BRAUERIA (Lunz am See, Austria) 39:7-21 (2012)

The biodiversity of Trichoptera assemblage in Doi Suthep-Pui and Doi Inthanon National Parks, Chiang Mai, Thailand

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Abstract
The Trichoptera in Doi Suthep-Pui and Doi Inthanon National Park (NP) was studied using light traps during 2009-2010. The study sites included five sites in Doi Suthep-Pui NP (i.e., Pu Ping water supply, Montatarn_upper, Montatarn_lower, Pa Lad, and Pa Ngerb at 1,171, 746, 693, 686 and 461 m asl, respectively) and six sites in Doi Inthanon NP (i.e., Kaew Mae Pan_upper, Kaew Mae Pan_lower, Siribhum, Siritarn, Wachiratarn, and Mae Klang at 2,070, 2,051, 1,380, 890, 750, and 630 m asl respectively). A total of 4339 male Trichoptera representing 195 species (122 identified species in Doi Suthep-Pui and 114 identified species in Doi Inthanon) were collected in 87 light traps during the study period. Trichoptera data from previous light trap studies at Doi Suthep-Pui NP and Doi Inthanon NP (PROMMI (1999) and THAMSENANUPAP (2005)) were combined with those from the present study to create a comprehensive Trichoptera database thus allowing for comparison and evaluation of species diversity, distribution, and abundance over time. The present database contains 23,702 individuals (males) belonging to 23 families and representing a total of 319 species recorded at Doi Suthep-Pui and Doi Inthanon NPs. Establishment of this initial Trichoptera database will serve as a data repository for future expansion to other locations throughout Thailand, and will allow for the evaluation of best research practices, and the long-term assessment of the conservation status of species and habitats.

Introduction
Freshwater ecosystems, particularly lotic ecosystems (streams and rivers), are an essential resource for the survival of many living organisms including human beings. Although lotic ecosystems represent a minute fraction of the Earth's water storage, they play a significant role in supporting a wealth of biodiversity and interdependent biosystems. As with virtually all ecosystems on earth, lotic ones are facing increasing pressure primarily from anthropogenic threats. The primary threats that have been reported include overexploitation, watershed degradation, flow modification, instream habitat alteration, non-native species invasion, pollution, and global climate change (ALLEN & FLECKER, 1993, DUDGEON & al. 2006, STRAYER & DUDGEON, 2010).

Among the many animal species found in riverine ecosystems around the world, Trichoptera in particular, represent taxa of crucial importance to the functional and structural makeup of these ecosystems. They are great in species richness and abundance. Their special role in the riverine ecosystem ecology has attracted considerable study by biologists which is well-documented by the research on taxonomy, biology and ecology in many regions, especially temperate zones. Some species show particular sensitivity to environmental changes, while others demonstrate considerable tolerance. They have also shown the ability to adapt to and thrive in a variety of instream habitats (VINSON & HAWKINS, 1998). As such, Trichoptera serve as important bioindicators in studies of lotic ecosystems (NÓGRÁDI & UHERKOVICH, 1999; MALICKY, 2010).

To-date, 1000 species of Trichoptera have been identified throughout Thailand (MALICKY, 2010), beginning with the first Trichoptera study in 1987 at the Doi Suthep-Pui National Park (NP) (MALICKY & CHANTARAMONGKOL, 1987). The research on Trichoptera in Thailand not only involves taxonomic evaluation, but also includes increasing work on their ecology, biology and biomonitoring (SOMPONG & CHANTARAMONGKOL, 1999; THANI & CHANTARAMONGKOL, 1999; CHAIBU & al., 2002; THAMSENANUPAP & al., 2005). Among the many sites where Trichoptera have been found, Doi Suthep-Pui NP and Doi Inthanon NP have been key research areas due to their species diversity and extraordinary environment. Most of the Trichoptera type specimens come from these two areas (MALICKY, 2010).

Overnight light trap collecting by PROMMI (1999) in Doi Suthep-Pui NP from 1998-1999 resulted in the identification of 153 different Trichoptera species along the NP's Huay Kaew stream (at 4 sampling sites with elevation differences), and the Huay Koo Kaew and Pa Lad streams. In 2002-2003, light trap collecting by THAMSENANUPAP (2005) revealed 93 different species from the Montatarn and Sai Yoi waterfalls in Doi Suthep-Pui NP, and 186 different species from the Huai Sai Lüang, Mae Pan Noi, Siribhum and Mae Klang streams in Doi Inthanon NP.

Additionally, THAPANYA & al. (2004) published a review of several Trichoptera studies that used various collecting methods and reported a total of 199 different species that were found in Doi Suthep NP and 249 different species found in Doi Inthanon NP including the altitudinal range and phenology. He concluded that the total number of species found in both national parks was 345; this represents about 34.5% of all the identified species in Thailand (MALICKY, 2010).

With respect to the conservation status of Trichoptera, as the result of their vulnerability to changes in habitat and water quality, IUCN has listed 4 species of caddisflies as extinct (IUCN, 2010). In Hungary, Trichoptera species have been categorized into 6 groups (unknown, extinct, endangered, vulnerable, presumed vulnerable, and not threatened) and eleven threatened trichoptera species are legally protected (NÓGRÁDI & UHERKOVICH, 1999). Further, SCHMERA (2001, 2002, 2003 and 2004) developed a procedure to categorise the conservation status of Trichoptera species and their habitat using a calculation based on their rarity, abundance and occurrence, collected by light traps.
The purpose of the present study was to provide current data on the status of Trichoptera (collected using light traps) in Doi Suthep-Pui and Doi Inthanon NPs and to construct a Trichoptera database that will facilitate the comparison and evaluation of species diversity, distribution, abundance and rarity status at both NPs over time. Establishment of this initial Trichoptera database will serve as a data repository for future

expansion to other locations throughout Thailand, and will allow for the evaluation of best research practices, and the long-term assessment of the conservation status of species and habitats.

Methods

Mae Klang-Sob Aeb is a wide stream (about 10-13 m in width). The water surface has full exposure, and the predominant substrate is boulders. Wachiratarn and Siritarn are turbulent waterfalls, with a high amount of discharge throughout the year and a dominant substrate of bedrock. Siribhum has a variety of microhabitats such as bedrock, boulder and gravel and the area along the stream has been modified as a tourist attraction. Kaew Mae Parn_lower and upper reaches have dense riparian forest, water temperature less than 15°C throughout the year, and a predominate substrate of rock, gravel and organic materials. Pa Ngerb stream reach has a variety of microhabitats in which gravel and rock are predominant. Montatarn_upper and lower waterfalls are tourist areas, and the streambed has been modified and disturbed. The predominant substrate is bedrock, gravel and sand. Pa Lad has bedrock and gravel as the predominant substrate. During the hot dry season, part of the stream dried out for few days. On Pu Ping water supply, the stream reach has been regulated by a permanent dam. The predominant substrate includes bedrock and sand.

In order to construct a comprehensive database for Trichoptera, abundance data from PROMMI (1999) and THAMSENANUPAP (2005) were included with those from the present study. This provided for a more complete evaluation of species richness and abundance and allowed for comparison with the current study. The expected Trichoptera biodiversity was estimated using EstimateS 8.2 (COLWELL, 2009). Random sampling in each area was used for calculations such as species accumulation predictor (Chao 1), abundance coverage estimator (ACE), and raw observed species (Sobs). Cluster analyses of the abundance data from the study sites in each NP, were assessed using MVSP MultiVariate Statistical Package 3.1 (KOVACH, 1999). A dendrogram was constructed to illustrate the similarity of the assemblages using Simpson's Coefficienct and the UPGMA method. Simpson's Coefficient is defined by the following:

$$I = a/[a+\min(b,c)]$$

a = number of species that were found in both assemblages
b = number of species that were found only in assemblage 1
c = number of species that were found only in assemblage 2

Study sites. The study sites were located in Doi Suthep-Pui and Doi Inthanon National Park, Chiang Mai Province, Thailand (Figure 1). The study site locations included:

Doi Inthanon NP

1. Mae Klang-Sop Ab (MK; 630 m asl)	18° 31' 47" N 98° 36' 34" E
2. Wachiratarn (WCRT; 750 m asl)	18° 32' 30" N 98° 35' 57" E
3. Siritarn (SRT; 890 m asl)	18° 32' 36" N 98° 34' 47" E
4. Siribhum (SRB; 1,380 m asl)	18° 33' 11" N 98° 34' 33" E
5. Kaew Mae Parn_Lower (KMP_lower; 2,051 m asl)	18° 32' 47" N 98° 30' 58" E
6. Kaew Mae Parn_Upper (KMP_upper; 2,074 m asl)	18° 32' 37" N 98° 28' 34" E

Doi Suthep-Pui NP

1. Pa Ngerb (PNG; 461 m asl)	18° 48' 47" N 98° 56' 18" E
2. Montatarn_lower (Mon_lower; 693 m asl)	18° 49' 00" N 98° 55' 24" E
3. Montatarn_upper (Mon_upper; 746 m asl)	18° 49' 02" N 98° 55' 24" E
4. Pa Lad (PL, 686 m asl)	18° 47' 02" N 98° 55' 24" E
5. Pu Ping water supply (PP; 1,171 m asl)	18° 48' 19" N 98° 54' 28" E

Insect collecting was conducted from November 2009 through November 2010 using light traps (pan traps) which consisted of a black light lamp, 12N11 rechargeable battery and plastic pan (measuring 33 x 33 x 14 cm) filled to one third full with a water and detergent mixture. The traps were set up overnight (just before sunset till sunrise) at each site. A total of 87 light trap collecting sessions were conducted over the study period with 45 light traps set up in the 5 sites in Doi Suthep-Pui NP and 42 light traps in the 6 locations in Doi Inthanon NP (Table 1). The male Trichoptera fauna were identified using the illustrated key from the "Atlas of Southeast Asian Trichoptera" (MALICKY, 2010). The specimens from this study were deposited as a reference collection at the Environmental Monitoring: Aquatic Insect Research Unit, Biology Department, Faculty of Science, Chiang Mai University.

Results

A total of 4339 male Trichoptera representing 194 different species (122 identified species in Doi Suthep-Pui NP and 113 identified species in Doi Inthanon NP with 41 shared species (species repeats) between the two NPs) were collected during the current study (see Table 2). Of the 122 species identified in Doi Suthep-Pui NP, only 83 (or 40% of the total identified species in Doi Suthep-Pui NP) showed overlap with species identified in previous studies (PROMMI, 1999; THAMSENANUPAP, 2005). Of the 113 species identified in Doi Inthanon NP, only 76 (35% of the total identified species in Doi Inthanon NP) were also identified in previous studies (THAMSENANUPAP, 2005) (Table 2).

The Trichoptera database (composed of data from the current study and that from PROMMI, (1999) and

THAMSENANUPAP (2005)) contained information on a total of 23,702 male Trichoptera belonging to 23 families (a total of 28 families have been identified throughout Thailand) and representing a total of 319 different species in the Doi Suthep-Pui and Doi Inthanon NPs combined (See Table 2). There were 89 species identified with only 1-2 specimens per species (rare), 169 species with 3 - 100 specimens per species (common), 61 species with 101-1,000 specimens per species (abundant), and 4 species with >1,000 specimens per species (e.g. *Chimarra suthepensis* CHANTARAMONGKOL & MALICKY, 1998 and *Cheumatopsyche cocles* MALICKY & CHANTARAMONGKOL, 1997 which were mostly found in Doi Suthep-Pui NP and *Paduniella semarangensis* ULMER, 1913 and *Ugandatrichia maliwan* MALICKY & CHANTARAMONGKOL, 1991 which are only found in Doi Inthanon NP).

Only 14 species of caddisflies were found in the highest study sites (2050 and 2071 m asl) during the 2009-2010 collections (number in the parentheses represent number of individuals): *Rhyacophila bicolor doiangka* MALICKY 1999 (1), *Rhyacophila blenda* MALICKY & CHANTARAMONGKOL 1993 (5), *Rhyacophila falita* ROSS 1956 (5), and *Rhyacophila murhu* MALICKY & CHANTARAMONGKOL 1989 (4) (Family Rhyacophilidae), *Chimarra inthanonensis* CHANTARAMONGKOL & MALICKY 1989 (2), *Dolophilodes torrentis* KIMMINS 1955 (36), and *Wormaldia serrata* KIMMINS 1955 (1) (Family Philopotamidae), *Arctopsyche variabilis* SCHMID 1968 (4) (Family Arctopsychidae), *Nothopsyche muqua* MALICKY & CHANTARAMONGKOL 1989 (1) and *Moropsyche gerolan* MALICKY & CHANTARAMONGKOL 1991 (2) (Family Limnephilidae), *Lepidostoma inthanon* MALICKY & CHANTARAMONGKOL 1994 (52), *Lepidostoma varithi* MALICKY & CHANTARAMONGKOL 1994 (1), *Paraphlegopteryx angkangensis* WEAVER 1999 (2) and *Paraphlegopteryx malickyi* WEAVER 1999 (4) (Family Lepidostomatidae).

The grouped similarity of sites based on species composition and their abundance was revealed by UPGMA with Simpson's coefficient. In Doi Suthep-Pui, the data showed that four groups likely relate to habitat features (stream and waterfall+stream) (Figure 3) and in Doi Inthanon, four groups were represented by distinctive elevation differences (figure 4).

The accretion species curve for Doi Suthep-Pui showed the asymptote graph of $y = 30.943\ln(x) + 21.086$, $R^2 = 0.9976$. For Doi Inthanon, the curve showed a rising trend graph where $y = 22.48 \ln(x) \quad 33.067$, $R^2 = 0.8768$.

Discussion

Over the past two decades of study on the Trichoptera fauna of Thailand mainly concentrates in northern areas, about 1000 species have been recorded (MALICKY, 2010). The current study, together with those by PROMMI, (1999) and THAMSENANUPAP (2005), have identified a total of 319 species in both Doi Suthep-Pui and Doi Inthanon NPs. These species, collected by light trap, account for approximately 32% of the Trichoptera fauna found in Thailand. Given the high diversity of Trichoptera in these two NPs, there is considerable likelihood for the discovery of more new species in other areas of Thailand (MALICKY & PROMMI, 2006).

Based on the review of the accretion species curve for Doi Suthep-Pui, the curve had reached asymptote, although most of sites were located only on one side of the mountain. Meanwhile, the accretion species curve for Doi Inthanon showed that more collecting should be conducted to reveal the complete biodiversity of the area.

Doi Inthanon NP is remarkable for its biodiversity and a well-known tourist attraction due to the impressive and unique forest. In particular, the high elevation streams support an unique habitat with year round cold water temperatures and dense, moist riparian forests. This ecosystem is also home to potentially rare species such as *Nothopsyche muqua* MALICKY & CHANTARAMONGKOL 1989. This species has only been found in Doi Inthanon, at 1200-1300 m asl (MALICKY & CHANTARAMONGKOL, 1993) and during the current study in Keaw Mae Pan_upper (one specimen was identified at 2071 m asl). These are the only reports of this species in Thailand. Similarly, during the current study, *Eubasilissa maclachlani* WHITE 1862, the largest caddis species in Thailand, was found in Siribhum (1380 m asl) and in Keaw Mae Pan_lower (2050 m asl). From a conservation standpoint, these rare species may serve a useful role as candidate flagship species (see GUINEY & OBERHAUSER, 2008) helping to generate public awareness and appreciation of the need for habitat conservation of critical lotic ecosystems.

To date, establishment of the Trichoptera database (composed of data from the current study and that from PROMMI (1999) and THAMSENANUPAP (2005)) has provided a more comprehensive understanding of the distribution, occurrence and abundance of species in Doi Suthep-Pui and Doi Inthanon NPs. This database has allowed for comparison of species composition both geographically and temporally. It also has demonstrated the need for additional and continuous updating of information so as to ensure adequate evaluation of Trichoptera and associated habitats. Establishment of this initial database will serve as a data repository for future expansion to other areas throughout Thailand, and will allow for the evaluation of best research practices, the application of Trichoptera as bioindicators for water and habitat quality, and the long-term assessment of the conservation status of the species and their habitats.

Acknowledgements
This study was supported by The TRF/BIOTEC Special Program for Biodiversity Research and Training grant BRT T552063.

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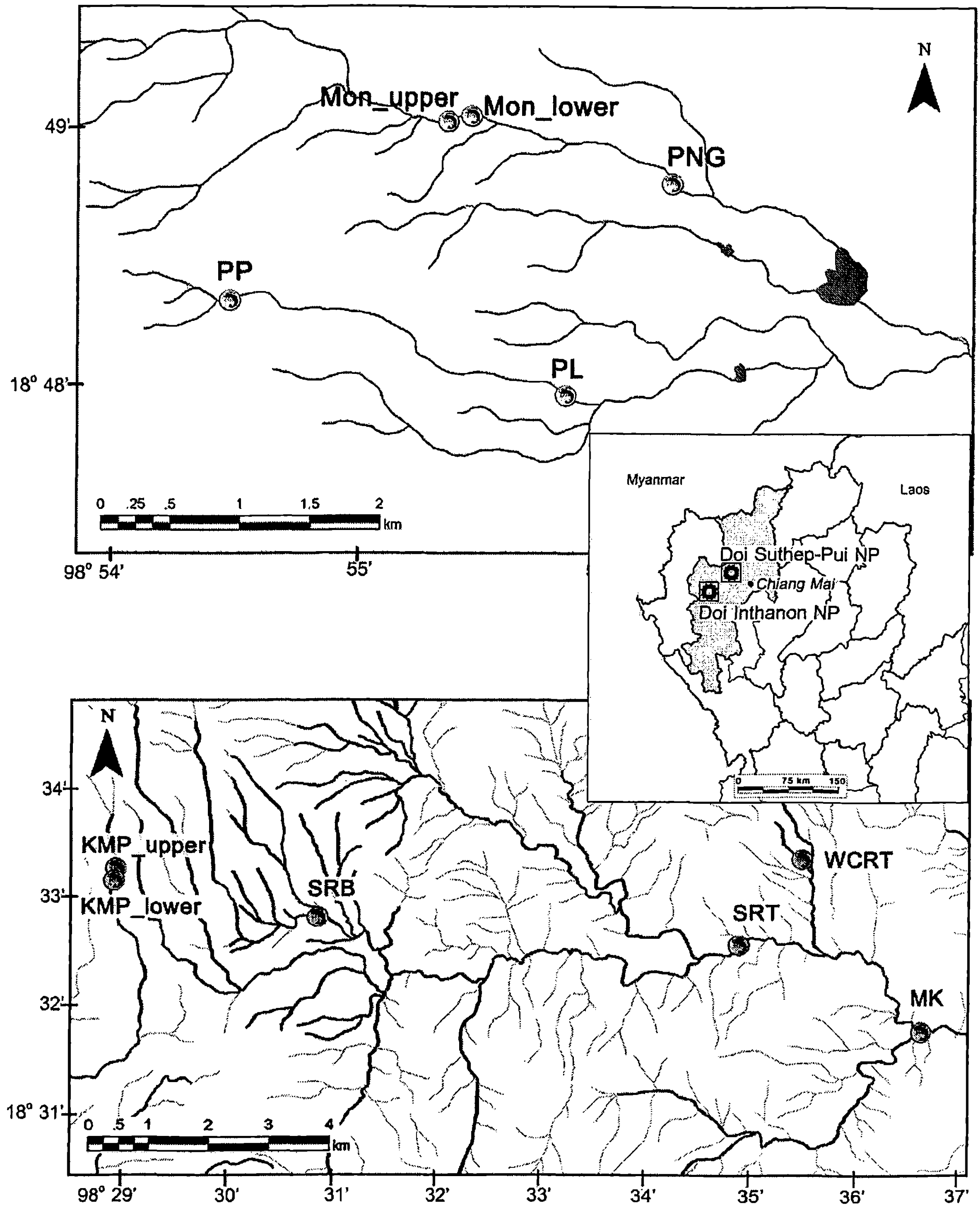

Figure 1 Location of the collecting sites in Doi Suthep-Pui NP (top) and Doi Inthanon NP (below) during 2009 - 2010.

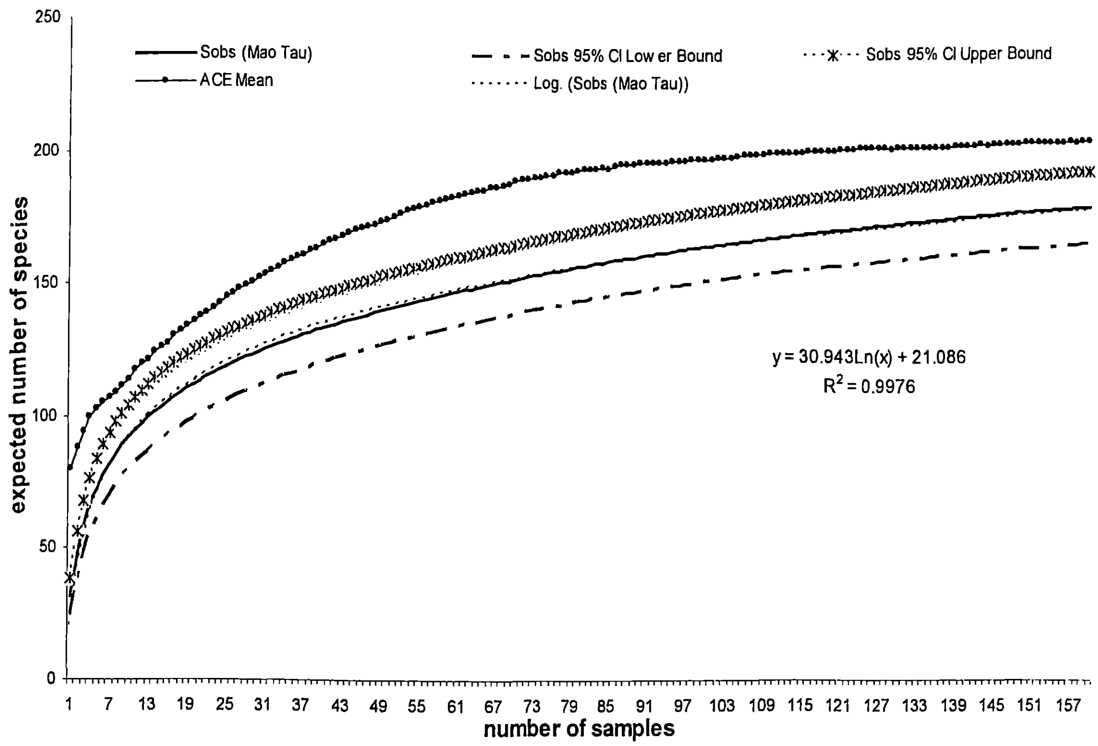

Figure 2 Species accumulation curve for all sites in Doi Suthep-Pui N P [combined data from Prommi (1999), Thamsenanupap (2005) and Bunlue et al. (current study)]. The solid lines show the observed species (Sobs) and the dash lines show the corresponding 95% confidence bounds.

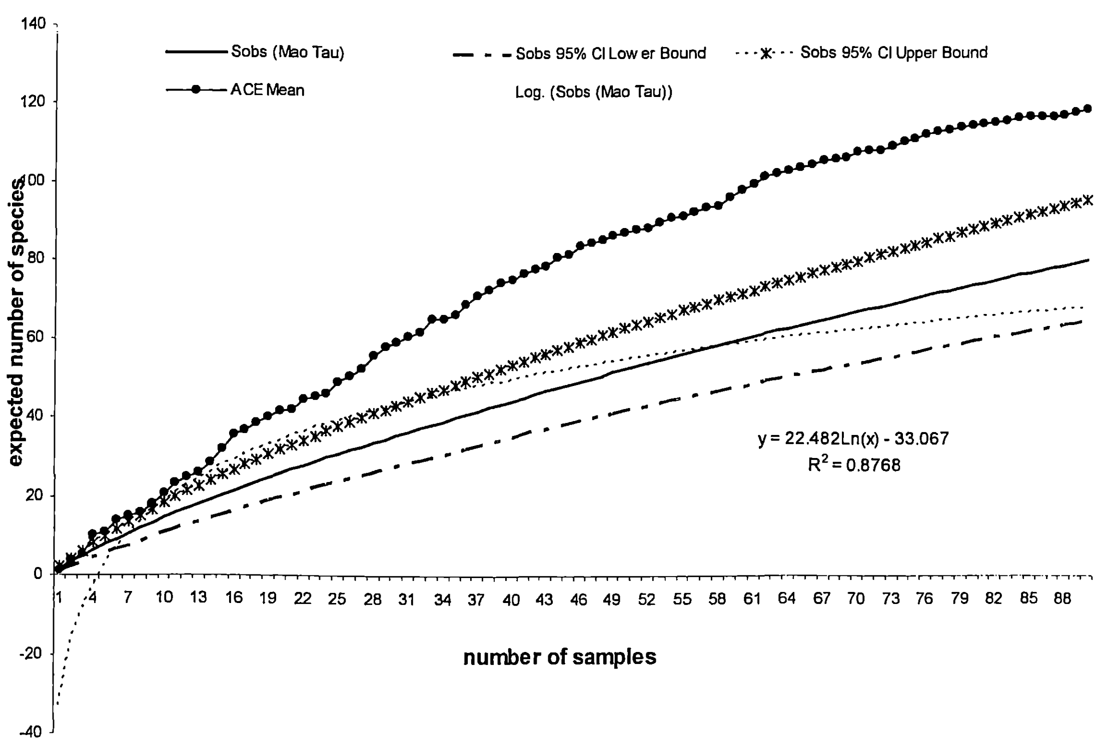

Figure 3: Species accumulation curve, all sites in Doi Inthanon NP [combined data from Thamsenanupap (2005) and Bunlue et al. (current study)]. The solid lines show the observed species (Sobs) and the dash lines show the corresponding 95% confidence bounds.

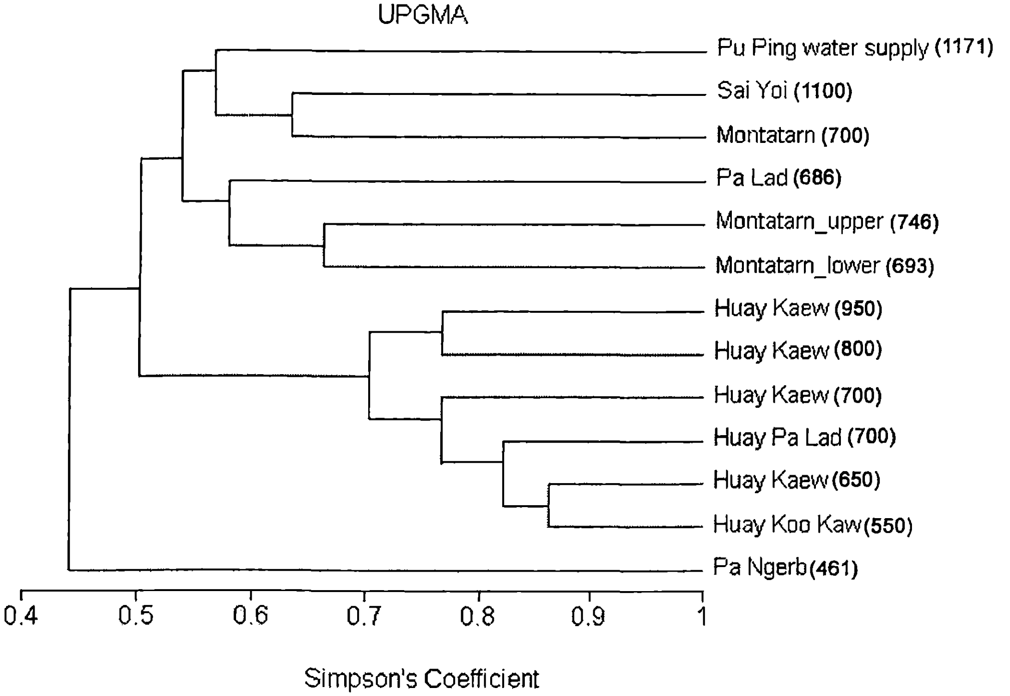

Figure 4: Cluster analysis (UPGMA and Simpson's coefficient) of sites in Doi Suthep-Pui NP based on abundance data of adult trichoptera from Prommi (1999), Thamsenanupap (2005) and Bunlue et al. (current study). Numbers in the parentheses indicate elevation (m asl).

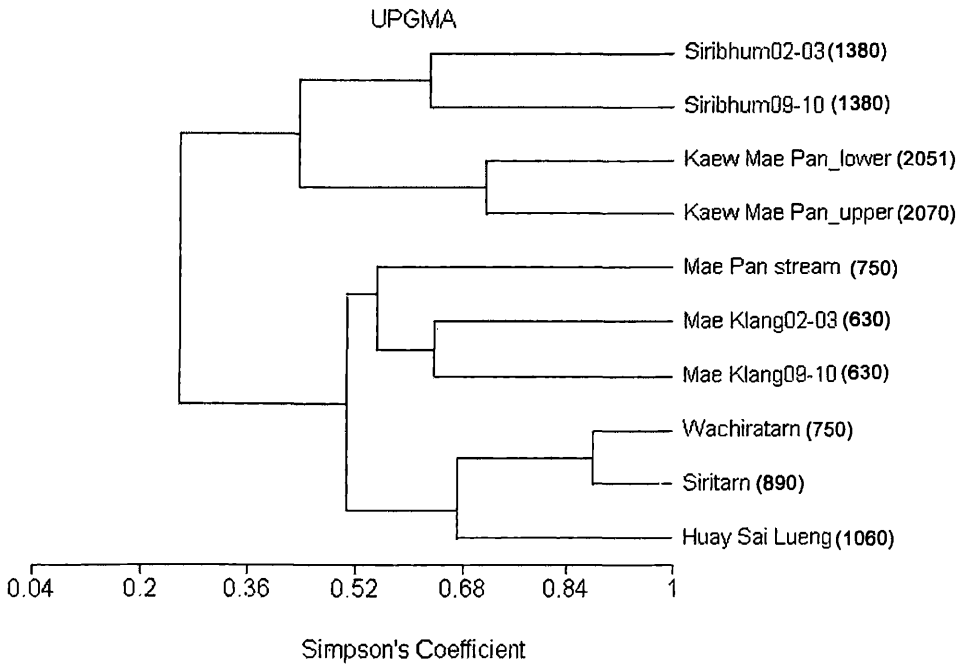

Figure 5: Cluster analysis (UPGMA and Simpson's coefficient) of sites in Doi Inthanon NP based on abundance data of adult trichoptera from Thamsenanupap (2005) and Bunlue et al. (current study). Number in the parentheses indicate elevation (m asl).

Table 1 Summary of species richness and abundance at Doi Suthep-Pui and Doi Intanon NPs

Study Site	Elevation (m asl)	Habitat Type	# Light Trap Collecting	#Species	#Individuals (males)
Doi Suthep-Pui NP.					
2009-2010 (Bunlue *et al.*, current study)					
Pa Ngerb	461	stream	9	60	532
Montatarn_lower	693	waterfall+stream	9	57	273
Montatarn_upper	746	waterfall+stream	9	55	268
Pa Lad	686	waterfall+stream	9	43	478
Pu Ping water supply	1,171	waterfall+stream	9	45	207
Total			45	(122)	1,758
2002-2003 (Thamsenanupap, 2005)					
Montatarn	700	waterfall+stream	12	68	938
Sai Yoi	1,100	waterfall +stream	12	67	1,356
Total			24	(93)	2,294
1998-1999 (Prommi, 1999))					
Huay Koo Kaw	550	stream	16	64	568
Huay Pa Lad	700	stream	16	65	1,143
Huay Kaew	650	stream	16	93	1,867
Huay Kaew	700	stream	16	92	1,712
Huay Kaew	800	stream	16	76	1,429
Huay Kaew	950	stream	16	81	1,659
Total			96	(153)	8,378
Doi Inthanon NP.					
2009 - 2010 (Bunlue *et al.*, current study)					
Mae Klang	630	stream	7	42	884
Wachiratarn	750	waterfall+stream	7	39	702
Siritarn	890	waterfall+stream	7	24	237
Siribhum	1,380	waterfall+stream	7	51	498
Kaew Mae Pan_lower	2,051	stream	7	20	145
Kaew Mae Pan_upper	2,070	stream	7	23	115
Total			42	(113)	2,581
2002-2003 (Thamsenanupap, 2005)					
Mae Klang	630	stream	12	71	3,700
Mae Pan Noi	750	stream	12	78	898
Huay Sai Lueng	1,060	waterfall+stream	12	99	1,939
Siribhum	1,380	waterfall+stream	12	79	2,154
Total			48	(186)	8,732
Grand Total			255	(319)	23,702

Note: Species numbers in parentheses () indicate the total number of different species identified at each NP by each study. Species repeats among locations are not reflected in the totals. The grand total () represents the total number of different species identified by all studies in both NPs combined.

Table 2 Species occurrence and abundance of adult male trichoptera found in Doi Suthep-Pui and Doi Inthanon NP. (Doi Inthanon NP: 1=Mae Klang-Sob Ab, 2=Wachiratarn, 3=Siritarn,4= Siribhum, 5=Kaew Mae Parn_lower, and 6=Kaew Mae Parn_upper; Doi Suthep-Pui: 1=Pa Ngerb, 2=Montatarn_lower, 3=Montatarn_upper, 4=Pa Lad, and 5=Pu Ping water supply). Abundance status was defined as rare : species for which only 1-2 specimens have been recorded; common : species for which 3-100 specimens have been recorded; and abundant: species for which > 100 specimens have been recorded.

Species / Study site	Doi Inthanon National Park							Doi Suthep-Pui National Park							abundance
	Bunlue *et al.*, current study						Thamsenanupap (2005)	Bunlue *et al.*,current study					Prommi (1999)	Thamsenanupap (2005)	
	1	2	3	4	5	6		1	2	3	4	5			
Rhyacophilidae															
Himalopsyche acharai M & C 1989				6	2	2	111 (630-1380)	1		6	2		9 (650, 800)	75 (700, 1100)	abundant
Rhyacophila bicolor doiangka Malicky 1999					1										rare
Rhyacophila blenda M & C 1993					4	1									common
Rhyacophila cornuta Kimmins 1953							1(1380)								rare
Rhyacophila curvata Morton 1900		2	1				41 (1060-1380)	3	10	13	16	10	166 (550-950)	36 (700, 1100)	abundant
Rhyacophila dorsampa Schmid 1970							1(1060)								rare
Rhyacophila drokpa Schmid 1970							9 (750-1060)								common
Rhyacophila falita Ross 1956				2		3									common
Rhyacophila gyamo Schmid 1970														1 (1100)	rare
Rhyacophila inaequalis Denning & Schmid 1971							2 (630,1380)	1						2 (1100)	common
Rhyacophila malayana Banks 1931		1		5	4	4	82 (1060-1380)			4		1	104 (550-950)	22 (700, 1100)	abundant
Rhyacophila manna M & C 1993									1			2	6 (700, 950)	5 (700, 1100)	common
Rhyacophila mayestril Malicky 1991						1	2(1060)								common
Rhyacophila muktepa Schmid 1970							1(1060)								rare
Rhyacophila murhu M & C 1989					3	1									common
Rhyacophila petersorum Schmid & Denning 1971		8	3	2		4	64 (630-1380)	1	8	20	6	4	64 (550-950)	76 (700, 1100)	abundant
Rhyacophila scissa Morton 1900				5	1	10	2(1060)			5	3		56 (550-950)		common
Rhyacophila scissoides Kimmins 1953							82 (1060-1380)			1		3	5 (650-950)	62 (700, 1100)	abundant
Rhyacophila voccia M & C 1993							6 (1060-1380)								common
Rhyacophila xayide M & C 1989							1(1060)								rare
Hydrobiosidae															
Apsilochorema utchtchunam Schmid 1970							1(1060)								
Glossosomatidaei															
Agapetus dangorum Oláh 1942													5 (550-700)		common
Agapetus halong Oláh 1988							11 (630-750)	13	1		1		24 (550-800)		common
Agapetus lalus M & C 1992													34(550-650,800-950)		common
Agapetus viricatus M & C 1992							1(1060)						1 (700)	1 (1100)	common
Agapetus voccus M & C 1992			1	1			1(750, 1060)						2 (650)		common
Glossosoma atitto M & C 1992							1(1060)								rare
Glossosoma elvisso M & C 1992							7 (630-1060)								common
Glossosoma jentumar M & C 1992				1			15 (750-1380)								common
Glossosoma malayanum Banks 1934				1			17 (750-1380)								common
Poeciloptila briatec M & C 1992	5														common
Hydroptilidae															
Hydroptila keres Malicky 2004								1			1				rare
Hydroptila psyche M & C 2007								10	1	7	3	1			common
Hydroptila thuna Oláh 1989											1				rare
Microptila hintama Oláh 1989		1													rare
Ugandatrichia hairanga Oláh 1989													1 (700)		rare
Ugandatrichia kerdmuang M&C 1991													1 (700)		rare
Ugandatrichia honga Oláh 1989							403 (630-750)	2							abundant

Ugandatrichia maliwan M & C 1991				1			1342 (630-1380)								abundant
Philopotamidae															
Chimarra akkaorum C & M 1989	1						8 (630-750)	56	54	4			50 (550-700)		abundant
Chimarra alleni C & M 1989									1						rare
Chimarra aneca M & C 1993							1(1060)					1			rare
Chimarra atara M & C 1993												1	33 (650-950)	1 (700)	common
Chimarra atnia M & C 1993									2				67(550-800)	3 (700)	common
Chimarra chiangmaiensis C & M 1989	1	1		3			5 (630-750)	54	20	3	2		2 (550)	5 (700)	common
Chimarra cumata M & C 1993							2(1060)								rare
Chimarra devva M & C 1993								2					81 (550-950)	1 (700)	common
Chimarra htinorum C & M1989							121 (1060-1380)		2	19	30	20	133 (550-950)	342 (700, 1100)	abundant
Chimarra inthanonensis C & M 1989						2									rare
Chimara jabal M & C 2009															
Chimarra khamuorum C & M1989	2						205 (630-750)						34 (550-700)		abundant
Chimarra lahuorum C & Mv1989				1	2	3	50 (1060-1380)							2 (1100)	common
Chimarra lannaensis C & Mv1989				1			39(630,1060-1380)	1	7	2		1	34 (550-950)	36 (700, 1100)	abundant
Chimarra lavuaorum C & M 1989													33 (650-950)		common
Chimarra matura M & C 1993													190 (550-950)		abundant
Chimarra meorum C & M 1989													3 (550, 700)	1 (700)	common
Chimarra momma M & C 1993							15 (1060-1380)		4				12 (650-700, 950)	19 (700, 1100)	common
Chimarra monorum C & M 1989													4 (650-700)		common
Chimarra nahesson M & C 1993							4(1060)								common
Chimarra okuihorum Mey 1998		1						2	2	2					common
Chimarra pipake M & C 1993								1					33 (550-700)		common
Chimarra podarge Malicky & Thamsenanupap 2006											1				rare
Chimarra schwendingeri C&M 1989							1(1060)				1	3	77 (650-950)	1 (1100)	common
Chimarra shanorum C & M 1989														1 (700)	rare
Chimarra shiva M & C 1993	1	1		5			22 (630-1380)						138 (550-950)	6 (1100)	abundant
Chimarra spinifera Kimmins 1957	1	6	3				8	86	153	14	5	2	2 (950)	37 (700, 1100)	abundant
Chimarra suadulia M & C 1993										1					rare
Chimarra suthepensis C & M 1989				117			74 (1060-1380)	2	3	21	27	23	577 (550-950)	510 (700, 1100)	abundant
Chimarra toga M & C 1993								9					35 (550-700)		common
Chimarra uppita M & C 1993							1(630)								rare
Chimarra yaorum C & M 1989												5	4 (800-950)	5 (1100)	common
Dolophilodes adnamat M & C 1993								1		2	1	1	61 (650-950)		common
Dolophilodes bullu M & C 1993													107 (550-950)		abundant
Dolophilodes torrentis Kimmins 1955					14	22									common
Dolophilodes truncata Kimmins 1955													231 (550-950)		abundant
Gunungiella segsafiazga M & C 1993									1				6 (700)		common
Kisaura cina M & C 1993				2			25 (1060-1380)							26 (700, 1100)	common
Kisaura consagia M & C 1993		1	1	1			27 (630-1380)	4	16	4	2	1	503 (650-950)	24 (700, 1100)	abundant
Kisaura filiformis Mey 1996							9(1060)								common
Kisaura longispina Kimmins 1955				10	22	35	45(1060)						1 (950)		abundant
Kisaura sura M & C 1993		1					7 (1060-1380)		3	1		12	(650-950)	12 (700, 1100)	abundant
Kisaura surasa M & C 1993													23 (650, 950)		common
Kisaura venusta M & C 1993													2 (800)		rare
Wormaldia abas M & C 1996													1 (650)		rare
Wormaldia etto M & C 1993													2 (700, 950)		rare
Wormaldia gressitti Ross 1956							3(1060)								common
Wormaldia inthanonensis M & C 1993							1(1060)								rare
Wormaldia relicta Martynov 1935							1(1060)						3 (950)		common

Wormaldia serrata Kimmins 1955						1									rare
Stenopsychidae															
Stenopsyche haimavatika Schmid 1969							1(630)								rare
Polycentropodidae															
Eoneureclipsis querquobad M & C 1989							3(1060)						3 (950)		common
Kambaitipsyche hykrion M & C 1991													1 (950)		rare
Nyctiophylax chiangmaiensis M & C 1993								1	13	13	5	1	30 (550-700, 950)	5 (700)	common
Nyctiophylax suthepensis M & C 1993													231 (550-950)		abundant
Pahamunaya jihmita Schmid & Denning 1979													28 (550-700, 950)		common
Polyplectropus admin M & C 1993							12 (630, 1060)	8	4	1			8 (550-700)	2 (700)	common
Polyplectropus ibykos M & C 2003														2 (1100)	rare
Polyplectropus menna M & C 1993							2(1060)				2	1	92 (550-950)	5 (700)	abundant
Polyplectropus nahor M&C 1993							1(1060)								rare
Polyplectropus nangajna M & C 1993													3 (550, 700-800)		common
Pseudoneureclipsis achim M & C1993													16 (650-950)		common
Pseudoneureclipsis amon M & C 1993													2 (550)	4 (700)	common
Pseudoneureclipsis asa M & C 1993								1		2			26 (550-800)		common
Pseudoneureclipsis ramosa Ulmer 1913													124 (550-950)		common
Pseudoneureclipsis josia M & C 1993													3 (800-950)	2 (1100)	common
Pseudoneureclipsis kainam M & C 1993													2 (550, 700)		common
Pseudoneureclipsis saccheda Schmid & Denning 1979													5 (650-700, 950)	2 (700)	common
Pseudoneureclipsis sukrip M & C 1993							1(1060)								common
Pseudoneureclipsis uma M & C 1993								1					10 (650, 800-950)		common
Pseudoneureclipsis usia M & C 1993								21		1		1	246 (550-800)	13 (700, 1100)	abundant
Psychomyiidae															
Lype atnia M & C 1993													3 (800-950)	19 (1100)	common
Paduniella maeklangensis M & C 1993							110 (630, 1060)								abundant
Paduniella semarangensis Ulmer 1913	20	1				1	1210 (630-750)								abundant
Paduniella suwannamali M & C 1993							1 (630)								rare
Paduniella wangtakraiensis M & C 1993							4 (630)		1						common
Psychomyia amor M&C 1997													1 (650)		rare
Psychomyia arthit M & C 1993	4	1					157(630)						1 (950)		common
Psychomyia barata M & C 1993		2								3	7		41 (650-800)	2 (700)	common
Psychomyia benyagai M & C 1993							2 (630,1380)								rare
Psychomyia chompu M & C 1993	1						143 (630,1060-1380)								abundant
Psychomyia kaiya M & C 1993	5						314 (630-750)						2 (550-600)		abundant
Psychomyia kerynitia Malicky & Nuntakwang 2006										2	1				common
Psychomyia kiskinda M & C 1993	1						2 (630-750)			3					common
Psychomyia lak M & C 1993	6						199(630-750,1380)								abundant
Psychomyia monto M & C 1993							1(630)	4			1				common
Tinodes acheron M & C 1996													7 (800-950)		common
Tinodes cincibilus M & C 1993				5			4(1060)								common
Tinodes mahalat M & C 2009										1					rare
Tinodes mogetius M & C 1993				1			36 (1060-1380)								common
Tinodes ragar M & C 1989							5(1060)								common
Tinodes ragu M & C 1993													5 (550-600)		common
Xiphocentronidae															
Abaria guatila M & C 1992								1			1			3 (1100)	common
Cnodocentron brogimarus M & C 1992													7 (650-950)	4 (1100)	common
Drepanocentron curmisagius M & C 1992								6	4			5	17 (550, 700, 950)		common
Drepanocentron vercaius M & C 1992												2			rare

Melanotrichia attia M & C 1992				1			2 (1060-1380)								common
Ecnomidae															
Ecnomus alkestis M & C 1997							5(630)								common
Ecnomus areion Malicky 1999							3 (1060-1380)							2 (700)	common
Ecnomus jojachin M & C 1993													2 (700)		rare
Ecnomus robustior Ulmer 1951							3(630)								common
Ecnomus suadrus M & C1993											1		59 (650-950)	4 (700, 1100)	common
Ecnomus venimar M & C 1993							2(630)	1	2				48 (550-700, 950)		common
Arctopsychidae															
Arctopsyche hynreck M & C 1991				24			128 (750-1380)								abundant
Arctopsyche variabilis Schmid 1968					3	1									common
Hydropsychidae															
Cheumatopsyche admetos M & C 1996												5	12 (650-700, 950)		common
Cheumatopsyche automedon M & C 1997							1 (1060)							2 (1100)	common
Cheumatopsyche bardiana Malicky 1997							4 (630-750)								common
Cheumatopsyche caieta M & C 1997							2(630)								rare
Cheumatopsyche carmentis M & C 1997							54 (630-750, 1380)								common
Cheumatopsyche ceres M & C 1997				2			113 (750-1060)							6 (1100)	abundant
Cheumatopsyche charites M & C 1997	323	70	1	1			20(1060)								abundant
Cheumatopsyche chrysothemis M & C 1997													1 (650)		rare
Cheumatopsyche cocles M & C 1997				1			4(1060)		32	23	25		1235 (650-950)	83 (700, 1100)	abundant
Cheumatopsyche copia M & C 1997	282	253	71				98 (630-750)				1				abundant
Cheumatopsyche cressida Malicky 1997							6 (630-750)								common
Cheumatopsyche criseyde M & C 1997	33	14	2	1			226 (630-750)								abundant
Cheumatopsyche globosa Ulmer 1910								1						1 (700)	rare
Cheumatopsyche jiriana Malicky 1997													1 (800)		rare
Cheumatopsyche niasensis Malicky 1997													1 (550)		rare
Cheumatopsyche naumanni Malicky 1986							176 (630-750)								abundant
Cheumatopsyche ningmapa Schmid, 1975							21 (630-750)								common
Cheumatopsyche schwendingeri M & C 1997							1(1060)						1 (700)		
Cheumatopsyche temburonga Malicky, 1997							1(630)								rare
Cheumatopsyche tramota M & C 1997							3(1060)								common
Cheumatopsyche trilari M & C 1997													4 (800-950)		common
Diplectrona aurovittata Ulmer 1906				8		1	68 (630-1380)	5	9	6	7			19 (700, 1100)	abundant
Diplectrona eurydike M & C 2002		3	3	1			17 (750-1380)	1	3	1	1			27 (700, 1100)	common
Diplectrona harpyia M & C 2002				2	26	1						1			common
Diplectrona hermione M & C 2002							4 (1060-1380)		1	1	1	9		25 (1100)	common
Diplectrona joannisi Navas 1932							1(1060)			1		16		3 (700, 1100)	common
Hydromanicus abiud M & C 1993		1						3	3	2	1	6	56 (550-800)	22 (700, 1100)	common
Hydromanicus adonis M & C 1996							4(1060)		14	2		5	4 (700-950)	14 (700, 1100)	common
Hydromanicus eliakim M & C 1993				9			146 (750-1380)						3 (700-800)		abundant
Hydromanicus inferior C & M 1995	7	70	83	57			80 (630-1060)	17	3	6	2		83 (550-950)	6 (700)	abundant
Hydromanicus klanklini M & C 1993							2(630)	1	9	3	4	3	110 (550, 700-950)	6 (700)	abundant
Hydromanicus luctuosus Ulmer 1905				18						8	10	3			common
Hydromanicus punctosalis Mey 1996				15							1				common
Hydromanicus scotosius Mey 1996				1			7 (1060-1380)							3 (1100)	common
Hydromanicus sealthiel M & C 1993							1(630)			1		6	196 (800-950)	61 (700, 1100)	abundant
Hydromanicus serubabel M & C 1993							27(630)	14	47	9	21		695 (550-950)	16 (700, 1100)	abundant
Hydromanicus truncatus Betten, 1909							185 (750-1380)						245 (650-950)	115 (700, 1100)	abundant
Hydropsyche appendicularis Martynov 1931							226 (630-1380)								abundant
Hydropsyche angkangensis M & C 2000														2 (700)	rare

Hydropsyche appendicularis Martynov 1931							1(1060)								rare
Hydropsyche arcturus M & C 2000							15 (750,1060-1380)			1	3			71 (700, 1100)	common
Hydropsyche askalaphos M & C 2000	9	45	21	2			123 (630, 1060)								abundant
Hydropsyche atropos M & C 2000							6 (630, 1060)								common
Hydropsyche augeias M & C 2000							8 (630-1060)								common
Hydropsyche bacchus M & C 2000							5(1060)							5 (700, 1100)	common
Hydropsyche binaria Mey 1996				7	1	2	8(1060)				4				common
Hydropsyche bonuseventus M & C 2000							34 (630-1060)								common
Hydropsyche bootes M & C 2000		48	21	34			158 (1060-1380)		4	16	15	2		52 (700, 1100)	abundant
Hydropsyche briareus M & C 2000	17	56	5				79 (630-1060)								abundant
Hydropsyche cacus M & C 2000							6(630)		1					1 (700)	common
Hydropsyche camillus M & C 2000							5 (630-750)	1						5 (700, 1100)	common
Hydropsyche cerva Li & Tian 1990							8(1060)								common
Hydropsyche clitumnus M & C 2000							79 (750-1060)				2			13 (700, 1100)	common
Hydropsyche doctersi Ulmer 1951	4	2					6 (630-750)								common
Hydropsyche formosana Ulmer 1911									1						rare
Hydropsyche harpagofalcata Mey 1995		26	1												common
Hydropsyche napaea Mey 1996							70 (750-1060)								common
Hydropsyche pallipenne Banks 1938						1	12(1060)		10						common
Hydropsyche uvana M & C 2000	3	11	3				19 (630-1380)								common
Macrostemum fastosum Walker 1852				10			25 (630-1060)	2	1		2	7	82 (550-950)	3 (700)	abundant
Macrostemum floridum Navas 1929							2(630)						5 (700)		common
Macrostemum hestia M & C 1998							11(1060)						18 (650-950)		common
Macrostemum midas M & C 1998								2			1		22 (550-800)		common
Potamyia alleni M & C 1997							13(630)								common
Potamyia aureipennis Ulmer 1930													1 (700)		rare
Potamyia elektra M & C 2001	58	7													common
Potamyia flavata Banks 1934											1		2 (700)		common
Potamyia horvati M & C 1997	13	14	3				5 (630, 1060)								common
Potamyia panakeia M & C 1997	3	10					151 (630-1060)								abundant
Potamyia phaidra M & C 1997													4 (550, 700)		common
Pseudoleptonema quinquefasciatum Martynov 1935	16	2					49(630)								common
Trichomacronema paniae M & C 1991				61			167 (630-1380)			6	6		18 (650-800)	151 (700, 1100)	abundant
Phryganeidae															common
Eubasilissa maclachlani White 1862					3		1(1060)								
Brachycentridae															rare
Micrasema asuro M & C 1992							1(1060)						1 (650)		abundant
Micrasema fortiso M & C 1992							66(1060)			4	6	1	80 (550-950)	10 (700, 1100)	common
Micrasema helveio M & C 1992													9 (550-700, 950)		rare
Micrasema turbo M & C 1992													1 (950)		rare
Limnocentropodidae															
Limnocentropus auratus M & C 1989							4 (750-1060)								common
Limnocentropus hysbald M & C 1991	11	11	4	6			3(630)								common
Limnocentropus inthanonensis M & C 1989						2	1(1060)								common
Limnocentropus sammuanensis M & C 1989							82 (750-1060)								common
Limnephilidae															
Moropsyche gerolan M & C 1991					2										rare
Moropsyche huaisailianga M & C 1989							2(1060)		7		2	8	40 (650-950)	1 (700)	common
Nothopsyche muqua M & C 1989						1									rare
Goeridae															
Goera ateduna M & C 1992							13(630)								common

Goera atiugo M & C 1992				13			2(1060)						3 (700-950)	2 (700)	common
Goera ilo M & C 1992							12 (750-1380)						8 (650, 950)	3 (700, 1100)	common
Goera mandana Mosely 1938							1(630)								rare
Goera matuilla M & C 1992							1(630)	2					1 (650)		common
Goera minor Mosely 1938													3 (650-700)		common
Goera redsat M & C 1992	2	2					38 (630-750)						1 (700)		common
Goera redsomar M & C 1992	2						21 (630-750)	1					1 (700)		common
Goera schmidi Denning 1982							11 (630-750)								common
Goera seccio M & C 1992													1 (650)		rare
Goera unica Ulmer 1951	1	1					15 (630-750)								common
Goera uniformis Banks 1931														1 (700)	rare
Larcasia lannaensis M & C 1996										1	1		6 (650-800)	52 (700, 1100)	common
Lepidostomatidae															
Lepidostoma abruptum Banks 1931										1	1		302 (550-950)	12 (700, 1100)	abundant
Lepidostoma augustus M & C 1994							1(1060)								rare
Lepidostoma brueckmanni M & C 1994		1	1	5			29 (630-1380)					1			common
Lepidostoma daidalion Malicky & Prommi 2000							1(630)			1	2			19 (700, 1100)	common
Lepidostoma diespiter Malicky & Saengpradab 2001														1 (1100)	rare
Lepidostoma doligung Malicky 1979							4 (630-750)	4			1		63 (550-950)		common
Lepidostoma februarius M & C 1994							8 (1060-1380)						10 (700, 950)	16 (1100)	common
Lepidostoma fischeri M & C 1994				5			262 (750-1380)								abundant
Lepidostoma inthanon M & C 1994					39	13									common
Lepidostoma lannaensis M & C 1994							1(1060)								rare
Lepidostoma longipenis Weaver 1989													22 (700-950)		common
Lepidostoma martius M & C 1994		1	1				3(1060)	1				1	16 (650-950)	1 (1100)	common
Lepidostoma montatan M & C 1994							16 (750-1060)						7 (550-950)		common
Lepidostoma moulmina Mosely 1949							18 (750-1060)		9	1	1	22	79 (550-950)	20 (700, 1100)	abundant
Lepidostoma navasi Weaver 2002							52(1060)								common
Lepidostoma pratetaiensis M & C 1994							9 (750-1060)	4			1	1	70 (550-950)	18 (700, 1100)	abundant
Lepidostoma pseudabruptum M & C 1994								1		1					rare
Lepidostoma septembrius M & C 1994							1(1060)						3 (650-800)	11 (700, 1100)	common
Lepidostoma taunggya Mosely 1949							2(1060)		1			4	16 (550-700, 950)	2 (1100)	common
Lepidostoma varithi M & C 1994					1										rare
Paraphlegopteryx angkangensis Weaver 1999					2										rare
Paraphlegopteryx malickyi Weaver 1999					1	3									common
Leptoceridae															
Adicella evadne Schmid 1994				22			63 (1060-1380)	1	2			1		3 (1100)	common
Adicella kanaka M & C 2002				3			23 (630,1380)	2							common
Adicella koronis Malicky & Thani 2002							1(1060)							1 (1100)	rare
Adicella larentia Malicky & Cheunbarn 2002							1(1060)					1			rare
Adicella longicerca Kimmins 1963							1(1060)								common
Ceraclea globosa Yang & Morse 1988	25														rare
Ceraclea iambe Malicky & Prommi 2002							2(1060)								common
Leptocerus hylaios Malicky & Thamsenanupap 2005	4														common
Leptocerus inthanonensis M & C 1991	1						2(630)	1							rare
Leptocerus lampunensis M & C 1991							1(630)								rare
Leptocerus protesilaos Malicky & Prommi 2006	2														common
Leptocerus suthepensis M & C 1991													4 (550-700)		rare
Mystacides elongata Yamamoto & Ross 1966							1(1060)								rare
Oecetis miletos Malicky & Naewvong 2005								1							rare
Oecetis pretakalpa Schmid 1995	1														rare

Oecetis purusàmedha Schmid 1995	1														rare
Oecetis raghava Schmid 1995								1							common
Oecetis tripunctata Fabricius 1793								3		1			1 (650)		rare
Oecetis villosà Kimmins 1963							2 (630-750)								common
Setodes abhirakta Schmid1987		1							4	6	16				rare
Setodes argentiguttatus Gordon & Schmid 1987	1														common
Setodes endymion M & C 2000							2(630)			1					rare
Setodes isis Malicky & Nawvong 2006								1							common
Setodes kerkopos M & C 2006				1						2	1				rare
Setodes menestratos Malicky & Thamsenanupap 2006	1														rare
Setodes mercurius Malicky & Bunlue 2006	1														common
Setodes metis Malicky & Thapanya 2006	5														rare
Setodes neleus M & C 2006								1							abundant
Setodes tcharurupa Schmid 1987	5	1						147							rare
Triaenodes pellectus Ulmer 1908							1(630)								rare
Helicopsychidae															
Helicopsyche rodschana M & C 1992							3(1060)						1 (700)	3 (700)	common
Helicopsyche admata M & C 1992														1 (1100)	rare
Odontoceridae															
Inthanopsyche trimeresuri Malicky 1989				8	8		14(1060)								common
Lannapsyche chantaramongkolae Malicky 1989				1			7 (750-1380)						21 (550-700, 950)	1 (700)	common
Marilia aerope M & C 1996		21	1				2(1060)						5 (700, 950)		common
Marilia mogtiana Malicky 1989	3	1	2				24 (630-1380)	4					89 (550-950)	1 (700)	abundant
Marilia sumatrana Ulmer 1951							2 (1060-1380)	1		3			117 (550-950)	5 (700, 1100)	abundant
Psilotreta abudeb M & C 1991				2											rare
Psilotreta baureo Malicky 1989		3	3	1			17 (1060-1380)					1	2 (650, 800)	5 (700)	common
Psilotreta quin M & C 1991	1						16 (630,1060-1380)								common
Calamoceratidae															
Anisocentropus brevipennis Ulmer 1906								1					13 (550-700)		common
Anisocentropus diana M & C 1994												1		1 (1100)	rare
Anisocentropus janus M & C 1994							7 (630-750)	7		3	4		225 (550-950)	6 (700, 1100)	abundant
Anisocentropus minutus Martynov 1930													1 (700)		rare
Anisocentropus pan M & C 1994							2(630)	3	4			1	22 (550-950)	3 (1100)	common
Anisocentropus pandora M & C 1994							2(1060)								rare
Anisocentropus salsus Betten 1909				2			2 (1060-1380)								common
Ganonema dracula M & C 1994				4			16(1060)								common
Ganonema extensum Martynov 1935										3	1		66 (650-950)		common
Ganonema fuscipenne Albarda 1881	1		2				2(630)	3							common
Molannidae															
Molanna oglamar M & C 1989							1(630)						6 (550-700)		common
Molannodes hydorn M & C 1991													2 (800-950)		rare
Molannodes lirr M & C 1989										1	3		120 (550-950)	2 (700, 1100)	abundant
Molannodes magdiel M & C2009								1							rare

Note: M & C = Malicky & Chantaramongkol, C & M = Chantaramongkol & Malicky
Numbers in parentheses represent elevation (m asl)
rare species which have been recorded only 1-2 specimen
common : species which have been recorded 3-100 specimen
abundant species which have been recorded > 100 specimen