

**SCIENCE IN CITIES:
THE BIOLOGY AND ECOLOGY
OF THE SOUTHEAST ASIAN
BOX TURTLE
AND ITS USES AND TRADE IN
MALAYSIA**

SABINE SCHOPPE

A TRAFFIC SOUTHEAST ASIA REPORT



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**Cover: Only few hatchlings of the Southeast Asian Box Turtle
Cuora amboinensis reach maturity**

Photograph credit: Sabine Schoppe/TRAFFIC Southeast Asia

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Sabine Schoppe/TRAFFIC Southeast Asia

**Commercial traps used for the collection of the of the Southeast Asian
Box Turtle *Cuora amboinensis* catch all size classes**

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GLOSSARY AND ACRONYMS

Adult – Referring to a sexually mature animal. Here specifically referring to specimens of freshwater turtles which have established external sexual dimorphism.

Anon. – Anonymous.

Article IV – Under the convention text of CITES (see below), concerning the Regulation of Trade in Specimens of Species Included in Appendix II. The export of any specimen of a species included in Appendix II shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met: (a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species; (b) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora; and (c) a Management Authority of the State of export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment.

Assurance population – Referring to those populations of the Southeast Asian Box Turtle that are protected and that live under conditions that provide nutrition, mates and an environment that allows population growth.

Category I – One of three categories for species under Review of Significant Trade. A Category I species is considered a species of urgent concern and shall include species for which the available information indicates that the provisions of Article IV, paragraph 2 (a), 3 or 6 (a), are not being implemented.

CITES – The Convention on International Trade in Endangered Species of Wild Fauna and Flora.

CN – ISO code for China.

Commensal – Here referring to turtle species that are commensals of man, meaning turtles that inhabit anthropogenically disturbed habitats.

Consumption trade – Trade in freshwater turtles and tortoises, including the Southeast Asian Box Turtle, for food.

Exporter – Referring to a trader who exports turtles for commercial purposes.

Fecundity – The potential reproductive capacity of an organism or population, measured by the number of eggs. Fecundity can increase or decrease in a population according to current conditions and certain regulating factors such as food supply, birth, death, growth rate.

Femorals – 2nd to the last plates on the turtle plastron.

Gross exports – Referring to the definition of the CITES Trade Database which is “the total quantity (re-)exported of a given commodity”.

Gross imports – Referring to the definition of the CITES Trade Database which is “the total quantity imported of a given commodity”.

Hatchling – A life history stage. Here for the Southeast Asian Box Turtle defined as the stage from hatching until the egg tooth is lost, which is usually 10-19 days after hatching.

HK – ISO code for Hong Kong.

IATA – International Air Transport Association, which has created standards for the transport of live animals by air.

ID – ISO code for Indonesia.

Ikan – Bahasa Malaysia word for “fish”.

In-situ conservation – Meaning “on-site conservation”. It is the process of protecting an endangered plant or animal species in its natural habitat.

IUCN – International Union for Conservation.

Juvenile – Here referring to sexually immature individuals of freshwater turtles.

Kg. = *Kampung* – Bahasa Malaysia for ‘small village’.

Kura Kura – The general Malay term for hard-shelled turtles.

Labi Labi – The general Malay term for softshell turtles.

MA – CITES Management Authority. A national management body designated in accordance with Article IX of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. The Management Authority is responsible for implementing the Convention in its country. In particular, it is the only body competent to grant import, export permits, and re-export certificates on behalf of that Party. Even though a Party may designate more than one Management Authority, one must be designated as the Management Authority responsible for communication with other Parties and the Secretariat.

Malayan Box Turtle – English name of the subspecies *C. amboinensis kamaroma* that occurs in Malaysia. In the following the term Malayan Box Turtle is used if the statement is only valid for the Malayan subspecies *C. amboinensis kamaroma*.

MeCL – Median carapace length, measured in straight carapace length.

Melaleuca swamps – Referring to low lying coastal areas, seasonally inundated by fresh water and dominated by water-loving trees, the *Melaleucas* of the family Myrtaceae.

Merit release – Referring to the Chinese tradition of releasing one or several turtles to a temple or to the wild believing that this will bring long life to the person performing the action. Here categorised as one of the potential uses for trading the Southeast Asian Box Turtle.

Middleman – Referring to a trader who buys turtles from collectors and sells them to a supplier or to an exporter.

MoNRE – Malaysia’s Ministry of Natural Resources and Environment.

MY – ISO code for Malaysia.

NDF – Non-detrimental or non-detriment finding – A conclusion by a Scientific Authority that the export of specimens of a particular species will not negatively affect the survival of the species in the wild. The non-detriment finding by a Scientific Authority is required prior to the issuance of an export or import permit or a certificate for an introduction from the sea may be granted for a specimen of an Appendix-I species, and prior an export permit or a certificate for an introduction from the sea may be granted for a specimen of an Appendix-II species.

Net exports – Referring to the definition of the CITES Trade Database which is “the positive difference between total (re-)exports (gross) and the total imports (gross)”.

Net imports – Referring to the definition of the CITES Trade Database which is “the positive difference between total imports (gross) and the total (re-)exports (gross)”.

NGO – Non-government organization.

Normal distribution – In statistics a function that represents the distribution of many random variables as a symmetrical bell-shaped graph.

Orang Asli – Indigenous people of Peninsular Malaysia.

PERHILITAN – Pejabat Hidupan Liar dan Taman Negara = Department of Wildlife and National Parks, one of the key CITES Management Authorities in Peninsular Malaysia, responsible for issuance of permits for all fauna except fish and marine species.

Pet trade – Referring to the trade of species such as the Southeast Asian Box Turtle for the purpose of keeping it as pet.

Population – The number of individuals of a certain species in a certain place.

Precautionary Principle - A rule according to which pre-emptive conservation measures to avoid or

minimize a threat to a population of a species may be taken even when there is a lack of full scientific certainty as to the threat.

Protected species – Referring to species that are protected under Malaysian law.

Review of Significant Trade – A CITES-mandated process in cases, where export levels for Appendix II species are significant and/or considered to be of concern for conservation measures. Resolution Conf. 8.9 (Rev.) provides a mechanism whereby the CITES Animals or Plants Committee can review the situation and formulate recommendations to ensure that the export is not detrimental to the survival of wild populations of the species under review.

Schedule – Wildlife species that are protected or which are otherwise regulated under the Malaysian Government are divided into different schedules, whereas Schedule I lists totally protected species and Schedule II lists protected species.

Scientific Authority (SA) – A national scientific advisory body designated in accordance with CITES Article IX of the Convention. A Scientific Authority is responsible for providing technical and scientific advice to its Management Authority, in particular as to whether the export or introduction from the sea of a specimen will be detrimental to the survival in the wild of the species involved. A Party may designate more than one Scientific Authority.

SEA – South-east Asia.

SG – ISO code for Singapore.

Sg. = *Sungai* – Bahasa Malaysia term for “river”.

Southeast Asian Box Turtle – English name for the species *Cuora amboinensis* that comprises four subspecies. Here the term Southeast Asian Box Turtle is used when referring to the species *C. amboinensis* in general.

Subadult – A life history stage used to classify immature individuals, which are sometimes also referred to as large juveniles or late juvenile. Subadults already express external sexual dimorphism.

Supplier – Referring to a trader who buys turtles either from collectors or from middlemen and sells them either to the local market or to an exporter.

Tamu – Bahasa Malaysia term for a large street market where mainly food but also clothing and handicrafts are sold. Every of these markets usually has at least one aquarium/pet stall that sells fishes and/or pet animals incl. freshwater turtles.

TCM – Traditional Chinese Medicine; this is one of the major reasons for trading the Southeast Asian Box Turtle.

Testudines – Taxonomic term that comprises all turtles, terrapins and tortoises.

Tortoise – Term commonly used for terrestrial turtles not associated with wetlands.

Trader – Refers to any person dealing with the Southeast Asian Box Turtle or other reptile species, including collectors, middlemen, suppliers, and exporters.

TRAFFIC – The wildlife trade monitoring network, a joint programme of WWF and IUCN.

TSD – Temperature-dependent sex determination.

Turtle – Here generally used for all freshwater turtles and tortoises.

TW – ISO code for Taiwan.

UKM – Universiti Kebangsaan Malaysia (National University of Malaysia).

UNEP – United Nations Environment Program.

Unprotected – Referring to nationally unprotected species.

US – ISO code for United States of America.

VES – Visual encounter survey, a renowned quantification methods for surveying wildlife.

VN – ISO code for Viet Nam.

WCMC – World Conservation Monitoring Centre, now known as UNEP-WCMC.

WCS – Wildlife Conservation Society.

Wet market – Referring to daily or weekly markets that sell fresh products such as fish, meat and vegetables.

Wild population – In accordance with CITES glossary: the total number of free-living individuals of a species within its area of distribution.

WWF – the global conservation organization, also known as World Wide Fund for Nature and World Wildlife Fund.

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EXECUTIVE SUMMARY

The Southeast Asian Box Turtle *Cuora amboinensis* is one of 18 freshwater turtle and tortoise species native to Malaysia. It is widely distributed in Southeast Asia, having four subspecies with similar habitat requirements but different geographic distribution. Among them, the Malayan Box Turtle *C. a. kamaroma* occurs in Malaysia. In Malaysia, as elsewhere throughout its range, the Southeast Asian Box Turtle is considered the most common freshwater turtle. Nevertheless, the survival of the species is in peril due to over-exploitation. Of the hard-shelled freshwater turtle species in Asia, it has the highest exploitation rate, and is the species most sought after by East Asian consumers and Traditional Chinese Medicine (TCM) markets. Thousands are harvested annually in Southeast Asian source countries and exported. The Southeast Asian Box Turtle has a slow reproductive cycle characterized through late maturity and limited number of eggs. It is therefore feared that the continuous high-volume exploitation in combination with its life history might lead to serious population reductions and finally to local extinction. The species was first assessed by the IUCN Red List of Threatened Species in 1996 as “Low Risk: Near Threatened” before it was upgraded to Vulnerable in 2000. In the same year, all species under the genus *Cuora* were listed in Appendix II of CITES, bringing requirements of legal provenance and sustainable management to any international trade in the species.

In terms of limiting trade to sustainable levels, Article IV of the Convention requires a non-detriment finding (NDF) to be made prior to the issuance of any export permit. A thorough NDF should examine levels of trade with reference to any negative or detrimental effects to the survival of wild populations, and assess various aspects of the biology and ecology of the species, its distribution, abundance and exploitation.

Malaysia became a party to CITES in 1977. The CITES Management Authority (MA) of Peninsular Malaysia, i.e. PERHILITAN, had established a quota system to regulate the export of the Malayan Box Turtle from West Malaysia, but declared an export ban in 2005. Under the respective Sabah and Sarawak State-level wildlife laws, the species cannot be exported from Sabah and Sarawak. The Malayan Box Turtle is not included in the Wildlife Act 1972, and does not receive any protection or management in Peninsular Malaysia. This makes it extremely vulnerable to exploitation in Peninsular Malaysia. In Sabah and Sarawak, the collection for local use is officially regulated through a licensing system.

The present study found records for high export volumes before the turtle’s listing as an Appendix species and also thereafter, it further found evidence of continuing export of the species after the Malaysian export ban. In each Malaysian State, at least one supplier was operational, and in three States exporters were encountered in addition. The main destinations for illegally traded individuals are reported to be Hong Kong and mainland China. A smaller percentage is illegally imported by Singapore. Countries that engage in the pet industry of this and other freshwater turtle and tortoise species such as Japan, Europe and the USA had contributed roughly 10% to the total trade of the species from Malaysia and stopped importing completely after Malaysia’s export ban. Locally, the species is used by indigenous groups for consumption, and by ethnic Chinese for religious beliefs, TCM and consumption in East and West Malaysia. In the northern States of West Malaysia, Thais constitute another local consumer group.

Results show that the majority of individuals traded are adults (98% in Peninsular Malaysia and 88% in Sarawak), and most were between 170 and 199 mm in median carapace length. A harvest survey at two suppliers in Sabak Bernam yielded 385 Malayan Box Turtles in 38 days, or a conservative mean of 1823.7 individuals per year for one supplier. Multiplication by the number of confirmed suppliers to the export market (12) provides an annual mean estimate of 21 884 illegally exported Malayan Box Turtles.

There is no commercial breeding operation of *C. amboinensis* in Malaysia or elsewhere in the world because it is an expensive, time-consuming and economically unfeasible task.

A survey in a plantation yielded an estimated population density of only 0.82 individuals/ha, which is believed to be the result of over-exploitation.

Interviews with representatives of the various user groups of the Malayan Box Turtle as well as with farmers, fishers and residents provided information that indicates that the Malayan Box Turtle is rarely seen compared to 5-10 years ago. Most respondents believe that unregulated international trade has led to over-exploitation. There are indications from every State in Peninsular Malaysia that populations of the Malayan Box Turtle are over-exploited or even locally extinct. This is especially true for populations around trade centres such as cities. Despite being a commensal species, it is nowadays difficult to find a Malayan Box Turtle in the wild near residential or agricultural areas.

Levels of harvest and illegal trade in the Malayan Box Turtle in Malaysia demonstrate that immediate action is needed to regulate exploitation for the future sustainable management of the species. TRAFFIC recommends the following actions are taken:

- To allow populations of the Malayan Box Turtle to recover from past and current over-exploitation related to illegal international trade, a total harvest ban or rather the strict implementation of the existing export ban for the duration of one generation should be implemented by PERHILITAN.
- Ports of export and import need to improve control mechanisms to prevent illegal trade. This includes the development of bribe-proof CITES permits (more signatories, digitized identification documents of exporters, etc.). The CITES MA of Malaysia, Indonesia (since many of the turtles originate from there), China and Singapore should jointly elaborate means to avoid or at least reduce forging of documents.
- Increase the number of law enforcers along trade routes, trade centres and exit and entrance points. Customs, Police and Anti-smuggling Units should be established or revived to support PERHILITAN which has insufficient staff.
- Officers at borders should be changed regularly to reduce the possibility of bribery.
- Strict law enforcement and regular inspection of traders, markets and pet and aquarium shops should be conducted by the CITES Management Authorities in Peninsular Malaysia, Sabah and Sarawak. Eventual collaboration with the academic could lessen the workload of the CITES MA while at the same time providing research topics for graduate students.

- The CITES authorities in collaboration with academic institutions, organizations or individuals, and accredited rescue centres should provide (refresher) training for law enforcers in species identification and local legislation.
- Every State should draft a legislation to regulate the exploitation of native turtle species as provided for by the Fisheries Act 1985. At least (10%) of the Malayan Box Turtle populations of each State should be totally protected and the harvest of the remainder should be regulated.
- PERHILITAN should revise the Protection of Wildlife Act 1972 to include the Malayan Box Turtle and other freshwater turtles and tortoises. The Wildlife Act should regulate the number of wild-caught animals. The current situation requires a severe reduction of harvest for local use.
- The international pet trade in the Malayan Box Turtle originating from Malaysia constitutes only about 10% to the total trade and is considered sustainable if standing alone. It could be continued if illegal international trade for food and TCM is halted.
- The CITES Authorities should not encourage captive breeding of the Malayan Box Turtle.
- The CITES Scientific Authority in collaboration with local universities and NGOs should direct efforts towards detailed in-situ conservation measures and ecological studies of the Malayan Box Turtle as well as of other heavily exploited species. Long-term studies for example would be needed to provide comparative data towards determining whether the Southeast Asian Box Turtle decreased in size over time.
- Malaysia is currently planning to revise their CITES implementation legislation to include – among others - freshwater turtles and tortoises and to increase penalties while at the same time providing incentives for the public to provide information on illegal wildlife trade.
- As part of the ASEAN-WEN, Malaysia could set up multi-agency task forces to improve inter-agency co-operation to ease illegal wildlife trade.
- If the CITES Authorities in Malaysia re-consider international trade in the species once illegal trade is stopped, harvest and export quotas should be calculated in line with the findings of this study. Furthermore, to provide a basis for sustainable trade, a rigorous survey method to estimate and monitor population trends has to be established. Minimum characteristics that should be monitored on a regular basis are the composition of population members in terms of size, life-history stages and sex, population density, and catch-per-unit-effort (CPUE). These should be monitored once a year at the same time of the year and at the same sites. Recommended are sites that are significant trading centres around harvest locations such as Selangor, Johor, Kedah, Perak and Penang. Specifically trends of the following should be monitored:
 - Abundance in the wild;
 - Abundance in trade;
 - Mean size of animals in the wild;
 - Mean size of animals in trade;
 - Size-frequency distribution of population members in the wild;

- Size-frequency distribution of individuals in trade;
 - Are any traded turtles declared captive-bred?
 - Is the number of seizures stable, increasing or decreasing?
 - Does illegal international trade continue?
 - What is the extent of the illegal international trade?
 - What is the trend in the sex ratio of population members in the wild and in trade?
 - Is the price stable?
-
- Surveys could be guided by the methodology applied in this study and by TRAFFIC's paper *Non-Detrimental Finding Methodology for the Trade of Southeast Asian Freshwater Turtles and Tortoises (Family Geoemydidae)* (Schoppe, 2007).

INTRODUCTION

The Southeast Asian Box Turtle

This study focuses on the Southeast Asian Box Turtle *Cuora amboinensis* (Daudin, 1802) of the family Geoemydidae, subfamily Geoemydinae (Spinks *et al.*, 2004). In Malaysia, the Southeast Asian Box Turtle is one of 18 freshwater turtles and tortoises (Lim and Das, 1999). It is widely distributed in Southeast Asia (Ernst *et al.*, 2000). Four subspecies with similar habitat requirements but different geographic distribution are currently recognized (Rummler and Fritz, 1991; McCord and Philippen, 1998): the Wallacean Box Turtle *C. amboinensis amboinensis* (Daudin, 1802) often referred to as East Indian Box Turtle, the Malayan Box Turtle *C. a. kamaroma* Rummler and Fritz, 1991, the Indonesian Box Turtle *C. a. couro* (Schweigger, 1812), and the Burmese Box Turtle *C. a. lineata* McCord and Philippen, 1998. Only the Malayan Box Turtle occurs in Malaysia. It occurs throughout Peninsular Malaysia as well as in Sabah and Sarawak on Borneo (Figure 1).

In Malaysia and elsewhere in its range countries the Southeast Asian Box Turtle is considered the most common freshwater turtle (IUCN, 2007). Nevertheless, the survival of the species is in peril due to over-exploitation. Of the hard-shelled turtle species in Asia, the Southeast Asian Box Turtle has the highest exploitation rate in Asia (Anon., 2002a; UNEP-WCMC CITES Trade Database, 2007), and is the species most sought after by East Asian consumers (for meat and as tonic food) and Traditional Chinese Medicine (TCM) markets (Ades *et al.*, 2000; Cheung and Dudgeon, 2006). Thousands of *C. amboinensis* are harvested annually in Southeast Asian source countries and exported (van Dijk *et al.*, 2000).

The Southeast Asian Box Turtle has a slow reproductive cycle characterized through late maturity and limited number of eggs (Ernst *et al.*, 2000). As a result, it is feared that the continuous high-volume exploitation in combination with its life history might lead to serious population reductions and finally to local extinction.

The Southeast Asian Box Turtle was first assessed by the IUCN Red List of Threatened Species in 1996 as “Low Risk: Near Threatened” (Baillie and Groombridge, 1996) before it was revised to Vulnerable in 2000 (Hilton-Taylor, 2000). In the same year, all species under the genus *Cuora* were listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), bringing requirements of legal provenance and sustainable management to any trade in the species (Anon., 1999; CITES, 2007). In terms of limiting trade to sustainable levels, Article IV of the Convention requires a non-detriment finding (NDF) to be made prior to the issuance of any export permit. A thorough NDF would examine levels

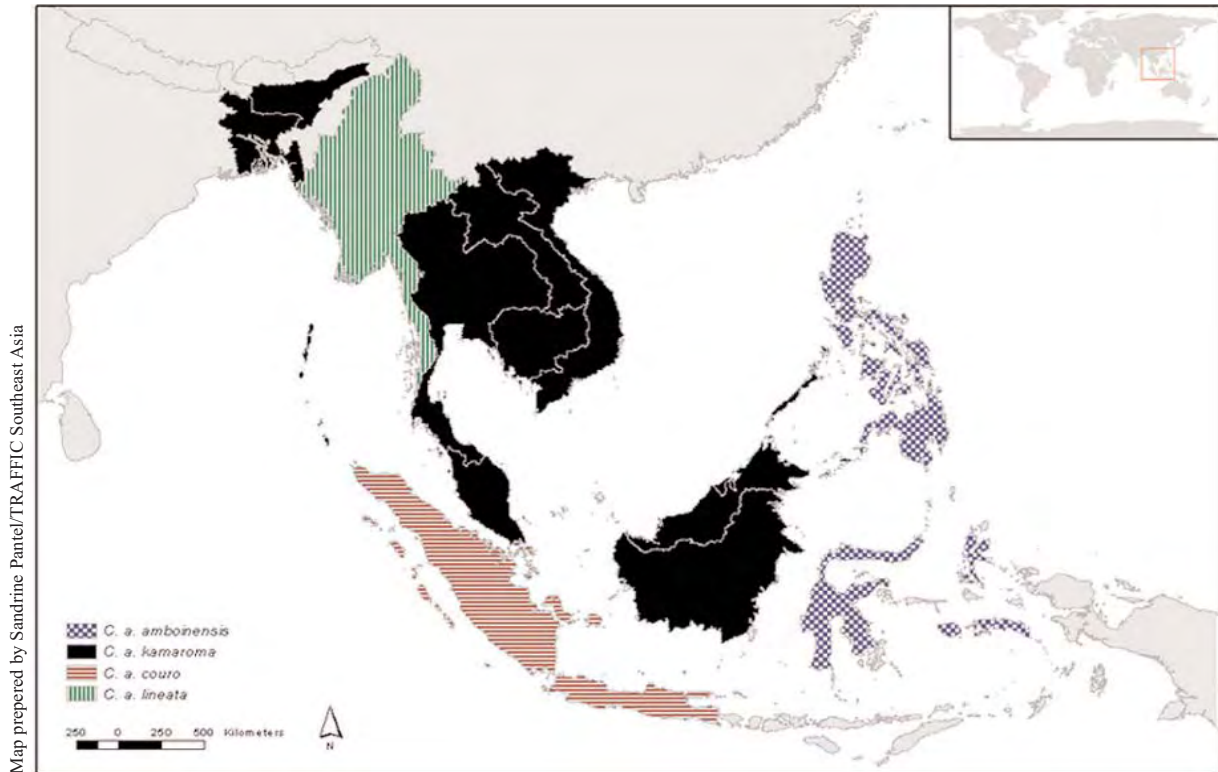


Southeast Asian Box Turtles *Cuora amboinensis* are weighed by crates at trade houses of suppliers

Sabine Schoppe/TRAFFIC Southeast Asia

Figure 1

Distribution of the four *C. amboinensis* subspecies. The Malayan Box Turtle (*Cuora amboinensis kamaroma*) occurs all over West and East Malaysia



of trade with reference to any negative or detrimental effects to the survival of wild populations, and assess various aspects of the biology and ecology of the species, its distribution, abundance and exploitation. The formulation of sustainable management strategies for Appendix II-listed species often includes the setting of annual harvest and export quotas.

A comprehensive NDF study requires expertise, time and funding – including the establishment of a practical monitoring system to allow for further data to be collected over time, so that changes in the species population dynamics due to harvest can be measured. An “adaptive management” approach would therefore consider these changes towards subsequent adjustments to the management regime and the annual quota. Until now, there are very few examples where Southeast Asian countries have undertaken detailed NDFs and made public the results. No range State is known to have carried out a NDF for the Southeast Asian Box Turtle.

Due to this cumulative set of factors, TRAFFIC selected *C. amboinensis* as a pilot study for science-based management by determining the conservation status of the species in Malaysia, considering that Malaysia is one of the main exporting countries. In line with this, the present study aimed to accomplish the following objectives:

- To review information on the biology and ecology of the Southeast Asian Box Turtle;
- To assess the effectiveness and implementation of legislation pertaining to freshwater turtle conservation in Malaysia;
- To determine past and current trade levels and activities; and

- To assess the abundance of the species in the country.

In addition, this study aims to support Malaysia in its leadership role in the implementation of the Regional Action Plan on Trade in Wild Fauna and Flora 2005-2010 of the Association of Southeast Asian Nations (ASEAN) wherein Malaysia committed to exchanging information on permit issuance, regional market dynamics and trade flows to improve understanding of producer-consumer relationships, including re-exports, in the region; encouraging research activities to ensure that sufficient biological and population dynamics information is available on species in trade in order to undertake non-detriment findings (NDFs) and to establish export quotas; and establishing a mechanism by which information about CITES-listed species may be shared, with a particular focus on illegally traded species found in more than one country (Anon., 2005).

METHODOLOGY

Malaysia is composed of eleven mainland States (Johor, Kedah, Kelantan, Melaka, Negeri Sembilan, Pahang, Perak, Perlis, Pulau Pinang, Selangor, and Terengganu) constituting Peninsular Malaysia or West Malaysia, two island States (Sabah and Sarawak) on Borneo forming East Malaysia, and one federal territory with three components, city of Kuala Lumpur, Labuan, and Putrajaya (Figure 2).

Figure 2
Map of Malaysia with political boundaries of the various states



The various ethnic groups in Malaysia treat freshwater turtles and other wildlife differently; therefore, the composition of the Malaysian populace is here mentioned. Malaysia has 24 821 286 million

inhabitants as of July 2007. Fifty percent (50.4%) are Malay, 23.7% Chinese, 11% indigenous people, 7.1% Indian, and 7.8% others (CIA, 2007).

Surveys for this study covered all Malaysian States. Some preliminary surveys were conducted in Selangor in July 2006. Continuous surveys were conducted from early September to the end of December 2006 (Selangor Sept. 21-23, Perak Sept 25-28, Johor Oct 4-6, Melaka and Negeri Sembilan Oct 7, Perak Oct 14-15, Sabak Bernam Oct 16-17, Pahang Oct 18-20, Selangor Oct. 24, Kelantan/Terengganu Oct 31-Nov 6, Sabah Dec. 3-8, and Sarawak Dec. 18-23, 2007). All surveys were carried out with Malaysian counterparts who assisted as guides and translators. A population survey was done in collaboration with Universiti Kebangsaan Malaysia (UKM). Local currency was converted into USD based on the mean exchange rate for the months July to Dec 2006, whereby 1.00 USD = 3.65952 MYR.

In Malaysia, the dry season usually starts in November and extends to March, and the wet season typically covers the months of April, May, September and October. According to local turtle collectors, the Malayan Box Turtle is best collected during the rainy months.

Biology and Ecology of the Southeast Asian Box Turtle

Published and unpublished material on the habitat, role in the ecosystems, reproduction and growth, and morphology of the Southeast Asian Box Turtle in general and on the Malayan Box Turtle specifically was compiled, enriched with observations during the present study and analysed. Information and references on general habitats and on protected areas with habitats for the Malayan Box Turtle was compiled based on information from protected area management staff, relevant government institutions, NGOs, academics, references on protected areas, field surveys, and interviews. Almost nothing is known on the growth of the species; hence, most of the information presented here is based on studies of the author on the Southeast Asian Box Turtle from Palawan where growth of the local subspecies was monitored for a four-year period (Schoppe and Dolorosa, *in prep.*). Published morphological data were compared with values that were gathered during the present study. For the latter, specimens encountered in the wild and at traders were considered. A detailed description on how and what measurements were taken is provided in the chapter on trade surveys (see below).

Conservation status of the Southeast Asian Box Turtle

The global conservation status of the species is based on the latest Red List of Threatened Species published by the International Union for the Conservation of Nature (IUCN, 2007) and the Convention on International Trade of Endangered Species of Wild Fauna and Flora, CITES (CITES, 2007). The national conservation status is based on the local legislation and on studies that provide information on abundance and trends.

Laws and regulations for the conservation of freshwater turtles

Information on management issues of CITES Appendix II-listed species was obtained from CITES online references (www.cites.org). Information on national and state legislation in place to regulate the harvest and trade in the Malayan Box Turtle was compiled from relevant offices such as the CITES Management Authorities of Peninsular Malaysia, Sarawak and Sabah, concerned NGOs such as WWF – Malaysia, Wetland International Malaysia, and academic institutions. The enforcement of these laws was examined and analysed based on interviews with law enforcement officers as well as traders.

Past trade levels of the Southeast Asian Box Turtle

Past trade data derived from CITES annual reports, CITES Trade Database maintained by UNEP-WCMC, herpetologists, traders, seizure records, and press releases were compiled and analysed. The trade review focuses on the time about 10 years before the inclusion of the Southeast Asian Box Turtle in Appendix II of CITES in 2000 through to 2006.

Current trade of the Malayan Box Turtle

Until 2003, the Malayan Box Turtle had been exported from Malaysia to China for consumption and TCM. In 2004, the CITES MA (PERHILITAN) of Malaysia banned the collection of the species for export. Since there is no legislation in Peninsular Malaysia to regulate the collection and trade within the country, local trade is openly accessible. The present study tried to identify those involved in use and trade (users), the purposes of collection (uses), and to determine the quantity and quality (size, life history stage and price) of trade. In line with different legislation as well as ethnic groups inhabiting West and East Malaysia, results are provided separately for Peninsular Malaysia, Sabah and Sarawak.

Users and uses of the Malayan Box Turtle were assessed based on wet market surveys, pet and aquarium shop surveys and interviews with residents, owners or labourers at reptile selling/keeping outlets in all major cities. Companies that were registered for the export of the Malayan Box Turtle before the ban and collectors, middlemen and suppliers to those exporters as well as to the local markets were also included in the survey. The addresses of some former exporters in Selangor were obtained from PERHILITAN headquarters in Kuala Lumpur. The addresses of additional traders in Selangor and other states were obtained through field interviews and asking local consumers and/or collectors and small-scale middlemen. Addresses of eventually unregistered reptile dealers were obtained by carefully interviewing collectors, pet shop staff, market vendors, registered traders or local residents.

To qualify and quantify the traded Malayan Box Turtles, the stock of the species present at the day of visit was assessed in terms of abundance, size, weight and sex. Since traders often had high numbers of individuals, and since some of the traders did not feel comfortable about the presence of researchers in their establishments, efforts were made to measure at least 10 individuals (5 male and 5 female) or if possible 10% of the stock. In some places where the species was illegally traded, measuring specimens was not carried out, if it was feared this might jeopardise the confidence of the trader.

In addition to the above which reflect the quantity and quality of trade for the day of survey, an extensive harvest survey was conducted from 21 Nov. to 27 Dec. 2006 in Sabak Bernam, Selangor. The site was selected since it is a renowned collection and trade centre for the Malayan Box Turtle and other turtle and reptile species. Two traders agreed to participate in the survey. They were visited at least once per week, and every time they informed the researchers that they had received new stock. The Malayan Box Turtles encountered were monitored in terms of the total number individuals and the relative percentage of females, males and juveniles. Furthermore, all individuals were measured and weighed following standard procedures. For all individuals that were measured, standard measurements such as median carapace length (MeCL), maximum carapace width (MaCW), median plastron length (MePL), plastron width 1 (PW1, at hinge), plastron width 2 (PW2, max. width at femorals), body height (BH), and body weight (Wt) were taken with callipers and kitchen scales, respectively.

Trade routes of the Malayan Box Turtle are described based on information gathered through interviews with traders (collectors, middlemen, suppliers and exporters).

Alternative production systems

Surveys were conducted to find out whether anybody in the country breeds the species. Information on breeding success was compiled from primary and secondary resources including other countries. The positive and negative factors influencing captive breeding of the Southeast Asian Box Turtle are discussed in relation to its life history.

Abundance of the Malayan Box Turtle in the wild

A population survey was conducted in a plantation in Batu Dua Sepintas, Sabak Bernam, Selangor from 21 November to 28 December 2006 (Figure 3). The study area is rectangular, extending over a length of about 650 m and a width of about 450 m, hence covering an area of 292 500 m² or 29.25 ha. The corner points of the area are geographically located at 03°47.409'N 100°59.895'E, 03°47.464'N 101°00.348'E, 03°47.654'N 101°00.206'E, and 03°47.249'N 101°00.041'E. It is a mixed plantation of 2-3 year old oil palms combined with banana plants, four-year-old oil palms, oil palms with banana, coconut palms, young and old bananas, and an area with pure oil palms. The plantation is surrounded by drainage channels, the water level of which depends very much on the weather. After a few days without rain the water level immediately drops and the water becomes stagnant, black and putrid. The aquatic flora was dominated by Water Spinach *Ipomoea aquatica*, free-floating *Azolla pinnata*, filamentous green algae, and the invasive Water Hyacinth *Eichornia crassipes* and Water Fern *Salvinia auriculata*. Vertebrates encountered in the drainage around the plantation included the Small-clawed Otter *Aonyx (Amblonyx) cinerea*, cat fishes *Clarias* spp., Climbing Perches *Anabas testudineus*, gouramis *Trichogaster* sp., snakeheads *Channa* sp., *Rasbora* sp., eels, several amphibians, Reticulated Python *Python reticulatus*, Water Monitor Lizard *Varanus salvator*, Black Marsh Turtle *Siebenrockiella crassicollis*, and the Asian Softshell Turtle *Amyda cartilaginea*.

The site is a known collection site for the Malayan Box Turtle (Sohor, Farmer, Batu Dua Sepintas, pers. comm., 25 Nov. 2006). According to turtle collectors in Sabak Bernam, people had stopped collecting in the site and had moved to areas around Sungai Ayer Tawar near Kg. Baru. Sabak Bernam is home to two well-known reptile traders who are supplied by collectors from Sabak Bernam as well as from nearby villages. According to one trader, the turtle price was low during the survey period and despite being turtle collection season (rainy season with good turtle catch), none of the suppliers collected the turtles (Bah Sam Kow, pers. comm., 21 Nov. 2006). Pythons were preferred as the price was higher. Turtles were rather accidental catches or brought in by non-professionals, including plantation workers and farmers, as well as by children.

Figure 3
Location of Kampong Sepintas, Sabak Bernam (circle) where the study site for the population survey was established



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Sabine Schoppe/TRAFFIC Southeast Asia

Figure 4: Funnel trap used in Sabak Bernam (22.11.06)

The Schnabel's capture-recapture method for closed population was applied (Krebs, 1998). A closed population is one that does not change in size during the study period: that is, the effect of births, deaths, and movements are negligible. Thus, populations are typically closed over only a short period. The method makes the following assumptions: the population size is constant without recruitment or losses, sampling is random, and all individuals have an equal chance of capture in any given sample. The major advantage of the multiple sampling in a Schnabel experiment is that it is easier to pick up violations of these assumptions. The assumption of dealing with a constant population size is justifiable considering that the study was conducted over a short period. The study was conducted daily for more than five consecutive weeks (38 days). Animals were collected mainly with baited funnel traps that were checked every

morning between 7-10:00 am. In addition, Visual Encounter Surveys were sporadically conducted in the early morning and in the late afternoon after dusk. Pitfall traps were not feasible in the area. The funnel traps were baited with bananas and/or dough made of flour and shrimp paste and set in water bodies of the drainage channels. Ready-made funnel traps that are locally sold to catch marine/estuarine crabs and freshwater turtles were used (Figure 4). A total of 42 funnel traps were set along the approximately 2200 m of drainage that surrounded the study site (Figure 5). All Malayan Box Turtles encountered were marked by notching the marginal scutes of the carapace (Figure 6). The coding scheme for marking the turtles was modified from Sajwaj *et al.* (1998).



Figure 5 (a-d): Various sections of the drainage channels that surround the plantation in Sabak Bernam (23.11.06)

For each individual standard measurements were taken (see above). In addition, all individuals were weighed, and sexed or categorized as juveniles.

After measurements were taken, animals were released to the place of capture. Since it is unlikely that the whole population can be counted, a statistical method was used to estimate population size and

density (Blomberg and Shine, 1996). Once the entire survey was finished the population size was estimated after Schumacher and Eschmeyer based on the compiled field records (Krebs, 1998):

$$N = \frac{\sum_{t=1}^s (C_t \times M_t^2)}{\sum_{t=1}^s (R_t \times M_t)}$$

The variance of the Schumacher estimator is obtained from linear regression theory as the variance of the slope of the regression. In terms of mark-recapture data,

$$\text{Variance } \frac{1}{N} = \frac{\sum (R_t^2 / C_t) - (\sum R_t \times M_t)^2 / \sum (C_t \times M_t^2)}{s - 2}$$

The standard error of the slope of the regression is obtained as follows:

$$\text{Standard error } \frac{1}{N} = \sqrt{\frac{\text{Variance } (1/N)}{\sum (C_t \times M_t^2)}}$$

Whereas:

C_t = total number of individuals caught in sample t

R_t = number of individuals already marked when caught in sample t

M_t = number of marked individuals in the population just before the sample t is taken

s = total number of samples

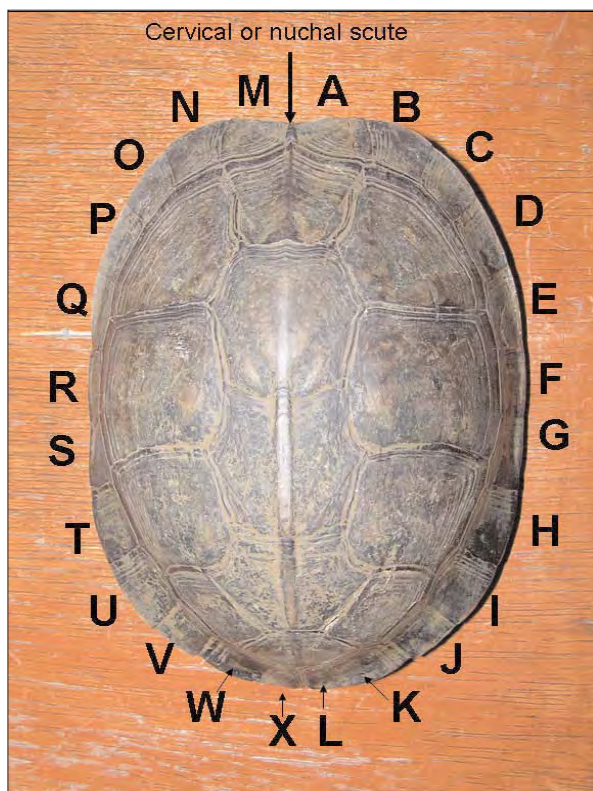


Figure 6: Notching system used to mark individual turtles

The mean size and standard deviation of adult males, adult females, and juveniles was computed based on the measurements of all individuals in the respective life history group. The relative composition of the population in terms of the numbers of mature and immature was also calculated, as was the sex ratio for adult individuals. The size frequency distribution of all individuals is illustrated in histogram using 10 mm intervals.

This animal has the ID code "0"



Additional information on the abundance of the Malayan Box Turtle in the wild and therewith also on impact harvest had has or has was gathered through interviews that were conducted with local residents, store owners, market vendors, collectors, traders, farmers and recreational fishermen. Interviews were not systematic nor were questionnaires or lead questions used. Interviews were rather informal aimed at getting information on the local distribution, abundance now and 5-10 years ago, and threats.

RESULTS AND DISCUSSION

Habitat

The present study found individuals in various natural and manmade habitats. Among natural habitats, individuals were found in swamp and peat swamp forests, marshes, permanent or temporary wetlands, and shallow lakes. The subspecies was also observed in manmade habitats such as flooded rice fields, oil palm and rubber plantations, drainages, irrigation ditches, channels, orchards, ponds and pools near residential areas. The above findings concur with Sharma and Tisen (2000) who stated that the subspecies is widespread in Peninsular Malaysia where it is found in rice fields, irrigation canals, *Melaleuca* swamps, freshwater swamps, lake and ponds, rubber and oil palm plantations, and riparian habitats. Lim and Das (1999) lists lowland water bodies with soft bottoms and slow currents, such as marshes, swamps, ponds, pools in streams, and also manmade flooded rice paddies, plantations such as those of oil palm, rubber, and orchards as habitats of the Malayan Box Turtle in West and East Malaysia. The Malayan subspecies does not differ in the range of habitats it occupies from the Indonesian and Wallacean Box Turtle subspecies. The same range of habitats was identified for the other two subspecies in a similar survey in Indonesia (Schoppe, *in prep.*).

Thanks to its ability to cope better than most turtle species with environments altered by man, Moll (1997) accurately described the Southeast Asian Box Turtle as generalist. Sharma and Tisen (2000) further stated that due to its diverse habitat types, there appears to be ample habitat for the species. However, most of the natural habitats of the species especially peat swamp areas have been cleared and drained for agriculture, settlement and other human activities (UNDP, 2006). Jenkins (1995) identified loss and degradation of natural habitats as threats of the species. Malaysia is currently the world's largest producer of palm oil (Khoo Khee and Chandramohan, 2002) the plantations of which cover former peat swamp areas. Peat swamp forests are in fact the most threatened wetland habitats in Peninsular Malaysia (PERHILITAN, 1992). Numbers provided by the Department of Wildlife and National Parks (PERHILITAN) show that peat swamp forests covered about 2.6 million acres (= 1 052 220 ha) in 1975, which is about 50% of what existed in the 1950s, and coverage is further decreasing. While former peat swamp areas were converted to agricultural lands, *Melaleuca* swamps – another important habitat of the species – had to give way for coastal development (Sharma and Tisen, 2000).

Of 1 563 180.9 ha conservation areas in Peninsular Malaysia, only 4459 ha (0.3%) are peat swamp and swamp areas and these are composed of only two areas in Selangor (Kuala Langat Selatan and Sungai Dusun), while all other conservation areas are forests and a few mangroves (PERHILITAN, 1992).

Oil palm plantations may be considered to constitute a new manmade habitat for the Malayan Box Turtle, as the species readily accepts oil palm plantations if they are wet enough to satisfy the turtle's requirements for water. One main disadvantage of manmade versus natural habitats for the species is

that individuals are much more accessible and easier to collect. Plantation workers collect the animals during their daily work. Hence, the adaptation of the species to human agricultural practices, once of advantage to the species, now leads to faster and more effective exploitation. This had been previously assumed by Gavino and Schoppe (2004) for the Palawan subspecies in manmade rice field habitats, and by Schoppe (*in prep.*) for the Indonesian subspecies. Sharma and Tisen (2000) had highlighted the fact that the Malaysian subspecies is not protected by State or federal wildlife law, makes capture in agricultural areas (oil palm and rubber estates), legal and that this will certainly lead to localized depletion.

Drainage and irrigation works also have a significant impact upon the environment. Among others they lead to the destruction of wetlands (Gregory and Sharma, 1997). Pollution of waterways, and possibly, incidental capture in fishing gear were other identified threats of the species in Borneo and Peninsular Malaysia (Lim and Das, 1999). There are however no quantitative data on pollution and its impact on the species. If pollution constitutes a serious problem for the species, the additional habitats provided by rice paddies and oil palm plantations become deadly traps for the species. Use of pesticides in rice fields was listed as one of the causes of population decline by numerous respondents during the course of this study.

With the information at hand, it is believed that the adaptation of the Malayan Box Turtle to manmade habitats has made it even more readily accessible for harvest. Considering that the safety of wild species in designated protected areas cannot be granted, it is assumed that none or only very few assurance populations of the species exist in the country.

Role in the ecosystem

Little is known about the long-term or large-scale consequences of the loss of reptiles from freshwater ecosystems (Cheung and Dudgeon, 2006). Turtles play a central role in their ecosystem's food chain either as predators of various invertebrates, or as prey species. Turtle eggs as well as a significant proportion of hatchlings are an important source of food for monitor lizards, crocodiles, herons and other riverine birds, and small mammalian predators such as civets (e.g. Moll and Moll, 2004). Information on the scale of predation on eggs and hatchlings is not available for any of the Southeast Asian Box Turtle subspecies nor for other Asian turtle species, but egg and hatchling survival of North American aquatic turtles is reported to be low and mortality mainly caused by predation. The common and widely distributed North American Painted Turtle *Chrysemys picta* and the Southeast Asian Box Turtle have similar size, sex ratio and age at maturity. For the Painted Turtle 92% mortality was recorded between egg laying and arrival of hatchlings at pond (Wilbur, 1975). A later study on the same species estimated 54% mortality, mainly due to predation (Mitchell, 1988).

In the wild, the Southeast Asian Box Turtle has an omnivorous but primarily vegetarian diet (Rogner, 1996), but shows preference for a carnivorous diet in captivity (Schoppe, *pers. obs.*). The species forages on aquatic plants, aquatic insects, molluscs, and crustaceans in the water and on plants, fungi, and worms on land (Lim and Das, 1999). Because of its consumption of worms and molluscs, some of which might act as intermediate hosts for various human diseases, this species may help to stem diseases (van Dijk, 2000). In determining the importance of Southeast Asian Box Turtle as a seed disperser it has been noted that fruits of five important trees e.g. fig trees *Ficus* sp., Indian Mulberry *Morinda citrifolia* are consumed (P. Widmann, Scientific Consultant, Katala Foundation Inc., Palawan, Philippines, *in litt.*, 18 Aug. 2006). Significant ecological impacts of turtle species loss might include

changes in energy flow, nutrient cycling and food-web structure, with heavily exploited species reduced to a level at which they become functionally extinct well before extirpation has taken place (Cheung and Dudgeon, 2006). Unfortunately, ecological studies of most Asian herpetofauna are extremely limited and, in this regard, Asian turtles have been described as “truly forgotten and ignored creatures” (Thirakhupt and van Dijk, 1994: 208; see also Moll and Moll, 2004).

Despite only limited information available, it is evident that the temporary or permanent removal of the Southeast Asian Box Turtle from its ecosystem leads to an imbalance but the gravity of this and the whole range of consequences cannot currently be estimated.

Morphology

Within the course of this study, 641 Malayan Box Turtles 608 were from Peninsular Malaysia and 33 from Sarawak were measured and weighed (Table 1). No specimens were measured in Sabah because most individuals were encountered in aquarium shops the owners of which did not allow handling of their animals. On the Peninsula, the largest individual (a female), measured 215 mm MeCL and weighed 1880 g. The largest male individual encountered on the Peninsula measured 210 mm MeCL and weighed 1250 g followed by 209 mm MeCL and a weight of 1420 g. The individuals that were measured in Sarawak only reached a maximum MeCL of 181 mm and 195 mm and a weight of 800 g and 850 g for female and male, respectively. The heaviest individual was a female with a weight of 1050 g at a median carapace length of 167 cm. Individuals measured in Sarawak weighed much less than individuals of similar size that were encountered in Peninsular Malaysia.

Table 1
Means and standard deviation (SD) and range in median carapace length and weight, and means \pm SD of other morphological data taken from Malayan Box Turtles in Peninsular Malaysia and Sarawak

		n	MeCL (mm)	MaCW (mm)	MePL (mm)	PW1 (mm)	PW2 (mm)	BH (mm)	Wt (g)
Peninsular	Male	217	181.5 \pm 15.2	132.9	164.6	83.9	93	75.7	916.9 \pm 204.9
			128.0-210.0	\pm 8.7	\pm 12.7	\pm 6.8	\pm 7.8	\pm 6.1	300-1420
	Female	362	173.5 \pm 23.0	133	166.9	85.5	90.8	80.2	933.2 \pm 338.7
			107.0-215.0	\pm 14.7	\pm 23.1	\pm 10.4	\pm 12.2	\pm 11.7	200-1880
	Juvenile	29	86.3 \pm 15.6	73	80.2	46.1	44.8	41.6	124.9 \pm 61.0
All	608	56.6-112.0	\pm 12.2	\pm 15.8	\pm 7.1	\pm 8.7	\pm 8.2	31-180	
Sarawak	Male	13	130.1	161	82.9	89.4	76.8		
			172.0 \pm 28.5	\pm 18.1	\pm 26.9	\pm 12.3	\pm 14.6	\pm 12.8	888.3 \pm 335.7
	Female	16	151.9 \pm 23.6	114	138	73.3	81.7	63	548.5 \pm 193.7
			116.0-195.0	\pm 11.0	\pm 19.0	\pm 7.4	\pm 11.3	\pm 6.8	240-850
	Juvenile	4	156.4 \pm 19.1	120.4	150.5	79.3	84.7	67.8	666.3 \pm 265.4
All	33	124.0-181.0	\pm 11.6	\pm 21.3	\pm 8.7	\pm 10.8	\pm 8.0	250-1050	
All Malaysia	641	73.8 \pm 17.3	64.5	69.2	43.9	41.6	34.3	72.5 \pm 53.2	
		57.0-98.0	\pm 14.5	\pm 16.4	\pm 10.2	\pm 10.5	\pm 6.5	30-150	
			111.1	135.7	72.6	78.3	61.8		
			144.6 \pm 33.5	\pm 21.1	\pm 32.2	\pm 13.8	\pm 17.5	\pm 12.8	547.9 \pm 287.4
			129.2	160.6	82.4	88.8	76		
			\pm 18.7	\pm 27.8	\pm 12.6	\pm 15.0	\pm 13.2	871.2 \pm 341.8	

Comparison of maximum medium carapace lengths of the Indonesian Box Turtle (214 mm), the Wallacean Box Turtle (200 mm) and the Malayan Box Turtle (215 mm) from Indonesia (Schoppe, *in*

prep.) showed that individuals of the Malayan Box Turtle in Malaysia and in Indonesia grow to a larger size than the other two subspecies. Lim and Das (1999) stated that the Malayan subspecies can reach 250 mm. This supports the assumption that the Malayan Box Turtle is the largest of the subspecies. It is assumed that size and weight in combination with geographic distribution and abundance makes the Malayan Box Turtle the preferred and most common subspecies on the Chinese food markets. This is supported by statements of traders who stated that the Malayan Box Turtle is the preferred subspecies in the consumption trade because of its larger size and higher meat quality (Lim Hau Tiong, Exporter, Medan, Indonesia, pers. comm., 20 May 2006, and Pak Ian, Virensa Anugrah, Export company, Medan, Indonesia, 25 May 2006).

No quantitative study has ever looked into size classes of traded Southeast Asian Box Turtles therefore comparative data are negligible. Moll had measured Malayan Box Turtles from Peninsular Malaysia between 1975 and 1989 (E.O. Moll., Professor Emeritus of Zoology at Eastern Illinois University, *in litt.* 12 January 2007, and 7 June 2007). The male had a mean MeCL of 181.8 mm (n=17), and the females averaged 179.9 mm (n=21). Moll's males and females were 0.3 mm and 6.4 mm larger than those measured during the course of this study (Table 1). This might indicate that traded individuals, especially females, declined in mean size over the years but comparative data are too few for a reliable analysis and conclusion.

A decline in size was noted for the Malayan Giant Turtle *Orlitia borneensis* and the Elongated Tortoise *Indotestudo elongata* at markets in South China (Lee *et al.*, 2004), for the Elongated Tortoise in western Thailand (Thirakhupt and van Dijk, 1994), for the Red-eared Slider *Trachemys scripta elegans* in North America (Close and Seigel, 1997), and the Columbian Slider *T. callirostris callirostris* in South America (V.P. Paez, University of Antioquia, *in litt.*, 12 January 2007). Thirakhupt and van Dijk (1994) interpret the smaller average size of traded Elongated Tortoises compared to those of individuals in protected areas as being caused by long-term removal of adults. The same trend is noticeable but not yet supported with data for the Asian Softshell Turtle traded in Thailand (P.P. van Dijk, *in litt.*, 11 January 2007). The present research concurs with assumptions of van Dijk that a decrease in average size of turtles in trade is probably a sign of ongoing long-term exploitation at modest intensity, in contrast to intensive exploitation of a previously undisturbed population.

Growth and reproduction

There are neither published studies on the growth rate of the Southeast Asian Box Turtle nor on size at maturity. So far unpublished studies on captive animals from Palawan have revealed that it takes about 14-16 or a mean of 15 months for individuals to grow to a MeCL of ≥ 115 mm and therewith reach subadulthood (Schoppe and Dolorosa, *in prep.*). During these first 15 months, the daily growth rate ranges from 0.06-0.39 mm (mean 0.18 mm/day). The daily growth rate is fastest during the first (0.39 mm/day), second (0.37 mm/day) and third month (0.26 mm/day) after hatching (mean 0.34 mm/day). Assuming a mean growth rate of 0.06 mm/day for subadult animals until 24 months of age and a mean growth rate of 0.038 mm/day for adults results in four years and five months to attain an adult size of 160 mm MeCL in captivity. Praedicow (1985) observed maturity of females at 5-6 years and of males at 8-9 years. In a sister species, the Chinese Three-striped Box Turtle *Cuora trifasciata*, it takes about 7-8 years until maturity is reached in semi-natural conditions (Meier, 2000). With enhanced feeding and high temperature of about 30°C maturity might be reached at an age of 3 years (Meier, 2000). Moll observed a captive male Malayan Box Turtle that appeared to be mature in its fifth year (E.O. Moll, Professor Emeritus of Zoology at Eastern Illinois University, *in litt.*, 13 January

2007). Growth is usually slower in the wild than under proper captive conditions since captive animals are given food on a regular basis and therefore have better growth performance. It is therefore assumed that maturity in the wild is retarded by at least a year. It is presumed that it takes about 5½-6 years to attain maturity in the wild (Schoppe, *pers. obs.*). This information on growth is very important for the consideration of captive breeding as an alternative production system.

Once maturity is reached, the species is known to lay two to four clutches, usually of only two eggs (Ernst *et al.*, 2000). Lim and Das (1999) confirmed this but stated that exceptionally a total of 4-6 eggs can be produced. The present study considers a mean of three clutches, each with two eggs per year. The average reproductive output of a mature female would then be six eggs per year. Mortality of eggs and early juveniles is estimated to be roughly around 50% (see Wilbur, 1975; Mitchell, 1988), hence one female can probably only produce three juveniles in one year. Life expectancy is 25-30 years; a maximum age of 38.2 years was recorded for an animal in captivity (Bowler, 1977).

The relatively slow growth and the low reproductive rate of the Southeast Asian Box Turtle result in a slow turnover rate of breeding individuals in a population. Accordingly, generation length that can be defined as ‘the average age of reproducing animals’ or ‘the time it takes for an animal to be replaced by its offspring’ is extensive. Generation time can be approximated by taking the median or mid-point between age at maturity and age at mortality. In the case of the Southeast Asian Box Turtle, that would be $6 [= \text{age at maturity}] + 1/2 * (30 - 6) [\text{half of reproductive life-span}] = 6 + 1/2 * 24 = 6 + 12 = 18$ years generation time.

Demographic studies on the North American Ornate Box Turtle *Terrapene ornata ornata* revealed an adult population growth rate (λ) of 1.006 (SE = 0.065); this would result in a 58% probability of a population decrease over a 20-year period (Converse *et al.*, 2005). Converse *et al.* (2005) conclude that significant human disturbance, such as commercial harvest or turtle mortality on roads, represents a potential risk to box turtle populations. No such studies are available for Asian freshwater turtles.

Conservation status of the Southeast Asian Box Turtle

After being recognized as potentially threatened in 1996, the Southeast Asian Box Turtle was first listed as “Lower Risk: Near Threatened” in the IUCN Red List of Threatened Species (Baillie and Groombridge, 1996). When studies found that the global population continued to decline rapidly, the species was upgraded to “Vulnerable” during the next IUCN Red List assessment in 2000 (Hilton-Taylor, 2000).

This status is in line with the IUCN Red List of Threatened Species criteria A1d+2d of version 2.3: “a taxon is classified Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by an observed, estimated, inferred or suspected reduction of at least 20% over the last 10 years or three generations, whichever is the longer, based on actual or potential levels of exploitation” (A1d) and because “a reduction of at least 20%, is projected or suspected to be met within the next ten years or three generations, whichever is the longer, based on actual or potential levels of exploitation” (A2d). Since 2000, the status of the species has not been assessed again (IUCN, 2007). Considering that three generations of the Southeast Asian Box Turtle take about 54 years, this translates to a reduction of at least 20% between 1946 and 2000, which was the year of assessment, and further reduction of at least 20% between 2000 and 2054.

Within its global range, no quantitative information on the abundance of Southeast Asian Box Turtle populations is available. A range State evaluation of the status for the IUCN Red List classified the species “vulnerable” in Malaysia (Asian Turtle Working Group, 2000; IUCN, 2007). Sharma and Tisen (2000) stated that the Malayan Box Turtle appears to be abundant in most Malaysian States that still have swamps and manmade wetland habitats such as rice fields, irrigation canals and ponds. At the same time, Sharma and Tisen found that the capture of individuals from the wild undoubtedly contributes to population reduction, particularly in areas where harvesting is regular and in large quantities. The Malayan Box Turtle is among the three most common species in trade in Malaysia (Jenkins, 1995; Lim and Das, 1999). It was reported to be “widely found and extensively exported” to China (Ministry of Science, Technology and Environment of Malaysia *in litt.* to German CITES Scientific Authority, 9th June 1999). Due to extensive and regular collection, this subspecies experienced reduction in numbers in multiple locations in Malaysia (Sharma, 1999; Sharma and Tisen, 2000). Azrina and Lim (1999) categorize the Malayan Box Turtle as “common and vulnerable” and highly exploited in Selangor. There is neither a historical record of population abundance of any non-marine turtle species for Sarawak (Jensen and Das, 2006) nor for Sabah.

Laws and regulations for the conservation of freshwater turtles

Peninsular Malaysia

The *Fisheries Act 1985* (Anon., 1985) allows for controlled exploitation of native turtles and their eggs in Malaysia provided that each State draws up legislation and regulations regarding turtles and inland fisheries. Of the eleven peninsular States, only six (Kedah, Negeri Sembilan, Melaka, Johor, Kelantan, Terengganu) have laws pertaining to the protection and regulation of exploitation of some turtle species, and three States (Pahang, Penang, and Perak) had draft documents under review in 1997 (Gregory and Sharma, 1997). Until today these draft have not been finalized. Perlis and Selangor do not have any law to protect tortoises and freshwater turtles (Gregory and Sharma, 1997; Sharma and Tisen, 2000). None of the 11 States regulates in any way the exploitation of the Malayan Box Turtle. Freshwater turtles and tortoises are however state subject matters over which the federal government has no jurisdiction. Hence without state-based laws to regulate the exploitation of freshwater turtles and tortoise, there will not be any federal law either.

The primary legislation for the protection of wildlife in Peninsular Malaysia is the *Protection of Wild Life Act 1972* (Anon., 1972), which is implemented by PERHILITAN. The Act categorizes wild animals into totally protected and protected species as listed in the schedules of the Act. Totally protected species are not permitted to be handled in any way unless given approval by the Ministry and unless it is for non-commercial purposes only. For protected species, licences are given for activities such as hunting, keeping and trading. Tortoises and freshwater turtles, fishes and amphibians are not covered by the Act. Peninsular Malaysia has no specific CITES implementation legislation, but an amendment to the Protection of Wildlife Act 1972 in 1991 added CITES Appendix I, II and III animals to the schedules of protected animals (Anon., 1991). However, no amendment was made to include taxonomic groups such as chelonians to the scheduled lists. Hence, until today freshwater turtles even those species that are listed under Appendix II of CITES do not receive any kind of local protection or harvest regulation in Peninsular Malaysia.

The lack of specific legislation concerning the conservation of freshwater turtles including the Malayan Box Turtle in Malaysia makes these species extremely vulnerable to over-exploitation. This has already been highlighted and criticised previously by various authors (Jenkins, 1995; Gregory and Sharma, 1997; Azrina and Lim, 1999; Sharma, 1999; Shepherd *et al.*, 2004).

Sabah and Sarawak

With their entry into the Federation in 1963, the States of Sabah and Sarawak were granted special rights and powers.

In Sabah, the *Parks Enactment 1984* provides blanket protection to all animals from exploitation within the boundaries of Sabah's parks (Anon., 1984). Other than that Sabah's wildlife is managed and conserved through the *Wildlife Conservation Enactment 1997* (Anon., 1997). Wildlife species are divided among four schedules. Only four species of turtles are protected. Two marine species are considered totally protected and consequently listed under Schedule I. The Asian Brown Tortoise *Manouria emys* and the Malayan Giant Turtle *Orlitia borneensis* are considered protected species and listed under Schedule II. Hunting of wildlife under Schedule II is limited and regulated through licences. No other chelonian is listed under the various schedules. However, the *Wildlife Conservation Enactment 1997* defines "protected" species as all those specified in Appendix I or II of CITES, Part I of Schedule I, Part I of Schedule II or Schedule III (Anon., 1997). Hence, Appendix II-listed species, including the Malayan Box Turtle, can only be collected, hunted, kept, reared, possessed and/or traded if a licence has been secured. The possession of Appendix II species or those of Part I of Schedule II or Schedule III is fined with up to USD 8197 or up to three years imprisonment or both. Furthermore, animal rights are covered by the Act and any kind of torture or infliction of pain or injury is punishable by the law.

Similar to Sabah, Sarawak's *National Parks and Nature Reserve Ordinance 1998* protects all kind of wildlife within the boundaries of a national park or nature reserve (Anon., 1998a). Sarawak's *Wildlife Protection Ordinance 1998* divides wildlife between two schedules whereas wild animals are under Schedule I and wild plants are under Schedule II (Anon., 1998b). Schedule I is divided into Part I (totally protected animals) and Part II (protected animals). Part I lists all marine turtle species under the families Cheloniidae and Dermochelyidae, the Painted Terrapin *Batagur borneoensis*, and the Malayan Giant Turtle. Part II lists the Asian Brown Tortoise and all native species of softshell turtles under the family Trionychidae. Under "additional species" it is here mentioned that all species of animals listed in Appendix I and II of CITES excluding those already listed in Part I are considered "protected" animals. Hunting, killing, capturing, offering for sale or claiming to offering for sale, importing, exporting, or possession of any "protected" animal requires a licence. In addition, commercial sale of any kind of wild animal (including unprotected species) excluding those that are captive bred, reared or kept in accordance with a licence, is prohibited. Furthermore, the sole possession of wildlife without licence is illegal with the exception of natives residing in Native Area Land or Native Customary Land who are allowed to possess wildlife for their own consumption, and any other person who has not more than 5 kg of wildlife for their own consumption. The possession of more than 5 kg per person is considered trade and fined accordingly. Illegal hunting, killing, captures, selling or offering for sale, importing or exporting or possession of protected species is penalized with imprisonment for one year and a fine of USD 2732.60. As with Sabah's Wildlife Conservation Enactment 1997, animal rights are also covered by the Wildlife Protection Ordinance.

Trade regulations for the Malayan Box Turtle

Malaysia became a party to CITES in 1977, and the convention came into force on 18 January 1978. The Ministry of Natural Resources and Environment (MoNRE) is the central CITES Scientific and Management Authority in the country.

The Department for Wildlife and National Parks (PERHILITAN) is the CITES Management Authority for Peninsular Malaysia. Since 1995, the Agriculture Department, the Fisheries Department and the Forestry Department are appointed additional management authorities for policy matters in Peninsular Malaysia. PERHILITAN Headquarters and the PERHILITAN offices in Penang and Johor Bahru are designated competent authorities to issue export and import permits for all fauna except fish and marine species. For fish and marine species export and import permits are issued by the Fish Health Management and Quarantine Division of the Department of Fisheries. Enforcement authorities in Peninsular Malaysia are PERHILITAN, the Department of Agriculture, the Department of Fisheries, the Forestry Department, and Interpol Malaysia. Border control is under the management of Royal Malaysian Customs.

In Sabah, the Sabah Wildlife Department is the CITES Management Authority and at the same time the Enforcement Authority for all species. The management of all marine species (including corals) except otters, dugongs and turtles falls under the authority of the Department of Fisheries. Sabah's timber and timber products are regulated by the Malaysian Timber Industry Board.

Sarawak's CITES Management Authority is the Sarawak Forest Department and since 2003 also the Sarawak Forestry Corporation. Until 2003, the Forestry Department was the sole entity in charge of wildlife management. Responsibilities were divided and the Sarawak Forestry Corporation that was created in 1995 (Anon., 1995) became responsible for resource management including research and enforcement of compliance by licensees. The Forestry Department on other hand is in charge of issuing licences. Interviews with representatives from both Government Offices revealed that both offices are unhappy with the splitting of responsibilities among them, which has led to envy and unwillingness to collaborate.

From 1998 to 2002 trade in Appendix II-listed turtle species had been regulated through national *export quotas*, which were replaced by *administrative quotas* in 2003 (Anon., 2004). Differences between the two quotas are however not clear. Already in 2004, the CITES Secretariat concluded that "Malaysia should be encouraged to explain the distinction that it makes between an '*administrative*' quota and an '*export*' quota" (Anon., 2004). PERHILITAN has explained that it defines an export quota as one which is communicated to the CITES Secretariat and which is binding for export (L.K. Seong, Assistant Director, Law and Enforcement Division, PERHILITAN, pers. comm. to NDF workshop participants, Kuala Lumpur, 20 August 2007). Administrative quotas are PERHILITAN's internal quotas. They are not communicated to the CITES Secretariat and are exclusively for internal management purposes. This has caused considerable confusion since a quota that is not known to other CITES Parties can also not be controlled and implemented and consequently the trade in the species is cannot be properly managed.

The export quota for the species was 50 000 in 2001 and 2002, and was reduced to an administrative quota of 15 000 in 2003 (Anon., 2002b). From 2005, a zero quota has been in place (Anon., PERHILITAN, pers. comm., 17 July 2006). According to a high-ranking officer of PERHILITAN, the Malayan Box Turtle will not be allowed to be legally exported again as long as it is not protected under Malaysian law (Anon., PERHILITAN, pers. comm. to the investigator, 17 July 2006). It is too difficult to regulate trade of an unprotected species.

It remains unclear what the basis is for the establishment of quotas in Malaysia. This was one of the main reasons why the trade of the Southeast Asian Box Turtle in Malaysia was recommended for

“review of significant trade” in 2002 (Anon., 2002b). As a response, the CITES MA explained that the basis for the establishment of the export quota is the realized export of the previous year and the observed stocks in collection centres (Anon., 2003). At the same time, Malaysia banned the export of the Malayan Box Turtle in 2005 (zero quota). According to the CITES MA, in 2004 only trade in wild-caught specimens from existing stocks that had been collected in 2003 was allowed (Anon., 2004). In December 2003, the enforcement unit of PERHILITAN checked and inventoried those stocks, and export of wild specimens was based on those inventories. In line with the suspension of trade in wild-collected specimens, the MA had urged traders to set up breeding operations and to stop depending on wild populations (Anon., 2004).

PERHILITAN did not answer to the CITES Secretariat’s question on how Malaysia implements Article IV for trade in the Malayan Box Turtle in Peninsular Malaysia, Sabah and Sarawak, but stated that Peninsular Malaysia is the main exporter of freshwater turtles and tortoises and that trade in those species from Sabah and Sarawak is almost negligible (Anon., 2004).

Past trade levels of the Southeast Asian Box Turtle

Official records of export volumes for the Malayan Box Turtle from Malaysia are only available from 2000 onward when the species was listed on Appendix II of CITES (UNEP-WCMC CITES Trade Database, 2007). The database does not differentiate between Peninsular Malaysia and Sabah and Sarawak but according to the MA of Peninsular Malaysia, most if not all individuals were exported from Peninsular Malaysia. Despite the lack of official records, there is evidence that numerous Malayan Box Turtles together with other tortoises and freshwater turtles were exported from Malaysia to Hong Kong (Sharma, 1999). In 1995, Hong Kong imported 25 196 individuals, and from January to August 1996, there are records for 15 818 live turtles from Malaysia (S.K.H. Lee *in litt.* to German Scientific CITES Authority, 1996). Records from PERHILITAN indicate that the Malayan Box Turtle contributed 18.49% or 456 541 wild-caught individuals to the total number of exported freshwater turtles between January and October 1999 (PERHILITAN as cited by Sharma and Tisen, 2000). One exporter in Perak reported buying more than 800 turtles daily from middlemen for further export to Shenzhen, China (Sharma and Tisen, 2000). This sums up to 292 000 individuals per year for only one exporter. Lau *et al.* (2000) observed the Southeast Asian Box Turtle among the 10 most heavily traded chelonians between 1998-1999. It was consistently present in the food trade.

International trade of the Southeast Asian Box Turtle continued to be intense and probably above sustainable levels despite its Appendix II listing in 2000 (van Dijk *et al.*, 2000; Cheung and Dudgeon, 2006). The species remained the most abundant species in trade, and Indonesia followed by Malaysia are the two major exporters (Anon., 2002a; UNEP-WCMC-CITES Trade Database, 2007). Comparative studies in both countries have shown that Malaysia ranks second after Indonesia as far as harvest and export volumes are concerned (Schoppe, *in prep.*). Unfortunately, not only legal trade volumes remained high but also illegal trade continued after 2000. On 11 December 2001, Hong Kong customs officials seized an illegal shipment of about 10 000 Asian turtles, of which about 2000 were already dead. Among the survivors were 1798 Southeast Asian Box Turtles (Ades and Crow, 2002). The turtles originated most likely from Malaysia and destined for food markets in South China (Hudson and Buhlmann, 2002). This was the largest-ever seizure of live turtles in Hong Kong (Anon., 2002c). Six tons of wild-caught freshwater turtles were seized in Hanoi, Viet Nam in March 2003 had been exported by air using false permits from Malaysia (C. Shepherd, TRAFFIC Southeast Asia, *in litt.* to J. Thomson, September 2004). It is not known how many of these were Southeast Asian Box Turtles

but usually this species constitutes the highest number of individuals to illegal shipments of freshwater turtles. In the same year Customs officers in Xiamen investigated two cases of illegal importation of Southeast Asian Box Turtle from Malaysia, resulting in the confiscation of over 5000 live specimens in 2003 (Anon., 2004).

A survey by Artner and Hofer (2000) of the Qing Ping Free Market, the largest open-access Chinese market selling live turtles, in November 2000 revealed that the Southeast Asian Box Turtle was still abundant in trade despite its listing as Appendix II species of CITES in the same year. Lee *et al.* (2004) who surveyed major wild animal markets and shops in Guangzhou and Shenzhen from 2000-2003 found the Southeast Asian Box Turtle as the most numerous turtle species in trade. They found the trade to involve many different species and the volume was believed to be larger than during the 1993-1994 surveys by Lau *et al.* (1995). Unfortunately, those reports could not reveal the origin of the specimens and it can only be assumed based on previous trade statistics that most of the Southeast Asian Box Turtles originated from Indonesia and Malaysia.

Official data on the international trade in the species are available since its listing in Appendix II of CITES. From 2000-2005, Malaysia's reported exports of the species can be accessed through the UNEP-WCMC CITES Trade Database (2007) and from official statements of PERHILITAN in various CITES publications (Anon., 2003; Anon., 2004). However, information on the applicable quotas were neither posted on the CITES web page (www.cites.org) nor available from PERHILITAN. The quotas for the years 2001 to 2003 were only stated in documents presented to the CITES Animals Committee and the CITES Conference of the Parties (Anon., 2003; Anon., 2004). Available data show 1) discrepancies between exports reported by Malaysia and imports from Malaysia reported by other countries in their CITES annual reports; 2) the data from importing countries indicate that export quotas might have been exceeded in some years; and 3) the data from importing countries indicate that exports might have continued after the ban. For example, PERHILITAN had reported in occasions other than the annual report to the CITES Secretariat that 11 650 individuals were exported in 2003 (Anon., 2004) while the CITES Trade Database has records from importing countries for a total of 129 577 individuals and 600 kg of plastron imported from Malaysia (Table 2). Furthermore, there are records for imports from Malaysia in 2004 and 2005 after Malaysia had banned harvest in 2004 and imposed an export ban in 2005. In 2004, PERHILITAN had allowed the export of only "old" stock of animals that had been encountered and inventoried at warehouses of officially registered traders in December 2003. According to PERHILITAN (Anon., pers. comm. to the investigator, 13 July 2007), 14 990 individuals of old 2003 stocks were exported in 2004. The CITES Trade Database (2007) however has import records for 74 293 Malayan Box Turtles that were reported by importing countries. In 2005, no live specimens were exported according to records of the CITES MA in Malaysia, but importing countries claimed to have imported 33 969 individuals and 390 kg of plastron from Malaysia (Table 2). Generally, it can be summarized that Malaysia's reports to CITES indicate that quotas were respected, while import records are at significant odds with Malaysia's reports which raises the possibility that additional trade took place. Discrepancies in reporting may have a wide range of explanations such as the time of reporting to the CITES Secretariat, the number of permits issued versus the actual trade or the accuracy of reporting. As of this point we cannot be certain whether import data are misreported or miscoded since this cannot be checked by UNEP-WCMC.

Table 2
Official records on export volumes of the Malayan Box Turtle from Malaysia

Year	Quota	Reported exports by PERHILITAN	Reported exports by MY**** (live)	Reported imports by other countries to MY**** (live)
2000	?	276 000*	277 190	43 981
2001	50 000 ^e	50 000*	35 036	36 608
2002	50 000 ^e	44 980**	38 746	24 456
2003	15 000 ^a	11 650**	13 957 (+600kg)	129 577
2004	15 000 ²⁰⁰³	14 990***	33 835 (+200kg)	74 293
2005	0	0	0 (+390kg)	33 969 (+390kg)

^e = export quota; ^a = administrative quota; ²⁰⁰³ = only individuals that were collected in 2003 were allowed to be exported; * = Anon., 2003; ** = Anon., 2004; *** = PERHILITAN, Anon., pers. comm. to the investigator 13 July 2007, **** = Taken from the WCMC-UNEP CITES trade database - Comparative tabulation

Looking into the comparative tabulation of reported imports and (re-)exports by Malaysia, Indonesia, China, Honk Kong and Singapore, many discrepancies in reporting are noticeable (Table 3). In 2004, Malaysia reported the import of 20 500 individuals from Indonesia, which were re-exported to Hong Kong. Hong Kong however, reported importing only 6000 of these animals, but reported another 50 908 with origin Malaysia. As noted above, one of these countries has misreported or data were miscoded.

In accordance with its export ban, Malaysia has no reported exports of live Malayan Box Turtles in 2005 but China reported to have imported 33 969 individuals from Malaysia. In addition, both Malaysia and Singapore reported to have exported and imported, respectively a total of 390 kg of plastron (Table 3). PERHILITAN had however never legalized the international plastron trade. Again, this could indicate poor reporting by Malaysia or even illegal trade and the use of false permits.

Table 3
Export and import volumes of Southeast Asian Box Turtles during the years 2004 and 2005

Year	Importer	Exporter	Origin	Import Quantity	Import Unit	Import Term	Import Purpose	Import Source	(Re-export) Quantity	(Re-export) Unit	(Re-export) Term
2004	MY	ID		20 500		live	T	W			
2004	CN	MY		16 000		live	T	W			
2004	HK	MY	ID	6000		live	T	W	20 500		live
2004	HK	MY		50 908		live	T	W	11 350		live
2004	HK	MY							200	KIL	carapaces
2004	SG	MY		400		live	T	W	1200		live
2005	HK	ID		900		live	T	F	828		live
2005	HK	ID		4600		live	T	W	6500		live
2005	CN	MY		33 969		live	T	W			
2005	SG	MY		390	KIL	carapaces	T	W	390	KIL	carapaces
2005	CN	VN	LA						21 000		live

source: WCMC-UNEP CITES trade data base – comparative tabulation

There are alleged imports of Southeast Asian Box Turtles from the Solomon Islands into Malaysia for which there are no records in the UNEP-WCMC CITES Trade Database (2007). During the 13th

Conference of the Parties (CoP13) to CITES, the Malaysian MA had reported to the CITES Secretariat that they were investigating imports of the species from the Solomon Islands that the PERHILITAN office in Johor Bahru had allowed (Anon., 2004). The PERHILITAN headquarters however questioned the origin of the specimens and upon learning that the species does not occur in the Solomon Islands, disallowed further imports.

Trade records clearly identify China/Hong Kong as the main importer of the species from Malaysia (Table 3), with end uses likely to be consumption as meat and tonic foods, and TCM. Countries that imported the species from Malaysia as pets include Japan, the USA and Europe. However, the relative amount that can be inferred to have been traded for the pet industry was approximately 10% or less of the total number of individuals exported from Malaysia. Altherr and Freyer (2000) had noted earlier that the volumes traded for the pet market have always been of lesser economic value and importance compared to the food trade. Although economically less important, the species is popular in the pet trade in the USA, Europe and Japan (Yuwono, 1998; Altherr and Freyer, 2000). Schlaepfer *et al.* (2005), who analysed import and export data based on records of the USFWS Law Enforcement Management Information System (LEMIS), revealed that 48 335 live wild-caught Southeast Asian Box Turtles plus 99 kg had been imported to the USA between 1998 and 2002. According to the UNEP-WCMC CITES Trade Database (2007), the USA had a gross import of 11 835 individuals from Malaysia compared to 21 234 individuals imported from Indonesia between 2000-2005. Compared to other exporting countries, Malaysia plays a minor role as pet exporter of the Malayan Box Turtle. The combined import of the Southeast Asian Box Turtles to the US, Japan and Europe between 2000 and 2005 was 89 882 individuals, and only 19.5% (17 522 individuals) of these were exported by Malaysia while the remainder (72 360 individuals) originated from Indonesia (Table 4).

Table 4
Gross export of Southeast Asian Box Turtles from Indonesia and Malaysia to the main pet importing countries (Europe, Japan and US)

Country	2000	2001	2002	2003	2004	2005	Total 00-05
MY	5150	6436	3296	1655	985	0	17 522
ID	5517	14 895	12 890	12 672	15 590	10 796	72 360

Source: UNEP-WCMC CITES Trade Database, 2007.

According to the official records of the UNEP-WCMC CITES Trade Database (2007), Malaysia did not export any Southeast Asian Box Turtle to Europe or any other pet importing country in 2005 (Table 4). It is assumed that this is due to strict law enforcement in the pet importing countries. In February 2005, the European Union released a list of wildlife that cannot be imported into Europe from Asia (Asian Turtle News, 2006). Five turtle species were listed including the Southeast Asian Box Turtle. The suspension on imports of Southeast Asian Box Turtle was limited to Malaysia only. The ban applies only to wild-caught animals and includes both live animals and parts or products made from wild-caught animals.

Current trade of the Malayan Box Turtle

Users of the Malayan Box Turtle

A total of 10 user groups were identified (Table 5). In Peninsular Malaysia and in Sabah, the Malayan

Box Turtle was most frequently encountered in aquarium or pet shops. The main user group in Sarawak were private individuals. Second in rank among the user groups were suppliers in Peninsular Malaysia, and private individuals in Sabah (Table 5). Despite the export ban, exporters were identified as one of the user groups in Peninsular Malaysia.

Table 5
Number of informants per user group

No.	User group	Peninsular	Sabah	Sarawak
1	Private individuals	15	4	7
2	Markets	8	0	0
3	Temples	10	-	2
4	Recreational centres	3	1	2
5	Aquarium/pet shops	25	10	2
6	Drugstores	-	1	-
7	Collectors	12	-	-
8	Middlemen	8	-	-
9	(Ex-) Suppliers	(2)+18=20	-	-
10	(Ex-) Exporters	(6)+3=9	-	-
	TOTAL	107	16	13

No entry (-) means that no representative of this user group was interviewed.

Restaurants selling wild meat were dealt with as potential users since they are usually run and frequented by ethnic Chinese. A total of six restaurants were visited and owners and/or costumers interviewed. None of these served the Malayan Box Turtle or any other hard-shelled turtle, but most regularly offered softshell turtles. All respondents agreed that in Malaysia the species is rarely eaten, but that East Asians eat the species and/or use it for TCM. Interviews all over the country confirmed that Malaysian Chinese rarely eat hard-shelled turtles in restaurants. If they do, they prepare the dish at home while others might prepare TCM at home.

Uses of the Malayan Box Turtle

Among the various users of the Malayan Box Turtle, the following uses were identified: consumption, TCM, merit release, pet, display, local trade, and international trade (Table 6). Display refers to parks, botanical or zoological gardens, or venues where the species is exhibited. Local trade refers to those trade activities where the end user is in the country, while international trade refers to those trading the species for destinations outside Malaysia. The current findings agree with Sharma's observations in 1994, which identified pet trade, meat source, zoo exhibit, religious use and medicinal use as national uses of the species in Peninsular Malaysia (Sharma, 1999).

In 2006, the three most common uses in Peninsular Malaysia were for merit release (26.6%), followed by consumption (25.8%), and international trade for meat and consumption (19.5%) (Table 6).

Table 6
Uses of the Malayan Box Turtle in Malaysia

Purpose	Peninsular	Sabah	Sarawak
Consumption	33 (25.8%)	2 (10.5 %)	6 (40 %)
TCM	15 (11.7%)	3 (15.8 %)	0
Merit release	34 (26.6%)	2 (10.5 %)	4 (26.7 %)
Pet	8 (6.3%)	8 (42.1 %)	4 (26.7 %)
Display	1 (0.8%)	1 (5.3 %)	1 (6.6 %)
Local trade	2 (1.6%)	0	0
International trade	25 (19.5%)	0	0
Not revealed	10 (7.8%)	3 (15.8 %)	0

Among the Chinese, it is a common practice to release a turtle since the act of doing so is believed to extend the longevity of the person. The present survey revealed that for some Chinese in Malaysia it might be an irregular activity while others use to release one or more turtles once a week on Sundays. Among those that release turtles, the wealthier a person is the more turtles are released. Malaysian Chinese pet shop owners stated that some clients would buy as many as 100 Malayan Box Turtle for one release ceremony. In states with a high percentage of ethnic Chinese, such as Penang and Perak, religious beliefs are the main reason for local trade in the species (Figure 7).



Figure 7: Market vendor selling Malayan Box Turtles in Air Hitam, Penang (11.11.06)

In Sabah, the most common use of the Malayan Box Turtle was for pets (42.1%), followed by TCM (15.8%) and not revealed uses (15.8%). In Sarawak only four uses were identified overall, and consumption ranked first (40%) among them (Table 6).

The local wild meat trade for the species has a long history, and previous studies show that it is intensively captured for that purpose in Peninsular Malaysia (Sharma and Tisen, 2000). Traders in Kelantan and Perlis alone bought hundreds of individuals from trappers weekly as the study of Sharma and Tisen (2000) had revealed. The turtles

end up in wet markets and Chinese pet stores. In Malaysia, Chinese, indigenous groups and to some extent Indians are known to eat turtles. The religion of the Muslim community of Malaysia does not allow the eating of meat of tortoises and freshwater turtles. Conversely, Malaysian Chinese, eat the Malayan Box Turtle for assumed medicinal values. One of the medicinal values of the flesh of the Malayan Box Turtle is its assumed cure for nocturnal urination in bed by children. This has been

consistently reported as a well-established traditional use during interviews by Sharma (1999), in surveys in Indonesia (Schoppe, *in prep.*) and during interviews of the current study. Rearing the species as a pet is not a common practice in Malaysia, as noted by Sharma (1999).

In 25 cases, international trade was given as the reason for having the Malayan Box Turtle in Peninsular Malaysia (Table 6). Most people interviewed easily volunteered information on the uses of the Malayan Box Turtle and its possible destinations. Only very few were suspicious about the intentions of the researchers. This may indicate that most trade participants involved in international trade or who know about international trade in the species are not afraid of legal enforcement action. The CITES Management Authority of Peninsular Malaysia on the other hand insists that international trade has totally stopped (Anon., PERHILITAN, pers. comm. to the investigator SEA, 13 July 2007). It has to be concluded that law enforcers in Peninsular Malaysia are either not inspecting (potential) traders or that they assume that individuals are only intended for the local market. Unlike in Sabah and Sarawak, the Malayan Box Turtle does not receive any kind of harvest regulation or protection in Peninsular Malaysia.

Neither information gathered through interviews nor direct observations that were made give reason to believe that the Malayan Box Turtle is exported from Sabah and Sarawak. There are at least three possible reasons why no sign of international trade was found in East Malaysia:

1. The costs of exporting the species from the island of Borneo to East Asia currently make it economically unfeasible.
2. The current survey was too short and covered only the capital cities and nearby areas, hence was not able to reveal illegal international trade activity.
3. Law enforcement is relatively effective and makes illegal international trade difficult or impossible.

No final conclusion can be drawn since data are insufficient. Economic infeasibility (reason No. 1) seems to be the most logical reason for no international trade activity of the Malayan Box Turtle from East Malaysia. Reason No. 3 might have influenced the ease of international trade in this and other freshwater turtle species from Indonesia to East Malaysia. Jensen and Das (2006) observed a recent decrease in the obvious sale of protected species such as the Malayan Box Turtle during studies of the Asian Softshell Turtle in Sarawak. They attributed the decrease in trade to the implementation of the Sarawak Wildlife Ordinance that prohibits the collection, consumption and trade in the species. According to Jensen and Das (2006), Sarawak Wildlife Officers regularly patrolled trade centres such as markets and made illegal activities difficult.

In the following the various uses or collection purposes were analysed for the different user groups. Among the 15 private individuals that were found to keep the Malayan Box Turtle in Peninsular Malaysia, 33% kept individuals as pets, 60% said that they regularly catch and use the species for consumption and 6.7% used it as a TCM treatment for cancer (Table 7). In Sabah, all those who kept the species said that they keep individuals as pets. In Sarawak, most (85.7%) of the respondents (all native Iban) used the species for consumption, and only one Bedayu family kept 10 Malayan Box Turtles at home as pets (Table 7).

Table 7**Purpose of private individuals in purchasing or handling the Malayan Box Turtle**

Purpose	Peninsular Malaysia	Sabah	Sarawak
Pet	5 (33.3 %)	4 (100 %)	1 (14.3 %)
Consumption	9 (60 %)	0	6 (85.7 %)
TCM	1 (6.7 %)	0	0
TOTAL	15	4	7

Generally, Malaysians who consume the species for food belong to indigenous groups such as the Orang Asli of Peninsular Malaysia and the Bedayuh and Iban of Sarawak. These ethnic groups appreciate turtles and other wildlife traditionally as a food source (Sharma and Tisen, 2000; Wetlands International, 2002). Sharma and Tisen (2000) stated that most indigenous groups consume the flesh of the species purely for food and not for medicinal purposes. The present study found 87.5% of all Iban families visited in Sarawak in the possession of turtles at the day of visit. Seventy-five of these had the Malayan Box Turtle, and all usually catch and consume freshwater turtles (Figure 8). In Pahang, 70% of the indigenous families visited still regularly consume the Malayan Box Turtle (Figure 9). They catch them with baited traps (*bubu*), which are left for about 2-3 days after which they eventually catch 3-7 individuals (Figure 10). Another family stated that they can get two or three individuals in a day, but that some 5-10 years ago they could get 6-10 individuals in a day. One family eats up to 10 individuals in a day. The more “modern” Orang Asli in Pahang (20% of the families visited) now keep them as pets and 10% do not keep them at all. “Modern” Orang Asli live in urban centres and do not (openly) practice their own cultural beliefs. Other studies confirm that traditional Orang Asli heavily harvest local freshwater turtles including the Southeast Asian Box Turtle. In the peat swamp forest of Sungai Babar in Pahang large piles of discarded carapaces were observed by a WWF Officer (A.Z.A. Wahab, Scientific Officer, WWF-Malaysia, *in litt.*, 2 October 2006). The present study further revealed that besides native Malaysians, Thai people collect and eat the Malayan Box Turtle and other freshwater turtle species. This is an issue along the Malaysian-Thai border.

A total of 22 markets distributed among major cities in all West Malaysian States were visited and assessed for the presence of Malayan Box Turtles and other freshwater turtles and tortoises. Of these, eight sold the Malayan Box Turtle while the remainder did not sell any turtle (Table 8). The highest number of markets that sell the Malayan Box Turtle were encountered in Perak (62.5%), followed by Penang (25%) and Pahang (12.5%). The market vendors claimed to sell the species for consumption, TCM and release but not as pets.

Table 8**Number of markets selling the Malayan Box Turtle**

Purpose	Peninsular Malaysia	Sabah	Sarawak
Malayan Box Turtle	8 (36.4 %)	0	0
No turtles	14 (63.6 %)	5 (100 %)	3 (100 %)
TOTAL	22	5	3



Figure 8: The Ibans in Sarawak are familiar with the local species of turtles, which they regularly consume for food but were unaware that turtles can be the subject of research (21.12.06)



Figure 9: This Orang Asli Family had five juvenile Black Marsh Turtles and one juvenile Malayan Box Turtle waiting to be cooked, Tasek Bera Ramsar Site, Pahang (19.10.06)



Figure 10: Turtle traps used by the Orang Asli around Tasek Bera, Pahang (19.10.06)

Studies on the utilization of Malaysian freshwater turtles and tortoises by Moll (1976) and Sharma (1999) found the species to be abundant in the markets of Teluk Intan, Perak and Kuala Lumpur (Pudu market), respectively. Sharma (1999) noted that the meat of the whole animal was sold for consumption. Sharma and Tisen (2000) described it as the most common semi-aquatic species sold in wet markets and Chinese pet stores in Kuala Lumpur, Ipoh and Melaka. Customers are usually ethnic Chinese who buy the species for religious purposes, TCM and also food. Unlike Thais who usually collect the species themselves (see above), Chinese prefer to buy them.

In Sabah and Sarawak, the five and three markets surveyed respectively, did not sell the species. In 2005, the Malayan Box Turtle was still openly observed in some wet markets (Satok in Kuching, Daru, and Sibul) in Sarawak (Jensen, 2006). One of the largest markets in Sarawak is in the Malaysian-Indonesian border town of Sirikin. This market has been famous for the smuggling of wildlife and

other products from Indonesia to Malaysia (Figure 11). Prior to the passing of *Sarawak's Wildlife Protection Ordinance*, many wildlife species including the Malayan Box Turtle and other freshwater turtles could be seen for sale, Jensen (2006) noted. According to I. Das (University of Sarawak, pers. comm. to the investigator, 19 December 2006) many turtles were still openly sold in the market of Sirikin in 2002. In 2004 and 2005, Jensen (2006) did not encounter wildlife openly for sale but observed many law enforcement officers patrolling the market.

Interviews during the course of the present study and a visit of the Sirikin market and the Duyung weekend market confirmed that no wildlife was sold in the market (Figure 12). Market vendors are well aware of the laws and fear the high penalties (USD 2732 and imprisonment for one year) charged for wildlife trade. However, interviews also revealed that the illegal import of wildlife from Indonesia did not completely stop but continues at a reduced level in clandestine fashion in the early morning. Some small markets near the Indonesian border sell wildlife between 3:00 and 7:00 am (Anon., restaurant owner, Bau, pers. comm. to the investigator, 20 December 2006). Restaurant owners drive 100 km or more to the border markets to buy Asian Softshell Turtles and other wildlife. The informant stated that despite stricter law enforcement there are still many law enforcement officers that can be bribed, which helps facilitate smuggling across the border in both directions. The Malayan Box Turtle and other hard-shelled turtles are not commonly sold since there is no major demand for them. On the other hand, the demand for the Asian Softshell Turtle is very high.



Sabine Schoppe/TRAFFIC Southeast Asia

Figure 11: This signboard in Sirikin near the border to Indonesia explains that any wildlife trafficking across the border is prohibited (20.12.06).



Figure 12: Weekend market in Duyung a few kilometres before entering Sirikin. Live animals have almost completely disappeared from the vendors tables, but the trade in “protected” pitcher plant continuous unhampered (23.12.06)

Among the 15 Buddhist temples visited in Peninsular Malaysia, 10 had Malayan Box Turtles and other freshwater turtle species and five had no turtles at all (Table 9). Generally, if a temple had a release pond individuals of the Malayan Box Turtles were observed. Sharma (1999) had noted that it is the most abundant species encountered in temples in Penang and Perak. Amongst the temples in Peninsular Malaysia, Sam Po Tong in Ipoh and Kek Lok Si in Penang Island are the temples that hold the highest density of the Malayan Box Turtle in the whole country. In Sam Po Tong, more than 100

individuals were encountered in 2006 (present study) and about 40+ individuals were counted in 2004 by Hendrie (2004). Kek Lok Si held about 30 Malayan Box Turtles in 2006 (this study).

Table 9
Temples keeping the Malayan Box Turtle

Purpose	Peninsular Malaysia	Sabah	Sarawak
Malayan Box Turtle	10 (75 %)	0	2 (100 %)
No turtle	5 (25 %)	0	0
TOTAL	15	0	2

Despite the numbers observed that could constitute a good basis for an assurance population, conditions in both of these ponds as well as in all others that were visited are very poor (nutrition deficient, bad health conditions, and reproduction likely impossible) (Figure 13). Only one of 10 ponds had conditions provided for egg laying and reproduction. Hence, the individuals kept in Buddhist temples cannot be considered assurance populations. In Sabah, no temples were visited. The two temples visited in Sarawak had few Malayan Box Turtles (Table 9).

All of the recreational centres such as zoological and botanical gardens in West and East Malaysia had a few Malayan Box Turtles among other native and exotic turtle species for display. None of these establishments had proper conditions for captive management. Sharma (1999) had noted that although rearing the species as pets was not common in Malaysia, the species was commonly displayed in recreational areas such as zoos.

In Peninsular Malaysia, a total of 76 pet or aquarium shops were surveyed (Table 10). Seventeen (22.4%) of those shops had Malayan Box Turtles for sale and vendors informed that they regularly sell the species. However, more shops (40.2%) sell exotic turtles rather than the Malayan Box Turtle or



Figure 13: A Malayan Box Turtle among other native and exotic freshwater turtles fighting for space on dry land in a “Release Pond” in Penang (20.11.06)

other native species. Furthermore, most of the shops selling the Malayan Box Turtle do not sell it as a pet but rather for merit release and also for local consumption (Figure 14). The exotic turtle and tortoise species that are sold in those shops are however sold as pets. In Sabah and Sarawak, the situation is similar and more shops sell exotic species rather than the Malayan Box Turtle (Table 10). Included under “pet shops” in Sabah and Sarawak were small pet stalls that sell on weekly markets (so-called *Tamu*) (Figure 15, 16). The *Tamus*

in and around Kota Kinabalu, Sabah regularly accommodate aquarium/pet stalls that sell the Malayan Box Turtle as pets (Figure 17) but maybe also for consumption (Figure 18).

Table 10

Aquarium shops and pet shops surveyed for sale of the Malayan Box Turtle

Purpose	Peninsular Malaysia	Sabah	Sarawak
Malayan Box Turtle, regularly	17 (22.4 %)	9 (33.3 %)	2 (33.3 %)
Malayan Box Turtle, rarely	8 (10.5 %)	1 (4.5 %)	0
Only softshell species	0	1 (4.5 %)	0
Only exotic turtle species	31 (40.2 %)	10 (37.0 %)	3 (50 %)
No turtles	20 (26.3 %)	6 (22.2 %)	1 (16.7 %)
TOTAL	76	27	6

In earlier studies it was mentioned already that the Malayan Box Turtle is not valued as a pet in Malaysia, but rather for TCM, food or merit release. Sharma (1999) observed that food for its medicinal value rather than keeping as pets is the main reason why the species features commonly in local pet markets. Out of 26 shops surveyed in three peninsular districts in 1994, 12 offered turtles for sale and the Malayan Box Turtle was the most common species. Thirty to 40 individuals were seen to arrive daily at a pet shop in Petaling Street, Kuala Lumpur alone (Sharma, 1999). Earlier surveys by Moll (1976, 1997) also found the species to be common and always present in food-selling pet shops.



Figure 14: This “pet” shop in Melaka sold adult Malayan Box Turtles for USD 3.3 each (06.10.06)



Figure 15 a and b: Several Malayan Box Turtles for sale at Lily Aquarium in Kota Kinabalu, Sabah (05.12.06)

A random survey of the investigator at two Chinese drugstores in Kota Kinabalu revealed that they both sell turtle plastron but only one had plastron of the Malayan Box Turtle and of the Asian Softshell Turtle while the other traded plastron of the Black Marsh Turtle. Both drugstores import their supplies from China. The shop owners revealed that it is impossible to get supplies from Sabah because 1) there are only a few turtles left in Sabah compared to China where there are many, and 2) it is illegal to collect native turtles. The medicinal vendors buy the plastron from China per kilogram and sell it in medicinal doses of 37.5 grams (1 ‘tahil’). Plastron of the Malayan Box Turtle is bought for USD 45.6 /kg and sold for USD 2.73 /tahil (72.9 USD/kg). Some three to four years ago they could still buy it



Figure 16: Customers who buy Malayan Box Turtles at the Golden Fish Aquarium Shop in Kuching, Sarawak get them mainly for religious purposes (20.12.06)



Figure 17: On the weekend market in Tamparuli near Kota Kinabalu small juvenile Malayan Box Turtle and Red-eared Slider hatchlings are sold to children as pets (06.12.06)



Sabine Schoppe/TRAFFIC Southeast Asia

Figure 18: Every Thursday is *Tamu* (street market) day in Donggongon near Kota Kinabalu. Live Malayan Box Turtles as well as Malayan Softshell Turtles, Red-eared Sliders and the meat of monitor lizards are sold in plastic bags (07.12.06)

for only USD 10.9 /kg but now it is very expensive, the shop owner said. Plastron of the Black Marsh Turtle and the Asian Softshell Turtle is much cheaper. It was sold for USD 0.82 /tahil (USD 21.86 /kg). The higher price of Malayan Box Turtle plastron is related to the higher perceived medicinal values of the species compared to other freshwater turtles.

People who collect the species as a sideline business – here classified as “collectors” – were only encountered in Peninsular Malaysia but not in Sabah and Sarawak. Excluded here are those people who collect the species for their own consumption, the latter are included under “private individuals” (see above). Twelve collectors were interviewed, with five (41.7%) stating that they sell the specimens to a middleman who caters for the local market (Table 11). Six (50%) said they sell to middlemen or suppliers who sell to the international market. One collector did not reveal the purpose of his collection.

Table 11

Number of Malayan Box Turtle traders who sell the species for the local or international market

	Collectors	Middlemen	Suppliers
Local market	5 (41.7 %)	3 (37.5 %)	6 (33.3 %)
International market	6 (50.0 %)	5 (62.5 %)	12 (66.6 %)
Unknown	1 (8.3 %)	0	0
TOTAL	12	8	18



Sabine Schoppe/TRAFFIC Southeast Asia

Figure 19: Turtles at this middleman's premises in Kedah are stored for several days or weeks until enough are accumulated to sell to the supplier (09.11.06)

Eight middlemen were identified dealing with the Malayan Box Turtle in Peninsular Malaysia (Table 11). Three of them (37.5%) supply the local market, while five (62.5%) sell either directly to exporters or supply suppliers who sell to exporters (Figure 19). No middleman, supplier or exporter was encountered in Sabah or Sarawak.

A total of 18 suppliers were identified dealing in the Malayan Box Turtle. Six (33.3%) stated that they supply the local market only (Table 11). For 12 (66.6%) suppliers it was found out that they supply exporters (Figure 20). An additional two ex-suppliers were interviewed. Both stated that they stopped dealing with the Malayan Box Turtle and other freshwater turtles when trade was banned.

A total of nine exporters, six of which are believed to have stopped exporting the species, were met and interviewed. Among the six former exporters, four had been registered as Malayan Box Turtle exporters with the CITES MA in Peninsular Malaysia before the trade ban. The other two were never registered and had exported specimens without a licence. One of them stopped the business after being



Figure 20: Malayan Box Turtles at a supplier in Selangor have a fast turnover rate and are stored in plastic crates (background) for a maximum of one week before they are sold to an exporter. Turtles are just one commodity this wildlife trader is dealing in. Hunting dogs (right and background) are used to chase pangolins, wild boar and other mammals.



Figure 21: Malayan Box Turtles in a warehouse of an exporter in Kedah. Exporters usually have huge tanks where they sort the turtles by species when they arrive from the various suppliers. They usually do not stay more than a couple of days before they are packed in plastic crates (foreground left) and exported with trucks. (09.11.06)

caught with an illegal shipment while the other one stopped because he did not any longer consider the business to be lucrative. Only for two of the remaining three exporters sufficient evidence was gathered to prove that they were illegally exporting the species (Figure 21), and for the third, illegal export is assumed but not proven.

Quantity and quality of trade in the Malayan Box Turtle

The stocks of Malayan Box Turtles available at 18 collectors, suppliers and exporters in Peninsular Malaysia and at seven private houses, aquarium shops and temples in Sarawak were assessed in terms of numbers, sex ratio, size, and life history stages. In Sabah, only very few Malayan Box Turtles were encountered in captivity and no measurements were taken. For a total of 612 Malayan Box Turtles encountered in Peninsular Malaysia the number of male, female and juveniles was assessed and the ratio of males to females computed. The same was done for 33 individuals in Sarawak.

Results show that by far the majority of the individuals traded are adults. Ninety-eight percent of the traded individuals in Peninsular Malaysia and 88% of those in Sarawak were adults (Table 12). Relatively more juveniles were encountered in Sarawak (12%) than in Peninsular Malaysia (2%) which is related to the locations where animals were encountered. All the individuals analysed here from Peninsular Malaysia were encountered at either collectors, middlemen, suppliers or exporters, hence, at places that supply the consumption, TCM and to lesser extent also the “release” markets. Accordingly, large individuals are preferred by customers. In Sarawak, on the other hand turtles were encountered in a temple, pet shops, and private households that trade all sizes of animals.

In Peninsular Malaysia as well as in Sarawak, most of the collected individuals were females. Females constituted 61% and 49%, respectively the total number of individuals in these two geographic locations (Table 12). Accordingly, the ratio of male to females was 1:1.6 in Peninsular Malaysia and 1:1.2 in Sarawak. Theoretically, the primary sex ratio of freshwater turtles should be 1:1 (Fisher, 1939) and available data of adult populations confirm a 1:1 sex ratio for species with genotypic sex determination (Bury, 1979; Moll and Legler, 1971). Skewed sex ratios can be caused by a variety of factors such as temperature-dependent sex determination (TSD), differential age at maturity for males and females, differential mortalities between sexes, differential migration between sexes, and sampling bias just to mention a few (Georges *et al.*, 2006; Gibbons, 1990; Girondot and Pieau, 1993). Long-term over-exploitation of one gender (either because of selective collection of females that are slightly larger than males or of selective collection of males that are more active because they are in search of mates and therefore might more easily end up in traps) might also be a reason for a biased sex ratio. The analysis of the underlying reasons for a biased sex ratio is complex but most important is to monitor the sex ratio of populations over time.

To visualize the number of individuals per size class that were traded, data are presented in a size-frequency histogram (Figure 22). This clearly shows that mainly adults between 170 and 199 mm in MeCL were traded. Consequently, this size class is prone to over-exploitation that will result in an imbalanced population. It is well known that a small decrease in annual subadult or adult survival can negatively impact long-term population viability (Congdon *et al.*, 1993; Gamble and Simon, 2003). Any removal of reproductive adults from one or a few small populations of animals with a limited annual reproductive potential and late maturity has significant effects on the population structure, recruitment and population genetics. Congdon *et al.* (1993) further stated that the concept of sustainable harvest cannot be applied to long-lived animals such as freshwater turtles. Reed *et al.* (2002) showed that an annual increase in adult mortality in female Alligator Snapping Turtles *Macrochelys temminckii* by less than 1% would result in population declines. Similarly, Congdon *et al.* (1994) found that Common Snapping Turtle *Chelydra serpentina* populations would be negatively affected by an annual harvest of 10% of adult females. Gamble and Simon (2003) found that Painted Turtles *Chrysemys picta* are susceptible to over-harvest with an annual removal of only 4-5% of the female population. This sensitivity to harvest is in line with the previously mentioned turtle species.

Table 12

Number of male, female and juvenile Malayan Box Turtles encountered at different user groups in Peninsular Malaysia and Sarawak

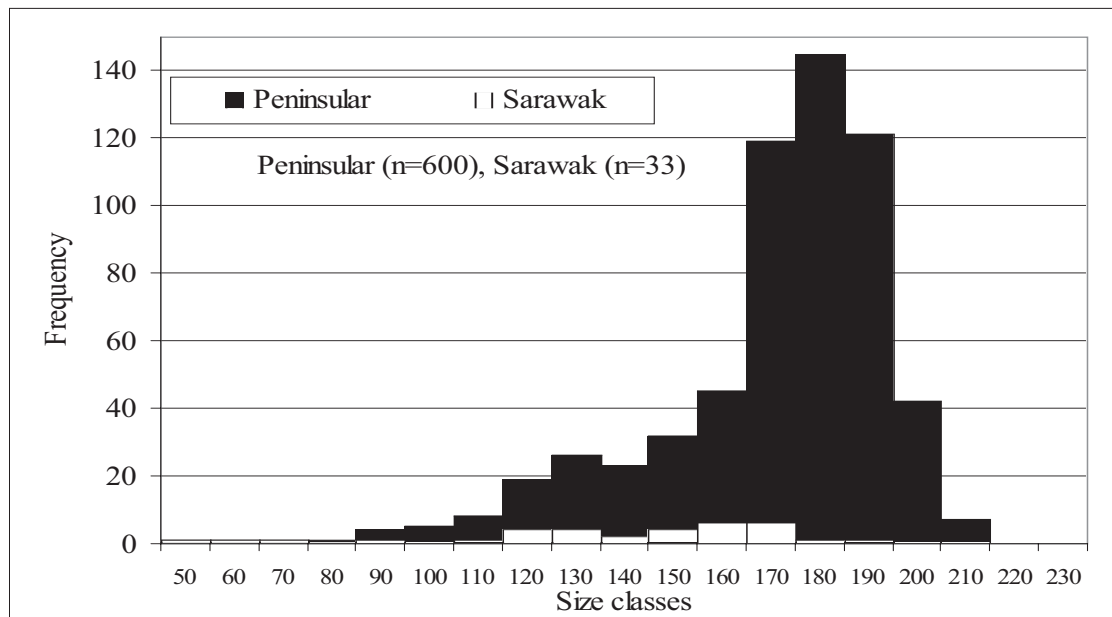
	Location	Male	Female	Juvenile	Total	Ratio male : female
Peninsular Malaysia	Trader 1	3	3	1	7	1:1
	Trader 2	71	134	5	210	1:1.9
	Trader 3	62	104	0	166	1:1.7
	Trader 4	1	4	0	5	1:4
	Trader 5	11	10	3	24	1:0.9
	Trader 6	0	2	0	2	1:2
	Trader 7	1	15	0	16	1:15
	Trader 8	2	0	0	2	1:0
	Trader 9	10	6	0	16	1:0.6
	Trader 10	15	20	0	35	1:1.3
	Trader 11	1	2	0	3	1:2
	Trader 12	12	13	1	26	1:1.08
	Trader 13	7	15	2	24	1:2.1
	Trader 14	8	11	1	20	1:375
	Trader 15	1	5	0	6	1:5
	Trader 16	8	10	0	18	1:1.25
	Trader 17	2	1	0	3	1:0.5
	Trader 18	12	17	0	29	1:1.4
	Total	227 (37 %)	372 (61 %)	13 (2 %)	612	1:1.6
Sarawak	Temple	3	3	1	7	1:1
	Shop 1	0	1	0	1	0:1
	Shop 2	4	6	0	10	1:1.5
	House 1	1	1	0	2	1:1
	House 2	3	2	0	5	1:0.7
	House 3	2	3	0	5	1:1.5
	House 4	0	0	3	3	
		Total	13 (39 %)	16 (49 %)	4 (12 %)	33

If the exploitation of the Malayan Box Turtle in Peninsular Malaysia continues with the same intensity, the exploited populations will collapse in a short time. Since basically all populations of the species in Peninsular Malaysia are affected and no assurance populations exist, the species might become locally extinct. The other subspecies of the Southeast Asian Box Turtle are equally affected as studies on the Indonesian subspecies (Indonesian Box Turtle, Wallacean Box Turtle and Malayan Box Turtle) (Schoppe, *in prep.*), and Myanmar subspecies (Burmese Box Turtle) have shown (McCord and Philippen, 1998). McCord and Philippen noted almost 10 years ago already that the population dynamics of the species, and the very low clutch size of only 1 or 2 eggs will probably lead to population collapse if exploitation continuous.

Two of the traders listed in Table 12 were monitored for five consecutive weeks (38 days) while the stock assessment of all other traders refers only to the stock that they had at the day of visit. During the 38 days of harvest survey in Sabak Bernam, 385 Malayan Box Turtles were encountered at these

Figure 22

Size-frequency histograms for the Malayan Box Turtle encountered in trade in Peninsular Malaysia and in Sarawak



two suppliers who agreed to join the survey (Table 13). It is assumed that these constitute 100% of the stock that was traded by the two suppliers. Most of these turtles were collected with baited funnel traps and only a few were occasionally collected by hand. To better understand the extent of exploitation, daily, monthly and yearly mean catches were calculated for the total of the two suppliers and as a mean of the two (Table 13). This resulted for the two supplies in a total mean catch of 10.1 individuals/day, or 303.9 individuals/months or 3647.4 individuals/year. Accordingly, one supplier would then collect a conservative mean of 1823.7 individuals/year (Table 13). It was not possible to calculate catch per unit effort (CPUE) since neither the number of collectors of each supplier was constant nor was the number of hours spent to catch (effort) known.

If the calculated annual mean export of 1823.7 individuals is multiplied with the confirmed number of suppliers in Peninsular Malaysia (=12) a conservative estimates derives at 21 884 illegally exported Malayan Box Turtles by the 12 suppliers per year.

Table 13
Quantity of Malayan Box Turtles traded by two suppliers in Sabak Bernam, Peninsular Malaysia

Supplier	Total	Mean/day	Mean/month	Mean/year
I	208	5.5	164.2	1970.5
II	177	4.7	139.7	1676.8
Total I & II	385	10.1	303.9	3647.4
Mean I & II	192.5	5.1	152	1823.7

The only comparative data are those from a study in West Kalimantan, Indonesia where the catch of four middlemen was assessed (Schoppe, *in prep.*). Unlike in Sabak Bernam, in Indonesia animals were collected from a large flood plain. The four Indonesian middlemen collected in 58 days together a total

1547 individuals (Table 14). Accordingly, total means per year for all middlemen and mean annual catch for one middleman were 13 403.5 individuals and 3350.9 individual, respectively. The latter is about twice of what one supplier in Sabak Bernam can gather on average in a year.

Table 14
Quantity of the Malayan Box Turtle traded by two middlemen in Kota Bangun, West Kalimantan, Indonesia (Schoppe, *in prep.*)

Middleman	Total	Mean/day	Mean/month	Mean/year
A	546	12.7	380.9	4 571.2
B	844	19.6	588.8	7 066.0
C	85	2.7	79.7	956.3
D	72	2.3	67.5	810
Total A-D	1547	37.2	1117	13 403.5
Mean A-D	386.8	9.3	279.2	3350.9

Generally, data are believed to be comparable, because the traders in both areas stated that the survey period fell into a lean collection time, either due to seasonality as in West Kalimantan or due to low prices as in Malaysia. This implies that the abundance of the Malayan Box Turtle in the Malaysian survey site is lower than in the Indonesian site. Lower abundance might be related to differences in habitat type (manmade plantation versus natural wetland) or to differences in the level of exploitation. Considering the results from the population survey that was conducted in the same area as the harvest survey, resources in the Sabak Bernam are clearly over-exploited. Data on the composition of the population in terms of life history stages and sex ratio noticeably show the detrimental effects of exploitation.

In addition to abundance and composition of the turtle stocks, traders were asked for the prices. Not all who sell the Malayan Box Turtle revealed the price they usually achieve, but in 56 occasions, the author was able to gather related information (Table 15). Only if the species is sold as pet or for ‘merit release’ the price refers to one individual, in all other occasions the price is per kilogram body weight. Among all, the lowest price was USD 0.82 /kg paid to a collector and the highest was USD 9.56 /kg sales price of a supplier to the local market. Interesting is that higher prices were achieved when sold locally on markets (mean of USD 2.92 /individual) or in pet shops (mean USD 3.82 /individual) rather than when sold for export (USD 1.95 /kg at supplier and USD 2.73 /kg at exporter). Before 2000 and before the trade ban the price was USD 3.80 /kg and now it is only about USD 0.80 /kg one ex-exporter stated.

Prices in Malaysia are similar to those in Indonesia were the price ranged from USD 2.17-13.57 / individual in markets and pet shops while between USD 1.74 and USD 2.17 was the price that suppliers and exporters paid to collectors for one individual (Schoppe, *in prep.*).

According to Moll (1976) one kilogram of Malayan Box Turtle meat was sold for USD 0.60-0.80, which was about the price for one chicken egg in 1976. A women who has used Malayan Box Turtles to treat her cancer for many years, stated that one individual cost only about USD 0.14-0.27 in Ipoh Perak in 1986 (H. Wong, Ipoh, pers. comm., 28. Sept. 2006). Data from 1994 show that the prices had

Table 15**Mean and standard deviation (SD) of prices (USD) paid for the Malayan Box Turtle at different occasions**

Location	Category	Price (USD)	Remarks
Peninsular Malaysia	Mean ± SD Collector	1.62±0.54	n=6
	Mean ± SD Middleman	1.09±0.39	n=2
	Mean ± SD Supplier to exporter	1.95±1.07	n=10, mean of purchase and
	Mean ± SD Supplier to local market	3.21±3.18	n=6
	Exporter	2.73	n=1
	Mean ± SD Shops	3.82±1.75	n=26, most prices are per
	Mean ± SD Markets	2.92±2.29	n=5, small individuals are usually sold per individual and not per kg.
Sabah	Mean ± SD Shops	3.53±2.36	n=9, prices are per individual
Sarawak	Mean ± SD Shops	6.15±0.97	n=2, prices are per individual

substantially increased for more than 500% as a survey in seven pet shops in Penang, Melaka and KL had revealed (Sharma, 1999). The mean price per individual Malayan Box Turtle was USD 3.60. Twelve years later, during the time of this survey, the price had decreased again (Table 15), was however much higher than the one for other typical protein resources. A chicken egg for example then cost 0.08 USD and chicken meat was sold for USD 1.91/kg. This reflects the availability of the Malayan Box Turtle. Thirty years ago, when the Malayan Box Turtle was still abundant it was as cheap as one chicken egg but now that it is rare and difficult to get it is more expensive than an egg that can be easily farmed.

Within only one year the price for one Malayan Box Turtle individual had more than doubled in Sarawak. The present survey indicated that individuals were sold for a mean of USD 6.15. In 2005, the Malayan Box Turtle was sold for USD 2.19-2.73 per individual in wet markets (Satok in Kuching, Daru, and Sibul) in Sarawak, but that the species was rarely observed for sale (Jensen, 2006).

Trade routes

The present study found proof of illegal trade activity in every State in Peninsular Malaysia. Every State has at least one major supplier and in three States an exporter was also encountered. Although exported turtles may pass through several countries (Thailand, Myanmar, Lao PDR) there are only two final destinations for illegally traded turtles from Malaysia: China and Singapore. Roughly 70-80% is believed to be exported to China while the remainder is exported to Singapore. Most are transported by truck and sometimes by aeroplane. According to an exporter, the probability of being caught while flying the animals out is much higher than by land. The informant also said that law enforcement is stricter in Penang airport compared to Kuala Lumpur airport. At least one of the exporters seems to use a chartered plane sporadically to export his illegal freight.

Turtles from the northern parts of States along the border with Thailand (Perlis, Kedah, and Kelantan) are usually exported via Thailand. Trucks easily pass the Malaysian-Thai border undetected along small roads (Figure 23). Exporters collect the supplies around midnight and bring them to Thailand from where they proceed via Myanmar to China, a supplier near the Thai border in Kelantan revealed. From the east coast border town of Kg. Pengkalan Kubur in Kelantan, turtles are also frequently

shipped to the Thai side of the river. The owner of a shop in the Duty Free Zone in Kg. Pengkalan Kubur said that illegal wildlife trade is rampant (Anon., Businessman, Kg. Pengkalan Kubur, pers. comm., 2 Nov. 2006). He witnessed several pangolin seizures in the recent past. At night, traders smuggle the wildlife in small boats to Thailand.

A visit to the Animal Quarantine at the border town of Padang Besar in Perlis did not provide much information. The office had records of exported turtles before the ban, but those records are filed in the main office in Kangar. During the past two to three years, no turtles or other wildlife have passed through quarantine at the border, according to the officer in charge, who also said that they do not have a species list of those animals which can be exported, and those



Figure 23: Large wooden crates filled with Malayan Box Turtles, other freshwater turtles and wildlife are loaded onto trucks to be transported to China via Thailand. (09.11.06)

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Figure 24: Plastic crates with Thai labels at a chicken and turtle trader in Perak. Freshwater turtles are concealed in trucks under various layers of crates with chickens. Despite the trade ban in chicken due to avian influenza, it is easy to get a chicken truck across the Malaysian-Thai border. (08.11.06)

which are banned. The usual practice is that they inform PERHILITAN staff in Kangar in case of suspicious cargoes. The Customs officers are in charge of checking the vehicles. They inform quarantine if there are animals. Currently, all birds including chickens are banned from export due to avian influenza. This was interesting to note, since many traders reported that turtles cross the border concealed in chicken trucks. This implies that customs officers are bribed to let chicken shipments pass with turtles hidden under the chicken cages (Figure 24).

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The triangle Padang Serai (Kedah), Lunas (Kedah) and Bukit Mertajam (Penang) constitutes a major trade nexus, which accumulates turtles especially from the States of Kedah, Penang, Perak, Kelantan, Johor and to a lesser extent from Terengganu and Pahang. A supplier from northern Kelantan who also exports directly via Thailand said that he also regularly sells to Penang from where the turtles are exported to Hong Kong and China (Figure 25). Airport staff in Penang explained that air cargo is often mislabelled, and turtles or pangolins are declared “crabs” (Anon., pers. comm., Penang, 10 November 2006). Enforcement officer / inspection officers were said to be “easily bribed”.

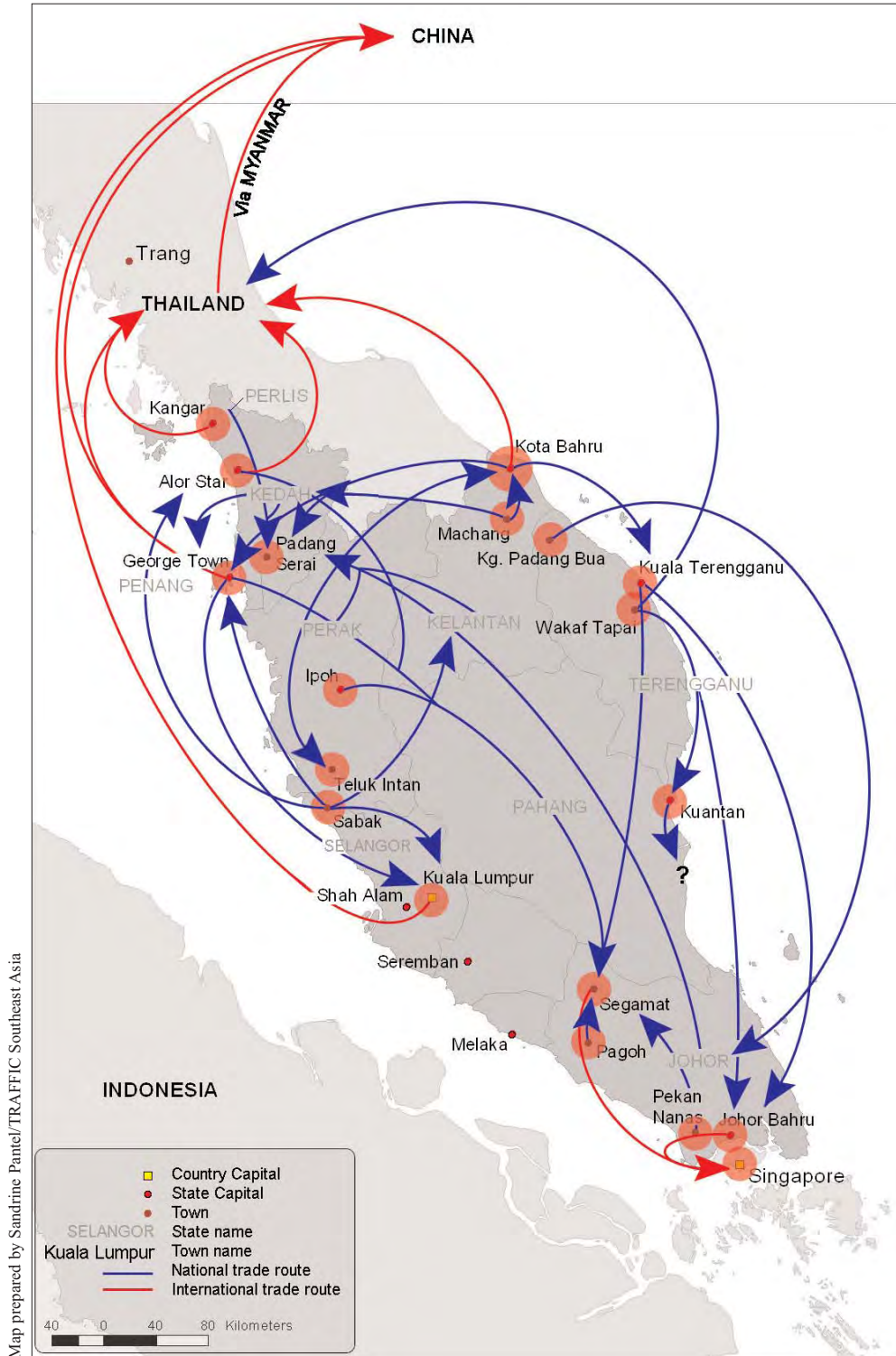
The trade centre in Selangor is Sabak Bernam. Traders from Kedah, Penang, Perlis, Johor, and Kuala Lumpur come to Sabak Bernam and pick the supplies up with trucks. Traders from Alor Star (Kedah) and Penang for example would call the supplier to check the availability of turtles, which are then picked up, with little risk of detection. Most of the transactions are done at night but even daytime transactions remain undetected because the police do not interfere or are unaware of the activities. Interviews revealed that it is considered risky to fly turtles out and therefore exporters use trucks to China via Thailand and Myanmar. The illegal freight is hidden in chicken trucks. The above was confirmed by two former exporters. They all agreed that not only turtles are illegally exported but that pangolins are usually traded together with the turtles. The present study found evidence for pangolin trade in most of the place where turtles were traded. A recent press release confirms this (TRAFFIC, 2006).

A supplier in Ipoh revealed that her family exports Malayan Box Turtle and other freshwater turtles and tortoises to China (Anon., Market vendor, Pasar Besar, Ipoh, pers. comm., 28. Sept. 2006) from their main warehouse in Segamat, Johor. The Johor company used to be a registered exporter before the ban. They deal with turtles, snakes and monitor lizards on a large scale. A visit to the company revealed that at least 80 – mainly Indonesian workers were engaged in skinning and processing snakes and lizards, sorting turtles, and storing them in plastic crates until they are shipped. Turtles are usually exported once per week. The company gathers turtles with trucks from suppliers all over Peninsular Malaysia. They pack them in styrofoam boxes which are usually used for fruit and fly the animals as cargo to China. The business proprietor stated that they would pack as many individuals as possible in one box in order to maximize the shipment. The cargo is paid per kilogram and it was stated that “nobody would check the contents”. This not only violates national policy and international CITES regulations but also standards for the transport of live animals by air of the International Air Transport Association (IATA).

All information and evidence indicates that the Segamat trader is the largest turtle (reptile) exporter in Johor and probably also in Peninsular Malaysia. There is however another large wildlife trader in Johor but turtles seem to be of negligible importance to him. The latter probably trades his turtles to the Segamat trader who is the main exporter in turtles. The company of this second large wildlife trader is located in Pekan Nenas near Johor Bahru at the border to Singapore. Some Malayan Box Turtle suppliers especially those from Terengganu have mentioned that they supply an exporter in / near Johor Bahru who exports to Singapore. The suppliers stated that the price is higher if traded to Johor Bahru (USD 2.73 /kg) then if traded via Thailand to China. It is not known if these suppliers refer to the wildlife trader in Pekan Nenas or whether there is another export company in or near Johor Bahru.

Figure 25

Map of Malaysia with the political boundaries of the states wherein national trade routes are indicated by blue arrows and international ones by red arrows. There are three main export routes for the illegal trade of Southeast Asian Box Turtles: by land via Thailand to China, by air freight from KL and in some cases from Penang to China, and by land via Johor Bahru to Singapore



Alternative production systems

There are no commercial breeding operations for native tortoise and freshwater turtle species in Peninsular Malaysia (Anon., 2004) or elsewhere in the range countries of this species. The species is only bred in small numbers by private breeders outside countries of its origin (Struijk and Woldring, 2005). The UNEP-WCMC CITES Trade Database (2007) has records for 4500 specimens declared as captive bred Malayan Box Turtles that were exported to China and for 3800 heads that were exported to Hong Kong in 2000. This is obviously mis-information since nobody bred or breeds the species in Malaysia.

When the Malaysian CITES MA suspended trade in wild-collected tortoises and freshwater turtles in 2004, it urged traders to set up breeding operations and to stop depending on wild populations (Anon., 2004). The MA said it was working together with traders to establish these operations. However, currently there is no evidence for any action undertaken by PERHILITAN to assist traders in the establishment of captive breeding facilities.

A former exporter of Malayan Box Turtles in Perak (now running a breeding operation for Red-eared Sliders) had tried to breed Malayan Box Turtles but gave up because the number of eggs laid was too few for commercial purposes (Anon., Turtle Breeder, Teluk Intan, Perak, pers. comm. to the investigator, 25. Sept. 2006). When asked whether the collection of wild turtles or breeding was the better business he said that collection from the wild for export was better due to the difficulties of breeding the native species. Provided a species can be successfully bred, the advantage of breeding is that it is a stable business and prices do not go up and down every now and then as they do for species collected from the wild. Prices for wild caught species fluctuate with the availability which is related to abundance in the wild, quotas and extent of illegal trade.

Captive breeding of the Southeast Asian Box Turtle is an expensive and time-consuming task. The species reaches under favourable conditions maturity with 4-5 years in captivity, and females lay 2-4 (mean 3) clutches of 1-5 (mean 2) eggs per clutch per year. This would result in an average of $3 \times 2 = 6$ eggs per mature female per year. Assuming a 50% survival from egg to juvenile, a mature female could produce three juveniles in one year. Under most favourable conditions, these could grow to 100 mm MeCL in one year (Schoppe and Dolorosa, *in prep.*), which is the minimum size for pet turtles traded to the US. If conditions are less favourable and feeding not appropriate or irregular a hatchling might take up to two years to reach a size that is marketable for the pet trade (Schoppe and Dolorosa, *in prep.*). Sub-adulthood (≥ 116 mm MeCL) and therefore a marketable size for the consumption trade is reached at about 13-15 months depending on captive management conditions. To obtain fast growth the juveniles have to be kept in enclosures that grant regular uptake of calcium and vitamin enriched food, clean water, shelter, exposure to sun, among other needs. Hatchlings and small juveniles are predominantly carnivorous, which does not only mean that feeding them is more expensive than herbivorous ones, but it also involves more maintenance of the tanks since rotten food items will easily deteriorate the water quality of the tank.

Furthermore, Lee *et al.* (2004) stated that breeding of endangered species for commercial use, other than the ones that are self-sustained now, should not be attempted, as survival in the wild would be further threatened by the need for founding and supplementary stock. Jenkins (1995) stated that for Southeast Asian Freshwater Turtles captive breeding operations may help to meet the demand for pets and for release animals, but that it is likely that in the majority of cases growth rates will be too slow

to provide animals for the food and medicinal traders at an economic rate, at least while wild collected animals are still available. This agrees with the findings of the present study.

The Department of Wildlife and National Parks in its Wildlife Plan for Peninsular Malaysia has set some biological indicators that should be considered in deciding whether a species is feasible for commercial trade (PERHILITAN, 1992). These indicators include high productivity, disease resistance, availability of food and marketability. According to PERHILITAN (1992), high productivity can be measured through conversion of food to body weight whereas a highly productive animal will grow rapidly. According to the Wildlife Plan, productivity can also be measured through the rate of reproduction whereas prolific animals will produce offspring rapidly and populations will increase in a short time. Considering the life history of the Southeast Asian Box Turtle, the species does not meet the qualifications needed for commercial wildlife trade that were set by the Management Authority in the Wildlife Plan.

Abundance of the Malayan Box Turtle in the wild

During the course of a 38-day population survey in an oil palm plantation in Sabak Bernam a total of 24 Malayan Box Turtles were caught. The Schumacher and Eschmeyer population size estimate coincided with the actual number of individuals encountered. The area measured approximately 29.25 ha, hence, the population density was 0.82 individuals/ha (Table 16). This seems to be low considering that throughout the study, farmers, collectors and traders have indicated that oil palm plantations constitute a perfect habitat and collection site for the Malayan Box Turtle, a species that easily adapts to manmade wetland habitats.

This is only the second known assessment of Southeast Asian Box Turtle wild population size. The only other data from the same species are from Indonesia where TRAFFIC conducted a similar survey but in a natural habitat in Sulawesi (Schoppe, *in prep.*). In Sulawesi, the population size of the Wallacean Box Turtle was assessed in a peat swamp forest, which is part of a national protected area. The study area in Sulawesi measured only 2 ha but a total of 71 individuals was caught and the density was 60 individuals/ha (Table 16).

Table 16
Comparison of two population surveys conducted on the Southeast Asian Box Turtle

	Exploited area	Protected area
Sub-species	Malayan Box Turtle	Wallacean Box Turtle
Habitat	Oil palm plantation	Peat swamp forest
Conservation status of habitat	Open accessible plantation	Nationally protected park
Size of study area (ha)	29.3	2
No of individuals caught	24	71
Estimated population size	24	120
Population density (individuals/ha)	0.82	60

Source: This study Schoppe, *in prep*

The available data suggest that the population in the plantation is over-exploited. Furthermore it is assumed that a population density of 0.82 individuals/ha is not enough to sustain the population, considering that population density in a protected area is 60 individuals/ha and therewith chance high

to meet a mate. Other possible reasons aside from over-exploitation for the lower density in the plantation versus the natural habitat might be the availability of food and the abundance of predators. Quantitative studies in exploited and un-exploited oil palm plantations and natural habitats of the species would be necessary for clarification.

Based on the median carapace length individuals were assigned to life history stages. Results showed that the population was composed of 0 hatchlings, 17 juveniles, two subadults and five adults (Table 17). For direct comparison with data that only distinguish between two general life history stages (immature and mature), these more general stages were also applied here. Accordingly, the population under study was composed of 79.2% immature and 20.8% mature individuals (Table 17). Again, only few comparative data are available. Alviola *et al.* (2003) have looked into a population of the Wallacean Box Turtle in the Philippines. They found eight juveniles (14.8%), 16 (29.6%) sub-adults and 30 (55.5%) adults. The relative composition of the population in the protected national park in Indonesia was 26.8% juveniles, 28.2% subadults and 45.1% adults. The latter two are assumed to represent healthy populations where reproduction and recruitment is granted by a relative high number of adults (>45% of the population). In the Malaysian population under study however reproduction is not any longer granted as only five adults were encountered in 29 ha. The probability of encountering a mate is negligible.

Table 17
Absolute and relative abundance per life history stage of the Malayan Box Turtle collected in Sabak Bernam

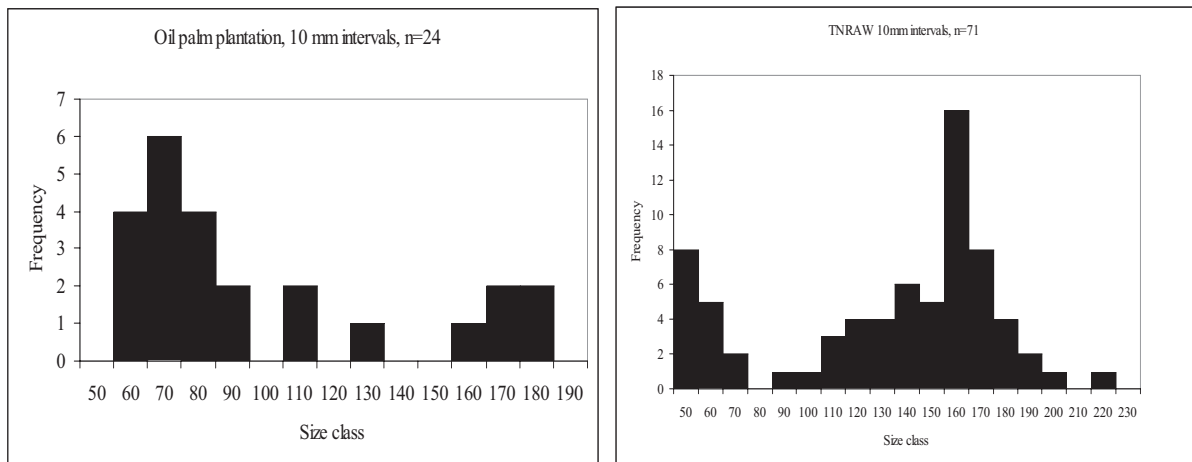
Size class	MeCL (mm)	Specific life history stage	n	%	General life history stage	n	%
I	<50	Hatchling	0	0	Immature	19	79.2
II	51-115	Juvenile	17	70.8			
III	116-159	Subadult	2	8.3			
IV	>160	Adult	5	20.8	Mature	5	20.8

The assumption that reproduction is no longer viable in the population in Sabak Bernam is supported by the sex ratio. Sex ratio is an important characteristic of a population from both ecological and theoretical point of view (Girondot and Pieau, 1993). The adult individuals were composed of two males and three females, hence a ratio of male : female of 1:1.5. To grant reproduction in the wild, the sex ratio should ideally be 1:1 or slightly in favour of females. A relatively ‘healthy’ sex ratio of 1:1.2 was for example found in the protected area in Indonesia (Schoppe, *in prep.*). Sex ratio varies among species and age groups. Ernst *et al.* (1994) noted based on American freshwater turtles that sex ratio should be 1:1 or slightly in favour of females to grant reproduction in the wild. This seems also to be true for marine turtles. For the Kemp’s Ridley Sea Turtle *Lepidochelys kempi* it was found out that the greatest rate of reproductive return was achieved with a sex ratio of 1.28F:1.0M (56.2% female) (Coyne, 2000). To determine whether harvest is not exceeding sustainable limits the most important aspect is whether the sex ratio changes over time as a result of over-exploitation.

Size-frequency of the population encountered in the openly accessible site in Sabak Bernam was compared with the population in the protected are in Sulawesi (Figure 26). The histogram of the Sabak Bernam population shows three clusters: juveniles, subadults and adults (from left to right) but none of the clusters shows normal distribution (bell-shaped form). The juvenile cluster lacks hatchlings, indicating that there was no recent recruitment. The subadult cluster is negligible, and the adult

cluster lacks individuals larger than 180 mm MeCL. This might indicate over-exploitation of these life history stages. The low population size (24 individuals) and the size distribution of its members represent an unfit population, which is a result of over-exploitation. In comparison, the Indonesian population clearly shows two clusters: juveniles and subadults/adults together (Figure 26, right). The bell-shaped clusters indicate normal distribution and a healthy and fit population.

Figure 26
Size-frequency distribution of populations of the Malayan Box Turtle in an oil palm plantations in Peninsular Malaysia (left) and of the Wallacean Box Turtle in a protected area in Indonesia (right)



Interviews with representatives of the various user groups of the Malayan Box Turtle as well as with farmers, fishers and residents provided a lot of information all of which indicates that the Malayan Box Turtle is rarely seen nowadays compared to 5-10 years ago. Most respondents believe that this is caused by unregulated international trade that led to over-exploitation. Some representative statements of informants are listed below (Box 1).

Box 1

Statement of respondents regarding population trends of the Malayan Box Turtle

- An ethnicity Thai couple, both residents in Kg. Berchang, Kelantan said independently that the Malayan Box Turtle and other turtles are over-exploited due to large volumes that were exported.
- The owner of a Mini Market in Kg. Berchang, Kelantan confirmed that turtles are over-exploited due to the large volumes that were exported before based on his personal observations. Until today, a Chinese and a Malay trader sometimes buy turtles from the locals during rainy season, he said.
- Three Malay women from Koh Seraya, Kelantan agreed that turtles are over-exploited due to export to Thailand. Until two to three years ago there was unlimited exploitation, now there is only one trader left in the area.
- A farmer near Selisling, Kelantan stated that the Malayan Box Turtles was still very common until some five years ago. Nowadays it is hardly seen. The turtles are over-exploited for trade to Thailand and negatively affected by the use of pesticides in rice fields, he believes.
- A Malay man near Kg. Aril, Kota Bahru, Kelantan said that the Malayan Box Turtle and other turtles are clearly over-exploited. Pesticide use does not constitute a problem, he believes, declines are solely due to over-collection.

Box 1 (continued):**Statement of respondents regarding population trends of the Malayan Box Turtle**

- Three Malay men near Sekayu, Terengganu agreed that the Malayan Box Turtles and other turtles are over-exploited due to high demand (high price). Until two to three years ago people regularly collected, and many people were full time engaged in turtle collection. Nowadays turtles are hardly seen, but if seen they are collected and sold to a trader in Wakaf Tapai, they said.
- A male and a female respondent of about 60 years of age said that turtles, snakes and pangolins are almost locally extinct due to over exploitation in Desa Jaya Sg. Tong area in Terengganu. The area is characterized by its oil palm plantations. The turtle export ban did not change anything, they stated, people continue to collect only that now they hardly find turtles and other wildlife. About five years ago, wildlife was still regularly seen.
- Populations have declined during export times and have not yet recovered, a former exporter in Simpang Lima, Perak said.
- A Chinese pet shop owner in Bukit Martajam area, Penang said that the Malayan Box Turtle is heavily over-exploited in the area. He cannot get any supply from the vicinity and is therefore supplied from Ipoh.
- Residents in Kg. Paya Mak Insum near Alor Star in Kedah said that turtles were still common some 10-20 years ago. Now they are over-exploited by Thais who eat them.
- A former supplier to KL, now supplier to Lunas, Kedah stated that the Malayan Box Turtle populations have decreased in numbers but the species remains the most common freshwater turtle in Peninsular Malaysia. Exploitation and habitat alteration are the reasons for the decrease.
- A guard in an oil palm estate near Muar, Johor said there are no or only a few turtles left in the area. Some 10 years ago, there were still many turtles but now they are over-exploited.
- A Chinese pet shop in Batu Pahat, Johor gets his Malayan Box Turtles from northern Malaysia (Perlis, Kedah) since there are no more in Johor, the shop owner said.
- Orang Asli in Bukit Gemurok, Pahang, said that there are less turtles nowadays because more and more of the swamp areas are drained and converted for development.
- A middleman in Kg, Baru, Kerayong, Pahang said that there are much less turtles nowadays because habitats are converted and drained.

In summary, there is indication from every State that populations of the Malayan Box Turtle are over-exploited or even locally extinct. This is especially true for populations around trade centres such as cities. Despite being a commensal species, it is nowadays difficult to find a Malayan Box Turtle in the wild near residential or agricultural areas.

CONCLUSIONS

The Southeast Asian Box Turtle is a commensal species and oil palm plantations are nowadays one of the main habitats of the species in Peninsular Malaysia. The advantage of adjusting to habitat alterations by humans are outbalanced by the fact that individuals in plantations are much more accessible and easier to collect than those in natural habitats. It is believed that although the Malayan Box Turtle is in a stronger position than those freshwater turtle species that depend on pristine habitats, its adaptation to manmade environments which are not protected by State or federal wildlife law offers little security for remaining populations. If unlimited exploitation continues local

extinction of the species is the logical consequence. The removal of the Southeast Asian Box Turtle from its habitat on the other hand will lead to an ecological imbalance the gravity of which can only be estimated.

The Southeast Asian Box Turtle grows relatively slowly. It reaches maturity after 4.5 years in captivity or after 5.5-6 years in the wild. In addition to slow growth, fecundity is low. Such slow reproduction rate in combination with continuous harvest has a detrimental effect on populations. Among the subspecies (Indonesian Box Turtle, Wallacean Box Turtle, Malayan Box Turtle) the Malayan Box Turtle grows larger than the other two subspecies. The large size and its reputation of having higher meat quality, make the Malayan Box Turtle the preferred subspecies for consumption at Chinese markets. Long-term removal of adults to satisfy consumer markets on the other hand leads to a decline in mean size as first comparative data indicate. This concern could be tackled through banning harvest of adults (≥ 160 mm MeCL). This is however impractical since control is too difficult.

The lack of state-based and federal legislation concerning the conservation of freshwater turtles including the Malayan Box Turtle in Peninsular Malaysia makes the species extremely vulnerable to exploitation. The species' Appendix II-status under CITES is the only reason for its regulation in international trade from Malaysia. Such regulation is however rather theoretical than practical in its implementation. Malaysia has previously not conducted a NDF on the species, nor are its export quotas related to past or current abundance of the species. Instead, explanations indicate that the quotas are rather demand-oriented and guided by previous-year export volumes.

The international trade of the Malayan Box Turtle has two main purposes: consumption for food or TCM and to supply the demand for pets. China, Hong Kong and Singapore import the species exclusively for consumption, while Japan, the USA and European countries imported it for the pet market. Before Malaysia's international trade ban in 2005 it played a minor role as a pet exporter but was a major supplier to the Chinese consumption market. Until today, high volumes of Malayan Box Turtles are illegally traded from Malaysia to China and Singapore. Volumes of trade for pets, when considered separately, would not be harmful for the survival of the Malaysian populations but the unregulated consumption trade easily leads to over-exploitation. The East Asian markets for food and TCM are supplied by substantial amounts of illegally exported Malayan Box Turtles, in contrast to the end-markets for the pet trade.

The CITES Management Authority of Peninsular Malaysia is not aware of or ignores the ongoing illegal export of the Malayan Box Turtle which has continued since the zero quota was imposed in 2005. Interviews with traders and users of the Malayan Box Turtle revealed lax law enforcement. Most people who are involved in or know about international trade appear to be unafraid of being caught by law enforcement agencies. It has to be concluded that law enforcers in Peninsular Malaysia are either not inspecting (potential) traders or that they assume that the turtles are only intended for the local market. Strict law enforcement and regular check of traders and markets can diminish or even temporarily cease illegal trade as the situation in Sarawak has shown.

Results of the population survey and the harvest survey in Sabak Bernam indicate that the populations are over-exploited and that continuous exploitation affects the composition of populations. Over-exploitation had a detrimental effect on the population and conditions for reproduction are not any longer given in the study site. This is expected to be true for all areas with harvest history, needs however to be verified with comparative studies from unexploited plantations.

The present study also looked into prices and found out that the price paid for one kilogram ranged from USD 0.82-9.56 for the live animal and was USD 72.9/kg for plastron ready to be used in TCM. The plastron price is higher than that of any other soft- or hard-shelled turtle species, which is related to the high medicinal values of the Malayan Box Turtle. The lowest price for live animals was paid to a collector and the highest was achieved by a supplier when selling the species at a local market. Interestingly, suppliers to the international market only attained prices between USD 1.95 and 2.73 /kg. Generally, the species has a higher value now than 30 years ago, which is assumed to be related to its decreasing abundance.

There are three main export routes for the illegal trade of the Malayan Box Turtle: by land via Thailand to China, by air freight from KL and in some cases from Penang to China, and by land via Johor Bahru to Singapore. Evidence shows that exports have not stopped despite the ban. Frequency of shipments and volumes are less than before the harvest ban in 2004 but more than the populations can deal with without detrimental effects to the survival. Illegal trade is relatively obvious and could easily be dealt with if an adequate number of law enforcers would systematically control trade points, routes, and exit points. However, PERHILITAN has insufficient staff, especially in border towns and along the borders. They would need the active support of Customs, Police and Anti-smuggling Units. Species identification problems are considered minor issues and can easily be addressed through appropriate training.

Decreasing abundance of the Malayan Box Turtle in the wild cannot be counterbalanced through captive breeding / farming operations. Rearing individuals to adult size is not economically feasible. Providing the option to declare individuals as captive-bred, only leads to misreporting and masking of illegal activities.

The study found signs of over-exploitation or local extinction of the Malayan Box Turtle in every State. This was especially obvious for populations around trade centres such as cities. Despite being a commensal species, it is nowadays difficult to find a Malayan Box Turtle in the wild near residential or agricultural areas. The species, despite its CITES status, is not adequately protected against over-collection. The volume of animals taken from the wild is large enough to potentially extirpate populations or the species. The large-scale exploitation for the food trade is unsustainable.

If the calculated annual mean export of 1823.7 individuals per supplier is multiplied with the confirmed number of suppliers in Peninsular Malaysia (=12) a conservative estimates derives at 21 884 illegally exported Malayan Box Turtles by the assessed suppliers per year alone.

Of utmost importance for sustainable management of the Southeast Asian Box Turtle is the curtailing of harvest for illegal export to consumption and TCM markets in Hong Kong, mainland China and Singapore.

The main reasons that facilitate illegal export in the Malayan Box Turtle and other illegally traded wildlife from Malaysia are:

- Wrong declaration e.g. as crabs;
- Bribing of officers;
- Transport at night;
- Concealment below other freight, e.g. chickens.

The study provides data on the abundance in the wild and in legal and illegal trade, on the composition of the populations in terms of size, life-history stage and gender, and on trade routes and weaknesses in legislation and law enforcement. These are important baseline data the monitoring of which will provide information on population trends. The latter is needed to determine sustainable harvest quotas which are not detrimental to the survival of the species in Malaysia.

RECOMMENDATIONS

- To allow populations of the Malayan Box Turtle to recover from past and current over-exploitation related to illegal international trade, a total harvest ban or rather the strict implementation of the existing export ban for the duration of at least one generation or five years should be implemented by PERHILITAN.
- Ports of export and import need to improve control mechanisms to prevent illegal trade. This includes the development of bribe-proof CITES permits (more signatories, digitized identification documents of exporters, etc.). The CITES MA of Malaysia, Indonesia (since many of the turtles originate from there), China and Singapore should jointly elaborate means to avoid or at least reduce forging of documents.
- Increase the number of law enforcers along trade routes, trade centres and exit and entrance points. Customs, Police and Anti-smuggling Units should be established or revived to support PERHILITAN which has insufficient staff.
- Officers at borders should be changed regularly to reduce the possibility of bribery.
- Strict law enforcement and regular inspection of traders, markets and pet and aquarium shops should be conducted by the CITES Management Authorities in Peninsular Malaysia and Sabah and Sarawak. Eventual collaboration with academics could lessen the workload of the CITES MA while at the same time providing research topics for graduate students.
- The CITES authorities in collaboration with other academic institutions, organizations or individuals, and accredited rescue centres should provide (refresher) training for law enforcers in species identification and local legislation.
- Every State should draft legislation to regulate the exploitation of native turtle species as provided for by the Fisheries Act 1985. At least (10%) of the Malayan Box Turtle populations of each State should be totally protected and the harvest of the remainder should be regulated.
- PERHILITAN should revise the Protection of Wildlife Act 1972 to include the Malayan Box Turtle and other freshwater turtles and tortoises. The Wildlife Act should regulate the number of wild-caught animals. The current situation requires a severe reduction of harvest for local use.
- The international pet trade in the Malayan Box Turtle originating from Malaysia constitutes only about 10% to the total trade and is considered sustainable if standing alone. It could be continued if illegal international trade for food and TCM is halted.

- The CITES Authorities should not encourage captive breeding of the Malayan Box Turtle.
- The CITES Scientific Authority in collaboration with local universities and NGOs should direct efforts towards detailed in-situ conservation measures and ecological studies of the Malayan Box Turtle as well as of other heavily exploited species. Long-term studies for example would be needed to provide comparative data towards determining whether the Southeast Asian Box Turtle decreased in size over time.
- Malaysia is currently planning to revise their CITES implementation legislation to include – among others freshwater turtles and tortoises and to increase penalties while at the same time providing incentives for the public to provide information on illegal wildlife trade.
- As part of the ASEAN-WEN, Malaysia could set up multi-agency task forces to improve inter-agency co-operation to ease illegal wildlife trade.
- If the CITES Authorities in Malaysia re-consider international trade in the species once illegal trade is stopped, harvest and export quotas should be calculated in line with the findings of this study. Furthermore, to provide a basis for sustainable trade, a rigorous survey method to estimate and monitor population trends has to be established. Minimum characteristics that should be monitored on a regular basis are the composition of population members in terms of size, life-history stages and sex, population density, and CPUE. These should be monitored once a year at the same time of the year and at the same sites. Recommended are sites that are significant trading centres around harvest locations such as Selangor, Johor, Kedah, Perak and Penang. Specifically trends of the following should be monitored:
 - Abundance in the wild;
 - Abundance in trade;
 - Mean size of animals in the wild;
 - Mean size of animals in trade;
 - Size-frequency distribution of population members in the wild;
 - Size-frequency distribution of individuals in trade;
 - Are any traded turtles declared captive-bred?
 - Is the number of seizures stable, increasing or decreasing?
 - Does illegal international trade continue?
 - What is the extent of the illegal international trade?
 - What is the trend in the sex ratio of population members in the wild and in trade?
 - Is the price stable?
- Surveys could be guided by the methodology applied in this study and by TRAFFIC's paper *Non-Detrimental Finding Methodology for the Trade of Southeast Asian Freshwater Turtles and Tortoises (Family Geoemydidae)* (Schoppe, 2007).

REFERENCES

- Ades, G. and P. Crow (2002). The Asian Turtle Rescue Operation: Temporary holding and placement at Kadoorie Farm and Botanic Garden, Hong Kong. *Turtle and Tortoise Newsletter*, 6: 2–7.
- Ades, G., Banks, C.B., Buhlmann, K.A., Chan, B., Chang, H.-C., Chen, T.-H., Crow, P., Haupt, H., Kan, R., Lai, J.-Y., Lau, M., Lin, H.-C., and H. Shi (2000). Turtle trade in Northeast Asia: Regional summary (China, Hong Kong, and Taiwan). In van Dijk, P.P., Stuart, B.L. and A.G.J. Rhodin (eds.). *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Chelonian Research Monographs, 2: 52–54.
- Altherr, S. and D. Freyer (2000). The decline of Asian turtles. *Pro Wildlife*, Munich, Germany, 23 pp.
- Alviola III, P.L., Cosico, E.A., and E.G. Eres (2003). Determination of relative age, sex and sex ratio of the Malayan Box Turtle (*Cuora amboinensis* Daudin) in Pinaglubayan River, Polillo Island, Quezon, Philippines. *Asia Life Sciences*, 12(2): 111–121.
- Anon. (1972). Protection of Wild Life Act No. 76 of 1972. Law of Malaysia, 35 pp.
- Anon. (1984). Parks Enactment 1984. The Sabah Government Gazette.
- Anon. (1985). Fisheries Act 317 of 1985. Peninsular Malaysia
- Anon. (1991). Amendment to the Protection of Wild Life Act No. 76 of 1972. Law of Malaysia.
- Anon. (1995). Laws of Sarawak, Chapter 17. Sarawak Forestry Corporation Ordinance 1995. The Sarawak Government Gazette, Part I (Main Series), Vol. HI (NS): 3, 23 pp.
- Anon. (1997). Wildlife Conservation Enactment 1997. Sabah
- Anon. (1998a). National Parks and Nature Reserves Ordinance 1998. The Sarawak Government Gazette, Part III, Vol. LI, No. 6, 29 pp.
- Anon. (1998b). Laws of Sarawak, Chapter 26. Wildlife Protection Ordinance 1998. The Sarawak Government Gazette, 33 pp.
- Anon. (1999). Proposal Prop. 11.36. Inclusion of all species of the Genus *Cuora s.l.* in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), amended 30th November 1999. www.cites.org/eng/cop/11/prop/36.pdf
- Anon. (2002a). Convention on International Trade in Endangered Species of Wild Fauna and Flora. Technical workshop on conservation of and trade in freshwater turtles and tortoises. Kunming, Yunnan Province, China, 25–28 March 2002. AC18 Inf. 12, 19 pp.
- Anon. (2002b). Convention on International Trade in Endangered Species of Wild Fauna and Flora. Eighteenth meeting of the Animals Committee, San Jose (Costa Rica), 8–12 April 2002. AC18 Summary record.
- Anon. (2002c). Seizures and Prosecutions. *TRAFFIC Bulletin*, 19(2): 108 pp.
- Anon. (2003). Convention on International Trade in Endangered Species of Wild Fauna and Flora. Nineteenth meeting of the Animals Committee, Geneva (Switzerland), 18–21 August 2003. AC19 Summary record.
- Anon. (2004). Convention on International Trade in Endangered Species of Wild Fauna and Flora. Thirteenth meeting of the Conference of the Parties, Bangkok (Thailand), 2–14 October 2004. CoP13 Doc. 33, 10 pp.
- Anon. (2005). ASEAN Regional Action Plan on Trade in Wild Fauna and Flora 2005–2010. Adopted Special Meeting AEG CITES, 6 pages. www.cites.org/
- Artner, H. and A. Hofer (2000). Observations in the Quing Ping Free Market, Guangzhou, China, November 2000. *Turtle and Tortoise Newsletter* 3: 14.
- Asian Turtle News (2006). EU Suspends Imports of wildlife from Asia. 26 May 2006
- Asian Turtle Working Group (2000). *Cuora amboinensis*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. www.iucnredlist.org. Downloaded on 10 January 2007.

- Azrina, L.A. and B.L. Lim (1999). Legislative status of Chelonian species in Selangor, Peninsular Malaysia. *Malayan Nature Journal*, 53(3): 253–261.
- Baillie, J. and Groombridge, B. (1996). *1996 IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland.
- Blomberg, S. and R. Shine (1996). 7. Reptiles. In: W.J. Sutherland. *Ecological Census Techniques*. Cambridge University Press, 352pp.
- Bowler, J.K. (1977). Longevity of reptiles and amphibians in North American collections as of 1 November, 1975. *Society for the Study of Amphibians and Reptiles, Miscellaneous Publications, Herpetological Circular* 6: 1–32.
- Bury, R.B. (1979). Population ecology of freshwater turtles. In: Harless, M. and H. Morlock (eds.) *Turtles Perspectives and Research*. Wiley Interscience, New York, pp. 571–602.
- Cheung, S.M. and D. Dudgeon (2006). Quantifying the Asian turtle crisis: market surveys in southern China, 2000–2003. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 16: 751–770.
- CIA (2007). CIA – The World Factbook – Malaysia. <https://www.cia.gov/library/publications/the-world-factbook/print/my.html>
- CITES (2007). Appendices I, II and III valid from 3 May 2007. Convention on international trade in endangered species of wild fauna and flora. www.cites.org/
- Close, L.M. and R.A. Seigel (1997). Differences in body size among populations of Red-eared sliders (*Trachemys scripta elegans*) subjected to different levels of harvesting. *Chelonian Conservation Biology*, 2(4): 563–566.
- Congdon, J.D., A.E. Dunham, and R.C. Van Loben Sels (1993). Delayed sexual maturity and demographics of Blanding’s turtles (*Emydoidea blandingii*): Implications for conservation and management of long-lived organisms. *Conserv. Biol.* 7: 826–833.
- Converse, S.J., Iverson, J.B. and J.A. Savidge (2005). Demographics of an Ornate Box Turtle population experiencing minimal human-induced disturbances. *Ecological Applications*, 15(6): 2171–2179.
- Coyne, M.S. (2000). Population sex ratio of the Kemp’s Ridley sea turtle (*Lepidochelys kempii*): Problems in population modelling. Dissertation, Office of Graduate Studies of Texas A&M University, 124 pp.
- Ernst, C.H., Altenburg, R.G.M. and R.W. Barbour (2000). *Turtles of the World*. World Biodiversity Series. Biodiversity Center of ETI, ETI/NLBIF, online version as of January 6, 2006, www.nlbif.eti.uva.nl/bis/turtles.php
- Ernst, C.H., J.E. Lovich, and R.W. Barbour (1994). *Turtles of the United States and Canada*. Smithsonian Institution Press, Washington D.C.
- Fisher, R.A. (1930). *The Genetical Theory of Natural Selection*. Clarendon Press, Oxford.
- Gamble T., and A.M. Simon (2003). The commercial harvest of painted turtles in Minnesota. Final Report to the Minnesota Department of Natural Resources, Natural Heritage and Nongame Research Program. Conservation Biology Research Grants Program. Natural Heritage and Nongame Research Program, Division of Ecological Services, Minnesota Department of Natural Resources, 53 pp.
- Gavino, C.M. and S. Schoppe (2004). First information on the trade of freshwater turtles in Palawan. Agham Mindanaw, Ateneo de Davao *Journal of Science and Technology*, 2: 53–60.
- Georges, A., F. Guarino and M. White (2006). Sex-ratio bias across populations of a freshwater turtle (Testudines: Chelidae) with genotypic sex determination. *Wildlife Research*, 33: 475–480.
- Gibbons, J.W. (1990). Sex ratio and their significance among turtle populations. In: J.W. Gibbons (ed.) *Life History and Ecology of the Slider Turtle*. Smithsonian Institution Press, Washington, pp. 171–182.

- Girondot, M and C. Pieau (1993). Effects of sexual differences of age at maturity and survival on population sex ratio. *Evol. Ecol.*, 7: 645–650.
- Gregory, R. and D.S.K. Sharma (1997). Review of legislation affecting marine and freshwater turtles, terran, and tortoise conservation and management in Malaysia: recommendations for change. WWF Tabung Alam Malaysia Project Report, 45 pp.
- Hendrie, D.B. (2004). Site Visit. Sang Poh Tong Temple. Asian Turtle Conservation Network. www.asianturtlenetwork.org/
- Hilton-Taylor, C. (2000). 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, UK.
- Hudson, R. and K. Buhlmann (2002). Turtle Rescue – Turtle Survival Alliance Executive Summary. *Turtle and Tortoise Newsletter*, 6: 12–14.
- IUCN (2007). *2007 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Downloaded on 13 September 2007
- Jenkins M.D. (1995). *Tortoises and Freshwater Turtles: The trade in Southeast Asia*. TRAFFIC International, United Kingdom, 48 pp.
- Jensen, K.A. (2006). Ecology and use of the Asian soft-shell turtle (*Amyda cartilaginea*) with notes on other species. Unpublished MSc Thesis, University Malaysia Sarawak. Xxii + 140 pp.
- Jensen, K.A. and I. Das (2006). Biological observations on the Asian Soft-shell Turtle in Sarawak, Malaysian Borneo, with notes on the biology and conservation of other non-marine turtles. *Testudo*, 6(3): 39–49.
- Khan, M.A.R. (1982). Chelonians of Bangladesh and their conservation *J. Bombay Natur. Hist. Soc.* 79: 110–116.
- Khoo Khee, M. and D Chandramohan (2002). Malaysian palm oil industry at crossroads and its future directions. *Palm Oil Industry Economic Journal*, 2(2): 10–15.
- Krebs, C.J. (1998). *Ecological Methodology*, 2nd edition. (New York: Harper Collins), 654 pp.
- Lau, M.W., Ades, G., Goodyer, N., Zou F., 1995. *Wildlife Trade in Southern China Including Hong Kong and Macao*, Kadoori Farm & Botanic Garden Cooperation.
- Lau, M., Chan, B., Crow, P. and G. Ades (2000). Trade and conservation of turtles and tortoises in the Hong Kong Special Administrative Region, People’s Republic of China. *In* van Dijk, P.P., Stuart, B.L. and A.G.J. Rhodin (eds.). *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Chelonian Research Monographs, 2: 39–44.
- Lee, K.S., M.W.N. Lau and B.P.L. Chan (2004). Wild animal trade monitoring in selected markets in Guangzhou and Shenzhen, South China 2000–2003. Kadoorie Farm and Botanic Garden Corporation, Lam Kam Road, Tai Po, N.T., Hong Kong SAR.
- Lim, B.L. and I. Das (1999). *Turtles of Borneo and Peninsular Malaysia*. Natural History Publications, Borneo, 151pp.
- McCord, W.P. and H.-D. Philippen (1998). A new sub-species of box turtle, *Cuora amboinensis lineata*, from Northern Myanmar (Burma), with remarks on the distribution and geographic variation of the species. *Reptile Hobbyist*, p. 51–58.
- Meier, E. (2000). Eine Methode zur Zucht aggressiver und stressempfindlicher Wasserschildkröten, exemplarisch dargestellt an der Moorschildkröte, *Clemmys muhlenbergii* (Schoepff, 1801) und der Dreistreifen-Scharnierschildkröte *Cuora trifasciata* (Bell, 1825) *Grosses Schildkrötensymposium*. 5. Jahrestagung der Schildkrötenfreunde Oesterreich, Salzburg, Natur und Tier Verlag, p. 53–68.
- Mitchell, J.C. (1988). Population ecology and life histories of the freshwater turtles *Chrysemys picta* and *Sternotherus odoratus* in an urban lake. *Herpetological Monograph*, 2: 40–61.

- Moll, E.O. (1976). West Malaysian turtles: Utilization and conservation. *Herp. Review.*, 7: 163–166.
- Moll, E.O. (1997). Effects of habitat alteration on river turtles of tropical Asia with emphasis on sand mining and dams. *In* J. Van Abbema (ed.), *Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles. An International Conference*, pp. 37–41. July 1993, State University of New York, Purchase. New York Turtle and Tortoise Society, New York, 494 pp.
- Moll, E.O. and J.M. Legler (1971). The life history of a neotropical slider turtle, *Pseudemys scripta* (Schoepff) in Panama. *Bulletin of the Los Angeles County Museum of Natural History (Science)* 11: 1-102.
- Moll, D. and E.O. Moll (2004). *The Ecology, Exploitation, and Conservation of River Turtles*. Oxford University Press, 393pp.
- Moll, E.O., and J. Vijaya (1986). Distributional records for some Indian turtles. *J. Bombay Natur. Hist. Soc.*, 83: 57-62.
- PERHILITAN (1992). Department of Wildlife and National Parks 1992. *Wildlife Plan for Peninsular Malaysia*. Department of Wildlife and National Parks, Kuala Lumpur, Malaysia, 66 pp.
- Praedicow, G. (1985). Langjaehrige Erfahrung bei der Pflege von *Cuora amboinensis* (Daudin). *Herpetofauna* 7(37): 6-14.
- Reed, R.N., Congdon, J., and J.W. Gibbons (2002). The Alligator snapping turtle [*Macrochelys (Macroclemys) temminckii*]: A review of ecology, life history, and conservation, with demographic analyses of the sustainability of take from wild populations. A report, Division of Scientific Authority, United States Fish and Wildlife Service, 17 pp.
- Rogner, M. (1996). *Schildkröten*, Vol. 1 and 2. Heiro-Verlag, Hürtgenwald, Germany, 49 pp.
- Rummler, H.-J. and U. Fritz, 1991. Geographische Variabilität der Amboina-Scharnierschildkröte *Cuora amboinensis* (Daudin, 1802), mit Beschreibung einer neuen Unterart, *C. a. kamaroma* subsp. nov. *Salamandra*, 27(1): 17-45.
- Sajwaj, T.D., S.A. Piegrass, and J.W. Lang (1998). Blanding's Turtle (*Emydoidea blandingii*) at Camp Ripley: Critical habitats, population status and management guidelines. Final Report to Nongame Wildlife Office, Minnesota DNR, Brainerd.
- Schlaepfer, M.A., Hoover, C. and C.K. Dodd Jr. (2005). Challenges in evaluating the impact of the trade in amphibians and reptiles on wild populations. *BioScience*, 55(3): 256-264.
- Schoppe, S. (*in prep.*). Status, trade dynamics and management of the Southeast Asian Box Turtle *Cuora amboinensis* in Indonesia. TRAFFIC Southeast Asia, Technical Report, Kuala Lumpur, Malaysia.
- Schoope, S. (2007). Non-Detrimental Finding Methodology for the Trade of Southeast Asian Freshwater Turtles and Tortoises (Fam. Geoemydidae). Unpublished report to TRAFFIC Southeast Asia, Kuala Lumpur, Malaysia, 19pp.
- Schoppe, S. and R.G. Dolorosa (*in prep.*) Growth of the Southeast Asian box turtle *Cuora amboinensis* from Palawan, Philippines.
- Schoppe, S. (2007). Non-Detrimental Finding Methodology for the Trade of Southeast Asian Freshwater Turtles and Tortoises (Fam. Geoemydidae). Unpublished report to TRAFFIC Southeast Asia, Kuala Lumpur, Malaysia, 19 pp.
- Sharma, D.S.K. (1999). *Tortoise and Freshwater Turtle Trade and Utilisation in Peninsular Malaysia*. TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia, 39 pp.
- Sharma, D.S.K. and O.B. Tisen (2000). Freshwater turtle and tortoise utilization and conservation status in Malaysia. *In* van Dijk, P.P., Stuart, B.L. and A.G.J. Rhodin (eds.). *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Chelonian Research Monographs, 2: 120-128.

- Shepherd, C.R., Burgess, E.A. and M. Loo (2004). Demand Driven: The trade of Indian Star Tortoises *Geochelone elegans* in Peninsular Malaysia. TRAFFIC Southeast Asia, 11 pp.
- Spinks, P.Q., H.B. Shaffer, J.B. Iverson, and W.P. McCord (2004). Phylogenetic hypothesis for the turtle family Geoemydidae. *Molecular Phylogenetics and Evolution*, 32: 164-182.
- Struijk, R.P.J.H. and L.A. Woldring (2005). *Cuora* studbooks, an overview. *Radiata*, 14(2): 64-73.
- Thirakhupt, K. and P.P. van Dijk (1994). Species diversity and conservation of turtles of western Thailand. *Natural History Bulletin of the Siam Society*, 42: 207-259.
- TRAFFIC (2006). Thai authorities seize illegal cargo of pangolins and freshwater turtles at Bangkok airport. www.traffic.org/news/Thai.htm.
- UNDP (2006). Malaysia's Peat Swamp Forests: Conservation and Sustainable Use. United Nations Development Program (UNDP), Malaysia, 33 pp.
- UNDP (2007). Malaysia Facts and Figures – Malaysia People. www.undp.org.my/
- UNEP-WCMC CITES Trade Database, 2007. CITES trade statistics derived from the *CITES Trade Database*. UNEP World Conservation Monitoring Centre, Cambridge, UK. <http://sea-bov.unep-wcmc.org/citestrade/>
- van Dijk, P.P. (2000). The Status of Turtles in Asia. *In* van Dijk, P.P., Stuart, B.L. and A.G.J. Rhodin (eds.). *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Chelonian Research Monographs, 2: 15-18.
- van Dijk, P.P., Iskandar, D.T., Palasuwan, T, Rhodin, A.G.J., Samed, Sharma, D.S.K., Shepherd, C.R., Tisen, O.B. and V.R. Genorupa (2000). Turtle trade in Southeast Asia: Regional Summary (Indonesia, Malaysia, Papua New Guinea, and Thailand). *In* van Dijk, P.P., Stuart, B.L. and A.G.J. Rhodin (eds.). *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Chelonian Research Monographs, 2: 145-147.
- Wetlands International (2002). A Guide to the Endangered and Endemic Flora and Fauna of Tasek Bera Ramsar Site, Pahang, Malaysia. Wetlands International-Malaysia Programme.
- Wilbur, H.M. (1975). The evolutionary and mathematical demography of the turtles *Chrysemys picta*. *Ecology*, 56: 64-77.
- Yuwono, F.B. (1998). The trade of live reptiles in Indonesia. *Mertensiella*, 9: 9-15.

TRAFFIC, the wildlife trade monitoring network, works to ensure that trade in wild plants and animals is not a threat to the conservation of nature. It has offices covering most parts of the world and works in close co-operation with the Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

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