCullough 1998; Francois et al. 1991; Luce 1959). Hence by understanding certain virtues of Terengganu tourism and Malaysia's policies, we concluded that the expectations of green economy application in Tasik Kenyir would give birth to those stated in Table 2.

Table 1 Suggested methods of engaging different stakeholders (Brown et al. 2001)

Type of stakeholder	Example of group	Method
Cohesive organisation with formal structure	Village council	Focus group
Cohesive organisation without formal structure	Informal trade group	Focus group
Mobile individuals, time-limited	Tourists	Questionnaire
Mobile individuals, frequent users	Informal sector worker	Individual interviews
Leaders of hierarchical organisations	Policymakers	Individual interviews
Workers within hierarchical organisations	Government departments	Structured group interviews

Table 2 Expectations in trade-off analysis for Tasik Kenyir based on preliminary analysis

Variable	Expected Sign	Explanation
Ecological management	+	Utilisation of ecological management leading to expectations of higher sustainability of environmental entities. Green visitor preferences surplus will result in higher tourism preferences.
Tourism capacity	–	Expectation of overall utilities, physical attractions and other preferences to decline with congestion. This will cause the site to experience a reduction in tourism preferences and tourism life cycle (TLC) degradation.
Economic spillover	+	The expectation of tourism bloom leading towards higher growth of tourism services, and contributing positively to local economic growth. Tourists believe that an increase in employment may support the needs of tourism and sustainable development of the local economy.
Conservation charge	–	Expectation that users are unwilling to pay more for better services. This situation explains the reduction of marginal utilities, which indicate visitors will pay if and only if the services are on a par with the price, or when the price offered is lower.
Accessibility	+	The increase in transport services to the tourist attraction will lead to better accessibility. Increase in information accessibility will also contribute to positive development.
Fiscal growth	+	Expected revenue towards government coffers via taxes as more visitors arrive.

Methods

Trade-off analysis measured the weighing of respondents' preferences for various product features (McCullough 1998; Francois et al. 1991; Luce 1959). In these cases, respondents were asked to consider alternatives and state a likelihood of purchase or preference for each alternative (Lola et al. 2019). This method was suitable only for simple decision analysis. In order to simulate multiple criteria, the corresponding situation required the involvement of several decision tools.

Conditional Logit Model

Conditional Logit is a common estimator for choice modelling (Train 2003; McFadden 1973). In trade-off, Conditional Logit was used to empirically determine the preferences of subject n, towards J alternative (consider J as an alternative set of n). Hence, the Conditional Logit vector could be written as in Eq. 1

$$P_{in} = f\left(X_{in}, X_{jn}; j \neq i, \beta\right) \tag{1}$$

where;

X_{in} = choice of alternative i over n respondents; where the alternative is mutually exclusive and finite;

P_{in} = probability of respondents n choosing the alternative i depends on the objective alternative i compared to other alteratives. (X_{in} related to all X_{jn}; $j \neq i$, β where all choice set exhaustive in all possible alternative are included); and,

β = marginal value of each green economic attribute in respondent choice set.

In this case, the functionality of observer data, f, was the function that related all observer data with choice probability. Conditional Logit specified up to some vector of test parameter, β, to be estimated.

Trade-Off Analysis

Considering the basic linear programming problem, we needed to identify all (infinite) possible combinations of values of a set of decision variables, x_j; a set which maximised a given linear objective function while also obeying a set of constraints which restricted the combinations of x_j values that were admissible (Community 2009). The constraints were also all represented by linear functions and, in addition, the decision variables were required to take only non-negative values as in Eqs. 2 and 3:

$$maximise \sum_{n}^{j=1} a_i x_j \tag{2}$$

Subjected to;

$$\begin{gathered} \sum_{n}^{j=1} a_{ij} x_j \le b_i \left(i = 1, \ldots, m\right) \\ x_j \ge 0 \left(j = 1, \ldots, n\right) \end{gathered} \tag{3}$$

where;

x_j = decision variable where the stakeholder holds control;
a_i = numerical parameter whose related and have reflect relative contribution;
$\sum_{n}^{j=1} a_i x_j$ = objective function;
$\sum_{n}^{j=1} a_{ij} x_j \le b_i$ = function constrain which expresses the value of x_j are limited towards the environment of the decision-maker; and,
$x_j \ge 0$ = non-negative constrain that requires x_j to not take a negative value.

However, assuming the corresponding analysis consists of (1) and parts of all decision variant (V_i) and a multidimensional option or scenario (S_j); i = 1, 2, …, m and j = 1, 2, …, n. Hence, a matrix consisting of $m \times n$ evaluated criteria, the evaluation of the best scenario (R_{ij}), could be determined in Eq. 4.

$$R_{ij} = \max/\min \sum_{n}^{j=1} a_i x_j = \left(V_i, S_j\right) \begin{bmatrix} C_{1,1} & \cdots & C_{1,j} \\ \vdots & \ddots & \vdots \\ C_{i,1} & \cdots & C_{i,j} \end{bmatrix} \tag{4}$$

where each criteria ($C_{i,j}$) is determined using score-based evaluation of data collected (Rotarescu 2011).

Discussion

This part of the study described an entry point into stakeholder-led negotiations on priorities for management. The set of systematically-ordered information for the trade-off analysis was used to engage all stakeholders to evaluate their priorities in terms of decision-making criteria based on development scenarios and outcomes that had been introduced. Therefore, by understanding the point of multi-evaluation

by Rotarescu (2011), we could determine that there were at least four kinds of trade-off probabilities (P_{in}) that could be considered for analysis later in the extensive study on Tasik Kenyir. The probabilities involved were:

A:	Limited tourism development without complementary environmental management;
B:	Limited tourism development with complementary environmental management;
C:	Extensive tourism development without complementary environmental management;
D:	Extensive tourism development with complementary environmental management; and,
E:	Stagnant tourism development and environmental management

It is fair to say that out of five, four probabilities represented the surface of green economy and tourism application of trade-off analysis in Tasik Kenyir. Choosing between scenario for tourists to determine the value of green economy and sustainable development was one of the ways to evaluate the core in feasibility of applying green economy in Tasik Kenyir. Hence, with further research in this direction, we could provide insight for the deification of a green economy.

However, the preliminary research was insufficient to cover the overall aspect in valuation. Hence, to amplify the needs of evaluation, new dimensions need to be covered. Marginal Values (Ecological Management, tourism capacity, tourism life-cycle evaluation, economic spillover, conservation, accessibility and fiscal growth) that emerged from eco-tourism should be further evaluated and investigated. Therefore, we suggest some model that should be used and incorporated in the trade-off analysis based on previous studies, such as the "spending per day" model (Sun and Styres 2006; Agarwal and Yochum 1999) with its "per day spending" formula, the "willingness to pay" (WTP) concept as an indicator of tourist satisfaction or visitation enjoyment (Breidert et al. 2006; Schiffner et al. 2002; Rodgers 2001), and other suitable models. This would hopefully help to cover all necessary dimensions of green economy evaluation.

Conclusion

If the Malaysia was to meet its environmental targets, it would need to apply a wider range of measures; research, policy and assorted application. Trade-off analysis was a collection of standard statistical techniques that provided objective insight into consumer preferences using a quantifiable and repeatable approach. There was a perception that trade-off research was expensive and difficult to conduct, but with the right design, it could be surprisingly efficient and flexible. Trade-off analysis extended to informed policy planning, setting of fees and charges, understanding consumer behavior, and identifying values and priorities. The trade-off approach that was used to understand the different introduced scheme that might be used to determine the direction of development in Tasik Kenyir could be enhanced with further assessment using other methods. These included the analytical Hierarchy

Process (AHP), multidimensional analysis or multi-criteria analysis, and other suitable methods that could bring the trade-off analysis onto another level.

Acknowledgements This research was financially supported by the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA) of Universiti Malaysia Terengganu (UMT) Trans-disciplinary Research Grant Scheme (TRGS/UMT/2015/59373), and Universiti Sains Malaysia (USM) research grant (RUI/2015/1001/PJJAUH1/8219). We thank and acknowledge those who participated in this study.

References

Agarwal, V. B., & Yochum, G. R. (1999). Tourist spending and race of visitors. *Journal of Travel Research, 38*, 173–176.

Breidert, C., Hahsler, M., & Reutterer, T. (2006). *A review of methods for measuring willingness-to-pay*. Innovative Marketing (Preprint version).

Brown, K., Tompkins, E., & Adger, W. N. (2001). *Trade-off analysis for participatory coastal zone decision-making*. Norwich: BD&H Printers.

Community. (2009). *Multi-criteria analysis: A manual*. London: Department for Communities and Local Government.

Dwyer, L., Forsyth, P., & Dwyer, W. (2010). *Tourism economics and policy* (Vol. 3). Bristol: Channel View Publications.

Ekins, P., & Speck, S. (2000). Proposals of environmental fiscal reforms and the obstacles to their implementation. *Journal of Environmental Policy and Planning, 2*, 93–114.

Eugene, F. F., & Miller, M. H. (1974). *The theory of finance*. New York: Holt Rinehart and Winston.

Francois, P., MacLachlan, D. L., & Jacobs, A. (1991). *Bridging designs for conjoint analysis: The issue of attribute importance*. Leuven: Katholieke Universiteit Leuven.

KETENGAH. (2012). *Laporan tahunan 2012*. Terengganu: Lembaga Kemajuan Terengganu Tengah.

KETENGAH. (2013). *Laporan tahunan 2013*. Terengganu: Lembaga Kemajuan Terengganu Tengah.

KETENGAH. (2014). *Laporan tahunan 2014*. Terengganu: Lembaga Kemajuan Terengganu Tengah.

Kosquela, E., & Schob, R. (1999). Alleviating unemployment: The case for green tax reform. *Europe Economy Review, 43*, 1723–1746.

Lola, M. S., Ramlee, M. N. A., Hussin, M. F., Ibrahim, Y., & Khadar, N. Z. A. (2019). Trade-off analysis for eco-tourism of the Tasik Kenyir protected area. In M. T. Abdullah, A. Mohammad, M. Nor Zalipah, & M. Safiih Lola (Eds.), *Greater Kenyir landscapes social development and environmental sustainability: From ridge to reef* (pp. 245–256). Springer: Cham.

Luce, D. (1959). *Individual choice behavior: A theoretical analysis*. New York: Wiley.

Lynn, K., & Eda, G. A. (2013). *Communicating sustainability for the green economy*. New York: M.E. Sharpe.

Maharaj, V. R., & Keith, W. (2015). Introduction: Tourism in the green economy; Rio to post-2015. In M. V. Reddy & W. Keith (Eds.), *Tourism in the green economy* (pp. 12–23). London: Routledge. Retrieve from https://www.tanderbooks.com/doi/view/10.43244.

Markandya, A., Gonzalez-Eguino, M., & Escapa, M. (2013). From shadow to green: Linking environmental fiscal reforms and the informal economy. *Energy Economics, 40*, 108–118.

Markkula, A., & Moisander, J. (2012). Discursive confusion over sustainable consumption: A discursive perspective on the perplexity of marketplace knowledge. *Journal of Consumer Policy, 35*, 105–125.

McCullough, R. D. (1998). Data use: Trade-off analysis: A survey of commercially available techniques. *Marketing Research Review*. Retrieved from http://www.quirks.com/articles/a1998/19980203.aspx

McFadden, D. (1973). *Conditionial logit analvsis of qualitative choice behavior*. In P. Zaremiibka (Ed.), *Frontiers in Econometrics* (pp. 105–135). New York: Wiley.

Menning, N. L. (1995). Traffic and tourism in the bitterroot: Tourism promotion, development, and management. *Montana Business Quarterly, 33*, 2–7.

Mu'tamar, F. M., Eriyatno, M., & Soewardi, K. (2013). Dynamic model analysis of raw material supply in minapolitan shrimp agroindustry. *Industrial Engineering Letters, 3*, 36–44.

Munasinghe, M. (1993). *Environmental economics and sustainable development*. Washington, DC: World Bank Environmental Paper.

Ottman, J. A. (1998). *Green marketing: Opportunity for innovation*. Lincolnwood: NTC Business Books.

Rodger, L. (2001). Willingness-to-pay: An examination of non-use value. *Economic, 2*, 1–28.

Rotarescu, E. (2011). Mathematical modeling in decision making process under conditions of uncertainty in human resources training and development. *Revista Notas de Matemática, 7*, 46–56.

Rusli, M. Y., Alias, R., & Khairil, W. A. (2008). *Economic valuation of marine park ecotourism Malaysia: The case of Redang Island Marine Park*. Serdang: Universiti Putra Malaysia Press.

Safiih, M. L., Mohd, N. A., Naeim, A. R., Ikhwanuddin, A. M., Madzli, H., Syerrina, Z., & Marzuki, I. (2015). *A system dynamics model for analyzing the eco-aquaculture system with policy recommendations: Case study on integrated aquaculture park (i-Sharp), Setiu, Terengganu, Malaysia*. AIP Conference Proceedings.

Schiffner, R., Brunnberg, S., Hohenleutner, U., Stolz, W., & Landthaler, M. (2002). Willingness to pay and time trade-off: Useful utility indicators for the assessment of quality of life and patient satisfaction in patients with port wine stains. *British Journal of Dermatology, 146*, 440–447.

Suess, C., & Mody, M. (2016). Gaming can be sustainable too! Using Social Representation Theory to examine the moderating effects of tourism diversification on residents' tax paying behavior. *Tourism Management, 56*, 20–39.

Sun, Y.-Y., & Styres, D. J. (2006). A note on estimating visitor spending on a per-day/night basis. *Tourism Management, 27*, 721–725.

Telfer, D., & Sharpley, R. (2008). *Tourism and development in the developing world*. London: Routledge.

Train, K. (2003). *Discrete choice methods with simulation*. Cambridge: England; Cambridge University Press.

Valor, C. (2008). Can consumers buy responsibly? Analysis and solutions for market failures. *Journal of Consumer Policy, 31*, 315–326.

Wasik, J. F. (1996). *Green marketing and management: A global perspective*. Cambridge: Blackwell.

World Travel & Tourism Council [WTTC]. (2016). *Travel & Tourism; Economic Impact 2016 World*. The Authority on World Travel & Tourism World Travel & Tourism Council (WTTC). Retrieved from https://dossierturismo.files.wordpress.com/2016/04/informe-wttc-turismo-2016.pdf

Zakaria, M. Z., Jalal, K. C. A., & Ambak, M. A. (2000). Length weight relationship and relative condition factor of Sebarau, Hampala macrolepidota (Van Hasselt) in Kenyir Lake, Malaysia. *Pakistan Journal of Biological Science, 3*(5), 721–724.

Mohd Tajuddin Abdullah, PhD is a professor and was the former Director of the Institute of Tropical Biodiversity and Sustainable Development (BIO-D TROPIKA), Universiti Malaysia Terengganu (UMT). He has conducted his fieldworks in Malaysia, Indonesia and Thailand with a broad interest in biodiversity, biogeography, molecular ecology, mammalogy, park and wildlife conservation. Recently, he received the best zoological and ecotourism book awards in the Malaysia National Book Award 2017 and 2019 respectively. He has published about 100 indexed journal manuscripts and co-edited nine books, two of which by Springer Nature Publisher. Currently, he is an active independent researcher affiliated to the Academy of Sciences Malaysia of which he is a fellow and a new found hobby as a YouTuber (Taj Abdullah).

Candyrilla Vera Bartholomew graduated with MSc in Zoology from the Institute of Tropical Biodiversity and Sustainable Development Universiti Malaysia Terengganu. She did her BSc in Zoology at the Universiti Malaysia Sarawak. She has been involved in scientific research and conducted social surveys of the Orang Asli to characterise their forest resource use patterns and determining factors affecting the involvement of Orang Asli to hunt and collect forest resources. She also co-authored journal and conference manuscripts and a local book and two book chapters within, which characterise resource utilisation by the Orang Asli.

Glossary

Bertam	Is a palm with spikes; the leaves are used by Orang Asli to attap roofing for their huts
Bubu	Fish trap
Buluh	Bamboo
Bunga	Flower
Chandan	Agarwood
Daun	Leaves
Gaharu	Agarwood
Geradu	Agarwood
Hulu	Headwater
Kampung	Village
Kulat	Mushroom
Lawog	Is an intermediate river where several pahong (smaller stream) merges; about 10–30 m wide and the most important water body for fishing among the Orang Asli around Kenyir
Orang Asli	Indigenous people
Pahog	Is a small stream or Pahog is a small stream or tributary of less than 10 m wide and less then 1–2 m deep
Sikat	Comb
Sungai	river
Tasik	Lake
Ubi	Tuber

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6

Index

M. T. Abdullah et al. (eds.), *Resource Use and Sustainability of Orang Asli*,
https://doi.org/10.1007/978-3-030-64961-6