RIMBA: Sustainable Forest Livelihoods in Malaysia and Australia

Editors

Gillian Ainsworth
Stephen Garnett

Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia
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# CONTENTS

<table>
<thead>
<tr>
<th>Acknowledgement</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>9</td>
</tr>
</tbody>
</table>

## BACKGROUND PAPERS PRESENTED

### Values of the Malaysian Environment

1. **Geoheritage Conservation in the Langkawi Global Geopark.**
   Prof Dato' Dr Ibrahim Komoo and Prof Dr Mohd Shafeea Leman, UKM
   
2. **Comparative phylogeography of Mountain Blackeye (Chlorocharis emiliae) populations in Malaysian Borneo.**
   Dr Mustafa Abdul Rahman and Dr Dency F Gawin, UNIMAS

3. **Review on the Molecular Phylogeny of Selected Malaysian Bats.**
   Dr Mohd Tajuddin Noor Haliza Hasan, Faisal Ali Anwarali Khan, Jeffrine Japning Rovie-Ryan, Jayaraj V Kumaran, Yuzine Esa, Imelda Vivian Paul, Siti Nurlydia Sazali & LS Hall, UNIMAS

4. **Ethnobotanical Resources in Peat Land Forests in Kabong, sub-district of Roban, Sarawak, Malaysia.**
   Dr Gabriel Tonga and Dr Peter Songan, UNIMAS

## Co-management of Protected Areas

1. **Collaborative Management of Protected Areas: Integrating Management Concepts and Approaches to Implement and Improve Co-management.**
   Dr Arturo Izurieta, CDU

2. **Impacts of Highly Disturbed Teru River Catchment on the Survival of Loagan Bunut Lake.**
   Prof Dr Lau Seng, Prof Dr Murtedza Mohamed, Assoc Prof Dr Gabriel Tonga Noweg, Dr Alexander Sayok and Dr Richard Dagang Belanda, UNIMAS
3. Co-management of Loagan Bunut National Park, Sarawak, Malaysia.
   Dr Alexander K Sayok UNIMAS, Dr Hj Sapuan Ahmad, Forest Department, and Dr Andrew A Tuen, UNIMAS

   Natasha Stacey and Arturo Izurieta, CDU

   Shaharuddin Mohamad Ismail, Ahmad Fariz Mohamed, Abdul Rahim Nik and Grippin Akeng, UKM

   Prof Dr Mazlin Mokhtar, Mohamed Abdullah Abraham Hossain, Dato' Shaharuddin Mohamad Ismail, Mr Tan Kok Weng and Emeritus Prof Dato' Dr Hood Salleh, UKM

Landscape Approaches to Natural Resource Management

1. Joint Management And Multiple Use In A Climate Change Era.
   Prof Stephen Garnett and Ms Gillian Ainsworth, CDU

   Dr Saiful Arif Abdullah, Abdul Malek Mohd Yusuf and Shukor Md Nor, UKM

   Dr Neil Collier and Prof Stephen Garnett, CDU

   Dr Andrew A Tuen and Dr William Beavitt, UNIMAS
Overview Papers

   Prof Ian Thynne, CDU

2. Integrated Public Education for Heritage Conservation: A Case for Langkawi Global Geopark
   Assoc Prof Norzaini Azman, Sharina Abd Halim & Ibrahim Komoo, UKM

Symposium Organization

1. Programme
2. Organizing Committee
3. List of Participants
ACKNOWLEDGEMENT

We would like to thank Charles Darwin University, the Universiti Kebangsaan Malaysia, Institute for Environment and Development (LESTARI) and the Universiti Malaysia Sarawak, for their interest, support and encouragement provided. We would like to thank all the presenters for their presence, valuable contributions and kind support.

We are most grateful to CDU Deputy Vice-Chancellor-Research Professor Bob Wasson for his expertise and support in ensuring the success of the Symposium and its associated partnerships and collaborations.

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Finally we would like to express our sincere thanks to the Organizing Committee Members for their time and tremendous effort in making the Regional Symposium and Workshop a success.

Stephen Garnett
Gillian Ainsworth
Charles Darwin University (CDU)

Mazlin Mokhtar
Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia (UKM)

Adrew Alex Tuen
Universiti Malaysia Sarawak (UNIMAS)

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RIMBA (Research Innovation for Malaysian Peninsula, Borneo and Australia) is an international research collaboration for the innovative management of resources for sustainable livelihoods. The collaboration is between three universities: Universiti Kebangsaan Malaysia (UKM) of Kuala Lumpur, Universiti Malaysia Sarawak (UNIMAS) of Kuching and Charles Darwin University (CDU) of Darwin in Australia. The universities are tied together by a mutual interest in forest environments (Rimba in Malay) and the many ways they contribute to the well-being of people.

For some years research leaders in all three universities have identified that their institutions share many areas of interest and have complementary skills. All three institutions are interested in:

- innovative natural resource management
- the interaction between conservation and livelihoods
- tropical landscapes – hot and humid landscapes that are often rich in natural resources but poor in human and social capital

A process by which this recognition could be translated into action was initiated in June 2008 when research leaders from the three universities assembled in Darwin to identify pathways for collaboration. Researchers at this meeting focused on the relationship between people and the environment as being the areas of greatest common interest. Against this background the universities have also negotiated Memoranda of Understanding to enable co-badging of post-graduate degrees and the sharing of responsibilities for supervision of students working on projects of mutual interest. Arrangements are thus in place for constructive engagement to the benefit of all universities and the communities they serve.

It is envisaged that, as the collaboration matures, a wide array of projects will be undertaken under its umbrella.

As a preface to the collaboration, the three universities held a symposium in April 2009 in Bali, Indonesia to synthesize research objectives and identify potential collaborative projects. The focus of the "CDU-UKM-UNIMAS Regional Symposium and Workshop" was sustainable natural resource management. A group of seventeen researchers from the School for Environmental Research (CDU), LESTARI (UKM) and the Institute of
Biodiversity and Environmental Conservation (UNIMAS) was invited to present an outline of relevant research projects which corresponded with four main themes:

Theme 1: Values of the Malaysian environment
Theme 2: Co-management of protected areas
Theme 3: Landscape approaches to natural resource management
Theme 4: Governance, education and knowledge

It is the proceedings of this workshop that are presented here. As papers they describe the skills and interests of the individual researchers. Together they represent a critical mass of research expertise spanning multiple fields but with an overall focus on the well-being of the people and the environment that supports them.
VALUES OF THE MALAYSIAN ENVIRONMENT
1. Geoheritage Conservation in the Langkawi Global Geopark

I Komoo¹ & MS Leman¹

Langkawi was endorsed as a member of the UNESCO Global Geoparks Network in 2007 primarily because it possesses the oldest rock formation and the most complete Palaeozoic sedimentary rock sequence in the Southeast Asian region. However, as a concept, the Geopark is not only about conservation of geological heritage, but the territory must also provide a balanced effort between natural and cultural conservation, promotion of knowledge-based tourism and enhancement of socio-economic activities within the local community. This paper focuses on the concept of geological heritage and briefly describes the evolution of geoheritage conservation within Langkawi Geopark. It begins with the identification and characterization of geodiversity, namely rocks, minerals, fossils, geological structures and features, and landforms. Some of these identified geodiversity sites which contain important scientific records as well as esthetic and recreational value have been proposed as geoheritage sites. Through the geopark concept, these sites have been introduced either as protected geosites, geological monuments or as landscapes of scenic beauty. Since a large number of these geoheritage sites are located within the forest reserve, an innovative approach to nature conservation known as Geoforest Park is proposed to integrate biodiversity and geodiversity conservation. Ultimately, it is hoped that the Langkawi Geopark will become a leader in promoting a holistic approach to conservation that integrates biological, geological and cultural heritage which in turn will serve as a model for sustainable heritage conservation within the geopark.

Introduction

In reality, most of our geological heritage resources are not well known as a result of being physically covered by thick soil formation and dense tropical forest, and furthermore due to limited public understanding of their existence and value. Such neglect and ignorance have led to the extensive destruction of these resources even though geodiversity is often said to be less sensitive to disturbance than biodiversity.

¹Institute for Environment and Development (LESTARI) Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor
The physical landscape and its geological foundation provide the essential foundation upon which all other conservation issues are built. It is vital in controlling critical features such as topography, micro-climate, water distribution and soil type. For this reason, nature conservation, particularly biological conservation, in many instances, is dependent upon geodiversity conservation. This paper will briefly discuss the concept of geodiversity and geoheritage conservation as it applied within the development of Langkawi Global Geopark.

**Langkawi Global Geopark**

The initial concept promoted by UNESCO stated that a geopark should be used as a tool to better understand geoheritage and the sustainable use of the Earth's resources by raising public awareness of the balance between people and the environment. The definition of geopark has evolved to include a nationally protected area containing a number of geoheritage sites of particular importance, rarity or aesthetic appeal which can be developed as part of an integrated concept of conservation, education and local socio-economic development.

Langkawi was adopted as a national geopark by the State of Kedah in 2006 prior to its endorsement as a member of the UNESCO Global Geoparks Network in 2007. Located in the State of Kedah, the Langkawi Geopark is unique in the sense that it comprises 99 beautiful islands that formed the legendary Langkawi archipelago. Langkawi is an international tourism destination, with a total land area of about 478 sq. kilometers, which has attracted more than 2 million tourists annually.

Langkawi was accepted as a member of GGN for the following criteria:

a) consists of the oldest rock formation and the most complete Palaeozoic sedimentary rock sequence in the Southeast Asian region; b) includes a comprehensive geoheritage conservation program through the establishment of the three Geoforest Parks; c) has a well developed and wide range of tourism infrastructure and activities; and d) extensive local community participation towards tourism development which has enhanced their socio-economic potential (Rahman et al. 2004; Leman et al. 2007). However, there are many other aspects of geopark components which can be further improved, particularly regarding activities for public education on geoheritage and the environment, biological and cultural heritage conservation, involvement of all stakeholders to promote geopark activities, well coordinated community participation, and global networking.
Geological Heritage

Due to its long geological history and large variety of rock formations and geological processes, Langkawi inherited a wealth of geodiversity. It covers all known types of geodiversity from minerals, rocks, fossils, primary and secondary geological structures, to erosion and deposition features as well as landform and landscape features. This diverse geodiversity together with biodiversity and cultural diversity have indeed made Langkawi a unique region for research and public education, and for tourism and recreation based on outstanding nature and scenic beauty (Komoo 2003).

Examples of Langkawi geodiversity are found at various natural and man-made exposures in different parts of the islands. Rocky coasts, steep slopes, mountain peaks, pinnacles, caves, meandering rivers, rapids and waterfalls are amongst the best and most common natural exposures found in Langkawi islands. Some important exposures which contain one or more types of high heritage value geodiversity have been studied and classified as geoheritage sites. Currently, more than 100 geoheritage sites have been identified and described in Langkawi, 10 of which have been included into the National Geoheritage List.

Geoheritage Conservation in Langkawi

To date, no legal system for conserving geoheritage resources has ever been established in Malaysia even though nature conservation activities started long before the country’s independence. Existing nature conservation systems were enacted either under the Wildlife and National Park Department Legislation – as in National Park, State Park, and Wildlife Reserve or Sanctuary; or under the Department of Forestry Act – as in Protected Forest Reserve, Amenity Forest; all of which are focusing on conservation of faunal and floral diversity.

In Langkawi, under the geopark concept, 4 types of geoheritage conservation are proposed, namely protected geosite, geological monument, landscape of scenic beauty and Geoforest Park. These proposed geoheritage conservation mechanisms have been adopted by Langkawi Global Geopark Conservation Sub-Committee, being implemented at various stages from planning to establishment and monitoring. Three Geoforest Parks have been established in 2005 under the jurisdiction of the Kedah State Forestry Department. Most of Langkawi’s proposed protected geoheritage sites are already enclosed within the boundary of
Values of the Malaysian Environment

GeoForest Parks and are currently being managed and monitored as part and parcel of forest reserve (Ismail et al. 2005).

A geological monument is an area or site which represents a single geological or landscape system of outstanding heritage value. Three geological monuments have been identified within the Langkawi Geopark, namely:

- Pulau Ular Geological Monument – a small island off the coast of Teluk Baru and Porto Malai which due to pre-historic marine erosion has been separated into several undulating hills with a unique snake-like appearance and has the best preserved raised wave-base erosion platform. The island also contains diverse significant sedimentary structures including among the best sites for Permian glacio-marine dropstones and trace fossils in the region;

- Pulau Singa Kechil Geological Monument – a small island off the northern coast of Pulau Singa Besar portraying a scenic limestone column of Chuping Formation resting on the muddy rocks of Singa Formation represents a rare site of gradual changes between two rock formations; and

- Pulau Langgun Geological Monument – located at the northeastern corner of Langkawi Archipelago, this highly fossiliferous island has many important geosites, especially the stratigraphic type-sections and fossil type-localities.

While Pulau Langgun Geological Monument is part of the Kilim Karst Geoforest Park, the Pulau Ular and Pulau Singa Kecil geological monuments are part of the Langkawi forest reserve but have no specific designation for conservation.

A Protected Geosite is a site which contains one or several geological or landscape features of outstanding heritage value. Currently, 28 geosites in Langkawi have been identified as amongst the most significant in terms of their scientific value, and therefore are proposed as protected sites. Some of these geosites fall within the geoforest parks and other forest reserves. All these geosites are thus protected under the Forestry Act By-laws. However, there are a few geosites which are located outside the forest reserve that need new mechanisms for protection.
Values of the Malaysian Environment

Landscape of Scenic Beauty is proposed to an area containing a landscape system characterized by the beauty, grandeur or attractive appearance of their landforms or geomorphological features which can be considered as of high heritage value. Currently, most of Langkawi landscapes of scenic beauty have already been incorporated within the geoforest parks. However, this approach of conservation can also be applied to an area outside geoforest parks when the need arises.

Geoforest Park

Geoforest Park is an innovative concept of nature conservation in which both biological and geological resources within the forest reserve are conserved hand in hand in order to promote integrated nature conservation and sustainable ecotourism (Ismail et al. 2004). This concept was first introduced in 2005 by the Forestry Department of Peninsular Malaysia when they declared three large areas within forest reserves in Langkawi as geoforest parks. They are the Machinchang Cambrian Geoforest Park, Kilim Karst Geoforest Park and Dayang Bunting Marble Geoforest Parks.

- Machinchang Cambrian Geoforest Park – a mountainous region in the northwestern-most part of Langkawi exhibiting uniquely crested ridges of Cambrian sandstone, famous with its climbing bamboo and medicinal plant Eurycoma or locally known as "Tongkat Ali". Along its northern coastline, an almost complete Cambrian rock sequence is exposed including the region’s oldest fossil fauna. The two tallest waterfalls of Langkawi are set within this geoforest park. This park also features 2 geopark trails; the Pasir Tengkorak – Tanjung Buta and Machinchang Peak Trail, and three Recreation/Amenity Forests; the Pasir Tengkorak, Temurun and Telaga Tujuh Recreation Forests. This geoforest park is served by excellent facilities. The Machinchang Cambrian Geoforest Park provides employment opportunities for local communities in Kuala Triang and Teluk Ewa.

- Kilim Karst Geoforest Park – a geoforest park in the northeastern corner of Langkawi, very well known for its mangroves, hanging cycads and brown eagle habitat. The limestone karst landscape is simply stunning; with razor sharp pinnacles; hills and islands with all sorts of natural sculptures; caves and tunnels with various legends, cave dwellers and cave deposits; and narrow meandering rivers in between mangrove swamp forests. At Pulau Langgun one
can walk along the Teluk Mempelam geopark trail and observe various rock types, fossils and structures along the type section of the Ordovician – Devonian Setul Formation. It is also possible to observe the fossil graveyard at Pulau Anak Tikus and the Devonian red bed and experience a journey to the Tasik Langgun at the centre of the island. The adjacent Pulau Tanjung Dendang is dated some 7000 years old and located an extra-ordinary 23 metres above sea-level. The famous Kilim Mangrove Boat Tours have provided plenty of employment opportunities for communities of Kampung Kilim and Tanjung Rhu.

• Dayang Bunting Marble Geoforest Park – located in the southeast of Langkawi islands, the Dayang Bunting Marble Geoforest Park, unlike those of Kilim, is largely covered by terrestrial plant occupying dry dolines. The pinnacles and caves are not as spectacular, but the Pasir Dagang cave does contain some incredibly beautiful cave features. Small islands off the Pulau Dayang Bunting offer breathtaking scenic views with sea-arches, land arches and sea-caves. The main attraction of this geoforest park is the large legendary Tasik Dayang Bunting or the Lake of the Pregnant Maiden, which has been made into a recreation forest. At the moment, this geoforest park has not been fully capitalized by local communities at Pulau Dayang Bunting and Pulau Tuba. Instead, most of the popular Dayang Bunting and Island Hopping Boat Tours are being operated by the peoples of Kuah Town. Research on further development of geopark and geoheritage related trails is still in its preliminary stages at the Dayang Bunting Marble Geoforest Park.

Conclusion

Today, geoheritage conservation in Langkawi Global Geopark is not under independent operation since Malaysia is still in the process of formulating appropriate legislation with regards to geological resource conservation. As such, Langkawi Global Geopark Authority seeks assistance from the Kedah State Forestry Department not just to protect their forest, but also to look after the health of their biodiversity foundation: the rocks, soils, air and water. For this purpose the Forestry Department, District Office, Geology Department, Drainage and Irrigation Department, Marine Department, Wildlife Department and Environmental Department have worked hand-in-hand to achieve holistic nature conservation. The Malaysian Geological Heritage Group chairs the Langkawi Global Geopark Technical Committee and is advising the Forestry Department, which heads the Conservation
Committee, on suitable sites for conservation. Public lectures, tour guides and nature programs for school children have been conducted continuously in order to build capacity among stakeholders and to help them understand, care for and protect the geoheritage resources of Langkawi Global Geopark.

References


2. Comparative phylogeography of Mountain Blackeye (*Chlorocharis emiliae*) populations in Malaysian Borneo

MA Rahman & DFA Gawin

Historical events, for instance refugia isolation, contraction and expansion of habitats as well as movement of species from their original areas may contribute to a genetic variation within species (Slatkins 1987). Physical barriers (for example mountain range, river, and sea) may also lead to the evolutionary processes of species (Rice & Hostert 1993). It is believed that physical barriers will stop gene flow between populations of a species and, in the end the evolutionary process ultimately leads to reproductive isolation and consequently, speciation. According to Mayr (1964), geographical variation is the first sign of the speciation process. The topography of Borneo, which is dominated by highland areas, may have an effect on the variability of bird fauna within this island (Smythies 1999). Due to prolonged confinement in isolated mountain areas, some species may have experienced evolutionary processes and may have been subject to morphological and genetic changes. In this study, Mountain Blackeye (*Chlorocharis emiliae*) (Sharpe 1888), a bird species endemic to Borneo (Smythies 1999), was chosen to investigate the genetic variation among selected populations. The black ring around its eye makes it easily identifiable. It is commonly found in montane forests 1,600 m above sea level or higher (Smythies 1999). This species likes to rove from the tops of the trees to the ground and among stunted bushes in search of food, which include insects, nectar and fruits (Smythies 1999).

The bird is dispersed along the central mountainous region of Borneo, starting from the northern part going downward along the Sarawak and Kalimantan border before culminating on a few peaks in the southwest (Smythies 1999). It is the commonest bird at the higher elevations, ranging from 1,650 to 3,100 m on Mount Kinabalu, Sabah (Biun 1999). Besides Mount Kinabalu, the Mountain Blackeye can be found on Mount Trus Madi, the second highest summit in Sabah (Smythies 1999) and also on Mount Tombuyokun. In Sarawak, populations of Mountain Blackeye extend beyond the Padas Gorge in Sabah and stretch to southwestern Borneo. To the northeast of Sarawak, Mountain Blackeye populations can be found in Maga mountains (Harrison 1955), Mount Mulu, Mount

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1 Department of Zoology, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
Murud (Rahman et al. 2005) and continue down to the Tama Abo Range. The populations discontinue after Tama Abo Range due to extensive lowlands before continuing at Pueh Range in the southwest of Sarawak and Mount Niut in northwest West Kalimantan region (Harrison 1955; Smythies 1999). Classical taxonomists divided this species into four subspecies, namely Chlorocharis emiliae, C. e. trinitiae, C. e. fuscicpes and C. e. moultoni (Monroe & Sibley, 1993; Smythies 1999). C. e. emiliae can only be found on Mount Kinabalu, while C. e. trinitiae is found on Mount Trus Madi, C. e. fuscicpes on Maga mountains and C. e. moultoni in Tama Abo Range and on Mount Murud, Mount Mulu and Mount Pueh (Harrison 1955; Smythies 1999).

The findings from this study will answer whether there is genetic variation among Mountain Blackeye populations in Borneo as well as try to connect with a series of historical events responsible for a geographically distributed species such as this. This species never moves below the upper montane forests, and therefore there is no amalgamation between all Mountain Blackeye populations in Borneo (Harrison 1955). The isolation process for all those populations encourages the formation of new sub-species. Based on that account, the phylogenetic data from this study will answer specific questions about whether or not there is gene flow among the selected populations of Mountain Blackeye due to geographical isolation.

Materials and Methods

Sample collection

In Sabah, samples were collected from two populations; Layang-layang on Mount Kinabalu (N 06° 03.509; E 116° 33.960) (2,600 m asl) and the ‘Taman Bunga’ on Mount Trus Madi (N 05° 33.27; E 116° 30.03) (2,350 m asl). In Sarawak samples were collected from Camp Four on Mount Mulu (N 04° 02.676; E 114° 54.844) (1,826 m asl) and Church Camp on Mount Murud (N 03° 55.36; E 115° 30.49) (2,100 m asl) (Figure 1). Blood was collected from birds by non-destructive methods (Taberlet & Luikart 1999). The blood sample was then kept in a sterile screw-cap vial containing blood lysis buffer (Seutin & Boag 1991).

Laboratory Methods

Forty blood samples were extracted from Mountain Blackeyes (10 samples from each population), using the GeniSpin™ Blood DNA kit.
polymerase chain reaction (PCR) amplifications were carried out using the Applied Biosystems Gene Amp PCR System 2400. The amplifications were done in 50 μl reaction volumes. A pair of control region primers, the forward primer L 816 (Gawin 2007) and reverse modified primer H 1251 (Sorenson 1999) was used for this study. Both primers amplify 360 bp in length of second domain in the highly variable control region of mitochondrial DNA. DNA templates were amplified with PCR parameters as follows: (1) the initial denaturing step was done at 96°C for five minutes; (2) 30 cycles of 35 seconds at 95 °C, annealing at 62 °C for 45 seconds, and a one minute extension step at 72 °C; and (3) seven minutes of final extension at 72 °C. The successful PCR products were then purified using DNA extraction kits (Fermentas). Sequencing of successful purified PCR products was performed using a Big Dye® Terminator v31 Cycle Sequencing Kit (Perkin Elmer Corporation). All PCR products were sequenced for both strands. The sequencing products were precipitated using the sodium-precipitation method and the sequences were then run on an ABI Prism® 377 DNA Sequencher.

**Phylogenetic Analysis**

Sequences were aligned and edited using the Sequencher™ version 4.1 (Gene Codes Corporation) and the Clustal-X Version 1.81 (Thompson et al. 1997). For phylogenetic analyses, maximum parsimony and maximum likelihood strict consensus trees were constructed in parallel using Phylogenetic Analysis Using Parsimony (PAUP) Version 4.0b10 (Swofford 2000). MODELTEST 3.7 (Posada & Crandall 1998) was run to decide the appropriate model of nucleotide substitution and the parameter values for maximum likelihood analysis. Bootstrap analyses (Felsenstein 1985) were performed for both maximum parsimony and maximum likelihood, using the 1000 heuristic bootstrap replicates with 1,000 random-addition-sequence replicates and specified by tree-bisection-reconnection (TBR) branch swapping with the MULTREES option on (Swofford 2000). The black-capped white-eyes (Zosterops atricapilla) of Mount Mulu was taken as the outgroup.

**Results**

After alignment and deletion of putative superfluous gaps, we only used 315 bp of the partial part of the control region in the analyses. Of 315 bp, 29 polymorphic sites (9.21%) were detected from 41 samples (40 ingroups and one outgroup). Using Collapse 1.2 (Posada 1999), 11 distinct haplotypes were collapsed from 40 ingroup sequences of Mountain Blackeye with gaps considered as fifth variants. The distribution of haplotypes is presented in Table 1.
Table 1: Distribution of haplotypes among the four populations of Mountain Blackeye in Malaysian Borneo.

<table>
<thead>
<tr>
<th>Haplotype</th>
<th>Mt Kinabalu</th>
<th>Mt Trus Madi</th>
<th>Mt Murud</th>
<th>Mt Mulu</th>
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<tr>
<td>Hap 1</td>
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<td>2</td>
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<td>Hap 10</td>
<td>8</td>
<td>3</td>
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<td>-</td>
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<tr>
<td>Hap 11</td>
<td>-</td>
<td>5</td>
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Total 10 10 10 10

MODELTEST selected HKY (Hasegawa et al. 1985) as the best fitting model, with parameters estimated as follows: base frequencies (A=0.3739; C=0.2437; G=0.0858; T=0.2966); -lnL of 575.22 and a transition/transversions ratio of 1.71. Both maximum and likelihood analyses produced similar trees (Figure 1). Two clades were recovered from the four populations, with 93%-100% bootstrap values. Six haplotypes (Haplotype 1 to Haplotype 6), were obtained in Sarawak (Mount Murud and Mount Mulu) and grouped into one clade. The other clade included six haplotypes (Haplotype 7 to Haplotype 11) from Sabah (Mount Kinabalu and Mount Trus Madi). The phylogenetic trees reveal that the Sabah populations are totally separate from the Sarawak populations (Figure 2).
Figure 1: Map of Borneo showing the selected sampling sites of Mountain Blackeye. Numbers on the map represent the sampling sites: 1- Mount Kinabalu, 2- Mount Trus Madi, 3- Mount Murud and 4- Mount Mulu.
(Source: www.wikipedia.com).

Figure 2: Parsimony and likelihood dendrogram of Mountain Blackeye populations in Sabah and Sarawak. Numbers indicate parsimony bootstrap support/likelihood bootstrap support.
Discussion and Conclusion

Based on the phylogenetic analysis results, Mount Mulu and Mount Murud populations that are geographically separated by lowlands, showed evidence of gene flow between them. The results also indicate that the two Sarawak populations were previously connected lineages. Apparently, the genetic patterns between the two populations support the previous study (Harrison 1955) that sub-species moulioni confines in both populations. The occurrence of gene flow was also detected between Mount Kinabalu and Mount Trus Madi populations. Both populations might be from the same lineages. This finding does not correspond to the previous study, that sub-species emiliae on Mount Kinabalu is distinctly separate from sub-species trinitae on Mount Trus Madi (Harrison 1955).

It is assumed that the morphological changes of both sub-species occurred faster than the genetic changes. Morphological differences between the two sub-species can be due to adaptation of the species to environment. Many workers associated morphological variation among geographically isolated populations with environmental adaptation (Gould & Johnston 1972; Williams 1992). Some workers did suggest that species adaptation is controlled by natural selection (Burrow 1968).

By looking at the four populations, Mountain Blackeye populations in Sabah are distinctly separate from the two populations in Sarawak, and it was assumed that the populations in Sabah have been isolated from the population in the northern part of Sarawak. The distinct phylogenetic patterns of the four Mountain Blackeye populations coincide with the other patterns from other bird species, such as white-fronted falconet (Microhierax latifrons), white-crowned shama (Copsychus stricklandi) and black-and-crimson pitta (Pitta ussheri) (Moyle et al. 2005). It is suggested that physical or ecological barriers (break) prevented intra-migration of Mountain Blackeye between Sabah and Sarawak populations during Pleistocene periods. This geographical “break” might have prevented gene flow between those two populations and eventually they evolved independently. Besides gene flow, other processes, such as founder effects, inbreeding and different selection forces (Smith et al. 1997) could have induced the divergence of Mountain Blackeye populations in Malaysian Borneo.

In conclusion historical events and evolutionary mechanisms have promoted variation among Mountain Blackeye sub-species. However, other analyses should be conducted in exploiting genetic information of Mountain Blackeyes. It would not be enough just to look into the
Values of the Malaysian Environment RIMBA

phylogenetic trees. Perhaps, other quantitave analysis might answer more questions regarding the divergence of this species. In addition, genetic data of the Mountain Blackeye in Borneo is vital for conservation of this endemic species. This study could be a platform for other endemic species in Borneo, in terms of identifying which populations should be conserved by applying the ‘Evolutionary Significant Unit’ (Moritz 1994). In addition the application of biogeographical and molecular data in this study can be a set point in understanding the historical evolutionary forces within this region.

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References


