ASSESSMENT OF MANAGEMENT AND COLLECTION OF ZOOLOGICAL SPECIMENS AT NATURAL HISTORY MUSEUMS IN MALAYSIA

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For my beloved families and friends who always believe in me. Your love and support are my strength to keep me going

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ABSTRACT

There are many causes contributing to biodiversity loss and lack of understanding on the importance of natural history collections is one. Ineffective dissemination of biodiversity knowledge, poor maintenance of natural history collection and lack of understanding as perceived by Malaysian why the need for a natural history museum are problems answered by this research. This study aims, firstly, rationalize natural history collections as a tool in mainstreaming biodiversity in Malaysia, and secondly, to provide a guideline on maintaining biological specimens critical to their management. Data collection was done by gathering qualitative data from the field through study visits, interviews, questionnaires as well as experiments. Eleven institutions in Malaysia and each from Singapore, Indonesia, and Thailand were visited, and found having similar problems in managing zoological collection. From this study, the reason why Malaysia did not excel in the collection management was not because of the curators aptitude, but more to other factors that influencd the quality of collections management, such as funding and human resource. For the second objective, lack of awareness on biodiversity among Malaysian made them incapable to see the need to establish a natural history museum. A study case done to Natural History repository, Universiti Tun Hussein Onn identified *Aspergillus* sp., *Chaetomium* sp. and *Mucor* sp. were present on bat skin and entomological specimens used in this study. Invertebrate pests, *Vollenhovia* sp. and *Dermatophagoides* sp. were circumstantially found. However sign of insect activities such frass, shed skins and other body parts are actual evidences of insect pest occurrence. The low temperature and alcohol treatment proved to be the best non-pesticidal methods for remediation of zoological collections. Data from curators and case study were compiled into management practice for the care of zoological collections.

ABSTRAK

Pelbagai punca menyumbang ke arah kemorosotan biodiversiti dan salah satu adalah kurangnya pengetahuan mengenai kepentingan koleksi sejarah alam semulajadi. Penyebaran pengetahuan biodiversiti yang kurang berkesan, penyelenggaraan koleksi sejarah alam semulajadi yang lemah, dan kekurangan kefahaman mengenai pandangan rakyat Malaysia terhadap muzium sejarah alam semulajadi merupakan persoalan yang dijawab di dalam kajian ini. Kajian ini pertamanya bertujuan untuk merasionalkan koleksi sejarah alam semulajadi sebagai alat untuk mengarusperdana biodiversiti di Malaysia dan kedua menyediakan panduan untuk menyelenggara dan mengurus spesimen biologi. Data dikumpul secara kualitatif di lapangan menerusi lawatan kerja, wawancara, kaji selidik; dan eksperimen. Sebelas pusat koleksi dan muzium sejarah alam semulajadi di Malaysia dan Singapura, Indonesia dan Thailand telah dilawati. Semuanya mempunyai permasalahan pengurusan koleksi zoologi yang serupa. Kajian ini mendapati sebab mengapa Malaysia tidak dapat maju dalam pengurusan koleksi bukan kerana kurang pengetahuan tetapi faktor luar yang mempengaruhi kualiti pengurusan koleksi seperti kewangan dan sumber manusia. Untuk objektif kedua, kurangnya kesedaran pada rakyat Malaysia mengenai biodiversiti menyebabkan mereka tidak nampak mengenai keperluan pembentukan muzium sejarah semulajadi di Malaysia. *Aspergillus* sp., *Chaetomium* sp. dan *Mucor* sp. kulat yang biasa ditemui pada koleksi muzium juga ditemui dalam kajian ini. Perosak invertebrate, *Vollenhovia* sp. dan *Dermatophagoides* sp. ditemui secara tidak sengaja; namun penunjuk kewujudan seperti *frass*, dan kulit tergelupas hadir. Rawatan secara suhu rendah dan menggunakan alkohol terbukti sangat berkesan bagi memulihkan koleksi zoologi. Data yang diperolehi sewaktu lawatan dan eksperimen .akan dikumpul dan dijadikan panduan bagi amalan pengurusan dalam penjagaan koleksi zoologi.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

BZM	-	**Bogor Zoological Museum**
CBD	-	**Convention on Biological Diversity**
FRIM	-	**Forest Research Institute Malaysia**
IBD	-	**Institut Biodiversiti, PERHILITAN**
ICOM	-	**International Council of Museum**
IMR		**Institute for Medical Research**
IUCN	-	**International Union for Conservation of Nature**
KATS	-	**Ministry of Water, Land and Natural Resources**
LKCNHM	-	**Lee Kong Chian Natural History Museum**
MOH	-	**Ministry of Health**
MONRE	-	**Ministry of Natural Resources and Environment**
MOTAC	-	**Ministry of Tourism, Arts and Culture**
PERHILITAN	-	**Department of Wildlife and Parks**
PERHUTANAN	-	**Jabatan Perhutanan**
PSU	-	**Prince of Songkhla University**
SDA	-	**Sabaroud Dextrose Agar**
UKM	-	**Universiti Kebangsaan Malaysia**

UM	-	**Universiti Malaya**
UMS	-	**Universiti Malaysia Sabah**
UNDP	-	**United Nation Development Programme**
UNIMAS	-	**Universiti Malaysia Sarawak**
UTHM	-	**Universiti Tun Hussein Onn Malaysia**

LIST OF APPENDICES

LIST OF PUBLICATIONS

Journals:

(i) Arney Sapaat, Siti Fatimah Sabran, Nur Amalina Ismail, Izdihar Ismail, Maryati Mohamed, Mohamad Noh Dalimin (2017) "Voucher Specimens as a tool to documenting traditional knowledge medicinal plants of Jakun people in Endau-Rompin (PETA)." *Journal of Engineering and Applied Sciences.* Vol. 12, No. 9, pp. 2388-2395.

(ii) Arney Sapaat, Maryati Mohamed, Mohamad Noh Dalimin (2018) "Pest Management in Universiti Tun Hussein Onn Malaysia Natural History Repository." *Journal of Tropical Biodiversity and Biotechnology*. Vol. 3, No. 3, pp. 80-84.

(iii) Arney Sapaat, Maryati Mohamed, Mohamad Noh Dalimin (2019) "Gauging the status of natural history collactions in Malaysia". IOP Conference Series: Earth and Environmental Science. Vol. 269, No. 1, pp. 1-6

Proceedings/ Conference/Seminar

(i) Arney Sapaat, Maryati Mohamed (2015) "New Interest in Johor: Natural History Museum", Proceeding in International Conference On Biodiversity 2015 (ICB 2015), UTHM, 16-17 November, 2015.

(ii) Arney Sapaat, Mohamad Noh Dalimin, Maryati Mohamed (2016) "Natural history collections as important tool in wildlife conservation", Proceeding in Seminar Biodiversiti PERHILITAN, Awana Genting, 21-25 November, 2016.

(iii) Arney Sapaat, Siti Fatimah Sabran, Nur Amalina Ismail, Izdihar Ismail, Maryati Mohamed, Mohamad Noh Dalimin (2017) "Voucher Specimens as a tool to documenting traditional knowledge medicinal plants of Jakun people in Endau-Rompin (PETA)." Conference on Herbal Science, Technology and Medicine (HERBSTEM), Krabi, 29-30 November, 2017

CHAPTER 1

INTRODUCTION

"Malaysia is committed to conserve its biological diversity, promote its sustainable use and ensure fair and equitable sharing of the benefits arising out of the utilization of biological resources"

(National Policy on Biological Diversity 2016-2025)

Natural history emerged as a discipline in the 18th century as part of the Enlightenment, a philosophical movement in Western Europe based on rationalism (Mayr, 1982). The core of the natural history tradition is the quest to find order in nature. From its onset, the tradition sought order in three realms, which are geology, botany and zoology. Collections, life-history facts, and ethograms are products of conceptual pursuits in natural history. Collections, in the broad sense of specimens and the information associated with them, are hugely important resources. The availability of information on biological collection plays an important role in monitoring the extinction of local species. In addition, with excellent information on the presence of a species in a locality, one could monitor the newer species that are coming into the area. Biological collecting may be defined as gathering biological specimens and samples to further the understanding of the natural world (Patterson, 2002).

Main framework for this study is to highlight two important factor for natural history museum, management and collections. This research comprises of three main parts. Part one gauges the status of natural history collections in Malaysia. In this respect, natural history collections all over Malaysia were visited and interviews were carried out with managers of the collections. This is then compared to the three

selected natural history museums from Indonesia, Thailand and Singapore to determine where Malaysia's collection stands at the regional level.

Part two determines the problems faced by collection managers when maintaining natural history collections in their centres. The focus is basically on zoological collections. Part one and two highlights the management of natural history museum.

Part three was carried out after determining the damages and problems on zoological specimens in natural history collections. This highlights the collection part of natural history museum. The focus of this part is the identification of pests and effective treatments for it. All this contributes to the management practice for the care of zoological specimens in natural history collections.

1.1 Research Background

Habitat loss and degradation are identified as the main threat to 85% of all species described in the IUCN Red List, with illegal trade and invasive species also being key drivers of population decline. MONRE 2012 also estimated that 22% to 40% of plants will be extinct by 2050 It is estimated that only 10% of vertebrates remain to be described, but greater than 50% of terrestrial arthropods and up to 95% of protozoa are undescribed as stated in the cross cutting issues number ten of Global Taxonomy Initiative (Malaysia's Clearing House Mechanism portal, 2011) At the most conservative estimate, there are more unknown species than known ones on earth. A review by Pyke & Ehrlich (2010) stated that biological collections have been useful as sources of information about variation in attributes of individuals to environmental variables and species distribution. In the colonial history of Southeast Asia, linkages between natural history museums have been parallel and separate; Malaysia and Singapore with the United Kingdom, Indonesia with Netherlands, the Philippines with the United States, and Cambodia, Vietnam and Laos with France. This has hindered the advancement of taxonomic and natural history knowledge across Southeast Asia. Needless to say, species in the region are closely related to each other. Without holistic regional overview, many studies in natural history undertaken in the former colonies have been deficient due to ignorance of what lies over the borders. The natural history scientists of neighbouring countries like Indonesia, the Philippines, Thailand and

Brunei also tend to confine themselves to their own countries. As a result, the regional experts on Southeast Asian natural history are based almost entirely in Europe, USA and Japan. This become an issue as whenever regional expertise is needed, the experts have to be invited from outside the region (MONRE, 1998).

Due to the segmented and limited nature of records and documents on Malaysian natural history, very few scientists in Malaysia have experience that could make an impact locally, regionally or globally in terms of recording biodiversity. This is unfortunate since Malaysia ranks 12th in the world in terms of biodiversity wealth. Due to historical factors, Malaysian scientists and managers of biodiversity in most sectors such as agriculture, medical, and environment have depended much on the relationship and assistance from Britain in terms of taxonomic needs. The Convention on Biological Diversity in 1992 had been an event that sparked the enthusiasm of more Malaysian scientists to venture into taxonomy.

In Malaysia, natural history collections are limited by the state and national boundaries. As a result, the taxonomic scientist work within small geographical boxes. For example, a scientist working on a museum collection in Sabah would have Sabah specimens to examine but few from outside Sabah (MONRE, 1997). All natural history units in Malaysia face similar limitation. No natural history unit in Malaysia is responsible for the whole of Malaysia, except perhaps Forestry Research Institute of Malaysia (FRIM) and even that was after 1998 when Malaysia produced its own National Policy on Biological Diversity (NPBD, 1998). Vast majority of the specimens collected over 100 years ago from Malaysia were deposited overseas, namely in Singapore as well as United Kingdom. Newer collections made from approximately 50 years ago are in Malaysia (Ng, 2008). These collections are important and could be developed to support the local and regional needs for biodiversity. Common problems in Malaysia are loss of expertise and breaks in continuity when experienced staff retire, lack of space, and insufficient funds for maintenance. Generally, it is not appreciated in the country that the 3 million collections collectively constitute a priceless national scientific heritage.

1.2 Problem Statement

In brief, this research was carried out to address three problems. First, ineffective dissemination of biodiversityy knowledge. Despite being rich in biodiversity, the transfer of knowledge on biodiversity could not be done effectively due to the present status of natural history collection in Malaysia. Meanwhile, biodiversity is eroding fast. Second, poor maintenance of natural history collection. Specimens need to be handled carefully to allow thorough biodiversity documentation. However, problems in specimen maintenance and its solution should be first identified. Unfortunately, prior to this study, the threats that damages our natural history collection and the best treatment method to counter the damage have not been addressed. Third, lack of understanding on how Malaysian perceive a natural history museum. Hence, there is still the big question of how natural history collection can be used as a tool to educate Malaysians on biodiversity erosion.

1.3 Research aim and objectives

This study aims to rationalize natural history collection as a tool in mainstreaming biodiversity in Malaysia by gauging it current status and management practice as well as to provide a guideline in maintaining biological specimens critical to their management.

For each of the aim the objectives are:

1. To gauge current status of collection centres in Malaysia (museums, government departments and universities) and the need of Malaysian public for natural history museum
2. To compare the status of NH collection centres in Malaysia and those in Thailand, Indonesia and Singapore.
3. To determine causes that damage zoological specimens
4. To determine the effectiveness of treatments on damaged specimens through a simulation experiment

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