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Reptiles of Phetchaburi Province, Western Thailand: a list of species, with natural history notes, and a discussion on the biogeography at the Isthmus of Kra

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ABSTRACT.–A study of herpetological biodiversity was conducted in Phetchaburi Province, in the upper part of peninsular Thailand. On the basis of a review of available literature, original field observations and examination of museum collections, a preliminary list of 81 species (12 chelonians, 2 crocodiles, 23 lizards, and 44 snakes) is established, of which 52 (64 %) are reported from the province for the first time. The possible presence of additional species is discussed. Some biological data on the new specimens are provided including some range extensions and new size records. The herpetofauna of Phetchaburi shows strong Sundaic affinities, with about 88 % of the recorded species being also found south of the Isthmus of Kra. A biogeographic affinity analysis suggests that the Isthmus of Kra plays the role of a biogeographic filter, due both to the repeated changes in climate during the Quaternary and to the current increase of the dry season duration along the peninsula from south to north. A biogeographic boundary seems to occur at the northern end of the peninsula, corresponding with the current position of a dry season of four month's duration.

KEY WORDS: biodiversity; biogeography; Reptilia; Phetchaburi; Kra Isthmus; Thailand

INTRODUCTION

The Isthmus of Kra, the narrow land bridge located approximately in the middle of the Thai-Malay Peninsula, has long been considered as an important zoogeographic transition separating animals from the Indo-Malayan Subregion from those of the Indochinese and Indo-Himalayan Subregion (see, for example, Kloss [1929] and Smith [1943]). In the context of our study of the herpetofauna of Thailand, we here present the results of a preliminary investigation of the reptile fauna of Phetchaburi Province. We compare the fauna of this province, which lies about 200 km north of the Isthmus of Kra, with the fauna of Phang-nga Province which lies an equal distance south of the Isthmus.

The province of Phetchaburi (often called Phetburi) is situated at the extreme north of the Thai-Malay Peninsula, and is bordered to the north by the province of Ratchaburi, to the east

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by the Gulf of Thailand, to the south by the province of Prachuap Khiri Khan, and on the west by a 120 km international boundary with Myanmar. The heaviest population densities and the most intensive cultivation activities are to be found in the districts of Khao Yoi, Ban Laem, Nong Ya Plong, Muang, Ban Lat, Tha Yang, and Cha-am, aligned north to south in the eastern part of the province. In the center and west, Kaeng Krachan District contains the largest protected area of Thailand, Kaeng Krachan National Park. This 2,915 square-kilometre park, established in 1981 following a providential visit of H.M. King Bhumipol Adulyadej, is dissected by the Tenasserim Range (also called Tanaosi Range), with the highest summit in the province (Khao Phanoen Thung, 1,207 m). Recent descriptions of the park can be found in Gray et al. (1994), Grassman (1999), Tourism Authority of Thailand (2000) and Elliott and Cubitt (2001). The vegetation of the park is composed of mixed deciduous forest, evergreen forest and dry-dipterocarp forest. Within the park lies the Kaeng Krachan Reservoir, linked to the Gulf of Thailand by the Phetchaburi River. In the eastern districts, small isolated patches of disturbed secondary forest, often associated with limestone massifs, contrast with gardens, ricefields and sugar palm tree plantations. Some areas of mangrove (*Rhizophora apiculata*) occur along the coast, particularly in Ban Laem District. Gairdner (1914, 1915) gave a general description of the province, its relief and vegetation, with a brief overview of its bird and mammal fauna.

Despite the proximity and accessibility of Phetchaburi Province from Bangkok and the large variety of its biotopes, the published data on the local herpetofauna are scarce and scattered. The province was cited only once by Taylor (1963: 897) and once by Cox (1991: 299) in their monographs on the Thai lizards and snakes, respectively. In spite of its biogeographic and faunistic importance, and the presence of the largest Thai national park, the herpetofauna of this province has never been more than casually investigated. In this paper we present the first list of reptiles, with emphasis on those in the cultivated areas and degraded habitats of the eastern part of the province.

MATERIAL AND METHODS

The following species list is based both on the examination of museum specimens with reliable locality data, and on original field observations sporadically gathered during 1996-2002. No specimens were secured in protected areas nor were protected species collected by the authors in the course of this study. The majority of the observed snakes were traffic victims. Detailed scale counts and measurements were recorded from every specimen, but for the sake of brevity they will not be presented here. Our biological notes for each species are exclusively based on our own observations made in Phetchaburi Province, i.e., not general statements drawn from the literature. Although some observations were made in Kaeng Krachan National Park and Kaeng Krachan District, most were made in the cultivated lands and secondary forests of the eastern districts. All eight towns can be found on standard atlas maps (e.g., Cummings and Nebesky [1995: 22] and Anonymous [undated]). Pala-u site is situated on the border between Phetchaburi and Prachuap Khiri Khan provinces; Ban Pala-u is indicated as being in Phetchaburi Province by Anonymous (undated). The Pala-u records were included in our list. The Thai words *ban* (village), *khao* (mount), *tham* (cave) and *wat* (temple) are not translated when they are part of official locality names.

Museums and institutions abbreviations:

BMNH: British Museum of Natural History, now the Natural History Museum, London

CUMZ(R): Chulalongkorn University Museum of Zoology (Reptiles), Bangkok

IRSNB: Institut Royal des Sciences Naturelles de Belgique, Brussels

KUZ: Kyoto University, Department of Zoology, Kyoto

MCZ: Museum of Comparative Zoology, Cambridge, Massachusetts

MNHN: Muséum National d'Histoire Naturelle, Paris
MZUSP: Museum of Zoology, University of São Paulo, São Paulo
QSMI: Queen Saovabha Memorial Institute, Thai Red Cross Society, Bangkok
RFD: Royal Forest Department of Thailand, Bangkok.

Other abbreviations: DOR: dead-on-road; KKNP: Kaeng Krachan National Park.

RESULTS

Chelonii

Trionychidae

Amyda cartilaginea (Boddaert, 1770)

One specimen found in Phetchaburi River, Ban Salakern, Ban Lat District, on 19 Apr. 1998. It was observed at 3 p.m. buried in the sandy bottom of the river at a depth of 80 cm.

Pelochelys cantorii Gray, 1864

Carapace of an adult specimen kept in Nom Sataboot's private collection. The specimen had been caught by fishermen twenty years ago just below Kaeng Krachan Dam in Phetchaburi River, Kaeng Krachan District.

Cheloniidae

Chelonia mydas (Linnaeus, 1758)

One subadult specimen examined by KT in 1997 in Cha-am where it was kept in a restaurant. It had been caught nearby in the Gulf.

Eretmochelys imbricata (Linnaeus, 1766)

One stuffed specimen (carapace curved length 28.2 cm) examined on 6 Aug. 2000 by CC & OSGP in a fisherman's home in Hat Chao Samran, Muang District. It had been collected by net in the 1980's off the village beach.

Testudinidae

Indotestudo elongata (Blyth, 1854)

On 7 Jan. 2002, we examined the carapace of an adult specimen kept as an ornamental item in a house at Ban Kaeng Krachan. It was caught in bamboo forest at Khao Mai Ruak, Kaeng Krachan District, a few years before.

Manouria emys phayrei (Blyth, 1853)

CUMZ(R) 2002.01.14.1 (carapace), Khao Phanoen Thung, Kaeng Krachan District. This specimen had been collected in the 1980's, eaten, and its carapace kept as an ornamental item at Udomsin Farm in Ban Khao Kling, Kaeng Krachan District.

Bataguridae

Cuora amboinensis (Daudin, 1802)

One adult specimen kept alive in Wat Kaeng Krachan on 7 Jan. 2002. It had recently been collected near the temple, in Kaeng Krachan District.

Cyclemys dentata (Gray, 1831)

A specimen collected by T. Bundhitwongrut in Jan. 1999 on Khao Phanoen Thung, Kaeng Krachan District. It was crossing a path in forest during rain. The turtle was still alive in 2003 and will be deposited in the CUMZ collections.

Heosemys grandis (Gray, 1860)

A specimen found walking on the bank of Phetchaburi River, Ban Salakern, Ban Lat District, on 4 July 1998, among bamboo thickets, in the early afternoon. Ban Lat villagers report the species as being rare. On 7 Jan. 2002, we examined a carapace in Nom Sataboot's private collection; it had been collected in Kaeng Krachan District. Another specimen was kept alive in Wat Kaeng Krachan at the time of our visit on 7 Jan. 2002; it had been caught near the temple in Kaeng Krachan District.

Malayemys subtrijuga (Schlegel & Müller, 1844)

A decayed specimen found by CC and OSGP in the cave of Wat Khao Tham Rong, Ban Tham Rong, Ban Lat District, on 23 Aug. 1997, near a pool of putrid, dark water polluted by the guano of numerous bats (*Taphozous melanopogon* Temminck, 1841), where a large population of these turtles is said by locals to live. A juvenile (carapace length 6 cm) was observed at Ban Salakern on the side of Phetchaburi River on 26 May 2000 by CC. On 7 Jan. 2002, we examined carapaces from specimens collected in Kaeng Krachan District in Nom Sataboot's private collection. On 11 May 2002, we caught and released a subadult in Tham Nang

Noowan, Khao Yai Subdistrict, Cha-am District. This species is still common in the province and is often offered for food in local markets.

Siebenrockiella crassicollis (Gray, 1831)

We examined on 7 Jan. 2002 the carapace of an adult specimen kept in Nom Sataboot's private collection; the specimen had been collected in Kaeng Krachan District.

Crocodylia

Crocodylidae

Crocodylus siamensis Schneider, 1801

On 1st Jan. 2002, we examined the skull of an adult collected sixty years ago behind Nom Sataboot's house, in the Phetchaburi River at Ban Wang Krai, Moo 3, Tha Yang District (Sataboot, private collection).

Lacertilia

Gekkonidae

Cnemaspis siamensis (Smith, 1925)

CUMZ(R) 2000.294, KKNP, 28 Feb. 2000.

The circumstances of the discovery of this specimen are quite peculiar. On the afternoon of 28 Feb. 2000, a day and half walk west from Ban Krang Camping Area, KKNP, one of us (CC) followed a narrow trail frequently used by elephants. Numerous fresh traces, tracks and dung, indicated that about 24 hours before a herd of several individuals had taken a mud bath in the nearby stream named Huay Mae Sa Riang, and then climbed a steep slope, damaging numerous trees with their mud-covered bodies. The trunk of a badly damaged Siamese sal *Shorea obtusa* Wallich ex Blume, a dipterocarp locally called *teng rang*, was examined. Under a partly detached piece of bark, the recently dead *Cnemaspis* was found, its squashed head stuck to the bark, 1.6 meter above the ground. The bark under which the gecko was discovered was covered with mud, indicating that it had been killed (unintentionally) by wild elephants.

Cosymbotus platyurus (Schneider, 1797)

CUMZ(R) 1999.07.15.6, IRSNB 15461-3, IRSNB 15467, MNHN 1998.0595, MNHN 1999.7607, Ban Salakern, Ban Lat District, 27 Mar. 1998, 19 Aug. 1997, 4 July 1998, 12 Feb. 1998, 23 Aug. 1997. - IRSNB 15464-5, MZUSP 87787, Ban Pao Khu, Ban Lat District, 20 Aug. 1997. - IRSNB 15466, Kaeng Krachan District, 21 Aug. 1997.

Extremely common species everywhere in the province, especially in houses and gardens. CUMZ(R) 1999.07.15.6 caught in the afternoon on a mango tree in a garden. IRSNB 15461, IRSNB 15464-5, MNHN 1998.0595 and MZUSP 87787 found in the evening in a house. IRSNB 15462-3 found on a palm tree by day. IRSNB 15466 collected on a wall near a neon light in a farm at night in strict syntopy with *Gekko gecko* and *Hemidactylus frenatus* (see below). MNHN 1999.7607 found under logs in a garden in strict syntopy with *Dixonius siamensis*, *Gehyra mutilata*, and *Hemidactylus frenatus* (see below). At dusk on 5 May 2002, seven adults observed at the entrance of the cave of Samnak Song Tham Khao Nakwang temple, Nayang Subdistrict, Cha-am District, in syntopy with *G. gecko*.

Dixonius siamensis (Boulenger, 1898)

IRSNB 15155, Ban Khao Kling, Kaeng Krachan District, 22 Aug. 1997. - MNHN 1998. 0522, Ban Tham Rong, Ban Lat District, 19 Aug. 1997. - MNHN 1999.7606, Ban Salakern, Ban Lat District, 23 Aug. 1997. - MNHN 1999. 7627, Huay Kwang Jing, Tha Yang District, 22 Aug. 1997.

Nocturnal species found in gardens and forested areas; we never observed it inside houses. IRSNB 15155 found while it was active on the ground one meter from a pool at 1.00 a.m. MNHN 1998.0522 caught at dusk on the ground in a disused shed at the base of a limestone massif. MNHN 1999.7606 found under logs in a garden in the afternoon in syntopy with *Cosymbotus platyurus* (see above), *Gehyra mutilata* and *Hemidactylus frenatus* (see below). MNHN 1999.7627 active on rocks just near a swamp at 3.00 a.m. Stomach contents included 2 caterpillars (Lepidoptera) belonging to 2 distinct species (IRSNB 15155) and remains of Blattoptera (MNHN 1999.7606).

Gehyra mutilata (Wiegmann, 1834)

CUMZ(R) 1999.07.15.2-3, IRSNB 15468, IRSNB 15469-70, IRSNB 15471, MNHN 1999. 7602-5, Ban Salakern, Ban Lat District, 23 Aug. 1997, 4 July 1998, 19 Aug. 1997, 12 Mar. 1998, 23 Aug. 1997.

Quite common in gardens but we never found it inside houses. The present specimens found in the afternoon under logs in a garden in syntopy with *Cosymbotus platyurus*, *Dixonius siamensis* and *Hemidactylus frenatus*; stomachs of MNHN 1999.7602 and MNHN 1999.7604 contain remains of Blattoptera.

Gekko gecko (Linnaeus, 1758)

MNHN 1998.0520, Ban Pao Khu, Ban Lat District, 20 Aug. 1997. - MNHN 1998.0545, Ban Salakern, Ban Lat District, 18 Aug. 1997. – MNHN 1998.0547, Ban Dong-ma-kok, Tha Yang District, 22 Aug. 1997. - MNHN 1998. 0548, Kaeng Krachan District, 21 Aug. 1997.

Ubiquitous nocturnal species, found in houses as well as in evergreen forest. MNHN 1998.0520 found on a house wall near a light at night. MNHN 1998.0545 caught under the floor in a house on piles in the afternoon. MNHN 1998.0547 found on a farm wall near a lamp at 2.00 a.m. MNHN 1998.0548 collected on a wall near a fluorescent light on a farm at night in syntopy with *Cosymbotus platyurus* (see above) and *Hemidactylus frenatus* (see below). Stomach contents included: remains of a large beetle (MNHN 1998.0520), remains of various arthropods including a pentatomid bug and a millipede (MNHN 1998.0545), freshly ingested bird feathers and beetles (MNHN 1998. 0547), and remains of winged insects (MNHN 1998.0548). At dusk on 5 May 2002, we caught and released an adult at the entrance of the cave of Samnak Song Tham Khao Nakwang temple, Nayang Subdistrict, Cha-am District, where it lived in syntopy with *Cosymbotus platyurus*.

Hemidactylus frenatus Duméril & Bibron, 1836

CUMZ(R) 1999.07.15.1, IRSNB 15475-6, MNHN 1999.7608-12, Ban Salakern, Ban Lat District, 23 Aug. 1997, 18 Aug. 1997, 23 Aug. 1997. - IRSNB 15472-4, Chao Samran, Muang District, 25 Dec. 1996. - IRSNB 15477, Ban Tham Rong, Ban Lat District, 19 Aug. 1997. - IRSNB 15478-84, MZUSP 87788, Kaeng Krachan District, 21 Aug. 1997. - MNHN 1999. 7644-6, Ban Bang Thalu, Muang District, 24 Dec. 1996.

Commonest gecko in houses where it is found at night around lamps syntopically with *Cosymbotus platyurus*. Active both night and day and also frequently observed on trees. CUMZ(R) 1999.07.15.1 and MNHN 1999. 7608-12 found under logs in a garden in the afternoon in syntopy with *Cosymbotus platyurus*, *Dixonius siamensis* and *Gehyra mutilata* (see above). MZUSP 87788 and IRSNB 15480 are females; each contained two 6 mm diameter eggs and had stomachs full of insect remains, mainly moths (Lepidoptera).

Agamidae

Acanthosaura crucigera (Boulenger, 1885)

Several specimens observed and photographed in Nov. 1997 by CC during the afternoon in evergreen forest in Ban Krang Camp, KKNP.

Bronchocela cristatella (Kuhl, 1820)

A single specimen observed by CC at 2.00 p.m. in evergreen forest near Than Tip Waterfall in KKNP in May 1999.

Calotes mystaceus Duméril & Bibron, 1837

Several adults observed in Ban Salakern, Ban Lat District, on mango trees in a garden in the afternoon in March-April 1998. Probably due to its shyness and its arboreal habits, we rarely encountered this species.

Calotes versicolor (Daudin, 1802)

Extremely common diurnal species, found on bushes in open areas throughout the province. A specimen observed on a path along the Phetchaburi River at 11.30 a.m. on 18 Aug. 1997, in Ban Salakern, Ban Lat District, another in a garden in the afternoon of 19 Aug. 1997 at Wat Khao Tham Rong, Ban Lat District, a pregnant female crossing a road at night in a forested area in Kaeng Krachan District, on 21 Aug. 1997, and numerous specimens in the afternoon on trees along roads in cultivated areas, respectively at Hat Chao Sam-

ran, Muang District, on 3 July 1998, and at Ban Bang Thalu, Muang District, on 24 Dec. 1996.

Draco blanfordii blanfordii Boulenger, 1885

Eight specimens observed by CC & OSGP in one hour on trees bordering Pala-u Waterfall in the afternoon of 26 Apr. 2002. One caught and released for precise identification. Very common locally.

Uromastycidae

Leiolepis belliana belliana (Gray, 1827)

CUMZ(R) 2002.01.14.2, Ban Ton Kaet, Kaeng Krachan District, 8 Jan. 2002. - IRSNB 15137-8, MNHN 1999.7636-9, Ban Tamlu, Ban Lat District, 22 Mar. 1998.

Timid species, active on the ground during the hottest hours of the day in open areas where it digs its burrows. All the specimens of our series found in the same hole at the same time of afternoon on the bank of a irrigation canal in a cultivated area. MNHN 1999.7636 is presumably the mother of the other specimens. Stomach of IRSNB 15137 full with insect remains, notably ants and bugs; stomach of IRSNB 15138 contained insect remains, notably acridians. Stomach of MNHN 1999.7636 full of vegetal matter. CUMZ(R) 2002.01.14.2 found DOR at midday in a cultivated area near a hill.

Scincidae

Isopachys anguinoides (Boulenger, 1914)

CUMZ(R) 1999.07.15.12, CUMZ(R) 2000. 1, IRSNB 15296, IRSNB 15485, KUZ 50564, MNHN 1999.7711, cave of Wat Khao Tham Rong, Ban Tham Rong, Ban Lat District, 23 Aug. 1997, 22 Nov. 1999, 23 Aug. 1997, 20 Aug. 1997, 4 July 1998, 23 Aug. 1997. - IRSNB 15528-9, Tham Khao Luang, Muang District, 25 Aug. 1997.

All specimens found at the entrance to caves, a few centimeters under the surface in soft soil, in the afternoon. When caught, they tried vigorously to escape and had easy recourse to caudal autotomy. Specimens from Tham Khao Luang found in syntopy with *Riopa bowringii* (see below). IRSNB 15485 has a SVL of 37.8 mm (tail length 27.3 mm); it is the shortest known specimen in the genus. IRSNB 15529 has a SVL of 75.0 mm (tail length 67.1 mm) and thus becomes the largest known specimen of *I. anguinoides*, the previous maximal cited SVL being 71 mm (Lang and Böhme, 1990: 238). Previous northernmost locality for the species at Bang Lamung, Chonburi Province (Lang and Böhme, 1990: 237).

Lipinia vittigera (Boulenger, 1894)

One specimen observed in Aug. 1998 by CC in KKNP by day on a tree trunk in the forest.

Lygosoma quadrupes (Linnaeus, 1766)

CUMZ(R) 2000.3, Ban Salakern, Ban Lat District, 27 Oct. 1999. - MNHN 1998.0526, Hat Chao Samran, Muang District, 25 Dec. 1996. - MNHN 1999.7642, Ban Bang Thalu, Muang District, 24 Dec. 1996.

Rarely seen due to its fossorial habits, but quite common in fields and open secondary forest. CUMZ(R) 2000.3 found in a garden. MNHN 1998.0526 collected in the afternoon under pieces of wood under a wooden house on piles in a cultivated area. MNHN 1999.7642 found in the afternoon under a heap of logs in a cultivated area.

Mabuya multifasciata (Kuhl, 1820)

IRSNB 15131, IRSNB 15486, IRSNB 15487, IRSNB 15488, Ban Salakern, Ban Lat District, 24 Aug. 1997, 24 Aug. 1997, 27 Aug. 1997, 27 Mar. 1998. - MNHN 1999.7620, Ban Bang Thalu, Muang District, 24 Dec. 1996. - MNHN 1999.7647-8, Hat Chao Samran, Muang District, 25 Dec. 1996.

IRSNB 15131 and IRSNB 15486-8 found under logs in a garden in the afternoon. MNHN 1999.7620 collected in the afternoon on the ground in a ricefield under dead palm leaves; two other specimens escaped by diving in the turbid water of an irrigation canal, reappearing on the opposite bank. MNHN 1999.7647-8 found in the afternoon in a cultivated area under leaves on the ground. Stomach of MNHN 1999.7647 full of insect remains, notably Orthoptera. An adult specimen observed on the bank of an artificial pond at Wat Kaeng

Krachan, Ban Kaeng Krachan, Kaeng Krachan District, on 7 Jan. 2002.

Riopa bowringii (Günther, 1864)

IRSNB 15295, Ban Yang Yong, Tha Yang District, 2 July 1998. - IRSNB 15489, Chao Samran, Muang District, 25 Dec. 1996. - IRSNB 15490, MNHN 1999.7616, MZUSP 87790, Ban Salakern, Ban Lat District, 27 Aug. 1997, 4 Dec. 1997, 24 Aug. 1997. - IRSNB 15511-5, Tham Khao Luang, Muang District, 25 Aug. 1997.

Very common in fields and disturbed secondary forest. IRSNB 15295 caught on a sunny afternoon while it was crossing a road paralleling an irrigation canal in a cultivated area. MNHN 1999.7616 caught by day on the street of a village. MZUSP 87790 and IRSNB 15489-90 found in the afternoon under logs in gardens. IRSNB 15511-5 found in syntopy with *Isopachys anguinoides* (see above).

Sphenomorphus maculatus mitanensis (Annandale, 1905)

A single adult caught and released in the afternoon of 26 Apr. 2002 at Pala-u Waterfall, KKNP. It was active by day on the ground two meters from the waterfall.

Note: We follow the taxonomic arrangement proposed by Yamasaki et al. (2001), in which *Sphenomorphus maculatus* (Blyth, 1854) is divided into two subspecies. In Thailand, the nominative subspecies is present only in the north (Doi Chiang Dao, Mae Hong Son and Doi Inthanon), whereas populations ranging from southern Myanmar (south of Moulmeyn), southwestern and southern Thailand are referred to *S. m. mitanensis*.

Lacertidae

Takydromus sexlineatus ocellatus Cuvier, 1829

CUMZ(R) 2000.293, MNHN 1998.0523, Ban Salakern, Ban Lat District, 18 Oct. 1999, 9 May 1998.

Both specimens found on a house wall at noon following very heavy rains. We never found the species in the surrounding gardens or elsewhere in the province in spite of intensive searching in open areas covered with high grass, reported to be its typical biotope. We think that these two specimens may have lived in the trees overhanging the house, and that they were independently driven down by rain.

Varanidae

Varanus bengalensis nebulosus (Gray, 1831)

Several animals observed by CC in Ban Lat, Tha Yang and Kaeng Krachan districts. A large adult observed on the road near the park headquarters at Pala-u Waterfall, KKNP, in the afternoon of 26 April 2002. Commonly seen in trees.

Varanus salvator (Laurenti, 1768)

Several observations along the Phetchaburi River at Ban Salakern, Ban Lat District, notably in Dec. 1996 (CC & OSGP). On 12 Dec. 1999, a large specimen observed by CC & OSGP in the mangrove of Bantaboon Subdistrict, Ban Laem District.

Specimens regularly seen in the afternoon basking on the bank of the river and along irrigation canals. According to the villagers, large specimens have become rare due to hunting.

Serpentes

Typhlopidae

Ramphotyphlops braminus (Daudin, 1803)

CUMZ(R) 1998.12.11.31-2, CUMZ(R) 2000.295, MCZ 182611, MCZ 182613-5, MCZ 182618, Ban Salakern, Ban Lat District, 27 Oct. 1998, 14 Nov. 1998, 22 Apr. 2000, 25 Dec. 1996, 9 Nov. 1997, 23 Mar. 1998. - IRSNB 16230, Cha-am, Cha-am District, May 2001.

Rarely seen due to its fossorial habits, but quite common. CUMZ(R) 1998.12.11.31 found while it was crawling in a garden on a sunny afternoon. CUMZ(R) 1998.12.11.32 killed by a farmer who was digging in his garden on an afternoon. CUMZ(R) 2000.295 found in a bedroom during the day. MCZ 182611 discovered during the day inside a rotten trunk in a mango tree plantation. MCZ 182613-5 were swimming together, all three entwined, during the day in a kitchen flooded by heavy rains. A cat was playing with MCZ 182618 in a house. IRSNB 16230 discovered crawling on a city street on a sunny afternoon.

Xenopeltidae

Xenopeltis unicolor Boie, 1827

CUMZ(R) 1998.12.11.29, Ban Mae Khamoei, Kaeng Krachan District, 7 Nov. 1998. - CUMZ(R) 1998.12.11.30, Ban Salakern, Ban Lat District, 14 Nov. 1998.

Very common in fields. CUMZ(R) 1998.12.11.29 found DOR at night in a cultivated area. CUMZ(R) 1998.12.11.30 killed by a farmer who found it on the ground under pieces of wood in a garden during the afternoon. We observed a specimen by day under leaves in a garden at Ban Tha-Ma-Pood, Ban Lat District, on 3 Apr. 1998, and another found DOR at night in Tha Yang, Tha Yang District, on 4 July 1998.

Note: Distribution and morphological variation of this species were discussed by Orlov (2001) but we do not agree with him in crediting to Reinwardt the authorship of the specific nomen. Reinwardt most probably was the author of the specific nomen, but obviously did not write anything, and his alledged description was not even cited by Boie. In agreement with Art. 50.1 of the *Code* (ICZN, 1999), Boie (1827) made the nomen available in writing the first published description, and must be regarded as the sole author of this taxon.

Uropeltidae

Cylindrophis ruffus (Laurenti, 1768)

CUMZ(R) 2000.292, MNHN 1998.0576, Chao Samran, Muang District, 7 Apr. 1999, 3 July 1998. - IRSNB 15042, Ban Wang Jan, Tha Yang District, 8 June 1998. - IRSNB 15043, Ban Tham Rong, Ban Lat District, 2 Apr. 1998.

CUMZ(R) 2000.292 killed by a farmer in a ricefield. IRSNB 15042 and MNHN 1998.0576 found freshly DOR in cultivated areas in the morning and at 8 p.m., respectively. IRSNB 15043 found at 7 a.m. under a stone on the muddy bank of a river.

Pythonidae

Python molurus bivittatus Kuhl, 1820

We examined a DOR juvenile at Ban Khao Kling, Kaeng Krachan District, on 22 Aug. 1997 in a cultivated area. Quite common in fields and secondary forests. L.I. Grassman (pers. comm., Apr. 2001) observed a specimen which had just consumed a civet-sized animal in KKNP. On 6 Aug. 2000, a child showed us a juvenile that he had just caught by day in a garden in a cultivated area at Hat Chao Samran, Muang District.

Python reticulatus (Schneider, 1801)

On 23 June 1998, at Ban Salakern, Ban Lat District, we examined a juvenile which had been killed by the owner of the house into which it entered during the day. Species often found along rivers, near the villages and in the forest.

Colubridae

Ahaetulla prasina (Boie, 1827)

CUMZ(R) 1998.12.11.18, Kaeng Krachan Dam, Kaeng Krachan District, 20 Aug. 1998.

Occurs in bushes and trees in primary and secondary forests. CUMZ(R) 1998.12.11.18 found freshly killed at 3 p.m. on a road in secondary forest; this female contains ten distinct embryos aligned between ventrals 140 and 190 (total number of ventrals 200). Suwannapak (1999: 97) reported this species as being common in the forests of KKNP.

Boiga multomaculata (Boie, 1827)

IRSNB 15066, Kaeng Krachan District, 4 July 1998. - MNHN 1998.0519, Ban Thung Kham, Cha-am District, 6 July 1998.

Nocturnal species commonly met in forested areas; was not found in fields. IRSNB 15066 and MNHN 1998.0519 were crossing paths in secondary forest at 9.15 p.m. and 11 p.m. respectively.

Boiga ocellata Kroon, 1973

CUMZ(R) 1998.12.11.19, Ban Kha Non, Ban Lat District, 12 Nov. 1998. - IRSNB 15084, Ban Bang Thalu, Muang District, 7 June 1998.

Found in bushes and trees in open lands and fields, also sometimes encountered in villages. CUMZ(R) 1998.12.11.19 found freshly DOR at dusk in a cultivated area. IRSNB 15084 found in the afternoon injured by a car on a road through a village.

Cerberus rynchops (Schneider, 1799)

The specimen from "Petchaburi", illustrated by Manthey and Grossmann (1997: 331), was actually photographed by W. Wüster at Ban Laem, Ban Laem District, where the species is found in mangroves and in shrimp farms (Wüster, pers. comm., Oct. 2000).

Chrysopelea ornata (Shaw, 1802)

IRSNB 15083, Ban Salakern, Ban Lat District, 20 May 1998. - IRSNB 16550, Tham Leng, Khao Nayang, Nayang subdistrict, Cha-am District, 9 May 2002. - MNHN 1998.0533, Ban Peuk Tian, Tha Yang District, 14 Apr. 1998. - MNHN 1999.7625, Ban Chao Samran, Muang District, Oct. 1997.

Diurnal species, common in gardens and often ventures into houses where it frenetically hunts geckos. IRSNB 15083 killed by a dog at 2 p.m. in a garden. MNHN 1998.0533 hit by a car on the road at 5 p.m. in a cultivated area. MNHN 1999.7625 caught in a cultivated garden. A freshly DOR specimen found at Cha-am, Cha-am District, at noon on 23 Dec. 2001. We examined a picture of an adult specimen taken by P. Haffner in the headquarters of KKNP on 14 Dec. 1998; the snake was observed in the afternoon while it was swallowing a *Hemidactylus frenatus* on a house table. IRSNB 16550 caught in the afternoon at the entrance of the cave.

Dendrelaphis cyanochloris (Wall, 1909)

CUMZ(R) 1998.12.11.1, Km 32, Road 3219 from Hua Hin to Pala-u, 9 Nov. 1998.

Found DOR.

Dendrelaphis pictus (Gmelin, 1789)

CUMZ(R) 1998.12.11.22, Ban Rai Pha Niat, Muang District, 15 Nov. 1998. – CUMZ (R) 2000.291, MNHN 1998.0539, Ban Salakern, Ban Lat District, 11 Mar. 1999, 9 Apr. 1998. - IRSNB 15133, Phetchaburi City, Muang District, 26 Aug. 1997. - MNHN 1998.0594, Ban Khao Kling, Kaeng Krachan District, 4 July 1998.

Diurnal species, common in open areas, fields and gardens. CUMZ(R) 1998.12.11.22 found freshly DOR in the morning in an urbanized area. CUMZ(R) 2000.291 caught by children on a shrub beside a football field in the afternoon. IRSNB 15133 injured by a bicycle in the city while it was crossing a road in the afternoon; its stomach contains remains of a ranid frog. MNHN 1998.0539 was crossing a road in the afternoon in a cultivated area; its stomach also contains frog remains. MNHN 1998.0594 found DOR at dusk in a cultivated area. DOR specimen examined at Cha-am, Cha-am District on 23 Dec. 2001.

Dryocalamus davisonii (Blanford, 1878)

CUMZ(R) 1998.12.11.21, Ban Salakern, Ban Lat District, 14 Aug. 1998. - IRSNB 15085, Ban Wang Won, Kaeng Krachan District, 4 July 1998.

Rarely encountered. CUMZ(R) 1998.12.11.21 was active in a house at 9 p.m. and was killed by the owner. IRSNB 15085 was crossing a road in secondary forest at 9 p.m.

Elaphe radiata (Boie, 1827)

CUMZ(R) 1998.12.11.20, Ban Tamlu, Ban Lat District, 15 Sep. 1998.

Aggressive snake, common in cultivated areas. CUMZ(R) 1998.12.11.20 killed by a farmer in his house in the afternoon. A specimen found freshly DOR at noon in a cultivated area at Ban Bang Thalu, Muang District, on 7 June 1998. Another found under pieces of wood in a field at 11.30 a.m. at Ban Salakern, Ban Lat District, on 9 June 1998.

Note: Helfenberger (2001) referred this species to the genus *Coelognathus* Fitzinger, 1843, along with *Elaphe erythrura*, *E. flavolineata*, *E. helena*, *E. philippina* and *E. subradiata*. The type species of this genus is *Coluber radiatus* Boie, 1827 by original designation, and not by monotypy as stated by Helfenberger (2001: 52). However, his study is preliminary and did not include mtDNA-based analyses. As the position of many species of *Elaphe* sensu lato is still unresolved, we adopt a conservative approach in retaining this species in the genus *Elaphe*, pending further studies of this difficult group.

Enhydris enhydris (Schneider, 1799)

CUMZ(R) 1998.12.11.25, Ban Pho Yai, Ban Lat District, 15 Nov. 1998. - MNHN 1997.6572, Hat Chao Samran, Muang District, 25 Aug. 1997. - MNHN 1997.6596, Cha-am, Cha-am District, 8 Feb. 1998.

Very common in swamps. Stomach of CUMZ(R) 1998.12.11.25 contains numerous nematodes and the remains of fish; this female snake also contained eggs at an early stage of development. MNHN 1997.6572 was on a road along a swamp at night; its stomach contained a 8 cm-long fish and a dozen 2 cm-long nematodes. MNHN 1997.6596 found freshly DOR at dusk in a cultivated swampy area.

Enhydris plumbea (Boie, 1827)

CUMZ(R) 1998.12.11.23, Wat Salakern School, Ban Salakern, Ban Lat District, 1st Sep. 1998. - CUMZ(R) 1998.12.11.24, Ban Ton Kaet, Kaeng Krachan District, 7 Nov. 1998. - MNHN 1999.7622, Ban Salakern, Ban Lat District, 23 Aug. 1997.

Nocturnal species, very common in cultivated areas in and near water. Often found in temporary pools without vegetation along roadsides; fights vigorously when caught and often tries to escape by jumping. CUMZ(R) 1998.12.11.23 collected in a garden under leaves in the afternoon. CUMZ(R) 1998.12.11.24 caught at night in a shallow pool in a garden. MNHN 1999.7622 found at 2.30 p.m. under dead leaves on the ground in a garden; its stomach contains the remains of a *Microhyla* sp. (Anura: Microhylidae).

Erpeton tentaculatum Lacepède, 1803

MNHN 1997.6588, Hat Chao Samran, Muang District, Oct. 1997.

The adult MNHN 1997.6588 caught by fishing net in an irrigation canal. It is the only specimen that we observed, but the species is said by local fishermen to be quite common in the canals and irrigation ditches of Muang District.

Homalopsis buccata (Linnaeus, 1758)

CUMZ(R) 1998.12.11.26, Ban Sala Moo Sri, Ban Lat District, 15 Nov. 1998. - MNHN 1997.6580, Ban Ta-lo, Tha Yang District, 11 Feb. 1998. - MNHN 1998.0575, MZUSP 11483, Ban Salakern, Ban Lat District, 4 Feb. 1998. - MZUSP 11485, Hat Chao Samran, Muang District, 9 Feb. 1998.

Very common in stagnant water with much vegetation in disturbed and open areas. CUMZ(R) 1998.12.11.26 found DOR at night on a road passing through a swamp. MNHN 1998.0575 and MZUSP 11483 contain respectively 8 and 10 eggs, at an early development stage in MNHN 1998.0575, more developed in MZUSP 11483 but without visible embryos. MNHN 1998.0575 and MZUSP 11483 accidentally caught in the early morning by a fisherman who used a fish as bait and then abandoned his fishing rods. The other specimens were found at night on the road; all were particularly aggressive when caught. Although we encountered the species throughout the year, it was much more visible in February, during the middle of the dry season.

Lycodon capucinus Boie, 1827

IRSNB 16551, Cha-am, Cha-am District, Apr. 2002.

This specimen found DOR by day in the city.

Oligodon fasciolatus (Günther, 1864)

CUMZ(R) 1998.12.11.2, Km 22, road 3219 from Hua Hin to Pala-u Waterfall, 9 Nov. 1998. - IRSNB 16552, Cha-am, Cha-am District, 12 May 2002. - MNHN 1998.0530, Ban Khao Kling, Kaeng Krachan District, 21 Aug. 1997.

The specimens CUMZ(R) 1998.12.11.2 and MNHN 1998.0530 found freshly DOR at midnight in cultivated areas. The adult male IRSNB 16552 collected by day between houses near the beach; when caught, it showed the defensive hemipenis display reported by Wüster and Cox (1992).

Note: We follow Wagner (1975) in referring to as *Oligodon fasciolatus* (Günther, 1864) Thai populations with 21 or 23 scale rows at midbody, widely identified in the literature as *Oligodon cyclurus*. *Oligodon cyclurus smithi* (Werner, 1925) and *O. cyclurus superfluens* Taylor, 1965 become junior synonyms of *Oligodon*

fasciolatus. This latter taxon is known from eastern Myanmar, Thailand, Cambodia, Laos and Vietnam, whereas *O. cyclurus* (Cantor, 1839) is restricted to India, Bangladesh, and western, central and northern Myanmar.

Oligodon mouhoti (Boulenger, 1914)

IRSNB 16553, Khao Nakwang, Nayang subdistrict, Cha-am District, 11 May 2002. - IRSNB 16554, MNHN 1999.7635, Ban Salakern, Ban Lat District, 2001, 3 Mar. 1998. - MNHN 1998.0572, Ban Ton Kaet, Kaeng Krachan District, 4 July 1998.

The adult IRSNB 16553 crossing at 3.35 p.m. a sandy path between the foot of Khao Nakwang and a rice field. IRSNB 16554 killed in a house in which it entered by day. MNHN 1998.0572 crossing a road in secondary forest at night. MNHN 1999.7635 caught inside a house in the evening.

Pareas carinatus Wagler, 1830

CUMZ(R) 1998.12.11.3, Km 16, Road 3219 from Hua Hin to Pala-u, 9 Nov. 1998.

Only this specimen, DOR, found during our surveys.

Pareas margaritophorus (Jan, 1866)

We examined pictures of a DOR specimen, freshly killed and clearly identifiable, taken by P. Haffner on 15 Dec. 1998 in KKNP.

Psammodynastes pulverulentus Boie *in* Boie, 1827

Several specimens observed by CC in deep forest at KKNP in 1998-9.

Psammophis indochinensis Smith, 1943

MNHN 1997.6575, MNHN 1998.0578, Hat Chao Samran, Muang District, both 6 Feb. 1998. - MNHN 1998.0571, Ban Peuk Tian, Tha Yang District, 5 Feb. 1998.

Specimens MNHN 1997.6575 and MNHN 1998.0578 found freshly DOR in a swampy area in the afternoon. MNHN 1998.0571 found, obviously killed with a stick, in a cultivated area. We did not observe this species at other times in the year; it seems that, as for *Homalopsis buccata*, February corresponds to a peak in their movement activity.

Note: We consider to be of specific level the differences which can be seen in the illustrations by Brandstätter (1995) of the dorsal scale microdermatoglyphic patterns of *Psammophis condanarus condanarus* (echinate pattern) and *P. c. indochinensis* (canaliculate pattern). We follow Hughes (1999: 65) who treated *P. indochinensis* as a full species.

Ptyas korros (Schlegel, 1837)

CUMZ(R) 1998.12.11.28, Ban Salakern, Ban Lat District, 8 Nov. 1998.

Diurnal species. After *Xenochrophis flavipunctatus*, the most often encountered snake in cultivated areas. CUMZ(R) 1998.12.11.28 killed by a farmer in a garden at 3 p.m. Freshly DOR specimen found in the afternoon on a road passing through secondary forest in Kaeng Krachan District on 21 Aug. 1997, and another DOR adult in Ban Pala-u, Kaeng Krachan District on 26 April 2002. We also examined a specimen which had been caught during the day in a ricefield in Oct. 1997 at Ban Chao Samran, Muang District.

Ptyas mucosa (Linnaeus, 1758)

Only four specimens seen. Seems much less common than *P. korros*. A specimen found under dead wood in a garden at Ban Salakern, Ban Lat District at 11 a.m. on 5 June 1998. A large adult killed by a farmer in a garden of the same village on the evening in Oct. 1997, just after it had eaten two large *Bufo melanostictus* Schneider, 1799. Another observed in Ban Salakern while it was foraging in a garden at 11 a.m. on 1st June 1998. We examined a specimen which had been killed by farmers in a ricefield at Ban Chao Samran, Muang District in Oct. 1997.

Note: As shown by David and Das (2003), the generic nomen *Ptyas* is of feminine gender.

Rhabdophis nigrocinctus (Blyth, 1856)

Two specimens, one adult and one juvenile, observed by CC in primary evergreen forest in KKNP on 28 Feb. 2000.

Rhabdophis subminiatus (Schlegel, 1837)

CUMZ(R) 2000.2, Ban Salakern, Ban Lat District, 24 Nov. 1999.

Although widespread and often common in Thailand, seems very uncommon in this province. CUMZ(R) 2000.2 caught in a garden at night. Two DOR specimens seen by CC & OSGP a few cm from each other on 21 Nov. 1999 in Ban Salakern. Curiously, all three specimens found during this study were seen within four days in places that were searched on many other occasions. We encountered the same phenomenon in Raman Forest Park, Phang-nga Province, where within a period of a few days in August 2001, we found several specimens of the natricine *Xenochrophis trianguligerus*, a species which we never observed there before.

Xenochrophis flavipunctatus (Hallowell, 1860)

CUMZ(R) 1998.12.11.11, CUMZ(R) 1998. 12.11.14-5, Ban Salakern, Ban Lat District, 31 Aug. 1998, 31 Aug. 1998, 10 Sep. 1998. – CUMZ(R) 1998.12.11.12, Ban Rai Fang, Ban Lat District, 7 Nov. 1998. - CUMZ(R) 1998. 12.11.13, Ban Song, Kaeng Krachan District, 7 Nov. 1998. - CUMZ(R) 1998.12.11.16, Ban Had Sai, Ban Lat District, 15 Nov. 1998. – CUMZ (R) 1998.12.11.17, Ban Khao Kling, Kaeng Krachan District, 7 Nov. 1998. - MNHN 1997.6585, Ban Ton-ma-muang, Muang District, 25 Aug. 1997. - MNHN 1997.6586, Ban Tha-mai-luak, Tha Yang District, 21 Aug. 1997. - MNHN 1998. 8571, Ban Ra Han Noi, Ban Lat District, 6 July 1998. - MNHN 1998. 8581, Ban In Jam Pa, Ban Lat District, 5 July 1998. - MNHN 1998.8578, MNHN 1999.7617, Ban Tha Yang, Tha Yang District, 8 June 1998, 7 July 1998. - MNHN 1999.7615, Hat Chao Samran, Muang District, 6 Feb. 1998. - MNHN 1999.7641, Ban Bang Thalu, Muang District, 24 Dec. 1996. - MZUSP 11484, Ban Wang Krai, Tha Yang District, 7 June 1998.

By far the most commonly encountered snake in cultivated areas, mostly active at dusk. CUMZ(R) 1998.12.11.11 killed by a farmer in his bathroom at 10 a.m. CUMZ(R) 1998.12.11. 12 crossed the road at dusk in a cultivated area. CUMZ(R) 1998.12.11.14, CUMZ(R) 1998.12. 11.17, MNHN 1997.6585-6, MNHN 1998. 8578, MNHN 1999.7615 and MNHN 1999. 7617 found DOR at night in cultivated areas. CUMZ(R) 1998.12.11.15 found active in a garden at 7 p.m. CUMZ(R) 1998.12.11.16 crossing a road near a canal. MNHN 1998. 8571 found freshly DOR at mid-day. MNHN 1998.8581 collected in late afternoon while it was crossing a road close to a canal in a cultivated area. MNHN 1999.7641 found DOR in a swampy area. MZUSP 11484 found freshly DOR near a ricefield; its stomach contains two juvenile *Limnonectes limnocharis* (Gravenhorst, 1829) (Anura, Ranidae).

Note: We regard *Xenochrophis flavipunctatus* and *X. piscator* as two distinct species, following Taylor (1965) but contrary to other authors (notably Cox et al., 1998). These taxa are readily identifiable with the key provided by Taylor (1965: 832). A reevaluation of the respective distributions of these often confused species is necessary.

Elapidae

Bungarus fasciatus (Schneider, 1801)

Several specimens observed by CC at Ban Salakern, Ban Lat District. The animals were seen at night in ricefields. Said by the farmers to have recently become very rare; some explained that it is probably due to the intensive use of pesticides in the fields during the last decade.

Naja kaouthia Lesson, 1831

Two specimens examined at Hat Chao Samran, Muang District, in Oct. 1997, and one at Ban Don Hua Chang, Muang District, on 24 Aug. 1997. Common in cultivated areas. All three cobras caught in daytime in ricefields.

Naja siamensis Laurenti, 1768

CUMZ(R) 1998.12.11.27, Ban Tamlu, Ban Lat District, 24 Oct. 1998.

Seems less common than *N. kaouthia*. Our specimen was killed by a farmer in the afternoon in his house in a cultivated area.

Ophiophagus hannah (Cantor, 1836)

CUMZ(R) 2000.251 (skin), Kaeng Krachan Dam, Kaeng Krachan District, Feb. 1999.

Within the province, seems restricted to forested areas in Kaeng Krachan District. CUMZ (R) 2000.251 killed in the forest by poachers

who prepared its skin in order to sell it. Another large specimen observed by CC & OSGP in the late afternoon on a path in secondary forest near the headquarters of KKNP in July 1998.

Viperidae

Calloselasma rhodostoma (Boie, 1827)

Often encountered by CC in Ban Lat District. CC also examined a DOR specimen at Cha-am, Cha-am District, in Apr. 2001. Hoge and Romano Hoge (1983: 105) listed one specimen (BMNH 1968.837) from "O Cham-Am P. Siam foot of Hill, M.A. Smith pres." The locality written in the catalogue of the BMNH and in Malcolm Smith's hand-written catalogue to his collections is in fact "Cha-am, P. Siam" (McCarthy, pers. comm., June 2000). Said to be common by the farmers, who also reported us that it is responsible for most snakebite cases in Ban Laem District.

Trimeresurus albolabris (Gray, 1842)

IRSNB 15139, MNHN 1998.0569-70, Ban Salakern, Ban Lat District, 16 June 1998, 26 Aug. 1997, 8 June 1998. - QSMI 730, Kaeng Krachan Dam, Kaeng Krachan District, 16 Nov. 1998.

Specimen IRSNB 15139 found at 11 a.m. by a farmer in a rice loft. MNHN 1998.0569 injured by a bicycle while it was crossing over a road in a cultivated area at night. MNHN 1998. 0570 killed at 7.30 p.m. on the lawn of their school by children. According to the villagers, most of the human envenomation cases in Ban Lat District are due to *Trimeresurus*.

DISCUSSION

Composition of the herpetofauna

We list in Table 1 all reptile species currently known from Phetchaburi Province together with sources for earlier records.

Based on these results, the herpetofauna of Phetchaburi Province is currently composed of 81 reptile species, as follows:

Chelonii: 12 species (Trionychidae: 3; Cheloniidae: 2; Testudinidae: 2; Bataguridae: 5)

Crocodylia: 2 species (Crocodylidae)

Lacertilia: 23 species (Gekkonidae: 8; Agamidae: 5; Scincidae: 6; Varanidae: 2; Lacertidae: 1; Uromastycidae: 1)

Serpentes: 44 species (Colubridae: 27; Elapidae: 8; Viperidae: 3; Pythonidae: 2; Acrochordidae: 1; Typhlopidae: 1; Uropeltidae: 1; Xenopeltidae: 1)

The two literature records of *Tomistoma schlegelii* (see Table 1) need confirmation, but the species is meanwhile included in our list. Suwannapak (1999: 99) reported two species of crocodilians from KKNP and gave their vernacular names only: *djorake nam tjut* (corresponding to *Crocodylus siamensis*) and *djorake pak kra thung heo* or *takhong*, these latter names generally applied to *Tomistoma schlegelii*. Old villagers stated us that some decades ago, the *takhong* (which they distinguish well from *C. siamensis*) was still found in the swamps and quiet rivers in forested areas in Ban Lat and Muang districts.

As explained above, this survey is highly preliminary, inasmuch as little attention could be given to the hilly, forested and protected areas of the western part of the province. Consequently, in addition to the above listed reptile species, we can predict the discovery of many other taxa, on the basis of their occurrence in neighbouring provinces.

Chelonii: Based on its known distribution, *Hieremys annandalei* (Boulenger, 1903) (Bataguridae) might be added to the above list. Thirakhupt and van Dijk (1994a: 45, 1994b: 241) reported that a large shipment of mixed turtles, including the North American emydid *Trachemys scripta elegans* (Wied, 1839) was brought from Bangkok and released in Kaeng Krachan Reservoir. As the latter species is probably able to reproduce in Thailand and as it is often sold and kept as a pet in the province, escapees and introduced specimens are likely to be found in the future. Similarly, as there are commercial breeding centers for the softshell, *Pelodiscus sinensis*, in the province (Somsri, no date; Anonymous, 1998: 94), escapees can be expected to turn up in local rivers and reservoirs.

TABLE 1. Synoptic table of the Reptile species listed from Phetchaburi Province.

Taxon	Authority
Trionychidae	
Amyda cartilaginea	This work
Dogania subplana	Tantasuth (no date: 9)
Pelochelys cantorii	This work
Cheloniidae	
Chelonia mydas	This work
Eretmochelys imbricata	This work
Testudinidae	
Indotestudo elongata	This work
Manouria emys phayrei	This work
Bataguridae	
Cuora amboinensis kamaroma	This work
Cyclemys dentata	This work
Heosemys grandis	This work
Malayemys subtrijuga	Srinarumol (1995: 20, 22, etc.; from "Tharang District" = Tharang Subdistrict, Muang District); Pauwels et al. (2000a); this work
Siebenrockiella crassicollis	This work
Crocodylidae	
Crocodylus siamensis	Nabhitabhata and Tantiwithayaphithak (1987: 60, from KKNP); Kreetiyutanont (1993: 136; from KKNP); Keeratiyutanon (1994: 177; from KKNP); Anonymous (2000: 27, 49, 147); Platt et al. (2002; from KKNP); this work
Tomistoma schlegelii	Anonymous (1991: 217); Tourism Authority of Thailand (2000: 27, 49)
Gekkonidae	
Cnemaspis siamensis	This work
Cosymbotus platyurus	This work
Cyrtodactylus brevipalmatus	Ulber (1993, from KKNP); Manthey and Grossmann (1997: 220)
Cyrtodactylus oldhami	Ulber (1993, from KKNP); Manthey and Grossmann (1997: 224; from KKNP)
Dixonius siamensis	This work
Gehyra mutilata	This work
Gekko gecko	Stanner et al. (1998; from "Geong Gra Jang [= Kaeng Krachan] nature reserve, Fet Boni [= Phet Buri = Phetchaburi] Province"); Ota et al. (1999: 665; Kaeng Krachan); this work
Hemidactylus frenatus	This work
Agamidae	
Acanthosaura crucigera	This work
Bronchocela cristatella	This work
Calotes mystaceus	Taylor (1963: 897); Angsirichinda (1997: 55); this work
Calotes versicolor	This work
Draco blanfordii blanfordii	Honda et al. (1999: 547; from "Pa Lao U"=Pala-u); this work
Uromastycidae	
Leiolepis belliana belliana	Gairdner (1914: 40); Pauwels et al. (2000a); this work
Scincidae	
Isopachys anguinoides	This work
Lipinia vittigera	This work
Lygosoma quadrupes	This work
Mabuya multifasciata	This work
Riopa bowringii	This work
Sphenomorphus maculatus mitanensis	This work
Lacertidae	
Takydromus sexlineatus ocellatus	This work
Varanidae	
Varanus bengalensis nebulosus	Flower (1899: 643; "*Varanus nebulosus*", from "Petchaburee"); Gairdner (1914: 40; 1915: 143; "*Varanus nebulosus*"); this work
Varanus salvator	Aggimarangsee (1992: 133; from "Ban Lard" [=Ban Lat] District); this work

TABLE 1. Synoptic table of the Reptile species listed from Phetchaburi Province. - Continued

Taxon	Authority
Typhlopidae	
Ramphotyphlops braminus	Niyomwan (1999: 27, 78; from Ban Salakern, Ban Lat District); this work
Xenopeltidae	
Xenopeltis unicolor	This work
Uropeltidae	
Cylindrophis ruffus	This work
Pythonidae	
Python molurus bivittatus	This work
Python reticulatus	Chaiyakham (1994: 115; from KKNP); this work
Acrochordidae	
Acrochordus granulatus	Taylor and Elbel (1958: 1133-34)
Colubridae	
Ahaetulla prasina	Suwannapak (1999: 97); this work
Boiga multomaculata	This work
Boiga ocellata	This work
Cerberus rynchops	Manthey and Grossmann (1997: 331)
Chrysopelea ornata	This work
Dendrelaphis cyanochloris	This work
Dendrelaphis pictus	This work
Dryocalamus davisonii	This work
Elaphe radiata	Schulz (1996: 223), this work
Elaphe taeniura ssp.	Schulz (1996: 264; a peculiar form from Kaeng Krachan Dam area)
Enhydris enhydris	This work
Enhydris plumbea	This work
Erpeton tentaculatum	This work
Gonyosoma oxycephalum	Schulz (1996: 181)
Homalopsis buccata	This work
Lycodon capucinus	This work
Oligodon fasciolatus	This work
Oligodon mouhoti	This work
Pareas carinatus	This work
Pareas margaritophorus	This work
Psammodynastes pulverulentus	This work
Psammophis indochinensis	This work
Ptyas korros	This work
Ptyas mucosa	This work
Rhabdophis nigrocinctus	This work
Rhabdophis subminiatus	This work
Xenochrophis flavipunctatus	This work
Elapidae	
Bungarus fasciatus	This work
Enhydrina schistosa	Taylor and Elbel (1958: 1163; "Phet Buri")
Hydrophis caerulescens	Taylor and Elbel (1958: 1167; "Phet Buri province")
Hydrophis ornatus	Purana nanda (1957: Fig. 7; "*Disleira ornata*")
Lapemis curtus hardwickii	Taylor and Elbel (1958: 1163-64; "Phet Buri province"); Taylor (1965: 1023)
Naja kaouthia	Viravan et al. (1992: 101, fig. 3); this work
Naja siamensis	Cox (1991: 299, as *Naja* sp., from Tha Yang District); Viravan et al. (1992: 101, fig. 3, as *Naja atra*); Jintakune and Chanhome (1995: 85); Wüster et al. (1997: 779-80, 783); Niyomwan (1997: 117); Chanhome et al. (1998: 314); Pauwels et al. (2000a); this work
Ophiophagus hannah	This work
Viperidae	
Calloselasma rhodostoma	Wanadorn (1918: 46); Hoge and Romano Hoge (1983: 105); Viravan et al. (1992: 102, fig. 4); this work
Trimeresurus albolabris	Viravan et al. (1992: 102, fig. 5); this work
Trimeresurus popeiorum	Wüster (1992: 24, from Ban Pala-u)

Lacertilia: Considering the species distributions given in Taylor (1963) and Manthey and Grossmann (1997), the number of lizards is predicted to increase by at least 11 species, namely: *Gehyra fehlmanni* (Taylor, 1962), *Hemidactylus garnotii* Duméril & Bibron, 1836, *Hemiphyllodactylus typus* Bleeker, 1860, *Ptychozoon* sp. (Gekkonidae), *Calotes e. emma* Gray, 1845 (the absence in our survey of this widely distributed taxon is remarkable, the species having been reported from Prachuap Khiri Khan Province by Chan-ard et al., 1999: 93), *Draco maculatus* Gray, 1845 and *D. taeniopterus* Günther, 1861 (Agamidae), *Dasia olivacea* Gray, 1839, *Isopachys gyldenstolpei* Lonnberg, 1916 (OSGP examined the specimen BMNH 1933.12. 3.30 from Hua Hin, Prachuap Khiri Khan Province, a few kilometers south of the border with Phetchaburi Province, and the species is also known from Kanchanaburi Province according to Lang and Böhme [1990]), *Mabuya longicaudata* (Hallowell, 1856), and *Tropidophorus robinsoni* (Smith, 1919) (Scincidae). Dibamidae are also very likely to be present.

Serpentes: We predict that at least 40 other species might be present. First, based mainly on the general distributions given by Cox (1991), the following 23 species of landsnakes are likely to occur in suitable areas of the province: *Ramphotyphlops albiceps* (Boulenger, 1898), *Typhlops muelleri* Schlegel, 1839 (Typhlopidae), *Python brongersmai* Stull, 1938 (Pythonidae), *Acrochordus javanicus* Hornstedt, 1787 (Acrochordidae), *Ahaetulla nasuta* (Lacepède, 1789), *Boiga cyanea* (Duméril, Bibron & Duméril, 1854), *Calamaria pavimentata* Duméril, Bibron & Duméril, 1854, *Elaphe porphyracea* (Cantor, 1839), *Enhydris bocourti* (Jan, 1865) and *E. smithi* (Boulenger, 1914), *Liopeltis scriptus* (Theobald, 1868), *Lycodon laoensis* Günther, 1864, *L. subcinctus* Boie, 1827, *Ptyas carinata* (Günther, 1858), *Rhabdophis chrysargos* (Schlegel, 1837), *Sibynophis collaris* (Gray, 1853), *Xenelaphis hexagonotus* (Cantor, 1847), *Xenochrophis punctulatus* (Günther, 1858) (see Pauwels et al., 2002a) (Colubridae), *Bungarus candidus* (Linnaeus, 1758), *Calliophis maculiceps* (Günther, 1858) (Elapidae), *Ovophis monticola* (Günther, 1864; in the higher parts of the province), *Trimeresurus macrops* Kramer, 1977 (Crotalidae), and *Daboia russelii* (Shaw & Nodder, 1797) (Viperidae).

Second, some farmers of Ban Salakern, while talking about *Bungarus fasciatus*, told us that this snake has "a very rare cousin, also of triangular body section, but black with red head and tail", that was sometimes found in the forested areas of the province. They unambiguously recognized this species as *Bungarus flaviceps* Reinhardt, 1843 on the basis of the picture in Cox (1991: 307). As the species is already known from the adjacent province of Ratchaburi just north of Phetchaburi Province and in the far southern province of Nakhon Si Thammarat (Soderberg, 1973: 213), its occurrence in Phetchaburi Province is highly probable.

Last, the 20 species included in the key to the seasnakes of the Gulf of Thailand by Murphy et al. (1999) might all occur in Phetchaburi coastal waters; so far only four of them have been recorded. Smith (1926) notably reported *Aipysurus eydouxii* (Gray, 1849), *Hydrophis cyanocinctus* Daudin, 1803, *Praescutata viperina* (Schmidt, 1852) and *Thalassophis anomalus* Schmidt, 1852 from Hua Hin, Prachuap Khiri Khan Province, a few kilometers south of the border with Phetchaburi Province.

Several species were erroneously listed from Phetchaburi Province in the literature. Bourret and Le Poulain (1941: 26) listed *Indotestudo elongata*, *Manouria emys*, *Heosemys grandis* and *Platysternon megacephalum* from the "districts de Ratbury et Petchabury" on the basis of the work of Smith (1915), who in fact mentioned them from "Sai Yoke district" (see Smith, 1915: 153), thus in Kanchanaburi Province. Moreover, on the map provided by Bourret & Le Poulain, Phetchaburi is obviously confused with Phetchabun (Central Thailand).

In the same way, Taylor (1963: 891) quoted *Calotes versicolor* from "Ratburi" and "Petchaburi" on the basis of the work of "M. Smith and Gairdner, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 3, Mar. 1915, pp. 130, 154". Page 130

is blank; page 154 listed a specimen from Sai Yok District (see Smith, 1915: 153), Kanchanaburi Province.

The distribution map provided by Hallermann & Böhme (2000: 205) for the genus *Pseudocalotes* shows a record from Phetchaburi Province for *P. microlepis*. However, the locality given for this sole specimen in the material examined is "Doi Nang Ka (= Mt. Nang Kao ? = Phu Khoa Pram, 9°20'N 98°31'E)". Hallermann (pers. comm., Sept. 2000) is not sure about the exact location of Doi Nang Ka, and told us that it could in fact correspond with "Doi Nang Kham (Hill) 17°23'45''N 99°39'24''E", a much more probable locality in our opinion, as the Thai word *doi* is only used in northern Thailand. Accordingly, we do not presently include *Pseudocalotes microlepis* in the list for Phetchaburi Province.

The recent record of *Dendrelaphis striatus* (Cohn, 1905) by Seesook (2000) was based on two pictures of a single specimen taken in KKNP, and would have constituted a major range extension northwards for this species. However, after our examination of the meristic and coloration characters visible on these published pictures, we refute this identification. Furthermore, we examined a specimen from Kroeng Krawia, Sangklaburi District, Kanchanaburi Province (IRSNB 15294) which presented exactly the same coloration, but with all meristic characters perfectly concurring with those of *Dendrelaphis cyanochloris*, to which we hence also refer the specimen illustrated by Seesook. Our report of the presence of *D. striatus* in Phetchaburi Province (Pauwels et al., 2000a), based on Seesook (2000), must thus be retracted.

Grassman (1998: 20) reported a case of predation by a Golden Cat, *Catopuma temmincki* (Vigors and Horsfield, 1827), on a *Natrix* sp. in KKNP. However, since 1960 the genus *Natrix* Laurenti, 1768 has been split into several genera of which some are represented by various species in the area; a precise identification of this natricine specimen is hence not possible.

The map provided by Cox (2000: 80) for *Calliophis maculiceps* shows a dot on Phetchaburi Province. However this map was not intended to depict specific locations, only general locations, and the author did not examine any specimen from this province (Cox, pers. comm., Nov. 2000); accordingly, we do not include this species in our list.

The 120 cm long snake, "azure-blue covered with small white spots, the whole head and last 6 inches of the tail being a brilliant red, glistening as though painted with enamel", identified by Gairdner (1915: 137) as "possibly *Doliophis bivirgatus*" could indeed be a *Calliophis bivirgatus flaviceps* (Cantor, 1839) (the generic position of this species formerly referred to the genus *Maticora* is based on Slowinski et al. [2001]). However, the uncertainty of Gairdner himself as to the identity of this snake leads us to wait documented confirmation of its presence before including it in the list.

Soderberg (1973: 240) listed "*Naja k. kaouthia*" from Phetchaburi Province. However, as he recognized only one species of *Naja* in Thailand, his report might as well concern *Naja siamensis*.

Biogeographic discussion

Although the Isthmus of Kra has never been definitely considered a biogeographic barrier, it has long been regarded as the convenient zoogeographic boundary between the Indochinese Subregion and the Malayan Subregion of the Oriental Region (Boulenger, 1912; Kloss, 1915, 1929; Smith, 1943). This presentation of the preliminary list of reptiles of Phetchaburi Province, which lies about 200 km north of the isthmus, coupled with our recent descriptions of the fauna of Phang-nga Province (Pauwels et al., 2000b, 2002b), which lies about 200 km south of Kra, allows a first test of this old hypothesis as it effects reptiles.

Reiterating, Pauwels et al. (2000b, 2002b) found 110 species in Phang-nga Province, and predicted that the true species count may be more than 170 species. In Phetchaburi Province, our preliminary survey revealed 81 species and we expect to eventually record 38

TABLE 2. Land snake distributions in four regions of southeast Asia

TAXA	PHETCHABURI	PHANG-NGA	W. MALAYSIA	CAMBODIA
Acrochordus granulatus	x	x	x	x
Acrochordus javanicus	-	-	x	x
Ahaetulla fasciolata	-	x	x	-
Ahaetulla mycterizans	-	-	x	-
Ahaetulla nasuta	-	-	-	x
Ahaetulla prasina	x	x	x	x
Amphiesma inas	-	-	x	-
Amphiesma cf. *modestum* (1)	-	-	-	x
Amphiesma petersii	-	-	x	-
Amphiesma sanguineum	-	-	x	-
Amphiesma sarawacense	-	-	x	-
Amphiesma stolatum	-	-	-	x
Anomochilus leonardi	-	-	x	-
Aplopeltura boa	-	x	x	-
Asthenodipsas laevis (2)	-	-	x	-
Asthenodipsas malaccanus (2)	-	-	x	-
Bitia hydroides	-	-	x	-
Boiga cyanea	-	x	x	x
Boiga cynodon	-	x	x	-
Boiga dendrophila melanota	-	x	x	-
Boiga drapiezii	-	x	x	-
Boiga jaspidea	-	x	x	-
Boiga multomaculata	x	-	x	x
Boiga nigriceps	-	x	x	-
Boiga ocellata	x	-	-	x (3)
Bungarus candidus	-	x	x	x
Bungarus fasciatus	x	-	x	x
Bungarus flaviceps	-	x	x	-
Calamaria albiventer	-	-	x	-
Calamaria lovii	-	-	x	-
Calamaria lumbricoidea	-	-	x	-
Calamaria pavimentata	-	-	x	x
Calamaria prakkei	-	-	x	-
Calamaria schlegeli	-	-	x	-
Calliophis bivirgatus (4)	-	-	x	x
Calliophis gracilis	-	-	x	-
Calliophis intestinalis (4)	-	x	x	-
Calliophis maculiceps (4)	-	-	x	x
Calloselasma rhodostoma	x	x	x	x
Cantoria violacea	-	-	x	-
Cerberus rynchops	x	x	x	x
Chrysopelea ornata ornatissima	x	x	x	x
Chrysopelea paradisii	-	x	x	-
Chrysopelea pelias	-	-	x	-
Collorhabdium williamsoni	-	-	x	-

TABLE 2. Land snake distributions in four regions of southeast Asia - Continued

TAXA	PHETCHABURI	PHANG-NGA	W. MALAYSIA	CAMBODIA
Cylindrophis ruffus	x	x	x	x
Daboia russelii	-	-	-	x
Dendrelaphis caudolineatus	-	x	x	-
Dendrelaphis cyanochloris	x	x	x	-
Dendrelaphis formosus	-	x	x	-
Dendrelaphis pictus	x	x	x	x
Dendrelaphis striatus	-	x	x	-
Dendrelaphis subocularis	-	-	-	x
Dryocalamus davisonii	x	-	-	x
Dryocalamus subannulatus	-	x	x	-
Dryophiops rubescens	-	-	x	-
Elaphe flavolineata	-	x	x	-
Elaphe porphyracea	-	-	x	x
Elaphe prasina	-	-	x	-
Elaphe radiata	x	x	x	x
Elaphe taeniura	x	x	x	x
Enhydris bocourti	-	-	x	x
Enhydris enhydris	x	-	x	x
Enhydris indica	-	-	x	-
Enhydris innominata longicauda	-	-	-	x
Enhydris jagori	-	-	-	x
Enhydris pahangensis	-	-	x	-
Enhydris plumbea	x	x	x	x
Enhydris punctata	-	-	x	-
Erpeton tentaculatum	x	-	-	x
Fimbrios klossi	-	-	-	x
Fordonia leucobalia	-	-	x	-
Gerarda longicauda	-	-	x	-
Gongylosoma baliodeira (5)	-	-	x	-
Gonyophis margaritatus	-	-	x	-
Gonyosoma oxycephalum	x	x	x	x
Homalopsis buccata	x	x	x	x
Lepturophis albofuscus	-	-	x	-
Liopeltis tricolor	-	-	x	-
Lycodon butleri	-	-	x	-
Lycodon capucinus	x	x	x	x
Lycodon effraenis	-	-	x	-
Lycodon laoensis	-	x	x	x
Lycodon subcinctus	-	x	x	x
Macrocalamus jasoni	-	-	x	-
Macrocalamus lateralis	-	-	x	-
Macrocalamus schulzi	-	-	x	-
Macrocalamus tweediei	-	-	x	-
Macropisthodon flaviceps	-	-	x	-
Macropisthodon rhodomelas	-	-	x	-

TABLE 2. Land snake distributions in four regions of southeast Asia - Continued

TAXA	PHETCHABURI	PHANG-NGA	W. MALAYSIA	CAMBODIA
Naja kaouthia	x	x	x	x
Naja siamensis	x	-	-	x
Naja sumatrana	-	x	x	-
Oligodon barroni	-	-	-	x
Oligodon cinereus	-	-	x	x
Oligodon eberhardti	-	-	-	x
Oligodon fasciolatus	x	-	-	x
Oligodon inornatus	-	-	-	x
Oligodon mouhoti	x	-	-	x
Oligodon ocellatus	-	-	-	x
Oligodon octolineatus	-	-	x	-
Oligodon purpurascens	-	x	x	-
Oligodon signatus	-	-	x	-
Oligodon taeniatus	-	-	-	x
Ophiophagus hannah	x	x	x	x
Opisthotropis balteatus	-	-	-	x
Oreocalamus hannitschi	-	-	x	-
Ovophis monticola	-	-	x	x
Pareas carinatus	x	-	x	x
Pareas macularius	-	-	x	-
Pareas margaritophorus	x	-	x	x
Pareas vertebralis	-	-	x	-
Psammodynastes pictus	-	-	x	-
Psammodynastes pulverulentus	x	-	x	x
Psammophis indochinensis	x	-	-	x
Pseudorabdion longiceps	-	-	x	-
Pseudoxenodon macrops	-	-	x	-
Ptyas carinata	-	x	x	-
Ptyas fusca	-	x	x	-
Ptyas korros	x	x	x	x
Ptyas mucosa	x	-	x	x
Python brongersmai	-	x	x	-
Python molurus bivittatus	x	-	-	x
Python reticulatus	x	x	x	x
Ramphotyphlops albiceps	-	x	x	-
Ramphotyphlops braminus	x	x	x	x
Ramphotyphlops lineatus	-	-	x	-
Rhabdophis chrysargos	-	x	x	x
Rhabdophis conspicillatus	-	-	x	-
Rhabdophis nigrocinctus	x	x	-	x
Rhabdophis s. subminiatus	x	x	x	x
Sibynophis collaris	-	-	x	x
Sibynophis melanocephala	-	x	-	-
Trimeresurus albolabris	x	-	-	x
Trimeresurus borneensis	-	x	x	-

TABLE 2. Land snake distributions in four regions of southeast Asia - Continued

TAXA	PHETCHABURI	PHANG-NGA	W. MALAYSIA	CAMBODIA
Trimeresurus hageni	-	x	x	-
Trimeresurus macrops	-	-	-	x
Trimeresurus popeiorum	x	x	x	x
Trimeresurus purpureomaculatus	-	x	x	-
Trimeresurus sumatranus	-	-	x	-
Trimeresurus vogeli	-	-	-	x
Tropidolaemus wagleri	-	x	x	-
Typhlops muelleri	-	x	x	x (6)
Typhlops siamensis	-	-	-	x
Xenelaphis ellipsifer	-	-	x	-
Xenelaphis hexagonotus	-	-	x	-
Xenochrophis flavipunctatus	x	x	x	x
Xenochrophis maculatus	-	-	x	-
Xenochrophis trianguligerus	-	x	x	-
Xenodermus javanicus	-	-	x	-
Xenophidion schaefferi	-	-	x	-
Xenopeltis unicolor	x	x	x	x
TOTAL OF TAXA	**40**	**57**	**124**	**71**

more non-marine species (for a total of 119 non-marine species) and up to 16 species of sea snakes. A preliminary analysis (Pauwels et al., 2000c) showed that at least 40 of the 64 non-marine reptile species known at that time from Phang-nga were shared between these two provinces. On another hand, Pauwels et al. (2000a) reported that 61 (94 %) of the 65 land species (seasnakes and *Acrochordus* excluded) recorded from Phetchaburi Province were also known south of the Isthmus of Kra. New data on the faunas of these two provinces show that:

Total number of reptile species in Phetchaburi: 81
Total number of reptile species in Phang-nga: 110
Number of shared species between these provinces: 50

These 50 shared species represent 45.5 % of the Phang-nga reptile fauna. Conversely, 62 % of the Phetchaburi reptile fauna has been found in Phang-nga. Taking a broader geographic view, it appears that not less than 71 reptile species of Phetchaburi, out of a total of 81 (88 %) are known from somewhere south of the Isthmus of Kra. This latter statistic is based on reliable records from Thai provinces south of Ranong and Chumphon, West Malaysia and southwards.

The importance of the Isthmus of Kra as a potential biogeographic barrier can be ascertained in comparing the faunas of Phetchaburi and Phang-nga, and also by comparing these faunas with two more distant regions, namely, in the south, the fauna of peninsular Malaysia (or West Malaysia), and in the east the fauna of Cambodia. Besides comparing directly the number and percentage of shared species, we also use Jaccard's Coefficients of Community (see Das, 1996). For sake of convenience, our analysis was conducted only on the snake fauna, excluding the seasnakes (members of the genera *Enhydrina*, *Hydrophis*, *Kolpophis* and *Laticauda*). Data on the fauna of Phang-nga originate from Pauwels et al. (2000b, 2002b), whereas data from West Malaysia (taxa introduced in Singapore are not included) come from

Tweedie (1983) and Chan-ard et al. (1999). For Cambodia, we relied on Saint Girons (1972), David and Ineich (1999) and Daltry and Dany (2000). Unfortunately, the reptile fauna of northern and central Thailand is too imperfectly known to even permit a comparison between faunas of northern and southern Thailand, hence our choice of Cambodia as a proxy northern representative.

We are aware that our comparisons suffer from three shortcomings, namely (1) our field investigations are still preliminary; (2) the comparisons between these two provincial lists are biased because, in Phetchaburi, we concentrated on the herpetofauna of cultivated and degraded areas, while in Phang-nga, we concentrated on forested areas located in the south of the province (little work was conducted in the highly cultivated parts of the north and north-east and in the higher parts of the central hills); and (3) comparisons with the fauna of West Malaysia and Cambodia are biased by their much larger area (131.598 km^2 and 181.035 km^2 respectively), compared with the areas of Phetchaburi (6225 km^2) and Phang-nga (4170 km^2), and also by the fact that about 30 of the 124 snake species of West Malaysia are known there only from mountainous regions of central West Malaysia.

Nevertheless, in spite of these shortcomings, our lists for the provinces of Phang-nga and Phetchaburi allow us to make a direct zoogeographic comparison, not only between these Thai provinces themselves, but also between them and the fauna of peninsular Malaysia, in the south, and Cambodia in the east. The full list of regional snakes appears in Table 2, where they are placed in alphabetical order by genus. Unconfirmed records are not considered.

Notes for Table 2:

(1): The status of these populations will be discussed elsewhere (David et al., in prep.)

(2): These two species were referred to the genus *Internatus* Yang & Rao, 1992 by Yang & Rao (in Rao & Yang, 1992), but, as pointed out by Iskandar & Colijn (2001), the genus *Asthenodipsas* Peters, 1864 (type species: *Asthenodipsas malaccana* Peters, 1864 by monotypy) has priority over *Internatus* Yang & Rao, 1992.

(3): As *Boiga cynodon* in Saint Girons (1972).

(4): The generic position of species formerly referred to the genus *Maticora* follows Slowinski et al. (2001).

(5): The specific nomen *baliodeira* (meaning: "ocellate neck") is a noun in apposition, not an adjective, and should not be accorded with the gender of the generic nomen.

(6): As *Typhlops diardi* in Saint Girons (1972).

A simple snake species number comparison for the four regions is presented in Table 3. In each cell, the number of shared species and the percentage of shared species for each specific pair of regions compared are shown. In this table, as in the following discussion, we consider the whole snake fauna of each region. Comparisons based on forest species or on species

TABLE 3. Comparison of the snake fauna North and South of the Isthmus of Kra

	Phetchaburi	**Phang-Nga**	**W. Malaysia**	**Cambodia**
Phetchaburi	---	24	30	39
(n = 40)		60.0 %	75.0 %	97.5 %
Phang-Nga	24	---	55	28
(n = 57)	42.1 %		96.5 %	49.1 %
West Malaysia	30	55	---	44
(n = 124)	24.2 %	44.4 %		35.5 %
Cambodia	39	28	44	---
(n = 71)	54.9 %	39.4 %	62.0 %	

largely present in disturbed areas may present different values. However, as our discussion bears on the biogeographical impact of the Isthmus of Kra on snakes, we do not differentiate these species on the basis of their ecology, which, furthermore, is often too poorly known.

It appears from these values that, unsurprisingly, the fauna of Phang-nga Province is strongly Sundaic, with 96.5 % of the species of the province found also in West Malaysia, and that the fauna of Phetchaburi is largely present in Cambodia, with 97.5 % of the Thai province species found in this latter country. In both cases, there are no climatical nor geophysical barriers between these areas.

More surprising are the slightly greater affinities of Cambodian species with those of West Malaysia, on the opposite side of the Gulf of Thailand, with 62 % of Cambodian species present in Malaysia, but only 54.9 % in Phetchaburi Province. Even more surprising, and in spite of the presence of the Isthmus of Kra, is the higher proportion of species from Phetchaburi Province found in West Malaysia than in the relatively close Phang-nga Province (75.0 vs. 60.0 % of Phetchaburi Province species). The result is similar when it is expressed in comparing Phang-nga species numbers shared with Phetchaburi and Cambodian faunas, namely 42.1 and 49.1 % of shared species respectively. Obviously, an hypothesized role of the Isthmus of Kra as a barrier could not explain the stronger affinities of the Thai provinces with distant areas rather than between themselves. It is worth noting than 22 out of the 24 species shared between Phetchaburi and Phang-nga provinces are wide ranging species present in the four selected areas, and found in a number of biotopes and climatic conditions (such as *Ahaetulla prasina*, *Chrysopelea ornata*, *Elaphe radiata*, *Lycodon capucinus* and *Ptyas korros*).

The similarities of these snake faunas can also be expressed in using Jaccard's Coefficient of Community (Das, 1996). This coefficient C_{AB} is defined as:

$$C_{AB} = S_{AB} / (N_A + N_B - S_{AB})$$

where, S_{AB} = number of shared species between regions A and B;
N_A and N_B = number of total species in region A and B respectively.

According to our results, the Coefficients of Community for the four regions are given in Table 4.

Besides the strong affinities found above between Phetchaburi and Cambodia, and between Phang-nga and West Malaysia respectively, other coefficients of community are rather similar, for example between Phetchaburi and Phang-nga on one side, and West Malaysia on the other side, or between Cambodia and Phang-nga and West Malaysia.

TABLE 4. Coefficients of Community for the four investigated regions

	Phang-Nga	Phetchaburi	W. Malaysia	Cambodia
Phetchaburi	0.33	---	0.22	0.54
Phang-Nga	---	0.33	0.44	0.28
West Malaysia	0.44	0.22	---	0.29
Cambodia	0.28	0.54	0.29	---

The significance of these values may be exemplified in comparing the similarities of the snake fauna of two islands both off China, namely Hainan, close to the mainland, and Taiwan, separated from eastern China by an about 140 km wide strait, with the snake fauna known from south-eastern China (Provinces of Fujian, Guangxi, and Guangdong, and Hong Kong Special Area). Based on Zhao and Adler (1993) and Zhao et al. (1998), the number of land snakes in this region is 95; Hainan and Taiwan are the hosts to 58 and 39 snake species respectively, of which 53 (91.4 %) and 31 (79.5 %) occur in the specified part of the mainland. The Coefficients of Community are in this example 0.53 and 0.38, values similar to those of our regions without barrier (Phetchaburi / Cambodia) and with a supposed biogeographic barrier (Phetchaburi / Phang-nga). These results should also be compared with the trans-Sundaland coefficients of 0.53-0.71 obtained by Inger and Voris (2001).

In a summary, the percentage of herpetofauna distributed on each side of the Isthmus of Kra is high, with nearly 88 % of the number of reptile and more than 77 % of snake species (31 out of 40) respectively found in Phetchaburi Province being also present somewhere south of the Isthmus. Consequently, it appears that the arbitrary limit between the Sundaic Subregion and the rest of the Oriental Region, once regarded as being the Isthmus of Kra, has little meaning as to the distribution of the Oriental snake fauna. In contrast, Inger (1999) regarded the Isthmus of Kra as a more significant limit for amphibian distributions. He placed the limit between two zoogeographic regions, the "Southeast Asian Lowlands" (Region 5) and "Tenasserim and Malay Peninsula" (Region 6) in the northern part of the peninsula (Inger, 1999: fig. 8:4).

However, if the isthmus has never been regarded as a biogeographic barrier, there is nevertheless marked progressive decreases in the number of "northern" snake species going southwards through this narrow bridge of land and, conversely, in the number of Sundaic species going northwards. This region, whatever the reason(s), induced an influence on the distribution of the herpetofauna. Palaeobiogeography of the region, although imperfectly known, may provide some cues. Heaney (1991) presented an hypothetical analysis on the evolution of the climate in Southeast Asia, which may explain the relative poverty of species in Phetchaburi Province, and, more generally speaking, on the influence of the area immediately north of the Isthmus of Kra on the biogeography of the fauna of this part of Southeast Asia. On another hand, during the Pleistocene period of the Quaternary, Southeast Asia was repeatedly affected by a global lowering of sea level, cooler temperatures and both a higher seasonality and decrease in the volume of rainfalls (Morley and Flenley, 1987; Heaney, 1991, Holloway and Hall, 1998; Voris, 2000; Inger and Voris, 2001). The consequence of these climatic phenomenons led to the emergence of a large piece of land connecting Sumatra, Borneo and Java with mainland southeast Asia (see, for examples, Morley and Flenley, 1987: fig. 5.5 and Heaney, 1991: fig. 2). It has generally been accepted that these lowlands allowed the northwards dispersal of equatorial, or Sundaic, taxa, and vice versa. However, the Quaternary was several times affected by strong modifications of the climate, with stronger seasonality in the climate prevailing on the Sunda Region, and a decrease of rain falls. According to Morley and Flenley (1987), these modifications, especially the seasonality and decrease of rain falls, induced a marked ecological change in the central part of the Sundaland. The land exposed by sea regression was largely low and flat, excepted on the margin of this basin, still currently emerged as southern Indochina and the Thai-Malay Peninsula. The most likely effect of the increasing dryer conditions during the Pleistocene was a wide scale reduction of the land covered with lowland rain forests in the flat central part of the Sunda Region, replaced by savannas, open woodlands and peat swamps (Inger and Voris, 2001), whereas, following Heaney (1991), slightly higher western and southern parts of the Sundaland were not so much affected. As a consequence, many Indo-Malay snake species restricted to a wet equatorial climate, previously widely present in the emerged Sundaland, most probably subsequently disappeared from its too dry central, northern and northwestern parts. At the same time, areas of the modern southern Thailand and West Malaysia and, also, southern Vietnam, not affected by these dry conditions, may have been used as a refuge for forest-associated Indo-Malayan taxa. Recent investigations (N. Orlov, pers. comm., August 2000) in Vietnam revealed the occurrence of typically Indo-Malayan taxa, especially through the confirmation of the presence of *Tropidolaemus wagleri* and *Boiga dendrophila*. During the last glaciation, a good number of Indo-Malayan species may have been able to reach again parts of what was left of the Sunda Region after the sea level raised again (see Voris, 2000, for a time scale) through a northwards dispersion from southern unaffected areas, namely from

West Malaysia and extreme southern Thailand. However, one may assume that the areas at the northwestern distal area of the former land-bridge straddling the present Gulf of Thailand, now reduced to the peninsular Thailand, either could not be recolonized in time before the climate turned again to the comparatively dry conditions still prevailing nowadays, or that Indo-Malayan species were halted by the climate and ecological conditions which remained unsuitable.

Inger (1999: fig. 8.5) provided current climatic data in the area of the Isthmus of Kra. Whereas the west-facing slopes of the mountain range extending north-south along the western part of the peninsula receive abundant annual rainfall (4000-4800 mm), the eastern side and adjacent lowlands both receive much less rainfall (1500 mm) and are subject to a longer dry season. As emphasized by Inger about the distribution of amphibians, if the hill or mountain range extending in the Isthmus Kra, wet and covered with evergreen forests allows the presence and a north-south passage of forest species, the dryer conditions in the remaining part of the northern part of the Isthmus block other species. These comparatively dry climatic conditions in the northern part of the Isthmus of Kra, in spite of some wet areas, as the Kaeng Krachan NP, made of this latter region a biogeographic filter towards the north for Indo-Malay species. These climatic variations may explain, for example the greater affinity between the faunas of Phetchaburi and Cambodia than between Cambodia and the much more humid Phang-nga Province, and affinities of this latter one with West Malaysia, in contact when the sea levels were low, as well as north-south decreasing affinities of the fauna of Phetchaburi.

On these considerations, we follow McKenna (1973) in regarding the Isthmus of Kra as a biogeographic filter, impeding movement of only a part of the biota. This concept of biogeographic filter was also adopted by Das (1996). We speculate that the Isthmus of Kra plays the role of a filter, due both to palaeo- and current climatic conditions, namely to the modern south-north increase of the dry season duration. The significantly disturbed ecological conditions affecting most of the provinces of the central peninsula of Thailand, are a very recent factor, which might also have bearings on the dispersion of the Indo-Malay fauna through a region reduced to a very narrow land corridor. A partial answer to the hypothesis of the biogeographic filter, and the influence of its geographic narrowness could be obtained through a better knowledge of the herpetofaunas of wet, hilly forest-covered areas of extreme western peninsular Thailand and in the west side of the Tenasserim in Myanmar, which may play the role of a refuge. Furthermore, we suspect that many species (see Table 2) found in Phetchaburi and in West Malaysia, but not yet recorded from Phang-nga, will be found there in suitable biotopes, when the herpetofauna of the province is better known. Among the 50 or more species regarded as of probable occurrence in Phang-nga Province by Pauwels et al. (2000b), not less than five are already definitely known from Phetchaburi. In the opposite way, about 10 species regarded here as probable in Phetchaburi are known from Phang-nga Province.

Based on all the published data on the distribution of snake species in Thailand, it appears that, if a tentative biogeographic boundary separating Indo-Malay from Indochinese taxa of eastern and southern Asia had to be drawn, it should be placed further north, following a line from western Thailand and the north of the Central Plain of Thailand, north of Bangkok, and then running to southern Vietnam, including, from west to east, the discontinuity in Tanen Taunggyi Range near Kanchanaburi, the Central Plain of Thailand, the Khorat Plateau, eastwards through the central plains of Cambodia up to the northern limit of the lowlands of southern Vietnam north of Saigon. This line seems to agree very well with the 4-month limit of duration of the dry season, as figured in Gloyd and Conant (1990: 383, Map 22). North of this line, excepted in the west-facing slopes of the western hill and mountain range, the dry season increases significantly, whereas the 2-month and 1-month limits of the dry season,

relatively close each from the other (100 or 150 km), are located on the Thai/West Malaysia border. The 3-month-limit is not figured on the map, but would cross the Phang-nga Province.

Inger (1999: fig. 4) included the whole of the hilly region north of the discontinuity in Tanen Taunggyi Range in his Region 3, the "Northeastern Montane Region", recognizing this discontinuity in the western range as its southern border and hence as a biogeographic limit, an interpretation with which we fully agree. As far as snakes are concerned, the depression crossing the Tanen Taunggyi Range of western Thailand is marked, for example, by the southernmost locality of *Xenochrophis piscator*, present in northwestern Thailand, Myanmar and Indian Peninsula, whereas the influence of the dry central plains of Thailand is examplified by the occurrence of the typical forest dweller *Trimeresurus vogeli* (David et al., 2001) in the wet hills located at the eastern and southern fringes of this extensive plain which ranges eastwards straightforward across Cambodia towards Vietnam, with some isolated wet hills.

The available data on the distribution of Thai reptiles suggest that, if the zoogeographic regions recognized by Inger (1999) are also very meaningful for snakes, the limit between Inger's Regions 5 and 6 should be placed farther north, well north of the Isthmus and in contact with the southern limit of Region 3. This line constitutes a wavy but strong biogeographic limit, acting as a barrier for many snake species, and also for lizards (see, for example, Yamasaki et al., 2001 about the variation in *Sphenomorphus maculatus*). The relatively dry conditions and the lack of wet forests prevailing in these areas are undoubtedly a stronger filter for all taxa inhabiting wet lowland forests.

CONCLUSION

Our study shows that the herpetofauna of Phetchaburi Province is composed of at least 81 species distributed in all major groups of reptiles, a number which, as explained above, may raise to as high as 135. The poor knowledge of the provincial herpetofauna is stressed by the fact that a proportion of 64 % of species reported here are recognized for the first time from the province. By comparison, a proportion of 50 % was noted for the first time by Pauwels et al. (2000c) for their recent herpetological survey of Phang-nga Province. Such results are indicative of our poor state of knowledge of the Thai herpetofauna and should strongly encourage the continuation of field studies and systematic inventories. As a direct spin-off, the discovery of both an unsuspected and ever richer biodiversity and of rare or localized species will inevitably lead to conservation measures when appropriate, for species as well for their biotopes. We here stress the admirable efforts done by the Royal Forest Department of Thailand for the preservation of wildlife of Kaeng Krachan National Park, and by the Bang Taboon Witaya School for the preservation of mangroves in Ban Laem District.

Nevertheless, we have no doubt about the presence of a much more rich herpetofauna in Phetchaburi Province. A number of species cited above were found only in KKNP, which was only casually surveyed. The reptile list of the Province should be greatly increased through thorough surveys in forested areas. In particular, the KKNP and elevated regions along the border with Myanmar will undoubtedly reveal numerous expected species, from southern Myanmar, and unexpected species, either new, or from the northern, Indo-Himalayan part of this latter country.

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