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IN LOWER KINABATANGAN, SABAH

LEE SHAN KHEE

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DECLARATION

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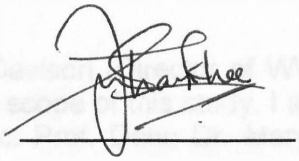

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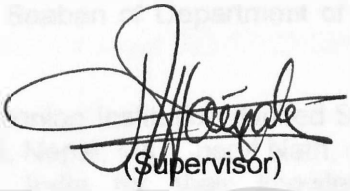
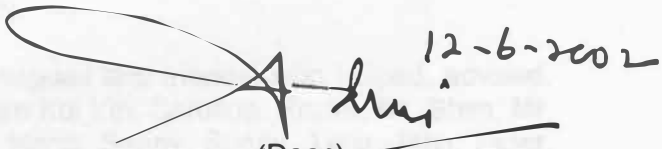


Prof. Datin Dr. Maryati Mohamed
University Malaysia Sabah
(Supervisor)

Dr. Geoffrey Davison
WWF Malaysia, Borneo Programme
(External Supervisor)

Prof. Dr. Azizah Kassim
University Malaysia Sabah
(Internal Examiner)

Dr. Shahrul Anuar Mohd. Sah
University Science Malaysia
(External Examiner)



Prof. Dr. Zainodin Hj. Jubok
School of Science & Technology
University Malaysia Sabah
(Dean)

Prof. Dr. Mohd. Zahedi Daud
Pusat Pengajian Pascasiswazah
University Malaysia Sabah
(Dean)

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LEE SHAN KHEE
May 2002
e-mail: shankhee@hotmail.com

DEDICATION

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especially in Lower Kinabatangan, Sabah, Malaysia.

ABSTRACT

The seasonal movements of elephants and the socio-economic impacts of damage in cultivated areas in Lower Kinabatangan were studied from January 1999 to August 2000 so as to identify a "win-win" resolution to reduce the conflicts between humans and elephants. The elephants in Lower Kinabatangan are isolated into two populations, one population occurring west of Bukit Garam, which was not studied, while the study population occurs between the villages of Batu Putih and Abai in the Lower Kinabatangan Wildlife Sanctuary (LKWS). Approximately 80 elephants have been observed within 318.37 km^2 in LKWS. One intensively studied family group (Maturup) was successfully tracked for 153 days between August 1999 and August 2000. The rate of elephant deaths detected in the Lower Kinabatangan due to human-elephant conflict was estimated as 0.91 individuals per year, and there were no cases of human death due to elephants in the region so far. The average number of cases of crop raiding in the Lower Kinabatangan was estimated as 10.82 ± 5.25 cases per year throughout the period from 1990 to 2000. Raiding frequency reached a peak during January-March, which is the wet season and immediate post-wet season. The total cost of damage by elephants within the 20 months of the study period was estimated as RM 478,400.50. The reported group size of problem elephants that raided crops varied from one to more than 40 individuals. Oil palm was the most frequently raided (92.64%) of all raided crops. The minor crops that have been raided were paddy (3.02%), banana (2.19%), maize (1.33%), coconut (0.68%) and minor fruits (0.14%). The results suggested that 55.56% of damage by elephants was upon oil palm trees below the age of two years old. The damage decreased with the increasing age of trees, and no trees aged seven or more were raided. Batu Putih was the village with the highest levels of conflict (52.63% of cases), followed by Sukau (26.32%), Billit (15.7%) and Abai (5.26%). Some 39% of oil palm plantations (n=8) were presently having power fencing as a mitigation method. The most effective mitigation method used throughout estates in the region was considered to be bright lights (40.74%); while the most common and traditional method used in villages was sound (59.37%). There were 21 families and 46 species of plants collected and identified as elephants' foods, with Graminae, Maranthaceae and Zingiberaceae being the three major plant families consumed. The most conventional 'win-win' solution recommended is *in-situ* conservation of elephants in LKWS, with mitigation measures such as fencing to maintain the elephants within the sanctuary.

KONFLIK ANTARA MANUSIA DAN GAJAH DI HILIR KINABATANGAN, SABAH.

Abstrak

Kajian mengenai laluan gajah mengikut musim dan kesan-kesan gajah terhadap sosio-ekonomi penduduk sekitar kawasan Hilir Kinabatangan telah dijalankan. Kajian ini bermula dari bulan Januari 1999 hingga Ogos 2000, bertujuan mengenalpasti dan melakarkan cara-cara penyelesaian yang sesuai dan "saksama" demi mengurangkan konflk yang berlaku di antara manusia dan gajah di Hilir Kinabatangan. Populasi gajah di Hilir Kinabatangan didapati telah terpisah menjadi dua kumpulan yang berasingan. Salah satu kumpulan tersebut berada di bahagian barat Bukit Garam iaitu di luar kawasan kajian ini. Sementara kumpulan gajah yang lain berada di dalam kawasan kajian iaitu menduduki kawasan antara Kampung Batu Putih dan Kampung Abai. Terdapat lebih kurang 80 ekor gajah telah diperhatikan berada di kawasan hutan seluas 318.37 km^2. Salah satu unit kumpulan gajah yang diberi nama "Maturup" telah berjaya dijejak selama 153 hari (iaitu antara Ogos 1999 - Ogos 2000). Kadar kematian gajah yang berpunca daripada konflik manusia dan gajah di Hilir Kinabatangan dianggarkan sebanyak 0.91 individu setahun dan tiada kes kematian manusia dilaporkan setakat ini. Purata bilangan kes kerosakan tanaman yang berlaku antara tahun 1990 hingga 2000 dianggarkan sebanyak 10.82 $\pm$ 5.25 kes setahun. Bilangan kes kerosakan tanaman yang disebabkan oleh gajah paling tinggi dicatatkan antara bulan Januari hingga Mac, iaitu merupakan musim hujan dan sebaik-baik sahaja selepas musim hujan. Kos bagi kerosakan tanaman sepanjang kajian ini dijalankan (20 bulan) dianggarkan berjumlah RM 478,400.50. Terdapat dua jenis saiz kumpulan gajah yang terlibat dalam kerosakan tanaman iaitu sama ada seekor atau lebih daripada 40 ekor gajah. Kelapa sawit (92.64%) merupakan jenis tanaman yang paling kerap dirosakkan oleh gajah berbanding dengan tanaman-tanaman lain seperti padi (3.02%), pisang (2.19%), jagung (1.33%), kelapa (0.68%) dan buah-buahan (0.14%). Hasil kajian ini menunjukkan kadar kekerapan kerosakan tanaman kelapa sawit menurun dengan meningkatnya usia kelapa sawit yang ditanam. Sebanyak 55.56% daripada kerosakan tanaman kelapa sawit berumur kurang daripada dua tahun dan tiada kerosakan dilaporkan bagi umur tujuh tahun dan ke atas. Daripada jumlah kes kerosakan tanaman, Kampung Batu Putih menghadapi masalah kerosakan tanaman paling tinggi iaitu sebanyak 52.63%, diikuti oleh Sukau (26.32%), Bilit (15.7%) dan Abai (5.26%). Lebih kurang 39% daripada semua ladang kelapa sawit telah memasang pagar berelektrik sebagai cara mengatasi masalah kemasukan gajah ke dalam kawasan ladang. Kaedah yang digunakan oleh pihak perladangan untuk mengatasi kemasukan gajah yang paling berkesan adalah menggunakan cahaya (40.74%), manakala pihak perkampungan menggunakan bunyi (59.37%). Sebanyak 21 famili dan 46 spesies tumbuhan hutan telah dikenalpasti sebagai makanan gajah. Famili Graminae, Maranthaceae dan Zingiberaceae merupakan makanan yang utama. Cara pengurusan yang dicadangkan untuk mengurangkan konflik antara manusia dan gajah di Hilir Kinabatangan ialah pemuliharaan *In-situ* gajah di kawasan yang berkenaan. Selain itu, penggunaan pagar berelektrik adalah disarankan untuk menghalang gajah keluar dari kawasan pemuliharaan.

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GLOSSARY

SWD	-	Sabah Wildlife Department
LK	-	Lower Kinabatangan
GIS	-	Geographical Information System
LKWS	-	Lower Kinabatangan Wildlife Sanctuary
N	-	North
E	-	East
DE	-	Daily Express
CITES	-	Convention on International Trade in Endangered Species of Wild Fauna and Flora
IUCN	-	International Union for the Conservation of Nature and Natural Resources
WCE	-	Wildlife Conservation Enactment
US Dollar	-	United State Dollar
FFB	-	Fresh fruit bunch
GPS	-	Global Positioning System
sp.	-	Species
DWNP	-	Department of Wildlife and National Park

SYMBOLS

%	-	Percentage
ha	-	Hectare
km^2	-	Square kilometre
±	-	Plus minus
kg	-	Kilogram
km	-	Kilometre
$miles^2$	-	Square miles
°C	-	Degree Celsius
mm	-	Millimetre
RM	-	Ringgit Malaysia
km^{-2}	-	Per square kilometre
≤	-	More than or equal to
SD	-	Standard Deviation
SE	-	Standard Error
ft	-	Feet

CHAPTER ONE

INTRODUCTION

Although 60% of the island of Borneo still remains under 'green' cover, deforestation and habitat disturbance are proceeding at a terrifying rate (MacKinnon, 1992). Several Bornean plants and animals have been considered as endangered species by scientists (Kiew, 1991; IUCN, 1996). They include six species of *Rafflesia* (Ghazally, 1990), Clouded leopard (*Neofelis nebulosa*), Orang utan (*Pongo pygmaeus*), Proboscis monkey (*Nasalis larvatus*), Asian elephant (*Elephas maximus*), Wild cattle or *Tembadau* (*Bos javanicus*) and Sumatran rhinoceros (*Dicerorhinus sumatrensis*) (Abd. Hamid, 1991; MacKinnon, 1992; Boonratana, 1993).

Human beings share a rich and ancient history with wild animals over the centuries (Boonratana, 1993). The Asian elephant is the largest of the three giants mammals of Borneo, the other being Tembadau and Sumatran rhinoceros (Mjöberg, 1999). It has been postulated that the elephants in Borneo are the descendants of a small herd presented to the Sultan of Sulu by the British East India Company in 1750 (de Silva, 1968). Folklore has it that the Sultan of Sulu soon tired of his expensive present, and turned all the animals free into the jungle (Shelford, 1985; Yong, 1999). However, elephants may be truly native to Borneo (Medway, 1977). Whatever the origins of elephants in Borneo, improper management of habitat has created conflicts between elephants and humans. This is a major concern in elephant conservation

because it has immediate negative effects on both people and elephants (Hoare, 1999).

"Problem elephants" are defined as animals whose range extends into human settlement, and which normally feed on a wide variety of cultivated crops, also sometimes damaging human properties, fences and barriers, and occasionally injuring or killing people (Hoare, 1999). Planters have responded by encircling their own plantation crops with barbed wire or other barriers, but this may fail to stop the visiting of elephants. Elephants may increase and visit night after night, and destroy the barriers. Violent clashes or "conflicts" sometimes occur, as people try to drive the elephants away from cultivated land with fire or rifles. This can result in cases of both people and elephants being killed or injured (Nath & Sukumar, 1998). The exact number of elephants that have been killed during such clashes is unknown.

About 30% of Sabah's land is reckoned to be suitable for commercial agriculture such as oil palm and cocoa. This together with demand for palm oil has meant that oil palm plantations expanded rapidly, and they have made an increasingly important contribution to the national income (Andau & Payne, 1987). Therefore, almost all of the forest in the eastern part of Sabah has been cleared for that purpose since 1980. In 1998, about 876,334 ha of land in Sabah were planted with oil palm; it rose 2280% compared to the 38,433 ha land that were cultivated with oil palm in 1970 (Fuad *et al.*, 1999).

The main element in the conflict between humans and elephants is habitat, as the viability of the remaining habitat for elephants in Sabah has been declining constantly for the past three decades. Some reserves have been set aside, for example Tabin Wildlife Reserve and Danum Valley Conservation Area (Marsh, 1995).

Nevertheless, animals do not recognize park boundaries, particularly wide-ranging species like elephants (Parker & Graham, 1989). As the habitat continues to decline, and people squat on the buffer zones between the protected areas and developed land, the amount of land for unrestricted elephant movements becomes smaller (Hoare, 1999).

Elephants need to "migrate" with the seasons to find the best feeding areas every year (Mjöberg, 1999). The extent to which these movements are regular and predictable, and thus deserving of the term "migration", is unknown in Borneo. However, the migration routes or routes for movement have been disrupted, and herds are constantly confronted by new settlements and agriculture, where they are not welcomed by people who own that particular land. The incidences of crop raiding in Sabah have been recorded by Sabah Wildlife Department (SWD). Nevertheless, the intensity and impact of the conflict between human and elephant have not been analyzed in detail and studied in the past. To amend its effects, human-elephant conflict must be quantified and hypotheses on fundamental factors must be tested before any management recommendations are made.

This study on human-elephant conflict was conducted at Lower Kinabatangan (LK) in Eastern Sabah ($5^0$10' – $5^0$50'N; $117^0$40' – $118^0$30'E) for 20 months from January 1999 until August 2000. The movement patterns of elephants, locations utilized, feeding sites and conflict areas were mapped out using GIS ArcView Programme. Population size of elephants was estimated. Plants consumed and major crops raided were identified. The socio-economic loss as a result of elephant incursions was studied and determined. The current types of mitigation methods used to control elephants were listed. The results of this study provide an overview of the current status of human-elephant conflict in LK. It is hoped that the information and

recommendations given may reduce the conflict in the area, for better management and conservation of the species and other animals, and also for the whole of the Lower Kinabatangan Wildlife Sanctuary (LKWS).

1.1 Aims of Study

This study on human-elephant conflict in LK is the first of its kind in Sabah and it has the following aims:

1. To determine the current types of human and elephant conflict in LK;
2. To verify the seasonal migration routes of elephants in the LK area;
3. To study the existing mitigation methods used to control elephants;
4. To identify the types of plants consumed and crops raided by elephants;
5. To recommend, "win-win" solutions to reduce the current human-elephant conflict in LK.

CHAPTER TWO

LITERATURE REVIEW

2.1 The Study Animal

2.1.1 Introduction

Elephants are categorized in the order Proboscidea, the scientific name referring to its long nose. The living and extinct Proboscidea are subdivided into six families; they are Moeritheriidae, Gomphoteriidae, Mammutidae, Deinotheriidae, Barytheriidae and Elephantidae (Kanapathipillai, 1994). There were 300 species that belonged to this category during the Tertiary period (Kemf & Santiapillai, 2000). However, only two genera and two species of the family Elephantidae have survived until today, living in Asia (the Asian elephant *Elephas maximus*) and Africa (the African elephant *Loxodonta africana*) respectively. Although the elephants in Borneo have not yet been subjected to DNA analysis, some taxonomists have accorded the Bornean elephant separate subspecies status (*E. m. borneensis)* based on its anatomical characters such as a small skull and very straight tusks (Kemf & Santiapillai, 2000).

The Asian elephant's ancestors originated from Africa some 55 million years ago and ranged from modern Iraq and Syria to the Yellow River in China (de Silva, 1968). Nevertheless, they are now only found in 14 countries from India to Vietnam, with a tiny beleaguered population in the extreme southwest of China's Yunnan Region (Kemf & Santiapillai, 2000).

Features such as size of body, skin texture, ear size, head shape and the 'finger-like' tip at the end of the trunk have been used to distinguish the two living genera of elephants (Groning & Saller, 1999). The Asian elephant has an arched back; an angular head with a steep forehead, small ears and a fairly smooth skin and only has one 'finger-like' tip at the end of its trunk (de Silva, 1968; Groning & Saller, 1999). Compared to African elephant, the Asian elephant is much smaller. Whereas, African elephant has a saddle-shaped back which slopes away backward from the shoulders, a long head with a sloping rounded forehead, large, fan-shaped ears, which cover its neck and shoulders, and a greater body and leg length. It has two 'finger-like' tips to the trunk (Reade, 1966; Benyus, 1992).

The valuable ivory tusks of elephants are enlarged incisor teeth of the upper jaw. The hollow shaft, which is located without a root in the bone of the upper jaw, extends for about one-third the length of the tusk, and carries a nerve. If an elephant overstrains its tusk and breaks it, the animal will feel pain, which may make it irritable and dangerous (Groning & Saller, 1999). Distinct from the African elephant, only male Asian elephants have tusks. About 5 to 10% of males in Southern India, 50% in Northeastern India, and 90% in Sri Lanka were found to be tuskless – such animals are locally called *makhnas* (Nath & Cuong, 2000). Frequently, such tuskless males are bigger than their tusked relatives (Basappanavar, 1998; Nath & Sukumar, 1998). Female Asian elephants have small upper incisor teeth, which seldom protrude beyond the lip. An elephant's tusks are more important to it as a tool than as a weapon. They are used together with the trunk to help expose roots and tear into the bark of trees in times of drought, and remove obstacles. For elephants in captivity, the trunk and tusks become lifting machinery for heavy timber.